Scientific Posters
SP01-SP175: Platform 5 Café, Level 1
SP176-SP488: Lomond Suite, Level 0

The authors of abstracts marked *** have indicated a financial interest.
The authors of abstracts marked ‡‡‡ have failed to indicate whether or not they have a financial interest.

SP 01  PIEZOELECTRIC DEBONDING FOR CERAMIC BRACKET DEBONDING
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AIMS: To develop a new method to debond ceramic brackets using a piezoelectric unit.
MATERIALS AND METHOD: Twenty ceramic brackets were bonded to extracted sound premolars with the same adhesive material. The bonded teeth were divided equally into two groups: conventional and piezoelectric ultrasonic debonding. Bond failure and bracket failure were evaluated.
RESULTS: Bond failure at the bracket-adhesive interface occurred with significantly greater frequency when using the piezoelectric than conventional debonding technique. The incidence of bracket failure during debonding was significantly less with the piezoelectric technique.
CONCLUSION: The piezoelectric unit allows for a less aggressive and safer method to perform orthodontic debonding.

SP 02  PERCEPTION OF TREATMENT OUTCOME AFTER RAPID MAXILLARY EXPANSION AND FACEMASK THERAPY
Secil Acar, Tuba Tortop, Department of Orthodontics, Gazi University, Ankara, Turkey

AIMS: Rapid maxillary expansion (RME) and facemask therapy is considered to be effective for correcting skeletal Class III malocclusions. The purpose of this study was to evaluate the perception of soft tissue changes of RME and facemask therapy from the perspective of lay people, dental students and orthodontists and to compare these with lateral cephalometric measurements.
MATERIALS AND METHOD: Pre- and post-treatment lateral cephalometric radiographs of 10 patients treated with RME and a protraction facemask were used to generate standardized profile silhouettes. The subjects were selected according to varying degrees of improvement in ANB angle. The profile silhouettes were judged by lay people, second and fifth grade dental students and orthodontists (n = 50 each group) using a five-point Likert scale. They also chose the most attractive silhouette from randomly selected silhouettes. Eight angular and five linear measurements were used to evaluate skeletal and soft tissue changes. One-way ANOVA, paired t- and Pearson correlation tests were used for statistical analysis.
RESULTS: Significant increases in SNA and ANB angles were found at the end of treatment (P = 0.001). Upper incisor to NA (mm) and overjet and H angle also showed significant increases (P < 0.05). The increase in ANB angle was found to be correlated with treatment outcome assessments of orthodontists (P = 0.047). It was observed that the scores of orthodontists for profile silhouettes were greater than for other groups when the change in ANB angle was greater. Furthermore, there was strong agreement between the evaluations of lay people and second-grade dental students. General concordance was found between participants in their aesthetic profile preferences.
CONCLUSION: Although orthodontists’ and other groups’ profile aesthetic preferences were similar, orthodontists were more focused on the improved skeletal normality after RME and protraction facemask therapy. Perception of improvement in profile might change due to the degree of education and dental training.
QUALITY OF LIFE OUTCOMES OF CLASS III TREATMENT WITH FACEMASK AND RAPID MAXILLARY EXPANSION: PATIENT AND PARENT PERCEPTIONS
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AIMS: Malocclusion may be an important determinant for oral health related quality of life (QoL) since it may have functional, psychological, physiological and social impacts. In this respect, early intervention may be beneficial for the patients. However, wearing extraoral appliances in public and living with intraoral anchorage appliances may also worsen QoL. Recording parents’ perceptions of treatment is also important to understand the experiences of patients from another point of view and determine their impact on parents’ feelings. Therefore the aim of this study was to evaluate the effects of Class III treatment with facemask and rapid maxillary expansion (FM-RME) on the QoL of patients and how it was perceived by the parents.

SUBJECTS AND METHOD: Fifty-three patients (31 girls, 22 boys; mean age 11.5 ± 1.6 years) and their parents (34 mothers, 19 fathers; mean age 37.5 ± 6.3 years) were asked to answer a modified version of the short form of Oral Health Impact Profile (OHIP-14) questionnaire 3 months after the start of treatment with a posterior acrylic cap splint RME and Petit-type FM. Categorical variables and continuous variables were evaluated with Chi-square and Mann-Whitney U tests, respectively. Pearson correlation analysis was chosen for correlations (P < 0.05).

RESULTS: With regard to gender differences, girls felt significantly tenser than boys after treatment. The most pronounced impact of FM-RME therapy was food stuck between the teeth for the patients, while parents were more disturbed by their children being tenser and irritable with other people in the family, and their bad breath. Mothers were significantly more disturbed about their children’s prolonged meal times and psychological discomfort such as being tense and embarrassed and caring what other people thought. Overall, answers of patients and parents were significantly correlated in the sense that parents were aware of children’s feelings, embarrassment, tension and being teased by others.

CONCLUSION: FM-RME therapy had an impact on patients’ QoL, which was mostly perceived by the parents. Clinicians may benefit from data obtained from proxy reports of parents to evaluate changes regarding their children’s QoL during Class III treatment.

AN AUDIT ASSESSING THE BENEFITS OF INTRODUCING ORTHODONTIC RETAINER CONSENT FORMS AND PATIENT INFORMATION POSTERS ON RETENTION
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AIMS: To design and implement a retainer information poster and consent form to improve patient knowledge and departmental information regarding retainer wear and care, to assess whether patient knowledge improved through the introduction of retainer information posters and consent forms and to improve patient knowledge of their required retention regime and care of their retainers, thereby hopefully reducing breakage rates, improving clinical efficiency and reducing laboratory costs.

MATERIALS AND METHOD: This was a prospective questionnaire-based audit carried out within the Orthodontic Department at the Eastman Dental Hospital, UCLH between January 2014 and March 2014. The retainer consent form and patient information posters were designed in conjunction with clinical staff input and UCLH Media Policy guidelines. The questionnaire was developed through general departmental consensus, piloted on five patients and modified to construct the final questionnaire. It had seven main sections: patient demographics, awareness of necessity for retention, cleaning regime, wear routine, retainer storage, clarity of instructions issued and breakages and cost implications. The questionnaire was distributed in two rounds - prior to the introduction of a departmental retainer consent form and patient information poster, and after their implementation. Thirty consecutive patients attending for their first retainer fit appointment following orthodontic debond were recruited in each round. This allowed assessment of the effect the introduction of the consent form and poster on patient information recall and satisfaction. Patients in both rounds were provided with existing accepted verbal instructions and a British Orthodontic Society 'Retainers' leaflet. Questionnaires were anonymized.
RESULTS: There was a general significant increase in patient knowledge and awareness surrounding their retention regimen, its importance and retainer maintenance. There was a 44 per cent increase in knowledge of correct wear routine, a 40 per cent increase in awareness of need for long term retention, a 47 per cent increase in knowledge of ideal cleaning regime, 100 per cent maintenance in the knowledge of appropriate storage in both rounds, a 33 per cent increase in clarity of instructions, to 100 per cent of patients in second round and a 20 per cent increase in awareness of costs for loss or breakages, to 100 per cent of patients in second round.

CONCLUSION: Introduction of patient information posters and a structured retainer consent form augmented verbal instructions to optimise the consent process.

SP 05 HOW ORTHODONTIC THERAPISTS HAVE CHANGED THE PROVISION OF ORTHODONTIC TREATMENT
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AIMS: As it has been 10 years since the General Dental Council (GDC) permitted the training of orthodontic therapists in the UK, the aim was to explore how the introduction of orthodontic therapists had impacted the orthodontic workforce and changed the provision of orthodontic treatment in both primary and secondary care. MATERIALS AND METHOD: A literature review was conducted to determine the impact of orthodontic therapists within the UK. Access to specialist-led care, geographical inequality, the quality of treatment provided by orthodontic therapists and the impact of orthodontic therapists on both primary and secondary care were investigated. In addition, how the training of orthodontists had been impacted and the supervision guidelines for orthodontic therapists was considered. At the Consultant Orthodontist Group (COG) Symposium in Liverpool 2016, a survey was conducted looking at the use of orthodontic therapists within secondary care.

RESULTS: Since the introduction of orthodontic therapists, there has been an increase in accessibility to a specialist-led orthodontic workforce and a decrease in geographical inequality. As local general dental practitioners with orthodontic experience have retired, orthodontic therapists have allowed commissioners to cost-effectively redistribute funding amongst existing local specialists. In both primary and secondary care, orthodontic therapists allow for a better use of skills mix through task delegation and provide a continuity of care; this can result in increased efficiency of the orthodontic workforce. In secondary care orthodontic therapists can help allow consultants to meet increasing clinical and management demands, while still fulfilling their other key roles. It has also been shown that using orthodontic therapists had no impact on the quality of orthodontic care provided. The survey at the COG Symposium in 2016 showed that the reasons why orthodontists would not employ an orthodontic therapist included lack of finances, management interest, capacity and time.

CONCLUSION: The introduction of orthodontic therapists has allowed for the development of a more cost-effective, cost-efficient, accessible service in both primary and secondary care without impacting on the quality of the treatment provided.

SP 06 HYPODONTIA IN NIGERIAN ORTHODONTIC PATIENTS
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AIMS: Absence of one or more teeth in the maxillary and mandibular arches could have a major impact on dental and facial aesthetics, function, speech and social well-being. The eruption of a full complement of teeth is considered essential for pleasing dental aesthetics and balanced facial harmony. Hypodontia is the term most frequently used to describe the phenomenon of one to six congenitally missing teeth, excluding the third molars. The objective of this study therefore was to determine the prevalence of hypodontia in orthodontic patients of Nigerian ancestry in Benin City, Nigeria.

SUBJECTS AND METHOD: A total of 150 patients consisting of 57 males (38%) and 93 females (62%) aged 10-40 years (mean age of 18.4 7.6 years) who presented for orthodontic treatment were assessed for congenitally missing permanent teeth. The type and number of missing teeth and distribution within the arches were evaluated with dental histories, study casts and panoramic radiographs. Orthodontic patients of Nigerian ancestry with complete records and history were evaluated and those with history of tooth loss due to other
causes were excluded from this study. Descriptive statistics were performed for the study variables and age and gender differences in the frequency of missing teeth were evaluated with the chi-square test.

RESULTS: The frequency of hypodontia among the total sample was 14.7 per cent. The prevalence of hypodontia was significantly higher in females ($P < 0.01$) and missing teeth was mostly observed in patients aged 11-20 years. The most frequently missing teeth were the maxillary lateral incisors. One tooth was absent in 50 per cent of the patients, two teeth were missing in 36.4 per cent and three teeth in 13.6 per cent. The predominant number of the missing teeth was seen in the patients with an Angle Class I malocclusion. The treatment of choice in 90.9 per cent of the patients was orthodontic space closure.

CONCLUSION: This study revealed that the prevalence of hypodontia was higher in the maxilla and the most frequently missing teeth were the permanent maxillary lateral incisors in the orthodontic patients seen at Benin City, Nigeria.

SP 07 AN ELECTROMYOGRAPHIC STUDY COMPARING THE IMPACT OF RAPID MAXILLARY EXPANDERS ON MASTICATORY MUSCLE ACTIVITY AMONG GROWING ORTHODONTIC PATIENTS: A PROSPECTIVE CLINICAL STUDY

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AIMS: To evaluate and compare masticatory activity of the anterior temporalis (AT) and masseter muscles (MM) among different growing posterior crossbite (PCB) patients (unilateral/bilateral) in relation to normal occlusion subjects.

SUBJECTS AND METHOD: Eighty-six children (mean age 11.14 years) were divided into two groups: PCB growers who required rapid maxillary expansion (RME) treatment (PCB group, $n = 51$), and normocclusion growers (non posterior crossbite ‘NON_PCB’, $n = 35$). Surface electromyographic (sEMG) activity of the AT and MM of both sides were analyzed before and after RME treatment in the PCB group. The same data were collected from the control group. The mean interval between the two analyses was 12 to 15 weeks. Muscular activity was analyzed at four different positions: at rest, during clench 1, clench 2 and mastication.

RESULTS: sEMG analysis showed that the activity of the AT and MM increased significantly in PCB patients after RME during clenching and mastication ($P < 0.01$). After RME, significant sEMG changes of both muscles in unilateral posterior crossbite (UPCB) subjects were found ($P < 0.01$). MM activity decreased significantly after RME on the CB side of UPCB patient compared to the non-CB side of the same patient during clenching ($P < 0.05$).

CONCLUSION: RME does not act directly on the masticatory muscles, but produces important changes in muscle tone. However, further longitudinal investigations are required to evaluate the changes in stability after RME, which may clarify the possible amount of future relapse.

SP 08 SURFACE HARDNESS OF ORTHODONTIC ADHESIVE MATERIALS CURED WITH DIFFERENT LIGHT EMITTING DIODE UNITS

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AIMS: To evaluate the polymerization performance of three light emitting diodes (LEDs) with the surface hardness values of different orthodontic adhesive materials.

MATERIALS AND METHOD: Specimen discs of three different adhesive composites; Grëngloo™ Adhesive (Ormco), Light-Bond-Paste (Reliance), Transbond XT (3M Unitek), and two different band adhesives; Ultra Band Lok (Reliance), 3M Multicure Glass Ionomer were fabricated. A polywave LED (Valo; 395-480 nm, 3200 mW/cm²), a monowave LED (DemiUltra; 450-470 nm, 1100-1300 mW/cm², Kerr) and a second-generation LED (Optima; 420-480 nm, 1200 mW/cm²) were used to polymerize the discs through a lamella of 1 mm thickness. In total 75 discs were fabricated, and each disc was tested five times from the bottom and the top surfaces. Mann Whitney U, Kruskal-Wallis, and Dunn’s multiple comparison tests were used for the statistical analysis.

RESULTS: A significant difference was found among the top and bottom surfaces of band adhesives cured with different LEDs ($P < 0.05$). Each material was evaluated according to the LED unit and the top surfaces showed no significant difference. On the other hand, a significant difference was found for the bottom surfaces ($P < 0.05$). The highest hardness was recorded with Optima for the Band-Lok and with Valo for the 3M Multicure Glass
Ionomer. A significant difference was found among the top and bottom surfaces of composite adhesives cured with different LEDs (P < 0.05). The Light-Bond-Paste showed the highest hardness on the top and bottom surfaces among the three materials. The top surfaces of Transbond XT Light Cure and Grēngloo™ showed no significant difference. However, the bottom hardness values showed significant difference. The highest values for the bottom surface were recorded with Optima for both materials. The top and bottom hardness values of Light-Bond-Paste composite showed a significant difference (P < 0.001). The highest hardness was obtained on the upper and lower surfaces with Optima.

CONCLUSION: The materials cured with different LED units showed similar surface hardness values, however the bottom surfaces showed differences. These findings indicate that there is difference in curing depth performance of different LEDs.

SP 09 RADIOPHGRAPIC EVALUATION OF UPPER THIRD MOLARS IN DIFFERENT ANTEROPosterior SKELETAL PATTERNS: A PILOT STUDY
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AIMS: To evaluate the differences in upper third molar inclination related to maxillary dimensions in different anteroposterior skeletal structures.
MATERIALS AND METHOD: Pre-treatment lateral cephalograms of 106 orthodontic patients (43 males, 63 females) having upper third molars between 16 and 25 years of age. The sample was divided into three groups: group 1 (n = 51) skeletal Class I subjects (ANB = 0-4), group 2 (n = 36) skeletal Class II (ANB >4), and group 3 (n = 19) skeletal Class III. A Shapiro-Wilk test was performed to verify normal distribution of the data. To determine the differences between the groups, Mann-Whitney U and Kruskal-Wallis tests were used.
RESULTS: There were no statistically significant differences between the groups in terms of upper third molar inclination, pterygomaxillary fissure-upper first molar distance (PTV-U6) and condylion-A (Co-A) distances(P > 0.05). A positive correlation was found between the PTV-U6 and Co-A distances (r = 0.255). No correlation was determined either between the age and PTV-U6 distance or the Co-A distances. In all groups males had greater values than females in Co-A and PTV-U6 measurements (P < 0.05).
CONCLUSION: With the study limitations, the present findings indicate that upper third molar inclination did not show any difference regarding the anteroposterior skeletal pattern. Further studies with an increased sample size are needed to clarify the findings.

SP 10 ENAMEL COLOUR CHANGES AFTER FIXED ORTHODONTIC TREATMENT
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AIMS: To follow-up long-term the enamel colour changes observed in the gingival, middle, and incisal thirds of the buccal tooth surfaces due to fixed orthodontic treatment.
MATERIALS AND METHOD: One hundred and twenty maxillary central, lateral and canine teeth of 20 subjects who had fixed orthodontic treatment. Spektro Shade was used to evaluate the colour changes of teeth. Measurements were made from the gingival, middle, and incisal thirds of the buccal surfaces of the teeth after fixed orthodontic treatment (AT) and at 3 (T1), 6 (T2) and 12 (T3) month of the retention phase. The CIE L*a*b* system that expresses the colour coordinates in L*, a* ve b* symbols was used to determine tooth colour and ΔE values between the different time periods were calculated. Repeated measurement analysis of variance was used in evaluating the colour changes.
RESULTS: Enamel colour changes observed in the gingival, middle and incisal thirds of the maxillary central, lateral and canine teeth at AT-T1, AT-T2, AT-T3, T1-T2, T1-T3 and T2-T3 year were statistically significant within themselves. The ΔE values of gingival, middle and incisal thirds were between 1.67-3.62, 1.52-3.57, and 1.31-3.55, respectively and it was determined that visible but clinically acceptable colour changes occurred.
CONCLUSION: While the most enamel colour change was observed at T3, the least enamel colour change was observed at T2. The enamel colour change observed in the gingival third was more than in the middle and incisal thirds.

SP 11 COLOUR CHANGE OF INFILTRATED WHITE SPOT LESIONS SUBJECTED TO BLEACHING
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AIMS: To quantitatively analyze colour change due to whitening of white spot lesions previously treated with resin infiltrant (RI) and to compare those changes with intact enamel.

MATERIALS AND METHOD: A total of 40 extracted human premolars and molars were split into four different groups (n = 10/group): one control and three different whitening groups. The left buccal half of each tooth underwent demineralization and received RI treatment. The right half of each tooth served as the non-resin infiltrated (NRI) control. All groups were immersed in red wine for seven days and then underwent the assigned whitening protocol. Tooth colour was assessed at: baseline (T0), following demineralization and Icon RI treatment (T1), upon staining and polishing (T2) and post-whitening (T3). The colour difference ($\Delta E^*$) was calculated for each half of the tooth and between all time points and across all whitening groups. Analysis of variance (ANOVA) and independent sample t-tests were used to analyze the data. Multiple comparisons were performed with Bonferroni post hoc tests. The level of significance was set at $P < 0.05$.

RESULTS: No significant colour difference was observed between the left and right sides for the T0-T1 comparisons ($\Delta E^*$ NRI = 2.5, RI = 2.2). The T2-T3 period exhibited no significant differences in colour between the left (RI) and right (NRI) sides in the control and whitening group 2. Whitening protocols #1 and #3 demonstrated significant differences for the T2-T3 period ($P < 0.05$) with the NRI side exhibiting a significantly lighter colour ($\Delta E^*$ group 1 = –15.0, group 3 = –11.3) when compared to the RI side ($\Delta L$ group 1 = –8.3, group 3 = –7.5).

CONCLUSION: Resin infiltrated surfaces did not respond to whitening protocols similar to the NRI surfaces. NRI tooth surfaces exhibited lighter colour upon bleaching.

SP 12 REFERRAL PATTERNS OF PAEDIATRIC DENTISTS AND GENERAL PRACTITIONERS TO ORTHODONTISTS BASED ON CASE COMPLEXITY
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AIMS: To analyse the correlation between paediatric and general dentists' perceived case complexity and the discrepancy Index (DI), and to determine if case complexity influences providers’ referral decisions to orthodontists.

SUBJECTS AND METHOD: Paediatric dentists (n = 20) and general dentists (n = 21) participated in a web-based survey. Pre-treatment orthodontic records of 20 cases with a variety of malocclusions and a range of DI scores were obtained. Dental providers were asked to determine subjective case complexity using a 100-point visual analogue scale (VAS) and whether they would refer the case in question to an orthodontic specialist. Differences between the treatments provided by the two groups were assessed with Fisher’s exact test. Pearson correlation coefficient was used to assess the overall correlation of the average complexity score and the DI score in each panel group. A mixed model multivariate data analysis was used to evaluate the subjective case complexity using fixed factors such as DI score, type of panel member, experience, annual continuing education rate and gender.

RESULTS: General dentists provided more overall orthodontic treatment than paediatric dentists including clear aligner therapy ($P < 0.05$). Paediatric dentists, however, provided significantly more limited orthodontic treatment than general dentists ($P < 0.05$). Pearson correlation coefficients indicated a high correlation between DI and VAS score in the sample ($r = 0.71$, 95% CI (0.38, 0.87]). However, the perceived complexity score for cases was not significantly different between the two panel groups ($P = 0.820$). The association between DI score and perceived complexity was similar in both panel groups ($P = 0.183$). Paediatric dentists had a higher referral rate for cases that presented DI scores below and above 20. With a one-point increment in DI ($P < 0.001$) and VAS ($P < 0.001$), odds ratios for the referral decisions increased significantly in the whole panel group, but significant differences were noted between the paediatric and general dentists in the individual case referral decision as evaluated by the DI ($P < 0.037$) and VAS ($P < 0.042$) scores.

CONCLUSION: DI score was significantly associated with perceived complexity score in both groups. Paediatric dentists, however, had higher referral rates to orthodontic specialists.
SP 13  ADHESIVE PRE-COATED BRACKET SYSTEM AND OPERATOR COATED BRACKET SYSTEM IS THERE ANY DIFFERENCE? A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: To investigate whether pre-coated brackets are more efficient than non-pre-coated regarding failure rate and bonding time, patient experience, gingival health, plaque accumulation and white spot lesions formation.

MATERIALS AND METHOD: Five online data bases; the Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, PubMed, Medline, Web of Science was searched for potential eligible randomized controlled trials (RCTs) without applying any restriction regarding language, publication date or study design. The search strategy for each database was unique and individually tailored. A Google Scholar search was undertaken by the main author. References of included studies were screened for potential eligible studies and authors were contacted when needed. Results collected from each database individually and modified Cochrane data extraction sheet forms were completed by two authors independently and any conflict was resolved by a third author. Quality assessment was performed using Cochran RoB 2.0 tool for RCTs.

RESULTS: Five studies met the inclusion criteria. All reported failure rates using metal brackets for both adhesive pre-coated (APC) and operator coated (OPC) systems except one that compared clear adhesive pre-coated brackets to clear operator coated brackets. Three studies reported bonding time difference between both bracket systems. Quantitative synthesis of four studies reporting failure rates and three reporting bonding time was undertaken. Random effect meta-analysis determined that there were no statistically significant differences in the bond failures between the bracket systems with an odds ratio of 0.890 \((P = 0.808)\) demonstrating comparable failure rates. Bonding showed a statistically significantly shorter bonding time with OPC \((P = 0.01)\). There was insufficient evidence to assess plaque accumulation, gingival health and experience for both patient and operator. Relatively low heterogeneity was observed among bonding time however, increased heterogeneity was noticed in failure rate.

CONCLUSION: The limitations that faced reviewers were mainly the decreased numbers of studies included. There is no superiority of either bracket systems regarding failure rate. OPC bracket system are statistically significantly superior over APC bracket systems although this was not clinically significant.

SP 14  INITIAL SLIDING RESISTANCE OF A 0.014 INCH NON-THERMAL NICKEL TITANIUM WIRE, IN TWO TYPES OF MALOCCLUSIONS WITH DIFFERENT LIGATING METHOD
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AIMS: To compare in vitro study the frictional attributes of conventional and self-ligating stainless steel brackets in two different types of typical malocclusions with a 0.014 inch nickel titanium (NiTi) archwires.

MATERIALS AND METHOD: The test was performed with four sets of 0.022 inch maxillary brackets: (1) conventional stainless steel brackets (MBT®) with stainless steel ligatures, (2) with elastomeric ligatures, (3) stainless steel self-ligating brackets (Carriere®) and polysulfone self-ligating brackets (Camaleón®) (4). Right sided brackets were used to design a 1 mm intrusion canine malocclusion, and left brackets were used to design a 10 degree tip canine malocclusion. 0.014 inch NiTi wire was tested in this study. To monitor frictional force, a universal testing machine (Instron®) was used, which allowed movement of the archwire along the brackets. In the first part of the clinical experiment, four types of brackets in the two different malocclusions were compared. In the second part, the influence of the stainless steel ligatures in the friction levels were investigated. A Mann-Whitney \(U\) test was used to test the difference between groups of malocclusion and Kruskal-Wallis \(H\) and Mann-Whitney \(U\) tests were used to analyse the difference between groups of brackets and the influence of the stainless steel ligature.

RESULTS: All the pairs of brackets showed highly significant differences \((P < 0.001)\) between them. The sliding resistance of the 0.014 inch NiTi wire was higher in the canine 10 degree tip malocclusion than the 1 mm intrusion malocclusion \((P < 0.001)\) in all subgroups except for brackets with elastic ligature \((P < 0.05)\). In the second part, highly significant differences were observed for friction levels \((P < 0.001)\) in the way the stainless steel was tightened.
CONCLUSION: When comparing conventional brackets with stainless steel ligatures or elastomeric ligatures, self-ligating brackets can produce significantly less friction during sliding; the tightening method of the stainless steel ligatures seems to be important for the friction level.

SP 15 CRANIOFACIAL ADAPTATIONS TO TONGUE VOLUME REDUCTION SURGERY: A SYSTEMATIC REVIEW
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AIMS: To systematically investigate the available literature regarding craniofacial adaptations after tongue volume reduction surgery, and to critically evaluate the quality of existing evidence.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data on craniofacial adaptations in patients of any age having undergone tongue volume reduction surgery were reviewed. Methodological quality was evaluated using the instrument developed by the Effective Public Health Practice Project.

RESULTS: Out of 425 initially identified unique records, only three articles, which followed patients up to one year post-surgery, fulfilled the selection criteria for inclusion in the systematic review. Two studies presented data on various functional characteristics involving the tongue. After tongue volume reduction surgery, although resting pressures were generally lower than before surgery, no significant difference were noted in the rest position, as well as during chewing and swallowing. At the same time, minimal influence was noted on oral stereognosis and motor ability. The third study that investigated the effect of tongue volume reduction on dentofacial structures after mandibular set-back, showed that there was no significant difference in the assessed skeletal, hyoid position and airway cephalometric variables at 1 year. Methodological quality assessment identified various drawbacks in the included studies.

CONCLUSION: The present systematic review showed that overall no statistically significant differences were noted in terms of tongue function and dentofacial structure adaptation following tongue volume reduction surgery in the medium term. More studies of high quality are needed in order to further investigate the craniofacial adaptations following this procedure.

SP 16 ANATOMICAL PECULIARITIES OF THE UPPER RESPIRATORY TRACT IN PROGNATHISM AND MOUTH BREATHING
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AIMS: Diseases that frustrate normal nose breathing force the individual to change his/her model of breathing to mouth breathing, which in its turn creates a predisposition for collapse of the pharyngeal walls in older subjects and alterations in craniofacial growth and development in those of a younger age. An open mouth would decrease the cross section of the pharyngeal dilator muscle and thus reduce the force it would otherwise generate due to its dorsal displacement. The purpose of this research was to identify the anatomical peculiarities of mouth breathing patients (skeletal Class and vertical facial type, sagittal dimensions of the upper respiratory tract), by comparing them to a control group of patients with normal nose breathing.

MATERIALS AND METHOD: Profile radiographs of 117 males (55 nose breathers with a skeletal Class III forming the control group, 62 Class III mouth breathing patients based on data collected from case history and clinical examinations). Cephalometric analysis of the facial skeleton, the pharynx and the tongue were undertaken. The collected data were entered and processed by the statistical package IBM SPSS Statistics 22.0.

RESULTS: Initially, the studied contingent of mouth breathers was distributed by frequency of occurrence according to skeletal Class (ANB) and vertical facial type (SN-ML).

CONCLUSION: Skeletal Class III, hyperdivergent mouth breathing patients had smaller sagittal dimensions of the jaws, mandibular angle and osseous pharyngeal boundaries as compared to skeletal Class III, hyperdivergent nose breathing patients. The same had a larger tongue and oropharynx as compared to normal breathers. In consideration of the peculiarities in the morphology of skeletal Class III, hyperdivergent mouth breathing patients, it would be necessary to apply a modified therapeutic approach for preventive orthodontic treatment, especially.
EXAMINATION OF EFFECTIVENESS OF DIFFERENT INTRAORAL MOLAR DISTALIZATION METHODS: A LITERATURE REVIEW
Yavuz Albayrak, Seyit Ahmet Öztürk, Hasan Orakçıoğlu, Adıyaman University Faculty of Dentistry, Turkey

AIMS: To examine the effectiveness and applicability of different intraoral molar distalization methods. MATERIALS AND METHOD: The PubMed database was used to review the literature of this topic. The search that was conducted using the following descriptors: ‘intraoral distalization’ and ‘intraoral molar distalization’ revealed 54 and 53 articles, respectively. RESULTS: After reviewing the content of the articles based on these criteria, 34 articles were selected for this study. CONCLUSION: Extraoral molar distalization is very important for orthodontic practice because it may cause serious problems such as acceptability and patient compliance. According to the literature, many traditional methods were redesigned with the use of miniscrews and miniplate support. Although intraoral distalization methods have some risks, they have been gaining more attention along with the improvements in medical technology.

PLASTER STUDY MODELS AND THEIR PHOTOCOPIED AND DIGITAL EQUIVALENTS ASSESSED BY THE PEER ASSESSMENT RATING INDEX
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AIMS: To evaluate the validity and reproducibility of the Peer Assessment Rating (PAR) index from plaster casts and their photocopied models as well as their three-dimensional (3D) digital equivalents. A secondary aim was to establish the range of scoring differences between two observers: one recently calibrated, and the other an experienced PAR scorer. MATERIALS AND METHOD: The study sample consisted of 30 randomly selected dental models which represented a wide range of malocclusions. All the models were available in plaster casts, photocopies and in their 3D digital equivalents. PAR scoring was done with the UK weightings by two calibrated examiners independently using the PAR index ruler. Plaster models were scored first to evaluate intra-examiner agreement. Then, photocopies and digital models scoring was undertaken twice with a 1 week interval by both examiners. Digital models were viewed and scored on a computer screen using appropriate software. RESULTS: High intra-examiner reproducibility was found from plaster PAR scoring for both examiners. When assessed using an unpaired t-test, no statically significant difference was found between the two observers in any of the three media. The greatest difference was found for scoring photocopies (mean difference 5.7 PAR points, $P = 0.068$). Analysis of Variance (ANOVA) also showed no statistical difference between all scorings ($P = 0.087$). However, there was one significant difference found between the photocopies PAR scorings of the recently calibrated and the digital PAR scorings of the experienced scorer when the Tukey post-hoc test was evaluated (of 8.85 PAR points, $P = 0.046$). Finally, the root mean square and Bland-Altman tests showed that there were higher random errors and wider limits of agreements for both investigators. CONCLUSION: 3D virtual study models are suitable substitutes for plaster models when scoring the PAR index. PAR scoring photocopied models was not significantly different from the other two media, however the minor statistical differences justify the need for further work in this area. Also, PAR index calibrated examiners should be evaluated regularly for the need of recalibration.

ANALYSIS OF PATIENT MOVEMENT DURING Cone Beam Computed Tomography Imaging – A PILOT STUDY
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AIMS: Patient movement during cone beam computed tomography (CBCT) scanning is a significant concern, potentially leading to artefacts. The aim of this pilot study was to assess the range of patient movement during CBCT imaging.
SUBJECTS AND METHOD: Eight postgraduate students (4 males, 4 females) and five staff members (1 male, 4 females) were included in the pilot study. A 3D printed, custom-made, mouthpiece was constructed, carrying a plate with a millimetre grid. A camera (Panasonic Lumix DMC-ZS5) was placed in front of the plate in the CBCT unit (NewTom VGi), fixed on a tripod, without being in contact with either the machine or the patient. A video, focused on a centre point of the millimetre grid, was recorded during a dry-run of the CBCT. Video files for analysis of patient movement were examined using the Tracker Video Analysis and Modelling Tool.

RESULTS: Head movement in the vertical and transverse direction was recorded and descriptive statistics of the x and y data were computed. All subjects showed involuntary movement that exceeded 0.5 mm and in some cases 1 mm in both axes.

CONCLUSION: In all cases patient movement was larger than commonly used voxel sizes and therefore this factor may significantly contribute to reduced image quality. Further studies in younger orthodontic patients is needed to assess possible differences in movement compared to the age group in this study.

SP 20 FABRICATION AND CHARACTERIZATION OF A NOVEL BIOMIMETIC POLYCARBONATE-ALUMINA COMPOSITE FOR ORTHODONTIC BRACKETS
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AIMS: Nowadays, the desire for aesthetic fixed orthodontic appliances has increased particularly with the demands for adult orthodontic treatment. Aesthetic brackets still have some disadvantages such increased hardness for ceramics and low wear resistance for plastics. The aim of this study was to fabricate polycarbonate-alumina composite materials consisting of a porous alumina preform, infiltrated with polycarbonate polymer and investigate their physical and mechanical properties as orthodontic bracket material.

MATERIALS AND METHOD: Alumina powder was mixed with dispersant in distilled water and aelatine solution was added to the slurry as a binder and then ball milled for 6 hours in an oven. Slurries were frozen in a custom-built system and then freeze dried and finally sintered in a furnace. The porous ceramic scaffolds were then infiltrated with polycarbonate under pressure in an oven. Physical and mechanical properties such as density, compressive and flexural strengths and hardness were then measured. The fabrication technique used in this research resulted in two interconnected phases composite materials. Two composite structures were produced. The first contained 35.92 per cent alumina and 64.08 per cent polycarbonate, while the second 54.84 per cent alumina and 46.16 per cent polycarbonate.

RESULTS: The measured mechanical properties of the biomimetic composites were influenced by its precursors. A higher ceramic fraction implied a higher density and increased hardness. The compressive strength was 252 and 230 MPa for composites with 35.92 and 57.35 per cent alumina fractions respectively. The flexural strength values were 175 and 190 MPa for composites with 35.92 and 54.84 per cent alumina fractions, respectively. The relatively enhanced mechanical properties imply a reinforcement mechanism of the precursor ceramic scaffold by a flexible polymer phase.

CONCLUSION: The use of the freeze casting technique can result in a composite material combining the advantages of both ceramic and polymer. As the density, compressive strength and flexural strength are similar to a tooth as well as having less hardness than ceramics this make the novel biomimetic polycarbonate-alumina composite an option to consider as an orthodontic bracket material.

SP 21 CLINICAL GUIDELINES FOR SELECTING MINISCREWS FOR ORTHODONTIC ANCHORAGE
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AIMS: In recent years, extensive research has introduced novel ways of reinforcing orthodontic anchorage using a variety of devices temporarily anchored in bone (miniscrews). Bone anchorage devices are indicated when a large amount of tooth movement is required or when dental anchorage is insufficient e.g. hypodontia or periodontal disease. Such devices may also be useful when asymmetric tooth movements are attempted, during intrusive mechanics, intermaxillary fixation/traction and during orthopaedic traction. These devices appear to be rapidly growing in acceptance in routine orthodontic practice. Currently, there are numerous manufacturers with different miniscrew designs on the market. Carrying out this review was deemed necessary to present a
clinical selection criteria of miniscrews in different clinical settings taking into account the primary determinant factors.

MATERIALS AND METHOD: A review of the literature was carried out using the following search methods: Medline, Embase and the Cochrane Central Register of Controlled Trials. The search was focused on various keywords including: ‘bone anchorage device’, ‘miniscrew’, ‘temporary anchorage device’ and ‘TADs’ as well as hand literature searches, which were conducted on studies published until December 2017.

RESULTS: More than 20 orthodontic miniscrew manufacturers were identified in the search and each individual miniscrew from all the identified manufacturers was studied in detail. The material, insertion technique, endosseous length, endosseous diameter, transmucosal neck design and head design were investigated. All features were then summarised and presented as a clinical guideline for the selection of miniscrews.

CONCLUSION: Miniscrews have added to the support of anchorage in orthodontics.

SP 22  NOVEL BIOACTIVE GLASS VARNISHES TO TREAT WHITE SPOT LESIONS ASSOCIATED WITH FIXED ORTHODONTIC APPLIANCES
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AIMS: To evaluate the ability of novel light-cured strontium-fluoride containing bioactive glass varnishes to prevent and/or treat white spot lesions (WSLs) and to assess ion release and remineralisation over a sustained period of immersion in two solutions in vitro.

MATERIALS AND METHOD: Two types of inert glasses and experimental bioactive glasses (BAGs) were prepared using the commercial melt quench route. Each glass was integrated with resin to develop a light-cured mixture. The control and the experimental samples were prepared in 10 x 0.35 mm specimens in three different glasses to resin ratios: 20:80, 40:60, and 60:40. Two discs were immersed in one of two different 10 ml solutions (artificial saliva: pH = 7 and artificial saliva: pH = 4) over seven time periods from 0 hours to 3 months. Ion specific electrode, inductively coupled plasma and pH tests were used to determine the ion release and pH values, respectively. Fourier transform infrared spectroscopy, X-ray diffraction and scanning electron microscopy (SEM) were also used to investigate apatite formation in the specimens.

RESULTS: The experimental sample had higher fluoride, calcium, strontium and phosphate ion release after 3 hours of immersion in both neutral and acidic conditions. These levels increased with time in two solutions with the pH value considerably increased after 3 hours of immersion maintaining a constant level over the immersion period. FTIR, XRD and SEM confirmed that apatite formation occurred and increased with time.

CONCLUSION: The ability of the BAG varnishes to release remineralising ions and to form apatite with ‘smart’ controlled release particularly under acidic conditions was demonstrated. However, further laboratory and clinical examinations are required to refine these materials and to confirm the potential benefit of these varnishes.

SP 23  LIP THICKNESS HAS A MINOR ROLE IN UPPER LIP RESPONSE TO ORTHODONTIC MOVEMENT OF INCISORS
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AIMS: A change in the position of the anterior dentition during orthodontic treatment may affect lip position, however, soft tissue response to tooth movement is difficult to predict. The aim of this study was to investigate the association between upper lip thickness and the amount of upper lip repositioning upon retraction of the maxillary incisors, in cases without a change in lip thickness during treatment.

MATERIALS AND METHOD: Pre- and post-treatment lateral cephalograms of 101 patients (34 males, 67 females) were reviewed. All subjects were treated with fixed orthodontic appliances including extraction of two maxillary premolars. Only subjects without a change in lip thickness between pre- and post-treatment cephalograms were included.

RESULTS: A significant correlation was found between the change in maxillary incisor position following premolar extraction and the change in upper lip position (r = 0.95, P < 0.001). The average ratio between
maxillary incisor retraction and upper lip repositioning was 1.43:1. Upper lip thickness was not significantly associated with this ratio ($r = 0.003, P > 0.05$).

CONCLUSION: Although there is a highly significant correlation between maxillary incisor retraction and upper lip repositioning, lip thickness is not significantly associated with the amount of repositioning. Pre-treatment compression of the upper lip is the primary determining factor for the profile change in patients where the maxillary incisors are retracted.

SP 24 THE INFLUENCE OF OVERJET AND OVERBITE ON SOFT TISSUE PROFILE IN MATURE ADULTS. A CROSS-SECTIONAL POPULATION STUDY
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AIMS: To explore the association of soft tissue profile and severity of overbite and overjet in a large adult population.
SUBJECTS AND METHOD: The study population consisted of 1630 adult 46 year old subjects (712 males, 919 females), all part of the Northern Finland Birth Cohort 1966 (NFBC 1966). A clinical examination was performed on all subjects, including recording of overjet and overbite, and digital facial (frontal and profile) photographs were obtained. A multivariate regression model was developed to study the correlation of soft tissue measurements to overjet and overbite, taking into consideration the effect of gender.
RESULTS: The regression model explained approximately 30 per cent of the variability in overjet within in the sample population, and approximately 22 per cent of the variability in overbite. Overjet was related more significantly to upper and lower antero-posterior (A-P) lip position, and upper and lower face height ($P < 0.05$). Overbite showed a stronger association to A-P position of the lower lip, pogonion and soft tissue point B ($P < 0.05$).
CONCLUSION: Soft tissue profile was weakly to moderately correlated to severity of overjet and overbite in the entire sample. However, in cases with negative overjet (mandibular prognathism), this association was highly significant.

SP 25 CLINICAL CROWN LENGTH, GINGIVAL RECESSION DEVELOPMENT AND SAGITTAL INCLINATION CHANGES ASSOCIATED WITH ORTHODONTIC TREATMENT: A RETROSPECTIVE STUDY
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AIMS: To retrospectively investigate clinical crown length changes and the development of gingival recession in the labial aspect of the maxillary and mandibular incisors associated with orthodontic treatment and relate them to the observed changes in their sagittal inclination.
SUBJECTS AND METHOD: Eighty-two consecutive subjects, treated by means of fixed orthodontic appliances in both arches and with good quality pre- and post-treatment dental casts and lateral cephalograms, were selected from the archives of a private orthodontic clinic. Incisor clinical crown length before and after orthodontic treatment, as well as the presence or absence of recession was measured on digitized study models. Sagittal inclination change was assessed on the lateral cephalograms and categorized as proclination, retroclination or no change ($±1°$). Spearman’s correlation coefficient and one-way analysis of variance were used for analysis.
RESULTS: The mean change of clinical crown length for the maxillary incisors was from ~0.24 to 0.01 mm and for the mandibular incisors from 0.06 to 0.10 mm. The inclination changes were ~1.78 and 1.03 degrees, respectively, but no correlations were observed with changes in clinical crown length. Overall, no significant differences were observed regarding clinical crown length changes and the presence of gingival recession between the proclination, retroclination and no change groups.
CONCLUSION: The change of incisor inclination during treatment did not seem to affect labial clinical crown length increases and gingival recession development in this specific sample.
EVALUATION OF ACCURACIES OF VIRTUAL PLANNING METHODS USED IN ORTHOGNATHIC SURGERY – A SYSTEMATIC REVIEW
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AIMS: The elaboration of a precise pre-surgical plan is essential during surgical treatment of dentofacial deformities. The aim of this study was to evaluate the accuracy of computer-aided simulation compared with the actual surgical outcome following orthognathic surgery reported in clinical trials.

MATERIALS AND METHOD: The search was performed in PubMed, Embase, Cochrane Library and SciELO. A total of 387 articles identified were assessed independently and in a blinded manner using eligibility criteria, out of which only 10 articles were selected for inclusion in the research. Data were presented in different ways: intraclass correlation coefficient, linear and angular differences in three dimensions and percentage rate of alignment.

RESULTS: Comparison of the accuracy analyses for the examined method showed an average translation < 2 mm in the maxilla and also in the mandible (in all three planes). The accuracy values for pitch, yaw and roll (°) were <2.75, <1.7 and <1.1 for the maxilla, respectively, and <2.75, < 1.8 and < 1.1 for the mandible. Six studies combined dental model scans with dentofacial scans and found good accuracy values as well. Currently, the most often used software for three-dimensional virtual planning is SimPlant (Materialise) and Dolphin (Dolphin Imaging, USA).

CONCLUSION: Virtual planning appears to be an accurate and reproducible method for orthognathic treatment planning.

A NOVEL METHOD FOR THE TREATMENT OF CLASS III MALOCCLUSION IN GROWING PATIENTS
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AIMS: To evaluate the dentoskeletal and profile soft tissue effectiveness of a novel protocol in growing participants with retrogrowthic maxillae.

SUBJECTS AND METHOD: Fourteen growing participants (7 males, 7 females; 12.05 ± 1.09 years), who displayed Class III malocclusions with retrogrowthic maxillae, were recruited. Cone beam computed tomographic (CBCT) scans were taken before commencing treatment. All participants had a hybrid micro-implant supported rapid maxillary expansion (Meterminate) appliance that was activated by the alternating rapid maxillary expansion and constriction (Alternating Rapid Maxillary Constriction – Alt-RAMC) protocol for 9 weeks. Full-time bone-anchored Class III elastics, delivering a force of 400 g/side, were then used for maxillary protraction. When a +2 mm overjet was achieved, protraction ceased and a CBCT scan was taken. Linear and angular cephalometric variables were blindly measured. In addition, three-dimensional (3D) colour mapping superimposition using the cranial base as a stable structure was undertaken.

RESULTS: The maxilla significantly protracted (SNA: 1.87° 1.06°; Vert.T-A: 3.2 1.54 mm P < 0.001), while the mandibular base significantly redirected posteriorly (SNB: −2° + 0.85°, Vert.T-B: −3.43 4.47 mm, P < 0.0001). The upper incisors were significantly proclined (+2.98° 2.71°, P < 0.05), coupled with a significant retroclination of the lower incisors (−3.2° 3.4°, P < 0.05). The combined skeletal and dental effects significantly improved the overjet (5.62 1.36 mm, P < 0.001) and the soft tissue Harmony angle (2.7° 1.8°, P < 0.001). 3D colour mappings showed that most patients had positive (outward) movement in the anterior maxillary region (12:14) and in the zygomatic processes (10:14). The changes in the anterior mandibular region showed a negative (inward) movement (12:14) or no changes were noticed after treatment (2 participants). There were small individual differences in the left and right condyles, but all participants showed a negative (inward) change on the anterior surfaces. The soft tissues in the upper lip region showed positive changes for all participants but one subject had considerable improvement.

CONCLUSION: Class III elastics combined with the Alt-RAMC activation protocol of the MARME appliance, is an efficient treatment method for mild/moderate Class III malocclusions. The long-term stability of these changes needs further evaluation.

DOES FLUORIDE CONCENTRATION IN THE HAIR AND BIG TOENAILS CORRELATE WITH THE DEGREE OF ROOT RESORPTION?
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AIMS: To correlate fluoride (F) level in hair and big toenail clipping samples with the level of fluoride (F) in drinking water, and the degree of root resorption when heavy and light orthodontic forces are applied for 4 weeks and after 8 weeks of retention.

SUBJECTS AND METHOD: Forty eight participants were selected, 24 (15.2 ± 2.5 years) were residents of Isparta city with a F concentration in the drinking water above 2 ppm, and 24 patients (15.2 ± 0.9 years) were from the city of Samsun which has a low F concentration (≤0.05 ppm) in the drinking water. Toenail clippings and hair were collected for blind analysis of their F concentration. Each group were randomly subdivided into two balanced subgroups: groups (HFL-HF) and (LFL-HF) who received a high buccal tipping orthodontic force (HF) of 225 g, and (HFL-LF) and (LFL-LF) who received 25 g of low buccal tipping orthodontic force (LF). Forces were applied bilaterally for 28 days; then the maxillary left premolars were extracted while the maxillary right first premolars were retained for an additional 8 weeks and then extracted at day 84. Extracted teeth were scanned with microcomputed tomography for volumetric assessment of the orthodontically induced inflammatory root resorption. Data was analysed using the Mann-Whitney and Spearman’s rank tests.

RESULTS: The mean F concentrations collected from toenail clippings (2.34 ± 1.19 mg/Kg, CI 95%) and hair samples (0.24 ± 0.16 mg/Kg, P = 0.004) of the residents of Isparta city were significantly higher (P = 0.001) than that for Samsun city, 0.98 ± 0.35 mg/Kg and 0.14 ± 0.08 mg/Kg, respectively. The difference in the degree of OIIRR between group HFL-HF and LFL-HF at day 28 was significant with the former group exhibiting the least OIIRR (P = 0.032) but this was not significant at day 84 (P = 0.212). A significant positive correlation (r = 0.733; P = 0.016) between F level in toenail clippings and hair samples was observed in participants aged less than 14 years 3 months (171 months).

CONCLUSION: The findings shed the light on the use of hair and big toenail clippings as biomarker to predict patients who might be susceptible to increased root resorption. F level had a protective function as well as the ability to repair with respect to root resorption, however the reparability effect becomes irrelevant when heavy force is applied.

SP 29 COMPLIANCE ANALYSIS OF CERVICAL HEADGEAR TREATMENT: A PROSPECTIVE STUDY
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AIMS: Compliance in orthodontics is critical. The aim of this study was to evaluate compliance in children with a Class II malocclusion using cervical headgear.

SUBJECTS AND METHOD: Twenty children (12 girls; 8 boys) with a Class II malocclusion aged 8-12 years, in the mixed dentition and prior to eruption of the second maxillary molars were randomly selected. These children were instructed to wear a cervical headgear 12 hours daily for a period of 9 months. The headgears were equipped with an electronic module, which measured temperature and force every 15 minutes. The patients were made aware of this compliance-recording device at the time of appliance delivery. A single operator treated all patients, adjusting the headgear and performing follow-up visits monthly. The recorded values were exported from the electronic modules onto an Excel spreadsheet. They were analyzed to determine the number of days the headgear was used, the number of hours per day it was worn, and the percentage of compliance (100% equating to 12 hours a day).

RESULTS: The average treatment period was 8.4 months with 5.8 months of effective use and 2.6 months of lack of collaboration (30% of the time). When effectively used, headgear was worn 8.7 hours a day instead of the prescribed 12 hours (compliance was 73% on average). Taking into account the days where it was not worn, compliance dropped to 6.2 hours (52%). There was a systematic drop of compliance during the third and fourth month of wear, which corresponded to the summer period for most children, indicating a very low compliance during vacations. No significant differences were found between boys and girls with regard to compliance during the study period.

CONCLUSION: The average compliance with cervical headgear use was on average 8.7 hours daily when the headgear was worn, despite a 12 hours prescription. The headgear was effectively used only 5.8 months over
the study period, with roughly 30 per cent of days in which the headgear was not used. During the summer period compliance was particularly poor.

SP 30  ROLE OF COMPLIANCE ON MOLAR DISTALISATION USING CERVICAL HEADGEAR: A PROSPECTIVE STUDY
Luis Huanca Guislanzoni, Sofian Ameur, Gregory Antonarakis, Stavros Kiliaridis, Department of Orthodontics, University of Geneva, Switzerland

AIMS: To test the importance of compliance as a factor related to the amount of distalisation of the upper first molars in children with a Class II malocclusion using cervical headgear.
SUBJECTS AND METHOD: Twenty children (12 girls; 8 boys) with a Class II malocclusion aged 8-12 years, in the mixed dentition and prior to eruption of the second maxillary molars were randomly selected. After obtaining their agreement, they were instructed to wear a cervical headgear 12 hours daily for a period of 9 months. Impressions for maxillary models were taken one week before placing the headgear (T0) and just after band removal (T1). The upper dental casts (T0 and T1) were scanned using a laser scanner and superimposed using a mushroom area including the palatal rugae and the medial part of the palatal vault. Distalisation of the upper first molars was assessed as the linear difference between the vestibular-mesial cusp of the first molars at T0 and T1. The headgears were equipped with an electronic module, which measured temperature and force every 15 minutes. The molar distalization was related to the time the appliance was used by linear regression analysis.
RESULTS: The average net distalisation of the upper first molars was 1.1 mm (SD: 1.1). The average duration of headgear therapy was 8.4 months with 70 per cent of the time when the appliance was used at least a few hours during the day, and 30 per cent where the headgear was not used at all. The R2 value of correlation between distalisation and hours of use was 27 per cent, while that between distalisation and days of use was 38 per cent. No significant differences were found between boys and girls with regard to the amount of distalisation and compliance.
CONCLUSION: The total amount of distalisation of the upper first molars is mildly correlated to compliance and total time of use. Other factors may influence the amount of distalisation.

SP 31  LINGUAL ORTHODONTICS, THE INVISIBLE TRUTH!
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AIMS: Despite being available for over 40 years, it is perhaps only in the last 10 years or so that lingual appliance therapy has entered the mainstream and become a viable treatment option in orthodontics. Lingual appliances allow the correction of tooth malposition through fixed orthodontic appliances bonded to the lingual/palatal tooth surfaces. This technique presents a significantly better aesthetic appearance when compared with conventional orthodontic treatment. This review outlines the developments of lingual orthodontics as well as problems encountered with traditional lingual techniques. It also describes how the introduction of fully-customized lingual appliances has helped overcome many of the issues with the conventional lingual appliances. The aim of this presentation was to review the literature regarding: 1. Current developments in lingual orthodontics. 2. Favourable and unfavourable cases for lingual orthodontics. 3. The types of lingual appliance systems available along with their advantages and disadvantages.
MATERIALS AND METHOD: The literature was reviewed using Medline, Embase and Web of Science databases including all studies up to November 2017. The search terms included the following keywords: ‘lingual appliance treatment’, ‘lingual brackets’, ‘lingual orthodontics’ and ‘invisible orthodontics’. Only articles published in English were included. First, the titles were sorted to identify relevant papers, then the abstracts of these papers were subsequently reviewed and full text articles of relevant papers were analysed.
RESULTS: The results revealed eight broad types of lingual bracket systems, which were presented in two categories, conventional and self-ligating brackets. The bracket systems were also studied in detail identifying the mode of positioning, as well as comparing their advantages and disadvantages.
CONCLUSION: This review has revealed improved technology in the construction of the brackets and improved bonding techniques have made the use of lingual appliances more user-friendly with predictable results.
SP 32  CORRELATION BETWEEN SEVERITY IN OBSTRUCTIVE SLEEP APNOEA AND LATERAL CEPHALOMETRIC ANALYSIS FOR JAPANESE MALES AND FEMALES
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AIMS: Epidemiological studies have found that not only obesity but also craniofacial morphology are critical factors associated with the development or severity of obstructive sleep apnoea (OSA) especially for Asian people. While subjects in most previous studies on OSA have been male, a few studies have suggested that the demographic characteristics of OSA patients may differ between male and female, indicating the need for further epidemiological and clinical research. The purposes of this clinical investigation were to assess the influence of obesity, craniofacial morphology and gender on the degree of OSA in Japanese individuals.

SUBJECT AND METHOD: One hundred and twelve Japanese adult patients (56 males, 56 females) with the chief complaints of snoring and apnoea. Lateral cephalograms were taken at the first visit, and overnight polysomnography was carried out for evaluation of each subject before treatment. Based on body mass index (BMI) value and age, the patients were divided into three and two groups, respectively. Spearman’s rank-correlation coefficient was determined to identify factors affecting the severity of OSA on each group.

RESULTS: There were significant positive correlations between the apnoea-hypopnoea index (AHI) and BMI, vertical, anteroposterior position of the hyoid bone and tongue area in all subjects. In terms of degree of obesity, in both males and females, there was a significant positive correlation between AHI and hyoid bone position only in the mildly obese group. However, no correlation between AHI and hyoid bone position was found in the standard and severe obese groups. By age group, there were few parameters correlated with AHI in females under 50 years old.

CONCLUSION: BMI and certain cephalometric parameters might serve as significant predictors of OSA in Japanese patients. It is suggested that the characteristics of OSA pathology differed depending on gender, degree of obesity and age.

SP 33  NEGATIVE EFFECTS IN THE TREATMENT OF IMPACTED UPPER CENTRAL INCISORS
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AIMS: To systematize the negative effects accompanying the treatment of impacted upper central incisors

SUBJECTS AND METHOD: The selection criteria for the patients involved in the study were: 1. A delayed eruption of an upper central incisor for more than 1 year of its physiological eruption; 2. Eruption of the same tooth on the contralateral side; 3. Patients not affected by malformations and syndromes that cause dental impaction. The documentation of an orthodontic practice for a period of 12 years was reviewed. Of the total number of 3900 examined patients, 14 individuals were identified as requiring orthodontic help due to a delayed eruption of the upper first incisor. Dental pantomograms of patients with this problem were investigated. The causes of retention in two groups were systematized: group I: Early childhood trauma before 4 years of age in the region of central primary incisors; group II. The presence of one or more mesiodens aligned in a correct or incorrect position.

RESULTS: From the analysis of photographs taken during treatment and biometric analysis, the following negative effects were found: 1. Presence or lack of space for the upper central incisor. 2. Position of the upper central incisor - correct or incorrect. 3. Degree of root formation as a determining factor for the deformation - complete or incomplete root development. 4. Position of the frenulum of the upper lip - changed or not. 5. Location of the eruption of the upper central incisor dystopic or not. 6. Shape of the crown - correct or incorrect. 7. Dimensions - in a vestibulo-lingual direction or in a mesio-distal direction of the upper central incisor. 8. Time of eruption of the tooth. 9. Gingival margin of the incisor - regular or malformed. 10. Ankylosis of the impacted upper central incisor.

CONCLUSION: The causes of retention of the first upper incisor have been systematized. Systematic problems are encountered in introducing the upper central incisor into the right position in the dental arch.
SP 34  SURVIVAL AND SUCCESS OF TOOTH AUTOTRANSPLANTATION USING THREE-DIMENSIONAL PRINTING OF SURGICAL TEMPLATES FACILITATED BY CONE BEAM COMPUTED TOMOGRAPHY
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AIMS: To prospectively evaluate the survival and success rates of autotransplanted teeth during a follow up period of up to 8 years for a technique using three-dimensional (3D) printing of surgical templates aided by cone beam computed tomography (CBCT)

SUBJECTS AND METHOD: Sixteen consecutive patients who had a total of 18 autotransplanted teeth between 2009 and 2017 were followed up clinically and radiographically. The mean age at autotransplantation was 13 years 2 months (standard deviation 4 years 2 months). Follow-up was for up to 8 years 9 months with a mean of 4 years 10 months (standard deviation 2 years 9 months). Fourteen premolars, three supplemental laterals and one canine were transplanted. The survival rate was defined as the percentage of transplanted teeth still present during examination. The success rate was defined as the percentage of transplanted teeth meeting the following criteria: 1) No progressive root resorption 2) Healthy periodontal tissues and 3) No abnormal mobility.

RESULTS: The survival rate was 94.4 per cent and the success rate 77.8 per cent. The reasons for autotransplantation were trauma (11 teeth), hypodontia (2), macrodontia (2), hypodontia with supplemental lateral incisor (1) and transposition (1)

CONCLUSION: This finding shows a high rate of survival and success in autotransplanted teeth using this technique. Pre-operative CBCT allows for careful assessment of the recipient site and construction of a 3D surgical template, which is a replica of the donor tooth, to prepare the recipient site. This procedure greatly reduces the extra-oral time of the transplant. Wherever possible, autotransplants should be considered in growing patients as they offer significant advantages over other restorations, for example, by maintaining the periodontal ligament, alveolar bone width and height, continued alveolar bone growth, proprioception, continued eruption and may be moved orthodontically if required. After surgery, restoration and maintenance of the autotransplant is simple and cost effective.

SP 35  LONG-TERM STABILITY OF ANTERIOR OPEN BITE TREATMENT: POSTERIOR INTRUSION VERSUS ANTERIOR EXTRUSION
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AIMS: To analyze the long-term stability of treatment of an anterior open bite (AOB) by means of two non-surgical treatment alternatives: extrusion of the anterior sector using the multiloop edgewise archwire (MEAW) technique and intrusion of the posterior sector through temporary anchorage devices (miniplaques or miniscrews).

MATERIALS AND METHOD: A bibliographic review was carried out through a computerized search in the following electronic databases: PubMed, Web of Science, Embase (Elsevier, Science Direct) and Cochrane (The Cochrane Library), where all the literature published until 2016 was searched, including those articles in which a stability analysis was performed after a minimum of 1 years and a maximum of 4 years retention in adult patients treated through these two techniques.

RESULTS: In patients treated by intrusion of molars, a decrease in lower facial height was achieved, shown in a decrease of the mandibular plane. However, with extrusion of the incisors, large changes in the angle of the mandibular plane were not observed. Regarding the stability of treatment, the percentage of relapse varied between 5.59 and 21.58 per cent of the overbite achieved, without having a control of stability over a period of 4 years.

CONCLUSION: 1. Both techniques are effective for the treatment of an AOB bite but only with intrusion of the posterior sectors are skeletal changes achieved; 2. An AOB malocclusion has a low stability rate of its long-term correction regardless of the type of treatment performed. 3. To treat this malocclusion in the most appropriate way possible, it is necessary to undertake an exhaustive study of the patient attending to the possible factors. 4. Longer term studies are necessary for a more complete statistical analysis of the recurrence of these treatments. 5. There are no reliable data that show the greater or lesser effectiveness of the different retention mechanisms.
SP 36  EFFECTS OF TEMPORARY OCCLUSION BLOCKING ON POSTURAL CONTROL IN PERFORMANCE ATHLETES
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AIMS: Documentation and analysis of a temporarily created symmetrical as well as asymmetrical 1 mm or 2 mm occlusion blocking on postural control in competitive athletes.
SUBJECTS AND METHOD: Sixteen male players of a ‘1st Bundesliga’ handball team in Germany were examined. For every player the occlusion was blocked with a 1 or 2 mm thick silicone panel between the left and right premolars on one side as well as on both sides. The investigations were conducted in randomized order. In these conditions, the postural control of the participants was measured with a pressure measuring plate (GP Multisens, GeBioM, Münster, Germany). In addition to the frontal and sagittal fluctuations, the percentage changes in forefoot back-foot loads were also evaluated. The Friedman test with subsequent Wilcoxon-matched-pairs test was used for statistical evaluation, with the data also subjected to a Bonferroni-Holm correction.

RESULTS: Statistical comparison of the neutral measuring position with the respective bite blockings by the silicone panels showed no significant changes. Both, the frontal and sagittal variations as well as the forefoot-to-rear foot ratio and the percentage comparison of the load between the left and right foot remained unchanged for the measured competitive athletes.

CONCLUSION: The neuromuscular compensation mechanisms in the stomatognathic system caused by occlusion blockage appear to be well balanced and intercepted in competitive athletes and these influences have no effect on postural control. In competitive sports, this is essential in order to be able to constantly call up adequate performances of the same quality. In addition, a well-developed musculature is able to compensate sensorimotor influences in an optimal way, which can be confirmed by the present results.

SP 37  THE EFFECT OF MASSETER MUSCLE HYPOFUNCTION ON EXPERIMENTAL TOOTH MOVEMENT IN RATS
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AIMS: The level of the occlusal force may influence orthodontic tooth movement (OTM), whereby patients with a weak bite force may show a tendency to achieve quicker OTM. The aim of this study was to investigate the influence of the occlusal force magnitude on the rate of OTM.
MATERIALS AND METHOD: Ten-week old male Wistar rats (n = 16) were divided into two groups: a control group and a masseter-hypofunction group, after injection of botulinum neurotoxin type A into both right and left masseter muscles. Three days after the injection, a 10 cN nickel titanium coil spring was set between the incisors and the maxillary left first molar, and the first molar was moved mesially for 14 days. The rats were fed a soft diet (pellet powder) \textit{ad libitum}. Microcomputed tomographs were taken to measure the amount of OTM on days 0 and 14. After the rats were sacrificed, the masseter muscles were excised and weighed.

RESULTS: There was no significant difference in body weight between the two groups. However, masseter muscle weight was significantly lower in the hypofunction group (mean = 0.49, SD = 0.08) than in the control group (mean = 0.85, SD = 0.08; \( P < 0.01 \)). Concerning the amount of tooth movement, orthodontic displacement in the hypofunction group (mean = 0.45, SD = 0.11) was significantly larger than that in the control group (mean = 0.28, SD = 0.10; \( P < 0.01 \)).

CONCLUSION: In rats, the amount of OTM was increased after injection of botulinum neurotoxin type A into the masseter muscle. Masseter muscle hypofunction may facilitate orthodontic tooth displacement.

SP 38  THE ASSOCIATION OF OVERJET WITH TRAUMATIC DENTAL INJURIES: A SYSTEMATIC REVIEW
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AIMS: The objective of this review of association (aetiology) was to identify the relationship between different overjet measurements and developing a traumatic dental injury (TDI) across different dentition stages.
MATERIALS AND METHOD: This review used the Joanna Briggs Institute methodology. A three-step search strategy was performed, which included a search of four electronic databases, where studies of healthy human participants (not reported in the study as having been diagnosed presently or in the past with a disease, condition and impairment) of any age and in any dental dentition stage, were considered for inclusion. Prospective and retrospective cohort (longitudinal) studies, case-control studies and analytical cross-sectional studies were considered for inclusion. Reviews, text and opinion based articles, conference abstracts, case reports, case-series and descriptive cross-sectional studies were excluded. The third step involved screening references of included studies for identification of potentially relevant studies. Using standardized instruments, independently assessed methodological quality and data was extracted from the included studies. In situations for which there were sufficient studies, a meta-analysis was conducted using the random-effects model, supplemented with the fixed effects model in situations for which statistical heterogeneity was less than 50 per cent, which was assessed using the I2 (I-squared) statistic.

RESULTS: Three thousand six hundred and forty four papers were identified through electronic database searching. After exclusion of duplicate records, the titles and abstracts of 2843 were screened, leaving 106 for full-text assessment, of which 41 were included in the systematic review. Heterogeneity owing to methodological differences across studies precluded the inclusion of all papers into the meta-analyses. A strong and significant association was found between overjet measurements greater than 3 mm and the development of a TDI for children in the primary dentition (n = 1755; Risk ratio, 1.83; 95% confidence interval, 1.60 to 2.10; \(P < 0.00001\)). Both random- and fixed effects models produced similar results.

CONCLUSION: Children in the primary dentition with an overjet greater than 3 mm have a higher prevalence and nearly a two-fold increased risk for developing TDIs, irrespective of the mechanism of trauma.

SP 39 INFLUENCE OF MAXILLARY REPOSITIONING WITH A LE FORT I OSTEOTOMY ON NASAL CAVITY AND SEPTUM CHANGES
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AIMS: Nasal septum deviation is one of the most common complications that can develop after a Le Fort 1 osteotomy. The aim of this retrospective study was to evaluate the effects of repositioning of the maxilla with a Le Fort 1 osteotomy on the nasal cavity and septum.

SUBJECTS AND METHOD: Forty adult patients (23 females, 17 males, mean age 20.52 ± 4.4 years) with a skeletal discrepancy treated with a Le Fort I osteotomy with or without a bilateral sagittal split osteotomy. Postero-anterior and lateral cephalometric radiographs taken before surgery and at least 3 months after surgery were evaluated. Twenty-four skeletal cephalometric parameters were measured to evaluate nasal cavity, nasal septum and maxillo-mandibular changes. Deviation of the nasal septum was evaluated by angular measurements and also linear measurements were made for nasal transverse changes. All measurements were statistically analysed with a paired \(t\)-test and Pearson correlation analysis was used to calculate the relationship between variables.

RESULTS: There was no statistically significant change in the deviation parameters (\(P > 0.05\)); but a statistically significant decrease was found for left and right nasal cavity heights after surgery (\(P < 0.05\)). No significant correlation was found between septal deviation angle and extent of maxillary movement (\(P > 0.05\)). Negative correlations were found between nasal cavity width and the amount of maxillary impaction (\(P < 0.05\), \(r = -0.494\)).

CONCLUSION: Although the influence of maxillary repositioning with a Le Fort I osteotomy on nasal septum deviation was not significant, it significantly affected the nasal cavity width.

SP 40 AN INVESTIGATION OF INITIAL BOND FAILURES DURING INDIRECT BONDING OF ORTHODONTIC ATTACHMENTS: RESULTS FROM A RANDOMIZED CLINICAL TRIAL
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AIMS: To explore the characteristics of initially failed attachments during the indirect orthodontic bonding procedure.
MATERIALS AND METHOD: This data is a part of a randomized trial in which two different bonding trays were compared for the transfer accuracies of the attachments. As part of the transfer accuracy data collection all working models and patients’ arches were scanned after bracket placement with an intraoral scanner. A total of 384 brackets-tubes were prepared for indirect bonding in 16 patients. All bonding procedures were performed using a chemically cured adhesive and a tongue and cheek retractor along with high volume suction to prevent saliva contamination. Initially failed attachments were recorded after the bonding sessions. The localization of the failed attachments and the transfer accuracies of the bonded attachments neighbouring these failed attachments are described.

RESULTS: Sixteen (4.2%) of the brackets and tubes in seven patients initially failed. Two patients were particularly prominent with 5 and 4 initially failed attachments. Four of the failed attachments belonged to the incisor teeth, three to premolar teeth and nine to molar teeth. Three of the failed incisor brackets belonged to the same patient, suggesting the contamination of etched enamel which seemed possible due to the design of the retractor. Fifteen of the initially failed attachments were localized either in the most anterior or the most posterior part of the trays. Only one failed attachment had successfully bonded neighbouring attachments on both the mesial and distal sides (teeth 32 failed, but 31 and 33 were bonded in the same tray). Eight of the failed attachments were in groups of two adjacent teeth (25-26, 26-27, 41-42, 46-47). Five out of 11 bonded attachments neighbouring the terminal initial fail sites had torque problems during transfer (greater than 2°) suggesting that misfit of the bonding trays might be responsible for the initial failures.

CONCLUSION: These findings seem to agree with the common knowledge as the cause of initial bonding failures were attributed to technical issues and surface contamination. However, further studies are required order to understand specifically the reasons behind initial bond failures.

SP 41 BIOMECHANICAL ANALYSIS OF TOOTH MOVEMENT IN CASES WITH BONE LOSS AND MANDIBULAR CROWDING USING THE FINITE ELEMENT METHOD
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AIMS: In order to eliminate plaque niches remaining after periodontitis therapy caused by malpositioning of the teeth and to prevent recurrence of the periodontal infection, orthodontic treatment of pronounced crowding could be a solution. The treatment indication results from functional and aesthetic motives. The aim of this study was to investigate the biomechanical behaviour of the mandibular incisors in the presence of bone loss and crowding.

MATERIALS AND METHOD: A finite element (FE) model simulating mandibular incisor crowding of about 4 mm and bone loss of 4 to 5 mm was generated. Similarly, segmented treatment elements adapted to the situation were modelled with forces of 0.2 N per anterior tooth for alignment of the crowding. The second premolars and molars served as anchorage units. The material parameters from earlier studies for bone (homogeneous, isotropic, E = 2 GPa), tooth (E = 20 GPa) and ‘healed’ periodontal ligament (PDL) were integrated into the FE models and into the initial calculated tooth movement. The results were compared on the one hand with those of a patient model with reduced attachment but unchanged PDL and on the other with that of a patient model with morphologically healthy bones and PDL.

RESULTS: In crowded mandibular incisors the orovestibular centre of resistance (CR) of tooth 41 shifted by about 1 mm (about 10%) coronally in the presence of a bone defect compared to a model without bone defects. The initial tooth mobility was almost twice as high due to the reduced attachment. Anterior teeth with periodontal defects show higher strain (up to 65%) of the PDL, especially in the apical region. Although the teeth from the first premolar to the second molar were grouped together as anchoring units, they experienced mesializing, rotating and tilting movements.

CONCLUSION: Using very small forces (around 0.5 N/incisor) adapted to the increased tooth mobility and the consideration of the distinct different CR compared to bone-healthy patients, a periodontal overload during orthodontic treatment can be reduced or completely avoided.

SP 42 THREE-DIMENSIONAL ANALYSIS OF DENTOFACIAL EFFECTS IN THREE-DIMENSIONAL PRINTED MINIPLATES ANCHORED MAXILLARY PROTRACTION
Aims: To evaluate in three-dimension the skeletal and dentoalveolar effects of maxillary protraction using 3D printed miniplates compared with conventional facemask therapy.

Subjects and Method: Forty Class III subjects who were in the prepubertal or pubertal skeletal growth periods. In group 1, = 20 facemasks were applied from miniplates, which were designed according to the positions of the roots and tooth germs, and then three-dimensionally printed to place in the maxilla. In group 2, = 20 patients received maxillary protraction therapy with conventional facemasks. Before maxillary protraction, rapid maxillary expansion was performed in both groups. Cone-beam computed tomograms were obtained at the beginning and end of the treatment periods in both groups and analyzed.

Results: The maxilla moved forward significantly in group 1 compared with group 2 (P < 0.01). The mandible showed more clockwise rotation in group 2 (P < 0.01). Less change of the maxillary incisors and molars was found in group 1 (P < 0.01).

Conclusion: Maxillary protraction using 3D printed miniplates as anchorage produced more orthopaedic changes than the conventional method. The undesired tooth effects of conventional facemask therapy were reduced with skeletal anchorage.

Sp 43  A modified procedure of surgically assisted rapid maxillary expansion

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Aims: To examine a new protocol of preparing surgically assisted rapid maxillary expansion (SARME), in order to minimize the risks of the injury to the tooth structure and the periodontal tissues.

Subjects and Method: All 11 patients treated were free of craniomaxillofacial discrepancies. None of them have been previously treated orthopaedically and the mid-palatal sutures were fused in every subject. The preparation protocol started with bonding the Hyrax appliance, then the patient started to expand and constrict the appliance periodically for 45 days. Alternating 0.2 millimetre expansion and constriction every third day, so that the sutures are loosened by the time of maxillary surgery is the believed to be advantageous in patients before SARME. The subtotal Le Fort I was performed lege artis, except that interradicular it was not necessary to use the chisel. An unsharpened blade was sufficient to complete separation of the midline sutures, which seemed to be a less radical procedure than chiselling in that critical area. Expansion started 5-7 days postoperatively until the required width of the upper jaw had been reached. The Hyrax appliance was left in place as retention for 6 months.

Results: All patients have successfully undergone surgery following the protocol. There were no traumatic signs, and the patients seemed to have less post-operative complaints compared to those treated with the standard method.

Conclusion: The modified protocol seemed to be less invasive but as efficacious as the standard process. Postoperative inconvenience and swelling were significantly reduced but further subjective and quantitative studies are needed.

Sp 44  2017 survey of diagnosis and treatment procedures among French orthodontic practices

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Aims: To assess trends in French orthodontic practices in 2017.

Materials and Method: This study was based on the methodology of the sixth Journal of Clinical Orthodontics survey of diagnosis and treatment procedures published in 2014. The questionnaire was conducted on-line via SurveyMonkey™ and included 75 questions. E-mails were sent out to the 1087 registered orthodontists who were either members of the Société Française d’Orthopédie Dentofaciale or listed in the 2014 ‘Annuaire Dentaire’. The initial e-mail was sent out in January 2017, and two follow-up reminders were
subsequently sent in February 2017. Data were processed with the R statistical software. Medians rather than means were reported for continuous variables (cf. JCO report). Questions tried to approach new technologies introduced in orthodontics and assessed among others the following topics: accelerated orthodontics, clear aligners, skeletal anchorage, surgical-orthodontic treatments and retention. For most items of this questionnaire, orthodontists were asked whether they used ‘routinely’ or ‘occasionally’ an appliance or a procedure.

RESULTS: A total of 197 orthodontists completed anonymously the questionnaire representing a response rate of 18.1 per cent. Digital data in French offices: 62 per cent of respondents reported using cone-beam computed tomography either routinely or occasionally before treatment whereas 23 per cent used routinely intraoral digital scanners. A total of 48 per cent of the orthodontists declared using routinely or occasionally digital models. Fifteen per cent of respondents used occasionally computer generated archwires. Treatments were still performed with extraction(s) and 56 per cent reported treating between 0 and 15 per cent of their cases with extraction(s). Thirty seven per cent routinely used self-ligating brackets. Faced with the increasing demand for aesthetic treatments, each orthodontist started on average five new aligner cases and one new lingual case per year. Temporary anchorage devices (TADs) introduced a paradigm shift in orthodontics. The median number of cases treated with skeletal anchorage was however only two per specialist and 22 per cent of orthodontists inserted their TADs themselves.

CONCLUSION: This nationwide study is the first comprehensive report in its kind conducted in France. Similarly to the repeated JCO studies, future comparable surveys will allow the evolution of orthodontics being performed in France to be defined.

SP 45  OCCLUSAL CHANGES IN RELATION TO WEAR TIME MEASURED WITH A MICROSENSOR IN T-APPLIANCE ACTIVATOR TREATMENT
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AIMS: To investigate the association between occlusal changes and wear time of the T-appliance activator. The hypothesis: ‘patients with good compliance achieve more change in occlusion compared to patients with poor compliance’ was tested. Influencing factors such as gender, age and location were also investigated.

MATERIALS AND METHOD: Data were collected from two orthodontic practices in the Netherlands. The study sample comprised 172 Class II patients with a mean age of 11.64 (± 1.00) years at start of treatment. All patients were treated with a T-appliance activator in combination with a micro-electronic chip (Theramon) to assess compliance in term of wear time per day. Occlusion at the beginning of treatment was scored on three-dimensional scans or digital photographs, and occlusion at the end of the active treatment was obtained from the patient records. The difference in occlusion was measured and compared to wear time by means of a ‘response to treatment factor’.

RESULTS: Patients with an average wear time of more than 9.00 hours per day achieved more change in occlusion compared to those with an average wear time equal to or less than 9.00 hours per day. A statistically significant difference was found between the change in occlusion in males and females. There was a statistically significant negative correlation between age and wear time. Patients treated in a rural area had a higher compliance compared to those treated in an urban area.

CONCLUSION: Patients with good compliance (average wear time >9.00 hours/day) during treatment with a T-appliance activator achieved a more favourable change in occlusion compared to those with poor compliance (average wear time ≤ 9.00 hours/day). Older subjects showed less compliance compared to younger patients in terms of wear time. Females showed a higher amount of average wear time per day compared to males. Patient compliance was higher in rural areas compared to urban areas.

SP 46  EFFECTS OF RAPID MAXILLARY EXPANSION: HYRAX TWO BANDS VERSUS HYRAX FOUR BANDS VERSUS BONDED ACRYLIC EXPANDER
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AIMS: To compare the effects of rapid maxillary expander (RME) treatment with three types of expansion appliances on the midpalatal suture, incisors and maxillary intermolar distance in adolescents in the mixed or permanent dentition with maxillary constriction.

SUBJECTS AND METHOD: A prospective observational cohort analytical study was performed. Eleven patients (male and female) who exhibited a need for expansion were enrolled in the study with an age range between 7 and 15 years (mean: 10.45 ± 2.84 years). The patients underwent treatment that consisted of a RME; four with a two band Hyrax expander, three with a four band Hyrax expander and four treated with a bonded acrylic expander. All patients underwent radiological and orthodontic examination, with the following measurements: maxillary intermolar distance, width of the interincisal diastema and assessment of the opening of the midpalatal suture, at baseline (T0) and at 7 (T1), 14 (T2) and 21 (T3) days of RME.

RESULTS: The midpalatal suture was always open before the expansion began and there was a gradual increase of this opening during palatal expansion. The midpalatal suture opened with a triangular pattern with the base on the front for the three types of expansion appliances. The increase in the opening of the midpalatal suture was always accompanied by an increase of the interincisal diastema to at least T2 for the three types of expansion appliances. There was less recurrence at the interincisal diastema level for the two band Hyrax than the four band Hyrax and bonded acrylic expander (P < 0.05). There was greater expansion with the two band Hyrax at the level of the maxillary intermolar distance than with four band Hyrax and bonded acrylic expander and more relapse for the four band Hyrax from T3 (P < 0.05).

CONCLUSION: RME has always been effective in opening the midpalatal suture. In general, the Hyrax (two band) showed less relapse at the level of the interincisal diastema than the Hyrax (four band) and bonded acrylic expander. There was greater expansion with the Hyrax two bands at the level of maxillary intermolar distance than with Hyrax four bands and bonded acrylic expander.

SP 47 DENTOSKELETAL LONG-TERM SIDE EFFECTS OF MANDIBULAR ADVANCEMENT DEVICES IN OBSTRUCTIVE SLEEP APNOEA PATIENTS: A SYSTEMATIC REVIEW WITH META-REGRESSION

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AIMS: To identify in a systematic review with meta-regression the dental and skeletal long-term side effects of mandibular advancement device (MAD) therapy and to evaluate the influence of time.

MATERIALS AND METHOD: An electronic search was performed in Medline, Cochrane Database of Systematic Reviews, Google Scholar Beta, ISI Web of Knowledge, Scopus and Lilacs to select randomized controlled trials and cohort studies investigating dental and/or skeletal side effects in adult patients wearing a MAD for obstructive sleep apnoea or snoring treatment for at least two years. The quality of evidence was evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE). For each study included and for each dental and/or skeletal parameter, the mean difference and 95 per cent confidence interval was calculated between baseline and follow-up.

RESULTS: Twenty studies with a follow-up between 2 and 11 years were included. The side effects identified were a decrease of overjet, overbite and upper incisor inclination, and an increase of lower incisor inclination, ANB and anterior face height. Meta-regression analysis showed that the side effects were influenced by the therapy duration for all parameters (P < 0.05). According to GRADE, the quality of evidence was moderate for all the outcomes except for lower incisor inclination which was low.

CONCLUSION: MAD therapy produced both dental and skeletal side effects which are influenced by the duration of therapy. The dental side effects could be clinically relevant, while the clinical importance of skeletal side effects seems to be questionable. Since the side effects are progressive, patients need to be continuously monitored over time.

SP 48 TEMPOROMANDIBULAR JOINT CHANGES IN SKELETAL CLASS II PATIENTS WHO UNDERWENT ORTHOGNATHIC SURGERY: SYSTEMATIC REVIEW WITH META-ANALYSIS

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AIMS: To conduct a systematic review with meta-analysis to assess if skeletal Class II patients who underwent orthognathic surgery with mandibular advancement surgery results in temporomandibular disorders determined by condylar resorption.

MATERIALS AND METHOD: A literature search was performed using the electronic databases PubMed, Web of Science, Cochrane Library, Google Scholar and Embase. Inclusion criteria were systematic reviews published in English between January 2007 and September 2017, performed on skeletal Class II patients aged more than 18 years who underwent bilateral sagittal split osteotomy (BSSO) with mandibular advancement surgery. The electronic search identified 908 publications. Three publications fulfilled the inclusion criteria and were included in this meta-analysis. Qualitative assessment of the selected studies was performed using the Critical Appraisal Skills Programme checklist.

RESULTS: Three systematic reviews were included in this review. Despite its low incidence all studies reported condylar resorption. However, there were methodological limitations in all assessed articles.

CONCLUSION: Condylar resorption should be taken into account as a potential post-surgical complication after BSSO with mandibular advancement surgery.

SP 49 THREE-DIMENSIONAL EVALUATION OF FACIAL ASYMMETRY IN PATIENTS WITH HEMIFACIAL MICROsomia USING STEREOPHOTOGRAMMetry

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AIMS: To propose a non-invasive and accurate technique to objectively quantify soft tissue asymmetry, globally and topographically, in young patients with different degrees of hemifacial microsomia, using stereophotogrammetry.

SUBJECTS AND METHOD: Twelve patients (mean age 13.1 ± 3.3 years) and 15 healthy controls (mean age 12.2 ± 3.5 years). All subjects were imaged with a three-dimensional (3D) photogrammetric face scanner in a natural head position and each 3D photograph was processed using specific software; then the original image was duplicated in a mirror version by reflecting along an arbitrary plane outside of the face. To measure the level of asymmetry, the original and the mirror images were overlapped by a superimposition technique in order to minimize distances between the two surfaces. Root mean square error (RMSE) was chosen as reference variable and was calculated for the whole facial surface and for each trigeminal third; to improve the selection of facial thirds a set of 16 landmarks was manually digitized on 3D images. Furthermore, colour maps were elaborated for each subject to obtain a visual representation of asymmetry level and distribution. After a 2 weeks interval, the same operator repeated RMSE measurements and landmarks digitizing process in 11 subjects randomly selected. Statistical analysis was undertaken to check differences in gender and age distribution between the samples, to measure intra-operator repeatability and to assess statistically significant differences when comparing each facial area investigated.

RESULTS: Mean RMSE values increased with the amount of asymmetry, reaching the highest levels in the lower third, in both groups. Statistically significant differences were found in the comparison of RMSEs for each facial area, within the same group and also among patients and controls. High levels of intra-operator repeatability were found.

CONCLUSION: This technique appears to be effective in providing a non-invasive and accurate topographic analysis of facial asymmetry. Although further studies should be carried out to achieve a standardized method, stereophotogrammetry could be a useful device to improve the management of craniofacial asymmetric pathologies such as hemifacial microsomia.

SP 50 VOLUMETRIC ANALYSIS OF ROOT RESORPTION AND BONE REMODELLING FOLLOWING TOOTH MOVEMENT IN MICE USING MICROCOMPUTED TOMOGRAPHY

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AIMS: Orthodontic tooth movement is associated with bone remodelling and root resorption. Traditionally, these phenomena were assessed employing two-dimensional (2D) histology. Nowadays, microcomputed tomography (µCT) allows analysis of the true volumetric changes. The aim of the study was (a) to develop a method for quantification of root resorption and bone remodelling, and (b) to assess, to what extent such root resorption and bone remodelling are correlated.

MATERIALS AND METHOD: In 22 mice, a coil-spring was inserted between the upper first left molar and the canine, whereas the right molar served as the control (split mouth design). At 11 days of protraction, the animals were killed, and the jaws were scanned using µCT. Image processing was performed using Amira: The volumes were cropped at the test and control sites. The teeth were segmented semi-manually using the watershed algorithm, and the data sets were aligned with respect to the cemento-enamel junction (CEJ). The palatal, distal, and mesial roots were separated 36 voxels below the CEJ and the respective volumes were calculated. To assess bone remodelling, a volume of interest (VOI) with a width of 10 voxels located adjacent to the roots was defined, and the amount of calcified tissue was measured within this VOI. Statistical analyses were performed using R: A paired t-test was used to compare the root volumes at the test and control sites. Additionally, a quotient was calculated from the bone and the root volume and tested for linear association by means of a linear regression analyses. The results were found significant at \( P < 0.05 \).

RESULTS: A significant loss of root volume [95% CI: \((-0.11, 0.03)\) mm\(^3\)] due to resorption was found in the mesial roots at the test sites compared to the control sites (\( P < 0.001 \)). Linear regression analyses revealed a significant association between the bone fraction and root volume (\( R^2 = 0.84, P < 0.001 \)).

CONCLUSION: µCT analyses provide quantification of root and bone volume fractions. The comparison between test and control sites allowed comparison between test and control sites, and thus for changes following orthodontic tooth movement. Root and bone resorption were found to be correlated.

SP 51  OPTIMAL INSERTION ANGLE AND POSITION FOR ORTHODONTIC MINI-IMPLANTS IN THE ANTERIOR PALATE – A CONE BEAM COMPUTED TOMOGRAPHIC STUDY IN HUMANS
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AIMS: Orthodontic mini-implants are used to provide extra anchorage for orthodontic appliances. Frequently, the implants are placed in the anterior palate owing to the low risk of iatrogenic trauma to adjacent anatomical structures and due to sufficient bone quality. Despite high success rates, anchorage loss can occur whenever implants become loose. Thus, implants should be placed at locations of sufficient bone quality. The aim of the present study was to identify an optimal insertion angle and position for orthodontic mini-implants in the anterior palate.

MATERIALS AND METHOD: Maxillary cone beam computed tomographic (CBCT) scans from 30 patients (m/f: 8/22, age: 18.6 ± 12.0 years) were analysed. To assess the maximum possible length of an implant, a 25-reference point grid was defined: Five sagittal slices were extracted along the median plane, and bilaterally at 3 and 5 mm distance, respectively. Within each slice, five dental reference points were projected to the palatal curvature at the contact point between the canine (C) and first premolar (PM1), mid of PM1, between PM1 and PM2, mid of PM2, and between PM2 and the first molar (M1). Measurements were conducted at \(-30, -20, -10, 0, 10, 20\) and \(30\) degrees to a vector placed orthogonal to the palatal curvature. Statistical analysis was conducted with R using a random-effects mixed linear model and a Tukey-post-hoc test with Holm correction.

RESULTS: High inter-individual variability was detected. Maximum bone heights were detected within a T-shaped area at the mid of PM1 and contact point PM1-PM2 (\( P < 0.01 \)). Within the anterior region, a posterior tipping was advantageous, whereas in the posterior regions, an anterior tipping was beneficial (\( P < 0.01 \)). At the mid of the median plane, tipping did not reveal a significant influence.

CONCLUSION: Within the limits of the study, optimal insertion positions were found within a T-shaped area at the height of PM1/PM2 in the anterior palate. For paramedian implants, anterior or posterior tipping appeared beneficial. High inter-individual variation was found and should be considered carefully by the clinician.

SP 52  THE EFFECTIVENESS OF A REMINERALISING PASTE ON THE REGRESSION OF EARLY CARIES AFTER ORTHODONTIC FIXED APPLIANCE TREATMENT; A RANDOMIZED 12-MONTH FOLLOW-UP CLINICAL TRIAL
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AIMS: To evaluate the long-term effect of MI-Paste-Plus® versus a placebo paste on remineralisation of enamel after fixed orthodontic treatment over a 12-months period.

SUBJECTS AND METHOD: Patients with subsurface lesions scheduled for removal of the appliance were included, and randomly allocated to a test or control group. They either applied MI-Paste-Plus® (N = 35), or a control paste (N = 30) once a day at bedtime for 12 months, complementary to normal oral hygiene. Changes in enamel lesions were determined by quantitative-light-induced-fluorescence assessing fluorescence loss and lesion area. Microbial composition was determined by conventional plating.

RESULTS: Fifty one patients were analysed; (N = 25) in the test group versus (N = 26) in the control group; Data loss 36 N = 14). There were no significant differences between the groups over time for all the used outcome measures. There was a significant improvement in enamel lesions (fluorescence loss) over time in both groups, with no differences between groups.

CONCLUSION: The additional use of MI-Paste-Plus® in patients with subsurface enamel lesions after orthodontic fixed appliance treatment did not improve these lesions at one year following debonding.

SP 53 RELATIONSHIP BETWEEN NATURAL HEAD POSTURE AND ANTERIOR DENTAL ALVEOLAR MORPHOLOGY
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AIMS: To investigate anterior dental alveolar morphology in relation to natural head position.

MATERIALS AND METHOD: Fifty lateral radiographs in the natural head position of subjects with a Class I malocclusion. Nine cranio-cervical and 30 dental alveolar variables were measured. The relationship was analyzed by Pearson correlation analysis.

RESULTS: A statistically significant correlation was found. Negative correlations were observed between overbite and head posture, and positive correlations existed between the upper and lower dental alveolar structures and head posture.

CONCLUSION: Flexion and extension of the head affects anterior dental alveolar morphology and craniofacial structures.

SP 54 CLASS III SUBJECTS – CHANGES IN SKULL PARAMETERS
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AIMS: To detect age-related change intensity in the facial and cerebral parts of the skull of Class III children as well as to detect skull morphological structures different from their normal growth intensity during the mixed dentition period.

MATERIALS AND METHOD: Measurements on the lateral radiographs of 60 patients (10 longitudinal and 10 vertical) of the cerebral and facial parts of skull of 45 children (9-12 years old) during mixed dentition and 15 children (12-16 years old).

RESULTS: The intensity of age-related changes of most vertical and longitudinal parameters of the skull was significantly different from normal.

CONCLUSION: Patients with Class III malocclusion must be treated as early as possible.

SP 55 2542 COMPLETED AUDIT CYCLE ON TUBE AND BRACKET FAILURES IN A DISTRICT HOSPITAL ORTHODONTIC DEPARTMENT
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AIMS: To quantify failure rate following placement of fixed appliances and to identify adjustments in materials and techniques to reduce the failure rate.

MATERIALS AND METHOD: Gold standard set: No more than 6 per cent of tubes and brackets should fail. A first round audit gathered data from 97 patients with a total of 1518 tubes and brackets placed. The number of tube
and bracket failures was recorded. The second round audit gathered data from 121 patients with a total of 1606 tubes and brackets placed. The number of tube bracket failures was recorded. The first round audit involved the use of self-etch primer (SEP) for bonding bracket and tubes and the second round audit intervention involved changing the SEP to separate etch 37 per cent phosphoric acid, bond and composite.

RESULTS: The failure rate in the first round was 8.0 per cent. In the second round, after intervention, the failure rate was 6.7 per cent.

CONCLUSION: Overall the 6 per cent standard was not met. The main reason for failure was unknown; when patients were asked how or why their brackets or tubes had debonded they were unable to provide a definitive answer. The second most common reason for failure was due to trauma mainly caused by eating, although during the consent process all patients were warned of hard and/or sticky foods they should avoid, not all patients complied with these dietary restrictions. The third reason for failure was due to clinical failure, possibly due to lack of moisture control leading to salivary, water or blood contamination. Poor bonding technique with SEP and incorrect and/or inadequate light curing of the orthodontic brackets and tubes which were pre-coated with composite can compromise the bond between the enamel and the orthodontic bracket or tube. Further investigation or interventions are required to ensure bracket and tube failure rates are decreasing. The interventions can include changing the brackets which may further help to reduce the bracket failure rate or testing and renewing the light cure to ensure that there is adequate intensity.

SP 56  PATIENT NEEDS CONE BEAM COMPUTERISED TOMOGRAPHY AND SURGERY...HOW LONG? LET'S SEE...
Kirpal Benawra, Craig Dunbar, Department of Orthodontics, Forth Valley Royal, Larbert, U.K.

AIMS: To assess the time from new orthodontic patient (NOP) appointment to surgery for impacted teeth and to compare the difference in time from NOP appointment to surgery, between patients requiring cone beam computed tomography (CBCT) and not requiring CBCT. A further aim was to note the incidents of pathology reported on CBCTs.

MATERIALS AND METHOD: Data was gathered from 94 patients (36 males, 58 females) requiring surgery identified from joint clinics. The included details were: age, gender, surgery carried out, NOP appointment date, joint clinic appointment date, surgery date, CBCT taken and pathology noted on CBCT.

RESULTS: On average a total of 32 per cent of patients waited < 18 weeks for surgery. The average percentage of patients not requiring CBCT who waited less than 18 weeks for surgery was 36. For patients requiring CBCT it was 0 per cent. On average the total number of weeks from NOP clinics to surgery was 23. For patients not requiring CBCT the average was 20 weeks and for those requiring CBCT it was 45 weeks.

CONCLUSION: The standards were not met. On average approximately 1 in 3 non-CBCT patients received surgery within 18 weeks. On average non-CBCT patients waited for 20 weeks to receive surgery. No patients requiring CBCT had surgery within 18 weeks.

SP 57  ORTHODONTIC EXTRUSION TO REGENERATE THE INTERDENTAL PAPILLA
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AIMS: To evaluate, through a literature review, the regeneration of the interdental papilla with dental extrusion.

MATERIALS AND METHOD: A bibliographic search was carried out in PubMed/Medline using the following keywords: ‘extrusion AND interdental papilla’, ‘extrusion AND periodontal disease’, ‘orthodontic extrusion AND periodontium’, and by manual search. Articles that mentioned slow extrusion for the recovery of the interdental papilla and slow extrusions of central incisors were included and those that referred to forced extrusions due to root fractures for subsequent placement of implants, restorations due to caries, or iatrogenic perforations were discarded.

RESULTS: Twenty four articles were selected showing that the levels of interproximal alveolar bone and papilla increased significantly with slow dental extrusion. The distance between the crest of bone and the interproximal contact point was related to the presence of the interdental papilla. Another important result was the link between speed and force in tooth movement.

CONCLUSION: Slow extrusion is an effective method for regeneration of the interdental papilla but even so, more case studies where this technique is applied are necessary.
SP 58 ‘LONG FACE’ FAMILY RELATIONS
Barbara Bimler, Private Practice, Wiesbaden, Germany

AIMS: Assessment of facial type in siblings.

SUBJECTS AND METHOD: Eighty one randomly selected vertical facial type subjects, and their sibling. Vertical was defined according to the Bimler Cephalometric Analysis with the facial height (FH-M) exceeding facial depth (A-TM).

RESULTS: Thirteen had a horizontal type and 19 a neutral facial type sibling. The other 49 also had a vertical face type sibling.

CONCLUSION: Facial growth type seems to be a rather dominant family feature.

SP 59 GINGIVAL RECESSION AND INCISOR CLINICAL CROWN LENGTH CHANGES ASSOCIATED WITH ORTHODONTIC TREATMENT: A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: To systematically investigate and appraise the quality of the available evidence regarding gingival recession prevalence and magnitude, as well as incisor clinical crown length changes during orthodontic treatment.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data on gingival recession prevalence and magnitude, as well as incisor clinical crown length changes before and after orthodontic treatment, and from case-control studies, were reviewed. Relevant information was extracted, methodological quality was evaluated using the instrument developed by the Effective Public Health Practice Project and the random effects model was used to combine the retrieved data.

RESULTS: Nine studies following patients for up to 6 years after orthodontic treatment were finally identified. Orthodontic treatment seemed to increase the odds for a patient to exhibit gingival recession, in at least one tooth, compared to before treatment. Also, orthodontic treatment seemed to increase the odds for a patient to exhibit gingival recession, in at least one mandibular incisor, compared to before treatment or the untreated controls. Moreover, clinical crown length increased after orthodontic treatment [weighted mean difference (WMD): 0.10 to 0.50 mm] and during retention [WMD: 0.67 to 0.95 mm], however, in general no differences were noted between the group that underwent proclination compared to the non-proclination group.

CONCLUSION: The present systematic review and meta-analysis showed that some increases in gingival recession prevalence may be encountered after orthodontic treatment. Moreover, although clinical crown length increases during orthodontic treatment and retention, overall no statistically significant differences were noted between incisors having undergone proclination compared to the non-proclination group. More studies of high quality are needed in order to further elucidate possible associations.

SP 60 CAN LATERAL CEPHALOGRAMS REPLACE CONE BEAM COMPUTED TOMOGRAPHY TO ASSESS THE THICKNESS OF THE PALATAL VAULT
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AIMS: To determine the correlation between palatal vault thickness measured on cone beam computed tomography (CBCT) scans and on lateral cephalograms in orthodontic patients, and to assess if cephalograms assure a safe insertion of miniscrews in the palate.

MATERIALS AND METHOD: This retrospective observational study was based on baseline CBCT scans and cephalograms of 45 orthodontic patients (age 11-16 years) with Class I malocclusion, overjet <5 mm, and crowding treated with pre-adjusted fixed appliances and premolar extractions between March 2005 and June 2008. CBCT slices were selected in the median sagittal plane and four parallel planes 2, 4, 6 and 8 mm on left
Palatal thickness was measured in an anterior-posterior direction at seven locations 2 mm apart on both CBCT slices and cephalograms in the FACAD program. The CBCT slices and cephalogram of each subject were matched using reference structures (palatal plane, edge of central incisors) and all images were calibrated. The calculation of range, means, standard deviations, differences in thickness and Pearson correlation were performed with Microsoft Excel.

RESULTS: The average palatal thickness was largest in the anterior lateral region (mean 13.2 ± 2.7 mm) and smallest in the posterior lateral region (mean 2.8 ± 0.9 mm) on CBCT scans. A strong correlation was found between CBCT scans and cephalograms (range 0.8-0.9). The thickness of the palatal vault was overestimated on the cephalograms compared to CBCT slices in 42.6% of the locations, and its extent was < 1 mm in 58 per cent and >3 mm in 4 per cent of the locations. The relative risk of overestimation of palatal thickness was < 20 per cent in the anterior lateral and posterior middle region, while it was > 50 per cent in the paramedian anterior and posterior lateral regions, and in all locations 4 mm away from the median sagittal plane.

CONCLUSION: Although a strong correlation exists between CBCT scans and cephalograms, the latter overestimated palatal thickness (42.6%). The clinician should be aware of this when inserting miniscrews in the palate.

SP 61 THREE-DIMENSIONAL EVALUATION OF THE MAXILLARY ARCH AND PALATE IN UNILATERAL CLEFT LIP AND PALATE SUBJECTS USING DIGITAL DENTAL CASTS
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AIMS: To assess arch width, palatal surface area and volume in surgically treated unilateral cleft lip and palate (UCLP) mixed dentition children in comparison with non-cleft lip and palate (NCLP) children using three-dimensional (3D) laser scanning.

SUBJECTS AND METHOD: Thirty eight subjects (Caucasian origin), 5.63 to 11.9 years of age (mean 9.33 ± 1.67 years), were included (19 in each group UCLP and NCLP). Digital dental casts were obtained using a 3 Shape R700 laser scanner. The 3D data were imported to a reverse modelling software package Rapidform™ 2006. Intercanine and intermolar widths (cusp and gingival levels), palatal surface area and volume were measured. The palatal surface area and the palatal volume were calculated with the gingival and distal planes used as boundaries for the palate. The gingival plane was created by connecting the midpoints of the dentogingival junction of all upper erupted primary and permanent teeth. The distal plane was created through two points at the distal of the first upper permanent molars perpendicular to the gingival plane. Data were tested for normal distribution according to Levene’s test. An independent sample Student’s t-test and an ANOVA were undertaken with significance set as P < 0.05.

RESULTS: Intercanine widths at the cusp (5.60 mm; P < 0.001) and at the gingival level (3.11 mm; P = 0.014), palatal area (141.5 mm²; P = 0.009) and volume (890.7 mm³; P = 0.029) were significantly lower in the UCLP compared to the control group.

CONCLUSION: Subjects with a UCLP have significantly reduced intercanine maxillary arch widths, while intermolar widths are similar to those measured in matched subjects without malocclusion. Furthermore, a significantly smaller palatal surface area and volume was seen in UCLP subjects in whom early orthodontic or orthopaedic treatment was not performed. Thus 3D evaluation of the maxillary arch and palate highlighted significant differences between UCLP and non-UCLP subjects in the mixed dentition phase, suggesting that orthopaedic maxillary expansion is advisable in UCLP.

SP 62 LONG-TERM ORAL-HEALTH EFFECTS OF CLASS II TREATMENT – A RETROSPECTIVE LONGITUDINAL INTERVENTIONAL COHORT CONTROL CLINICAL TRIAL
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AIMS: To investigate the long-term (≥15 years) benefit of orthodontic Class II treatment (Tx) on oral health (OH) in a retrospective longitudinal interventional cohort control clinical trial.
SUBJECTS AND METHOD: One hundred and fifty two patients who had undergone Class II correction (Herbst-Multibracket Tx, end of active Tx ≥ 15 years ago) were invited for recall (clinical examination, interview, impressions and photographs). Records from after active Tx were used to assess the long-term OH effects. The data were compared to corresponding population-representative age-cohorts as well as to untreated Class I controls without orthodontic Tx need during adolescence.

RESULTS: Seventy two out of 152 treated Class II patients could be located and participated at 33.7 ± 3.0 years (pre-Tx age: 14.0 ± 2.7 years). The majority (70.8%) were fully satisfied with their teeth and the function of their masticatory system. The Decayed, Missing, Filled Teeth Index (DMFT) was 7.1 ± 4.8 and thus almost identical to the untreated Class I controls (7.9 ± 3.6). In contrast, the DMFT in the population-representative age-cohort was 56 per cent higher. The mean Community Periodontal Index (CPI) maximum score (1.6 ± 0.6) was also comparable to the untreated Class I controls (1.7 ± 0.9) but in the corresponding population-representative age-cohort it was 19-44 per cent higher. The extent of lower incisor gingival recessions did not differ significantly between the treated Class II participants and the untreated Class I controls (0.1 ± 0.2 versus 0.0 ± 0.1 mm).

CONCLUSION: Orthodontic Tx of severe Class II malocclusions seems to result in long-term OH benefits in comparison to population representative age-cohorts.

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SP 63 THE EFFECTIVENESS OF TWO TYPES OF MANDIBULAR ADVANCEMENT DEVICES FOR OBSTRUCTIVE SLEEP APNOEA THERAPY
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AIMS: To determine differences in effectiveness between two types of mandibular advancement device (MAD).

MATERIALS AND METHOD: A retrospective, cohort study. The two devices used where MAD type Somnondent-Flex (MAD 1) and MAD type Herbst (MAD 2). A total of 137 patients with complete data available, were selected. Of these 137 patients, 67 were treated with MAD 1 and 70 with MAD 2. The indication MAD with obstructive sleep apnoea (OSA) was based on a polysomnography test, in accordance with the Dutch-CBO guidelines. The effectiveness of MAD therapy was determined by a second polysomnography test (with the MAD in situ). The apnoea-hypopnea index (AHI) was registered during the first (T1) and the second (T2) polysomnography test. Changes in these values determined the effectiveness. The results were compared by means of the independent samples t-test and paired-samples t-test. ANCOVA was used to correct for correlations between means.

RESULTS: A significant decrease in AHI was found regarding T1 and T2 for both MADs: F(1, 134) = 140,850; P < 0.001. The mean differences of both MADs was correlated with T1. After correcting for this covariance there was no significant difference between the two MAD devices regarding the AHI value: F(1,134) = 1,160; P = 0.283. Considering the size of the effect, a larger sample size is needed to prove a possible significant difference in change of AHI value between MAD 1 and 2.

CONCLUSION: The results of the present study show no significant difference in effectiveness between MAD 1 and MAD 2 with respect to the change in AHI-value.

SP 64 DENTAL AND SKELETAL TRANSVERSE CHANGES IN PATIENTS TREATED BY ORTHODONTIC CORTICOTOMY ASSISTED TREATMENT: A PILOT STUDY
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AIMS: To quantify, in a pilot study, the transversal changes in basal bone and in the posterior dentition of the upper jaw after corticotomy-assisted orthodontic treatment.

