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.

**Houston Posters**

**HP 01**  CLASS II FUNCTIONAL APPLIANCE TREATMENT AND DYNAMIC THREE-DIMENSIONAL MIMIC MUSCLE EVALUATION

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AIMS: To analyse changes in facial expressions, using three-dimensional (3D) mimic muscle evaluation, in growing children with a Class II malocclusion and large overjet, undergoing functional appliance treatment.

SUBJECTS AND METHOD: Fifteen growing children with a Class II division 1 malocclusion, selected prospectively and consecutively, had dynamic 3D recordings of facial expressions prior to and 12 months after commencing functional appliance treatment. The facial expressions recorded were smile and lip pucker, and the movements of the oral commissures were analysed in the x, y, and z planes, as well as mouth width and its symmetry. A group of 15 age- and gender-matched growing control children without immediate need for orthodontic treatment had similar recordings prior to and after a 12-month observation period.

RESULTS: Each group consisted of six girls and nine boys with an average age of 11.1 years. In the treatment group, the Class II malocclusion in all children showed an improvement after 12 months of functional appliance wear. When looking at the movement of the oral commissures in the x, y, and z planes, the initial recordings of the treatment group did not show any significant differences to the control group for either smile or lip pucker. Differences were noted however when looking at mouth width asymmetry, where changes during the study period at rest and during smiling were significantly different between the treatment and control groups. Mouth width tended to become more symmetrical in the treatment group, during rest and during smiling, following functional appliance wear while it became more asymmetrical in the control group with time.

CONCLUSION: The current study shows that the use of removable functional appliances in children with a Class II division 1 malocclusion may have a positive effect on mouth width symmetry when smiling, making it more symmetrical.

**HP 02**  CONSENT IN ORTHODONTICS: THE 'MONTGOMERY ERA'

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AIMS: To ascertain which benefits and risks are discussed by orthodontists when consenting patients for the treatment of various common malocclusions. The objective was to develop a ‘gold standard’ list of benefits and risks that should be discussed with patients during the informed consent process for specific scenarios.

MATERIALS AND METHOD: An online survey was developed, presenting a number of clinical scenarios. Scenarios included a generic fixed appliance example and several malocclusion specific treatment plans. Respondents were asked to detail the benefits and risks which they would discuss with patients for each of the scenarios. Following a pilot study, all specialist orthodontists registered with the British Orthodontic Society (BOS) were asked to complete the survey.

RESULTS: One hundred and seventy six responses were received, and the response level was estimated to be around 16 per cent of BOS members. An initial thematic type analysis was carried out for the generic scenario. The responses for the benefits section were categorised under four main themes: dental health, aesthetics, functional and psychosocial. The risks section was divided into seven themes: health related risks, aesthetics, compliance and commitment factors, psychosocial, evaluation of treatment progress, requirement for potential extractions and post-treatment long-term implications. A tricolour framework was created for the generic scenario to
represent the proportion of respondents who mentioned each benefit and risk subtheme. A red colour represented subthemes which <25 per cent of respondents noted, with green utilised for subthemes included by >75 per cent of respondents. Amber was used between these two levels. No subtheme within the benefits section achieved a green level whereas three subthemes within the risks section (decalcification, root resorption and relapse) did achieve this standard.

CONCLUSION: A generic and seven malocclusion specific scenarios with a range of treatment modalities, generated themes and subthemes for their respective benefits and risks, with great variation noted amongst responding clinicians. These themes and subthemes were mostly in agreement with the literature, demonstrating that utilising results from this study would be consistent with evidence-based practice.

**HP 03** REDUCING MICROBIAL PLAQUE ON ORTHODONTIC CLEAR ALIGNERS THROUGH A COPPER-CALCIUM-HYDROXIDE SOLUTION: AN EX VIVO PILOT STUDY

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**AIMS:** To investigate *ex vivo* the ability of a copper-calcium hydroxide-based compound on removing microbial plaque naturally produced on orthodontic clear aligners.

**MATERIALS AND METHOD:** A commercially available dental paste (Cupral, Humanchemie GmbH, Alfeld, Germany), based on copper-calcium hydroxide, was used. A healthy volunteer was enrolled (female, 32 years old), undergoing orthodontic treatment with thermoplastic clear aligners (Nuvola®, Rome, Italy). Following 2 week usage, the aligners, exposed or not to Cupra, were then laboratory assessed for microbial load, by conventional/confocal microscopy, colony forming units analysis. The evaluation was repeated four times during a 12 month orthodontic period treatment.

**RESULTS:** At all time-points assessed, the total microbial load approached 10 to the 9th power CFU/aligner, though slightly differing in aerobiciosis and anaerobiosis conditions. Following Cupral treatment, microbial load decreased to undetectable levels, irrespective of the conditions considered. Macroscopically, six different types of colonies were detected and identified by standard microbiological procedures as *Haemophilus parainfluenzae*, *Neisseria mucosa/sicca*, *Staphylococcus aureus*, *Streptococcus mitis/oralis*, *Streptococcus sanguinis* and *Rothia aeria*. By confocal microscopy, the presence of extensive biofilm on the aligners and a relevant decrease, both in plaque thickness and matrix, following Cupral treatment was documented. In particular, plaque thickness ranged between 4 and 8 µm on the untreated aligners, while it decreased to around 1-1.5 µm, following Cupral treatment.

**CONCLUSION:** Exposure of clear aligners to Cupral results in the elimination of contaminating microorganisms. The antimicrobial effects are retained even at 100 time dilutions and 1 hour treatment. Overall, the data strongly support a successful clinical use of Cupral, as a novel tool in the management of the daily care-hygiene of aligners.

**HP 04** IS VISUAL IMAGERY ABILITY AS IMPORTANT A CAPACITY FOR ORTHODONTIC STUDENTS COMPARED TO STUDENTS IN OTHER DISCIPLINES?

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**AIMS:** To investigate the effect visual imagery may have on career choice amongst current university students at University College London (UCL) attending the Slade School of Fine Art, UCL Bartlett School of Architecture, Faculty of Laws and UCL Eastman Dental Institute.
MATERIALS AND METHOD: A cross-sectional questionnaire-based study comparing four main groups of UCL students was conducted. A questionnaire based on the Vividness of Visual Imagery Questionnaire (VVIQ) was distributed alongside questions regarding demographic information and relating to participants’ ability to visualise and its importance relating to their career choice. Statistical analyses were performed on this data to investigate the presence of associations between career choice, as operationalised by university course and school, visual imagery capacity and demographic variables such as age and gender.

RESULTS: There were no significant differences between the VVIQ scores across the four included Schools/Faculty; F(3,219) = 2.160, P = .094. There were no significant differences in the scores for the orthodontic students (M = 60.80, SD = 13.39) and the remaining other included students (M = 61.44, SD = 9.68); t(–0.232) = 221 P = 0.817. Aphantasia was uncommon, with a prevalence of 0.9 per cent. A positive correlation was found between age group and total VVIQ score, with older participants scoring higher on the VVIQ. With respect to people considering their own visual imagery ability when choosing a career, females were significantly more likely to say that their ability to visualise had affected their career choice than male respondents.

CONCLUSION: There were no significant differences between the VVIQ scores across the four included Schools/Faculty. Visual imagery ability did not differ in dental or orthodontic students in comparison to other student groups. Further work is needed to replicate these findings in more diverse samples.

Scientific Posters

SP 01 THE EFFECTS OF LOW-LEVEL LASER THERAPY ON CONDYLAR GROWTH WITH A MANDIBULAR ADVANCEMENT APPLIANCE
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AIMS: To evaluate the effect of low-level laser therapy (LLLT) on the temporo-mandibular joint (TMJ) remodelling and advancement, with the concomitant use of functional appliance therapy. This literature review concentrated on the research undertaken on animals in order to achieve the best applicable investigation protocol on humans.

MATERIALS AND METHOD: The search was done in PubMed, Cochrane and ScienceDirect databases. Until today the articles that studied this subject are very limited; only five investigations were found: four on rats and one on rabbits.

RESULTS: Studies performed today have tried to establish the correct histological effect on skeletal and chondral tissues remodelling, and to specify the exact efficient dose, frequency and application distance of laser radiation. The rats and rabbits were assigned into first a control group, second a group with functional appliance and third a group with functional appliance with LLLT. The studies showed significant skeletal tissue formation in the lasered groups in comparison with the controls, while there was no increase in fibrous or cartilaginous tissue formation rates.

CONCLUSION: Mandibular advancement treatment accompanied by laser application on the TMJ area, in rats and rabbits, can increase the rate of growth and remodelling of the condyle, which could be quite beneficial in treating skeletal Class II malocclusion in humans.

SP 02 TREATMENT DURATION FOR COMBINED ORTHODONTIC AND ORTHOGNATHIC TREATMENT AT COUNTESS OF CHESTER HOSPITAL: A RE-AUDIT
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AIMS: Orthognathic surgery is a highly complex treatment, lasting between 3 to 3.5 years. The fixed orthodontic appliances remain in place for the duration of this time, with the surgery taking place two-thirds of the way through treatment. Treatment time is measured from the date the
fixed appliance is placed. The aim of this study was to assess the duration of combined orthodontic and orthognathic treatment and to investigate the factors that may influence the length of treatment and produce realistic guidelines.

MATERIALS AND METHOD: This was a retrospective, observational audit based on analysis of data collected from patients’ records. One hundred and twenty patients who underwent orthognathic surgery and joint orthodontic/orthognathic management in the period of January 2014 to July 2017 inclusive, were identified from the hospital’s paperless database record and physical records. Data collected from the case notes included; patient’s skeletal Class, extraction plan, and osteotomy plan. Date and number of visits at specific stages of treatment namely; 1) Pre-surgical joint clinic, 2) Start of pre-surgical orthodontics, 3) Pre-operative joint clinic after completion of pre-surgical orthodontics, 4) Date of post-surgical orthodontic debond, 5) Number of visits for pre- and post-surgical orthodontics.

RESULTS: Sixty seven per cent of patients had treatment according to the gold standard recommended by the Royal College of Surgeons’ guideline. The median and mean duration between the start of pre-surgical orthodontics and the orthognathic surgery date, were 25.9 and 27.9 months, respectively. The median and mean duration between the pre-operative joint clinic to surgery were 4.2 and 5.4 months, respectively. The mean and median duration of post-operative treatment was 6.6 and 7 months, respectively (range, 1.6 to 18.6 months).

CONCLUSION: A duration of 36 months for total treatment time is considered an achievable timeline to inform patients prior to commencement of treatment. Post-surgical orthodontics was completed within the ideal treatment time of between 6 to 12 months. Combined orthodontic and orthognathic treatment carried out in between 2014-2017 at the Countess of Chester Hospital were within the recommended standard.

SP 03 A PROSPECTIVE RANDOMIZED CLINICAL TRIAL TO COMPARE TWO LEVELLING AND ALIGNMENT PROTOCOLS FOR THE TREATMENT OF CLASS II DIVISION 2 MALOCCLUSIONS
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AIMS: To compare two different treatment modalities for Class II division 2; to start treatment in the upper arch first until an adequate overjet is obtained or to start in the lower arch first with a removable anterior bite plane in the upper arch.

SUBJECTS AND METHOD: Fifty four subjects with a Class II division 2 participated in this study. The subjects were randomly divided into two groups; group 1 started their treatment with an upper arch bond-up (29 patients) and when a 4 mm overjet was reached, the lower arch was bonded. Treatment continued until 0.019 × 0.025 inch stainless steel wires were reached in both arches. Group 2 commenced with a lower arch bond up with a removable anterior bite plane in the upper arch (25 patients). When 0.019 × 0.025 inch stainless steel wire was reached, the upper arch was bonded. The treatment continued until 0.019 × 0.025 stainless steel wires were reached. Two cephalograms were taken for each patient in both groups; pre-treatment (T0) and at the end of levelling and alignment in both arches (T1). Cephalometric measurements were made. Skeletal and dentoalveolar treatment changes were compared within and between the groups.

RESULTS: Forty four patients completed the study (23 in group 1, 21 in group 2). Point A moved forward by 0.9 ± 1.5 mm in group 1 and 0.8 ± 2.0 mm in group 2. Point B moved 0.8 ± 2.0 mm forward and 1.1 ± 2.0 mm downward in group 1 and 2.7 ± 2.3 mm in group 2. The upper incisors moved forwards 4.6 ± 1.7 mm in group 1 and 3.6 ± 1.6 mm in group 2. P values ranged from P ≤ 0.05 to P ≤ 0.001

CONCLUSION: More backward rotation of the mandible occurred in group 2 while more upper incisor proclination occurred in group 1.

SP 04 SUCCESS RATE OF A SECONDARY ALVEOLAR BONE GRAFT WITH AND WITHOUT THE PRESENCE OF THE LATERAL INCISOR OR CANINE ADJACENT TO THE CLEFT SITE
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AIMS: To assess the status of the bone graft (preservation versus resorption) in relation to the presence or absence of a tooth into the grafted area (lateral incisor, supernumerary tooth) and to the orthodontic movement of the canine into the grafted alveolar area (canine substitution).

MATERIALS AND METHOD: Eighty one secondary alveolar bone grafts from the iliac crest were carried out in 65 patients. The quality of bone graft was evaluated radiographically using the Witherow scale consisting of six categories [A (best) to F (worst)] and the Bergland scale consisting of four categories [I (best) to IV (worst)]. Aesthetic evaluation of the alveolus was assessed using final intraoral frontal photographs and rated from 1 to 3 (1: optimal, 2: suboptimal, 3: obvious alveolar defect). The quality of the bone graft was scored using both the radiographic and clinical assessment and compared using a chi-squared test. Significance was set at 0.05.

RESULTS: The mean age of the patients was 14.7 years. Sixty five per cent were male and 35 per cent female. Cleft type was unilateral (n = 48) or bilateral (n = 17). Adjacent teeth were present in 60 per cent (n = 39) and absent (congenitally missing or extracted before grafting) in the remaining 40 per cent (n = 26). Alveolar grafts received an A or C score (Witherow) and a I or a II score (Bergland) in 95 per cent of the cases with lateral incisors or canines present. When no adjacent tooth was present, 92 per cent of cases were scored as a D or F (Witherow) or a III or IV on the Bergland scale. Photographic evaluation was significantly different based on the presence or absence of adjacent teeth (lateral incisor or canine; P < 0.0001). In the absence of an adjacent tooth, ratings were a 3 (obvious) in 65 per cent of the cases compared to only 5 per cent for cases with an adjacent tooth present. Sixty five per cent of cases with an adjacent tooth had an optimal rating of 1.

CONCLUSION: Presence of an adjacent tooth was significantly associated with better Witherow and Bergland scores for graft preservation and better aesthetic outcomes.

SP 05 COMPARISON OF FACTORS INFLUENCING PATIENTS CHOICE BETWEEN AN ORTHODONTIST, GENERAL DENTIST, AND DIRECT-TO-CONSUMER ALIGNERS FOR ORTHODONTIC TREATMENT

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AIMS: To evaluate the factors that influence how potential adult orthodontic patients choose between an orthodontist, general dentist, and direct-to-consumer (DTC) aligners for their treatment.

MATERIALS AND METHOD: An electronic survey of 22 items was administered via a commercial polling company to 250 individuals among the general population of adults in the United States. Questions were designed to determine the respondent’s level of interest in pursuing orthodontic treatment with each orthodontic provider type and identify factors that influenced their selection. The demand for each provider type were compared using ANOVA models and Tukey’s post hoc test. Pearson’s chi-squared test and ANOVA were used to evaluate the factors that influenced patients in their selection.

RESULTS: Forty four per cent of respondents preferred and orthodontist, 34 per cent DTC aligners, and 22 per cent a general dentist as a provider for treatment. Older respondents (45-65 years of age) selected DTC aligners at a higher rate (44-54%) compared to the younger age groups (22-30%, P = 0.005). Female respondents selected DTC aligners at a higher rate (49%) than male respondents (26%, P = 0.0221). For respondents who indicated they were moderately interested in pursuing orthodontic treatment, only 21 per cent selected an orthodontist and 48 per cent selected DTC aligners. For those who indicated they were very interested or not very interested, 27-35 per cent selected DTC aligners and 50 per cent selected an orthodontist (P = 0.0023). The biggest perceived advantage with an orthodontist was quality of treatment, and the biggest disadvantage was cost. This differed from DTC aligners, where the biggest perceived advantage was convenience, followed
by cost, and the biggest disadvantage was quality of treatment \((P < 0.0001)\). Among respondents with children, 40 per cent selected an orthodontist for themselves compared to 62 per cent when selecting for their child, and 34 per cent selected DTC aligners for themselves and only 16 per cent for their children \((P = 0.0001)\).

CONCLUSION: Orthodontists remain the provider of choice for the largest number of potential orthodontic patients. DTC aligners, however, are the preferred option for a significant portion of adult patients. Specifically, the patient population that prefers DTC aligners tends to be female, older than 45 years old, and have only a moderate interest in pursuing orthodontic treatment.

SP 06 RELIABILITY OF THREE-DIMENSIONAL IMAGING FOR ASSESSMENT OF AIRWAY IN OBSTRUCTIVE SLEEP APNOEA PATIENTS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIMS: To investigate the reliability of three-dimensional (3D) imaging for assessment of the effects of oral appliances on the upper airway in obstructive sleep apnoea (OSA) patients.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literatures and hand searching was performed. Data on effects of oral appliances on the upper airway as well as the reliability of 3D imaging and computed tomography scans in assessment of airway dimensions in OSA patients was reviewed. Relevant information was extracted, methodological quality was evaluated, and the random effects model was used to combine the retrieved data.

RESULTS: Twelve studies that satisfied the inclusion criteria were identified and selected. Data indicated that oral appliance treatment produce significant effects on the airway dimension in OSA and that 3D imaging is a reliable tool for the assessment of these changes.

CONCLUSION: The present systematic review and meta-analysis showed that oral appliances were effective in reducing OSA severity and that 3D imaging was considered a reliable tool for assessment of airway dimensions in OSA patients.

SP 07 EVALUATION OF THE EFFECTS OF TWO DIFFERENT LINGUAL RETAINERS ON STABILITY

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AIMS: To evaluate the 6-month follow-up outcomes of two different lingual retainer used for stabilization of the mandibular anterior segment.

SUBJECTS AND METHOD: Sixty patients treated without extractions were included in this prospective study. The patients were randomly divided into two groups. In group 1 (20 females; 10 males, mean age 15.6 ± 1.59 years), 0.0215-in five-strand stainless steel wire (Pentaflex, GC Orthodontics, Germany) was used. In group 2 (25 females; 5 males, mean age 15.93 ± 1.60 years), 0.016 × 0.022-inch dead-soft retainer wire (Bond-A-Braid, Reliance Orthodontic Products, USA) was used. All retainers were bonded with the same adhesive (Transbond LR, 3M Unitek, USA). Pre- (T0), post- (T1) and 3 (T2) and 6 (T3) months post-treatment three-dimensional orthodontic models were evaluated. Little’s irregularity index, intercanine distance and arch length were measured using Ortho Analyzer software (3Shape, Denmark). Data was analysed by using Mann Whitney U and Friedman tests to compare the differences between groups and times.

RESULTS: Statistically significant irregularity changes were found between the groups at all time intervals. In group 2, the increase in lower arch irregularity was greater than in group 1. There was a statistically significant decrease in intercanine distance in both groups over time and these changes were statistically significant between groups except for T2-T3. There were no significant differences in arch length parameters between the groups and times.

CONCLUSION: The findings regarding mandibular arch measurements indicate that fabrication of a lingual retainer can be more safely accomplished with 0.0215 inch five-strand stainless steel wire than with 0.016 × 0.022 inch dead-soft retainer wire.
SP 08 ASSESSMENT OF THE RELATIONSHIP BETWEEN LINGUAL RETAINER WIRE TYPE AND PERIODONTAL HEALTH
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AIMS: To evaluate the effects of two different lingual retainers on periodontal health of the mandibular anterior segment with a 6-month follow-up.

SUBJECTS AND METHOD: Sixty patients randomly divided into two groups. In group 1 (20 females; 10 males, mean age 15.6 ± 1.59 years), 0.0215 inch five-strand stainless steel wire (Pentaflex, GC Orthodontics, Germany) was used. In group 2 (25 females; 5 males, mean age 15.93 ± 1.60 years), 0.016 × 0.022 inch dead-soft retainer wire (Bond-A-Braid, Reliance Orthodontic Products, USA) was used. All retainers were bonded with the same adhesive (Transbond LR, 3M Unitek, USA). Periodontal health was assessed using the plaque and gingival indices of Silness and Löe. Data were collected at placement of retainers and after 3 and 6 months. Data was analysed using Mann Whitney U and Friedman tests to compare the differences between groups and times.

RESULTS: There was a statistically significant increase in plaque and gingival indices in both groups with time, but these differences were not statistically significant between the groups.

CONCLUSION: Clinically insignificant differences were found between 0.0215 inch five-strand stainless steel and 0.016 × 0.022 inch dead-soft wires on the periodontal health of patients 6 months after retention.

SP 09 PLATE REMOVAL AFTER JOINT ORTHODONTIC-ORTHOGNATHIC SURGERY TREATMENT: A 10 YEAR RETROSPECTIVE HOSPITAL-BASED CLINICAL AUDIT
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AIMS: To determine the incidence, indications and correlations for plate removal following orthognathic surgery within a centralised Orthodontic and Maxillofacial Surgery Hospital Service.

MATERIALS AND METHOD: A total of 907 consecutively treated orthodontic-orthognathic surgery cases were identified between 2008-2017 from hospital database records. The service consisted of one central and four satellite orthodontic and maxillofacial surgery units and six consultant surgeons. Data was collected for patient demographics, surgical procedure, timing and indication for removal of plates and site of plate removal. Additional variables assessed included simultaneous third molar removal and smoking status. Data was analysed with descriptive statistics.

RESULTS: In total, 19 of the 907 patients underwent plate removal (2.09%). Of these, 68 per cent were female. In this cohort, 36 per cent had only bilateral sagittal split osteotomies, 34 per cent had only Le Fort I osteotomies and 30 per cent had bimaxillary osteotomies. Most plates (63%) were removed within the first post-operative year, with a mean at 12.1 months (range: 1-60 months). The most common indication was post-operative infection (63.2%), followed by clinical irritation with palpable plates (15.8%), subjective discomfort (15.8%), and exposed plates (5%). In this cohort, there were 595 mandibular procedures (66%) and 582 maxillary procedures (64%). However, more plates were removed from the mandibular sites (84.2%) than the maxillary sites (15.8%). Furthermore, 50 per cent of plates removed from the mandible had simultaneous third molar removal, whereas no third molars were removed during the maxillary procedures. Only one patient had declared a positive smoking status.

CONCLUSION: The incidence of plate removal of 2.09 per cent, and infection as the most common indication, concurs with previous studies (O’Connell et al., 2009). Correlation with other variables may be weak due to the small sample within the large cohort (Widar et al., 2017; Kuhlefelt et al., 2010), however there was a female predilection for plate removal (Falter et al., 2011). Clinicians may use this new data to illustrate the risks of treatment to patients at the stage of informed consent.
SP 10  CLINICAL OUTCOMES OF COMBINED ORTHODONTIC AND ORTHOGNATHIC TREATMENT USING THE PEER ASSESSMENT RATING INDEX: A RETROSPECTIVE AUDIT.
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AIMS: To evaluate the success of combined orthodontic and orthognathic treatment using the Peer Assessment Rating (PAR) Index, and to identify factors that influence treatment outcome.

MATERIALS AND METHOD: Twenty-five consecutively treated orthodontic-orthognathic surgery patients were identified within an orthodontic and maxillofacial unit. All patients were treated by the same consultant orthodontist and maxillofacial surgeon. Retrospective data collection from hospital records included patient demographics, skeletal relationship, surgical procedure and treatment duration. The occlusal features of 25 pre- and post-treatment study models were scored by a calibrated examiner. Reduction in PAR score and percentage PAR reduction were calculated. The gold standard, based on national guidelines, was that the mean reduction in PAR score should be greater than 70 per cent (British Orthodontic Society, 2009). Data was analysed with descriptive statistics.

RESULTS: The results met the audit standard. The mean pre- and post-treatment PAR scores were 30 and 6, respectively, with a mean percentage PAR reduction of 77. As per the PAR index, 76 per cent of patients were considered to have ‘greatly improved’ (achieving an improvement of greater than 70%) and 24 per cent had ‘improved’ (a mean PAR reduction greater than 30%). There were no patients in the ‘worse or no different’ category. Within this cohort, 8 per cent had only Le Fort I osteotomies, 12 per cent had only bilateral sagittal split osteotomies and 80 per cent had bimaxillary osteotomies. Of the 25 patients, 84 per cent had a Skeletal III malocclusion. The mean duration of treatment was 45 months (range: 26-62 months).

CONCLUSION: The mean percentage PAR reduction of 77 per cent indicates a high-quality outcome at this unit. A greater improvement can be expected from cases with higher pre-treatment PAR scores and longer treatment duration.

SP 11  EFFECT OF LASER AND CASEIN PHOSPHOPEPTIDE AMORPHOUS CALCIUM PHOSPHATE ON THE PREVENTION OF ENAMEL DEMINERALIZATION
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AIMS: To study the effect of erbium, chromium, yttrium, scandium, gallium, garnet laser Er,Cr:YSGG), casein phosphopeptide amorphous calcium phosphate (CPP-ACP), and their combined use on the prevention of enamel demineralization.

MATERIALS AND METHOD: A randomized controlled in vitro study design was selected to address the aim of the study. A sample of 80 human premolar teeth was selected with clear inclusion and exclusion criteria. The teeth were numbered and randomly allocated to four equal groups (n = 20). Group 1: Control group received none of the preventive treatments. Group 2: CPP-ACP topical application. Group 3: Er,Cr:YSGG laser irradiation. Group 4: Er,Cr:YSGG laser irradiation followed by CPP-ACP application. Specimens were subjected to thermocycling and brushing challenge protocols equivalent to 1 year in the oral environment. Then, all teeth were subjected to acid challenge. Each tooth was examined visually and photographed using a stereomicroscope to assess the severity of white spot lesions (WSL). The teeth were then sectioned longitudinally and examined under a polarized light microscope and the depth of the lesion was measured and compared between the four groups. For statistical analysis the data were analyzed using IBM SPSS software package version 20.0. (IBM Corp., Armonk, New York, USA). Significance of the obtained results was judged at the 5 per cent level. The tests used were: Chi-square, Fisher’s exact and Kruskal Wallis.

RESULTS: Group 4 showed the least severe WSL formation and the least lesion depth with a statistically significant better difference between it and all other groups. Groups 2 and 3 also
showed a significant reduction in the severity of WSL formation and lesion depth when compared to the control group, however it was significantly less than their combined use together. No significant difference was found between the CPP-ACP alone or laser alone. Increased surface roughness was noted only in group 3.

CONCLUSION: The combined use of a laser and CPP-ACP showed the best prevention against the development of WSL regarding the severity and depth. The use of CPP-ACP alone or laser alone also resulted in a significant reduction in lesion depth and severity but was significantly less than their combined use. No difference was found between the CPP-ACP alone or laser alone.

SP 12 PHYSICAL AND MICROBIOLOGICAL PROPERTIES OF TEFOLON COATED ARCHWIRES – CLINICAL TRIAL
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AIMS: Peeling of Teflon coated archwires results in rough surfaces that may cause plaque accumulation and the exposed core material may not meet aesthetic expectations. The aim of this study was to evaluate the surface roughness, Streptococcus mutans (S. mutans) colonization, and discolouration of Teflon coated archwires from three different manufacturers following clinical use.

MATERIALS AND METHOD: Teflon coated 0.016 inch and 0.016 × 0.022 inch archwires of three different manufacturers [EverWhite (American Orthodontics, Sheboygan, USA), Titanol Cosmetic (Forestadent, Pforzheim, Germany), Proflex (G&H Orthodontics, Franklin, USA)] were investigated. Initial and progress surface roughness and colour change data were collected before and after 28 days of use. As received and retrieved samples from each archwire were analyzed with an atomic force microscope (AFM; Brand: NT-MDT Model: Netweaver Solaris) to record surface roughness. Colour measurement was performed using a Vita Easyshade Compact (Vita Zahnfabrik, Bad Sackingen, Germany) spectrophotometer. After clinical use, all bacteria were removed, and the wires were incubated. S. mutans was assessed in terms of colony forming unit. The Statistical Package for the Social Sciences (SPSS Inc, Chicago, Illinois, USA) 21.0 was used for statistical analysis.

RESULTS: The average surface roughness values in all study groups were significantly higher than the initial mean (P < 0.005). There was no statistically significant difference in the amount of S. mutans bacterial adhesion for the majority of the wires (P > 0.005). S. mutans adhesion values for round EverWhite wires were significantly higher than for Proflex wires (P = 0.001). Rectangular EverWhite wires exhibited a significantly higher bacterial adhesion than Titanol Cosmetic branded wires (P = 0.047). The data on the amount of S. mutans adhesion with the AFM device were not correlated. There was no statistically significant difference between the groups in comparison of the colour change. However, a clinically noticeable colour change was observed in Titanol Cosmetic and EverWhite wires, while a very significant colour change was observed in Proflex wires.

CONCLUSION: Surface roughness values were not found to be correlated with the amount of S. mutans adhesion. All archwires showed increased surface roughness and clinically noticeable colour change.

SP 13 MATRIX METALLOPROTEINASE-8 MOUTHRISE AS A DIAGNOSTIC TOOL IN ORTHODONTICALLY INDUCED INFLAMMATORY ROOT RESORPTION
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AIMS: To prospectively investigate if it is possible to predict the orthodontically induced inflammatory root resorption (OIIRR) by an active MMP-8 mouthrinse before the start of orthodontic treatment.

SUBJECTS AND METHOD: This study has included 20 patients, mean age of 14.3 years old. All examinations and sampling were performed at two intervals in each patient, before polishing and placement of braces (T1) and 8 months into active orthodontic treatment with fixed appliances
The following methods were used: 1. A chairside mouthrinse test based on an active MMP-8 (aMMP-8) immunoassay, PerioSafe® PRO and 2. Radiographic examination: Intra-oral periapical radiographs were taken prior to the start of and 8 months after the start of orthodontic treatment. The radiographic examination included the four upper incisors. Signs of root resorption were registered for each tooth, with index scores from 0 to 4, described by Malmgren et al. Furthermore, comparison between the PerioSafe® PRO results before and 8 months after the beginning of the active treatment was performed with non-parametric McNemar test using the Chi square test statistics.

RESULTS: Twenty eight per cent of the studied sample presented a slight increase in root resorption (score 2) based on Malmgren index after 8 months of active treatment with fixed appliances. There were no statistical differences on PerioSafe® PRO measured before and after 8 months of fixed appliance treatment ($P = 1$).

CONCLUSION: MMP-8 testing of oral rinse samples can be a useful tool in periodontal diagnostics for orthodontic patients. Testing may be an additional clinical method in combination with other clinical screening methods. The measurements taken using PerioSafe® PRO before and 8 months after orthodontic treatment with fixed appliances did not show any significant differences. The MMP-8 levels may vary between different individuals depending on their different biomarker profiles.

SP 14  EFFECTIVENESS OF PROCEDURES OTHER THAN EXTRACTION OF THE PRIMARY CANINE AS INTERCEPTION TO PALATALLY DISPLACED PERMANENT CANINES: A SYSTEMATIC REVIEW
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AIMS: Although rapid maxillary expansion (RME), a transpalatal arch (TPA) and cervical-pull headgear (HG) have been suggested as interventions in the mixed dentition to increase the rate of normal eruption of palatally displaced permanent canines (PDCs), the relevant evidence has been inconclusive. The aim of this study was to investigate their effectiveness in an evidence-based manner.
MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data on the prevalence of physiologic PDCs eruption from randomized controlled trials (RCTs) that investigated the used of RME, TPA and HG adjunctively, or alternative to extraction of the primary canines, were reviewed. The individual study risk of bias was assessed using the Cochrane Risk of Bias Tool.
RESULTS: From the initially identified records, finally data from five RCTs (at high risk of bias) were included, involving analyzing 480 PDCs in total and following for up to 5 years. RME, TPA and HG used adjunctively or alternatively to extraction of primary canines can significantly increase the rate of normal eruption of PDCs in the long-term compared to no intervention, while no difference was observed in comparison to extraction. Only when HG was used after the extraction of the primary canine, a statistically significant benefit was shown compared to the extraction of the primary canine only group.
CONCLUSION: RME, TPA and HG used adjunctively or alternatively to extraction of primary canines can significantly increase the rate of normal eruption of PDCs compared to no intervention; however, compared to extraction no differences were noted overall. Further research and better study standardization are warranted.

SP 15  MANDIBULAR SECOND MOLAR PROTRACTION ASSISTED BY PIEZOELECTRIC CORTICOTOMY: RANDOMIZED CLINICAL STUDY
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AIMS: To investigate the effect of piezoelectric corticotomy (PC) on the rate of molar protraction to close old first molar extraction space.

SUBJECTS AND METHOD: Thirteen patients (average age 22.25 ± 2.55 years) presented with bilateral lower first molar extraction (at least 1 year) were included. A split mouth design was utilized with piezocision randomly assigned to the patients’ left or right sides. Roth prescription edgewise brackets with 0.022 inch slots were used. When 0.019 × 0.025 inch stainless steel archwires were reached, molar protraction was performed using a nickel titanium closed coil springs (150 g) attached to a miniscrew located between the apices of mandibular canine and first premolar roots. Before molar protraction and after the alignment and levelling phases, PC was performed on one side while the other side acted as the control (no piezocision). Alginate impressions were taken at each review visit for 3 months. Gingival crevicular fluid (GCF) samples were obtained from the mesiogingival side of the lower second permanent molar to detect the levels of total IL-1ß. Molar protraction was measured monthly from dental casts using a three-dimensional model for 3 months.

RESULTS: The rate of second molar protraction was doubled during the first 3 months after performing piezocision. The total amount of molar protraction was 0.66 mm larger on the piezocision side compared with the comparison side (P < 0.001). A significant elevation of interleukin-1ß level in GCF on piezocision side during the first 24 hours compared to no piezocision side (P = 0.02) was detected.

CONCLUSION: Piezocision before starting second molar protraction into old first molar extraction spaces increases the rate of molar movement.

SP 16 COMPARATIVE ASSESSMENT OF THE CHANGE IN VERTICAL GINGIVAL DISPLAY ASSOCIATED WITH UPPER FIRST AND SECOND PREMOLARS EXTRACTION TREATMENT
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AIMS: Extraction of teeth has been anecdotally blamed to increase vertical gingival display (VGD) anteriorly with more increase associated with upper first premolars compared to second premolar extraction treatment. The objectives of this study were- to compare the changes in VGD between patients treated with upper first and those treated with upper second premolars extraction treatment plan.

SUBJECTS AND METHOD: Following ethical approval, 60 subjects who presented with a high smile line between 3 to 6 mm (averaged 3.21 ± 1.44 mm) were included. Subjects who met the inclusion criteria were subdivided into one of three groups according to their individualized treatment plan as follows: group 1: upper first premolar extraction (20 subjects); group 2: upper second premolar extraction (20 subjects) and group 3: control (20 subjects happy with their teeth-no treatment). Initial records (dental pantomogram, lateral cephalogram, study casts and clinical photographs (static) and video captures) were taken for all subjects. A paired t-test, ANOVA with post hoc (Bonferroni) and regression analysis were carried out for data analysis.

RESULTS: In both premolar extraction groups, VGD increased after treatment in static and video captures (P < 0.001). The change in VGD was comparable between the two extraction groups (P > 0.05). The lip-incisal distance increased by up to 1 mm after premolar extraction treatment in the static and dynamic positions (P < 0.001). No difference between the two treatment groups in lip-incisal distance was detected (P > 0.05). The increase in VGD after premolar extraction demonstrated a significant association with the amount of canine retraction, the pre-treatment ANB angle and the amount of upper incisor retraction.

CONCLUSION: Extraction of upper first and second premolars increases the amount of VGD and the lip-incisal distance. The changes in VGD and lip-incisal distance were comparable between the two extraction groups. The amount of canine retraction, the pre-ANB and the amount of incisor retraction are associated with the change in VGD during treatment.

SP 17 ANALYSIS OF THE PREVALENCE OF POSTURAL DISORDERS AND DENTOFACIAL ANOMALIES
AIMS: To analyze the prevalence of postural disorders and dentofacial anomalies
SUBJECTS AND METHOD: One hundred and forty seven patients aged 6 to 11 years. The patients were divided into three age category groups: group 1, 6-7 years, group 2, 8-9 years and group 3, 10-11 years. All were assessed clinically, by anthropometric methods and computer optical topography of the spine. The obtained data were statistically analyzed.
RESULTS: All examined patients had postural disorders, which were accompanied by malocclusion. It was revealed that 35.86 per cent had a mesial (Class III) occlusion (22.76% female; 13.10% male) and 64.14 per cent a distal (Class II) occlusion (35.17% female, 28.97% male). At the same time, postural disorders were more marked in females with mesial occlusion (63.46%), and almost an equal ratio in females (54.84%) and males (45.16%) with a distal one. Analysis of patients in the age category groups indicated a two-fold increase the number of patients in group 3 (55.17%) compared to group 2, while group 2 (29.66%) was twice as great as group 1 (15.17%). Of the patients aged 6-7 years 45.45 per cent had a mesial occlusion (70% female, 30% male), and the remaining 55.55 per cent has a distal occlusion (66.67% female, 33.33% male).
CONCLUSION: Grown up children have a geometric progression of the increasing the prevalence of dentoalveolar anomalies which are associated with an increase of postural disorders.

SP 18 PRIMARY CANINE EXTRACTIONS FOR THE RELIEF OF SEVERE CROWDING IN THE EARLY MIXED DENTITION – DOES IT INFLUENCE LATER ORTHODONTIC INTERVENTION?
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AIMS: To explore whether, in the long-term, there is any difference in orthodontic treatment requirement, treatment time, number of visits and permanent tooth extractions, between an intervention and control group. The null hypothesis is that there would not be any difference in the outcome.
MATERIALS AND METHOD: Patient records and study casts representing the late mixed or early permanent dentitions of 44 subjects, 19 from the extraction group and 25 from the control group were retrieved. A paired t-test was performed for comparison of treatment time and number of visits and Fishers exact test was used for analyzing further extractions and orthodontic treatment requirement.
RESULTS: The majority (35/44) of the subjects had received orthodontic intervention. There were no statistically significant differences between the groups regarding orthodontic treatment requirement (89.5% of extraction group and 72% of control group had orthodontic treatment), number of visits (mean 15 visits in both groups), treatment time (extraction group, mean 21.7 months; control group, mean 20.4 months). Extraction of permanent teeth was more prevalent in the extraction group (58.8%) compared with the control group (27.8%), however this was not statistically significant (i = 0.09). Thus the hypothesis could not be rejected.
CONCLUSION: Early removal of primary canines will neither reduce the requirement of later orthodontic treatment nor shorten the treatment time.

SP 19 VALIDITY OF FACIAL PHOTOGRAPHIC WRAPPING ON CONE-BEAM COMPUTED TOMOGRAPHY: COMPARISON OF ORTHODONTIC SOFT TISSUE PARAMETERS
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AIMS: There are several technologies for obtaining three-dimensional (3D) facial photographs, however, they are time consuming, difficult to handle and expensive. The purpose of the present study was to determine the validity of two-dimensional (2D) standard frontal photographic
wrapping on cone-beam computed tomography (CBCT) soft tissue image by comparing soft tissue landmarks between a CBCT scan and a 3D facial photograph generated from a 2D photograph.

MATERIALS AND METHOD: Thirty subjects who had initial CBCT scans and initial 2D standard frontal photograph were included. Patients’ CBCT scans were imported to Invivo5 software and reoriented in the natural head posture in a sagittal, coronal, and axial view. Using the 3DAnalysis tool, the 2D standard frontal photograph of the corresponding patient was wrapped on the CBCT soft tissue image. The outline of the subject’s face on the 2D standard frontal photographs was matched with the facial outline of the CBCT image. Following wrapping, 16 soft tissue landmarks were identified on the generated 3D facial photograph from a 2D standard frontal photograph and CBCT scan. To validate the photographic wrapping, six vertical and seven horizontal linear measurements were measured and compared between the generated 3D facial photograph and the CBCT soft tissue image.

RESULTS: The means and standard deviation of each vertical and horizontal linear measurement from CBCT soft tissue image and 3D face generated from 2D standard frontal photograph and CBCT soft tissue image were calculated. For the vertical measurements, the differences ranged from 0.2 to 1.4 mm and for the horizontal measurements from 0.1 to 0.6 mm. The vertical linear measurement between labrale superius and labrale inferius showed a significant difference between CBCT soft tissue image and the 3D face. This difference can be explained by the fact that the vermillion border is difficult to locate on the colourless CBCT image. Bland-Altman plotting was performed for both vertical and horizontal measurements.

CONCLUSION: The validity of 2D standard facial photograph wrapping on CBCT soft tissue is clinically acceptable.

SP 20 DOES INCREASED BODY MASS INDEX AFFECT THE CHARACTERISTICS OF ORTHODONTIC TREATMENT? A SYSTEMATIC REVIEW.
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AIMS: To systematically investigate the available literature regarding the effect of increased body mass index (BMI) on various characteristics associated with orthodontic treatment.

MATERIALS AND METHOD: A search without restrictions in eight databases and hand searching were carried out. Controlled studies investigating the effect of increased BMI on various characteristics associated with orthodontic treatment were reviewed. Following study retrieval and selection, relevant data was extracted and the risk of bias was assessed according to the Cochrane Collaboration guidelines.

RESULTS: Out of 1677 initially identified unique records, five fulfilled the selection criteria for inclusion in the systematic review. During orthodontic treatment with removable appliances, overweight patients appeared to wear their appliances less, while during treatment with fixed appliances, increased BMI was suggested to constitute a risk factor for less cooperation, longer treatment duration and more oral health-related problems. Also, obese patients were reported to experience more pain and consume a higher overall amount of oral analgesics. Gingival crevicular fluid flow rate was greater in overweight individuals than normal weight individuals. Data regarding salivary leptin levels and the rate of tooth movement were conflicting. Regarding the risk of bias, various problems were noted in diverse domains.

CONCLUSION: Overweight patients may exhibit differences in various treatment characteristics from normal weight individuals, indicating that they may require special attention. Although the overall quality of evidence provides the clinician with a cautious perspective on the strength of the relevant recommendations, the orthodontist may need to consider the possible implications.
SP 21  PERCEPTION OF LAY PEOPLE AND PROFESSIONALS OF ALTERED SMILE AESTHETICS OF ANTERIOR TEETH DUE TO DECALCIFICATION (WHITE SPOT LESIONS)
Iyad Al-Omari, Zaid AlBitar, Orthodontic Department, University of Jordan, Amman, Jordan

AIMS: To compare the perception of lay people and professionals to various degrees of decalcification (white spot lesions) on smile aesthetics.
MATERIALS AND METHOD: Seven photographs representing incrementally altered tooth decalcification lesions of maxillary anterior teeth ranging from mild to severe were shown randomly to the study participants. A visual analogue scale was used to assess the perception of smile aesthetics. Photographs were rated by a matched sample of orthodontists, general dentists and laypeople.
RESULTS: The three groups of raters could distinguish between different decalcification levels. Raters gave a more negative scores as the decalcification level increased. There was a statistically significant differences between the threshold of deviation at which each group distinguished the ideal smile and deviation from the ideal smile for the decalcification lesion (P < 0.001). Orthodontists were sensitive to a decalcification score of three or greater as noticeable and aesthetically unpleasant. Lay people and general dentist showed a similar agreement to a negative appearance of decalcification score of two or greater.
CONCLUSION: The three groups of raters could distinguish between various degrees of decalcification lesions. Orthodontists were less sensitive than the other groups of general dentist and laypeople when comparing the scores for each decalcification category.

SP 22  LONG-TERM STABILITY OF OCCLUSAL OUTCOMES IN ORTHODONTIC PATIENTS. A SYSTEMATIC REVIEW
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AIMS: To systematically search the literature and assess the available evidence regarding the long-term (>5 years) occlusal stability of treatment outcomes in orthodontic patients.
MATERIALS AND METHOD: An electronic and manual search of published and unpublished literature in seven databases was performed (up to October 2018); Medline via PubMed, CDSR, DARE, CENTERA, VHL, WOK, and Scopus without any language or date restriction. Data extraction and quality assessment of the included studies were performed individually and in duplicate by two reviewers. The Cochrane Collaboration Risk of Bias tool and Newcastle-Ottawa Scale were used to address the latter. Any disagreements were resolved by discussion.
RESULTS: From the 1853 initially identified articles, after application of specific criteria, 25 studies (only 1 RCT and 24 retrospective) were considered eligible for inclusion. The level of evidence was deemed fairly moderate. The lack of standardized protocols and the high amount of heterogeneity precluded a valid interpretation of the actual results through pooled estimates. There was substantial consistency among researchers, however, that relapse is almost inevitable, irrespective of the retention protocol. Most changes occurred during the first years in retention and remained relatively stable in the long-term. Moreover, there was great individual variability in post-retention response to treatment changes. Finally, there was some evidence suggesting better stability of mandibular alignment with fixed retention.
CONCLUSION: The current evidence regarding retention is insufficient. However, there was considerable agreement among researchers that an individualized retention regimen is necessary. Further high-quality research of prospective design is needed to draw reliable conclusions.

SP 23  THE EFFECT OF PREMOLAR EXTRACTIONS ON UPPER AND LOWER THIRD MOLARS: A RETROSPECTIVE LONGITUDINAL STUDY
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AIMS: To analyse the effect of premolar extractions on eruption position and angulation of upper and lower third molars after orthodontic treatment

SUBJECTS AND METHOD: The sample consisted of 212 patients of which 106 patients were orthodontically treated without extractions and 106 patients with extraction of the premolars. The age for both groups was matched at start of orthodontic treatment. The angulation, vertical position, the relationship with the mandibular canal and the mineralization status of the third molars were evaluated using pre- and post-treatment panoramic radiographs. All data were statistically analyzed.

RESULTS: Significantly lower scores for the vertical and horizontal position of the lower third molar were obtained after treatment in both groups. However, there was no significant difference between either group in the pre-post change. The prevalence of narrowing of tramlines and horizontal inclination increased for the lower third molar in patients treated without premolar extractions. These changes were significantly different from the extraction group. There was a significant decrease in both groups, with the decrease being significantly stronger in the patients treated with premolar extractions for the vertical position of the upper third molar. There was no significant difference in the change of third molar angulation and mineralization status between either group, neither in the upper, nor in the lower third molars between patients treated with or without premolar extractions.

CONCLUSION: Premolar extractions have a positive influence on inclination, vertical position and horizontal position of third molars, whereas they do not influence the angular changes of third molars.

SP 24 AGE ESTIMATION BASED ON WILLEMS’ METHOD VERSUS A COUNTRY SPECIFIC MODEL IN SAUDI ARABIAN CHILDREN

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AIMS: To develop new maturity scores for dental age estimation in Saudi Arabian (SA) children according to the method of Willems et al. (2001) and to compare age prediction performance of both methods.

MATERIALS AND METHOD: A total of 1341 panoramic radiographs of healthy SA children (716 males, 625 females) in the age range of 2 to 18 years (mean age 10.5 years) were selected to obtain developmental staging scores according to Demirjian et al. (1973). Willems’ BC methodology was applied to develop new country specific maturity scores (Willems SA). Age prediction performance of Willems’ BC and SA were compared.

RESULTS: Willems BC methodology was applied to develop new country specific maturity scores (Willems SA). Age prediction performance of Willems BC and Willems SA were compared.

CONCLUSION: There were no important differences in calibration slope between either approach. With both approaches, the age of older subjects tended to be underestimated, whereas that of younger subject tended to be overestimated.


SP 25 NATIONAL RECRUITMENT IN THE UNITED KINGDOM: 10 YEARS LATER, IS IT WORKING?

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AIMS: Despite being first introduced in the United Kingdom (UK) over 10 years ago, national recruitment still remains a contentious topic which is regularly debated by both interviewers and interviewees. The aims of this research are to present a timeline of the selection process for orthodontic specialty training in the UK and to discuss the advantages and disadvantages of national recruitment from both the interviewers and interviewees perspective.

MATERIALS AND METHOD: The literature was searched using Medline, Embase and Web of Science databases including all studies up to November 2018. The search terms included: ‘recruitment’, ‘interviews’, ‘specialty training’ and ‘selection process’. First, the titles were read to identify relevant papers published in English, then the abstracts were reviewed and full text articles of relevant papers were subsequently analysed.

RESULTS: National recruitment was introduced in the UK for economic benefits and efficient workforce planning. Following the introduction of national recruitment for dental foundation training in 2011, there was a 100 per cent fill rate for all 927 places. Economic benefits included reduced time needed to shortlist the applications and less days away from work for interviews. Studies assessing the perceptions of national recruitment for orthodontic specialty registrars have concluded that both interviewers and interviewees were consistently positive about the fairness and organisation of the interview process. On the other hand, concerns have been expressed that national recruitment cannot truly assess how an individual performs within their current job, and rather, tests the candidates’ performance on the interview day. Studies have shown that location is the most influential characteristic of a training position for a trainee, followed closely by a supportive work environment. Certain locations are more competitive, resulting in some candidates being placed in locations that were not their places of choice.

CONCLUSION: It appears, that national recruitment is here to stay due to economic benefits, efficient workforce planning and greater interviewer and interviewee satisfaction. However, it is important that regular quality assurance takes place, to ensure mistakes are minimised, on a significant day for candidates, which may determine not only where they are located for the short-term, but also how their careers may progress in the future.

SP 26 DOES INCLINATION OF THE POSTERIOR OCCLUSAL PLANE PREDICT THE FINAL SKELETAL PATTERN?
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AIMS: 1. To examine the relationship between the sagittal inclination of the posterior occlusal plane (POP) and the antero-posterior (A-P) skeletal pattern. 2. To test the ability of the POP at age 8 years (pre-pubertal) to predict the A-P skeletal pattern at age 15 years (post-pubertal)

MATERIALS AND METHOD: A sample of 32 untreated subjects with paired digitised lateral cephalometric radiographs were selected from the archives of the North American (Burlington) Growth Study and the Eastman Dental Hospital at an early age (8.5 ± 2.5 years) and a later age (15.5 ± 2.5 years). Using a simple computerised cephalometric analysis for measurements, the study comprised two sections: an error study using repeat measurements of the main sample radiographs undertaken 4 weeks apart to estimate random errors and a correlation study to assess the relationship between the sagittal inclination of the POP at the pre-pubertal stage with the final skeletal pattern variables at post-pubertal stage.

RESULTS: The error study showed that none of the repeat measurement results were significant at $P < 0.05$ level, and that the cephalometric analysis was deemed appropriate. The degree of association between the inclination of the posterior occlusal plane (SNPOP; FHPOP) and the final skeletal pattern (ANBT2; WitsT2) was not statistically significant and had a very weak correlation.

CONCLUSION: The inclination of the POP at age 8 years does not predict the A-P skeletal pattern at age 15 years. Simply using the ANB difference or Wits appraisal showed greater potential as a predictor in relatively mild skeletal discrepancies. However, it would be interesting to examine the
predictive ability of the inclination of POP in more extreme cases than those in the present study, particularly in subjects with a Class III skeletal pattern.

SP 27  LINGUISTIC ADAPTATION AND VALIDATION OF ITALIAN VERSION OF THE OBSTRUCTIVE SLEEP APNOEA-18, A QUALITY OF LIFE QUESTIONNAIRE
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AIMS: To translate and validate, in Italian, the obstructive sleep apnoea (OSA)-18 questionnaire and to investigate the correlations between OSA-18 score and the degree of severity of the OSA.

SUBJECTS AND METHOD: A prospective instrument validation study was conducted in children from 3 to 12 years old referred with suspected OSA. All children included in the study underwent overnight oximetry and the McGill Oximetry Score (MOS) was used to assess the presence and severity of OSA. The participants were divided into a non-OSA group (MOS = 1) and an OSA group (MOS > 1). Caregivers completed the Italian version of the OSA-18 obtained from the translation and adaptation process from the original English version during the first visit and at one month. Caregivers of children with OSA who underwent surgery completed the questionnaire again 3 months after surgery. Psychometric measurements included internal consistency, test-retest reliability and validity. Validity was assessed correlating OSA-18 and MOS scores, comparing OSA and non-OSA groups, and calculating the questionnaire’s sensitivity and specificity. In OSA children who underwent surgery, pre- and post-operative total scores were compared to evaluate responsiveness.

RESULTS: Fifty-seven children, out of 65 recruited, fully completed the initial questionnaire and the retest evaluation. Cronbach’s alpha was 0.933 at the retest examination. Total MOS and OSA-18 retest scores were significantly correlated \((P < 0.001)\). Children with OSA had higher total OSA-18 score than participants without OSA. In the non-OSA group, the median OSA-18 score was 42, IQR (32-62), while in the OSA group the median OSA-18 scores were 63, IQR (52-93), 76, IQR (60-83) and 84, IQR (75-87), respectively, for mild, moderate and severe OSA subgroups. Sensitivity to detect OSA, as diagnosed by oximetry, was 66.7 per cent, and specificity 75.0 per cent. Although all OSA subgroups differed significantly from the non-OSA group, there were no significant differences between non-OSA and moderate OSA groups and between moderate and severe OSA subgroups. After surgery, OSA-18 scores decreased significantly compared to pre-operatively, indicating good responsiveness.

CONCLUSION: The Italian version of OSA-18 questionnaire has satisfactory internal consistency reliability and responsiveness, is equivalent to the original English version and is suitable for use with Italian-speaking patients.

SP 28  FACEMASKS IN PATIENTS WITH a CLEFT LIP AND PALATE – A LITERATURE REVIEW
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AIMS: Cleft patient have a high prevalence of malocclusion caused by scarring from early surgery. Commonly, skeletal discrepancies between the maxilla and mandible can create an anterior crossbite. The purpose of this research was to evaluate the effectiveness of a facemask in the treatment of anterior crossbite in patients with a cleft lip and palate (CLP).

MATERIALS AND METHOD: A research was undertaken using the PubMed database using the following MeSH terms: [('Cleft lip and palate' [All Fields] AND 'Facemask' [All Fields]) OR 'Anterior crossbite' [All Fields] OR 'Maxillary hypoplasia' [All Fields]] AND English[lang]). The inclusion criteria used were publications from 1989 to 2017 in English. The quality evaluation of the included studies was performed using the Critical Appraisal Skills Programme.

RESULTS: The electronic search identified 41 publications and 11 were selected. The literature often describes an improvement of the sagittal relationship in patients that underwent treatment with a facemask combined with a maxillary bonded expander. Despite the difference between
unilateral (more skeletal effect) and bilateral (more dentoalveolar effect) clefts, the soft tissue profile changes were nearly the same. This indicates a close relationship between the soft tissue profile and the supporting hard tissue structures.

CONCLUSION: The use of a facemask in patients with a CLP is an effective treatment to correct maxillomandibular disharmony in most cases, improving dental occlusion and facial appearance.

SP 29 COMPARISON OF FORCE SYSTEM AND EFFECTIVENESS OF TWISTED ARCHWIRES WITH VARYING CROSS SECTIONS TO CORRECT LINGUAL ROLLING OF LOWER MOLARS.
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AIMS: To investigate the effectiveness of the twisting technique for uprighting lingually tipped mandibular molars and the influence of the use of different wire material and cross-section dimensions on the force systems in simulated tooth movement. Using a rectangular archwire inserted into the molar tube in a twisted form, is the technique which was evaluated in this study.

MATERIALS AND METHOD: Three archwire materials were tested: TMA, stainless steel and nickel titanium (NiTi) with rectangular cross-section. The wires were inserted on bracketed mandibular Frasaco models, with a segmented right molar. Simulated uprighting for the mandibular right molar was performed on the Orthodontic Measurement and Simulation System, which recorded the force systems during tooth movement. Descriptive analysis and a Student’s test were used for the statistics. A clinical trial was performed in parallel (3 patients). The effectiveness of the treatment technique was assessed by comparing the amount of uprighting achieved final tooth movement with the initial situation of the tooth by means of Onyx Ceph software.

RESULTS: Force and torque components are significantly influenced by wire material and cross-section. The greatest torque was recorded, 36.1 to 39.6 Nmm, on tooth 46 in combination with stainless steel. Minimum torque values were 12.1 and 11.5 Nmm in combination with NiTi 0.016 × 0.022 and NiTi 0.017 × 0.025 inch, respectively. However, the uprighting values (translation and rotation) was unambiguously influenced neither by the selected wire material nor by wire thickness. The twisting technique seems to have a critical role in the results. It is recommended for this technique, to use the NiTi rectangular wire which exerts lower torque values (11.5 to 12.1 Nmm) within the biological safe range.

CONCLUSION: Overall, the twisting technique for uprighting a lingual tipped molar is recommended. The archwires NiTi 0.016 × 0.022 in bracket slot 18 and NiTi 0.017 × 0.025 inch in bracket slot 22, due to their appropriate force system behaviour and minimal side effects are recommended.

SP 30 EVOLUTION OF SELF-ESTEEM DURING ORTHODONTIC TREATMENT
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AIMS: An earlier study (De Baets et al., 2012) on the effect of orthodontic treatment on the evolution of Oral Health Related Quality of Life (OHRQoL) reported a significant but weak negative correlation between OHRQoL and treatment need, and a similar but positive correlation was found between OHRQoL and self-esteem. This study aimed to investigate whether self-esteem is a stable construct during orthodontic treatment in adolescents and whether it is mediated by gender, age, educational level or socioeconomic status and to determine whether self-esteem and perceived treatment need are correlated.

SUBJECTS AND METHOD: Three hundred and twenty six adolescents aged 11 to 16 years who received orthodontic treatment completed the Child Perception Questionnaire (CPQ) and the Harter’s test (Dutch adaptation). Data were statistically analyzed with the Spearman correlation.

RESULTS: There was no evidence of a change in global self-esteem during orthodontic treatment. A significant gender-by-time interaction for scholastic competence (P < 0.05), a decrease in self-esteem for females and an increase for males between was observed. A significant age (T0) by time
interaction for physical appearance and global self-worth ($P < 0.05$), a negative correlation between self-esteem and self-assessed Aesthetic Component of the Index of Orthodontic Treatment Need for the subdomain of close friendship ($P < 0.05$) was found.

CONCLUSION: Global self-esteem acts as a stable construct during orthodontic treatment. The subdomains of self-esteem could be influenced by age and gender. Self-esteem and the subjective need for orthodontic treatment were found to be negatively correlated.

SP 31  COMPARISON OF DENTAL MATURITY AND DENTAL ANOMALIES IN FINNISH INDIVIDUALS BORN WITH VAN DER WOUDE SYNDROME AND ISOLATED CLEFT PALATE
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AIMS: To compare dental maturity (DA), prevalence and severity of taurodontic molars and tooth agenesis in children born with Van der Woude syndrome (VWS), non-syndromic isolated cleft palate (NSCP) and an aged matched control group.

MATERIALS AND METHOD: Dental panoramic tomographs (DPT) of 204 children divided into 51 DPT of patients born with VWS mean age ($x = 8.17 \pm 1.34$ years) and 51 DPT of patients born with NSCP mean age ($x = 8.09 \pm 1.41$ years) and 102 DPT of healthy children as control mean age ($x = 8.62 \pm 1.24$ years) were evaluated. Age, gender and group were blinded during the examination. For dental maturity age Demirjian methods with the Nyström Finnish scoring system were used to evaluate the developmental stages of the seven left mandibular teeth (excluding third molars). For prevalence and severity of taurodontic molars, upper and lower first molars were evaluated using the taurodontism index, modified by Tulensalo. Furthermore, comparison and description of the crown malformation and tooth agenesis between groups were performed. Differences between DA and chronological age (CA) were determined with one-way ANOVA.

RESULTS: The mean DA/CA difference in healthy children (0.40 years) was significantly greater than in both VWS (0.12 years) and NSCP (0.09 years) ($P = 0.016$) groups. The severity of taurodontism in all upper and lower first molars was significantly greater in VWS and NSCP patients compared to healthy children ($P = 0.001$). No differences in severity between VWS and NSCP groups was found ($P = 0.883$). The taurodontic molars in patients with VWS was categorized as hypotaurodontism except one molar that was mesotaurodontic. The mean prevalence of taurodontism in VWS (43.4 ± 2.98%) was greater than in both NSCP (32.75 ± 3.56) and healthy children (13.72 ± 7.51). Most often the missing teeth in patients with VWS were 15, 12, 22, 25, 35 and 45.

CONCLUSION: The null hypothesis was rejected. Dental maturity was delayed in patients born with VWS but at same level of patients born with NSCP. Prevalence of taurodontism was high in patients born with VWS.

SP 32  DO SATISFACTORY POST-TREATMENT AND LONG-TERM RESULTS MEET THE IDEAL NORMS OF OCCLUSION? A RETROSPECTIVE, LONGITUDINAL, COHORT STUDY‡‡‡
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AIMS: Evaluation of inter-occlusal contacts at the end of active treatment and at long-term in Class II division 1 malocclusions. According to the null-hypothesis, improvement of inter-occlusal contacts during treatment (T2-T1) is not correlated to their overall improvement (T3-T1).

MATERIALS AND METHOD: Records of 68 patients with a pre-treatment Class II/1 malocclusion, with satisfactory occlusal results at the end of active treatment, were used. Three sets of three-dimensional (3D) dental models; pre-treatment (T1), end of active treatment (T2) and at least 3 years post-retention (T3) were assessed by a three-dimensional (3D) software program. The ideal
occlusal contact points in the incisors, canines, (pre)molars region were identified on the 3D models and compared with the actual contact points. A scoring system was developed to quantify the deviations from ideal contacts. The distance between ideal occlusion (score 0) and actual situation was described as inter-occlusal distances. These distances were pooled for left and right central and lateral incisors / canines/ premolars. Reliability tests, descriptive statistics, correlation analysis and t-tests were carried out.

RESULTS: Only a small number of teeth achieved ideal contacts (score 0) at T2 and T3; they were scarce at all time points. Overall mean significant improvement (T3-T1) was as follows: 1.3 mm for the incisors, 1.7 mm for the canines, 0.6 mm for the premolars and 0 mm for the molars. Treatment changes (T2-T1) of incisors and premolars were positively correlated with each other. Also, there was a positive correlation of post-treatment changes (T3-T2) of incisors and canines. Treatment changes and post-treatment changes of molars and incisors were negatively correlated.

CONCLUSION: The null-hypothesis was accepted except for molars. Overall a long-term significant improvement was achieved except for first molars, but there was a large variation. Improvement of the inter-occlusal contacts of premolars continued after treatment, reflecting a tendency to settling. For incisors and molars, relapse was proportional to treatment change. Clinically satisfactory results do not meet the meticulous norms for ‘ideal’ occlusion.

SP 33  EFFECTS OF MATERIAL- AND DESIGN-DEPENDENT VARIATIONS ON THE FAILURE RATE OF BONDED RETAINERS: A RETROSPECTIVE, LONGITUDINAL COHORT STUDY‡‡‡
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AIMS: To assess the relationship between retainer failures on the one hand and material-dependent variations (type of the wire and adhesive) and types of retainer design on the other. The null hypothesis of this study is that these variables have no influence on the failure rate of bonded retainers.

MATERIALS AND METHOD: Records of 89 patients with 4-19 years of follow-up were used. Two brands of adhesive (Clearfil, LCR™), several types of stainless steel wire (0.015, 0.025 and 0.017 × 0.025 inch twisted and 0.016 plain wire) and different retainer designs (single/segmented) were evaluated. All retainers were fabricated, fitted and repaired by the same orthodontist. A weighted repair score based on the time points of retainer failures was calculated. Reliability tests, descriptive statistics, t-tests and regression analyses were performed.

RESULTS: No significant differences were found between different types of wire and adhesive as well as retainer designs. Clearfil performed significantly better in the mandible than in the maxilla (P < 0.05). For LCR™, failure rate was equal for both jaws. Also, 0.017 × 0.025 twisted wire and segmented retainers showed better results in both jaws, however these were statistically insignificant.

CONCLUSION: The null hypothesis could not be rejected. Nevertheless, the lower failure rate of Clearfil in the mandible might be related to the loadings. Maxillary retainers are exposed to more wear and degradation, whereas this is not the case for mandibular retainers. Therefore, to reduce the retainer failure in the maxilla, adhesive with more fillers should be preferred. The better performance of 0.017 × 0.025 twisted wire might be related to higher strengths, less resilience and better retention for adhesives. Better performance of segmented retainers might be related to more retentive areas for adhesives, better adaptation to the tooth surface and more resistance to transverse loadings. Consequently this type of retainer seems to be more suitable for the maxilla.

SP 34  MANDIBULAR CONDYLE POSITION AND TEMPMORMANDIBULAR JOINT BONE DENSITY IN DIFFERENT VERTICAL SKELETAL PATTERN
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AIMS: To evaluate the position of the mandibular condyle (joint spaces) and bone density of mandibular condyles in non-growing males and females with varying skeletal patterns

SUBJECTS AND METHOD: Ninety non-growing patients were divided into three groups according to vertical skeletal pattern (normodivergent, hypodivergent and hyperdivergent). The position of mandibular condyle (joint spaces) and bone density of the mandibular condyle and glenoid fossa was measured on the cone-beam computed tomographs (CBCT). All the CBCT scans were obtained by a single machine with a constant field of view and acquisition time. The position of the mandibular condyle and bone density of the mandibular condyle and glenoid fossa was measured in the sagittal and coronal plane.

RESULTS: The hyperdivergent subjects had significantly decreased superior joint space when compared to normodivergent ($P < 0.05$) and hypodivergent ($P < 0.05$) in sagittal orientation. Furthermore, hyperdivergent subjects had significantly decreased joint space in superior ($P < 0.05$), medial ($P < 0.05$) and lateral ($P < 0.05$) areas when compared to hypodivergent subjects. Similarly, the bone density of the mandibular condyle in the hypodivergent group was significantly increased when compared to normodivergent ($P < 0.05$) and hyperdivergent ($P < 0.05$) groups in sagittal orientation. The bone density of the glenoid fossa in the hypodivergent group was significantly increased compared with the normodivergent ($P < 0.05$) group both in sagittal and coronal orientation.

CONCLUSION: The vertical skeletal pattern affects the position of the mandibular condyle and bone density of the temporomandibular joint structures. A hyperdivergent skeletal pattern leads to posteriorly positioned condyles, while hypodivergent subjects had more bone density of the mandibular condyle and glenoid fossa.

SP 35 BISPHOSPHONATES ENHANCE POST-EXPANSION STABILITY BY MODULATING MYOFIBROBLAST DIFFERENTIATION
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AIMS: Maxillary expansion is utilized during orthodontic treatment to address transverse maxillary constriction in a wide variety of patients, including those with craniofacial abnormalities. However, post-expansion stability can be adversely affected by relapse which occurs in up to 45 per cent of orthodontic patients and 80 per cent of craniofacial patients undergoing this treatment. The aetiology of post-expansion relapse is multifactorial and the oral myofibroblasts in soft tissue are believed to play a critical role. The goal of this study was to evaluate the effect of bisphosphonates on post-expansion stability by regulating myofibroblast differentiation.