SUBJECTS AND METHOD: Fifteen consecutive patients. Two different types of orthodontic appliance (wide arches and expanders) were used. Moreover, two different techniques corticotomies (monocortical tooth dislocation and ligament distraction and piezocision) were performed to increase arch length. Changes observed between initial and final casts in the transverse plane in the basal bone (Walla ridge reference) of canines, premolars and molars as between dental canines of the same teeth were measured.
RESULTS: A significant increase in dental width was observed with a more important augmentation at the first and second premolar level. Concerning basal bone, significant changes were found just at the canines and first premolar width.

CONCLUSION: Corticotomy-assisted orthodontics is an efficient and safe technique to increase dental movement. Different orthodontic and corticotomy techniques means different results, or different amounts of transverse widths.

SP 65 MORPHOMETRIC COVARIATION BETWEEN PALATAL SHAPE AND SKELETAL PATTERN IN OPEN BITE GROWING PATIENTS
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AIMS: To assess the morphological shape variations of the palatal vault in subjects with skeletal and dentoalveolar open bite (OB) using three-dimensional (3D) geometric morphometrics.

MATERIALS AND METHOD: A sample of 76 OB subjects (39 females, 37 males; mean age 8.5 ± 0.8 years), was collected retrospectively according to the following inclusion criteria: European ancestry (Caucasian), anterior open bite, overbite less than 0 mm, increased vertical dimension as assessed on latero-lateral cephalograms, mixed dentition stage, prepubertal skeletal maturation. Pre-treatment digital 3D maxillary dental casts and lateral cephalograms were available before treatment. Landmarks and semi-landmarks were digitized (239) on digital dental casts and geometric morphometric methods (GMM) were applied. Procrustes analysis and principal component analysis (PCA) were performed to reveal the main patterns of palatal shape variation. The sample was divided into two groups according to the aetiology of open bite: skeletal factors (SF), sucking habits (SH). The differences between the palatal shape of SF and SH were calculated through Procrustes distance between group means.

RESULTS: Comparisons within the whole sample revealed no morphologic palatal shape variations in OB subjects. Using the presence of referral oral habits as a criteria of comparison, no statistically significant size difference between palatal shape of OB SF subjects and OB SH subjects was found (P > 0.05).

CONCLUSION: The morphological palatal shape variations in OB subjects are not influenced by the aetiology of OB.

SP 66 OBJECTIVE ASSESSMENT OF ORTHODONTIC PATIENT COMPLIANCE USING A MICROSENSOR: A REVIEW
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AIMS: To assess the objective compliance of wear of removable orthodontic appliances measured by the TheraMon® microsensor.

MATERIALS AND METHOD: A systematic search of the following databases was carried out: PubMed, Embase, Cochrane Oral Health Group’s Trial Register and Cochrane Register of Controlled Trials, Web of Science, Scielo and Scopus. Randomized and non-randomized controlled trials, prospective cohort studies and retrospective studies which objectively assessed compliance levels were selected. The quality of the studies was assessed using the Cochrane Collaboration’s risk of bias tool or risk of bias in non-randomized studies of interventions.

RESULTS: Of 2157 records, six studies meeting the selection criteria and were included in the qualitative and quantitative analyses. The mean compliance recorded by the chips was 9.5 hours/day, based on four studies. Younger patients showed significantly greater compliance than older patients (7-9 years 12.1 hours/day, 10-12 years 9.8 hours/day, and 13-15 years 8.5 hours/day; P < 0.0001). The median wear time for females (10.6 hours/day) was 1.4 hours/day longer than for males (9.3 hours/day; P = 0.017). Privately insured patients had significantly longer wear times than state insured patients. No significant differences in compliance were found between intra- and extraoral appliances, and neither psychological scores, treatment duration, nor awareness of being monitored had any significant effect. No significant difference in wear time was noted according to device type for all studies. One study found significant differences between subjective and objective wear time when patients did not know that their wear time had been monitored.

CONCLUSION: Objective measures are necessary to assess compliance with removable orthodontic appliances since patient compliance is a critical issue for the treatment achievement, TheraMon® microsensor is a valuable
device that provide the clinician with objective information regarding their patients’ compliance, in order to individualize the treatment plan based on the wear-time documentation.

SP 67  ORTHOGNATHIC SURGERY: THE POST-SURGERY DIET
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AIMS: Diet and nutrition are important for successful recovery post-orthognathic surgery. The aim of this research was to assess and improve the knowledge of patients in how to obtain adequate nutrition post-surgery and develop a dietary recommendation protocol in order to ensure an uneventful recovery.

MATERIALS AND METHOD: A 3 month retrospective audit was carried out to assess the quality of diet advice given prior to orthognathic surgery. Twenty five patients who were previously operated on were given a 10 part questionnaire at their follow-up clinic appointment. The questions related to their knowledge on nutrition, post-surgery diet awareness and quality of the advice given. The gold standard was that over 90 per cent of patients should be well informed prior to surgery.

RESULTS: The initial questionnaire showed a poor understanding of adequate nutrition following surgery with over 80 per cent of patients unsure as to how long they were to follow a high calorie soft diet. Seventy two per cent of patients felt that inadequate time and emphasis was given around diet in their preparation for surgery and insufficient information was provided. Over 50 per cent of patients experienced dietary problems, loss of appetite and weight loss. Although many patients reported receiving verbal dietary instructions, they felt written instructions to take home would be beneficial.

CONCLUSION: A dietary recommendation protocol has been developed and a reaudit is currently ongoing. This protocol has allowed us to ensure an interdisciplinary approach to care, involving surgeons, orthodontists and dieticians permitting delivery of high quality care with regards to both information and preparation of patients. Many patients have reported they were well informed and have had a positive experience post-operatively. It is recommended that a similar approach is adopted by other units in the management of orthognathic patients.

SP 68  A NOVEL MODEL FOR EXPLORING CAUSES AND TREATMENT OF CRANIOFACIAL BIRTH DEFECTS
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AIMS: Previous research has shown that the oxidative stress-inducing compound auranofin (AFN) may cause craniofacial cartilage defects in zebrafish embryos. This study aimed to determine how environmental causes of craniofacial birth defects affect growth and survival of cells contributing to the craniofacial skeleton during embryonic development in a zebrafish model. A second objective was to determine whether factors, such as antioxidant molecules, could rescue craniofacial defects.

MATERIALS AND METHOD: AFN was applied to zebrafish embryos and the resulting cartilaginous phenotype characterised at 5 days post-fertilisation (dpf) using light microscopy. Terminal deoxynucleotidyl transferase dUTP nick end labelling (TUNEL) staining was used to determine whether craniofacial defects were due to cell death. An antioxidant, Riboceine (RBC), was added with AFN to investigate whether the defect caused by AFN could be rescued. The structure of the craniofacial cartilages were analysed quantitatively using a cartilage stain, Alcian blue, for each of the treatment groups. Quantitative reverse-transcriptase polymerase chain reaction analysed the expression of antioxidant genes in the different treatment groups.

RESULTS: AFN caused defects in craniofacial cartilage of five dpf zebrafish embryos. Higher AFN doses led to greater numbers of TUNEL-positive cells, indicating the defects are likely due to increased cell death. RBC consistently ‘rescued’ the jaw defect phenotype caused by AFN. The proportions of embryos with normal cartilage were similar in the RBC groups as the untreated control group. Application of RBC led to a decreased number of TUNEL-positive cells when compared to embryos treated with AFN only. Treatment with AFN increased the level of antioxidant gene expression and by 48 hours post-fertilisation (hpf) RBC treatment did not return antioxidant gene expression to the level of the untreated control embryos.

CONCLUSION: Oxidative stress results in craniofacial cartilage defects that can be rescued by the antioxidant RBC in a zebrafish model. These findings may have translational significance, as treatment with antioxidants may
help prevent craniofacial defects in children, especially in families with an identified genetic or environmental risk.

**SP 69** EVALUATION OF THE EFFICIENCY OF THE MONOBLOC APPLIANCE IN CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA OR PRIMARY SNORING: POLYSOMNOGRAPHIC AND CEPHALOMETRIC ANALYSIS

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**AIMS:** To evaluate the impact of monobloc treatment on upper airway dimensions, polysomnography (PSG) findings, behavioural disorders and quality of life (QoL) in mandibular retrognathic Class II children with primary snoring or obstructive sleep apnoea (OSA).

**SUBJECTS AND METHOD:** Fourteen children with primary snoring, 16 children with OSA with a skeletal Class II malocclusion treated with a monobloc appliance, and a control group of 10 children with a skeletal Class I pattern. Skeletal, dental and airway measurements were performed on lateral cephalograms before and after treatment. A second polysomnography was obtained for the children with OSA in the apnoea group after treatment for objective evaluation of sleep. In addition to these measurements, to examine the difference in behavioural disorders and QoL, the parents were asked to complete four questionnaires (strength and difficulties questionnaire, inattention and hyperactivity assessment, paediatric sleep questionnaire and Pittsburgh sleep quality index). The IBM SPSS Statistics 22 program was used for statistical evaluation.

**RESULTS:** The skeletal Class II malocclusion improved with an increase in SNB angle and a reduction in ANB angle and overjet. Airway dimensions increased, the apnoea-hypopnea index decreased and there was an increase of sleep quality. The quality of life also improved.

**CONCLUSION:** Monobloc therapy of OSA patients improves the skeletal pattern and QoL.

**SP 70** DOES MAXILLARY PROTRACTION INFLUENCE GROWTH OF THE FRONTAL SINUS?

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**AIMS:** The frontal sinus is known to expand during growth period by pneumatization. However, there are a few controversial opinions regarding frontal sinus growth. The purpose of this study was to investigate whether maxillary protraction influences growth of the frontal sinus.

**SUBJECTS AND METHOD:** The three-dimensional size of the frontal sinus was evaluated in 18 patients (10 boys, 8 girls, mean age: 8.9 ± 1.2 years) who received maxillary protraction therapy (group 1). Twenty patients (7 boys and 13 girls, mean age: 10.5 ± 1.5 years) who did not received maxillary protraction therapy were compared with group 1 (group 2). Fourteen landmarks in the frontal sinus were identified and three-dimensionally measured on pre- (T1) and post- (T2) treatment cone beam computed tomographs, then the measurements were compared between T1 and T2, and groups 1 and 2.

**RESULTS:** The anterior wall of the frontal sinus moved forward while the position of the posterior wall did not differ between T1 and T2. The frontal sinus widened laterally and vertically at T2. However, there was no significant difference in dimensional change of the frontal sinus between groups 1 and 2.

**CONCLUSION:** The frontal sinus expanded in the anterior, lateral, and superoinferior direction in growing children. However, maxillary protraction seems not to influence growth of the frontal sinus. Further studies are needed by increasing the number of samples.

**SP 71** EFFECTIVENESS OF PULSED ELECTROMAGNETIC FIELD FOR PAIN CAUSED BY INITIAL ORTHODONTIC WIRE: A PRELIMINARY SINGLE-BLIND RANDOMIZED CLINICAL TRIAL

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**AIMS:** To assess, in a two-arm parallel trial, the effects of a pulsed electromagnetic field (PEMF) on the reduction of pain caused by initial orthodontic tooth movement.
SUBJECTS AND METHOD: Thirty-three female patients (mean age, 16.8 ± 3.8 years) who began orthodontic treatment using fixed appliances were examined. Each patient had brackets bonded on the maxillary teeth, and a 0.014 inch nickel-titanium archwire was tied with elastomeric rings. Their maxillary arches were randomly divided into left and right sides in a split-mouth design: a normal PEMF device (experimental group) was used on one side, and a PEMF device with an inversely inserted battery (placebo group) was used on the opposite side of the arch for 7 hours on three consecutive nights. A Google survey link was sent to the patients’ mobile phones via text message, and they were instructed to record their current pain on the survey. The survey was sent a total of six times after insertion of the initial archwire at 0 (T0), 2 (T1), 6 (T2), 24 (T3), 48 (T4) and 72 (T5) hours. Patients recorded the degree of pain during resting and clenching using a numeric rating scale (NRS) from 1 (no pain) to 10 (worst pain). PEMF devices were used after T2. Generalized linear mixed models, along with ancillary pairwise analyses, were used to model and evaluate the differences in pain reported over 72 hours.

RESULTS: The NRS scores did not differ across the groups during the before-PEMF phase for resting (mean difference, −0.07; 95% confidence interval [CI], −0.73 to 0.59; $P = 0.842$) and clenching (mean difference, −0.28; 95% CI, −1.11 to 0.56, $P = 0.513$). During the after-PEMF phase, NRS scores in the experimental group were significantly lower than those in the placebo group during both resting (mean difference, −1.46; 95% CI, −2.06 to −0.85; $P < 0.001$) and clenching (mean difference, −1.88; 95% CI, 2.74 to 1.02, $P < 0.001$). The NRS scores did not differ across the groups during the before-PEMF phase for either state but were significantly lower in the experimental group than in the placebo group at T3, T4, and T5 ($P < 0.01$). The average NRS score in the clenching state was significantly greater than in the resting state.

CONCLUSION: PEMF was effective in reducing orthodontic pain caused by initial archwire placement.

SP 72  EXTERNAL LABORATORY AUDIT: THE FIRST CYCLE OF THE PROCESS
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AIMS: A change from an internal hospital orthodontic-production laboratory was undertaken in December 2016, with an external off-site orthodontic laboratory commissioned. The aim of this audit was to assess the quality and efficiency (in terms of timely return of work) of the new laboratory over an 8-month period.

MATERIALS AND METHOD: 1. Quality standard: All appliances returned, are made to the prescription applied (100%). 2. Efficiency standard: All appliances are returned by the date specified on the prescription card (100%). Errors were recorded for laboratory work undertaken by the external laboratory from 1 December 2016 - 31 July 2017. Clinicians were asked to record errors in a proforma which requested: details of the appliance or work involved, the nature of the error and whether a remake was required.

RESULTS: Two per cent (72/3497) of all appliances were associated with an error, however there was a strong element of under reporting with clinicians getting used to a new process. Seventy four per cent (53/72) of all errors were due to incorrect adherence to the respective prescription and 72 per cent (52/72) of all errors resulted in the appliance having to be remade. The two most common appliances associated with errors were thermoformed retainers (36%) and upper removable appliances (17%).

CONCLUSION: Feedback was provided to the head technician of the external laboratory over a formal meeting. The nature of the errors were also discussed. A new data collection proforma was introduced to look at the issues in more detail and a second cycle is due to be completed by February 2018.

SP 73  CLINICAL EFFECTIVENESS OF A NEW SILICONE ELASTOMERIC APPLIANCE ON PHASE 1 ORTHODONTIC TREATMENT***
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AIMS: Early interceptive orthodontics can reduce the severity of a developing malocclusion and the complexity of orthodontic treatment. The aim of this pilot study was to evaluate the clinical effectiveness of a new silicone elastomeric appliance on phase 1 orthodontic treatment.

SUBJECTS AND METHOD: Twenty patients (9 girls, 11 boys) who required interceptive orthodontic treatment were selected for this six month clinical trial. Patients were instructed to wear a silicone elastomeric appliance
daily for minimum of 2 hours plus overnight during sleep. Peer assessment rating (PAR) scores were obtained at the start of treatment (T1) and six months after T1 (T2) for all patients by model rating.

RESULTS: The mean PAR score for the sample was 25.6 ± 9.7 at T1 and 11.4 ± 6.8 at T2. Paired t-tests showed that the PAR score was significantly reduced from T1 to T2 (P < 0.001)

CONCLUSION: The short term clinical effectiveness of the new silicone elastomeric appliance is marked in Phase I orthodontic treatment. However, the long-term clinical effectiveness of the new appliance warrants further study.

SP 74  PREDICTION ACCURACY OF THREE-DIMENSIONAL SOFT TISSUE CHANGES FOLLOWING ORTHOGNATHIC SURGERY IN SKELETAL III CHINESE PATIENTS
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AIMS: To assess the accuracy of a three-dimensional (3D) orthognathic planning software in predicting soft tissue outcome of Chinese patients who had undergone two-jaw orthognathic surgery for the correction of a Skeletal III dentofacial deformity.

MATERIALS AND METHOD: Pre- and post-operative 3D facial stereophotogrammetric scans and time-matched cone beam computed tomographs (CBCT) were taken of 10 Chinese patients who had undergone two-jaw orthognathic surgery for the correction of a Skeletal III dentofacial deformity. The pre-operative 3D facial scan was fused with the pre-operative CBCT using the Synthes ProPlan CMF (Materialise, Leuven, Belgium) software. Virtual osteotomies were simulated using the pre-operative CBCT with the bony segments moved to match the post-operative CBCT, resulting in a textured soft tissue prediction. The simulated soft tissue 3D face was then compared with the actual 3D facial scan obtained at least 6 months post-operatively. The percentages of 3D points where the distance was <1 mm, <2 mm and <3 mm between the predicted and actual soft tissue surface meshes and the root mean square (RMS) error were calculated for the full face. The Euclidean distance between the two meshes at six median sagittal and four paramedian landmarks were also determined. The accuracy of the 3D soft tissue prediction was correlated to the amount of surgical sagittal movement.

RESULTS: For the full face, the mean absolute difference and RMS error between the predicted and actual soft tissue surface meshes was 0.73 mm (SD 0.21 mm) and 0.92 mm (range: 0.57 to 1.39 mm), respectively. The percentages of 3D points where the distance was <1 mm, <2 mm and <3 mm between the predicted and actual soft tissue surface meshes were 68.3, 90.9 and 96.7 per cent, respectively. The mean Euclidean distances between the two meshes at the 10 landmarks ranged from 2.04 to 4.03 mm, with the greatest value at Labrale inferius (4.03 ± 1.82). The accuracy of soft tissue prediction, assessed using RMS error for the full face, was significantly correlated to the amount of antero-posterior surgical movement (r = 0.712, P = 0.021).

CONCLUSION: The accuracy of 3D soft tissue predictions for orthognathic surgery in Chinese Skeletal III patients was clinically inadequate especially for the lower lip region. More studies on 3D soft tissue response to orthognathic surgery on Chinese subjects are needed to provide soft tissue simulation algorithms for 3D prediction software.

SP 75  RELATIONSHIP BETWEEN POSITION OF THE FORAMINA FOR THE TRIGEMINAL NERVE AND FACIAL SKELETAL TYPE
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AIMS: To investigate the relationship between the position of the foramina of the trigeminal nerve and facial skeletal type.

SUBJECTS AND METHOD: One hundred and forty seven adults (57 males, 90 females; mean age, 26.1 years) without facial asymmetry or any facial deformity. The sample was divided into three groups according to facial type based on ANB angle. Subjects with an ANB between 1 and 3 degrees were classified as group I, ANB over 5 degrees as group II, and ANB below −1 degree as group III. Seven foramina in the craniofacial area; foramen rotundum (Rot) and foramen ovale (Ov) in the cranial base, infraorbital foramen (IOF), greater palatine foramen (GPF), and incisive foramen (IF) in the maxilla, mandibular foramen (MDF) and mental foramen (MTF) in the mandible were identified on cone-beam computed tomographic images. Linear and angular measurements and ratios were three-dimensionally calculated and were compared between groups.
RESULTS: The distances between the foramina in the cranial base did not differ among the three groups. The distance from Rot to IF was smaller in group III than in the other groups, and the angle between the IOF-IF plane and FH plane was smaller in group III than in the other groups. The distances from Ov to MDF, from OV-IF plane, and from MDF to MTF were smaller in group II than in the other groups. The angles between MDF-MTF plane and FH plane were larger in group II, while smaller in group III.

CONCLUSION: The position of the foramina of the trigeminal nerve is related to facial skeletal type. The foramina of the trigeminal nerve can be used for diagnosis of skeletal malocclusion.

SP 76  EFFECTS OF VARIOUS REMOVABLE ORTHODONTIC RETAINERS ON MICROBIOLOGICAL PARAMETERS: A RANDOMISED CONTROL TRIAL

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AIMS: Orthodontic retainers are worn for long periods after active orthodontic treatment and may act as reservoirs for cariogenic bacteria, namely, Streptococcus mutans (S. mutans). This study aimed to investigate the effects of various removable orthodontic retainers on microbiological parameters, specifically salivary S. mutans. SUBJECTS AND METHOD: Twenty subjects were randomised into three groups to receive Hawley, Essix or Vivera® retainers after debonding. Another four subjects who had not received orthodontic treatment with an Index of Treatment Need score of 2 and below served as controls. Unstimulated saliva was collected from the test subjects for quantitative analysis of S. mutans and total bacterial count using real-time polymerase chain reaction at the baseline appointment, during retainer issue (T0) and 8-15 weeks later (T1). Linear regression analysis was carried out to investigate whether there was any significant difference in the T1 data in S. mutans count, total bacteria count and proportion of S. mutans to total bacteria among the four groups (Hawley, Essix, Vivera® and control) adjusting for their respective T0 measurements. All the analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, North Carolina, USA). Significance level was set at < 0.05.

RESULTS: There was no significant difference in the total bacteria count for the Hawley, Essix, Vivera® and control group after adjusting for their respective T0 measurements. However, S. mutans counts at T1 for the Hawley group were significantly higher compared to the Essix (P = 0.001) and Vivera® (P = 0.011) group after adjusting for S. mutans count at T0. The proportion of S. mutans to total bacteria at T1 for the Hawley group was significantly higher compared to the Essix (P = 0.003) and Vivera® (P = 0.021) groups after adjusting for T0 values.

CONCLUSION: Hawley retainers displayed an increased intraoral colonisation of S. mutans as compared to the Essix and Vivera® retainers and should not be recommended to susceptible patients from a caries-risk point of view. However, long-term studies with a larger sample size and inclusion of caries incidence as an outcome measure are needed.

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SP 77  ARE METHODS OF DETERMINING THE SKELETAL MATURATION COMPATIBLE WITH EACH OTHER? A SYSTEMATIC REVIEW

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AIMS: To systematically review the correlation between the methods used in the field of orthodontics to determine optimal timing of treatment. These methods are cervical vertebral maturation (CVM), hand and wrist bone maturation and Demirjian’s method.

MATERIALS AND METHOD: In electronic databases such as PubMed, Medline, and Web of Science, the search for ‘skeletal maturation determined’, ‘tooth age’, ‘Demirjian method for skeletal maturation’, ‘skeletal maturation in orthodontics’ and combinations thereof.

RESULTS: A total of 3605 articles were found. After reading the titles of these articles, 804 of them were in the field of orthodontics. After reading the abstracts of the selected articles, the full text of 11 articles were read, considering the purpose and scope of the research.
CONCLUSION: The CVM method has become more popular in recent years to prevent additional radiographic exposure. There was a high correlation coefficient between chronological age and skeletal maturation of cervical vertebrae. There was a high correlation between both genders, but significantly better for females. As a result of the review, the CVM method is more simple and useful than the hand and wrist method. However, there is a need for further studies.

SP 78  PAIN AND ORAL QUALITY OF LIFE WITH CONVENTIONAL BRACKETS, LOW-FRICTION BRACKETS AND ALIGNER TREATMENT: A RANDOMIZED CLINICAL TRIAL†‡‡ Pedro Colino1, Adrian Curto2, Javier Montero3, Alberto Albaladejo2, Alfonso Alvarado2, 1Department of Craniomandibular Disorders, Universidad Europea Miguel de Cervantes, Valladolid, Departments of 2Ortodoncia and 3Prothesis, Universidad de Salamanca and 4Department of Ortodoncia, Universidad Alcalá de Henares (ITECO), Spain

AIMS: To assess the influence of the different orthodontic techniques on pain and oral health quality of life (OHQoL).

MATERIALS AND METHOD: Randomized longitudinal study approved by the Comité de Bioética de la Universidad de Salamanca (Bioethics Committee for Experimental Research of the University of Salamanca, USAL_16/060), in 90 patients assigned into three arms: conventional brackets (Victory®), low-friction brackets (Sinergy®) and Invisalign®. Pain was assessed through a visual analogue scale from the first 4 hours up to day 7. OHQoL was assessed 1 month after the start of treatment.

RESULTS: The mean age of patients was 27.2 ± 11.4 years. In terms of pain, statistically significant differences (P < 0.05) were observed at each of the assessment time points, except on day 7. Conventional brackets presented the highest level of pain (3.5 ± 2.4) followed by Invisalign® (3.0 ± 2.1). Low-friction brackets presented the lowest level of pain (2.9 ± 2.5). In terms of the impact on OHQoL, statistically significant differences (P < 0.01) were observed related to pain levels, psychological distress and oral health impact profile total scores. The patients with conventional brackets described a higher impact versus those with Invisalign® who indicated the lowest impact.

CONCLUSION: The peak of maximum pain took place between the first 24 and 48 hours. The orthodontic technique had an impact on pain and OHQoL. Low-friction brackets were related to a lower level of pain.

SP 79  DIMENSIONS OF SELLA TURCICA AND CRANIAL BASE IN PATIENTS WITH MANDIBULAR PROGNATHISM Tatjana Cutovic1, Julija Radojicic2, 1Military Medical Academy, Belgrade and 2Faculty of Medicine, University of Nis, Serbia

AIMS: To investigate the morphology of the cranial base and sella turcica in patients with mandibular prognathism, which will contribute to clarification of doubts and opposing views in the literature.

MATERIALS AND METHOD: Cephalometric radiographs of 60 patients were analysed. On the basis of dentoskeletal relationship of the jaws, the subjects were divided into two groups: mandibular prognathism and eugnathic. Nine cephalometric parameters related to the cranial base, sella turcica and sagittal intermaxillary relationships were measured and analyzed.

RESULTS: Sella turcica dimensions (width and depth) were significantly increased in patients with mandibular prognathism, while the other analyzed dimensions of the cranial base did not play a significant role in the development of mandibular prognathism. Interrelationship analysis indicated a statistically significant negative correlation between the cranial base angle (NSAr) and the angles of maxillary (SNA) and mandibular (SNB) prognathism, as well as a positive correlation between the angle of sagittal intermaxillary relationships (ANB).

CONCLUSION: Patients with mandibular prognathism all had larger measurements of sella turcica, but the enlargement was not correlated with the degree of the anomaly. The impact of the cranial base on the profile development in patients with mandibular prognathism was much smaller, but certainly more complex, and therefore suggests, for future research, that morphogenetic tests of the maxillomandibular complex should be included in the assessment of this impact.

SP 80  GINGIVAL CREVICULAR FLUID COMPOSITION DURING ORTHODONTIC TREATMENT WITH FIXED APPLIANCES: EVALUATION BY SURFACE-ENHANCED RAMAN SPECTROSCOPY
AIMS: Vibrational spectroscopies can constitute an efficient method to obtain a characterization of the gingival crevicular fluid (GCF) composition with high sensitivity to subtle chemical and structural changes during orthodontic treatment. Raman and infrared spectroscopies have been shown to be effective in the analysis of many biofluids. Among the different vibrational techniques, the surface enhanced Raman spectroscopy (SERS) was used in this study to evaluate GCF changes at different time points of orthodontic treatment.

SUBJECTS AND METHOD: Informed patients aged between 12 and 22 years were consecutively recruited and GCF samples collected before and after 2, 7 and 14 days of non-extraction orthodontic treatment with fixed appliances using standardized paper cones. SERS spectra of GCF extracted from these cones were obtained. GCF samples were excited by the light of a He-Ne laser operating at a wavelength $\lambda = 633$ nm. The SERS spectra collected showed a smeared background signal. In order to enhance the signal readability and to attenuate the background and noise components, an automatic numerical treatment based on a wavelet algorithm was used.

RESULTS: The contributions of the main functional groups and the changes related to the different time points of orthodontic treatment were clearly shown in SERS spectra. The Amide I band intensity increased immediately after the start of treatment and decreased at subsequent time points. In addition, the centre of the Amide I band shifted to lower wavenumber values indicating a rearrangement of Amide I band Raman components reflecting a change in the protein fold configuration. From SERS results, the changes in the contribution of cytochrome complex, a small hemoprotein with high oxidation properties, was also noted. Moreover, the deconvolution of Amide I band confirmed the modification of the secondary structure of the GCF protein content during orthodontic tooth movement.

CONCLUSION: SERS is able to detect GCF changes during orthodontic treatment and can be considered as a powerful tool for monitoring the processes occurring during orthodontic treatment and to choose the appropriate orthodontic force application individually for each patient.

AIMS: A multivariate data analysis was used to evaluate spectra obtained by Raman micro-spectroscopy ($\mu$-RS) on gingival crevicular fluid (GCF) samples collected during early fixed orthodontic treatment.

MATERIALS AND METHOD: GCF samples were collected from patients aged between 12 and 22 years using standardized paper cones. The samples were obtained before bracket bonding and after 2, 7 and 14 days of non-extraction orthodontic treatment with fixed appliances at the buccal side of the first premolars. $\mu$-RS spectra were directly acquired on GCF paper cones without any manipulation. The Raman spectra showed a smeared background signal able to reach 80 per cent of the whole average intensity. To enhance signal readability and to attenuate the background and noise components, an automatic numerical treatment based on a wavelet algorithm was used. GCF samples were excited by the light of a He-Ne laser operating at $\lambda = 633$ nm. The spectra were numerically analyzed using the Bioinformatics Toolbox of Matlab® software to determine a discriminative selection criterion to distinguish the differences occurring in GCF due to the orthodontic process. They are typically employed for processing large data files and here they were used for processing Raman spectra. The adopted procedure enabled selection of a reduced set of spectral points/features that may be used to distinguish Raman spectra from patients at different stages of orthodontic treatment. Among multivariate analysis methods, the principal component analysis (PCA) proved to be suitable for analyzing the Raman spectra. Interval-PCA was performed on the wavelet-treated GCF Raman spectra using the narrow spectral regions (relevant intervals, RI) outlined in a ranking analysis. Then, each spectrum was described using the scores of the first three PCs found in the RIs.
RESULTS: The spectral characteristics of the main functional groups and the changes in cytochrome, amide III, and amide I contributions were highlighted in the different phases of orthodontic treatment with μ-RS analysis. 

CONCLUSION: μ-RS provides a precise biochemical analysis of GCF changes during the different stages of orthodontic treatment using a statistical approach based on numerical classification of the spectra and a multivariate analysis.

SP 82 EFFECTS OF FUNCTIONAL AND SURGICAL MANDIBULAR ADVANCEMENT ON UPPER AIRWAYS DIMENSIONS: A SYSTEMATIC REVIEW. 
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AIMS: To systematically review the data regarding changes in the upper airway dimensions after orthopaedic or orthognathic mandibular advancement.

MATERIALS AND METHOD: Electronic and manual literature searches were performed up to January 2017. Two reviewers independently screened titles and abstract. Human studies assessing the effect on the upper airways of mandibular advancement by means of a functional appliance (in growing subjects) or surgical intervention (in adults) were included. With regard to the functional treatment, only studies with a Class II control group were included. Studies focusing on obstructive sleep apnoea or other respiratory disease were excluded. The quality of the studies was assessed by means of a modified Downs and Black checklist for non-randomised clinical trials and of a Quality Assessment Tool for Before-After (Pre-Post) Studies for those without control group. The level of evidence was evaluated by means of the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) tool.

RESULTS: Seven studies on functional treatment and nine on surgical mandibular advancement were included. No randomised clinical trials were found. Regarding the studies on functional treatment, two showed a medium quality and five a low quality, as assessed with the modified Downs and Black checklist. With regard to the studies on the surgical intervention, three showed a medium quality and six a low quality, as assessed by the Quality Assessment Tool for Before-After (Pre-Post) Studies. The majority of the articles showed an increase of the upper airway dimensions after mandibular advancement. Most of the significant results were found in the oropharyngeal tract, rather than in the nasal or hypopharyngeal area.

CONCLUSION: Mandibular advancement (after orthopaedic or surgical treatment) is associated with an increase of the oropharyngeal tract. Further research is needed to determine whether the change in the airways dimension is associated with an improvement of the respiratory functions.

SP 83 LOW LEVEL LASER THERAPY ON ROOT RESORPTION REPAIR: A DOUBLE-BLIND, SPLIT MOUTH RANDOMISED CONTROL TRIAL
Chun Ang Khaw Oyku Dalci², M Ali Darendeliler, Alexandra Papadopoulou, Department of Orthodontics, University of Sydney, Surry Hills, Australia

AIMS: To investigate, in a two-arm parallel, split-mouth trial, the effect of low level laser therapy (LLLT) on the repair of orthodontically induced inflammatory root resorption (OIIRR).

SUBJECTS AND METHOD: Twenty patients were included in this split-mouth study with one side randomly assigned to receive LLLT whilst the other side served as a sham. Eligibility criteria included need for bilateral maxillary first premolar extractions as part of fixed appliance treatment. OIIRR was generated by applying a buccal tipping force of 150 g on the maxillary first premolars for 4 weeks. After removal of the active force, the teeth were retained for 6 weeks. LLLT commenced with weekly laser applications using a continuous beam 660 nm 75 mW AlGaInP laser with 1/e2 spot size of 0.260 cm², power density of 0.245 W/cm² and fluence of 3.6 J/cm². Contact application was used at eight points buccally and palatally above the mucosa over each tooth root for 15 seconds with a total treatment time totalling 2 minutes. After 6 weeks, the maxillary first premolars were extracted and scanned with microcomputed-tomography for primary outcome OIIRR calculations. Subgroup analysis included assessment per root surface, per vertical third and sites of heaviest compressive forces (buccal-cervical and palato-apical). Randomisation was generated using www.randomisation.com and allocation was concealed in sequentially numbered, opaque, sealed envelopes. Blinding was applicable for
treatment and outcome assessment. Two tailed, paired t-tests were used to determine whether there were any statistically significant differences in total crater volumes of laser versus sham treated teeth.

RESULTS: Total crater volumes were 0.746 mm$^3$ for the laser treated teeth and 0.779 mm$^3$ for the sham. There was a mean difference of 0.033 ± 0.39 mm$^3$ (95% CI: −0.214 mm$^3$ to 0.148 mm$^3$) greater resorption crater volume in the sham group compared with the laser group, which was not statistically significant ($P = 0.705$). No harm was observed.

CONCLUSION: No significant difference was found between LLLT and sham control groups in OIIRR repair.

SP 84  TWO- AND THREE-DIMENSIONAL METHODS FOR THE DIAGNOSIS OF FACIAL ASYMMETRY: A SYSTEMATIC LITERATURE REVIEW  
Domenico Dalessandri, Laura Pedersoli, Linda Sangalli, Stefano Bonetti, Corrado Paganelli, Department of Orthodontics, University of Brescia, Italy

AIMS: To systematically review the literature regarding the diagnosis of facial asymmetry. The goal was to identify the most used methods, both in two- and three-dimensions, available for clinicians in everyday orthodontic routine and try to compare them in terms of accuracy, precision and sensitivity.

MATERIALS AND METHOD: A literature search was conducted on PubMed (National Library of Medicine, NCBI), Scopus, Lilacs and Google Scholar (last access 1st October 2017) from 1982 to 2017. The initial search, after duplicate elimination, resulted in the selection of 775 papers, the majority of which were excluded after reading their abstracts because they did not relate to the topic of this study. Fifty eight papers, available in full text, were considered relevant and analysed in detail.

RESULTS: Both two (2D) and three (3D) dimensional methods are used in clinical practice for the diagnosis of facial asymmetry. 2D methods include radiographic techniques such as postero-anterior cephalogram, panoramic radiography (dental pantomogram) and submentovertex projection. The latter is no longer used in daily practice as it exposes the thyroid to a high radiation dose, it obligates the patient to assume an uncomfortable position during the examination and there is superimposition of different anatomical structures that result in a lower accuracy compared to other methods. Digital photography represents a valid non-radiographic two-dimensional technique for the diagnosis of facial asymmetry. As regards 3D methods, clinicians can use cone-beam computed tomography to evaluate asymmetry, potentially creating 3D virtual models from it. Stereophotogrammetry, laser scanners and contact digitalization represent the 3D non-radiographic counterpart.

CONCLUSION: Some different methods are available to clinicians for the diagnosis of facial asymmetry. 3D methods seem to be more accurate, precise and sensitive than 2D methods and less subject to technical limitations. However, regardless of the method used, the first fundamental step in the diagnostic process of a patient with facial asymmetry is represented by the clinical exam.

SP 85  THREE-DIMENSIONAL McNAMARA CEPHALOMETRIC ANALYSIS WITH CONE BEAM COMPUTED TOMOGRAPHY IN ADULTS FROM THE ANKARA REGION  
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AIMS: Many clinical and radiographic studies have been carried out to establish and examine orthodontic cephalometric norms. Because of the deficiencies of two-dimensional lateral cephalograms in terms of showing clear findings, three-dimensional (3D) imaging and studies including analysis methods of these images have come to the forefront. It has been determined that the 3D data differ between populations and studies have been undertaken to determine the norm values.

SUBJECTS AND METHOD: Individuals who were between 18 and 30 years of age, with a complete dentition, balanced face profile, Class I normal occlusal relationship and who had received no orthodontic treatment were included in the study. 3D cephalometric analysis was performed on cone beam computed tomography images.

RESULTS: The mean values obtained differed from other populations studies. The mean linear measurement values for males were found to be greater than for females. Male subjects showed a larger mandibular length ($P < 0.001$), midface length ($P < 0.001$), maxillary/mandibular difference ($P < 0.01$) and ANS-Me distance ($P < 0.001$) when compared to females.
CONCLUSION: The values obtained using McNamara measurements for individuals in the Ankara region are specific. They can be especially useful for orthodontists and maxillofacial surgeons when planning orthognathic surgery.

SP 86 \hspace{1em} COMPARISON BETWEEN FACEMASK ORTHOPAEDIC MAXILLARY PROTRACTION AFTER RAPID MAXILLARY EXPANSION OR ALTERNATE RAPID MAXILLARY EXPANSION AND CONSTRICTION PROTOCOL
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AIMS: To assess the skeletal effectiveness of facemask (FM) maxillary protraction in the correction of Class III dentoskeletal malocclusion when combined with rapid maxillary expansion (RME) or the alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol.

SUBJECTS AND METHOD: Twenty-two patients with a Class III dentoskeletal malocclusion and maxillary deficiency were randomly selected and divided into two groups. Patients in group A (5 males, 6 females, mean age 8.93 ± 2.99 years) were treated with RME for 1 week followed by FM protraction, whereas those in group B (6 males, 5 females, mean age 9.18 ± 2.16 years) underwent 5 weeks of Alt-RAMEC followed by FM treatment. Both groups were treated with an acrylic-splint expander and a Petit facemask until a sufficient amount of expansion, positive overjet and overcorrection were seen. The subjects were evaluated at the beginning and end of orthopaedic treatment through lateral cephalometric radiographs. Comparison between the groups was performed with a Student's t-test.

RESULTS: Both protocols showed favourable effects leading to correction of the Class III malocclusion. The total treatment time was 9.88 ± 2.42 months for group A compared to 10.13 ± 2.64 months for group B. The RME/FM protocol showed more anterior displacement and counterclockwise rotation of the maxilla and a greater improvement in the maxillomandibular relationship. Downward and backward rotation of the mandible was also larger group A, resulting in a greater increase in anterior face height. Statistically significant differences, though, were only seen in maxillary forward displacement (A-NPog increased 1.44 ± 1.02 mm in group A compared to 0.25 ± 1.19 mm in group B) and intermaxillary relationship (ANB increased 2.07 ± 0.91° in group A compared to 0.62 ± 1.25° in group B).

CONCLUSION: Both protocols efficiently corrected the Class III skeletal malocclusion. However, short-term outcomes showed that the RME/FM protocol led to more maxillary anterior displacement and a greater improvement in the maxillomandibular relationship compared to the Alt-RAMEC/FM protocol.

SP 87 \hspace{1em} THREE-DIMENSIONAL EVALUATION OF SECONDARY ALVEOLAR BONE GRAFTING IN CLEFT LIP AND PALATE PATIENTS: A SYSTEMATIC REVIEW OF THE CLINICAL OUTCOMES
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AIMS: To provide an overview of the existing literature concerning three-dimensional (3D) evaluation and clinical outcomes of secondary alveolar bone grafting (SABG) in cleft lip and palate (CLP) patients and to gain insight into the 3D imaging protocols used in the radiological follow-up, how 3D imaging is applied to assess the cleft site, the success and resorption rate of SABG and whether there is a difference between graft types.

MATERIALS AND METHOD: A literature review concerning 3D imaging protocols and clinical outcomes of the radiological follow-up of SABG in CLP patients was performed on PubMed, Embase and the Cochrane Library until July 2017. Publications using 3D imaging for the evaluation of SABG were included. Exclusion criteria were: primary or tertiary bone graft, use of two-dimensional images only, animal studies, case reports, reviews, letters or articles in languages other than English or Dutch. Study quality was evaluated using the methodological index for non-randomized studies (MINORS) for observational and non-randomized studies and the Cochrane Collaboration’s tool for assessing risk of bias was used for randomized clinical trials (RCT). Reporting was executed adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

RESULTS: The search yielded 1657 citations, of which 38 met the inclusion criteria. A large variability in imaging protocol and bone graft evaluation was observed. The majority of articles were observational studies with medium to low methodological quality. One RCT was scored as having a low risk of bias.
CONCLUSION: There is a pressing need for a consistent radiological protocol for diagnosis and follow-up of SABG. Although 3D methods seem to be superior to others, care should be exercised when comparing measuring techniques as they can deliver different outcomes. Although insight into the morphology and size of the pre-operative cleft and the amount of bone resorption is of clinical value, the success of SABG is a more complex concept whose evaluation cannot be solely based on quantitative volumetric measurements.

SP 88  ACTIVATION OF NOTCH SIGNALLING IN PERIODONTAL LIGAMENT CELLS DURING RAT MOLAR TOOTH ERUPTION AND OCCLUSION ESTABLISHMENT
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AIMS: Tooth eruption is involved in new tissue formation as well as remodelling in the periodontal ligament (PDL). The whole procedure starts from initial lineage differentiation of dental sac cells and ceases upon occlusion establishment. The molecular mechanisms involved in this dynamic process have not been fully elucidated. Notch signalling pathway is required for most if not all kinds of stem cell maintenance and differentiation. However, little is known about the expression and function of the Notch pathway in tooth eruption. In this study, we aimed to identify the key Notch receptors expression in the PDL cells at sequential tooth eruption stages and to explore the functions of Notch.

MATERIALS AND METHOD: New born Wistar rats were used. Based on macroscopy and histology analyses, tooth eruption stages of the first molar were defined as: pre-occlusal (16 days); transitional (21 days, upon occlusion establishment) and occlusal (28 days, after occlusion establishment). Antibodies targeting intracellular domains of Notch1 and Notch2 receptors, and Periostin, a key PDL matrix protein were applied for quantitative immunofluorescent analysis using Imaris 9.0 software. To research the function of the Notch pathway, human periodontal cell lines were used for small hairpin RNA mediated gene knockdown of RBP-Jkappa, the key effector/transcriptional factor of the Notch pathway and the downstream target genes were evaluated using real time reverse-transcription polymerase chain reaction. To overexpress Notch signalling in the same cell line a controllable retroviral mediated Notch1 intracellular domain nuclear transfer was used.

RESULTS: The Notch pathway, indicated by nuclear translocation of Notch1 and Notch2 intracellular domains were highly induced in the PFL cells upon tooth eruption. The cells facing the alveolar bone side expressed stronger Notch signals, as well as Periostin. Knocking down RBP-Jkappa gene in the cultured PDL cells could bring down Periostin expression while over expressing Notch in the same cells achieved the opposite effect.

CONCLUSION: The results confirm that the Notch pathway dynamically participates in PDL development and remodelling during tooth eruption through controlling key PFL linked matrix gene expression.

SP 89  ASSESSMENT OF MULTIDISCIPLINARY CONSENT FOR SURGICAL EXPOSURE OF IMPACTED CANINES BY AN ORTHODONTIC AND ORAL AND MAXILLOFACIAL/ORAL SURGERY DEPARTMENT
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AIMS: Following the Montgomery case of 2015, the Bolam test no longer applies to the issue of consent. Following the Supreme Court judgement, the law on informed consent has changed and clinicians must now ensure that patients are aware of any ‘material risks’. The Department of Health and General Dental Council guidelines also advise that patients should be informed of any ‘material’ or ‘significant’ or unavoidable risks (even if small). The risks and complications associated with surgical exposure of impacted canines include standard surgical risks, ankylosis/failure to erupt, damage to adjacent teeth, debonding of gold chain and soft tissue overgrowth. Any of these may require a repeat or alternative procedure including a repeat general anaesthetic (GA). The aim of this study was to assess the standard of consent for surgical exposure of impacted maxillary canines by an Orthodontic and Oral and Maxillofacial/Oral Surgery Department and to evaluate the rate of occurrence of common complications within 3 months of exposure.

MATERIALS AND METHOD: Retrospective analysis of 50 clinical records and consent forms for: 1) Documentation of discussion of following risks: surgical risks, ankylosis/failure to erupt, damage to adjacent
teeth, debonding of gold chain, re-exposure and alternative procedure; 2) Documentation of complications occurring within 3 months of surgical exposure; 3) Documentation of repeat general anaesthetic.

RESULTS: One hundred per cent of cases had surgical risks documented all others risks were well below the required standard. No patients required a repeat GA. One case required re-exposure under LA, this risk was not documented in the patient’s notes or consent form. The risk of re-exposure was documented in only 7 per cent of cases.

CONCLUSION: Recommendations: Advise discussion and consent for both open and close procedures as treatment may change under a GA; Training on consent for dental core trainees and handouts for future reference. Discussion within the orthodontic department on the threshold for warning and documenting risk of ankylosis and failure of eruption. Re-audit 12 months.

SP 90  IMPACTED MAXILLARY CANINES: A FIVE YEAR RETROSPECTIVE AUDIT ON THE TREATMENT OUTCOMES OF SURGICAL EXPOSURE
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AIMS: To assess the rate of successful orthodontic alignment of impacted maxillary canine(s) following surgical exposure and the proportion requiring re-treatment. A further aim was to identify the reasons for re-treatment and if this or any other clinical factors affected the overall outcome.

MATERIALS AND METHOD: A five year retrospective review was carried out within Dorset County Hospital, U.K. Patients were identified using treatment codes for the surgical exposure of impacted maxillary canines. This identified 84 patients suitable for inclusion in this audit. As there are no national guidelines available, the agreed standard used was formulated from local policies and results of similar previous audits: 1. 92 per cent of canines should be successfully aligned; 2. <6 per cent should require a re-exposure procedure. Patients’ electronic records were accessed and reviewed. All patients had a clinical diagnosis of one or more impacted maxillary canines and this was confirmed by radiographic examination and at time of surgery.

RESULTS: In the time period audited, 84 patients (52 females, 32 males) underwent exposure of an impacted maxillary canine(s). A total of 100 canines were exposed (83 open, 17 closed). At the time of review, 11 canines were still undergoing active orthodontic treatment and therefore excluded from the results. Eighty eight per cent of canines (n = 78) were classified as successful following their first treatment. The remaining 12 per cent (n = 11) were initially classified as failures. Following re-treatment, eight successfully erupted increasing the success rate to 97 per cent. Three canines failed to erupt post-exposure and were extracted. The primary reasons for failure were chain decementation, difficult access, loss of pack and ankylosis.

CONCLUSION: A success rate of 97 per cent was achieved which is comparable to published data. Case selection is important to identify patients suitable for surgical exposure and to maximise success. Although the re-exposure rate was higher than expected, numerous methods have been introduced to help reduce this. All patients should be informed that re-exposure may be required. A prospective re-audit will be implemented to ensure continued improvement and excellent standards of patient care.

SP 91  ORTHODONTIC MINOR ORAL SURGERY: REFERRAL TO OPERATION TIME SERVICE EVALUATION
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AIMS: To determine if changes implemented following a previous departmental audit, had improved waiting times for patients referred for minor oral surgery (MOS). The previous audit identified that 15 per cent of patients had procedures within 16 weeks with an average wait of 32 weeks.

MATERIALS AND METHOD: A prospective service evaluation over a 19-month period (May 2015 to December 2016) at the Royal London Hospital. A 16-week wait from referral to procedure is set out in the National Health Service Constitution. All patients referred from the orthodontic department for MOS with paediatric dentistry/oral surgery/oral and maxillofacial surgeons were included in this service evaluation. Data was collected from the Logbook on clinic, CRS Millennium and Electronic Patient Record systems.
RESULTS: Referrals were made for 104 patients (76 paediatric and 28 over-16s) over the evaluation period. The majority of referrals were made from January to July. The mean wait overall was 28.2 weeks. Of the 45 completed patients, only 11 (24%) were operated on within 16 weeks. Paediatric patients had a longer average waiting time (28.4 weeks) than adult patients (26.6 weeks)

CONCLUSION: Marginally more patients were seen within the 16 week period than in the previous cycle. However, the overall findings remain disappointing. On this basis, an amendment to referral pathways, more robust pre-surgical screening and increased access to theatre time for surgical colleagues has been suggested.

SP 92 ACCELERATION METHODS OF ORTHODONTIC TREATMENT WITH EXTRACTIONS
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AIMS: To evaluate if there are additional surgical and non-surgical procedures that can decrease the time to align the teeth.

MATERIALS AND METHOD: A bibliographic review was carried out, with an electronic search of scientific articles in the following main electronic databases: PubMed (MeShDatabase), Medline, Science Direct, Embase, Google Scholar, and Cochrane. The combinations of words used were: ‘acceleration of orthodontic movement’, ‘micro-osteo perforations’, ‘custom brackets’, ‘low intensity laser’ and ‘surgery first’. All these combined were used to find literature published on each topic between 2007 and 2017. Inclusion criteria were patients with extraction of the first upper premolar, maximum anchorage, orthodontic patients, both genders, any age but permanent dentition and studies in English, French or Spanish. Exclusion criteria were in vitro or animal trials, patients with craniofacial disorders, orthognathic, surgery patients, previous orthodontic treatment and subjects with multiple tooth loss.

RESULTS: Three articles met the inclusion criteria. They compared space closure in different patients with extraction of the upper first right and left premolars using laser, micro-osteo perforation and corticotomy on one side of each patient. Micro-osteo perforations increased the canine retraction rate 2.3 times compared to the control group. But, extractions can change the speed of tooth movement by increasing the activity of inflammatory markers, which could obscure the effect of micro-osteo perforations. Low level laser therapy (GaAlAs) in the configuration of the parameters of that study had no effect on the rate of orthodontic movement of the teeth during any period of time, between one and three months. Corticotomies can be an effective method for patients who wish to shorten the duration of orthodontic treatment.

CONCLUSION: Among the alternatives for acceleration of dental movement, corticotomies show the best results in terms of reduced treatment time. There is no significant evidence of dental acceleration for the other options. Quality studies are required to confirm if these procedures can accelerate dental movement.

SP 93 EVALUATION OF CERVICAL VERTEBRAL ANOMALIES IN UNILATERAL CLEFT LIP AND PALATE PATIENTS
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AIMS: To evaluate the development and anomalies in the cervical region of the vertebrae in patients with a unilateral cleft lip and palate (UCLP).

MATERIALS AND METHOD: The archived lateral cephalograms of 30 patients (mean age: 15 ± 7 years) with a UCLP and 30 patients (mean age: 15 ± 3 years) with a skeletal Class I malocclusion were evaluated. In total 60 cephalometric radiographs were evaluated to determine vertebral anomalies [Posterior arch deficiency (PAD); Spina Bifida, Dehiscence and Fusion, Block Fusion and Occipitalisation (FUS)] anomalies. One observer undertook all evaluations. The Chi square test was used for the statistical evaluation.

RESULTS: Cervical vertebral anomalies were observed in 56.7 per cent of the UCLP group and in 40 per cent of the control group. Both groups showed more fusion anomalies than the posterior arch deficiency. Thirty per cent PAD and 43.3 per cent FUS were found in UCLP group and 13.3 per cent PAD and 33.3 per cent FUS in the control group. There was no statistically significant difference between the groups (P = 0.196). Although not statistically significant, in the UCLP group, spina bifida was observed in 30 per cent and in the control group it was 13.3 per cent. Block fusion in the UCLP subjects was 6.7 per cent, and occipitalisation 3.3 per cent. In the
control group 16.6 per cent showed both cervical vertebral anomalies whilst this was 29.4 per cent in the UCLP group.

CONCLUSION: In this pilot study, the UCLP group had more cervical vertebral anomalies than the control group. More studies with a larger number of patients with a unilateral or bilateral cleft lip and/or palate should be undertaken to reach more definite results.

SP 94 EVALUATING MAXILLARY EXPANSION IN PATIENTS WITH A CLEFT LIP AND PALATE: A CONE-BEAM COMPUTED TOMOGRAPHY STUDY
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AIMS: To evaluate dentoskeletal changes in the maxilla of patients with a cleft lip and palate (CLP) treated with the quadhelix appliance.

SUBJECTS AND METHOD: Twenty patients (mean age 10.7 years) with a CLP. A pre-treatment cone-beam computed tomography (CBCT) image was taken as part of the initial orthodontic records, and a second tomography was taken after maxillary expansion and justified because of its importance in bone graft planning. A fully automated voxel-wise method was used to superimpose the images, using the cranial base as reference. Occlusal and frontal sections were used to measure maxillary transverse dimensions and posterior tooth inclinations.

RESULTS: The quadhelix appliance showed a significant differential expansion between anterior and posterior regions, revealing a greater arch width in the anterior maxillary region. Expansion also produced buccal tipping of molars, premolars and primary canines (when present) as well as an increase in arch perimeter.

CONCLUSION: Analyses of superimposed CBCT image reconstruction provides good information regarding treatment changes. This study showed differences between the two images regarding maxillary width and teeth position. Post-expansion assessment revealed a greater anterior maxillary expansion compared with the posterior region.

SP 95 EFFICACY OF RAPID MAXILLARY EXPANSION IN OBSTRUCTIVE SLEEP APNOEA – A SYSTEMATIC REVIEW WITH META-ANALYSIS
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AIMS: Obstructive sleep apnoea (OSA) is characterized by a reduction or absence of airflow in the oral/nasal cavity. Rapid maxillary expansion device (RME) has been considered an important treatment option. The objective was to review the literature to assess the effectiveness of RME in the treatment of children with OSA.

MATERIALS AND METHOD: A research was developed over the following primary and secondary electronic data bases (PubMed, Web of Science, Lilacs, Embase and Cochrane Library). A search strategy was made using the English terms: [palatal expansion technique (Mesh)] AND (sleep apnoea, obstructive' (Mesh)] limited to randomized controlled trials, cohort studies, systematic review and meta-analysis, in Portuguese and English, performed in humans under 18 years and regarding articles published between January 2000 and December 2016.

RESULTS: A total of 84 articles were identified, 16 of which were considered potentially relevant. After applying the inclusion and exclusion criteria, 10 publications were eliminated. Of the six accepted publications, only five had a positive result after the Critical Appraisal Skills Programme quality assessment and therefore were included in this study.

CONCLUSION: RME is effective in the treatment of children with OSA combined with inadequate respiratory capacity and transverse maxillary deficiency, resulting in the improvement of polysomnographic variables, especially in the apnoea-hypopnea index.

SP 96 COMPARATIVE FACIAL ANALYSIS OF PATIENTS WITH ASYMMETRICAL MALOCCLUSIONS ACCOMPANIED BY A SKELETAL CLASS III MALOCCLUSION AND UNILATERAL CONDYLAR HYPERPLASIA†††
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AIMS: To determine photometric facial features of patients with asymmetric malocclusions accompanied by a skeletal Class III and unilateral condylar hyperplasia.

MATERIALS AND METHOD: Comparative photometric analysis of 50 patients with asymmetric malocclusions accompanied by skeletal Class III and unilateral condylar hyperplasia was carried out on two groups: 25 patients with asymmetrical malocclusions and a skeletal Class III (group I) and 25 patients with a skeletal Class III and unilateral condylar hyperplasia (group II). In all cases analysis was carried out on standardized full-face photographs with skin marks of anthropometric points. Symmetry assessment was based on analysis of symmetry of attractive faces from the world literature data with main facial indexes and angular parameters.

RESULTS: Statistical data analysis showed no statistically significant difference between groups I and II, while in both groups statistically significant difference of contralateral side symmetry were revealed. Photometric ratio of contralateral sides for Zy-GO (23%), Zy-Ch (20%), Go-Me (28%), Ch-MRS (37%) according to normal value were statistically significant (P < 0.05) in both groups.

CONCLUSION: Similar facial asymmetry was shown in both groups of patients in Zy-GO, Zy-Ch, Go-Me ratio parameters with 25-37 per cent value, while photometric analysis was not effective for differential diagnosis for patients with asymmetric malocclusions accompanied by a skeletal Class III and unilateral condylar hyperplasia.

SP 97  LINEAR AND ANGULAR MEASUREMENTS OF THE POSITION OF PALATALLY IMPACTED CANINES – TWO VERSUS THREE DIMENSIONS

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AIMS: To determine the reliability of three different radiographic methods used for measuring the position of palatally impacted canines.

MATERIALS AND METHOD: Treatment records of 43 patients, with 51 palatally impacted canines were measured. Impacted canine inclination and the distance to the vertical and occlusal planes were measured on panoramic radiographs, cone beam computed tomographic (CBCT) scans and panoramic radiographs generated from CBCT. In order to determine measurement reliability, the repeatability and reproducibility of three different imaging methods were measured. Repeatability was evaluated by technical error of measurement using the Dahlberg method and the coefficient of variation. Reproducibility was quantified by the coefficient of repeatability according to Bland and Altman and by Bland-Altman plots.

RESULTS: Good and clinically acceptable repeatability was proven for panoramic radiographs, CBCT scans and generated panoramic radiographs in all linear and angular impacted canine position measurements with respect to the reference planes. The findings showed good and clinically acceptable reproducibility for all radiographs in linear measurements, but poor and clinically unacceptable reproducibility in angular measurements of impacted canine position with respect to the reference planes. A large and clinically significant bias in angular impacted canine position measurements was proven between three-dimensional (3D) CBCT scans and two-dimensional (2D) panoramic radiographs and generated panoramic radiographs.

CONCLUSION: Given the different results of 2D and 3D imaging methods for impacted canine position measurements, these methods are not interchangeable and previous findings obtained from 2D methods cannot be automatically applied to CBCT scans.

SP 98  DIAGNOSIS OF TOOTH ANKYLOSIS USING PANORAMIC VIEWS, CONE BEAM COMPUTED TOMOGRAPHY, AND HISTOLOGICAL DATA

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Aims: To determine whether cone beam computed tomography (CBCT) is a reliable radiological method to diagnose tooth ankylosis.

Materials and Method: A series of teeth clinically diagnosed as ankylosed were collected after extraction in a private practice from 2009 to 2015 and analyzed retrospectively. Inclusion criteria comprised permanent molars extracted due to failed tooth eruption in the absence of any visible mechanical obstruction, existing panoramic view (PV), and CBCT and histological sections of sufficient quality. The CBCT scans and PVs were evaluated twice for signs of ankylosis by two independent observers using the following score: clear signs, possible signs, and no signs. The histological sections were evaluated and graded similarly to the radiographs by a specialist blinded to the radiographs and treatment.

Results: From an initial group of 22 patients, nine subjects with 10 affected teeth were included for final evaluation. The age ranged from 8.3 to 17 years. No agreement was seen when comparing the PV scores to the histological sections. Fair to moderate agreement was seen when comparing the CBCT scores to the histological sections. All histologically confirmed ankylosis were detected on CBCT by both observers but some false positive results were found. Due to the small sample size available as the disorder is rare, it was difficult to distinguish ankylosis from primary failure of eruption.

Conclusion: CBCT images can be a useful adjunctive diagnostic tool to diagnose ankylosed teeth, but cannot be recommended as a single diagnostic modality as false positive results were found.

Sp 99  Enamel Microcracks As a Form of Dental Injury During Orthodontic Debonding: A Systematic Review and Meta-analysis of In Vitro Studies
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Aims: To evaluate and compare enamel microcracks (EMCs) characteristics (both qualitative and quantitative) as the form of dental injury before and after bracket removal from human teeth of in vitro studies.

Materials and Method: Eligibility criteria: laboratory studies evaluating and measuring EMCs characteristics before and after debonding metal and ceramic brackets on human teeth with intact buccal enamel. An electronic search of four databases (all databases of the Cochrane Library, CA Web of Science, Medline via PubMed and Google Scholar) and additional manual searches were carried out, without language restrictions. Studies published between 2000-2017 years were selected. Reference lists of the included articles were screened, and authors were contacted when necessary. For risk of bias assessment, the following six parameters were analyzed: blinding of examiner and outcome assessment, incomplete outcome data before and after debonding, selective outcome reporting, and incomplete reporting of EMCs assessment.

Results: Out of 430 potentially eligible studies, 259 were screened by title and abstract, 180 were selected for full-text analysis, 14 were included in the systematic review. Seven studies were selected for the meta-analysis. The results for EMCs characteristics were expressed as mean differences (MDs) with their 95% confidence intervals (CIs), and calculated from random-effects meta-analyses. The debonding procedure was associated with an increase in number (three studies, MD = 3.50, 95% CI, 2.13 to 4.87, P < 0.00001), length (seven studies, MD = 3.09 mm, 95% CI, 0.75 to 5.43, P < 0.00001) and width (three studies, MD = 0.39 µm, 95% CI, -0.01 to 0.79, P = 0.06) parameters of EMCs. Due to limited number of studies, subgroup analyses could not be performed. Considerable statistical heterogeneity was found for two forest plots evaluating the debonding effect on the number and length characteristics.

Conclusion: There is weak evidence indicating that the length and width of EMCs increase following bracket removal but the scientific evidence concerning quantitative evaluation of the number parameter before and after debonding is insufficient. However, there is strong evidence that after debonding the number of EMCs is likely to increase.

Sp 100  An Evaluation of Periodontal Screening for Orthodontic Patients
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AIMS: The global prevalence of periodontal disease is increasing and litigation resulting from undiagnosed periodontal disease is not uncommon. The Basic Periodontal Examination (BPE) has been developed as a simple, rapid screening tool and is recommended as a preliminary screening for every new patient. The aim of this project was to ensure that periodontal screening is being undertaken for every new patient, and that the appropriate departmental protocol is being adhered to.

MATERIALS AND METHOD: A retrospective analysis of the case records of 40 consecutive new patients referred to a university orthodontic department were assessed in June 2015 (cycle one), equally split between the five orthodontic consultant clinics. This was repeated in September 2017 (cycle two). Patients older than 15 years were included, as below this age the likelihood of periodontal disease is low, and in some cases anxiety may preclude periodontal screening. Each set of case notes were examined to determine if a BPE score had been recorded, and whether the departmental protocol had been adhered to.

RESULTS: In cycle one, 25 per cent of patients did not have a BPE score recorded at initial consultation, whilst in cycle two this increased to 45 per cent. Certain clinicians were superior at recording a BPE score. In the first cycle, 5 per cent of patients did not have the appropriate periodontal management instituted as per the departmental protocol. No patients scored a 4 or * in either cycle.

CONCLUSION: Periodontal screening is not being undertaken adequately, and the departmental protocol is not being followed in every case. Patients with active periodontal disease should not be accepted for orthodontic treatment due to the risk of provoking and exaggerating periodontal destruction. All clinical staff should be reminded of their clinical duty to conduct periodontal screening for all patients, and the departmental guidelines for patients requiring periodontal management.

SP 101 A RANDOMISED CONTROLLED TRIAL TO DETERMINE THE RATE AND MECHANISM OF OVERTBITE REDUCTION IN ADOLESCENTS
Evelyn Dunbar, Grant McIntyre, Peter Mossey, University of Dundee, U.K.

AIMS: To 1) determine if re-establishment of occlusal contact is achieved within six months following insertion of fixed anterior bite planes in adolescents, and 2) evaluate the occlusal changes that produce the reduction in overbite.

SUBJECTS AND METHOD: Subjects were recruited from the new patient clinics and treatment waiting list. Following enrolment, participants were randomly allocated to either the intervention or control groups using the sealed envelope method. A lateral cephalogram was taken of all subjects as well as a baseline intraoral scan and clinical photographs. The intervention group had fixed anterior bite planes placed and a second intraoral scan and photographs immediately afterwards. Every six weeks the intraoral scan and photographs were repeated. After six months a final intraoral scan, photographs and lateral cephalogram were obtained. The control group were recalled after six-months for a final intraoral scan and photographs. The scan data were analysed with ANOVA and Mann-Whitney U tests. The data from the radiographs and photographs were analysed with a non-parametric Mann-Whitney U and Wilcoxon signed rank tests.

RESULTS: Overbite reduction in the intervention group was achieved within six months. The predominant tooth movement was molar eruption. In the control group the overbite remained static. This difference in tooth movement was statistically significant (P < 0.05). There was no statistically significant skeletal change associated with overbite reduction.

CONCLUSION: Overbite reduction in adolescents can be achieved within 12 weeks with a fixed anterior bite plane and is achieved predominantly by molar eruption with a lesser degree of incisor intrusion. There is no discernible skeletal change associated with overbite reduction in adolescents.

SP 102 CONSENT FOR ORTHODONTIC TREATMENT – DO PATIENTS REMEMBER EVERYTHING WE TELL THEM?
Evelyn Dunbar, Grant McIntyre, Gurpreet Pye, Department of Orthodontics, University of Dundee, U.K.

AIMS: To determine the acceptability of the orthodontic consent process from the patients’ perspective using a specifically designed patient survey.

MATERIALS AND METHOD: One hundred questionnaires were distributed to patients/carers undergoing orthodontic treatment during February/March 2017.
RESULTS: The majority of questionnaires were completed by the patient (54%). Ninety-five per cent of responders felt they received a suitable amount of information at consent, and 81 per cent recalled being given written information leaflets. When asked if responders recalled being advised of an estimated treatment time, 79 per cent felt they had been given this information. Only 4 per cent felt they did not understand the risks of orthodontic treatment whilst 87 per cent felt they were given adequate information on retainers prior to embarking on treatment. Various suggestions for improving understanding prior to embarking on orthodontic treatment were proposed. The responders collectively favoured photographs (32%), leaflets (22%) and diagrams (21%). A copy of the consent form (9%) and more time to consider options (5%) were less popular.

CONCLUSION: The results indicate some shortfalls in the current procedures for gaining informed consent for orthodontic treatment. Clinicians are encouraged to give all patients written information leaflets to take home, as well as a copy of the consent form.

SP 103 AN EVALUATION OF THE ACCURACY AND SPECIFICITY OF THE ORTHODONTIC CONSENT PROCESS
Evelyn Dunbar, Grant McIntyre, Gurpreet Pye, Department of Orthodontics, University of Dundee, U.K.

AIMS: To determine 1) if written consent forms are being used in every case and supplemented by documentation in the case records where appropriate, and 2) if the content of the consent form is accurate. The content included appliance type, extraction pattern, duration of treatment and retention, and risks involved with orthodontic treatment.

MATERIALS AND METHOD: The case records of 100 orthodontic patients consecutively treated from 2012 onwards at a university orthodontic clinic were assessed. Treatment had been carried out in entirety in the department, and all patients had completed active orthodontic treatment. In addition to the case records, the electronic appointment system was accessed to record attendances and appointment records for each patient.

RESULTS: There was no written consent form present in 10 per cent of the case records examined. An explanation of the risks associated with treatment was documented in only 89 per cent of records examined. When alterations were made to the original treatment plan (in 9% of the cases examined) a new consent form or amendment to the original form was not made. The actual length of treatment was as proposed or within 3 months of the proposed length in only 37 per cent of cases. In 52 per cent of cases the proposed treatment length was underestimated. The number of visits in retention ranged from 0-14 visits, with the majority of patients (84%) in on-going regimes.

CONCLUSION: Changes to the current consent process are required, as the accuracy and specificity was noted to be inadequate. Clinicians need to be reminded to use the departmental consent form, which will be updated to include greater detail and emphasis on patient responsibility, a copy of which should be given to the patient to retain. This also includes a statement in relation to long-term responsibility for retention after discharge.

SP 104 EARLY TREATMENT OF CHILDREN WITH CLASS II DIVISION 2 MALOCCLUSIONS
Maria Dushenkova, Marina Pavlova, Irina Rubleva, Tatyana Klimova, Moscow State University of Medicine and Dentistry, Russia

AIMS: To: 1) study the intensity and direction of the age-related changes in the linear and angular parameters of individual morphological structures of the face and cerebral skull sections of children with a Class II division 2; 2) conduct a comparison of the intensity of age-related changes in the linear and angular parameters of children with a physiological occlusion and a Class II division 2 malocclusion; 3) identify the features of the intensity of age-related changes in individual morphological structures.

MATERIALS AND METHOD: Fifty three lateral teleroentgenograms were obtained of children with an Angle Class II division 2 malocclusion. Twenty eight of these subjects (6-12 years of age) were obtained during the mixed dentition and 25 children (12-15 years of age) after this period. The values of 19 linear and 16 angular parameters of the cerebral and facial skull sections were measured.

RESULTS: The data obtained on peculiarities of intensity of the age-related changes in linear and angular parameters of the skull indicated that orthodontic treatment for children with distal occlusion and retrusion of the upper anterior teeth is necessary at an early age. During diagnosis attention should be paid to the linear and angular parameters of age-related changes which considerably differ from normal.
CONCLUSION: In children with a Class II division 2 in the mixed dentition, there is a significant deviation from the norm in the intensity and direction of age-related changes in many linear and angular parameters of the skull, which indicates a disruption in the dynamics of the formation of the individual morphological structures of cerebral and facial skull sections.

SP 105 RESEARCH ON SKULL PARAMETERS OF CLASS II DIVISION 2 SUBJECTS
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AIMS: To improve the diagnosis of dental diseases of patients with Class 2 division 2 differing from the normal growth rate.
MATERIALS AND METHOD: Fifty three lateral teleroentgenograms of the head were obtained and 13 longitudinal and 14 vertical parameters of the facial and cerebral parts of the skull of 28 children (6-12 years of age) during the mixed dentition and of 25 children (12-15 age of age) after this period.
RESULTS: The intensity and severity of morphometric changes increased from group 1, 22.2 per cent of patients without 'joint complaints'; group 2, 17.8 per cent of patients with TMJ ‘licking’ during wide mouth opening only; group 3, 31.1 per cent of patients with TMJ ‘clicking’ and painful mouth opening, and group 4, 28.9% per cent of patients with painful mouth opening and limited mandibular mobility. The morphometric characteristics of the TMJ bone elements in all the patients were studied based on cone beam computer tomography data.
CONCLUSION: Data obtained showed that children with Class II division 2 should be treated as early as possible.

SP 106 MORPHOMETRIC CHARACTERISTICS OF BONE ELEMENTS OF THE TEMPOROMANDIBULAR JOINT IN PATIENTS WITH DYSFUNCTION
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AIMS: To improve orthodontic treatment results by evaluation of the morphometric characteristics of the temporomandibular joint (TMJ) bone elements in patients with TMJ dysfunction.
SUBJECTS AND METHOD: Two hundred patients aged 18 to 50 years with TMJ dysfunction were divided into four groups according to TMJ dysfunction: group 1, 22.2 per cent of patients without 'joint complaints'; group 2, 17.8 per cent of patients with TMJ ‘licking’ during wide mouth opening only; group 3, 31.1 per cent of patients with TMJ ‘clicking’ and painful mouth opening, and group 4, 28.9% per cent of patients with painful mouth opening and limited mandibular mobility. The morphometric characteristics of the TMJ bone elements in all the patients were studied based on cone beam computer tomography data.
RESULTS: The incidence and severity of morphometric changes increased from groups 1 to 4: the mandibular head position in mandibular fossa changed in usual occlusion (the number of patients with a normal mandibular position decreased from 30% to 15.4% from groups 1 to 4, respectively; the mandibular head retro position increased from 10% to 15.4%). The disorders of the mandibular fossa form and articular tubercle was found only in patients in groups 3 and 4 (21.4% and 23.1%, respectively). Mandibular head osteophytes were noted only in patients in groups 3 and 4 (14.3% to 23.1%, respectively). Mandibular head structure disorders were also noted only in patients of these groups (21.4% and 38.5%, respectively). The metric parameters of the TMJ gap were revealed in 91.4 per cent of patients. The average value of the TMJ gap width was: in the anterior segment –3.10 ± 0.11 mm, in the upper segment –3.05 ± 0.16 mm and in the posterior segment 2.55 ± 0.12 mm. Upper mandibular head dislocation was observed in 40.9 per cent, anterior dislocation in 43.2 per cent, and posterior dislocation in 11.4 per cent of patients.
CONCLUSION: Mandibular head dislocation in patients without occlusal abnormalities may indicate hidden musculo-articular disorders that need orthodontic correction for prevention of subsequent TMJ bone element deformations.

SP 107 THE VALIDITY AND RELIABILITY OF A NEW SOFTWARE FOR DIGITAL SCORING OF THE AMERICAN BOARD OF ORTHODONTICS OBJECTIVE GRADING SYSTEM
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AIMS: To investigate the validity and reliability of new software to score the American Board of Orthodontics Objective Grading System (ABO OGS) using digital models to replace the conventional method of using plaster models. The secondary aims of the study were to assess the level of agreement between orthodontists and non-orthodontists scores and compare the time taken to score the ABO OGS using both methods.

MATERIALS AND METHOD: Thirty one post-treatment plaster models were scanned using a laser scanner. Four investigators with different levels of orthodontic knowledge scored the ABO OGS using the conventional method on plaster models (gold standard) and digital models using the new software. All investigators received appropriate training prior to scoring the models. The time taken for scoring was compared between both methods. The Pearson correlation coefficient and Bland-Altman plots were used to assess the correlation and agreement between the two scoring methods as well as intra- and interexaminer reliability. ANOVA was used to assess the difference in scoring time.

RESULTS: There was no agreement between the new software and the conventional scoring method in any of the ABO OGS components, except the buccolingual inclination component. The new software had acceptable intraexaminer reliability: the total score was R = 0.583 (P = 0.001); however, interexaminer reliability was found to be low, with a correlation R = −0.039 (P = 0.834). The conventional scoring method had high intra- and interexaminer reliability, with correlation as high as R = 0.915 (P = 0.000) for intraexaminer reliability and R = 0.970 (P = 0.000) for interexaminer reliability for the total score. The difference in the level of orthodontic knowledge among examiners had a significant influence on the reliability of the new software but not on the conventional scoring method. The new software took significantly more time for scoring than the conventional method (mean difference 20.09 minutes, P = 0.00).

CONCLUSION: The new software is not a valid method for ABO OGS scoring; it cannot replace the conventional plaster model.

SP 108 DO PATIENTS WITH JUVENILE IDIOPATHIC ARTHRITIS HAVE DEFORMED AND INFLAMED TEMPOROMANDIBULAR JOINTS? A SYSTEMATIC REVIEW
Martina Eichenberger, Karma Kyburz, Papageorgiou Spyridon, Theodore Eliades, University of Zurich, Switzerland

AIMS: To assess, in a systematic review, to what extent are the temporomandibular joints (TMJs) of patients with juvenile idiopathic arthritis (JIA) affected by the disease.

MATERIALS AND METHOD: Nine electronic databases were searched from inception to October 2017 without year, language, or publication type limitations for clinical studies employing magnetic resonance imaging to screen the TMJs of JIA patients for abnormalities and inflammation. Study selection, data extraction, and risk of bias within studies were performed in duplicate by two authors. The results of included studies were synthesized quantitatively by calculating pooled percentage rate of symptoms and their 95% confidence intervals (95% CI) with a random-effects model. Differences in the prevalence of joint deformities or symptoms between JIA patients and healthy controls were assessed with Relative Risks (RR) and their 95% CIs, while the quality of evidence was measured with the GRADE approach.

RESULTS: After applying the pre-defined eligibility criteria, a total of 17 unique clinical studies were included. Signs of joint enhancement were seen in 83 per cent of JIA patients (6 studies; 95% CI = 74-91%; 12 = 61.2%), condyle erosion in 45 per cent (5 studies; 95% CI = 18-73%; 12 = 93.4%), joint effusion in 36 per cent (4 studies; 95% CI = 18-55%; 12 = 77.0%), pannus in 21 per cent of JIA patients (3 studies; 95% CI = 9-35%; 12 = 40.5%), and condylar disc abnormality in 71 per cent (3 studies; 95% CI = 35-97%; 12 = 92.7%). Considerable heterogeneity in symptom prevalence was observed, which corresponded significantly with patient characteristics and especially disease severity. Finally, JIA patients showed increased prevalence of joint enhancement compared to healthy patients (RR = 38.61; 95% CI = 2.49-over 100; P = 0.009). However, the quality of evidence was judged as low, due to the inclusion of biased study designs with methodological limitations, imprecision, and inconsistency.

CONCLUSION: Evidence from magnetic resonance imaging indicates that JIA patients present considerable involvement of the TMJ to a varying degree, which is increased compared to healthy patients.

SP 109 WHAT EFFECT HAS FUNCTIONAL APPLIANCE TREATMENT ON THE TEMPOROMANDIBULAR JOINT? A SYSTEMATIC REVIEW
Karma Kyburz, Spyridon Papageorgiou, Theodore Eliades, University of Zurich, Switzerland
AIMS: To assess, in a systematic review, the effect of functional appliance treatment on the temporomandibular joint (TMJ) of human patients.

MATERIALS AND METHOD: Nine electronic databases were searched from inception to October 2017 without year, language, or publication type limitations for clinical studies assessing the effect of functional appliance treatment for Class II malocclusion on the TMJ morphology. Study selection, data extraction, and risk of bias within studies were performed in duplicate by two authors. The results of included studies were expressed quantitatively and the quality of evidence was measured with the GRADE approach.

RESULTS: After applying the pre-defined eligibility criteria, a total of nine papers pertaining to eight unique clinical controlled studies were included. These studies included a total of 175 Class II patients treated with various functional appliances (Activator, Bionator, Forsus Fränkel, Herbst, or Twin Block) with mean age 11.4 years and 127 untreated control patients with a mean age of 11.9 years. Functional appliance treatment was associated with significant increases compared to untreated controls in the TMJ spaces in all three regions relative to the condyle: anterior (change = 0.53 mm; 95% CI = 0.31 to 0.75 mm), posterior (change = 1.01 mm; 95% CI = 0.83 to 1.19 mm), and superior joint space (change = 0.64 mm; 0.35 to 0.93 mm). There was a minimally greater increase in the volume of the condyle and glenoid fossa in treated patients compared to untreated ones (net increase of 9 mm$^3$ for the condyle and 8 mm$^3$ for the glenoid fossa), which was not statistically significant. Finally, patients treated with functional appliances showed greater superior and posterior condylar growth than the untreated controls (3.5 mm and 2.0 mm, respectively). However, existing evidence is of low quality according to GRADE, due to the limited number of contributing studies and potential bias from the use of retrospective study designs and historical control groups.

CONCLUSION: There is limited evidence of low quality regarding the effect of functional appliance treatment on the TMJ structures.

SP 110 FIRST PERMANENT MOLAR EXTRACTION FOLLOWED BY ORTHODONTIC SPACE CLOSURE: A SYSTEMATIC REVIEW
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AIMS: A systematic review of studies investigating first permanent molar extraction followed by orthodontic space closure.

MATERIALS AND METHOD: Clinical studies on first permanent molar extraction followed by orthodontic space closure were included. Two authors independently searched and extracted the records. The search covered the period from January 1, 1900 to August 31, 2017. Studies in languages other than English, Arabic or German were excluded. Risk of bias was assessed using the Newcastle-Ottawa scale. Electronic databases (PubMed, Embase, Livivo and Google Scholar) were screened, and hand searches and cross-referencing performed. Studies were included after consensus was reached through discussion.

RESULTS: From 2420 identified studies, 185 were evaluated full text, and 74 studies investigating different orthodontic management modalities for space closure after extraction of the first permanent molars clinical trials were included. Forty nine were case reports and case series, 20 retrospective studies, and five prospective studies. Eleven investigated Class I patients with a mean age of 24.6 (3-58) years, 44 Class II patients with a mean age of 17.0 (10.7-34.2) years, 11 Class III patients with a mean age of 21.7 (11.8-47.6) years, while eight studies did not mention the Angle Class. Included studies showed mainly moderate to high risk of bias.

CONCLUSION: First permanent molar extraction followed by orthodontic space closure seems to be a valid successful treatment option, however, many factors (including the patient’s preference and the cost-effectiveness) have to be considered for each patient individually to come to the most suitable treatment decision. The lack of prospective studies must be highlighted. The majority of studies were observational studies (66% case reports and case series, 27% retrospective cohort studies and 6% prospective cohort studies). Strong recommendations are not possible based on the current evidence. Future studies should aim for high internal and external validity, a prospective (randomized controlled) design and follow-up patients for longer time periods and also include outcomes relevant to patients and public services.

SP 111 EVALUATION OF PIEZOCISION IN RAPID CANINE RETRACTION
Ahmed Elkalza, Department of Orthodontics, Alexandria University, Egypt
AIMS: To evaluate the effectiveness of the piezocision technique during rapid canine retraction.

SUBJECTS AND METHOD: Twenty four patients ranging from 16 to 25 years of age with malocclusions that required first premolar extractions followed by canine retraction. Before starting canine retraction, maximum anchorage was ensured by placing miniscrews 10 mm in length and 1.6 mm in diameter between the second premolar and first molar. In the experimental group, two vertical incisions were made on the buccal aspect mesial and distal to the canine. A piezo electric knife was used to create cortical bone incisions to a depth of 3 mm. Canine retraction was performed on both sides using nickel titanium closed coil springs with force of 150 g. Scanned casts were used to evaluate canine retraction movement on both sides.

RESULTS: When comparing the two sides at the same time, a significant difference was found between the sides; the test side was decreased significantly more than the control side.

CONCLUSION: Piezocision assisted orthodontics is an effective treatment alternative that decreases the time required for canine retraction.

SP 112 COMPARATIVE STUDY OF ROOT RESORPTION BETWEEN TWO METHODS FOR ACCELERATED ORTHODONTIC TOOTH MOVEMENT
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AIMS: To compare the susceptibility of external apical root resorption (EARR) between two methods for acceleration of orthodontic tooth movement (micro-osteoperforation and piezocision assisted orthodontics).

SUBJECTS AND METHOD: Sixteen patients indicated for maxillary first premolars extraction and canine retraction, randomly divided into two groups equally. In group A, micro-osteoperforations were performed 1.5 mm wide and 2-3 mm in depth distal to retracted canine on experimental side using propel orthodontics and the other side considered as the control. In group B, piezocision cuts 5 mm in length were performed on mesial and distal sides of the retracted canine on the experimental side while other side served as the control. Canine retraction was done in both groups using nickel titanium closed coil springs delivering force of 150 g per side. Anchorage was ensured by placing miniscrews bilaterally between first molar and second premolar. Before and after canine retraction, cone beam computed tomographic scans were taken for each patient to evaluate EARR. The coronal, sagittal and axial planes were adjusted to intersect in the pulp chamber of the canine at the level of the cementoenamel junction. Root length was measured from the most apical point of the root to the cusp tip, along the long axis in the sagittal view. The measurements were obtained using software tools including linear measurement tool and a digital magnification sense.

RESULTS: In the micro-osteoperforation group, there was insignificant difference between both sides (P > 0.05). In the piezocision group, there was a significant increase in the amount of root resorption on the experimental side in comparison to the control side after canine retraction (P < 0.05). On comparing the experimental side in both groups regarding EARR post-operatively, the piezocision group showed a significant increase in root resorption more than micro-osteoperforation group.

CONCLUSION: Piezocision assisted orthodontics results in a statistically significant increase in the amount of root resorption in comparison to micro-osteoperforation for accelerating orthodontic tooth movement after application of a buccally tipping force to the maxillary canine. There is a risk of iatrogenic root damage when performing piezocision assisted orthodontics.

SP 113 FORCES AND MOMENTS EXERTED BY ALIGNERS DURING MESIAL AND DISTAL DEROTATION OF A MANDIBULAR CANINE: AN IN VITRO STUDY
Fayez Elkholy, Bernd G. Lapatki, Department of Orthodontics, University of Ulm, Germany

AIMS: To determine the force and moment (F/M) components applied by different PET-G aligner thicknesses during a simulated mesial and distal derotation of a mandibular right canine.

MATERIALS AND METHOD: The experimental set-up comprised an acrylic model of the lower teeth with a separated right canine mounted on a hexapod via a three-dimensional F/M sensor. Duran+® aligners (Scheu Dental, Germany) with thicknesses of 0.5, 0.625 and 0.75 mm were thermoformed on plaster models with the measurement tooth in its original neutral position. The F/M values were recorded during mesiorotation or
distorotation of tooth 43 in one-degree steps up to ±15 degrees, corresponding to 0.5 mm displacements of the mesial and distal edge of the tooth, respectively. Each rotation step included renewed seating of the aligner on the acrylic model. Three aligners were tested for each thickness and direction of rotation.

RESULTS: The median rotational moment for the 0.5 mm aligner seated on a 15 degree distorotated tooth 43 was 27.49 Nmm [interquartile range (IQR), 1.45 Nmm]. The corresponding values for the 0.625 and 0.75-mm aligners were 41.04 Nmm (IQR 5.62 Nmm) and 42.48 Nmm (IQR 2.17 Nmm), respectively. The rotational moments were on average 15 per cent higher during distorotation compared to mesiorotation of tooth 43 (P = 0.01). High collateral F/M components, specifically an intrusive force and labio-lingual and mesio-distal tipping moments, were also observed.

CONCLUSION: To avoid overloading of periodontal structures, derotation of lower canines should be limited to 10 degrees per set-up step, leading to rotational moments of about 15 Nmm. Due to the nearly similar mechanical loads exerted by the 0.625 mm and the 0.75 mm aligner, the 0.625 mm aligner may be omitted from the aligner sequence. Further studies are required to investigate specific aligner modifications or attachments for minimizing collateral F/M components during canine derotation.

SP 114 ACCURACY AND TIME SAVING OF AUTOMATIC TOOTH WIDTH MEASUREMENT ON DIGITAL THREE-DIMENSIONAL ORTHODONTIC STUDY MODELS

Fayez Elkholy, Katharina Stöckel, Bernd G. Lapatki, Department of Orthodontics, University of Ulm, Germany

AIMS: Previous studies comparing conventional and digital three-dimensional (3D) model analysis revealed a strong similarity in terms of tooth dimensions and time needed for the analogue and manual digital measurements. The aim of the current study was to investigate whether comparably accurate measurements in less time could be achieved with automatic tooth width determination featured by model analysis software.

MATERIALS AND METHOD: Fifty pre- and post-therapeutic model pairs were included in the study. The widths of the teeth 6-6 in both jaws were determined in the following manner: 1. on the stone models with a slide gauge (conventional), 2. on the digital models by manually marking the most mesial and distal point of each tooth (digital-manual), and 3. on the on the digital models by using the automatic point placement feature of the model analysis program (digital-automatic). The digital measurements were performed by using the OnyxCeph™ model analysis software.

RESULTS: When compared to the conventional method, the digital-manual method showed average tooth width deviations of 0.05 mm. With the digital-automatic method, in contrast, the mandibular posterior teeth were 0.25 mm wider [interquartile range (IQR) 0.33 mm] and those of the anterior teeth (3-3) were 0.15 mm (IQR 0.30 mm) narrower compared to conventional tooth width determination. In terms of time, the conventional and digital-manual methods required similar time with values of 157 and 154 seconds, respectively. The digital-automatic method, in contrast, was about half minute faster and required only 121 seconds.

CONCLUSION: With regard to tooth width determination, the conventional method and the two evaluated digital methods can be considered as equivalent, since the existing metric differences lie within a clinically negligible range (IQR for all tooth groups <0.15 mm). The digital-automatic method required the least amount of time and, therefore, can be favoured for future clinical use.

SP 115 TOOTH AGENESIS AND ITS MANAGEMENT FROM THE PATIENT’S PERSPECTIVE: A SYSTEMATIC REVIEW AND META-ANALYSIS OF PATIENT-REPORTED OUTCOME MEASURES

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AIMS: Unlike laboratory or clinical indices, patient-reported outcomes may provide more information on physical and psychosocial effects of various conditions or treatments. The aim was to systematically investigate the available literature regarding the impact of tooth agenesis and its management from the patient’s perspective.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data from studies investigating the impact of tooth agenesis on children and the effect of subsequent treatment, with psychometrically validated instruments, were reviewed, and the random effects
method was used to combine the retrieved data. The clinical significance of the changes was evaluated following relevant guidelines.

RESULTS: Out of 1785 initially identified unique records, six fulfilled the selection criteria for inclusion in the systematic review: four cross-sectional studies on the impact of tooth agenesis on children using the Child Perceptions Questionnaire 11-14 and two prospective studies investigating the effect of treatment by means of the Oral Health Impact Profile-49. Overall, children with tooth agenesis experienced impacts from the condition. Combined orthodontic and restorative management resulted in moderate to large changes in the investigated patient-reported dimensions.

CONCLUSION: Tooth agenesis exerts an impact on oral health related quality of life that is mitigated by orthodontic and restorative treatment. Better standardization and reporting in long follow-ups are necessary in order to understand fully the effect of the condition and its management from the patient’s perspective.

SP 116 WHICH INSTRUMENTS HAVE BEEN USED FOR ASSESSING HEALTH-RELATED QUALITY OF LIFE OF PATIENTS WITH TOOTH AGENESIS? A SYSTEMATIC REVIEW
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AIMS: To present the psychometrically validated instruments used in the international scientific literature for the investigation of Health-Related Quality of Life (HRQoL) in patients with tooth agenesis.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data from studies evaluating HRQoL in patients with tooth agenesis were reviewed. Methodological quality was assessed with Consensus-based Standards for the Selection of Health Measurement Instruments checklist elements.

RESULTS: In the identified studies, the following instruments for HRQoL measurements were used: Cantril’s Self-Anchoring Ladder; Child Perceptions Questionnaire 11-14 (CPQ11-14); Child Perceptions Questionnaire 11-14 Short Form; Hospital anxiety and depression scale; Kaasa’s psychosocial well-being questionnaire; Oral Health Impact Profile-49 (OHIP-49); Oral Health Impact Profile-14; Oral Impact on Daily Performance; Rosenberg self-esteem scale; Short Form-36 Health Survey and the United Kingdom Oral Health-Related Quality of Life measure. Most studies used OHIP-49 and CPQ11-14. Methodological quality appraisal produced varying results.

CONCLUSION: The present systematic recording of HRQoL instruments used in patients with tooth agenesis revealed a yet limited but continuously growing research interest, and constitutes the beginning of the formation of a reference list in which researchers can use in order to choose the most appropriate HRQoL measurement instrument, both for clinical and research purposes.

SP 117 LOAD TRANSFER OF VARIOUS COMMERCIALY AVAILABLE STAINLESS STEEL WIRES USED FOR FIXED RETAINERS IN ORTHODONTICS
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AIMS: To assess in vitro the load transfer of various commercially available stainless steel wires used for fixed retainers in orthodontics.

MATERIALS AND METHOD: A robotic device in combination with two load sensors (S1 and S2) to calculate forces and moments in three dimensions, was set up to simulate a 10 degree proclination of a maxillary lateral incisor connected to the other three upper incisors through a fixed retainer. In increments of 0.25 degrees proclination, the load was measured at the lateral incisor (S1) and at the adjacent central incisor (S2). These measurements were performed for eight different stainless steel retainer wires with six samples of each wire (SS 0.016 × 0.016 inch plain, with and without heat treatment, Forestaflex 0.016 × 0.022-inch braided, with and without heat treatment, Respond® 0.0175 inch coaxial, Triple Flex™ 0.017 inch coaxial, Ortho-FlexTech™ 0.039 × 0.014 inch chain, Bond-A-Braid™ 0.026 × 0.010-inch 8-strand braided). Differences in load transfer between the types of wire were statistically analyzed through non-parametric statistics (Kruskal-Wallis and Student-Newman-Keuls post-hoc test).
RESULTS: The largest load transfer was measured for the Bond-A-Braid™. The two multistranded wires, Respons® and Triple Flex™, showed the smallest loads. Annealed wires showed both a markedly reduced load transfer and a torsional stiffness compared with their raw form; braided wires even more than non-braided ones.

CONCLUSION: The effective load transfer depended on the dimension and type (plain, braided, coaxial or chain) of the wire. Plain and braided retainers showed a more controlled load transfer than multistranded retainers, which may have stored more energy in the area between the composite bonding sites. This could be an explanation why unexpected complications with bonded retainers have been reported in the literature mainly for multistranded wires.

SP 118 SIDE EFFECTS DURING ALIGNER THERAPY – PREVALENCE AND INCIDENCE OF WHITE SPOT LESIONS
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AIMS: To analyze the prevalence and incidence of white spot lesions (WSL) in teenagers before and after aligner therapy (Invisalign teen®) using a newly-developed evaluation tool.

MATERIALS AND METHOD: Digital photographs of 42 patients were evaluated. At the beginning, their age was 14.0 ± 1.8 years. The average number of aligners was 43.4 ± 11.1 in the upper jaw and 42.7 ± 11 in the lower jaw. Different types of attachments, the intensity based on the Enamel Decalcification Index (EDI) of Banks and Richmond, and the extent (in %) were taken into consideration. Statistical analysis was performed using frequency tables, cross-tables and logistic regression.

RESULTS: Prior to aligner therapy, 16.7 per cent of the patients had at least one WSL and afterwards 52.4 per cent. Prior to treatment, 1.1 per cent of the tooth surfaces (TS) were found to have an EDI grade of between 1 and 3 and after treatment 9 per cent of TS. Prior to aligner therapy, 98.8 per cent of the TS did not show any WSL. Following treatment, 91 per cent of the TS did not show WSL; 9 per cent of the TS showed an extent of ≥20 per cent.

CONCLUSION: In this study, a low prevalence and low incidence rate of new WSL were observed during aligner therapy in teenagers.

SP 119 COMPARISON OF NASOPHARYNGEAL AIRWAY AFTER ORTHOPAEDIC AND SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION
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AIMS: To retrospectively evaluate and compare changes in the nasopharyngeal area after orthopaedic rapid maxillary expansion (RME) and surgically assisted rapid maxillary expansion (SARME).

SUBJECTS AND METHOD: Thirty-six patients between 16 and 18 years of age. Twelve patients were treated with RME, 12 patients with SARME and 12 patients comprised the untreated control group. Cephalometric radiographs were taken of each patient before and after the expansions/controls. The adenoidal area, aerial area and total area were measured. Statistical analysis, one-way ANOVA and post hoc Tukey multiple comparison tests were used for intergroup comparison and the paired samples t-test for intragroup evaluations.

RESULTS: After treatment, adenoidal, aerial and total areas were significantly increased in both groups (P < 0.05) in comparison with pre-treatment values. After SARME and RME, adenoidal and total areas were significantly increased compared to the control group (P < 0.05). The increase of adenoidal, aerial and total areas in the SARME group was greater than in the RME group, but not statistically significant (P > 0.05).

CONCLUSION: Both SARME and RME treatments positively affect nasopharyngeal airway and cause a significant increase in the nasopharyngeal area in patients with transversal maxillary constriction.

SP 120 DETERMINATION OF THE FACIAL BIOTYPE: RELATIONSHIP BETWEEN THE MANDIBULAR PLANE AND THE CERVICAL VERTEBRAE
AIMS: To assess whether or not there is a relationship between the pattern of cephalometric facial growth and the cutting area of the mandibular plane extension over the cervical vertebrae.

SUBJECTS AND METHOD: Fifty four patients with an age range between 13.1 and 67.2 years. The facial growth pattern had previously been determined by the values of the angle of the mandibular plane of Steiner’s analysis (Go-Gn/S-N) and the VERT of Ricketts analysis from a cranial teleradiograph. An orthodontist drew a tangent to the mandibular plane (Ag-Me) that passed through the cervical vertebrae and cut areas were established by the cervical vertebrae (Zone A; upper third of C2, Zone B; middle third of C2, Zone C; lower third of C2, Zone D; cervical vertebrae C3). Statistical analysis was performed with R. A t-test was used to assess whether there were any significant differences between (a) the Go-Gn/S-N values for different cutting zones, and (b) the VERT value for different cutting zones taking all individuals together and then by gender. The percentage of growth pattern types for each cutting area was also calculated.

RESULTS: There were significant differences for Go-Gn/S-N angle values in the different cutting zones when comparing all individuals. VERT values showed no significant differences between zones A and B and B and C. In females significant differences were found between all areas except A and B and B and C for both the Go-Gn/S-N angle and VERT. In the male group no significant differences were found when comparing Go-Gn/S-N values between zones B and C and C and D. There were no significant differences between zones A and C and C and B when comparing VERT values. The percentages show that in cutting area A 100 per cent of patients had a dolicofacial pattern according to Steiner’s classification.

CONCLUSION: If the extension of the mandibular plane passes through zone A (upper third of C2) it can be determined that the patient has a dolicofacial growth pattern.

SP 121 PREVALENCE OF PULP DAMAGE OF MAXILLARY INCISORS IN ORTHODONTIC PATIENTS: A SURVEY AMONG NORWEGIAN ORTHODONTISTS.
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AIMS: To investigate the prevalence of pulp damage of maxillary incisors in orthodontically treated patients in Norway.

MATERIALS AND METHOD: A questionnaire was sent to all orthodontists registered in the Norwegian Orthodontic Society (239). They were asked, during three working days, to register clinically visible changes in maxillary incisors in patients who have had fixed appliances for more than six months. In addition to discoloration, fillings and/or anatomic changes of the maxillary incisors, the orthodontists were asked to register probable etiological factors where applicable, and the type of bracket used (conventional or self-ligating). It was also of interest to know if the patients themselves were aware of the possible changes. Means, standard deviations and percentages were used to evaluate the sample.

RESULTS: Of the 239 orthodontist included in this survey, 60 replied within 4 weeks, which gives a response rate of 25 per cent. As the survey was anonymous, no reminders were sent afterwards. The total number of registered patients was 1238 with 4952 maxillary incisors. Out of these, only 24 (1.9%) had visible signs of pulp damage (one incisor per patient), after orthodontic treatment for more than 6 months. Almost all of the affected incisors (23) were central incisors. The majority (73%) had signs of pulp damage before the start of treatment and mainly due to trauma (17 incisors) and dental anomalies (3 incisors). Ten of these were endodontically treated before orthodontic treatment. Four of the incisors with discoloration were of unknown etiology, and two of these (0.04%) developed signs of pulp damage during treatment. Conventional and self-ligating brackets were equally distributed. Only 13 patients reported being aware of the clinical changes.

CONCLUSION: The prevalence of pulp damage in maxillary incisors during orthodontic treatment is very low. Trauma before treatment seems to be the major etiologic factor leading to pulp injury and clinical discoloration of the incisors.
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AIMS: Patients who fail to attend their appointments result in wastage of clinical time and resources. Two previous audit cycles (2015 and 2016), have failed to achieve the desired gold standard and demonstrate an improvement. The aim of this audit was to analyse whether the number of failed appointments within the orthodontic department of Pinderfields Hospital had decreased since the introduction of a short message service (SMS) reminder.

MATERIALS AND METHOD: Retrospective analysis of all the patients who were expected to attend the orthodontic department (including joint clinics) in June 2017 was carried out. Clinic day lists were analysed and cross-referenced with the patient administration system. As used in earlier audit cycles the standards for the audit were kept at a failure to attend rate of 5 per cent or less (Jackson and Clark, 2009).

RESULTS: Five hundred and thirty four appointments were scheduled. Thirty patients failed to attend their appointments. The failure to attend rate was calculated at 5.6 per cent.

CONCLUSION: The combined use of an automated telephone reminder service and a SMS reminder demonstrated a reduction in the failure to attend rate. However, the gold standard was still not met. To achieve further compliance, contact details for each patient should continue to be updated and the audit will be repeated in 12 months’ time.

SP 123 MANDIBULAR ADVANCEMENT DEVICES: INTERDISCIPLINARY PROTOCOL FOR PATIENTS SELECTION
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AIMS: Obstructive sleep apnoea (OSA) consists of repeated episodic reduction or cessation of airflow as a result of upper airways obstruction. First-line treatment for middle-aged adults includes continuous positive airway pressure (CPAP). Oral appliances are a viable treatment alternative. An interdisciplinary approach is intended to predict and control efficacy of oral devices in OSA patients. Focus on sleep disorders has increased in last 20 years. Despite steps in diagnosis, patients are hardly compliant with therapeutic options. The aim was to evaluate results obtained from oral device therapy in patients affected by slight and moderate OSA. An oral device is transportable, invisible, non-invasive, but also expensive, not always effective and associated with facial and dental pain, those often reducing patient compliance.

SUBJECTS AND METHOD: Forty eight patients with an average body mass index aged 24 to 75 years, with mild or moderate OSA, underwent sleep endoscopy, to detect whether mandibular advancement was favourable for increasing space. Thirty patients were selected for oral appliance therapy (mandibular advancement device SomnoDent® type), but only 25 were included for the paired samples t-test. The drop out was due to refusal or postponing the oral device therapy and lack of a post-therapy control polysomnography. The efficacy of the oral device therapy was evaluated comparing the apnoea-hyponea index (AHI) overbite depth indicator (ODI) index and perception of symptoms improvement (Epworth test) before and after the use of the oral device.

RESULTS: AHI and ODI indices showed a statistically significant result ($P < 0.01$). There was also a significant decrease in the Epworth value ($P < 0.01$). All patients selected for this study benefited from the therapy. The patients passed from a moderate to a slight entity of the syndrome (post-therapy AHI was reduced under to less than 50% in 86% of patients) or in a range of non-syndromic parameters (20% of the sample).

CONCLUSION: The findings suggest that oral appliances have a definite role in the treatment of OSA and that an interdisciplinary approach has proved to be successful in selecting patients for MAD therapy.

SP 124 POST-ORTHODONTIC DEVELOPMENT AND CROWDING
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AIMS: To assess the relationship between the duration of retention (RT) and post-retention (PR) periods and long-term post-retention development in maxillary and mandibular anterior segments, after extraction and non-extraction treatment, and to test the hypothesis that there is no relationship between these variables and long-term recrowding.
SUBJECTS AND METHOD: Sixty-four successfully treated subjects with moderate to severe pre-treatment crowding in the upper and lower anterior segments. Retention involved fixed canine to canine bars in the mandible and removable Hawley retainers in the maxilla. Photographs of plaster models pre-treatment (13 ± 4 years), post-treatment and long-term (35 ± 8 years, at least 3 years post-retention) were analyzed by measuring the irregularity index (II) and tooth size arch length discrepancy (TSALD) with a modified Viewbox program. RT varied from no retention to 5.6 years and PR from 3 months to 33 years. Formulas expressing the relationship between RT and PR were tested.

RESULTS: The ratio PR²:RT² showed the strongest association with long-term crowding. In the maxilla both long-term ALD and long-term II showed a significant correlation with the ratio PR²:RT²; in the mandible this was only the case for the II. Mandibular long-term II and PR were also significantly correlated. A significant negative correlation between the amount of maxillary II relapse and extraction was found. Regression analysis showed that the ratio PR²:RT² predicted 36 per cent of the post retention ALD in the maxilla, and for the post retention II 22 and 11 per cent for the maxilla and mandible, respectively.

CONCLUSION: A longer RT and shorter PR were related to less long-term crowding in the upper and lower anterior segments; this relationship was stronger in the mandible.

SP 125 BUCCAL BONE PLATE THICKNESS EVALUATION AFTER RAPID MAXILLARY EXPANSION IN THE MIXED AND PERMANENT DENTITION
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AIMS: To compare changes of buccal bone plate thickness on upper first permanent molars after rapid maxillary expansion (RME) performed in the mixed and permanent dentitions with different anchorage.

SUBJECTS AND METHOD: Two groups of patients were evaluated with cone beam computed tomography before (T0) and after (T1) RME. Group E (21 patients) underwent RME using the primary teeth as anchorage and group 6 (16 patients) underwent RME using the permanent teeth as anchorage. A Wilcoxon test was used to compare changes between the timepoints within the same group and Mann Whitney-U test to compare differences between the groups.

RESULTS: In group E, generally, no statistically significant reduction was found in buccal bone plate thickness between timepoints. In group 6 most of the measurements showed a significant reduction in buccal bone plate thickness (P < 0.05) between timepoints, with a maximum decrease of 1.25 mm.

CONCLUSION: RME performed in the mixed dentition with the appliance anchored to the primary teeth did not reduce the buccal bone plate thickness of the upper first permanent molars, except for the mesial roots on both sides, while there was a reduction of buccal bone plate thickness of the upper first permanent molars when they were employed as anchorage in the permanent dentition.

SP 126 MULTICENTRE SURVEY OF PATIENT REPORTED EXPERIENCE OF MOUTHGUARD ADVICE AND USE
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AIMS: To assess the proportion of patients aged ≥ 6 to <17 years referred to the orthodontic department using mouthguards during contact sports and the incidence of previous dental trauma and to determine whether dentists and schools/clubs are advising patients to wear mouthguards and their experience with the different types available. The Faculty of Sport and Exercise Medicine, the Faculty of Dental Surgery and the Royal College of Surgeons of England recommend that all children of school age must wear a mouthguard for contact sports. The standard was set as 90 per cent of patients/parents being advised to wear a mouthguard and 90 per cent of patients wearing them for contact sports.

MATERIALS AND METHOD: A prospective questionnaire based survey was completed by patients/parents and clinicians during consecutive orthodontic consultation clinics in four orthodontic hospital departments in the
United Kingdom. Patients <6 years, ≥ 17 years or who had already commenced orthodontic treatment were excluded.