MATERIALS AND METHOD: Myofibroblasts were induced by transforming growth factor beta (TGF-ß) and its marker alpha smooth muscle actin (αSMA) expression was evaluated by real-time polymerase chain reaction and Western blot. A total of 30 male mice were used; control group with saline (5 mg/kg, 0.9% sodium chloride) and experimental group with bisphosphonates (0.1 mg/kg of Zoledronate) administration. First, both groups underwent 1 week of maxillary expansion using an expander with a helical spring and arms that loop around the central incisors. Then, the expanders were converted to retention appliances and allowed 7 days of retention. After retention, half of the animals from each group were sacrificed. The other half was sacrificed after 7 days of relapse in which the retention device was removed. After sacrifice, the maxillae were analyzed using micro-computed tomography (µCT) and histology.

RESULTS: Bisphosphonates administration significantly reduced the relapse ratio. Bisphosphonates inhibited the expression of αSMA mediated by TGF-ß1 in myofibroblasts. µCT and three-dimensional imaging demonstrated the marked bone formation and higher ratio of bone to tissue volume at the expanded region in the experimental group as opposed to the control group. Moreover, histologic analysis of the expanded region revealed bone formation in the sutural area of the experimental group while the control group showed soft tissue architecture.

CONCLUSION: The results suggest that bisphosphonates administration inhibited myofibroblast differentiation and enhanced stability following orthodontic palatal expansion.
SP 36  ACCURACY OF AN AUTOMATED METHOD OF THREE-DIMENSIONAL SOFT TISSUE LANDMARK DETECTION – A PILOT STUDY
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AIMS: To test the accuracy of an automated algorithm to identify anatomical landmarks on three-dimensional (3D) soft tissue images by comparing with manual annotation.

MATERIALS AND METHOD: Thirty 3D soft tissue images were obtained from a private orthodontic practice using a 3dMD stereophotogrammetry unit. The sample consisted of 15 males and 15 females between 9-17 years of age. The images were aligned along a standardised reference plane to setup a Cartesian co-ordinate system. Twenty landmarks were manually annotated by two calibrated observers and their co-ordinates were subsequently derived (x1, y1 ,z1). A JAVA-based mathematical algorithm was developed to identify the landmarks using an automated process based on their anatomical definition. The automated process was based on adapting each image with a chosen template by means of translation, rotation and scaling. The resultant 3D co-ordinates were subsequently derived (x2, y2, z2). Euclidean distances were then calculated to measure the straight line distance between the two points for each landmark.

RESULTS: Inter- and intraobserver reliability for the manually annotated landmarks using intraclass correlation coefficient was >0.9. In the individual axes, the mean differences between manual and automated landmarks for the x, y and z axes were 0.91 mm, 1.32 mm and 0.82 mm, respectively. The average Euclidean difference and standard deviation for all 20 landmarks was 3.0 mm and 1.56 mm respectively. Sixteen out of 20 landmarks had a mean difference <4 mm. The points with the greatest agreement (≤2 mm) were mainly in the midline: pronasale, subnasale, subspinale, labiale superius, stomion, with the exception of chelion right.

CONCLUSION: Landmarks located in the mid-sagittal plane in the oro-nasal area had the greatest accuracy (≤2 mm). The algorithm was determined to be clinically relevant in the detection of mid-sagittal landmarks and associated measurements within the studied sample of adolescent Caucasian subjects. This algorithm can be used to efficiently develop a database of soft tissue anthropometric measurements using stereophotogrammetry.

SP 37  APICAL ROOT RESORPTION AFTER ORTHODONTIC TREATMENT IN PATIENTS WITH A UNILATERAL CLEFT LIP AND PALATE
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AIMS: To present the incidence of external apical root resorption (EARR) in the maxillary anterior teeth of patients with complete unilateral cleft lip and palate (CUCLP), and to evaluate the influence of several patient- and treatment-related variables on the development of EARR.

SUBJECTS AND METHOD: Forty-one patients with CUCLP participated in the study. In total, 175 maxillary anterior teeth were well documented and evaluated for EARR. Dental pantomograms, taken before orthodontic treatment (OT) with fixed appliances (T1), and periapical radiographs (PAs) of the maxillary anterior teeth taken at the end of OT (T2) were assessed for EARR. A history of oral habits beyond the age of 8 years of the patient, the use of intermaxillary elastics and the direction and amount of tooth movement were recorded. Signs of root resorption were registered, with index scores from 0 to 4, following the Malmgren et al. scoring system.

RESULTS: The incidence of EARR at T2 (97.6%) was considerably higher than at T1 (51.2%). Central incisors and canines on the cleft side showed a significantly higher score (P < 0.01, P < 0.05 respectively) of EARR in comparison to the same group of teeth on the non-cleft side. Pre-existing shorter roots and abnormal root morphology were identified as predisposing factors for EARR. There was no statistical significance between patient’s age or gender, an oral habit and intermaxillary elastics. On the contrary, total OT time (T1-T2) of the canines (P < 0.05) on the cleft
side, as well as the total amount of labio-palatal movement of the lateral incisors \((P < 0.01)\) seem to have an effect of the development of EARR.

**CONCLUSION:** Most of the patients with CUCLP undergo challenging and long-term OT with multiband orthodontic appliances (MBA) related to the special anatomical features of the bone, the rotational position of teeth located in the cleft, and the special OT needs of these patients. Patients with CUCLP treated with MBA have a higher incidence of EARR on the anterior teeth of the cleft side. Severe EARR is rather rare but more often observed on central incisors of the cleft side.

**SP 38 EVALUATION OF THE DIFFERENT THREAD DEPTH AND THE PITCH OF ORTHODONTIC MINISCREWS ON MICRODAMAGE TO THE CORTICAL BONE**

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**AIMS:** To histologically evaluate microdamage on the cortical bone in terms of two different diameter miniscrews of three brands with different thread pitch and depth. Thread shape factor (TSF) is calculated by thread depth/pitch.

**MATERIALS AND METHOD:** Six groups of seven miniscrews with different TSF values and an outer diameter of 1.5-2.0 mm. The miniscrews were inserted into pig rib bone using a miniscrew driver. After fixation, bone specimens were sectioned as bone blocks including the miniscrew. The bone blocks were ground parallel to the miniscrew axis with a thickness of 40 \(\mu\)m with a sensitive hard tissue device. The histomorphometric parameters including microcrack length, total microcrack number, and crack density were examined and all parameters were calculated using a digital scanning software program. Data were statistically analyzed.

**RESULTS:** When groups were compared, no statistically significant differences were found between TSF value and microcrack number, microcrack length, and crack density \((P > 0.05)\) but microcrack number was increased with higher TSF values in the 1.5 mm outer diameter miniscrew group. Excluding the Absoanchor miniscrew groups, the higher miniscrew diameters showed higher crack length. For miniscrews of the same brand and different TSF values, the crack density was increased when the miniscrew had the higher diameter value.

**CONCLUSION:** Miniscrew success is very important for clinicians and its design is one of the factors that affects clinical success. There is no influence of TSF on microdamage performed on the cortical bone. More experimental studies with new miniscrews which have different TSF values are required to examine the effects of TSF on the accumulation of microcracks. The findings also highlighted the need to investigate the influence of microcrack formation on the primary stability of miniscrews.

**SP 39 EFFICACY OF ORTHODONTIC MINI-IMPLANTS FOR EN MASSE RETRACTION IN THE MAXILLA: A SYSTEMATIC REVIEW AND META-ANALYSIS**

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**AIMS:** Retraction of the upper incisors/canines requires maximum anchorage. The aim of the present study was to analyze the efficacy of mini-implants in comparison to conventional devices in patients with a need for en masse retraction of the upper anterior teeth.

**MATERIALS AND METHOD:** An electronic search of PubMed, Web of Science, and Embase and hand searching was performed. Relevant articles were assessed, and data were extracted for statistical analysis. A random effects model, weighted mean differences (WMD) and 95 per cent confidence intervals (CI) were computed for horizontal and vertical anchorage loss at the first molars in the analyzed patient treatments.

**RESULTS:** A total of seven randomised controlled trials employing direct anchorage through implants in the alveolar ridge were finally considered for qualitative and quantitative analysis, and a further five publications were considered for qualitative analysis only (three studies: indirect anchorage through implant in the mid-palate, two studies: direct/indirect anchorage in the alveolar ridge). In the control groups, anchorage was achieved through transpalatal arches, headgear,
Nance buttons, intrusion arches, and differential moments. WMD [95% CI, P] in anchorage loss between test and control groups amounted to $-2.79 \text{ mm} [-3.56 \text{ to } -2.03, P < 0.001]$ in the horizontal and $-1.76 \text{ mm} [-2.56 \text{ to } -0.97, P < 0.001]$ in the vertical favouring skeletal anchorage over control measures. Qualitative analysis revealed that minor anchorage loss can be associated with indirect anchorage, whereas anchorage gain was commonly associated with direct anchorage. Implant failures were comparable for both anchorage modalities (direct 9.9%, indirect 8.6%).

CONCLUSION: Within its limitations, the meta-analysis revealed that maximum anchorage en masse retraction can be achieved by orthodontic mini-implants and direct anchorage; however, the ideal implant location (palate versus alveolar ridge) and the beneficial effect of direct over indirect anchorage needs to be further evaluated.

SP 40 CAN IMPLANTS MOVE IN BONE? A PRELIMINARY LONGITUDINAL MICROCOMPUTED TOMOGRAPHIC ANALYSIS OF IMPLANTS UNDER TENSILE FORCES IN RAT VERTEBRAE

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AIMS: Whereas stationary stability of implants has been postulated for decades, recent studies suggested a phenomenon termed ‘implant migration’. This describes a change in position of implants as a reaction to applied forces while maintaining stability. The underlying biological phenomenon and thus both time- and tension-dependent bone remodelling have not been deeply investigated. The aim of the present investigation was to assess dynamic bone remodelling and micro-angiogenesis at immediately and continuously loaded implants through image registration of in vivo microcomputed tomography (μCT) scans from different time points.

MATERIALS AND METHOD: Two customized machined implants (RISystem, Switzerland) were placed in the dorsal portion of caudal vertebrae in n = 61 rats. The implants were exposed to standardized tensile forces (test groups: 0.3 N, 1.0 N, 1.5 N) applied though a flat nickel titanium tension spring, or no forces (control). In vivo μCT scans were performed at 0, 1, 2, 4, 6, and 8 weeks after surgery. The baseline image from week 0 was registered with the forthcoming scans using Amira 6.5 and the metric ‘normalized mutual information’. Implant migration was measured as the Euclidean distance between implant tips. Bone remodelling was quantified between baseline and the subsequent scans and micro-angiogenesis was assessed through injection of a silicon rubber.

RESULTS: The preliminary findings confirmed a positional change of the implants at 4 weeks of healing (n = 4, 0 N: 140 μm, 0.3 N: 468 μm, 1.0 N: 405 μm, 1.5 N: 431 μm). Bone apposition was observed around the implants, and accompanied by angiogenesis, formation of load-bearing trabeculae and a general cortical thickening close and also distant to the implants.

CONCLUSION: Preliminary analysis confirmed that implants can migrate in bone as a consequence to tensile forces while maintaining a high bone to implant contact. The tensile forces seemed to stimulate bone thickening, which could explain why implants migrate without affecting stability.

SP 41 LONG-LIVED OSTEOCYTES ARE EMBODIED BY THE CRANIOFACIAL SKELETON IN YOUNG AND OLD MICE, BUT THEY DECREASE IN NUMBER IN POSTCRANIAL SKELETONS AT OLDER AGES

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AIMS: Osteocytes are engaged in life-enduring processes such as bone remodelling, fracture healing or osseointegration of implants. Over age, ossification processes and regenerative capacity can greatly differ in the mandible and femur. Mesenchymal stem cells from cranial and postcranial bones are of different embryologic origins. This may be the reason why the regenerative capacity differs between cranial and postcranial bones in older patients. It was hypothesised that different
ageing patterns, reflected by osteocyte density, lacunar density and osteoid formation, exist between murine mandibles and femurs.

**MATERIALS AND METHOD:** The mandibles and femurs of young (4 months) and old (34-36 months) male C57Bl/6 mice were histologically investigated to determine the number of lacunae occupied with osteocytes. Osteoid formation was revealed by Masson-Goldner staining, and the spatial distribution of BMP-2 synthesis was examined.

**RESULTS:** Over lifetime, the number of lacunae occupied with osteocytes only showed a modest decrease in mandibular bone (old 85.63%/young 91.12%) while greatly diverging in the femur (old 55.99%/young 93.28%). In equal measure, old femurs exhibited less osteoid formation and decreased BMP-2 expression.

**CONCLUSION:** Tissue-specific conduct of bone ageing is moulded by osteocytic activities, which was found to vary between the postcranial and craniofacial skeleton. The latter harbours long-lived osteocytes also in older animals which assures lifelong bone integrity. Preliminary concurring findings from a human cadaver, also presented in this contribution, provide a rationale for recommending the translatability to humans.

**SP 42: ACCURACY OF FORCE DELIVERY OF NICKEL TITANIUM COIL SPRINGS**

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**AIMS:** To compare the *in vitro* force levels of variable force and constant force nickel titanium (NiTi) closed coils at three different activation lengths (3, 6 and 9 mm).

**MATERIALS AND METHOD:** Ten samples from each of five different NiTi coil types (RMO, GAC Medium, GAC Heavy, G&H Light, and G&H Medium) from three manufacturers (RMO, GAC and G&H). Each coil type was tested 10 times at 9, 6 and 3 mm extensions, using a Tinius Olsen tension compression tester, model H5 1K-S with Tinius’s test navigator software© (Tinius Olsen TMC, Horsham, Pennsylvania, USA). The distribution of data was tested with Q-Q plots, and Levene’s test was used to examine the assumption of equal variances between groups. Within group comparisons were performed with repeated measures ANOVA and a paired t-test. One-way ANOVA was used for comparisons between groups. In cases where normality was violated, appropriate non-parametric tests were used (Mann-Whitney; Kruskal-Wallis). The level of statistical significance was set at 0.05.

**RESULTS:** There were significant differences in variation of force delivery between different coil types at 9, 6 and 3 mm of activation length (P9 mm < .001; P6 mm< .001; P3 mm< .001). Furthermore, there was a significant reduction in force delivery within each type of coil as the activation length decreased (PRMO < 0.001; PGACmedium < 0.001; PGACHEavy < 0.001; PG&Hlight < 0.001; PG&Hmedium < 0.001).

**CONCLUSION:** There are significant differences in force delivery of closed NiTi coils from various manufacturers. Furthermore, there is large variability in force delivery within each manufacturer when coils are extended to different activation lengths. This is also true for coils that are advertised to deliver a constant force upon activation.

**SP 43: ANALYSIS OF TRANSITION TEMPERATURE AND FORCE DELIVERY: A COMPARISON OF COPPER NICKEL TITANIUM AND NICKEL TITANIUM ORTHODONTIC WIRES‡‡‡**

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AIMS: To test compare the mechanical properties of various copper nickel titanium (CuNiTi) and nickel titanium (NiTi) from the same manufacturer.

MATERIALS AND METHOD: Wires of two dimensions (0.016 inches and 0.016 × 0.022 inches) and three advertised transformation temperatures (Af = 27°C, 35°C, 40°C) were included in this investigation, for a total of 10 types of wires. To evaluate transition temperature ranges, six specimens of each wire were tested using DSC Q200 (TA Instruments-Waters, New Castle, Delaware, USA); and the produced DSC plots were analyzed by the DSC manufacturer software Universal Analysis 2000 (TA Instruments-Waters). Calculations of the initial and final temperatures (As, Af, and Af-As) of the austenitic phases were produced according to methods of standard transition temperature determination. To assess force delivery, 12 samples of each archwire were tested using the Tinius Olsen HIKS 3-point bend machine (Tinius Olsen, Horsham, Pennsylvania, USA). Each sample was only tested once to eliminate the influence of cyclic loading. Comparisons between CuNiTi versus NiTi wires at each dimension and advertised temperature were performed with two-sample t-tests. All P values less than 0.05 were considered statistically significant.

RESULTS: The Af-As ranges of the CuNiTi wires with advertised Af values of 35°C and 40°C were higher than the NiTi wires of the same dimension and advertised Af values, respectively (P < 0.001). On the other hand, CuNiTi wires with an advertised Af of 27°C had lower Af-As ranges than their NiTi counterparts (P < 0.001). All CuNiTi wires presented a relatively constant Af-As range (11-15°C) and their actual Af values were closer to the advertised ones by the manufacturer. Furthermore, CuNiTi wires of all dimensions had lower unloading forces at 2 mm than their NiTi counterparts (P < 0.001). In both groups, force delivery decreased as the advertised Af value increased.

CONCLUSION: CuNiTi orthodontic wires consistently had a significantly lower unloading force and a significantly narrower stress hysteresis compared to NiTi wires. The experimental Af of CuNiTi wires were closer to the advertised Af compared to NiTi wires.

SP 44 NASAL SEPTUM CHANGES IN PRE-PUBERTAL PATIENTS AFTER RAPID PALATAL EXPANSION: A CONE-BEAM COMPUTED TOMOGRAPHY STUDY

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AIMS: Nasal septum deviation (NSD) is one of the most common structural causes of nasal obstruction involving around 65-80 per cent of the population. Rapid palatal expansion (RPE) is nowadays the first choice to treat maxillary transverse deficiency, but this can also influence the nasal cavity structure. The present study aimed to consider the changes in NSD using cone-beam computed tomography scans in pre-pubertal patients treated with RPE.

SUBJECTS AND METHOD: This was a retrospective study evaluating 18 patients [mean age 10 years, standard deviation (SD) 2 years] with a diagnosis of transverse maxillary constriction treated with RPE. This sample also presented a mild/moderate NSD as an incidental finding. The outcome measures were NSD tortuosity and area achieved from transverse and coronal views of records taken before and after RPE. Continuous data were expressed as mean the and SD. Intrarater reliability was assessed with intraclass correlation coefficient (ICC) and 95 per cent confidence interval (CI). The variations in NSD tortuosity and area were calculated as the difference over time divided by the length of follow-up in each patient.

RESULTS: NSD was mild in 12 patients (78%) and moderate in six (22%). NSD tortuosity did not significantly change over time (mean difference 0.002 mm/year, 95% CI −0.005 to 0.008; P = 0.58) as well as NSD area (mean difference 2.103 mm²/year, 95% CI −2.283 to 7.039; P = 0.38). ICC was 0.73 (95% CI 0.60 to 0.86) for NSD tortuosity and 0.84 (95% CI 0.75 to 0.92) for NSD area.

CONCLUSION: NSD tortuosity and area did not significantly change in pre-pubertal subjects after treatment with RPE. However, additional studies using the same procedure in larger samples would be necessary to clarify the role of RPE in NSD treatment.
EVALUATION AND COMPARISON OF STRESSES DURING MAXILLARY EXPANSION WITH DIFFERENT BONE-BORNE PALATAL Expanders: A THREE-DIMENSIONAL FINITE ELEMENT METHOD ANALYSIS

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AIMS: Palatal expansion is useful to correct transverse deficiency and should maximize orthopaedic movement and minimize dental movement. In recent years it has been combined with miniscrews to achieve minor side effects on the teeth. The aims of this study were to analyze and compare the stress distribution and displacement on the maxillary bone, the palatal suture, the teeth and the periodontal ligament obtained using two versus four mini-implant anchorage during bone-borne palatal expansion using finite element analysis.

MATERIALS AND METHOD: The model, taken using cone beam computed tomography, was processed using Mimics software while Abaqus software was used to solve the mathematical equation. The total displacement was set a 0.1 mm on each side simulating a screw activation. Four types of expanders were used: two supported by two miniscrews with and without dental supports and two or four miniscrews, one with them implanted on the alveolar side and the other on four parallel miniscrews.

RESULTS: Maximum displacement occurred in the transverse direction at the level of the central incisors. The tensions observed were concentrated on the miniscrews on the teeth and the palatal suture. The highest tension was detected with the device supported by four parallel mini-implants with ossification. In the model with four lateral screws, higher dentoalveolar tension was observed. Moreover, with these two types the expansion of the two palatal portions was more parallel than that obtained with only two mini-implants. The version with dental supports in the adult patient caused excessive molar tipping and lower skeletal effects.

CONCLUSION: Palatal expansion in a young patient is obtainable with expanders on two miniscrews, for young adult patients it is preferable to have an expander on four miniscrews without supports and for adult patients four miniscrews with the possible use of surgically assisted rapid palatal expansion.

PRESENCE OF THIRD MOLARS IN PATIENTS WITH AGENESIS OF SECOND PREMOLARS IN RELATION TO TOOTH TRANSPANTATION

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AIMS: Autotransplantation of developing third molars can be an attractive option to replace missing second premolars, but those teeth have the highest prevalence of agenesis which is also correlated with other tooth agenesis. The aim of the study was to assess the presence and distribution of third molars in patients with agenesis of second premolars in the light of a favourable donor to be used for tooth transplantation.

MATERIALS AND METHOD: Panoramic radiographs from the files of all available patients with agenesis of at least one second premolar were assessed. The exclusion criteria included patients < 10 years, hypodontia < 6 teeth and syndromic patients. A logistic regression model was used to investigate the association between the number of second premolars and third molars. An alternate logistic regressions model was applied to analyze the probability of the additional occurrence of second premolars and third molars.

RESULTS: One hundred and thirty one patients (82 females, 49 males) with a mean age of 13.9 years (range: 10-22 years) were included. Eighty per cent of patients were missing one or two premolars, mostly mandibular premolars. At least one third molar was present in 75.6 per cent of the subjects and all third molars in 42.7 per cent of the patients. Maxillary third molars were more often present than mandibular third molars. A significant effect on the number of missing third molars occurred.
molars and second premolars was observed (odds ratio: 8.2, 23.5 and 42.1 for the absence of one, two and three premolars). There was also a significant association between agenesis of maxillary second premolars and agenesis of third molars, but no such association was present for mandibular second premolars.

CONCLUSION: Autotransplantation of third molars is a valid option regarding the presence of a donor in patients with missing mandibular second premolar in contrast to patients with missing maxillary second premolars in whom third molars could be also absent and other treatment options might need to be considered.

SP 47 CLINICAL USE AND EFFECTS OF THE FORSUS FATIGUE RESISTANT DEVICE WITH SKELETAL ANCHORAGE: A SYSTEMATIC REVIEW
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AIMS: To systematically review evaluate the results obtained with the use of Forsus Fatigue Resistant Device (FFRD) with skeletal anchorage: miniscrew and miniplate.
MATERIALS AND METHOD: A search was performed on PubMed, Cochrane, Medline, Web of Knowledge, ISI, Embase and grey literature databases, complemented with a hand search. Inclusion criteria were: articles published after 2010 in which adolescent patients in the permanent young dentition were treated with a protocol of FFRD with skeletal anchorage, with previous and post-treatment cephalometric measurements and with no dental extractions before the treatment.
RESULTS: One hundred and thirty four articles were identified, of which eight fulfilled the inclusion criteria. The use of FFRD with miniscrews produced less proclination of the lower incisors, while the use of FFRD produced retroclination of the lower incisors, in addition to a skeletal effect of mandibular advancement.
CONCLUSION: The use of FFRD with miniscrews produces less lower incisor proclination than conventional FFRD. Miniplates also resulted in more mandibular advancement.

SP 48 DO PRE-TREATMENT CONCERNS AFFECT PATIENT SATISFACTION WITH ORTHODONTIC TREATMENT?
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AIMS: Orthodontic treatment is undertaken to reduce dental health risks and oral health-related quality of life impacts arising from malocclusion. This study aimed to evaluate patient-reported concerns prior to orthodontic treatment and satisfaction with treatment outcome.
SUBJECTS AND METHOD: The study was undertaken in one hospital orthodontic department and two specialist orthodontic practices in Yorkshire, UK. National Health Service (NHS) patients aged 12 years and older who had completed comprehensive orthodontic treatment were invited to participate. Those with craniofacial anomalies were excluded. The study used a validated questionnaire, the Orthodontic Patient Treatment Index Questionnaire (OPTIQ) to measure patient’s pre-treatment concerns (problems and symptoms) and post-treatment outcome and satisfaction. Data was collected anonymously using paper-based questionnaires then inputted into Microsoft Excel. Statistical analysis was performed.
RESULTS: One hundred and seventy three questionnaires were returned; 43 from the hospital and 119 from specialist practice. Fifteen were excluded as incomplete, leaving 158 for analysis. Fifty-four males and 104 females responded: 43 young people aged 12-15 years (28%), 83 young adults aged 16-18 years (55%) and 24 adults (17%). The most common pre-treatment problems included malalignment (89%), overlapping teeth (60%), spacing (54%), teeth in the wrong position (48%) and overjet (47%). The most common symptoms were psychosocial concerns including embarrassment when smiling (62%), impact on general well-being (54%) and embarrassment to eat (25%). Pain was reported by 30 per cent respondents. The majority of respondents (97%) reported an improvement
following orthodontic treatment and fewer than 1 and 3 per cent of respondents reported worsening in problems and symptoms, respectively. Interestingly, 55 per cent reported improvement in dental health and 54 per cent reported improved ability to clean teeth. Those with pre-treatment problems and symptoms reported greater improvement in those specific domains, however, there was no significant difference in overall satisfaction between those with and without self-reported pre-treatment concerns.

CONCLUSION: People seek treatment for a range of problems and symptoms. Orthodontic treatment successfully addresses these issues for the majority of people and leads to a high level of satisfaction. The OPTIQ is a useful tool for measuring patient-reported concerns and outcomes.

SP 49 COMPARISON BY THREE-DIMENSIONAL MONITORING OF DENTOALVEOLAR EFFECTS AND KINETICS OF DISJUNCTION BY HYRAX SCREW VERSUS LEAF EXPANDER
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AIMS: Transverse maxillary deficiency is the most common problem in young patients. Many devices are usually employed to increase the transverse diameter, with different technical characteristics and biomechanical aspects. The aim of this research was to the dentoalveolar effects and kinetics of the leaf expander with a conventional Hyrax expander in growing patients.

SUBJECTS AND METHOD: Twenty patients (mean 10.0 ± 1.6 years) with maxillary hypoplasia were randomly assigned to a Hyrax or leaf expander group. Intermolar, premolar and canine distances and buccolingual tipping of these teeth were monitored using orthoanalyze software and dental monitoring. Student’s and Chi2 test were used for statistics.

RESULTS: The amount of expansion was comparable in both groups, but the speed was different (P < 0.01). The intermolar, interpremolar and intercanine distances were not statistically different in the two groups after treatment. No statistically difference was shown for tipping when considering the premolar and canine. Molar tipping was significantly more important with the Hyrax 4.2 ± 1.53 degrees, than in the leaf expander group 1.3 ± 1.26 degrees (P < 0.01)

CONCLUSION: There appears to be no difference between either appliance in term of expansion. The only differences were the higher degree of buccal tipping with the Hyrax expander and the slower expansion with the leaf expander.

SP 50 LATE DETECTION OF IMPACTED PERMANENT CANINES: A LONGITUDINAL PROSPECTIVE SURVEY
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AIMS: To assess the incidence of missed and/or late diagnosed impacted canines and to find out to what extent this caused complications. The secondary outcomes were to investigate the reasons for the missed diagnosis and to assess if any preventive measures were made.

MATERIALS AND METHOD: The study had a prospective longitudinal design and took place in the County Region of Halland, Sweden, during September 2015 to September 2018. Dental records of patients with impacted canines that had a late (>12 years of age) or missed diagnosis were consecutively collected. Additionally, patients were identified from a referral list of patients who had undergone surgical exposure or surgical extraction of impacted canines during the same time period.

RESULTS: Eighty-four individuals with 114 late or missed canines were found among 33,488 12-20 year old adolescents. The average age was 13.75 years (58% girls, 42% boys). In most patients the primary canine was persisting. Eighty six per cent of the missed canines were in the maxilla, the rest in the mandible. Of the maxillary canines 74.5 per cent were palatally impacted while for the mandibular canines 69 per cent were located buccally. The late/missed canine was discovered mainly by the general dental practitioner (74%), followed by the orthodontist (14%) and the dental
hygienist (12%). In 56 per cent of the cases it was not written in the dental records whether the canine could be palpated or not and only in 27 per cent was a diagnosis of the canine made. Root resorption of the adjacent teeth was noticed in 13 per cent of the patient’s but none of the teeth had to be extracted. No changes in clinical routines were made to avoid future late detections.

CONCLUSION: The incidence of late or missed diagnosis of impacted canines was very low. Root resorption of the adjacent teeth was observed in 13 per cent of the cases but none of these teeth had to be extracted.

SP 51  COMPARISON OF THE RESISTANCE TO SLIDING AT THE BEGINNING OF ORTHODONTIC MOVEMENT OF A 0.014 INCH NICKEL-TITANIUM ARCHWIRE IN 0.018 AND 0.022 INCH BRACKETS
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AIMS: To compare the resistance to sliding at the beginning of the orthodontic movement of a round 0.014 inch nickel-titanium (NiTi) archwire, in different 0.018 and 0.022 inch slot brackets of the same prescription.

MATERIALS AND METHOD: An experimental in vitro study was performed using various types of brackets (Roth prescription): conventional metallic 0.018 and 0.022 inch brackets, self-ligating aesthetic 0.018 and 0.022 inch brackets (Camaleón). Independent variables included the type of brackets, the type of ligature, the width of the bracket slot and the type of malocclusion (intrusion and tip). A materials testing machine with specific software was used to measure strength. ANOVA was performed to determine potential differences.

RESULTS: Average values of movement resistance were higher with 0.018 than in 0.022 inch brackets. These results were maintained when comparing malocclusions, with differences between 0.018 and 0.022 inch being steeper with tip than with intrusion (P < 0.001). The same outcome was obtained when comparing different types of ligatures, also resulting in self-ligating brackets (Camaleón) generating much less friction than metallic or elastomeric ligatures (P < 0.01).

CONCLUSION: There are significant differences regarding the resistance to sliding at the beginning of the orthodontic movement of a round 0.014 inch NiTi archwire between 0.018 and 0.022 inch brackets. The 0.018 inch brackets showed more friction than the 0.022 inch brackets.

SP 52  BOTOX FOR TREATING A GUMMY SMILE
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AIMS: To investigate the efficient, non-surgical, and less invasive use of Botox (BTX-A) injections for the correction of a gummy smile in orthodontics.

MATERIALS AND METHOD: PubMed, Medline and Cochrane databases were searched, and additional manual searches were undertaken for the period from January 2008 up to December 2018. All types of studies were included. The search focused on the correction of a gummy smile and any methods of BTX-A injection. The keywords used were: Botulinum toxin, Botox, gingival exposure, gingival display, gummy smile, hyperfunctional lip elevators, orthodontic. Articles were restricted to English and Spanish language publications only.

RESULTS: Seventy eight articles were found of which 24 that met the inclusion criteria were included. Two articles were systematic reviews, three articles used experimental in vivo design, five articles were pilot studies and seven papers were case reports.

CONCLUSION: Injection with BTX-A provides effective, minimally invasive, temporary improvement of gummy smiles for patients with hyperfunctional upper lip elevator muscles.

SP 53  CORRELATION OF TEMPOROMANDIBULAR JOINT DISORDERS WITH INCLINATION OF THE UPPER POSTERIOR OCCLUSAL PLANE IN CLASS II PATIENTS
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AIMS: To find the correlation between the steepness of the upper posterior occlusal plane with temporomandibular joint disorders (TMD) in Class II patients.

SUBJECTS AND METHOD: One hundred and thirty patients with a Class II malocclusion were examined, standardized anamnesis was collected. A clinical functional examination was accomplished, true hinge axis condylography and cephalometric evaluation were performed. The selection criteria were occlusal parameter availability for all patients, above 18 years of age and all teeth present in all quadrants (except third molars). The following technical equipment was used: condylograph and Cadiax Diagnostic, cephalostat, reference SL articulator, gamma dental software version 7.7.14. Cephalometric evaluation of the inclination of the upper posterior occlusal plane (upper 5 cusp to distal cusp upper 7) to palatal plane was performed and the individual horizontal plane was established. In order to assess the presence of TMD, a condylographic evaluation was performed for all patients.

RESULTS: Analysis of obtained data revealed that 63.8 per cent of Class II patients had signs of TMJD correlated with a steep posterior occlusal plane (67-81°). Also, the majority of Class II patients with TMJD showed a steepness of upper posterior occlusal plane of 76-77 degrees.

CONCLUSION: Inclinations of the upper posterior occlusal plane can be considered as a diagnostic criteria, predicting TMD. There is an evident correlation between the upper posterior occlusal plane and condylar displacement, especially in subjects with a Class II skeletal pattern. It is, therefore, important to determine upper posterior occlusal plane steepness, for a complex and detailed diagnosis. It provides the possibility to identify the patients at risk and to choose the most reasonable treatment plan.

SP 54 THE PREVALENCE OF GENDERS OF IMPACTED TEETH IN A NORTH-EASTERN ROMANIAN ORTHODONTIC POPULATION
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AIMS: Tooth impaction represents the intraosseous or intra-mucosal retention of a permanent tooth with a fully developed root, after the normal eruption period, without any potential for eruption. The purpose of the study was to analyze the prevalence of genders on a sample of patients with impacted teeth from the north-eastern region of Romania.

MATERIALS AND METHOD: The data from the orthodontic records of 67 patients (29 males, 38 females) with impacted teeth (except third molars), aged between 6-37 years (mean age 13.97 ± 5.35 years), treated between 1991-2010, were statistically evaluated using the SPSS 20.0 software package according to the oral status, the aetiological causes, the clinical and radiographic features and the treatment options.

RESULTS: Canine impaction (53.7%) was found with a ratio between males and females of 1:2, incisor impaction (37.3%) had a ratio 1:0.4 and premolar impaction (9.0%) a ratio of 1:0.8. The ratio between males and females for impactions was: single tooth (83.6%) was 1:1, for two teeth (16.4%) 1:0.9, total (76.1%) 1:1.2, partial (23.9%) 1:0.6, mild (9.0%) 1:1.5, moderate (14.9%) 1:0.8, severe (76.1%) 1:1, vertical (41.8%) 1:0.8, horizontal (22.4%) 1:0.7, oblique (35.8%) 1:1.9, buccal (37.3%) 1:1.1, palatal (37.3%) 1:0.8 and medium (25.4%) 1:1.1. For both genders the impacted teeth were more frequent in the maxilla, in Angle Class I (76.1%), the reasons being the decreased space (49.3%) and obstacles (40.3%). Conservative treatment had a ratio between genders of 1:1 and radical treatment of 1:0.9. Statistically significant correlations were found between genders and the types of impacted teeth ($P = 0.018$).

CONCLUSION: The prevalence on genders of impacted teeth in the studied sample had differences, especially in the case of canine and incisor, mild and oblique impactions, but statistically significant differences were found only for the types of impacted teeth.

SP 55 THE EFFICIENCY OF MULTIMEDIA AND VIDEO TOOLS IN ORTHODONTIC TRAINING
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AIMS: Research conducted over the past 20 years has found that multimedia instructional design has significant effects on the quality and ease of learning. The purpose of this study was to investigate postgraduate students’ options regarding classical and modern didactic methods adopted by academic staff during courses and the practical stages, in order to optimize the quality of teaching.

SUBJECTS AND METHOD: Forty two orthodontic postgraduate students (18 males, 24 females) aged between 24 and 27 years (average age 25.19 ± 1.087 years) completed a 15 item questionnaire about their opinions regarding the efficacy and attractiveness of three types of presentation used during courses and practical stages: (1) oral and practical presentations without multimedia support; (2) oral speech accompanied by PowerPoint presentations; and (3) oral speech accompanied by original videos, created in using Sony Vegas Movie Studio Platinum 14.0. Statistical analysis was performed in SPSS 16.0 (SPSS Inc., Chicago, Illinois, USA) for Windows

RESULTS: Eighty one per cent of postgraduate students preferred oral speech accompanied by videos, without significant differences between genders (P = 0.650). Oral speech accompanied by PowerPoint presentations was preferred by 52.4 per cent (females 58.3%, males 44.4%), but still without significant differences (P = 0.372). Oral and practical presentations without multimedia support was chosen by 35.7 per cent, without a significant difference between genders (P = 0.710).

CONCLUSION: Multimedia content is accepted by postgraduate students in orthodontics as the most efficient way to receive theoretical and practical information. The findings confirm previous research about the good impact of using videos as didactic tools on catching postgraduate students’ attention during classes.

SP 56 DETERMINING TRENDS AND REASONING BEHIND PATIENTS WHO DISCONTINUE TREATMENT PRIOR TO ORTHOGNATHIC SURGERY
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AIMS: At a time of finite resources, it is important to justify that orthognathic case selection is optimal to prevent waste of clinical and patients’ time. Patients who cease treatment prior to their planned surgery may indicate insufficient pre-treatment discussion prior to the consent process. As a result, patients can often be left with a compromised result. The aim of this study was to determine the number of patients who discontinue treatment prior to undergoing orthognathic surgery, but after pre-surgical orthodontics has commenced; and ascertain possible reasons for this.

MATERIALS AND METHOD: Clinical notes and letters of all joint clinic attendees over a five year period were scrutinised. Failure or success in completing all treatment was noted and tabulated. The proportion of those who fully completed treatment, including their planned surgery, was compared with those who discontinued treatment after commencement of pre-surgical orthodontics.

RESULTS: Nine subjects (7%) out of 123 failed to complete treatment with a mean treatment duration of 19 months. The mean age of these nine patients at their first joint clinic was 22 years with 5/9 (56%) being females with a Class II skeletal pattern - a trend noted in similar projects. Compliance (44.5%) and social circumstances (33.5%) were the most common reasons for discontinuation of treatment.

CONCLUSION: Drop out proportions from the UK have been reported between 7 and 28 per cent, demonstrating how this centre is performing well against the units that make up this spectrum.

SP 57 MULTI-LEVEL BIOLOGICAL RESPONSES FOLLOWING LOCALIZED PIEZOELECTRIC ALVEOLAR DECORTICATION TO ACCELERATE ORTHODONTIC TOOTH MOVEMENT: A STUDY IN RATS
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AIMS: To explore alveolar bone tissue response and its dynamics at the tissue, cellular and molecular levels following a piezocision procedure in a rat model.

MATERIALS AND METHOD: Sixty rats were randomly allocated to either a control (conventional orthodontic tooth movement; TM) or a test (piezocision-assisted orthodontic tooth movement; TM+PS) group. Tissue, cellular and molecular analyses were performed at 7, 28 and 42 days after the procedures. Orthodontic tooth movement (OTM) and bone volume fraction (BVF) were evaluated using nano-computed tomographs. Moreover, histological parameters such as the number of osteoclasts were assessed, and the expression of cytokines involved in the bone turnover was investigated using quantitative real time polymerase chain reaction analysis.

RESULTS: OTM was 1.8 times faster in the TM+PS compared with TM at day 42. A significant decrease in BVF was found in the TM+PS group compared to the TM group at day 7 and day 28, while no difference was observed at day 42. The number of osteoclasts was significantly higher in the TM+PS group compared to the TM group at day 7. No difference between the two groups was found in the number of osteoclasts involved in root resorption. RANKL and osteoprotegerin were significantly higher in the TM+PS group than in the TM group at day 7.

CONCLUSION: Under the above conditions, the efficacy of piezocision-assisted alveolar decortication to accelerate tooth movement was demonstrated, and the underlying biological responses at the tissue, cellular and molecular levels were emphasized.

SP 58 EFFECTS OF COMBINED ADMINISTRATION OF PARATHYROID HORMONE AND BISPHOSPHONATE IN THE MANDIBULAR CONDYLE OF MICE
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AIMS: The concurrent administration of parathyroid hormone (PTH) and bisphosphonate has been suggested as a therapy to increase bone density in osteoporotic patients. The goal of this study was to determine the effects of this combination (PTH and bisphosphonate Alendronate) in the cartilage and subchondral bone of the temporomandibular joint of mice.

MATERIALS AND METHOD: Three-week-old triple collagen reporter mice (Col1a1-green X Col2a1-blue X Col10a1-red) were injected with 60 μg/kg of PTH (daily), 50 μg/kg of Alendronate (once every 3 days), PTH and Alendronate or saline solution (control group) for 10 days. All mice received injections of fluorochrome labels (calcein and alizarin) and cell proliferation label (ethynyldeoxyuridine) before euthanasia. Changes in the mandibular condyle were assessed by microcomputed tomography (μCT) and histology. One-way ANOVA was used for statistical comparison between groups.

RESULTS: μCT analysis revealed that mice in the PTH group showed a significant increase in bone volume, while Alendronate and PTH and Alendronate groups presented with greater bone volume. Analysis of mineralization labels showed a similar trend, however the combination of PTH and Alendronate caused significant increased mineralization as illustrated by a decrease in the distance between the mineralization labels and the outer layer of the cartilage. Moreover, PTH treated mice showed a significant decrease in Col1a1 positive cells (undifferentiated pre-chondrocytes), while Alendronate treatment induced an opposite effect. Regarding distribution of Col2a1 (differentiated chondrocyte), all experimental groups exhibited increased numbers of Col2a1 cells in comparison to the control. In addition, PTH treatment significantly reduced the number of Col10a1 positive cells (hypertrophic chondrocytes), while Alendronate administration significantly increased the number of hypertrophic chondrocytes. Finally, it was observed that PTH or Alendronate treated mice showed increased extracellular matrix synthesis, while the combination of PTH and Alendronate decreased the separate effects of these drugs.

CONCLUSION: PTH or Alendronate administration increases cartilage thickness and subchondral bone mineralization, although each of these agents induces distinct effects in chondrocyte differentiation. However, the enhanced mineralization caused by the combination of PTH and Alendronate caused a decrease in cartilage thickness.
RELIABILITY OF A MICROSCREW DEVICE USED AS ORTHODONTIC ANCHORAGE: A CLINICAL LONGITUDINAL STUDY
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AIMS: Miniscrews have become a useful alternative as orthodontic anchorage elements despite relatively low reliability. Less is known about the reliability and clinical effectiveness of the microscrew device ‘CT8’. The aim of the study was to evaluate the success rate of the microscrew device ‘CT8’ in routine orthodontic treatment.

MATERIALS AND METHOD: This was a longitudinal study from October 1999 to February 2015, with five practitioners operating in two centres. The microdevice comprised one or two screws made of Ti6Al4V alloy, with a length of 5 mm and a diameter of 2 mm, associated with 11 types of connector wire adapted to the clinical situation. The device was introduced under the free mucosa at five different anatomic sites. The connector wires emerged at the bottom of the vestibular fold, offering a large amount of orthodontic movement possibilities from incisor intrusion until autonomous impacted canine traction. The primary endpoint was the survival rate of the device (screws and connectors) at least 12 months after insertion.

RESULTS: A total of 644 microscrews (381 maxilla, 263 mandible) fixed to 434 connectors were inserted in 262 patients (164 females/98 males). An overall cumulative survival rate of 96.8 percent (intraclass correlation 95% [94.5-98.1]) was found for the microscrew device. Sixteen microscrews and five connectors failed in 14 patients. Otherwise, clinical evaluation revealed successful dental movements during orthodontic therapy: incisor intrusion, incisor retraction, molar intrusion, molar uprighting, molar distalization, molar mesialization, impacted canine traction.

CONCLUSION: This is one of the largest longitudinal studies in the category of temporary bone anchorage. This anchorage system represents a new tool in the orthodontic therapeutic arsenal.

CORROSION RESISTANCE AND IONS DISSOLUTION OF RHODIUM-COATED NICKEL TITANIUM AND NICKEL WIRES IN ACIDIC PH SOLUTIONS
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AIMS: To compare the corrosion resistance potential and ion dissolution of the surface of modified and non-modified nickel-titanium (NiTi) and nickel (Ni) wires in varying acidic pH solutions.

MATERIALS AND METHOD: Four types of wires (Rh coated Ni, Rh coated NiTi, uncoated Ni, uncoated NiTi) with a diameter of 0.016 × 0.022 inches and a length of 25 mm were tested. Wires were individually submerged in lactic acid solutions of varying pH (7.5, 3.5) at 37°C constant for 1 and 2 weeks. Solutions were then analyzed with inductively coupled plasma-atomic emission spectrometry for detection of released metal ions.

RESULTS: All wires showed an increase of metal ions dissolution with time. Uncoated Ni wires released the highest levels of Ni ions followed by Rh-coated Ni, NiTi, Rh-coated NiTi. Rh coated Ni showed less release in week 1 and 2 (−59.57%, −82.92%) compared to uncoated Ni. Significant difference in ions release was found between coated and uncoated Ni for both week 1 and 2 (P = 0.0005, P < 0.0001). Coated NiTi showed a higher release of Ni and Ti ions in week 1 (78.49%, 30.22%), uncoated NiTi showed a higher release in week 2 (69.27%, 77.34%). Total release of Ni and Ti ions were lower in the coated Ni group (−9.30%, −42.23%). Total Ti ions was significantly different by week 2 (P = 0.0006), no significant difference was observed in Ni (P = 0.3124).

CONCLUSION: Rhodium as a coating material is aesthetic, corrosion resistant and chemically inert. However, the coating could not provide absolute resistance against acidic attacks. Dissolution observed in coated NiTi could suggest galvanic corrosion activity occurring on parts of wires with possible coating defects, such as cracks or chipping. Despite the increase of dissolution in NiTi wires, levels were under the daily intake threshold. NiTi should be considered a safe and stable...
material, suitable for daily clinical use. Rhodium coating proved to be a valid option for added protection, but further trials and developments may be needed.

SP 61 INFLUENCE OF VARIOUS RETAINERS ON CARIES RISK FACTORS: A RANDOMISED CONTROL TRIAL***
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AIMS: Being foreign objects, removable orthodontic retainers may alter caries risk factors such as salivary flow rate, pH and buffering capacity. In addition, they may influence oral hygiene status and demineralisation incidence. This study aimed to investigate the influence of various removable orthodontic retainers on salivary characteristics, oral hygiene status and demineralisation incidence.

SUBJECTS AND METHOD: Twenty subjects were randomised into three groups to receive either Hawley, Essix or Vivera® retainers after debonding. Another four subjects who had not received orthodontic treatment with an Index of Treatment Need (IOTN) score of 2 and below served as the controls. Oral hygiene status was assessed by measuring the plaque score using the O’Leary Index (O’Leary et al., 1972). Demineralisation incidence was recorded using the International Caries Detection and Assessment System (ICDAS II). Unstimulated salivary flow rate, pH, buffering capacity, plaque score and demineralisation incidence were recorded 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 unstimulated salivary flow rate, pH, buffering capacity and plaque score among the four groups adjusting for their respective T0 measurements. Poisson regression was performed to evaluate the demineralisation incidence among the four groups. All the analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, North Carolina, USA). Significance level was set at $P < 0.05$.

RESULTS: There were no significant difference in the unstimulated salivary flow rate ($P = 0.480$), pH ($P = 0.835$), buffering capacity ($P = 0.614$) and plaque score ($P = 0.874$) for the Hawley, Essix, Vivera® and control group at T1 after adjusting for their respective T0 measurements. However, the demineralisation incidence for the Hawley group was significantly higher compared to the Essix ($P = 0.044$) and control ($P = 0.007$) group.

CONCLUSION: Hawley retainers displayed an increased demineralisation incidence as compared to the Essix retainer and should not be recommended to susceptible patients from a caries-risk point of view.

SP 62 SOCIAL AND PSYCHOLOGICAL EFFECT OF IMPACTED INCISORS ON THE CHILD PATIENT AND THEIR PARENT
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AIMS: To investigate how patients and their parents are affected by impacted maxillary incisors socially and psychologically. The secondary aim was to explore what information patients would like to be given about their impacted maxillary incisors and how they would like to receive it.

SUBJECTS AND METHOD: A qualitative methodology was employed where semi-structured, in-depth interviews were undertaken with child orthodontic patients and separately with their parents to identify common themes within each group. In total, 23 participants were interviewed, 11 of which were children (mean age of 10.4 years) and 12 parents.

RESULTS: Framework analysis of the interview transcripts identified several themes. Themes from the child patient group included lifestyle changes, self-esteem, the gold chain, information they would have liked to have prior to treatment and peer opinion. Parental themes included the effect of impacted teeth and treatment on their child’s life, concerns regarding school and social life
changes, general anaesthetic, information they would have like to receive before treatment and modes of information. Many of the participants felt there had been significant changes in their daily life as a result of their impacted maxillary incisor and treatment. These included changes that needed to be made to their diet, sports and smiling. Both parents and children worried about future problems including bullying and thought completing treatment before secondary school was important to avoid these problems. Parents expressed significant concern about the anaesthetic procedures and lack of information. Most of the participants wanted their clinician to give them all relevant information verbally.

CONCLUSION: This study has indicated that there is a wide range of perceived social and psychological effects related to both having an impacted maxillary incisor and its subsequent treatment. Aspects most important to children and their parents have been identified. These can be utilised to ensure children and their parents are well-informed and prepared for the treatment they are undertaking, thus improving both the level of care and treatment experience.

SP 63 AN AUDIT ON THE QUALITY OF ORTHODONTIC PHOTOGRAPHS BY DENTAL CARE PROFESSIONALS
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AIMS: To assess the quality of orthodontic photographs taken by dental care professionals (DCPs) and ensure all photographs had valid consent. Orthodontic photographs taken by DCPs form important records for multidisciplinary clinics at Newcastle Dental Hospital. The British Orthodontic Society and General Dental Council state the importance of obtaining photographic records.

MATERIALS AND METHOD: The gold standard was that 100 per cent of records should have valid consent and 100 per cent of records should consist of nine photographs (4 extraoral, 5 intraoral). Regarding quality: 95 per cent of photographs should meet a satisfactory quality. From the 1st May 2018, 50 consecutive patient records were accessed using the Dolphin software via a secure National Health Service. All 50 paper records were obtained from medical records. A secure spreadsheet was created which had a list of quality indicators for extra- and intraoral photographs. The percentage of photographs conforming to these indicators could be calculated and an overall percentage given.

RESULTS: In total 450 photographs were audited. All patient records contained a consent form (complete in 94% of records). All patients had a standard set of nine photographs but with variability in quality. From 200 extraoral photographs, 81 per cent met requirements with the main issues including camera focus and head positioning. Intraoral (general), from 250 photographs, 77 per cent met requirements, but camera angulation and the occlusal plane were frequently highlighted as unsatisfactory. From 100 buccal photographs, 57 per cent met requirements and only half demonstrated the molar relationship. From 100 occlusal photographs, 80 per cent met the requirements.

CONCLUSION: From the first audit cycle, all photographs had valid patient consent, with a standard set of nine photographs available. There was variability in the quality with only 57 per cent of intraoral (buccal) photographs meeting a satisfactory standard. The action plan has so far included presentation and a teaching session for DCPs. Photographs form part of important contemporaneous records for orthodontists, required to aid diagnosis and in case of litigation. Low quality photographs waste time and can result in a wrong diagnosis if relied upon. A second audit cycle is planned for Spring 2019.

SP 64 APPROPRIATENESS OF ORTHODONTIC REFERRALS TO WHIPPS CROSS HOSPITAL: AN AUDIT
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AIMS: To determine the appropriateness of orthodontic referrals to Whipps Cross Hospital. A 90 per cent target was set for the following criteria: patients with satisfactory dental health; patients who desired treatment; correctly timed referrals according to the British Orthodontic Society (BOS)
‘Quick reference guide to orthodontic assessment and referral’ which is based on dental development and patients added to the waiting list

MATERIALS AND METHOD: A prospective two-cycle audit was carried out on the new patient clinic of three orthodontic consultants. A proforma was created and data collected on 200 new patients between July and December 2017. Following this, an intervention was held by means of an educational Section 63 meeting with local referrers, including both general dental practitioners (GDPs) and specialists. This covered a variety of topics. Referral guidelines and a referral proforma were also sent to all referrers by post. A second cycle was undertaken between June and October 2018 ensuring all new referrals were sent after the meeting.

RESULTS: The majority of patients were referred by GDPs with an IOTN of 4. The number of patients with an IOTN 5 increased from 34 to 38 per cent. Minimal change was seen in satisfactory dental health, which improved by only 2 per cent to 73 per cent. An improvement was seen in patients wanting treatment from 87 to 95 per cent. Both cycles showed 98 per cent of referrals were correctly timed according to the BOS guidelines but also that only 24 per cent were added to the waiting list. This was predominantly due to suitability for care in practice and early referrals in both cycles, the latter of which was attributed to orthognathic patients and intervention of skeletal discrepancies.

CONCLUSION: Only minor improvements were seen following the intervention. Targets were achieved for desire for treatment and referral timing only. However, many referrals that required growth modification or cessation were deemed as too early, highlighting that dental development is not necessarily indicative of treatment timing. This audit has also highlighted great difficulty in changing practitioners’ clinical practice. More regular interactive local meetings may be required.

SP 65 OPEN BITE: EXTRACTIONS VERSUS SKELETAL ANCHORAGE. A LITERATURE REVIEW
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AIMS: To perform a literature review regarding stability of open bite closing with temporary anchorage devices (TADs) versus extraction treatment

MATERIALS AND METHOD: The databases searched were PubMed (MeShDatabase)-Medline, Science Direct, EMBASE, Cochrane Library, as well as hand-search of journals: American Journal of Orthodontics, European Journal of Orthodontics, International Journal of Oral and Maxillofacial Surgery, International Orthopaedics and Journal of Craniofacial Surgery. Keywords: open bite, treatment, stability, extraction, TADs, miniscrews, miniplates, molar intrusion, incisor extrusion. Retrospective observational and case control studies were included in the search with at least nine patients per group.

RESULTS: From 342 initial articles searched, only six articles were included in the review. Extraction treatment is stable, despite the fact that it may cause some molar extrusion. TAD intrusion results in a stable closing of the open bite, but further long-term studies are still needed.

CONCLUSION: Nowadays, the therapeutic approaches regarding an open bite are fundamentally focused on skeletal anchorage, which presents a risk-benefit cost much more favourable for the patient than orthognathic surgery. The skeletal anchoring devices perform absolute intrusion of the posterior teeth, favouring mandibular anterorotation and consequently producing closure of the anterior open bite. Tooth extractions solely for the purpose of a decrease in the vertical dimension of a patient and increased overbite in the treatment of open bite is not justified since the differences in treatment in patients treated with extractions with respect to those treated without extractions are not statistically significant.

SP 66 ASSESSMENT OF ORTHODONTIC TREATMENT BASED ON AESTHETIC COMPONENTS OF THE INDEX OF ORTHODONTIC TREATMENT NEED IN THE SERBIAN ADOLESCENTS
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AIMS: The greatest motivating factor for undertaking of orthodontic treatment is poor dental aesthetics, as a consequence of occlusal abnormalities. The aim of this study was to determine the need for orthodontic treatment on the basis of the aesthetic component (AC) of the Index of Orthodontic Treatment Need (IOTN), to compare the degree of the AC of the IOTN and subjective perception of individuals about their dental aesthetics, and to compare the evaluation of the AC of the IOTN subject in comparison with the evaluation of the therapist.

SUBJECTS AND METHOD: The study was conducted on a sample of 70 pupils, age 9-10 years, who were not in orthodontic treatment prior to the survey. The research was carried out with the use of the IOTN which consists of dental and aesthetic components on the basis of which the need for therapy is determined.

RESULTS: According to the grades of subjects the need for orthodontic treatment was present in 10.53 per cent of male subjects and 9.38 per cent of female subjects. According to evaluations by the therapists, the need for orthodontic treatment was present in 7.89 per cent of male subjects and 12.50 per cent of female subjects. The difference was not statistically significant.

CONCLUSION: Subjects have quite a rational view about the aesthetics of the teeth and the need for orthodontic treatment. Good correlation between self-perception and the real need for therapy indicates that patients are able to understand their clinical condition. Such understanding has a positive effect on the goals of the treatment, reduces the likelihood of compromised outcomes of the treatment and guarantees better results.

SP 67  CLINICAL OUTCOMES OF A NEW ORTHOPAEDIC APPLIANCE FOR CLASS III MALOCCLUSION TREATMENT: A CEPHALOMETRIC STUDY
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AIMS: To evaluate the dental and skeletal effects of a new orthopaedic appliance for the treatment of Class III malocclusions in growing patients.

MATERIALS AND METHOD: This retrospective cephalometric study was performed on a sample of 18 subjects with a skeletal Class III malocclusion (4 males; 14 females; mean age 8.8 ± 1.5 years) treated with the Pushing Splints 3 (PS3) protocol. The control group consisted of 18 subjects (5 males; 13 females; mean age 9.1 ± 1.8 years) selected from a database of subjects with untreated Class III malocclusions. The cephalometric analysis was performed at the beginning (T0) and end of the orthopaedic therapy (T1). Significant differences between the treated and control groups were assessed with an independent samples t-test (P < 0.05).

RESULTS: In the PS3 group T1 values showed a forward displacement of the maxilla resulting in a statistically significant increase of the SNA angle. ANPg and Wits appraisal improved significantly compared with the control group. Lingual inclination of the mandibular incisors and buccal inclination of the upper incisors were significantly increased in comparison to the control group. No significant differences were recorded for backward mandibular rotation.

CONCLUSION: The PS3 was effective for orthopaedic treatment in growing Class III patients. Favourable dental and skeletal changes were observed in the maxilla. In the treated group, no significant differences in mandibular divergence were found when compared to the control group.

SP 68  SECONDARY ALVEOLAR BONE GRAFTING USING AUTOLOGOUS VERSUS ALLOPLASTIC MATERIAL IN PATIENTS WITH A CLEFT LIP AND PALATE: SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: A systematic review assessing autologous bone versus alloplastic material for secondary alveolar bone grafting in patients with a cleft lip and palate was published in 2011 that included only one randomized controlled trial comparing traditional iliac bone graft to recombinant human
bone morphogenetic protein-2 (rh-BMP2). The aim was to perform a systematic review with meta-analysis on the use of secondary alveolar bone grafting (autologous bone and rh-BMP2 graft) in order to improve bone volume and height in patients with a cleft lip and palate (CLP).

MATERIALS AND METHOD: An electronic search was conducted via PubMed/Medline, Cochrane Central Register of Controlled Trials (Control) via Cochrane Library; Embase via Ovid and Lilac for studies published between January 2008 and September 2018. The systematic review registration number at PROSPERO was 42018085858. Only randomized clinical trials were included. Inclusion criteria were patients with the diagnosis of unilateral CLP older than 5 years of age; radiographic evaluation [computed tomograph (CT) and/or cone beam CT] of the cleft area; at least a 6-month follow-up. Bone formation and bone height by radiographic CT evaluation (pre-operatively, after 6 months and after 1 year of follow-up) and length of hospital stay were assessed.

RESULTS: Four studies met strict inclusion criteria. Autologous bone graft showed statistically significant higher bone formation after 6 month follow-up [mean difference –14.410; 95% confidence interval (CI) –22.392 to –6.428; \( P = 0.000 \)]. No statistically significant difference was noted after 1-year follow-up (MD 6.227; 95% CI –15.967 to 28.422; \( P = 0.582 \)). No statistically significant difference in bone height was noted after 6 months (MD –18.737; 95% CI –43.560 to 6.087; \( P = 0.139 \)) and at the 1year follow-up (MD –4.401; 95% CI –30.636 to 21.834; \( P = 0.742 \)). Patients who underwent rh-BMP2 graft had a statistically significant reduced hospital stay (MD –1.146; 95% CI –2.147 to –0.145; \( P = 0.025 \)).

CONCLUSION: Autologous bone and rh-BMP2 graft showed similar effectiveness in maxillary alveolar reconstruction in patients with unilateral CLP assessing bone graft volume and height although rh-BMP2 graft showed, with high uncertainty level, a relatively shorter length of hospital stay.

SP 69  OPTIMIZING ALIGNER TREATMENT WITH REMOTE MONITORING***
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AIMS: Aligner treatments are now an integral part of the therapeutic range for today’s orthodontists. However, one of the key points of a satisfactory outcome for those treatments is observance on the part of the patient and regular control on the part of the practitioner. The aim of this study was to evaluate if new technology of remote monitoring, artificial intelligence and ‘Go Live’ protocols could improve compliance and efficiency in adult aligner treatment.

SUBJECTS AND METHOD: A three-year study was conducted including 2000 adult patients undergoing aligner treatment, using a mobile app to take intraoral photographs for remote monitoring. Patients were educated to take these photographs at the end of each aligner. A dental monitoring service with artificial intelligence analysis and a clinical team, checked all photographs, particularly on the adaptation of the aligners. Notifications were classified as: satisfactory adaptation of aligner, slight unseat, noticeable unseat. Protocols were predefined, according these results, in which patients received an instruction to change to next aligner ‘Go Message’ or to maintain their aligners ‘No Go message’ with different advices to wear their aligners permanently.

RESULTS: Significant improvements were globally observed in terms of better adaptation of treatment and reduction of importance and frequency of additional reassessment. Some clinical cases will be presented to show the first benefits of this new protocol. The GoLive protocol of remote monitoring, with continuous stimulation, allowed the patient to become more proactive and implicated in treatment. This could be an explanation as to why improvement in compliance and efficiency was observed.

CONCLUSION: Regular remote monitoring can complement aligner treatment by augmenting the amount of clinical control while optimizing the therapeutic action of the treatment.

SP 70  A PROSPECTIVE STUDY ON THE EFFECTS OF CASEIN PHOSPHOPEPTIDE-AMORPHOUS CALCIUM PHOSPHATE PASTE, FLUORIDE AND A COMBINATION ON WHITE SPOT LESIONS IN ORTHODONTIC PATIENTS AFTER DEBONDING
Aims: To assess the influence of casein phosphopeptide-amorphous calcium phosphate paste (CPP-ACP paste, fluoride and a combination on the development and evolution of white spots lesions (WSL) based on clinical investigation.

Subjects and Method: Patients with at least three WSL at debonding were included. They were randomly allocated to four groups: control group, TM (CPP-ACP) group, MIPP (CPP-ACP/Fluoride) group and EMG (highly concentrated fluoride gel) group. The application of the assigned products was as instructed and differed by group. The additional use was complementary to conventional fluoride toothpaste. The primary outcome measure was the change in WSL determined by the Andersson Index scaled by clinical photographs measured at debonding (T0), and at 2 (T1) and 4 (T2) months after debonding. Statistical analysis was performed using the Chi-Square test ($P < 0.05$).

Results: One hundred and ninety two teeth were enrolled in this study: TM (n = 61), MIPP (n = 50), EMG (n = 40) versus control group (n = 41). There was a statistically significant improvement ($P < 0.001$) of WSL (reduction in the Andersson Index from higher to a lower grade) over 2 and 4 months for all the groups. Improvement of grade 0 for TM: 41.7 per cent between T0-T1, 9.2 per cent between T1-T2 and an overall improvement of 54.8 per cent. For MIPP, there was an improvement: 14.1 per cent between T0-T1, 14.2 per cent between T1-T2 and an overall improvement of 30.3 per cent. For EMG, the percentages were 25.5, 9.8 and 37.8, respectively. For the control group, there was an improvement of 23.0 per cent between T0-T1, 5.6 per cent between T1-T2 and overall of 29.9 per cent. Comparing the groups, the results were statistically significant ($P < 0.001$) for the experimental groups but not for the control group ($P > 0.05$).

Conclusion: The additional use of CPP-ACP-paste, fluoride and a combination improved the reduction of WSL 2 and 4 months after debonding in comparison with conventional fluoride toothpaste.

SP 71 IS IT NECESSARY? IS A GROUP AND SAVE A REQUIREMENT FOR PATIENTS REQUIRING ORTHOGNATHIC SURGERY?
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Aims: To retrospectively assess the incidence of blood transfusions in patients requiring orthognathic surgery and to investigate the need for pre-operative group and save analysis. There are patient safety and financial implications associated with blood transfusions and pre-operative testing and the risks and disadvantages of these traditional practices versus the benefits and clinical gain within this subspeciality will be considered.

Materials and Method: Clinical records and data of the most recent 100 patients who underwent orthognathic surgery, performed by the same consultant surgeon, were retrospectively assessed to identify the pre-operative blood testing carried out and if a post-operative blood transfusion was given and why.

Results: One hundred per cent of patients were found to have a group and save prior to surgery and the results revealed that, in all cases, an intraoperative or post-operative blood transfusion was given to 0 per cent of patients following orthognathic surgery.

Conclusion: It is suggested that the need for pre-operative group and save analysis is unnecessary and requires further consideration given the low rate of blood transfusions post-orthognathic surgery; however further research and collaboration with other centres would be helpful in establishing speciality wide guidelines. This initial study has identified areas for discussion and consideration which will aid clinicians in considering the overall implications of requesting special investigations but also the importance of judicious patient management for each individual case.
CONVENTIONAL HERBST VERSUS HERBST WITH TEMPORARY ANCHORAGE DEVICES:
BIBLIOGRAPHIC REVIEW
Alejandro Dias Méndez, Ethel Martín Acosta, Iván Nieto Sánchez, Ana Macías Gago, Laura Aneiros Fernández, San Rafael Hospital, Centro Universitario San Rafael-Antonio de Nebrija University, Madrid, Spain

AIMS: To compare conventional Herbst versus Herbst with miniscrews regarding lower incisor proclination through a literature review

MATERIALS AND METHOD: A bibliographic review was made in databases such as PubMed, Cochrane, Web of Science, Embase and Scopus until November 2018 using the keywords ‘herbst’, ‘incisor inclination’ and ‘miniscrews’. Only articles that analyzed the proclination of the lower incisor, among other parameters, with the use of Herbst were selected.

RESULTS: Only seven articles that met the inclusion criteria were included. Of these, six found significant differences in relation to proclination of the lower incisor associated with Herbst with temporary anchorage devices (TADs). Only one did not find statistically significant differences between the use of conventional Herbst or together with TADs; however, the group with TADs showed a lower inclination of the incisors than the group without skeletal anchorage.

CONCLUSION: The use of a Herbst appliance together with TADs may be able to reduce inclination of the lower incisors, compared with the use of a Herbst alone.

NON-EXTRACTION TREATMENT OF SEVERE CROWDING IN ADULT PATIENTS WITH LINGUAL ORTHODONTICS***
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AIMS: To present the opportunities for non-extraction treatment of severe crowding with the STb lingual technique.

SUBJECTS AND METHOD: Orthodontic treatment was undertaken in 18 patients (female), aged 23 to 48 years, with a skeletal Class I and severe crowding, more than 7.0 mm. They were treated non-extraction with STb lingual appliances in the upper and lower arches. The braces were attached by indirect positioning after digital set-up. A full orthodontic analysis, included casts, cephalometric analysis and photographs, was undertaken before and after orthodontic treatment. Statistical evaluation was made using descriptive, variation and graphic analyses.

RESULTS: Distalization, inclination and interproximal stripping of the teeth was carried out according to the diagnosis and treatment plan to complete levelling and alignment of dental arch to a Class I occlusion. In two patients changes in the vertical skeletal discrepancies were observed. Correction of the overbite is observed in 50 % of patients with a dentoalveolar deep bite. Within the dental arch changes were measured (I/NS: 5.2 ± 6.8°; i/MP: 6.75 ± 9.75°; I/i: 6.84 ± 9.16°; LO: 1.34 ± 3.36; Lu: 0.85 ± 2.95).

CONCLUSION: The STb lingual technique is effective, aesthetic and comfortable. The biomechanics of STb braces allows three-dimensional levelling of the teeth, which reduces the number of extractions required in the orthodontic treatment of patients with severe crowding.

CORRECTION OF CROWDING IN ADULT PATIENTS WITH DIGITAL ALIGNERS
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AIMS: To follow-up the rate of dental correction in the treatment of mild crowding with digital aligners (Dent@Lign).