RESULTS: Four hundred and nine patients (208 female: 201 male), with a mean age of 12.8 years (SD 2.3, range 6.5-16.9) participated. Most had a Class II division 1 (37.7%) or Class I (33%) malocclusion. A mouthguard was worn by 31.8 per cent during contact sports. The types worn were ‘boil and bite’ (69.2%), ‘preformed’ (23.1%) and custom-made (7.7%). Problems with these included poor fit and discomfort when wearing. The most common reason for not wearing one was the lack of awareness of their need. Only 5.9 and 22.5 per cent of patients reported that their dentist or school, respectively had suggested mouthguard wear. A history of trauma was reported by 10.5 per cent of patients during sports. Within this cohort, 21 per cent of patients had multiple dentoalveolar traumatic injuries, with 35 per cent requiring dental treatment.

CONCLUSION: The standards set were not achieved. Increased awareness of the need for mouthguard wear during contact sports to minimise the risk of dental trauma is required within the dental profession, schools/clubs and the public.

SP 127 AN AUDIT OF ORTHODONTIC RETENTION AT THE CUMBERLAND INFIRMARY AT THE CUMBERLAND INFIRMARY IN CARLISLE
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AIMS: Orthodontic patients in retention are reviewed on dedicated ‘retainer days’ at the Cumberland Infirmary three- and twelve-months after debond prior to discharge. The aims of the audit were to assess compliance against the gold standards that all patients should attend, and bring their retainers. Issues in relation to non-attendance and retainer loss / breakage were also investigated.

SUBJECTS AND METHOD: All patients booked for 12 month retainer review appointments, over two retainer days were analysed. After applying exclusion criteria 91 patients were eligible. Data was collected using a pro-forma whilst the patient was examined on clinic. If patients did not attend data was collected retrospectively from the clinical notes. The gold standards were that 100 per cent of patients should attend their 12 month review appointment, 100 per cent should bring their retainers and less than 5 per cent of retainers (excluding specific criteria) should be remade.

RESULTS: Fifty six patients attended their 12 month retainer review appointment (61.5%). Eighty six per cent of patients who attended received their appointment by letter. Seventy one per cent of these patients received this letter 8-9 months in advance of their appointment. A text-message reminder was only received by 11 per cent of patients. Of the 56 patients who attended, 35 brought their retainers (62.5%). Initially 183 retainers were provided for the 91 patients analysed. During the 12 month retention period, 107 retainers were subsequently remade. Thirteen retainers were excluded because these were replaced following planned restorative work. This meant 94 extra retainers were subsequently remade; a replacement rate of 51.4 per cent.

Reasons for replacement included wear and tear, loss, and failure to care for the retainers.

CONCLUSION: The gold standards were not achieved. The resulting action plan was to investigate why patients were not receiving text message reminders. The departmental retention strategy has been reviewed and updated to reduce the amount of wear and tear; the requirement reduced from full time for three months, to full time for one week followed by night time wear, in accordance with the current evidence base. Patient charges (with explicit exemptions) are being introduced for replacement retainers to deter careless loss and breakage.

SP 128 A MECHANICAL STRAIN MODEL FOR THE ASSESSMENT OF PERIODONTAL LIGAMENT CELL ENDOPLASMIC RETICULUM STRESS IN THREE-DIMENSIONAL CULTURE
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AIMS: 1) To validate a three-dimensional (3D) hydrogel model in which to culture human periodontal ligament (PDL) cells and 2) To examine cell viability, apoptosis, and the expression of endoplasmic reticulum (ER) stress- and unfolded protein response (UPR)-related genes following the application of mechanical strain (mimicking orthodontic tooth movement) to PDL cells.

MATERIALS AND METHOD: Primary cultures of PDL cells were obtained from premolar teeth extracted from three individuals for orthodontic reasons. Viability and apoptosis assays were used to profile the time required by cultured PDL cells to establish themselves in hydrogel and assess their optimal seeding density. Non-strained
PDL cells were used as controls. Optimal gel constitution and seeding density were determined and the cells were subjected to 24 hours of static mechanical strain (18% dimensional substrate elongation). Following strain, viability and apoptosis were assessed, and real-time quantitative polymerase chain reaction techniques were used to assess the relative expression of mechanical strain- and UPR-related genes.

RESULTS: A tendency for reduced cell viability was observed following the application of mechanical strain to both two dimensional (2D) and 3D cultures of PDL cells (cell viability of strained 2D and 3D cells was 83.0% and 73.1%, respectively, of control values), while there was no difference in caspase activity. For monolayer samples, the lysyl oxidase gene (involved in cross-linking of collagen and elastin) demonstrated a tendency to be upregulated following mechanical strain (mean fold-regulation = +9.22, \( P = 0.25 \)). In 3D samples, a number of UPR-related genes were differentially upregulated; including CREB3L3 (mean fold-regulation = +1.91, \( P = 0.063 \)), which plays a role in the acute inflammatory response, and DDIT3 (mean fold-regulation = +17.0, \( P = 0.438 \)), a well-established pro-apoptotic factor in the UPR.

CONCLUSION: A model for the application of mechanical strain to 3D cultures of PDL cells has been validated. While a reduction in cell viability was observed following strain, an increase in caspase activity was not evident, thus the reduction in viability appears to be mediated via caspase-3/7-independent mechanisms. There is potential for the UPR to be involved in orthodontic tooth movement, and future experiments could include increased strain periods and varying strain magnitudes.

SP 129 UPPER CERVICAL SPINE MORPHOLOGY AND HEAD POSTURE IN CHILDREN WITH A DEEP BITE
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AIMS: 1) to compare deviations in upper cervical spine morphology and head posture in children with a skeletal deep bite with children with a dentoalveolar deep bite and 2) to analyze the association of upper cervical spine morphology and head posture with craniofacial morphology in both groups together.

SUBJECTS AND METHOD: Ninety nine pre-orthodontic children and adolescents (aged 8-15 years, mean age 11.6 years) with a deep bite of more than 5 mm were divided into two groups: 31 subjects (12 girls, 19 boys) with a skeletal deep bite and 68 subjects (24 girls, 44 boys) with a dentoalveolar deep bite. Visual assessment of the upper spine and measurements of craniofacial morphology and head posture were performed on lateral cephalograms. Differences between the two groups and associations in the two groups together were analyzed by general multiple linear regression analysis adjusted for age and gender.

RESULTS: Deviations in the morphology of the upper cervical spine occurred in 22.6 per cent of the subjects in the skeletal deep group and in 17.6 per cent in the dentoalveolar deep bite group, but the difference was not significant. No significant differences in head posture between the groups were found. Head posture and upper spine morphology was associated with craniofacial morphology: flexed head posture (NSL/OPT, NL/OPT, NSL/CVT, NL/OPT) was associated with a small cranial base angle (n-s-ba; \( P < 0.05 \)), prognathia of the jaws (s-nss, s-n-pg; \( P < 0.001 \)), a small inclination of the jaws (NSL/NL, NSL/ML; \( P < 0.05 \)) and decreased vertical jaw relationship (NL/ML; \( P < 0.05 \)). Backward head posture (OPT/HOR, CVT/HOR) was associated with a decreased mandibular inclination (NSL/ML; \( P < 0.05 \)) and decreased vertical jaw relationship (NL/ML; \( P < 0.05 \)). Posterior arch deficiencies in terms of partial cleft and dehiscence of the first cervical vertebrae were associated with a small cranial base angle (n-s-ba; \( P < 0.05 \)) and retrognathia of the maxilla (s-n-ss; \( P < 0.05 \)).

CONCLUSION: The results may prove valuable for diagnosis and treatment planning in children and adolescents with a deep bite.

SP 130 PREVALENCE OF LATERAL INCISOR ANODONTIA AND ASSOCIATION WITH THE CONOID TOOTH OF ITS HOMOLOGIST
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AIMS: To verify the prevalence of lateral incisor anodontia in patients with orthodontic anomalies with maxillary lateral incisor teeth and its association with the conoid tooth of its homologue and to compare the two anomalies, lateral incisor anodontia and conoid tooth.
MATERIALS AND METHOD: A total of 220 patient records were evaluated (110 males, 110 females) aged 5 to 68 years, in whom 20 patients aged 10 to 49 years were found with abnormalities: anodontia, tooth conoid and microdontia. The study material included panoramic radiographs, photographs and patient charts.

RESULTS: The prevalence of the dental anomaly in the sample with anodontia was 55 per cent (n = 11) being female 30 per cent (n = 6) and male 25 per cent (n = 5). Among the patients seeking orthodontic treatment, unilateral anodontia was present in 3.18 per cent (n = 7), with a higher prevalence of females 1.82% (n = 4) patients and males corresponding to 1.36 per cent (n = 3) patients.

CONCLUSION: The association of unilateral anodontia with a conoid tooth in the homologous that was 28.6 per cent (n = 2) of patients with unilateral anodontia (one female and one male). The results obtained are consistent with the hypothesis that anodontia has an association with tooth conoid and microdontia and are biological variables in a complex of genetically linked dental anomalies.

SP 131 OUTCOME CHANGES OF EARLY TREATMENT OF PRENORMAL OCCLUSION WITH A RAPID MAXILLARY EXPANDER IN COMBINATION WITH A FACEMASK
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AIMS: To evaluate treatment effects of a rapid maxillary expander combined with a face mask as measured by registration of the ANB angle and Wits index before and after treatment of an anterior crossbite in Class III malocclusions.

SUBJECTS AND METHOD: This study was undertaken starting January 2008 until August 2017. Forty consecutive subjects, aged 7-10 years, diagnosed with a skeletal Class III malocclusion (ANB < 0 degrees) and with an anterior crossbite, were offered and accepted orthodontic treatment. Subjects with only a dental Class III malocclusion or skeletal Class III with intellectual disability were excluded from the study. The subjects were allocated to two groups; an early treatment group aged 7-8 years (19) and a late treatment group aged 9-10 years (21). The objective measurements (ANB, Wits index) were recorded on standardized lateral radiographs of the head with the commercial software program (Arne©) before and following treatment. Descriptive statistics was applied for demonstrating treatment effects and differences between the 7-8 and 9-10 year old subjects. Comparisons were made with untreated Class III subjects with corresponding ages (Alexander et al., 2009). This study was approved by the local ethical committee Linköping University (Dnr. 2013-175-31).

RESULTS: 1) Mean treatment duration for the 40 subject was 13.4 months (range 3-26). 2) Mean treatment change in ANB value was a 5 degree improvement (range 0.2-11.1). 3) Mean treatment change in Wits Index was a 6.9 mm improvement (range –1.5-13.2). 4) There was a greater improvement in both ANB and Wits index in the 7-8 year old group. 5) Comparisons with untreated basal Class III subjects showed a pronounced treatment effect.

CONCLUSION: Treatment with a rapid maxillary expander and a face mask seems to give considerably improvement in some skeletal measurement (ANB, Wits) on the lateral radiographs. However, the long-term effect/ gain of this treatment on skeletal Class III subjects remain to be seen.

SP 132 COMPARISON BETWEEN DUAL ENERGY X-RAY ABSORPTIOMETRY AND COMPUTED TOMOGRAPHY IN THE EVALUATION OF BONE MINERAL DENSITY: META-ANALYSIS
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AIMS: To establish a correlation between dual energy X-ray absorptiometry (DXA) and computed tomography (CT) techniques through a systematic review with a meta-analysis.

MATERIALS AND METHOD: A systematic literature search was conducted in the electronic databases: PubMed, Cochrane Library, Lilacs and Embase. The inclusion criteria were: randomized controlled trials, non-randomized controlled trials, cohort studies and systematic reviews published in English, Spanish or Portuguese between January 2001 and June 2017, assessing DXA and CT to evaluate bone density. The following keywords: densitometry, absorptiometry, DEXA and computed tomography, combined with Boolean operators ‘AND’ and ‘OR’ were used. Qualitative assessment of the selected studies was performed using the Critical Appraisal Skills...
SP 133 EFFICACY OF CEPHALOMETRIC NORMS AS A PREDICTABLE METHOD FOR SOFT TISSUE POSITIONING AND FACIAL AESTHETICS AFTER ORTHODONTIC-ORTHOGNATHIC INTERVENTIONS
Inês Francisco, Mariana Rodrigues, Ana Roseiro, Patrícia Quaresma, Francisco do Vale, Department of Orthodontics, Faculty of Medicine of the University of Coimbra, Portugal

AIMS: To verify if there are morphological differences in the soft tissue profile between individuals submitted to orthodontic-orthognathic treatment and individuals belonging to an aesthetically ideal population.

SUBJECTS AND METHOD: A total of 578 young Portuguese adults of both sexes were submitted to an examination, and after applying the inclusion criteria previously defined for this study, only 55 were considered for the control group. In this ideal population sample (mean age 22.6 years) lateral cephalograms were obtained in the natural head position and centric occlusion. The sample of the population who successfully underwent orthodontic-orthognathic treatment of a dentoskeletal Class III consisted of 20 young adults (mean age of 22.75 years). Cephalometric analysis was performed using Dolphin Imaging Software/32 (High Quality Digital Imaging Software for Orthodontics, Cosmetics and Medical Imaging, version 8.0.6.12 of Dolphin Imaging Systems Inc., USA) and the cephalometric points used mainly from the cephalometric atlas of Miyashita and Dixon (1996). For statistical analysis of the obtained data, a Student t distribution was used and a significance level 0.05 was adopted, therefore a confidence level of 95 per cent was considered.

RESULTS: Among the variables that represent the upper and middle thirds of the face, only TVL:UL (true vertical line:upper lip) characterize the upper lip in the posterior-anterior plane. These variables were significantly different between the two populations (α = 0.05). In the lower third of the face the variables were almost all significantly different between the populations (α ≤ 0.05).

CONCLUSION: If the cephalometric norms obtained in this study are accepted as the ideal for the Portuguese population, then orthodontic and/or orthodontic-orthognathic interventions based on dentoskeletal norms are not enough to obtain a good facial aesthetics.

SP 134 DENTOALVEOLAR AND SKELETAL EFFECTS OF THE SANDER BITE JUMPING AND THE HERBST APPLIANCES: A RETROSPECTIVE CONTROLLED STUDY
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AIMS: To evaluate dentoskeletal effects of Herbst appliance (HBT) and Sander’s Bite Jumping appliance (BJA) in skeletal Class II malocclusion patients compared with a group of untreated subjects.

MATERIALS AND METHOD: A set of 22 cephalograms (14 boys, 8 girls; mean age 11.9 ± 1.3, HBT group) of patients with a skeletal Angle Class II malocclusion due to mandibular retrusion, with cervical maturation stage (CVMS2-CVMS3) treated using the HBT appliance, was compared with 22 cephalograms (14 boys, 8 girls; mean age 11.4 ± 1.3, BJA group) of patients treated by means of BJA and with an untreated control group including 22 subjects (14 boys, 8 girls; mean age 10.6 ± 1.3, CTR group) matched by malocclusion, gender and CVMS. Data were annualised over a 12 month period. The cephalometric measurements were performed by one blinded operator using a modified Pancherz’s analysis. Between and within group differences were assessed by means of parametric and non-parametric statistical analysis. Statistical significance was set at P < 0.05.

RESULTS: In the CTR group sagittal and vertical skeletal measurements increased as a result of growth, however, skeletal discrepancy (ANB, P=NS) and overjet (OVJ, P=NS) remained unchanged. In the HBT group, there was significant upper dental arch distalisation (maxillary molar, P < 0.001), lower incisor proclination (IMPA, P < 0.001) and ANB reduction (P = 0.028) compared with the control, while the BJA group showed a greater increase
in mandibular length (CoPg, P = 0.020; GoPg, P = 0.024) and a smaller protrusion of the lower incisors (mandibular incisor, P = 0.020) with respect to the HBT group.

CONCLUSION: Both devices determine the correction of Class II malocclusion by a combination of dental and skeletal effects, but the BJA resulted in greater skeletal changes compared to HBT. Even if both devices determined proclination of lower incisors, the dental effects were greater in the HBT group.

SP 135 ULTRASONOGRAPHIC EVALUATION OF LINGUAL FUNCTION DURING DEGLUTITION IN PATIENTS WITH MANDIBULAR PROGNATHISM BEFORE AND AFTER ORTHOGNATHIC SURGERY
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AIMS: A previous study revealed a characteristic pattern of tongue pressure production during swallowing in patients with mandibular prognathism. The present study sought to compare changes in tongue movement during swallowing using ultrasonography before and after orthognathic surgery in patients with mandibular prognathism.

SUBJECTS AND METHOD: Tongue movement was recorded before and after orthognathic surgery using ultrasonography while swallowing 4 mL of jelly in three patients with mandibular prognathism and in 10 healthy volunteers participating as controls. Swallowing was evaluated by analysing the time durations defined by the shape of tongue in the central and peripheral areas from the motion-mode (M-mode) waveforms of ultrasonography of the tongue.

RESULTS: In the patients before surgery, the central area of the tongue showed a significantly increased time of groove disappearance, interval between time of grooving and contact with the palate, and total swallowing time as compared with controls. For the peripheral area, total swallowing time was significantly increased and showed a characteristic continuous up and down movement. After surgery, these parameters were significantly decreased. The M-mode waveforms of ultrasonography of the tongue appeared similar to those of the controls. Pre-operatively, the patients with mandibular prognathism probably had a lower tongue posture and experienced difficulty raising the entire tongue, but post-operatively tongue elevation may become easier, which contributes to shortening of total swallowing time.

CONCLUSION: The present study showed changes in the pattern of tongue movements in the patients with mandibular prognathism after orthognathic surgery. The post-operative findings in the pattern of tongue movements during swallowing are considered probably due to adaption to morphological changes following orthognathic surgery.

SP 136 GEOMETRIC MORPHOMETRIC ANALYSIS OF PALATAL MORPHOLOGY IN PATIENTS WITH PALATALLY DISPLACED CANINES
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AIMS: To use geometric morphometrics to evaluate the variability of palatal shape and arch dimension associated with palatally displaced canines.

SUBJECTS AND METHOD: Forty-six patients (18 males, 28 females; mean age 13.8 ± 1.2 years) with palatally displacement of one or both canines (PDC) were compared with a control group (CG) of 25 subjects (11 males, 14 females, mean age 14.6 ± 4.7 years) presenting no eruption disorders. The PDC were divided into two groups: unilateral palatally displaced canines (UPDC; 14 males, 17 females; mean age 14.4 ± 2.1 years) and bilateral palatally displaced canines (BPDC; 4 males, 11 females; mean age 13.7 ± 1.9 years). For each subject, dental casts were taken and the upper arch was scanned using a three-dimensional (3D) scanner. To study the entirety of the shape of the palate at any point of the surface, 3D geometric morphometrics was applied. On each digital model, 3D and linear measurements were performed to analyse maxillary arch morphology. Procrustes analysis and principal component analysis (PCA) were performed to reveal the main patterns of palatal shape. Linear measurements differences were tested with the ANOVA multicomparison test and the independent sample Student’s t-test (P < 0.05).

RESULTS: For morphology of the palate, the three principal components (PCs) considered for the maxillary casts were width, height and length. There was no statistically significant difference between the groups PDC versus CG, UPDC versus CG, BPDC versus CG, UPDC versus BPDC with regard to the three components. Regarding linear
measurements, there was no statistically difference between the groups except the intercanine width which was significantly smaller in the PDC, UPDC, BPDC subjects when compared with the controls. Moreover, maxillary linear measurement comparison between the UPDC versus BPDC showed no statistically significant differences. CONCLUSION: The morphometric variation of the palatal vault or the alteration of maxillary arch dimensions cannot be considered as aetiological factors in PDC. Therefore, these results confirm the genetic theory that states that canine positional anomaly appears to be a product of polygenic, multifactorial inheritance.

SP 137  ENAMEL RESISTANCE TO DEMINERALIZATION AFTER BRACKET DEBONDING
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AIMS: To evaluate the elemental content and morphology of enamel subjected to demineralization cycles after bracket debonding and adhesive remnant removal.
MATERIALS AND METHOD: One hundred bovine teeth were used. Fifty samples were covered with an acid-resistant nail varnish (60-seconds nail-varnish, Rimmel, London, UK) leaving an area of exposed enamel of 2 x 4 mm. On the other hand, 50 upper central incisor brackets were bonded on 50 teeth with Transbond Plus Self-Etching Primer and Transbond XT Paste (3M-Unitek-Dental-Products, Monrovia, California, USA) and covered with the nail varnish leaving 2 mm of enamel uncovered around each bracket. Afterwards the brackets were debonded and remaining adhesive was removed using a carbide-tungsten bur (T21XR, Edenta Ag, Switzerland), and polished with Soft-Lex discs (3M-Espe Soft-Lex. Dental-Products, St Paul, USA). The samples were divided into four groups (n = 25): 1) Intact enamel; 2) Intact enamel and demineralization cycles (DC); 3) Enamel after adhesive removal; 4) Enamel after adhesive removal and DC. Groups 1 and 3 were kept in artificial saliva at 37°C for 8 days. The saliva pH was adjusted and maintained at 6.57. Groups 2 and 4 samples were submerged in artificial saliva at 37°C for 8 days, and subjected to DC for 2 hours, three times per day, and returned to artificial saliva between cycles. The weight percentages of calcium and phosphorous were calculated using energy-dispersive X-ray spectroscopy. Samples were observed under scanning electron microscopy (SEM). Data were analyzed using the Kruskal-Wallis test (P < 0.008) and the Mann-Whitney test applying Bonferroni correction (P < 0.005).
RESULTS: The weight percentages of calcium (Ca) and phosphorus (P) in group 1 were significantly higher than in groups 2 and 4. The weight percentages of Ca and P in group 2 were significantly higher than in group 4. Group 3 presented significantly higher percentages of Ca and P than group 4. SEM images showed an increase in enamel surface porosity in group 4.
CONCLUSION: Enamel after bracket debonding and adhesive removal was more susceptible to undergo demineralization than intact enamel.

SP 138 GUMMY SMILE TREATMENT: ATTRACTIVENESS AND EFFECTIVENESS OF ITS TREATMENT WITH LIP REPOSITIONING AND THE INJECTION OF BOTULINUM TOXIN TECHNIQUES
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AIMS: To compare the techniques of lip repositioning and injection of botulinum toxin in the treatment of a gingival smile caused by hypermobility of the upper lip and to determine the improvement of the gummy smile and the stability of the techniques.
MATERIALS AND METHOD: A bibliographic search was carried out in PubMed, Science Direct, Cochrane and Prospero databases; including articles published between 2000 and 2017; with the keywords attractiveness perception, gingival display, gummy smile, orthodontic treatment, orthognathic surgery and Botox.
RESULTS: One hundred and fifty five articles were found, of which 19 were included in the study. There are several treatment alternatives for a gingival smile. An exhaustive diagnosis is essential to determine the aetiological factor of this problem and to approach it therapeutically.
CONCLUSION: 1. The options of lip repositioning and injection of botulinum toxin are acceptable by the patients assessing the personal satisfaction. 2. The literature confirms satisfactory results with both techniques in the correction of the gingival smile caused by hypermobility of the upper lip; but they have little scientific evidence.
More research is necessary. 3. The injection of botulinum toxin manages to improve the gingival smile in a range of 2-4 mm, with a duration of its effect of approximately 6 months. 4. The lip repositioning technique provides good results with a decrease in the gingival smile of 2-8 mm. The published studies reveal 1-year post-treatment stability and in some cases relapse occurs.

SP 139 RELIABILITY OF LABIAL LINEAR MEASUREMENTS PERFORMED ON STEREOPHOTOGRAMMETRY RECORDS
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AIMS: To assess reliability of labial linear measurements performed on three-dimensional (3D) photographs.

MATERIALS AND METHOD: 3D images of 20 subjects were acquired with a stereophotogrammetry system (Planmeca ProFace, Helsinki, Finland.) and .obj files were imported to Nemescan software (Nemotec, Madrid, Spain) for orientation of records in the three planes of space and to measure distances. Two orthodontic students performed eight lip measurements on each 3D photograph on two occasions one week apart fully blinded, without any interaction. Intra- and inter-examiner reproducibility was assessed according to intraclass correlation coefficient, Lin’s concordance correlation coefficient (CCC) and a paired t-test.

RESULTS: Most labial measurements yielded excellent intraexaminer reliability (CCC ranged from 0.86 to 0.97 for examiner 1 and 0.7 to 0.97 for examiner 2) (ICC ranged from 0.93 to 0.99 for examiner 1 and 0.8 to 0.99 for examiner 2). Moderate to excellent agreement was achieved for interexaminer measurements (CCC ranged from 0.8 to 0.97 on all distances except for two measurements where 0.5 and 0.6 values were obtained; ICC ranged from 0.7 to 0.99). Some statistical differences were reported on several measurements when using the paired t-test for both intra- and inter-examiner measurements.

CONCLUSION: Most labial measurements yielded excellent intraexaminer reliability. Moderate to excellent agreement was achieved for interexaminer measurements. Some statistical differences were detected on several distances. However, these differences were not clinically relevant. Therefore, 3D stereophotogrammetry is a reliable method to assess lip morphology.

SP 140 MICROVIBRATION ON OSTEOLASTS AND BONE MARROW DERivate OSTEOCLASTS CULTIVATED IN VITRO PRODUCE SOLUBLE FACTORS FOR OSTEOCLAST INHIBITION
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AIMS: It has been claimed that micropulse vibration for a period of 20 minutes per day at 0.25 N and 30 Hz can accelerate the rate of tooth movement during orthodontic treatment. However, it is unknown if this period of 20 minutes of vibration could be enough to alter the cytokine production of the bone cells in order to enhance bone remodelling. The aim of this study was to understand how this might be mediated by measuring alterations in osteoprotegerin (OPG) and soluble RANKL (sRANKL) signalling molecules of osteoblast/osteoclast function following micropulse vibration.

MATERIALS AND METHOD: Primary calvarial mouse Balb/c osteoblasts were grown to confluence in Ham’s F12/Dulbecco’s modified eagle medium and bone marrow derivate osteoclasts were cultivated -MEM media. Both mediums contained 10 per cent foetal calf serum, 100 g/ml streptomycin, 100 U/ml penicillin and 0.25 g/ml amphotericin. Furthermore both types of cells were placed on 24 well plate (n = 5) and subjected to micropulse vibration (0.25 N; 30 Hz) with the AcceleDent® aura appliance for a period of 20 minutes per day for three days and assayed for OPG and sRANKL protein by enzyme-linked immunosorbent assays.

RESULTS: When using murine osteoblasts and bone marrow derivate osteoclast' culture supernatant, micropulse vibration resulted in OPG up-regulation and sRANKL down-regulation compared with the control group during the three days of the experiments.

CONCLUSION: Osteoblasts and osteoclasts are able to sense gentle micropulse vibration and respond by producing soluble factors that contribute to osteoclasts inhibition.

SP 141 LONG-TERM SOFT TISSUE CHANGES AFTER FACEMASK PROTOCOL
AIMS: To analyze soft tissue changes produced by the facemask protocol (FMP; rapid maxillary expander, facemask, and removable lower bite-block) in Class III growing patients with respect to an untreated Class III sample by means of Bergman’s soft tissue analysis.

SUBJECTS AND METHOD: The treated group consisted of 32 (15 females, 17 males) Caucasian patients with a dentoskeletal Class III malocclusion treated with the FMP. All patients were evaluated before treatment (T1, mean age 8.4 years, before puberty CS 1-3 in cervical vertebral maturation), at the end of active treatment with the FMP (T2, mean age 10.7 years) and at a long-term follow-up observation (T3, mean age 15.8 years, after puberty CS 4-6 in cervical vertebral maturation). The control group consisted of 20 untreated subjects (10 females, 10 males) with a dentoskeletal Class III malocclusion. The untreated group matched the treated group as to type of dentoskeletal disharmony, skeletal maturation at the different observations, and duration of observation intervals. Statistical comparisons between the treated and control groups were performed with the independent samples t-test (level of significance, P < 0.05).

RESULTS: Significant short-term improvements (T1-T2 changes) were found for the profile facial angle (~4.4°), nasolabial angle (~4.6°), mandibular sulcus (~5.8°), upper lip protrusion (~1.7 mm) and lower lip protrusion (~0.8 mm) in the treated group when compared with untreated subjects. These improvements were maintained in the treated group versus the control sample when analyzing the long-term interval (T1-T3 changes): Profile facial angle (~5.8°), nasolabial angle (~4.4°), mandibular sulcus (~10.3°), upper lip protrusion (~0.7 mm), and lower lip protrusion (~1.1 mm). No significant long-term effects were found in terms of lower face percentage between two groups.

CONCLUSION: The FMP induced positive effects on soft tissue facial profile with good long-term stability. In particular, the treated group showed a significant improvement of the Class III concave profile that became more balanced, and better lip competence and posture after FMP.

SP 142 GINGIVAL RECESSION IN ORTHODONTIC PATIENTS 10 TO 15 YEARS POST-TREATMENT: A RETROSPECTIVE OBSERVATIONAL STUDY

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AIMS: To retrospectively investigate the long-term development of gingival recession in a cohort of orthodontic patients and compare the prevalence of gingival recession in orthodontically treated patients 10-15 years post-treatment to that of untreated individuals with malocclusion.

SUBJECTS AND METHOD: Eighty eight patients with a mean age of 12.1 (SD = 2.4) years pre-treatment, 15.1 (SD = 2.4) years post-treatment and 27.9 (SD = 2.5) years 10-15 years post-treatment. The control group comprised of 102 untreated patients seeking orthodontic treatment with a mean age of 28.7 (SD = 3.1) years. Gingival recession was evaluated on study models.

RESULTS: The prevalence of both labial/buccal and lingual/palatal gingival recession increased during orthodontic treatment with a further increase during the long-term post-treatment period. Of the orthodontically treated participants 98.9 per cent had at least one labial/buccal recession, while 85.2 per cent of the patients had at least one lingual/palatal recession 10-15 years post-treatment. In addition, the proportion of patients with multiple labial/buccal or lingual/palatal recession sites increased considerably in the same time period. The prevalence of labial/buccal gingival recession was similar in orthodontically treated patients 10-15 years post-treatment and in the untreated controls. Study group patients with a crossbite prior to treatment showed 2.73 (95%CI 0.28, 5.17; P < 0.029) more recessions than those without a transverse discrepancy. Untreated individuals with crowding >3 mm per arch had 3.29 (95%CI 0.73, 5.68; P < 0.012) to 4.92 (95%CI 1.70, 8.15; P < 0.003) more recession sites than those with mild or no crowding.

CONCLUSION: Within the limitations of the present study, it seems that in regard to the prevalence of gingival recession that orthodontically treated patients are not compromised in the long-term when compared to individuals with malocclusions left untreated for many years.
SP 143 THE BEHAVIOUR OF DIGITALLY FABRICATED FIXED RETAINERS IN RELATION TO DIFFERENT MATERIAL PROPERTIES. A THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS
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AIMS: To investigate the influence of material properties used to fabricate retainers on physiologic root movement.

MATERIALS AND METHOD: A finite element model of six lower teeth with simulated roots was created from an intraoral scan. A 0.012 × 0.012 inch (0.3 × 0.3 mm) flat square retainer was designed. The apices of all teeth were constrained in the buccolingual and mesiodistal directions. The apices of the central incisors were additionally constrained in the vertical axis. A single force of 100 N was applied vertically on tooth 43 to simulate an occlusal force. Different moduli of elasticity were assigned to the retainer to represent four different materials: martensitic Nitinol (m-NiTi at 28 GPa), austenitic Nitinol (a-NiTi at 83 GPa), beta-Titanium (β-Ti at 115 GPa) and stainless steel (SS at 220 GPa). The displacements of the teeth were calculated and examined.

RESULTS: For m-NiTi, the vertical displacement of 43 was more than double compared to SS (1.33 and 0.61 mm, respectively). For β³-Ti, the vertical displacement was 0.73 mm. The upward displacement of 33, due to the seesaw effect of the retainer, ranged from 0.18 mm for SS to 0.21 mm for m-NiTi.

CONCLUSION: The higher the modulus of elasticity, the less physiological root movement is seen on the loaded side. However, upward movement of the canine on the contralateral side of the retainer was almost independent of the stiffness of the retainer.

SP 144 ACCURACY OF LANDMARK-BASED, SURFACE-BASED AND VOXEL-BASED THREE-DIMENSIONAL CONE BEAM COMPUTED TOMOGRAPHY SUPERIMPOSITION METHODS: A COMPARATIVE STUDY
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AIMS: To evaluate and compare the accuracy and reliability of three different methods of three-dimensional cone-beam computed tomography scan (3D CBCT) superimpositions: landmark-based, surface-based and voxel-based.

MATERIALS AND METHOD: Pre- and post-orthodontic treatment CBCTs (T1 and T2) of 20 subjects with a mean age of 11 years were obtained. Seven points on the zygomatic arch and supraorbital region were selected to perform landmark-based superimposition. Surface- and voxel-based superimpositions were performed using the anterior cranial base as a reference. Each superimposition method of T1 and T2 scans was repeated twice to assess the reliability. Accuracy of each technique was tested by superimposing duplicated sets of T1 scans. A total of 11 landmarks on the anterior cranial base, maxilla and mandible were located, and deviations of these landmarks on superimposed data were quantified to assess reliability and accuracy of all superimpositions.

RESULTS: There were no significant differences from zero when duplicated sets of T1 scans were superimposed using the surface- and voxel-based methods. Statistically significant differences were detected in several parameters when evaluating the accuracy of the landmark superimposition. Superimposition of T1 and T2 scans for testing the reliability revealed intraclass correlation coefficients greater than 0.90 for all measurements except for ACP-x and PNS-y of the landmark-based method as well as ANS-x of voxel-based method.

CONCLUSION: Surface- and voxel-based superimposition methods using the anterior cranial base as a reference structure were accurate and reliable in detecting changes in landmark positions when superimposing. The landmark-based superimposition method was reliable but less accurate than the other methods.

SP 145 CLINICAL EFFECTIVENESS OF ALIGNER ORTHODONTIC TREATMENT. A SYSTEMATIC REVIEW
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AIMS: To systematically search the literature and assess the available evidence regarding the clinical effectiveness of the Invisalign® system.

MATERIALS AND METHOD: Electronic database searches of published and unpublished literature were performed. The reference lists of all eligible articles were hand-searched for additional studies. Study selection, data extraction, and risk of bias assessment were performed individually and in duplicate. Randomized clinical trials (RCTs), prospective, and retrospective studies with patients of any age were included.

RESULTS: Three RCTs, eight prospective, and 11 retrospective studies were included in this review. In general, the level of evidence was moderate and the risk of bias ranged from low to high, given the low risk of bias in included RCTs and the moderate (n = 13) or high (n = 6) risk of the other studies. The lack of standardized protocols and the high amount of clinical and methodological heterogeneity across the included studies precluded a valid interpretation of the actual results through pooled estimates. However, there was substantial consistency among studies that the Invisalign® system is a viable alternative to conventional orthodontic therapy in the correction of mild to moderate malocclusions in non-growing patients that do not require extractions. Moreover, Invisalign® aligners can predictably level, tip, and derotate teeth (except for circular teeth). On the other hand, limited efficacy was identified in arch expansion through bodily tooth movement, extraction space closure, corrections of occlusal contacts, and larger antero-posterior and vertical discrepancies.

CONCLUSION: Despite the fact that this review included a considerable number of studies, no clear clinical recommendations can be made, based on solid scientific evidence, apart from non-extraction treatment of mild to moderate malocclusions in non-growing patients. The results need to be interpreted with caution due to the high heterogeneity.

SP 146 ASSESSMENT OF METHODS USED FOR THREE-DIMENSIONAL SUPERIMPOSITION OF CRANIOFACIAL SKELETAL STRUCTURES. A SYSTEMATIC REVIEW
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AIMS: To systematically summarize and assess all the available information on accuracy, precision, and reproducibility of methods and techniques used to superimpose computed tomographic (CT) or cone beam computed tomographic (CBCT) derived three-dimensional (3D) skeletal models of the human head.

MATERIALS AND METHOD: Relevant studies were identified through electronic (PubMed, Embase, Google Scholar) and hand searches (last update: September 2017). Due to increased technical considerations of the topic only studies published after 2000 were included. Risk of bias was assessed through the relevant Cochrane risk of bias tool for diagnostic accuracy studies (QUADAS-2).

RESULTS: Ten studies were eligible for inclusion in this review. Significant heterogeneity was evident regarding samples, methods, and outcomes. Nine of the studies tested CBCT and only one CT derived 3D models. Eight studies tested voxel-based, one study surface based-registrations and only one study tested both approaches. Sample sizes ranged from 3 to 31 subjects. Software systems also varied considerably. Five studies included non-growing subjects, four growing and one both. Regarding the superimposition references, three studies focused on mandibular structures, two on maxillary structures and five on the cranial base, whereas two of them tested also alternative regions. All studies claimed to provide satisfactory results, but only three had a low and seven a high risk of bias. Furthermore, regarding applicability concerns, only one study was judged as unclear and the rest nine studies as high.

CONCLUSION: Based on the present information, no clear recommendation can be made regarding the methods used for 3D superimposition of craniofacial skeletal structures of the head. There is an urgent need for further high quality research in the field, since radiographic 3D imaging is rapidly being incorporated in daily practice.

SP 147 SPEECH PROBLEMS RELATED TO ORTHODONTIC MALOCCLUSIONS: REVIEW OF THE LITERATURE
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AIMS: Although it is widely accepted that there is a complex interaction between speech production and the oral mechanism, the relationship between phonetic disorders and orthodontic malocclusions are not clearly identified. The aim of this study was to evaluate related studies to determine the correlation between speech impairment and orthodontic malocclusions.
MATERIALS AND METHOD: A digital search was performed for articles, including sources until December 2016, with the following keywords: ‘Speech disorders’ AND ‘malocclusion’ AND ‘orthodontics and speech’ AND ‘pronunciation’. Databases searched were: PubMed (Medline), Science Direct, Google Scholar, ResearchGate. Some publications were also obtained manually and a total of 11 publications were included for final evaluation.

RESULTS: The most consistently reported malocclusions commonly associated with speech disorders were: Class III relationships, anterior open bite and increased overjet. However, no direct relationship was found between the severity of the malocclusion and the severity of speech impairment except for cleft palate cases.

CONCLUSION: Most researchers found that the incidence of malocclusion was high in individuals with speech impairment but there was no evidence of speech impairment in every individual with a malocclusion. Also there was no significant evidence that orthodontic treatment always has a positive effect on pronunciation disorders. Cooperation with a speech therapist is important in orthodontic patients with speech impairment throughout treatment.

SP 148 EFFECT OF MANDIBULAR FIRST MOLAR MESIALIZATION ON ALVEOLAR BONE HEIGHT: A SPLIT MOUTH STUDY
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AIMS: To evaluate the risk of vertical alveolar bone loss (ABL) in mesialized mandibular permanent molars due to space closure, in patients with unilateral second premolar agenesis. The contralateral side served as the control.

SUBJECTS AND METHOD: Twenty-five retrospectively selected subjects (median age: 14.9, range: 12.0, 31.9 years) were analyzed. Space closure (approximately 10 mm) was performed using skeletal anchorage. ABL was measured at the mesial and distal sites of first molars on pre- and post-treatment dental pantomograms. Measurements were corrected for distortion and magnification of the radiographs. Molar angulation in regards to the occlusal plane was also evaluated. Permutational multivariate analysis of covariance (MANCOVA), followed by pairwise comparisons, was performed.

RESULTS: MANCOVA resulted in no difference in ABL between the distal sites of mesialized molars and the control sites. On the contrary, there was statistically higher ABL, at the mesial sites of mesialized versus non-mesialized molars (P = 0.042; median: 0.19 mm; range: ~0.82, 1.33); though not clinically significant. On the space closure side, mesially, only two patients had ABL greater than 1 mm. No patient had a severe bone level height defect (>3 mm distance from the cementoenamel junction) at any point. When testing differences in molar angulation between sites and from pre- to post-treatment condition, no significant difference was detected (P > 0.05, median: −1.9°, range: −13.5, 6.2).

CONCLUSION: Space closure through extensive tooth movement was identified as a risk factor for vertical ABL, at the mesial sites of mandibular first molars. However, the amount of ABL was not considered clinically significant.

SP 149 INFLUENCE OF BUCCAL CORRIDORS ON SMILE ATTRACTIVENESS
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AIMS: To analyze the influence of buccal corridors on smile attractiveness when evaluated by orthodontists, general dentists, and laypersons.

MATERIALS AND METHOD: Intraoral and frontal extraoral photographs were taken of the smile of a female subject using a digital camera (Canon-EOS-450D, Madrid, Spain). Both photographs were manipulated digitally with Adobe Photoshop-CS3 (Adobe, Systems-Inc., San José, California, USA) to create three images: A) smile from first molar to first molar without buccal corridors; B) smile from second premolar to second premolar with buccal corridors; C) smile from first premolar to first premolar with larger buccal corridors than in photograph B. The three images were shown to three groups of evaluators (n = 40): orthodontists with over 10 years’ experience, general dentists with over 10 years’ experience, laypersons aged between 40 and 50 years. Each image was given a score of 1-10, one being the least aesthetically favourable and 10 the most attractive. Data were analyzed using the Kruskal-Wallis test (P < 0.05) and Mann Whitney test for two independent samples with Bonferroni correction (P < 0.016).
RESULTS: For orthodontists and laypersons, significant differences were found between the three Images ($P < 0.05$). Both groups evaluated the Image A as significantly more aesthetic than Image C ($P < 0.016$), but their evaluations of Images A and B did not differ significantly ($P > 0.016$) nor for those of photographs B and C ($P > 0.016$). General dentists also found significant differences between the three Images ($P < 0.05$). They evaluated Images A and B as significantly more aesthetic than Image C ($P < 0.016$). They evaluated the aesthetics of Images A and B similarly ($P > 0.016$).

CONCLUSION: For orthodontists, general dentists and laypersons, exposure of buccal corridors influences the perception of smile aesthetics. The three groups evaluated similarly the aesthetics of the smile from first molar to first molar without buccal corridors and the smile from second premolar to second premolar with buccal corridors. The most unattractive photograph evaluated by the three groups was the smile from first premolar to first premolar with larger buccal corridors.

SP 150  TRANSLATION AND VALIDATION OF THE SWEDISH VERSION OF THE PSYCHOSOCIAL IMPACT OF DENTAL AESTHETICS QUESTIONNAIRE

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AIMS: Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) is an instrument with four subscales developed for assessment of orthodontic specific aspects of Oral Health Related Quality of Life (OHRQoL). This study aimed to translate and validate the Swedish version of PIDAQ (PIDAQ-S) for use in Swedish 12-19 year-olds.

MATERIALS AND METHOD: The translation process was performed according to the ‘Guidelines for Establishing Cultural Equivalency of Instruments’ by Ohrbach et al. in the following steps; 1) Forward translation, 2) Back translation, 3) Independent review, 4) Expert panel review, 5) Pre-testing, 6) Instrument review, 7) Field testing in a group of consecutive patients who were about to start orthodontic treatment (pre-treatment group) and a group of consecutive patients who had recently finished orthodontic treatment (post-treatment group). The sample size estimation showed that, for 80 per cent power when the alpha level was set to 0.05, a sample size of 63 individuals in each group was needed. A Student’s t-test was used to analyze differences between groups. For reliability testing of the internal consistency Cronbach’s alpha was used.

RESULTS: Preliminary results are available at the moment. So far 124 questionnaires [50 pre-treatment (21 M, 29 F, mean age 14.5 years) and 74 post-treatment (30 M, 44 F, mean age 17.4 years)] have been collected. When the inclusion process is finished 140 completed questionnaires will have been completed. Thirty individuals will fill in the questionnaire a second time for test-retest analysis. The mean total PIDAQ-S score was significantly higher ($P < 0.001$) in the pre-treatment group (40.2 ± 20.2) than in the post-treatment group (9.5 ± 10.5). The mean total PIDAQ-S score was also significantly higher ($P < 0.001$) in females (49.4) than in males (27.6) in the pre-treatment group, whereas differences between genders were not significant ($P = 0.253$) in the post-treatment group. The Cronbach alpha value was 0.78 for the total scale. The results imply a satisfactory reliability.

CONCLUSION: The PIDAQ-S shows satisfactory reliability.

SP 151  THE INDEX OF ORTHOGNATHIC FUNCTIONAL TREATMENT NEED: A RETROSPECTIVE AUDIT

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AIMS: To assess the validity of the Index of Orthognathic Functional Treatment Need (IOFTN) whilst evaluating its potential impact on the provision of orthognathic treatment in The Royal Gwent Hospital.

MATERIALS AND METHOD: Patients attending their first combined clinic in 2016 were identified using the computerised booking system. The IOFTN of 30 patients were calculated using patient notes, study models, radiographs and clinical photographs. The data was captured using a standardised data collection form.

RESULTS: The audit standard, that 90 per cent of patients managed with orthognathic surgery should be grade 4 (great need) or grade 5 (very great need) of the IOFTN, was attained.
CONCLUSION: This audit suggests the IOFTN is a valid index to assess patients’ suitability for orthognathic surgery and will not have an impact on orthognathic services provided.

SP 152  CLINICAL AND GENETIC DIAGNOSIS FOR PRIMARY FAILURE OF ERUPTION
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AIMS: Primary failure of eruption (PFE) is characterized by non-syndromic eruption failure of permanent teeth which are not ankylosed, but fail in their eruptive process partially or completely, without any systemic disease or mechanical interference identifiable. This condition is different from the mechanical failure eruption due to a mechanical obstacle. Recent studies support that this dental phenotype is inherited and that mutations in PTH1R genes explain several familial cases of PFE. Clinical signs of PFE are those described by Proffit and Vig. In this study, a group of patients with PTH1R mutation was investigated to find out clinical signs of PFE.

SUBJECTS AND METHOD: Seventeen subjects were selected for having a genetic variation of PTH1R, from a group of 45 patients with at least one tooth affected by partial or complete failure of eruption. The clinical signs of PFE were identified, according to Proffit and Vig.

RESULTS: All the subjects showed some of the clinical signs of PFE according to Proffit and Vig, but the clinical features of the patients were different for type and frequency of the signs related to PFE.

CONCLUSION: In PFE it is very difficult to diagnose the problem on a clinical basis only. A genetic test is decisive to confirm the diagnosis.

SP 153  INVESTIGATION OF THE THREE REGIONS OF ELASTICITY OF TRITANIUM ORTHODONTIC ARCHWIRE
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AIMS: One of the most important factors determining the efficiency of moving teeth is the choice of appropriate orthodontic archwire. When activating the wire, biologically tolerable forces must be released that do not induce hyalinization and root resorption. Since the area of the root surface of individual teeth is different, it is logical to apply less force on the anterior teeth and larger forces on the posterior teeth. Progress in metallurgy in the manufacture of nickel-titanium alloys leads to the creation of such archwires, which are activated by heat and, in defined areas, release different forces. With such features is the orthodontic arch TriTanium (American Orthodontics). This study aimed to identify the chemical composition and structure of the as-received wire in the three regions of elasticity: anterior (encompassing the four incisors), middle (encompassing the canine tooth and the premolars) and posterior (the molars).

MATERIALS AND METHOD: As-received orthodontic TriTanium wires with dimensions of 0.016 × 0.022 inches were studied in three elastic areas. The following methods were used to achieve the goal: X-ray diffraction analysis (XRD), energy dispersive X-ray analysis (EDX) and scanning electron microscopy (SEM).

RESULTS: EDX analysis showed that Ni and Ti are the main elements in the composition of the examined wires. The room temperature XRD patterns showed typical peaks for a NiTi alloy with austenite type structure. SEM micrographs showed rough surfaces specific for the different types of NiTi wires. The results with were compared with a previous study for as-received 0.016 × 0.022 inches heat-activated wire (3M Unitek), which has equal elasticity in all regions.

CONCLUSION: The findings will be useful for more precise application of TriTanium orthodontic archwire in clinical practice.

SP 154  SKELETAL COMPARISON OF PATIENTS WITH MAXILLARY LATERAL INCISORS AGENESIS IN THE ORTHODONTIC PATIENT POPULATION IN THE SOUTHEAST ANATOLIAN REGION
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AIMS: To investigate the prevalence of maxillary lateral incisor agenesis (MLIA) and associated skeletal characteristics in the southeast Anatolian region of orthodontic patient population.

MATERIALS AND METHOD: Records of 622 patients receiving orthodontic treatment were reviewed for MLIA. The following data were recorded for each subject: gender, age, unilateral or bilateral agenesis of MLI and side. The lateral cephalogram of each subject with MLIA was digitally traced. Cephalometric measurements of patients with MLIA were compared with those of Class I patients.

RESULTS: The prevalence of MLIA in the southeast Anatolian region was 5.6 per cent (35 patients) of which 71.4 per cent were female. There was a significant difference between MLIA patients and controls in sagittal relationships (SNA, angle of convexity, U1-SN, L1-NB angle and UL-E) \( P < 0.05 \).

CONCLUSION: Maxillary development in patients with MLIA was less compared to the Class I patients in the control group.

SP 155 CHARACTERIZATION OF DENTAL PHENOTYPE IN PATIENTS WITH CLEIDOCRANIAL DYSPLASIA USING LONGITUDINAL DATA

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AIMS: To investigate the characteristics of the dental phenotype in patients with cleidocranial dysplasia (CCD) using longitudinal data.

SUBJECTS AND METHOD: Twelve unrelated Korean CCD patients were observed using a longitudinal series of radiographs and clinical photographs. Statistical analysis was performed on the dental phenotypic data.

RESULTS: Although dysplasia of the clavicles, open fontanelle, and wormian bone were observed in all 12 patients, delayed fusion of the mandibular symphysis was found in four subjects. One patient did not have a supernumerary tooth (ST). However, 62 STs were found in 11 patients (mean, 5.6 per patient; range of ST emergence, 5 years 6 months-14 years 8 months; developing position, occlusal to the permanent incisors, canines, and premolars and distal and apical to the permanent molars). The mandibular premolar region was the most frequent area of ST development (50.0%, \( P < 0.001 \)). All 12 patients showed impacted permanent teeth (IPT), including one patient without ST (mean, 17.8 per patient). Impaction occurred most frequently in the mandibular premolar region and least frequently in the maxillary molar region (93.8% versus 39.6%, \( P < 0.01 \)). The ratio of spontaneous eruption of IPT after removal of retained primary teeth and/or ST was highest for the maxillary and mandibular incisors (all 54.6%) and lowest for the mandibular canines and premolars (26.7% and 28.9%, respectively), however the difference was not significant.

CONCLUSION: The emergence time and developmental position of ST and the root development of IPT should be considered to determine the timing for removal of ST and forced eruption of IPT.

SP 156 EVALUATION OF MAXILLARY AND MANDIBULAR RIGHT AND LEFT SIDE TOOTH SIZE DISCREPANCIES IN AVERAGE AND HIGH BOLTON GROUPS

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AIMS: Bolton analysis relates upper and lower tooth size discrepancies and ratios to obtain an ideal orthodontic occlusion while right and left side semi-arch tooth size asymmetries were mostly underestimated in an orthodontic treatment plan. To evaluate the effect of maxillary and mandibular right and left side tooth size discrepancies on maintaining dental and midline symmetry and obtaining a favourable orthodontic occlusion.

MATERIALS AND METHOD: Ninety orthodontic pre-treatment dental casts with 6-8 mm of crowding both in the upper and lower arches in the permanent dentition were randomly and selected classified according to the Bolton analysis as average Bolton group (ABG; \( n = 67 \)) and high Bolton group (HBG; \( n = 23 \)). Manual measurements were done with a digital calliper directly on dental casts in order to measure the mesiodistal width of the maxillary and mandibular teeth and to identify left and right dentition size asymmetries among them. The statistical hypothesis test was used to test the hypothesis that claims ABG and HBG patients have equal right and left mesio-distal tooth widths. An independent samples \( t \)-test was also used to compare statistically ABG and HBG. The results were evaluated at a significance level of \( P < 0.05 \).

RESULTS: The statistical hypothesis test results showed that the difference between the sum of upper right and left dentition width was \( 0.65 \pm 0.55 \) mm and that between the right and left dentition width was \( 0.55 \pm 0.49 \) mm.
in the ABG ($P < 0.05$), while in HBG the difference between the width of upper right and left dentition was $0.55 \pm 0.39$ mm and that between the lower right and left dentition was $0.53 \pm 0.43$ mm ($P < 0.05$). The independent samples $t$-test showed no statistically significant differences between the ABG and HBG groups ($P > 0.05$).

CONCLUSION: The results of this first study in this area showed that both in ABG and HBG patients there are minimal but statistically significant differences between the left and right tooth size sums which should be taken into consideration to obtain ideal orthodontic treatment result and dental midline symmetry.

SP 157 COMPARISON OF TREATMENT EFFECTS BETWEEN FIRST PREMOLAR EXTRACTION AND TOTAL ARCH DISTALIZATION USING THE MODIFIED C-PALATAL PLATE

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AIMS: To compare the skeletal, dental and soft tissue treatment effects of non-extraction therapy using the modified C-palatal plate (MCP) with those of premolar extraction (PE) treatment in Class II adult patients.

MATERIALS AND METHOD: Pre- and post-treatment lateral cephalographs of 40 adult patients with a Class II malocclusion were retrospectively analyzed. The MCP group consisted of 20 patients treated with total arch distalization of the maxillary arch while PE group comprised of 20 patients treated with four premolar extractions. Fifty eight linear and angular measurements were analyzed to assess the changes before and after treatment. Descriptive statistics, paired $t$-test and multivariate analysis of variance were performed to evaluate the treatment effects within and between the two groups.

RESULTS: The MCP group presented 3.4 mm of retraction, 1.0 mm of extrusion, and 7.3 degrees of lingual inclination of the maxillary central incisor. In comparison, the PE group displayed a greater amount of maxillary central incisor retraction and retroclination, mandibular incisor retraction, and upper lip retraction (5.3 mm, 14.8°, 5.1 mm, and 2.0 mm, respectively; $P < 0.001$ for all). Also, the MCP group showed 4.0 mm of distalization, 1.3 mm of intrusion with 2.9 degrees of distal tipping of the maxillary first molars.

CONCLUSION: The findings support that the MCP is an effective distalization appliance in maxillomandibular arches. The amount of incisor retraction, however, was significantly increased in the PE group. Therefore, four premolar extraction may be recommended for greater improvement of incisor and profile changes.

SP 158 A PROJECTION ON THE EFFECT OF A CHANGE IN PROTOCOL IN ORTHOGNATHIC SURGERY WILL HAVE ON THE AVERAGE LENGTH OF STAY AND COSTS IN THE NORTH WEST OF ENGLAND

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AIMS: To project the reduction of bed-occupancy and savings to the trust following a change in protocol in orthognathic surgery in the North West of England.

MATERIALS AND METHOD: A comparative analysis was conducted in North Wales regarding the length of stay of orthognathic patients from the pre-early discharge protocol period (October 2006 to October 2012) to post-early discharge protocol period (October 2014 to October 2016). The orthognathic patients were split into three groups: Le Fort 1 osteotomy; bilateral sagittal split osteotomy (BSSO) and bimaxillary surgery. The change in mean length of stay of patients following the introduction of the early discharge protocol in North Wales was calculated and applied to a cohort of patients in the North West of England who had previously undergone orthognathic surgery. A projection was made of the reduction in bed-occupancy days and savings to the trust if the early discharge protocol was to be introduced in the North West of England.

RESULTS: In all three categories of patients who underwent orthognathic surgery, the mean length of stay of North Wales patients was considerably less after the introduction of the early-discharge protocol. The mean length of stay for bimaxillary surgery was reduced from 2.21 to 1.56 days, while for sole BSSO the reduction was from 1.31 to 0.66 days and for sole Le Fort 1 osteotomies 1.81 to 1.61 days. Using the average cost of bed occupancy per day, it is estimated that a total saving of £85,226 could be achieved if the early-discharge protocol was to be adopted in the North West of England. A change in protocol is recommended to be introduced in the Northwest which will focus on changing the team’s approach and mindset in the pre-operative work-up of orthognathic patients.
CONCLUSION: The above data supports the proposed change in policy as it enable patient outcomes to be maintained whilst reducing bed occupancy rate and costs in orthognathic surgery for the region.

**SP 159 A COMPARATIVE ANALYSIS BETWEEN LENGTH OF STAY OF PATIENTS UNDERGOING ORTHOGNATHIC SURGERY IN THE NORTHWEST OF ENGLAND AND NORTH WALES**

Mohamed Hania, Helen Cashman, David Laraway, Aintree University Hospital, Liverpool, U.K.

AIMS: To study the effect of a protocol driven early discharge policy following elective orthognathic surgery, and to compare outcomes, including length of stay across two major surgical units.

MATERIALS AND METHOD: A cohort of orthognathic patients in the North West and North Wales were retrospectively analysed and compared from the period of June/2014 to July/2016. The exclusion criteria was: patients who attended for solely genioplasties and syndromic patients who required craniofacial reconstruction as an adjuvant procedure or who had previously undergone such procedure; The resulting sample population were then further subdivided into three categories: 1. Bimaxillary surgery, 2. Bilateral sagittal spilt osteotomy and 3. Le Fort 1 osteotomy

RESULTS: In all three categories of patients who underwent orthognathic surgery, the length of stay of North Wales patients was considerably less when compared to Northwest patients with no associated disparity in the rate of complications such as infection, readmissions or resulting malocclusion. A new protocol is recommended to be introduced in the Northwest that will focus on changing the team approach and mindset in the pre-operative work up of orthognathic patients, whilst incorporating factors that have been shown to be statistically significant in reducing the length of stay in orthognathic surgery e.g. use of peri-operative steroids, hypotensive anaesthesia, semi-rigid fixation.

CONCLUSION: In a high volume unit like the Northwest, it is considered that this comparative service evaluation along with new proposals will enable patient outcomes to be maintained whilst reducing bed occupancy for orthognathic patients with resultant cost implications.

**SP 160 ROMSE: A DATABASE FOR RARE DISEASES WITH OROFACIAL AND CRANIOFACIAL MANIFESTATIONS**

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AIMS: Worldwide 6000 to 8000 rare diseases are known and 15 per cent can become manifest in the orofacial region e.g. craniofacial dysplasia such as cleft lip and palate (CLP), dysgnathia and hypodontia. Orthodontics forms a major field in rare diseases. Dentists and orthodontists are often the first to come into contact with young patients who are affected by a rare disease. Unfortunately there is little knowledge and experience in rare diseases and their diagnosis and treatment. The aim is to establish a database for orofacial manifestations in people with rare diseases (ROMSE) in order to improve diagnosis and treatment.

MATERIALS AND METHOD: Since 2011 material from various databases such as Orphanet, OMIM, as well as PubMed, was evaluated. Starting in 2013 the gathered information was incorporated into the web-based, freely accessible database at http://romse.org.

RESULTS: So far 535 rare diseases with orofacial manifestations have been listed in the ROMSE database. One hundred and fifty one rare diseases include dysgnathia, 12 of them craniofacial dysplasia and 148 with CLP. There are already two institutions that offer consultations for patients with rare diseases with orofacial manifestations.

CONCLUSION: Rare diseases and their symptoms come with difficult challenges regarding therapy. By setting up ‘ROMSE’ a platform is provided for dentists, orthodontists and oral and maxillofacial surgeons to work on interdisciplinary treatment strategies. Specialized consultation centres should be more common in order to help patients and to improve treatment.

**SP 161 PSYCHOSOMATIC PATIENTS IN THE ORTHODONTIC OFFICE**

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AIMS: Patients with aesthetic treatment demand sometimes have psychosocial disorders. The identification of these body dysmorphic disorders could be difficult to detect. The aim of the study was the investigation of psychosomatic orthodontic patients in a university hospital.

SUBJECTS AND METHOD: About 100 patients with psychosomatic disorders who in one year had an interdisciplinary consultation with specialists from prosthodontic and psychosomatic departments in a university hospital. Ten of them and 15 new orthodontic patients were examined (16 females, 9 males, aged 40 to 58 years). The history, symptoms of complaint, pain and malocclusion were recorded. The Index of Orthodontic Treatment Need (IOTN) was used for estimation of severity.

RESULTS: All patients reported experiencing pain and pressure in different regions [temporomandibular joint (TMJ), eyes, third molars, anterior teeth and lateral segments] and showed minor crowding in the incisor region (IOTN <2). Most had previously visited another dentist. From their point of view the pain and malocclusion were caused by the permanent pressure feeling. One female patient believed that the crowding was caused by abnormal swallowing. They wanted to correct the malocclusion or have the third molars removed to improve their health. Oral inspection, radiographic images and TMJ registrations did not show any evidence for the reported symptoms. The contraindications of orthodontic treatment or tooth extractions were discussed with them to convince them to again visit a psychosomatic specialist or psychologist.

CONCLUSION: Patients with psychosomatic disorders show minor malocclusions with a great effect on their well-being. There is no indication to start treatment. Especially removal of teeth and stripping as an irreversible trauma has to be avoided.

SP 162 PILOT STUDY OF A TRANSLATED ARABIC INSTRUMENT TO MEASURE ORAL HEALTH-RELATED QUALITY OF LIFE IN YOUNG INDIVIDUALS WITH MALOCCLUSION
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AIMS: To pilot test an Arabic translated version of the Malocclusion Impact Questionnaire (MIQ-A).

MATERIALS AND METHOD: After translation according to current guidelines, the MIQ-A was piloted in a convenience sample of native Arabic speakers, 10 to 16-years-old, attending for a new patient consultation appointment in a postgraduate orthodontic clinic. Cronbach’s alpha was used to test the internal consistency/reliability and Spearman’s rho for test-retest reliability. Statistical tests were undertaken using SPSS (v24 IBM Corp., New York, USA).

RESULTS: Item analysis revealed that the reliability of the MIQ-A in measuring the impact of malocclusion in the sample was at a very high level (Cronbach’s alpha= 0.93 > 0.70). Following examination of corrected item to total correlations and the value of coefficient alpha if the item was deleted, all questions in the scale were retained. In addition, the average discrimination index of the scale was at very high level (0.67 > 0.30). Test-retest reliability analysis showed that the majority of correlations (Spearman’s rho) were statistically significant (P < 0.05) and their magnitude ranged from medium to strong (0.31-0.52). Principal components analysis with oblique rotation, resulted in four significant dimensions explaining 75.6 per cent of the total variance.

CONCLUSION: Pilot testing has shown that the MIQ-A may exhibit good psychometric properties in terms of validity and reliability. Further evaluation is required to confirm these initial results.

SP 163 ORTHOGNATHIC SURGERY FROM THE PATIENT’S PERSPECTIVE: A META-ANALYSIS OF OUTCOMES FROM A CONDITION SPECIFIC HEALTH-RELATED QUALITY OF LIFE INSTRUMENT
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AIMS: Unlike laboratory or clinical indices, patient-reported outcomes may provide more information on physical and psychosocial effects of various conditions or treatments. The aim of this study was to systematically investigate the available literature regarding the effects on Health-Related Quality of Life (HRQoL) perceptions measured by a condition specific instrument before and after orthognathic surgery.
MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data from prospective studies that compared HRQoL before and after orthognathic surgery by means of the orthognathic quality of life questionnaires were reviewed and the random effects method was used to combine changes. The clinical significance of the observed changes was assessed following relevant guidelines.

RESULTS: Eleven prospective studies were finally identified. Initially, significant deterioration of HRQoL perception occurred, followed by gradual improvements beyond pre-treatment levels up to the time of debonding orthodontic appliances.

CONCLUSION: Overall, improvements in the perception of condition specific HRQoL dimensions were observed following orthognathic surgery. Better standardization and reporting in long follow-ups are necessary in order to fully understand the effect of orthognathic surgery from the patient’s perspectives.

SP 164 ATTITUDES OF HIGH SCHOOL STUDENTS TOWARDS ORTHODONTIC TREATMENT Anne Bo Hattem, Annemieke Bos, ACTA, Amsterdam, Netherlands

AIMS: To examine the attitude of high school students towards orthodontic treatment in the Netherlands and to investigate differences between orthodontically treated and untreated participants and between male and female subjects. A secondary aim was to assess possible differences between high school students in Amsterdam and Heerenveen.

SUBJECTS AND METHOD: Two schools were included in this study. A total of 163 subjects between 14 and 17 years old participated; 139 in Amsterdam and 24 in Heerenveen. A questionnaire was used to examine the participants. Both orthodontically treated and untreated subjects were included.

RESULTS: Only for four items were significant differences (P < 0.01) found between orthodontically treated and untreated subjects. Females scored significantly (P < 0.05) higher than males on the total mean score of questionnaire part I. Two subscales were significant predictors of the general attitude of treated subjects towards orthodontics.

CONCLUSION: There seemed to be no significant differences in attitude towards orthodontics between orthodontically treated subjects and untreated subjects. Male subjects scored more negatively than females on general attitude and on almost all subscales of questionnaire part II. Significant predictors for general attitudes towards orthodontics were the relationship with the orthodontist and the attitude towards follow-up appointments. No significant differences were found in attitudes between students in Amsterdam and Heerenveen.

SP 165 APPLICATION OF A NEW SUPERIMPOSITION TECHNIQUE IN THE CREATION OF THREE-DIMENSIONAL FACIAL IMAGES IN SIMULATED JAW SURGERY Shuma Hattori1, Manabu Murabayashi1, Atsushi Fujiwara1, Akitoshi Katsumata2, Noriyuki Kitai1, Departments of 1Orthodontics and 2Oral Radiology, Asahi University, Gifu, Japan

AIMS: To apply a new superimposition technique for creating three-dimensional (3D) facial images based on the conventional cephalometric superimposition method in simulated jaw surgery.

MATERIALS AND METHOD: The surface image of a phantom human head (Kyoto Kagaku, Co. Ltd., Japan) was recorded using a 3D surface imaging device (3MDcrani System, 3dMD, USA) and the phantom was radiographed using a cephalometric X-ray system (CX-150W, Asahi Roentgen Ind., Co. Ltd., Kyoto, Japan). 3D surface and cephalometric images were also recorded after simulated jaw surgery (10 mm forward movement of the maxilla and mandible of the phantom). The 3D surface and cephalometric digital data were integrated at four points, the glabella, nasion, pronasale, and subnasale before and after movement of the maxilla and mandible (pre-movement integrated image and post-movement integrated image, respectively). The pre- and post-movement integrated images were superimposed based on the conventional cephalometric superimposition method. The 3D coordinates of the glabella, nasion, pronasale, subnasale, labrale superius, stomion, and labrale inferius were identified five times on the pre- and post-movement integrated images. Statistical analysis was performed to investigate the differences in the 3D coordinates on the pre- and post-movement integrated images.
RESULTS: There were no significant differences in the positions of the glabella, nasion, and pronasale before and after movement of the maxilla and mandible. Comparison of the pre-movement and post-movement images revealed significant changes in the positions of the subnasale, labrale superius, stomion, and labrale inferius, which were found to have moved in an anteroinferior direction on the post-movement image.

CONCLUSION: This new superimposition technique is therefore suggested to be useful for superimposition between pre- and post-treatment 3D facial images.

SP 166 ROLE OF THE INFERIOR ALVEOLAR NERVE IN THE MESENCHYMAL STEM/PROGENITOR CELLS
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AIMS: In developing teeth, epithelial and mesenchymal stem cells form the niches and provide the sources of cells which give rise to generation, growth and repair of the dental tissues. The origin of these stem cells has been a matter of considerable discussion and recent researches have been shown that the peripheral nerves play the important roles in providing mesenchymal stem cell (MSC). To address whether neural tissues play important roles in MSC maintenance and tooth growth, we used rodent incisors. Rodent incisors grow continuously. Thus, it is a great model system to address the origin of dental stem cells. In this study, we examined that the effect of inferior alveolar nerve (IAN) neurectomy on rat's lower incisal growth and both epithelial and mesenchymal stem/progenitor cell homeostasis.

MATERIALS AND METHOD: The right IAN was transected at the level of mandibular ramus of 8 weeks old rats. After 4 weeks, lower incisal structures were analyzed using micro CT. Subsequently, 10 μm sections of the mandibular bones were prepared for histological and immunohistochemical observations. Primary antibodies, CD90 for mesenchymal progenitor, p40 for epithelial progenitor and LRIG1 for both epithelial and mesenchymal stem cells were used to detect dental stem/progenitor cell population. Sham operations without nerve transection were done as controls.

RESULTS: The abolished odontoblast and bone like tissues in the pulp termed osteodentin were observed 4 weeks after IAN resection. In the epithelial tissues, thinner enamel and the disorganized ameloblast layer in the inner enamel epithelium were observed as well. The lower incisal eruption speed was reduced in IAN denervated incisor. Immunohisto staining revealed that the ratio of mesenchymal stem/progenitor cells as a percentage of the total cell number was reduced after IAN resection. On the other hand, epithelial stem/progenitor cell ratio was not affected by the IAN resection.

CONCLUSION: These results indicate that a change in the dental stem/progenitor cell microenvironment via IAN resection significantly altered the mesenchymal stem/progenitor cell homeostasis in rat incisors, although that of the epithelial tissue did not show significant alteration. It is implying that vital innervation is important for mesenchymal stem/progenitor cell maintenance and normal tooth growth.

SP 167 EARLY TREATMENT OF SKELETAL CLASS III PATIENTS
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AIMS: To investigate the amount of maxillary protraction with rapid maxillary expansion (RME) and facemask. The changes in the sagittal dimension were measured with SNA angle and the Wits appraisal. The vertical alteration was shown by the increase in anterior face height (NL-ML).

SUBJECTS AND METHOD: Fourteen prepubertal skeletal Class III patients with an anterior crossbite. Patients with anterior open bite and cleft patients were excluded. In the first phase of the treatment a bonded expander was used, following the alternating RME and constriction (Alt-RAMEC) protocol. This included 5.6 mm of alternating expansion and constriction (0.8 mm/day) for 6 or 7 weeks, finishing with a correct transversal position of the maxilla. In the second phase of the treatment, the children wore a facemask for 3-4 months, 12-15 hours a day. With the facemask the maxilla was protracted with a force of 400-600 cN, in a forward and downward direction. The pre-treatment and 6-9 months post-treatment lateral cephalograms were analysed. The changes of the SNA and NL-ML angles and the difference in the Wits appraisal were measured.
RESULTS: An increase of 1.16 degrees (SD: 2.50°) was measured in the SNA angle, and the maxilla was protracted 2.50 mm (SD: 2.01 mm) forward according to the Wits appraisal. The NL-ML angle was enlarged by 1.40 degrees (SD: 3.32°).

CONCLUSION: Maxillary protraction with a facemask after using the Alt-RAMEC protocol can significantly promote maxillary growth and change the direction of mandibular growth in the prepubertal period. This method is a reliable, time and cost effective treatment option in the correction of Class III malocclusions.

SP 168 RELATIONSHIP OF LATERALITY AND CHEWING SIDEDNESS IN TWINS
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AIMS: To study whether there are associations between initiative chewing side preference and other lateralities, whether there is a genetic origin for preferred chewing side, and its relationship to gender and birth order.

SUBJECTS AND METHOD: One hundred and thirteen adolescent and adult twin pairs [57 pairs monozygotic (MZ), 47 pairs same gender dizygotic and 9 pairs of the opposite gender]. Lateralities were studied mainly by asking, as well as birth order. If necessary, the preferred chewing side was studied by providing gum and examining, which side was used, handedness by asking to write with a pen, footedness to kick a ball and eyedness to look into a telescope-like cylinder.

RESULTS: Right-handed, -footed, and -eyed as separated groups, and true-right sided (as combined), were evenly distributed by preferred chewing side. By contrast, left-handed, -footed, -eyed and non-right sided used more left or both sides when chewing. Birth order affected preferred chewing side among MZ twins: the first-born twin was more likely to have the preferred chewing side on the non-right, while second born twins used the right side. Chewing and eyedness were also significantly associated in MZ-twins and MZ-co-twins. However, gender and zygosity were not statistically significant factors.

CONCLUSION: The mechanisms that create laterality in various symmetric organs are still poorly known. Apparently genetic factors and brain side dominance play major roles. In contrast some scholars believe that only early environmental factors, for example prenatal or perinatal hypoxia, frequently observed in MZ twins, may have influence. These opinions are supported here by the facts that MZ twins seem to be more receptive to develop a preferred chewing side on the same side as the co-twin, chewing side was associated significantly with other lateralities, and variation was observed according to birth order. Methodologically the examination of chewing sidedness could have been done in several different ways in terms of duration of laterality of chewing cycles, to provide a definite result. Also the quality of occlusion and head form might have had an effect on the results.

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SP 169 THE EFFECT OF A FUNCTIONAL APPLIANCE WITH OR WITHOUT HEADGEAR ON UPPER AIRWAY DIMENSIONS IN SKELETAL CLASS II DIVISION 1 PATIENTS
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AIMS: To: 1) compare upper airway dimensions before and after treatment in children with a skeletal Class II, division 1 in two groups treated with a functional appliance without headgear (group A) and with headgear (group B), 2) compare changes in upper airway dimension before and after treatment between groups A and B and 3) analyze the associations of changes in the airway dimension before and after treatment with changes in prognathia of the maxilla and mandible, sagittal jaw relationship and mandibular rotation.

SUBJECTS AND METHOD: Sixty four skeletal Class II division 1 children (32 girls, 32 boys, mean age 12.4 years) with a horizontal maxillary overjet ≥6 mm were treated with functional appliances (mean treatment time 18.5 months) and divided into two groups: 21 children without headgear (group A) and 43 children with headgear (group B). Upper airway dimensions were measured before and after treatment on lateral cephalograms. Differences within and between the groups and associations were analysed and adjusted for skeletal age and gender by the general linear model.
RESULTS: When the results were adjusted for skeletal age and gender, no significant differences were seen in upper airway dimensions before or after treatment in the two groups. Changes in the hypopharynx dimension (va-pva) before and after treatment were significantly larger in group B than group A ($P = 0.022$). For group A, the change in va-pva before and after treatment was significantly positively associated with the mandibular rotation ($P = 0.027$) and significantly negatively associated with maxillary prognathia ($P = 0.011$). For group B, the change in oropharynx dimensions (ve-pve, rl-prl) before and after treatment was significantly positively associated with the mandibular rotation ($P = 0.026$) and changes in the sagittal jaw relationship ($P = 0.041$).

CONCLUSION: Functional appliances with headgear showed a positive effect on the hypopharynx compared to functional appliances without headgear. Furthermore the treatment-induced mandibular rotation may affect the upper airway dimensions.

SP 170 THE EFFECTS OF VIBRATION AND LIGHT ON ORTHODONTIC TREATMENT DURATION IN THE ALIGNMENT PHASE
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AIMS: To evaluate the effects of vibration and photobiomodulation techniques on mandibular incisor tooth alignment compared with conventional orthodontic treatment. Today there are invasive or systemic methods to accelerate tooth movement. With this study it was also desired to create a more conservative technique to accelerate tooth movement than those other methods, which would easily be accepted by the patients and have continuous effects throughout the desired period of treatment.

SUBJECTS AND METHOD: A total of 36 patients (mean age 20 years 11 months, 14 males, 24 females) were included in the study and assigned to four groups. The first group (control) consisted of eight patients, the second group with 10 patients received a vibrating device, the third group of nine patients received a device which produced light and the last group comprising nine patients a device which combined vibration and light features (HOT device). All patients with devices were asked to use them for 20 minutes a day. At the initial appointment and at days 30 and 60 impressions were taken to produce dental casts. Tooth movements were recorded by measuring the differences in the amount of crowding. The results were statistically analysed using the Statistical Packages for Social Sciences program 23.0.

RESULTS: The following tooth movement was observed: control group $1.97 \pm 0.17$ mm, vibration group $2.38 \pm 0.52$ mm, light group $3.28 \pm 0.62$ mm and HOT group $4.05 \pm 0.39$ mm. These measurements revealed statistical differences between the control and light groups as well as between the control and HOT groups ($P < 0.05$); whereas the vibration group showed no statistical difference compared to the control.

CONCLUSION: Photobiomodulation application and the combined use of photobiomodulation and vibration can enhance tooth movement and are effective methods.

SP 171 ECTOPIC ERUPTION OF UPPER FIRST PERMANENT MOLARS: INCIDENCE, ASSOCIATED DENTAL ANOMALIES AND TREATMENT
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AIMS: To study the incidence, associated dental anomalies and treatment of ectopic eruption of upper first permanent molars.

MATERIALS AND METHOD: The initial study material comprised of 2522 completed orthodontic cases in a single health care centre between 1.1.2003-31.12.2015. Inclusion criteria was based on study model examination: healthy Caucasian children with uni- or bilateral ectopic eruption of the upper first permanent molar were included. Patients with facial/dental traumas, extraction/loss of upper second primary molar for other reason as ectopic eruption of upper first permanent molar, and cleft lip and palate or syndromes were excluded. Patient files were examined to record tooth extractions and treatment associated with ectopic eruption. Panoramic radiographs were used to verify the initial study model inclusion decision, and associated dental anomalies. Lateral head radiograms were used for cephalometric analysis to study sagittal and vertical skeletal relationships.

RESULTS: Uni- or bilateral ectopic eruption was found in 48 patients (22 girls, 26 boys), i.e. the incidence was 1.9 per cent. There were in total 78 ectopically erupted upper first molars: 44 on the right and 34 on the left side.
Ten patients (20.8%) had infra-occlusion of a primary molar, eight had a congenitally missing tooth (16.7%) and three (6.3%) an ectopically erupting upper canine. Facial skeletal structure varied greatly among subjects. In 51 per cent of the cases the second upper primary molar was spontaneously exfoliated due to the ectopic eruption, and the upper molar erupted mesially. Despite varying and extensive orthodontic care to upright and open space for all teeth, in 56 per cent of cases extraction of permanent teeth was later needed.

CONCLUSION: The incidence of ectopic eruption of upper first molar was 1.9 per cent. Ectopic eruption seems to be associated with other dental anomalies (infra-occlusion of primary molars, congenitally missing teeth, and ectopic eruption of upper canines). Ectopic eruption seems to predict crowding and need for tooth extractions.

SP 172 THE ROLE OF CIRCULAR RNA CDR1AS IN CEMENTOBLAST DIFFERENTIATION OF PERIODONTAL LIGAMENT STEM CELLS

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AIMS: Cementoblasts can resist and repair resorption defects at the root surface. Differentiation of periodontal ligament stem cells (PDLSCs) into cementoblasts will benefit in repairing root resorption. Circular RNA (circRNA) is involved in cell growth and differentiation and may be a novel target to regulate PDLSC differentiation. The purpose of this study was to clarify the role and mechanism of circRNA-CDR1AS in the differentiation of PDLSCs into cementoblasts.

MATERIALS AND METHOD: Microarray was used to detect the profile and change of circRNAs during cementoblast differentiation of PDLSCs. The role and function of CDR1AS in cementoblast differentiation of PDLSCs in vitro using the loss-of-function approach was investigated. Specific siRNA were used to knock down CDR1AS in PDLSCs. Cementoblast differentiation induction, alkaline phosphatase (ALP) staining, Alizarin red staining, real time-polymerase chain reaction (qRT-PCR), Western blot were performed according to standard procedures.

RESULTS: circRNA-CDR1AS expression was upregulated after induction of PDLSCs into cementoblasts by microarray. The qRT-PCR results also demonstrated that CDR1AS and cementoblastic markers were significantly upregulated after cementogenesis of PDLSCs. After successful knockdown of CDR1AS, the extracellular matrix mineralization as revealed by ALP staining and Alizarin red staining was inhibited, and the cementogenic gene expression was also downregulated. In the study of molecular mechanism, it was found that CDR1AS inhibited miR-7 expression, and miR-7 targeted growth differentiation factor 5 (GDF5). MiR-7 acted as a negative regulator in cementoblastic differentiation of PDLSCs.

CONCLUSION: circRNA-CDR1AS promoted cementoblast differentiation of PDLSCs via miR-7 to regulate GDF5 expression. This study indicates the use of CDR1AS as a molecular target to repair dental root resorption.

SP 173 NEED FOR REOPERATION AFTER ORTHOGNATHIC SURGERY. A REVIEW OF 796 PATIENTS

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AIMS: This quality control study was carried out to assess the incidence of patients who had been re-operated after orthognathic surgery and to examine associated factors related to patient characteristics and type of surgery. The reason for re-operation was explored and it was examined whether there had been change in incidence of re-operation over time.

MATERIALS AND METHOD: Between 1994 and 2011 796 patients were monitored by the University of Oslo orthognathic team 3 years post-surgery and registered in the electronic archives at the Department of Orthodontics, Faculty of Dentistry. Among the 796 patients (446 females, 350 males) 30 (3.5%) had been re-operated (13 females, 17 males). The 766 patients without re-operation served as controls. Information about diagnosis, surgical procedures, and patients’ attitudes was available. Differences between samples were analysed by independent t-test and chi-square test.

RESULTS: A tendency for more frequent re-operation among men was observed. The patients who had a second operation were somewhat older at the time of the initial surgery compared to the controls [mean age 32.2 years and 26.3 years (P < 0.001)]. Before treatment the majority of the total sample (56.7%) had skeletal a Class III malocclusion. There was no difference in skeletal Class between the re-operated and the controls. However,
there was a tendency to more patients being re-operated among those having bimaxillary surgery with advancement of the mandible combined with a Le Fort I osteotomy (10.8% re-operated) compared to one-jaw surgery and bimaxillary surgery with setback of the mandible (2.8 to 3.7% re-operated). Three years after surgery 25 per cent of the re-operated patients and 8.4 per cent of the controls reported dissatisfaction with the treatment result \( (P < 0.01) \). No difference in the incidence of re-operated patients over time was revealed.

CONCLUSION: In this sample there was a tendency for more frequent re-operations among those with bimaxillary surgery involving advancement of the mandible. Among the variables explored, age at the time of operation was the only variable with a significant difference between samples. The present findings indicate that it is preferable to perform orthognathic surgery before the age of about 30 years, especially for bimaxillary surgery with mandibular advancement.

**SP 174  IN VITRO STUDY OF THE SHEAR BOND STRENGTH IN DIRECT AND INDIRECT BONDING WITH THREE TYPES OF ADHESIVE SYSTEMS**

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AIMS: To compare the shear bond strength (SBS) and adhesive remnant index (ARI) between bracket and tooth; using three adhesive systems and two bonding techniques (direct and indirect).

MATERIALS AND METHOD: Seventy two human premolars divided into six groups: The first three groups (G1, G2, G3) were bonded with a direct technique, while the groups G4, G5 and G6 were bonded using the indirect technique. Conventional acid etching primer (Transbond XT) was used in G1 and G4; self-etching bonding (Beauty Ortho Bond) in G2 and G5 and a self-adhesive (GC OrthoConnect) in G3 and G6. All groups were exposed to thermocycling of 1500 cycles between 5 to 55 degrees. SBS was analyzed with a universal testing machine at a speed of 0.1 mm/minute and the ARI was examined with ×4 magnification.

RESULTS: There were statistically significant differences between the three adhesive systems. The highest strength values were observed in G1 (13.54 ± 4 MPa), while the lowest was in G2 (5.05 ± 2 MPa). Statistical analysis revealed no significant difference between the direct or indirect bonding techniques when the three groups were compared.

CONCLUSION: SBS was significantly influenced by the type of primer and bonding material, while there was no difference between indirect and direct bonding techniques. The indirect bonding technique is a practical and effective procedure for the adhesion of orthodontic bracket with several adhesive materials. There were significant differences in ARI scores among the acid-etch and self-etch groups; in which the first one presented the majority of samples between 0-1 scores, while the acid-etch groups resulted in scores between 2-3 in more than half of the study subjects, with no statistical difference between the two groups.

**SP 175  CHARACTERIZATION OF BIOACTIVE GLASS COATING FORMED ON STAINLESS STEEL ORTHODONTIC WIRE**

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AIMS: To investigate surface modification with bioactive glass (BG) for orthodontic stainless steel wire, in order to make an aesthetically attractive surface with good biocompatibility.

MATERIALS AND METHOD: Thin BG layers were deposited on stainless steel wires (cross-sectional dimensions: 0.017 × 0.025 inch; 3M Unitek) using electrophoretic deposition (EPD). Non-coated wires served as a control. The BG coatings were characterized by spectrophotometry (ISR-2600, Shimadzu), laser microscopy (VK-X200, Keyence), and nanoindentation testing (ENT-1100a, Elionix). Three-point bending tests (EZ test, Shimadzu) were performed using a 12 mm span size. The results were compared using ANOVA and Tukey’s test, with \( P \) set at < 0.05 for statistical significance.

RESULTS: Thin BG coating layers with a milky-white appearance were formed on stainless steel wires using an EPD process with a BG suspension. Quantitative colour measurements showed that the EPD process using higher voltage (15 V) produced higher values for the reflectance (%) in the range of 350-800 nm and \( L^* \). Similar \( a^* \) and \( b^* \) values were obtained for most BG-coated wires. The surfaces of BG coated wires were significantly rougher than the non-coated wires. The surfaces of BG coated wires coated at higher voltage (15 V) showed significantly lower roughness than those coated at a lower voltage (10 V). The hardness and elastic modulus of the BG layers
were significantly lower than those of the non-coated wires. The specimens coated at higher voltage (15 V) showed significantly higher hardness and elastic modulus of the BG layers than those coated at a lower voltage (10 V). For three-point bending test, the elastic modulus decreased 6.9\textendash}12.0 per cent with the EPD process compared with non-coated wires.

CONCLUSION: The BG-coated process using a higher voltage (15 V) may be better than using a lower voltage (10 V). The surface modification technique using EPD and BG for orthodontic stainless steel wire offers the possibility of developing new orthodontic metallic wire with a satisfactory aesthetic appearance and bending property.

SP 176 ORTHODONTIC TREATMENT AMONG CHILDREN WITH SLEEP DISORDERED BREATHING – THE PANIC STUDY

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AIMS: To study the impact of different orthodontic treatment modalities in development of sleep disordered breathing (SDB) during 2.2-year follow-up in children.

SUBJECTS AND METHOD: The study based on the cross-sectional data of the Physical Activity and Nutrition in Children (PANIC) study. This study consisted of 370 children (48.1\% girls), the mean age at the baseline being 7.6 years (SD 0.4) and after 2.2-year follow-up 10.1 years (SD 0.5). Previous or ongoing orthodontic treatment was classified as quadhelix, headgear or other treatment (mostly eruption guidance appliance). The parents filled out a questionnaire regarding symptoms of SDB (witnessed breathing pauses or frequent snoring or loud snoring or nocturnal mouth breathing) at baseline and at the follow-up. Chi-square statistics or Fisher’s exact test were used to compare the prevalence of orthodontic treatment and treatment modalities between children with SDB and those without it. A P-value of < 0.05 was considered statistically significant.

RESULTS: Of the children 40 (10.8\%) had SDB at baseline and 44 (12.1\%) at the 2.2-year follow-up. During the follow-up SDB appeared in 26 children (7.0\%). Altogether, 82 (22.1\%) children had previous or ongoing orthodontic treatment (quadhelix therapy 4.9\%, headgear therapy 4.6\%, other orthodontic therapy 15.1\%). The difference in the prevalence of orthodontic treatment was statistically significant between children with SDB and those without it, 15.4 and 3.9 per cent, respectively ($P = 0.008$). The prevalence of headgear therapy was significantly higher in children with SDB (11.9\%) compared to those without it (3.0\%); $P = 0.005$). The difference was also significant in headgear therapy between children with an incident SDB and those without it, 15.4 and 3.9 per cent, respectively ($P = 0.026$). Instead, SDB was not significantly associated with quadhelix therapy or with other orthodontic treatment.

CONCLUSION: Deviant craniofacial morphology and certain malocclusions have been shown to be risk factors for SDB in childhood. Consequently, orthodontic treatment need is significantly higher in children with SDB than those without it. Early orthodontic treatment is thought to prevent the progression of SDB by modifying the deviant craniofacial morphology and by correcting malocclusions. However, it is suggested that among different orthodontic modalities, headgear therapy may increase the risk of development of SDB.

SP 177 DAY CASE ORTHOGNATHIC SURGERY: THE FIRST KNOWN CASE SERIES. A NEW ERA?

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AIMS: To present a unique case series of over 75 day case orthognathic osteotomies. These cases were operated on by a single experienced oral and maxillofacial surgeon, over a four-year period. This is, to our knowledge, the first data set of its kind. The aim is to show that in an era of increased budget constraints, day case orthognathic surgery is not only possible but potentially a new model for the future.

MATERIALS AND METHOD: The data collected from theatre databases, electronic records and case notes was rigorously interrogated and all cases where day case procedures were undertaken were highlighted. These were grouped these into single or two jaw surgery. Data on complication rate, readmission rate and overall length of surgery was also collected.

RESULTS: Seventy five patients underwent a mixture of orthognathic procedures (bimaxillary, maxillary and mandibular osteotomies), all of whom were treated safely as day case procedures. There were no returns to
theatres and no readmissions within 7 and 30 days, respectively. Late complication rates (such as plate removal for late infections) were less than the figures in published data.

CONCLUSION: Orthognathic day case surgery is a safe undertaking in an appropriate setting and select patient group. Patients need to be selected on an individual basis, guided by an experienced surgeon. The use of a multidisciplinary approach is recommended. It has been shown that treatment can be streamlined and the length of stay can be reduced, differing from the Royal College of Surgeons orthognathic treatment commissioning guide with an average 2-night stay. In an era where commissioning and financial constraints are becoming more apparent, this could be a stable move in the right direction.

SP 178 ARE FOUNDATION DENTISTS EXPERIENCED AND CONFIDENT ENOUGH TO PLACE STAINLESS STEEL CROWNS?

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AIMS: To Identify whether foundation dentists (FDs) received lecture-based and/or practical-based teaching on stainless steel crowns (SSCs) and the ‘Hall technique’ during undergraduate and foundation training; to quantify the number of SSCs placed by FDs during undergraduate and foundation training; to determine the change in self-reported confidence in placing SSCs between dental school to foundation training; to determine the reasons, if any, for the lack of experience and confidence in placing SSCs during foundation training and to provide recommendations, if required, to improve the experience and confidence of FDs in placing SSCs and the Hall technique.

MATERIALS AND METHOD: An anonymous, electronic voluntary survey was created using Google Forms© and distributed to all FDs within the Thames Valley and Wessex deanery. The survey was open to participants for a three-month period ending in March 2017. The data was analysed using Google Docs©.

RESULTS: A total of 32 FDs participated in the survey, achieving a 58.1 per cent response rate. Undergraduate training: over 40 per cent of respondents had placed between 1-4 SSCs, with a similar percentage (40.6%) having not placed a single SSC. Self-reported confidence in placing SSCs varied, however, the majority stated they were either ‘not confident at all’ 9.4%, or ‘not very confident’, 46.9 per cent. Foundation training: Self-reported confidence levels were equally distributed between the ‘confident’ categories and ‘not confident’ categories. Interestingly, 78.1 per cent of FDs that had not placed a SSC during foundation training, and the most common reason being that their dental practice did not stock SSCs. Over 26 per cent attributed the limited experience to a lack of confidence.

CONCLUSION: The Hall technique equips the competent practitioner with an evidence-based efficacious treatment option to biologically manage primary molar caries. Adoption of this technique must not be limited to undergraduate training, but instead promoted during foundation training and beyond. Compulsory investment in SSC by foundation training practices is recommended, and the inclusion of placing SCC as a clinical requirement for satisfactory completion of foundation year. Furthermore, public health bodies must see the Hall technique as an integral part of the dental practitioner’s armamentarium, and re-incentivise its implementation into the National general dental practice.

SP 179 EFFECTS OF FIXED LABIAL ORTHODONTIC APPLIANCES ON SPEECH IN CLASS II DIVISION 1 PATIENTS

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AIMS: To determine the effects of fixed labial orthodontic appliances on speech sound production in Class II division 1 patients by reviewing published studies.

MATERIALS AND METHOD: Electronic databases namely PubMed, EbscoHost and Scopus were searched until November 2017. All studies were included for analysis except those that looked at patients with a cleft lip and palate, craniofacial syndromes, known speech and hearing disorder and studies that were reported in languages other than English. Keywords used were: increased overjet, Class II division 1, orthodontics, speech, and fixed appliance.

RESULTS: The initial search resulted in 49 studies and after reviewing the abstracts individually, only eight studies were found relevant and thus included in this review. Four studies looked at how an increase in overjet
can cause speech impediment and the other four at how fixed appliances can cause speech difficulty. In the earlier four studies that looked at patients with increased overjet, two reported that speech was negatively affected. One study reported difficulty in pronouncing /s/ sound and the other reported distortion in the /r/ sound. No significant relationship between malocclusion and speech distortion was found in the other two studies. However, they found that the greater the need for orthodontic care, the more likely was the patient to have difficulty with speech sound production. None of the latter four studies specifically looked at patients with an increased overjet, whilst three out of four studies compared fixed labial to lingual orthodontic appliances. Only transient effects were considered as the period of these studies was one to three months. The studies described speech distortion immediately after the insertion of fixed labial orthodontic appliance and gradual improvement within a period of one to two months.

CONCLUSION: There is a paucity of information in the current literature regarding the effects of fixed labial orthodontic appliances on speech in Class II division 1 patients. More research and data are required to enable clinicians to correctly inform patients on whether orthodontic treatment can improve, worsen or have no effect on their speech and pronunciation.

SP 180 CHANGES IN ORAL HEALTH-RELATED QUALITY OF LIFE IN CHILDREN BEFORE, DURING AND AFTER ORTHODONTIC TREATMENT: A LONGITUDINAL STUDY
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AIMS: To investigate whether there is a change in the reported oral health-related quality of life (OHRQoL) before, during and after orthodontic treatment, to find out whether there is a relationship with the original treatment need and to evaluate the influence of self-esteem (SE).

MATERIALS AND METHOD: Answers to OHRQoL questionnaires were collected in an ongoing observational prospective cohort study at baseline (T0), 1 year after the start (T1) and 1 month after the end of active orthodontic treatment (T2). The children were 11 to 16 years old at baseline and 215 complete cases were selected from a total of 479 children. OHRQoL was scored using the Child Perception Questionnaire (CPQ11-14), SE was assessed by the Dutch adaptation of the Harter’s Self-Perception Profile for Adolescents and the need for treatment was defined by the Index of Orthodontic Treatment Need (IOTN). The Oral Aesthetic Subjective Impact Scale (OASIS), a tool to score perceived orthodontic treatment need, was also included. Data were analyzed with Spearman correlation, the Mann-Whitney U-test and regression models.

RESULTS: A significant decrease in the aesthetic and dental health components of the IOTN and in OASIS was noted throughout the different stages of examination (P < 0.0001). CPQ results show a decrease from T1 to T2 and an increase from T0 to T1. Between T0 and T2 there was also a significant decrease in CPQ scores (P < 0.0001). This was valid for the overall CPQ scores as well as its subdomains except for the results of emotional well-being, which decreased from T0-T1-T2. A moderate negative correlation was found for baseline SE and the change of total CPQ scores, also for the subdomain of emotional well-being between T0 and T2 (r = −0.308 and r = −0.357). Other correlations for baseline SE, treatment need and age were weak (r < 0.3).

CONCLUSION: OHRQoL ameliorates after orthodontic treatment in comparison to before treatment. Besides, high baseline SE works as a protective factor for OHRQoL.

SP 181 THE INFLUENCE OF LOW-LEVEL LASER THERAPY ON PAIN RELIEF IN THE ORTHODONTIC TREATMENT
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AIMS: Low-level laser therapy (LLLT) has an analgesic, anti-oedema, anti-inflammatory function. It improves microcirculation, stimulates immune processes and helps to regenerate tissues. The use of a low-level laser at the initial stage of orthodontic treatment limits the discomfort experienced by the patient. The aim of this study was to evaluate the effect of the LLLT on the reducing the pain associated with orthodontic treatment.

SUBJECTS AND METHOD: Thirty patients who started orthodontic treatment with a fixed appliance. Each patient’s pain threshold was assessed with an algometre and oral hygiene was measured with the Approximal Plaque Index (API). Once the appliance was fixed, the patients underwent a therapeutic session with a diode biostimulation laser (wavelength 670 nm, power output 75 mW, 30 seconds per tooth). The tip of the diode
laser probe was placed at the buccal as well as the palatal gingiva directed at the middle third of the root. The study was conducted over the subsequent 5 days. The control group consisted of 30 patients who started orthodontic treatment but were not exposed to LLLT. The selection of patients to each of the group was on a random basis. Additionally, each patient completed a questionnaire (pain perception, eating habits, oral hygiene habits) each day once they had undergone the laser procedure. Information on age, weight, height and gender of each patient was also collected. The results were statistically analysed by Chi-square and Mann-Whitney U tests.

RESULTS: Statistical analysis showed a significant decrease in pain felt by the study group of patients undergoing a LLLT. The disorders suffered were less oppressive and shorter when compared to those experienced by the control group (P < 0.05).

CONCLUSION: The findings show a beneficial effect of LLLT which results in a reduction of pain felt by patients undergoing orthodontic treatment, thus enhancing their satisfaction and motivation.

SP 182 CORRELATION BETWEEN A DEEP BITE AND DENTOFACIAL MORPHOLOGY IN CLASS II DIVISION 1 MALOCCLUSION SUBJECTS
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AIMS: A deep overbite has been related to multiple factors. The purpose of this study was to determine the correlation between a deep bite and dentofacial morphology in Class II division 1 malocclusion subjects.

MATERIALS AND METHOD: Lateral cephalograms were obtained from 30 subjects (12 females, 18 males, age between 10 and 14 years, mean 11.9 ± 1.8 years). All individuals presented a Class II division 1 malocclusion with ANB >5 degrees and overbite =/> 4 mm. Fourteen cephalometric variables were analyzed to evaluate dentofacial morphology. Spearman correlation coefficient was performed to determine the relationship between a deep bite and other cephalometric variables at the P < 0.05 level.

RESULTS: All dentofacial variables were not statistically significant correlated with a deep bite except lower face height (LFH) and lower posterior dental height (LPDH). A deep bite was negatively correlated to LFH and LPDH. As LFH and LPDH decreased, the more overbite increased.

CONCLUSION: A deep bite in Class II division 1 malocclusion is mainly associated with a decreased LFH and decreased LPDH. Evaluation of influencing factors could provide useful data for orthodontic diagnosis and treatment planning.

SP 183 A STUDY TO INVESTIGATE THE AGE AT REFERRAL OF PATIENTS PRESENTING WITH IMPACTED MAXILLARY INCISORS OVER A FIVE AND A HALF YEAR PERIOD
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AIMS: To investigate: the age at referral of impacted maxillary incisors due to the presence of a supernumerary tooth or teeth; treatment received for different age groups; re-operation rate; and outcome of treatment in patients treated at the Royal Surrey County Hospital between July 2011 and June 2017.

MATERIALS AND METHOD: Data for patients diagnosed with at least one impacted maxillary incisor were retrieved from clinical notes collated using patient numbers from operating lists. Patients whose surgical procedure was between 01 July 2011 and 01 June 2017 were included.

RESULTS: A pilot sample of 17 cases showed nine subjects cases were referred by the age of 9 years. All cases had been assessed by an orthodontist. Fourteen patients were treated initially by extraction of supernumerary teeth alone. One case required a second procedure to be completed.

CONCLUSION: The pilot data currently available show that 53 per cent of patients presenting with impacted upper incisor(s) due to the presence of supernumerary teeth were referred by the age of 9 years. Forty seven per cent presented later than Royal College of Surgeons guidelines state. Eighty two per cent of cases were managed with removal of supernumerary teeth alone. Data collection is ongoing to retrieve records and complete data collection from 50 cases.

SP 184 UPPER AIRWAY DIMENSIONS AND HEAD POSTURE IN CHILDREN WITH HORIZONTAL MAXILLARY OVERJET
AIMS: To analyze the difference in head posture and in the antero-posterior dimension of the upper airway between children with skeletal horizontal maxillary overjet (HOB) and dentoalveolar HOB.

SUBJECTS AND METHOD: Two hundred and sixteen children with HOB were divided into two groups: 104 children with a skeletal HOB of more than 6 mm due to retrognathia of the mandible and/or prognathia of the maxilla (48 girls, 56 boys, mean age 10.5 years) and 112 children with dentoalveolar HOB more than 6 mm due to proclination/retroclination of the incisors and/or dentoalveolar protrusion/retrusion (53 girls, 59 boys, mean age 11.3 years). Head posture and upper airway dimensions were analyzed on lateral cephalograms. Differences between the groups adjusted for age and gender were tested by general linear model analysis.

RESULTS: When the result were tested for the effect of age and gender no significant differences in upper airway dimensions between the two groups were found, but there was a tendency towards a larger airway dimension at the level of radix lingualis in children with a skeletal HOB (rl-prl, P = 0.0986). The cranio-vertical angle (NSL-VER, P = 0.0386) was significantly larger in the skeletal group and the cervical lordosis (OPT-CVT, P = 0.062) tended to be larger in the children with a skeletal HOB, meaning that head posture was more extended and the upper cervical spine was more curved in children with a skeletal HOB compared to those with a dentoalveolar HOB.

CONCLUSION: There was a tendency towards a larger airway dimension at the level of radix lingualis in children with a skeletal HOB. This might be explained by the difference seen in the head and neck posture between the two groups, where the children with a skeletal overjet had a more extended and curved head and neck posture than children with a dentoalveolar overjet.

SP 185 FORCE-INDUCED INCREASED OSTEOGENESIS ENABLES ACCELERATED ORTHODONTIC TOOTH MOVEMENT IN OVARIECTOMIZED RATS

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AIMS: Whilst the number of elderly orthodontic patients is increasing, whether orthodontic tooth movement (OTM) causes subsequent alveolar bone loss and is harmful to alveolar bone health under osteoporotic conditions is still unclear. In this study, the aim was to clarify the influences of OTM on alveolar bone in osteoporotic rats.

MATERIALS AND METHOD: Ninety six 6-week-old non-pregnant female Sprague Dawley rats were utilized. Fifty four rats were randomly selected for bilateral ovariectomy (OVX) and the other 42 rats were subjected to a sham OVX. Three months after surgery, OTM was conducted. Histological examination was performed in the OVX and sham groups on days 0, 1, 3, 7, 15 and 21. Sequential fluorochrome labelling and histomorphometric analysis were used to analyze bone formation rate. The changes of microarchitecture in alveolar bone in the OVX rats on the 21st day of OTM and 3 months post-OTM were studied by microcomputed tomography.

RESULTS: OTM was accelerated in OVX rats as a result of increased bone resorption in the pressure area. At the same time, anabolic bone formation was promoted in the tension area during OTM in OVX rats. Microcomputed tomographic analysis of alveolar bone revealed a decrease in bone mineral density, trabecular bone volume and trabecular thickness in the OTM group compared with that in sham rats on day 21 of OTM, suggesting that OTM caused alveolar bone loss in OVX rats during OTM. However, the OTM-induced bone loss could be recovered 3 months after OTM in OVX rats.

CONCLUSION: The findings suggest that increased osteogenesis may compensate for the increased bone resorption during and after OTM and enable effective accelerated OTM in OVX rats.

SP 186 A NEW PROCEDURE FOR JOINT ORTHOGNATHIC-ORTHODONTIC TREATMENT IN PATIENTS WITH IDIOPATHIC CONDYLAR RESORPTION

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AIMS: To stabilize the relationship between condylar head and glenoid fossa, a conservative functional splint is used to lead into the treatment. The aim of this study was to evaluate the long-term stability of orthognathic surgery in patients with idiopathic condylar resorption (ICR) by repositioning the mandible in a stable position with functional splint therapy (FST).

SUBJECTS AND METHOD: This was a retrospective cohort study. It included 35 female ICR patients (18-23 years old). The patients were treated with conventional FST for 7.5 ± 1.5 months before orthognathic surgery. Long-term stability was evaluated with follow-ups varying from 6-36 months.

RESULTS: A stable occlusion was obtained. An aesthetic facial profile was achieved with no skeletal relapse. The patients had a normal amount of mouth opening with normal protrusive and lateral excursion.

CONCLUSION: FST helps restore temporomandibular joint function in patients with ICR by repositioning the mandible. Patients treated with FST before orthognathic surgery have a low relapse rate. FSR may be of value in patients with ICR treated orthognathically.

SP 187 READY-MADE VERSUS CUSTOM-MADE MANDIBULAR ADVANCEMENT APPLIANCES IN OBSTRUCTIVE SLEEP APNOEA: A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: Mandibular advancement appliances (MAA) are an increasingly accepted treatment choice in obstructive sleep apnoea (OSA) management. The ready-made MAA has questioned the need for a customised MAA, given the former is more accessible and considerably cheaper. A systematic review and meta-analysis was conducted to evaluate both objective and patient-centred outcomes in relation to ready-made and custom-made MAA.

MATERIALS AND METHOD: Biomedical electronic databases, clinical trials registers and grey literature were searched to January 2017, for randomised controlled trials. Meta-analysis of clinical trials was conducted for a range of objective [apnoea-hypopnoea index (AHI), treatment response] and subjective scales (daytime sleepiness; quality of life; patient preference and adherence).