SUBJECTS AND METHOD: Digital aligners were used to treat mild crowding (3-7 mm) in 41 dental arches (13 upper, 28 lower) of 26 patients, aged 21 to 61 years. Each step of treatment included three aligners, each with a different thickness: 0.5, 0.625 and 0.75 mm. The patients were required to wear the aligners at least 20 hours a day, according to the treatment plan. Digital set-up and virtual analyses were conducted for every patient that allowed determination of the number of treatment steps of aligners before the beginning of treatment. Motivational models were produced
for all patients including adjusted transparent passive retainers with a 1 mm thickness. For all patients included in the study, treatment results were reached from the previous virtual analyses. The results can be visualized by successfully adjusting the transparent passive retainer, made before the beginning of treatment, and after the end of treatment. The values of rotations and inclinations (tip and torque) were measured for every step until the end of treatment. Statistical evaluation was made using descriptive, variation and graphic analyses.

RESULTS: Rotations and inclinations (tip and torque) and interproximal stripping of the teeth was undertaken according to the virtual analyses and treatment plan to complete levelling and alignment of the dental arch. The final results were achieved by a shift in the aligners on average at an insertion step for rotation (3.06 ± 3.39° for the upper dental arch, 3.04 ± 4.08° for the lower dental arch; tip: 1.47 ± 5.00° for the upper and 1.34 ± 2.00° for lower dental arch; torque: 1.63 ± 2.15° upper and 1.01 ± 2.39° lower dental arch).

CONCLUSION: Dent@Lign digital aligners are an effective treatment alternative for crowding in adult patients.

SP 75 LET’S FACE IT: THE EFFECT OF ORTHOGNATHIC SURGERY ON FACIAL RECOGNITION

ANALYSIS

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AIMS: To evaluate the ability of a publicly available facial recognition application program interface (API) to calculate similarity scores for pre- and post-surgical photographs of patients undergoing orthognathic surgery. The primary objective was to identify which surgical procedure(s) had the greatest effect(s) on similarity score.

MATERIALS AND METHOD: Standard treatment progress photographs for 25 retrospectively identified, orthodontic-orthognathic patients were analyzed using the API to calculate similarity scores between the pre- and post-surgical photographs. Photographs from two pre-surgical timepoints were compared for each patient as controls. Both relaxed and smiling photographs were included in the study to assess the added impact of facial pose on similarity score. Surgical procedure(s) performed on each patient, gender, age at time of surgery, and ethnicity were recorded for statistical analysis. Non-parametric Kruskal-Wallis rank sum tests were performed to univariately analyze the relationship between each categorical patient characteristic and each recognition score. Multiple comparison Wilcoxon rank sum tests were performed on the subsequent statistically significant characteristics. P values were adjusted for using the Bonferroni correction technique.

RESULTS: Patients that had surgery on both jaws had a lower median similarity score, when comparing relaxed expressions before and after surgery, compared to those that had only mandibular surgery ($P = 0.014$). It was also found that patients receiving LeFort and bilateral sagittal split osteotomy (BSSO) surgery had a lower median similarity score compared to those that received only BSSO ($P = 0.009$). For the score comparing relaxed expressions before surgery versus smiling expressions after surgery, patients receiving two-jaw surgery had lower scores than those that had only mandibular surgery ($P = 0.028$). Patients that received LeFort and BSSO surgery were also found to have lower similarity scores compared to patients that received only BSSO when comparing pre-surgical relaxed photographs to post-surgical smiling photographs ($P = 0.036$).

CONCLUSION: Two-jaw surgery was associated with a statistically significant decrease in similarity score when compared to one-jaw procedures. Pose was also found to be a factor influencing similarity scores, especially when comparing pre-surgical relaxed photographs to post-surgical smiling photographs.

SP 76 A HOSPITAL-WIDE AUDIT TO ASSESS THE ACCESSIBILITY AND PROFESSIONALISM OF CLINICAL STAFF AND STUDENTS’ FACEBOOK PROFILES
AIMS: Social media is an integral part of modern society and is increasingly being used by patients and clinical staff alike. The General Dental Council (GDC) and most employers have social media guidelines to ensure employees use social media responsibly and do not put their organisations into disrepute. This was a hospital-wide prospective audit carried out from January to March 2018, which aimed to establish the accessibility of Facebook social media profiles of the staff and students at Eastman Dental Hospital (EDH) to the general public and to assess compliance with the latest GDC social media guidance (2016).

MATERIALS AND METHOD: The names of all clinical members of staff and students at EDH were searched for on Facebook using a dummy profile account, to simulate a member of the general public. The profiles were assessed for the accessibility of personal information, affiliations to University College London (UCL) or University College London Hospital (UCLH), personal views, social networking and unprofessional conduct. The gold standard was 100 per cent compliance with: (a) GDC’s social media guidance; (b) UCL and UCLH social media policies.

RESULTS: Two hundred and nineteen (50%) out of 440 profiles were identified and were accessible to varying degrees. The majority of accessible profiles had a visible profile photograph and accessible personal information such as their gender and location. Six per cent (n = 14) and 2 per cent (n = 4) of the identified profiles displayed unprofessional conduct and substance abuse, respectively.

CONCLUSION: It was not possible to identify all staff/students through the Facebook search function. However, of the Facebook profiles identified, no violations of patient confidentiality were seen. Whilst the majority of profiles did not put UCL/UCLH into disrepute, a small minority displayed behaviour not in keeping with GDC/UCL/UCLH guidance. This audit demonstrated that many of the Facebook profiles of hospital staff and students were readily identifiable, highlighting the importance of maintaining professionalism on social media and updating privacy settings to ensure personal Facebook accounts are kept private and inaccessible to the general public.

SP 77 CEPHALOMETRIC FEATURES OF AN ANGLE CLASS III MALOCCLUSION WITH DIFFERENT DENTOALVEOLAR COMPENSATION – A RETROSPECTIVE STUDY
Dina Elfouly, Eiman Marzouk, Hanan Ismail, Department of Orthodontics, Alexandria, University, Egypt

AIMS: To investigate the different aspects of dentoalveolar compensation in untreated Class III patients and its relationship to different vertical discrepancies.

SUBJECTS AND METHOD: This retrospective study was conducted on 102 untreated Class III malocclusion patients. They were divided into group 1 (overjet < 0 mm, n = 51) and group 2 (overjet < 0 mm, n = 51). Twenty-seven cephalometric readings were compared between the two groups to assess the anteroposterior position of the maxilla and the mandible, the intermaxillary and the vertical and dental relationships. Correlation analysis was performed between the overjet with skeletal and dental measurements. Regression analysis was performed to determine the overjet.

RESULTS: For skeletal measurements, ANB, the angle of convexity, Wits appraisal and bony chin measurements were significantly higher in the positive overjet group than in the negative overjet group, while SNB, A-N-Pg and gonial angles were significantly higher in the negative overjet group. Dentally: U1-A-Pg (mm) was significantly higher in the positive overjet group while L1-NB (mm) was significantly higher in the negative overjet group. The overjet was significantly correlated to the same skeletal and dental readings. Nine regression equations for overjet were calculated with the highest coefficient of determination of 0.33.

CONCLUSION: Overjet was closely associated with the sagittal skeletal discrepancy, but not with the vertical one. Moreover, the position of the maxillary and mandibular incisors on the basal bone, rather than their inclination, contributed in dentoalveolar compensation.
SP 77  CONDYLAR RESORPTION IN ORTHODONTICS AND ITS MANAGEMENT: A REVIEW
Salwa El-Habbash, Timothy McSwiney, Dublin Dental University Hospital, Ireland

AIMS: To provide a review of condylar resorption (CR) and its impact on orthodontic treatment and subsequent management.

MATERIALS AND METHOD: A review of the literature on condylar resorption was carried out using several search engines including Medline, PubMed and Embase using the following key terms: condylar resorption, condylar remodelling, orthodontics and orthognathic surgery.

RESULTS: CR can be categorised into functional remodelling and dysfunctional remodelling of the temporomandibular joint (TMJ). Remodelling of the TMJ is dysfunctional if it adversely affects the joints and the occlusion. The literature extensively describes dysfunctional remodelling of the TMJ as CR with functional remodelling referred to as condylar remodelling. CR is a well-documented but poorly understood pathological entity that predominantly affects young women. It represents a progressive alteration of the shape and volume of the mandibular condyle. It can occur spontaneously or post-orthognathic surgery. It is distinguished by decreased condylar head volume, decreased ramus height, progressive mandibular retrusion and an anterior open bite. Its aetiology although controversial can be categorised into surgical and non-surgical risk factors with the most favoured theory being the hormone mediated theory. This is mainly documented with low oestrogen and low serum 17 β-oestradiol which results in increased intraarticular pro-inflammatory cytokines and proliferation of peri-articular tissues. CR is diagnosed by a combination of clinical and radiographic findings as well as a detailed patient history. Multiple treatment options have been described in the literature, including medical management, orthognathic surgery, TMJ and orthognathic surgery combined, and total joint prosthesis reconstruction.

CONCLUSION: Further research is required to better understand the aetiology of CR and more long-term, controlled, multicentre clinical studies should be developed to evaluate the outcomes of surgical and non-surgical management of CR patients.

SP 78  EFFECT OF DIFFERENT ATTACHMENT GEOMETRIES ON THE MECHANICAL LOAD EXERTED BY ALIGNERS DURING MANDIBULAR CANINE DEROTATION
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AIMS: The derotation of teeth with rounded shapes such as canines has proven to be a difficult task for aligners. The aim of this study was to investigate the effect of different attachment geometries on the three-dimensional (3D) forces and moments (F/M) exerted during derotation of a mandibular canine.

MATERIALS AND METHOD: The experimental set-up comprised an acrylic mandibular arch model with a separated right canine mounted on a hexapod via a 3D F/M-sensor. Polyethylene-terephthalate-glycol (PET-G) aligners of thickness of 0.5, 0.625 and 0.75 mm were tested in combination with quarter sphere, vertical-ellipsoid or pyramidal attachments bonded on tooth 43. The experimental movement consisted of a mesiorotation and distorotation of tooth 43 in one-degree-steps up to ±15 degrees, corresponding to 0.5 mm displacements of the tooth’s mesial and distal edge, respectively. Each rotation step included renewed aligner seating prior to registering the F/M values. Three aligners were tested for each thickness, direction of rotation and attachment geometry.

RESULTS: Independent from the rotation direction or the aligner thickness, the vertical-ellipsoid and quarter-sphere attachments induced the highest rotational moment increases by median factors ranging between 1.5-12.3 when referred to measurements without attachments. The influence of the pyramidal attachments on the rotational moments was significantly smaller in most combinations (Mann-Whitney U test, P < 0.05). During the distorotation of tooth 43, the quarter-sphere attachments prevented the intrusive forces in a range from 0-6.07 degrees. The corresponding intrusion prevention range for the vertical-ellipsoid (2.95°) and pyramidal (2.88°)
attachments was significantly lower (Mann Whitney U test, \( P < 0.05 \)). During mesiorotation of tooth 43, none of the investigated attachment geometries was capable of completely preventing intrusive forces.

CONCLUSION: The quarter-sphere attachment geometry showed the best influence during canine derotation, due to the relatively high rotational moment increase and the efficiency in counteracting the intrusion forces induced by the aligner. According to the determined maximum attachment dislodgement and intrusion prevention angles, a mandibular canine derotation of 6 degrees is suggested for each set-up step. However, this angle might be slightly exceeded due to the elastic periodontal ligament properties.

SP 80 COMPARISON OF THREE DIFFERENT LINGUAL RETAINER WIRES: AN IN VITRO STUDY
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AIMS: The prevention of relapse of crowding, rotations, or spacing in the maxillary and mandibular anterior segments after orthodontic treatment often necessitates long-term retention. Fixed lingual retainers are frequently chosen for this purpose. The purpose of this study was to compare the detachment force, amount of deformation and fracture type of three different fixed lingual retainer wires.

MATERIALS AND METHOD: In this in vitro study 0.0195 inch six-stranded round wire (dead-soft coaxial Respond,Ormco, group I), 0.0215 inch five-stranded wire (PentaOne™, Masel, group II) and 0.0175 six-stranded round wire (Ortho Technology, group III) were evaluated. Ninety lower incisor teeth were embedded into acrylic blocks of two in each. Fifteen teeth were selected from each group and the retainer wires were bonded to the models. Acrylic blocks were subjected to a force vertically directed to the interdental wire and detachment forces were recorded. After detachment, the deformations and fracture types were evaluated. Fracture types were compared with Fisher’s exact test and detachment force data were analyzed using one-way analysis of variance and Tukey honestly significant difference tests.

RESULTS: Detachment forces and fracture types did not show significant differences between the groups. The least deformation (mean 0.7 mm) was observed in group II (\( P < 0.001 \)). No statistically significant difference was observed between group I (mean 2.9 mm) and group III (mean 3.1 mm).

CONCLUSION: The wires used in the study showed similar findings in terms of detachment force and fracture type. It was observed that the 0.0215 inch five-stranded wire had the least deformation.

SP 81 COMPARISON OF INTRAORAL SCANNING AND ALGINATE IMPRESSIONS; AN ASSESSMENT OF PATIENT PREFERENCE AND TREATMENT COMFORT.
Noor Esmaiel, David Birnie, Sarah Rolland, Newcastle University, Newcastle-upon-Tyne, U.K.

AIMS: To compare patient preference and treatment comfort between an intraoral scanner (iTero HD 2.9) and alginate impressions when undertaken by operators with varying levels of experience.

SUBJECTS AND METHOD: This was a prospective cohort study. A total of 60 participants were recruited. This included 20 postgraduates, 20 fourth year students (clinical), and 20 second year students (preclinical). Within each group there were 10 operators and 10 patients. Operators were asked to complete five intraoral scans and take five sets of alginate impressions over five sessions. Patients were given questionnaires to complete after each session. This involved completing visual analogue scales (VAS) to establish patient preference (0 = prefers scan, 100 = prefers impressions) and treatment comfort (0 = uncomfortable, 100 = comfortable). As the data was not normally distributed, non-parametric tests were used and \( P < 0.05 \) was considered significant. Focus groups were conducted to provide qualitative data and were analysed following the principles of thematic analysis.
RESULTS: Focus group analysis showed that the main factors that influenced patient preference were ‘comfort’ and ‘time taken’. Some patients preferred alginate because it was faster, whilst others preferred the scanner because it did not make them gag. Both alginate impressions (first session: 59.0, fifth session: 64.0) and the intraoral scanner (first session: 44.0, fifth session: 64.0) were perceived to be more comfortable with repeated sessions, with the greatest improvement seen in the scanner ($P < 0.05$). Although there were slight differences in patient comfort and preference between the year groups (for both scanning and alginate impressions), these were not statistically significant ($P > 0.05$). Patients initially preferred impressions but were equally happy with both techniques after the fifth session (first session: 64.0, fifth session: 49.5).

CONCLUSION: Patients initially preferred alginate impressions but expressed no preference for either after the last session. Patient comfort improves with repeated sessions. Operator’s level of experience did not influence patient preference and comfort.

SP 82 AN IN VITRO STUDY OF FRICTIONAL RESISTANCE OF CONVENTIONAL AND SELF-LIGATING ORTHODONTIC APPLIANCES DEPENDING ON DIFFERENT ALIGNMENT CONDITIONS
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AIMS: To quantify and compare the static frictional force generated by various combinations of brackets, archwire sizes and the amount of displacement during the initial alignment phase of orthodontic treatment using various stereolithographic typodonts.

MATERIALS AND METHOD: One conventional bracket ligated with elastic ligatures or metallic ligatures, one active self-ligating bracket and one passive self-ligating bracket were tested with 0.014 and 0.016 austenitic nickel titanium (NiTi) arches. To simulate the malocclusion status, the first premolar tooth was displaced vertically. Static frictional force was measured with a universal testing machine. To validate the sample, an ANOVA factorial with a confidence interval of 95 per cent and a comparative method Least Square Difference was used. The statistical survey was based on intraoperator analysis (Cronbach’s alpha).

RESULTS: Static frictional force was increased in ascending order: passive self-ligating bracket, active self-ligating bracket SLA, conventional bracket with metallic ligature and conventional bracket with elastic ligature regardless of archwire size. The 0.014 NiTi wire showed significantly lower friction than the 0.016 NiTi wire.

CONCLUSION: These findings suggest that a combination of a passive self-ligating bracket and 0.014 NiTi archwire can produce lower static frictional force than other combinations of bracket or arch.

SP 83 RATE OF ORTHODONTIC TOOTH MOVEMENT DURING APPLICATION OF PRIMARY ORTHODONTIC FORCE AND AFTER ORTHODONTIC RELAPSE IN RATS
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AIMS: This study, using an animal model to address an interesting and potentially clinically relevant question, compared the rate of orthodontic tooth movement (OTM) during the application of initial force in comparison to force applied post-relapse.

MATERIALS AND METHOD: Fifty male Wistar rats were divided into five groups ($n = 10$). The orthodontic force was applied to the maxillary left first molar. The rats were sacrificed in group 1 after two weeks of load application which was followed by the sacrifice of group 2 after 2 weeks OTM and 14 days’ relapse, group 3 after 21 days. groups 4 and 5 after 2 weeks OTM for the second time after 14 and 21 days’ relapse, respectively. The maxillae were dissected followed by an assessment of OTM, bone density (BD), and histological analysis. The groups were statistically compared using one-way ANOVA. A post-hoc test was applied for pairwise comparisons of the groups.
RESULTS: Maximum and minimum rate of OTM occurred in groups 4 and 1, respectively. OTM was not different in groups 4 and 5 but both groups showed significantly higher OTM than others ($P < 0.05$). The highest and lowest BD belonged to group 4. The highest osteoclast count was observed in group 1, while the lowest was found in group 3. The resorption lacunae number were highest in group 1 and lowest in group 3. Maximum and minimum periodontal ligament widths were found in groups 5 and 3, respectively.

CONCLUSION: Based on the above findings, it seems that realigning teeth after orthodontic relapse occurs significantly faster than the time required for OTM for the first time.

SP 84  THE EFFECTS OF FIXED ORTHODONTIC APPLIANCES ON PERIODONTAL PATHOGENS
Roberto Fariello, Rosa Yañez Vico, Javier de la Cruz Perez, Alfonso X el Sabio University, Madrid, Spain

AIMS: To perform a literature review regarding the effect of orthodontic appliances on patients’ periodontal pathogens.
MATERIALS AND METHOD: Database: PubMed. Keywords: (orthodontics [MeSH Terms]) AND microbiota [MeSH Terms]; (orthodontics [MeSH Terms]) AND periodontopathogens; (orthodontics [MeSH Terms]) AND biofilm [MeSH Terms]; (orthodontics [MeSH Terms]) AND bacteria [MeSH Terms].
Inclusion criteria: Characteristics of the participants: Patients who had fixed multibrackets appliances. Outcomes: number and type of bacteria pre-treatment, during treatment and post-treatment. Sample size: more than 15 patients. Exclusion criteria: removable appliances in vitro and animal studies
RESULTS: Five hundred and sixty two articles were found in PubMed, of which 26 were included in this literature review according to the inclusion and exclusion criteria
CONCLUSION: There is moderate evidence that the presence of fixed orthodontic appliances has an influence during orthodontic treatment on the periodontium and periodontal pathogens, both in adults and children. There is a tendency for periodontopathogens to return to the initial situation after treatment. This effect may depend on maintenance of oral hygiene during treatment, especially in patients not sufficiently motivated and instructed.

SP 85  GENETIC FACTORS ASSOCIATED TO THE CO-OCCURRENCE OF OROFACIAL CLEFTS AND TOOTH AGENESIS: AN UPDATED REVIEW OF THE LITERATURE
Guillem Farrés, Marta Torres, Khaled Kasem, Nuno Gustavo d’Oliveira, Josep Maria Ustrell, University of Barcelona, Spain

AIMS: To analyse the prevalence of the co-occurrence of both orofacial clefts and tooth agenesis and the genes that contribute to this association.
MATERIALS AND METHOD: The research was performed using PubMed and Embase databases, using the search terms genetics, cleft palate, orofacial clefts, tooth agenesis and hypodontia. The literature review was limited to the last 5 years in English language. A total of 33 articles were obtained from the databases. 24 were reviewed from which 13 were excluded after analysis.
Eleven studies were included in this review.
RESULTS: Co-occurrence of dental anomalies, specifically tooth agenesis and orofacial clefts is frequently seen in the clinic. The articles reviewed included numerous gene candidates for both congenital defects. Although some of the identified genes could be involved in orofacial cleft cases with tooth agenesis, a comprehensive molecular and genetic exploration of the key genes for the common pathogenesis has not been performed so far.
CONCLUSION: The results of this study provide a list of candidate genes which could eventually be examined in future studies in order to determine those specifically associated with the co-occurrence orofacial clefts and tooth agenesis and those that are not.

SP 86  TREATMENT EFFECTS OF THE HERBST APPLIANCE IN SKELETAL CLASS II SUBJECTS DURING THE PRE- AND POST-PUBERTAL PERIODS
Aims: To compare treatment outcomes of subjects with a Class II malocclusion treated with the Herbst appliance before and after puberty.

Subjects and Method: Thirty-six patients (based on sample size calculation) with a skeletal Class II who required comprehensive orthodontic treatment were recruited in this study and divided into two groups; pre-pubertal (18 patients, 9.15 ± 1.5 years) and post-pubertal group (18 patients, 16.3 ± 1.0 years) according to the modified cervical vertebral maturation stages at the time of initial consultation when they sought orthodontic treatment. All patients were fitted with a metallic splint supported Herbst IV appliance for 7 months. Pre-treatment (T1) and post-Herbst treatment (T2) cephalometric radiographs were obtained for both groups. The mean and standard deviation values for the selected skeletal and dental parameters were calculated for each group. Data were tested for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests and showed parametric (normal) distribution. A pairwise t-test was used to compare between different variables (T1 and T2) in the same group. An independent sample t-test was used to compare pre- and post-pubertal groups. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

Results: In the pre-pubertal group, the sagittal position of point B (2.13 ± 1.7 mm, $P = 0.003$) and SNB angle (1.53 ± 0.04º, $P = 0.01$) were statistically significant. The post-pubertal group showed no statistically significant differences in the sagittal position of point B (0.3 ± 1.7 mm, $P = 0.1$) and SNB angle (0.52 ± 0.04º, $P = 0.2$); the maxillary readings were statistically insignificant in both groups. The upper and lower incisors and molars showed a significant change after Herbst treatment in both age groups. Comparison between the two groups revealed statistically significant differences in skeletal parameters of the mandible; point B ($P = 0.03$), ANB angle ($P = 0.02$).

Conclusion: The mandibular sagittal effects of the Herbst IV appliance were more evident in the pre-pubertal group while the dental effects were similar in both groups.

SP 87 HIGH TECHNOLOGY AND LOW COSTS IN PALATAL ANCHORAGE: MISSION (IM)POSSIBLE?
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Aims: Palatal skeletal anchorage is a clinical reality increasingly used by orthodontists. However, the costs, especially for the initial design, can limit the use of palatal devices. The purpose of this work is to illustrate, through the use of videos, two of the most common license-free software that have orthodontic applications and can be used to reduce costs.

Materials and Method: Two license-free and multiplatform software were tested. The first was Blue Sky Plan (Blue Sky Bio, LLC 2019), a software developed for implant design in the surgical field. DICOM files and STL files can be matched in an extremely simple and intuitive way and it is possible to insert virtually fully customised temporary anchorage devices (TADs) into the project. The creation of the surgical guide is simple and intuitive, and it can be exported in .stl format and three-dimensionally printed. The second software was Meshmixer, a free three-dimensional (3D) modeller distributed by Autodesk. It was developed to model and repair 3D meshes: it can modify surfaces, repair, combine, or colour them and even create ad hoc support structures. Ten patients were analyzed (8 females, 2 males, average age 21.9 ± 8 years), in whom a palatal device with skeletal anchorage was applied on two miniscrews each. A total of 20 TADs were inserted using a surgical guide designed by combining the two described software.

Results: The guided design allowed insertion of the palatal miniscrews with excellent precision, parallel to each other and conforming to the project. There were no surgical complications and at the end of the orthodontic movements all 20 miniscrews showed good stability.
CONCLUSION: There are many free softwares that can easily be used by orthodontists in everyday practice. For many of these, free online tutorials are available on the web allowing the user to quickly learn the functions and commands of the programs in total autonomy and in a short time. This new generation of programs will help to create a new horizon and new perspectives in the orthodontic field. The future is in front of us.

SP 88  LIP MUSCLE ACTIVITY CHANGES BEFORE AND ONE-YEAR AFTER LIP BUMPER TREATMENT
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AIMS: To prospectively analyze the muscle activity of the upper and lower lips before and one year after lip bumper (LB) treatment using a new recording device to explore the changes, if any, due to muscle adaptation to the appliance.

SUBJECTS AND METHOD: Twenty five young patients with a mean age of 10 years 1 month (range 7 years 1 month to 13 years 3 months) before and after one year of LB treatment. Electromyographic recordings were made at closed lip rest position, swallowing of 5 ml of water and during articulation of words such as ‘church’, ‘phone’ and ‘pop’.

RESULTS: The pre-treatment recordings with the LB in situ measured increased activity of the upper and lower lips at rest and during swallowing, while the registrations were variable for the speech. There was an initial increase of muscle activity concomitant with LB insertion at rest position that was followed by a decrease after one year below pre-treatment levels ($P < 0.05$).

CONCLUSION: Overall significant differences appeared in comparison between the pre- and post-treatment measurements. The results showed a significant short-term influence on the lips with the insertion of the appliance and indicated short-term adaptation of the lower lip at rest.

SP 89  SET-UP HEAD POSITION OF THREE-DIMENSIONAL IMAGING WITH FACIAL LANDMARKS: A TRIAL BASED ON STEREOPHOTOGRAMMETRY
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AIMS: As three-dimensional (3D) image technology is increasing in orthodontics, this study aimed to explore a way to set 3D facial images into a reliable and repeatable head position for clinical observation, diagnostic reference and scientific analysis.

MATERIALS AND METHOD: This study was approved by local ethics committee. Both natural and smiling 3D facial images of volunteers were taken by 3dMDface system (3dMD Inc., Atlanta, Georgia, USA). 3D coordinates were established by facial landmarks. The midpoints of the lips together with hairline point, glabella, nasal tip and subnasal point were chosen to form the y axis. Inner and outer canthus points were used to build the x axis and glabella was chosen as the original point to decide the z axis. The iterative closest points (ICP) calculation method was adopted to improve the reliability of the axis. Then the head position was settled corresponding to the 3D coordinates. Two independent researchers set up the head position for 3 consecutive days. The 3D coordinates of each landmark were collected. SPSS (version18.0, IBM, USA) was used to examine if there was statistical difference in coordinates between and within the two researchers. Significance rate was set as 0.05.

RESULTS: A series of acceptable 3D facial images with a settled head position were gained after improving the y axis with ICP. The facial images showed no obvious tipping. There was no statistically significant difference in 3D coordinates of the facial landmarks both between and within researchers ($P > 0.05$). However, discernible deviation of images still existed visually.

CONCLUSION: The head position of 3D facial imaging by stereophotogrammetry could be set up with the establishment of 3D coordinates. The ICP calculation method would improve the reliability of the axis to enhance the repeatability of head position. The introduced method may be helpful in scientific analysis of 3D facial images. For its clinical application, efforts would be needed to improve the visual consistency.
SP 90  COMPARISON OF VIRTUAL VERSUS CONVENTIONAL SURGERY PLANNING AND ACTUALLY ACHIEVED TOOTH POSITION AFTER ORTHOGNATHIC SURGERY FOR DOUBLE JAW PROCEDURE
Sara Fernandes, Paulina Suzanowicz, Thomas Klit Pedersen, Sven Erik Nørholt, Michel Dalstra, Aarhus University, Denmark

AIMS: To retrospectively assess the differences between virtual surgery planning (VSP) and conventional plaster surgery planning (CPSP), and the post-surgical outcome in hard tissues.

MATERIALS AND METHOD: A retrospective, quality assessment study was performed on a cohort of 35 patients selected from a population treated with orthognathic surgery consecutively from 2014 to 2018. Cone beam computed tomography (CBCT) scans and digital models were taken before and 6/8-weeks post-surgery. The positions of six reference points were determined in the pre- (T1), planned (T2) and post-treatment (T3) situation: central incisors, canines and first molars in both upper and lower jaws. Subsequently, the planned movements (T2-T1) and the actual movements achieved (T3-T1) were compared for both VSP and CPSP with an unpaired t-test.

RESULTS: The positions of the segments, measured by the positions of the central incisors, canines and first molars, after VSP came closer to the actual positions achieved after orthognathic surgery when compared to CPSP. In particular, for the vertical direction these differences were statistically significant.

CONCLUSION: The differences between the planned movements of the segments during VSP for double procedures and the actual movements at 6/8-weeks post-surgery were smaller when compared to those of the CPSP. Virtual surgery planning is advisable for a more accurate planning outcome for double procedure orthognathic surgery.

SP 91  ROOT RESORPTION AND ORTHODONTICS: A NARRATIVE REVIEW
Joana Maria Ferrer, Khaled Kasem, Nuno Gustavo d'Oliveira, Josep Maria Ustrell, Master of orthodontics, University of Barcelona, Spain

AIMS: To analyze the factors of root resorption and to establish early diagnosis and early treatment guideline.

MATERIALS AND METHOD: A search for scientific articles published in Medline/PubMed and Cochrane databases was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta- Analyses guidelines. The search was limited to publications for the last 10 years. The search retrieved 108 articles. After applying inclusion an exclusion criteria, 42 articles were selected for this review. The keywords were: root resorption, orthodontics, orthodontic treatment, management, risk factors, endodontic treatment.

RESULTS: The most harmful factors for root resorption are intensive forces, long-term treatment and intrusive movement. Other factors that might worsen root resorption are the use of intermaxillary elastics for treatment of Class II malocclusions, endodontically treated teeth and previous dental trauma with signs of root resorption before orthodontic treatment.

CONCLUSION: It is essential to perform an initial radiographic control, during treatment and post-treatment to detect root resorption and to act in time.

SP 92 DENTAL TRAUMA FOLLOW-UP IN ORTHODONTICALLY TREATED PATIENTS: A RETROSPECTIVE STUDY
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AIMS: To evaluate the types of trauma in patients presenting for orthodontic treatment, providing a status report of pulp condition, apical root resorption and general condition of the injured teeth before and after orthodontic therapy and to compare the aesthetic outcomes between patients with or without incisor extractions.
MATERIALS AND METHOD: Patients with a history of dental trauma followed by orthodontic treatment and with complete orthodontic records were selected. After applying the inclusion criteria, 110 records were included. Out of these, all relevant data were collected such as age, type of treatment, dental injury and condition of anterior teeth before and after orthodontic therapy.

RESULTS: The major causes of dental trauma were: a simple fall (59%) or a cycling accident (15.45%). The upper central incisors were most often damaged. Forty-four teeth showed signs of concussion, 28 of subluxation and 17 of lateral luxation. Eight teeth were intruded, five extruded and 42 avulsed. Eight teeth had an alveolar bone fracture. Thirty-six teeth showed an enamel fracture, 62 an uncomplicated and 12 a complicated enamel dentine fracture. Seven teeth had a crown root fracture, of which two had pulpal involvement and two showed a root fracture. Seventy-eight patients were orthodontically treated without extraction, 32 had one or more incisors extracted. Significantly higher values of root resorption were observed in teeth with hard dental tissue and/or periodontal trauma. Teeth with a history of dental trauma showed significantly more signs of deterioration of pulpal condition and worsening of pulpal treatment complexity during orthodontic treatment compared to the surrounding anterior teeth. In the incisor extraction cases the gingiva line scored aesthetically significantly less and the papilla was significantly more reduced than in the non-extraction cases.

CONCLUSION: Despite the general tendency of injured teeth to have a greater risk of complications during orthodontic treatment, there are individual variations in the clinical presentation of dental injuries as a result of trauma. Making solid conclusions about the effect of an orthodontic therapy on injured teeth is therefore complicated. Additionally, the long-term effects of dental trauma should not be underestimated.

SP 93 CONDYLAR DYSFUNCTIONAL REMODELLING AND RECORTICATION: A CASE-CONTROL STUDY
Filippo Forin Valvecchi, Roberto Conte, Giovanni Bruno, Alberto De Stefani, Antonio Gracco, Università di Padova, Italy

AIMS: The use of medicaments in the therapy of degenerative joint disease (DJD) is controversial and there is very little in the scientific literature that supports their efficacy.

SUBJECTS AND METHOD: This was a case-control study. Twenty patients diagnosed with DJD according to the 2014 Diagnostic Criteria for Temporomandibular Disorders (TMD) were chosen and each of them underwent a documentation protocol including extra- and intraoral photographs, dental casts, casts mounting on an articulator to evaluate centric occlusion (CO) versus centric relation (CR) discrepancy index and cone beam computed tomography of the mandibular condyles taken in a closed mouth position. Seven coronal and 10 sagittal cuts were performed on the head of the condyle to highlight the amount of cortication, before and after application of two different therapeutic protocols. Protocol 1 (10 patients) included the exclusive use of a splint, while protocol 2 (10 patients) included the use of a splint associated with pharmacological therapy (non-steroidal anti-inflammatory drugs, antioxidant, omega3). The revaluation was performed on an asymptomatic patient after a period of 6-8 months. The pain for each patient was assessed using a visual analogue scale (VAS) from 0 to 10. The VAS was evaluated after 10 days from the beginning of treatment, after 3 months, and after 8 months at the end of the treatment. Statistical analyses were carried using chi-squared test (P < 0.05).

RESULTS: No significant differences in CO-CR discrepancy or in the amount of cortication were found on radiographic re-evaluation between the two different therapeutic protocols. It was however noticed that the use of medicaments resulted in pain resolution in a shorter period of time (P = 0.00001 after 10 days; P = 0.0251 after 3 months).

CONCLUSION: According to this study, pharmacological protocols in the therapy of TMD seem to affect neither condylar cortication nor CO-CR discrepancy resolution. Medicaments however seem to accelerate the disappearance of clinical symptoms.
EVALUATION OF TOOTH SIZE IN NON-SYNDROMIC UNILATERAL AND BILATERAL CLEFT LIP AND PALATE PATIENTS: A RETROSPECTIVE STUDY
Alessandro Frezza, Giovanni Bruno, Alberto De Stefani, Antonio Gracco, University of Padua, Padova, Italy

AIMS: To evaluate tooth size in patients with non-syndromic unilateral and bilateral cleft lip and palate (CLP) presenting at least one congenitally missing lateral incisor and to compare the results with a control group of orthodontic patients without tooth agenesis. Different studies in the literature have shown that patients with hypodontia also have smaller crown dimensions than normal subjects in the remaining dentition. Moreover, anomalies in the size of permanent teeth (macro and microdontia), especially in the anterior maxillary region, is a characteristic of cleft patients.

MATERIALS AND METHOD: Dental casts of 26 orthodontic patients with a CLP (cleft group, 8 females, 18 males) were analysed. Patients were selected from the database of the Maxillo-Facial Surgery Clinic of the San Bortolo Hospital of Vicenza. The control group consisted of 26 healthy subjects with a full dentition and without any syndrome (control group, 16 females and 10 males). The inclusion criteria of the study were: complete tooth eruption (except second and third molars), good quality models and complete dental records. The largest mesiodistal crown dimension for all teeth (excluding second and third molars) was measured on the study models with a digital calliper. Tooth width measurements were compared between the groups using a Student’s t-test at $P < 0.05$ of significance.

RESULTS: The difference in tooth size between the two groups was not statistically significant. No differences were found between unilateral and bilateral CLP.

CONCLUSION: Missing lateral incisors in CLP patients are not associated with a reduced tooth size since the remaining permanent dentition was comparable between the cleft and control group. Furthermore, there were no differences between unilateral and bilateral cleft patients.

ANGLE CLASS II DIVISION 2 MALOCCLUSION: PREVALENCE AND PATTERN OF TOOTH AGENESIS
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AIMS: To assess the prevalence and pattern of tooth agenesis in a group of Italian subjects with a Class II division 2 malocclusion. The findings will then be compared with an Italian control group of orthodontic patients and with previous studies performed in other countries.

MATERIALS AND METHOD: In this observational study, records of 600 patients (37 with an Angle Class II division 2 malocclusion and 563 general orthodontic patients), aged 7 or older, were collected. Inclusion criteria for Class II division 2 were: U1-SN less than 90 degrees and overbite $>3$ mm. Third molars were excluded from the analysis. Statistical analysis was carried out with a Chi-square test with Yates correction and Fisher’s exact test. The test was considered significant if $P$ was lower or equal to 0.05.

RESULTS: The prevalence of tooth agenesis in the Angle Class II division 2 group was 18.92 per cent, while in the general population it was 8.35 per cent. This result was sufficient to demonstrate a statistical difference between the Angle Class II division 2 group and tooth agenesis ($P$ value lower than 0.05).

CONCLUSION: Prevalence of permanent tooth agenesis was more than two times higher in the Class II division 2 group than in the control group. No agenesis of maxillary lateral incisors was found in the Class II division 2 group.

CLINICAL INVESTIGATION OF MASTICATORY PERFORMANCE IN SKELETAL CLASS III PATIENTS USING A FULLY AUTOMATIC MEASURING SYSTEM
AIMS: Previous studies on mastication of skeletal Class III patients have examined various aspects such as occlusal contact area, mandibular movement, and masticatory muscle activity. However, there have been few reports on investigation of the relationship between objective masticatory performance and craniofacial morphology in patients with a skeletal Class III malocclusion due to the lack of an easy-to-handle and time-saving method. This study aimed to clarify the usability of a fully automatic measuring system by testing the relationship between masticatory performance and craniofacial morphology for skeletal Class III patients.

SUBJECTS AND METHOD: Ten patients with a skeletal Class III malocclusion (age: 16.7 ± 1.3 years) and 10 volunteers with normal occlusion (age: 22.6 ± 2.6 years) as a control. At the initial examination, lateral cephalograms were taken and analyzed. Masticatory performance was assessed by a visual scoring method and a fully automatic measuring system (Tokyo-koden, Tokyo, Japan) using a testing gummy jelly (UHA-Mikakuto, Osaka, Japan). Occlusal contact areas were measured using a silicone testing material and analyzing device (BiteEye, GC, Tokyo, Japan). Maximum bite force was also measured using an occlusal force meter (Morita, Osaka, Japan). Wilcoxon’s rank sum test was used for comparison between the two groups in masticatory performance, occlusal contact area and maximum bite force. Spearman’s rank correlation coefficient was employed to evaluate the relationship between masticatory performance and craniofacial morphology.

RESULTS: Masticatory performance, occlusal contact areas and maximum bite force were significantly lower in the skeletal Class III group than in the normal occlusion group. A negative correlation was found between masticatory performance and gonial angle, ANS-Me and Cd-Gn. These results have suggested that skeletal Class III patients decrease both occlusal contact areas due to skeletal incompatibility and maximum bite force greatly affected masticatory performance.

CONCLUSION: The fully automatic measuring system was useful for describing the decline of masticatory performance in skeletal Class III patients objectively and quantitatively.

SP 97 A STUDY OF THE MAIN OCCLUDING AREA IN SUBJECTS WITH MANDIBULAR PROTRUSION AND DEVIATION

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AIMS: To investigate the location of the main occluding area (MOA) in patients with mandibular protrusion and deviation.

SUBJECTS AND METHOD: Ten patients with mandibular protrusion and deviation were instructed to clench a piece of temporary stopping in the particular occluding area that was preferably used during mastication. The subjects were divided into the corresponding group (CG) and non-corresponding group (NCG) between mandibular deviation and habitual mastication sides. The MOA was judged by locating the tooth on which the temporary stop rested. In addition, it was carried out by linear measurements using the frontal cephalograms.

RESULTS: In the CG, the maxillary MOA was located more buccally on the deviated side than on the non-deviated side, and the mandibular MOA was located more lingually on the deviated side than on the non-deviated side. On the other hand, in the NCG, the locations of maxillary and mandibular MOA were no different between the deviated and non-deviated sides. The CG showed four crossbites in the molar region of the deviation side and one scissor bite in the molar region of the non-deviation side. On the other hand, the NCG showed three bilateral crossbites in the molar region. On frontal cephalogram analysis, the CG showed that maxillary and mandibular width on the deviation side was significantly larger than on the non-deviation side. On the other hand, the NCG showed that the maxillary width on the deviation side was significantly larger than that on the
non-deviation side, but there was no difference of mandibular width between the deviation and non-deviation sides.

CONCLUSION: These results suggest that the location of MOA in patients with mandibular protrusion and deviation is related to the maxillary and mandibular width and the occlusion in the molar region.

SP 98  RELATIONSHIP BETWEEN DENTAL AGENESIS AND FAMILY HISTORY OF HYPODONTIA IN ORTHODONTIC PATIENTS
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AIMS: To evaluate the relationship of dental agenesis with family background in a sample of orthodontics patients.

SUBJECTS AND METHOD: Once ethical approval was obtained, a written questionnaire was completed by orthodontic patients showing at least one dental between 2017 and 2018. Questions dealt with family history of agenesis, oral trauma, radiotherapy and syndromes. Finally all data were analyzed with a Student’s t-test.

RESULTS: A convenience sample of 89 orthodontic patients: 47 female (52.8%) and 42 male (47.2%) was employed. The mean age was 19.30 (SD. 9.68) for female and 16.98 (SD. 9.49) for male. The highest incidence of agenesis was found for the second lower left premolar, (39.33%), followed by the second lower right premolar (35.96%) and then the upper right lateral incisor (32.58%). A family history of dental agenesis was reported by 46.1 per cent of the sample compared to 36 per cent without agenesis and 18 per cent who did not know or did not answer. There was a previous oral trauma in 5.62 per cent, compared to 92.1 per cent without and 2.2 per cent who did not know or did not answer. There was only an association between family history and agenesis for the upper right lateral incisor (P < 0.05).

CONCLUSION: In this sample, there was no association between dental agenesis and the studied variables (oral trauma, syndromes, radiotherapy, chemotherapy) but there was a family history of dental agenesis and only in upper lateral right incisor.

SP 99  LONG-TERM EVALUATION OF RAPID MAXILLARY EXPANSION AND A BITE-BLOCK IN OPEN-BITE GROWING SUBJECTS: A CONTROLLED CLINICAL STUDY
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AIMS: To evaluate the long-term stability of rapid maxillary expander (RME) and posterior bite-block (BB) treatment in subjects with a dentoskeletal open bite.

SUBJECTS AND METHOD: Sixteen subjects (2 boys, 14 girls; mean age, 8.1 ± 1.1 years) treated consecutively with RME and BB appliances. The patients were re-evaluated at the end of active treatment (mean age, 9.6 ± 1.2 years) and at least 4 years after the completion of treatment (mean age, 13.5 ± 1.4 years). A control group of 16 untreated subjects with the same dentoskeletal disharmony was used for the statistical comparison (independent t-test). The inclusion criteria included: no sucking habits before treatment; overbite < 0 mm; transverse discrepancy ≥5 mm; Frankfort horizontal to mandibular plane angle greater than 26 degrees; full eruption of first permanent molars, and maxillary and mandibular incisors.

RESULTS: In the long-term, the RME and BB group showed, a greater increase in overbite (1.8 mm), an extrusion control of maxillary and mandibular molars (–1.9mm; –1.3 mm), and a decrease in facial divergence (–2.8°) when compared with the controls.

CONCLUSION: The use of the RME and BB protocol led to successful outcomes in 100 per cent of the patients. Correction of the dentoskeletal open bite was associated with a clinically significant control of vertical dimension preventing extrusion of the maxillary and mandibular molars.
A COMPREHENSIVE APPROACH TO THE DIAGNOSIS AND TREATMENT OF PATIENTS WITH MAXILLOFACIAL ANOMALIES

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AIMS: To improve the diagnosis of dysfunction of the temporomandibular joint (TMJ) and planning of comprehensive dental treatment.

SUBJECTS AND METHOD: One hundred and eighty nine patients 25-60 years of age divided into several groups: patients with clicks and crunches in the TMJ in a state of compensation without painful symptoms and limitation of articulation movements; patients without signs of changes in the TMJ, with loss of interalveolar height with significant destruction of teeth; patients without signs of changes in the TMJ, with a slight loss of interalveolar height with periodontal diseases, soft and hard tissue recession of the alveolar ridge, patients in a state of decompensation and aggravation after dental treatment. The Transcutaneous Electrical Nerve Stimulation method and digital axiography were used for diagnosis. The examination was performed in the following sequence: computed tomography using Sirona Galileos Comfort Pluse Fasescan (Germany); axiography using Freecoder BlueFox and CAR equipment (Germany) and virtual repositioning of the lower jaw condyles.

RESULTS: The use of functional diagnostics of the TMJ in the comprehensive dental treatment of patients at the stage of planning rehabilitation using digital technologies allows the exact stages of treatment to be formulated, to prevent complications and create good relationships between patients and the team of doctors of various dental profiles.

CONCLUSION: Application of a created technical plan for articulator settings for more than 20 systems allows doctors from different clinics to use different types of treatment, without complications and development of delayed pathologies of the TMJ dysfunction.

SP 101 AUDIT ON SATISFACTION WITH NEW PATIENT ASSESSMENTS ON HYPODONTIA CLINICS AND TREATMENT MANAGEMENT OPTIONS

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AIMS: 1) Audit to assess patient satisfaction on new patient hypodontia consultations over a 6 month period; 2) Identify the spread of space closure and space opening treatment options for the patients attending this clinic

MATERIALS AND METHOD: A questionnaire was distributed to new patients attending the hypodontia clinic at the end of their appointment. The spread of treatment options was assessed from the patients’ notes. The gold standard, taken as 100 per cent was as follows: 1) Patients given enough (verbal and written) information about their condition and treatment options; 2) Patients involved in decision making with the opportunity to discuss their concerns; 3) Patients treated with dignity and respect by the hypodontia team.

RESULTS: The gold standard was met where 100 per cent of patients felt that they were treated with dignity and respect by the hypodontia team. One hundred per cent also felt that they were provided with the right amount of information verbally during their consultation. However, only 94 per cent of patients considered that they were fully involved in decision making about their treatment. Only 56 per cent of patients received written information to support their patient experience. A further 13 per cent highlighted that they would have liked to have received written information. Overall 76 per cent of patients were suitable for the space opening treatment option, and 11 per cent for the space closing option.

CONCLUSION: Positive patient reported experiences are essential for provision of high quality care and this is a vital goal of every health care service. Whilst the gold standard was met in some areas, it fell short with regards to fully involving patients during their treatment consultation. Additionally, there was significant underperformance with the desired gold standard of always providing patients with written information to support their consultation and the overall patient experience.
The following recommendations were made: 1) Written protocol developed for new patient assessments distributed to the hypodontia team including a new patient proforma and use of information leaflets, 2) Training workshops for the hypodontia team on multidisciplinary treatment planning and delivery of information to patients, 3) Re-audit in 6 months.

SP 102 THE PREVALENCE OF A TOOTH AGENESIS PATTERN IN PATIENTS WITH MILD HYPODONTIA
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AIMS: To evaluate the genetic factors and the prevalence of missing teeth in patients with mild hypodontia to aid orthodontic or multidisciplinary treatment.

SUBJECTS AND METHOD: From 338 agenesis patients aged 6 to 18 years, 74 with mild hypodontia (1 to 2 teeth) were investigated. Genealogical anamnesis, clinical examination of the patients, their parents and siblings, dental records and radiographic examination were performed. Patterns of tooth agenesis were analyzed using the Tooth Agenesis Code (TAC) values according to Van Wijk and Tan.

RESULTS: Among the whole sample (21 male, 53 female) with mild hypodontia the agenesis was a family feature in 29 (39.2%). The total number of missing teeth was 139 with 1.88 ± 0.33 per patient. The incidence of the agenesis in the maxilla was 78.4 per cent with the average number of missing teeth 1.42 (sd = 0.82) and in the mandible 28.4 per cent with hypodontia of 0.46 (sd = 0.77) teeth. In 65 (87.8%) cases there was congenital absence two teeth and in nine (12.2%) one tooth. In 37 (50%) patients hypodontia was revealed only in the maxilla, in 16 (21.6%) in the mandible and in five (6.7%) in both jaws. Analysis of the all hypodontia patterns in the entire dentition presented in 41 (55.4%) patients bilateral agenesis of the maxillary lateral incisors with TAC value 2.2.0.0 followed by the mandibular central incisors in nine (12.2%; TAC 0.0.1.1); in four (5.4%) unilateral absence of tooth 1.2 was identified and in three (4%) symmetrical absence of the mandibular second premolars (TAC 0.0.16.16 ) or maxillary canines (TAC 4.4.0.0).

CONCLUSION: Knowledge about typical tooth agenesis in hypodontia cases will contribute to timely diagnosis and allow a more comprehensive long-term treatment plan with more favourable results. The results of this investigation suggest that hypodontia is a genetically determined condition in almost 40 per cent of cases. The pathology involved the presence in previous generations; in 7.5 times more often through the maternal line and existed 2.4 times more often in female relatives of hypodontia patients. Mild hypodontia is 2.5 times more common in females than in males.

SP 103 THREE-DIMENSIONAL MORPHOLOGICAL CHANGES OF THE UPPER AIRWAYS BEFORE AND AFTER ORAL APPLIANCE THERAPY IN OBSTRUCTIVE SLEEP APNOEA
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AIMS: Obstructive sleep apnoea (OSA) shows apnoea or hypopnoea due to upper airway stenosis during sleep with its typical symptoms including snoring during sleep and excessive daytime sleepiness. Cone beam computed tomography (CBCT) is useful to reach an accurate three-dimensional (3D) volumetric analysis of the upper airways. Oral appliances (OA) are considered to be an effective treatment for OSA. The aim of this study was to detect morphological changes in the upper airways using CBCT before and after OA therapy.

SUBJECTS AND METHOD: Thirty patients (18 males, 12 females) diagnosed with OSA using polysomnography (PSG). Some criteria was applied to diagnose OSA: an apnoea-hypopnoea index (AHI) of >5 per hour during sleep and pathological daytime sleepiness. The therapeutic effect of an OA was evaluated using PSG and when it showed an AHI of <10 or a decrease of >50 per cent. Two types of OA were used: the mandibular advancement device and twin block appliance. These enlarged the upper airways by holding the mandible forward, at 60-70 per cent of maximum
mandibular advancement and at the minimum vertical position. CBCT was performed in all the patients.

RESULTS: The mean upper airway 3D volumetric reconstructions increased significantly during the presence of OA versus the absence of OA ($P < 0.01$). AHI diminished significantly during the presence of OA ($P < 0.01$). Oral therapy is effective for treating mild and moderate OSA.

CONCLUSION: The advantage of a 3D evaluation of the upper airway during OA therapy is the accurate visual confirmation of morphological changes in each region of the upper airway which could increase the compliance and motivation of the patients for treatment. OSA treatment methods include surgery, nasal continuous positive airway pressure, weight reduction, drug therapy and, in mild to moderate OSA, the use of OA. CBCT is useful to detect morphological changes or the upper airways, by 3D evaluation analysis during oral device use. The treatment recommendations should be proposed using a multidisciplinary approach, that involves different specialists: otorhinolaryngologists, surgeons, neurologists, sleep doctors and dentists.

SP 104 RELIABILITY OF NASAL LANDMARK PLACEMENT PERFORMED ON STEREOPHOTOGRAMMETRY RECORDS
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AIMS: To assess the reliability of nasal landmarks placement 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 Nemoscan software (Nemotec. Madrid, Spain). One orthodontic student placed nine nasal landmarks on each 3D photograph twice, one week apart fully blinded. The values $x$, $y$, $z$ of each point were exported for statistical analysis. Intraexaminer reproducibility was assessed according to intraclass correlation coefficient and paired t-test.

RESULTS: Moderate to excellent agreement was achieved for intraexaminer measurements. Identification of landmarks closest to the midline was more precise than further from it. Points located in curved surface area (alar curvature) were less reliable than those located in sharpest ones (nostril top point).

CONCLUSION: Most nasal landmark placement yielded excellent intraexaminer reliability. Moderate to excellent agreement was achieved for some landmarks such as nasal base left. Some statistical differences were detected on some points. However, these differences were not clinically relevant. Therefore, 3D stereophotogrammetry is a reliable method to assess nasal morphology.

SP 105 ACCELERATED ORTHODONTICS ON YOUTUBE™: A VIDEO ANALYSIS
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AIMS: YouTube™ is the foremost resource of videos on all kinds of issues. The aim of this study was to investigate videos related to accelerated orthodontic treatment on YouTube™ in terms of characteristics, content, popularity and viewers’ assessment.

MATERIALS AND METHOD: The six keywords related to accelerated orthodontic treatment were searched on YouTube™. After sorting by view-count, all 116 videos were examined and exclusion criteria was defined as: as a language other than English, unrelated to topic, poor video quality and duplication. Finally 80 videos were analyzed for general characteristics, primary purpose, information content, relevance, audio-visual quality and also viewers’ interaction index. Viewing rate formulas were calculated for each video.

RESULTS: The final 80 videos were viewed 177,328 times in total. Most videos were uploaded by educational units ($n = 40; 50.0\%$), followed by orthodontists ($n = 20; 25.0\%$). Most videos (51.25\%) were classified as having excellent general information content. Thirty per cent were rated as
moderate, and 18.75 per cent as poor. Videos generally involved educational (47.50%), followed by product presentation (20%), and then technical about accelerated orthodontics (11.25%). Only 6.25 per cent of videos (n = 5) had a viewers’ interaction index greater than 3.

CONCLUSION: YouTube™ videos about accelerated orthodontic treatment were mostly inadequate. High quality and easy to understand videos about accelerated orthodontic treatment should be uploaded to YouTube™.

SP 106 MOTIVATION, EXPECTATIONS, AND UNDERSTANDING OF PATIENTS AND THEIR PARENTS SEEKING ORTHODONTIC TREATMENT IN SPECIALIST PRACTICE
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AIMS: An investigation into the motivation, expectations, and understanding of patients and their parents seeking orthodontic treatment in specialist practice.
MATERIALS AND METHOD: A survey of new patients referred for orthodontic assessment at three orthodontic specialist practices in the Surrey and Berkshire areas (United Kingdom) was carried out. A total of 500 questionnaires were issued across the three sites (250 were issued to patients and 250 to parents). The patient questionnaire consisted of questions focusing on motivation, expectations, and understanding of orthodontic treatment.
RESULTS: Referral for orthodontic treatment was initiated by the patients’ general dental practitioner in 77 per cent of cases. Most patients and parents appeared to be highly motivated and accepting of appliances and extractions for orthodontic treatment. Both groups generally had realistic expectations of treatment, but were not well informed about the nature and duration of orthodontic retention. Those patients who reported having been teased about the appearance of their teeth, were significantly fewer than in previous, hospital based, studies.
CONCLUSION: The anticipation of improved dental appearance was a prime motivating factor to seek treatment

SP 107 ACCURACY AND REPRODUCIBILITY OF PEER ASSESSMENT RATING INDEX SCORE MEASUREMENTS ON THREE-DIMENSIONAL DIGITAL MODELS COMPARED TO PRINTED PHYSICAL MODELS
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AIMS: To compare the accuracy and reproducibility of Peer Assessment Rating (PAR) index scores measured on digital models and their printed physical model equivalents
MATERIALS AND METHOD: Thirty pairs of pre- and post-treatment models were selected from the archives. All digital impression files were generated with a Trios intraoral scanner (3Shape, Copenhagen, Denmark). Assessment of the PAR index was carried out by two operators: first digitally using a built-in feature of OrthoAnalyzer software (3Shape) and then manually on printed physical models, using a digital calliper. All measurements were repeated after one week. Intraclass correlation coefficients (ICC) were used to test intra- and inter-observer reproducibility.
RESULTS: The ICC was high for all recorded measurements. The interobserver reproducibility was 0.985 with a 95 per cent confidence interval (CI) of 0.968-0.993 for physical models, and 0.996 with a CI of 0.991-0.998 for digital models. Intraobserver reproducibility was excellent both for physical (ICC = 0.984) and digital models (ICC = 0.993).
CONCLUSION: Measurement of PAR index scores on digital and physical models showed excellent reliability. The PAR index measuring tool on Orthoanalyzer software proved to be accurate and reliable and should be considered a viable option for clinical application.

SP 108 AN AUDIT ON BASIC PERIODONTAL EXAMINATION IN ORTHODONTIC NEW PATIENTS UNDER 18 YEARS
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AIMS: To assess compliance with current guidelines set by the British Society of Periodontology and British Society of Paediatric Dentistry, which state that a ‘simplified’ basic periodontal examination (BPE) should be undertaken in all patients under the age of 18 years prior to commencing orthodontic treatment.

MATERIALS AND METHOD: A retrospective sample of 50 records was selected based on patients under the age of 18 years attending orthodontic new patient clinics between September 2017 and June 2018. The gold standard was that 100 per cent of records had evidence of a BPE.

RESULTS: All 50 records had evidence of oral hygiene status documented. Nineteen of the patients were considered to have unsatisfactory oral hygiene, of which 13 were referred for onward management of their periodontal disease. Interestingly, only 12 records (24%) had evidence of a BPE, well below the gold standard of 100 per cent. Six of these patients were seen by undergraduate dental students, five by an associate specialist, and one by a consultant.

CONCLUSION: The findings from the audit were presented at a departmental audit meeting. An action plan involved raising clinicians’ awareness of the need to perform a ‘simplified’ BPE in all orthodontic patients under the age of 18 years; a BPE chart to be included in the orthodontic new patient proforma; disposable BPE probes to be made available chairside in orthodontic new patient clinics. A second cycle of the audit has been carried out with the results much improved, but still short of the gold standard.

SP 109 AN ACCURATE AND EFFICIENT METHOD FOR MEASUREMENT OF TOOTH WEAR ON THREE-DIMENSIONAL DENTAL PATIENT MODELS: AN IN VITRO STUDY

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AIMS: To develop and in vitro to assess the precision and accuracy of a three-dimensional (3D) superimposition method used to measure occlusal tooth wear.

MATERIALS AND METHOD: Sixteen pre-existing dental models with (n = 8; 4 maxillary, 4 mandibular) and without (n = 8; 4 maxillary, 4 mandibular) straight teeth were selected from the archive. Eighteen teeth of each tooth type (incisors, canines, premolars, and molars) were manually ground on their occlusal (T1) and in a second step, slightly, also on their buccolingual surfaces (T2), to simulate various degrees of tooth wear. The dental casts were scanned using a high accuracy laboratory 3D surface scanner. The crowns of the ground teeth (T1 and T2) were manually segmented and compared to the original crowns (T0) using two 3D superimposition methods, with two sets of settings each, and the gold standard method. The gold standard measurements (GM) were obtained using the adjacent intact teeth and the alveolar process as superimposition reference areas. The T0 and T1 3D models of each patient were superimposed using the Viewbox software’s implementation of the iterative closest point algorithm.

RESULTS: Multivariate regression analysis showed that the results were affected by tooth type (P < 0.05). The four 3D superimposition techniques used to assess tooth wear differed significantly from each other in all tooth groups (Friedman’s test, P < 0.05). Pairwise differences between techniques were also evident in almost all cases (Mann-Whitney test, P < 0.05). The median differences of the four techniques from the gold standard method ranged from −0.33 to 0.07 mm³ and from −3.40 to −0.07 mm³, for occlusal and occlusal plus buccolingual tooth wear, respectively. The use of the whole crown as a superimposition reference area with a user defined estimated overlap of meshes (mean: 37%) showed the minimum differences from the gold standard method [occlusal attrition median: −0.07, interquartile range (IQR): 0.12 mm³; occlusal plus buccolingual attrition median: −0.11, IQR: 0.12 mm³].

CONCLUSION: The suggested novel 3D superimposition technique offers an efficient and highly accurate tool for tooth wear assessment using serial 3D digital dental models.
INTRAORAL SCANS AND ALGINATE IMPRESSIONS IN PRE-ORTHODONTIC CHILDREN/ADOLESCENTS
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AIMS: To compare dental arch distances, chair-side time, patient experience and cost of dental models derived from digital intraoral scans and alginate impressions in pre-orthodontic children and young adolescents.

SUBJECTS AND METHOD: Fifty nine children and adolescents (9-15 years, mean 12.70 years) had an intraoral scan and an alginate impression prior to orthodontic treatment. During the procedures, chair-side time was measured in minutes and patient experience was assessed using a visual analogue scale questionnaire. Four maxillary dental arch distances were measured on digital models, on plaster casts and directly in the mouth (intraoral). The costs of each procedure were presented graphically. Differences in dental arch distances and chair-side time were tested by a paired t-test, and patient experience by a general linear model.

RESULTS: No statistically significant differences in dental arch distances between digital models and plaster casts were found, but dental arch distances measured intraorally differed significantly from both digital models and plaster casts (P < 0.05). No significant difference in chair-side time between the two procedures was found. Patient experience was statistically better during intraoral scan compared to alginate impression concerning comfort, gag reflex, breathing, smell/sound, taste/vibration and all statements concerning anxiety (P < 0.05). Cost calculation showed that at 4.4 years the two procedures were equal in cost.

CONCLUSION: Dental arch measurements on plaster casts and digital models were equally precise, but neither were the same as the intraoral measurements. Chair-side time was the same. Young pre-orthodontic children and adolescents preferred intraoral scans compared to alginate impression. At 4.4 years the two procedures were equal in cost. The results may prove valuable in the decision to implement an intraoral scanner in orthodontic practice.

PREDICTABILITY OF INTERPROXIMAL REDUCTION DURING CLEAR ALIGNER TREATMENT
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AIMS: Interproximal tooth reduction is a recurrent procedure during clear aligner treatment to reduce mesiodistal size. Its indications are lack of space, Bolton tooth-size discrepancy, correction of morphologic anomalies, tooth reshaping. The aim of this study was to evaluate the predictability of interproximal reduction (IPR) during clear aligner treatment.

SUBJECTS AND METHOD: A total of 30 consecutive patients in treatment with clear aligners, were selected. Pre- and post-treatment digital models were acquired using a Trios intraoral scanner (3Shape, Copenhagen, Denmark) and digital set-ups were developed using Clin Check (Align Technology, California, USA). Patients were instructed to wear the aligners for 22 hours per day. For each patient the upper and lower arch was analysed before (T0) and after (T1) stripping. All measurements were performed by the same operator using Orthoanalyzer software (3Shape). For continuous variables a Student’s t-test was performed in order to consider planned and performed IPR.

RESULTS: IPR was planned for 17 patients in both arches, in eight only in the lower and in the remaining four only in the upper arch. On average, enamel reduction programmed in the upper arch was 1.15 mm (SD 1.19), after treatment the amount of enamel removed was 0.56 (SD 0.67) mm. In the lower arch, planned IPR was 1.48 mm (SD 1.07) and performed 0.89 mm (SD 0.91). The difference between the amount of enamel removed and programmed was on average 0.59 (SD 0.67) in both arches. When the planned IPR was compared to the amount of enamel removed, a statistically significant difference was found (P = 0.022 upper arch, P = 0.026 lower arch).
Predictability of IPR in the upper arch was estimated to be 50.90 per cent while this value in the lower arch was 39.68 per cent.

CONCLUSION: During treatment with clear aligners the amount of performed IPR is less than that programmed at the start of treatment with a virtual set-up. The predictability of enamel removed is less in the lower than in the upper arch.

SP 112 PERCEIVED DENTAL ATTRACTIVENESS IN CHILDREN AND ADOLESCENTS WITH AND WITHOUT JUVENILE IDIOPATHIC ARTHRITIS
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AIMS: a) to test the validity of a modified version of the Aesthetic Component scale (AC) when evaluating perceived dental attractiveness, b) to evaluate perceived attractiveness in children and adolescents with and without juvenile idiopathic arthritis (JIA) using the AC scale.

MATERIALS AND METHOD: This sub-study is based on baseline data of an ongoing longitudinal Norwegian multicentre study among young individuals with JIA (centre sites: Bergen, Trondheim and Tromsø). Baseline data was collected during 2015-2018. Cases of children with JIA were matched with a healthy control according to gender, age, study site and background origin (western or non-western origin). Inclusion criteria were 8-16 years with no present fixed appliance. The 10-grade AC scale of the Index of Orthodontic Treatment Need was based on photographs (n = 10), varying in the degree of attractive arrangement of teeth. Both children/adolescents and caregivers were asked to indicate the photograph most like ‘your own/your child’s’ teeth. Grade 1 was the most and grade 10 the least attractive option. Two global items were used to validate the AC scale. 1) ‘How do you consider your/your child’s oral health’, 2) ‘How satisfied or dissatisfied are you with the appearance of your/your child’s teeth?’. Responses were dichotomized into (1) ‘good/satisfied’ and (2) ‘poor/unsatisfied’. An independent samples t-test was used to compare AC means between children/adolescents being satisfied with child’s dental appearance/oral health and their counterparts being dissatisfied. Cases and controls were compared regarding AC severity grades using cross tabulation and chi square statistics.

RESULTS: Inclusion criteria was met by 385 [mean age: 12.9 years (standard deviation (SD): 2.4)]. The AC scale discriminated statistically significantly between children/adolescents who confirmed being satisfied and dissatisfied with the appearance of teeth; with mean values of 2.41 (SD = 1.54) versus 2.84 (SD = 1.92), P = 0.033, respectively. Corresponding values regarding parents’ assessment were 2.51 (SD = 1.80) versus 3.15 (SD = 1.87), P = 0.002. Comparing each case with the matching control, no significant differences were found between cases and controls in the severity of AC grading.

CONCLUSION: The AC scale was found to be valid for use in evaluating perceived dental attractiveness. The AC values did not differ between cases and controls.

SP 113 THIRD MOLAR AGENESIS AND ITS ASSOCIATION WITH HYPOdontIA AMONG ORTHODONTIC PATIENTS OF EASTERN NEPAL
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AIMS: To determine the prevalence of hypodontia (excluding the third molars) among orthodontic patients and to investigate the association between third molar agenesis and hypodontia.

MATERIALS AND METHOD: This study was conducted between October 2015 and March 2018 after obtaining ethical approval. The records (case history sheet and dental pantomogram) of 1000 orthodontic patients (584 females, 416 males) were analyzed by a single examiner following a pre-established protocol: overall observation of teeth including third molars, followed by systematic analysis of present or missing teeth in each quadrant. The records of the patients with a dubious history of extraction were excluded from the study. Pertinent descriptive statistics were used for the study variables. A Chi-square test was used to determine the association between 1) third
molar agenesis and hypodontia and 2) gender and hypodontia. P < 0.05 was considered statistically significant.

RESULTS: The overall prevalence of hypodontia, excluding the third molars, was 9.2 per cent. The most commonly missing teeth were the maxillary lateral incisors (38.04%) followed by the mandibular premolars (23.91%) and mandibular central incisors (16.31%). The prevalence of hypodontia was 11.1 per cent in males compared to 7.9 per cent in females, however, the difference was not statistically significant (Chi sq. value = 2.94, P = 0.086). Agenesis of at least one third molar was seen in 24 per cent of the patients and 7.1 per cent had agenesis of all four third molars. A statistically significant association was seen between third molar agenesis and hypodontia (Chi sq. value = 12.71, P = 0.001).

CONCLUSION: The prevalence of hypodontia excluding the third molars among the orthodontic patients was 9.2 per cent with the maxillary lateral incisor most commonly affected. There was a statistically significant association between third molar agenesis and hypodontia. However, hypodontia did not exhibit any gender predilection.

SP 114 BLEACHING AS A METHOD OF MANAGEMENT OF INITIAL CARIES LESIONS: A SYSTEMATIC REVIEW
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AIMS: To systematically search the literature and assess the available evidence regarding bleaching as a method to treat or alleviate white spot lesions (WSLs) of teeth due to caries, compared with other technologies, placebo or no treatment.

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 two authors. Randomized clinical trials (RCTs) and in vitro studies were included.