RESULTS: The review included three randomised clinical trials which revealed a low risk of bias. Custom-made MAA achieved a significant mean difference in the AHI (Δ–3.2; 95%CI −5.18, −1.22; P = 0.004), daytime sleepiness (Δ−0.98; 95%CI −1.97, 0.01; P = 0.05), observed mean difference in functional outcomes of sleep questionnaire scores (Δ0.76; 95%CI 0.14, 1.38; P = 0.02), self-reported adherence (Δ6.4-7 nights per week and 5-6.3 hours per night) and expressed preference (P = < 0.001) when compared to the ready-made MAA.

CONCLUSION: Custom-made MAA offer clear definable advantages, demonstrating significant clinical effectiveness, patient preference and adherence to the custom-made MAA.

SP 188 AN AUDIT TO ASSESS ORTHODONTIC STAFF AWARENESS OF THE LOCATION AND USE OF MEDICAL EMERGENCY EQUIPMENT IN A UNIVERSITY TEACHING HOSPITAL
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AIMS: Professional bodies such as the General Dental Council and Resuscitation Council outline guidelines for dental professionals to ensure that patients are treated in a safe manner at all times. Highlighted in this, is awareness of medical emergency equipment and drugs within a dental department. The purpose of this audit was to assess if there was 100 per cent compliance by the orthodontic staff with the management of medical emergencies.

MATERIALS AND METHOD: A two cycle audit was performed with 14 members of the orthodontic staff; including consultant, specialists, training grade staff and nurses, at James Cook University hospital, Middlesbrough. The following questions were asked: 1) Where are the emergency drugs kept? 2) Where are the oxygen cylinder and masks kept? 3) Are you aware of the administration of emergency drugs for anaphylaxis in a teenager? 4) Where is the defibrillator kept? 5) Is your basic life support training up to date?

RESULTS: First versus second cycle results: 64.3 versus 100 per cent of staff knew the correct location of emergency drugs, 64.3 versus 92.9 per cent knew where the oxygen cylinder was kept. 78.6, 21.4 and 92.9 per cent versus 100, 64.3 and 92.9 per cent of all staff knew the correct drug, dosage and route of administration respectively for anaphylaxis management. Of the staff 64.3 versus 92.9 per cent knew where the defibrillator (AED) was and 85.7 versus 92.9 per cent were up-to-date with their basic life support training.
Recommendations after the first cycle included informing all staff of the location of medical emergency equipment via oral discussion, paper handouts and emails. Handouts of medical emergency drugs and management summaries were also given and staff were encouraged to book on to BLS training courses.

CONCLUSION: Improvements were made in all aspects in the second cycle of this audit. Although serious medical emergencies are rare within the orthodontic environment, they can happen at any time. All members of the orthodontic team should be aware of the management of medical emergencies.

SP 189 COMPARISON OF TWO ASSESSMENT METHODS OF SKELETAL MATURATION
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AIMS: To compare the cervical vertebral maturation (CVM) method and the maturation staging of the midpalatal suture on cone beam computed tomographs (CBCT).

SUBJECTS AND METHOD: Thirty two patients who were healthy, free of craniomaxillofacial discrepancies and who had not previously been treated orthopaedically. The developmental stage of the suture was shown by two methods, CBCT scans were used to show the state of the midpalatal suture based on the method described by Angelieri et al and the CVM method described by Baccetti et al. The patients were divided into two groups based on the state of the bony fusion of the suture (expansion recommended or not recommended) using CBCT or CVM, then the two methods were compared in each group.

RESULTS: The age of the patients in the ‘recommended expansion’ group using CBCT was between 9-16 years, and with the CVM method between 9-15 years. Bony fusion of the suture was first observed at the age of 11 years in CBCT group compared to the CVM group where expansion may not be recommended from 12 years of age. Clinical assessment of the results showed, that even though there was overlap between the two methods, in some cases the CVM method suggested that expansion of the maxilla may be recommended, but the CBCT showed fusion of the two halves of the maxilla. In other cases conventional expansion of the maxilla may be followed by unfavourable side effects based on the CVM method but the suture is still shown open on CBCT.

CONCLUSION: CBCT scans of the maxilla seem to be necessary in cases of rapid maxillary expansion after the age of 10-11 years.

SP 190 TWENTY YEAR LONG-TERM FOLLOW-UP OF BIONATOR-TREATED PATIENTS – A RETROSPECTIVE STUDY ON DENTAL CASTS
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AIMS: To retrospectively evaluate changes in tooth position, dental arches and occlusion after exclusive functional orthopaedic treatment of growing patients with a Class II malocclusion with the Bionator of Balters, modified by Ascher, and long-term stability within a follow-up observation period of 20 years.

MATERIALS AND METHOD: Dental casts were analysed at three stages: before treatment (T0), after treatment with the Bionator (T1) and 20 years after the end of treatment (T2). The following parameters were recorded: arch width, arch depth, arch perimeter, sagittal molar and canine relationship, overjet, overbite, mandibular incisor irregularity (Little’s irregularity index) and the Peer Assessment Rating (PAR) Index.

RESULTS: After treatment (T0-T1) upper arch perimeter showed a significant increase, lower arch perimeter only marginal higher values. Within T1-T2, a significant decrease of arch perimeter was conspicuous in both dental arches. Arch depth showed minor, non-significant changes in both time periods (T0-T1 and T1-T2). A significant increase in intermolar and interpremolar distances was observed during T0-T1, whereas during T1-T2 both distances remained fairly unchanged. Only the interpremolar distance in the lower arch decreased significantly. Lower intercanine distance remained mostly unchanged during T0-T1, but showed a significant decline during T1-T2. Lower incisor irregularity increased slightly during T0-T1, but significantly during T1-T2. After treatment (T0-T1), the median overjet was reduced, the sagittal relationship improved; those changes were significant and remained stable during the follow-up observation period of 20 years after treatment. During T0-T1 overbite decreased, however, relapse occurred in T1-T2 period. The PAR index was significantly lower during T0-T1 and remained stable in the long-term (T1-T2).
CONCLUSION: Twenty years after functional orthopaedic treatment with the Bionator the achieved improvement of overjet, sagittal relationship and reduction of the PAR index remained fairly stable. Long-term changes of arch perimeter in both dental arches, mandibular intercanine distance and mandibular incisor irregularity were most likely due to physiological ageing processes and not associated with Bionator treatment.

SP 191 PATIENTS’ PERCEPTIONS REGARDING ORTHODONTIC PAIN
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AIMS: Currently, temporary anchorage devices (TADs) are widely used for orthodontic anchorage. However, patients are apprehensive when they need to undergo TAD procedures, and little is known about the pain associated with TADs.

SUBJECTS AND METHOD: One hundred and twenty seven TADs were placed in the maxilla and mandible in 65 patients as anchorage for orthodontic treatment. The patients were asked to rate pain perception with various orthodontic procedures (separation, TADs placement, tooth extraction and initial tooth alignment) on a visual analogue scale (VAS) for the entire 7 day to 1 month period.

RESULTS: Patients’ perceptions of TAD placement resulted in a significantly lower level of pain compared with separation, tooth extraction and initial tooth alignment (P < 0.05). The perception of post-operative pain decreased continuously from day 1 to 1 month for all orthodontic procedures. TAD placement in the maxilla at day 1 was significantly greater than TAD placement in the mandible (P < 0.05). Most patients (67%) were satisfied with the TADs. However, 16 per cent of patients had discomfort with TAD placement on the buccal side and 17 per cent had discomfort on the palatal side.

CONCLUSION: Patients’ perceptions of TAD placement is a lower level of pain compared with separation, tooth extraction and initial tooth alignment. However, it is necessary to consider the implantation site and configuration of the screw head in order to reduce discomfort.

SP 192 THE LONG-TERM EFFICACY OF FACEMASK TREATMENT IN CLASS III MALOCCLUSION: A SYSTEMATIC REVIEW
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AIMS: To provide a comprehensive update of the literature on evaluating the long-term effects and stability of the treatment with a facemask appliance on patients with a Class III malocclusion.

MATERIALS AND METHOD: A systematic review of the literature was conducted using PubMed/Medline, Embase, Scopus and the Cochrane Central Register of Controlled Trials. Articles were selected on established inclusion/exclusion criteria. Study selection, data extraction and risk of bias assessment were performed individually and in duplicate by the first two authors.

RESULTS: The search strategy resulted in 222 articles. Nine studies were eligible for the final analysis. Among them were one randomised controlled trial (RCT) and eight controlled clinical trials, six retrospective and two of a prospective design. The risk of bias within included articles was assessed by ACROBAT-NRSI tool of Cochrane for non-randomized trials and on the basis of the Cochrane risk of bias tool for the RCTs. According to the reported evidence the long-term success rate of treatment with a facemask device ranged from 62.7 to 100 per cent. The long-term success was identified as a positive overjet as well as with acceptable aesthetic and functional characteristics.

CONCLUSION: This study constitutes so far the only review in the international literature, which focuses exclusively on the long-term efficacy of facemask appliance therapy. There is considerable agreement between studies that the effects of treatment with a facemask remain quite stable and any kind of relapse is attributed to uncontainable late growth of the mandible. Therefore, further investigation concentrating on effects after the completion of growth is needed.

SP 193 ORAL HEALTH RELATED QUALITY OF LIFE AMONG CHILDREN WITH AN EXCESSIVE OVERJET COMPARED TO CHILDREN WITH A UNILATERAL POSTERIOR CROSSBITE
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AIMS: To investigate oral health related quality of life (OHRQoL) among 9-year-old children in the mixed dentition and compare the OHRQoL of children with a unilateral posterior crossbite (UPC) to those with an excessive overjet (EO).

MATERIALS AND METHOD: The study sample was sourced from 18 Public Dental Service Clinics in Sweden. The baseline data originated from two different randomized controlled trials, one regarding UPC and the other focusing on EO. The UPC group comprised 93 children (45 boys, 48 girls) and the EO group 71 children (36 boys, 35 girls). In conjunction with a clinical examination, all the 9-year-old children completed the Children Perceptions Questionnaire (CPQ 8-10) for evaluation of the OHRQoL. The CPQ 8-10 comprise 25 questions grouped into four domains: oral symptoms, functional limitations, emotional well-being and social well-being. Validated questions about pain in the jaws and face were also included.

RESULTS: The total mean CPQ score was 5.1 for the UPC and 7.4 for the EO group, showing a significant difference (P = 0.01) which remained when adjusted for the confounders, caries, trauma, enamel defects and headache. The children with EO reported significantly higher scores in the domains oral symptoms (P = 0.02), emotional well-being (P = 0.02) and social well-being (P = 0.01) but not for the domain functional limitations.

CONCLUSION: Young children with EO reported significantly lower self-perceived OHRQoL compared to children with a UPC. However, the children generally reported low CPQ scores that imply an overall fairly good OHRQoL.

SP 194 THREE-DIMENSIONAL EVALUATION OF TRANSVERSE CHANGES THROUGH SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION WITH CONE BEAM COMPUTED TOMOGRAPHY***
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AIMS: Rapid maxillary expansion (RME) is used in orthodontics to correct maxillary transverse and arch length discrepancies. The aim of this study was to compare and evaluate dentoalveolar transverse changes using cone beam computed tomography (CBCT) before and after surgically assisted RME (SARME).

SUBJECTS AND METHOD: Twenty patient requiring maxillary expansion treated with a modified acrylic bonded RME appliance after the surgical procedure. On CBCT images taken before (T1) and immediately after (T2) expansion; intermolar distance, intercanine distance, molar teeth-palatal plane angle, canine teeth-palatal plane angle and intermolar angle were evaluated. Dependent and independent sample t-tests were used for statistical comparison.

RESULTS: At T2, intercanine and intermolar distances were increased significantly in both groups (P < 0.05) in comparison with T1 values. Due to significant tipping of the palatal roots of the maxillary right and left molars, an increased intermolar angle was observed (P < 0.05). Although canine teeth-palatal plane angles decreased were insignificant (P > 0.05) the molar teeth-palatal plane angles decreased significantly both on the right and left sides (P < 0.05).

CONCLUSION: The increase in root angulation indicates not only skeletal expansion, but also buccal crown tipping. To prevent tipping, different modified RME systems with increased skeletal anchorage may be preferred. There is a need to define standardized reference planes and comparable methodology to achieve compatible results among studies.

SP 195 CLINICAL AND RADIOLOGICAL CHARACTERISTICS IN ORTHODONTIC PATIENTS WITH A THIN GINGIVAL BIOTYPE AND MALOCCLUSION
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AIMS: To improve the quality of orthodontic treatment of patients with different periodontal biotypes by increasing the information content of diagnostic data while using clinical methods, ultrasonic scanning and cone-beam computed tomography (CBCT).
SUBJECTS AND METHOD: Sixty patients aged 19-25 years with malocclusions were divided into two groups: group A 30 subjects with a thin gingival biotype and group B, 30 subjects with a thick biotype. Clinically biotype was investigated using a colorimetric probe (Colourvue biotype probe, Hu-Friedy). The thickness of the gingiva was examined using the MyLabTwice ultrasonic device (Esaote). The condition of the alveolar bone of the jaws of all patients was assessed using CBCT.

RESULTS: According to the scanning in group A gingival thickness was $0.75 \pm 0.3 \text{ mm} (P < 0.005)$ and in group B $1.9 \pm 0.4 \text{ mm} (P < 0.005)$. CBCT in addition to the differences in bone thickness showed that 69 per cent of group A had dehiscence and 17 per cent fenestrations, in group B this was 20 and 3 per cent, respectively.

CONCLUSION: Clinical evaluation of gingival biotype using the colorimetric probe only allows determination of the approximate evaluation of the gingiva. This does not allow adequate planning of orthodontic teeth movement without the threat of further bone and soft tissue destruction. Ultrasonic evaluation of gingival thickness leads to the degree of planning of tooth movement and torque changing minimizing the risk of recessions. CBCT significantly increases information about the thickness of bone structures on all surfaces. Integrated application of these methods allows optimization of the choice of orthodontic intervention and the limits of moving teeth and buccal inclination, to improve the efficiency of orthodontic treatment in general and to prevent damage to the periodontal structures.

SP 196 SIZE AND MORPHOLOGY OF SELLA TURCICA IN CLEFT LIP AND PALATE PATIENTS
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AIMS: In cleft lip and palate (CLP) patients not only the cleft area but also peripheral structures are affected by the anomaly. Research has indicated relationship between maxillary development and pre- and post-natal formation of sella turcica. The aim of this study was to evaluate the morphology and dimensions of sella turcica in patients with a unilateral and bilateral CLP.

MATERIALS AND METHOD: Lateral cephalometric radiographs of CLP patients were evaluated retrospectively. Seventy three individuals (36 females, 37 males) were divided into two groups as follows: 6-13 years and over. To evaluate the dimension of sella turcica, three parameters were used; length, depth, antero-posterior diameter. Normal morphology, oblique anterior wall, double contour of the floor, sella turcica bridging, irregularity in the posterior part of dorsum sellae and pyramidal shape of dorsum sellae were used to examine the morphology of sella turcica. For statistical evaluation a Mann Whitney U test was used.

RESULTS: While the incidence of normal sella turcica morphology was 66.7 per cent in the non-cleft group, the rates were 15 per cent for the unilateral and 20 per cent for the bilateral cleft groups at 6-13 years of age, and 43.75 and 44.5 per cent in the unilateral and bilateral cleft groups, respectively, at 14 years of age and over. The size of sella turcica was smaller in the cleft groups. An age correlated increase in sella turcica dimensions was seen in both cleft and non-cleft groups.

CONCLUSION: The differences in morphology and dimensions of sella turcica in cleft patients decrease with age, but the alteration in sella turcica morphology affects the localization of sella point which causes inaccurate diagnosis and treatment planning. Because of sella turcica morphology variations in cleft patients, using new cephalometric norms created for cleft patients enables clinicians to make an accurate diagnosis and plan treatment.

SP 197 THE RESISTANCE TO AXIAL DISLODGEMENT OF NICKEL TITANIUM COMPRESSION ARCHWIRE HOOKS
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AIMS: To evaluate in vitro the amount of force which is required to axially displace Trillium Compression Hooks™ (Hespeler Orthodontics) installed on orthodontic archwires.

MATERIALS AND METHOD: The compression hooks, made entirely of nickel titanium (NiTi), were installed on the archwires using a special hook plier. The resistance to axial dislodgement of the hooks was tested on a total of 240 compression hooks which had been installed in a standardized way on round (0.016, 0.018 and 0.020), square (0.020 × 0.020) and rectangular (0.016 × 0.022 and 0.019 × 0.025) archwires made of stainless steel (SS), NiTi or ß-titanium. During the experiment 12 hook/wire combinations were tested. The forces required to displace the compression hooks axially were recorded in newton (N) using an Instron tensile testing machine.
RESULTS: The compression hooks’ resistance to axial dislodgement differed significantly ($P < 0.001$) between all hook/wire combinations tested in the SS, NiTi and $\beta$-titanium groups, respectively. The average forces required to displace the hooks varied between $59.2$ N (range $40.4-69.0$ N) and $142.3$ N (range $126.7-161.9$ N). The lowest average force for axial dislodgement was recorded in the $0.016$ NiTi group and the highest average force in the $0.016 \times 0.022$ $\beta$-titanium group. In the SS wire group the hooks installed on the $0.019 \times 0.025$ wires exhibited the greatest average resistance to dislodgement, $101.7$ N (range $76.1-125.4$ N). The lowest average resistance in the SS wire group was found in the $0.016$ wires, $60.7$ N (range $49.1-80.9$). The present data were compared with the results reported in similar studies carried out using crimpable archwire hooks.

CONCLUSION: The forces needed for axial dislodgement of the tested Trillium Compression Hooks™ considerably exceeded the force levels which have been previously reported for crimpable archwire hooks.

SP 198 RELATIONSHIP BETWEEN THE CRANIAL BASE AND NASOMAXILLARY COMPLEX IN MAXILLARY DEFICIENCY CHILDREN***

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AIMS: The effect of the morphology and flexion of the cranial base on the development of the nasomaxillary complex has been debatable. The purpose of this study was to examine the relationship between the cranial base and nasomaxillary complex in maxillary deficient children focusing on nasal septum (ethmoidal, vomer) morphology.

MATERIALS AND METHOD: Forty one pre-treatment lateral cephalograms and three-dimensional (3D) computed tomography (CT) images of Japanese 41 boys (mean age: $8.5 \pm 1.5$ years). The subjects were allocated to two groups on the basis of McNamara line to point A distance. A0 deficiency group (n = 21), 0 $\leq$ A 3.0 normal group (n = 20). Pearson correlation coefficient (r) was calculated between the cranial base and nasomaxillary complex in maxillary deficient and normal children. Measurement point on CT image; V: The distal upper point of vomer, EV: The lower contact point of between ethmoidal and vomer, Cf: The most distal point of cribiform foramina.

RESULTS: Concerning anteroposterior palatal length, no correlations were found in the normal group observed in the AO group. ANS-PNS versus N-ANS (r = 0.60), ANS-EV (r = 0.43), SN-ANS (r = 0.63), SN-EV (r = 0.40). Concerning the position of ANS, $\angle$S-N-ANS the AO group showed positive correlations with ANS-VE (r = 0.56), and negative correlations with $\angle$PNS-ANS-N (r = -0.79). On the contrary, $\angle$S-N-ANS in the normal group showed positive correlations with V-PNS (r = 0.44), ANS-EV (r = 0.47), SN-V (r = 0.47), SN-PNS (r = 0.60), and negative correlations with $\angle$SN-FH(r = -0.47), $\angle$SN-ANSPNS (r = -0.50). Concerning the position of vomer, $\angle$V-PNS-ANS in the AO group showed positive correlation with V-PNS (r = 0.74), $\angle$SN-ANSPNS (r = 0.51), and negative correlations with SN-PNS (r = -0.65), $\angle$PNS-ANS-N (r = -0.57), $\angle$SN-FH (r = -0.40). On the contrary, $\angle$V-PNS-ANS in the normal group showed a positive correlation with V-PNS (r = 0.84).

CONCLUSION: The morphological features of maxillary deficient children are vertical and antero-posterior growth of the vomer bone.

SP 199 INFLUENCE OF SOCIO-ECONOMIC STATUS AND ETHNICITY ON ORTHODONTIC TREATMENT EXPERIENCE OF ADOLESCENTS IN NORTHERN NORWAY

Anna Kasbekar, Anders Sjögren, Heidi Maria Kerosuo, Tannahelsetjenestens kompetansesenter for Nord-Norge, Tromsø, Norway

AIMS: To investigate orthodontic treatment experience and normative aesthetic treatment need in relation to socio-economic status and ethnic background among adolescents in Tromsø, Norway.

SUBJECTS AND METHOD: The sample in this cross-sectional study consisted of 961 first year high school students from Tromsø and Balsfjord (469 females, 492 males) aged 15 to 18 years, who were invited to participate in the 2010-2011 Fit Futures study. The data on parental education level and occupation rate, ethnic background and orthodontic treatment experience (OTE) were collected via questionnaires. Aesthetic treatment need was assessed on a set of three intra-oral photographs using the Aesthetic Component of the Index of Orthodontic Treatment Need. Treatment experience and aesthetic treatment need were analyzed in relation to gender, parental education level, occupation rate, and ethnic background using Chi-square and Fisher’s exact tests.
RESULTS: Parental education level had no significant effect on the adolescent’s treatment experience or normative aesthetic treatment need. Parental occupation rate and ethnicity had no significant effect on aesthetic treatment need. However, females from families with no parent working part or full time had significantly less OTE (3.7%) compared to females from families with one (25.2%, \(P < 0.01\)) or two (33.6%, \(P < 0.01\)) parents working. Although no significant differences in OTE were recorded for parental ethnic background, females who considered themselves as Norwegian had more OTE than females of other ethnicity (96.3% and 3.6% respectively, \(P < 0.01\)).

CONCLUSION: The results suggest that gender, parental occupation rate and ethnicity may have some influence on OTE among adolescents in northern Norway.

SP 200 WORKING PROPERTIES OF NICKEL-TITANIUM ARCHWIRES AFTER CORROSION IN ORAL ANTISEPTICS AND SALIVA
Visnja Katic\(^1\), Marijana Rincic Mlinaric\(^2\), Magda Trinajstic Zrinski\(^1\), Andrej Pavlic\(^1\), Stjepan Spalj\(^1\), 1University of Rijeka and 2University of Zagreb, Croatia

AIMS: To explore working properties of uncoated, rhodium- and nitride-coated nickel-titanium wires after corrosion in artificial saliva and various oral antiseptic solutions.

MATERIALS AND METHOD: Uncoated (uNiTi), rhodium- (RhNiTi) and nitride- (NNiTi) coated nickel-titanium wires were immersed in artificial saliva for 28 days and incubated at 37°C. Every week the wires were taken out of the artificial saliva and immersed in Gengigel, Curasept and Listerine for 5 minutes at 37°C. For the negative control, one set of wires was immersed in artificial saliva alone. For absolute control, one set of wires was tested in as-received condition. There were six specimens for every wire/experimental condition. Three-point-bending was performed on 2.5 cm long wire samples upon completion of immersion protocol. The load-deflection curves were used to obtain data on total energy (during loading), recovered energy (during unloading) and dissipated energy (difference between loading and unloading energy). One-way ANOVA with Student-Newman-Keuls post hoc test and Pearson’s correlations were used for analysis.

RESULTS: For the uNiTi wire there were no differences between the observed media during unloading. Curasept induced significantly higher total energy, when compared to both negative and absolute controls (\(P = 0.004\)). Dissipated energy was significantly higher after exposure to Curasept and Gengigel, as compared to the as-received and artificial saliva alone samples (\(P = 0.002\)). There was significant difference between media for total, recovered and dissipated energy for both RhNiTi wire (\(P \leq 0.004\)), and NNiTi wire (\(P \leq 0.002\)). The lowest level of recovered energy was for NNiTi after exposure to Listerine. Pearson’s correlation showed that the fluoride ion concentration in oral antiseptics was best predictor of energy levels in uNiTi and RhNiTi, in direct proportion to the increase in total, recovered and dissipated energy for the uNiTi (\(R = 0.653, P < 0.000\); \(R = 0.447, P = 0.013\); \(R = 0.523, P = 0.003\)), and for the RhNiTi (\(R = 0.783, P < 0.001\); \(R = 0.443, P = 0.014\); \(R = 0.539, P = 0.002\)). For NNiTi, the concentration of hydrofluoric acid is a better predictor than fluoride ions.

CONCLUSION: The recovered energy of NiTi archwires, which are used to move teeth, deteriorates only in NNiTi wire due to corrosion in Listerine.

SP 201 QUALITY OF LIFE RELATED TO SMILE AESTHETICS – CONSTRUCTION AND VALIDATION OF A NEW SHORT PSYCHOMETRIC INSTRUMENT
Stjepan Spalj\(^1\,^3\), Visnja Katic\(^1\,^3\), Vjera Perkovic\(^2\), Daniela Kovacevic Pavlicic\(^3\), Lajnert Vlata\(^3\), 1Department of Orthodontics, 3University of Rijeka and 2University of Zagreb, Croatia

AIMS: Orofacial aesthetics raises psychosocial issues. The purpose of this study was to create and validate new short instrument for patient reported outcome measures of psychosocial impacts of altered smile aesthetics.

SUBJECTS AND METHOD: A team of four experts; an orthodontist, two prosthodontists and psychologist, and a dental student attending the final semester generated items that could draw up specific hypothetical psychosocial dimensions (69 items initially, 39 in final analysis). The sample consisted of 261 Caucasian subjects attending local high schools and university (26% male) in the 14-28 year age range that self-administrated the designed questionnaire. Factorial analysis, Cronbach’s alpha, Pearson correlation, paired samples t-test and analysis of variance were used for analyses.
RESULTS: Three dimensions of psychosocial impacts of altered smile aesthetics were identified: dental self-consciousness, dental self-confidence and social contacts, which can best be fitted by 12 items, four items in each dimension. Internal consistency was good ($\alpha$ in range 0.85-0.89). The new instrument is able to detect some problems related to impaired smile aesthetics. The increase of the degree of self-perceived impairment of the aesthetic component of malocclusion leads to an increase in self-consciousness and a decrease in self-confidence ($P \leq 0.007$). Good stability was confirmed.

CONCLUSION: The new instrument, Smile Esthetics-Related Quality of Life, is short and has proven to be a good indicator of psychosocial dimensions related to perception of smile aesthetics. It might have practical validity when applied in aesthetic dental clinical procedures.

SP 202 A QUANTITATIVE GEOMETRIC MORPHOMETRIC METHOD FOR MANDIBULAR CONDYLE SHAPE DESCRIPTION
Niki Katsigialou, Demetrios Halazonetis, School of Dentistry, National and Kapodistrian University of Athens, Greece

AIMS: To present a method for quantitative and comprehensive description of condylar shape in three-dimensions.
MATERIALS AND METHOD: In order to ensure comprehensive description of the condylar shape, 187 sliding semi-landmarks were digitally located on the surface of the condylar process. Furthermore, three curves were traced, outlining the mandibular fovea’s borders. The curves, together with 21 sliding semi-landmarks on them, served as the foundation for the sliding of the surface semi-landmarks. Partial Procrustes superimposition was applied to obtain an average shape to serve as the reference. The surface semi-landmarks were then allowed to slide to a new position that minimized the bending energy between the reference and each specimen. Procrustes superimposition, using generalized Procrustes analysis, was performed and the Procrustes coordinates were fed to Principal Component Analysis to obtain the Principal Components (PCs) of the shape variation. The protocol was evaluated by applying to nine cone beam computed tomographs of non-pathological joints or joints with disc-displacement, with or without reduction, randomly selected from the records of a private clinic.
RESULTS: Inter- and intra-observer error assessment showed that the method was reproducible, with no systematic or random error corresponding to a small percentage of the total variance of the sample. The two first PCs described 68.1 per cent of the total shape variability (PC1 described 43.4% and PC2 24.7%). PC1 primarily described differences in height to width ratio (medio-lateral dimension between the poles). PC2 described angular and shearing shape differences between the anterior and posterior condylar surfaces.
CONCLUSION: In cases of non-pathological joints or joints with disc displacement, the above methodology can be successfully applied for quantitative and comprehensive description of the condylar shape. Potential improvement of the protocol will be assessed by inclusion of an additional curve on the narrowest periphery of the condylar neck.

SP 203 FUNCTIONAL STATE OF MAXILLOFACIAL AREA IN PATIENTS WITH CLASS II MALOCCLUSION CAUSED BY ABNORMALITIES OF THE JAW BONE
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AIMS: To determine the functional state of the muscles in patients with a skeletal Class II malocclusion, depending on the structure of the facial skull and the position of the upper incisors in the sagittal plane.
SUBJECTS AND METHOD: Sixty adults aged 18 to 40 years with a skeletal Class II malocclusion, before and after the combined treatment. The patients were divided into four groups depending on the structure of the facial skull and the position of the maxillary incisors: 1) horizontal type with protrusion of the maxillary incisors 2) horizontal type with retrusion of the incisors 3) vertical type with protrusion 4) vertical type with retrusion. Each group included 15 patients. The following groups of muscle were investigated: right and left masticatory muscles, temporal, suprathyroid, sternocleidomastoid muscle. This study was conducted during primary contact of teeth antagonists and compression. Each group of patients was compared with the norm.
RESULTS: At primary contact the biopotential of the temporal muscles in all four groups increased from 14 to 91 per cent and the sublingual muscle increased from 1 to 100 per cent, with the lowest figures in groups 1 and 2 and the large in group 4. The right masticatory muscle in group 1 decreased in terms of potential, the left muscle increased, the 2nd right increased, the left decreased, 3rd both increased, in group 4 both decreased. Sternocleidomastoid muscle in all groups decreased. General muscle biopotentials increased in all groups. When compressing the temporal muscle biopotentials significantly reduced compared with the norm from 2 to 54 per cent. The smallest of differences was observed in group 2, in the other groups there was a high degree of difference. The masticatory and sublingual muscles in all groups reduced. Sternocleidomastoid muscles were reduced in groups 1, 2 and 3 but increased in group 4. General muscle action potential in all groups showed a high degree of difference. Total muscle potential was reduced by more than hundred per cent.

CONCLUSION: it is necessary to take into account the functional condition of the maxillofacial area and apply an individual approach when treating patients depending on the type of structure of the facial skull.

SP 204 IMPACT OF MALOCCLUSION ON ORAL HEALTH-RELATED QUALITY OF LIFE OF 11-18-YEAR-OLD SCHOOLCHILDREN IN LITHUANIA
Aistė Kavaliauskienė, Antanas Šidlauskas, Clinic of Orthodontics, Lithuanian University of Health Sciences, Medical Academy, Faculty of Odontology, Kaunas, Lithuania

AIMS: To estimate the impact of malocclusion on the oral health-related quality of life (OHRQoL) of schoolchildren aged 11-18 years old in Lithuania.

SUBJECTS AND METHOD: The study followed a cross-sectional design and targeted adolescents aged 11 to 18 years. The sample was made up of students from 27 randomly selected government schools of general education using two stage random cluster (school, class) sampling. The Child Perceptions Questionnaire (CPQ) was assessed during a schoolchildren’s survey (N = 1510). The clinical variables were obtained from clinical examination (N = 996). The Index of Orthodontic Treatment Need - Dental Health Component (IOTN-DHC) was used to measure malocclusion. For data analysis multiple Poisson regression models estimating the rate ratios (RR) and their respective confidence intervals (95% CI) were used.

RESULTS: Among 996 clinically examined participants, 419 (42.1%) were boys. There were three age groups: 207 (20.8%) were aged 11-14 years, 467 (46.9%) were aged 15-16 years and 322 (32.3%) were aged 17-18 years. There was no significant difference in the orthodontic treatment need comparing boys and girls (34.3% versus 32.7%; P > 0.05), but the slightly increasing orthodontic treatment need was related to the age (28.5%, 33.2% and 35.7%, respectively by age groups; P = 0.092). The findings demonstrated that children with severe malocclusion experienced greater negative impact on the total CPQ scores compared to those with mild or no malocclusion. With regard to the health domains of the CPQ, in the adjusted analysis (for gender and family affluence) the significant effect of severe malocclusion on OHRQoL was confirmed in the 17-18 age group only in emotional and social domains [RR (95%CI) of 1.24 (1.15;1.33) and 1.08 (1.01;1.16), respectively]. There was no significant association in the CPQ domains with malocclusion in the younger schoolchildren.

CONCLUSION: The results suggest that malocclusion impacts the quality of life of young people in Lithuania. The higher impact occurs in the emotional and social well-being domains, but this impact has higher effect on schoolchildren aged 17-18 years than on their younger counterparts.

SP 205 RELATIONSHIP BETWEEN THE LOWEST OXYGEN SATURATION OF THE PERIPHERAL ARTERY AND CRANIOFACIAL SKELETON IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA
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AIMS: To evaluate the facial types and relationship between the lowest oxygen saturation of the peripheral artery (lowest SpO2) and craniofacial skeleton in males with obstructive sleep apnoea (OSA).

SUBJECTS AND METHOD: Twenty-two Japanese patients (mean ± standard deviation: 53.3 ± 13.0 years), who had been diagnosed with OSA at Juntendo University Sleep Laboratory (Bunkyo, Japan) and/or five private sleep clinics in Tokyo, Japan, were identified from hospital records. The patients were selected based on OSA
AIMS: Given the steady increase in the frequency of radiological damage, the aim of this study was to review if biochemical indicators could be used instead of radiographic indicators of skeletal maturation assessment that may lead to decrease radiological damage of orthodontic treatment.

MATERIALS AND METHOD: A computerized PubMed, Science Direct, Google Scholar and Research Gate search was carried out. The following keywords were: ‘skeletal maturation’ AND ‘skeletal maturation assessment’ AND ‘biologic maturation indicators’ AND ‘biochemical maturation indicators’. The search was limited to articles published within the last 5 years.

RESULTS: The review of the literature demonstrated that biochemical indicators such as ‘insulin growth factor-1’ (IGF-1), ‘alkaline phosphatase’ (ALP), ‘parathyroid hormone related peptide’ (PHRP), ‘Creatinine’ and ‘Cortisol’ which were found in serum, urine, saliva and gingival crevicular fluid have correlation with skeletal maturation stages. IGF-1 highly correlated with MP3 and cervical skeletal maturity from the pre-pubertal to the late pubertal stages. ALP highly correlated with cervical skeletal maturity pubertal stages when compared with pre- and post-pubertal stages. PHRP had a weak correlation with cervical skeletal maturity from the pre-pubertal to the late pubertal stages but not from the late pubertal to the post-pubertal stages. Creatinine had a weak correlation with skeletal maturity because it is significantly affected by weight and gender. Cortisol levels were increased just in the pubertal stage but did not correlate in the other stages with skeletal maturity.

CONCLUSION: Clinically, a skeletal maturation indicator is required to be reliable, simple, valid for both genders and parallel to the development of facial bones, however, there is no single indicator that meets all these criteria. Non-invasive biochemical indicators could be an alternative for the standard assessment of skeletal maturation in orthodontic clinical practice in the near future.

SP 206 SKELETAL MATURATION ASSESSMENT WITH BIOCHEMICAL INDICATORS: REVIEW OF THE LITERATURE

Cansu Kaya, Evren Öztaş, Department of Orthodontics, Istanbul University Faculty of Dentistry, Turkey

AIMS: Given the steady increase in the frequency of radiological damage, the aim of this study was to review if biochemical indicators could be used instead of radiographic indicators of skeletal maturation assessment that may lead to decrease radiological damage of orthodontic treatment.

MATERIALS AND METHOD: A computerized PubMed, Science Direct, Google Scholar and Research Gate search was carried out. The following keywords were: ‘skeletal maturation’ AND ‘skeletal maturation assessment’ AND ‘biologic maturation indicators’ AND ‘biochemical maturation indicators’. The search was limited to articles published within the last 5 years.

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SP 207 CHANGES IN THE BIOMECHANICAL PROPERTIES OF THE PERIODONTAL LIGAMENT AFTER ORTHODONTIC TREATMENT – A NUMERICAL ANALYSIS

Ludger Keilig1, Ranja Al-Malat1, Johanna Skupin1, Anna Konermann2, Christoph Bourauel1, Departments of 1Oral Technology and 2Orthodontics, University of Bonn, Germany

AIMS: Clinical experience shows that the tooth mobility after orthodontic treatment is increased, and it decreases again during the retention phase over a period of several weeks. The aim of this numerical study was to interlink these observations based on clinical data with the change of the biomechanical properties of the periodontal ligament (PDL).

MATERIALS AND METHOD: A series of patient-individual three-dimensional finite element (FE) models of the right upper central incisor was created using the radiographic images of 21 patients from a previous clinical study which determined the change of the force/deflection behaviour of orthodontically moved teeth in vivo (Ethics Committee of the University of Bonn approval 181/13). In that study the crowns of the incisors were
moved 0.2 mm in a buccal-lingual direction while simultaneously measuring the required force. The loading velocity varied between 0.02 and 1.00 mm/second. Measurements were performed at six different times, starting immediately after debonding (T1) up to 6 months later (T6). In the current study, time-dependent FE simulations were performed for each patient and each velocity to determine force/deflection curves, which were then compared with the clinically measured curves. By varying the material parameters in the bilinear material model describing the PDL material behaviour, individual parameter sets were determined for each patient and each measurement time/velocity.

RESULTS: Using the optimised material parameters, the numerical simulations were successfully fitted to the curves measured *in vivo*. The determined mean values of the biinear Young's moduli E1 and E2 showed a significant increase between the values for T1 (e.g. E1 = 0.37 MPa at 1.00 mm/s) to T2 (E1 = 0.53 MPa). The stiffness increased with increasing loading velocity (E2 = 4.0 MPa at 0.02 mm/s versus 5.0 MPa at 1.00 mm/s). For some patients, the determined values reached reference values of untreated patients after only two to four weeks.

CONCLUSION: The material behaviour of the PDL in the retention phase after orthodontic treatment was reproduced successfully. The material behaviour of the PDL was restored to pre-treatment values after two to four weeks.

SP 208 DOES THE USE OF A NOVEL CONE BEAM COMPUTED TOMOGRAPHY ROOT RESORPTION PICTOGRAM AFFECT ORTHODONTIC TREATMENT PLANNING?

Anna Kelly¹, Zynab Jawad¹, Fiona Carmichael², Nadine Houghton¹, Claire Bates¹, Departments of ¹Orthodontics and ²Oral and Maxillofacial Radiology, Leeds Dental Institute, U.K.

AIMS: To determine whether use of a novel root resorption pictogram in cone beam computed tomography (CBCT) reporting was associated with a difference in the extraction decisions made by orthodontists in cases of lateral incisor root resorption caused by impacted maxillary canines and to assess orthodontists’ opinions about the root resorption pictogram.

MATERIALS AND METHOD: A team of orthodontists and oral and maxillofacial radiologists developed a root resorption pictogram to show the position and severity of incisor root resorption caused by impacted canines. The pictogram was named the ‘Three Dimensional Leeds Orthodontic Root Resorption Target Scale’ (3D-LORTS) and was designed for use as a radiographic reporting tool for CBCT images. Members of the British Orthodontic Society were invited to complete an online survey. Participants selected their preferred extraction pattern for a series of six impacted canine cases with associated lateral incisor root resorption. Each case was presented twice, first without the 3D-LORTS and subsequently with the pictogram. Cases were randomised appropriately. Primary outcome measures were the distributions of extraction decisions with and without the 3D-LORTS. Stewart-Maxwell tests and Bonferroni corrections were conducted to test for differences between decisions made with and without the pictogram. Kruskal-Wallis tests and Kendall’s Tau-B correlation coefficients were used to assess whether participant professional background variables affected the likelihood of decision changes. Participants were also asked about their experience of using the 3D-LORTS.

RESULTS: The study sample comprised 258 individuals, 194 of whom completed the entire survey. Statistically significant differences were found between extraction decisions made with and without the 3D-LORTS for three of the six individual cases, and for the six cases overall (P < 0.05). None of the participant professional background variables significantly affected the number of decision changes. The majority of participants had a positive perception of the 3D-LORTS, particularly with respect to: ease of use; impact on understanding of root resorption severity and location; and usefulness as a communication aid.

CONCLUSION: Inclusion of the 3D-LORTS in CBCT reports was associated with an overall change in orthodontists’ extraction decisions. The null hypothesis was rejected. The majority of orthodontists expressed positive opinions about the 3D-LORTS.

SP 209 ASSESSMENT OF COMPLIANCE WITH THE ORTHOGNATHIC MINIMUM DATASET IN CLEFT ORTHOGNATHIC SURGERY

Zohaib Khan, Simon Van Eeden, Madhavi Seshu, Susana Dominguez-Gonzalez, Alder Hey Children’s Hospital, Liverpool, U.K.
AIMS: The British Orthodontic Society and British Association of Oral and Maxillofacial Surgeons (BOS/BAOMS) have set guidelines on the minimum dataset of records to be taken at different stages of the orthognathic patient pathway, to enable standardisation of record as well as allowing for future audit, research and for medico-legal reasons. It is imperative that these records are up to date and available during joint cleft orthognathic multidisciplinary clinics, in order to plan the patient’s treatment and have a record for future reference. The aim of this audit was to assess whether the appropriate records are taken at the correct stages for orthognathic patients seen in the cleft orthognathic clinic, according to the BOS/BAOMS dataset.

MATERIALS AND METHOD: Patients were identified from the cleft orthognathic database and a review of clinical notes, photographs, radiographs and study models was carried out for cleft patients who had orthognathic surgery between June 2008 and December 2016 (n = 42). The inclusion criteria was cleft patients who had surgery and orthodontic treatment completed between the time frame selected. Patients who had distraction osteogenesis were excluded from this audit.

RESULTS: Compliance at pre-treatment stage was excellent, with 100 per cent of participants having a full set of records available. Record compliance varied at debond, which at 2 years post-debond was poor. This was due to the overall poor attendance for the joint cleft orthognathic clinics at the 2 year post-debond appointment.

CONCLUSION: Whilst compliance pre-operatively and at time of debond was good, a number of patients did not have photographs available at either of these times. These patients had orthodontic treatment at peripheral (spoke) units. Compliance at 2 years post-debond was poor, mainly due to failure to attend review appointments. The findings have helped to identify the patients as well as the issues in record collection. This has been discussed with the clinicians involved in the care of cleft patients and a protocol has been agreed to improve the record compliance.

SP 210 CLINICAL OUTCOME AUDIT OF COMBINED ORTHOGNATHIC TREATMENT
Zohaib Khan, Gavin Barry, Madhavi Seshu, Orthodontics & Oral Maxillofacial Surgery, Arrowe Park Hospital, Wirral, U.K.

AIMS: The primary aims of this audit were to ascertain the Peer Assessment Rating (PAR) outcomes for patients who had completed combined orthodontic and orthognathic surgery since 2014, and to identify any difference in outcomes between different clinicians by comparing the average PAR score reduction. Secondary aims included assessing the malocclusion traits of patients who had undergone combined orthodontic treatment and orthognathic surgery, as well as assessing patient demographics.

MATERIALS AND METHOD: A retrospective audit carried out between 01/01/14 and 31/12/16 at Arrowe Park Hospital, Wirral. Patients who had completed combined treatment were identified using the database from the Department of Maxillofacial surgery and Orthodontics. Study models of these cases were retrieved from the department storage facilities. A PAR calibrated examiner who did not provide the orthodontic treatment and orthognathic surgery was selected to score the models. All cases selected must have complete records and have undergone combined orthognathic treatment. This retrospective audit would include maxillary, mandibular and bimaxillary procedures.

RESULTS: A total of 35 patients were included in this audit. Ninety seven per cent of patients had ‘Greatly improved’ PAR scores following combined treatment, hence the gold standard was achieved. Average PAR score reduction was 43. The average percentage PAR reduction was 90.

CONCLUSION: This audit demonstrates positive PAR outcomes following combined orthognathic treatment and demonstrates the high standard of service provided at this unit. The PAR index is a validated measure, and is systematic and quick to use.

SP 211 ABSTRACT WITHDRAWN

SP 212 APPLICABILITY AND ADAPTATION OF THE DEMIRJIAN DENTAL AGE ESTIMATION METHOD ON NORTH GERMAN CHILDREN
Nadijda Khdairi¹, Talal Halilah¹, Mohannad Khandakji², Paul-Georg Jost-Brinkmann¹, Theodosia Bartzela¹, ¹Center for Dental and Craniofacial Sciences Department of Orthodontics, Dentofacial Orthopedics and Pedodontics, Charité - Universitätsmedizin, Berlin, Germany and ²Dr Nahed Dental Clinic, Doha, Qatar
AIMS: To test the accuracy of Demirjian’s method for dental age (DA) estimation on a large sample of north German children. In addition, to adapt the method used in case of inaccuracy in the sample and to enable a percentile position assessment of the dental maturity of an individual basis of this sample.

MATERIALS AND METHOD: Dental pantograms (DPTs) of 1145 north German children (504 males, 641 females) aged 5-17 years were used. The DPTs were divided into two samples; the first consisted of 945 DPTs (416 males, 529 females) and the second sample 200 DPTs (88 males, 112 females). Demirjian’s dental maturity scale for the seven left mandibular teeth was applied on the first sample to estimate DA which was compared to the chronological age (CA) of the children. For adaptation of Demirjian’s method, new weighted maturity scores were created with the use of a linear regression formula. Polynomial percentile curves of total dental maturity in comparison to the CA were presented. Adapted total maturity scores were extracted from the polynomial percentile curves. The second sample was used to evaluate the adapted method and to compare it to the original method of Demirjian. The significance of the difference between CA and DA was statistically analyzed for each age cohort and gender separately by the Wilcoxon signed rank test.

RESULTS: Demirjian’s method overestimated the mean CA of boys by 0.35 ± 0.93 years and of girls by 0.44 ± 0.87 years. The adapted total maturity score percentiles underestimated the mean CA of boys by −0.02 ± 0.89 and of girls by 0.13 ± 0.88. The new adapted weighted scores underestimated the CA of boys by 0.01 ± 0.83 and of girls by 0.01 ± 0.90.

CONCLUSION: Demirjian’s method when applied to north German children overestimated most age cohorts for both genders. The adapted weighted scores and the percentiles showed a significant improvement in age estimation of the sample and were more suitable for CA estimation of north German children when compared to the original Demirjian method.

SP 213 THREE-DIMENSIONAL EVALUATION OF ALVEOLAR BONE MORPHOLOGY IN THE REGION OF CONGENITALLY MISSING MANDIBULAR LATERAL INCISORS
Sujin Kim, Sooin Jung, Woowon Jang, Soonsin Hwang, Kyung-Ho Kim, Department of Orthodontics, College of Dentistry, Yonsei University / Gangnam Severance Dental Hospital, Seoul, Korea, South

AIMS: To analyze the changes in the morphology and thickness of the anterior alveolar bone in cases with a missing mandibular lateral incisor.

SUBJECTS AND METHOD: Eight male and 15 female patients with missing mandibular lateral incisor on one side. A control group of patients who had no missing or crowding symptoms was selected. The ratio between the total arch perimeter and the anterior arch perimeter was obtained. The distances between the roots of the anterior teeth were measured on the cementoenamel junction (CEJ) plane and the axial plane at 9 mm lower than the CEJ and the values were compared. The thickness and density of the alveolar bone in the missing areas and in the opposite lateral incisor areas were measured and compared. Furthermore, the thicknesses of the total alveolar bone, buccal and lingual cortical bones at points 3, 6, 9 and 12 mm lower than the CEJ were measured.

RESULTS: The arch perimeter of the anterior mandibular bone decreased at the CEJ and at the point 9 mm lower than the CEJ in patients with a missing mandibular lateral incisor compared to the control group. Root divergences were observed near the missing incisor area. The thicknesses of the total alveolar bone and cancellous, buccal bones decreased at the points 3, 6 and 9 mm lower than the CEJ in the missing mandibular lateral incisor area but not at the point 12 mm lower than the CEJ. The thickness of the lingual cortical bone did not significantly decrease at any of the measuring points.

CONCLUSION: The anterior arch perimeter and the thicknesses of the buccal cortical bone and cancellous bone decreased in the cases of missing of mandibular lateral incisors. These findings can be incorporated in future treatments.

SP 214 ROLE OF HEAT SHOCK TRANSCRIPTION FACTOR 1 IN PERIODONTAL LIGAMENT TISSUE
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AIMS: To examine the expression of heat shock transcription factor 1 (HSF1) in mouse periodontal ligament (PDL) tissues and investigate whether HSF1 is up- or downregulated in patients with periodontitis, and in human periodontal ligament cells (hPDLCs) stimulated with nicotine and lipopolysaccharide (LPS).

MATERIALS AND METHOD: To determine the temporal and spatial pattern of the expression of HSF1 during tooth/root development by immunohistochemistry, mouse first mandibular molars were examined at the following developmental periods: pre-root formation stage (postnatal day 7, PN7), root formation, and PDL alignment stage (PN14), and tooth eruption stage (PN28). The expression and differentiation of HSF1 in hPDLCs were assessed using reverse transcription-polymerase chain reaction, alkaline phosphatase (ALP) activity, alizarin red staining, and Western blotting.

RESULTS: During PN7, high levels of HSF1 protein were localized in the dental follicle cells, ameloblasts, and osteoblasts while during PN14 and PN28, HSF1 immunoreactivity was observed in osteoblasts, cementoblasts, and PDLCs. The number and distribution pattern of HSF1-expressing cells did not change during the developmental stages. HSF1 was expressed in PDLCs, cementoblasts, and osteoblasts in periodontal tissue in vivo as well as in PDLCs stimulated with nicotine and LPS in vitro. Inhibition of HSF1 inhibited osteoclastic differentiation and recovered osteoblastic differentiation via Smad1/5/8, toll-like receptor, Akt, mitogen-activated protein kinases, and nuclear factor-κB pathways in PDLCs stimulated with nicotine and LPS.

CONCLUSION: The present study suggests that HSF1 may be a pivotal molecular target for periodontal regeneration and orthodontic tooth movement through regulating osteoclast or osteoblast differentiation.

SP 215 PERIODONTAL CONSEQUENCES OF MANDIBULAR INCISOR PROCLINATION DURING PRE-SURGICAL ORTHODONTIC TREATMENT IN CLASS III MALOCCLUSION PATIENTS

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AIMS: To test the hypothesis that periodontal changes are similar between proclined and minimal-changed mandibular incisor position groups during pre-surgical orthodontic treatment for Class III orthognathic surgery.

SUBJECTS AND METHOD: The following measurements were performed before and after pre-surgical orthodontic treatment of 75 patients (proclination group, 39 subjects; minimal-change group, 36 subjects): clinical crown length, sulcus and bone probing depths, and width of attached gingiva from clinical examination, infradentale-to-MP (perpendicular distance of infradentale to mandibular plane) from examination of lateral cephalograms, and the distance between the cementoenamel junction and alveolar crest from examination of periapical radiographs. Data were compared between the two groups, and a regression analysis was performed to investigate factors affecting the periodontal changes.

RESULTS: In both groups, clinical crown length and bone probing depth increased during pre-surgical orthodontics (P < 0.05). Infradentale-to-MP and the width of attached gingiva decreased more in the proclination group than in the minimal-change group (P < 0.05). Proclination and protrusion of the mandibular incisors, and treatment duration affected the periodontal changes.

CONCLUSION: The null hypothesis was rejected. Proclination of the mandibular incisors for decompenasion in Class III surgery patients seems to result in labial alveolar bone recession and a decrease in width of attached gingiva. However, the amount of the periodontal recession appeared to be clinically insignificant.

SP 216 VALID GENE EXPRESSION NORMALIZATION BY QUANTITATIVE REVERSE TRANSCRIPTION POLYMERASE CHAIN REACTION IN STUDIES ON HUMAN PERIODONTAL LIGAMENT FIBROBLASTS WITH FOCUS ON ORTHODONTIC TOOTH MOVEMENT AND PERIODONTITIS

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AIMS: Valid quantitative reverse transcription polymerase chain reaction (RT-qPCR) relative gene expression analyses require appropriate reference genes for normalization and compliance with reasonable RT-qPCR quality standards (e.g., MIQE). Human periodontal ligament fibroblasts (hPDL) play an important mediating role in orthodontic tooth movement and periodontitis. Although in vitro gene expression studies on these cells have been a focus of interest for many years, there is currently no information on suitable reference genes or RT-
qPCR quality control. The aim of this study was therefore to identify suitable reference genes for the normalization of gene expression in untreated hPDL fibroblasts as well as in experiments on simulated orthodontic tooth movement or periodontitis \textit{(Aggregatibacter actinomycetemcomitans (Agac))}.

MATERIALS AND METHOD: Pooled hPDL fibroblast lines (4 patients, 16-23 years, 6th passage) were incubated for 48 hours under physiological conditions, either untreated, stimulated for 24 hours by compressive orthodontic forces of 2 g/cm² or 48 hours by Agac bacterial lysate. RNA extraction, cDNA synthesis and RT-qPCR were performed according to the MIQE guidelines. The suitability of 13 candidate reference genes were examined using four different algorithms (geNorm, NormFinder, comparative ΔCq and BestKeeper) and ranked according to their expression stability.

RESULTS: PPIB, TBP, and RPL22 were identified as the most stable and appropriate reference genes for normalizing gene expression in RT-qPCR studies on hPDL for orthodontic tooth movement (PPIB/RPL22) and periodontitis (Agac, PPIB/TBP). However, significant differences in gene stability were observed between the experimental groups and individual algorithms. Two reference genes in combination proved to be sufficient for normalization in all experimental conditions.

CONCLUSION: This study presents a standardized and valid method for quantitative gene expression analysis in hPDL fibroblasts according to the MIQE guidelines and shows that reference gene stability depends on the experimental set-up. Many traditional and commonly used reference genes such as RNA18S5, POLR2A or GAPDH have shown limited suitability and should therefore be avoided in future experiments on hPDL fibroblasts.

This work was supported by the German Orthodontic Society (DGKFO) (Kirschneck 12-01-2015).

SP 217 IMPROVED ERUPTION PATH AND TREATMENT TIME PROGNOSIS IN ALIGNMENT OF IMPACTED MAXILLARY CANINES USING CONE BEAM COMPUTED TOMOGRAPHIC IMAGING
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AIMS: Orthodontic alignment of impacted upper canines is desirable for functional and aesthetic reasons, but time-consuming and difficult. Estimated treatment time is thus an important factor in treatment planning. Treatment time predictability of hitherto available methods based on two-dimensional radiological measurements, however, is quite limited (maximum 39.1-42%). Thus new prediction methods were developed based on a more precise quantification of the actual three-dimensional eruption path length in baseline cone-beam computed tomographic (CBCT) diagnostic data.

MATERIALS AND METHOD: Baseline CBCT data and treatment times of 30 adolescent non-syndromic/cleft orthodontic patients with a unilaterally palatally impacted upper canine, which was aligned by fixed orthodontic non-extraction traction treatment (closed eruption), were retrospectively analysed. Eruption path length was quantified by a trigonometric-exact and simplified optical-visual method, correlated with time to canine alignment and a prediction equation derived by linear regression.

RESULTS: Trigonometrically/optically visually determined CBCT eruption path length and time to canine alignment did not show significant gender, age or impaction side differences, but a distinct correlation \((r = 0.856 /0.844, P < 0.001)\) with a high concordance of both methods (Lin’s CCC = 0.9438). Linear regression yielded a predictability \((r^2 \times 100\%)\) of time to canine alignment from eruption path length of 73.3 and 71.3 per cent, respectively.

CONCLUSION: Treatment time prediction for alignment of impacted upper canines can be achieved at an improved certainty of up to 73.3 per cent by the proposed CBCT methods for quantifying eruption path length. Due to absence of gender, age and impaction side differences, the derived regression formula should be universally usable in non-syndromic/cleft adolescents with palatally impacted upper canines.

SP 218 UNILATERAL CONDYLAR HYPERPLASIA: FACIAL ASYMMETRY AND OCCLUSAL RELATIONSHIP AFTER HIGH CONDYLECTOMY
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AIMS: Unilateral condylar hyperplasia is a rare disorder due to pathological overgrowth of the mandibular condyle. Delayed diagnosis can lead to significant facial asymmetries and malocclusions. The aim of the present study was to analyze changes in facial asymmetry and sagittal occlusal relationships in patients who underwent high condylectomy on the affected side.

MATERIALS AND METHOD: Between 2003 and 2016, 10 patients (17.4 ± 4.7 years) with unilateral condylar hyperplasia (diagnosed by SPECT) underwent high condylectomy on the affected side. Facial asymmetry on pre- and post-surgical en face photographs were analyzed using the asymmetry index by Nakamura. Plaster casts before and after surgery (mean time 8.5 months after condylectomy) were used to assess the sagittal occlusal relationship, overjet, overbite and midline deviation. Statistical analysis was performed with the post-hoc t-test.

RESULTS: Analysis of the en face photographs showed a significant ($P = 0.016$) improvement of the mean asymmetry index from 0.55 ± 0.25 to 0.30 ± 0.17 Analysis of the plaster casts could be performed for 8 of 10 patients. After high condylectomy, five of the eight patients had a more distal occlusal relationship on the affected side (¼-1 canine widths). In two patients, the molar relationship remained unchanged, whereas one patient showed a slightly more mesial relationship. The overjet remained stable (difference of 0.1 ± 0.2 mm), whereas overbite (1.1 ± 1.0 mm) and midline deviation (0.5 ± 0.5 mm) showed a slight decrease. Until now, four out of 10 patients have undergone a second comprehensive orthognathic surgery and two more are scheduled.

CONCLUSION: During the first year after high condylectomy, facial asymmetry improves statistically significantly. The sagittal occlusal relationship becomes, in most cases, more distal. Nevertheless, a clinically relevant degree of asymmetry prevails in the majority of patients, requiring further orthognathic intervention.

SP 219 PREVALENCE OF ERUPTION DISORDERS IN AN ORTHODONTIC UNIVERSITY DEPARTMENT BETWEEN 1986 AND 2016 WITH FOCUS ON AFFECTED MOLARS

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AIMS: To analyze tooth eruption disorders during the last 31 years with respect to prevalence, affected teeth and possible etiologic factors.

MATERIALS AND METHOD: Panoramic radiographs of all patients planned for orthodontic treatment at the Department of Orthodontics, Justus-Liebig-University Giessen, Germany between 1986 and 2016 were assessed. Permanent teeth excluding third molars, which had neither penetrated the gingival mucosa completely nor reached the occlusal plane despite completed root length development were characterized as eruption disorder. The following data were recorded: (1) number and (2) type of affected teeth, (3) age of the patients at the time of diagnosis. For all patients with affected molars, the radiologic criteria by Pilz et al. (2014) were used to differentiate a primary failure of eruption (PFE). Furthermore, possible local reasons such as undermining resorption of primary teeth or a marked space deficiency for third molars were assessed.

RESULTS: Three hundred and sixty four (4.8%) out of 7542 patients showed eruption disorders of one or more teeth. Upper canines (37.4%) were the most affected teeth, followed by upper central incisors (8.2%). Overall, the prevalence of impactions decreased over time. Molars were affected in 0.5 per cent (n = 37) of all patients and showed a marked increase of eruption disorders since 2011. Out of these patients, two (5.4%) had a PFE-phenotype, whereas five additional patients (13.5%) fulfilled only 5 out of 6 radiologically criteria for PFE. Undermining resorption of primary teeth was seen in nine patients (24.3%), while a marked space deficiency for third molars was noticed in seven subjects (18.9%). In 14 patients, no obvious local factors for the molar eruption disorder were detectable.

CONCLUSION: The prevalence of eruption disorders in orthodontic patients has decreased within the last 31 years. In contrast, impactions of molars were more often seen since 2011. The reason for the latter increase remains unclear, although 43.2 per cent of molars showed possibly local factors.

SP 220 THE ASSOCIATION BETWEEN RISK FACTORS AND TEMPOROMANDIBULAR DISORDERS IN THE NORTHERN FINLAND BIRTH COHORT 1966

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AIMS: To examine possible associations between temporomandibular disorders (TMD) risk factors and TMD signs and symptoms in subjects from the Northern Finland birth cohort 1966 (NFBC, 1966).

SUBJECTS AND METHOD: NFBC 1966 is a longitudinal epidemiological research programme consisting of 12 058 subjects born in 1966 in Oulu and Lapland. A total of 1962 subjects, of which 1050 were women and 912 were men, attended an NFBC 1966 follow-up examination. This consisted of three questionnaires and clinical examinations. The questionnaires were completed before the clinical examination and included questions on background information, oral and general health, well-being, socio-economic status and environmental factors. The subjects were 46 years old at the time of the study. Quantitative analysis was performed using cross tabulations and logistical regression models. Chi-square and Fishers’ exact tests were used when analyzing differences between groups. Statistical significance was determined at $P < 0.05$.

RESULTS: Statistical associations were seen between TMD signs and symptoms and females as well as subjective health and bruxism. Statistical associations were also seen between some issues in general health (i.e. depression, migraine, fibromyalgia, gastrointestinal diseases, asthma, rheumatic diseases, osteoarthritis and temporomandibular joint-osteoarthritis) and one or several pain related TMD signs and symptoms.

CONCLUSION: Female gender, poor subjective health, bruxism and several general health issues have a significant association with TMD signs and symptoms. It is important to take these risk factors into consideration when diagnosing and treating patients with TMD.

SP 221 ANALYSIS OF FACTORS AFFECTING ORTHOGNATHIC TREATMENT DURATION
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AIMS: To determine the treatment duration for patients undergoing orthognathic treatment at the Eastman Dental Hospital and UCLH NHS Foundation Trust and compare this against a set gold standard (90% of patients completing treatment within 36 months). A further aim was to investigate those factors which have a significant impact on treatment duration.

MATERIALS AND METHOD: This audit was conducted with records of all patients who underwent routine orthognathic surgery between 1st January 2010 and 31st December 2015, who started and completed all of their treatment at the hospital and where full records were available. Patients with complex craniofacial conditions were excluded. Univariable and multivariable statistical analyses were undertaken to identify the impact of malocclusion-related, treatment-related and patient compliance-related factors on overall treatment duration.

RESULTS: Full data was available for 150 of the patients who underwent surgery during this period. The median overall treatment duration was 35.6 months, with the pre- and post-surgical phases taking 26.8 and 7.1 months respectively. Despite this, only 51 per cent of the patients completed treatment within 36 months, thus the gold standard was not met. A number of factors were statistically significant and the final multivariable equation explained 55.5 per cent of the variation in treatment duration. Factors significantly associated with increased treatment time included whether extractions were undertaken ($P = 0.005$), transfer of care between clinicians ($P = 0.003$) and appointment-related factors including gaps in treatment exceeding 3 months ($P = 0.026$), missed appointments ($P = 0.023$) and appointments with loss/breakages ($P = 0.001$). There was a borderline association with bimaxillary surgery at $P = 0.058$. In contrast, a history of previous orthodontic treatment ($P = 0.020$) and senior clinician grades ($P = 0.005$) were related to a reduction in treatment duration.

CONCLUSION: The 36 month estimate relayed to patients is relatively accurate when the median treatment duration is considered. However, the gold standard was not met. The majority of those patients who did not meet the gold standard had compliance and attendance issues. Such patients should therefore be identified much earlier in treatment and treatment objectives re-evaluated or treatment stopped. The use of alerts in the patient’s notes is currently being considered to identify missed appointments and allow decisions to be made as soon as a concern is noted.

SP 222 INVESTIGATION OF NON-INVASIVE ADENOID DIAGNOSTIC METHODS USING ACOUSTIC ANALYSIS***
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AIMS: Chronic mouth breathing caused by pharyngeal tonsil hypertrophy (adenoid) affects growth of dental arch and maxillofacial skeleton. Therefore, early detection and treatment of adenoids are important to prevent malocclusion. Conventionally, radiographic imaging such as cephalograms and computed tomography (CT) is used to diagnose adenoids. However, these cause radiation exposure. The aim of this study was to investigate the utility of acoustic analysis as a non-invasive adenoid diagnostic method.

SUBJECTS AND METHOD: The adenoid group consisted of seven children diagnosed with adenoids (3 males, 4 females, mean age: 8.3 ± 1.2 years). The control group comprised eight children without pharyngeal tonsil hypertrophy (4 males, 4 females, mean age: 8.9 ± 1.4 years). It was confirmed that all subjects had no nasal obstruction by measuring nasal resistance with rhinomanometry. Patients with craniofacial anomalies, chronic medical problems, nasal diseases and history of adenoidectomies or tonsillectomies were excluded. Subjects spoke the Japanese nasal vowel /N/ for 3 seconds, and repeated it nine times. Formant frequencies were calculated by cepstrum analysis and then wavelengths of the resonant locations were estimated. The proportions of adenoid to the nasopharynx (Ad/Np), pharyngeal tonsil thickness and most narrow distance of airway were measured on lateral cephalograms. Airway volume and cross-sectional area in the adenoid section were measured from cone beam computed tomography (CBCT) images. These wavelengths of the resonant locations analyzed by cepstrum analysis were compared with measured values on lateral cephalograms and CBCT images.

RESULTS: Ad/Np, pharyngeal tonsil thickness, most narrow distance of airway, airway volume, and cross-sectional area showed a significant difference between two groups. The wavelengths of the resonance locations of the adenoid group were shorter than those of the control group. This result showed that the wavelengths of the resonance locations became shorter with a narrow airway.

CONCLUSION: The use of acoustic analysis could detect stenosis of the airways as a result of adenoids. Acoustic analysis could be useful as non-invasive methods without radiation exposure and pain.

SP 223 LITHIUM CHLORIDE AFFECTS TOOTH ROOT MOVEMENT AND REduces ROOT RESORPTION BY ORTHODONTIC FORCE IN RATS
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AIMS: To investigate how lithium chloride (LiCl) affects orthodontic tooth movement, orthodontically induced root resorption, and bone morphometry.

MATERIALS AND METHOD: Ten-week old female Sprague Dawley rats (n = 32) were divided into four groups by the concentration of LiCl administered everyday per weight: 0 (control group), 0.32, 0.64, and 1.28 mM/kg. The maxillary left first molars were moved mesially by a 10 cN coil spring for 14 days. Micro-computed tomography, scanning electron microscopy, and scanning laser microscopies were obtained to measure the amount of orthodontic tooth movement, the volume of orthodontically induced root resorption, and bone morphometry.

RESULTS: Orthodontically induced root resorption clearly decreased depending on the amount of LiCl administered though orthodontic tooth movement moderately decreased. The tooth inclined mesially and the root apex moved distally in the control and 0.32 mM groups. On the other hand, the tooth inclination angle became smaller and the root apex moved mesially in the 0.64 and 1.28 mM groups. In bone morphometry, the cortical bone mineral content and bone volume increased due to LiCl administration, and the trabecular bone measurements decreased. Orthodontically induced root resorption negatively correlated to cortical bone measurements, and the amount of orthodontic tooth movement significantly correlated to cortical bone morphometry.

CONCLUSION: In rats, LiCl induced mesial movement of tooth root apex, and reduced orthodontically induced root resorption. In addition, orthodontically induced root resorption positively correlated to cortical bone morphometry.

SP 224 A NOVEL METHOD OF DETECTING THREE-DIMENSIONAL MAXILLA CHANGES RELATED TO SOFT-DIET FEEDING
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AIMS: Soft-diet (SD) feeding is a widely-used experimental model for studying the association between skeletal morphology and muscle-related loading on the bone. Traditionally, these studies have been based on two-dimensional (2D) radiographs in the lateral view. However, 2D observation cannot detect three-dimensional (3D) changes in detail. Therefore, a modified surface-based analysis using micro-3D computed tomography (CT) has been developed to examine and detect 3D changes of the mandible associated with soft diet feeding. In this study, the focus was on the changes to maxilla morphology using the same method.

MATERIALS AND METHOD: Mice at three weeks of age were fed a powdered SD or hard-diet (HD) of regular rodent pellets until nine weeks of age. Micro-CT images were then taken at nine weeks of age to reconstruct the anatomical architecture images. To evaluate how food consistency influences the whole maxillary morphology a wire mesh fitting was applied for 3D analysis of micro-CT data. A wire mesh fitting analysis using approximately 9,000 points of wire mesh on the maxillary surface was used to assess the quantitative topographic variation in the bony surface of the maxilla. This approach clearly visualized the 3D distribution of significant changes on the maxillary surface in response to changes in food consistency.

RESULTS: As a change in the horizontal direction, the outer surface of the zygomatic arch and zygomatic arch base were significantly displaced in an inward direction in the SD group. Consequently, the transverse distance between the zygomatic arch and the width of the zygomatic arch decreased significantly in comparison to the HD group. As a change in the vertical direction, the areas showing significant differences were widely distributed along the inferior surface of the zygomatic arch, where a remarkable upward displacement was observed due to SD feeding. As a change in the antero-posterior direction, the anterior surface of the zygomatic arch and zygomatic arch base were displaced significantly in the anterior direction in the SD group.

CONCLUSION: The surface-based analysis provided quantitative evidence of how masticatory activity affects the site-specific response on the bone surface and consequently 3D complicated growth of the maxilla in mice.

SP 225 IS THERE A PLACE FOR THE ORTHODONTIST IN THE TREATMENT OF OBSTRUCTIVE SLEEP APNOEA? AN UMBRELLA REVIEW AND EVIDENCE-BASED RECOMMENDATIONS
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AIMS: Obstructive sleep apnoea (OSA) affects 1-4 per cent of children and 3-7 per cent of adults. Effectiveness of oral appliances, maxillary expansion, and maxillomandibular advancement in the treatment of OSA has not yet been adequately assessed in an evidence-based manner in children and adults.

MATERIALS AND METHOD: An umbrella review was performed based on Cochrane Handbook and PRISMA statement to provide an overview of existing systematic reviews. Data synthesis was performed only from randomized controlled trials with Paule-Mandel random-effects meta-analyses / meta-regressions using mean differences (MDs) and 95 per cent confidence intervals (CIs) and was followed by the qualitative evaluation of the meta-evidence.

RESULTS: Twenty nine systematic reviews were included (until August 2016), seven of which provided quantitative data and 20 primary studies (until 2015). Oral appliances were effective in improving apnoea hypopnea index (AHI) compared to both placebo appliances (12 trials; 525 patients; MD = -11.70; 95% CI = -15.38; -8.01; P < 0.001) and no treatment (1 trial; 24 patients; MD = -14.30; 95% CI=-21.59, -7.01; P < 0.001). Only the former was supported by robust meta-evidence. Effectiveness of oral appliances compared to placebo on Epworth sleepiness scale and minimum oxygen saturation was low and moderate, respectively, and was not supported by robust meta-evidence. No randomized or prospective controlled trials were found on the effectiveness of maxillary expansion (conventional or surgically assisted) and maxillomandibular advancement.

CONCLUSION: Oral appliances are effective in reducing AHI and their use is substantiated by robust evidence. Treatment with maxillary expansion (conventional or surgically assisted) and maxillomandibular advancement cannot yet be supported by high quality research.
AIMS: Insertion of orthodontic fixed appliances has been known to induce a mostly transient qualitative and quantitative alteration of the intraoral microbiota. However, the extent to which treatment with fixed appliances might have a lasting adverse effect on the periodontal attachment of the teeth has not yet been investigated in an evidence-based manner. The aim of this systematic review was to assess the effect of comprehensive treatment with fixed orthodontic appliances on clinical attachment levels of adolescent and adult periodontally healthy patients.

MATERIALS AND METHOD: Seven databases were searched from inception to February 2017 for randomized and prospective non-randomized longitudinal clinical studies. After duplicate study selection, data extraction, and risk of bias assessment according to the Cochrane guidelines, Paule-Mandel random-effects meta-analyses of the clinical attachment loss and its 95 per cent confidence intervals (CIs) were calculated.

RESULTS: A total of nine prospective non-randomized longitudinal clinical studies were identified that included 335 treated patients (at least 34% male/66% female) with an average age of 22.6 years. The average pooled clinical attachment loss was 0.11 mm (9 studies; 335 patients; 95% CI = 0.12 mm gain to 0.34 mm loss; \( P = 0.338 \)) with high heterogeneity. Furthermore, one study hinted that a small amount of clinical attachment might be gained by intrusion of upper incisors. Additional analyses indicated that the results were robust to addition of untreated patient groups, while patient age and timing of outcome measurement might play an important role.

CONCLUSION: According to existing evidence from longitudinal clinical studies orthodontic treatment with fixed appliances has little to no clinically relevant effect on periodontal clinical attachment levels.

Registration: PROSPERO (CRD42017057042).

SP 227 THE RELATIONSHIP OF SEVERE MALOCCLUSION TO PATIENTS’ MENTAL AND BEHAVIOURAL DISORDERS, GROWTH, AND SPEECH PROBLEMS

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AIMS: To investigate whether patients with severe malocclusions have more mental and behavioural disorders, growth or speech problems than controls without severe malocclusion.

MATERIALS AND METHOD: This retrospective register study consisted of 722 adolescence patients, born in the year 2000 (study group 362: boys 51%, girls 49% and controls 360: boys 51%, girls 49%, mean age 16 years), who were screened for the need of orthodontic treatment using the Treatment Priority Index (TPI). The study group consisted of subjects with a severe malocclusion (TPI 8-10) and the control group consisted of patients who did not have a severe malocclusion (TPI 0-7). Patients with mental and behavioural disorders were considered separately and also divided into two groups: 1: neurodevelopmental disorders, where there was established evidence for a genetic component and 2: disorders where the genetic component was not well established. The data were collected and analyzed using SPSS cross tabulation and one-way analyses of variance. Significance were calculated by Pearson Chi-Square test and Fishers’ exact test (\( P \leq 0.05 \)).

RESULTS: The most common malocclusions in the study group (TPI 8-10) were traumatic deep bite (53%), retrognathic mandible (48%), severe crowding (27%), retrognathic maxilla (26%) and prognathic maxilla (20%). Patients with severe malocclusions had statistically significantly more multiple psychiatric diagnoses than controls (\( P = 0.00 \)). Patients in group 1 had significantly more speech problems (42.2%), retrognathic maxilla (22.9%) and hypodontia (12%) compared to controls (\( P < 0.05 \)). The severe malocclusion patients had significantly more other mental disorders (11, 3%) than controls (1, 0.3%; \( P = 0.004 \)), and mood disorders (14, 3.9%) than controls (5, 1.4%) (\( P = 0.037 \)). The patients with severe malocclusions had a lower body mass index (BMI) than controls and underweight patients had significant relationships to a retrognathic maxilla (22.9%) than
normal or overweight patients (12.6%; \( P = 0.020 \)). Speech problems were significantly related to a retrognathic mandible (40.2%; \( P = 0.006 \)).

CONCLUSION: The results indicate that certain mental and behavioural disorders, speech problems and growth problems seem to be significantly more represented in patients with severe malocclusions. Patients with severe malocclusions had lower BMI than controls and being underweight had a significant relationship to a retrognathic maxilla.

SP 228  LONG-TERM PRESERVATION OF HEADGEAR ACTIVATOR TREATMENT EFFECTS
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AIMS: Recent randomized clinical trials (RCTs) have challenged the efficacy, efficiency and clinical value of growth modification in developing Class II malocclusions. This study evaluated the long-term outcomes of patients treated with headgear activator (HGA) appliances for moderate to severe Class II malocclusions.

MATERIALS AND METHOD: The cephalometric and study cast records of 40 patients (20 males; 20 females) were selected. They had been treated during their growth phase with a HGA (van Beek), followed by full-fixed appliances, between 2000 and 2015, and were evaluated before treatment (T0), end of HGA treatment (T1) and end of treatment (T2). A sub-group (T3), returned for an intraoral and profile retention evaluation in 2016. Matched untreated growing subjects from the Burlington Growth Study, served as the control group. Data were evaluated with descriptive statistics, Chi-square and t-tests.

RESULTS: Overjet (OJ) decreased significantly (9.1 mm at T0; 4.9 mm at T1; 3.3 mm at T2; 4.1 at T3; \( P < 0.05 \)), as did overbite (OB) (4.6 mm at T1; 3 mm at T1; 1.3 mm at T2; 2.9 mm at T3). At T3 there was a 0.8 mm OJ relapse (\( P > 0.05 \)) and a 1.6 mm OB relapse (\( P < 0.05 \)). The relapse at T3 in OJ and OB was not deemed to be clinically important. Overall, correction consisted of maxillary restraint, mandibular stimulation, counter clockwise palatal plane rotation and dental tipping (T2 to T0 = UI retroclination: \( P > 0.05 \); LI proclination: \( P < 0.01 \)). Cephalometrically, ANB angle, Wits measurement and convexity improved significantly from T0 to T2 (\( P < 0.05 \)) and growth direction (MPA and Y-axis) remained unaltered (\( P > 0.05 \)). Significant net changes occurred between the control group and HGA groups (\( P < 0.05 \)).

CONCLUSION: HGA treatment of growing patients followed by full-fixed orthodontics is clinically highly effective in correcting Class II malocclusions, via producing favourable skeletal and dental improvements, which are maintained in the long-term, in contrast to data from many RCTs. Orthodontists should consider each patient on an individual basis and bear in mind that growth modification in a compliant patient, may prevent the need for extractions and even orthognathic surgery, as well as improving a patient’s profile, facial aesthetics and self-esteem.

SP 229  THE EFFECT OF ORTHODONTIC TREATMENT WITH FOUR PREMOLAR EXTRACTIONS ON THE SKELETAL VERTICAL DIMENSION: A SYSTEMATIC REVIEW.
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AIMS: To assess the available evidence for the effects of orthodontic treatment with four premolar extractions on the vertical dimension of the face compared to non-extraction treatment.

MATERIALS AND METHOD: Electronic database searches of published and unpublished literature and hand searches of eligible studies were performed. The following electronic databases with no language or publication date restrictions were searched: Medline, Embase, the Cochrane Oral Health Group’s Trials Register and CENTRAL. Two review authors performed data extraction independently and in duplicate using data collection forms. Risk of bias was assessed using the ROBINS-I tool.

RESULTS: After application of the eligibility criteria, 14 studies were included in this systematic review. All studies were retrospective. Five of them were assessed as moderate, five as serious and four as critical risk of bias. Eleven studies investigated patients of various skeletal vertical patterns and Classes of malocclusion and found no difference between extraction and non-extraction treatment. From the rest three, one serious risk of bias study found a significant increase in the N-Me distance (4 mm) with non-extraction compared to extraction treatment in hyperdivergent Class I patients, whereas no difference was detected in the FMA angle. Another
moderate risk of bias study in hyperdivergent Class II division 1 patients detected a significant, but clinically questionable increase in SN-GoGn angle (1.7°) with non-extraction compared to extraction treatment, again without any difference in the FMA angle. On the contrary, one critical risk of bias study in normodivergent Class I patients detected a significant increase in N-Me distance (1.4 mm) with extraction treatment, whereas no difference was detected in FMA angle.

CONCLUSION: Although the quality of evidence ranged from moderate to poor, there is a considerable amount of evidence suggesting that orthodontic treatment with four premolar extractions is not linked to a specific effect in the skeletal vertical dimension. Thus, reduction or control of the vertical dimension does not seem to justify the adoption of an extraction treatment protocol in clinical practice.

SP 230 THE IMPACT OF FIXED ORTHODONTIC TREATMENT ON SALIVARY PROPERTIES AND IN ORAL MICROBIAL FLORA. A PROSPECTIVE STUDY

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AIMS: This prospective study was designed to observe the effect of fixed orthodontic treatment on saliva properties and in oral microbial flora.

MATERIALS AND METHOD: Paraffin-stimulated salivary samples were collected from orthodontic patients immediately before the placement of fixed orthodontic appliances (T0), 4 weeks later (T1) and 12 weeks after the initial placement (T2). pH, flow rate and buffering capacity was measured. Afterwards, each saliva sample underwent a 1000-fold dilution by sterile normal saline (0.9% NaCl). Saliva culturing was performed using a quantity of 10 μl diluted saliva onto Chapman, chocolate and Sabouraud agar plates for two days. Colonies that arose from any culture (including Neisseria species, Streptococci, Staphylococcus aureus, coagulase negative Staphylococci and Candida species) at a number of 1 × 100,000 or more colonies per millilitre of saliva were designed to be processed for species identification by means of contemporary standard methods. The non-parametric Friedman test was applied for repeated measurements. Thirty adolescent patients (13 girls, 17 boys) were included in the study.

RESULTS: Buffering capacity and flow rate, showed a trend for higher measurements over time. There were no statistically significant findings among pH or the number of colonies for any of the microbial species.

CONCLUSION: The increase of salivary flow rate and buffering capacity might be protective against the appearance of dental caries. The microbial findings might indicate that fixed orthodontic treatment at the initial stages is not related to an increased risk of dental decay.

SP 231 THE EFFECTIVENESS OF A MINISCREW ANCHORAGE APPROACH IN MOLARS DISTALIZATION IN PATIENTS WITH A CLASS III MALOCCLUSION

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AIMS: To evaluate the effectiveness of treatment in patients with a Class III malocclusion using a miniscrew anchorage approach without performing orthognathic surgery.

SUBJECTS AND METHOD: Ten patients (3 men, 7 women) aged 15-25 years with a Class maloclusion III with a mildly protrusive mandible, an anterior crossbite, and a deviated midline treated with the vestibular braces system. The patients had a miniscrew placed in the retromolar area within 6 months following third molar removal. Two elastic chains (force of 150 g) were used for molar distalization, placed from the hook behind the tube of the second molar, to the miniscrew. When the second molar was near the miniscrew, distalization of the first molar was started. After molar and premolar distalization, distalization of the anterior teeth was performed en-masse. Cephalometric radiographs were obtained performed before and after treatment to assess the changes in the sagittal and vertical planes.

RESULTS: After treatment, the molar and canine relationship was Class I with a normal overjet and overbite. Improved inclination of incisors was achieved. Lower molar distalization was 6 ± 2.3 mm. During treatment, the
mandibular anterior teeth were retracted approximately 4 ± 0.8 mm without negative lingual inclinations. The movement of the mandibular first molar was almost bodily translation. There was an aesthetic improvement in the profile.

CONCLUSION: Tooth distalization with a miniscrew anchorage approach in the retromolar area is an effective method to treat patients with a Class III malocclusion.

SP 232  MYOFUNCTIONAL AND BREATHING THERAPY: MUSCLE FUNCTIONING AND BREATHING‡‡‡
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AIMS: To develop strategies for 100 per cent accessibility and effectiveness of myofunctional and breathing therapy.

SUBJECTS AND METHOD: A method developed by Kozyk which includes the Buteiko method and principles of orthotropics, kinesiology and osteopathy. Two categories of participants were observed while carrying out exercises for developing correct muscle patterns and nose breathing. The total number of participants was 100 divided into two equal groups. In group A the subjects undertook exercises on their own for 45 days after receiving one-time coaching with instructions for correct step-by-step exercising. In group B the patients attended group classes five times over a period of 45 days and every day they received distant individual coaching and control. After 45 days, the statistics of the exercising results was assessed. Two objective criteria were used: 1) timing of the number of correctly (the tongue is tightly pressed against the palate) performed swallowing movements per minute (minimum 50 times); 2) the controlled pause (test which measures breathing volume by practicing a comfortable breath hold) was prolonged by minimum 18 seconds over 45 days.

RESULTS: The participants achieved the set goals (minimum of correct swallowing movements of 50 times per minute and prolonged control pause for a minimum 18 seconds) over 45 days (group A: 10%, group B 90%). The participants achieved either one of the criteria or improved in both (group A 15%, group B 8%). The subjects had no or slight results due to different reasons (group A 75%, group B 2%).

CONCLUSION: The achieved results suggest that myofunctional and breathing therapies are more effective as educational methods rather than medical manipulation and that group coaching in combination with individual control is the most appropriate.

SP 233  DIFFERENTIAL DIAGNOSTIC METHOD FOR MORPHOLOGICAL AND FUNCTIONAL DEVIATIONS OF THE MANDIBLE USING FRONTAL CEPHALOGRAMS
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AIMS: Transverse maxillofacial discrepancies require a comprehensive differentiation and diagnosis in order to achieve good treatment results. Mandibular symmetry is determined according to the skull’s bisector in clinical practice. However, this can be misleading and may give inaccurate results during interpretation. As a result of this, the mandible was considered as a separate body with a bisector of its own. Hence, a differential diagnostic method was created for assessment of morphological and functional deviations of the mandible using frontal cephalograms. A graphical model was established which encompasses and differentiates all possible transverse deviations of the mandible.

MATERIALS AND METHOD: Frontal cephalograms were done according to the method of Ricketts. A conventional X-ray generator (Orthophost, CD, Siemens, Germany) was used. Certain cephalometric points necessary for the establishment of the graphical models were used. The midsagittal line was built in accordance with Sassouni. A bisector for the mandible was also built.

RESULTS: Eight graphical models of all possible transverse deviations in the position and morphology of the lower jaw was established by ascertaining the mutual position of the two bisectors (of the skull and the mandible) and determining if mandibular menton lies on the bisector of the mandible. They are distinguished by their uniqueness, simplicity, and accuracy using mathematical and geometrical values. These models determine the asymmetry in the mandible, the rotation and translation in the temporomandibular joints and any possible combinations between them.
CONCLUSION: The designed graphical models for radiographic assessment of transverse facial discrepancies allows for accurate differentiation between transverse discrepancies in the occlusion and discrepancies related to the position and growth of the lower jaw. This differential diagnostic method explains the diagnostics related to facial asymmetry (determining if it is morphological or functional).

SP 234 CORRELATION BETWEEN INCISOR INCLINATION AND ALVEOLAR BONE IN ADULTS WITH CROSSBITE IN THE ANTERIOR SEGMENT
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AIMS: A crossbite in the anterior segment is defined as an occlusal trauma leading to pathological changes in the periodontal tissues. Due to the change in the direction of occlusal forces when biting the upper incisors cause labial movement of the lower incisors in the thin vestibular cortical bone of the mandible and accordingly fenestration and dehiscence develop. The aim of the study was to determine the inclination of the upper and lower incisors on a lateral cephalogram in patients with an anterior crossbite in relation to the alveolar bone.
MATERIALS AND METHOD: Forty two lateral cephalograms of patients aged between 18-45 years all exhibiting an anterior crossbite of either one or a group of teeth were analysed. Steiner’s C method was used to determine the inclination of the incisors in the upper and lower arches and their correlation to the alveolar bone. The distance between the cementoenamel junction of the incisors to the alveolar bone in the upper and lower arches was measured in order to determine the presence and extent of bone loss. The measurements were performed with digital callipers accurate to 0.01 mm. The statistical methods used are variational and correlational analysis.
RESULTS: There were twice as many patients with protrusion of the upper incisors (63.41 ± 7.52%) in the sample group. Similarly, patients with protrusion of the lower incisors (73.17 ± 6.92) were prevalent. A statistically insignificant (Pearson’s correlation coefficient of 0.02), but clinically significant correlation was established between the inclination of the incisors and the extent of resorption of the alveolar bone.
CONCLUSION: Patients with an anterior crossbite develop proclination of the incisors more often in the mandible. Although an insignificant correlation was established between the inclination of the anterior teeth and the extent of resorption of the alveolar bone, the clinical significance is of importance since protrusion and/or retrusion of the incisors in patients with an anterior crossbite is always associated with resorption of the alveolar bone.

SP 235 THIRD MOLAR ERUPTION AFTER ORTHODONTIC TREATMENT WITH AND WITHOUT PREMOLAR EXTRACTIONS: A RETROSPECTIVE STUDY
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AIMS: To assess the effect of premolar extractions during orthodontic treatment on spontaneous third molar eruption.
MATERIALS AND METHOD: Third molar eruption was assessed on digital study models and photographs taken before (T0) and 5 years after (T5) orthodontic treatment of patients selected from the retention archives at the Department of Orthodontics, University of Oslo. The inclusion criteria were presence of at least three third molars and good records. Out of 248 patients, 69 (36 females, 33 males) fulfilled the inclusion criteria: 33 patients were treated without extractions and 36 patients were treated with four premolar extractions. The degree of eruption for each third molar was assessed as: not erupted, partially erupted and fully erupted at T5. The Peer Assessment Rating (PAR) index was calculated at each experimental period. Descriptive statistics, t-test and Fisher exact test were used for data analysis.
RESULTS: The mean age before treatment was 12.8 ± 0.8 years in the extraction and 13.2 ± 0.7 years in the non-extraction group. At T5, mean age was 19.4 ± 2.3 years and 19.8 ± 1.8 years, respectively. There were no significant differences in gender and age at any evaluated period between the groups. Pre-treatment PAR index differences were also insignificant (30.8 ± 9.8 in the extraction and 29.8 ± 9.0 in the non-extraction group). However, anterior mandibular crowding before treatment was significantly higher in the extraction group (5.5 ±
2.7 versus 4.0 ± 1.8). This group also had a significantly longer treatment time (1.7 ± 0.5 versus 1.4 ± 1.1 years). At T5, 38 third molars in the extraction group and 82 molars in the non-extraction group were unerupted. In contrast, 90 third molars were fully erupted in the extraction group, the corresponding number being 33 in the non-extraction group. The difference was significant for each third molar in both genders.

CONCLUSION: The findings indicate that removal of premolars as part of the orthodontic treatment has a significant impact on spontaneous third molar eruption 5 years post-treatment.

SP 236 IS IT POSSIBLE TO DIAGNOSE FACIAL TYPE FROM PHOTOGRAPHS?
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AIMS: Adult vertical alveolar growth has been reported to be increased in high- versus average- and low-angle individuals. Hence, the risk for infraposition of dental implants in the long-term is anticipated to be greater for high-angle patients. The vertical facial pattern should therefore be considered in planning implant treatment in the aesthetic zone. The purpose of the study was to examine whether assessment of vertical facial type from facial profile photographs corresponds to diagnosis assessed from analysis of lateral cephalograms.

MATERIALS AND METHOD: Visual stimuli, including facial profile photographs of 12 individuals representing high-, average-, and low-angle facial types, were selected mainly from photographs obtained from 35 dental students aged 23 to 35 years. Allocation to facial group was based on cephalometric analysis (ML/FH and RL/ML) and standards for 20-year old individuals. The test panel included 41 dentists (general practitioners and specialists) who were asked to categorize the photographs according to the three facial types. Their assessments were compared to the cephalometric diagnosis.

RESULTS: The test panel performed a total of 492 assessments. Of these, 62.2 per cent was in correspondence with the facial type based on cephalometric diagnosis. For each facial type agreement between rating of the photograph and the cephalometric category was observed among 47 per cent of the low-angle, 78.7 per cent of the high-angle, and 61 per cent of the average faces. Comparison between three groups of dentists (general practitioners, specialists in three disciplines, and orthodontic specialists) showed that the strongest correspondence with the cephalometric assessment was observed for the orthodontic specialists.

CONCLUSION: Clinicians involved in dental implant treatment should be familiar with facial growth patterns and be able to evaluate the facial type in order to provide the patients with relevant information about aspects of timing of implant insertion and possible need for prosthodontics in the long-term.

SP 237 FACIAL MORPHOLOGY OF CLASS III MALOCCLUSION IN CHILDREN AFTER RAPID MAXILLARY EXPANSION AND FACEMASK TREATMENT IN THE PRE-PUBERTAL PERIOD – A THREE-DIMENSIONAL EVALUATION
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AIMS: To evaluate facial differences of Class III (CIII) children in the pre-pubertal stage after rapid maxillary expansion (RME) and facemask (FM) therapy.

SUBJECTS AND METHOD: Both the CIII (7.31 ± 1.00 years) and control (CG) (7.36 ± 0.98 years) groups consisted of 24 Caucasian children. Three-dimensional (3D) images of the faces were obtained (3dMD) and processed (Rapidform®) before (T0) and after (T1) treatment. The T1 facial shells were superimposed on the respective T0 facial shells using a best-fit method. The differences were quantified between facial regions defined by vertical and horizontal planes as follows: nose (vertically through the inner canthi and horizontally through glabella and subnasale), upper lip (horizontally through subnasale and left and right cheilions and vertically through the cheilions), lower lip and chin (horizontally and vertically through the cheilions and below), left and right cheeks (horizontally through the left and right palpebrale inferius and vertically through the left or right cheilions to the left and right and below). Average distances (AvgD) with standard deviations between T0 and T1 in these regions were statistically evaluated using ANOVA (P < 0.05).

RESULTS: In the nose region, no significant differences between CIII and CG were found (P > 0.05). However, the upper lip region moved forward in the CIII children (AvgD = 1.12 ± 0.77 mm) as compared to CG (AvgD = 0.36 ± 0.89 mm; P = 0.003). In the lower lip and chin region, a high statistical significance was revealed between the groups (P < 0.001), with smaller distances in the CIII group (AvgD 0.36 ± 1.09 mm) compared to CG (AvgD = 0.71 ±
0.45 mm), indicating a backward rotation of the mandible in the CIII group. A statistically significant difference was also found in the right and left cheek regions \((P = 0.010\) and \(P = 0.025\), respectively), demonstrating a greater protrusion of the midface area in the CIII group than in CG.

CONCLUSION: Orthopaedic treatment of CIII malocclusion in the prepubertal period significantly changes facial morphology, especially in the most affected areas (midface, upper lip, and the lower lip and chin region) after RME and FM treatment protocol. Non-invasive 3D imaging systems can provide an alternative accurate method for soft tissue evaluation of early orthopaedic treatment.

SP 238 EVALUATION OF OCCLUSAL CHANGES DURING CLASS II DIVISION 1 TREATMENT AND LONG-TERM FOLLOW-UP: IN VIEW OF IDEAL OCCLUSION, A THREE-DIMENSIONAL MODEL STUDY
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AIMS: To apply a technique with three-dimensional (3D) measurements to assess occlusal contact changes during and after treatment, hypothesizing that a good posterior occlusion at the end of active treatment leads to optimal long-term occlusal contacts.

MATERIALS AND METHOD: Digitized models of 30 non-extraction Class II division 1 patients (11-26 years) treated with full fixed appliance which meet the requirements of the Dutch board examination for finishing, were selected. The mean post-treatment follow-up and retention period was 8.3 and 4 years, respectively. The retention appliances were maxillary Hawley plates and fixed mandibular retainers. Actual and ideal position of the cusp tips of premolars and molars were assessed using a 3D software program by marking the points in the fissures and on cristae of the antagonists and by marking where these points should be located in an ideal Class I occlusion. After marking, the distance between the actual and the ideal cusp tips were measured 3D in guidance of occlusal plane.

RESULTS: Transversally, no significant differences were found between any time point \((P > 0.05)\). However, upper (pre)molars had a tendency to relative lingual positioning. Vertically, the mean distances between the cusps and fossae improved by approximately 0.6 mm during the post-treatment period. At long term only 10 per cent of the molars and 20 per cent of the premolars showed tight, favourable vertical occlusal contacts. Sagittally, mean treatment change from Class II towards a Class I occlusion was about 2 mm with small but significant post-treatment improvement \((0.4 \text{ mm}; P < 0.005)\). No correlation was found between the ideal and actual sagittal, vertical and transverse occlusion.

CONCLUSION: Cusps and fossae were hardly brought into ideal tight occlusal contacts. Achievements of the correct sagittal, transverse and vertical occlusion seem unrelated to each other. Ideal norms for assessing the quality of finishing in terms of occlusion should be refined to obtain a more objective judgment of improvement.

SP 239 INFLUENCE OF TONGUE THRUSTING ON TONGUE PRESSURE PRODUCTION DURING SWALLOWING IN PATIENTS WITH AN ANTERIOR OPEN BITE
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AIMS: An anterior open bite (AOB) is vertical deformity of jaw and/or dentition. Abnormalities of swallowing in patients with an AOB have not been evaluated quantitatively. This study aimed to detect the influence of tongue thrusting on tongue pressure production during swallowing in patients with an AOB.

SUBJECTS AND METHOD: Eleven patients and eight volunteers with a normal occlusion as the control. The patients included eight with an AOB with tongue thrust at swallowing and three without a tongue habit. Tongue pressures while swallowing 4 ml jelly were recorded by a sensor sheet system with five measuring points \((\text{Ch}1-5)\) attached to the hard palate. The order, maximum magnitude, duration and swallowing time of tongue pressure were analyzed based on the wave of tongue pressure.

RESULTS: The tongue pressure waveform of the control group and the non-habit group showed a similar pattern. On the other hand, the tongue pressure waveforms in the tongue habit group were very diverse, compared with the other two groups. In all groups, the onset of tongue pressure in the medial line \((\text{Ch}1-3)\) was directed from the anterior to the posterior and the offset of tongue pressure in the periphery \((\text{Ch}4, 5)\) was almost simultaneously developed, but in the tongue habit group, the onset of tongue pressure tended to delay
at the other parts with respect to Ch1 compared with the other two groups. The duration at the posterior-
median part in the tongue habit group was significantly shorter, and the maximum magnitude at the mid-
median and the posterior-median part showed a significantly lower than those in the control group. The
duration at the posterior-median part in the non-habit group was significantly shorter than in the control group,
but no significant difference in maximum magnitude was found between them. The present results have
suggested that the compensatory action by which the tongue closes the front part of the oral cavity could make
it difficult to lift the tongue and affect the transfer of the bolus.
CONCLUSION: AOB patients with tongue thrusting at swallowing showed diversity of tongue pressure
waveforms and the impact was noticeably weaker from the mid-median to the posterior-median part than that
in the control.

SP 240  MONITORING OF VERTICAL DISPLACEMENT OF UNOPPOSED MOLARS
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AIMS: Unopposed teeth tend to over erupt. But does the eruption have a stable rate throughout time after the
antagonist's loss? The aim of this study was to measure longitudinally the amount and velocity of post-emergent
eruption of unopposed molars in growing rats by morphometric analysis.
MATERIALS AND METHOD: Twenty-eight 4-week old male Wistar rats were monitored, 12 served as controls and
16 as experimental. Unilateral extractions of the maxillary molars were performed for the experimental group.
The rats were weighed weekly to verify their well-being. They were fed a soft diet and water ad libitum. All the
rats were scanned by microcomputed tomography in vivo during 3 months. Fifteen recordings were taken in a
regular predetermined base and the results analyzed with Osirix software. Overeruption of the first mandibular
molars was measured with reference points at the mandibular canal. Data were analyzed with an unpaired t-test
for the weight and a repeated measures ANOVA for the eruption and velocity.
RESULTS: There was no statistically significant difference between the average weight of the experimental and
control groups. At the end of the 3-month period, overeruption of the unopposed molars with respect to the
contralateral ones was 1145 (SD ± 301) microns. Most of this overeruption that is 937 (SD ± 189) microns,
occurring during the first 3 weeks and then the unopposed teeth continued to erupt at a slightly higher rate than
the opposed ones. Thus, the velocity of eruption of the unopposed molars decreased from 83 (SD ± 34) to 45 (SD
± 10) microns/day following which there was a linear decrease. No differences were found between the
continuous eruption pattern of the opposed molars of the experimental group and the molars of the control
group.
CONCLUSION: Unopposed molars show an increased rate of eruption three weeks after the loss of the
antagonist molars and then resume at almost the rate of eruption seen for the control molars.

SP 241  EFFECT OF A FLUORIDE-RELEASING VARNISH ON DENTAL ENAMEL COMPOSITION AFTER
DEMINERALIZATION
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AIMS: To determine the calcium, phosphorous and fluoride mineral content of demineralized enamel after
applying a fluoride varnish (Clinpro XT Varnish, 3M Espe).
MATERIALS AND METHOD: Forty bovine incisors were divided into four groups (n = 10). Group 1: Intact enamel.
Group 2: Demineralized enamel (the teeth were placed in a demineralizing solution for 48 hours). Group 3:
Intact enamel was etched with 37 per cent orthophosphoric acid for 30 seconds, washed and dried. Clinpro XT
Varnish was applied to the whole vestibular surface, and photopolymerized for 20 seconds. Afterwards, samples
were submerged in artificial saliva at 37°C for 15 days. Group 4: The teeth were placed in a demineralizing
solution for 48 hours and followed the same procedure as in group 3. Samples were washed in distilled water
and were cleaned with a dental prophylaxis brush. The varnish layer of groups 3 and 4 was carefully removed
with a scalpel blade. Then, all surfaces were given an ultrasonic bath for 60 minutes. The weight percentage of
calcium (Ca), phosphorous (P) and fluoride were quantified by means of energy dispersive X-ray spectrometry
(EDX). Ca/P stoichiometric ratios were calculated. Samples were examined under scanning electron microscopy (SEM). Ca and P values were analyzed with one-factor ANOVA and Tukey test (P < 0.05). Ca/P stoichiometric ratio data was performed with the Kruskal Wallis test and the Mann Whitney test, applying Bonferroni correction (P < 0.008).

RESULTS: The weight percentage of Ca was significantly higher in groups 1 and 3 (P < 0.05) than in groups 2 and 4. The weight percentage of P was significantly higher in group 1 (P < 0.05) than in the other groups. Ca/P stoichiometric ratios were significantly higher in groups 1 and 3 (P < 0.008) than in groups 2 and 4. F was detected only in groups 3 and 4.

CONCLUSION: The application of Clinpro XT Varnish to demineralized enamel after 15 days in saliva did not show results of remineralization. The fluoride detected would correspond to the remains of varnish which were seen in some SEM images.

SP 242 DOES TONGUE POSTURE IN ANTERIOR OPEN BITE AFFECTS SPEECH? A THREE-DIMENSIONAL ULTRASOUND ASSESSMENT

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AIMS: An anterior open bite (AOB) is defined as a vertical gap between the incisors with the teeth in centric occlusion. An AOB is one of the most difficult problems in growing children. Heredity and multifactorial aetiology play an important role in early diagnosis and interceptive treatment. Irregular tongue posture affects the aetiology of AOB, speech disorders and post-treatment stability. The assessment of tongue posture is unreliable due to anatomical limitations in children. The aim of this study was to assess the prevalence of AOB and speech disorders in children with impaired ear, nose and throat (ENT) conditions and orofacial disorders. The assessment of tongue posture was performed using three-dimensional ultrasound (3D US) in children with/without AOB.

SUBJECTS AND METHOD: Four hundred and forty six children, 236 boys and 210 girls, aged 3 to 7 years. All were examined for ENT conditions, malocclusions, oral habits and speech disorders. Questionnaires were answered by parents. Orthodontic clinical examination, photographs and dental casts were obtained from AOB subjects only. An ENT specialist and speech therapist examined ENT condition, phonetic and speech disorders. Tongue posture was assessed twice (radiologist and orthodontist independently) using 3D US Voluson730 Expert with a 3D convex conductor (RAB 2-5 MHz, GEH). The 4D View Program, the R-Program, Mann-Whitney, Chi² or Fisher’s exact, McNemar tests and the multiple logistic regression model were used [confidence interval (CI) of 95%, P < 0.05].

RESULTS: An AOB was diagnosed in 32 children (7.2 %) aged 3-7 years (4.9 years). Orthodontic findings: inappropriate facial appearance (72%), incompetent lip seal (97%), improper tongue posture and swallowing (97%). In subjects with an AOB more phonetic and articulation speech disorders were discovered (84%): sigmatism, roticism, gammacism, kapacism, lambdacism and combinations. ENT and breathing disorders together with oral habits, thumb sucking, bottle feeding and prolonged pacifier use were the most important aetiological factors in children with an AOB. The 3D US of tongue posture showed the tongue to be on the mouth floor, which differed significantly from tongue posture in the non AOB group.

CONCLUSION: 3D US assessment of tongue posture can be an important tool to objectify early diagnosis of tongue irregularities, to assess the role of the tongue in AOB aetiology, and to objectify the effectiveness of treatment planning. The main advantage of the method is its non-invasiveness, also its simple, quick, repeatable and a patient friendly procedure in children.

SP 243 EVALUATION OF TREATMENT DURATION FOR HYPODONTIA PATIENTS IN A MULTIDISCIPLINARY SETTING

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AIMS: To identify the treatment duration of patients with hypodontia within a multidisciplinary setting; to highlight the source of any delay to treatment and to determine whether the acceptance criteria for hypodontia patients treated in secondary care should be reviewed.
MATERIALS AND METHOD: Retrospective data was collected from the clinical notes of hypodontia patients debonded during 2015-2017. Non-hypodontia cases were also assessed to create a baseline for comparison of treatment duration. Twenty patients were identified for each group and all patients were treated at The Royal London Hospital, UK. Data was analysed using Microsoft Excel®.

RESULTS: The mean time for active orthodontic treatment (records to debond) were comparable for both hypodontia (42.6 months) and non-hypodontia (38.8 months) cases. Out of the hypodontia cohort, more patients presented with an Index of Orthodontic Treatment Need (IOTN) of 4h (75%), with the remainder being 5h. The cases with an IOTN of 5h took longer to treat (referral to discharge), with a mean treatment time of 83.2 months compared to 69.1 months for 4h patients.

CONCLUSION: There is a much longer pathway, with additional complexity of care for hypodontia patients; this is reflected in the increased treatment times. The source of delay can be attributed to: 1. Waiting times prior to records being taken (9.3 months); 2. Active orthodontic treatment and the wait for hypodontia joint clinic appointments; 3. Completion of restorative work (7.4 months). There is a need to revise the standard operating procedure for hypodontia patients. This could include a changed acceptance criteria, allowing for less complex, single unit replacements to be treated in primary care. Furthermore, efficiency and capacity of the hypodontia joint clinic can be increased by the use of clinical photographs to facilitate treatment planning.