RESULTS: One RCT and eight in vitro studies were eligible for inclusion in this review. The high amount of heterogeneity precluded a valid interpretation of the results through pooled estimates. The results mostly focused on the effect of bleaching therapy on the enamel hardness and colour changes of tooth surfaces with caries-like lesions, followed by susceptibility for enamel demineralization. Colour changes were evaluated by a spectro-radiometer or clinical examination only, while Knoop enamel microhardness values were obtained in most studies. Thus, the bleaching therapeutic scheme used (10-15% hydrogen peroxide), was successful in camouflaging WSLs while 30 per cent of the patients had some mild hypersensitivity as expected. Moreover, bleaching procedures on enamel with caries-like lesions did not worsen the demineralization, since it was demonstrated that sound bleached surfaces presented less formation of porosities on enamel surface than caries-like lesions after treatment. Addition of fluoride to 10 per cent carbamide peroxide gel resulted in a significantly smaller average depth of the lesion.

CONCLUSION: This is the first review investigating bleaching as a distinct method for the management of WSLs. There was considerable agreement among studies that bleaching diminished the colour disparities between affected area, while in some in vitro studies bleaching did not promote further demineralization, even though different concentrations of bleaching agents were used.

SP 115 EFFECTS OF SELF-LIGATING ORTHODONTIC APPLIANCES IN THE PERIODONTAL HEALTH OF ADOLESCENT PATIENTS. A PROSPECTIVE COHORT STUDY
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AIMS: To evaluate the association between orthodontic treatment with fixed appliances and periodontal health during treatment, by examining gingival inflammation indices.

SUBJECTS AND METHOD: Thirty consecutive orthodontic patients, aged 11-18 years, who were eligible for fixed orthodontic appliances, were included in the study. Plaque index (PI) and gingival index (GI) were recorded at three time-points: exactly before placement of orthodontic fixed appliances (T0) and 3 (T1) and 18 (T2) months after bonding.

RESULTS: The hypothesis that PI would remain constant across time-points was rejected. There was an increase of PI from T0 to T1 [0 to 1 scale, T1-T0: mean difference (MD) = 0.16, 95% confidence interval (CI) = 0.88, 0.23, P = 0.01], while it decreased at T2; T2-T0: MD = –0.08, 95% CI = –0.18, 0.02, P = 0.12). There was also statistical significance that GI changed at T2 (T2-T0: MD = 0.20 95% CI = 0.09, 0.30, P < 0.001). Moreover, PI was found on average higher for the mandibular dentition by 0.10 (95% CI = 0.04, 0.17). As for the different groups of teeth examined, molars were found to present statistically significant differences when compared to other groups of teeth; the initial difference of the molars’ PI compared to other group of teeth, however, appeared to decrease with time.

CONCLUSION: In the frame of the current study, orthodontic treatment appeared to affect the periodontal health of patients; nevertheless, this was observed in a negligible manner, as far as clinical aspects are concerned.

SP 116 COMPARATIVE STUDY OF THE ARTEFACTS OF BRACKETS IN DUAL-ENERGY COMPUTED TOMOGRAPHY IN VIVO

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AIMS: Studies on the use of monochrome (MC) imaging after implantation of metallic materials on the extremities or spine have shown that artefacts can be significantly reduced. Due to the high atomic numbers and high density of materials used in orthodontics, maxillofacial surgery and tooth preservation, hardening artefacts present a major problem in computed tomography (CT) imaging of the teeth, and jaw. The limitations of the image quality caused by the visualization of the jaw, and conceivable possibilities for improvement have not been adequately investigated. The aim of this work was to investigate artefacts and reduce them by creating MCs in the lower and upper jaw area.

MATERIALS AND METHOD: Dual energy CTs (DECTs) were performed on 10 corpse heads with and without orthodontic appliances. Subsequently, MCs of 80 to 160 kV were produced. The artefacts were assessed qualitatively and quantitatively using established methods.

RESULTS: On anatomical structures such as the floor of the mouth and the soft palate, which are not in the same axial plane with high artefact producing objects of high atomic number, an increase of the Hounsfield units (HU) could be observed with an increasing kV number of MC. On structures in the same plane with artefact-producing objects, a decrease of HU could be observed with an increasing kV number of MC.

CONCLUSION: This study shows that it is also possible to reduce artefacts in the jaw area using MC. In all investigations no significantly increased artefacts were found in the setting with orthodontic appliances compared to that without orthodontic appliances.

SP 117 GENE EXPRESSION SIGNATURES OF PRIMARY MOLAR ANKYLOSIS WITH INFRAOCCLUSION

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AIMS: To compare gene expression profiles of infraoccluded primary mandibular second molars with no permanent successors with that of non-infraoccluded primary mandibular second molars with no permanent successors, and identify genes that are differentially expressed. It was then amended to generate hypotheses to facilitate future hypothesis-testing research. The null hypothesis was that there is no difference in the gene expression profile between primary mandibular second molars that are infraoccluded and those that are not infraoccluded.

SUBJECTS AND METHOD: Twelve healthy subjects who presented with a retained primary mandibular second molar and no succedaneous premolar were recruited. Six retained primary molars were infraoccluded and six were not. Bone samples were obtained from the sockets immediately after extraction and stabilized. The bone samples were homogenised, then RNA was extracted and purified. Whole-genome gene expression data was generated with the HumanHT-12v4 Expression BeadChip (Illumina®) array. The pre-processed data was log-transformed then normalized by the variance-stabilizing method. An empirical Bayes t-test was used to compare the mean gene expressions of the infraocclusion samples against that of control samples. The Benjamini-Hochberg procedure was applied to P values to control for false discovery rate due to multiple testing. Genes with adjusted P values of < 0.05 were extracted. From this group, those that were up- or downregulated with a fold change of greater than 1.5 times were further selected. These genes were identified and classified by gene function and ontology.

RESULTS: Twenty genes were significantly upregulated and four genes were significantly downregulated in the infraoccluded samples. Differential gene expression showed a general pattern of increased levels of pro-inflammatory modulators, metastasis and cell invasion promoters, and genes responsible for collagen deposition. Of particular interest, genes CLIP4 and HLA-DQB1 that are associated with autoimmune diseases were also significantly upregulated. This fits the pattern of isolated destruction of the periodontal apparatus, resulting in ankylosis and subsequent infraocclusion.

CONCLUSION: Several promising genes were identified that were differentially expressed in the infraoccluded samples. These genes can be further examined in candidate-driven studies to better understand their effect on eruption and infraocclusion.

SP 118 EFFECTS OF BETA2 ADRENALINE RECEPTOR BLOCKERS ON AN EXPERIMENTAL RAT PERIODONTITIS MODEL
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AIMS: The number of adults who wish to have orthodontic treatment is increasing, and a considerable proportion of these adults have periodontitis. Recently it has become known that the sympathetic nervous system has a high relevance to the regulation of bone metabolism. Recent studies show that experimental periodontal disease is greatly exacerbated in spontaneously hypertensive rats (SHR) with sympathicotonia. In this study, the effect of the selective β2 adrenaline receptor (β2-AR) blocker [butoxamine (BUT)] on periodontitis in SHR was examined.

MATERIALS AND METHOD: The four groups consisted of two normotensive Wister Kyoto rats (WKY) groups and two SHR groups each with one control and one BUT group. The two groups were administered BUT at a dose of 1mg/kg/day per os. Periodontitis was induced by placing an orthodontic ligature wire around a contact point between the left maxillary first molar (M1) and second molar (M2). After sacrifice at four weeks, the remaining alveolar bones between M1 and M2 were measured using microcomputed tomographic image analysis software and then histological analysis was performed.

RESULTS: The remaining alveolar bone mass in WKY and SHR groups treated with BUT was higher than in the WKY and SHR control groups. The attachment loss was lower in both the WKY and SHR groups treated with BUT than in the WKY and SHR control groups. Also osteoclast counts of both
the WKY and SHR groups treated with BUT were lower than the WKY and SHR control groups. Immunohistochemical findings in the periodontal tissue revealed that the scores of tyrosine hydroxylase of sympathetic nerve fibre marker were lower in both the WKY and SHR groups treated with BUT than in the WKY and SHR control groups. The scores of TNF-α and IL-1β and IL-6 of inflammatory cytokines were lower in the SHR group treated with BUT than in the SHR control group. The scores of TNF-α and IL-1β were lower in the WKY group treated with BUT than in the WKY control group.

CONCLUSION: These results suggest that the administration of BUT is effective in the prevention of periodontitis.

SP 119 DOES ORTHODONTIC TREATMENT IMPROVE ORAL HEALTH-RELATED QUALITY OF LIFE?
PRE-TREATMENT DATA COLLECTION AT THE EASTMAN DENTAL HOSPITAL
Keegan Gowans, Susan Cunningham, Samantha Hodges, Department of Orthodontics, Eastman Dental Hospital, London, U.K.

AIMS: The malocclusion impact questionnaire (MIQ) was developed as a malocclusion specific questionnaire and has been shown to have good validity, internal reliability/consistency and test-retest reliability. However, the responsiveness of the questionnaire still needs to be evaluated before it can be considered for widespread use. This study looked at pre-treatment questionnaire data from a single unit from part of a multicentre longitudinal study.

MATERIALS AND METHOD: This study was part of a multicentre, longitudinal, prospective, clinical cohort study, to determine the responsiveness of the MIQ. There are currently six units within the UK involved in patient recruitment. The questionnaires were completed at three time points during treatment: pre-treatment (T1), any time within the 3 months before any orthodontic intervention; post treatment (T2), a retainer review 6 to 15 weeks after the end of active orthodontic treatment; post treatment (T3), at a review appointment 9 to 15 months after the end of active orthodontic treatment. Details about the patients’ malocclusion were also recorded. This study analysed data from one unit, the Eastman Dental Hospital (EDH), at T1.

RESULTS: During initial T1 data collection at EDH 30 patients (15 females, 15 males) were recruited, with an average age of 13.5 years. Significant correlations were seen between the MIQ and both the Child Health Questionnaire and the Child Oral Health Impact Profile (COHIP; \( P < 0.001 \)). There were, however, no significant relationships between the MIQ and the different clinical features recorded.

CONCLUSION: The sample size recruited thus far at the EDH is relatively small which means that all of the data analysis has to be viewed with caution. A significant and positive finding of this early analysis was how strongly associated the MIQ was with the ‘gold standard’ COHIP questionnaire. This significant finding with a small sample size is positive and adds to the validity and reliability of the MIQ. It will be interesting when all of the data from the multicentre trial is collated to identify any clinical features which may potentially significantly affect a patient’s quality of life and to complete the responsiveness testing of the MIQ.

SP 120 EFFECT OF A FUNCTIONAL LATERAL SHIFT OF THE MANDIBLE ON HYALURONIC ACID DECOMPOSITION RELATED TO LUBRICATION OF THE TEMPOROMANDIBULAR JOINT IN GROWING RATS
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AIMS: Hyaluronic acid (HA) is a major molecular component of the articular cartilage of the temporomandibular joint (TMJ). The characteristic viscosity and slippery nature of HA ensure effective joint lubrication. HA is degraded by hyaluronidase (HYAL) 1 and 2. Efficient HYAL function is important to maintain optimal articular quantities of HA. However, the metabolism of HA in the articular cartilage of the TMJ caused by a functional lateral shift of the mandible (FLSM) remains
This study investigated the role of FLSM in the decomposition of HA and lubrication of the TMJ in growing rats.

MATERIALS AND METHOD: Thirty 5-week-old male Wistar rats were divided into an experimental and control group. The rats in the experimental group were fitted with a guiding plate to produce 2 mm FLSM during the bite down action. The rats in the control group underwent a sham operation. All animals were sacrificed at the age of 7 weeks. Histopathological changes in specimens obtained from the rats were evaluated using haematoxylin and eosin, Safranin-O and fast green stains. Decomposition of HA was evaluated using HA binding protein (HABP) staining and immunohistochemical examination to determine HYAL1 and HYAL2 protein expression.

RESULTS: The experimental group showed flattening of the ipsilateral condyle in the lateral region and increased thickness of the contralateral cartilage in the middle region. In the experimental group, the areas stained with Safranin-O and the areas showing positive HABP staining were reduced in all regions in the ipsilateral condyle but only in the lateral region of the contralateral condyle. Areas showing positive HYAL1 immunostaining were increased in the lateral regions bilaterally, and areas showing positive HYAL2 immunostaining were increased in all regions in the ipsilateral condyle of the experimental group.

CONCLUSION: FLSM could affect decomposition of HA in the articular cartilage of the TMJ in growing rats, which might lead to the altered lubrication of the TMJ.

SP 121 EVALUATION OF CERVICAL VERTEBRAL ANOMALY PREVALENCE IN DIFFERENT TYPES OF SKELETAL MALOCCLUSION: A RETROSPECTIVE STUDY IN THE INNER AEGEAN REGION
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AIMS: To compare the incidence of cervical vertebral anomalies (CVA) in different sagittal skeletal discrepancies.

MATERIALS AND METHOD: This retrospective study was performed on pre-treatment lateral cephalometric radiographs taken of patients accepted for treatment. Three hundred and sixty five patients (261 females, 104 males) aged between 9-32 years (mean age 15.6 years) who were randomly recruited were included in this study. The patients were visually scanned according to skeletal malocclusion type and presence of CVA. All radiographs were evaluated twice separately by experienced orthodontic research assistants. Then, all cephalometrics were reviewed by both research assistants for the third time to make a final and decisive decision. The results were considered by an assistant professor of oral radiology. In order to categorize skeletal malocclusion type, ANB angle was used as Class I (4° ≥ ANB <0°), Class II (ANB >4°), and Class III (ANB <0°). CVA were classified as ponticulus posticus, partial ponticulus, fusion, block fusion, partial cleft, capitalizations, accessory ossicle and dehiscence. A total of 71 cervical vertebral anomalies were found on the 365 radiographs and were classified according to skeletal discrepancy. The collected data was transferred to the SPSS 22.0 program for statistical analysis. Fisher’s exact test was performed to identify the prevalence of CVA in different sagittal skeletal patterns.

RESULTS: CVA were identified in 71 (19.4%) of 365 patients. The distribution of the 71 patients with CVA were classified according to their skeletal malocclusion; 31 Class I patients presented 17 (54.84%) ponticulus posticus, five (16.13%) partial ponticulus posticus, nine (29.03%) fusion anomaly. Thirty four Class II patients presented, 14 (41.18%) ponticulus posticus, eight (23.53%) partial ponticulus posticus, and 12 (35.29%) fusion anomaly. For six Class III patients the findings were: one (16.67%) ponticulus posticus, three (50%) partial ponticulus posticus and two (33.3%) fusion anomalies.

CONCLUSION: No statistical significance was found between CVA and sagittal skeletal malocclusions (P = 0.3420).

SP 122 THE RELATIONSHIP OF THE FRANKFORT HORIZONTAL PLANE TO THE TRUE HORIZONTAL
AIMS: To ascertain which Frankfort horizontal is the closest to true horizontal - that passing through anatomical porion, machine porion, or tragion.

SUBJECTS AND METHOD: The sample consisted of 45 orthodontically non-treated participants (16 men, 29 women) aged between 7 and 33 years. Twenty-five participants were skeletal Class I (ANB = 0 ± 2°) and 18 were skeletal Class II (ANB 4°). Every participant had a cephalogram and a lateral facial photograph in the natural head position. On the photographs, the true horizontal was traced on the basis of a horizontal shelf placed behind the participant, while the soft tissue Frankfort horizontal was traced by connecting the tragion and orbitale of the soft tissue. On the cephalograms, the anatomical Frankfort horizontal was traced by connecting anatomical porion and orbitale, while the machine Frankfort horizontal was traced by connecting the machine porion and orbitale. The cephalograms were superimposed onto the photographs using PowerPoint™, and the angles between the true horizontal and the three Frankfort horizontals were measured. With the participants facing left, a clockwise rotation was assigned a negative value and an anticlockwise rotation a positive value. Tracings and measurements were performed by three observers.

RESULTS: The mean orientation of the anatomical Frankfort horizontal to the true horizontal was –2.3 degrees [standard deviation (SD) = 4.27°], while the mean orientations of the machine Frankfort horizontal and soft tissue Frankfort horizontal were 1.4 degrees (SD = 4.58°) and 1.3 degrees (SD = 4.07), respectively. No statistically significant age, skeletal Class, or interobserver differences were found. The mean orientation of the machine Frankfort horizontal in women was 0.26 degrees (SD = 4.28°) lower than in men, constituting a significant difference. In men, the closest Frankfort horizontal to the true horizontal was the anatomical Frankfort horizontal, which had a mean value of 0.71 degrees (SD = 0.39°).

CONCLUSION: On average, soft tissue Frankfort horizontal was the closest to true horizontal. With regards to gender, the machine Frankfort horizontal was closer to the true value in women, while the anatomical Frankfort horizontal was closer in men.

SP 123 DO PROBIOTICS AFFECT ORAL HEALTH IN PATIENTS UNDER TREATMENT WITH FIXED ORTHODONTIC APPLIANCES? A SYSTEMATIC REVIEW
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AIMS: As the presence of fixed appliances increases biofilm retention, deterioration in periodontal clinical parameters may be observed and, under certain conditions, a cariogenic environment may develop, leading to enamel decalcification. The aim of the present review was to systematically investigate the available literature regarding the effects of probiotics on gingival health and enamel decalcification development in patients under treatment with fixed appliances.

MATERIALS AND METHOD: A search without restrictions in eight databases and hand searching was carried out. Randomized controlled studies investigating the effect of probiotics on gingival health and enamel decalcification development in patients under treatment with fixed appliances were reviewed. Following study retrieval and selection, relevant data was extracted and the risk of bias was assessed according to Cochrane collaboration guidelines.

RESULTS: Out of the initially identified unique records, four studies fulfilled the selection criteria for inclusion in the systematic review. Three studies evaluating gingival inflammation after probiotic use for up to one month, did not show any significant changes. The only study investigating enamel decalcification for a mean duration of 17 months of probiotic use, did not demonstrate differences in the incidence of white spot lesions between the groups at debonding. No adverse effects were reported. Various problems were noted during risk of bias assessment.
CONCLUSION: Short-term probiotic administration does not seem to have an effect on the gingival health and enamel decalcification development in patients under treatment with fixed appliances. More high quality studies, of longer duration of intervention and follow-up are warranted.

SP 124 A COMPARATIVE STUDY OF THREE DENTAL AGE ESTIMATION METHODS IN 5-17 YEAR OLD NORTH GERMAN CHILDREN
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AIMS: To analyze and compare three dental age estimation methods, Demirjian’s new weighted scores, the adapted Cameriere’s formula, both adapted for a north German population, and the Willems’ method in a cohort of north German children.

MATERIALS AND METHOD: Dental pantograms of 200 children (88 males, 112 females) aged 5-17 years were evaluated. Seven mandibular teeth were staged according to Demirjian’s dental maturity scale. Dental age (DA) was calculated using the adapted Demirjian and Cameriere’ methods, both adapted for north German children, and the Willems’ method. The DA for each method was compared with the chronological age (CA) for each patient. The paired t-test was used to assess the difference between CA and DA for each method. Absolute accuracy was determined by means of the absolute differences of DA and CA. All statistical tests were performed for girls and boys, and age cohorts separately.

RESULTS: The adapted Demirjian’s method underestimated the mean age of girls by –0.01 ± 0.87 years and overestimated that of boys by 0.01 ± 0.83 years. The adapted Cameriere’s method underestimated the mean age of girls by –0.08 ± 0.96 years and of boys by –0.04 ± 0.94 years. The Willems’ method underestimated the mean age of girls by –0.23 ± 0.88 years and of boys by –0.01 ± 0.84 years. The adapted methods showed no significant difference between DA and CA, however Willems’ method showed significant differences both in boys and girls.

CONCLUSION: The adapted methods for north German children performed accurately and precisely with no significant differences in DA estimation. The accuracy was different between boys and girls, performing better for boys with all tested methods. The Willem’s method although performed with high accuracy for the estimation of CA in north German children, showed significant differences; due to its low precision some ages showed extreme differences. Therefore, the adaptations done for the Demirjian’s and Cameriere’s method for the north German population can be used for DA estimation of that region. Further studies are required for the evaluation of the accuracy of DA estimation methods in different regions of Germany.

SP 125 IN VIVO STUDY OF THE EFFECT OF PHOTODYNAMIC THERAPY ON GINGIVAL HYPERPLASIA DURING TREATMENT WITH FIXED APPLIANCES – AN UPDATE
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AIMS: To investigate the effect of photodynamic therapy on gingival hyperplasia developing during fixed appliance therapy.

SUBJECTS AND METHOD: In this prospective, randomized, split-mouth cross-over pilot study (approved by the local ethics committee and registered as a clinical trial: DRKS-ID: DRKS00006292) 29 patients (6 dropouts) with fixed appliances and gingival hyperplasia at the first molars and in the incisor region were investigated. Exclusion criteria were: pre-orthodontic PSA <1, antibiosis 4 weeks before photodynamic treatment, gravidity, mental retardation, leukaemia, gingival fibromatosis, medication causing gingival hyperplasia as a side-effect. After obtaining informed consent all patients received professional tooth cleaning. Subsequently the test teeth were treated with photodynamic therapy (Helbo®). This was repeated after 7 days. Before, during and up to 7 weeks after the first photodynamic intervention the following parameters were recorded at the first molars and lateral incisors in the treated and control quadrants (1 + 3 versus 2 + 4): approximal
plaque index (API), modified papilla bleeding index (PBI), vertical extension of the papilla, and polymerase chain reaction analysis of the bacterial composition of the colonization in the (pseudo) sulcus (as collected with sterile paper tips).

RESULTS: Over the 7 week study period the modified PBI was markedly reduced in all quadrants with no significant difference between Helbo® and control side. However, the changes in the other parameters were much more diverse and the effect on colonization varied greatly inter-individually. No significant effects of Helbo® therapy (as applied in this study) were found for any of the investigated parameters.

CONCLUSION: While manual individual and professional cleaning is difficult and occasionally impossible with hyperplastic papilla, photodynamic therapy is easy to apply and reduces inflammation (bleeding). However, no obvious effect on gingival hyperplasia was observed.

SP 126 THE INFLUENCE OF AIR-POWDER POLISHING ON THE CORROSION BEHAVIOUR OF SELF-LIGATING BRACKETS
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AIMS: To assess the effects of air abrasive polishing on nickel (Ni) and chromium (Cr) ion release and surface micromorphology of different stainless steel (sst) self-ligating brackets.

MATERIALS AND METHOD: One hundred and sixty sst self-ligating brackets of four brands, Damon Q, Discovery, Leone 1000 and Lotus plus, were exposed to an air polishing procedure at different application periods (0, 5, 10, 20 seconds). Brackets were immersed in artificial saliva with pH values of 6.75 ± 0.15 and 3.5 ± 0.15 for 28 days. Ni and Cr ions were evaluated using atomic absorption spectrophotometer at 7, 14 and 28 days. Simultaneously, surface micromorphology was assessed using a scanning electron microscope and atomic force microscope. Statistical analysis was carried out using analysis of variance and Tukey’s tests.

RESULTS: There was a significant increase in Ni and Cr ions release in all brackets concomitant with the increase in polishing time. Unlike Cr, the release profile of Ni showed that the bulk amount occurred during the first two weeks. This process is time dependent and enhanced by an acidic environment. Furthermore, the surface of the brackets showed a marked change in surface topography represented by the appearance of new pits and crevices with an increase in surface roughness. Damon Q brackets exhibited the least amount of ion release and surface changes followed by Discovery brackets.

CONCLUSION: Ni and Cr ions release from sst self-ligating brackets subjected to air polishing procedure were significantly increased compared to non-polished brackets irrespective of bracket band. Although, the 5 second polishing period showed a significantly lower amount of ion release this may be recommended with caution.

SP 127 DENTOSKELETAL EFFECTS AND BUCCAL BONE LOSS PRODUCED BY THREE RAPID MAXILLARY EXPANSION DEVICES: A SINGLE-CENTRE, RANDOMISED CONTROLLED TRIAL
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AIMS: To investigate, in a randomized controlled clinical trial, the dental and skeletal effects and buccal bone loss produced by Hyrax, hybrid-Hyrax and Keles (a novel keyless expander) rapid maxillary expansion (RME) devices.

SUBJECTS AND METHOD: Sixty patients (mean age 14.2 ± 1.49 years) with a unilateral or bilateral posterior crossbite were randomised into three groups; Hyrax (n = 20), Hybrid-Hyrax (n = 20) and Keles (n = 20). The hybrid-Hyrax group received two 2 × 9 mm palatal miniscrews. The expansion protocol for all groups included two turns per day (0.2 mm/turn) until 30 per cent overexpansion was achieved. The appliances were removed after 6 months of retention. Pre-post treatment radiographs were analysed to investigate the changes in skeletal and dental parameters as well as the bone loss on the buccal surface of the posterior anchor teeth.
RESULTS: All appliances produced a significant transverse change in all skeletal and dental measurements. Between groups, for upper first molar skeletal linear measurements, the internal hard palate showed a suggestive significant difference between hybrid-Hyrax compared to the Hyrax group. For upper first premolar skeletal linear measurements, nasal width and upper palatal area measurements showed a significant difference between hybrid-Hyrax and both other treatment groups. The hybrid-Hyrax group also showed less angulation change of the posterior teeth. There were increased rates of fenestrations and dehiscences post-treatment. The hybrid-Hyrax group had smaller reductions in alveolar bone thickness compared with the other two appliances.

CONCLUSION: All three expansion devices successfully corrected a unilateral/bilateral posterior crossbite. There was a greater increase in nasal width and palatal area and less tipping of the lingual alveolar crest at the first premolars in the hybrid-Hyrax group compared to the Hyrax and Keles groups, however some of these differences were not clinically significant. Following RME there is a reduction in buccal alveolar bone thickness on anchor teeth and an increased number of fenestrations/dehiscence on the upper first premolars and molars.

SP 128 DENTAL ARCH WIDTHS AFTER EARLY OR LATE CERVICAL HEADGEAR TREATMENT – A RANDOMIZED CLINICAL TRIAL
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AIMS: To compare the effects of cervical headgear treatment on dental arch widths in children with a Class II occlusion after early or later timed headgear treatment.

SUBJECTS AND METHOD: Sixty seven children (39 boys, 28 girls) with a Class II malocclusion randomly divided into two groups. Headgear treatment was started at the age of 7.8 years (SD 0.53) in the early group and at the age of 9.5 years (SD 0.59) in the late group. Headgear treatment was continued in both groups until a Class I occlusion was obtained. Impressions were taken at the beginning of the follow-up (T0, mean age 7.5 years, SD 0.56), at the age of 9.5 (T1, SD 0.50), at the time of the end of treatment of the late group (T2, mean age 11.5, SD 0.62) and four years later (T3, mean age 15.3, SD 0.36). Dental casts were scanned into three-dimensional models (3Shape, R700 Scanner, Denmark) and measured with an analyzing program (3Shape, Ortho Analyzer 2012). The independent samples t-test was used to compare the means of the groups. A Mann-Whitney U-test was used for those differences, which did not follow normality of the sample.

RESULTS: Forty-four children (28 boys, 16 girls) completed the study. All dimensions were larger in the early group compared to the late group at T3. The lower dental arch was 1.74 mm wider at T3 (P = 0.03). The distance between the lower first molars 1.97 mm larger in girls (P = 0.09) and 1.59 mm longer in boys at T3 (P = 0.11). The distance between the upper first molars was 1.25 mm larger at T3 (P = 0.12).

CONCLUSION: Early timed headgear treatment has a significant positive effect on dental arch widths compared to later timed headgear treatment.

SP 129 A VALIDATION STUDY OF THE MALOCCLUSION IMPACT QUESTIONNAIRE TO MEASURE ORAL HEALTH-RELATED QUALITY OF LIFE IN YOUNG ARABS WITH MALOCCLUSION
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AIMS: To translate, culturally adapt and validate the malocclusion impact questionnaire (MIQ) in a sample of Arab adolescents with malocclusion.
MATERIALS AND METHOD: After translation according to current guidelines, the comprehensiveness of the Arab version of MIQ (MIQ-AR) was verified previously in a pilot study of 20 Arab adolescents. The current main study was undertaken in a sample of 184 native Arab speakers, aged 10-16 years, who presented for an initial orthodontic consultation appointment. The Child Perceptions Questionnaire short version (CPQ11-14 ISF-16), which was already validated for use in the Arabic language, was used to investigate criterion validity. Thirty-nine adolescents completed the same questionnaires (MIQ-AR and CPQ11-14 ISF-16) again after 3 weeks in order to test the repeatability of the measurements. Cronbach’s alpha was used to test the internal consistency/reliability and Spearman’s rho for the criterion validity. Test-retest reliability was tested using intraclass correlation coefficient (ICC). Statistical tests were undertaken using SPSS.

RESULTS: The MIQ-AR presented high internal consistency (Cronbach’s alpha = 0.929 > 0.70) and very satisfactory discrimination index (DI = 0.63 > 0.30). A positive, very strong, and statistically significant correlation was found between the total scores of the MIQ-AR scale and the CPQ11-14 ISF-16 scale (rho = 0.752, P < 0.001). Test-retest reliability was at high levels (ICC = 0.958, P < 0.001).

CONCLUSION: The MIQ-AR may exhibit good psychometric properties in terms of validity and reliability and seems to be a reliable instrument to assess oral health-related quality of life in Arab adolescents. Further testing of the measure is required in a variety of environments.

SP 130 IN VITRO ASSESSMENT OF FRICTIONAL RESISTANCE FOR A THREE-DIMENSIONALLY PRINTED ORTHODONTIC NOVEL BRACKET DURING SLIDING MECHANICS
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AIMS: Friction, binding, and notching impede orthodontic tooth movement during sliding mechanics. The purpose of this study was to evaluate resistance between a novel bracket and archwire. The bracket design utilized a cutting edge three-dimensionally printed manufacturing technique and implemented Teflon-coated rollers. The technology allows for a cost-effective bracket that could reduce sliding resistance during space closure.

MATERIALS AND METHOD: Brackets in five different groups (n = 10, each) were pulled on an MTS Instron universal testing machine along an 0.019 × 0.025 inch archwire with a test jig. The brackets tested were: a passive self-ligating bracket, a conventional twin bracket, a three-dimensionally printed direct metal laser sintering (DMLS) bracket with Teflon™ rollers, DMLS without Teflon rollers, and a computer numeric controlled (CNC) machined milled bracket with Teflon rollers. Each bracket was mounted to the test jig at 0 degrees of tip with no torque, initially. After the baseline measurement at 0 degrees of tip, each bracket was then tested at 4 and 8 degrees of tip. The brackets were pulled along the archwire under the tie wings for 3 mm at a rate of 5 mm/minute and the peak force was recorded in Newtons (N). One-way ANOVA analysis was conducted to evaluate the impact of manufacturing processes DMLS, CNC, and Teflon coated rollers on peak sliding resistance.

RESULTS: There were significant differences in peak sliding resistance at 0 (P < 0.0001), 4 (P < 0.0001), and 8 (P < 0.0001) degrees of tip. At 0 degrees, Damon brackets had significantly higher peak sliding resistance than both CNC milled Teflon and Protolabs Teflon (adjusted P < 0.0001, 0.0003, respectively). At 4 degrees, the Damon and Protolabs non-Teflon had significantly higher resistance than CNC milled Teflon, Protolabs Teflon, and Victory (adjusted P < 0.05). At 8 degrees, CNC milled Teflon and Protolabs Teflon had significantly lower resistance than Victory (adjusted P = 0.0072, 0.0517, respectively). Damon and Protolabs non-Teflon had significantly higher resistance than the others (adjusted P < 0.05 for all).

CONCLUSION: The data suggests that a new bracket design with Teflon rollers could potentially decrease resistance to sliding during orthodontic movement.

SP 131 THE RELATIONSHIP BETWEEN CHONDRODYSPLASIA AND RPL5-ASSOCIATED CELL DEATH IN PATIENTS WITH DIAMOND-BLACKFAN ANAEMIA
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AIMS: Diamond-Blackfan anaemia (DBA) is a rare congenital pure red cell aplasia caused by mutation of ribosomal protein genes (RPs) playing an essential role in ribosome assembly. Approximately 40 per cent of DBA patients exhibit physical abnormalities, especially craniofacial deformities, some of which seem to be due to chondrodysplasia. In erythrocyte, abnormalities of RP have been found to activate the p53 pathway by inhibiting MDM2-mediated p53 suppression in response to RP mutations. However, the mechanism of RP genes in the craniofacial deformities is poorly understood. The aim of this study was to determine the relationship between chondrodysplasia and RPL5 associated cell death in DBA.

MATERIALS AND METHOD: Induced pluripotent stem cells (iPS) from leukocytes of DBA patients carrying RPL5 mutation were produced; and healthy siblings served as a control. iPSc were differentiated into chondrocytes via mesenchymal stem cells (MSC) differentiation, chondrogenic differentiation ability by quantitative polymerase chain reaction (QPCR) and cartilage formation ability by Alcian-blue (AB) staining were evaluated. Secondly, apoptosis was evaluated by TUNEL assay. MDM2 activator was added to patient-derived cells (DBA group), and MDM2 inhibitor to control derived cells (NOR group), and apoptosis evaluated in chondrocytes by TUNEL assay and qPCR.

RESULTS: Both the DBA group and the NOR group showed upregulation of SOX9 after chondrogenic differentiation, but the DBA group showed weaker AB staining than the control. In the chondrocyte of the DBA group cell death was significantly enhanced, and BAX and CASP9, which are the target genes of p53 transcription factor, increased significantly, although p53 expression level was unchanged in both groups. The MDM2 activator suppressed cell death and ameliorated cartilage formation in the DBA group, and the MDM2 inhibitor increased cell death and deteriorated chondrogenesis in the NOR group.