SP 244 A NOVEL THERAPY AID FOR BRUXISM AND TEMPOROMANDIBULAR JOINT DYSFUNCTION: A PILOT STUDY
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AIMS: This pilot study investigated the therapeutic effects of the RelaxBogen with respect to bruxism and symptoms of temporomandibular joint dysfunction (TMD).

SUBJECTS AND METHOD: Ten subjects were investigated. Selection criteria were the presence of bruxism and initial symptoms of TMD, which were verified by the use of Brux-Checker® foil for two nights and a history of pain. On admission a comprehensive dental history was documented together with the following TMD parameters: SL-NRS questionnaire, palpation of 42 muscles in the head and neck region and the six exit points of the trigeminal nerve. After the examination the RelaxBogen was worn for at least 10 weeks and the named parameters were rechecked and compared to each other.

RESULTS: The pre- and follow-up examination showed a strong tendency towards a reduction of general symptoms and perceived pain in the mandibular region. After wearing the RelaxBogen a clear reduction in muscular pain triggered by palpation could be observed. Clear positive tendencies could also found in improvement of general well-being. The results suggest that statistical significance is to be expected in a larger subject population.

CONCLUSION: In patients suffering from bruxism and TMD symptoms, the RelaxBogen leads to a clear reduction of perceived pain and an increase in well-being. In addition to the decrease in pain perception and a reduced feeling of tension in the large muscles of the jaws, positive tendencies could also be determined in the region of the neck, cervical and shoulder muscles.

SP 245 THE ADHESIVE CAPACITY OF AESTHETIC BRACKETS USING DIFFERENT ENAMEL CONDITIONING TECHNIQUES
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AIMS: To evaluate the shear bond strength (SBS) and adhesive remnant on tooth after debonding of Clarity-Advanced brackets with the APC-Flash-Free system incorporated, comparing this with Clarity-Advanced brackets bonded with Transbond™ XT (TXT), using different enamel conditioning techniques.

MATERIALS AND METHOD: One hundred and fifty Clarity-Advanced brackets were bonded to 150 bovine incisors, which were divided into six groups (n = 25). Group 1: Transbond™ Plus Self-Etching-Primer, (TSEP) + APC-Flash-Free. Group 2: 37 per cent phosphoric acid + TSEP + APC-Flash-Free. Group 3: polished with prophylaxis paste + TSEP + APC-Flash-Free. Group 4: TSEP + TXT. Group 5: 37 per cent phosphoric acid + TSEP + TXT. Group 6: polished with prophylaxis paste + TSEP + TXT. SBS was measured using a universal test machine.
(Autograph AGS-1KND, Shimadzu, Japan) with a crosshead speed of 1 mm/minute. After debonding, the teeth were examined under a stereomicroscope (Nikon SMZ-U zoom 1:10) and an Adhesive Remnant Index (ARI) score was assigned to each tooth.

RESULTS: Bond strength values in group 1 were significantly lower than for the rest of groups (P < 0.05). There were no significant differences (P > 0.05) in SBS of groups 2, 3 and 4; this being significantly lower than in groups 5 and 6 (P < 0.05). Group 5 showed the highest SBS values (P > 0.05). Regarding the ARI, in the groups where the enamel was not treated prior to the application of TSEP, the amount of adhesive on the tooth decreased.

CONCLUSION: The SBS of Clarity-Advance brackets bonded with APC-Flash-Free or TXT significantly increases whether the enamel was etched with phosphoric acid as if it was polished with prophylaxis paste prior to application of TSEP. The bond strength of Clarity-Advanced brackets bonded with Transbond XT and TSEP, was significantly higher than that provided by the APC-Flash-Free System, being similar to that observed in the latter when the enamel was acid etched or polished prior to application of TSEP. On the other hand, a tendency to an increase in the amount of adhesive remnant on the tooth was observed when the enamel had been treated previous to the application of TSEP.

SP 246 THREE-DIMENSIONAL FOLLOW-UP STUDY OF FACIAL ASYMMETRY AFTER DEVELOPMENTAL DYSPLASIA OF THE HIP
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AIMS: To determine the change in facial asymmetry among subjects treated for developmental dysplasia of the hip (DDH) from childhood to adolescence using three-dimensional (3D) imaging.

SUBJECTS AND METHOD: A total of 39 adolescents (26 females, 13 males), born and treated for DDH during 1997-2001, participated in the first examination in 2007 (T1) and in the follow-up in 2016 (T2). At T1, the mean age was 8.2 years and at T2, 16.6 years. In this longitudinal study, 3D images were taken using a 3DMD face system based on a stereophotogrammetric method. Facial asymmetry was determined by superimposing the original shell and a mirror-like template. The average distance (mm) was calculated between the original and mirrored face. The symmetry percentage (%) was calculated as the face area where the distance between the original face and the mirrored surface did not exceed 0.5 mm. All subjects had a clinical dental and occlusal examination and information on previous orthodontic treatment was gathered. A paired-samples t-test was used to analyze differences between T1 and T2. A P value of < 0.05 was considered significant.

RESULTS: The average distance between the original face and the mirrored face increased for the whole face from 0.48 to 0.57 mm (P < 0.05) and for the lower face from 0.74 to 0.85 mm (P = 0.154). Correspondingly, the facial symmetry percentage decreased for the whole face from 61.23 to 62.29 per cent (P < 0.05), for the upper face from 69.27 to 62.24 per cent (P < 0.05), for the mid-face from 62.29 to 55.63 per cent (P < 0.05) and for the lower face from 43.37 to 42.19 per cent (P = 0.79).

CONCLUSION: Facial asymmetry increases from childhood to adulthood in subjects treated for DDH. Orthodontic treatment does not eliminate this asymmetric facial growth.

SP 247 PREDICTION OF OPTIMAL BENDING ANGLES OF A RUNNING LOOP TO ACHIEVE BODILY PROTRACTION OF A MOLAR USING THE FINITE ELEMENT METHOD
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AIMS: To predict the optimal bending angles of a running loop for bodily protraction of the mandibular first molars and to clarify the mechanics of molar tipping and rotation.

MATERIALS AND METHOD: A three-dimensional finite element model was developed for predicting tooth movement, and a mechanical model based on beam theory was constructed for clarifying force systems.
RESULTS: When a running loop without bends was used, the molar tipped mesially by 9.6 degrees and rotated counterclockwise by 5.4 degrees. These angles were almost similar to those predicted by the beam theory. When the amount of tip-back and toe-in angles were 11.5 and 9.9 degrees, respectively, bodily movement of the molar was achieved. When the bend angles were increased to 14.2 and 18.7 degrees, the molar tipped distally 4.9 degrees and rotated clockwise 1.5 degrees.

CONCLUSION: Bodily movement of a mandibular first molar was achieved during protraction by controlling the tip-back and toe-in angles with the use of a running loop. The beam theory was effective for understanding the mechanics of molar tipping and rotation, as well as for predicting the optimal bending angles.

SP 248 FACTORS AFFECTING THE OUTCOME OF IMPACTED TOOTH TRACTION USING THE INTERMAXILLARY METHOD WITH MINIPLATES

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AIMS: To compute the survival rate in traction of impacted teeth and identify the prognostic factors that can influence the failure rate in orthodontic traction.

MATERIALS AND METHOD: In this retrospective study, the sample comprised 154 subjects (82 females, 70 males; average age, 13.3 ± 6.2 years) who had been treated with intermaxillary traction of an impacted tooth using the C-tube orthodontic miniplate. On the basis of radiographic documents, the following clinical variables were considered: gender, age, vertical depth, mesiodistal position of impacted teeth, canine or not, plate loosening, inflammation, hygiene. The events of the impacted teeth and survival times were collected for the survival analysis. The event data of each impacted tooth was failure due to the severe mobility, inflammation and ankylosis. Survival was reported when the impacted tooth was moved into the line of occlusion even though there was some mobility, inflammation or they could not be brought into their original position until the end of the study. The relationship magnitude among factors and survival times of the impacted teeth was analyzed by multivariate analysis.

RESULTS: The results of the Cox proportional hazards regression model showed that age and miniplate loosening were decisive factors for orthodontic traction of impacted teeth when those factors were considered as a univariable analysis. However, when the factors which had a *P*-value around 0.2 were evaluated together as covariates in multivariable analysis, the inflammation parameter was added as a potential risk factor.

CONCLUSION: The present findings suggest that age, plate loosening and inflammation are prognostic factors for survival.

SP 249 IN VITRO EVALUATION OF CORROSION AND CYTOTOXICITY OF GUMMETAL ARCHWIRES WITH VARIOUS ACIDITIES

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AIMS: To evaluate cytotoxicity and surface corrosion of gummetal archwires in different acidities and immersion periods.

MATERIALS AND METHOD: Four orthodontic archwires were used: stainless steel (SS), nickel-titanium (NiTi), titanium-molybdenum and gum metal. Artificial saliva with no test wire and copper wire served as negative and positive controls, respectively. Each test wire was immersed in artificial saliva at different pH levels (pH 3.75 and pH 6.25) and was evaluated for 7 and 30 days. The cytotoxic effects of archwire corrosion products on L929 MF cell culture was assessed using XTT assay following ISO Standards (ISO 10993). Spectrophotometrical absorbance (450 nm) was measured through an ELISA reader to calculate optical density. Surface analysis was measured using a surface roughness tester and field-emission scanning electron microscope equipped with energy dispersive spectroscopy. For statistical analysis, three-way ANOVA was used to evaluate wire type, pH and immersion period followed by Tukey *post hoc* test and Mann-Whitney *U*-test for comparisons within each group. Two way ANOVA was used for surface roughness followed by an independent sample *t*-test.

RESULTS: No wires showed acute cytotoxicity. Gum metal showed the highest cellular viability at pH 6.25 (98.00 ± 8.89) while NiTi showed lowest viability at pH 3.75 (75.51 ± 4.96) (*P* > 0.001). Combined means, regardless of pH and immersion period showed SS having the highest viability compared to other experimental wires. The cellular viability was significantly decreased with acidic pH, and was highest on the first week of exposure to
 alloy extracts. Gum metal showed highest surface roughness while SS was the smoothest of all alloys tested ($P < 0.001$).

CONCLUSION: Biocompatibility of a material is significantly affected by wire type, pH and immersion period ($P < 0.001$). This highlights the importance of oral hygiene reinforcement at the start of treatment. Due to the low cellular viability percentage of NiTi archwires, from a biological standpoint, gum metal and SS may be a viable option in the initial stages of treatment.

SP 250 EVALUATING THE BONE GRAFTED ALVEOLAR CLEFT WITH CONE BEAM COMPUTED TOMOGRAPHY – A PILOT STUDY
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AIMS: To evaluate the bone grafted alveolar cleft using a grading system developed for three-dimensional (3D) imaging in cone beam computed tomography (CBCT).

SUBJECTS AND METHOD: Ten children born with cleft lip or cleft lip and palate were evaluated with CBCT 6 months after bone grafting the alveolar cleft. The cleft was grafted with autologous bone from the iliac crest when the children were between 7 and 9 years. The outcome was evaluated by assessing the horizontal bone thickness at four vertical levels (apical, midapical, midcervical and cervical) in relation to the central incisor root length and classified as ≥100, ≥75, ≥50, and < 50 per cent in relation to the central incisor root width at the same height level. The treatment outcome was considered as successful if the horizontal bone thickness was ≥75 per cent of the width of the central incisor at the three most apical levels.

RESULTS: Of the 10 bone grafted alveolar clefts a horizontal bone thickness ≥75 per cent of the width of the central incisor were seen in 80 per cent at the apical level, 80 per cent at the midapical level, 50 per cent at the midcervical level and 20 per cent at the cervical level.

CONCLUSION: If the outcome is based on combining the apical, midapical and midcervical levels, 4 out of 10 bone grafted children had a horizontal bone thickness ≥75 per cent at all three levels.

SP 251 A SUBJECTIVE COMPARISON OF LINGUAL AND LABIAL BRACKET SYSTEMS AS EXAMINED WITH A RETROSPECTIVE QUESTIONNAIRE
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AIMS: To examine the influence of bracket type on the amount of discomfort of patients treated with lingual and labial brackets.

MATERIALS AND METHOD: A retrospective questionnaire survey of 41 adolescent patients (mean age, 15.8 years; SD 2.7) with Class I malocclusion was performed to examine discomfort that may be caused by the lingual and labial orthodontic appliances. Twenty patients in the lingual group (14 females, 6 males, mean age 15.63 years, SD ± 2.24) were treated with prefabricated lingual brackets (STb lingual system, Ormco Corporation, Glendora, California, USA) and the patients in labial group (12 females, 9 males, mean age 16.33 years, SD ± 3.21) treated with 0.022-inch slot MBT brackets (Avex Mx, Opal orth, South Jordan, Utah, USA). Participants completed a standardized questionnaire 6 months after placement of the appliances. Chi-square and demographic values were used for data analysis.

RESULTS: After the orthodontic appointment, both the patients in the labial and lingual group suffered from pain. The number of people who reported pain was higher in the lingual group (39%; $P = 0.015$). The pain caused by the brackets did not affect the daily life of the patients in either group. In the lingual group, 26.8 per cent of subjects changed their eating habits. There was no effect on eating habits in 12.2 per cent of subjects in the labial group. Pain caused by orthodontic treatment did not affect the toothbrushing habit or speech performance in either group ($P = 0.443$). Patients in both groups reported pain during chewing and biting. The pain during biting was reported by more patients in the lingual group.

CONCLUSION: The findings indicate that patients treated with labial and lingual appliances rate similarly the level of overall pain they experience during treatment. However, ratings of pain differed at various sites with respect to the type of orthodontic appliance.
SP 252 POST-SURGICAL RELAPSE IN CLASS III PATIENTS TREATED WITH TWO-JAW SURGERY: HYBRID FIXATION IN THE BILATERAL SAGITTAL SPLIT OSTEOTOMY
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AIMS: Miniplate and screw fixation has been widely used in bilateral sagittal split osteotomy, but some issues remain unclear concerning its lack of rigidity when compared to Spiessl’s bicortical technique. The aim of this study was to determine the stability of the hybrid fixation technique in a skeletal Class III patients treated with two-jaw surgery.

SUBJECTS AND METHOD: Twenty five Korean skeletal Class III patients (12 males, 13 females; mean age 23 years) who underwent orthodontic treatment and orthognathic surgery. Serial lateral cephalograms were taken before (T0), immediately after (T1), at 6 weeks after (T2), 3 months after (T3), and at 1 year after (T4) surgery. The cephalograms were traced and analyzed by a single operator using the V-ceph program (version 5.5, CyberMed), Wacom Intuos4 digitizer (PTK-840, Wacom Co., Ltd) and Lens cursor for Intuos4 (KC210, Wacom Co., Ltd). Landmarks and reference planes; B, point B; HRP, horizontal reference plane, a horizontal plane angulated 7 degrees clockwise to the SN-line passing through nasion; VRP, vertical reference plane, a perpendicular line to the HRP passing through nasion. The horizontal distance from B to VRP (B-V, mm) was measured and post-surgical relapse rates (at 6 weeks; ΔB-V during T1-T2/ΔB-V during T0-T1, at 3 months ΔB-V during T1-T3/ΔB-V during T0-T1, and at 1 year ΔB-V during T1-T4/ΔB-V during T0-T1) were calculated using the Excel program (version 2007, Microsoft).

RESULTS: At T2 the relapse rate was 10.6 per cent; at T3 14.8 per cent; and at T4 20.2 per cent. If there was >30 per cent post-surgical relapse rate it considered ‘high relapse’. At T2 0 patients, at T3 four patients (2 males, 2 females), and at T4 six patients (2 males, 4 females) were considered as high relapse. The mean relapse rate was 37.9 per cent (30.2-42.0) at T4.

CONCLUSION: In Class III patients treated with two-jaw surgery using hybrid fixation there was a relatively low relapse rate. Hybrid fixation in Class III two-jaw surgery is considered to be rigid and stable.

SP 253 ECOLOGICAL MOMENTARY ASSESSMENT OF PAIN IN ADOLESCENTS UNDERGOING ORTHODONTIC TREATMENT USING A SMARTPHONE APPLICATION
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AIMS: To determine the feasibility of a Smartphone application to assess pain levels in real life, and to test their association with gender, age, time in orthodontic treatment, and type of orthodontic adjustment.

SUBJECTS AND METHOD: Eighty-two participants undergoing orthodontic treatment were recruited. A newly developed Smartphone application was used to assess pain scores at regular intervals in the three days after adjustment of the appliance. Resting and chewing pain were assessed using sliding digital visual analogue scales.

RESULTS: The mean age of the sample was 15.2 ± 1.6 years, the mean time in treatment was 12 ± 8.4 months, and the majority (56.1%) were female. Resting pain and chewing pain at the teeth increased steadily from baseline, peaked at approximately 20 hours, then decreased gradually over the next two days. Details of the orthodontic adjustments were associated with the total pain experienced at the teeth, with new bond-ups resulting in significantly more pain than routine orthodontic adjustments. Pain levels were not significantly associated with age, gender, or time in treatment.

CONCLUSION: This Smartphone application shows promise in measuring orthodontic pain in the real world, and will aid future research projects which investigate various factors that could influence pain severity.

SP 254 RESIN COVERAGE AND WHITE SPOT LESIONS: A PROSPECTIVE SPLIT-MOUTH STUDY TO EVALUATE BONDING TECHNIQUES.
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AIMS: To determine if resin coverage of the whole buccal surface is more likely to prevent white spot lesion (WSL) in comparison with only using resin underneath the bracket base when treating patients with fixed appliance.
SUBJECTS AND METHOD: Fifty-three subjects requiring fixed appliance treatment were consecutively selected. Their mean age was 15 years 1 month and the distributions in gender were 21 males and 32 females. They were randomly allocated in groups (A and B) according to a split-mouth study design. Group A had the upper right lateral and lower left canine treated with acid etching and resin coverage of the whole buccal surface (WBS). Group B was treated in the opposite way. Exclusion criteria were subjects that had buccal caries or visible demineralization or other diagnosed mineralisation disturbances such as molar-incisor hypomineralisation. Registrations were documented with standardised digital photographs of the upper laterals and lower canines. The photographs were taken at two angles before bonding and immediately following debonding. The depicted teeth were randomly evaluated on a high resolution screen by three orthodontic residents in a consensus decision according to a WSL scale (Gorelick et al., 1982). Descriptive statistics were applied on the material. A Chi-square test was used to evaluate the difference between WBS and UBB groups.

RESULTS: The mean treatment duration was 20 months (10-30). So far, 16 out of 150 teeth have been evaluated. No teeth out of eight in the WBS group showed WSL in contrast to the UBB group where two teeth out of eight had WSL. Quantification of enamel decalcification showed two teeth in the UBB group that scored one according to the WSL scale. A further 60 teeth will be evaluated February 2018.

CONCLUSION: At present there seem to be fewer WSL in the WBS treated group.

SP 255 STRUCTURAL ABNORMALITIES OF THE TEMPOROMANDIBULAR JOINT IN ORTHODONTIC PATIENTS
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AIMS: The effects of structural abnormalities of the temporomandibular joint (TMJ) on the processes and outcomes of orthodontic treatment have drawn increasing attention. In this study, common issues with the TMJ structure among patients with different types of malocclusions were systematically analyzed.

SUBJECTS AND METHOD: Three hundred and twelve randomly selected orthodontic patients (98 males, 214 females) with an age range of 10 to 55 years. Conventional anteroposterior and lateral cephalometric radiographs, panoramic radiographs, bilateral magnetic resonance images of the subjects’ TMJs in both the open and closed positions were acquired, and the TMJ structures were assessed.

RESULTS: Among the entire study population, 206 patients (66.03%) presented with TMJ structural abnormalities. In particular, TMJ structural abnormalities were found in 57 of the 98 examined male patients (58.16%) but were significantly more common among female subjects, occurring in 149 out of the 214 examined (69.63%). Sagittal analysis: 60.71 per cent of skeletal Class I patients had an abnormal TMJ structure, 72.97 per cent of skeletal Class II patients, and 64.04 per cent of skeletal Class III patients. Horizontal analysis indicated that an abnormal TMJ structure was present in 78.18 per cent of patients with a mandibular deviation to the left, in 60.87 per cent without mandibular deviation, and in 85.19 per cent with mandibular deviation to the right. Vertical analysis revealed that an abnormal TMJ structure was present in 77.12 per cent of high-angle patients, 56.88 per cent of average-angle subjects, and 70.59 per cent of low-angle patients.

CONCLUSION: TMJ structural abnormalities were present in a high proportion of orthodontic patients, especially females. In the sagittal direction, the highest incidence of structural TMJ abnormalities occurred in skeletal Class II patients. In the horizontal direction, the lowest incidence occurred in patients without mandibular deviation and in the vertical direction the lowest incidence occurred in the average-angle patients.

SP 256 SMARTPHONE APPLICATIONS CAN BE USED INTERCHANGEABLY WITH COMPUTER-BASED SOFTWARE FOR CEPHALOMETRIC ANALYSIS
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AIMS: To evaluate the diagnostic accuracy of two cephalometric Smartphone apps compared to a computer-assisted cephalometric analysis program.

MATERIALS AND METHOD: Pre-treatment digital cephalograms of 30 consecutive orthodontic patients (13 males, 17 females; mean age, 20.5 years; SD, 13.5 years) were retrospectively collected. Cephalometric tracings
were performed and repeated with a two-week interval by one investigator using CephNinja and OneCeph apps and Viewbox software. Seven angular and two linear measurements included in Steiner cephalometric analysis were examined: the angles SNA, SNB, ANB, SN to GoGn, upper incisor to NA, lower incisor to NB, interincisal angle, and the vertical distances of the of the most prominent points of the labial surfaces of the upper and lower incisors from NA and NB, U1 to NA and L1 to NB, respectively. Intra- and intertool reliability was calculated using intraclass correlation coefficient (ICC; two-way mixed effects model, single measures, absolute agreement) and Bland-Altman plots.

RESULTS: Intratool reliability was excellent, with ICC ranging from 0.89 to 1.00 for all variables measured with the three cephalometric analysis programs. The intertool reliability of Viewbox and OneCeph was excellent with ICC ranging from 0.92 to 0.97. The intertool reliability of Viewbox and CephNinja was good to excellent, with ICC ranging from 0.76 to 0.98; L1 to NB was the measurement with the least favourable reliability (ICC = 0.764, 95% CI = 0.228-0.912). Bland Altman analysis did not reveal clinically significant bias in the measurements obtained with OneCeph and CephNinja compared to Viewbox (mean differences in angular measurements ≤2.23° and mean differences in linear measurements ≤1.71mm).

CONCLUSION: OneCeph and CephNinja apps provide as accurate cephalometric measurements as Viewbox software.

SP 257 WHICH ORTHODONTIC STUDIES ATTRACT MORE ONLINE ATTENTION? AN ALTMETRIC STUDY
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AIMS: To evaluate the online visibility of the most popular orthodontic articles in Web platforms in relation to publication details and citations.

MATERIALS AND METHOD: Altmetric Explorer (Altmetric LLP, London, UK) was searched for articles published in 11 orthodontic journals without time limits in publication and citation on electronic resources. The 200 articles with the highest Altmetric Attention Score (AAS) were collected and screened for data related to publication (date, journal, access), authorship (number of authors, affiliation and origin of the corresponding author), and research (type, subject, funding). Citation counts were harvested from Scopus.

RESULTS: The top 200 articles presented a median AAS of 8.0 (range: 5.0-196.0), and were mostly bookmarked in Mendeley (median: 16.6 references; range: 0-199.0). American Journal of Orthodontics and Dentofacial Orthopedics, European Journal of Orthodontics and Angle Orthodontist contributed 86 per cent of the total number of research outputs. Studies investigating socio-demographics had significantly higher AAS compared to diagnostic studies (median AAS: 19.0; range: 7.0-34.0; versus median AAS: 6.0; range: 5.0-10.0. No other study parameter was found to be statistically significant. AAS did not correlate to the number of citations as reported in Scopus.

CONCLUSION: Visibility of orthodontic articles on the Web is not significantly correlated with citations. Studies on socio-demographics had a significantly higher number of online mentions. More constructive online presence of orthodontic journals is needed to reinforce dissemination of research data among scholars and non-scholars.

SP 258 THREE-DIMENSIONAL EVALUATION ON DIGITAL CASTS OF MAXILLARY PALATAL SIZE AND MORPHOLOGY IN PATIENTS WITH FUNCTIONAL POSTERIOR CROSSBITE
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AIMS: Previous studies have shown that subjects with a functional posterior crossbite may present asymmetric contracted maxillary morphology, with the crossbite side narrower than the non-crossbite side. However, these findings were obtained on plaster casts when measuring the intercanine and intermolar distances. To clarify this aspect, which could have clinical implications, the present study aimed to investigate palatal dimension and morphology in subjects with a functional posterior crossbite and to locate the area of contraction through a three-dimensional (3D) analysis procedure.

SUBJECTS AND METHOD: Study sample (SS) including 35 subjects (mean age 9.2 ± 0.8 years) diagnosed with a functional crossbite was matched with a control sample (CS) of 35 subjects (mean age 9.4 ± 0.9 years) without a
crossbite. Inclusion criteria were: Class I or edge-to-edge molar relationship, skeletal Class I relationship, pre-puberty cervical vertebral maturation as assessed on lateral cephalograms (CVMS1, CVMS2). Exclusion criteria were: missing teeth, craniofacial deformities, systemic diseases, previous orthodontic treatment, anterior crossbite, temporomandibular disorders, carious lesions, restoration and periodontal disease. Each digital model was analysed to assess palatal dimension size and symmetry by 1) measuring linear distances between the primary canines (D1) and first molars (D2) to the median palatal plane (Ortho Analyzer, version 1.6.1.6, 3Shape A/S, Copenhagen, Denmark) and 2) by performing the 3D deviation between the two specific models of the palatal vault (Geomagic Control™ X, version 2017.0.0, 3D Systems, Rock Hill, USA). A Student’s t-test was used to assess between-side differences of linear measurements in both groups and differences of matching percentages between the two groups. The Wilcoxon signed-rank test was used to assess differences between the two hemi-palatal volumes in both SS and CS.

RESULTS: D2 measurement was significantly narrower at the crossbite side in the SS sample. 3D deviation analysis showed a lower matching percentage of the palatal vault models in the SS (83.36%) compared to the CS (92.82%); moreover, in the SS maxillary contraction was mainly at the alveolar bone level at the crossbite side.

CONCLUSION: Based on these findings, subjects with a functional crossbite can present bilateral symmetrical contraction of the palatal vault with asymmetric contraction of the alveolar process.

SP 259 RELATIONSHIP BETWEEN CERVICAL VERTEBRAL MATURATION, DENTAL FORMATION, RETROMOLAR SPACE AND MAXILLARY SINUS
Kristina Lopatiene, Julija Nazimova, Antanas Sidlauskas, Giedre Trakiniene, Monika Sidlauskiene, Clinic of Orthodontics, Lithuanian University of Health Sciences, Kaunas, Lithuania

AIMS: To evaluate the relationship between the cervical vertebral maturation (CVM) phase and dental formation, retromolar space and the maxillary sinus.
MATERIALS AND METHOD: Pre-treatment panoramic radiographs and lateral cephalograms of 126 subjects (56 males, 70 females) with ages ranging from 7 to 17 years, randomly selected. Inclusion criteria were presence of all teeth, no previous orthodontic treatment, existing pathology or congenital malformations. The radiological evaluation was performed in the same digital cephalostat following a uniform procedure. The patients were divided into three groups according the CVM index (CVMI: group I - CVMI I; group II - CVMI II-III; group III - CVMI IV-VI) evaluated on lateral cephalogram. Dental maturity was evaluated on panoramic radiographs according to the Demirjian index, the mandibular third molar was assessed with the method of Nolla, retromolar space and the size of the maxillary sinus were measured. Statistical analysis was performed using Microsoft Excel 2013 and SPSS 22.0 software. The level of significance was P < 0.05.

RESULTS: In group I dental maturity significant findings were: canines: stage F, upper second premolars: stage D, lower second molars: stage E. More than 50 per cent of patients in group II had premolars at stage H and second molars at stage G. Group III - dental maturity was complete (stage H) and the third molars were stage E. In more than 50 per cent of group III the third molar maturation phase was one-third of root completed, according to Nolla’s method. A statistically significant increase of retromolar space in group III (16.89 ± 3.4 mm) was observed compared to groups I (11.79 ± 4.3 mm) and II (12.58 ± 3.9 mm; P < 0.001). The smallest measurements of the length of maxillary sinus were in group I (22.2 ± 5.8 mm) and the largest in group III (27.58 ± 6.8 mm; P < 0.05).

CONCLUSION: The growth period can be predicted by CVMI, stage 5 and 6 demonstrates the end of pubertal growth spurt, and significant features: dental maturity stage H, increased retromolar space more than 15 mm and length of maxillary sinus more than 25 mm.

SP 260 IN VITRO STUDY EVALUATING THE TENSILE STRENGTH OF THREE BONDING COMPOSITES OF A 0.0215 INCH THREE-STRAND STAINLESS STEEL FIXED WIRE RETAINER
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AIMS: To evaluate the bonding resistance of 0.0215 inch three-strand stainless steel retainers depending on the bonding agent used as well as the correlation between the sample dimensions (width, height and thickness) and the shear bond strength (SBS) of the samples.
MATERIALS AND METHOD: A total of 87 test samples, consisting of Transbond XT® (n = 28), Transbond LR® (n = 30), and Voco flowable® composite (n = 29), were constructed in a 0.0215 inch three strand stainless steel wire over 10 × 3 × 0.7 cm stoneware tiles (10 samples per tile, and a total of 9 tiles, 3 failures). Each tile was sandblasted with 80-micron alumina particles and thermocycled prior to testing. Testing was carried out with a Zwick Roell universal testing machine that provided traction to the wire with a constant force, measuring the maximum traction strength needed to debond the sample in newtons. Zwick TestXpert II® software measured and registered the data. Statistical analysis was made with SPSS V22®. Photographs of each test sample were taken with a ToupView® electronic microscope (resolution of 800px/mm) and measured to observe if the sample dimensions (height, width and thickness) had any influence on the results.

RESULTS: There was a significant association between thickness, height and width of the samples and the maximum strength needed to debond the sample (P < 0.001), increasing the maximum strength as the dimensions were higher. The tests also showed a significant association between the type of adhesive used and the maximum strength needed: Transbond XT® 8.5 ± 2.2 N, Transbond LR® 5.8 ± 1.9 N and Voco flowable® composite 2.9 ± 1.1 N. This could also be because the samples from the Transbond XT® presented the largest dimensions.

CONCLUSION: There is a large positive lineal correlation between sample dimensions (thickness, width, and height) and the maximum strength applied, with height having the largest correlation coefficient (0.797), followed by thickness (0.773) and finally width (0.6). Additionally, Transbond XT® required the most strength to debond the samples, followed by Transbond LR®. The lowest values were for Voco flowable® composite samples.

SP 261 FIXED RETAINER BONDING: BIBLIOGRAPHIC REVIEW
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AIMS: To compare, in a systematic review, failure rates of lower bonded retainers according to bonding agent and bonding method

MATERIALS AND METHOD: The following databases were searched between 2002 and 2017: Medline, Cochrane, Scopus, Web of Knowledge, PubMed, Embase using the keywords: retainers OR retention AND orthodontics AND bonding AND survival OR stability OR failure. The inclusion criteria was randomized clinical trials, meta analysis, prospective and retrospective, in humans after orthodontic treatment with braces and lower fixed retainers bonded direct or indirectly with the debonding rate specified. The exclusion criteria was: animal or in vitro studies, removable retainers, languages other than English, French or Spanish.

RESULTS: Out of the 225 initial found articles, only six were suitable for the qualitative analysis. Failure rates of bonded retainer varied from 26 to 46 per cent. The age and gender of the patient do not affect failure rate nor did the experience of operator.

CONCLUSION: Direct and indirect bonding have similar failure rates. The tooth most affected by debonding is lower left central incisor. The isolation method effect on failure rates needs further research.

SP 262 PREVALENCE OF PERMANENT SECOND MOLAR IMPACTION IN PATIENTS IN A DENTAL HOSPITAL
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AIMS: To assess the prevalence of permanent second molar impaction in a sample of patients attending a hospital dental clinic.

MATERIALS AND METHOD: Three hundred and twenty two medical histories were randomly selected of patients between 10 and 25 years of age who attended the Department of Dentistry at San Rafael's Hospital in Madrid during the last 20 years. Inclusion criteria: clinical history with good quality panoramic radiographs. Exclusion criteria: previous orthodontic treatment, large reconstructions of the first permanent molars and syndromes or history of previous dental extractions. Panoramic radiographs were evaluated by three examiners according to standardized impaction criteria. Ten per cent of the radiographs were evaluated twice by the same operator and by two different operators to calculate intra- and interoperator error.
RESULTS: The prevalence of impaction of the second molar was 6.52 per cent, being higher in women than men (71.4% and 28.6%, respectively). There was a relationship between the presence of the third molar and second molar impaction in women in 60 per cent of cases. In men the presence of the third molar occurred in 50 per cent of cases.

CONCLUSION: In this sample, there was a low prevalence of second molar impaction with a higher incidence among women.

SP 263 POST-SURGICAL UPPER AIRWAY CHANGES IN CHINESE SKELETAL CLASS III PATIENTS FOLLOWING BIMAXILLARY ORTHOGNATHIC SURGERY
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AIMS: To evaluate volumetric and cross-sectional surface area changes of the pharyngeal airway space (PAS) in Chinese skeletal Class III patients following bimaxillary orthognathic surgery using three-dimensional (3D) cone beam computed tomography (CBCT).

MATERIALS AND METHOD: Pre- and post-surgical CBCT scans of 10 adult patients who underwent bimaxillary surgery were examined. Four volumes of the PAS were assessed (nasopharynx, retropalatal area of oropharynx, retroglossal area of oropharynx and hypopharynx). Cross-sectional area was examined at three levels: (i) posterior nasal spine (PNS), (ii) soft-palate (SP) and the base of the epiglottis, and (iii) vallecula (V)). These were measured with SimPlant O&O 3D planning software (Materialise Dental, Leuven, Belgium). With statistical significance set at 5 per cent, comparison between pre- and post-surgery measurements were evaluated using the Wilcoxon signed-rank test. All readings were repeated and assessed by the Bland-Altman method. Intra-examiner agreement was achieved, with above 95 per cent of the repeated readings falling within the 95 per cent limits of agreement.

RESULTS: Following bimaxillary surgery for correction of Skeletal III malocclusion, a statistically significant increase in nasopharyngeal volume (P = 0.022) was found, with no significant changes in volumetric measurements of the other parts of the PAS. There was an increase in total volume of the PAS, though this was not statistically significant. There was also a significant increase in cross-sectional surface area at the level of the PNS (P = 0.017) after orthognathic surgery, with no significant changes in surface area observed at the other levels of the PAS.

CONCLUSION: Bimaxillary orthognathic surgery for skeletal Class III patients does not cause significant reduction of cross-sectional or volumetric parameters of the middle and lower airway. The inclusion of maxillary advancement in the surgical plan for skeletal Class III correction may negate the detrimental effects of isolated mandibular setback surgery on the PAS, and should be considered in cases that present potential for airway compromise.

SP 264 BACTERIAL ADHESION TO TOOTH ENAMEL OF DIFFERENT ROUGHNESS
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AIMS: Interproximal reduction and removal of excess adhesive around orthodontic brackets can result in increased surface roughness of enamel, even after careful polishing. The aim of this research was to assess the adhesion of bacteria to dental enamel after interproximal reduction and removal of excess adhesive, using both an in vitro and in vivo model. A second objective was to assess the effect of enamel polishing on bacterial adhesion. Only the findings from the in vivo study are reported.

MATERIALS AND METHOD: Thirty two human premolar teeth were subjected to enamel reduction with diamond burs (n = 8), diamond discs (n = 8), Soflex polishing discs (n = 8), or served as untreated controls (n = 8). The roughness of the enamel surfaces was assessed using atomic force microscopy (AFM). Streptococcus sanguinis cells were incubated with enamel samples and the colony-forming units (CFUs) adhering to enamel were counted.

RESULTS: The CFUs were highest on the roughest enamel surfaces that were created with the medium bur (CFUs = 12.3 ± 0.5 × 105), followed by the mesh disc (CFUs = 4.0 ± 0.5 × 105). The control surface had the next highest cell count (CFUs = 1.2 ± 0.1 × 105). The smoothest surfaces, created by Soflex polishing discs, had the lowest
number of adhering bacteria (CFUs = 0.3 ± 0.05 × 10^5) (P < 0.001 for all). A significant positive relationship was found between the enamel surface roughness and number of bacteria adhered (P < 0.001).

CONCLUSION: The in vitro findings indicate that larger numbers of S. sanguinis ATCC10556 adhered to the rougher enamel, showing that increased enamel surface roughness promoted its adhesion. Polishing enamel produced surfaces to which fewer bacteria adhered compared to untreated enamel. The results from an in vivo model will provide more insights into the relationship between common adhesive removal methods and bacterial adhesion.

SP 265 SUCCESS OF SURGICAL EXPOSURE OF IMPACTED MAXILLARY CANINES IN A TEACHING HOSPITAL SETTING
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AIMS: The primary objective of this audit was to determine the percentage of patients that required re-exposure of impacted maxillary canines following the initial procedure. The secondary objectives were to identify the reasons for these re-exposures, and factors that may have increased the chance of failure.

MATERIALS AND METHOD: This was a retrospective audit. Patients who had surgical exposures of impacted maxillary canines between 01/05/2016-30/04/2017 were identified from surgical records, allowing at least six months of clinical records to be examined for complications. Those receiving orthodontic treatment at Leeds Dental Institute (LDI) were included in the failure analysis. Two auditors examined the operative/orthodontic notes. Radiographic positions of exposed canines were graded for severity of ectopia, and the surgeon and surgical technique were noted. Based on previous studies, the gold standard was set at 5 per cent.

RESULTS: Fifty-eight patients (19 males, 39 females) had surgical exposures of 69 maxillary canines (12% buccal, 84% palatal, 4% line of arch). Post-exposure complications occurred in 10 patients (17%), or 12 teeth (17%). Causes of complications included gold chain debonds (7 teeth) and mucosal coverage (5 teeth). Five patients (9%), or seven teeth (10%), required re-exposure procedures, due to mucosal coverage (5 teeth) and gold chain debonds (2 teeth). Most re-exposures were carried out on canines that were more severely displaced, and positioned palatally (7 palatal, 1 buccal). Post-operative review times were longer in cases re-exposure due to mucosal coverage, and surgeons with smaller caseloads experienced a higher complication rate. Thirty-seven per cent of all gold chains placed debonded.

CONCLUSION: A review of surgical technique is required to limit post-exposure complications. Wider excisions and the use of light-cured rather than chemical-cured composite, which is currently used for closed exposures, were identified as possible ways to improve success rates. Review of open exposures within one week, and development of a post-exposure patient information leaflet is planned. The results of this audit were disseminated to both the orthodontic and surgical departments to address the issues highlighted, and a re-audit is planned for mid-2018.

SP 266 A STUDY TO QUANTIFY THE DEGREE OF FACIAL ASYMMETRY DURING MAXIMAL SMILE IN A HEALTHY GROUP OF ADULTS
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AIMS: Three-dimensional (3D) stereophotogrammetric motion-capture imaging is a novel technique in healthcare, capable of capturing and analysing facial expression. It may be of particular use in baseline assessment of cleft, orthognathic and facial-paralysis patients as well as assessing the outcome of any treatment interventions. This study aimed to establish a reference group for one such system by dynamically analysing maximal smile, a reproducible non-verbal facial expression.

MATERIALS AND METHOD: This was a single-centre cross-sectional study. Based on specific inclusion criteria, 108 volunteers (mean age 26.9 years) were imaged using a 3D motion-capture system whilst performing maximal smile. Twenty-one facial landmarks were digitised and tracked. Symmetry of displacement and speed of bilateral landmarks (right/left cheilion and labrale superius/inferius) were analysed in each direction (x, y, z and Euclidian), from rest (T0) to half-smile (T1) and maximal smile (T2), using paired t- and Wilcoxon signed rank tests. Facial asymmetry scores using Procrustes analysis and a clinically determined midline were calculated and compared.
RESULTS: Mean differences in displacement between right/left cheilion were statistically significant in the $x$- ($P < 0.001$) and Euclidian ($P = 0.002$) directions from T0-T1, and the $x$- ($P < 0.001$) and Euclidian ($P = 0.033$) directions from T0-T2. Differences in speed were significant in the $x$-direction ($P = 0.001$). Mean differences in displacement of labrale superius/inferius were statistically significant in all directions ($P < 0.05$) from T0-T2, and in the $x$- ($P = 0.007$), $z$- ($P < 0.001$) and Euclidian ($P = 0.020$) directions from T0-T1. The only clinically significant difference (>2 mm) was labrale superius/inferius in the $y$-direction from T0-T2. Differences in speed were statistically significant in the $x$-, $y$- and $z$-directions ($P < 0.05$). Asymmetry scores using the Procrustes technique showed a statistically significant increase from T0-T1 ($P < 0.001$), but not from T1-T2 ($P = 0.18$). The midline asymmetry score increased from T0-T1 ($P < 0.001$), and from T1-T2 ($P < 0.001$).

CONCLUSION: This study provides a reference data set for maximal smile expression. Differences in displacement and speed between landmark pairs reached statistical significance in multiple directions but only reached clinical significance for labrale superius/inferius from T0-T1. Asymmetry scores increased from rest to maximal smile, but were analysis dependent.

SP 267 TRANSVERSE AND TORQUE DENTAL CHANGES AFTER PASSIVE SELF-LIGATING FIXED THERAPY: A TWO-YEAR FOLLOW-UP STUDY

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AIMS: To measure the width of the maxillary and mandibular dental arches and torque changes after treatment with a passive self-ligating appliance, and stability at a 2-year follow-up.

MATERIALS AND METHOD: Maxillary and mandibular three-dimensional (3D) models from a sample group of 32 subjects (19 females, 13 males, mean initial age 14.9 ± 1 year) treated with a self-ligating appliance, were obtained before (T0), immediately after (T1) and 2 years after (T2) treatment. A total of 74 points were digitised by the same operator on every virtual model using the VAM software (Vectra, Canfield Scientific, Fairfield, New Jersey, USA). The correct sequence and positioning of the points were double checked by a second expert operator. The Kolmogorov Smirnov test was applied to verify the normal distribution of the sample. Descriptive analyses were evaluated at T0, T1 and T2. The variations between the three time points were tested with a one-way ANOVA, and any eventual difference was analysed with Scheffe’s post-hoc test. A statistically significant level was set conventionally at $P < 0.05$. (Statplus Pro, AnalystSoft Inc., v6, Walnut, California, USA). Method error was assessed by repeated digitisation of 10 randomly selected study casts by the same investigator at a 14 day interval.

RESULTS: The method error, assessed with the Dahlberg formula, was 1.3 degrees for the angular measurement and 0.2 mm for the linear measurement. 3D dental analysis showed a general increment of the arch widths, especially for the upper and lower premolars. The increase in transverse diameters was associated with a significant positive torque gain. No significant changes in arch perimeter or arch depth were recorded. In the retention period slight significant changes in transverse diameters were recorded, and a transverse diameter constriction was detected. Torque values remained almost unchanged in the follow-up period.

CONCLUSION: Transverse arch dimensions, along with torque values, increased significantly after treatment with a passive self-ligating appliance. At T2 there was a slight tendency to transverse diameter restriction, especially for the upper and the lower premolars but this was not statistically significant.

SP 268 THE REUSE OF ORTHODONTIC MINISCREWS

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AIMS: To investigate in vitro the effect of the reuse of orthodontic miniscrews on the amount of microdamage produced after insertion into porcine tibia bone.

MATERIALS AND METHOD: Ten Aarhus self-drilling orthodontic miniscrews (Medicon, Tuttlingen, Germany; diameter, 1.5 mm; length, 6 mm) were inserted into 1.5 mm (group 1; n = 10) thick cortical bone using a custom
drilling machine. A sequential staining technique was used to identify microdamage. The orthodontic miniscrews were then retrieved and reinserted in a new 1.5 mm thick cortical bone specimen and restained (group 2; n = 10). The stained segments were imaged using laser confocal microscopy. The images were stitched together using the image acquisition software, Leica Application Suite – Advanced Fluorescence (Leica Microsystems GmbH, Wetzlar, Germany). ImageJ (National Institutes of Health, Bethesda, Maryland, USA) was used to quantify the total damage area, diffuse damage area, maximum crack length, maximum damage radius, and maximum diffuse damage radius. Kruskal-Wallis tests and Wilcoxon rank sum tests were applied to analyse the data. RESULTS: All orthodontic miniscrews were completely inserted and none fractured during the experiment. There was no statistical difference (P > 0.05) between the torque requirement for insertion between the new and used orthodontic miniscrews. There were no statistically significant differences (P > 0.05) for the linear measurements; maximum crack length, maximum damage radius and maximum diffuse damage radius, between the two groups. There was a statistically significant difference (P < 0.05) with both area measurements; total damage area and diffuse damage area, with used orthodontic miniscrews producing greater damage. CONCLUSION: This study demonstrated a statistically significant change in microdamage area caused following reinsertion of an orthodontic miniscrew. These results appear to suggest that there is sufficient morphological change to retrieved self-drilling orthodontic miniscrews to affect their intended function and impact on their efficiency and safety. Orthodontic miniscrews are classed as single-use devices. If they are reused the original manufacturer would cease responsibility for safety of the device as it has been used outside of its specification. The onus is placed on the individual who has reused the device to the extent that the use of retrieved orthodontic miniscrews is not recommended.

SP 269 THE DEGREE OF MINERALIZATION OF UPPER CANINE AND LOWER PREMOLARS IN CLASS II DIVISION 2 AND CLASS III PATIENTS
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AIMS: To determine the development of the upper canines and lower premolars in patents with a Class II division 2 (Class II/2) and Class III malocclusions.
SUBJECTS AND METHOD: One hundred and forty six subjects (77 with Class II/2 and 69 with a Class III malocclusion). Chronological age of the entire sample was 9.8 ± 1.8 years. The analysis was performed on dental pantomographs and the development of the upper canine and lower premolars was determined using Demirjian’s method. The data were statistically analysed using the Mann-Whitney U test and the analysis of variance Friedmann ANOVA.
RESULTS: There was significantly a higher degree of mineralization of the germs of upper canines and a lower degree of lower premolars in Class II/2 patients and a lower degree of the upper canines and a higher degree of lower premolars in Class III patients.
CONCLUSION: Sagittal relationships affect the degree of the mineralization during the development of the permanent teeth.

SP 270 RELATIONSHIP BETWEEN AIRWAY DIMENSIONS AND FACIAL GROWTH PATTERN
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AIMS: To evaluate the dimensions of the upper and lower airways in adult patients with different facial growth patterns (normal, horizontal and vertical).
MATERIALS AND METHOD: Archived lateral cephalograms of 90 non-growing patients. Inclusion criteria: skeletal Class I and stage VI of vertebral development. The sample was divided into three groups of 30 subjects.
RESULTS: In group 1 (mesofacial), the mean value of the upper airway was 12.92 mm (SD 2.53), in group 2 (brachyfacial) 15.95 mm (SD 2.22) and in group 3 (dolichofacial) 11.26 mm (SD 2.21). In group 1, the mean value of the lower airway was 10.67 mm (SD 2.82), in group 2 11.17 mm (SD 3.14) and in group 3 8.50 mm (SD 1.92). The size of the upper airways was significantly greater in patients with horizontal growth (P < 0.0001). The size of the lower airways was significantly lower in patients with vertical growth (P = 0.0005).
CONCLUSION: The dimensions of the upper airways were significantly greater in patients with a horizontal growth pattern. The dimensions of the lower airways were significantly lower in patients with a vertical growth pattern.

SP 271 THE EFFECT OF MOUTH RINSES ON SURFACE MORPHOLOGY OF ORTHODONTIC ARCH WIRES
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AIMS: Prevention of caries and gingivitis is an indispensable issue of a successful orthodontic treatment. Besides mechanical tooth cleaning, orthodontists offer the use of mouthrinses to help maintain the oral hygiene of patients. Scientific research has reported that with the use of mouthwashes corrosion of the metal wires occurs. In a previous study it was shown that the material composition and microhardness of the wires changes. The aim of this study was to examine surface morphology changes of orthodontic archwires immersed for 1 month in different mouthwashes.

MATERIALS AND METHOD: Stainless steel brackets and different archwires were bent together and examined after 1 month immersion in acidic mouthrinses (pH 3.5, 4.2, 5.5). The surface morphology changes of the samples, nickel-titanium (NiTi) and titanium-molybdenum (TMA) archwires, were determined with a stereo- and metal microscopy.

RESULTS: Due to the different electrode potential an electrochemical reaction between the metal (brackets-archwires) and the electrolyte (mouthwash) occurred. Definite surface changes were observed. The longitudinal lines on NiTi samples became smoother and signs of whole corrosion were detected. For the TMA archwires homogenous ‘islets’ could be seen after the corrosive effect.

CONCLUSION: Surface morphology changes caused by galvanic corrosion in acidic mouthrinses assume metallic ion release from the examined orthodontic archwires, NiTi and TMA. This might have some cytotoxic effect on gingival fibroblast cells, which will be investigated in future research.

SP 272 EVALUATION OF ORTHODONTIC TREATMENT AFTER SURGICALLY ASSISTED RAPID PALATAL EXPANSION IN PATIENTS WITH UPPER JAW CONSTRUCTION
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AIMS: To increase the effectiveness of combined orthodontic and surgical treatment in patients with upper jaw constriction using various orthodontic fixed appliances based on evaluation of the adaptive changes of the dentoalveolar complex.

SUBJECTS AND METHOD: Twenty patients with maxillary constriction (mean age 27.5 years). The subjects were divided into two groups; group 1 10 patients treated with rapid palatal expansion (RPE) with a tooth-borne expander, fixed on the permanent molars and premolars crowns and group 2 10 patients treated with RPE with a bone-borne expander. The period of active expansion averaged 0.5-1.5 months in both groups. Surgically assisted rapid palatal expansions was used in all patients. Evaluation of the expansion of the maxilla, buccal tipping of the lateral teeth, thickness of the maxilla and tongue position was carried out on cone-beam computed tomographs before, after orthodontic treatment and immediately after the active period of expansion.

RESULTS: Maxillary expansion was achieved in both groups in the transverse direction. In group 1 insignificant buccal inclination of the posterior teeth was observed. Based on analysis of the diagnostic models of the jaws, positive changes in the shape of the dental arches were revealed: expansion of the upper dental arch of the first premolars by 7.6 ± 2.7 mm, molars by 9.7 ± 1.1 mm and contraction of the anterior upper dental arch by 2.1 ± 0.9 mm. The upper dentoalveolar arch increased by 6.7 ± 0.3 mm and the lower dental arch by 4.3 mm. There was no violation of the integrity of the cortical bone.

CONCLUSION: Combined orthodontic-surgical treatment is an indication for adult patients with constriction of the maxilla. Qualified orthodontic aids shorten the treatment period and contribute to the achievement of such treatment results, as: expansion of the maxilla in the transverse direction, avoidance of undesirable buccal
tipping of the lateral teeth and improvement of the smile arch. It allows reduction of relapse and complications due to orthodontic treatment in adults.

SP 273  EFFECTS OF SYSTEMIC MEDICATION ON ROOT RESORPTION ASSOCIATED WITH ORTHODONTIC TOOTH MOVEMENT: A SYSTEMATIC REVIEW
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AIMS: As tooth root resorptive processes involve the cementum and, in severe situations, the underlying dentine, theoretically they could be modulated by any medication taken that exhibits possible effects on the molecular pathways responsible for dental and periodontal tissue homeostasis or the alterations encountered during orthodontic tooth movement (OTM). The aim was to systematically investigate and appraise the quality of the available evidence regarding the effect of commonly prescribed systemic medication on root resorption associated with OTM.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data from controlled studies investigating the effect of systemic medications on root resorption associated with OTM were reviewed. Relevant data was extracted and the risk of bias was assessed using the SYRCLE’s Risk of Bias Tool.

RESULTS: Fifteen studies investigating root resorption associated with OTM following medication administration in animals were finally identified. Most studies were assessed to be of unclear risk of bias. Root resorption was shown to increase in Vitamin C treated animals, while a decrease was noted after the administration of prednisolone, meloxicam, simvastatin, lithium chloride and strontium ranelate compared to the control group. No difference was noted for celecoxib, tramadol, fluoxetine, calcium gluconate, zinc and atorvastatin. Finally, inconsistent effects were observed after the administration of L-thyroxine. The quality of the available evidence was considered at best as low.

CONCLUSION: Pharmaceutical substances administered systematically may exhibit variable effects on root resorption associated with OTM. Although the overall quality of evidence provides the clinician with a cautious perspective on the strength of the relevant recommendations, good practice would suggest that it is important to identify patients consuming medications and consider the possible implications.

SP 274  MANAGEMENT OF DIAGNOSTICS AND ORTHODONTIC REHABILITATION IN PATIENTS WITH HEMIFACIAL ATROPHY
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AIMS: To identify clinical features and radiographic analysis of maxillofacial disfigurements in scleroderma and Parry-Romberg syndrome and develop an algorithm of orthodontic treatment for these patients, taking into account the main disease.

SUBJECTS AND METHOD: A retrospective study of 20 patients, 12 diagnosed with scleroderma and eight with Parry-Romberg syndrome. Histories were taken, a dental examination was performed and additional research methods were carried out.

RESULTS: According to the collected clinical data, scleroderma is characterized by a lesion generally located in the frontoparietal skull, accompanied by alopecia. When the process extends to the face, an orbital bone and zygomatic area, the maxilla and the mandible may be affected. The process of atrophy may extend deep into the skin, involving underlying muscles and bones. The skin is thick, hyperpigmented, with fibrosis. The characteristic areas of deformation in the syndrome of Parry-Romberg are the zones of innervation of the trigeminal nerve, especially, the maxilla and the mandible are often involved. At the same time there are no phenomena of sclerosis, alopecia, hyperpigmentation; the skin is soft, shiny. Both diseases are accompanied by deformation of the mandible, microstomy, and also have similar manifestations in the oral cavity: the presence of a crossbite on the side of the lesion, disocclusion, xerostomia, resorption of the roots of the teeth and alveolar bones, widening of the periodontal ligaments. At the same time, the psychological state of the child and their social adaptation in society always suffers, because of the severe asymmetry of the face.
CONCLUSION: Dentists may be able to recognize a systemic disease from the findings of hemiatrophy in the oral cavity and on the face, and refer the patient to a general practitioner. It is important to postpone orthodontic treatment in an active phase of scleroderma. In the remission phase, the main goal of an orthodontist is to maintain the parallelism of the facial planes and to stimulate the growth zones on the affected side, by using functional orthodontic appliances. After completion of growth, reconstructive surgery is recommended to correct facial deformations.

SP 275 STATIC FRICTION OF CONVENTIONAL AND SELF-LIGATING APPLIANCES DEPENDING ON DIFFERENT ALIGNMENT CONDITIONS IN 0.014 NICKEL TITANIUM ARCH WIRES

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AIMS: To quantify and compare static friction in conventional orthodontic appliances and self-ligating brackets, depending on the type of ligature with 0.014 inch nickel titanium (NiTi) archwire in different crowding situations.

MATERIALS AND METHOD: An observational study of friction forces of conventional brackets (Low Profile MBT .022, American Orthodontics, Sheboygan Wisconsin, USA), passive self-ligating brackets (Damon Q .022, Ormco Corporation, Orange California, USA) and active self-ligating brackets (Innovation Roth .022, Dentsply GAC International, Bohemia New York, USA) was designed. The brackets were studied with 0.014 inch NiTi archwire to quantify static friction. With the conventional bracket group, elastomeric and metallic ligatures were compared. The sample was analyzed with ANOVA at a confidence interval of 95 per cent. Statistical results were validated with a Cronbach’s alpha, within 2 weeks by the same operator.

RESULTS: Passive self-ligating brackets showed the lowest static friction rates when used with 0.014 inch NiTi archwire (0.029 N/mm). Conventional brackets had the highest friction rates when used with elastomeric ligatures (12.003 N/mm). Static friction increased proportionally with the degree of crowding, despite the type of ligature used in conventional brackets and the type of self-ligating bracket. All values obtained were statistically significant (P < 0.05).

CONCLUSION: Self-ligating brackets show the lowest static friction. Active self-ligating brackets had higher friction rates than passive self-ligating brackets. With conventional brackets, friction increased with elastomeric ligatures.

SP 276 PROGRESSIVE CONDYLAR RESORPTION AFTER ORTHOGNATHIC SURGERY – SYSTEMATIC REVIEW WITH META-ANALYSIS

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AIMS: Condylar resorption after orthognathic surgery is a rare but well-known clinical entity affecting the temporomandibular joint. The aim of this research was to evaluate the incidence and relationship between condylar resorption following orthognathic surgery in patients with dentofacial deformities and to assess the therapeutic protocol best suited to the management of the pathology.

MATERIALS AND METHOD: A computerized search of studies up to January 2017 was undertaken using the electronic databases PubMed, MedLine, Ovid, Cochrane Library, Science Direct and Elsevier for current evidence in the world literature. The relevant articles were selected according to inclusion and exclusion criteria and the findings were compared on a meta-analysis.

RESULTS: A total of 18 papers with follow-up periods of 12 to 72 months met the eligibility criteria: one randomized controlled trial and 17 non-randomized studies. A sample of 2313 patients, with an age range from 16 to 46 years, that underwent mandibular or bimaxillary surgery was analysed and in 206 of these patients (8.9%) condylar resorption was observed.

CONCLUSION: Condylar resorption should be taken into account as a potential post-surgical complication after orthognathic surgery. However, its incidence and quantification need a careful interpretation due to the low level of evidence and the high heterogeneity of studies included in this meta-analysis.

SP 277 STRAIGHT TEETH – THE ULTIMATE GOAL OR IS THERE SOMETHING MORE BEHIND IT?
AIMS: To examine the psychosocial impact of malocclusion through the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ), its four factors: dental self-confidence, aesthetic concern, psychological impact and social influence of malocclusion, and adolescent’s perception of malocclusion using the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN).

MATERIALS AND METHOD: The research was conducted through a questionnaire among 295 students of both genders randomly selected aged 16-20 years. Self-rated Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ), self-rated AC IOTN. For testing the significance of differences between certain variables, depending on the distribution of data, tests were used for independent samples (Chi-square test with and without Yates correction and t-tests for independent samples, Mann-Whitney U test, Kruskal-Wallis test, analysis of variance, linear regression analysis). For determination of the correlation between two variables Pearson-Conn's coefficient of linear correlation (r) was used.

RESULTS: The majority of respondents (84.75%) were graded as score I of IOTN (AC). The PIDAQ score of its four factors presented highly significant differences (P < 0.001) with the IOTN (AC) groups, confirming that these variables are independent factors. PIDAQ scores did not differ between the genders. The total PIDAQ score, and the score of its four factors demonstrated highly significant correlation (P < 0.01) with the adolescent's perception of malocclusion - IOTN (AC). There is negative, indirect, highly significant correlation (P < 0.01) between the adolescent's dental self-confidence and their self-perception of malocclusion (IOTN AC), the aesthetic concerns and the psychological and social impact of malocclusion.

CONCLUSION: Malocclusion has a psycho-social impact in adolescents which increases with the increasing severity of the malocclusion. The IOTN (AC) can be considered an effective tool for evaluation and prediction of the psycho-social impact of a dental aesthetic malocclusion in adolescents. PIDAQ meets the criteria of a good instrument manifesting factorial stability across the samples, the consistency of the scales and criteria concerning validity. The level of dental self-confidence is a significant predictor of perception of malocclusion.

SP 278 THREE-DIMENSIONAL ANALYSIS OF PERIORAL SOFT TISSUES WITH THE USE OF GEOMETRIC MORPHOMETRIC METHODS

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AIMS: To examine the shape variation of the three-dimensional (3D) perioral soft tissues (PSTs) in a sample of orthodontic patients with the use of geometric morphometrics.

MATERIALS AND METHOD: Pre-treatment cone beam computed tomographic scans of the whole head of 39 Caucasian patients, which were retrospectively collected. A 3D face mesh of each patient was created and the PSTs were subsequently digitized using a novel 3D-PST template. Fixed landmarks and 3D surface semi-landmarks were used to describe the morphology of the PSTs. Procrustes superimposition and Principal Component Analysis were used in Viewbox 4 Software to analyze the shape data. For method error estimation, 15 randomly chosen patients were re-digitized. Correlation analysis was used for the shape, size and age parameters. Sexual dimorphism between the genders was tested within the sample with unpaired t-tests.

RESULTS: No method error was found. The first four principal components (PCs) accounted for about 69.3 per cent of the total shape variance. Shape variation in the PSTs was mostly evident in the vertical dimension as described by PC1, which accounted for 42 per cent of total shape variance. PC2 showed the variation of the PSTs mostly in the sagittal dimension. Shape variation was especially evident in the width and height of the perioral area, the upper and lower lip height, the sagittal relationship of the lips, the chin prominence, the nasolabial angle and the size of the nose as implied by the position of point Pronasale. The shape of the PSTs was not found to change during growth. However, their size was found to increase during growth (P = 0.015). Shape and size differences between males and females were not significant.

CONCLUSION: The first four PCs describe a great amount of the overall shape variation of the 3D PSTs. The greatest shape variation of PSTs was evident in the vertical and sagittal dimension combined with variation of specific parts, but these were not correlated to patient's age or gender. During growth, apart from their increase in size, no change of the PSTs is expected in either gender.
DENTAL MATURITY ESTIMATION IN SERBIAN POPULATION: A COMPARISON OF TWO METHODS

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AIMS: To test the applicability of Cameriere’s European formula for dental maturity estimation in non-adults on Serbian sample and compare its accuracy with Willems’ age estimation method.

MATERIALS AND METHOD: Panoramic radiographs (taken for orthodontic purposes) of 422 children (193 boys, 229 girls) aged between 5 to 15 years were evaluated. Willems’ method and the European formula were applied to estimate dental maturity. The total sample was divided into three groups (<7 years, 7-13 years, ≥13 years). Intraclass correlation (ICC) coefficients between estimated age and chronological age for each method and gender were reported separately. Furthermore, it was calculated how many individuals had an estimated age within error range of ±6 months.

RESULTS: The Willems’ method overestimated the age in both girls and boys (mean deviation 0.58 and 0.63, respectively) while the European formula underestimated the age in both genders (mean deviation 0.38). In individuals younger than 7 years, the highest ICCs were achieved with the European formula (0.609 in girls, 0.487 in boys). Willems’ method showed better results for individuals older than 13 years than the European formula (0.378 in girls, 0.600 in boys). In individuals between 7 and 13 years, the ICC was 0.900 in girls and 0.856 in boys with the European formula and 0.850 in girls and 0.812 in boys with Willems’ method. The European formula estimated the age in 47.6 per cent of girls and 42.5 per cent of boys within an error range of ±6 months. Nevertheless, Willems’ method reported similar results (45.4% in girls and 40.4% in boys).

CONCLUSION: Willems’ method is more appropriate for individuals older than 13 years and the European formula gives better results for individuals younger than 7 years. In individuals between 7 and 13 years there is no significant difference between the European formula and Willems’ method, yet, the European formula was found to be slightly more accurate. These results could be useful in determining the correct time to start orthodontic treatment.

EFFECTIVENESS OF VIDEO IN DELIVERING INSTRUCTION TO ORTHODONTIC PATIENTS: A REVIEW OF LITERATURE

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AIMS: At the commencement of orthodontic treatment, patients must have very good oral hygiene and they need to maintain it until the end of treatment. Treatment with fixed appliances requires extraoral hygiene care, as the components will predispose to plaque retention in the mouth. Hence, effective oral hygiene instruction must be provided to prevent future problems such as gingivitis and demineralization of enamel. However, little is known about how long patients retain the knowledge after receiving instruction. Thus, the aim of this review was to determine the effects of a video on oral hygiene behaviour and knowledge retention compared to other methods of instruction given to orthodontic patients.

MATERIALS AND METHOD: A literature search was conducted using electronic databases for articles published until November 2017. The search was performed using keywords: video, instruction, orthodontics, oral hygiene, information retention. English language papers and all types of studies were considered in this review.

RESULTS: The search with a combination of the keywords resulted in 33 articles. However, only five studies were relevant and used for this review. All of the studies were questionnaire based study and assessed the short-term (immediately after instruction) and up to 8 weeks for long-term. Four studies showed significant improvement of knowledge with video instructions, however, one study reported little difference among the methods of instruction used. For oral hygiene status, only two studies were found to evaluate plaque and gingival index before and after instructions were given. One study declared that there was no significant difference in oral health status between the methods while another showed significant improvement in a video instruction group.

CONCLUSION: The impact of knowledge retention is crucial as it facilitate patient compliance towards treatment. There is paucity in the literature regarding the effects of video instruction to orthodontic patients.
None of the studies assessed maintenance of the oral hygiene behaviour and retention of knowledge in follow-ups longer than 8 weeks.

**SP 281 A CEPhALOMETRIC ANALYSIS OF THE DIFFERENCES IN CRANIOFACIAL CHARACTERISTICS: STUDY FROM LARGE A SOUTHERN ITALIAN COHORT**

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AIMS: Reference standards for orthodontic diagnosis, such as linear and angular cephalometric measurements of the face and cranial base differ between girls and boys and change with age. Therefore, the aim of this cross-sectional study was to determine cephalometric standards in a large sample of children from the southern part of Italy.

MATERIALS AND METHOD: Initial lateral cephalograms of healthy children, with various types of occlusion and with no history of orthodontic treatment, were examined by one operator with no attempt to select only subjects with balanced and acceptable profiles. For the analysis 1059 lateral cephalograms of healthy children, between 8 to 12 years, with various types of occlusion, all with no history of orthodontic treatment before cephalometric analysis were examined. Seven angular and three linear measurements, and three ratios were considered. The angular measurements were SNA, SNB and ANB angles, the divergence angle SN^GoMe, the angle of the upper maxillary inclination PN^Pal, the upper and lower incisor inclination I^SN, i^GoMe. The three linear parameters were the length of the anterior cranial base Se-N, the length of the maxillary body PNS-A1, and the length of the mandibular body Go-Pg. The three ratios were the anterior cranial base to maxillary length Se-N/PNS-A1, the anterior cranial base to mandibular length Se-N/Go-Pg, and the maxillary to mandibular length PNS-A1/Go-Pg.

RESULTS: Changes in angular and linear parameters during the observation period occurred mostly between the ages of 10 and 12 years. The three ratios varied from age and were not characterised by a progressive rise in mean values. Se-N/Go-Pg was greater in 11 (P < 0.05) and 12 (P < 0.01) year-old boys; the crano-maxillary index Se-N/PNS-A1 was greater in 9-year-old girls (P < 0.05), whereas the maxilla-mandibular index PNS-A1/Go-Pg was greater in 9-year-old boys (P < 0.01).

CONCLUSION: The findings provided useful reference cephalometric normative measurements for the 8 to-12 year old southern Italian child population. Significant differences between boys and girls in the length of the anterior cranial base and ratio were observed.

**SP 282 REPRODUCIBILITY OF THE INDEX OF ORTHOGNATHIC FUNCTIONAL TREATMENT NEED SCORES DERIVED FROM PLASTER CASTS AND THEIR THREE-DIMENSIONAL DIGITAL EQUIVALENTS**

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AIMS: To determine the reproducibility of Index of Orthognathic Functional Treatment Need (IOFTN) scores derived from plaster casts and their three-dimensional (3D) digital equivalents.

MATERIALS AND METHOD: Thirty sets of plaster casts were selected to represent the pre-treatment malocclusions of patients requiring combined orthodontic-orthognathic surgical treatment. Casts were scanned using the 3Shape R1000TM desktop digital scanner and 3D models were produced using 3Shape OrthoAnalyzer™ computer software (3Shape Ltd, Copenhagen, Denmark). Four examiners independently determined the IOFTN scores for the plaster casts and digital models, on two occasions, two weeks apart, to test their inter- and intraoperator reliability. Additional information and clinical photographs were provided on all occasions.

RESULTS: Weighted kappa scores for intraoperator agreement with the major categories of IOFTN (1-5: treatment need) showed good to very good agreement for the plaster casts and digital models, with a range of 0.83 to 0.98 and 0.78 to 0.83, respectively. The weighted kappa scores for interoperator agreement with the ‘gold standard’ showed moderate to very good agreement, with a range of 0.58 to 0.82 for the plaster casts, and 0.65 to 0.92 for the digital models. Intraoperator agreement with the IOFTN sub-categories (1-14: feature of malocclusion) showed moderate to very good agreement for the plaster casts and digital models, with kappa scores with a range of 0.53 to 0.77 and 0.58 to 0.90, respectively. Interoperator agreement with the IOFTN sub-category gold standard showed moderate to good agreement for the plaster models, with a range of weighted...
kappa scores of 0.53 to 0.77; and moderate to very good agreement for the digital models, with a range of weighted kappa scores of 0.58 to 0.90.

CONCLUSION: There was moderate to very good intra- and interoperator reliability for both plaster and digital models, when using the IOFTN. It is concluded that digital models are an acceptable alternative to plaster casts for examining the malocclusion of those patients requiring combined orthodontic-orthognathic surgical treatment and determining treatment need.

SP 283 THE INFLUENCE OF INTERDENTAL SPACING ON PERCEIVED SMILE AESTHETICS
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AIMS: This cross-sectional study aimed to assess the influence of varying patterns and sizes of interdental spacing on perceived smile aesthetics amongst general dentists, orthodontists, lay people and children.

MATERIALS AND METHOD: A photograph of the ideal smile was digitally manipulated to display varying patterns and sizes of interdental spacing. In total, 25 images were shown per questionnaire to 40 participants in each group. Each photograph was aesthetically judged and ratings were recorded on a visual analogue scale (VAS).

RESULTS: The ideal image was preferred to interdental spacing by all groups ($P < 0.05$). The images with generalised spacing had a low VAS rating, and were deemed unaesthetic, compared to the ideal image. This result was statistically and clinically significant ($P < 0.001$). The difference in VAS scores between children and professional groups was statistically significant ($P < 0.05$), with children being the most critical group. A 0.5 mm increase in the size of the space, resulted in a statistically significant reduction in VAS ratings ($P = 0.00$).

CONCLUSION: Interdental spacing is disliked by all groups, and the size and pattern of spacing has an influence on aesthetic perception. Professional groups tolerated interdental spacing more than the lay groups. The large variation in VAS ratings highlights that aesthetics can mean different things to different people at different times.

SP 284 THREE-DIMENSIONAL IMAGING VERSUS TWO-DIMENSIONAL RADIOGRAPHY FOR CEPHALOMETRIC MEASUREMENTS
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AIMS: To compare two-dimensional (2D) lateral cephalometric radiography (LCR), 2D cone beam computed tomographic (CBCT) generated cephalogram and three-dimensional (3D) CBCT for assessing cephalometric measurements.

MATERIALS AND METHOD: The LCR, CBCT-generated cephalogram and CBCT images were taken and collected from 60 subjects. Eleven angular and 11 linear measurements were performed on all images. One-way ANOVA and the least significant difference test were used for statistical comparisons. Pearson’s correlation and Pearson chi-square test were used to assess the relationship of these imaging modalities for vertical cephalometric analyses.

RESULTS: There were significant differences between the 2D cephalograms (LCR and CBCT-generated cephalogram) and the 3D CBCT in two angular (U1-NA and L1-NB; $P = 0.027$ and $P < 0.001$, respectively) and five linear measurements (NMe/SGo, CoA, CoGn, Go-Me and ANS-PNS; $P < 0.004$). These measurement values with significant differences were generally greater (approximately 5° for angular measurements and 10 mm for linear measurements) on the 3D CBCT than on the 2D cephalograms. No significant difference was found between the two 2D cephalograms ($P > 0.164$). No significant difference was found among the three imaging modalities for the vertical cephalometric analyses ($P > 0.466$).

CONCLUSION: There were significant differences between the 2D cephalograms (LCR and CBCT-generated cephalogram) and the 3D CBCT in two angular and five linear measurements. The two 2D cephalograms were similar for cephalometric measurements. The three imaging modalities showed no significant difference for the vertical cephalometric analyses. The CBCT might not add value for every orthodontic situation.

SP 285 ORTHODONTIC TREATMENT RESULTS – ASSESSMENT AND MAXILLARY SUPERIMPOSITIONS
AIMS: To identify the mandibular superimposition method used by orthodontists in the evaluation of orthodontic treatment results, as well as to understand if there was a differentiated choice for cases with and without growth.

MATERIALS AND METHOD: The sample included 76 case reports from the American Journal of Orthodontics and Dentofacial Orthopedics, published in 2012 and 2013. Descriptive data analysis was performed using the IBM® SPSS® Statistics program, version 24. In the analytical study of the relationship between the two qualitative variables, the Chi-square independence test was used. Significant statistical evidence was found for values of probability less than 0.05.

RESULTS: Of the 76 clinical articles analysed, 71 (93.4%) presented two-dimensional lateral cephalometric superimpositions and five (6.6%) did not. In the 71 mentioned publications, only 46 (64.8%) manuscripts had attached maxillary superimpositions. In 20 (43.5%) of the articles with maxillary superimpositions, the method used is unknown. Considering the anatomical structures drawn and the superimposed areas, it was considered that only in one article (2.2%) could the Doppel’s structural technique be selected. In eight (42.1%) of the 19 clinical cases where the Doppel’s maxillary superimposition could not have constituted the option, there was growth. In the remaining 56.5 per cent (n = 26), linear maxillary superimposition methods were the most frequent (65.4%). All linear superimpositions (n = 17) were performed in the palatal plane, making a total of 76.5 per cent (n = 13) and 23.5 per cent (n = 4) in adults and children, respectively. No element of the sample was found in which the Doppel’s structural method had been applied. Björk’s maxillary superimposition was performed in only one case (3.8%). Of the linear ones, the most prevalent was the one that used the anterior nasal spine (Ans) as registration point (76.5%). No statistically significant association was found (X² = 8.576, gl = 9, P = 0.477) between growth and the preferred maxillary superimposition method.

CONCLUSION: For maxillary linear superimposition in the palatal plane, Ans, was the most frequently used. No statistically significant differences were found for the selected method in cases with and without growth.

AIMS: To identify the mandibular superimposition method that is preferably used by orthodontists to evaluate the results of orthodontic treatment, as well as to understand if the option was related to the presence or absence of growth.

MATERIALS AND METHOD: The sample, with 76 elements, included the American Journal of Orthodontics and Dentofacial Orthopedics ‘case reports’ published in 2012 and 2013. All data, collected by a single observer, was analysed using the IBM® SPSS® Statistics, version 24 software. In the analytical study of the relationship between the two qualitative variables, the Chi-square independence test (P = 0.05) was used.

RESULTS: Of the 76 clinical articles examined, 71 (93.4%) presented lateral two-dimensional cephalometric superimpositions while five (6.6%) did not. In the 71 mentioned publications, only 45 (63.4%) clinical cases had mandibular superimpositions. In 20 (44.4%) of the articles with coupled mandibular superimpositions, the method used was unknown. Taking into account the anatomical structures drawn and superimposed, it was considered that only in three manuscripts (6.7%) could Björk’s mandibular structural method have been selected. In six (35.3%) of the 17 clinical cases where Björk’s mandibular superimposition could not have been the option, there was growth. In the remaining 25 (55.6%), mandibular linear superimposition methods were the most frequent (64%). Björk’s mandibular superimposition was performed in only one case (4%). Of the linear (n = 16), the most prevalent was achieved in the mandibular plane at menton point (62.5%), making a total of 70 per cent (n = 7) and 30 per cent (n = 3) for adults and children, respectively. There was no statistically significant association (2 = 7.918, gl = 11, P = 0.721) between growth and the preferred mandibular superimposition method, so the two conditions may not be related.
CONCLUSION: The mandibular plane at menton point superimposition was the most frequently used. No statistically significant differences were found for the selected method in cases with and without growth.

SP 287 ROLE OF AUTOPHAGY IN ORTHODONTIC TOOTH MOVEMENT

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AIMS: Autophagy is a cellular mechanism of adaptation. On the one hand autophagy can secure survival of cells while on the other it can lead to cell death. It is still unknown if biomechanical loading, as applied during orthodontic tooth movement, can lead to autophagy in human primary periodontal ligament (PDL) fibroblasts and if autophagy varies with the magnitude of force. This study was conducted to investigate if autophagy is involved in the adaption to biomechanical loading in PDL fibroblasts.

MATERIALS AND METHOD: PDL fibroblasts were exposed to biomechanical loading in three different settings: low continuous tensile strain, high continuous tensile strain and low cyclic tensile strain. At the transcriptional level autophagy associated genes were analyzed by the means of special polymerase chain reaction assays. At the post-transcriptional level, flow cytometry and immunoblotting were used to quantify autophagy. Furthermore an Ingenuity Pathway Analysis® (Qiagen) was conducted. For statistical analysis ANOVA and post-hoc tests were applied.

RESULTS: Biomechanical loading caused pronounced changes in gene expression in multiple autophagy associated genes. Regulated targets varied with different settings of biomechanical loading. Especially high continuous tensile strain lead to a plethora of regulated targets, such as autophagy-related genes (ATGs), namely ATG4C, ATG7, and ATG10, which were significantly downregulated. ATG4C, ATG7, and ATG10 encode for proteins which are important for the formation of autophagosomes and therefore the perpetuation of the autophagic flux. Interestingly at the post-transcriptional level an enhanced level of autophagosomes was found under high continuous tensile strain.

CONCLUSION: These findings provide the first evidence that autophagy could play a key role in the adaption to biomechanical loading in PDL cells. Therefore, autophagy might be an important process in orthodontic tooth movement controlling survival and death of PDL cells dependent on the force applied.

SP 288 AUTOMATED ANALYSIS OF THREE-DIMENSIONAL DIGITAL MODELS IN PATIENTS WITH A CLEFT LIP AND PALATE

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AIMS: To assess maxillary arch width and dental arch relationships on three-dimensional digital models of patients with a cleft lip and palate (CLP), using an automated software tool which calculates the modified Huddart and Bodenham index (MHB).

SUBJECTS AND METHOD: A consecutive sample of 73 patients (47 male, 26 female) was selected. The sample included 45 subjects with a unilateral CLP; 14 with a bilateral CLP; nine with a cleft palate and five with cleft soft palate. All patients underwent alginate impressions for the construction of plaster models before orthodontic treatment (mean age 7.2 ± 2.7 years); for 30 patients with UCLP dental casts taken at the end of the interceptive orthodontic treatment were also available (mean age 9.2 ± 3.0 years). All plaster casts were scanned and exported as STL files. The digital models were landmarked for automatic scoring using a software plug-in: overjet, intercanine and intermolar widths were measured; additionally, MHB score was automatically calculated, following a method previously described by other authors. After a one-month interval, the same examiner repeated the landmark identification on 30 models randomly selected. Intraobserver reproducibility was tested using Pearson’s and Linn’s coefficients. Statistical analysis was performed to compare the investigated variables between the cleft groups (ANOVA) and to assess longitudinal changes within the UCLP group (paired Student’s t-test). The significance level was set as P < 0.05.
RESULTS: Intraobserver reproducibility was substantial (Pearson’s r and Linn’s ccc = 0.96). A statistically significant difference was found for MHB score between the groups. A statistically significant improvement of intercanine distance and MHB score was observed after orthodontic treatment in UCLP patients.

CONCLUSION: The digital automated system is a new, objective and reliable method for the assessment of surgical and orthodontic outcomes. Automatic MHB scoring is accurate to quantify interarch discrepancy among various cleft sub-phenotypes. Orthodontic treatment improved maxillary arch width and dental arch relationship, providing a differential expansion in anterior region.

SP 289 LIP MORPHOLOGICAL CHANGES IN CLASS II DIVISION 1 MALOCCLUSION BEFORE AND AFTER ORTHODONTIC TREATMENT

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AIMS: To review the current literature relating to the methodology used in assessment of lip morphological changes before and after orthodontic treatment in Class II division 1 malocclusions.

MATERIALS AND METHOD: A literature search was carried out. The search, across electronic databases, including PubMed, Google Scholar and EBSCOhost, was undertaken using the central keywords: ‘Class II malocclusion’ ‘lip morphology’ ‘orthodontic treatment’ and ‘morphometry’. Only English articles from the years 2012-2017 that fulfilled the inclusion criteria were included. Case reports and articles that involved subjects that underwent orthognathic surgery were excluded.

RESULTS: The initial search using the central keywords yielded a total of 211 articles. Several articles were excluded using the exclusion criteria which in turn yielded 15 articles. These 15 articles highlighted the various literature relating to the different approaches used in determining lip morphological changes in Class II division 1 malocclusion after orthodontic treatment. Most of the methodology carried out to determine lip morphological changes used linear measurements from either two- or three-dimensional imaging.

CONCLUSION: Further searches of literature focussing on morphometric techniques utilizing three-dimensional data and its application in orthodontics will provide an insight on the future direction of research within this area besides enabling an understanding of the effect of orthodontic treatment lip morphology in greater depth.

SP 290 TORQUE CONTROL EFFICACY OF ELASTOMERIC LIGATURES FOR LINGUAL APPLIANCES OVER TIME: AN EXPERIMENTAL STUDY

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AIMS: To investigate the torque control efficacy of elastomeric ligatures in a customized lingual appliance over time.

MATERIALS AND METHOD: A home-made typodont was built and bonded with Incognito® customized lingual brackets (3M Unitek). The tested wire was a 0.016 × 0.022 nickel-titanium and two different ligatures were evaluated: Alastik™ O-ring ligatures (3M Unitek) and Alastik™ lingual ligatures (3M Unitek). An extension was laser-welded to the bracket of one missing tooth in order to apply the forces necessary to study the system. A universal testing machine was used to apply forces to the system, using forces from 0 to 1 N. The TestXpert® II software was used for data collection. The torque moment was calculated by multiplying the force applied through the arm at the start of loading (T0). The torque angle was algebraically calculated: the ZwickLine® machine measures also the displacement performed by the extension, knowing the displacement and the arm the sine of the torque angle can be derived. The same tests were repeated after one month (T1), without changing the ligatures. During this period the specimens were kept in a saline solution.

RESULTS: At T1 for each ligature the torque control was similar to that recorded at T0. This finding was evident for both ligatures (O-ring ligature and Alastik lingual ligature).

CONCLUSION: At T1 both elastomeric ligatures showed a good persistence of torque control.

SP 291 COMPARISON OF PEER ASSESSMENT RATING SCORE CHANGES AFTER PHASE 1 TREATMENT FOR CLASS II DIVISION 1 MALOCCLUSIONS WITH TWO FUNCTIONAL APPLIANCES
AIMS: In a single centre prospective randomised clinical study to investigate a number of oral health outcomes including occlusal changes [Peer Assessment Rating (PAR) scores] with Phase 1 functional appliance (modified Clark Twin-Block (MCTB) or Fränkel II (FR2) treatment in the management of a Class II division 1 malocclusion in growing children.

SUBJECTS AND METHOD: Sixty patients were randomly allocated to treatment with either a MCTB or a FR2 appliance. The MCTB and FR2 were made to standardised designs. PAR1 scoring of pre- and post-treatment (when a Class I incisor relationship was achieved) study models was undertaken by a calibrated examiner blind to the treatment allocation group.

RESULTS: Twenty-two patients (12 females; 10 males) with a mean age of 13.4 ± 0.8 years and a mean starting overjet of 10.1 ± 1.3 mm completed treatment with a MCTB. Twenty patients (13 females; 7 males) with a mean age of 12.7 ± 1.2 years and a starting overjet of 11.1 ± 1.3 mm completed treatment with a FR2. There was no significant difference in mean change in PAR score from pre- to post-treatment with either appliance (MCTB: Pre 41.2 ± 7.5, Post 23.9 ± 11.9; FR2: Pre 43.5 ± 10.5, Post 23.9 ± 15.3) (P =0.4471). The mean change in PAR score for the MCTB and the FR2 appliance groups was 17.3 and 19.6, respectively, which indicates an overall ‘improved’ occlusion. Within each treatment group, however, the breakdown of the number of cases with ‘greatly improved’, ‘improved’ and ‘no change’ were 8, 8 and 6 for the MCTB and 10, 6 and 4 for the FR2.

CONCLUSION: PAR score change following Phase 1 treatment with an MCTB or FR2 appliance in this study indicated equal effectiveness for both appliances.


SP 292 SHORT- AND LONG-TERM PHYSICIAN- AND PATIENT-REPORTED OUTCOMES OF ONCOLOGIC AND HEALTHY SUBJECTS TREATED ORTHODONTICALLY – CASE CONTROLLED STUDY

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AIMS: Patient-reported outcome, being a health outcome directly reported by the patient who experienced it, has gained attention in recent years. Therefore, the aim of this study was to compare short- and long-term physician- and patient reported outcomes between onologic and healthy subjects.

SUBJECTS AND METHOD: The study included cancer-survivors and patients in maintenance therapy treated orthodontically between 2008 and 2014 (31 males, 25 females; median age 20.4 years). Moreover, 56 healthy control subjects matched for age, gender, and malocclusion served as the control group. Thirty five, eight and 13 patients were skeletal Class II, III and I, respectively. The Peer Assessment Rating (PAR) Index and the Index of Complexity, Outcome and Need (ICON) were assessed before treatment, after treatment and at the 3-year follow-up and compared with patient reported outcomes (including the patients’ expectations questionnaire, the Oral Health Impact Profile and patient satisfaction score). A repeated ANOVA was used to test the statistical relationship of the scores.

RESULTS: An appropriate occlusion was achieved in all patients with mean PAR scores of 4.2-6.3 in both study groups. The reduction in PAR score was on average 82.5 and 80.4 per cent in the control and onologic patients group, respectively. At follow-up, the average PAR score reduction significantly decreased for the cancer-survivor group which was not the case in the control group (72.3 versus 78.7; P < 0.05). Similar results were achieved in the ICON score. Significantly more complications were observed in the onologic group. The patients’ expectations were significantly higher in the control group. The overall quality of life (QoL) improved significantly after treatment (median number of subjects with oral health impact 7 versus 2; P < 0.05). However, there was no significant difference in QoL before or after treatment between the groups. Male onologic
patients reported significantly lower QoL during the treatment (38% versus 23%; \( P < 0.05 \)). There was no significant change in the patients’ satisfaction score.

CONCLUSION: The physician reported outcomes were comparable in both groups. However, patient reported outcomes were significantly different in the oncologic group, particularly in the male oncologic patients. These results allow for a more balanced planning of the orthodontic treatment in this group of patients.

SP 293 THE EFFECTIVENESS OF ORTHODONTIC TREATMENT USING TIGGLE BRACES
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AIMS: Tiggle braces are a tiny tube-shaped lingual orthodontic appliance with a high aesthetic and little foreign body sensation. It is used for partial orthodontic treatment of upper and lower anterior teeth. The purpose of this study was to quantitatively assess orthodontic treatment outcomes using Tiggle braces.

MATERIALS AND METHOD: This study was conducted in 2015-2016. Records of 20 patients were evaluated using methods from the American Board of Orthodontics Phase III examination. The discrepancy index (DI) was also used to analyze the state of patient. The Peer Assessment Rating Index and Index of Orthodontic Treatment Need (IOTN) was used systematically to grade for initial severity of malocclusion. \( P < 0.05 \) was used to determine statistically significant differences.

RESULTS: The average pre-treatment score with weighting was 16.6. And after treatment PAR score diminished to 4.55. Compared with the initial malocclusion, alignment and overjet improved but for buccal occlusion, overbite and the centreline there were no significant changes. The pre-treatment group, on average, lost ABO-OGS points more than the post-treatment group. The DI also changed similar to ABO-OGS points. For patients who were grade 2 or 3 of the IOTN and underwent treatment an improvement was obvious.

CONCLUSION: These data suggest that partial orthodontic treatment using Tiggle braces is useful.

SP 294 ASSOCIATIONS BETWEEN AMOUNTS OF ANTEROPosterior JAW SETBACK AND CHANGES IN DENTAL ARCH WIDTHS IN CLASS III SURGICAL ORTHODONTIC PATIENTS
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AIMS: In treatment planning in surgical orthodontics, it is essential to consider the intraoperative movement of the jaws and accordingly adjust the dental arch width (DAW) pre-operatively not only to achieve correct jaw movement during surgery but also to obtain a stable occlusion after surgery. Peri-operative changes in maxillary and mandibular DAW in Class III surgical orthodontic patients were measured to identify any consistent trends between the maxillary and mandibular DAW and to investigate associations between changes in DAW and anteroposterior movement of the jaws.

MATERIALS AND METHOD: The subjects of this retrospective study were 11 Class III surgical orthodontic patients who underwent mandibular setback surgery and 11 non-surgically treated orthodontic patients (age- and tooth extraction site-matched controls). Plaster dental models and lateral head films at the initial visit (T1) and post-treatment (T2) were examined. DAW was measured as the distance between the first molars for both the maxillary and mandibular arches on the plaster dental models. Then, the anteroposterior skeletal movement of the upper and lower jaws was analyzed on the head films using Pancherz’s analysis (1982). Based on the plaster model and cephalometric measurements, changes in maxillary and mandibular DAW and anteroposterior skeletal movement of the upper and lower jaws were measured and associations between them were evaluated.

RESULTS: Skeletal and dental parameters differed significantly between the surgical orthodontic patients and controls. The surgical orthodontic patients showed significantly decreased maxillary DAW at T2 but no significant change in mandibular DAW. The correlation coefficient for maxillary and mandibular DAWs increased from 0.51 (T1) to 0.73 (T2), and a linear approximation of T2 maxillary and mandibular DAW was \( y = 0.63 \times +17.14 \). Surgical orthodontic patients with larger anteroposterior movements of the upper and lower jaws had greater changes in maxillary and mandibular DAWs, and the changes were weakly correlated with the amount of skeletal movement of the jaws.
SP 295 IMPACTED TEETH AND THEIR TREATMENT IN JAPANESE ADOLESCENTS
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AIMS: Impacted teeth were often encountered in orthodontic practice. Impacted teeth affect the development of adjacent teeth, the dentition and alveolar bone. The purpose of this study was to investigate the actual condition of Japanese adolescents with impacted teeth.

MATERIALS AND METHOD: Orthodontic examination data of 66 patients with impacted teeth who attended from 2000 to 2015. The gender, age, the site and the number of the impacted tooth, the direction of the tooth, the cause, the type of the malocclusion, the treatment plan and the deformation of the tooth root were investigated.

RESULTS: The average age of the patients was 12 years 1 month. They were 27 males and 39 females. There was no difference in impaction frequency between left and right side. The maxillary central incisors and canines were the teeth most frequently impacted, 23 and 26 respectively. Impaction of the mandibular incisors, both first premolars and the maxillary second molars was not observed. The directions of the teeth were normal, inverted or horizontal (65, 6, and 10 subjects, respectively). They had various types of malocclusion, the main symptoms were crowding, reversed occlusion, spaced arch etc. There were obvious causes such as odontoma, cyst or supernumerary tooth etc., but most of them were unknown. In 51 patients the impacted teeth were orthodontically moved from lingual arch after fenestration and in only one subject was the impacted tooth extracted.

CONCLUSION: The cause of the impaction could not be fully understood. For half of the teeth that were moved orthodontically in the root incomplete period the shape of the root was affected. However, almost no root resorption was observed. Future research will focus on whether deformity of the root can affect prognosis.

SP 296 SHORT-TERM ORTHODONTICS: WHAT IS THE CURRENT EVIDENCE?
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AIMS: In recent years a vast array of short-term orthodontic (STO) systems have been introduced. These are commonly used by general dental practitioners to provide patients with ‘fast orthodontics’. STO is considered to be a quicker alternative to conventional orthodontics as it aims to align the anterior teeth only. The aims of this study were to review the current evidence with regards to STO and to compare and contrast the different STO systems currently available.

MATERIALS AND METHOD: The literature was reviewed using Medline, Embase and Web of Science databases including all studies up to November 2017. The search terms included the following keywords: ‘clear aligner’, ‘short term orthodontics’, ‘fast orthodontics’, ‘Inman’ and ‘Invisalign’ and included research published in the English language only. First, the titles were sorted to identify relevant papers, then the abstracts of these papers were subsequently reviewed and full text articles of relevant papers were analysed.

RESULTS: There are multiple systems currently used to deliver STO. However, the review revealed no relevant studies of high quality (apart from opinion papers) to support the use of STO nor to compare the different systems.

CONCLUSION: This review has revealed that the evidence base to support STO as a treatment option is limited and of poor quality. Specific treatment aims and objectives should be discussed based on the presenting complaint of the patient, complicating factors and the patient’s wishes. Patients need to be informed about the limitations of the evidence supporting STO as a treatment option and made aware of the alternatives available. STO implies a short treatment time however the long-term outcomes should be as stable and predictable as comprehensive orthodontics. STO maybe a viable treatment option in carefully selected cases however, clinicians and patients need to be aware of its limitations.
AIMS: Although several prescriptions and techniques exist for comprehensive fixed appliance treatment, their treatment effects have not yet been adequately assessed in an evidence-based manner. The aim of this systematic review was to assess the therapeutic and adverse effects of various prescriptions or techniques for orthodontic appliances from randomized clinical trials on human patients.

MATERIALS AND METHOD: Eight databases were searched up to November 2017 for randomized trials assessing any orthodontic prescriptions or techniques in human patients. After elimination of duplicate studies, data extraction, and risk of bias assessment according to the Cochrane guidelines, random effects meta-analyses with mean differences (MD) and their 95 per cent confidence intervals (CIs) were performed.

RESULTS: Compared to Roth pre-adjusted appliances, both Begg and modified Begg appliances were associated with statistically significantly worse occlusal outcomes assessed with Peer Assessment Review (PAR) scores (1 trial, MD 3.1 points, 95% CI 1.9-4.3 points and 1 trial, MD 2.4 points, 95% CI 1.2-3.6 points, respectively) with a low quality of evidence, due to bias and imprecision. Compared to a partially programmed fixed orthodontic appliance, a fully programmed appliance was associated with a statistically significant, but clinically irrelevant increase in treatment duration (1 trial, MD 2.4 months, 95% CI 0.6-4.2 months), supported by a high quality of evidence. However, caution is needed in the interpretation of these results as only a limited number of small trials with methodological issues were available.

CONCLUSION: Based on existing trials, there is limited evidence to support any robust clinical recommendation regarding the prescriptions or techniques for fixed orthodontic appliances.

Registration: PROSPERO (CRD42016042727).

SP 298 TIMING OF THE PUBERTAL GROWTH SPURT IN PATIENTS WITH CLEFT LIP AND/OR PALATE: A CROSS-SECTIONAL RADIOGRAPHIC EVALUATION

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AIMS: The timing of the pubertal growth spurt has been reported to be a determining factor in the management of maxillary hypoplasia related to various types of orofacial clefts. However, there is no unambiguous evidence regarding the timing of the pubertal growth spurt in cleft patients. Therefore, the aim of the present study was assessment of skeletal maturity as well as investigation of the presence of a delayed growth spurt in adolescent cleft patients.

MATERIALS AND METHOD: A sample of 72 (42 males, 30 females) cleft-patients and 211 (95 males, 116 females) non-cleft patients was derived from the Centre for Congenital Facial Anomalies and/or the Department of Orthodontics at Ghent University Hospital. Lateral cephalograms were retrospectively obtained and subsequently assessed according to the cervical vertebral maturation method. The following age intervals were considered eligible: 12-16 years (males) and 10-14 years (females). A non-parametric test for independent samples (Mann-Whitney U test) was used to evaluate between-group differences, while a model for ordinal regression was set up to investigate if clefting affects the timing of the pubertal growth spurt \( P < 0.05 \).

RESULTS: Cleft patients of both genders reached maturational phases at a later age compared to non-cleft adolescents. Eleven- to thirteen-year-old females and 13 to 14 year-old males had a significant variation in the distribution of cervical stages. Age, gender, and the presence of an orofacial cleft were determined as predictive parameters of the skeletal maturational status.

CONCLUSION: Cleft patients run a higher risk of developing a delayed growth spurt. It is therefore of utmost importance to identify each patient’s individual maturational status in order to optimally time dentofacial orthopaedics.

SP 299 THE INFLUENCE OF LINGUAL BRACKETS ON INTRAROAL SCAN PRECISION – A PHANTOM HEAD STUDY

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AIMS: To evaluate the influence of the presence of lingual brackets on the precision of digital impressions taken with three different intraoral scanners.

MATERIALS AND METHOD: One single plastic cast bonded with lingual brackets provided by 3M (Incognito, Monrovia, USA) was used for all scanning procedures. The cast was scanned both extraorally (fixed on a flat surface) and mounted on a phantom (dry and dampened with water). Three different scanning systems (3M True Definition Scanner, 3Shape Trios® scanner, Carestream Dental CS 3600 scanner) were used. The standardized landmarks were measured using image-analysis (Materialise Mimics® 18.0). All measurements were performed twice with at least a two-week interval. The error of the methods was calculated using Dahlberg’s formula.

RESULTS: The double measurement comparisons of either the setting for the different systems or the systems for the different settings showed statistically significant differences. For complete-arch scanning of lingually bonded casts, all three scanning systems delivered acceptable results. The Trios® 3 shape scanner was found to be the most precise. Mean differences ranged from 0.03 to 0.42 mm for maxillary scans and from 0.03 to 0.6 mm for mandibular scans. The Trios® 3Shape scanning system showed, in general, the smallest differences, ranging from 0.02 mm for mandibular intraoral dry scanning to 0.06 mm for maxillary intraoral dry scanning. The Carestream scanning system had the widest range of differences with very low values of 0.03 mm for mandibular extraoral scanning to 0.42 mm for maxillary extraoral scanning. The True Definition scanning system showed a low range of differences, ranging from 0.04 mm for maxillary extraoral dry scanning and mandibular intraoral dry scanning to 0.08 mm difference in maxillary intraoral dry scans.

CONCLUSION: Mandibular scans seem in general to have a higher accuracy than maxillary scans, independent of dry or wet environments. No decrease of scan precision due to water or powder was detected. Further studies are needed to validate the accuracy of these scanners under clinical conditions for full-arch scanning in lingual patients.

SP 300 DEVELOPMENT OF A NEW SUPERIMPOSITION TECHNIQUE FOR OBTAINING THREE-DIMENSIONAL FACIAL IMAGES

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AIMS: To devise a new superimposition technique for three-dimensional (3D) facial images based on the conventional cephalometric superimposition method and to examine the accuracy of the technique.

MATERIALS AND METHOD: The surface image of a phantom human head (Kyoto Kagaku, Co. Ltd., Japan) was recorded using a 3D surface imaging device (3dMDcranial System, 3dMD, USA) and the phantom was radiographed using a cephalometric X-ray system (CX-150W, Asahi Roentgen Ind., Co. Ltd., Kyoto, Japan). The 3D surface and cephalometric digital data were integrated twice at four points, the glabella, nasion, pronasale, and subnasale (first integrated image, second integrated image, respectively). The first and second integrated images were superimposed based on the conventional cephalometric superimposition method (Body-Rugle, Medic Engineering, Kyoto, Japan). The 3D coordinates for the glabella, nasion, pronasale, subnasale, labrale superius, stomion, and labrale inferius were identified five times on the first and second integrated images. Statistical analysis was performed to investigate the significance of differences between the 3D coordinates in the first and second integrated images.

RESULTS: There were no significant differences in the positions of the glabella, nasion, pronasale, subnasale, labrale superius, stomion, and labrale inferius on the first and second images.

CONCLUSION: The new superimposition technique for 3D facial images shows a high degree of accuracy.

SP 301 SERVICE REVIEW OF ORTHOGNATHIC PATIENT SATISFACTION AND OCCLUSAL OUTCOMES USING THE PEER ASSESSMENT RATING INDEX AND INDEX OF ORTHOGNATHIC FUNCTIONAL TREATMENT NEED

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AIMS: To ensure orthognathic patients are selected correctly, treated effectively and patients are satisfied with the results. This is to justify the service at Forth Valley Hospital, to find the effectiveness of occlusal outcome using the Peer Assessment Rating (PAR) index (75% of patients should have reduction of pre- to post-treatment PAR scores by 70% and less than 3% of patients should have a reduction less than 30%); to determine if the selection of patients for treatment meets the Index of Orthognathic Functional Treatment Need (IOFTN standard of need (100% of patients treated to score IOFTN 4 or 5) and to measure patient satisfaction against standards through a telephone questionnaire (90% should feel they achieved their treatment goals, willing to recommend it to others, satisfied with information given prior to treatment. A positive mean change in patient perception of bite, appearance (dental and facial), and chewing ability).

MATERIALS AND METHOD: Data was collected from patients who attended the joint orthodontic-orthognathic clinic from June 2013 to February 2017. Forty four patients had the required records for occlusal analysis and 21 of these responded to the telephone questionnaire. Subjects were scored for PAR and IOFTN by a team-member. Another team-member re-scored 10 cases and an inter-rater agreement (Cohen Kappa analysis) was carried out. For patient satisfaction, bite, appearance (dental and facial), and chewing ability, before and after treatment were each given a score out of 10 for satisfaction by the patient. Other questions such as whether their goals were achieved were a yes or no answer.

RESULTS: One hundred per cent of subjects had a pre-treatment IOFTN of either 4 or 5. All subjects had a PAR reduction of 70 per cent or more. All subjects scored good inter-rater agreement and Cohen Kappa analysis. The treatment goals were achieved in 100 per cent of subjects and 100 per cent would recommend it to others or undertake it again. Ninety five per cent were satisfied with the information given pre-treatment. Patient perception of bite, chewing ability, and appearance all showed improvement in mean score.

CONCLUSION: Overall the orthognathic cases were selected correctly, the occlusion was treated effectively and patients were pleased with the results. As a service in this cost-cutting environment, its continued presence in the National Health Service could be justified by this service evaluation.

SP 302 CROSS-SECTIONAL ANALYSIS OF PSYCHOLOGICAL ASSESSMENT FOR ORTHOGRANTHIC PATIENTS IN SCOTLAND
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AIMS: The psychosocial effect of dento-facial abnormalities is often great but can be vastly improved. However for some, although their treatment outcome may be a technical success they are still unhappy with the result. Sufferers of body dysmorphic disorder (BDD) are more likely to seek surgery and are more likely to be hypercritical with the outcome. Therefore it is prudent to have a method of identifying these patients, however there are no standards on this so each area may act differently. The aim of this study was to find the practices and resources available to orthognathic teams in Scotland for psychological assessment.

MATERIALS AND METHOD: A 10 question survey was sent to the Scottish consultant orthodontist and orthognathic surgeons group. The survey asked the following: location of the consultant’s work; whether they had undergone training for psychological assessment; how the patient was assessed; psychologically at the initial referral; whether a clinical psychologist was part of the team; if they believe all patients should have a psychological assessment prior to treatment; whether psychological counselling was available post treatment.

RESULTS: Six surgeons and 15 orthodontists across eight of the 14 health boards responded. Not all health boards have orthognathic services. Seven out of eight health boards have a referral service with one needing to use the neighbouring health board. One out of 15 orthodontists had some psychological training whereas three out of six surgeons do from medical training. One in eight health boards had a psychologist as part of their regular team. Others referred based on the clinician’s impression of the patient. How many patients are referred ranged from 1/10 to as few as 2-3 per year. Four out of eight health boards had post-treatment counselling services. Seven out of 15 orthodontists believed every patient should have a psychological assessment whereas 1/6 surgeons believed this.

CONCLUSION: There are differing practices for psychological assessment across Scotland particularly in services available post-treatment. Where patients must be referred, the numbers referred are low relative to the numbers treated. Opinions vary on whether all patients should be assessed. What benefit this has needs to be explored for an evidence base to aid decision-making on service provision.
SP 303 EFFECTIVENESS IN THE PLACEMENT OF SPACE MAINTAINERS IN THE LOSS OF SPACE AFTER EXTRACTION OR EARLY LOSS OF TEMPORARY TEETH

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AIMS: To evaluate, through a bibliographic review, the effectiveness of the placement of space maintainers in the prevention of space loss after premature loss of temporary teeth.

MATERIALS AND METHOD: A bibliographic review was performed in the following databases: PubMed (MeSh Database), Medline, Science Direct, EMBASE, Google Scholar and Cochrane. The key words combinations used were: ‘efficacy’, ‘effectiveness space maintainer’, ‘space loss’ and ‘space management’.

RESULTS: The premature loss of temporary teeth is one of the aetiological factors in the final malocclusion, which will depend on the type of tooth lost and the time when the loss occurred. The aetiology is multifactorial and has been associated with different factors. Adequate management of the space depends on several elements, such as the patient’s dental age, dental path pattern and sequence, amount of alveolar bone covering the permanent tooth, time elapsed since extraction, degree of crowding, space available in the arches and patient cooperation in both dental procedures and maintenance of good oral hygiene. The choice of whether or not to place a space maintainer, as well as the type, corresponds to criteria such as: when the tooth is lost, how many dental units have been lost, the presence or not of the permanent successor, the level of cooperation of the patient and the oral health.

CONCLUSION: The use of space maintainers after the premature loss of primary teeth, is effective in maintaining space. The placement must be carried in the first 6 months after tooth loss. For some authors, the placement is unnecessary when a first temporary molar is lost and the first permanent molars have already erupted and maintain a correct interdigitation with each other. The lingual arch is an effective space maintainer, maintains the arch perimeter at the expense of proclination of the lower incisors and also exerts good vertical control over the molars.

SP 304 AN AUDIT OF TREATMENT DURATION OF PALATALLY IMPACTED CANINES

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AIMS: To determine if the following recommendations, from a previous audit carried out at Dundee Dental Hospital (DHH) and School in 2009, were being followed: >80 per cent of clinicians should estimate orthodontic treatment duration, for exposed palatal canines, as 30-36 months on the written consent form; >80 per cent of patients should have their orthodontic treatment carried out within the estimated time on the written consent form.

MATERIALS AND METHOD: A retrospective audit of all patients, who attended DDH between 2010 and 2013 and had ectopic maxillary canines surgically exposed and aligned with fixed appliances. Patients were identified as requiring exposure cover plates using the Topas© laboratory booking software. Twenty-nine patients were identified. Data was collated and analysed using Microsoft Excel 2010©.

RESULTS: Data from 29 patients with 36 canines exposed was collected (a proportion of 21:8 female to male patients). Twenty-two patients had unilateral canine exposure and nine bilateral exposures. Twenty-five patients had written consent in their notes and four patients had no evidence of written consent. Sixty-six per cent of patients had their orthodontic treatment carried out within the estimated time on their consent form. Twelve patients (48%) exceeded their estimated time.

CONCLUSION: The audit standards set by were not met. Clinicians continue to underestimate the duration of fixed appliance treatment to align exposed palatally impacted upper canines. Only 52 per cent of patients completed active orthodontic treatment within the estimated time written on their orthodontic consent form. The following recommendations have been made: patients should be consented for 30-36 months of active
orthodontic treatment for exposed palatally ectopic canines. Patients should be advised that 66 per cent of patients complete treatment within 30 months.

SP 305 ASSESSMENT OF THE DENTAL EFFECTS OF A HYBRID HYRAK
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AIMS: To analyse the dental effects of rapid maxillary expansion (RME) using a Hybrid Hyrax.
SUBJECTS AND METHOD: Patients were assessed for eligibility and 12 of them (mean age: 14.0 years) met the requirements (did not have any prior orthopaedic or orthodontic treatment, accompanying disease or craniomaxillofacial discrepancy) and agreed to participate. A Hybrid Hyrax was used (anchored with two or four miniscrews) for RME. Two upper impressions were taken, one before bonding the Hybrid Hyrax and the other on the day when the appliance was blocked. Silicone caps with wires were inserted in the axis of the teeth on the casts. These were used to measure the difference between pre- and post-operative tipping of the first premolars and molars.
RESULTS: As a result of treatment the average premolar tipping was 0.36 degrees palatally (SD: 8.78°) and molar tipping was 4.66 degrees buccally (SD: 14.12°).
CONCLUSION: Despite skeletal anchorage, the molars tipped buccally. The premolars did not show the same dental side effects. These results are in line with that described in other studies and could be explained by the shift or bending of the miniscrew in the bone. Since the premolars do not seem to exhibit the above mentioned side effects, the appliance could be used in patients with aplasia, premolars with underdeveloped roots or periodontally compromised teeth.

SP 306 PERIOSTEAL DISTRACTION BY MAGNETS FOR CLEFT PALATE DEFECTS – A FINITE ELEMENT STUDY
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AIMS: To evaluate mechanical loading during mucoperiosteal tissue expansion in the cleft palate of newborns with unilateral and bilateral clefts.
MATERIALS AND METHOD: Three-dimensional computed tomographic scans of newborns with a cleft lip and palate were used to create a finite element model of the maxilla using dedicated image analysis software. The material properties of the individual elements in the model were linked to the local grey values of the scans edges of an osteodistraction implant across the palatal cleft. The external loading conditions were simulated by attraction forces generated by two magnetic strips, whose magnitude was based on previous in vitro experiments. The force-distance relationships were experimentally determined for a number of small dental magnets separated by various thicknesses of soft tissues. For a number of different magnetic force arrangements, the strains in the bone areas and the periosteum surrounding the palatal cleft were then analysed.
RESULTS: The experiments showed that the presence of soft tissue had no or little influence on the force-distance relationships for the magnets. The periosteal bone strains in the palate were predominantly tensile in the direction of distraction. Furthermore, the associated strain magnitudes were in the order of the adaptive and bone gain windows of Frost’s mechanostat theory. The positions where the magnetic forces were assumed to be applied had an influence on the strain distribution in the periosteum and underlying bone: a more concentrated distribution of the magnetic forces would lead to higher strain peak values in the direct vicinity of the implant.
CONCLUSION: The analyses suggest that the strains in the periosteum and underlying bone in the palate, generated by attractive forces, are of such nature and magnitude that is compatible with adaptive bone formation.

SP 307 DOES EXPOSURE TYPE AFFECT THE TREATMENT TIME OF IMPACTED CANINE? A SYSTEMATIC REVIEW
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AIMS: The treatment time for impacted maxillary canines has been a factor of concern to patients and orthodontists. Whereas the effects of different techniques on the periodontal status of labially impacted canines have been studied, the effect of these techniques on orthodontic treatment duration is still controversial.

MATERIALS AND METHOD: The following keywords were used: impacted canine, treatment, duration and maxillary on Scopus, PubMed, Ebso host databases and grey literature for dentistry such as Open Grey, World Health Organisation and Rand were searched and reference lists of the articles were screened. Original research studies were included and non-research article, unsuitable data, unvalidated measures; cleft samples were excluded. Two orthodontists independently evaluated the quality of the articles using the quality assessment of diagnostic accuracy studies (QUADAS-2) tool and derived data to obtain the results.

RESULTS: From 123 studies, 51 articles on palatally and 16 articles on labially impacted canines were identified and selected for further assessment. According to inclusion and exclusion criteria only 16 articles (13 articles for palatally and 3 for labially impacted canines) were evaluated. Final evaluation showed that establishing any relationship between exposure type and treatment duration was not feasible. The only important factor was the distance of the impacted canine to the occlusal line.

CONCLUSION: The current literature is insufficient to conclude which exposure procedure can reduce orthodontic treatment duration. Further original articles are required to clarify the subject.

SP 308 RELATIONSHIP BETWEEN BODY MASS INDEX PERCENTILE AND SKELETAL MATURATION AND DENTAL DEVELOPMENT
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AIMS: To determine whether an increased Body Mass Index (BMI) is associated with accelerated skeletal and dental maturation in Kırıkkale, Turkey.

MATERIALS AND METHOD: In this retrospective study, 240 subjects were divided into control group (BMI: 5-85th percentile; 97 females, 60 males) and overweight group (BMI: 85-95 percentile; 48 female, 35 male). Skeletal maturation was assessed using the cervical vertebral and hand wrist method and dental age with the Demirjian method. An independent sample t-test and Pearson correlation test were used.

RESULTS: The average weight subjects exhibited a significantly higher mean hand wrist maturation score (6.2 ± 2.6) than the overweight subjects (5.4 ± 2.6; P < 0.05). There was a statistically significant positive correlation between chronological age and dental age (r = 0.846; P < 0.001).

CONCLUSION: Orthodontists should consider weight status when evaluating growing children and adolescents because it can affect skeletal and dental development.

SP 309 EFFECTS OF TEMPORARY OCCLUSION BLOCKING ON THE CERVICAL SPINE WHILE STANDING UPRIGHT
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AIMS: Alterations in the temporomandibular system may influence posture. The aim of the present study was to determine a possible association between symmetrical or asymmetrical manipulation of the occlusion (occlusion blocked 4 mm) and the cervical spine.

SUBJECTS AND METHOD: Twenty three (18 females, 5 males) randomly selected healthy subjects. Exclusion criteria were symptomatic temporomandibular joint disorders or acute or chronic symptoms in the locomotor system which were assessed, prior to measurement, using a functional ability questionnaire. The position of the cervical spine was determined by ultrasonic distance measurements using the sonoSens®Monitor (Gefremed/Chemnitz/Germany) under five different measuring conditions: (1) habitual occlusion, (2) left-sided and (3) right-sided blocked in the premolar region, (4) symmetrical right and left-sided blocking and (5) anterior blocking. To block the occlusion, 4 mm thick silicone panels were used. Statistical evaluation was first carried out with the Friedman test followed by the Wilcoxon matched pairs test as a post-hoc test and additionally with the Bonferroni-Holm correction.

RESULTS: Statistical analysis shows a significant difference when asymmetrically blocking the occlusion on the right side (left: P = 0.02; right: P = 0.01), left side (right side: P = 0.001), and by symmetrical (right side: P = 0.001)
and anterior (both sides: $P = 0.001$) blocking compared to habitual occlusion in the frontal and sagittal planes. With regard to transverse movements of the cervical spine, significant changes were also assessed on both sides of the body (right-side blocking $P = 0.01$; otherwise $P = 0.001$). More extension, lateral flexion on the left side and a reduced rotation of the right side was shown.

CONCLUSION: There was a significant correlation between the temporomandibular system and the cervical spine. However, no causality can be formulated for the changes, as no clear ipsi- or contralateral reactions of cervical spine position were registered. The same muscular reactions tend to occur independently of the silicone panel position.

SP 310 FACIAL ASYMMETRY IN CHILDREN WITH UNILATERAL LAMBDOID CRANIOSYNOSTOSIS OR POSITIONAL POSTERIOR PLAGIOCEPHALY

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AIMS: To examine the sagittal position of the temporomandibular joint (TMJ) and symmetry of the mandible and maxilla in children with two types of posterior plagiocephaly; synostotic unilateral lambdoid craniosynostosis (ULC) and non-synostotic posterior positional plagiocephaly (PPP).

MATERIALS AND METHOD: The facial and lateral skull asymmetry of eight ULC children (mean age 1.37 years) was compared to 16 gender- and age-matched children with PPP (mean age 1.52 years). All children underwent cranioplasty between 1998 and 2016. Pre-operative computer tomographic scans were examined with Dolphin 3D software. The location of the TMJ, the maxillary anterior nasal spine (ANS) and the mandibular symphysis (Pgn) were identified. Furthermore, the mandibular length (Tm-Pgn) was measured. Facial asymmetry was compared between both posterior plagiocephalic groups.

RESULTS: In all children with ULC the TMJ was anteriorly displaced on the affected side compared to the unaffected side. Among PPP children the TMJ was displaced anteriorly or posteriorly. ANS shifted towards the affected side in all children with ULC and PPP. In ULC children the Pgn shifted variably to the affected and the non-affected side. However, in all PPP children the Pgn shifted towards the affected side. The mandible was shorter on the affected side compared to the unaffected side in all children with ULC (Tm-Pgn).

CONCLUSION: The results show that both types of posterior plagiocephaly are associated with an asymmetric position of the TMJ and asymmetry of the mandible and maxilla. Facial asymmetry was more frequently seen in ULC than PPP children.

SP 311 CAN TEETH MOVE IN NON-AUTOGENOUS GRAFTED ALVEOLAR CLEFTS? A REVIEW

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AIMS: To review the existing literature on the effect of tooth movement across intra-oral cleft defects in non-autogenous bone grafts.

MATERIALS AND METHOD: An electronic database search was undertaken in PubMed, Scopus and EBSCOHost from 15 October to 27 November 2017 using key words: ‘orthodontic tooth movement’, ‘tooth eruption’, ‘canine eruption’, ‘bone graft’, ‘bone substitute’, ‘bone replacement’, ‘alveolar cleft’, and ‘cleft palate’ for English language papers published or accepted within the last 10 years. Exclusion criteria were utilization of autogenous bone grafts without comparison, lack of orthodontic intervention or tooth eruption monitoring post-grafting and review articles. The final list was agreed upon by three autonomous reviewers. Articles in the final list were read in full and analysed.

RESULTS: An initial hit from the three search engines revealed 593 papers that were ultimately reduced to 12 after excluding duplicates. There were only two prospective clinical trials with the rest being animal model experiments, case reports and retrospective cohort studies. Both clinical trials compared autogenous bone graft with a composite of auto- and allografts. No significant difference in canine eruption between groups was reported; however, one paper was vague in their definition of primary endpoint. In animal studies, researchers were able to compare autogenous bone to completely non-autogenous grafts. Orthodontic tooth movement
was successful in all; while root resorption was less in the latter group. Prolonged facial swelling within the allogenic graft group was noted in a large retrospective cohort study.

CONCLUSION: Non-autogenous bone grafts show promise in orthodontic management of cleft cases as they appear to allow tooth movement and eruption similar to that of a standard iliac crest bone graft without the corresponding post-operative morbidity. However, due to a lack of prospective human trials, adverse effects of this procedure may not have been fully elucidated. There is a need for more systematic research in this area to reduce risks and to improve orthodontic outcomes.

SP 312 PREVALENCE AND PATTERN OF PERMANENT TOOTH AGENESIS IN NON-SYNDROMIC ISOLATED CLEFT PALATE PATIENTS

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AIMS: To characterize permanent tooth agenesis patterns and their prevalence in children with non-syndromic isolated cleft palate (CP).

MATERIALS AND METHOD: Retrospective dental records of CP patients from two cleft centres were extracted. Cleft palate presenting as part of craniofacial anomalies, syndromes, or medical conditions suggestive of a syndrome were excluded. A thorough examination using all available panoramic, periapical, and occlusal radiographs as well as dental charts and treatment notes of eligible subjects was conducted to confirm tooth agenesis in the permanent dentition. Sequential radiographs were used when available to confirm tooth agenesis. Tooth agenesis patterns were identified using the Tooth Agenesis Code (TAC). The TAC values were analysed using a website developed specifically for this purpose (http://www.toothagenesiscode.com). Frequencies and distributions for patterns of tooth agenesis, tooth counts and percentages were used to characterize tooth agenesis.

RESULTS: The overall prevalence of permanent tooth agenesis was 25 per cent (8 out of 32 patients). The total number of missing teeth was 23. The number of missing teeth per patient ranged from 0 to 7, with an average of 0.72 ± 1.66. All CP patients with agenesis had different agenesis patterns. The most commonly missing teeth were the lower lateral incisors and the upper and lower second premolars, similar to commonly missing teeth of Chinese and Malay patients in the local orthodontic population. These were also the most common bilaterally missing teeth. The lower right quadrant had the highest proportion of missing teeth. Agenesis was found in the upper and lower jaws at a similar frequency.

CONCLUSION: A characteristic agenesis pattern was not found in non-syndromic CP patients in this study.

SP 313 NASOLABIAL AESTHETICS IN PATIENTS WITH A CLEFT LIP AND PALATE: A COMPARISON OF TWO ETHNIC GROUPS

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AIMS: To compare nasolabial aesthetics between Vietnamese and Estonian patients with a repaired unilateral cleft lip and palate (UCLP).

SUBJECTS AND METHOD: Patients with non-syndromic UCLP who had lip surgery and palatoplasty were recruited. A total of 23 Vietnamese patients and 33 Estonian patients were included. Facial and profile photographs of the patients were cropped to show the nose and upper lip and coded. Using the coded images, a panel of five raters rated four features of the nasolabial region: nasal form, nasal symmetry, vermilion border, and nasolabial profile based on the Asher-McDade aesthetic index with reference photographs. Each feature was rated on a 5-point scale where 1 represented a very good appearance and 5 a very poor appearance. A Mann-Whitney test was used to compare the mean ratings between the two ethnic groups. Significance was set at $P < 0.05$.

RESULTS: The total nasolabial scores of Vietnamese and Estonia patients were 2.9 and 3.0, respectively. There were no significant differences between ethnic groups for both total nasolabial scores as well as individual aesthetic features.

CONCLUSION: The nasolabial aesthetics of Vietnamese and Estonian patients were considered as having a good and fair appearance, respectively; however, no significant differences in nasolabial aesthetics between ethnic
groups were detected. Overall good to fair nasolabial aesthetic results were obtained using different treatment protocols in the two countries.

SP 314 SIMULTANEOUS MONITORING OF INTRAORAL AND OESOPHAGEAL ACIDITY: IS THERE AN ASSOCIATION?
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AIMS: A low salivary pH due to gastrooesophageal reflux disorder (GORD) may increase the risk of tooth wear. This may be especially critical in orthodontic patients, as fixed and removable appliances can retain acidity and aggravate its consequence on teeth, such as erosion and white spot lesions (WSL). The aim of the present study was to test a possible relationship between oesophageal and salivary pH in GORD patients.

SUBJECTS AND METHOD: Eight volunteers were selected from a pool of patients with a clinical diagnosis of GORD in the previous 12 months, which had been confirmed by a previous 24-hour pH monitoring test. Salivary and oesophageal pH were simultaneously assessed for at least 12 hours, inclusive of sleep time, using two separate but synchronised pH recording units (Restech Dx-Recorder, San Diego, California, USA). Salivary pH was assessed with the aid of a small mouth guard, which held the probe at a palatal site close to the right upper molar. The oesophageal probe was inserted transnasally and always positioned 5 cm above the gastric sphincter. Data regarding food and drink intake, sleeping times and tooth brushing were also recorded.

RESULTS: The vast majority of patients (7/8) reported that the intraoral device was more tolerable than the oesophageal device. There were marked inter- and intraindividual fluctuations in both oral and oesophageal pH, which were suggestive of a circadian rhythm. Both oral and oesophageal average pH values were slightly reduced during sleep time compared to awake time (0.5-0.6 pH units). The pH recordings showed a varying degree of association, as the cross-correlation coefficients ranged from weak (0.21; P < 0.05) to moderate-to-strong (>0.50; P < 0.001) in three participants.

CONCLUSION: Salivary and oesophageal pH can be significantly cross-correlated in some GORD patients suggesting that salivary pH monitoring may provide useful diagnostic information for acid reflux, tooth wear, and WSL in dental as well as orthodontic patients.

SP 315 THE RELATIONSHIP BETWEEN THE APNOEA-HYPOPNOEA INDEX AND CRANIOFACIAL SKELETON IN POSTMENOPAUSAL PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA
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AIMS: To evaluate the facial types and relationship between the apnoea-hypopnoea index (AHI) and craniofacial skeleton in postmenopausal patients with obstructive sleep apnoea (OSA).

SUBJECTS AND METHOD: Sixteen Japanese post-menopausal patients (mean ± standard deviation: 58.5 ± 7.6 years; range, 46-69 years), who had been diagnosed with OSA at Juntendo University Sleep Laboratory (Bunkyo, Japan) and/or five private sleep clinics, were identified from hospital records. The patients were selected based on OSA symptoms, such as heavy snoring, witnessed apnoeas and/or daytime hypersomnolence. The patients were not obese, and none had anatomic craniofacial abnormalities or neurologic and cardiac disease. The measurement data of the apnoea-hypopnoea index (AHI) were evaluated. Lateral cephalometric radiographs were obtained with each subject was standing in a relaxed position with her head inside the cephalometer. All cephalograms were obtained before any medical or surgical intervention. Craniofacial skeletal variables were measured using cephalometric landmarks. Each patient was assigned to one of three facial types based on the sella-gonion/nasion-menton (N-ME) rate and the Siriwat and Jarabak classification: counter clockwise (CC) facial type, 80 > CC > 63; straight downward (SD) facial type, 63 ≥ SD ≥ 59; and clockwise (C) facial type, 59 > C > 54. In addition, the relationship between craniofacial skeleton and AHI was investigated with Pearson’s product correlation coefficient.

RESULTS: The mean AHI was 15.6 ± 7.4. Facial type C was the most frequently observed (7 patients, 43.75%), followed by SD (6 patients, 37.50%) and CC (3 patients, 18.75%). In addition, there were significant correlation differences in the AHI in relation to the N-ME distance (r = 0.625, P = 0.0083), lower face height (r = 0.509, P =
0.0431) and total facial height (r = 0.518, P = 0.0386). However, there was no significant correlation between AHI and craniofacial horizontal skeletal morphology.

CONCLUSION: Craniofacial vertical skeleton variables may be related to patients with both OSA and the lack of the secretion of female hormones.

SP 316 REPEATEDLY MEASURED QUALITY OF LIFE AMONG DUTCH CHILDREN WITH A CLEFT LIP AND/OR PALATE
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AIMS: To investigate the Oral Health Related Quality of Life (OHRQoL) of children with a cleft lip and/or palate (CLP). The scores of children and their parents were compared.

SUBJECTS AND METHOD: The sample consisted of 170 children (aged between 8-18 years) and their parents. All participants completed the Child Oral Health Impact Profile (COHIP) questionnaire. Of this sample 57 children also completed the COHIP in 2009. Their answers from 2013 were compared with their answers from 2009.

RESULTS: Parents scored significantly higher than children, on the subscale ‘oral symptoms’. On the subscale ‘functional well-being’ parents scored lower than children. No differences were found with regard to age. Females scored higher with regard to the subscales ‘functional well-being’ and ‘school’ than males. Children with a bilateral CLP scored lower on the subscale ‘functional well-being’ and ‘school’ than other subgroups. The scores of the females decreased, in the sample with repeated measurements, with regard to ‘oral symptoms’ whilst the subscale scores of the males increased. The scores of the males with regard to ‘emotional well-being’ decreased between 2009 and 2013, but for females the score on ‘emotional well-being’ was stable.

CONCLUSION: Significant differences between OHRQoL scores of children and their parents were found. No age differences were observed. Gender related differences were found with regard to the subscales ‘functional well-being’ and ‘school’. Children with a more complex cleft defect had a lower OHRQoL for some of the subscales.

SP 317 AUDIT OF ACCURACY OF LE FORT I OSTEOTOMIES
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AIMS: To assess whether the planned outcomes of Le Fort I osteotomies was achieved

MATERIALS AND METHOD: A retrospective audit carried out at Ipswich hospital of the last 20 patients who had undergone symmetric Le Fort 1 osteotomy with or without a mandibular procedure; cleft patients and those with a maxillary cant or panfacial asymmetries were excluded. Planned movements of the mesiobuccal cusp of upper first permanent molar (MB6) and upper incisor tip (UI) were recorded from the surgical planning sheet. Post-operative movements were recorded by tracing the pre and post-operative cephalometric radiographs and measuring the distance moved in the anteroposterior (A-P) and vertical dimensions of MB6 and UI. The planned and actual moves were then compared. Gold standard: Difference between the planned and actual surgical movements being within 2 mm for 100 per cent of patients

RESULTS: Twenty patients (100%) had all movements within 2 mm of the planned movements. The most common error was associated with the A-P movement of the UI. Fifteen subjects (75%) had A-P and vertical movements within 1 mm of the planned movements.

CONCLUSION: The predetermined audit standard was met. As significant changes in the near future are being planned, these results are important as a baseline. A re-audit is planned for 1 years’ time.

SP 318 BONE AND CORTICAL BONE THICKNESS OF MANDIBULAR RETROMOLAR TRIGONE AND ANTERIOR RAMUS FOR MINISCREW INSERTION IN ADULTS
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AIMS: To analyze bone thickness, bone depth and cortical bone characteristics of the mandibular retromolar trigone and anterior ramus to determine the most suitable sites for miniscrew insertion in adult patients.

MATERIALS AND METHOD: Cone beam computer tomographic (CBCT) records, randomly selected from a digital archive according to specific inclusion criteria, of 60 adult male and female subjects (mean age 32.8 ± 8.2 years)
were retrospectively evaluated. All CBCTs were obtained with an i-CAT scanner (Imaging Sciences International, Hatfield, Pennsylvania, USA), converted into digital imaging and communications in medicine format and processed with OsiriX Medical Imaging software. Correct view sections of the retromolar trigone were obtained for quantitative and qualitative bone characteristic evaluation on two lines parallel to the occlusal plane, 3 and 6 mm coronally dislocated. Four outcomes were considered on these two lines to measure bone depth and cortical bone thickness. Four additional corresponding outcomes were measured on two lines angulated at 45 degrees compared to the occlusal plane at 3 and 6 mm. The considered four lines were used as a reference to identify four coronal cross-section planes for mediolateral bone dimension evaluation. All measurements were evaluated separately in subjects with and without third molars. Inferential statistics were used to detect significant differences among the considered possible insertion sites. Parametric and non-parametric tests were used as appropriate according to data distribution.

RESULTS: Average bone depth was more than 10 mm for all investigated insertion sites. The insertion sites with a parallel insertion orientation to the occlusal plane showed significantly increased bone depth ($P < 0.001$) compared to the 45 degree insertion orientation. No statistically significant differences were found when comparing 3 and 6 mm insertion sites. Cortical bone thickness showed, on average, mean values greater than 3 mm. Mediolateral bone dimension showed a significant reduction in the anteroposterior direction ($P < 0.001$). No difference was found when comparing subjects with and without third molars.

CONCLUSION: The retromolar trigone and anterior ramus showed sufficient bone quantity and adequate bone quality for safe miniscrew insertion in adults. Considering average cortical bone thickness, pre-drilling is always recommended before screw insertion.

SP 319 DENTOSKELETAL EFFECTS OF MAXILLARY EXPANSION EVALUATED WITH COMPUTER TOMOGRAPHY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIMS: To evaluate the dentoskeletal effects of rapid maxillary expansion (RME) in growing patients assessed by computed tomography.

MATERIALS AND METHOD: This systematic review and meta-analysis was conducted according to the guidelines of the Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0) and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement. A total of 19 electronic databases were searched without languages restrictions up to October 2017. Clinical trials were included in this systematic review if they were conducted, including growing subjects with transverse maxillary deficiency treated with maxillary expansion and evaluating basal bones before and after rapid palatal expansion by means of one of the following three-dimensional imaging computer tomography techniques: cone beam, spiral and low-dose computer tomography. Two authors executed study selection, data extraction, and risk of bias assessment independently. To evaluate the efficacy of treatment studies were taken into account which considered transverse skeletal increase assessed in the molar area of the palatal basal bone. According to the period of time between the first and second observation, the outcomes evaluated in the considered studies were grouped into three different evaluation groups: 0-1/2 months, 0-7/8 months, 0-9/12 months.

RESULTS: Twenty two studies were included according to inclusion criteria; the studies presented a prospective and retrospective design. The ages of the patients varied across the studies with the majority of the trials having a sample with an age range between 8 and 12 years. The mean treatment effect of RME on basal bone dimension in the first molar region was 2.56 mm (95%CI, 1.97 to 3.15 mm) for the 0-1/2 months group; the same outcome was 2.15 mm (95%CI, 1.75 to 2.54 mm) for the 0-7/8 months group and 2.28 mm (95%CI, 1.50 to 3.07 mm) for the 0-9/12 months group.

CONCLUSION: This systematic review with meta-analysis evaluated, for the first time in the orthodontic literature, the skeletal effects of RME at different treatment stages by means of computer tomography. The results indicate that RME increases basal bone during active maxillary expansion however during retention skeletal basal bone seems to slightly decrease.

SP 320 RELATIONSHIP BETWEEN TONGUE POSITION DURING SPEECH***
AIMS: It has previously been reported that tongue posture at rest is lower and the articulation point of the consonant /ʃ/ is forward and lower in in Japanese tongue-thrust swallower. Therefore, the purpose of this study was to investigate relationship between the position of the tongue during speech and morphology of dental arch using acoustic analysis.

SUBJECTS AND METHOD: Twenty three girls in the fourth grade of elementary school (13 girls with normal swallowing, 10 girls with tongue-thrust swallowing). Inclination of the crown axis of the maxillary central incisors, maxillary dental arch width and tongue pressure were measured. The frequencies of the first formant (F1), the second formant (F2) and the fourth formant (F4) of the post-alveolar fricative consonant /ʃ/ were analyzed. F1/F4 and F2/F4 indicate the articulation point position of the consonant /ʃ/. F1/F4 represents the vertical position of the lingual apex and F2/F4 the horizontal position. When the articulation point is anterior, F2/F4 becomes high and when low, F1/F4 becomes high.

RESULTS: 1. A significant positive correlation was found between the F2/F4 and the inclination of the in maxillary central incisors crown axis (r = 0.62). 2. A significant negative correlation was found between the F1/F4 and the maxillary dental arch width (r = -0.41). 3. A significant positive correlation was found between the F2/F4 and tongue pressure (r = 0.51). In these correlations, the normal swallowing group and the tongue-thrust swallowing habit group were mixed. The findings suggest that labial inclination of maxillary central incisors a result of a protruded tongue at speech. A low tongue position at speech causes a narrow maxillary dental arch width. The articulation point of children with high tongue pressure is anterior.

CONCLUSION: It is not possible to evaluate the tongue position when unconsciousness.

SP 321 KINEMATIC POSTURE ANALYSIS OF THE EVERYDAY WORK ATTITUDE OF ORTHODONTISTS

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AIMS: Musculoskeletal disorders are often found in dentistry. This aim of this study was to conduct a kinematic analysis of occupational posture in orthodontists. A separate analysis of static postures for orthodontic and non-orthodontic activities evaluated the duration for which these particular postures were assumed.

SUBJECTS AND METHOD: The posture of 21 (13 females, 8 males) postgraduate students in orthodontics and orthodontists (31.5 ± 3.8 years) was analyzed over one working day. The kinematic detection of back positions was carried out with the personally attached Cuela system. Alongside kinematic analysis, the tasks performed on-site were also subject to a detailed computerized analysis [performed tasks: (I) treatment(II) office and (III) other activities]. Data analysis comprised evaluation and comparison of joint angle distribution for the regions of the head, neck, and torso in accordance with ergonomic standards. Those postures that were held statically for 4 seconds and longer were selected for further analysis.

RESULTS: The most common activities were executed in a seated position. During I (28%) participants most often worked with a straight back (84.7%) whereas a bent or twisted torso posture was observed 23.4 per cent of the time. For I an anterior inclination of the head and torso area was observed as well as a twist of the head and neck area to the right. Anterior back inclination and lateral back torsion to the right for was found for II and III). The differentiation of the duration of static postures were primarily short to medium-term (4-30 seconds) identified for I. Also, categories II and III predominantly demonstrated static back postures with a duration of up to 30 seconds. With regard to II it was observed that the back was ventrally inclined for 10.1 per cent of the total activity duration.

CONCLUSION: Orthodontists show characteristic postures during treatment activities. Postures differ in the head and cervical spine area and with regard to the various activities performed in the three categories. During treatment static strains are observed in the entire head and torso area. On the contrary, static postures prevalent in the torso area are essential for particularly office work. These findings allow identification of unfavourable and static postures.
SP 322  COMPARISON OF DIFFERENT INTRAORAL MOLAR DISTALISATION METHOD EFFECTS
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AIMS: To compare the skeletal and dentoalveolar effects of the Distal Jet, Jones Jig and Beneslider appliances on cephalometric radiographs and dental models.
SUBJECTS AND METHOD: Three groups, each of which included 10 patients.
RESULTS: The maxillary first molars were distalized with the Distal Jet (group 1) 3.75 mm in 7.7 months, with the Jones Jig (group 2) 4.12 mm in 7.6 months and with the Beneslider (group 3) 4.45 mm in 6.9 months. No statistically significant difference was seen in the amount of molar distalization or skeletal, soft tissue measurements between the three groups. Distopalatal axial rotation on the molars of 15.05 degrees was measured in group 2 and 1.2 mm molar intrusion in group 3. For the second premolars, group 1 showed 1.87 mm of mesial movement and 1.57 mm extrusion, group 2 2.5 mm of mesial movement, 4.8 degrees of tipping, 6.45 degrees of distobuccal axial rotation and 1.72 mm of extrusion. Group 3 showed 2.65 mm distal movement and 1.2 degrees of tipping. On incisors, in group 1 there was 1.9 mm mesial movement, 4.05 degrees of protrusion, an increase in overjet of 1.7 mm and a 0.8 mm decrease in overbite, for group 2 3.3 mm of mesial movement, 2.9 degrees of protrusion, a 1.4 mm increase in overjet and 1.35 mm decrease in overbite. The distance between the molars in group 1 was 5.55 mm and in group 3 4.3 mm and between the premolars a 1.4 mm increase was measured.
CONCLUSION: No significant difference in the amount of molar distalization was observed. The results suggest that the Beneslider is more reliable, because of its positive effects on transverse dimensions, control of vertical parameters and minimal side effects on the teeth.

SP 323  THE VALIDITY OF WITS AND RIEDEL ANALYSES IN SKELETAL III MALOCCLUSIONS BASED ON VARIATION IN VERTICAL FACIAL DIMENSIONS
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AIMS: To compare the relationship between Reidel and Wits appraisal in Skeletal III malocclusions and to assess the effect of variation in the vertical skeletal measurements.
SUBJECTS AND METHOD: One-hundred and twenty consecutive subjects with Class III malocclusions attending orthognathic clinics were analysed. Lateral cephalograms were hand-traced under standardized conditions. Cephalometric measurements included Reidel analysis, Wits appraisal, point A / point B to Frankfort plane (AF-BF) and vertical measurements.
RESULTS: The mean ANB and Wits values were −3.22 degrees and −11.39 mm, respectively. A positive correlation was found between ANB and Wits overall (r = −0.49; P < 0.001). However, there was poor agreement between both Wits (r = 0.087) and Reidel (r = 0.089) for AF-BF (P > 0.05). A negative correlation existed between Wits and LAFH% (r = −0.64, P-value < 0.001); however, no relationship was observed between ANB and LAFH% (P > 0.05).
CONCLUSION: There is a positive relation between ANB and Wits; however, neither correlated well with a more pure antero-posterior assessment (AF-BF). Furthermore, variations in the vertical skeletal measurements affect the strength of agreement. Caution is advised in the interpretation of antero-posterior analysis especially in the presence of vertical discrepancy. Development of correction factors might be helpful in making cephalometric diagnosis more reliable.

SP 324  EARLY EXTRACTION OF PRIMARY MOLARS AND CARIES EXPERIENCE IN RELATION TO ORTHODONTIC TREATMENT EXPERIENCE IN ALTA, NORWAY IN A 20-YEAR PERSPECTIVE
Tage Olsen, Heidi Kerosuo, Anders Sjögren, University of Tromsø, Norway

AIMS: To investigate if a presumed reduction in caries is reflected in reduced primary molar extractions and if there is a relationship between the aforementioned and frequency of orthodontic referrals and treatment experience.
MATERIALS AND METHOD: The sample in this study was collected from all children born in 1980, 1990 and 2000 that attended regular oral examinations in Alta, Norway. Inclusion criteria included complete dental and orthodontic records from ages 5 to 16 years. Exclusion criteria included agenesis of permanent teeth (apart from third molars) and craniofacial syndrome. Data from 585 subjects was collected retrospectively. The number of caries-free individuals at age 5 and 9 and the number of demineralized, missing and filled primary teeth (dmft) were recorded. The rate, number and age of primary molar extractions, referrals for orthodontic treatment and orthodontic treatment experience were also recorded. Early primary molar extractions were defined as extraction before 7.6 years of age. Statistical analysis used Pearson’s chi-square and Students t-test to compare group differences.

RESULTS: Between the 1980 cohort and the 2000 cohort, there was a significant increase in the rate of caries-free 5- and 9-year old children (18.5%, P < 0.01 and 16.9%, P < 0.01, respectively) and a significant decrease in the mean dmft values at age 5 (mean difference 1.83, 95% CI: 1.091 to 2.562, P < 0.01). However, no significant reduction in the early extraction of the first or second primary molars was found between these cohorts. There was no significant difference in orthodontic treatment experience between subjects with or without early primary molar extractions. Referrals for an orthodontic consultation, due to crowding, were significantly more common among subjects with early primary molar extractions than among those with no early primary molar extractions (61.9% and 35.9%, respectively, P < .001.)

CONCLUSION: In this study, a reduction in caries prevalence had little impact on early primary molar extractions, and early primary molar extractions did not affect orthodontic treatment experience.

SP 325 EFFECTS OF SHORT-TERM OCCLUSION BLOCKING ON THE UPPER BODY POSTURE OF COMPETITIVE ATHLETES
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AIMS: To investigate the possible connection between a systematically induced symmetric as well as asymmetric bite blockage and its influence on the upper body posture.

SUBJECTS AND METHOD: For this investigation 16 male players of a "1st Bundesliga" handball team in Germany were measured. A temporary vertical opening with a 1 or 2 mm thick silicone panel between the left and/or right premolars was caused while their upper body posture was recorded by means of a non-invasive, light-optical three-dimensional back scanner (ABW GmbH, Frickenhausen, Germany) and converted into a numerical topographic model. The back parameters calculated on this basis, such as the position of the spine, the position of the shoulder and pelvic axis in space and the torsion angles, determine the posture of the back. The parameters were evaluated using the non-parametric Friedman test followed by the Wilcoxon-matched-pairs-test with Bonferroni-Holm correction.

RESULTS: Comparison of the neutral starting position with the provoked bite positions showed a change of the sagittal trunk inclination (P = 0.02) with a symmetric blocking using 1 mm silicone. Comparison between the neutral position and a 2 mm blocking of the right body side resulted in a significant difference of the scapula height (P = 0.04). All other parameters showed no significant differences.

CONCLUSION: Although a symmetrical blocking by means of 1 mm panels tend to result in a more ventrally inclined upper body posture, or a 2 mm right side blocking lead to an adjustment of the scapula height, it should not be neglected that an occlusion blocking of 1 or 2 mm had hardly any effect on the statics of competitive athletes. Why trained people react less to these influences than untrained people needs to be investigated in further studies.

SP 326 ASSESSMENT OF THE EFFECTS OF FACEMASK THERAPY FROM A PARENT’S PERSPECTIVE‡‡‡
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AIMS: Facemask therapy is one of the most preferable treatments in growing Class III patients due to maxillary retrognathia. During facemask therapy several changes are expected such as; facial and dental aesthetics, function, speech, and psychology of the patient. The aim of this study was to assess the perception of the visual and psychological effects of facemask therapy by the parents obtained before and after treatment.
SUBJECTS AND METHOD: A total of 51 patients who had undergone facemask therapy were included. The subjects were divided into three groups according to their chief complaint as; dental (n = 12), skeletal (n = 13), and skeletal and dental (n = 26). A questionnaire, that included photographs taken from the lateral and frontal views, were given to the parents of the patients immediately before and after facemask therapy. Three-dimensional photographs were used to remind the parents of the physical appearance of the patients at the end of treatment. Data were collected in SPSS for statistical analysis.

RESULTS: There were statistically significant differences between three groups before and after treatment in function and physical appearance ($P < 0.05$).

CONCLUSION: The improvement achieved in the physical and psychological well-being of the patients who had undergone facemask therapy were significantly noticed by their parents. The changes obtained in the lateral view of the zygoma and frontal view of the upper lip and maxillary zone were observed the most while the lateral view of glabella trichion zone were noticed the least.

SP 327 EVALUATION OF THE PREFERENCE OF PATIENTS FOR CUSTOM DIGITAL ORTHODONTICS OR CONVENTIONAL ORTHODONTICS

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AIMS: To evaluate the preference of patients for custom digital orthodontics or conventional orthodontics.

SUBJECTS AND METHOD: Seventy patients were included in this study before treatment planning procedures. All participants completed a survey including a questionnaire with videos of treatment procedures. Questions were arranged by topics such as lingual orthodontics, labial orthodontics and aligner orthodontics which have the advantages and disadvantages of the treatment alternatives of custom digital methods and conventional methods.

RESULTS: Responses from the patients revealed that although digital custom orthodontics cost more it is preferable to conventional methods because of personalised brackets and a video of final digital planning. Patients trust their orthodontist but they do not trust the dental technicians for manual set up models. Eighty per of patients chose the indirect bonding methods rather than digitally planned or manually done by the technician guided. Thirty five per cent of patients found that treatment delivery time was long because of shipping and customs procedures.

CONCLUSION: The long duration of orthodontic treatment planning may pose disadvantages such as loss of patient motivation but treatment outcomes are more reliable and it can easily be undertaken. Custom digital orthodontic planning will be more preferable when the costs are reduced.

SP 328 COMPARISON OF FACIAL MORPHOLOGY LINEAR MEASUREMENTS ON DESIGN PICTURES

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AIMS: Facial analysis is important for treatment planning in orthodontics. Extraoral photographs have a major role in the diagnosis of the patient and to make a smile design. Photographs taken from different sides or three-dimensional images taken of patients are the gold standard for diagnosis. The aim of this study was to measure and compare facial morphology linear directions of 3dMD pictures and Cerec Smile Design (CSD) images for interdisciplinary treatment plans.

MATERIALS AND METHOD: According to CSD protocols, before taking the photograph small stickers were placed on points on the patients’ face (such as Exocanthion, Pronasale, Zygion, Cheillion, Labrale inferius, Labrale Superius (Ls), Gonion and Menton). Facial photographs were then taken of 40 patient (25-30 years old) with a Canon D600 and 3dMD Machine. Linear distances were measured between these points using Vernier callipers on patients, 3dMDvultus for 3dMD pictures and photoshop for CSD pictures. SPSS 19.0 was used for statistical analysis. ANOVA tests were used to determine differences between the groups.

RESULTS: Linear measurements were statistically significant between the three groups between the sagittal and transverse lines ($P < 0.001$). On coronal linear measurements the results were statistically significant between 3dMD and the direct group but not between the CSD and other groups.

CONCLUSION: Although direct and 3dMD measurements were similar and different from CSD, CSD picture measurements can be used for patient diagnosis. Sagittal and transverse lines provide more reliable results than
coronal lines on linear measurements. In interdisciplinary treatment planning care should be exercised with regard to coronal lines in CSD evaluation.

SP 329 RETROSPECTIVE ANALYSIS OF FUNCTIONAL TREATMENT NEEDS OF ORTHOGNATHIC SURGERY PATIENTS
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AIMS: To evaluate the need for orthognathic surgery of patients using the Index of Orthognathic Functional Treatment Need (IOFTN).
SUBJECTS AND METHOD: Eighty (48 female, 32 males) patients treated between March 2008 and August 2017 were included in the study. The components of IOFTN and the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) as well as the malocclusion type were recorded. A questionnaire was given to the patients in order to determine their main complaint. Descriptive analyses such as mean square and standard deviation were calculated. The percentage of cases with IOFTN 4/5 in each malocclusion and skeletal pattern category were calculated.
RESULTS: The mean age at surgery was 24.23 (3.98) years. The age range of the subjects varied from 19 to 30 years. A Class III malocclusion/skeletal pattern was the most prevalent type. The most prevalent IOFTN score in the sample was 5.3 (30%), followed by 4.4 (22.5%), 4.2 (18.75%) and 4.9 (%15), and the most prevalent osteotomy was bimaxillary.
CONCLUSION: IOFTN identified 86.25 per cent of subjects who had orthognathic surgery as having great or very great functional need. A higher percentage of Class III patients scored greater than 4 of the IOFTN, indicating a higher functional need for orthognathic surgery. Of the patients, 13.75 per cent reported aesthetic complaints more than functional need.

SP 330 PATIENTS’ PERSPECTIVES OF DIGITAL ORTHOGNATHIC SURGERY PLANNING AND PATIENT SPECIFIC IMPLANTS
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AIMS: To evaluate patients’ perspective for digital orthognathic surgery planning and patients’ specific implants (PSI).
SUBJECTS AND METHOD: Twenty-four (13 females, 11 males) patients were included in this study before orthognathic surgery planning. A questionnaire was given to the patients in order to assess their opinion and knowledge about digital surgery planning, digital surgery guide, digital fixation guide and treatment outcomes from the final digital planning.
RESULTS: Responses from the patients revealed that although digital surgery planning and surgical procedures cost more, they are more preferable than conventional methods because of digital planning results and digital guides. Of the patients, 37.5 per cent chose to see their three-dimensional model before orthognathic surgery because they thought that the surgeon could practice on the model before surgery. PSI fixation would be preferred by 79.16 per cent because it is personalised by patient, while 66.6 per cent of patients thought that digital planning had more reliable results than conventional methods because of digital calibration.
CONCLUSION: The future of the orthodontics is going to be digital. Therefore digital planning and PSI are going to be more common for orthognathic surgery planning and surgical procedures when it will have more reasonable prices. Surgeons and orthodontists will focus on digital planning in order to obtain experience in that topic to give the best treatment outcome.

SP 331 EVALUATION OF THE LINGUAL SURFACE TOPOGRAPHY OF ANTERIOR TEETH IN ORDER TO PRODUCE CUSTOM MADE LINGUAL BRACKETS FOR IMPACTED ANTERIOR TEETH
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AIMS: Impacted teeth are a common problem in orthodontics and also aesthetic outcome is very important for the anterior region. The aim of this study was to evaluate the different topography of the lingual surfaces of the anterior teeth in order to produce custom made lingual brackets for anterior impacted teeth.

MATERIALS AND METHOD: One hundred patients scanned with the Sirona Cerec 4.4.4 intraoral scanner system. The stl files were transferred into 3dMD-Vultus software. In this software a mirror image of the lingual surface can be taken and superimposed with the each other. The volumetric similarities were measured.

RESULTS: According to the comparison of symmetric morphology 83 per cent of the upper central incisors, 65 per cent of the upper lateral teeth and 87 per cent of the upper canine teeth have a similar morphology. Seventy seven per cent of the lower central incisors, 84 per cent of the lower lateral incisors and 82 per cent of the lower canine have similarities.

CONCLUSION: Custom made lingual brackets are beneficial in lingual orthodontics, since they reduce the risk of bracket loss due to detachment. Custom made brackets are more adaptive thus making them more comfortable for the patient.

SP 332 SKELETAL AND DENTOALVEOLAR CHANGES DUE TO CLASS II CORRECTION WITH A NON-COMPLIANCE DEVICE: A RETROSPECTIVE RADIOLOGICAL STUDY
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AIMS: An Angle Class II is the most frequent malocclusion in northern latitudes. The Bio Bite Corrector® (BBC) is a non-compliance Class II device, similar to the Herbst appliance, but is fixed directly on the archwires of the multibracket appliance. The aim of this retrospective study was to determine the skeletal as well as the dentoalveolar effects of the BBC.

MATERIALS AND METHOD: For this purpose lateral cephalometric radiographs of 36 patients were analysed. The first radiograph was taken shortly before the BBC was fixed (T1) and the second after removal of the whole multibracket appliance (T2). Cephalometric analysis included, inter alia, the parameters SNA, SNB, ANB and Wits as well as the distance of defined landmarks from a line constructed perpendicular to the occlusal plane (Olp) and running through the point sella.

RESULTS: All skeletal parameters changed during treatment with the BBC. The sagittal position of the maxilla was slightly reduced by 0.4 degrees. In contrast, the sagittal position of the mandible increased by 0.6 degrees. However, ANB angle and Wits showed a statistically significant improvement. During treatment, the distance of point A to the occlusal perpendicular line increased significantly from 72.8 to 74.0 mm, as well as the distance of point Pogonion to Olp, which increased from 73.0 to 76.3 mm. In addition, the sagittal length of the mandible increased from 82.1 to 85.3 mm, while the distance between condyilon and gnathion changed from 107.1 to 109.7 mm. The inclination of the upper incisors in relation to the Nasion-Sella-line decreased from 106.7 to 105.3 degrees during treatment. The distance of the upper incisal edge to the facial plane also decreased from 8.4 to 6.4 mm.

CONCLUSION: After consideration of all investigated parameters, the effect of the BBC is mainly due to a skeletal remodelling process. The results of this investigation are similar to those described in recent studies that examined the Herbst appliance using the same cephalometric parameters. The BBC therefore may be considered an effective and recommendable treatment option for adolescent patients with a Class II malocclusion.

SP 333 DETERMINATION OF CEPHALOMETRIC MANDIBULAR DIMENSIONS IN GROWING ANATOLIAN TURKISH CHILDREN
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AIMS: To determine cephalometric mandibular dimensions in growing Anatolian Turkish children and to compare the differences between gender and age groups.

MATERIALS AND METHOD: This retrospective study was conducted on a total of 603 lateral cephalometric radiographs of 371 female (median age 13 years, range 8-18 years) and 232 male (median age 13 years, range 8-18 years) Turkish Anatolian patients. Inclusion criteria were as follows; ANB angle between 0 and 4 degrees, all
mandibular teeth present except third molars, no previous orthodontic treatment history. Cephalometric measurements used in this study were; Co-Go: Ramus height, Go-Me: Corpus length 1, Go-Gn: Corpus length 2, Co-Gn: Mandibular length and gonial angle. Patients were grouped according to consecutive chronological-age intervals and measurements were classified according to one year intervals. A Student’s $t$-, Mann-Whitney $U$ and Kruskal-Wallis tests were used for comparison between gender and age groups.

RESULTS: There was statistically significant difference in corpus length among age groups in each gender ($P < 0.001$) and the most significant difference was observed between 8 and 11 years in females, and between 8 and 13 years in males. The most significant difference in ramus height was noted between 8 and 12 years in females ($P = 0.001$), and between 8 and 15 years in males ($P < 0.001$). The most significant difference in mandibular length was observed between 8 and 12 years in females ($P < 0.001$), and between 8 and 14 years in males ($P = 0.016$). In each age group, differences between gender groups were also evaluated. In each age group, mandibular length was significantly different after 9 years between male and female subjects ($P < 0.05$).

CONCLUSION: Mandibular dimensions differ in every population also in different age and gender groups. It is important to use Anatolian Turkish mandibular dimensions for growing children in daily orthodontic practice and treatment planning.

SP 334 COMPARATIVE EVALUATION OF EXTERNAL APICAL ROOT RESORPTION AFTER LABIAL AND LINGUAL FIXED ORTHODONTIC TREATMENT
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AIMS: External apical root resorption (EARR) is one of the undesirable side effects of orthodontic treatment and can be defined as shortening of the tooth from its apex. The objective of this retrospective study was to compare EARR on panoramic radiographs after labial and lingual fixed orthodontic treatment.

SUBJECTS AND METHOD: Sixty patients divided into two groups: lingual (30 patients) and labial (30 patients) fixed orthodontic treatment. The inclusion criteria were patients with a skeletal Class I with an Angle Class I or mild Class II malocclusion, completed root growth of the permanent teeth except second and third molars at the beginning of treatment, no evidence of EARR on any teeth before treatment and completed comprehensive orthodontic treatment. The lingual group consisted of 23 females and 7 males (mean age of group: 27.10 ± 13.76 years) and the labial group consisted of 20 females and 10 males (mean age of group: 26.77 ± 9.04 years). EARR was measured on panoramic radiographs obtained at the beginning (T0) and end (T1) of treatment. The maxillary and mandibular central, lateral and canine root lengths were measured at T0 and T1 for each group. The proportion of apical root shortening was calculated according to Fritz et al. An independent $t$-test was used at the 5 per cent level of significance for intergroup comparisons between T0 and T1.

RESULTS: No statistically significant difference was found for resorption rates between the labial and lingual treatment group ($P > 0.05$).

CONCLUSION: Both lingual and labial orthodontic techniques showed statistically similar amounts of root resorption.

SP 335 IMPACT OF PROFESSIONAL HYGIENE AND MOTIVATIONAL STRATEGIES ON THE GINGIVAL HEALTH OF PATIENTS WITH ORTHODONTIC TREATMENT: A PILOT STUDY
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AIMS: To evaluate the effect of clinical and motivational strategies of dental hygienist on the gingival health of patients undergoing fixed orthodontic treatment and clear aligner therapy after a 3-month follow-up.

SUBJECTS AND METHOD: Forty orthodontic patients with a full permanent dentition (26 females; 14 males, mean age 27.63 ± 12.62). Twenty subjects (mean age 20.55 ± 8.09 years) received multibracket fixed therapy [Fixed Group (FG)], while 20 subjects (mean age 34.7 ± 12.5 years) were treated with clear aligners [Clear Aligners Group (CAG)]. At baseline (T0) the patients underwent an evaluation of the periodontal health status through periodontal charting. The following clinical parameters were measured: gingival biotype, probing deep (PD), plaque index (PI), bleeding on probing (BOP) and gingival recession (REC). Subsequently, the patients
underwent professional oral hygiene therapy, scaling supra- and subgingival for removing bacterial plaque and calculus. Finally, all patients were instructed concerning individualized tooth-brushing techniques. Every two weeks, the subjects were re-called for reinforcement of the instructions on the daily oral hygiene. After 3 months (T1), all patients were re-evaluated through periodontal charting. Intragroup comparisons (T1 versus T0) were calculated with a paired sample t-test, while two-way ANOVA was used for intergroup comparisons. Statistical significance level was set at $P < 0.05$.

RESULTS: In both groups, a significant improvement of PD (FG: $P < 0.001$; CAG: $P < 0.0001$), BOP ($P < 0.0001$ in both groups) and PI ($P < 0.05$ in both groups) was observed at T1. REC was unchanged over time. For all the variables, no effect of the appliance was shown in the intergroup comparisons.

CONCLUSION: Adequate control of bacterial plaque and professional dental hygiene every 3 months allows maintenance of optimal gingival health, independent of the orthodontic appliance type.

SP 336 CHANGE OF POSITION OF THIRD MOLARS WITH OVERCROWDING OF INCISORS IN 7-25 YEAR OLD PATIENTS
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AIMS: To study the position of the third molars at the stages of their formation in patients with crowding of the incisors
MATERIALS AND METHOD: Eighty dental pantomograms (DPTs) of 7 to 25 year old subjects with an overcrowded position of the anterior teeth. The patients were divided into four age groups: group 1, 7-12 years; group 2, 12-15 years; group 3, 15-18 years and group 4, 18-25 years. The position of the third molars was studied on the DPTs. The formation of the rudiments of the third molars was determined by the stages of canine formation using the Demirjian method.

RESULTS: The average value of the angles characterizing the position of the upper third molars varied from 134 degrees in group 1 to 112.1 degrees in group 4, decreasing from 12.7 to 14 per cent. The position of the lower third molars changed, the angles increased, approaching 90 degrees. The lower third molars in group 1, with age, changed their position, their angle of inclination increased by 31.5-42.2 per cent (from 48.9 to 74.7° to 18-25 years). The stages of formation of the molar roots increased by 24.0-27.7 per cent (groups 1-4), from stage D to the intermediate stage (between stage G and H). The coefficient of difference in the angles characterizing the position of the third molars in group 1 was significantly different from that in patients in groups 3 and 4.

CONCLUSION: 1. In 7-25 year old patients with anterior crowding, the angles of inclination of the third molars in the upper jaw decreased while in the lower arch they increased with a different degree of reliability. 2. The stages of formation of the third molars increased with age with a high coefficient. 3. The magnitude of angles characterizing the position of the third molars in 15-18 and 18-25 year old subjects significantly differed from that in 7-12 year olds. Active changes in the position of molars occur before 18 years, and from 18 to 25 years the position of the third molars changes less.

SP 337 ASSESSMENT OF THE INTERDEPENDENCE OF THE POSITION AND STAGE OF FORMATION OF THIRD MOLARS
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AIMS: To evaluate the relationship between the position and the stage of formation of third molars with narrowing of the dentition in patients aged 7-25 years.
MATERIALS AND METHOD: Dental pantomograms (DPTs) of the jaws of patients with a narrowing of the dentition (72 cases) were studied. The position of the third molars was determined on the DPTs. The stages of formation of the third molar roots were studied according to the method of Demirjian. The material was grouped according to the age and type of anomaly. The criterion to include material in the study was the age of patients - 7-25 years with narrowing of the dentition.

RESULTS: The angles characterizing the position of the upper third molar decreased with age and the angles of the lower molar increased. This indicates a tendency to their vertical growth. In 37.8 per cent of cases of direct average force there were strong reliable correlations between the parameters. It was determined that the
position of the third molars was not related to age. A strong direct correlation ($r = 0.57-0.77$) of age and the stage of formation of molars showed that the older the patient, the higher the degree of formation of the root. The angles of the upper and lower third molars correlated only in the same jaw on the right and on the left ($r = 0.59$, $r = 0.50$, respectively). The stages of formation of the third molar roots in the upper and lower arches on the right and left have a direct strong correlation ($r = 0.59-r = 0.86$).

CONCLUSION: 1. In patients aged 7 to 25 years with a narrowing of the dentition, the position of the third molars is not related to age; the older the patient, the higher the degree of formation of the root. 2. The magnitude of the angles characterizing the position of the upper and lower third molars correlates with each other on the right and left but only in the same arch. A direct relationship exists between the magnitude of the angle of inclination of the third molar and the stage of formation of its root.

SP 338 EFFECTS OF FIXED ORTHODONTIC APPLIANCES IN ORAL HYGIENE: A PROSPECTIVE COHORT STUDY
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AIMS: To evaluate the correlation between orthodontic treatment with fixed appliances and gingival inflammation indices.

SUBJECTS AND METHOD: Thirty orthodontic participants, between 11 and 18 years old, were considered eligible to receive full fixed orthodontic appliances in both jaws. Two gingival indices were recorded: Plaque Index (PI) and Gingival Index (GI). PI was evaluated after colouration with fuchsin and GI by using a periodontal probe, recording the inflammatory surfaces of the teeth (distal, central, proximal at the lingual and labial sites). The first assessment took place before full bonding (upper and lower jaw; T0), the second one month (T1) and the third 3 months (T2) after. PI and GI were compared across time points using linear mixed models, while the effect of age was assessed by adding the former in the fixed effects portion of the models. These models were compared against those without the interaction terms using likelihood ratio tests. Statistical significance was set to $\alpha = 0.05$.

RESULTS: There was an increase of the PI with time [$T1$-$T0$: mean difference (MD) = 0.10, 95% confidence interval (CI) = 0.03, 0.18, $P = 0.01$; $T2$-$T0$: MD = 0.16, 95% CI = 0.08, 0.24, $P < 0.001$]. There was no evidence that GI changed across time-points ($P = 0.066$). The lingual/palatal surfaces, as anticipated, exhibited on average a decreased PI when compared to the labial ones, at any given time-point ($b = -0.09, 95\% CI= -0.14, -0.04, P = 0.001$), whereas the respective difference for GI was not statistically significant ($b = 0.04, 95\% CI= -0.01, 0.08, P = 0.11$).

CONCLUSION: In the frame of the current study, orthodontic treatment seems to influence oral hygiene of patients to a negligible extent. PI increased slightly during the first 3 months of treatment, whereas the GI presented no significant difference. Changes appear to have limited clinical consequences in oral hygiene status.

SP 339 SOCIAL MEDIA AND ORTHODONTIC TREATMENT FROM THE PATIENT’S PERSPECTIVE. A SYSTEMATIC REVIEW
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AIMS: To systematically search the literature and determine the various aspects of the inter-relationship between social media and orthodontics from the patient's perspective.

MATERIALS AND METHOD: Electronic database searches of published and unpublished literature were performed. The reference lists of all eligible articles were hand-searched for additional studies. Study selection, data extraction, and risk of bias assessment were performed individually and in duplicate by the first two authors. Randomised clinical trials (RCTs), prospective, retrospective and cross-sectional studies were included.

RESULTS: One RCT, three retrospective and four cross-sectional studies were deemed as eligible for inclusion in this review. The high amount of heterogeneity precluded a valid interpretation of the results through pooled estimates. The studies included patient statements on social media or results from questionnaires given to
patients. The social media reported in surveys were with order of frequency Twitter, You Tube, Facebook, and at a very low percentage Google+, Pinterest and Instagram. The results of the present research were divided into three categories according to their content: 1. The informational value of social media for orthodontic patients regarding the clinical part of the orthodontic treatment. 2. An insight into orthodontic patients’ perceptions and treatment experiences 3. Psychological effects of orthodontic treatment on patients.

CONCLUSION: Social media is one of the most common and easily accessible ways of gaining information about orthodontic treatment, especially by people of a younger age. Twitter users mentioned that they were occasionally subjects of bullying acts and, at the same time, the important role of the family in dealing with this emotional problem. On the other side, many patients reported that they were thankful for having braces, something that increased their self-esteem. The current study has shown that we can promote valid information to orthodontic patients and improve their already existing beliefs and behaviours around orthodontic treatment.

SP 340 EFFECT OF HYPERGLYCAEMIC CONDITIONS ON THE RESPONSE OF HUMAN PERIODONTAL LIGAMENT FIBROBLASTS TO MECHANICAL STRETCHING
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AIMS: To investigate the effect of hyperglycaemic conditions, simulating the diabetic state, on the response of human periodontal ligament (PDL) fibroblasts to cyclic mechanical loading.

MATERIALS AND METHOD: Human PDL tissues explants were used to develop primary cultures of PDL fibroblasts (hPDLF). Cells were either grown in normal glucose (5.5 mM) or in high glucose (30 mM) medium supplemented with 10 per cent foetal bovine serum. Cyclic tensile strain of (1Hz, 8% elongation) was applied to hPDLF with a specifically designed device. Western blot analysis was employed using specific antibodies against the phosphorylated forms of p38 MAPK, JNK and ERK. Expression of genes encoding for c-fos, Runx2, Osterix (Osx), alkaline phosphatase (ALP), osteopontin (OPN) and osteocalcin (OCN) was monitored by quantitative reverse transcription polymerase chain reaction analysis

RESULTS: Although high glucose has no effect on the cyclic stretching-induced activation of p38 MAPK signalling pathway, it lead to a decrease in the phosphorylation of ERK and JNK MAPK within the first 20 minutes of application of cyclic tensile strain. Moreover, both short-term exposure of PDL fibroblasts and long-term growth of cells under a high glucose environment inhibited the stretching-induced up-regulation of c-fos gene expression (2.49-fold decrease), a classical immediate cellular response to mechanical deformation. Furthermore, it down-regulated runt-related transcription factor 2 (Runx2) and Osx genes (0.93- and 0.81-fold down-regulation, respectively), encoding for two major transcription factors, downstream of c-fos, related to osteoblastic differentiation, as well as ALP (0.5-fold decrease), OCN (0.5-fold decrease) and OPN (1.03-fold decrease), three major osteoblastic markers.

CONCLUSION: High glucose concentration (simulating the diabetic state) has a negative impact on the osteogenic differentiation of hPDL fibroblasts during orthodontic therapy.

SP 341 EFFECT OF CYCLIC TENSILE LOADING ON OSTEOSTERIC DIFFERENTIATION OF HUMAN PERIODONTAL LIGAMENT FIBROBLASTS IN THE PRESENCE OF TUMOUR NECROSIS FACTOR-α
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AIMS: To assess the effect of cyclic tensile loading on human periodontal ligament (hPDL) fibroblasts' osteogenic differentiation after treatment with TNF-α, mimicking in vitro the inflammatory state in vivo.

MATERIALS AND METHOD: Human PDL tissues explants were used to develop primary cultures of PDL fibroblasts (hPDLF). Cells were stimulated with TNF-α at 1 and 10 ng/ml (simulating inflammatory conditions). Cyclic tensile strain of (1 Hz, 8% elongation) was applied to hPDLF with a specifically designed device. Western blot analysis was employed using specific antibodies against the phosphorylated forms of p38 MAPK, JNK and ERK. Expression of genes encoding for c-Fos, runt-related transcription factor 2 (Runx2), osterix (Osx), alkaline phosphatase
SP 342 ALIGNING ORTHODONTIC MECHANICS WITH EVIDENCE FROM NUMERICAL SIMULATIONS WITH THE FINITE ELEMENT METHOD
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AIMS: Efficient orthodontic biomechanics require precise application of forces on teeth that will facilitate the desired tooth movement. The aim of the present study was to investigate how evidence from numerical simulations in silico can be integrated in various clinical scenarios.

MATERIALS AND METHOD: Three-dimensional basic models were constructed to reflect the following three clinical scenarios: (a) alignment of an elongated mandibular premolar with a continuous wire (model of three premolars with periodontal tissues, bonded brackets and wire segment; 624,118 elements and 756,067 nodes) and (b) torque application on an upper central incisor (model of an upper central incisor with periodontal tissues, bonded bracket, and wire segment; 68,023 elements and 15,651 nodes). For each clinical scenario, anatomical/design characteristics and the materials of the orthodontic appliance were alternated to investigate their influence in the initial biomechanic response after activation (wire engagement in the malaligned premolar bracket; wire torsion for b). Afterwards, tooth displacement in all directions, strains in the periodontal ligament (PDL), and stresses in the orthodontic appliance were calculated and analyzed with the finite element program, MSC.Marc/Mentat version 2010 (MSC Software Corp., Santa Ana, California, USA).

RESULTS: In the premolar alignment scenario, developed strains in the PDL were mainly influenced by the wire (≥63% increase) and bracket (≥44% increase). Stresses developed within the appliance were likewise determined by the wire (≥148% increase) or bracket material (≥155% increase). In the upper torque application scenario, crown displacement was significantly affected by the material of the wire (≥150% increase), bracket positioning (≥94% increase), while the buccal apex displacement was significantly affected by bracket prescription (42% increase), bracket positioning (≥23% increase), and material of the bracket (≥19% increase). Strains in the PDL were affected mainly by wire material (≥127% increase), followed by bracket positioning (≥45% increase) and bracket material (≥230% variation). Finally, bracket prescription considerably affected the stresses in the bracket (≥144% variation).

CONCLUSION: Numerical insights from finite element simulations can aid to optimize the biomechanical systems applied on teeth during orthodontic treatment.

SP 343 ORTHODONTIC RANDOMIZED TRIALS ARE PUBLISHED LATE OR NOT AT ALL AND ARE RARELY REGISTERED A PRIORI, EVEN THOUGH NON-REGISTRATION IS LINKED TO BIAS
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AIMS: *A priori* registration of randomized clinical trials (RCTs) is crucial to the transparency and credibility of their findings. The aim of this study was to assess the frequency with which registered and completed randomized trials in orthodontics are published and to provide empirical evidence on bias originating from trial registration via a meta-epidemiological approach.

MATERIALS AND METHOD: ClinicalTrials.gov and ISRCTN were searched for registered RCTs trials in orthodontics that had been completed up to January 2017 and judged the publication status and date of registered trials using a systematic protocol. Statistical analysis included descriptive statistics, chi-square or Fisher exact tests, and Kaplan-Meier survival estimates. Additionally, a two-step meta-epidemiological approach with a Paule-Mandel random-effects model was implemented to calculate differences in standardized mean differences [Δ standardized mean difference (SMD)] between registered and unregistered trials and their 95 per cent confidence Intervals (CI), followed by subgroup and sensitivity analyses.

RESULTS: From the 266 orthodontic trials registered up to January 2017, 80 trials had been completed and included in the present study. Among these 80 included trials, the majority (76%) were registered retrospectively, while only 33 (41%) were published at the time. The median time from completion to publication was 20.1 months (interquartile range: 9.1 to 31.6 months), while survival analysis indicated that less than 10 per cent of the trials were published after 5 years from their completion. Finally, 22 (28%) of the completed trials remain unpublished even after 5 years from their completion. A total of 16 meta-analyses with 83 trials and 4988 patients collectively were finally included, which indicated that registered trials reported less beneficial treatment effects than unregistered trials (ΔSMD = −0.36; 95% CI = −0.60, -0.12). Although some small-study effects were identified, sensitivity analyses according to precision and risk of bias indicated robustness.

CONCLUSION: Publication rates of registered RCTs in orthodontics remained low, even 5 years after their completion date. Definite signs of bias from lack of trial protocol registration were found with non-randomized trials reporting more beneficial intervention effects than registered ones. Caution is warranted by the interpretation of non-registered randomized trials or systematic reviews thereof.

SP 344 MEASURING THE INFLUENCE OF ORTHODONTIC CLINICAL RESEARCH: DIFFERENCES ACROSS VARIOUS STUDY DESIGNS AND SCIENTIFIC JOURNALS: A FIVE-YEAR CITATION ANALYSIS

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AIMS: To assess the scientific influence of clinical research in both the dental literature overall and orthodontics. It was additionally assessed, if scientific impact is higher in evidence based studies such as randomized clinical trials (RCTs) or systematic reviews/meta-analyses (SR) and if it differs across scientific journals.

MATERIALS AND METHOD: Citation counts for all papers published in PubMed between 2010-2014 (allowing for a 2-year citation window) in dentistry and its specialties were gathered through the Web of Science. Scientific influence was measured on article level both conventionally with citation counts and using the novel relative citation ration (RCR) developed by the National Institute of Health, which normalizes citations across years and field. Differences according to (i) scientific field (dentistry versus orthodontics), (ii) publication journal, and (iii) study design (RCT, SR, or any other clinical study) were assessed via linear regression analyses on log-normalized scores. The effect of study design and journal on the prevalence of highly-influential orthodontic research (being in the top 20 per cent of all papers in the field) was assessed with binary regression with relative risks (RR) and 95 per cent confidence intervals (CI).

RESULTS: A total of 59202 studies published in PubMed during 2010-2014 were included, which were reduced to 44038 studies after elimination of duplicates and editorials/proceedings. The RCRs appropriateness across fields was validated, since it was consistent for general dentistry and orthodontics. Based on adjusted analyses, evidence-based study designs possessed significantly higher scientific influence than other clinical study designs ($P < 0.001$ for both), which was independent of publication year or journal. The largest improvement was seen for the European Journal of Orthodontics, which ended being ranked first in orthodontics for influence at the end of the observation period and consistently received more RCTs and SRs than other journals. Significant differences in the number of highly influential orthodontic papers were seen across orthodontic journals ($P < 0.001$), which were however almost completely explained by the design of the study. RCTs and SRs had on average 32 per cent higher probability of being highly influential (RR = 1.32; 95% CI = 1.10-1.58; $P = 0.003$).
CONCLUSION: Clinical research ranking high in the evidence-based pyramid has significantly higher scientific influence, independently of where it is published.

SP 345  HOW DO DENTAL PRACTITIONERS PERCEIVE DIFFERENT METHODS OF RECEIVING RESEARCH EVIDENCE? A QUALITATIVE STUDY USING ARTEFACTS
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AIMS: To explore how dentists perceive different existing and potential means of receiving and communicating research evidence.

MATERIALS AND METHOD: This was a qualitative study conducted through one-to-one artefact-stimulated semi-structured interviews conducted among general dental practitioners (GDPs) working in three European countries. Nine GDPs were recruited through purposive sampling.

RESULTS: Four themes emerged, as qualities essential for an artefact. First, a pleasant-to-use artefact; being multiplatform, more visual, interactive and inclusive of a social component. Second, a usable form of evidence; being brief/timely, easy to remember, convenient to use and easily found. Third, a relevant content; being contextualised and practical/procedural. Fourth, robustness of the evidence; having a trustworthy source.

CONCLUSION: The findings of the study suggest that research dissemination requires artefacts that are pleasant to use, while conveying a usable form of evidence, which is perceived both as relevant and trustworthy.

SP 346  GROWTH OF TREATED ISOLATED CLEFTS OF THE PALATE COMPARED TO NORMAL POPULATION – A CEPHALOMETRIC STUDY AT TEN AND SIXTEEN YEARS
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AIMS: To compare the growth of children born with an isolated cleft palate (ICP) and treated with one-stage palatoplasty with that of a normal population regarding cephalometric outcome at 10 and 16 years of age.

SUBJECTS AND METHOD: Treated group: 116 Caucasian (Swedish) children born with an ICP between 1987 and 2005. Individuals with other craniofacial malformations, apart from Pierre Robin Sequence, were excluded. The patients were treated surgically with one-stage palatoplasty (minimal incision technique) at a mean age of 13 months. The control group comprised 116 Caucasian (Swedish) children with a normal occlusion without a history of clefts and orthodontic intervention. The treated children (65 girls, 51 boys) were matched concerning gender and age with the children used as controls. A retrospective evaluation at 10 (mean age 10.6 years) and 16 (mean age 15.7 years) years of age was performed using lateral cephalograms. Ten skeletal and one soft tissue measurements were evaluated. Ninety five per cent confidence intervals were calculated and Student’s t-tests and three-way ANOVA with repeated measurements on one factor were performed.

RESULTS: The main differences in morphology were found between the treated and control group. There was a smaller cranial base angle (NSBa), a retrusive (SNA), smaller (maxillary length) and with increased inclination (NL/SN) maxilla, a smaller (mandibular length) and with increased inclination (ML/SN) mandible, a smaller ANB angle and a slightly more straight hard tissue convexity (NAPg) in the ICP cleft group.

CONCLUSION: Craniofacial cephalometric morphology at 10 and 16 years of age in treated patients born with an ICP palate differs compared to the morphology of a normal control group.

SP 347  CORRELATION BETWEEN PERIODONTAL SOFT TISSUE AND HARD TISSUE OF INCISORS IN SKELETAL CLASS III PATIENTS
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AIMS: To investigate the association between the soft tissue, alveolar bone, and dentoalveolar parameters surrounding incisors at baseline in skeletal Class III patients.

SUBJECTS AND METHOD: The study sample comprised 154 teeth of 28 patients with skeletal Class III malocclusion (19 males, 9 females, 21.15 ± 4.02 years). The condition of the periodontal soft tissue on maxillary
and mandibular incisors were evaluated using a periodontal probe and gingival recession, pocket probing depth, keratinized gingiva width (KGW) and keratinized gingival thickness (KGT) were recorded. To examine the morphological features of the alveolar bone, alveolar crest height, alveolar crest thickness, alveolar plate thickness, alveolar bone plate area, alveolar ridge thickness and tooth inclination were measured by cone-beam computed tomography (CBCT). Spearman’s rank correlation analysis was applied to identify relationships between soft tissue parameters and hard tissue factors. A Mann-Whitney U test was used to determine the difference in CBCT variables between thick and thin gingival types.

RESULTS: CBCT measurements were reduced to three hard tissue factors: lingual plate, coronal-buccal, and apical-buccal plate. KGW and KGT were positively correlated with the coronal-buccal plate factor, and negatively correlated with the apical-buccal plate factor. In the thin gingival biotype, the mandibular incisors were more proclined and the apical part of the buccal alveolar plate and the coronal part of lingual alveolar plate were thicker than in the thick gingival biotype.

CONCLUSION: The relationship between soft tissue biotype and underlying alveolar bone was not the same in all parts. It might be recommended to evaluate the periodontal tissue before treatment by dividing the region into the coronal-buccal and apical-buccal parts of the mandibular incisors in subjects with a skeletal Class III malocclusion. Tooth torque also seems to be associated with the gingival biotype and should be evaluated together.

SP 348 EFFECTS OF SIDEWAYS DISPLACEMENT OF THE TEMPOROMANDIBULAR JOINT ON DENTOFACIAL MORPHOLOGY IN WOMEN
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AIMS: Disc displacement of the temporomandibular joint (TMJ) significantly influences dentofacial changes. However, most studies have focused on associations only between anterior disc displacement of the TMJ and dentofacial morphology. The purpose of this study was to find the relationship between sideways disc displacement (SDD) of the TMJ and dentofacial morphology.

SUBJECTS AND METHOD: The sample consisted of 140 women older than 17 years of age. They had no systemic disease, no history of orthodontic or TMJ treatment, and no history of trauma involving the TMJs or juvenile rheumatoid arthritis. Each subject had routine lateral cephalograms and bilateral high-resolution magnetic resonance imaging (MRI) to evaluate the TMJs. They were divided into five groups depending on the sagittal and coronal images of MRIs of both TMJs: bilateral normal disc position, bilateral anterior disc displacement with reduction (ADDR) without SDD, bilateral ADDR with SDD, bilateral anterior disc displacement without reduction (ADDNR) without SDD, bilateral ADDNR with SDD. Twenty-six cephalometric variables were analyzed with the Kruskal-Wallis test to evaluate the differences in dentofacial morphology among the five groups.

RESULTS: Subjects with TMJ disc displacement had a retrognathic mandible with a hyperdivergent pattern, proclined mandibular incisors, and a large overjet, compared to those with a normal disc position. These specific characteristics became more severe from ADDR to ADDNR, irrespective of SDD. SDD significantly influenced the vertical and horizontal skeletal pattern in the presence of ADDR. The subjects in the ADDR group with SDD had a smaller N perpendicular to point B, and larger ANB, FMA, and maxillomandibular plane angle than those in the ADDR group without SDD, but no variable was significantly different between the ADDNR without SDD and ADDNR with SDD.

CONCLUSION: The findings suggest that TMJ SDD plays a significant role in the dentofacial morphology, specifically in subjects with ADDR.

SP 349 EVALUATION OF THE RELIABILITY OF THE 5-YEAR-OLD INDEX FOR RATING OCCLUSION, INCLUDED IN THE SWEDISH QUALITY REGISTRY FOR CLEFT LIP AND PALATE
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AIMS: To evaluate the reliability of the 5-year-old index (5YO) for rating occlusion in children born with unilateral cleft lip and palate (UCLP).

MATERIALS AND METHOD: Blinded study-casts (n=101) from 5-year-old individuals born 2009 to 2011 with a UCLP from six Jaw-orthopaedic centres in Sweden, were included. Assessment of the models was done individually by a senior orthodontist (n = 14) during one day twice, once in the morning and once in the afternoon. The 5YO (Atack et al., 1997) has five rankings, from 1 to 5, were 1 is evaluated as good and 5 as very poor dental relationship. For every score the sagittal relationship is the first to be evaluated and thereafter inclination of incisors, crossbite and open bites. A combined score was subsequently decided by each orthodontist. The statistical analysis was performed using IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, New York, USA). Inter- and intraexaminer reliability was calculated with quadratic weighted Kappa.

RESULTS: Agreement with the median was found in 78 per cent. The median differed one grade in the sample for score 1 in 16.7 per cent, score 2 in 23.6 per cent, score 3 in 26 per cent, score 4 in 32.1 per cent and score 5 in 32.7 per cent. A two-grade difference or more was found in 28 of the 101 cases. In 79 per cent of those cases only one orthodontist in the group differed from the other 13, in 12 cases by the same orthodontist. In five cases two orthodontists differed more than two grades and in one case three orthodontists differed more than two grades from the other 14. The assessment with quadratic weighted Kappa for the 5YO index by Atack et al. was found to be reliable with an intrarater agreement of 0.72-0.92 and intrarater agreement of 0.67-1.00.

CONCLUSION: The main objective of the registry was to ensure a good quality of treatment for the patient. Good agreement was found among the Swedish orthodontists. The 5YO index developed by Atack et al. included in the registry is a reliable method for rating the occlusion in children born with a UCLP.

SP 350 OCCLUSAL IMPROVEMENT FOLLOWING SPECIALIST ORTHODONTIST TREATMENT IN SCOTLAND – A PEER REVIEW OF 1140 CASES
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AIMS: To conduct a nationwide evaluation of the occlusal improvement gained following orthodontic treatment delivered by specialist orthodontic practitioners in Scotland, using the Peer Assessment Rating (PAR) Index. PAR is an index of occlusal irregularity. Unlike the Index of Orthodontic Treatment Need, the data produced is continuous, and as such, allows for a percentage calculation of occlusal improvement following treatment. PAR scoring has been shown to be both valid and reproducible when used by calibrated examiners and is therefore recognised by the British Orthodontic Society as a valid method of determining orthodontic treatment effectiveness.

SUBJECTS AND METHOD: Fifty one specialist orthodontists were invited to participate. Forty orthodontists replied with 38 (75%) being successfully enrolled, as two clinicians did not meet the inclusion criteria. Each practitioner was randomly assigned a colleague to peer review. In cases where a practitioner was matched with a colleague practicing in the same town or region they were given the opportunity to be re-matched if they did not want to be matched with that partner for political reasons. No participants requested a re-match. Practitioners assessed 30 consecutive cases completed by their paired colleague with each case being given a pre- and post-treatment PAR score. Prior to matching, each practitioner attended a PAR refresher course delivered by a consultant orthodontist with experience of delivering PAR certifying courses.

RESULTS: In total 1140 cases were assessed making this peer review the largest ever orthodontic related peer review to be undertaken in Scotland. The mean pre-treatment PAR score was 28.6. The mean post treatment PAR score was 3.5 giving a mean PAR reduction of 25.1. The mean percentage PAR score reduction was 86.8 per cent.

CONCLUSION: The standard of orthodontics was very high amongst the participating orthodontists with a mean PAR reduction of 86.8 per cent. This compares favourably to the 70 per cent PAR reduction required for an occlusion to be defined as ‘greatly improved’ following a course of treatment. Compulsory participation in national peer review should be considered as a method to establish current standards of orthodontics and identify areas in which care can be improved.

SP 351 CLINICAL NOTE KEEPING AMONGST SPECIALIST ORTHODONTISTS IN SCOTLAND
AIMS: To evaluate the standard of note keeping amongst specialist orthodontists in Scotland using a peer review methodology.

SUBJECTS AND METHOD: Every specialist orthodontist (51) in Scotland was identified through a process of cross-referencing existing email lists, the British Orthodontic Society website, the National Health Service Inform website, the General Dental Council website and from local consultant’s knowledge. Each specialist was invited to participate. Forty orthodontists replied; of which 38 satisfied the inclusion criteria. The participating orthodontists were randomly allocated another participant to assess. Each practitioner was given the opportunity to be re-matched if they did not wish to assess their assigned partner due to political reasons. No re-matching was requested. A total of 32 data points were included for each case. Each practitioner had 30 consecutive cases assessed in the peer review across six categories; dental pantomogram radiographs, photography, medical history, consent, written records and study models. Following data collection each practitioner was sent a report of their performance in each category compared to a national fixed number summary.

RESULTS: The data produced by the practitioners across the six categories was initially analysed using a quintile approach. The poorest performing category was consent; where a mean score of 40.8 per cent compliance was recorded. The best performing category was written records with a mean score of 100 per cent compliance being recorded in each of the five data points assessed. Of the data points 31/32 (96.9%) had a maximum score of 100 per cent highlighting that full compliance was attainable. Ten out of 32 (31.3%) of the data points had minimum scores of <5 per cent compliance suggesting that there are areas where significant improvements can be made following practitioner’” reflection on their scores.

CONCLUSION: Specialist orthodontic practitioners in Scotland are performing well in relation to record keeping in most areas. Following the peer review process each practitioner was encouraged to reflect on their performance in each category and implement methods in which performance could be improved. A peer review process holds specific advantages over audit as it allows orthodontists to gather, engage in wide ranging discussion and develop individual and group learning through shared experiences and evaluation.

SP 352 FACTORS THAT AFFECT THE AESTHETICS OF THE SMILE IN ADULTS WITH DIFFERENT OVERJETS
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AIMS: The smile is one of the most essential human facial expressions. Most patients seek orthodontic treatment for aesthetic purposes. It is therefore crucial for the orthodontist to be able to evaluate the smile aesthetics of a patient. Few studies in orthodontics have analysed the effect of the smile in the different types of malocclusion.

SUBJECTS AND METHOD: The sample comprised patients with a mean age of 20.07 (±4) years, divided into three groups according to the magnitude of the overjet before treatment (≤ 0 mm, 0-4 mm, >4 mm). Pre-treatment teleradiographic measurements were made involving cephalometric parameters (upper incisor inclination, lower incisor inclination, occlusal plane, Wits). A clinical smile analysis was likewise made of different parameters: buccal corridor, lower incisor exposure, smile arc ratio and arc shape.

RESULTS: Analysis of variance showed all the cephalometric parameters to be statistically significant in relation to the three overjet groups. With regard to correlations among the parameters, an association was noted between the occlusal plane (OP) and Wits and lower incisor (LI), and between Wits and LI. Increasing OP was associated with greater Wits, increasing OP to a lesser LI angulation, and greater Wits to a lesser LI angulation. With regard to the clinical variables, no significant differences were observed in any of the three groups, although near significance was recorded for buccal corridor (0.063) and arc shape (0.093): as overjet increases, so does the buccal corridor, while the arc shape value decreases. The correlation of the clinical variables also indicates that an increasing buccal corridor is associated with a decrease in smile arc. Moreover, an increasing buccal corridor is correlated to a decrease in arc shape value.

CONCLUSION: The smile is influenced by skeletal pattern and by horizontal discrepancy of the anterior teeth (overjet). The latter may be the main factor influencing smile pattern. The clinical variables were not statistically
significant, though buccal corridor and arc shape approached significance. This can be attributed to the small sample size.

SP 353 HYPODONTIA IN CLEFT PALATE FAMILIES
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AIMS: To evaluate the prevalence of hypodontia in parents and their children with non-syndromic cleft palate (NSCP) and to assess if hypodontia in the parents, a positive family history for oral clefs or the presence of a cleft in the parent influence the risk for hypodontia in children with NSCP.

SUBJECTS AND METHOD: Ninety three children with a NSCP and 91 of their mothers and 74 of their fathers from northern Finland. Dental records for 56 trios of the mother, father and the child of the same family were available for assessment of congenitally missing teeth. The family history of clefting was determined by interviewing the parents. Logistic regression analysis was used for the risk assessment for hypodontia in CP children.

RESULTS: Parents’ prevalence for hypodontia (8%) was similar to that in the Finnish non-cleft population. Children with a CP in this study sample had less hypodontia (20%) than previously reported in the Finnish cleft population. The presence of hypodontia in parents increased the risk five-fold for their child with a CP to have hypodontia. This is of the same order as the previously reported risk for hypodontia in families with NS incisor-premolar hypodontia. The family history of clefting was higher in this study population (50.5 %) compared to the previous reports in the Finnish population (20-25%). Mothers’ and fathers’ sides of the family contributed equally to the positive family history of clefting. More children with clefts of the hard palate had a positive family history (66%) than children with smaller soft palate clefts (24-29%). Nine parents (16.1%) had a cleft themselves. Nevertheless, family history of oral clefting or a cleft in the parent did not increase the risk for hypodontia in their children with a CP.

CONCLUSION: Parents of CP children did not have higher incidence of hypodontia compared to the general population, however, parental hypodontia increased the risk of their children with a CP to have missing permanent teeth at the same risk level as previously reported in families with NS incisor-premolar hypodontia.

SP 354 DIAGNOSTIC OPPORTUNITIES OF DENTAL PANTOMOGRAPHY IN LOCALIZATION OF IMPACTED MAXILLARY CANINES
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AIMS: The position of an impacted canine gauged radiographically is instrumental to the orthodontist’s decision to both expose and orthodontically align or to remove the impacted maxillary canine. The aim of this research was to determine the bucco-palatal position and prognosis of impacted maxillary canines on dental pantomograms (DPTs) according to the sector method.

MATERIALS AND METHOD: The material from this study consisted of 59 DPT of male and female patients, aged 11 to 18 years with maxillary canine impaction. On these DPTs, examinations for the determination of impacted maxillary canines, according to the Kuftinec and Chaushu methods, as well as the Ericson and Kurol sector method were performed.

RESULTS: The results for determination of the impacted canine crown position in relation to the adjacent tooth show a larger presence of palatal versus buccal position. For the majority of the analyzed teeth, or 47(59.49%), the canine cusp was between the long axis of the central and lateral incisors, or sector 2, which is the best prognosis for treatment longevity. An angulation of the impacted canine towards the median larger than 25 degrees was measured in 57 (72.15%) teeth, with mean angle α of 46.23 ± 13.7 degrees. A distance d larger than 14 mm was observed most often - 48 (60.76%) teeth.

CONCLUSION: Panoramic images were chosen to represent conventional radiographs because panoramic radiography is commonly used for the diagnosis and treatment planning of impacted canines.

SP 355 SEVERITY OF MALOCCLUSIONS IN CHILDREN WHO WANTED ORTHODONTIC TREATMENT AS ASSESSED BY THE INDEX OF MALOCCLUSION SEVERITY
AIMS: Frequently in determining the severity of the orthodontic malocclusion and the suitable starting time of the treatment different opinions have been expressed by specialists. This requires the use of objective criteria to determine the need for treatment. For quantitative determination of orthodontic treatment need in practice the orthodontic index has been introduced. There are several indices, approved in modern practice, but their main disadvantage is that they are not designed for use in the mixed dentition. The aim of this study was to determine the severity of malocclusion and orthodontic treatment need in children in the mixed and permanent dentition, who wished to undergo orthodontic treatment in two orthodontic clinics.

SUBJECTS AND METHOD: Three hundred and sixty children aged between 7-14 years (198 girls, 162 boys), who had not been previously been treated orthodontically were examined. The Index of Malocclusion Severity Assessment designed for use in the mixed and permanent dentition was used. This index consists of six groups of severity.

RESULTS: In 3.3 per cent of children very mild or no malocclusion was found. A mild malocclusion was observed in 16.1 per cent, a moderately severe malocclusion in 37.8 per cent, a severe malocclusion in 22.8 per cent, an extreme malocclusion in 18.9 per cent and an extreme malocclusion with complex treatment need in 1.1 per cent. The gender distribution was as follows: boys: 3 (1.8%) with very mild or no malocclusion, 26 (16%) with mild, 59 (36.4%) with moderately severe, 38 (23.5%) with severe, 33 (20.4%) with extreme malocclusion and 3 (1.9%) with extreme malocclusion with complex treatment need; girls: 9 (3.3%) with very mild or no malocclusion 32 (16.2%) with mild, 77 (38.9%) with moderately severe, 44 (22.2%) with severe, 35 (17.7%) with extreme malocclusion and 1 (0.5%) with extreme malocclusion with complex treatment need.

CONCLUSION: In 3.3 per cent of cases the first stage was found (very mild or no malocclusion). In these situations the orthodontic treatment is desired because of small aesthetic problems. There are no significant differences between the genders (P > 0.05). The girls dominate in the first three groups and the boys in the rest. In the last group the number is small number because patients seek treatment in hospitals.

SP 356 EFFECTS OF DIFFERENT VIBRATION MAGNITUDES AND FREQUENCIES ON CYCLOOXYGENASE-2 EXPRESSION IN HUMAN PERIODONTAL LIGAMENT CELLS

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AIMS: To investigate the effects of various vibration magnitudes and frequencies on the expression of cyclooxygenase-2 (COX-2) by human periodontal ligament (hPDL) cells and to determine the optimal vibration protocol that may enhance alveolar bone resorption.

MATERIALS AND METHOD: hPDL cell were subjected to mechanical vibration in a magnitude-dependent manner (frequency, 30 Hz; magnitude, 0.1, 0.3 or 0.6 g; 20 minutes every 24 hours and COX-2 expression was quantified at 6, 12, 24, 48 and 72 hours) or frequency-dependent manner (magnitude, 0.3 g; frequency, 30, 60 or 90 Hz; 20 minutes every 24 hours and COX-2 expression was quantified at 24 hours). COX-2 mRNA expression was determined with quantitative real-time polymerase chain reaction (qPCR). The protein expression of PGE2 in supernatant of PDL cells stimulated with vibration frequency 30 Hz, magnitude 0.3 g was determined with enzyme-linked immunosorbent assays (ELISA) at 24, 48 and 72 hours.

RESULTS: Mechanical vibration increased COX-2 mRNA expression in a time-, magnitude- and frequency-dependent manner. In response to vibration, COX-2 significantly increased and peaked at 24 hours, and then gradually decreased. With respect to magnitude, hPDL cells stimulated at magnitudes of 0.3 and 0.6 g expressed significantly higher levels of COX-2 compared to control cells; COX-2 expression peaked in cells exposed to 0.3 g mechanical vibration after 24 hours. With respect to frequency, COX-2 significantly increased in cells stimulated with 30 and 60 Hz vibration, but reduced in cells stimulated at 90 Hz. In addition, PGE2 protein levels in the cell culture media were found significantly upregulated in response to vibration at a frequency of 30 Hz and magnitude of 0.3 g compared to control cells.

CONCLUSION: The vibration frequency of 30 Hz and magnitude of 0.3 g was the lowest magnitude and frequency that induced highest increase in COX-2 mRNA expression in hPDL cells. The findings suggest that hPDL
cells respond to vibration at both the transcriptional and translational levels, which indicates application of vibratory stimuli may promote bone resorption when combined with compressive force.

SP 357  BONE FORMATION DURING ORTHODONTIC TOOTH MOVEMENT IN TYPE 2 DIABETIC RATS
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AIMS: To evaluate bone formation in a rat model of type 2 diabetes during orthodontic tooth movement.
MATERIALS AND METHOD: The animals were divided in four groups: Wistar control group (n = 14), Wistar appliance group (n = 14), Goto-Kakizaki (GK) control group (n = 14) and GK appliance group (n = 14). GK rats were used as a type 2 diabetes animal model. Animals of both appliance groups were fitted with a super-elastic closed coil spring appliance (F = 25 cN) between the upper first and second left molar and the upper incisors. Tooth movement was measured weekly from day 0 to day 42. Animals of each group were sacrificed on day 42 and tissue samples were prepared for further analysis. The alveolar bone area and osteoblast surface were determined histomorphometrically. Immunohistochemical staining with anti-osteocalcin antibodies was used to determine the number of osteocalcin-positive cells. Statistical analysis was performed using ANOVA, followed by Bonferroni’s multiple comparison test.
RESULTS: Physiological distal drift was greater in the GK control group compared to the Wistar control group (P < 0.01). No difference in the amount of tooth movement between type 2 diabetic and healthy rats was observed. Alveolar bone area was decreased in GK control and GK appliance groups compared to Wistar control and appliance groups (P < 0.01 and P < 0.001, respectively). Furthermore, the osteoblast surfaces in both diabetic groups were also decreased (P < 0.001). The number of osteocalcin-positive cells was significantly higher in the GK appliance group compared to the GK control group (P < 0.001), while no significant difference was observed comparing Wistar control and Wistar appliance group.
CONCLUSION: The amount of orthodontic tooth movement in type 2 diabetes is not affected. However, bone formation during orthodontic tooth movement in type 2 diabetes is diminished, despite the increase in osteoblast activity.

SP 358  RELIABILITY OF THREE-DIMENSIONAL CONE-BEAM COMPUTED TOMOGRAPHY SUPERIMPOSITION METHODS IN GROWING PATIENTS
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AIMS: To determine and compare the reliability generated by three three-dimensional (3D) cephalometric superimposition methods (voxel-based and landmark-based) in growing patients.
SUBJECTS AND METHOD: A retrospective, cross-sectional study was carried out on individuals receiving orthodontic treatment at the University of Alberta and University of Pacific. Twenty patients were randomly selected from a population of teenagers from 11 to 14 years. Acknowledging the controversial risk of cone beam computed tomographic (CBCT) scanning on young individuals, this study only analyzed gathered data from patients that participated in clinical trials. CBCT volumetric data were taken using the iCAT volumetric scanner at 120 kV, 5 mA and 8.9 seconds. Images were obtained and converted to Digital Imaging and Communications in Medicine (DICOM) format using the iCAT software with a voxel size of 0.3 mm. Utilizing AVIZO (Visualization Sciences Group, Burlington, Massachusetts, USA), ITK-SNAP (Penn Image Computing and Science Laboratory at the University of Pennsylvania), Slicer (Open Platform for the Medical Image Computing Community) and Dolphin software, the DICOM format images were rendered into a volumetric image using 512 × 512 matrices giving a range of 400-420 slices. Sagittal, axial and coronal volumetric slices, as well as the 3D image reconstructions, were used to determine the landmark positions, required for all three methods. Two images, pre- and post-treatment separated by a 24 month interval were analyzed for each patient. Analysis of the images was carried out by one researcher using the respective superimposition techniques (voxel-based and landmark-based methods). Intraobserver reliability was undertaken using 10 images and two repetitions each.
Data collected from each method was compared with each other. The Statistical Package for the Social Sciences was used to run the intraclass correlation coefficient (ICC) test to analyze the data. RESULTS: ICC was good to excellent for intraexaminer repeatability for most landmarks used when each method was assessed separately, ICC ≥0.97 (CI 95% 0.93,0.99). When reproducibility of the three methods was evaluated, ICC had a less powerful agreement with a wide range of confidence intervals. CONCLUSION: All methods provide an acceptable level of repeatability when assessed individually. Determining a gold standard is needed to evaluate the accuracy of 3D superimposition methods.

SP 359 SOFT TISSUE PROFILE IMPROVEMENT IN CLASS II GROWING PATIENTS. COMPARISON BETWEEN TWO TYPES OF REMOVABLE FUNCTIONAL APPLIANCES
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AIMS: To compare soft tissue treatment effects between two types of removable functional appliances and to estimate their connection with skeletal sagittal and vertical changes.
SUBJECTS AND METHOD: Two groups of 20 patients with a Class II division 1 malocclusion with mandibular skeletal retrusion. All patients were in the pre-puberty growth peak according to the vertebral maturation stage estimation. The patients in the first group were treated with Klammt’s elastic open activator and those in the second group with trainers T4K. All patients had lateral cephalometric radiographs from the beginning of treatment and after achievement of a Class I molar relationship. All radiographs were traced using the orthodontic software program (AudaxCeph Advantage). Customized cephalometric analysis was used which estimated soft tissue, skeletal and dentoalveolar changes, based on McNamara cephalometric analysis.
RESULTS: Improvements of soft tissue profile were noted in both treatment groups. In both groups there was a decrease in sagittal skeletal discrepancies and an increase in mandibular length. There was no significant influence on the facial height or vertical growth pattern. There was a decrease in upper incisor inclination in both groups.
CONCLUSION: Treatment of Class II division 1 growing patients with a removable functional appliance may favourably affect soft tissue convexity. Sagittal skeletal discrepancies and upper incisor inclination also decrease.

SP 360 PREVALENCE OF MALOCCLUSION AMONG 6-18 YEAR OLD CHILDREN WITH SPECIAL NEEDS IN THE REPUBLIC OF MOLDOVA
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AIMS: To assess the prevalence of malocclusion among school children with special needs in the Republic of Moldova.
SUBJECTS AND METHOD: Two thousand one hundred and fifty six children with special needs aged 6-18 years in the Republic of Moldova. Clinical examination recorded the malocclusions in the sagittal, horizontal and vertical planes according to a method evolved by Björk. The children were divided into two groups: 6-11 and 12-18 years of age. Malocclusions such as crowding and spacing of the teeth were also recorded.
RESULTS: There was a maxillary overjet in 7 per cent of 6-11 year old subjects and in 4 per cent of those aged 12-18 years. A mandibular overjet was present in 1 per cent of 6-11 year olds, but among those aged 12-18 it was 0.9 per cent. A deep bite was present in 8 per cent and open bite in 4 per cent of children aged 6-11 years. In children in the 12-18 year old group a deep bite was present in 4 per cent and an open bite in 2 per cent. A posterior crossbite was present in 4 per cent of 6-11 year olds and in 3 per cent of 12-18 year olds. Incisor segment crowding was the most common in lower dental arch (8% of those aged 6-11 age and 4% of 12-18 year olds). Spacing was found most in the upper dental arch (5% of 6-11 year olds and 3% of 12-18 year olds).
CONCLUSION: In 6-11 year old children a malocclusion seemed to be more frequent than in those aged 12-18 years. The frequency of malocclusion has increased in the child generation of today compared to the adolescent generation in the past.

SP 361 DIAGNOSIS AND TREATMENT OF PATIENTS WITH CLASS III MALOCCLUSION AND A VESTIBULAR POSITION OF THE UPPER PERMANENT CANINES
AIMS: To obtain and evaluate the results of integrated diagnosis and treatment of patients with a Class III and malocclusion and a vestibular position of the upper permanent canines.

SUBJECTS AND METHOD: Anthropometric methods, radiographic methods, gas-discharge imaging (GDI) and electropuncture by Foll were used all patients to diagnose disorders in the dentoalveolar system and diseases of various organs and body systems. Along with this, the ‘Korona TV’ device was used, which provides gas-discharge visualization and its registration. The state of the bioenergetic field was evaluated before and after correction of the bioenergetic state of the patient’s body over the area of the longitudinal section of the biofield (S) in squared centimetres (cm²). Investigations of kirlianograms of fingers were carried out with subsequent computer processing of data, using topological maps (Korotkov). Statistical processing of the results was performed before and after integrated treatment. The Foll method was performed on the ‘medis-Foll’ complex was undertaken in all subjects to assess their general state of the organism. This technique allows characterization of the state of human organs on the basis of recording the difference of bioelectric potentials between biologically active points on the hands. At the same time, an electric probe is used, and the patient holds the round electrode in his hand.

RESULTS: The area of the biofield after correction was, on average, 503.7 cm² before and 721.5 cm² after treatment. All subjects showed a weakening of their health, and in order to clarify the general disorders of the body, an electropuncture according to Foll was performed. There were violations on the meridians: joints in 11 patients (50.0%), stomach in 14 patients (63.6%), liver in 10 patients (45.5%) and allergies in six patients (27.3%), which indicated diseases of these organs.

CONCLUSION: Diagnosis of the general state of health in patients with a Class III malocclusion and a vestibular position of the upper permanent canines with the help of the Foll and GDI methods promotes acceleration of orthodontic and integrated treatment and significantly increases its effectiveness.

SP 362 COMPARATIVE CHARACTERISTICS OF THE POSITION OF THE THIRD MOLARS IN CLASS II AND III MALOCCLUSIONS

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AIMS: To compare the position of the third molars in patients with sagittal occlusal anomalies.

MATERIALS AND METHOD: Dental pantomograms (DPTs) of 110 patients aged 12-15 years with Class II (54 cases) and Class III (56 cases) malocclusions due to distal or mesial position of the mandible. The position of the third molars on the DPTs was estimated from the value of the internal angles formed by a perpendicular line connecting the vertices of the mesial and distal tubercles of the third molars: for the upper molars, to the infraorbital line (angles 1 and 2), for the lower molars, to the base of the lower jaw (angles 3 and 4). The material was statistically analysed.

RESULTS: In Class II subjects the angles characterizing the position of the upper third molars increased from 116 to 129 degrees and the angles characterizing the position of the lower ones from 64 to 71 degrees, reliably graphically confirmed by trend lines. In Class II patients the angles characterizing the position of the upper third molars increased from 112 to 136 degrees, and for the position of the lower molars from 67 to 82 degrees. On linear expression of the trend there were tendencies for a change in the position of the upper and lower third molars, the distance between them was more at 12 years and significantly decreased by 15 years. It was found that the increase of the angles of the upper molars was 6.5-8.2 per cent and for the lower molars a decrease of 3.3-4.0 per cent.

CONCLUSION: 1. The magnitude of the angles characterizing the position of the third molars varies with age and to a greater extent in patients with a Class III malocclusion than in those with a Class II malocclusion. 2. The older the patient with occlusal sagittal anomalies, the smaller the angles characterizing the position of the upper molars, while the lower molar angles on the contrary increase. 3. Changes in the angles characterizing the position of the third molars correspond to their vertical correct position.
**SP 363 COMPARISON OF THREE DIFFERENT METHODS OF ALVEOLAR CORVICOCISION IN ORDER TO IMPROVE ORTHODONTIC TOOTH MOVEMENT**

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AIMS: Corticocision has been described as an effective method to improve orthodontic tooth movement. However, little is known about its precision and possible risks. The aim of this study was to compare two piezo surgical and one conventional method for interradicular corticocisions

**MATERIALS AND METHOD:** Fifteen anatomical specimens of the human jaw obtained from the anatomical institute were included. They were fully dentate with exception of the third molars. For planning of the surgical procedure, all specimens received a digital volume tomography (Galileos Comfort Plus). Consequently, the three-dimensional planning software of the system served to determine the position of the vertical corticocisions on the buccal side distal from the canine. A total of 120 sites were suitable for the procedure and each of them was assigned to one of the three methods. Corticocision was performed either in a conventional way, with a rotating tool and a handpiece, or with one of the two piezo surgical tools (Mectron Piezosurgery or Acteon Piezotome)

**RESULTS:** Deviations between the planned and finally realized were detected at all sites and with all methods. However, both piezoelectric methods proved to be superior than conventional corticocision with a rotating tool. The deviations were significantly greater with conventional corticotomy.

**CONCLUSION:** Piezoelectric corticocision seems to be more secure than a conventional corticocision. However, safety distances are recommended in all three methods.

**SP 364 EFFECTS OF VIBRATIONAL FREQUENCIES ON GENE EXPRESSION OF WNT SIGNALLING MOLECULES AND TRANSCRIPTION FACTOR IN HUMAN MANDIBLE-DERIVED OSTEOLASTS**

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AIMS: To investigate the effects of different vibrational frequencies of low-magnitude, high-frequency mechanical vibration on gene expression of Wnt signalling molecules and transcription factor in human mandible-derived osteoblast-like (HOB) cells in vitro.

**MATERIALS AND METHOD:** HOB cells (n = 2) were subjected to vibration at 30, 60 and 90 Hz frequency with 0.49 g magnitude, 30 minutes/day for 48 hours. Wnt3A, Wnt5A, Wnt10B, and Runx2 mRNA expression were measured by real-time polymerase chain reaction. The results were presented as fold change compared to a control group. Statistical significant differences were determined using Kruskal Wallis test.

**RESULTS:** Vibrational frequency affected the expression of Wnt signalling molecules and transcription factor with the highest potency at 60 and 90 Hz. The expression of Wnt3A mRNA were downregulated in all vibrational frequency groups with the lowest expression at 60 Hz (0.15-fold). Wnt5A, Wnt10B and Runx2 mRNA decreased expression at 90 Hz (0.88-fold, 0.17-fold, and 0.70-fold respectively).

**CONCLUSION:** These results indicate that mechanical vibration suppresses the mRNA expression of WNT signalling molecules and Runx2 with the highest responses in the 60 and 90 Hz frequency group.

**SP 365 GENDER DIFFERENCES OF PERIODONTAL LIGAMENT CELLS IN ORTHODONTIC TOOTH MOVEMENT**

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AIMS: Gender differences in orthodontic tooth movement have been described in animals and humans. However, the expression of sex hormone receptors in periodontal ligament cells (PDLs), which are known to mediate bone remodelling during orthodontic tooth movement, have been discussed controversially. The aim of this study was to determine whether tooth movement is subject to gender-specific differences and might be influenced by sex hormones.

**MATERIALS AND METHOD:** Gender-specific differences and the expression of sex hormone receptors in PDLs from extracted premolars of adult donors (mean age female: 25.6 years, mean age male: 24.5 years) were
investigated in vitro using immunocytochemistry, Western blot analysis and real-time reverse transcription-polymerase chain reaction. To test the influence of sex hormones, the culture medium was supplemented with oestradiol for 24 hours.

RESULTS: Regarding isolation and cell culture, no gender-specific differences in PDLCs were observed. In the presence of oestradiol PDLCs demonstrated high expression of oestrogen receptor ß, while oestrogen receptor α was barely detectable. No gender differences in the expression of oestrogen receptors were observed.

CONCLUSION: Sex hormones might influence orthodontic tooth movement by regulation of gene expression patterns independent from biological gender. Further studies are required to determine possible sex hormone mediated changes in the expression of bone remodelling proteins such as receptor activator of NF-κB ligand or osteoprotegerin.

SP 366 ANALYSIS OF THE MAGNITUDE OF ROOT RESORPTION AFTER TREATMENT WITH BRACKETS
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AIMS: To compare the root resorption produced between conventional and self-ligating brackets, in addition to assessing the amount of apparent resorption that occurs on panoramic radiographs of the lower incisors due to proclination.

MATERIALS AND METHOD: In this study, the panoramic radiographs (pre- and post-treatment) of 50 patients were compared, recording the degree of radicular resorption of all teeth included in the multibracket system. Of the total sample, 29 patients had conventional brackets (with a 0.18 slot) and 21 patients self-ligating brackets (with a 0.22 slot). Resorption was measured using the Photoshop Cs6® program. Because the root size (in millimetres) of the dental piece is not known, the best and most precise way is to express the tooth size and radicular shortening in percentage. As the percentage in the Photoshop® program is expressed in relation to the total height of the radiograph, to find the percentage of root shortening it was necessary to make a rule of three or cross multiplication.

RESULTS: There was little difference between either bracket systems (P > 0.05), indicating that the degree of root resorption of the lower incisors is largely overestimated.

CONCLUSION: 1. Magnification, lack of reproducibility and dental proclination are the main limitations of longitudinal measurements on panoramic radiographs. 2. Similar radicular shortening between self-ligating and conventional brackets occur. 3. Shortening perceived (estimated) is 6.3 per cent (in lower arch, supported by other articles).

SP 367 CHANGES IN DEPRESSION AND PAIN IN ORTHODONTIC AND SURGICAL PATIENTS AT LONG-TERM FOLLOW-UP
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AIMS: To follow changes in depression during orthodontic or orthodontic-surgical treatment and whether pain and depression associated before and after treatment.

SUBJECTS AND METHOD: Sixty four patients (46 women, 18 men) 44 treated with combined surgery and orthodontics (ORT-SURG) or 20 orthodontically only (ORTH) because of severe malocclusion and functional problems. Data were collected with questionnaires before and on average three years after treatment. Depression was measured with the Finnish modification of the 13-item Beck Depression Inventory and the intensity of facial pain with a visual analogue scale (VAS). Statistical significance of the differences before and after treatment were assessed the with Mann-Whitney U test. When both groups were combined, the correlations between depression and pain were measured before and after treatment.

RESULTS: Significant reduction in VAS was found in both groups, ORT-SURG (3.2 versus 0.6 P < 0.001) and ORTH (3.1 versus 1.0 P = 0.007). Depression decreased in ORT-SURG group (2.3 versus 1.6, P = 0.045) but not in ORTH group (2.0 versus 1.9, P = 0.745). The correlation between pain and depression approached statistical significance before treatment r = 0.240, P = 0.058 but not after treatment r = 0.073, P = 0.566.
CONCLUSION: Combined surgical and orthodontic treatment of severe malocclusion and functional problems seems to decrease depression. However, this might not be due to decreased facial pain.

SP 368 MOTIVATION IN ADULT PATIENTS AFFECTED BY PERIODONTITIS FOR ORTHODONTIC TREATMENT EVALUATED BY AN ORAL HEALTH IMPACT PROFILE QUESTIONNAIRE

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AIMS: A large proportion of adults are affected by moderate to severe periodontitis. Fixed orthodontic appliances can successfully align pathologically migrated teeth and contribute to improvement of periodontal conditions in these patients. Therefore, interdisciplinary treatment has become increasingly important. Here, the motivations of adults with periodontitis to undergo orthodontic treatment were investigated.

SUBJECTS AND METHOD: One hundred and four adult patients with moderate to severe periodontitis answered an Oral Health Impact Profile questionnaire (Klages et al., 2004). Moreover, from each subject periodontal and orthodontic indices including the Periodontal Screening Index, bleeding on probing, Peer Assessment Rating Index, Little’s irregularity index and the Index of Orthodontic Treatment Need were assessed. Clinical data and answers obtained from the questionnaires were statistically analyzed.

RESULTS: One-third of the study subjects were willing to undergo orthodontic therapy and indicated long-term healthy and aesthetically appealing teeth as their main motives. In females, crowding and spacing of the upper incisors positively correlated with motivation for treatment. Also, correlations were found between subjectively experienced impaired quality of life (QoL) and interest in orthodontic treatment. More than half of the patients had never been provided with information about treatment options.

CONCLUSION: A considerable proportion of adult patients with periodontitis are interested in orthodontic therapy. Improved access to information about orthodontics for adults may help to provide them with treatment measures, such as tooth alignment, which can improve the outcome of periodontal therapy and increase QoL.

SP 369 QUALITATIVE AND QUANTITATIVE CHANGES IN THE ORAL BACTERIAL FLORA OCCUR SHORTLY AFTER IMPLEMENTATION OF FIXED ORTHODONTIC APPLIANCES: A PILOT STUDY

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AIMS: To determine, in a pilot study, the qualitative and quantitative microbial changes after implementation of fixed orthodontic appliances.

SUBJECTS AND METHOD: Ten healthy patients aged 12 to 15 years were recruited who had to undergo orthodontic treatment with fixed buccal appliances. The gingival conditions were assessed using the gingival index (GI), periodontal screening index and sulcus bleeding index (SBI). Microbiological samples were collected before and one week after start of the therapy from premolars and molars in the right upper quadrant. Bacterial species were identified by matrix-assisted laser desorption/ionization time of flight mass spectrometry (Wieser et al., 2012).

RESULTS: The total number of bacteria increased during the first week with multibracket appliances. There was a significant increase at the premolars (P < 0.05). Six bacterial species were identified, which are involved in caries and other infectious processes. They selectively adapted more efficiently to the new oral environment as compared to the general oral microbial background. There was a significant increase of Streptococcus spp. at the premolars and molars (P < 0.05). In all individuals symptoms of inflammation and gingivitis were detected as a response to the bacterial challenge (GI: P < 0.05, SBI: P < 0.01).

CONCLUSION: Orthodontic treatment induces significant changes in the oral microbial flora associated with periodontal and cariogenic reactions within the first days of orthodontic treatment. To prevent or reduce potential unwanted side effects, oral hygiene instruction and control of patients are necessary prior to and during the course of treatment.
SP 370  ANSWERING THE ORTHOGNATHIC PATIENT’S QUESTION: HOW LONG WILL I WEAR MY BRACES FOR?
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AIMS: The primary aim of this project was to assess how long patients undergoing a combination of orthodontics and orthognathic surgery at the Queen Victoria Hospital wear fixed appliances and secondly to determine if there were any factors that may influence this time.

MATERIALS AND METHOD: Data for a total of 244 patients was collected and assessed to determine the length of fixed appliance time from bond-up to surgery and also to debond. Possible influencing factors such as age, gender and type of surgery were assessed for impact.

RESULTS: The average amount of time surgical patients wear fixed appliances was 36.4 months (range 10.1–85.7 months). There was little difference in total treatment time between female (36.4 months) and male (36.0 months) patients. Patients prepared for bilateral sagittal split surgery (36.0 months) wore fixed appliances on average for shorter times than bimaxillary osteotomy surgery (36.4 months) and Le Fort 1 surgery (36.5 months), respectively. Those patients aged ≥31 (38.6 months) experienced a slightly increased treatment time when compared to patients <30 years old (36.0 months).

CONCLUSION: The average fixed appliance treatment time for patients undergoing orthognathic surgery within the Queen Victoria Hospital is 36.4 months which equates to 3.03 years. That data indicates that patients over the age of 31 experience a slightly increased treatment time while those prepared for bilateral sagittal split surgery appear to experience a shorter treatment time than for other surgeries.

SP 371  POSTNATAL DEVELOPMENT OF THE CRANIOFACIAL SKELETON IN SONIC HEDGEHOG HETEROZYGOUS MICE
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AIMS: The sphenoid bone is crucial for the study of craniofacial growth. Therefore, this bone and the sphen-occipital synchondrosis are well described. However, the impact of Sonic Hedgehog (Shh) signalling, a known key regulator of craniofacial growth, on this bone development needs to be thorough. Here, the role of SHH signalling in sphenoid bone formation and its consequences on post-natal architecture in mouse models was explored.

MATERIALS AND METHOD: This study was conducted with genetically modified mouse models. Heterozygotes Shh mouse embryos in comparison with control mouse embryos were investigated. The mouse skeletons were analyzed in red alizarin and blue alcian for a macroscopic study. The embryos were studied at 18.5 embryonic days (E), 12, 26 and 37 days post birth. Measurements of the skull and anatomy of the sphenoid were compared between the two groups to allow for statistical evaluation.

RESULTS: The hypomorphic mouse model of Shh signalling presents an abnormal anatomy of the basisphenoid bone. At E18.5, in Shh+/-, the basisphenoid shows a persistent foramen on the midline. The foramen was present in 75 per cent of the Shh+/− mice and absent in the control Shh+/+ mice. The pre-sphenoid was also affected, with a global hypodevelopment. The foramen suggests an ectopic pituitary gland and the persistence of the buccohypophyseal canal. An alteration in the intersphenoidal synchondrosis in Shh+- mouse was found at the adult stage. A loss of the synchondrosis was visible in 75 per cent of Shh+/- mice. Moreover, a significant difference in the cranial dimensions, with a reduction of the frontonasal complex and a widening of the posterior skull was observed on these mutants.

CONCLUSION: These results bring out the consequences of an anomaly of the basisphenoid on craniofacial growth at different stages of development in a Shh reduction context.

SP 372  REPRODUCIBILITY OF SMILE PHOTOGRAPHIC REGISTRATION IN ORTHODONTICS. COMPARISON OF THREE DIFFERENT INSTRUCTIONS GIVEN TO 39 SUBJECTS TO TRIGGER THEIR SMILE
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AIMS: To evaluate the reproducibility of otographic registration of a smile according to the photographer, the session and the instructions given to the subject. A secondary aim was to collect descriptive data about the recorded smile variables.

MATERIALS AND METHOD: One thousand eight hundred and seventy two facial smiling photographs were taken according to the three following instructions given to the subject: ‘give me a nice and big smile, one that shows your teeth’, repeat after me ‘Chester eats cheesecake on the Chesapeake’ and smile ‘smile and say cheese’. Following a pilot study, 39 dental undergraduates were enrolled after ethical review board approval. During one session, two different operators triggered the smile of the subjects by giving them the three instructions and took two photographs for each instruction. The photograph that showed teeth the most was then selected. This session was repeated one week later. Eleven variables derived from the Ackerman Smile Mesh were defined. Reproducibility was characterised with intraclass correlations (ICC) and smile variables were defined with standard descriptive statistics.

RESULTS: Twenty per cent of the subjects displayed a gingival smile greater than 0.5 mm. Gingival smile was more common in females than in males with a 2/1 ratio. Eighty seven per cent of the subjects displayed a consonant smile. Buccal corridors represented on average 19 per cent of the smile width. The change of photographer, the different sessions and instructions given to the patient led to variations of less than a millimetre. Most variables defined with the instruction ‘give me a nice and big smile, one that shows your teeth’ were identified as a major requirement compared to the other two instructions. One exception was the mandibular incisors which were more visible when the patients were instructed to ‘smile and say cheese’. A hierarchy could be defined between the three instructions regarding the reproducibility of the smile characteristics. The most reproducible instruction was ‘smile and say cheese’ (ICC = 0.99), followed by repeat after me ‘Chester eats cheesecake on the Chesapeake’ (ICC = 0.93), and finally by ‘give me a nice and big smile’ (ICC = 0.88).

CONCLUSION: The instruction ‘smile and say cheese’ results in the highest reproducibility of smile characteristics.

SP 373 CEPHALOMETRIC CHANGES IN CLASS III PATIENTS AFTER THE USE OF A FACEMASK WITH DISJUNCTION
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AIMS: To observe cephalometric changes in Class III patients after the use of a facemask with disjunction.

SUBJECTS AND METHOD: Forty patients who had received Class III orthopaedic treatment. For the study, the initial values were compared with the values after facemask treatment. The values from McNamara cephalometry (maxillary length, mandibular length and lower facial height), Steiner (SNA, SNB and ANB), and MSE cephalometry (mandibular body length, anterior cranial base, occlusal plane, dentoalveolar processes, Wits and soft tissues taking as a reference of true vertical) were measured. A chi-square biostatistic test was then performed to see if there was a relationship between age, gender and/or duration of treatment with the cephalometric values studied.

RESULTS: Assessing the means of each cephalometric value we observed that, in spite of greater mandibular growth than maxillary in all cases, an improvement of the Class III occurs when increasing both the Wits and the occlusal plane. The lower lip increases with the true vertical and the upper lip remained practically the same. In the statistical analysis it was observed that greater results obtained in patients aged 9 and 13 years.

CONCLUSION: The use of a facemask at an early age produced improvements of Class III, as a result of small results obtained in all the parameters studied.

SP 374 VALIDITY AND RELIABILITY OF A NEW ANALYSIS FOR SOFT TISSUES CHANGES USING THREE-DIMENSIONAL IMAGING
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AIMS: To create a new soft tissue analysis for three-dimensional facial scans (FS), and to assess its validity and reproducibility compared to cone beam computed tomography (CBCT).

SUBJECTS AND METHOD: A total of 60 subjects. 30 growing participants (8-17 years old) and 30 non-growing participants (older than 21 years old), with a full field of view CBCT and FS performed at a maximum of 10 days of distance, were collected. The FS were superimposed with a best fit alignment on the soft tissue segmented of the CBCT using areas least affected by gravity and facial expression. Two different reference systems on the same FS were constructed using the same axial plane (TrL, TrR, MEN) and changing the construction of the sagittal and coronal plane. On the CBCT, the reference system was built using S, N, Ba. Once CBCT and FS were aligned and superimposed, the two reference systems of FS were compared by measuring the differences (in degrees) between the sagittal and coronal planes. Successively, the two reference systems based on FS were compared with the reference systems built using the CBCTs, considered as the gold standard, to assess validity. After two weeks, all the FS were reassessed by the same examiner to evaluate intraoperator reproducibility. Validity and reproducibility were assessed by means of parametric and non-parametric statistical analysis. Statistical significance was set at \( P < 0.1 \).

RESULTS: The two analyses showed statistically significant differences in the position of both the sagittal and coronal planes (\( P < 0.1 \)). Both analyses showed no statistically significant differences in the sagittal plane between FS and CBCT (\( P > 0.1 \)), while the coronal plane of FS, constructed with both analyses, showed statistically significant differences with respect to the coronal plane of the CBCT (\( P < 0.1 \)). Finally, both the analyses presented good reproducibility; neither the coronal, sagittal or axial plane were different between the two time-points for either analysis (\( P > 0.1 \)).

CONCLUSION: Both the analyses tested in this study showed good validity and reproducibility and their use is suggested as a reference system for FS.

SP 375 PROFILOMETRIC SOFT TISSUES EVALUATIONS IN CLASS II PATIENTS TREATED WITH SANDER’S BITE-JUMPING APPLIANCE

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AIMS: To evaluate soft tissue effects of Sander’s Bite-Jumping appliance (BJA) in skeletal Class II malocclusion patients, compared with two groups of skeletal Class II and Class I untreated subjects.

MATERIALS AND METHOD: A set of 33 cephalograms (19 boys, 16 girls; mean age 10.3 ± 2.3 years, BJA group, T0-T1 before and after treatment) of patients with a skeletal Angle Class II malocclusion due to mandibular retrusion, with cervical maturation stage (CVMS) CVM2-CVM3 treated using the BJA appliance, was compared with 33 cephalograms (26 boys, 7 girls; mean age 10.6 ± 1.2 years, CTR group, T0-T1 observation period 12 months) of skeletal Class II untreated control group and with an untreated skeletal Class I control group including 53 subjects (26 boys, 27 girls; mean age 10 ± 1.4 years, Class I group, T0) matched by gender and CVMS. Data were annualised over a 12 month period. The cephalometric measurements were performed by one blinded operator using the cephalometric analyses suggested by Bergman and Malta. Between groups and within group differences were assessed by means of parametric and non-parametric statistical analysis. Statistical significance was set at \( P < 0.05 \).

RESULTS: At T0 there were no significant differences between BJA and CTR group, while all subjects with a Class II showed a reduction in facial profile (\( P < 0.001 \)) and nasolabial (\( P = 0.033 \)) angle, more protruded maxillary soft tissues (\( P < 0.001 \)) and more retruded mandibular soft tissues (\( P < 0.001 \)) with respect to Class I participants. At T1, the BJA group showed a significantly greater reduction of the protrusion of the maxillary soft tissues (\( P < 0.001 \)), and a greater forward movement of the mandibular soft tissues (\( P = 0.0042 \)) with respect to the CTR group. Finally, after treatment, the BJA group achieved on average the same cephalometric values as the Class I group (all \( P > 0.05 \)), showing that BJA improves the facial profile in patients with a skeletal Class II malocclusion.

CONCLUSION: Skeletal Class II with respect to skeletal Class I malocclusions showed a more convex profile with a close nasolabial angle a protruded maxilla and a retruded mandible. The Sander’s BJA had significant effects on patients’ soft tissues achieving cephalometric values similar to the Class I subjects.
SP 376 DESCRIPTIVE STUDY OF THE CHANGES IN SOFT TISSUE PROFILE AFTER TWIN-BLOCK APPLIANCE TREATMENT

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AIMS: To compare pre- and post-treatment changes in soft tissue profiles due to Twin-Block (TB) appliance treatment in Class II patients.

MATERIALS AND METHOD: Archived latero-lateral teleradiographs of patients treated with a TB appliance between 2009 and 2016. Fifty two TB treated patients were included in this study. For each pre- and post-treatment teleradiograph a cephalogram was drawn with NemoCeph software (Nemotec®). The following variables were measured: the distances in millimetres of the soft tissue points: Labrale superior (Ls), Labrale inferior (Li), Pogonion (Pg') and Menton (Me') from the Nasion perpendicular (McNamara analysis), as well as the amplitude in degrees of naso-labial and mento-labial angles.

RESULTS: Fifty two per cent of the sample was male and 48 per cent female. The average ages of the patients at the beginning and at the end of treatment were 10.9 ± 1.8 and 12.2 ± 1.8 years, respectively, while the mean duration of treatment was 17.2 ± 5.2 months. All variables measured on the cephalograms showed a statistically significant increase (P ≤ 0.05), except for Ls point.

CONCLUSION: The distances of the points Li, Pg' and Me' of perpendicular Nasion showed significant changes that determined a convexity reduction that characterizes Class II profiles, causing important aesthetic improvements. The naso-labial angle showed small changes that were not clinically significant. The mento-labial angle showed a significant increase that led to the improvement of the lip seal, determining a significant functional improvement.

SP 377 CRANIOFACIAL SHAPE IN PATIENTS WITH BETA-THALASSAEMIA: A MORPHOMETRIC ANALYSIS

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AIMS: To morphometrically evaluate the shape of the craniofacial complex of patients with beta-thalassaemia and compare it with matched controls.

MATERIALS AND METHOD: The beta-thalassaemia group consisted of 40 patients (16 females, 24 males). Each patient was matched according to their age and gender to two controls (n = 80 controls). A total of 120 lateral cephalometric radiographs were collected, one from each patient, digitized and traced with 15 curves and 127 semi-landmarks. These landmarks were subjected to Procrustes superimposition and principal component analysis in order to describe shape variability of the cranial base, maxilla and mandible, as well as of the whole craniofacial complex. Shape differences were visualized using thin plate spline (TPS) grids. The error of the method was evaluated using repeated digitizations by two different observers.

RESULTS: The beta-thalassaemia group was significantly different in shape to the control group (P < 0.001). The two groups were clearly separated in shape space with minimum overlap. The main differences were related to smaller mandibular body and midface protrusion. Also, augmented thickness appeared at the frontal and palatal area. The above findings suggest that the shape of the craniofacial complex in beta-thalassaemia patients is prone to be more convex and divergent than the normal. These shape differences are in accordance with the clinically and radiologically observed well known respective characteristics of this disease.

CONCLUSION: Beta-thalassaemia results in significant shape alterations of the craniofacial complex. Further studies are needed to evaluate the effect of different beta-thalassaemia genotypes on craniofacial shape.

SP 378 CLASS II DIVISION 1 TREATMENT – DOES SEVERITY OF THE CLASS II RELATIONSHIP AND SKELETAL MATURITY QUALIFY AS OUTCOME PREDICTIVE FACTORS?

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AIMS: To assess the influence of the severity of Class II relationship and skeletal maturity on treatment (Tx) outcome in Class II:1 patients.

MATERIALS AND METHOD: All Class II:1 patients who completed Herbst-Multibracket appliance (MBA) Tx between 1986 and 2014. Study casts from pre-Tx, post-Tx and (if available) after ≥24 months of retention were evaluated using the Peer Assessment Rating (PAR) Index. The patients were categorized into four occlusal

RESULTS: A total of 492 Class II:1 patients (mean 14.4 years, range: 9.8-44.4 years) were included. Tx consisted of a Herbst phase (mean 8.1 months) and a subsequent MBA phase (mean 16.1 months). Data from after ≥24 months of retention (mean 32.6 months) were available for 232 patients. For the complete sample, the PAR score was 32.4 ± 8.8 pre-Tx, 8.0 ± 4.5 post-Tx and 8.8 ± 5.1 after retention. No significant intergroup differences were seen either for the occlusal severity or for the skeletal maturity subgroups. Using Spearman’s rank correlation coefficient a very low association between pre-Tx severity of Class II occlusal relationship and PAR score reduction after retention (r = 0.23) was found but no association between pre-Tx skeletal maturity and PAR score reduction after retention (r = 0.031).

CONCLUSION: Herbst-MB Tx is a successful Tx option for Class II:1 patients irrespective of pre-Tx severity of the Class II occlusal relationship or pre-Tx skeletal maturity.

SP 379 ADHESION OF BRACKETS AND RETAINERS: A REVIEW
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AIMS: To evaluate the efficacy of self-etching primers versus the conventional technique and to know which light curing units (LCU) provide better bracket bonding through the available bibliography.

MATERIALS AND METHOD: Electronic data sources included Medline, Cochrane, Scielo and Google Scholar were consulted. Keywords were: ‘orthodontic’, ‘bonding’, ‘self-etching’, ‘photo curing’ and ‘light curing’. Inclusion criteria were clinical randomized control trials, orthodontics patients, both genders, any age but permanent dentition, studies with split mouth design and English, French or Spanish articles. Exclusion criteria were in vitro or animal trials, patients with craniofacial disorders, orthognathic, surgery patients and subject multiple tooth loss.

RESULTS: Fourteen articles met the inclusion criteria, eight comparing self-etching primers (SEP) and six comparing different curing-lights. In all eight articles concerning SEP, they used SEP from 3M® Unitek (Monrovía, California, USA) and as A conventional adhesive Transbond XT® 3M® Unitek. In vitro studies showed that brackets bonded with SEP showed less bond strength compared with the conventional etching technique but in vivo studies showed that brackets bonded with both techniques showed a similar survival rate. In vivo studies showed less bonding time with SEP. With reference to LCU, plasma resulted in less bonding time compared with halogen lamps, and light emitting diode units showed less time versus conventional halogen lamps. However, no difference was found in survival rate with any lamp used. All articles showed higher rates of debonding of brackets in the posterior segments.

CONCLUSION: There is no statistical difference using a SEP or conventional technique and there is no difference of survival rate between the different LCU units. In the absence of clear evidence to favour either system or LCU, the choice of bonding remains at the discretion of each operator.

SP 380 EFFECTS ON THE INCLINATION OF THE LOWER INCISOR ACCORDING TO THE DIFFERENT VARIANTS OF THE TWIN BLOCK
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AIMS: To compare lower incisor inclination change with the different modifications of the Twin block (TB), acrylic cap vs the vestibular arch versus ball hooks in Class II patients in the pubertal peak (according to cervical vertebrae staging).

MATERIALS AND METHOD: A retrospective cohort of 57 patients with a Class II malocclusion and retrognathic mandible was selected. They were treated with a TB (17 patients with a vestibular arch, 23 with ball hooks and 17 with a cap acrylic). Lower incisor inclination was measured before and after treatment in all three groups. Treatment time with the TB ranged between 6 months and 2 years of active treatment. Three angles were taken as reference: (IMPA, SNB-axis of the incisor of Steiner and A-Po-axis of the incisor of Ricketts). Subsequently, the three groups and the three angles were statistically compared by means of the analysis of variance (ANOVA) of a factor.
RESULTS: The design of the lower plate was decisive for lower incisor inclination change ($P < 0.05$). In the three modifications there were changes. With acrylic capping, it was observed that the IMPA had decreased 1.4 degrees, although it was not significant in any of the three groups ($P < 0.04$). With the use of a vestibular arch and ball hooks, SNB-lower incisor axis and A-Po-lower incisor angle, increased in a significant way, approximately 1.2 degrees ($P < 0.001$); the latter showing the greatest change.

CONCLUSION: The use of a TB for Class II correction causes changes in the inclination of the lower incisor. This change is completely related to the modification used in its lower plate. Furthermore, the increase or decrease of the above mentioned inclination depends fundamentally on the plane used to measure the inclination.

SP 381 PATTERN OF CLEFTS AND DENTAL ANOMALIES IN SIX-YEAR OLD CHILDREN: A RETROSPECTIVE OBSERVATIONAL STUDY IN WESTERN NORWAY
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AIMS: A cleft lip and/or palate (CLP) is the most common congenital disorder of the head and neck in Norway. The incidence is 1.8 per 1000 live births. The disorder has a multifactorial aetiology and complex clinical symptoms. It therefore requires multidisciplinary treatment with orthodontics playing a significant role. The goal of this study was to investigate the frequency and distribution of clefts of patients under treatment by the CLP team in Bergen. Other goals were surveying the amount of quantitative and qualitative tooth and occlusal anomalies among children with a CLP.

MATERIALS AND METHOD: The main inclusion criterion of this descriptive observational study was patients that were examined at 6 years old from spring 1993 to autumn 2012. The reports were obtained from the centre of CLP, Hordaland County Council. Nine hundred and eighty eight reports were eligible and made the foundation for the study.

RESULTS: The gender distribution among the patients with a cleft was 58.8 per cent male and 41.2 per cent female. Clefts of the palate (CP) were most common (39%), before CLP (26.8%) and cleft lip (CL) (25.8%). The frequencies of dental agenesis, supernumerary teeth and localized microdontia were 37, 18.1 and 7.7 per cent, respectively. Supernumerary teeth and localized microdontia were most common in CP, while CLP presented agenesis most frequently. The percentage diagnosed with at least one occlusal anomaly was 48.8 per cent. A unilateral posterior crossbite (38.8% in CLP) and reduced overbite (37.2% in CLP) presented the highest frequencies in the cleft subdivisions.

CONCLUSION: The gender distribution of individuals with orofacial clefts is stable, while CP is the most common subtype. Children with clefts present high prevalences of quantitative and qualitative dental anomalies, as well as malocclusions.

SP 382 CORRECTION OF CROSSBITES WITH A FUNCTIONAL SHIFT OF THE MANDIBLE IN THE SWEDISH PUBLIC DENTAL HEALTH SERVICE. A LONG-TERM FOLLOW-UP
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AIMS: To retrospectively evaluate the treatment outcome of unilateral posterior crossbites with a functional shift of the mandible, in the early mixed dentition with a quadhelix (QH) or expansion plate with screw (EP), carried out by general dentists (GD) at five Dental Public Health Clinics in Värmland County Council, Sweden.

SUBJECTS AND METHOD: A group of 47 children (16 boys, 31 girls, mean age 8.7 years SD +1.1) received treatment of crossbites with a QH ($n = 24$) or EP ($n = 23$) in 2012-2014. The study was conducted in the form of a journal review of all included patients according to a standardized protocol. Eleven patients agreed to participate in a long-term follow-up clinical examination (CE). They and their parent answered separate follow-up questionnaires concerning experience of different moments of treatment; involvement in the decision, information of treatment, tooth brushing, pain and acute visits. The same questionnaires were sent to patients and parents not participating in the CE ($n = 11$). For analysis descriptive statistic and cross tabulations were used.

RESULTS: The outcome variable ‘If the crossbites persists after treatment’ could not be investigated in the journals as information was often lacking. There was a significant difference in the length of treatment in favour
of QH. In terms of lost devices there was a significant increase in the EP group. There was no difference in retention time or number of acute problems and complications. A consultant orthodontist initiates often the treatment (QH) and if not, a GD with an experience >5 years, favouring EP. No crossbites were registered at the clinical follow-up (n = 11). The results are presented separately at an individual level. One child had received a fixed appliance and three children had started treatment because of impacted canines. The questionnaire results showed no differences in the experience of the devices between the groups.

CONCLUSION: There were no differences in the experiences of the devices between the groups besides the length of the treatment, shorter with QH, and the number of lost devices (EP). The results motivate future courses, training and practical exercises for GD.

SP 383  UPPER AIRWAY CHANGES AFTER TWIN BLOCK USE
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AIMS: To compare the change in length, in millimetres, of the upper airways before and after treatment with a Twin Block (TB) and also to compare the changes produced in mandibular length, skeletal Class and facial biotype.

MATERIALS AND METHOD: Lateral cranial radiographs (before and after treatment) of 30 patients (male and female, ages 9-14 years old) were compared, recording the change in length in millimetres of the upper airways, mandibular length, change of skeletal Class and facial biotype after the use of the TB appliance. The measurements were made with Nemotec®. For upper airways and mandibular length, McNamara cephalometry was used. Steiner’s cephalometry was used for skeletal Class and facial biotype.

RESULTS: Statistical significance (P < 0.05) was found in the upper pharyngeal diameter after use of the TB. For the other variables, no statistical significance was found (P > 0.05)

CONCLUSION: An increase in upper pharyngeal diameter can be expected after use of the TB.

SP 384 PLATELET RICH PLASMA AND ORTHODONTIC TREATMENT: A BIBLIOGRAPHIC REVIEW
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AIMS: To establish current scientific evidence regarding bone regeneration or acceleration in tooth movement applicable to orthodontics through the use of autologous platelet-rich plasma (PRP).

MATERIALS AND METHOD: A bibliographic review in different databases: Embase, PubMed, Cochrane and grey literature was performed with the following keywords: PRP, tooth movement and orthodontics. The search was limited to the last 15 years.

RESULTS: Alveolar bone density was decreased in the experimental groups compared to control groups. Osteoclastic activity was also higher in the experimental groups. The effect of PRP in localized acceleration of tooth movement is dependent of PRP concentration. The method of synthesis is critical for success. PRP injections may enhance the rate of tooth movement.

CONCLUSION: Moderate and high concentrations of Injected PRP may accelerate orthodontic movement by decreasing alveolar bone density.

SP 385 LONGITUDINAL SURVEY OF THE RELATIONSHIP BETWEEN MASTICATORY MOVEMENT PATH WIDTH AND DENTAL ARCH MORPHOLOGY
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AIMS: To investigate the relationship among masticatory movement, dental arch morphology and mandibular incisor crowding in childhood epidemiological research.

SUBJECTS AND METHOD: Thirty Japanese school children (18 males, 12 females) who were 7 years old in 2013. Analysis was carried out at 7 and 12 years of age. Measurement variables were as follows: dental arch width, dental arch length, bucco-lingual inclination of the first molars, incisor Irregularity index and masticatory
movement path width. The subjects were divided into two groups based on growth changes of the masticatory movement path width (wide and narrow groups). Growth changes were compared in the two groups.

RESULTS: There was no significant difference between the 7 and 12 year olds for any measurements. In the comparison of the wide and narrow groups, the wide group showed significantly increased mandibular arch width and arch length, decreased mandibular bucco-lingual inclination of the first molars and Irregularity index (\(P < 0.01\)) than those in narrow group. Significant positive correlations were found between masticatory movement path width and mandibular arch width (\(r = 0.43\)), maxillary arch length (\(r = 0.42\)) and mandibular arch length (\(r = 0.41\)). A significant negative correlation was found between masticatory movement path width and Irregularity index (\(r = -0.46\)).

CONCLUSION: Increasing the masticatory movement path width promotes dental arch width, uprights the mandibular first molars towards the buccal side and improves mandibular incisor crowding.

SP 386 THE PATTERN OF PRIMARY TOOTH AGENESIS
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AIMS: To evaluate the prevalence of the primary missing tooth pattern in children with the purpose of early diagnosis and prosthetic treatment.

SUBJECTS AND METHOD: From 340 children and adolescents with agenesis 46 patients (37 males, 8 females) aged from 1.5 to 6 years with congenital absence of the primary teeth were examined. After clinical examination, obtaining dental records and a dental pantomograph all children were examined by a dermatologist and geneticist. The pattern of primary tooth agenesis was analyzed using the tooth agenesis code (TAC) values, according to Van Wijk and Tan.

RESULTS: In the 46 patients the total number of missing primary teeth was 634 with 13.78 (SD = 3.2) per patient. The incidence of tooth agenesis in both jaws was 100 per cent with the average number of missing maxillary primary teeth being 6.1 (SD = 2.2) and mandibular teeth 7.7 (SD = 2.1). None of the 46 children had any mandibular incisors and maxillary lateral incisors and only three had upper first molars. A symmetrical pattern of temporary tooth agenesis in the maxilla was observed in 80.4 per cent and in the mandible in 76.1 per cent. Three children were anodontic with TAC values of 31, 31, 31, 31. In eight patients there was total absence mandibular primary teeth with mainly bilaterally presence of upper central incisors, second molars and canines. These teeth were the most stable primary teeth, which were present in 34, 32 and 23 children. In the other three patients TAC values were 10, 10, 31, 31. The dermatologic and genetic investigation confirmed the diagnosis of ectodermal dysplasia syndrome in all 46 children.

CONCLUSION: Multiple agenesis of the primary teeth in children aged 1.5 to 6 years indicates a syndromic form of oligodontia with the average number of missing teeth equal to 13.8. This pathology was more common in males than females with a prevalence ratio 4.6:1. In this study all children had severe agenesis: 29 per cent had total absence of the mandibular teeth and 14 per cent demonstrated complete anodontia. Early diagnosis of syndromic oligodontia and prosthetic treatment of these patients will contribute to their psychological health, adaptation among other children and social rehabilitation of their families.

SP 387 TOOTH AGENESIS PATTERN IN HYPODONTIA PATIENTS
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AIMS: To evaluate the prevalence of the missing teeth pattern and typical dental arch defects in children and adolescents with hypodontia to aid the treatment planning.

SUBJECTS AND METHOD: From 338 agenesis patients aged 6 to 18 years, 115 patients with hypodontia of 1-5 missing permanent teeth were investigated. A clinical examination was performed and dental records and a dental pantomograph were obtained. Patterns of tooth agenesis were analyzed using tooth agenesis code (TAC) values, according to Van Wijk and Tan.

RESULTS: Of the 115 patients (33 males, 82 females) there were 74 (64.3%) with mild hypodontia (1-2 missing teeth) and 41 (35.6%) with a moderate type (3-5 missing teeth). The total number of missing teeth was 308 with 2.68 ± 1.21 per patient. The incidence of tooth agenesis in the maxilla was 82.6 per cent with the average
number of missing teeth 1.7 (SD =1.04) and in the mandible in 50.4 per cent with agenesis of 0.98 teeth (SD =1.12). In 57 (49.6%) subjects hypodontia was located only in the maxilla, in 38(33%) in both jaws and in 20 (17.4%) in the mandible. Of the 95 cases with upper arch agenesis in 68.4 per cent there was a symmetrical pattern of hypodontia with the prevalence of congenital absence of 1.2, 2.2 teeth in 55.8 per cent patients. A TAC value of 2, 16, 18, mainly bilaterally, was observed in 88.4 per cent. In 58 patients with lower jaw agenesis bilateral absence of 3.1, 4.1 was identified in 29.3 per cent followed by 3.5, 4.5 in 22.4 per cent. In the mandible 72.4 per cent had TAC-values of 1 and 16, in 51.7 per cent- symmetrically (1.1; 16.16). In additional in 20.7 per cent the TAC-values were 1 and 16 either left or right side. The most stable teeth which were present in all 115 cases were the upper central incisors, lower canines and first molars.

CONCLUSION: Hypodontia is 2.5 times more common in females than in males. A mild form of hypodontia was found 1.8 times more frequently compared to the moderate type. The most frequently absent teeth were upper lateral incisors (45.5%) followed by lower second premolars (16.9%), lower central incisors (14%) and upper second premolars (11.7%). Knowledge about typical teeth agenesis and defects of the dentitions in hypodontia cases will contribute to timely diagnosis and allow a more comprehensive treatment plan with more favourable results.

SP 388 A NEW EVALUATION METHOD FOR LIP MORPHOLOGY IN THE THREE-QUARTER VIEW
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AIMS: To devise a new method of evaluating lip morphology in the three-quarter view.

SUBJECTS AND METHOD: Twenty patients (Test group, 9 males, 11 females; mean age, 9 years 10 months) who exhibited a Class I malocclusion with upper central incisor labial inclination and 15 patients (Control group, 7 males, 8 females; mean age, 9 years 0 months) who exhibited a skeletal Class I malocclusion with normal upper central incisor inclination were included. Three-dimensional (3D) morphology of the facial soft tissue was recorded using a 3D surface imaging device (3DMDCranial System; 3dMD, Atlanta, USA) and analyzed using an image processing software program (Face-Rugle; Medic Engineering, Kyoto, Japan). The mid-sagittal, axial, and frontal planes were defined based on several reference points. The frontal plane, which is rotated by 45 degrees around the Y-axis, was defined as the three-quarter plane. The central upper lip inclination angle on the lip sectioned by the three-quarter plane through the subnasale was then measured. Similarly, the right upper lip inclination angle through the facial insection of the right alar base and the left upper lip inclination angle through the facial insection of the left alar base was also measured. The differences in the lip inclination angle between the test and control groups were then statistically analyzed.

RESULTS: The central upper lip inclination angle in the three-quarter view was significantly larger in the test group than in the control group. The right and left upper lip inclination angles in the three-quarter view were significantly larger in the test group than in the control group.

CONCLUSION: Using the analysis method described in the present study, we were able improved insight into 3D lip protrusion was achieved. The findings suggest that this method should be applied for evaluation of lip protrusion in orthodontic patients.

SP 389 WHICH FACTORS INFLUENCE THE TORQUE FORCE NEEDED FOR NON-INVASIVE PALATAL IMPLANT REMOVAL†‡‡
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AIMS: Recently, a non-invasive method has been introduced to remove osseointegrated palatal implants with use of the implantation ratchet. Although this method has been described as safe and easy, the forces needed to explant have not been investigated. The aim of this study was to assess the removal torque required to explant with a ratchet previously successfully loaded palatal implants, and to assess potentially influencing variables.

SUBJECTS AND METHOD: Twenty-one consecutive patients (13 females, 8 males; age range: 11-51 years) with previously orthodontically loaded palatal implants were randomly assigned to either clockwise or counterclockwise non-invasive explantation by means of a ratchet usually dedicated for implant insertion. The highest
removal torque force needed to detach the implant from its socket was recorded for each patient individually, together with torque direction and other potentially influencing variables (gender, age, orthodontic loading time). Mean and standard deviations were established and normal distribution attested. Differences between the groups were investigated with Student’s t-tests, and Pearson correlation tests were conducted to clarify associations between torque force and age or loading time, respectively.

RESULTS: The mean removal torque for palatal removal in clockwise direction was non-significantly higher (128.8 ± 13.5 Ncm) compared to counter-clockwise direction (116.9 ± 17.5 Ncm). Extraction in males required significantly (P = 0.024) more force (153.5 ± 53.9 Ncm) than in females (103.6 ± 39 Ncm). Neither patient age (P = 0.89) nor loading time (P = 0.55) correlated with the removal torque force.

CONCLUSION: The safe and simple non-invasive method for palatal implant removal necessitates moderate, but not high torque forces, independently of the torque direction. The necessary force is influenced by gender, but not by age or loading time.

SP 390 THE IMPACT OF DIETARY CONSISTENCY ON STRUCTURAL CRANIOFACIAL COMPONENTS IN RODENTS. A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: To provide, in a systematic review, a comprehensive synthesis of available evidence evaluating the effect of dietary loading on temporomandibular joint/condyle, condylar cartilage, alveolar bone of the mandible and the periodontal ligament in healthy mice and rats.

MATERIALS AND METHOD: An electronic database search of published and unpublished literature was performed on the following canals: Medline via PubMed, Embase and Open Grey. Search terms included ‘mandibular condyle’, ‘alveolar bone’, ‘temporomandibular joint’, ‘condylar cartilage’, ‘periodontal ligament’, ‘rat’, ‘mice’. Data was extracted in standardized piloted forms. Risk of bias assessment was made through the use of the Systematic Review Centre for Laboratory animal Experimentation (SYRCLE) guidelines for animal studies and reporting quality was assessed using ARRIVE (Animal Research: Reporting In Vivo Experiments).

Random effects meta-analyses were performed for the outcomes of interest where applicable.

RESULTS: Of the 832 articles initially retrieved after duplicate exclusion, 33 were eligible for inclusion in the systematic review, while only six were included in the quantitative synthesis. The vast majority of studies (n = 30) used rats as the experimental unit. Risk of bias in all studies was judged to be high overall, while reporting quality was sub-optimal. According to the quantitative synthesis, in rats there was significantly reduced anteroposterior condylar length [4 studies, weighted mean difference: −0.40 mm; 95% confidence interval (CI): −0.47, −0.32; P < 0.001] and width (4 studies, weighted mean difference: −0.043 mm; 95%CI: −0.51, −0.36; P < 0.001) when soft diet group was compared to hard diet. Likewise, in mice the soft diet group presented significantly smaller anteroposterior condylar dimensions (2 studies, weighted mean difference: −0.049; 95%CI: −0.56, −0.43; P < 0.001).

CONCLUSION: Overall, there was strong evidence to suggest a significant effect of a soft diet on reduced condylar dimensions in rodents; however, there is a need for further high quality experimental studies to inform current knowledge on condylar cartilage, alveolar bone and periodontal ligament related outcomes.

SP 391 LONGITUDINAL CHANGES IN THE DEPTH OF THE MANDIBULAR ANTEGONIAL NOTCH
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AIMS: The mandibular antegonial notch is a morphological characteristic that often appears on lateral cephalograms. Controversy exists in the literature if it is linked to the subjects’ facial growth pattern. However, how the antegonial notch develops is not clear. The aim of this investigation was a) to identify among 18 year olds those subjects who had a deep antegonial notch, and b) analyse longitudinally how the deep antegonial notches developed from 7 to 13 and to 18 years of age.

MATERIALS AND METHOD: From the American Association of Orthodontists Foundation Craniofacial Growth Legacy Collection, the lateral cephalograms of 340 untreated 18 year old subjects (171 males, 131 females), were analysed to measure their antegonial notch. For those subjects who had, at the age of 18 years, a deep antegonial notch ≥3.6 mm additional earlier lateral cephalograms at ages 7 and 13 years were obtained. The
total sample was analysed with ANOVA and the longitudinal subsample with a Friedman test, while post hoc tests were performed with separate Wilcoxon signed-rank tests with a Bonferroni correction.

RESULTS: Based on the 340 lateral cephalograms, the antegonial notch was deeper in males (2.3 ± 1.1 mm) than in females (1.5 ± 0.7 mm, P < 0.001). Among all the untreated 18 year old subjects, 21 individuals had a deep antegonial notch ≥3.6 mm, all of them males. Their mean antegonial notch depth at 7 years was 2.6 ± 0.7 mm. This measurement at 13 years was 2.5 ± 0.7 mm and at 18 years 4.2 ± 0.5 mm. While no statistically significant differences were found between ages 7 and 13, the antegonial notch at 18 years was deeper than the other two age groups (P < 0.001).

CONCLUSION: The antegonial notch seen in children does not increase its depth at the pre-pubertal age but increases during puberty. It is possible that this increase in antegonial notch depth is linked to an increase of muscle mass during the pubertal period.

SP 392 TOOTH WEAR AND GINGIVAL RECESSION IN 210 ORTHODONTICALLY TREATED PATIENTS: A RETROSPECTIVE COHORT STUDY
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AIMS: To assess the association between tooth wear (TW) and gingival recession (GR).
MATERIALS AND METHOD: Two hundred and ten orthodontically treated participants (100 males) were evaluated. GR and TW were rated independently by four raters on plaster models at four time points: before treatment (T1), mean age 13.8 years (SD = 3.7); after treatment (T2), mean age 16.7 years (SD = 3.9); 3 years after treatment (T3), mean age 19.7 years (SD = 4.2); and 7 years after treatment (T4), mean age 23.9 years (SD = 4.8). Univariable and multivariable random effects logistic regression analyses were performed with scores for GR as dependent variables and with TW, age, gender, dental segments (maxillary and mandibular anterior and posterior segments), time points, and Angle classification as independent variables. Method reliability was assessed with kappa statistics.

RESULTS: Mandibular incisors, mandibular and maxillary first premolars and maxillary first molars were most vulnerable to GR. The prevalence of GR increased during the observation period. At T1 20.5 per cent participants had one or more recession sites, at T4 85.7 per cent of the participants had at least one GR. There was evidence of association between moderate/severe TW and GR for a tooth with moderate/severe wear, the odds of recession were 23 per cent higher compared to a tooth with no/mild wear (odds ratio 1.23; 95% confidence interval: 1.08-1.40; P = 0.002). Age, dental segment, and time were also significant recession predictors, whereas gender was not.

CONCLUSION: There is evidence that moderate/severe TW is associated with the presence of gingival recession. Clinical significance of this can be limited.

SP 393 MANDIBULAR ASYMMETRY CHANGES OF UNILATERAL AND BILATERAL CLEFT LIP AND PALATE BOYS FROM THE PRIMARY TO EARLY MIXED DENTITION STAGES: A LONGITUDINAL STUDY
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AIMS: To examine and compare the mandibular asymmetry changes in boys with a unilateral cleft lip and palate (UCLP) and bilateral cleft lip and palate (BCLP) from the primary to the early mixed dentition stages.

SUBJECTS AND METHOD: Twelve boys with a UCLP and 13 boys with a BCLP. Panoramic radiographs of each subject taken in the primary (mean age 4.8 ± 0.6 months for UCLP group, 4.9 ± 0.8 months for BCLP group) and early mixed dentition (mean age 8.3 ± 0.7 months for UCLP group, 8.6 ± 0.8 months for BCLP group) stages were traced and condylar height, ramal height, condylar plus ramal height and gonial angle were measured at the left and right sides by one author. Asymmetry indices (condylar, ramal and condylar plus ramal) were calculated. The growth changes in each parameter from the primary to the early mixed dentition stages were assessed using Wilcoxon test. A Mann-Whitney U test was used to compare the parameters between the UCLP and BCLP groups.
RESULTS: No statistically significant difference was found in condylar, ramal, condylar plus ramal height and gonial angle between the left and right sides in the BCLP group and cleft and non-cleft sides in the UCLP group. From the primary to the early mixed dentition stages, condylar height, ramal height, condylar plus ramal height for the right and left sides increased significantly in the UCLP and BCLP groups. Gonial angle did not change with growth in the BCLP group although it decreased significantly in the UCLP group at the cleft side. Condylar, ramal and condylar plus ramal asymmetry indices did not exhibit any significant difference between the UCLP and BCLP groups at the primary and early mixed dentition stages.

CONCLUSION: UCLP and BCLP boys have symmetrical mandibles at the primary and early mixed dentition stages. A statistically significant decrease in gonial angle was found in the UCLP boys at the cleft side from the primary to the early mixed dentition stage.

SP 394 PERCEPTION OF INTRAORAL SCANNING AMONG PRACTICING ORTHODONTISTS IN GERMANY AND ROMANIA
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AIMS: Digital orthodontics is growing rapidly and offers new solutions for the clinical practice. The use of three-dimensional intraoral scanners offers advantages both for patients and clinicians. For orthodontists, intraoral scanning leads to accurate digital models, enabling digital analysis and treatment planning, while patients experience a comfortable impression with a low risk of gag reflex. Little information can be found in the literature regarding the actual opinion and use of intraoral scanners among orthodontists. The aim of this study was to evaluate the perception of German versus Romanian orthodontists on the use of intraoral scanners in practice.

MATERIALS AND METHOD: An online questionnaire consisting of 17 questions (multiple-answer and open-answer type) was used to collect the data. The survey was prepared using Google Forms platform and distributed during April-May 2017 through email and social media networks to 50 practicing orthodontists in Romania and 50 practicing orthodontists in Germany. In order to have equal sample size, the first 32 responses were taken into consideration for each country. The data was statistically analyzed.

RESULTS: High awareness regarding intraoral scanners in both Germany and Romania was confirmed. In Romania almost half of the participants tested it, while in Germany about two-thirds of the participants tried it. The results are interesting since these are two European countries with different economic levels, practice organisation and medical systems. Nine per cent% of Romanian participants already use digital impressions in their practice, compared to 18.5 per cent of German respondents. Further results refer to advantages and disadvantages of this method, handling of the scanner, scanning time and other clinical aspects.

CONCLUSION: This study reports high interest towards intraoral scanning for both countries. The trend is towards a more positive view on intraoral scanners for Romanian orthodontists compared to Germans, but a better experience and knowledge in chairside digital impressions was recorded in Germany. Intraoral scanning is a technology with perspectives to become a widely used method in orthodontists’ daily practice.

SP 395 THE EFFECT OF NASAL CAVITY VOLUME CHANGE ON HALITOSIS IN PATIENTS UNDERGOING RAPID MAXILLARY EXPANSION
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AIMS: To evaluate the effect of rapid maxillary expansion (RME) on halitosis.

SUBJECTS AND METHOD: Thirty children (11-15 years old) were randomly divided into RME and control groups. The RME group consisted of 15 children treated with a Hyrax appliance and the control group 15 children without any treatment. Halitosis was evaluated with a halimeter and the organoleptic method. Plaque index (PI) and gingival index (GI) scores were recorded. Acoustic rhinometry was used to measure nasal volume. Measurements were obtained at two time points: before RME/Hyrax appliance placement and after consolidation/4 months. Wilcoxon signed rank and paired t-tests were used to determine the differences between groups and Mann-Whitney U and Student t-tests to compare groups.
RESULTS: Halitosis (halimeter and organoleptic values) decreased significantly in the RME group \( (P < 0.001) \). Insignificant changes in halitosis were observed in the control group. Intra- and intergroup comparisons showed no statistically significant difference for PI. GI values were significantly decreased with RME \( (P \leq 0.05) \). Nasal cavity volume increased significantly in the RME group \( (P < 0.01) \).

CONCLUSION: The expansion of the nasal cavity obtained by RME was shown to lower halitosis values. RME could be a treatment option for patients with maxillary transverse deficiency and halitosis.

SP 396 EFFECT OF MALOCCLUSION ON DENTAL SELF-CONFIDENCE AND SELF-ESTEEM AMONG DENTAL STUDENTS IN KIRIKKALE, TURKEY: A PILOT STUDY
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AIMS: To evaluate the prevalence of malocclusion and the effect of malocclusion on dental self-confidence and self-esteem (SE) of dental students and to determine the correct sample size.

SUBJECTS AND METHOD: The study was designed as a cross sectional trial. The Turkish version of the Dental Self Confidence (DSC - 6 questions) subscale of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) and Rosenberg Self-Esteem Scale (RSES - 10 questions) were administered to measure dental students’ DSC and SE. A single investigator interviewed and examined the subjects. Malocclusion severity was evaluated with the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need, Index of Complexity Outcome and Need (ICON) and Dental Aesthetic Index (DAI). The sample included 47 subjects (18 males, 29 females) aged 18 to 25 years. Statistical analysis was done using SPSS (version 20.0) software. A Chi square test was performed to observe age and gender distribution. DSC and SE differences between the malocclusion groups were evaluated with Mann-Whitney U test. Spearman correlation analysis was used to calculate the interrelationship between malocclusion grades and DSC and SE scores.

RESULTS: The mean age of the subjects was 20.9 years. The mean value of DSC was 11 (0, 18). The mean value of SE was 0.77 (0, 2.67). Forty five of the 47 subjects showed a minor malocclusion according to DAI (<25) and two subjects had definite malocclusion (both were 27). According to ICON only three subject had a treatment need (scores higher than 43). DSC and SE scores did not show significant differences between males and females and different malocclusion levels.

CONCLUSION: Malocclusion severity and orthodontic treatment need was low in this study sample. DSC and SE were relatively high. In order to make more reliable correlations between malocclusion grades and DSC and SE larger sample sizes must be included in future studies.

SP 397 EXTRACTION OF FIRST PERMANENT MOLARS AND ITS IMPACT ON THE DEVELOPMENT OF THE OCCLUSION
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AIMS: First permanent molars (FPMs) are essential teeth with regard to mastication, occlusion, and overall function, thereby rarely the obvious choice for extraction prior to orthodontic treatment. However, first permanent molars of poor prognosis are often planned for enforced extractions when the treatment is indicated. The aim of this research was to determine how extraction of FPMs affects the development of the occlusion and if orthodontic intervention is needed.

MATERIALS AND METHOD: A retrospective study including 102 medical records of patients who had undergone FPM extraction due to three underlying causes; caries, Molar Incisor Hypomineralisation (MIH) and other causes such as trauma and periodontitis. The patients were divided into three age groups; 6-8, 9-11 and 12-19 years. Their medical records were examined in order to determine whether an orthodontic follow-up control had been conducted and to what extent. Further, medical and radiographic documentation of patients who had undergone an orthodontic follow-up was analyzed in order to assess the impact of FPM extractions on the occlusion. All patients were evaluated within two intervals depending on the year of the extraction; 2011-2013 (the long-term group) and 2014-2015 (the short-term group).

RESULTS: Spontaneous space closure was achieved among all 6-8 year olds (i.e. 100%), 50-67 per cent among 9-11 year olds and 30-33 per cent among 12-19 year olds. In the long-term group, 22-52 per cent of all patients
had undergone an orthodontic follow-up control after treatment respectively, 0-28 per cent in the short-term group.

CONCLUSION: The hypothesis was confirmed; Extraction of FPMs before the age of 12 shows a high success rate of spontaneous space closure in the maxilla without orthodontic intervention.

SP 398 OUTCOME OF ORTHODONTIC SPACE-CLOSURE AND AUTOTRANSPLANTATION REPLACING A MISSING MAXILLARY CENTRAL INCISOR
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AIMS: To compare treatment outcome of autotransplantation (AUT) and orthodontic space closure in patients with one missing maxillary central incisor and to assess patient satisfaction.

SUBJECTS AND METHOD: A sample of 40 consecutively treated trauma patients was examined in a follow-up study. Most of them had undergone interdisciplinary treatment planning before treatment in a postgraduate clinic. The inclusion criteria were 20 patients who had AUT of developing premolars to replace maxillary incisor and 20 that had received orthodontic treatment with the objective of closing space (OR-C) for missing central incisors. The biological features and clinical appearance of the test tooth replacing the missing incisor were compared with the neighbouring intact central incisor (control tooth), assessed clinically and from intraoral radiographs, digital models and clinical photographs. A patient questionnaire addressed the same features that were examined. Descriptive statistics, Chi-square and t-tests were used for statistical evaluation.

RESULTS: At the 7.8 years follow-up, the mean age was 20.4 years in the AUT group (female 55%, male 45%) and 24.1 years in the OR-C group (female 65%, male 35%). The overall clinical status was satisfactory in the two groups. Crown length matched the controls in 65 per cent of both groups, gingival width matched the control in 55 per cent with AUT versus 65 per cent with OR-C. Tooth colour assessment showed a significant group difference as 85 per cent of test teeth matched the control in OR-C versus 45 per cent in AUT. The soft tissue evaluation was good for all test and control teeth. The mean distance from the mesial cementoenamel junction to marginal bone was significantly greater in the OR-C (2.2 mm) than in the AUT group (1.0 mm). The crown-root ratio (CRR) was mostly satisfactory, as only one subject in the AUT and three in the OR-C group had a CRR >1. The patients’ overall satisfaction with the treatment outcome was high (OR-C 80%, 95% in AUT).

CONCLUSION: Biological features and the clinical status of AUT premolars or lateral incisors replacing a missing maxillary incisor showed overall comparable results, and was in general satisfactory, even if a potential for restorative improvement was identified in some patients.

SP 399 A STUDY OF ORTHODONTIC TREATMENT NEED AND DEMAND IN TONGAN CHILDREN
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AIMS: To assess the a) normative, b) perceived and c), expressed need for orthodontic treatment amongst Tongan children and to determine the current awareness of orthodontic treatment amongst Tongan children and whether or not they are dentally fit.

SUBJECTS AND METHOD: A sample of 250 children aged between 12 and 15 years were chosen via a stratified cluster sampling method based on location. The Index of Orthodontic Treatment Need (IOTN) Dental Health Component (DHC) and Aesthetic Component (AC) were used to assess normative need. A questionnaire was developed using modified questions from the Oral Aesthetic Subjective Impact Scale (OASIS) and a visual analogue scale to assess perceived and expressed need, as well as knowledge of treatment. The levels of visible decay for each subject were recorded.

RESULTS: Fifty four per cent of children were assigned an IOTN DHC score of three to five. Treatment need (AC score 5 to 10) was reported for 29.6 per cent of children. The mean modified OASIS score was 13.89 (± 7.27) and the mean VAS score was 6.56 (± 3.09), indicating a moderate perceived need. Sixty three per cent of children had a perceived need and 4 per cent expressed a need for treatment, with 47.6 per cent unaware that braces could straighten teeth.

CONCLUSION: A high proportion of children had a normative and perceived need for orthodontic treatment. There was a higher need for treatment for dental health rather than aesthetic reasons. There was a low expressed need for treatment. The need for treatment in Tonga far exceeds the available provision.
Aims: A systematic review is required to explore different measurements that have been used to quantify aesthetic outcomes following surgical correction for cleft lip and palate. A measure based on best current evidence will be proposed and the reasons for this will be stated. Different measurements will be assessed on the following criteria: 1) reliability, 2) validity, 3) patient acceptability, 4) safety, 5) cost effectiveness and applicability.

Materials and Method: A systematic review of the literature using Medline, OVID, Dentistry and Oral Sciences Source, and CINAHL complete was conducted in line with the PRISMA statement recommendations.

Results: Twenty-five articles were reviewed. Five means of determining aesthetic outcome were identified: two-dimensional (2D) media and subjective scoring systems, 2D media and objective measurements, three-dimensional (3D) media and subjective scoring systems, 3D media and objective measurements, and videographic assessment. 2D media is most commonly used for assessment. The subjective Asher Mc-Dade scale had been validated in several studies. 3D assessments are the most accurate and reliable methods to assess aesthetic outcome. 3D imaging is more expensive and takes longer than 2D assessment.

Conclusion: There is no universally accepted method to assess aesthetic outcome. Although well validated, when not adhering to strict protocols, subjective Asher Mc-Dade assessments can be highly variably. Therefore, objective assessment should be considered. The relationship between symmetry and aesthetics in cleft patients must be determined in order for a true comparison to be made between the aesthetic outcome measures. Criteria have been suggested for the development of a new aesthetic outcome measure.
SP 402 THE INFLUENCE OF MORE REGULAR DENTAL VISITS ON PLAQUE AND GINGIVAL INDICES DURING FIXED ORTHODONTIC TREATMENT
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AIMS: To investigate patient compliance in maintaining adequate oral hygiene during conventional fixed orthodontic treatment, and to determine if more regular dental visits have any impact on plaque (PI) and gingival (GI) indices.

SUBJECTS AND METHOD: Forty seven patients (24 males, 23 females) were randomly selected. PI and GI were recorded, oral hygiene instructions were given and demonstrated before the start of treatment (T0). Additionally, each patient was provided with an orthodontic toothbrush and disclosing tablets. Patients were then recalled after 3 (T1), 6 (T2), 9 (T3) and 12 (T4) months after starting treatment. During each visit disclosing tablets were used, PI and GI were recorded and oral hygiene instruction reinforced.

RESULTS: A significant increase in both PI and GI was recorded from T0 to T1 (mean increase of PI: 0.90 ± 0.12 and GI: 0.85 ± 0.06). From T1-T4 a gradual decrease was registered in both indices (mean decrease from T1-T4 in PI: 0.78 ± 0.21 and GI: 0.70 ± 0.12). The increase in plaque accumulation stained by the disclosing tablets was mostly localised at the vestibular surface of the teeth under the archwire and around the brackets.

CONCLUSION: The findings demonstrate that there is an increase in plaque accumulation during fixed orthodontic treatment. This result suggests that orthodontic patients are in need of more regular dental visits in order to reinforce oral hygiene instruction and enhance their compliance in maintaining a good oral hygiene.

SP 403 SPECIFIC COLOUR CHANGES IN HARD AND SOFT CLEAR ORTHODONTIC ALIGNERS
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AIMS: To determine the specific colour change of hard and soft clear orthodontic aligners, after use and whether, it is visible to the human eye.

MATERIALS AND METHOD: Two hundred randomly selected aligners, 100 soft and 100 hard splints, which had been worn for 3 weeks, 22 hours per day and two reference aligners were used. Digital photographs were taken of each aligner, utilizing Adobe, Photoshop, version 7.0 to analyze the photographs. A reference point located on the lower right premolar of the aligners was selected by utilizing the eyedropper tool, subsequently the red, green, blue values (L*, a* and b*) for each aligner was determined. All measurements were done in the internationally standardized CIELab colour space. Total colour change (ΔE*ab) and specific changes in individual colour components were tested separately and comparisons were made to examine the difference between the values obtained.

RESULTS: The data collected clearly showed that discolouration occurred regardless of the type of aligner; however the colour change in the soft aligners was significantly greater than in the hard aligners (mean ΔE*ab values: soft: 39.743 and hard: 31.146). A yellow colour change was observed in both type of aligners (mean values: soft: 38.67, hard: 5.08). Changes in Δa* values were not significant and therefore excluded from the results.

CONCLUSION: The experimental design involved both hard and soft aligners, enabling multiple comparisons to be performed in order to detect a specific colour change and whether it is perceivable to the human eye. The study demonstrated that intraoral usage of clear aligners causes a great amount of yellow discolouration which is visible to the human eye, with the soft aligners showing a greater degree of discolouration.

SP 404 WHAT RECORDS ARE WE TAKING FOR ORTHOGNATHIC PATIENTS? AND ARE THEY AVAILABLE IN THE JOINT CLINICS? COMPLETE AUDIT CYCLE LOOP
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AIMS: Having accurate records is essential for appropriately planning patient management, to enable standardisation for audit and research and for medico-legal reasons. The aim was to assess whether appropriate records are taken at the different stages for orthognathic patients according to the British Orthodontic Society
and British Association of Oral and Maxillofacial Surgeons (BOS/BAOMS) minimum dataset and to also assess their availability during the multidisciplinary clinics. The standard was set as 90 per cent compliance with appropriate records being taken and availability of these in the clinic. Following an initial audit, actions were implemented and a second audit completed, closing the cycle.

**MATERIALS AND METHOD:** Data was collected prospectively during consecutive orthognathic clinics on a data collection sheet based on the BOS/BAOMS dataset. The initial audit was undertaken over a 3 month period in 2015. The aspects needing improvement were identified and some of the actions implemented included prior preparation of the clinic to identify errors and missing records, increasing awareness of clinicians regarding which records are required and organising for the three-dimensional photographs to be taken immediately following patients being seen in the joint clinics. A second cycle was undertaken over a 2 month period in 2017 to review the impact of these interventions in practice.

**RESULTS:** Data was collected for 104 patients and 73 patients in the first and second cycles, respectively. The standard was achieved for availability of medical records and dental panoramic radiographs in both cycles. Though a slight improvement was achieved for lateral cephalometric radiographs the standard was not reached; 81 and 86 per cent in the first and second cycles, respectively. Study cast availability improved from 77 to 85 per cent and presurgical impressions improved from 86.5 to 100 per cent. Photographs were taken at the correct stage in 80 per cent of cases but altered lip sensation was poorly recorded in both cycles.

**CONCLUSION:** An overall improvement in compliance was noted, especially with presurgical impressions, study casts and lateral cephalometric radiographs being taken and available, though some still did not reach the standard set. Further actions are suggested, which will be implemented and a re-audit undertaken in a year.

**SP 405 COMPARISON OF HIRING STRATEGIES OF ORTHODONTIC PRIVATE PRACTITIONERS**

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**AIMS:** To evaluate factors that influence hiring strategies of staff in orthodontic private practices.

**MATERIALS AND METHOD:** An original 22-question survey was developed for orthodontists regarding their hiring methods and outcomes. One thousand nine hundred and sixty three surveys were mailed in April 2017 to a random assortment of practicing orthodontists and active members listed on the American Association of Orthodontists’ database. Survey data was collected through September 2017. Chi-square tests were used to determine differences among orthodontists in sourcing methods, screening methods, interviewing methods, and outcome measurements.

**RESULTS:** Four hundred and fifty two responses were received (23% response rate). Eighty seven per cent of orthodontists reported hiring responsibilities at their practice. For the most recent hire, 65 per cent received 1-10 applicants and 54 per cent utilized online job sites for sourcing their candidates. Eighty per cent filled the position within the first 30 days and 94 per cent were still employed at 6 months. Posting jobs on online job sites was associated with increased number of applicants ($P < 0.0001$), number of days to fill the position ($P < 0.0001$), but was not associated with change in overall satisfaction with the hire. Almost half of respondents used the internet to screen candidates and 58 per cent of those had removed applicants based on information obtained. In future hiring considerations, more than 50 per cent of respondents plan to use internet sources to screen candidates and another 29% are undecided. More than half of respondents plan to use employee referrals for future hiring needs (57%). Respondents selected personality (62%) as the contributor to their most recent hire.

**CONCLUSION:** Even though online job sites accounted for the majority of the most recent hires, orthodontists indicated that their future preference is to utilize employee referrals for their staff hiring needs. The use of personal and professional relationships, rather than online job sites, may lead to a more efficient hiring process and satisfactory outcome.

**SP 406 ORTHODONTISTS’ AND PATIENTS’ PREFERENCES IN PRACTICE WEBSITE DESIGN**

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**AIMS:** To determine which website characteristics and designs are preferred by orthodontists, patients, and parents of patients, and the factors associated with website preferences.
MATERIALS AND METHOD: A paper survey was distributed to orthodontic patients, parents of patients, and orthodontists. 1000 active members of the American Association of Orthodontists and 750 active orthodontic patients/parents were sampled. Participants were asked to rate importance of website characteristics, to indicate presence of those characteristics on their current practice website, and to rank sample website images. Preferences were compared between orthodontists and patients/parents using t-tests and sample websites were compared using ANOVA models and Tukey’s adjusted post-hoc tests. Significance level was set at 0.05.

RESULTS: The response rate was 11 per cent for orthodontists and 53 per cent for patients/guardians. Of the 16 website characteristics studied, 11 showed significant differences between patients and orthodontists. Most notable, patients rated information about particular treatment options ($P = 0.0002$), before and after pictures ($P < 0.0001$), online payments ($P < 0.0001$), online scheduling ($P < 0.0001$), instant message customer support options ($P < 0.0001$) significantly higher than orthodontists. Orthodontists rated mobile-optimized ($P = 0.0002$), about the doctor section ($P = 0.0495$), coming up in the top three when using a search engine ($P = 0.0032$), and links to social media ($P < 0.0001$) significantly higher than parents. Females rated before and after pictures ($P = 0.0166$) significantly higher than males and online scheduling ($P < 0.0001$) significantly lower than males. Adult patients rated presenting aims/values ($P = 0.0276$) and information on charitable giving ($P = 0.0371$) higher than patient guardians. Sample website images revealed the overall preferences include: homepage with photographs of patients over the doctor or office, a standard-sized banner at the top of the page that included map and contact information, and an about the doctor section with bullet points rather than paragraphs.

CONCLUSION: No data is available in the orthodontic literature displaying patients’ preferences of information on orthodontic websites. This study showed significant differences in preferences between orthodontists and patients, by gender, and between adult patients and parents of adolescent patients. This information may be used to optimize orthodontic practice websites and enhance their experience.

SP 407 A RE-AUDIT TO ASSESS PATIENT SATISFACTION FOLLOWING ORTHODONTIC TREATMENT AND ORTHOGNATHIC SURGERY
Nausheen Siddiqui, Owais Khattak, Maire Morton, Royal Blackburn Hospital, U.K.

AIMS: To assess patient satisfaction following orthognathic surgery and orthodontic treatment and to determine patient satisfaction with the amount of information received pre-treatment.

MATERIALS AND METHOD: This was a retrospective re-audit. An audit standard of 90 per cent for each element was chosen which was based on a previous audit at Royal Blackburn Hospital. All patients undergoing orthognathic surgery over a 1 year period were included. A questionnaire was emailed out via Survey Monkey. It consisted of 37 questions based on four domains; patient demographics, reasons for treatment, satisfaction with treatment and satisfaction with the amount of information received. The answers were mostly dichotomous or on a Likert scale.

RESULTS: Thirty eight patients met the inclusion criteria, of which 26 completed the questionnaire (68.4%). Fifty six per cent of participants were female and 75 per cent were aged 18-25 years. Approximately one-third of the patients had each of the following types of surgery; bimaxillary osteotomy, Le Fort 1 osteotomy and bilateral sagittal split osteotomy. Reasons for treatment were mostly due to self-awareness or advice from the dentist/orthodontist, rather than influences from social media or friends and family. With regard to patient satisfaction, 93.75 per cent of patients did not regret having treatment, 87.5 per cent would undergo treatment again, 87.5 per cent would recommend treatment to others and 93.75 per cent had favourable comments on their new appearance. With regard to how well informed patients were, all participants stated that they received enough information about all aspects of treatment. Whilst 93.8 per cent of patients received a leaflet, 26.7 per cent would have liked to have seen photographs, 37.5 per cent would have liked to watch a video and 53.3 per cent would have liked to have been directed to a website.

CONCLUSION: An average of 90 per cent for patient satisfaction with treatment was achieved, thus the standard was met. With regard to patient satisfaction with the amount of information received, it was difficult to quantify 90 per cent. All participants stated they received enough information but it would be beneficial if this was supplemented with additional material.

SP 408 INCIDENCE OF PLATE REMOVAL FOLLOWING ORTHOGNATHIC SURGERY: AN AUDIT
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AIMS: To assess the rate of plate removal following orthognathic surgery.
MATERIALS AND METHOD: The audit standard was based on a study by Theodossy et al. at the Eastman Dental Institute in 2006. It followed 180 consecutive patients for 2 years demonstrating an overall rate of plate removal of 15.6 per cent. This audit was carried out in the maxillofacial department at the Royal Blackburn Hospital. The data was collected retrospectively for a 5 year period. A record of all of the patients who had undergone orthognathic surgery was kept by the department sister. The notes for all of these patients were analysed. The surgeon, patient’s age, gender and orthognathic procedure performed were recorded. Where plate removal occurred, the time since initial placement was noted. The minimum post placement observation period was 18 months. No orthognathic surgical procedures were excluded.

RESULTS: Two hundred and eight patients underwent orthognathic surgery. Plate removal occurred from 1-108 months following surgery (mean = 19.8 months). Twenty nine out of 208 patients undergoing orthognathic surgery underwent plate removal (13.9%); 18 out of 101 patients following bimaxillary osteotomies (17.82%), seven out of 54 patients following Le Fort 1 osteotomies (12.96%) and four out of 53 patients following sagittal split osteotomies (7.54%). Of the two operating consultants, 16 out of 136 patients (12.06%) underwent plate removal by one surgeon and 13 out of 72 (18.06%) by the other surgeon.

CONCLUSION: Less than 15.6 per cent of patients required plate removal, therefore the audit standard has been met. Bimaxillary osteotomies are associated with the highest rate of plate removal. High volume operators have a lower incidence of plate removal.

SP 409 ASSOCIATION BETWEEN OCCLUSAL DEVIATIONS AND ORAL HEALTH-RELATED QUALITY OF LIFE AMONG FINNISH ADULTS: THE NORTHERN FINLAND BIRTH COHORT 1966 STUDY
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AIMS: The associations between oral health-related quality of life (OHRQoL) and occlusion have mainly been studied in selected patient populations or young adults. The aim of this cross-sectional study was to investigate the associations between different occlusal deviations and OHRQoL among middle-aged Finnish adults.

SUBJECTS AND METHOD: The study material comprised of 1885 subjects from the Northern Finland Birth Cohort 1966. A clinical oral examination including registration of occlusion was carried out in connection with a 46-year follow-up. A standardized questionnaire included the 14-item Oral Health Impact Profile (OHIP-14) which was used to measure OHRQoL. Subgroups with different levels of increased/negative overjet, increased overbite/open bite, lateral crossbite and scissor bite were selected for further analysis. Subjects with normal occlusion were selected for the control group. Differences in OHIP scores between groups were evaluated using Mann Whitney U test.

RESULTS: The mean total OHIP-14 severity score for the total study group (n = 1885) was 3.82 (SD 5.58). Females reported slightly more oral impacts compared to males, mean OHIP-14 severity scores being 4.20 and 3.39, respectively. No statistically significant differences were found in total OHIP-14 scores between overjet groups and controls, although there was a trend for subjects with a negative or increased overjet to report oral impacts more often. The total OHIP-14 was not significantly associated with deviations in overbite or lateral malocclusion.

CONCLUSION: Single malocclusion traits were not correlating with OHRQoL when measured with total OHIP-14 score, in adults who were not seeking orthodontic care. Most of the adults with untreated malocclusion seemed to have adapted to the malocclusion. Thus, a patient-centred approach should be preferred when referring adult patients for orthodontic treatment instead of single malocclusion traits.

SP 410 IS THE RECOVERY PROFILE OF ORTHODONTIC-ORTHOGNATHIC PATIENTS AFFECTED BY THE HAEMODYNAMIC RESPONSE DURING GENERAL ANAESTHESIA?
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AIMS: Hypotensive anaesthesia is a well documented technique which successfully demonstrates a safe reduction in intraoperative blood loss. The aim of this study was to investigate if the recovery profile of
orthognathic patients is better using an arterial line (ART line) allowing continuous haemodynamic monitoring. It is standard practice to use an automated oscillometric technique which relies on sensing fluctuations in pressure oscillations due to arterial wall movement against the occluding cuff. The average in stay for patients is two nights.

MATERIALS AND METHOD: Retrospective analyses of 32 cases have been included. All patients were treated by a single surgeon and the same anaesthetist was used in all cases who ensured patients had an ART line in situ.

RESULTS: Ninety one per cent (n = 29) of patients were discharged within 23 hours or less with no cases of premature reviews or re-admissions. Seventy eight per cent (n = 25) were discharged after being admitted to the ward for 20 hours or less. Three patients stayed two nights due to existing comorbidities. Average blood loss in Mid-Yorkshire Hospitals Trust was 233 millilitres in comparison to 369.4 millilitres from a review of 10 randomised control trials.

CONCLUSION: The ART line means that the anaesthetist can maintain real time feedback of mean arterial pressure. This allows more control to achieve the best possible levels of haemodynamic response. Blood loss has been linked with patient recovery profiles. From this retrospective analysis it appears that the ART line is associated with better recovery of patients.

SP 411 PREVALENCE OF GINGIVAL RECESSIONS AFTER ORTHODONTIC TREATMENT IN EXTRACTION AND NON-EXTRACTION TREATMENTS 10 YEARS AFTER DEBONDING

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AIMS: To compare longitudinally the prevalence of buccal gingival recessions in extraction and non-extraction treatment 10 years after debonding.

SUBJECTS AND METHOD: Sixty one patients (32 female, 29 male) who underwent routine retention control 10 years after orthodontic treatment. Out of those, 33 patients were treated non-extraction and 28 with extraction of premolars. Plaster models and intraoral photographs were used for evaluation of the presence or absence of labial gingival recessions before treatment (T0; 12.5 ± 1.4 years), after treatment (T1; 14.7 ± 2.1 years) and 10 years after treatment (T10; 25.5 ± 1.5 years). The presence of recessions was divided into three segments for each jaw: maxillary left, anterior and right; and mandibular left anterior and right. Descriptive statistical analyses, t-test and one-way ANOVA were performed using the Statistical Package for STATA (Stata version 14.0; College Station, TX, USA).

RESULTS: There were no significant differences between the groups in terms of age, gender and Angle classification, overjet and overbite at T0. Little’s Irregularity Index (LII) was significantly higher in the extraction group at T0, but no significant differences in LII were found at T1 and T10. No recessions could be detected before treatment in any patient. A gradual, significant increase in labial recessions was registered in both groups at debonding (7% extraction and 3% non-extraction patients) and at T10 (42.9% extraction and 54.5% non-extraction patients). However, at each evaluated period, the intergroup differences, both among patients and per segment, were not statistically significant.

CONCLUSION: The prevalence of recessions increased gradually and significantly after orthodontic treatment in both the extraction and non-extraction groups. The post-treatment increase was significant, but irrespective of treatment modality. Within the limitations of this study, extractions do not seem to be a major risk factor for gingival recessions.

SP 412 CHARACTERISTICS OF ELECTROMYOGRAPHIC ACTIVITY OF MASTICATORY MUSCLES AFTER FUNCTIONAL TREATMENT IN PATIENTS WITH MALOCCLUSION AND TEMPOROMANDIBULAR DISORDERS

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AIMS: To study electromyographic (EMG) activity of masticatory muscles in patients with temporomandibular disorders (TMD) after functional treatment.

SUBJECTS AND METHOD: Twenty four adults [15 females (62.5%), 9 males (37.5%)] with malocclusion and clinical symptoms of TMD without a history of previous orthodontic treatment. The average age of the patients was 28.7 ± 1.31 years. Malocclusion was evaluated according to the Angle classification and TMD according to
the Research Diagnostic Criteria (RDC/TMD). Registration of EMG-activity of masseter and anterior temporalis muscles was performed during maximum voluntary clenching and clenching on the right and left sides. All patients underwent functional treatment with an occlusal splint in the first stage of orthodontic treatment before active orthodontic treatment mechanics with brackets. Clinical examination and EMG of the masticatory muscles were performed before and after functional treatment. The obtained data was statistically analyzed using the Student’s t-test and Fisher’s criterion X2. The hypotheses were verified at the level of significance $P < 0.05$.

RESULTS: Seventeen (70.8%) patients had TMD of group Ia (myofacial pain), seven (29.2%) subjects had a combination of groups Ia and IIa (disk displacement with reduction). Increased and asymmetrical EMG activity of the masticatory muscles was found in all subjects. After 3 months of functional correction the clinical symptoms disappeared in all subjects. EMG activity of the temporal and masseter muscles decreased and was symmetrical on both sides.

CONCLUSION: EMG activity of masticatory muscles in patients with TMD after functional treatment decreased and was within the normal range.

SP 413  THE RESULTS OF PALATALOGRAPHY BEFORE AND AFTER ORTHODONTIC TREATMENT IN PATIENTS WITH MALOCCLUSION AND TONGUE POSITION DISORDERS
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AIMS: To determine tongue position changes during swallowing and speech functions in patients with malocclusion before and after orthodontic treatment.

SUBJECTS AND METHOD: Orthodontic treatment was performed on 50 patients with malocclusion, accompanied by tongue position disorders during swallowing and speech. The patients were divided into two groups: control group (25 patients) and observation group (25 patients). All subjects had palatography performed during swallowing and speech tests at the beginning and after one year of orthodontic treatment.

RESULTS: After one year of orthodontic treatment, positive changes of the bite state and palatograms were indicated in the observation group in comparison to the control group: there was an increase of the ‘licked areas’ and displacement of their topography in the direction of hard palate.

CONCLUSION: In patients with malocclusion and tongue position disorders during swallowing and speech treatment leads to positive changes of tongue position which was objectively confirmed by the data of the palatographic study.

SP 414  A RE-AUDIT OF PATIENT SATISFACTION WITH THE MULTIDISCIPLINARY HYPODONTIA CLINIC IN A LONDON HOSPITAL
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AIMS: To re-assess patient satisfaction with the hypodontia clinic, and to identify areas of dissatisfaction and areas that can be improved.

MATERIALS AND METHOD: A prospective questionnaire based re-audit was carried out on new and review patients attending the hypodontia clinic at the Eastman Dental Hospital between July 2017 and October 2017. The 24-item patient questionnaire, about their experience, used in this second audit cycle, was a modified version of the questionnaire developed for the initial audit cycle. Patients'/parents' views on the reception and waiting room areas, members of the hypodontia team, experiences of the hypodontia clinic, radiography department and how they felt following their appointment were explored. These were answered using a four-point Likert scale. The gold standard was set at the 90 per cent satisfaction rate.

RESULTS: A total of 61 questionnaires were completed; 32 new patients and 29 review patients. Analysis revealed a comparable level of satisfaction to the initial audit cycle which was completed in 2013. Generally, a high level of satisfaction was achieved (90.7%), with review patients less satisfied (87.3%) than new patients (91.7%). The gold standard was not met for review patients. Areas of dissatisfaction included: waiting times to be seen and no patient information leaflet given. To address these areas, it was suggested that patients should be informed of any anticipated waiting time on arrival and that the British Orthodontic Society 'hypodontia'
patient information leaflet should be distributed with appointment letters, or on the hypodontia clinic. The results have been disseminated to the orthodontic and hypodontia teams. A re-audit has been suggested in a suitable time frame after the recommendations have been implemented.

CONCLUSION: Overall, a high level of satisfaction was achieved. Areas of dissatisfaction included waiting times to be seen and no patient information leaflet given. The majority of patients were happy with their experience of the hypodontia clinic and understood the next stage in their future treatment plan.

SP 415  INFLUENCE OF THE POSITION OF THE MANDIBLE ON THE DEVELOPMENT OF UPPER AIRWAY RESISTANCE SYNDROME
Ivan Solop, Alina Oksentyuk, Angelina Sviridenko, Daria Podoplelova, The First Moscow State Medical University, Russia

AIMS: To determine the influence of a distal position of the mandible on the development of upper airway resistance syndrome (UARS).

SUBJECTS AND METHOD: Thirty seven children aged from 11 to 15 years old undergoing dental treatment with no comorbidities. Lateral cephalograms, was calculated in the program AudaxCeph according to the methods of Sassouni et al. and Solow, were generated. The anteroposterior position of the mandible, craniocervical angle, as well as the diameter of the upper respiratory tract were evaluated. Analysis of the research was conducted using the correlation analysis method of Spearman’s rank.

RESULTS: Evidence was found that the distal position of the mandible is a predictor of the appearance of UARS during sleep. The following data was obtained: 13 per cent of subjects showed protrusion of the lower jaw, in 3 per cent the lower jaw was in a normal position and in 84 per cent there was retraction. Analysis of the craniocervical angle data showed that in 73 per cent of the patients the angle exceeded the normal value. When measuring the diameter of the upper respiratory tract a persistent reduction in diameter was observed in 70 per cent of subjects and accompanied by Skeletal II type. Statistical data suggested that the retrusion of the mandible leads to compression of the upper respiratory tract, which further promotes the formation of compensatory changes in the atlanto-axial-occipital junction expressed by forward location of the head.

CONCLUSION: There was a statistically significant association between the distal position of the mandible and the reduction of the diameter of the upper respiratory tract, as well as between the distal position of the mandible and the increase in the craniocervical angle.

SP 416  COMPARISON OF THE EFFICIENCY OF THE INDICES OF PONT AND KORKHAUS WITH THE KERNOTT TECHNIQUE IN PATIENTS WITH MAXILLARY NARROWING
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AIMS: To compare the efficiency of the indices of Pont and Korkhaus with Kernott’s method in patients with narrowing of the maxilla and to identify the use the technique in determining the symmetry of narrowing of the maxilla.

MATERIALS AND METHOD: Twenty three children aged from 8 to 12 years old undergoing dental treatment with no comorbidities. Study models were obtained for all patients and the models were photographed and loaded into AudaxCeph to carry out the biometric calculation. Two indices were used: Pont and Korkhaus to reveal the narrowing of the maxilla. After using Pont’s Index and Korkhaus analysis all the models were calculated with the method of Kernott (Kernott’s dynamic pentagon). Following data processing statistical analysis was undertaken.

RESULTS: The following data was obtained: 12 of the 23 models (52%) showed narrowing of maxilla, 18 of the 23 models showed a decrease of the length of the frontal sector of the maxilla (78% of all models calculated). After calculation, using Kernott’ analysis an asymmetrical narrowing of maxilla was revealed in 100 per cent of the models with narrowing calculated, using the indices of Pont and Korkhaus. In addition models of the maxilla, that seemed to be normal, based on Pont’s index also showed asymmetry.

CONCLUSION: The method of biometric calculation of maxillary models according to the standard indices of Pont and Korkhaus is inadvisable in the treatment of patients with narrowing of the maxilla, as these methods do not give a clear idea of the symmetry of the narrowing. On the contrary, Kernott’s method makes it possible to detect asymmetric narrowing of the upper jaw and undertake treatment using removable orthodontic devices.
SP 417 CLINICAL PRACTICE GUIDELINE FOR ORTHODONTICALLY INDUCED EXTERNAL APICAL ROOT RESORPTION
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AIMS: To develop evidence based and, if needed, consensus based recommendations on external apical root
resorption (EARR) concerning risk factors, management when EARR occurs during treatment and aftercare
requirements.
MATERIALS AND METHOD: The guideline was developed in accordance with the AGREE II instrument and EBRO
(method for evidence based guideline development). From a survey among all Dutch orthodontists concerning
the need for clinical practice guidelines four research questions (RQ) concerning EARR were developed. To
answer the questions a search strategy was performed in Medline and Embase and a systematic review of the
literature was carried out, followed by a quality assessment of the evidence using the GRADE approach. After
discussion of the evidence, a task force formulated considerations and recommendations. The concept guideline
was sent for commentary to all members of the Dutch Association of Orthodontists (NVvO) and the Dutch
Dental Association, as well as to the Patients’ Federation.
RESULTS: After literature screening and full text evaluation, in total 11 studies (one for RQ 1, seven for RQ 2, one
for RQ 3, two for RQ 4) met the inclusion criteria and were used for further elaboration. Following the literature
review, concept considerations and recommendations were made. The task force came to consensus after three
scheduled meetings and 13 final recommendations were formulated concerning the detection of EARR, risk
factors, how to react if EARR has occurred during treatment and aftercare requirements. An implementation
plan was made, in which strong recommendations must be implemented within one year after publication of
the guideline. All other recommendations are to be implemented within three years. During the commentary
phase, 63 comments were collected. After processing the comments, the final guideline was approved by the
NVvO and published in the national database for medical guidelines. The whole process took two and a half
years.
CONCLUSION: The guideline allows practitioners to discover EARR at an early stage, to react adequately to this
problem and to give patients good aftercare and information.

SP 418 ASSESSMENT OF TOOTH COLOUR ALTERATION AFTER LABIAL FIXED ORTHODONTIC TREATMENT
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AIMS: To evaluate the tooth colour alteration after labial fixed orthodontic treatment.
SUBJECTS AND METHOD: Sixty patients were randomly assigned to three groups. The anterior teeth of each
group were divided into two groups by left or right side, using different orthodontic adhesive systems: group A:
3M Unite/GC, group B: 3M Transbond XT /GC and group C: 3M Unite/3M Transbond XT. All anterior teeth of
each patient received colour measurements using an Olympus spectrophotometer before and after treatment. A
paired t-test and ANOVA were then used to analyze the data.
RESULTS: There were significant differences in tooth colour parameters before and after treatment. The
yellowness and redness were increased and the brightness was reduced. The discoloration of cervical part was
more easily observed. The cervical and central parts had the same degree of discoloration, while the incisal
section showed minimal changes. Compared with resin, the resin-modified glass-ionomer cement had smaller
variation in tooth colour alteration during orthodontic treatment.
CONCLUSION: The tooth colour altered by different degrees after labial fixed orthodontic treatment.

SP 419 CONE BEAM COMPUTED TOMOGRAPHIC ANALYSIS OF LOWER ANTERIOR ALVEOLAR BONE THICKNESS
IN SKELETAL CLASS III REGARDING VERTICAL SKELETAL PATTERN
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AIMS: To investigate the lower anterior alveolar bone thickness of skeletal Class III malocclusion patients with
different vertical skeletal patterns using cone beam computed tomography (CBCT).
SUBJECTS AND METHOD: Ninety three skeletal Class III malocclusion patients divided into three groups according to the SN-MP angle; 31 high angle (SN-MP > 38.0°), 32 normal angle (30.0° < SN-MP < 37.0°) and 30 low angle (SN-MP < 28.0°). Using CBCT, the buccal and lingual alveolar bone thickness of the mandibular incisors was measured at the alveolar crest (BT0, LT0) and 3, 6 and 9 mm apical to the alveolar crest (BT3, LT3, BT6, LT6, BT9, LT9).

RESULTS: The mandibular lateral incisor had thicker alveolar bone compared to the central incisor at BT0, BT3 in Class III high angle group and at BT3, LT3 in the Class III normal angle group. Regardless of vertical skeletal pattern, there was no significant difference in labial and lingual bone thickness at the alveolar bone crest and 3 mm apical to the crest. However, the lingual alveolar bone was thicker than the labial bone at 6 and 9 mm apical from the crest. The Class III high angle group showed significantly thinner buccal and lingual alveolar bone compared to the Class I normal angle group in all areas except for the buccal thickness at the alveolar crest. SN-MP angle had a negative correlation with the lower anterior alveolar bone thickness.

CONCLUSION: Skeletal Class III patients with high mandibular angles had a thinner alveolar bone thickness in all areas compared to the other groups. Skeletal Class III patients with normal or low mandibular angles had similar alveolar bone widths compared to skeletal Class I patients with normal mandibular angles. The alveolar bone thickness was similar for all groups in the area within the alveolar crest and 3 mm apical to the crest regardless of the mandibular plane angle.

SP 420 A PROPOSAL OF THREE-DIMENSIONAL ASSESSMENT OF THE FACE WITH CONE BEAM COMPUTED TOMOGRAPHIC IMAGES: A PILOT STUDY OF FACIAL ANALYSIS
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AIMS: To suggest a new reference frame concerning the zygoma area for the soft tissue analysis of the lower half of the face. The average relationship between the new frame and the facial landmarks of lower half face in skeletal Class I patients was studied using the cone beam computed tomographic (CBCT) records of Korean young adults.

MATERIALS AND METHOD: CBCT images of 48 patients (23 males, 25 females) were assessed. The average age of the subjects was 23.6 years. The anterior facial pyramid (AFP) was defined by four landmarks; pronasale, right and left zygomatic points and soft tissue pogonion. Linear and angular measurements of the AFP were conducted and the relative position of the nose and lip to the AFP were evaluated for both genders.

RESULTS: All linear measurements of the AFP were significantly longer in males than in females (P < 0.01). However, the midface angle was significantly larger in females compared to that of males by 4.2 degrees (P < 0.01). Pronasale, subnasale, labiale superius, labiale superius right/left, upper lip point and lower lip point were more protruded from the base of AFP in males than in females (P < 0.01). Labiale inferius right/left and labiale inferius were more anteriorly positioned to the base in males than in females (P < 0.05). There was no significant difference between genders in the distance between the lip landmarks and the side of AFP (P > 0.05). The upper lip point was positioned anterior to the anterior vertical edge for males and posterior for females.

CONCLUSION: This pilot study suggests the AFP as a new reference frame for soft tissue analysis of the lower face using CBCT images.

SP 421 DO INTRINSIC SUBSTANCES PRESENT AN EFFECT ON ROOT RESORPTION DURING ORTHODONTIC TOOTH MOVEMENT? A SYSTEMATIC REVIEW AND META-ANALYSIS IN ANIMAL STUDIES
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AIMS: The aim of the present systematic review was to provide a synthesis of animal studies based on experimental data on the effect of induced intrinsic/hormone-like substance administration on external root resorption after orthodontic tooth movement.

MATERIALS AND METHOD: An electronic database search of published and unpublished literature was performed (Medline via PubMed, Embase, Lilacs and Open Grey). Search terms included root resorption, tooth movement and animal type, while data was extracted in standardized piloted forms. Risk of bias assessment was made using the SYStematic Review Centre for Laboratory animal Experimentation (SYRCLE) guidelines for animal studies and reporting quality was assessed through ARRIVE (Animal Research: Reporting In Vivo Experiments).
Random effects meta-analysis was performed for the outcome root resorption after orthodontic tooth movement.

RESULTS: Of the 124 articles initially retrieved, 13 were eligible for inclusion in the systematic review, while only two were included in the quantitative synthesis. In 11 studies rats were used as the experimental units, whereas two were performed on mice. Five studies investigated the effect of Prostaglandin E2 (PGE2), four studies the effect of thyroxine, two the effect of calcium (Ca), while the rest investigated Misoprostol, Interleukin-12 and Interleukin-4. Risk of bias in all studies was judged to be high overall, while reporting quality was suboptimal. According to the quantitative synthesis, there was no difference in root resorption after orthodontic tooth movement when PGE2 coupled with Ca was administered in comparison to no substance administration (standardized mean difference: 0.48 mm²; 95% confidence interval: −0.22, 1.19; P = 0.18).

CONCLUSION: Overall, there was no evidence to suggest a variation in root resorption when PGE2 and Ca were administered. There is an overriding need for further high quality experimental studies to inform available evidence on the effect of intrinsic substances on external root resorption.

SP 422 CHANGES IN FACIAL EXPRESSIONS FOLLOWING FUNCTIONAL ORTHOPAEDIC TREATMENT FOR CLASS II MALOCCLUSION
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AIMS: To quantify changes in facial expressions in children with a Class II malocclusion treated with functional appliances.

SUBJECTS AND METHOD: A prospective controlled study was carried out evaluating 20 children with a Class II malocclusion (5 girls; 15 boys), aged between 8-14 years, treated with a functional appliance for a period of 12 months (treatment group). Age- and gender-matched children without an immediate need for orthodontic treatment were followed-up without treatment during the same 12 month period (control group). A video sequence was taken of each subject at the beginning and end of the 12 month study period, during which five distinct facial expressions were recorded: forced smile, aggressive smile, spontaneous smile, maximum mouth opening, and lip pucker. The video sequences were viewed, frame-by-frame, and the images at which each individual facial expression was at its peak were stored for further analysis. Using Image J software, changes in horizontal and vertical characteristic distances of the face, brought about by performing each facial expression, were analysed. All statistical analyses were performed using Excel software. Data were initially tested for normality using the Shapiro-Wilk test. Within-group differences following treatment were assessed using paired t-tests, while intergroup differences were assessed using unpaired t-tests.

RESULTS: All functional appliance treatments showed a reduction in overjet and improvement in molar relationships. Facial expressions at the beginning of the study period differed between groups, with the treatment group showing less marked changes during lip pucker and maximal mouth opening, when compared to the control group. In contrast, when looking at the post-treatment facial expressions, no statistically significant differences were found between the treatment and control groups for any of the facial expressions examined.

CONCLUSION: Functional appliance use in Class II malocclusion growing children tends to normalise soft tissue movements during facial expressions. Differences existing before treatment between the two groups were no longer present after treatment, demonstrating that the functional appliance had normalised facial expressions in the Class II subjects rendering them similar to the control group.

SP 423 SKELETAL AGE ASSESSMENT IN PATIENTS PLANNED FOR RAPID PALATAL EXPANSION TREATMENT
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AIMS: Individual variations in the development of patients indicate that chronological age appears to be an unreliable indicator for growth evaluation of the individual. Treatment with rapid palatal expansion (RPE) targeting correction of the transverse maxillary deficiency requires assessment in relation to the skeletal age of the patient. The purpose of the study was to make an assessment of the skeletal age of the patient using the morphological characteristics of the cervical vertebrae on lateral cephalograms of patients in need of RPE.
MATERIALS AND METHOD: The lateral cephalograms of 74 patients between the ages of 9 and 17 years before the beginning of treatment with RPE were analyzed. They were divided into two age categories in relation to the pubertal growth peak. The first group consisted of patients between 9 and 13.75 years of age who had not reached or were near the growth peak and the second group patients aged between 14 and 17 years who had completed the growth peak. The method for assessment of skeletal age was a combined technique, comprising parts of Baccetti’s (2005) and Lamparski’s (1972) methods (modified cervical maturation method). The patients were classified into six stages according to their skeletal age.

RESULTS: In order to compare the two age groups the χ-square test were used in consideration of the correlations and discrepancies between chronological and skeletal age. The first group showed 26.5 per cent of correlations which was significantly lower than those in the second group (78.6%) with a differential of 52.1 per cent (P < 0.001). A reverse tendency was observed regarding the discrepancies which reached 73.5 per cent in the first group and 21.4 per cent in the second, a differential of 52.1 per cent (P < 0.001).

CONCLUSION: In the group of patients before and near the growth peak, there was a prevalent discrepancy between chronological and skeletal age indicating that chronological age is an unreliable indication for the real skeletal age in patients between the ages of 9 and 13.75 years.

SP 424 OBSTRUCTIVE SLEEP APNOEA AND THE RISK FOR CORONARY HEART DISEASE, TYPE 2 DIABETES AND ITS COMPLICATIONS
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AIMS: Obstructive sleep apnoea (OSA) is a common but underdiagnosed respiratory disorder. To understand the role of OSA for cardiometabolic disease risk, the aim of this study was to evaluate if OSA modifies the risk of coronary heart disease (CHD), type 2 diabetes and diabetic complications, and also whether the effects are similar in males and females.

MATERIALS AND METHOD: The data of 37352 individuals from the national FINRISK Studies (n = 29250), Health 2000 Cohort (n = 6697) and the Botnia and PPP-Botnia Studies (n = 1405 with type 2 diabetes), including 1601 (4.3%) OSA patients with up to 25 years of follow-up. The associations with data for hospitalizations and causes of death obtained from national registries were tested by Cox proportional hazard models and validated by meta-analysis.

RESULTS: After adjustment for traditional risk factors, OSA increased the risk for CHD [Health Risk = 1.36, P = 0.0014, confidence interval (CI = 1.12-1.64], and particularly in females (HR = 2.01, CI = 1.31-3.07, P = 0.0012). Diabetes clustered with OSA independently of obesity and family history of diabetes (HR = 1.48, CI = 1.26-1.73, P = 9.108 x 1 ^(-7)). The risk of diabetic kidney disease increased 1.75-fold in OSA patients (CI = 1.13-2.71, P = 0.0128). OSA increased the risk for CHD similarly among diabetic patients and in the general population (HR = 1.36). All-cause-mortality was increased by OSA in the general population and slightly more in diabetic individuals (HR = 1.22, CI = 1.03-1.44, P = 0.0184; HR = 1.35, CI = 1.06-1.71, P = 0.0156, respectively).

CONCLUSION: OSA is an independent risk factor for cardiometabolic diseases and diabetic complications. Particularly the risk of diabetic kidney disease was 1.75-fold in OSA patients. Therefore, the adverse role of OSA for cardiometabolic disease, especially in females, needs more attention.

SP 425 SATISFACTION WITH ANTERIOR TOOTH POSITION IN RELATION TO ORTHODONTIC TREATMENT EXPERIENCE AND TREATMENT NEED AMONG ADOLESCENTS IN TROMSØ, NORWAY
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AIMS: To investigate if satisfaction with anterior tooth position was related to orthodontic treatment experience and/or to normative treatment need among first year upper secondary school students and to examine relationships between normative treatment need and wish for orthodontic treatment.

SUBJECTS AND METHOD: Four hundred and ninety adolescents (aged 15 to 18 years) based on all first year upper secondary school students in Tromsø, Norway. Satisfaction with anterior tooth position, orthodontic treatment experience and wish for orthodontic treatment were recorded from questionnaires. Normative orthodontic treatment need was graded on plaster models using the Dental Health Component and Aesthetic
Component of the Index of Orthodontic Treatment Need (IOTN DHC/AC) and the Need of Orthodontic Treatment Index (NOTI). Group differences regarding satisfaction, orthodontic treatment experience, normative orthodontic treatment need and wish for orthodontic treatment were analyzed using Chi-Square test, Fisher’s exact test and the likelihood ratio test.

RESULTS: Females with orthodontic treatment experience were significantly more satisfied with anterior tooth position than untreated females (80.6% and 64.5%, \( P = 0.015 \)), but no significant difference was seen between treated and untreated males. Subjects who were satisfied with anterior tooth position showed significantly lower grades for IOTN/AC, representing better aesthetics, than the unsatisfied subjects \( (P < 0.01) \). However, there were no significant differences between the satisfied and unsatisfied subjects regarding the IOTN/DHC and NOTI grades. Subjects with a wish for orthodontic treatment had significantly higher IOTN/AC grades compared to those with no wish for treatment \( (P < 0.01) \), but no differences were seen between these groups regarding the IOTN/DHC or NOTI grading.

CONCLUSION: Awareness of anterior tooth position may be influenced by gender. The IOTN/AC index could be helpful for dental professionals in reflecting patient satisfaction related to anterior tooth position and wish for orthodontic treatment.

SP 426 A CONSIDERATION OF THE EFFECT OF EARLY ORTHODONTIC TREATMENT
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AIMS: A goal of early orthodontic treatment includes improvement of skeletal problems, removal of premature contacts, a smooth exchange to permanent teeth and preparation for the next phase of orthodontic treatment. The aim of this study to investigate the effect of treatment on patients who underwent early treatment, had good results.

SUBJECTS AND METHOD: Forty eight patients (16 boys, 32 girls) who had early orthodontic treatment at 10 years, and had acceptable overjet, overbite (within 2 mm or more and 3 mm or less) at the end of early treatment, and no crowding at the end of treatment.

RESULTS: The average ANB pre-treatment was 2.9 ± 2.2 degrees, with Skeletal I patients accounting for the largest proportion. The expected discrepancy was –3.0 ± 3.6 mm in the maxilla and 0.7 ± 3.0 mm in the mandible. The overjet was 2.5 ± 2.6 mm and 1.9 ± 2.6 mm, respectively. ANB changed to 2.5 ± 2.1 degrees and FMA from 28.2 ± 3.4 degrees to 27.3 ± 5.0 degrees and mandibular growth was observed. In addition, FMIA increased from 57.8 ± 5.8 degrees to 59.1 ± 5.7 degrees, but was within the standard range.

CONCLUSION: After the end of growth observation, it is necessary to comprehensively judge the results of treatment and re-diagnose for the next phase. It is suggested that lack of eruption space can be improved by expansion of the dental arch in the maxilla.

SP 427 GENDER DIFFERENCE IN MASTICATIONARY PERFORMANCE JUSTIFIED BY DIFFERENT TYPES OF NATURAL TEST FOODS
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AIMS: To compare the median particle size of food in masticatory performance tests from almond and frankfurter sausage between a group of males and females

SUBJECTS AND METHOD: Thirty healthy subjects with complete dentitions (12 males; 18 females, age 18-32 years). Each subject was asked to chew a latex bag containing one type of test food either an almond or 5 g of 5 × 5 mm frankfurter sausage cubes. For one test food, four food containing latex bags were needed as the chewing was undertaken four times; 5 and 15 cycles on the left and another 5 and 15 cycles on the right. The median particle sizes of chewed test food were evaluated using a multiple sieving method. Median particle sizes of the left and right sides of the same cycle were averaged. An independent \( t \)-test was applied to identify the difference of the median particle size of each test food between males and females at the significance level of \( P < 0.05 \).

RESULTS: The median particle size of chewing almond and frankfurter sausage at 5 and 15 chewing cycles was 1.94 ± 0.90, 0.90 ± 0.57, 4.18 ± 0.19 and 3.75 ± 0.25 mm., respectively. The median particle size was significantly larger in females than males for both types of foods and all chewing cycles \( (P < 0.05) \).
CONCLUSION: The masticatory performance was significantly better in males than females for both types of food and for all chewing cycles. Therefore, considering gender-related differences in masticatory performance might be essential.

SP 428 BREAKING FOETOMATERNAL TOLERANCE BY HEME RESULTS IN ABORTION AND CRANIOFACIAL MALFORMATIONS; EFFECTS OF CYTOPROTECTIVE ENZYMES
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AIMS: A cleft lip and/or palate (CLP) is the most common facial congenital malformation. However, the exact mechanism leading to orofacial clefts remains to be elucidated. A combination of genetic and environmental factors are thought to be involved. The effects of the endogenous danger signal heme and the cytoprotective enzyme heme oxygenase (HO) on craniofacial development and abortion in pregnant mice was studied.

MATERIALS AND METHOD: In pregnant wildtype CD1 mice at gestational day 11 (E11) the HO-activity inhibitor tin mesoporphyrin (SnMP; 30 µmol/kg body weight) or different doses of heme at E12 (30, 75 and 150 µmol/kg body weight) and combinations of both (SnMP+ heme 30/75 µmol/kg body weight) were administered. All experimental groups were compared to the control group (no administration). After sacrifice of the animals at E16, foetuses and placenta were isolated and analyzed for morphological abnormalities.

RESULTS: Dose dependent effects of heme administration on craniofacial development and abortion were found. Thirty or 75 µmol/kg heme did not cause adverse effects, whereas 150 µmol/kg heme resulted in abortion of all foetuses. Similarly, when HO-1 and HO-2 activity was blocked by SnMP in combination with 75 µmol/kg heme all foetuses were aborted. However, 30 µmol/kg heme in combination with inhibition of HO-activity resulted in resorption of foetuses and craniofacial malformations besides healthy foetuses. Solely SnMP administration did not lead to abnormalities.

CONCLUSION: Haemorrhage-derived heme may promote pathological pregnancy, congenital abnormalities and abortion. HO-activity is crucial for maintaining foetomaternal tolerance by protecting against the deleterious oxidative and inflammatory insults of danger signals, such as heme, during pregnancy.

SP 429 IS THE CERVICAL VERTEBRAL MATURATION METHOD EFFECTIVE ENOUGH TO REPLACE THE HAND-WRIST MATURATION METHOD IN DETERMINING SKELETAL MATURATION?
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AIMS: To assess the usefulness of the cervical vertebral maturation (CVM) method and to verify the assumption, according to which the CVM method modified by Baccetti et al. may replace assessment of skeletal maturation based on a hand-wrist radiographs, which is known as the ‘gold standard’. MATERIALS AND METHOD: The literature between 2006 and 2016 was reviewed. In the first stage of selection 905 articles were obtained. Finally, 10 articles were enrolled for the review.

RESULTS: All studies presented a high level of correlation between the examined methods. In eight articles the researchers admitted that the CVM classification could replace the HWM method, known as the ‘gold standard’. In two studies, the researchers suggested considering the CVM method an additional method despite its compatibility and usefulness. The lowest correlation coefficient was 0.616 and the highest 0.937.

CONCLUSION: The CVM method shows a high level of correlation with the HWM method. The CVM method does not expose the patient to additional radiation exposure. Chronological age is not the indicator of skeletal age.

SP 430 FACIAL PROFILE AESTHETIC PERCEPTION
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AIMS: To determine the aesthetic perception of adult laypeople of nasolabial angle (NLA) and different antero-posterior positions of the mandible of a young female profile.
MATERIALS AND METHOD: A right profile photograph and a lateral cephalometric radiograph in the natural head position of a young Caucasian female were taken. A series of reproducible modifications were produced (changes in mandibular position and nasolabial angle) using NemoCeph® software (Nemotec, Madrid, Spain). A total of 25 profiles were shown in a Power Point presentation to 223 consenting laypeople who evaluated the attractiveness of the profile on a visual analogue scale. Profiles were classified in patterns depending on the anteroposterior mandibular position. All data were analysed with the Statistical Package for Social Science® (IBM Corp., Armonk, New York, USA).

RESULTS: For each mandibular pattern, profiles were ranked from the least to the most attractive depending on the NLA, in the following ascending order: severe protrusion: 110, 97 and 87 degrees; severe retraction: 93, 117 and 104 degrees; moderate protrusion: 111, 98 and 88 degrees; moderate retraction: 92, 115 and 102 degrees; mild protrusion: 112, 88 and 98 degrees; mild retraction: 103, 114 and 101 degrees; straight profile: 121, 83, 112, 103, 89, 96 and 99 degrees.

CONCLUSION: Preferences in NLA value change depending on the anteroposterior mandibular position. This should be considered in orthodontic treatment planning.

SP 431 CLINICAL KNOWLEDGE OF ORTHODONTIC RETENTION APPLIANCES IN SWEDISH GENERAL DENTISTS – A QUESTIONNAIRE STUDY
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AIMS: Different types of retention appliances are used in orthodontics for post-treatment stability. There seem to be problems concerning retention appliances among general dentists due to either lack of knowledge or lack of guidelines in this matter. The aim of this study was to examine the knowledge of general dentists in Sweden concerning retention appliances.

MATERIALS AND METHOD: A questionnaire consisting of 22 questions was collected from 403 randomly selected general dentists in different regions of Sweden. Statistical analysis was carried out using Microsoft Excel.

RESULTS: It was found that 12.5 per cent of general dentists referred patients to the orthodontist if a fixed retainer became detached, whereas 53 per cent referred if a removable retainer was lost. Dentists who had participated in continuing dental education (CDE) courses in orthodontics showed same results as those who had not participated in any CDE course. However, 42.5 per cent of the dentists in this study with maximum of 3 years of clinical experience and 58 per cent of dentists with more than 20 years of experience, referred patients to the orthodontist when a removable retainer was lost. Furthermore, 51 per cent of all participating dentists felt that the orthodontist did not provide them with enough information at the end of orthodontic treatment or felt that they wished for more information.

CONCLUSION: There is a lack of knowledge among Swedish general dentists regarding removable orthodontic retainers. Communication between general dentists and orthodontists should be improved.

SP 432 FRETTING BEHAVIOUR OF DIFFERENT ORTHODONTIC BRACKET/ARCHWIRE COMBINATIONS UNDER DRY CONDITIONS: AN IN VITRO STUDY
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AIMS: Fretting or reciprocative sliding is a wear process that occurs at the asperities of two loaded contacting materials, subjected to minute relative motion by vibration or some other force. This contact movement causes mechanical wear and material transfer on the interacting surfaces. The fretting wear process also occurs at the sliding bracket/archwire interface when performing orthodontic tooth movement. However, the wear pattern or fretting behaviour in orthodontics is not unique due to the large variety of bracket and archwire materials, dimensions and designs used. The severity of friction of the bracket-archwire combination determines the wear damage on the contact surfaces. This in vitro study aimed to investigate the friction coefficient and wear characteristics of different bracket/archwire combinations under ambient dry conditions.

MATERIALS AND METHOD: A stainless steel bracket was coupled with archwires of different materials, dimensions and cross-sections, using custom made fretting equipment. The test materials were subjected to 20 reciprocating sliding cycles with a length of 200 µm under a normal load of 2 N. The frictional forces were
measured and the generated wear tracks were inspected by scanning electron microscopy, accompanied by energy dispersive spectroscopy elemental analysis of the worn areas.

RESULTS: The frictional forces differed according to the used combination. Generally, the larger-sized rectangular wires showed a higher friction than the small-sized round wires due to the difference in contact geometry. Smooth, well-polished, harder wires showed less friction and a lower tendency to surface damage than the rough soft wires. High friction was accompanied by more damage and debris accumulation on the surface. The elemental analysis clearly showed material transfer between the interacting surfaces.

CONCLUSION: Clinically, it is important to achieve smooth efficient sliding to maintain the material integrity of the bracket-wire combination. This will avoid potential health hazards, considering that these effects take place in a patient’s mouth.

SP 433 ELECTROMYOGRAPHIC ACTIVITY AND BLOOD FLOW DURING GRADED EXERTION IN THE ORBICULARIS ORIS MUSCLE OF ADULT SUBJECTS WITH AND WITHOUT LIP INCOMPETENCE
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AIMS: The peri-oral muscles, including the orbicularis oris, are critical in maintaining equilibrium in tooth position. Lip incompetence (LI) can thus be a factor in malocclusion. The aim of this study was therefore to validate a technique to evaluate not only muscle activity via electromyography (EMG) but also muscle endurance and fatigue via blood flow (BF) for LI.

SUBJECTS AND METHOD: Subjects were classified into increased muscle tension/lip incompetent (experimental) and normal muscle tension/lip competent (control) groups. Each subject then exerted force on a custom-made traction plate connected to a tension gauge. Using laser speckle imaging and electromyographic measurements, muscle activity and corresponding BF rates in these subjects in various states of resting, loading, and recovery were characterized.

RESULTS: A significant difference was found between the experimental and control groups, notably in the rate of change in BF to the inferior orbicularis oris muscle under conditions of increasing load (graded exertion). Furthermore, the data suggested that the muscles in the control group undergo a more prolonged (and therefore presumably more complete) recovery than muscles in the experimental group. These factors of reduced BF and short recovery may combine to accelerate muscle fatigue and produce LI.

CONCLUSION: From these findings, it is concluded that reduced BF and inadequate recovery in the orbicularis oris muscles may be more significant than EMG activity in the assessment of LI.

SP 434 THREE-DIMENSIONAL LIP MORPHOLOGY IN SKELETAL CLASS I MALOCCLUSION WITH LABIAL INCLINATION OF THE UPPER CENTRAL INCISORS
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AIMS: To examine three-dimensional (3D) lip morphology in skeletal Class I malocclusion with labial inclination of the upper central incisors.

SUBJECTS AND METHOD: Thirty-five Japanese patients with malocclusions divided into two groups: 20 patients (test group, 9 males, 11 females; mean age, 9 years 10 months) who exhibited a Class I malocclusion with labial inclination of upper central incisors and 15 patients (control group, 7 males, 8 females; mean age, 9 years 0 months) who exhibited a skeletal Class I malocclusion with standard inclination of upper central incisors. 3D morphology of the facial soft tissues were recorded using a 3D surface imaging device (3dMDcranial System; 3dMD, Atlanta, USA) and analyzed using an image processing software program (Face-Rugle; Medic Engineering, Kyoto, Japan) for both groups. The mid-sagittal, axial and frontal planes were defined based on several reference points. The subnasale (sn) and labiomentale (labm) were identified. The lip base plane was defined as the plane through sn and labm and perpendicular to the mid-sagittal plane. The lip base area was defined as the area of the lip base plane. Lip protrusion variables, such as the lip protrusion surface area and volume, were defined based on whether the lip was protruded in relation to the lip base plane. Lip protrusion depth was defined as
the protrusion volume divided by the lip base area. Significant differences between the variables for the test and control groups were analyzed using Welch’s t-test.

RESULTS: The upper lip base area, protrusion surface area, volume and depth were significantly larger in the test than in the control group. Lower lip protrusion volume and depth were significantly larger in the test group than in the control group. However, no significant differences in the lower lip base area or protrusion surface area were observed between the test and control groups.

CONCLUSION: The upper lip showed wholly labial inclination and forward protrusion in Class I malocclusion subjects with labial inclination of the upper central incisors.

SP 435 ASSESSMENT OF ORTHODONTIC TREATMENT UPTAKE IN CHILDREN AND ADOLESCENTS IN ENGLAND, WALES AND NORTHERN IRELAND IN RELATION TO SOCIO-ECONOMIC STATUS
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AIMS: To assess the prevalence of orthodontic treatment uptake among 12- and 15-year-old adolescents in England, Wales and Northern Ireland, and to examine whether there is an association between the uptake of orthodontic treatment and the adolescents’ socio-economic status.

MATERIALS AND METHOD: The study was cross-sectional and based on data from the 2013 Children’s Dental Health Survey which adopted multistage sampling among schoolchildren from England, Wales and Northern Ireland. Separate analyses were performed for the two age groups. The main analysis samples comprised 2,182 and 2,074 adolescents of 12 and 15 years of age, respectively. Two different measures of socio-economic status were used: free school meal eligibility and relative area deprivation based on adolescents’ home postal code. Additionally, separate analyses were performed for 15-year-olds (i) who were undergoing orthodontic treatment at the time of the survey and (ii) who had a history of previous orthodontic treatment. Poisson regression was used to assess potential associations between socio-economic status indicators and orthodontic treatment uptake and whether a social gradient was present.

RESULTS: The overall prevalence of orthodontic treatment uptake was 9.5 per cent among 12-year-olds and 32.5 per cent among 15-year-olds. Girls were 2.35 [95% confidence interval (CI): 1.43-3.86] and 1.43 (95%CI: 1.21-1.7) times more likely to take up orthodontic treatment compared with boys, in the 12- and 15-year-olds respectively. Irregular attenders to the dentist were 83 per cent (Incidence Rate Ratio = 0.18; 95%CI: 0.07-0.47) and 63 per cent (IRR = 0.37; 95%CI: 0.25-0.54) less likely to take up orthodontic treatment than regular attenders among 12- and 15-year-olds, respectively. This study found no significant association between the uptake of orthodontic treatment and socio-economic status. A marginally significant unadjusted association between previous orthodontic treatment experience and free school meal eligibility in the bivariate analysis in 15-year-olds became non-significant after adjustment.

CONCLUSION: There was no significant relationship between orthodontic treatment uptake and socio-economic status. Considering factors such as the severity of orthodontic treatment need when examining the above association would be an interesting focus for future research. It is possible that although social inequalities do not seem to exist, there are differences when severity of malocclusion is considered.

SP 436 THE IMPACT OF FORCE MAGNITUDE ON PERMANENT MAXILLARY FIRST AND SECOND MOLARS IN CERVICAL HEADGEAR THERAPY
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AIMS: To study the impact of different force magnitude on permanent maxillary first and second molars in cervical headgear (CHG) therapy.
SUBJECTS AND METHOD: Subjects with a Class II or end-to-end molar relationship, mixed dentition and moderate crowding to be treated with CHG were recruited. Patients were allocated to light (L, 300 g) or heavy (H, 500 g) force with CHG. The force magnitude was set with the patient sitting and looking straight forward. The inner bow of the CHG was expanded (3-4 mm) and the long outer bow bent upwards 10-20 degrees in relation to the inner bow. Patients were asked to wear HG for 10 hours/day. HG use was controlled and adjusted every 6-8 weeks until the end of the study at 10 months. Adherence to instructions and force magnitude in HG use was monitored with a Smartgear (Swissorthodontics, Switzerland) module. Lateral cephalograms were taken before (T1) and after (T2) treatment, and studied with the modified Pancherz analysis with Planmeca Romexis Ceph module (Planmeca, Finland). Analysis was made twice; the mean value was used in the Mann-Whitney U test for statistical analysis. The present study was based on 40 children (L group n = 22, H group n = 18, mean age 9.73 ± 0.74 years and 9.88 ± 0.73 years; respectively; 15 males, 25 females). The total amount of days monitored was 11,344.

RESULTS: Children in the L group used CHG statistically significantly more than in the H group (10.0 ± 1.5 hours, and 8.3 ± 2.1 hours, respectively, \( P = 0.002 \)). The only statistically significant difference in cephalometric analysis was the inclination of upper incisors to Nasion-Sella Line (NSL) at T1 \( P = 0.042 \) 104.7 ± 8.6 and 99.2 ± 7.0 degrees and at T2 \( P = 0.004 \) 108.1 ± 9.2 and 100.8 ± 6.0 degrees in the L and H groups; respectively. The angle of NSL to the long axis of the maxillary permanent first molar was (T1) 112.8 ± 4.8 and 113.2 ± 6.6 degrees, (T2) 112.9 ± 4.8 and 116.1 ± 5.9 degrees and to the second molar was (T1) 122.6 ± 5.6 and 121.7 ± 6.7 degrees, (T2) 125.9 ± 6.8 and 128.5 ± 5.7 degrees in the L and H groups; respectively. During treatment posterior rotation was seen at the first molars \( P = 0.010 \) and second molars \( P = 0.000 \) in the H group, with great individual variability.

CONCLUSION: With heavy force in CHG the permanent upper first and second molars seem to tilt more easily to distal direction than with the light force, even if the long outer bow was bent upwards and CHG was used for fewer hours.

SP 437 EFFECT OF CYCLIC INSERTION AND REMOVAL ON THE MORPHOMETRIC SHAPE CHANGE OF VACUUM-FORMED RETAINERS OF DIFFERENT THICKNESS
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AIMS: To examine the effect of polymer material thickness on the change in morphometric shape of vacuum-formed retainers after mechanical stress from cyclic insertion and removal from a dental arch using an in vitro study model.

MATERIALS AND METHOD: Standardised vacuum-formed retainer specimens (N = 20) were constructed with Duran® poly(ethylene terephthalate glycol-modified) copolymer thermoplastic sheets, five each in 0.75 mm and 1.0 mm thickness as well as their respective control groups. Specimens were subjected to cyclic mechanical stress over a dental arch model using a custom-built machine simulating clinical insertion and removal of the retainer. Surface meshes replicating the fitting surfaces were generated by a semi-automatic segmentation process from cone-beam computed tomography scans of negative impressions made with vinyl polysiloxane impression material. Employing an iterative closest point algorithm for spatial alignment, processed surface meshes of the specimens obtained at cycle intervals simulating baseline, 3-months (365 cycles), 6-months (730 cycles), and 1-year (1460 cycles) of clinical use were registered to obtain root-mean-square values for corresponding sets of specimens. Assessment of the morphometric shape change was made by repeated measurement analyses performed on the root-mean-square values among the groups over the cycle intervals adjusting for the baseline measurement.

RESULTS: Vacuum-formed retainers constructed with Duran® 1.0 mm showed significantly less morphometric shape change compared to vacuum-formed retainers constructed with Duran® 0.75 mm \( P < 0.0001 \) at all cycle intervals.

CONCLUSION: The thickness of thermoplastic material influences the extent of morphometric shape change in vacuum-formed retainers subjected to cyclic insertion and removal.
AIMS: To investigate the amount of adhesive space during the indirect orthodontic bonding procedure and to assess the adhesive space differences between bonded and initially failed orthodontic attachments. MATERIALS AND METHOD: Eleven arches were bonded in seven patients using one piece double layer vacuum formed bonding trays. Before enamel etching a light body vinyl-polysiloxane impression material was applied with a mixing gun on the bracket-tube bases and the trays were seated on the arches for 2 minutes. The resulting silicone films were carefully peeled from the bases and collected. The bases were cleaned using detergent and water before bondings were performed. A chemically cured adhesive was used during bonding. Initially failed attachments were recorded after the bonding sessions. Standard monochrome photographs were taken from the silicone films which were seated on a white light source to calculate the average thickness of adhesive space between the enamel surfaces and bracket bases. Descriptive statistics and Mann-Whitney U tests were used to examine the data. RESULTS: Adhesive space was evaluated under 141 brackets. One hundred and twenty five of these brackets were bonded and 16 (11.3%) initially failed. The initial failures were observed in nine arches in six patients. Ten of the failed attachments belonged to the molars, two to premolars, one to canines and three to the incisors. Adhesive space thicknesses were predicted using a silicone template with known thickness and a regression formula. According to these results, the mean adhesive space thickness was 329.4 ± 239.2 micrometres. There were no statistically significant differences in the adhesive space thickness between bonded and failed attachments (Md: 280.6 and Md: 401.1). One positive outlier was detected among the measurements which belonged to the failed group (predicted thickness: 1549 micrometres). CONCLUSION: Adhesive space is usually under 800 micrometres in double layer vacuum formed trays. The amount of adhesive space does not seem to be associated with bonding success or failure in vacuum-formed trays. However, further studies are needed because excessive amounts of adhesive space thickness may interfere with the indirect bonding of orthodontic attachments.

SP 439  EFFECTS OF 940 NM DIODE LASER ON SUTURES IN RATS FOLLOWING EXPANSION
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AIMS: Evaluation of the effects of a phosphoride (InGaAsP) diode laser with different energy levels on orthopaedically expanded sutures at the cellular level in rats.

MATERIALS AND METHOD: Eighty Wistar rats were randomly divided into four groups (n = 20) as control (no laser application), low (18 J/cm²), moderate (42 J/cm²) and high (60 J/cm²), level laser groups according to energy given. Each group was divided into two groups (n = 10) according to the time points (7 and 21 days) until the laser application continued twice a week. An InGaAsP diode laser with a wavelength of 940 ± 10 nm, power output 0.1 W, frequency 50/60 Hz in continuous mode was used. The number of osteoblast, osteocyte and vessel, connective tissue, inflammation and newly formed bone area and the ratio of the newly formed bone to total bone area were evaluated statistically, at significance a level of P < 0.05.

RESULTS: For the low level laser group; the number of osteoblast, newly formed bone area and the ratio of the newly formed bone to the total bone area were significantly higher and connective tissue area was lower on both days 7 and 21. The number of osteocytes was significantly higher in the low level laser than in the control group on day 7 and control and in the high dose laser group day 21. The inflammation area was significantly higher for the high dose group on day 21. At day 21, the number of vessels in the moderate level laser group was significantly lower than on day 7 and both moderate and high level laser groups had fewer vessels than the low level laser group.

CONCLUSION: Low level InGaAsP diode laser represent a favourable effect on bone regeneration in an orthopaedically expanded inter-premaxillary suture.
AIMS: To critically appraise clinical evidence supporting the use of any clinician- or self-administered measures aimed at reducing the incidence and extent of white spot lesions (WSL) during fixed appliance orthodontic treatment.

MATERIALS AND METHOD: Ten electronic databases were searched from inception to October 2017 without year, language, or publication type limitations for randomized clinical trials assessing the role of any intervention aimed at preventing treatment-induced WSL, followed by manual searches. After duplicate study selection and data extraction, risk of bias within and across studies was assessed in duplicate with the Cochrane risk of bias tool and the GRADE approach, respectively. Random-effects meta-analyses of relative risks (RR) or mean differences with the 95 per cent confidence intervals (CIs) were conducted, followed by mixed-effects subgroup and sensitivity analyses.

RESULTS: A total of 798 studies were identified from the literature, which after applying the eligibility criteria yielded a total of 38 randomized trials. These trials investigated a wide array of therapeutic aspects including etching or bonding protocol/materials, bracket design, adjunctive fluoride in terms of mouthrinses, varnish, foam, or glass beads, use of probiotics, enamel surface sealing, toothbrush design, or patient motivation reinforcement. Statistically significant reductions in WSL incidence at the 5 per cent level were found with the use of indirect bonding [RR = 0.38; 95% confidence interval (CI) = 0.17, 0.85], an organoselenium sealant (RR = 0.19; 95% CI = 0.06, 0.55), fluoride foam (Risk Ration = 0.25; 95% CI = 0.20, 0.30), fluoride varnish (RR = 0.30; 95% CI = 0.15, 0.58), high-fluoride (5000 ppm), toothpaste (RR = 0.68; 95% CI = 0.46, 1.00), and an app-based approach to motivate patients towards oral hygiene (RR = 0.27; 95% CI = 0.08, 0.91), with considerable differences across interventions. However, the quality of evidence according to GRADE ranged from high to low, due to lack of allocation concealment or blinding, imprecision, inconsistency, and inappropriate handling of clustering effects. Finally, a moderate to low quality of evidence indicated that bonding material, use of fluoride foam, and toothbrush design might influence the severity of WSL.

CONCLUSION: There is moderate evidence that WSL occurrence during fixed appliance treatment can be reduced through modification of the bonding protocol and the use of fluoride adjuncts or patient motivation approaches.

SP 441 MASSETER MUSCLE THICKNESS AND TREATMENT OUTCOMES IN CHILDREN WITH A CLASS II DIVISION 1 MALOCCLUSION

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AIMS: To investigate if treatment outcome in patients with a Class II division 1 (Class II/1) malocclusion treated by a variety of approaches is affected by the pre-treatment thickness of the masseter muscles.

SUBJECTS AND METHOD: Fifty-three Class II/1 malocclusion children, 10.4 ± 1.6 years of age, were treated with headgear and/or fixed appliances with Class II intermaxillary elastics. Twelve children, 9.9 ± 1.9 years of age, were treated with functional appliances and served as a control group. All subjects had an overjet of 6 mm or more and none had extractions. Masseter muscle thickness measurements using ultrasonography were obtained before treatment, while lateral cephalograms and study casts were taken before and after treatment. Multivariate linear regression analysis was used to assess the association between masseter muscle thickness and treatment outcomes, as well as the gonial angle and treatment outcomes.

RESULTS: All children showed dentoalveolar sagittal improvement during treatment. In children treated without functional appliances no association was found between pre-treatment masseter muscle thickness or gonial angle and treatment outcome. Children treated with functional appliances showed an association between thinner pre-treatment masseter muscles and mandibular first molar mesialisation, as well as larger initial gonial angles and mesial movement of the mandibular first molars and distal movement of the maxillary first molars.

CONCLUSION: In the treatment of children with a Class II/1 malocclusion by means other than functional appliances, the masticatory muscle capacity does not seem to influence treatment outcome. However,
treatment outcome for patients treated with functional appliances may be partly determined by the initial condition of the masticatory muscles, whereby children with thinner masseter muscles or a larger gonial angle show greater dentoalveolar change towards a Class I relationship.

**SP 442 PHYSIOLOGIC FORCE FOR ORTHODONTIC TRACTION OF PALATALLY IMPACTED MAXILLARY CANINES**
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AIMS: Orthodontic treatment of palatally impacted maxillary canines is a challenging procedure, and the use of physiologic force not exceeding 0.6 N is fundamental to reduce the risk of complications such as root resorption. The objective of the present study was to quantitatively evaluate the force levels produced by a simple and reproducible system for orthodontic extrusion of impacted canines.

MATERIALS AND METHOD: Specimens made of a cantilever modelled with a 0.6 or 0.7 mm stainless-steel wire around a transpalatal bar with 3, 5, or 7 loops in the shape of a helical torsion spring, were positioned into a mechanical testing machine to measure the force produced by the cantilever at 3, 6, 9, 12 and 15 mm of deflection, having a fixed distance between the centre of the loops and the point of force application of 20 mm. An independent samples t-test was used to compare the forces produced at 15 mm of activation between the different combinations of wire diameter and number of loops.

RESULTS: The measured forces ranged from 1.24 ± 0.13 N for the 0.7 mm wire with three loops to 0.48 ± 0.04 N for the 0.6 mm wire with seven loops. The forces measured for the 0.6mm wire with three loops and the 0.7 mm wire with seven loops were comparable at 15 mm of deflection, since no statistically significant ($P > 0.05$) difference was detected.

CONCLUSION: The proposed system can provide a physiologic amount of force by changing the wire diameter and number of loops. In addition, it is resistant because it is made of stainless steel, and is easy to activate and manage.

**SP 443 NON-INVASIVE THREE-DIMENSIONAL IMAGING METHODS FOR THE ASSESSMENT OF FACIAL MORPHOLOGY, SYMMETRY, AND APPEARANCE IN CLEFT LIP AND PALATE: A SYSTEMATIC REVIEW**
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AIMS: To review the current literature relating to non-invasive three-dimensional (3D) methods for the assessment of facial morphology, symmetry, and appearance in cleft lip and palate (CLP), and to assess the reliability of these methods.

MATERIALS AND METHOD: Systematic literature searches were performed in the electronic databases Medline (via PubMed), Web of Science, Embase, and the Cochrane Library. The searches were limited to studies reporting assessment of facial morphology, symmetry, or appearance in CLP patients using digital 3D stereophotogrammetry or 3D surface scanning as imaging technique.

RESULTS: Overall, 1767 unique studies were identified of which 34 met the inclusion criteria. Stereophotogrammetry and, to a lesser extent, structured light-based and laser-based imaging technologies were used as 3D imaging system. The images were objectively assessed using elementary measurements and comprehensive statistical methods for superimposition, shape description, and structuring. Subjective assessment was performed using a Likert-type scale or a visual analogue scale. The method error was reported as reproducibility of landmark identification, reliability of the imaging system, or reliability of the registration method.

CONCLUSION: Stereophotogrammetry is reliable and the most widely reported 3D imaging system in CLP generating images for objective and subjective assessment of morphology, symmetry, and appearance.

**SP 444 OPEN BITE THERAPY: QUADHELIX/CRIB VERSUS OPEN BITE BIONATOR**
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AIMS: To compare the effects of the quadhelix/crib (Q-H/C) appliance and the open bite bionator (OBB) in patients with an open bite malocclusion.

SUBJECTS AND METHOD: The Q-H/C sample included 15 subjects, 11 girls and 4 boys. The average age for the Q-H/C group before treatment (T1) was 8.2 ± 1.3 years, and the mean duration of treatment was 2.6 years ± 9 months (T2). The OBB sample contained 15 subjects, 3 girls and 12 boys. The average age was 8.4 ± 1.4 years, and the mean duration of observation was 2.5 ± 1.2 years. Lateral cephalograms were analyzed at T1 and T2. The T1 to T2 changes in the two groups were compared with a Student’s t-test.

RESULTS: In the OBB group palatal inclination of the upper incisors was obtained. In the Q-H/C group above the palatal inclination of the upper incisors, a post-rotation of palatal plane and lingual inclination of the lower incisors was noted.

CONCLUSION: Comparison between the two treatment protocols for open bite malocclusion showed that both appliances were effective to correct the malocclusion, but the OBB appliance produced only dentoalveolar effects compared to the Q-H/C appliance which also showed skeletal effects.

SP 445 ASYMMETRIC MAXILLARY ARCH IN UNILATERAL POSTERIOR CROSSBITE: IMPLICATIONS FOR INTERCEPTIVE TREATMENT
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AIMS: The symmetrical transverse maxillary expansion in subjects with unilateral functional crossbite in the mixed dentition does not always lead to a full correction of the midlines discrepancy and of the asymmetric inter-occlusal sagittal molar relationship. The aims of this investigation were to study the maxillary arch asymmetry in these patients during the mixed dentition and to evaluate the association of the asymmetry parameters used with the midlines discrepancy and the inter-occlusal sagittal molar relationship.

MATERIALS AND METHOD: Digital dental cast measurements were performed in a sample of 48 subjects with unilateral posterior crossbite (14 males and 34 females, mean age 9.6 ± 1.2 years) and in a control group of 35 subjects with normal Class I occlusion (17 males and 18 females, mean age 9.9 ± 1.3 years). The Fisher's exact test, the independent sample t-test, and the Pearson correlation were used for statistical comparison.

RESULTS: A clinically significant ‘Upper Molar Rotation Asymmetry’ was present in 60.4% of the subjects with unilateral posterior crossbite versus 14.3% of the control group. The ‘Upper Molar Rotation Asymmetry’ group presented also a significant difference of the mesio-distal and bucco-palatal position between upper molars and canines in the right and left side when compared with the control group. There was a moderate (0.3< r <0.7) linear positive correlation between molar rotation and inter-occlusal sagittal molar relationship at the side where the molar rotation was higher.

CONCLUSION: The findings of this study show a more asymmetric maxillary arch in the unilateral posterior crossbite group and the correlation with Class II subdivisions present in these patients. The maxillary arch asymmetry might play a role in the aetiology of the posterior crossbite and requires a correction as part of the interceptive treatment of this malocclusion in the mixed dentition to obtain a symmetric inter-occlusal sagittal molar relationship.

SP 446 TEMPOROMANDIBULAR DISORDERS IN A SAMPLE OF CHILDREN AND ADOLESCENTS BEFORE STARTING ORTHODONTIC TREATMENT
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AIMS: To determine the prevalence of signs and symptoms using the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) index and to establish an association between signs and symptoms of TMD with age and the different types of dental malocclusions.

SUBJECTS AND METHOD: Twenty patients who were due to commence treatment between 2016-2017 were assessed for TMD using the DC/TMD protocol.
RESULTS: Clicking of the temporomandibular joint was observed in 31.58 per cent with opening, closing, protrusion and/or laterotrusion. Clicking associated with subluxation was noted in 15.79 per cent. No significant results were observed when comparing the type of malocclusion and the presence of TMD.

CONCLUSION: There was no correlation between the different signs and symptoms of TMD and the occlusion of the patients, establishing that TMD is a multifactorial disorder which needs to take into account not only physical symptoms and occlusion but also psychological aspects.

SP 447 A PILOT STUDY OF A TRANSLATED GREEK INSTRUMENT TO MEASURE ORAL HEALTH-RELATED QUALITY OF LIFE IN YOUNG INDIVIDUALS WITH MALOCCLUSION

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AIMS: To pilot test a Greek translated version of the Malocclusion Impact Questionnaire (MIQ-GR).

MATERIALS AND METHOD: After translation according to current guidelines, the MIQ-GR was piloted in a convenience sample of native Greek speakers, 10 to 16-years-old, attending for a new patient consultation appointment in a postgraduate and a private orthodontic clinic. Cronbach’s alpha was used to test the internal consistency/reliability and Spearmans’ rho for test-retest reliability. Statistical tests were undertaken using SPSS (v24 IBM Corp., New York, USA).

RESULTS: Item analysis revealed that the reliability of the MIQ-GR in measuring the impact of malocclusion in the sample was at a very high level (Cronbach’s alpha= 0.95 > 0.70). Following examination of corrected items to total correlations and the value of coefficient alpha if an item was deleted, all questions in the scale were retained. The average discrimination index of the scale was 0.49 (>0.30). Test-retest reliability analysis showed that the majority of correlations (Spearmans’ rho) were statistically significant ($P < 0.05$) and their magnitude ranged from medium to strong. Principal components analysis with oblique rotation, resulted in four significant dimensions explaining 88.4 per cent of the total variance.

CONCLUSION: Pilot testing has shown that the MIQ-GR may exhibit good psychometric properties in terms of validity and reliability. Further evaluation is required to confirm these initial results.

SP 448 THE IMPACT OF DENTAL ANXIETY IN PATIENTS WITH CLASS III MALOCCLUSION

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AIMS: The data from the literature show that 95 per cent of orthodontic patients suffer from various pain. Pain has a wide significance in the orthodontic patient (emotional, physical, social, etc.) and becomes apparent in various spheres ‘cognitive, motivational, etc.’ The presence of anxiety in the orthodontic patient increases the degree of manifestation of pain and decreases the pain barrier. Approximately 30 per cent of orthodontic patients refuse subsequent treatment because of pain. During recent years, the genetic aspect of pain has also been studied. The gene of susceptibility to orofacial pain was established. Three genotypes with high, medium and low susceptibility to pain were highlighted.

SUBJECTS AND METHOD: Fifty eight children aged from 9 to 12 years, divided into two groups that were statistically equivalent by age, gender, facial development, with an equilibrated psycho-emotional state. The patients in both groups were investigated by traditional clinical examination and the complementary examination was completed through a neurophysiologic examination. A comparative analysis of the dental anxiety level was performed, determined according to the Corah Dental Anxiety Scale (Corah, 1978).

RESULTS: On the basis of the performed investigations, we may establish the importance and need for studying and implementing the methods of diagnosis of the trigeminal system and trigeminal reflexes in children with an Angle Class III malocclusion. The arguments come from the clinical-neurophysiologic peculiarities highlighted in the study.

CONCLUSION: Prospective investigations in children with an Angle Class III malocclusion need focus on the elucidation of correlations between the degree of expression of the trigeminal reflexes and the functional deregulations in the stomatognathic-extra-stomatognathic systems (vestibular functions, algic syndromes).
Optimization of the diagnosis and orthodontic treatment is impossible without a deep knowledge of the interrelationship of the stomatognathic system with the trigeminal structures and cerebral trunk.

**SP 449 TRANSVERSE FACIAL MORPHOLOGY OF PATIENTS WITH ACROMEGALY**

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AIMS: Acromegaly is a slowly progressed disease due to hypersecretion of growth hormone (GH) and insulin-like growth factor-1 (IGF-1), mostly caused by a benign adenoma of the pituitary gland. The resultant clinical syndrome is characterized by excessive skeletal growth, mainly affecting the face and extremities. These patients visit a number of healthcare providers, including dentists and orthodontists, when the symptoms of the disease become visible. The aim of this study was to evaluate the transverse facial morphology of patients with acromegaly compared to healthy subjects.

MATERIALS AND METHOD: Posteroanterior radiographs of 21 patients with acromegaly (mean age, 47.9 ± 10.5 years; disease duration 5.7 ± 6.4 years) were compared with 16 control subjects (mean age, 47.7 ± 16.8 years). All acromegaly patients were treated with trans-sphenoidal surgery. Thirteen skeletal landmarks were measured regarding facial widths and heights on posteroanterior cephalograms. Independent t- and Mann Whitney-U tests were performed for comparison of patients with acromegaly and controls.

RESULTS: Patients with acromegaly differed from controls where the distance between right and left orbitale superior points (P < 0.01), lateroorbitale width (P < 0.01), bizygomatic width (P < 0.05) and lateronasal width (P < 0.01) were larger. No differences could be detected in transverse mandibular measurements, ramus length or frontal facial heights.

CONCLUSION: The present findings show that, compared to controls, the transverse facial morphological differences appeared at the midface region, where the contributing bones have either sutures with or are close to the sphenoid bone, and that these patients have a wider face especially at the level of orbita and zygoma.

**SP 450 EVALUATION OF THE RELATIONSHIP BETWEEN SAGITTAL SKELETAL MALOCCLUSIONS, SELLA TURCICA DIMENSIONS AND MORPHOLOGICAL VARIATIONS**

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AIMS: Sella turcica is one of the cranial structures which reaches its final morphology during early growth and development. Therefore, the aim of this study was to show whether sella turcica dimensions and morphology can be used as an indicator of developing skeletal sagittal malocclusions.

MATERIALS AND METHOD: This retrospective study was conducted on 192 randomly chosen archived lateral cephalograms (94 male, 98 female), taken between 2013 to 2017. Patient selection was based on age range and sagittal skeletal classification. The age range was set between 15 to 26 years in females, and from 16 to 26 years in males assuming that the lower limit represents the cessation of growth in both genders. According to the sagittal skeletal classification, based on ANB angle and Wits appraisal, 63 Class I, 63 Class II and 66 Class III patient cephalograms were included in the study. Evaluated variables on the cephalograms were sella turcica morphology from 1 to 6 (1: Normal sella turcica, 2: Oblique anterior wall, 3: Double contour of sellar floor, 4: Sella turcica bridge, 5: Irregularity (notching) in the posterior part of the dorsum sella and 6: Pyramidal shape of dorsum sella), and sella turcica dimensions.

RESULTS: Class III patients presented a higher percentage of notching in the posterior part of dorsum sella, whereas the percentage of pyramidal shape of dorsum sella was higher in Class II patients. On the other hand, a normal sella turcica was a common type in all skeletal Classes. Overall the dependency between variation groups and malocclusion groups was not statistically significant. The difference in height, length and diameter between malocclusion groups was also not statistically significant (P > 0.05). Sella turcica diameter distributions were similar between morphology groups; however, the difference between length and height was statistically significant (P = 0.002 and P = 0.040, respectively).

CONCLUSION: Notching in the posterior part and pyramidal shape of the dorsum sella may indicate Class III and Class II malocclusions, respectively.
Aims: Hemifacial microsomia (HFM) is a craniofacial anomaly with typical asymmetry due to unilateral mandibular hypoplasia and impairment of both muscle and bone growth. Little is known about the craniofacial morphology in patients with HFM, therefore the aim of this study was to investigate the dental and skeletal features of HFM patients and to compare the results to a control group of healthy subjects.

Subjects and Method: Sixteen patients, aged 5 to 12 years, with HFM referred from January 2016 to June 2017 were divided according to Pruzansky/Kaban classification into two groups: mild (group I and IIa) and severe (group IIb and III) HFM. A gender and age matched control group was randomly selected from the orthodontic database of the same hospital. Findings of the clinical examination, including dental and occlusal characteristics, and radiological investigations (panoramic and cephalometric radiographs) were studied. Measurements were analyzed by descriptive statistics and data were statistically analyzed by means of a Student’s t-test.

Results: Nine subjects were included in the mild HFM group and seven in the severe group. A Class I molar relationship was more frequent in the mild group, while a Class II slightly prevailed in severe HFM subjects. Occlusal plane canting was more evident in the severe group than in the mild group. Compared with healthy subjects, patients with HFM had more retruded mandibles and maxillae and a more vertical growth pattern. Moreover, there was a more retruded and vertical morphology on the affected side and in patients with a severe condition compared to those with a mild condition.

Conclusion: HFM is a complex condition that affects craniofacial muscular and skeletal growth in all three dimensions. Specific skeletal patterns are more frequent in HFM subjects than in non-HFM subjects. Due to these dental and skeletal characteristics, individualized treatment plans are required that consider the severity of the condition.
AIMS: To evaluate the biomechanical effects of three different auxiliaries-aligner designs for the rotation movement of a maxillary canine and to define the most effective design through finite element analysis.

MATERIALS AND METHOD: A full maxillary arch (14 teeth) was modelled by combining two different imaging techniques: cone beam computed tomography to reconstruct tooth roots and bone tissues, and surface structured light scanning to create digital tooth crown models from patient impressions. The appliance and auxiliary element geometries were created by exploiting CAD procedures. The aligner was supposed to have a uniform 0.7 mm thickness. The reconstructed digital models were imported within the Finite Element solver (Ansys® 17) and all bodies were modelled as linear elastic. The interface between aligner and teeth, the most important contact surface since it is responsible for the loading condition, was modelled using a frictionless model. For the rotation movement, an aligner without attachment was compared with two auxiliaries-aligner design: a couple of attachment and a design with an attachment and a pressure point. The resulting force-moment (MF) system delivered by the aligner to the target tooth and the tooth displacement and rotations, were calculated for each scenario.

RESULTS: The moment (M)z delivered to the tooth along its main axis increased adding a pressure point and the attachment to the standard aligner. The couple of attachments resulted in a lower Mz compared to the standard aligner, but also to lower undesired moments, Mx and My, improving the quality of the tooth movement. The maximum tooth displacement (0.085 mm) was obtained with attachment and pressure point while the lowest (0.058 mm) was obtained with the double attachment, which led to the most accurate rotation along z-axis.

CONCLUSION: Both attachment and pressure point can improve the effectiveness of the appliance. In particular, the pressure point showed a higher influence on the load absolute value. The method applied could be used to retrieve the best design configuration for each patient and specific orthodontic movement.

SP 454 DENTAL AGE ASSESSMENT IN CLEFT LIP AND PALATE PATIENTS: A SYSTEMATIC REVIEW
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AIMS: To investigate the possible delay in dental development in cleft patients compared with non-cleft patients. A good knowledge of this topic is important to make the right decisions concerning orthodontic treatment.

MATERIALS AND METHOD: An unlimited electronic search was performed in four databases (PubMed, Embase, Lilacs and OpenGrey), including all studies published until the 20th November 2017. Furthermore, a manual search was performed to detect studies that could have been missed by the electronic search. Full text articles concerning dental development or tooth eruption of non-syndromic children with cleft lip and/or palate (CL(P)) were included and reviewed. Case reports/series, review articles, articles in languages other than English, Dutch, French or Spanish and studies considering the eruption of primary teeth were excluded. Data extraction followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and the quality of the studies was assessed using the Methodological Index for Non-Randomized Studies.

RESULTS: The primary search resulted in 586 citations. After applying the selection criteria, 36 studies were considered eligible. The majority of the articles were retrospective studies based on panoramic radiographs, stating that there was a delay in dental development in the CL(P)-group compared to non-CL(P)-patients. The delay in development was prevailing in the lateral incisor on the cleft side. The role of gender and timing of the delay were also investigated with no agreement between the studies. Only one-third of the studies reported the influence of the type of cleft. The risk of bias was on average 15/24 and 9/16 for comparative and non-comparative studies, respectively.

CONCLUSION: No evidence-based conclusions can be drawn from this systematic review due to the large heterogeneity in the aims and methods of the studies and the limited scientific evidence. However, the majority of included articles indicate a delay in dental development in CL(P) patients compared to non-CL(P) patients. Further qualitative research is needed.

SP 455 EXPRESSION OF BIOLOGICAL MEDIATORS DURING ORTHODONTIC TOOTH MOVEMENT IN THE PERIODONTAL LIGAMENT: A SYSTEMATIC REVIEW
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AIMS: To perform a systematic review on the available scientific literature concerning biological mediators of orthodontic tooth movement (OTM) in animals and humans.

MATERIALS AND METHOD: All studies describing the differential expression of signalling proteins, receptors or intracellular signal transducers in the periodontal ligament (PDL) of teeth subjected to OTM from PubMed, Web of Science and Embase up to November 2017 were considered eligible for inclusion. The quality of the included studies was evaluated according to the validated Syrcle's RoB Tool for animal studies and the Methodological Index for Non-Randomized Studies scale for human studies.

RESULTS: Seven thousand five hundred and eighty three articles were retrieved in the initial electronic search, from which 81 were finally analyzed. Because of the large variety of the investigated proteins, few studies investigated the same protein. The most investigated proteins (4 studies or more) were: interleukin (IL)-1ß, IL-6, IL-10, tumour necrosis factor-α, chemokine ligand (CCL)2, CCL3, CCL5, vascular endothelial growth factor, transforming growth factor-ß1, osteocalcin, peristin, RANK, RANKL, osteoprotegerin, runt-related transcription factor 2, ostexix. Rats were the most frequently used animal model (50/81) studies. Only 2/81 studies were performed in humans. Sample size, applied orthodontic force and observation time varied widely.

CONCLUSION: The available literature was used to offer an overview of the processes that take place in the tissues during OTM. The expression of different mediators showed the following timeline of events: local tissue necrosis and hyalinization, stimulation of cells in the PDL by activated osteocytes, activation of osteoclast precursors and differentiation into osteoclasts, degradation of the non-mineralized osteoid, attachment of differentiated osteoclasts to the bone surface, bone formation at the apposition side, degradation of the extracellular matrix (ECM) and new ECM synthesis during remodelling of the periodontal structures around the tooth.

SP 456 TREATMENT OF UNILATERAL POSTERIOR CROSSBITES IN THE MIXED DENTITION: A RETROSPECTIVE STUDY OF CROSSBITE CORRECTION BY QUADHELIX OR EXPANSION PLATE
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AIMS: To evaluate and compare the success rate and treatment time for correcting unilateral posterior crossbites using the quadhelix appliance (QH) or removable expansion plate (EP).

MATERIALS AND METHOD: By retrospective collection of data, 123 children were divided into two groups according to treatment modality: 62 children treated with (QH) in a private orthodontic practice, and 61 children treated with (EP) at the Department of Orthodontics, University of Oslo. The success rates and treatment times were registered.

RESULTS: Among the 62 patients in the QH group, 61 patients (98%) were treated successfully. In the EP group, successful treatment was accomplished in 50 patients (82%). The mean treatment time in the QH group was 12.6 months, with a mean active treatment of 6 months and mean retention of 6.6 months. The mean treatment time in the EP group was 15.2 months, with mean active treatment of 11.3 months and mean retention of 3.9 months. During the 1-year post-treatment follow-up, two subjects (3.2%) in the QH group experienced relapse, and relapse in the EP group was noted in eight subjects (16%).

CONCLUSION: The results suggest that the QH treatment was superior to the EP in success rate and treatment time for correcting unilateral posterior crossbites in the mixed dentition.

SP 457 RELATIONSHIP BETWEEN SOFT AND HARD TISSUE SAGITTAL CHANGES FOLLOWING MAXILLARY OSTEOTOMIES IN CLEFT LIP AND PALATE PATIENTS: A META-ANALYSIS
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AIMS: To systematically investigate the available literature regarding the relationship between soft and hard tissue sagittal changes following maxillary osteotomies in cleft lip and palate (CLP) patients that could be used as an aid in cephalometric prediction.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data on the relationship between soft and hard tissue sagittal changes in patients with CLP
of any age having undergone any maxillary osteotomies for the correction of maxillary hypoplasia were reviewed and divided into two categories: (1) ratios between soft and hard tissue changes and (2) correlations between soft and hard tissue changes. Methodological quality was evaluated using the instrument developed by the Effective Public Health Practice Project and the random effects method for meta-analysis was used to combine data across studies.

RESULTS: Out of the 1054 initially identified unique records only three articles fulfilled the selection criteria for inclusion in the systematic review. Two studies presented ratios between soft and hard tissue sagittal changes. The ratios in the horizontal plane varied between 0.33 to 0.97 depending on the specific points considered and the time of assessment. Three studies presented correlations between soft and hard tissue changes that varied considerably from −0.35 to 0.95 depending on the structures considered and the assessment period. Methodological quality assessment identified various drawbacks in the included studies.

CONCLUSION: The present systematic review and meta-analysis showed that evidence-based conclusions on the relationship between soft and hard tissue sagittal changes following maxillary osteotomies in CLP patients are difficult to draw. More studies of high quality are needed in order to produce results robust enough to be used as a clinical aid during prediction.

**SP 458 WILL DNA PHENOTYPING IMPROVE FACIAL GROWTH PREDICTION FOR ORTHODONTISTS?**

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AIMS: To familiarize orthodontists with a controversial (Nature 549, 139-140, 14 September 2017) new technology for predicting, recreating and recognizing a face via DNA phenotyping, a merge of genomics and sophisticated computer modelling. Moreover, possible applications of DNA phenotyping for improving the accuracy of facial growth prediction were assessed.

MATERIALS AND METHOD: Medline/PubMed, recent texts on forensics and genetics, and the popular press were electronically searched for DNA phenotyping, face prediction, face recognition.

RESULTS: This critical review demonstrated that in the last few years scientists and companies venturing into DNA phenotyping rely on genetic material to forecast, with varying degrees of accuracy, physical traits such as eye, hair, and skin colour, facial morphology and ancestry mix. The implications of such ventures are already immense in forensics and criminology. Genetic material left at a crime scene, for instance, can craft a computer-generated image of the face of a criminal. While geneticists have a long way to go finding the genes to distinguish people, companies such as Parabon NanoLabs, Identitas and Human Longevity Inc. are offering DNA phenotyping services to law enforcement agencies. Their technology is considered sufficient to exclude suspects with specific physical traits from criminal lists but less adequate to identify individuals with certainty. Similarly, research utilizing suitable databases of specific gene variants linked to facial disharmonies could improve orthodontists’ ability to predict facial growth.

CONCLUSION: Facial features are complex, possibly influenced by hundreds or thousands of genes. To capture the complexity and the phenotypic variation of the human face, a tremendous number of faces must be studied in relation to their genomes. The contribution of orthodontists in the genes-to-face prediction could be decisive as they are trained to appreciate slight facial differences in a three-dimensional manner. This quality could assist geneticists into their venture to reverse engineer DNA to physical profiling.

**SP 459 COMPARISON OF BRACKET BASE SURFACE AREA OF DIFFERENT BRACKET TYPES WITH UNCOMMON SHAPE CALCULATED BY THE INDIRECT MEASUREMENT TECHNIQUE**

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AIMS: To demonstrate the use of photographic editing software for indirect measurement of the surface area of the bracket base with uncommon shape and to compare the bonding surface area of two different bracket types.

MATERIALS AND METHOD: The lower central incisor bracket with a shield-like shape base was used as an example for demonstration. First, the length of a bracket base was measured with a Vernier calliper. The value was kept as the reference length for later conversion in the photographic editing program. While the calliper held the bracket firmly, a photograph of a full area of bracket base along with the calliper was taken. Next, the
photograph was imported to the program. Then, the pixel length was converted to real world length and the base surface area was selected by painting tools. The selection was done in the quick mask mode and then an inverted selection was applied. Finally, the base surface area was computed and analyzed with analysis tools in the program. The bracket length and bracket width were also calculated. Two types of lower incisor stainless steel brackets (Mini Diamond, Ormco, Glendora, California, USA and Gemini MBT, 3M Unitek, Monrovia, California, USA) were used: each group consisted of 30 specimens. All measurements were done as described previously. The length, width and area value of a bracket base were examined.

RESULTS: The mean bonding area values were 9.12 ± 0.18 mm² and 9.25 ± 0.17 mm² for the Ormco and 3M Unitek, respectively. The independent samples t-test, used to compare differences between groups, showed no statistically significant differences in surface area values (P = .0045, t = −2.702) and width values (P = .178). However, statistically significant differences were observed for length values (P = .000).

CONCLUSION: The technique shown above is an alternative method for calculating the bracket base surface area when there is no data from the manufacturers. It can also be applied to measure custom made brackets.

SP 460 WHAT HAPPENS WITH THE LABIAL FRAENULUM ATTACHMENT DURING GROWTH? A LONGITUDINAL FIVE YEAR STUDY ON ORTHODONTIC PATIENTS
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AIMS: To evaluate the change of the maxillary labial fraenulum (MLF) attachment of children over the years and to compare it to the growth of the dentoalveolar process.

MATERIALS AND METHOD: A retrospective longitudinal study was conducted based on 461 orthodontically treated patients with a 5 year follow-up. Thirty-one subjects fulfilled the inclusion criteria of presence a low MLF. Changes in the position of the MLF during growth were evaluated on dental casts and lateral cephalograms of 31 patients (mean age 9.7 years) with records on three occasions, before orthodontic treatment (T0), after orthodontic treatment (T1) and 5 years under retention (T2). The distance between the incisal edge of the upper central incisors and the most gingival part of the MLF was measured directly on the dental casts. The median palatine contour of each cast and a mark corresponding to the most gingival part of the MLF were superimposed on the palate and the upper alveolar process of the cephalograms adjusted for magnification. Changes in the insertion of the MLF during the observation period were measured with respect to the palatal plane and the incisal edge of the maxillary central incisors.

RESULTS: Based on the dental casts measurements (T0 and T2) an increase of 1.24 mm (SD: 1.1045) was found in the distance between the MLF attachment and the incisal edge of the maxillary central incisors indicating an apical displacement of the MLF. On the lateral cephalograms, however, a lowering of the insertion of the MLF by 0.57 mm (SD: 0.0424) was found with respect to the palatal plane.

CONCLUSION: The MLF with respect to the palatal plane is slightly displaced occlusally during growth. However, this vertical change corresponds to one-third of the lowering of the maxillary incisors and the alveolar process, resulting in a relative apical displacement of the fraenulum with respect to the maxillary incisal edge.

SP 461 ASSOCIATIONS BETWEEN DISPLACED MAXILLARY CANINES AND TOOTH AGENESIS: A CROSS-SECTIONAL RADIOGRAPHIC STUDY IN A LARGE SAMPLE
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AIMS: To investigate prevalence, characteristics, gender distribution and significant associations with displaced maxillary canines (DMC) in a group of growing subjects with tooth agenesis; to analyze whether the severity of the tooth agenesis has an effect on dental development and the presence of DMC, and to evaluate whether hypodontia can be a factor involved in maxillary canine impaction when isolated in the maxilla or in the mandible.

SUBJECTS AND METHOD: The study group (SG) comprised 336 subjects (167 females, 169 males) with a mean age of 10.7 ± 1.2 years, presenting with at least one missing tooth. Exclusion criteria included syndromes, craniofacial malformations (e.g., cleft lip/palate), extractions and trauma history and previous orthodontic treatment. The SG was divided into three subgroups according to agenesis severity: mild agenesis with 1-2 absent teeth, moderate agenesis with 3-5 absent teeth and severe agenesis with 6 or more absent teeth. The
control group (CG) consisted of 336 subjects (167 females, 169 males) with a mean age of 10.7 ± 1.2 years, without agenesis. Stepwise multiple logistic regression using the backwards elimination and the Wald (W) test method was performed to identify the best combination of hypodontia and DMC (P < 0.05).

RESULTS: The most represented category in SG consisted of mild agenesis (86.9%); moderate and severe agenesis groups represented the 11.7 and 1.4 per cent, respectively of the SG. There was no significant association between agenesis severity and prevalence of DMC. Agenesis was diagnosed in both arches in 46 subjects. Maxillary and mandibular hypodontia was detected in 156 and 134 subjects, respectively. The most frequent missing teeth were mandibular second premolars (45.8%), lateral incisors (41.7%) and maxillary second premolars (17.8%). A significant correlation between agenesis and DMC was observed in the SG (P < 0.05). Only agenesis of maxillary lateral incisors remained in the final model during backward stepwise deletion. No significant association between the severity of dental agenesis and prevalence of DMC was found.

CONCLUSION: The outcomes revealed no difference related to the severity of dental agenesis and prevalence of DMC. Only agenesis of the maxillary lateral incisors should be considered as directly connected with DMC.

SP 462 HERBST APPLIANCE LOSS RATES – WHICH FACTORS PLAY A ROLE?
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AIMS: To analyze the association between rate of loss of cast splint Herbst appliances and different clinical or appliance-specific parameters.
MATERIALS AND METHOD: One hundred and thirty nine patients with Class a II division 1 malocclusion treated with the Herbst appliance. Pre-treatment digital three-dimensional models were analyzed concerning the clinical crown heights as well as the degree and symmetry of the Class II occlusal relationship. Information about patient characteristics (gender, age), appliance design (with/without hyrax) as well as the time points of appliance loss were derived from the patients’ records.
RESULTS: Thirty five per cent (n = 48) of the patients had no Herbst splint loss, 30 per cent (n = 42) had 1-2 splint losses and 35 per cent (n = 49) had >3 appliance losses. There was no association between clinical crown height and appliance loss rate (P = 0.364). Furthermore, no statistically significant correlation between Herbst loss rates and the degree of Class II malocclusion (P = 0.959) or asymmetry (P = 0.473) was found. Also no gender- (P = 0.140) or age- (P = 0.225) related loss rate of the appliance could be verified. Additionally, the combination of the upper splints with a hyrax did not significantly affect the loss rate (P = 0.876). The only statistically significant finding was a correlation between the time of first splint loss and the total number of appliance lost. Patients with >3 losses had a significantly (P < 0.001) earlier time point of the first splint loss (after a median of 47.7 days) than patients with only one complication (after 123.0 days).
CONCLUSION: All tested parameters did not allow for a prediction of Herbst appliance loss rate. However, it appears that patients with a lost appliance during the first 6 weeks of Herbst therapy had a significantly higher risk for more complications during the course of Herbst treatment.

SP 463 PARAMETERS INFLUENCING CLINICIANS’ DECISION IN DETERMINING LIMITS OF ORTHODONTIC CAMOUFLAGE
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AIMS: No concrete guideline is currently available to aid clinicians in determining when a Class III malocclusion is too severe for orthodontic camouflage treatment. This clinical decision is important when prescribing treatment options to ‘borderline’ orthodontic-orthognathic surgery patients with Class III malocclusions. This study aimed to ascertain the parameters influencing clinicians’ decision in determining limits of orthodontic camouflage among expert orthodontists, expert oral surgeons, novice orthodontists and novice oral surgeons who jointly managed orthodontic-orthognathic surgery cases.
MATERIALS AND METHOD: A cross-sectional questionnaire survey involving 55 clinicians stratified into four groups was conducted. Experts had 10 or more years of clinical experience while novices were in practice for fewer than 10 years. The participants assessed the diagnostic records of six borderline cases with Class III malocclusions and decided if each case could either be managed exclusively by an orthodontic camouflage
approach or required orthognathic surgery as the only viable treatment approach regardless of the patient’s concern. The parameters used to derive their decisions were recorded.

RESULTS: In the univariate analysis, ANB angle, Wits appraisal, maxillary-mandibular length ratio, molar relationship, incisor relationship, upper incisor to maxillary plane angle, lower incisor to mandibular plane angle and soft tissue pogonion to zero meridian line were the important parameters that influenced clinicians’ decision in deciding the limits of orthodontic camouflage (P < 0.05) in at least one of the six cases. Molar relationship was significant (P < 0.05) in three out of the six cases. When these parameters were controlled for clinician’s specialty and experience, all the parameters remained significant except for molar relationship in case 5 (P = 0.103). The above-mentioned parameters influenced clinicians’ decision on whether the case could be managed exclusively by orthodontic camouflage in at least one of the six cases irrespective of confounding factors which were clinician’s specialty and experience.

CONCLUSION: The eight parameters identified above could potentially serve as important parameters for assessment of the limits of orthodontic camouflage. This study may be a step in developing a practical framework for identifying diagnostic and treatment planning parameters across institutions and clinicians who manage borderline-severe Class III malocclusions.

SP 464 MICROBIOLOGICAL CHARACTERIZATION OF STREPTOCOCCUS SANGUINIS AFTER TREATMENT WITH COLD ATMOSPHERIC PLASMA

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AIMS: One reason for early loss of orthodontic miniscrews is inflammation due to plaque biofilm. Biofilm formation is a complex procedure, which starts with the adherence of specific bacterial species the first colonizer. The antimicrobial effects of cold atmospheric plasma (CAP) are well known, but it is important to investigate the ability of remaining bacteria for regrowth. Previous studies have shown the effects of CAP treatment, altering biofilm-morphology and formation. In this study, Streptococcus sanguinis (S. sanguinis), a first colonizer in plaque formation, was investigated after treatment with three different CAP devices.

MATERIALS AND METHOD: S. sanguinis was cultivated in 24-well-plates for 72 hours (approximately 106 CFU/ml) on titanium surfaces (diameter: 10 mm, Rz = 20 µm). For CAP treatment the plasma sources kINPenDent, kINPenMed and kINPen08 (INP Greifswald, Germany) were used. The working gas was Argon + 1 per O₂ and plasma was produced at atmospheric pressure. Biofilms were treated for 1 or 3 minutes, respectively. Plasma sources were fixed in a portal-machine, centrally positioned above the specimen. After plasma treatment, vital bacteria and biofilm-mass accumulation (crystal violet assay) were quantified. Furthermore scanning electron microscopy and confocal laser scanning microscopy analysis were performed, to study morphological changes. Statistical evaluation was conducted using GraphPad Prism (GraphPad Software, Inc., La Jolla, USA).

RESULTS: Plasma treatment for 1 or 3 minutes resulted in a reduction of vital bacterial counts for all tested devices in contrast to the untreated control. Quantification of vital bacteria showed that the kINPen08-device reduced vitality of biofilms by 4 log-levels. After exposition of biofilms with kINPenMed and kINPenDent, a reduction of vital bacteria by 3 and 2 log-levels was observed, respectively. No significant differences between treatment times of 1 or 3 minutes were noted. Biofilm-mass quantification confirmed the aforementioned results, indicating biofilm-removal after plasma-treatment with the kINPen08-device. For the other sources, no changes in biofilm-mass were examined.

CONCLUSION: Although all plasma devices used the same working gas the amount of bacterial regrowth differed markedly. Surprisingly, a higher treatment duration has no influence on the amount of bacteria. Until now it is only known that plasma treatment reduces bacterial amount, but no results are available concerning the mechanisms. Procedure of adherence has to be investigated in the near future.

SP 465 MORPHOLOGICAL CRITERIA OF DIFFERENT CLASS III MANIFESTATIONS, THEIR DIVISION AND VARIATION IN TIME

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AIMS: To classify the Class III syndrome according to morphological criteria, to determine their frequency and to identify differences between the various manifestations in the course of therapy.

MATERIALS AND METHOD: In a retrospective analysis 54 patients with a Class III malocclusion were examined at three time intervals (at the beginning of treatment at the age of 6-9 years, after treatment and at a long-term control in adult patients after about 25 years). For classification by morphological criteria only the initial documents before therapy were consulted.

RESULTS: In 40 per cent the Class III syndrome was caused by the lower jaw. The upper jaw was responsible in 11 per cent of cases for the appearance of the Class III syndrome and in 49 per cent a combination form was evident. In the lower jaw the primary cause for the development of a Class III syndrome was a large mandible (86.4%), in 9.1 per cent a prognathic position of the mandible and in 4.5 per cent a combination of both. In the maxilla the retrognathic position of the upper jaw was mainly responsible for the deformity, followed in 16.7 per cent by a too small maxilla and a combination of micrognathia and retrognathia. In combination cases a large lower jaw and the retrognathic position of the maxilla were dominant, followed by a larger lower and a smaller upper jaw. By classification of the different manifestations of prognathism significant differences, with respect to the standard values, in the course of therapy occurred. At the start of therapy the smaller SNA value was evident by maxillary retrognathia. At the long term control analysis the Class III combination group presented the largest maxillo-mandibular difference. NSGn and anteroposterior dysplasia indicator (APDI) values were closest to the standard values in cases of maxillary retrognathia and showed a larger lower face height. In comparison, the APDI values in the groups with mandibular prognathism and the combination form were significantly increased and increased further. NSGn increased especially in the group with mandibular prognathism.

CONCLUSION: The manifestations of a Class III syndrome vary greatly due to the hereditary component. Through accurate diagnosis, therapeutic approaches can be modified and used more effectively.

SP 466 DENTAL KNOWLEDGE RETENTION OF FIRST YEAR GRADUATE ORTHODONTIC STUDENTS
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AIMS: As dental schools in North America move towards pass/fail grading and eliminate class rankings, it becomes more difficult for graduate programmes to evaluate applicants. In order to determine how important academic performance is in the success of orthodontic graduate students, the objective was to assess the general dental knowledge of orthodontic residents in the first month of their programme.

SUBJECTS AND METHOD: Thirty first year orthodontic students at five accredited programmes in the United States and Canada were given a multiple choice examination consisting of 148 questions. Each question counted for 1 point, resulting in a maximum possible score of 148. The examination was a validated instrument devised as a mock board examination for dental students at one of the schools. The 148 questions covered a broad range of topics in both basic dental sciences and clinical dentistry. The students were given the examination without preparation and were allowed as much time as they needed to complete the examination in a controlled environment. The ethics boards at each of the five schools approved the project. Each student was assigned a random number so that the results of the examination could not be traced to an individual or a school. Descriptive statistics were generated.

RESULTS: The mean score was 74.1 ± 7.68, or 50.07 per cent. The median score was 75 (50.68%) The highest score was 84, or 56.76 per cent, and the lowest was 59 (39.86%).

CONCLUSION: Despite these students being among the highest rated from their respective schools (typically with a grade point average exceeding 3.5/4), the retention of general dental knowledge fell significantly below their previous achievements. This suggests that their dental school didactic knowledge base may not carry over into graduate programmes, even into the first year. Orthodontic educators may need to repeat and update topics covered during dental school that are relevant to an orthodontic graduate programme. Other aspects of
the applicant such as perceptual motor ability and personality should be evaluated as predictors for future success as graduate students.

SP 467 AN AUDIT TO ASSESS ORTHODONTIC BREAKAGES IN SPECIALIST PRACTICE
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AIMS: To determine the number of, and reasons for, orthodontic breakages in two separate practices and to try and identify any possible differences in breakage rate.
MATERIALS AND METHOD: A prospective audit was undertaken at Select Orthodontics in Middlesbrough and Seaton Carew. Gold standard: Orthodontic attendances due to breakages did not exceed 5 per cent of all orthodontic appointments. Orthodontic attendances due to breakages did not vary between the two separate practices. A proforma was given to orthodontic practitioners to record information for all orthodontic breakages during the audit period. The following data was collected: usual patient operator, routine or unscheduled appointment, type of breakage and reason for breakage.
RESULTS: Two hundred breakages were recorded out of 2409 appointments. Of the breakages, 60.5 per cent resulted in unscheduled appointments. Debonding of brackets was the most common fixed appliance breakage (51%). Broken retainers were the most common removable appliance breakages (44%). The most common reason for breakages was failure to follow care instructions (50%). The breakage rate was 7 and 11 per cent for Middlesbrough and Seaton Carew, respectively, failing to meet the gold standard. The breakage rate difference was 4 per cent between the practices, failing to meet the gold standard.
CONCLUSION: Both practices failed to meet the gold standards, highlighting an area for improvement.

SP 468 ORTHODONTIC TREATMENT DURATION AND DID NOT ATTEND RATES IN SPECIALIST PRACTICE: AN AUDIT
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AIMS: The primary aim of this audit was to determine the following: average treatment duration in days and number of visits required for a course of orthodontic treatment. Additional aims included an assessment of the effect of did not attend (DNA) rates on treatment duration, number of failed retainer review appointments and the number of unscheduled/emergency appointments.
MATERIALS AND METHOD: This retrospective audit was completed at Select Orthodontics. Data was collected for 250 orthodontic patients attending for debond appointments between 19th August 2015 to 29th June 2016. The gold standards were: average treatment time should be less than 24 months (730 days), average number of appointments should be less than 20 and 100 per cent patient attendance at review appointments. The following data was collected: treatment start date (first appliance fitted), treatment end date (debond), treatment duration in days, extraction or non-extraction treatment, patient’s date of birth, total number of appointments throughout treatment (records to debond), number of unscheduled/emergency appointments, total number of DNAs throughout treatment, number of orthodontic review appointment DNAs and whether the treatment was provided on the NHS or privately. All data was entered into a Microsoft Excel spreadsheet.
RESULTS: Two hundred and fifty patient records were analysed for this audit of which 238 were NHS patients and 12 were private patients. The average treatment duration was 561 days, which is less than the gold standard. The average number of appointments for one course of treatment was 14, which meets the gold standard of less than 20 appointments. Ten per cent of appointments were unscheduled. Sixty six per cent of patients DNA at least one appointment. Thirty per cent of patients DNA review appointments. There was a correlation between DNAs and unscheduled appointments.
CONCLUSION: The gold standards were met for both the average treatment duration and average number of appointments. Unfortunately the gold standard of 100 per cent patient attendance at review appointments was not met.

SP 469 THE METAL CONTENT OF GENERIC ORTHODONTIC BRACKETS OBTAINED FROM OVERSEAS ON E-BAY COMPARED WITH PROPRIETARY BRACKETS FROM ESTABLISHED DISTRIBUTORS
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Aims: A variety of ‘generic’ orthodontic brackets are available online from overseas which often lack manufacturer information. This study investigated the metal composition of generic orthodontic brackets compared with two well-known proprietary brands.

Materials and Methods: Five sets of different generic brackets were obtained directly from China via eBay (G1, G2...G5) ranging from $AU2.99 to $65 per set. Proprietary brackets were obtained from American Orthodontics (P1) and Rocky Mountain Orthodontics (P2). The 11, 12, 13 and 14 brackets from each set were digested and subjected to trace element analysis using inductively coupled plasma mass spectrometry and inductively coupled plasma optical emission spectroscopy with respect to nickel, chromium, iron, copper (Cu), molybdenum (Mo), manganese, cadmium, mercury, arsenic and lead. Statistical analysis investigated the compositional consistency within and between each brand.

Results: Compositional consistency varied across each brand depending on the metal and most metals were present at significantly different levels across each of the brands. The composition of P1 and P2 was in agreement with their manufacturer data. The generic groups typically had low Mo and higher Cu content. Lead was detected in G5.

Conclusion: Generic and proprietary brackets showed differences in metal composition which may have biocompatibility implications, and the cheapest generic bracket contained lead.

SP 470 A CLINICAL PRACTICE GUIDELINE FOR ORTHODONTIC RETENTION
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Aims: To develop evidence-based recommendations for orthodontic retention procedures.

Materials and Method: The guideline was developed to conform to the AGREE II instrument. An expert panel developed five PICO questions based on (a) stability, (b) survival time, (c) adverse effects, (d) patient’s satisfaction and (e) responsibilities of the orthodontist, patient and dentist. Subsequently, a systematic literature search using PubMed and Embase was performed by two independent researchers to identify studies with the above outcome measures; the risk of bias was assessed using GRADE. Finally, the concept guideline was sent to all members of the Dutch Orthodontic Society (NVvO), Dental Association (KNMT), and Patients’ Federation (NFvP) for review and comments before its approval.

Results: Literature screening and full text evaluation identified one systematic review with 15 studies which met the inclusion criteria. In the case of low evidence and lack of outcome measures, expert based considerations were developed. The expert panel reached consensus on the final recommendations in four meetings, after which the concept guideline was ready for the commentary period. The remarks received during this period were implemented in the concept guideline. The final guideline was approved by the NVvO, KNMT, and NFvP. The recommendations are: (1) fixed retainers are first choice for retention in the lower arch, (2) removable retainers are the first choice for retention in the upper arch in cases with minor risk for relapse, (3) dual retention is recommended in cases with high risk for relapse, (4) fixed retainers should be made of square or rectangular multistrand stainless steel wire material, (5) in patients with bad oral hygiene the use and design of fixed retainers should be carefully considered, (6) the first retainer check-up is advised within 3 months after placement of the retainer, (7) patients and general dentists should be informed about retainer care, check-ups and responsibilities.

Conclusion: The guideline provides practitioners a clinical practice guide with evidence-based and ‘where inevitable’ consensus-based recommendations for best practice procedures in orthodontic retention. A carefully chosen bonded and/or removable retainer combined with clear information and communication between orthodontist, dentist and patient is indispensable for successful life-long retention.

SP 471 TOOTH ANOMALIES IN PATIENTS WITH CLEFT LIP AND PALATE AT THE UNIVERSITY MEDICAL CENTRE MAINZ
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AIMS: The literature indicates a prevalence of tooth aplasia in patients with a cleft lip and/or palate (CLP) from 22 up to 86 per cent. The aim of this research was to examine frequency and location of dental hypo- and aplasia and their impact on the orthodontic or prosthetic treatment for space closure in CLP patients.

MATERIALS AND METHOD: Archived records (radiographs, medical files) of 356 patients with a CLP born between 1954-2007 were taken obtained from the University Medical Centre Mainz. Among other data the clinical parameters extracted: were cleft region and number of hypo- and aplasia, time of primary surgery, type of prosthetic restoration or orthodontic space closure. Descriptive analysis and Chi squared tests were performed using SPSS23.

RESULTS: Fifty per cent of the patients had a complete unilateral clefts, 16 per cent bilateral complete clefts. Lip- and alveolar clefts, as well as cleft palate only were found in 13 per cent each. Thirty seven per cent of the patients had no aplasia, 34 per cent showed one and 29 per cent two or more absent teeth. Thirty five per cent of patients had an aplasia of tooth 22, 27 per cent of 12, 15 per cent of 25, and 15 per cent of 15. Hypoplastic teeth were seen especially in the upper anterior region (10-28%); hyperdontia was seldom observed (6%). Of the 242 patients with involvement of a unilateral alveolar cleft, aplastic and hypoplastic teeth were found more often on the ipsi- than the contralateral side. There were no differences of position or frequency of tooth anomalies concerning the different times of primary surgery (P = 0.058-0.855), though the extent and prevalence of prosthetic replacement decreased. While 42 per cent of older patients had prosthodontic substitution of the ipsilateral lateral incisor, 80 per cent of the younger patients showed a maintained natural tooth or orthodontically closed gaps.

CONCLUSION: Timely surgical closure of a CLP combined with increased orthodontic space closure, and better dental care and education reduces the need for prosthodontic therapy. As consequence, there will be more patients without or minimal prosthetic restorations in their adult life.

SP 472 RECHARGEABLE CALCIUM PHOSPHATE NANOPARTICLE-CONTAINING ORTHODONTIC CEMENTS TO INHIBIT WHITE SPOT LESIONS

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AIMS: White spot lesions (WSL) are a major complication of orthodontic treatment. Previous studies developed dental composites containing nanoparticles of calcium phosphate (NACP) with calcium (Ca) and phosphate (P) ion release and caries-inhibition capability. The objective of this study was to develop a novel orthodontic bracket cement containing NACP to have adequate enamel bond strength and CaP ion release to inhibit WSL.

MATERIALS AND METHOD: NACP [Ca3(PO4)2] were synthesized using a spray-drying technique. The resin matrix consisted of 39.5 per cent ethoxylated bisphenol A dimethacrylate (EBPADMA), 44.5 per cent pyromellitic glycerol dimethacrylate (PMDGM), 10 per cent 2-hydroxyethyl methacrylate (HEMA), 5 per cent bisphenol A glycidyl dimethacrylate (BisGMA), and 1 per cent phenylbis (2,4,6-trimethylbenzoyl) phosphine oxide (BAPO). This resin was filled with six groups of fillers to yield six orthodontic cements: (1) 60 per cent glass particles; (2) 40 per cent glass + 20 per cent NACP; (3) 30 per cent glass + 30 per cent NACP; (4) 20 per cent glass + 40 per cent NACP; (5) 10 per cent glass + 50 per cent NACP; (6) a commercial orthodontic cement control (Transbond XT, 3M). Enamel shear bond strength and CaP ion release were measured.

RESULTS: Enamel shear bond strengths (MPa) of the six groups were (mean ± SD; n = 6): (1) (12.7 ± 3.6); (2) (12.4 ± 1.3); (3) (12.0 ± 2.2); (4) (8.0 ± 1.2); (5) (5.5 ± 0.8); (6) (13.3 ± 1.4). Groups 1-3 were not significantly different from the control (P > 0.1). Ca ion release concentration (mmol/L) at 42 days increased with increasing NACP content (mean ± SD; n = 6): (1) (0.69 ± 0.04); (2) (6.71 ± 0.05); (3) (8.68 ± 0.36); (4) (10.91 ± 0.12); (5) (12.19 ± 0.12) (P < 0.05). P ion release concentration (mmol/L) at 42 days also increased with increasing NACP content (mean ± SD; n = 6): (1) (0.07 ± 0.05); (2) (3.28 ± 0.21); (3) (4.97 ± 0.27); (4) (6.56 ± 0.39); (5) (7.12 ± 0.21). Group 6 had no Ca or P ion release.

CONCLUSION: A novel orthodontic cement containing 30 per cent NACP and 30 per cent glass particles had substantial Ca and P ion release, while possessing a high bracket bond strength to enamel matching that of a
commercial non-releasing orthodontic cement. NACP orthodontic cement is promising to inhibit enamel demineralization and WSL formation around bonded orthodontic brackets.

SP 473 ADAM10 IS ESSENTIAL FOR CRANIAL NEURAL CREST-DERIVED MAXILLOFACIAL DEVELOPMENT
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AIMS: Growth disorders of the craniofacial bones may lead to craniofacial deformities. The majority of maxillofacial bones are derived from cranial neural crest cells via intramembranous bone formation. Any interruption of the craniofacial skeleton development process might lead to craniofacial malformation. A disintegrin and metalloprotease (ADAM)10 plays essential roles in organ development and tissue integrity in different organs. However, little is known about its function in craniofacial bone formation. Therefore, the role of ADAM10 in the developing craniofacial skeleton, particularly during typical mandibular bone development was investigated.

MATERIALS AND METHOD: First, it was shown that ADAM10 was expressed in a specific area of the craniofacial bone and that the expression pattern dynamically changed during normal mouse craniofacial development. Then, wnt1-cre transgenic mice were crossed with adam10-flox mice to generate ADAM10 conditional knockout mice. Stereomicroscopic, radiographic, and von Kossa staining were used for research.

RESULTS: Conditional knockout of ADAM10 in cranial neural crest cells led to embryonic death, craniofacial dysmorphia and bone defects. Furthermore, impaired mineralization could be triggered by decreased osteoblast differentiation, increased cell death.

CONCLUSION: Overall, these findings show that ADAM10 plays an essential role in craniofacial bone development.

SP 474 A RAPID MAXILLARY EXPANSION DEVICE APPLIED BY ANCHOR SCREWS
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AIMS: For the treatment of malocclusion in the late teens and adults suffering from a narrow maxillary arch, a rapid maxillary expander (RME) is currently used which is supported by four orthodontic anchor screws as well as by being attached to four adjacent teeth. The following is an explanation of the device and a report on the findings of the treatment.

SUBJECTS AND METHOD: Nineteen subjects (12 females, 7 males), ranging from 17 years 6 months to 44 years 1 month with an average age of 24 years 7 months. All subjects were diagnosed as requiring lateral expansion of the maxilla. The design of the expander was based on the tooth-supporting RME which is held in place by four bands connected to the maxillary first premolars and first molars. It was modified to a tooth-bone supporting system by the insertion of four anchor screws. The four anchor screws were 7.0 mm in length and 2.0 mm in diameter, and were inserted 2 mm into the paramedian aspect of the midpalatal suture in the anterior and posterior palate, respectively. The expansion screw was activated (a quarter turn of 0.225 mm) once a day for 7 days. An open midpalatal suture was verified radiographically by an occlusal radiograph after 7 days of expansion. When the opening in the suture was identified, it was then allowed to widen to a predetermined amount. First, whether the suture was open was evaluated and then the survival rate was obtained by monitoring disturbance of the anchor screws.

RESULTS: The overall success rate as an open midpalatal suture was 73.7 per cent. Of the total successful cases, a success rate was achieved of 83.3 per cent in females and 57.1 per cent in males. The survival rate of the anchor screw was 94.7 per cent.

CONCLUSION: With this device, a new lateral expanding method is proposed that avoids surgery in adult cases. In the future, it is necessary to increase the number of cases in order to increase the predictability of expansion, and to investigate detailed anatomical changes using computed tomography.

SP 475 REVISITING ACCESS TO PRIMARY DENTAL CARE FOR CLEFT LIP AND PALATE PATIENTS IN SOUTH WALES: 7-YEARS ON
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AIMS: Cleft lip and palate (CLP) patients are a high priority group due to high dental and medical needs. It is vital that patients are able to access National Health Service (NHS) primary dental care to maintain good oral hygiene and prevent dental diseases. In 2009, a questionnaire-based audit was carried out to determine access to primary dental care by CLP patients in South Wales. The results showed that many respondents were finding access to primary dental care difficult or impossible. A consultant in paediatric dentistry has since been part of the South Wales cleft team for 7 years, who regularly updated local general dental practitioners, community dentists, dental care professionals and health educators regarding the dental management of CLP patients. The aim of this study was to revisit ease of access to NHS primary dental care for CLP patients living in South Wales.

MATERIALS AND METHOD: A self-administered questionnaire was given to parents of patients under the age of 18 years, who attended appointments with the cleft team at Morriston Hospital, Swansea and University Dental Hospital, Cardiff during 2016. The questionnaire identified the patient’s dental attendance, distance from home and ease of access to NHS primary dental care, episodes of dental emergency, provision of oral hygiene instructions and any other relevant medical conditions. The data collected was compared to that previously obtained in 2009.

RESULTS: There was an overall positive improvement to access to primary dental care in 2016. A total of 96 questionnaires were returned. Seventy two per cent of respondents stated that it was easy to find a dentist (+8% from 2009) and 18 per cent who found it difficult to gain access to primary dental care (−9% from 2009).

Oral hygiene instructions were received by 96 per cent of patients and there were 8 per cent dental emergency patients in 2016 (−4% from 2009). Medical problems were found in 24 per cent of patients, including asthma, attention deficit hyperactivity disorder, seizures, reflux, craniofacial syndromes and cardiac problems.

CONCLUSION: It is important that cleft teams continue to maintain and develop contacts with local dentists, as well as provide training to help improve knowledge and crucially confidence of dental providers, to ensure good dental care for cleft patients.

SP 476 EXAMINING ORAL HEALTH CARE OF ORTHODONTIC PATIENTS: A QUESTIONNAIRE STUDY
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AIMS: One of the most critical points of an orthodontic treatment is to maintain oral hygiene. The aim of this research was to examine the oral health care of orthodontic patients.

SUBJECTS AND METHOD: One hundred and twenty eight patients; 70 females (54.7 %), 58 males (45.3 %) whose ages ranged between 9-29 years. A 24-item questionnaire evaluating oral health care was applied to 41 patients (32%) who had undergone orthodontic treatment for 0-12 months, 40 patients (31.3%) for 1-2 years, and 47 patients (36.7%) for 2 years or more. For statistical analysis the IBM SPSS Statistics 22 program was used.

RESULTS: The results indicate that 42.2 per cent of patients brushed their teeth twice a day and 28.9 per cent once a day. During orthodontic treatment the frequency of tooth brushing changed to 52.3 per cent twice a day, and 41.4 per cent three times a day. Patient tooth brushing durations were determined as 1-2 minutes at the rate of 52.3 per cent and 5 minutes at the rate of 36.7 per cent. Use of the classical toothbrush was very common whereas the electric toothbrush was less. Most patients (47.7%) brushed their teeth in a circular motion; most of the patients do not brush their tongue (65.6%) and do not use interdental brush (60.9%). Almost patients did not use dental floss (88.3%) or a water pik (99.2%). Toothpastes with fluoride were widely used. The frequency of consuming acidic drinks and sugary, sticky foods was determined as 2-3 times in a week.

Even though prophylactic fluoride application was not performed before orthodontic treatment, the percentage of tooth decay (12.5%) and periodontal problems (29.7%) were low.

CONCLUSION: Application of tooth brushing 2-3 times a day, using fluoride toothpastes, less consumption of acidic drinks and sugary, sticky foods decreased the percentage of tooth decay formation and periodontal problems throughout orthodontic treatment. Besides increasing the duration and frequency of tooth brushing, the use of dental floss, an interdental brush and oral rinse contribute to diminish risk factors.

SP 477 A NEW E-LEARNING PLATFORM TO IMPROVE DIAGNOSTIC SKILLS IN DENTAL RADIOLOGY – A PROSPECTIVE LONGITUDINAL STUDY
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AIMS: Even though dentists are allowed to conduct and diagnose radiographs after their examinations within several European countries, diagnostic skills are often not trained systematically in dedicated lectures. However, radiologic diagnostic skills are essential to precisely identify pathologies at an early state. The aim of the present study was to develop an interactive learning platform [eLearning oral radiology and oral pathology [eLOROP]] to improve diagnostic skills, and to evaluate the educational benefit within a longitudinal study.

SUBJECTS AND METHOD: All students enrolled in a clinical three-semester course for dental and craniofacial diseases were granted access to the novel e-learning platform. At the start and end of the semesters, electronic examinations were conducted using the ILIAS platform. The questions were validated within a pilot phase in the winter semester of 2016/2017, and the test period ran in the summer semester 2017. Students’ satisfaction with the platform was evaluated using opinion polls.

RESULTS: Within the pilot phase, the reliability in the entry exam was 0.6, −1.0 and 0.6, and increased to 0.8, 0.9 and 0.9 at the final examination. In the test phase, the reliability was 0.8, 0.7 and 0.7 in the entry examination and 0.6, 0.5 and 0.8 in the final examination. The discriminatory powers changed from 0.2/0.3/0.1 to 0.2/0.3/0.3 in the pilot and from 0.4/0.3/0.4 to 0.3/0.3/0.4 in the test phase. Item difficulties were on average between 0.5 and 0.7 within all examinations. In the pilot phase, no significant improvement was noted from semester start to the end, whereas in the test phase, significant improvements were noted in two courses (paired t-test, P < 0.05). This phase was accompanied by continuous use of the novel platform. The opinion polls revealed high satisfaction with the platform, with 87 per cent rating the platform eligible to improve their diagnostic skills. Ninety three percent regarded the platform as a useful addition to the regular courses.

CONCLUSION: Within the limits of the study, the eLOROP platform proved its eligibility to improve diagnostic skills in the short term. The long-term effects still need to be evaluated.

SP 478 THREE-DIMENSIONAL ANALYSIS OF HUMAN PALATAL MORPHOLOGY: A LITERATURE REVIEW
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AIMS: To investigate the three-dimensional (3D) measuring method of human palatal morphology.

MATERIALS AND METHOD: A literature search from the following electronic databases were performed (PubMed, Medline, EBSCOhost, Cochrane) and additional manual searches covering from January 2000 up to June 2017. All types of studies were considered except for systematic reviews, meta-analysis, literature reviews, editorials, short communications and case reports. The search focused on the palate of human subjects and any methods of assessment of palatal morphology by means of a 3D approach. Articles were restricted to English language publications only. Keywords used were palatal morphology, shape, size, depth and 3D analysis.

RESULTS: The search strategy yielded 126 articles. After the review process, 10 full-text articles met the inclusion criteria. Four of the earlier articles utilised motion tracking software for measurement analysis, three articles used computer-aided-design (CAD) software, two articles used the 3D geometric morphometrics method and the final article measured with 3D engineering processing software. CAD analysis recorded the highest precision and accuracy. This might be due to use of a specialised 3D laser scanner which was meant for dental purposes. It can scan details with an accuracy of up to 15 micrometres while the other scanners showed larger variations. All the articles reported good reliability and reproducibility with a mean random error of less than 10 per cent. Apart from linear measurements, the palatal shape analysis was of great interest; each employed a different method of evaluation. Four articles measured by plotting 3D coordinates derived from curved lines drawn on the palate. One article used angular measurements. Two articles digitized landmark points which were evenly distributed on the palatal surface. Two more articles calculated by surface area. The last article determined the palatal shape by forming a polygon.

CONCLUSION: Human palatal morphology is a unique craniofacial structure that requires a precise 3D scanning technique together with detailed software to enable the characteristics of the palate to be effectively quantified.

SP 479 CORRELATION BETWEEN ORTHODONTIC TREATMENT AND PATIENTS’ QUALITY OF LIFE
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AIMS: Social and psychological effects are key motives for seeking orthodontic treatment; oral health related quality of life. The aim of this research was to determine the correlation between orthodontic treatment and the patients’ social life, to investigate if there is gender and age dimorphism among the treated patients, the different malocclusions and the types of brackets chosen.

MATERIALS AND METHOD: The survey included 46 polls arbitrarily chosen among the patients at the end of their treatment.

RESULTS: The average age of the patients was 21.41 years (from 13 to 42 years). The distribution among genders was 16 males (34.78%) and 30 females (65.21%). Seventeen patients (36.9%) had aesthetic and functional problems, four (8.69%) had only functional complaints, and 21 (45.65%) had only aesthetic problems. The average duration of treatment was 22 months. Thirty eight subjects (82.6%) were treated with metal brackets and eight (17.39%) with aesthetic brackets. The average age of the patients treated with metal brackets was 20.23 years (from 13 to 42 years). The distribution among genders was 15 males (32.6%) and 23 females (60.52%). The average age of the patients treated with aesthetic brackets was 27 years (from 13 to 40 years). The distribution among genders was one male (12.5%) and seven females (87.5%). The patients evaluated their oral hygiene on a 10 point system and the average assessment was 8.58 points (points from 4 to 10 were given). This result was higher than a professional assessment (7.31 points) with 1.27 points. Only 13 patients (28.26%) had ‘real’ self-estimates. Four patients (8.96%) gave themselves lower marks than the professionals. Only five subjects (10.86%) stated that the orthodontic treatment affected their social life. All patients were satisfied with the effects of treatment; 42 of them (91.3%) reported that their self-confidence had increased and they found their smiles more attractive.

CONCLUSION: Metal brackets are preferred for treatment in adolescence no matter of the type of problem - functional or only aesthetic. Aesthetic brackets are preferred by young female patients. Orthodontic treatment does not disturb a patient’s social life.

SP 480 IMPACTED PERMANENT MANDIBULAR MOLARS
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AIMS: To determine the prevalence of impacted lower molars among treated patients and to find the ratio of an extraction versus non-extraction treatment approach.

SUBJECTS AND METHOD: The survey included a total of 2857 patients. Among them 17 had impacted mandibular second molars. Their average age was 15.88 years (from 12 to 24 years).

RESULTS: The distribution of this disorder among the genders was as follows: five males (29.41%) and 12 females (70.58%), which was 1:2.4. The overall number of impacted second and third mandibular molars was 27. Impacted molars on the right side was 14 (51.85%), three third molars (11.11%) and 11 second molars (40.74%). On the left side there were 13 impacted molars (48.14%), nine second molars (33.33%) and four third molars (14.81%). Nine patients (52.94%) had only one impacted molar, six (35.29%) two impacted molars, one (5.88%) three impacted molars and one (5.88%) four impacted molars. Seven patients (41.17%) had impacted right second mandibular molar and five (29.41%) impacted left second mandibular molars. Eight patients (47.05%) had two impacted mandibular molars on the same side. The distribution of the impacted second and third molars on the left and right mandibular sides were equal, three (17.64%) cases. In one patient 46 and 47 were impacted and in the other 36 and 37. Two patients (11.76%) had an impacted tooth different from the molar. One patient (5.88%) had a cyst in the area of impaction. One patient (5.88%) had an ankylosed tooth 46 and for this reason for mesialization and impaction of 47. Four patients (23.52%) were treated with extraction of the third molar. No subject was treated with extraction of the second mandibular molar.

CONCLUSION: The prevalence of this disorder among these patients was 0.6 per cent, with a greater prevalence among females. The right side was affected more often than the left. Early diagnosis and an optimal treatment time is recommended to reduce complications. It is essential to diagnose and treat eruption disturbances as early as possible because treatment at a later stage is usually more complicated.

SP 481 STOMELYSIN-1 AND COLLAGENASE-2 EXPRESSIONS IN RAT MANDIBULAR CONDYLAR CARTILAGE ASSOCIATED WITH DIETARY LOADING, OESTROGEN LEVEL, AND AGEING
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AIMS: To investigate the effects of altered dietary loading, oestrogen level, and ageing on the thickness of the rat mandibular condylar cartilage and the expressions of Stomelysin-1 (MMP-3) and Collagenase-2 (MMP-8).

MATERIALS AND METHOD: According to the diet, 96 female rats were randomly divided into three groups: diet board, normal diet, and soft diet. In each group, the rats were further divided into two subgroups by ovariectomy at the age of 60 days. Then, rats were sacrificed at 100 and 360 days of age (n = 8). Toluidine staining and immunohistochemical staining for MMP-3 and MMP-8 were performed. A linear mixed model was used to assess the effects of dietary loading, oestrogen level, and ageing.

RESULTS: Heavy dietary loading was the main factor for the increase in the expression of MMP-3 and the thickness of the condylar cartilage, especially in the anterior and central parts of condylar cartilage. Lack of oestrogen was the main factor to decrease the expression of MMP-8. Ageing was associated with a reduced expression of MMP-8 and the whole thickness of the condylar cartilage.

CONCLUSION: The condylar cartilage structure and metabolism of female rats is sensitive to loading changes, hormonal levels, and also ageing. A correct balance of these factors is essential for maintenance of the condylar cartilage.

SP 482 TREATMENT WITH A FACEMASK AND MODIFIED TANDEM TRACTION BOW APPLIANCE: EFFECTS ON THE PHARYNGEAL AIRWAY
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AIMS: To retrospectively examine and compare the effects of a modified tandem traction bow appliance (MTTBA) and facemask (FM) on the pharyngeal airway during the treatment of Class III malocclusion.

MATERIALS AND METHOD: Pre- and post-treatment lateral cephalograms of 40 children with a skeletal and dental Class III malocclusion. In the first group, 20 patients (8 girls, 12 boys; mean age 10 years 1 month) were treated for 12 months with a MTTBA which comprised an upper splint, a lower splint, and a traction bow. The second group of 20 patients (6 girls, 14 boys; mean chronological age 10 years 5 months) were treated for 11.4 months with a FM and a removable upper appliance. Linear, angular and area measurements considering pharyngeal airway dimensions were evaluated on lateral cephalograms. The area measurements were determined by the Autocad software program (2017). Paired t- and Mann-Whitney U tests were used for statistical evaluation. P < 0.05 was considered as significant.

RESULTS: Significant increases in CoA, CoGn, SNA, vertical facial height measurements and mandibular posterior rotation were found in both MTTBA and FM treatments (P < 0.001). The mandible showed a clockwise rotation revealed by a significant decrease in SNB (P < 0.05) and increase in SN/GoGn (P < 0.001) angles. Although not significant, an anterior and inferior movement of the hyoid bone was observed in both groups. The pharyngeal airway demonstrated significant increases in nasopharyngeal height with FM and MTTBA (P < 0.05, P < 0.001; respectively). However, no significant differences were found in the linear, angular measurements considering pharyngeal airway dimensions between the groups. Also, comparison of oropharyngeal and nasopharyngeal areas between the groups showed no significant differences.

CONCLUSION: The FM and MTTBA approaches showed similar effects on the pharyngeal airway in the short term.

SP 483 ASSOCIATION BETWEEN ORTHODONTIC TREATMENT AND PAINFUL TEMPOROMANDIBULAR DISORDERS
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AIMS: To evaluate the relationship between orthodontic treatment and temporomandibular disorders (TMDs) in a nationally representative sample from South Korea.

MATERIALS AND METHOD: This study used the data from the Fifth Korean National Health and Nutrition Examination Survey (KNHANES V) 2012. A total of 8,057 participated in this survey with a total participation rate of 80.8 per cent. Exclusion criteria of the present study were as follows: (1) those aged < 19 years (1,765 participants) and (2) those with missing values in the health assessment or questionnaires (725 participants). The final sample size for this study was 5,567. Logistic regression analysis was performed to assess the
relationship between orthodontic treatment and TMDs. Odds ratios (ORs) and 95 per cent confidence intervals (95% CIs) were estimated after adjustment for potential confounders. The SAS software package version 9.2 for Windows (SAS Institute Inc., Cary, North Carolina, USA) was used. \( P < 0.05 \) was considered statistically significant.

RESULTS: The majority of subjects in the orthodontic treatment group were females (62.4%). The participants who received orthodontic treatment were more likely to be of a younger age, have a lower body mass index, a narrower waist circumference, a lower metabolic rate, and more difficulty in chewing and speaking. The adjusted ORs and their 95% CIs in orthodontic treatment and temporomandibular joint (TMJ) pain or functional impairment were not statistically significant between the two groups although ORs related to TMJ pain or functional impairment tended to decrease after adjusting for confounding factors.

CONCLUSION: This cross-sectional study showed that TMJ related pain or functional impairment was not associated with orthodontic treatment.

SP 484 CUSTOMIZED CEPHALOMETRIC ANALYSIS FOR PATIENTS WITH A BILATERAL CLEFT LIP AND PALATE
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AIMS: To define specific points and angles on lateral cephalometric radiographs in a group of patients with a bilateral cleft lip and palate (BCLP) for precise orthodontic and orthognathic surgery treatment planning.

MATERIALS AND METHOD: New stable points on lateral cephalograms were defined in a group of patients without malformations using Dolphin Imaging software. New points and angles were used in digitizing the lateral cephalograms in the patients with a BCLP aged from 8 to 16 years at different stages of treatment.

RESULTS: Differences in the measurements of maxillary rotation were found using general cephalometric analysis and customized cephalometric analysis in the group of patients with a BCLP.

CONCLUSION: For the successful treatment of patients a BCLP, it is necessary to use customized cephalometric analysis to reduce the necessity for possible post-treatment surgical corrections.

SP 485 2497 EFFECTS OF NOVEL MULTIFUNCTIONAL ORTHODONTIC CEMENTS ON PREVENTION OF ENAMEL DEMINERALIZATION NEAR BRACKETS
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AIMS: White spot lesions (WSL) due to biofilm acid-induced enamel demineralization are prevalent in orthodontic treatments. The aim of this study was to develop a novel bioactive multifunctional cement with protein-repellent, antibacterial and remineralizing capabilities, and investigate the effects on preventing enamel demineralization in vitro for the first time.

MATERIALS AND METHOD: Protein-repellent 2-methacryloyloxyethyl phosphorylcholine (MPC), antibacterial dimethylaminohexadecyl methacrylate (DMAHDM), and nanoparticles of amorphous calcium phosphate (NACP) were incorporated into a resin-modified glass ionomer (RMGI). Extracted human premolars had brackets bonded via four groups: (1) Transbond XT (TB), (2) GC Fuji Ortho (GC), (3) GC+MPC+DMAHDM, (4) GC+MPC+DMAHDM+NACP. Demineralization was induced via a dental plaque microcosm biofilm model for two weeks. Samples were subsequently evaluated using polarized light microscopy (PLM), cross-sectional hardness and scanning electron microscopy (SEM).

RESULTS: Incorporation of MPC, DMAHDM and NACP did not affect shear bond strength. PLM analysis showed that GC+MPC+DMAHDM+NACP had the least lesion depth at all measuring ranges \( (P < 0.05) \). Groups with NACP had the highest enamel hardness \( (P < 0.05) \). Mineral loss (\( \Delta S \)) of cement containing NACP was about one-third that of the GC control. GC+MPC+DMAHDM had a moderate effect on demineralization-inhibition, compared to the GC control. GC+MPC+DMAHDM+NACP and GC+MPC+DMAHDM were more effective in protecting enamel prisms from dissolving, than commercial controls.

CONCLUSION: There was a significant preventive effect of GC+MPC+DMAHDM+NACP cement in reducing enamel demineralization adjacent to orthodontic brackets from biofilm acids. This novel triple-agent bioactive cement is promising to prevent enamel WSL in orthodontic treatments.
APPLICATIONS OF THE AVERAGE FACE IN ORTHODONTIC AND GENETIC STUDIES
Alexei Zhurov, Stephen Richmond, Cardiff University, U.K.

AIMS: To describe the use of three-dimensional average facial templates in various orthodontic and genetic applications.

MATERIALS AND METHOD: The presentation applies to quantitative facial studies of any cohort of population with an arbitrary number of subjects, males or females, children or adults, normal or with abnormalities. Three-dimensional (3D) surface facial scans can be acquired using laser or optical imaging systems (e.g., Konica Minolta 900/910, 3dMD, Canfield Vectra, etc.). The images are further processed on a computer to stitch together individual portions, remove noise and unwanted data, and improve the mesh quality. This results in 3D facial shells are typically accurate to within 0.5-1 mm. With the method suggested and previously reported, average facial shells are constructed for selected groups of images. The algorithm registers images by removing relative translations, rotations, and size differences and performs several iterative averaging steps; three or four steps usually suffice. The algorithm relies on the surface information and may or may not use additional landmark data if available. The average faces of all groups of interest are then used to describe differences between the groups.

RESULTS: This approach has proven its utility in quantifying and visualising various effects in previously reported studies. Some of these include: (i) effect of skeletal disproportions and syndromes on face shape, including cleft lip and palate, facial asymmetry, breathing disorders, and atopy, (ii) effect of principal components of facial variation on face shape, (iii) effect of variant rs7559271 in gene PAX3 on nasion, (iv) evaluation of Class III malocclusions in young children, and others. Related studies that are currently underway include: (i) classification of nose shape, (ii) classification of lip shape, (iii) effect of genetic variants associated with nose and lip shapes, (iv) evaluation of a method for treating facial asymmetry, (v) evaluation of face variations due to gender, ethnicity, and individual differences.

CONCLUSION: Average facial templates have great potential for orthodontic and genetic studies helping quantify and visualise various effects on the face, assess the effectiveness of treatment methods and describe differences between various groups of population.

THE EFFECTS OF DIFFERENT TREATMENT SYSTEMS ON MANDIBULAR SYMPHYSIS MORPHOLOGY AND DIMENSIONS IN CLASS III PATIENTS
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AIMS: To retrospectively compare the effects of two different treatment systems on mandibular symphysis (MS) morphology and lower incisor dentoalveolar compensation in patients with a Class III malocclusion.

MATERIALS AND METHOD: Lateral cephalometric radiographs of 45 patients were divided into three groups according to treatment procedure: facemask group (6 girls, 9 boys; mean age, 10 years 5 months), intraoral modified Forsus group (8 girls, 7 boys; mean age, 10 years 5 months) and untreated control group (7 girls, 8 boys; mean age, 10 years 7 months). Ten linear and five angular parameters of the MS and lower incisors were measured on pre- and post-treatment lateral cephalograms. The differences between the mean measurements were tested using Wilcoxon signed-ranks test.

RESULTS: In the facemask group the total MS length (Id-Me), B-Pg (mm) and LH (mm) (bone inferior to the apex of the incisor) values increased significantly ($P < 0.05$). No significant changes were observed in MS measurements in the modified Forsus and control groups. The mandibular incisors were retroclined ($P < 0.01$) and extruded ($P < 0.05$) significantly in the treatment groups compared to the control group. However, there were no significant differences in the angular measurements of MS between the treatment and control groups. Only Id-Me (mm) value was changed significantly in the treatment groups compared to the control group.

CONCLUSION: These outcomes indicate that different Class III treatment systems may not affect MS morphology. A controlled trial conducted using a larger sample is needed to support and extend the data.

ASSESSMENT OF PERIODONTAL BIOMARKERS IN GINGIVAL Crevicular FLUID FOR BONE MATURATION AND ROOT RESORPTION IN ORTHODONTIC PATIENTS. A SYSTEMATIC REVIEW
AIMS: To systematically search the literature and assess the secretion of periodontal biomarkers in human gingival crevicular fluid (GCF) and its correlation to bone maturation and root resorption, in patients of any age during the course of orthodontic treatment.

MATERIALS AND METHOD: Electronic databases searches of published and unpublished literature were performed. The reference lists of all eligible articles were hand-searched for additional studies. Randomised controlled trials (RCTs), non-randomised prospective and retrospective clinical trials were evaluated on the basis of the Cochrane risk of bias tools. Cross-sectional studies were assessed according to the Newcastle-Ottawa Quality Assessment Scale.

RESULTS: Nine studies satisfied the inclusion criteria for bone maturation and root resorption. Among the five studies concerning bone maturation, two were prospective and three cross-sectional. One of the prospective studies was rated at serious risk of bias due to confounding, while the other one was rated at low risk. Cross-sectional studies obtained 5 to 6 stars (a score of 7 stars or more indicate a study of high level of evidence). Most usual biomarkers evaluated were Prostaglandin E₂ (PGE₂), Interleukin-6, Interleukin-1, granulocyte-macrophage colony stimulating factor, Receptor Activator of Nuclear Factor Kappa-B Ligand (RANKL), osteoprotegerin (OPG), Matrix metalloproteinase 9 (MMP-9) and alkaline phosphatase. On the other hand, among the four studies concerning root resorption, one was prospective and three were cross-sectional. The prospective one was rated at serious risk due to confounding. Cross-sectional studies obtained from 2 to 6 stars. Most usual biomarkers evaluated were osteopontin, OPG, RANKL, dentine sialoprotein, dentine matrix protein-1, phosphophoryn and dentine phosphoprotein.

CONCLUSION: The data retrieved from this review suggest that knowledge on bone maturation and root resorption through biomarkers of GCF may prove useful in a clinical setting, leading to the correct choice of biomechanics; this may in turn improve treatment outcomes, may shorten treatment time, and at the same time assisting in avoiding side effects.