CONCLUSION: Chondrodysplasia was observed in RPL5 haploinsufficient patients with craniofacial abnormalities. These results suggest that the chondrocyte apoptosis was increased by activation of p53 pathway in response to RPL5 mutation.

SP 132 THE EFFECT OF REGULAR DENTAL MODEL ARTEFACTS ON THE THREE-DIMENSIONAL SUPERIMPOSITION OF SERIAL DIGITAL MAXILLARY DENTAL CASTS
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AIMS: To evaluate the effect of regular artefacts on the superimposition outcome, using standard three-dimensional (3D) model acquisition and superimposition techniques.

MATERIALS AND METHOD: Ten pre- and post-orthodontic treatment plaster models were scanned through an intraoral scanner. Regular artefacts were removed in accordance with current practice and scanning was repeated. Cleaned models were scanned twice to assess the effect of the model acquisition process on the superimposition outcome. To assess the effect of artefact removal, superimpositions of cleaned and uncleared models were performed using the iterative closest point algorithm. Three different reference areas and two different software settings were evaluated. Measurements were repeated twice to assess interoperator error. Statistical analysis was performed using non-parametric multivariate analysis of covariance.

RESULTS: Cleaning status (artefact removal), software settings and measurement time-points did not affect the mean accuracy and precision of the performed measurements (P > 0.05). The choice of superimposition reference area was the only factor that affected measurements (accuracy: P = 0.001; precision: P = 0.016). However, assessment of individual cases revealed significant differences on the detected tooth movement depending on artefact removal (median of absolute differences in position: 0.41 mm, range: 0.07-1.06 mm; median of absolute differences in rotation:
1.2°, range: 0.32-3.05°) and on the 3D model acquisition process itself (median of absolute differences in position: 0.21 mm, range: 0.05-0.73 mm; median of absolute differences in rotation: 0.88°, range: 0.25-1.78°). The effects of all factors tended to decrease with an increased size of the superimposition reference area.

CONCLUSION: A certain amount of imprecision in individual tooth movement assessments through superimposition of serial dental models should be expected under clinical conditions, due to the presence of regular artefacts, as well as to the 3D model acquisition process. The findings highlight the importance of having accurate, artefact-free models, to obtain a valid and precise assessment of tooth movement that occurs between two time points, through serial 3D patient model superimposition.

SP 133  A NEW PROTOCOL FOR THE CORRECTION OF AN ANTERIOR OPEN BITE IN CHILDREN
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AIMS: The creation of a new treatment protocol in children with an open anterior bite (AOB), and mixed dentition, through treatment with an extrusion utility arch.

SUBJECTS AND METHOD: Twelve patients diagnosed, by means of a new cephalometric approach, for correct evaluation of dentoalveolar processes. Being open bites, the treatment plan proposed in the 12 cases was the extrusion of this process. Due to the involvement of lingual interposition with the AOB malocclusion, orthodontic treatment was combined with myofunctional therapy, in 7 of the 12 cases. Closure of the bite was carried out using a 0.016 × 0.022 Blue-Elgiloy section extrusion utility for a 0.018 slot, with a 135 degree tipback. It was necessary to place 0.018 inch MSE brackets on the four upper incisors, and auxiliary appliances (quadhelix or transpalatal arch) to avoid the mesial crown inclination effect as a consequence of the extrusion tip back.

RESULTS: A correction of the AOB was achieved in all subjects, reaching a correct overbite. The anterior sector extruded an average of 3.34 ± 1.12 mm, while for the molar there was a mesial tip of −0.55 ± 1.83 degrees.

CONCLUSION: The realization of this new protocol in patients in the mixed dentition with an AOB and diminished superior dentoalveolar process, is successful in the resolution of this malocclusion type. The molar tip is corrected during alignment and levelling, and subsequently it is correctly controlled by means of the auxiliary arms.

SP 134  SOFT TISSUE PROFILE CHANGES OF MONOZYGOTIC AND DIZYGOTIC TWINS DURING GROWTH
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AIMS: The present longitudinal study aimed to assess differences in the development of the soft tissue profile during growth between monozygotic and dizygotic twins.

MATERIALS AND METHOD: The sample consisted of 45 pairs of untreated twins (15 monozygotic, 30 dizygotic) from the Forsyth Moorrees Twin Study (1959-1975); lateral cephalograms taken from 6 to 18 years of age were analyzed at 3-year intervals. Cephalograms were traced, and longitudinal changes in the nasal prominence, the nasolabial angle, and the soft chin thickness between twins were analyzed with structural equation modelling.

RESULTS: Great variability during growth was seen for nasal prominence, which ranged from 9.2 mm (95% confidence interval (CI): 8.6-9.7 mm) to 15 mm (95% CI: 14.2-15.7 mm) from 6 to 18 years of age with broad-sense heritability being 62 and 35 per cent for monozygotic and dizygotic twins, respectively. The nasolabial angle ranged from 111.7 degrees (95% CI: 109.2-114.4°) to 112.7 degrees (95% CI: 110.4-115.1°) during the observation period with broad-sense heritability being 59 and 22 per cent for the monozygotic and dizygotic twins, respectively. Finally, mean soft chin
thickness increased from 10.7 mm (95% CI: 10.2-11.2 mm) to 12.6 mm (95% CI: 12.1-13.1 mm) from 6 to 18 years of age with broad-sense heritability being 38 and 28 per cent for the monozygotic and dizygotic twins, respectively.

CONCLUSION: Considerable differences were found in the genetic contribution of monozygotic and dizygotic twins to the development of the soft tissue profile, which were generally moderate. This supports the complex developmental mechanism of the human face and the varying influence of genetic and environmental factors.

SP 135 PATIENT REPORTED SATISFACTION AND PEER ASSESSMENT RATING OF COMBINED ORTHODONTIC/ORTHOGNATHIC TREATMENT; A MULTICENTRE AUDIT

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AIMS: Orthognathic treatment is a lengthy and extensive multidisciplinary treatment process. Clinical treatment outcomes can be measured to ensure the resources are being used efficiently in terms of occlusal outcome, but consideration should also be given to the patient’s perception of overall treatment. The aim of this audit was to assess satisfaction and overall treatment outcome in patients having combined orthognathic/orthodontic surgery across two sites.

MATERIALS AND METHOD: Standards set included 90 per cent of patients to feel they have achieved treatment goals and a mean reduction in the Peer Assessment Rating (PAR) index at the end of treatment should be more than 70 per cent. Secondary outcomes of interest included psychosocial wellbeing, function, aesthetics and morbidity. Data were collected from patients who had undergone orthognathic surgery between June 2016 and July 2017. Patients were contacted via telephone to be included in the survey. Distribution of a modified British Association of Oral and Maxillofacial Surgeons’ patient satisfaction questionnaire was undertaken via letter or online format. The study models of the identified patients were requested and analysed by two PAR calibrated assessors.

RESULTS: Twenty seven patients were included in the audit. Eighty one per cent of patients saw an improvement in their main reason for having treatment. The majority (82%) of patients would recommend orthognathic treatment to a friend or relative. One individual would not recommend treatment as they felt they were more anxious/depressed because of treatment. The mean percentage PAR reduction between the two hospitals was 83 per cent.

CONCLUSION: Overall the 90 per cent standard set was not achieved for patient satisfaction. Overall PAR outcomes exceeded standards set out. Recommendations were made for future practice in order to improve these outcomes and implementation of routine patient feedback through development of a departmental online questionnaire.

SP 136 A DEPARTMENTAL CONSENT FORM AUDIT

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AIMS: 1) To investigate if patients’ consent forms are present, stored and updated accordingly in the medical notes. 2) To investigate if the quality of information on the consent forms comply with the General Dental Council’s (GDC) standards.

MATERIALS AND METHOD: One hundred consecutive medical notes of patients in active treatment were collected and assessed over a week in July 2018. These patients were all seen and treated by orthodontic registrars. A data collection sheet was developed to gather information regarding the following: absence/presence and location of consent forms, general patient information, treatment information, additional risks (if applicable). The gold standard was 100 per cent for the presence of consent forms in the medical notes, correct location of consent forms and that the relevant GDC
orthodontic leaflet boxes on the consent forms checked. Ninety per cent for general information, treatment information and risks were recorded.

RESULTS: Only 96 per cent had consent form(s) present, thus the subsequent data presented is based on the 96 sets of notes with the consent form(s) present. Items for which gold standards were not met were: presence of consent forms (96%), correct location of consent forms (97%), patient’s signature (81%) and type of retention (65%). In terms of treatment for impacted teeth, clinicians often did not mention the risk of ankylosis, the need for repeated exposure and the unpredictable shape and colour of the teeth. For previously traumatized teeth, clinicians often did not mention the risk of root resorption, discolouration and ankylosis. Lastly, the post-orthodontic restorative provider for hypodontia patients was often not discussed and clarified during the consent stage.

CONCLUSION: As part of the GDC’s requirement, it is important to ensure that all signed consent form(s) are correctly completed and adequately stored in the record system. It is also imperative to ensure that the patients fully understand the procedures involved and are advised of all the potential risks and benefits of their orthodontic treatment. Patients under the age of 16 years should be encouraged to sign their consent form in addition to their parents as this allows children to gain more responsibility toward their treatment. A re-audit would be recommended.

SP 137 A REASSESSMENT OF MANDIBULAR GROWTH ROTATION DURING CHILDHOOD AND ADOLESCENCE
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AIMS: To compare the rate of true growth rotation of the mandible during childhood and adolescence and to compare the rate of true mandibular rotation to the rate of general somatic growth (measured as the increment in height of the cervical vertebrae) during the same stages.

MATERIALS AND METHOD: The records of 30 subjects (15 females, 15 males) were obtained from the Burlington Growth Study. The sample covered the range of skeletal Classes: Class I (n = 13), Class II (n = 12) and Class III (n = 5). Serial digital lateral cephalograms were selected at three stages: early mixed dentition (T1: 6.76 ± 0.54 years), onset of pubertal growth spurt (T2: 11.20 ± 0.48 years) and the later stage of puberty (T3: 16.16 ± 0.33 years). Digital superimpositions on the cranial base and mandibular natural reference structures were carried out to measure the total and annual amount of true growth rotation during both childhood (T1-T2) and adolescence (T2-T3) stages. The increments in vertebral height (C2 to C6) during both stages were measured to represent general somatic growth. A second set of measurement was made after at least four weeks to assess the precision of the measurements.

RESULTS: Analyses with paired t-tests found the annual rate of true forward mandibular rotation to be significantly greater (P = 0.019) in childhood (−0.99 ± 0.65°/year) than in adolescence (−0.64 ± 0.54°/year). Males showed significantly more (additional 0.6°/year) true forward rotation compared to females in the adolescent stage. No significant difference was found between the different molar relationships. The increase in vertebrae height was not significantly greater during adolescence than during childhood. Moderately significant negative correlations were found between the annual true rotation and the annual cervical height increment during childhood (r = −0.43, P = 0.017) and adolescence (r = −0.61, P = 0.000).

CONCLUSION: Despite the increased somatic growth represented by the increase in cervical vertebrae height during adolescence, true mandibular rotation was still significantly greater during childhood. This might be explained by the increased local dentoalveolar changes during the transition phase to the permanent dentition. Potential forward rotators with increased overbite may require an earlier start to treatment to control the overbite.

SP 138 THE ACCURACY OF THREE-DIMENSIONAL PRINTED MODELS FABRICATED USING A DIGITAL LIGHT PROCESSING METHOD
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AIMS: Storage of manually created plaster dental models is a major problem. In this work, the accuracy of dental models fabricated using a digital light processing (DLS) method was evaluated.

MATERIALS AND METHOD: Original STL data was created a framework to U-shape-like dental arch form and adding five hemispherical objects with a diameter of 1 mm on the upper surface for measuring by a free software (Blender). The effect of build direction and support shape was compared as follows; build direction patterns were set parallel (P model) and vertical (V model) to the upper plane, and a support structure was set at a diameter of 0.5, 0.8, 1.0, and 1.5 mm cylinder. Moreover, the accuracy due to the numbers of supports was tested. All printed models were scanned, and root means square values were measured between original data and scanned data by each measurement point.

RESULTS: Comparing build direction, the P model appeared distorted 0.10 mm from the upper plane with 0.9 per cent shrinkage. Distortion and shrinkage of the V model was significantly lower than that of the P model. As for accuracy verification by support shape, this showed a tendency to improve as the diameter became thicker. In addition, the increase in the density did not contribute to the improvement of accuracy. A sample with a diameter of 0.5 mm could not be reconstructed as the irradiated surface could not withstand the tensile stress.

CONCLUSION: It was found that contraction or distortion differed depending on build direction and support shape. However, for any of the models, deformation was less than about 0.9 per cent, and the accuracy as an orthodontic treatment model was sufficiently ensured.

SP 139 AUTOMATIC MARKING SYSTEM FOR MULTIPLE LANDMARKS ON CEPHALOGRAMS BY DEEP LEARNING
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AIMS: Cephalometric analysis is a standardized diagnostic method in orthodontics; however, it is time-consuming process even for a specialist. In recent years, research on deep learning has increased due to a high-speed computer with a large-capacity memory and a graphics processing unit (GPU). Tensorflow is provided as a module to use GPU for deep learning, and processing can be performed at high speed. In this project, the aim was to develop a basic program for detecting 14 landmarks (S, N, Or, A, B, ANS, GoI, L1, U1, L1R, U1R, Me, PNS, Peg) simultaneously by utilizing convolutional neural network (CNN).

MATERIALS AND METHOD: Python 3 (version 3.6.3) was used as a programming language and imported a numpy module for faster computing of mathematical tasks. The Keras module with Tensorflow as the backend included the CUDA platform was introduced as the way to implement GPU. Seven thousand cephalogram images with the size of approximately 1000 × 800 pixels were prepared. All 14 landmarks were made by an orthodontic specialist (train data). In order to perform high-speed processing, the image size was reduced to 1/5 times for training. Input image and landmarks data were connected to 6 convolution layers and run through two affine layers to reach the output (predict data). The structure of the CNN was run using the Ubuntu (ver16.04.4 LTS Xenial Xerus) with a Nvidia GeForce GTX 1080 Ti.

RESULTS: All landmarks were identified the corresponding positional relationship on cephalograms by present deep learning system. Especially, recognition of point S indicated high accuracy. The average distance between train data and predicted data when converged was, on average, less than 3 pixels on an image with 200 × 200 pixels.

CONCLUSION: As the first step of this project in which all landmarks on cephalograms were automatically extracted, the positional information between each point was very good and it was possible to detect all landmarks spontaneously. More accurate detection will be possible using...
cropped images from original cephalometric images, because these images can be used without reducing the pixel size and the processing speed will be faster.

SP 140 THE EFFECT OF SMILE DIMENSIONS AND LIP THICKNESS ON SELF-REPORTED SMILE ATTRACTIVENESS
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AIMS: To explore the influence of linear smile and lip dimensions on self-reported smile attractiveness.

SUBJECTS AND METHOD: The sample population consisted of 613 young adults (214 males, 399 females) from various ethnic backgrounds, who were all dental students. Three-dimensional (3D) resting facial photographs of all participants were obtained using a 3D stereophotogrammetry system (3dMD, Atlanta, USA). Digitization of 3D images and all linear measurements (smile width, smile height, upper and lower vermillion height) were performed using ViewBox 4 software (dHAL software, Kifissia, Greece). Assessment of participants’ perceptions regarding their smile attractiveness was performed with a short questionnaire, and answers were recorded with visual analogue scales (VAS). Appropriate regression models were developed to test the effect of smile width, smile height and upper and lower vermillion thickness during smile, on the attractiveness of the smile. All statistical analyses were performed at the 0.05 level of significance.

RESULTS: There were significant differences between males and females in self-perception of smile attractiveness with females reporting higher scores on the VAS (μF = 70.9 / μM = 67.5; P = 0.012). However, ethnicity did not appear to influence self-reported ratings. Only smile width had a significant effect on self-perceived smile attractiveness (ßWidth = 0.627; CI: 0.356-0.899; P < 0.001) smile height (P = 0.094) and lip dimensions upon smiling did not influence participants ratings of their smile attractiveness (PUpperLip = 0.201; PLowerLip = 0.468).

CONCLUSION: Smile width is the only smile dimension that significantly affects self-assessment of smile attractiveness. Smile height and lip dimensions during smiling do not appear to play a significant role.

SP 141 ECTOPIC ERUPTION OF THE MAXILLARY SECOND MOLAR: PREDICTIVE FACTORS
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AIMS: To investigate the diagnostic aspects, contributing conditions and predictive key factors associated with ectopic eruption of the maxillary second molars.

MATERIALS AND METHOD: The study models, lateral cephalographs and panoramic radiographs of 40 adults with bilateral ectopic eruption and 40 adults with normal eruption of the maxillary second molars. Independent t-tests, univariate and multivariate logistic regression analysis followed by receiver operating characteristic analysis was used for statistical evaluation.

RESULTS: Tooth widths of bilateral lateral incisors, canines and premolars were wider in the ectopic group, which resulted in greater arch lengths. The ANB angle and maxillary tuberosity distance (PTV-M1) were smaller in the ectopic group. Multivariate logistic regression analysis showed that three key factors - arch length, ANB angle and PTV-M1 distance were significantly associated with ectopic eruption of the second molars.

CONCLUSION: An increase in arch length, decrease in ANB angle and decrease in maxillary tuberosity distance to the distal aspect of the maxillary first molar were the most predictive factors associated with ectopic eruption of maxillary second molars.
SP 142 CHANGES IN OCCLUSAL FUNCTION AFTER EXTRACTION OF PREMOLARS: A 2-YEAR FOLLOW UP
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AIMS: To determine the effects of extraction and the number of teeth extracted on occlusal function measured by the occlusal contact area and occlusal force using pressure sensitive sheets.

SUBJECTS AND METHOD: Patients treated with fixed appliance were divided into non-extraction, two maxillary premolar extraction, and four premolar extraction groups. Occlusal contact area and force were measured before treatment, immediately after treatment and after the 2 year retention period.

RESULTS: The occlusal contact area and force after treatment decreased compared to the initial pre-treatment values but increased after the 2 year retention period in all groups. The occlusal contact area and force in the non-extraction and two maxillary premolar extraction groups recovered to the pre-treatment levels after the 2 year retention period.

CONCLUSION: In evaluation of the association after premolar extractions in orthodontic treatment, the occlusal contact area and force showed a tendency to decrease immediately after treatment and then gradually increase to pre-treatment levels after the 2 year period.

SP 143 EVALUATION OF THE MAXILLA AFTER RAPID MAXILLARY EXPANSION WITH A BONE-TOOTH-ANCHORED EXPANDER USING CONE BEAM COMPUTED TOMOGRAPHIC IMAGES
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Aims: To evaluate changes occurring after bone-tooth anchored maxillary expansion using cone beam computed tomographic images.

Subjects and Method: Nine consecutive females in the permanent dentition with a mean age of 17.71 years, who presented with maxillary deficiency and a complete ossification of the palatal suture; treated using bone-tooth anchorage expanders. The changes of the mid palatal suture were evaluated at the level of the first molar (SMP1), first premolar-second premolar (SMP2), canine (SMP3) and most anterior point of the dental arch (SPM4). The change of the transpalatal suture was measured at level of the union of the mid and transpalatal suture (ST1), 6 mm transpalatal suture (ST2), 12 mm (ST3) and 18 mm (ST4); and finally the intermaxillary suture (SI).

Results: Expansion with the use of these appliances resulted in the following opening values of the sutures: SMP1: 2.31 ± 0.9; SMP2: 2.7 ± 0.9; SMP3: 4.02 ± 1.5; SMP4: 4.25 ± 1.77; ST1: 0.82 ± 0.49; ST2: 0.57 ± 0.51; ST3: 0.29 ± 0.35; ST4: 0.57 ± 0.38; SI: 3.2 ± 1.27.

Conclusion: 1. Rapid maxillary expansion (RME) using these expanders can be an effective way to solve maxillary skeletal deficiency in patients in whom ossification of the mid palatal suture is complete. 2. RME resulted in increases in the maxillary transverse dimension at all the measured points, being higher in the anterior zone. 3. Studies with a larger number of cases are needed to obtain stronger evidence.

SP 144 STUDENTS` PERCEPTIONS OF A STUDY MODULE BASED ON INTERPROFESSIONAL EDUCATION IN UNDERGRADUATE ORTHODONTIC TRAINING
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Aims: The World Health Organization defines interprofessional education (IPE) as ‘when students from two or more professions learn about, from and with each other to enable effective collaboration and improve health’. In Finland, orthodontic treatment is usually delivered by a team
consisting of an orthodontist, a dentist, a dental hygienist and a dental nurse. The present study aimed to assess the perception of IPE among dental and dental hygiene students.

SUBJECTS AND METHOD: The study was conducted in collaboration with the University of Eastern Finland and the Savonia University of Applied Sciences in Kuopio, in 2018. Fourth year dental students (n = 37) and second year dental hygiene students (n = 28) participated in a study module ‘Orthodontic treatment and screening for treatment’ including three simultaneous practical exercises starting with the same demonstration and having partly the same teachers. Data were gathered by a questionnaire delivered at the end of the study module. The students were asked ‘if understanding of the topic increased’, ‘if the atmosphere for learning was supportive’, ‘if the teaching proceeded logically’ and ‘if the course material contributed to learning’. The answering options ranged from 1 to 5 (1 = fully disagree, 5 = fully agree). Free comments were asked in an open question.

RESULTS: Most of the participants agreed with the claims submitted. The mean scores indicating the opinions of the asked items varied between 4.04-4.68 among the dental students and 4.18-4.64 among dental hygiene students. Perception for logic of teaching was slightly better with dental hygiene students compared to dental students (P = 0.051). In free comments, dental hygiene students (39%) especially demanded more collaboration with dental students.

CONCLUSION: Overall feedback of this IPE based learning method implemented as shared practical exercises among dental and dental hygiene students was positive. It seems that IPE is well suited for undergraduate orthodontic training. In the future, more intensive educational collaboration between different oral health care professionals should be developed.

SP 145 A COMPARATIVE STUDY BETWEEN THE RIGHT AND LEFT HAND USING MATURATION OF THE MIDDLE PHALANX OF THE THIRD FINGER IN SKELETAL AGE EVALUATION

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AIMS: Orthopaedic treatment should be undertaken before the pubertal growth spurt and functional treatment during or immediately after this moment to obtain the maximum result in a shorter period. Several radiographic methods have been proposed to evaluate this growth parameter: historically hand-wrist radiograph and more recently the cervical vertebral maturation (CVM) method on lateral radiographs and the middle phalanx of the third finger (MPM) method. Both CVM and MPM methods show six stages (CVS and MPS): two prepubertal stages (CVS 1-2 and MPS 1-2), two pubertal stages (CVS 3-4 and MPS 3-4) and two puberty posts (CVS 5-6 and MPS 5-6). In the literature, the MPM is evaluated on the right hand as reference. The aim of this study was to evaluate if there is a differential skeletal maturation between the right and left hand and the possible relationship with the patient’s preferred hand.

MATERIALS AND METHOD: A sample of 130 patients was selected. Every radiograph was obtained with the finger on a 2 × 3 cm intraoral sensor. The cone of the radiographic machine was positioned to the orthogonal of the sensor. All radiographs were evaluated by the same operator. Statistical analysis was undertaken using Fisher’s exact test and P were significant when lower than 0.05.

RESULTS: Total agreement between right and left hand stages was found, except for MPS2. In the MPS2 stage 17.1 per cent of the patients showed disagreement. All these patients showed MPS3 stage in the left hand (P < 0.05).

CONCLUSION: Use of the right hand stage as reference to determine the growth pubertal spurt is confirmed. For patients with MPS2, an additional radiograph of the middle phalanx of the third finger of the left hand can be performed to increase diagnostic accuracy.

SP 146 RELATIONSHIP BETWEEN CANINE IMPACTION AND THE SHAPE OF THE MAXILLARY SINUS

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AIMS: Upper canine impaction is sometimes seen in routine dental practice, and impacted canines are occasionally associated with unfavourable root resorption of the adjacent teeth. Therefore, it is important to predict the possibility of canine impaction and start treatment before the canines
have impacted. The maxillary sinus bottom and side wall are often pushed up because the canines are impacted between the nasal wall and the maxillary sinus wall. This suggests that the maxillary sinus bottom and side wall protruding inward may be one of the predictors of canine impaction. Thus, the aim of this study was to examine the relationship between canine impaction and the shape of the maxillary sinus.

SUBJECTS AND METHOD: Patients whose canines were erupted naturally in the dental arch were included in the erupted group (n = 79), while those whose canines were impacted and needed surgical exposure were included in the impacted group (n = 52). Their panoramic radiographs at the age of 7-9 years were examined retrospectively. The shape of the maxillary sinus, the height of the cusp of the canine, the distance between the lateral incisor and the first premolar, and Nolla’s stages of tooth calcification were evaluated.

RESULTS: The maxillary sinus bottom and wall protruded inward more in the impacted group than in the erupted group. The distance between the lateral incisor and the first premolar was significantly shorter in patients whose maxillary sinus wall protruded inward than in patients whose maxillary sinus wall did not protrude. Nolla’s stage of the impacted canine was smaller than of the erupted canine.

CONCLUSION: The maxillary sinus bottom and wall protruding inward reflects the lack of eruption space for the canine and can be a predictor of canine impaction.

SP 147 CHANGE OF CEPHALOMETRIC VARIABLES AFTER ORTHODONTIC-ORTHOGNATHIC SURGERY TREATMENT
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AIMS: To evaluate the changes of cephalometric variables after orthodontic and orthognathic surgery treatment
SUBJECTS AND METHOD: This was a clinical statistical study of a descriptive nature. The sample consisted of 58 patients (38 females, 20 males) aged 17-39 years [mean and standard deviation (SD) 21.3 ± 5.2], who underwent orthodontic and orthognathic surgery treatment in the period October 2011 to April 2018. For all patients a careful clinic evaluation was made for diagnose placement. All patients had panoramic and lateral radiographs before and after treatment. Different types of orthognathic surgery were performed. Hard and soft tissue cephalometric analysis was undertaken before and after surgery.
RESULTS: Bimaxillary surgery was the most prevalent surgery in 60 per cent, followed by a bilateral sagittal split osteotomy 17.5 per cent, Le Fort I 7.5 per cent, surgically assisted rapid palatal expansion 12.5 per cent and genioplasty 2.5 per cent. A significant improvement after surgery was found in the sagittal and vertical planes. The SNA angle was lower and changed from 72.10 (SD 2.4) before surgery to 77.0 (SD 4.2) after surgery. SNB angle higher than 810 changed from 86.90 (SD 2.4) before surgery to 810 (SD 1.4) after surgery. MMA angle lower than 210 changed from 16.50 (SD 2.1) before surgery to 200 (1.4) after and values higher than 290, changed from 33 (SD 4.2) before surgery to 27.50 (4.9) after. A more significant improvement was seen in soft tissue parameters, nasolabial angle, face convexity angle and mentolabial angle.
CONCLUSION: A significant change was observed in soft and hard tissue cephalometric variables after orthodontic-orthognathic surgery

SP 148 PARENTAL INFLUENCE IS THE MOST IMPORTANT PREDICTION OF A CHILD’S ORTHODONTIC TREATMENT DEMAND IN PREADOLESCENCE
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AIMS: To explore predictive values of objective treatment need, impaired quality of life, and parental influence in orthodontic treatment demand in preadolescents and adolescents. A secondary goal was to validate 16-item Child Perceptions Questionnaire.11-14

SUBJECTS AND METHOD: Predictors of treatment demand were explored in 197 orthodontic patients; 93 preadolescents (51% females) and 104 adolescents (55% females). The Index of Orthodontic Treatment Need (IOTN DHC) was used to assess objective treatment need. Hierarchical linear regression and multilevel binary logistic regression models were used to explore the predictive power of age, gender, objective treatment need, impaired quality of life and parental influence on treatment demand.

RESULTS: Impaired emotional well-being, parental influence and IOTN DHC were significant linear predictors of treatment demand ($\beta = 0.335, 0.221$ and $0.152$). In logistic regression analysis, by controlling for gender, objective treatment need and impaired quality of life, parental influence was revealed as the most important predictor of treatment demand in preadolescents (OR = 7.7) while it was objective treatment need in adolescents (OR = 4.5). Increase of impairment in the index by one point increased treatment demand by 1.3-1.4 times in both age groups.

CONCLUSION: Greater parental agreement and motivation for treatment could result in higher preadolescent cooperation. Orthodontic treatment in adolescents could be more effective with a patient-orientated approach.

SP 149 PROBIOTIC BACTERIA LACTOBACILLUS REUTERI PRODENTIS CAN INDUCE CORROSION DEGRADATION OF THE SURFACE OF NICKEL TITANIUM ALLOY ABOVE THE INFLUENCE OF SALIVA

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AIMS: To determine if probiotic bacteria have an additional effect above the influence of saliva on the surface on two principle alloys used in orthodontics and if this influence is modified by the coating of the alloy.

MATERIALS AND METHOD: Research was conducted on four types of archwires with dimensions of 0.508 x 0.508 mm, three nickel titanium (NiTi) alloys (composition w(Ni) = 50.4%; w(Ti) = 49.6 %) with uncoated surfaces, rhodium and titanium nitride coated, as well as stainless steel (SS). They were exposed for a period of 28 days to pure artificial saliva (pH = 4.8), as well as saliva with the addition of probiotic bacteria Lactobacillus reuteri prodentis. Unexposed archwires were used as the control. The surface roughness was quantitatively studied using atomic force microscopy. Raman spectroscopy was used to identify metal oxides formed on the surface of alloys.

RESULTS: Probiotic bacteria affected the surface and their effect was dependent on the type of alloy and coating. They increased surface roughness in the case of uncoated NiTi above the influence of saliva ($P < 0.05$). Probiotic bacteria tended to decrease corrosive influence of saliva on SS and also on NiTi when the alloy was coated with rhodium or titanium nitride. Raman spectroscopy confirmed that only SS samples were prone to oxidation processes, more favoured upon exposure to saliva than probiotic bacteria.

CONCLUSION: Probiotic bacteria induce degradation of the surface of NiTi alloy above the influence of saliva, but only if the surface is uncoated. It does not produce additional roughness on SS above the influence of saliva.

SP 150 FIXED ORTHODONTIC TREATMENT INDUCES TIME-VARYING DYSBIOSIS IN BOTH COMPOSITION AND FUNCTION OF SUPRAGINGIVAL ORAL BIOFILM

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AIMS: As orthodontic treatment is known to increase both caries and periodontal disease risk, it was postulated that this risk is mediated via changes in the composition or activity of the oral microbiome. In this longitudinal pilot study among adolescent orthodontic patients, the hypothesis was tested that the introduction of fixed appliances induces taxonomic and functional dysbiotic shifts in the supragingival dental biofilm, as assessed by the next-generation sequencing methods.

SUBJECTS AND METHOD: Ten healthy orthodontic patients (aged 13-15) scheduled for treatment with fixed appliances. One trained and calibrated examiner recorded clinical measures of bleeding on probing, gingival index, and plaque index. Supragingival plaque samples were collected from facial surfaces of the maxillary incisor and mandibular premolar index teeth using sterile scalers at four time points: before bonding of orthodontic appliances and at 1, 6, and 12 weeks after bonding. Samples were placed in Tris-EDTA solution and snap-frozen. DNA was isolated using a MagMAX Pathogen DNA isolation kit (ABI) and a 16S amplicon library was prepared to carry out pair-ended, (2 × 250 bp) Illumina sequencing. RNA was isolated using a Power Micobiome kit (Qiagen). After rRNA removal, total pair-ended (2 × 150 bp) illumina sequencing of the pooled library was executed. After bioinformatics processing and estimation of taxa, gene family abundance, pathway abundance, and pathway coverage; diversity indices and metagenomic/metatranscriptomic correlated data were analyzed over time and across bacterial species of interest.

RESULTS: Biofilm taxonomic diversity decreased (phylogenetic diversity, whole tree, Shannon index) in both DNA and RNA from baseline (pre-treatment) to one week (post-treatment). This shift was primarily due to a 66 per cent relative decrease in Corynebacterium matruchotii and relative increases in Actinobacteria: (86%) and Veillonella (32%). Concurrently, metatranscriptomic pathway Lautropia Mirabilis abundance diversity (Shannon index) decreased. Corynebacterium matruchotii showed a decrease both in abundance and expression at 1 week, and Veillonella showed a marked increase in expression through 12 weeks after bonding, consistent with all participants developing gingivitis.

CONCLUSION: These results provide initial proof-of-principle evidence that an elective oral disease risk-increasing intervention, fixed orthodontic appliances, can induce a dysbiotic shift in both the composition and function of the supragingival oral biofilm of healthy patients.

SP 151 EFFECTS OF TEMPOROMANDIBULAR DISC DISPLACEMENT ON CONDYLAR DIMENSIONS IN ADULT ORTHODONTIC PATIENTS
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AIMS: It has not been fully investigated which dimension of the condyle is influenced by progress in disc displacement of the temporomandibular joint (TMJ) and gender. The purpose of this study was to investigate condylar dimensions with respect to TMJ disc displacement and gender using computed tomography (CT) and magnetic resonance imaging (MRI) in adult orthodontic patients.

MATERIALS AND METHOD: A total of 165 condyles from 83 adult orthodontic patients (39 men, 44 women) were examined by MRI and CT. TMJ disc displacement was divided into three groups based on TMJ MRI: normal disc position (NR), disc displacement with reduction (DDR), disc displacement without reduction (DDNR). After condylar height, condylar thickness, condylar width, anterior condylar angle, horizontal condylar angle, and medial condylar angle were calculated from CT images, differences in age and condylar dimensions with respect to gender and TMJ disc displacement were tested with two-way analysis of variance at a significance level of P = 0.05.

RESULTS: Condylar height and thickness were smaller in condyles with DDNR than those with NR, but there was no significant difference between NR and DDR or between DDR and DDNR (NR > DDR > DDNR). However, condylar width gradually decreased from NR to DDR and condyles with DDNR showed the smallest condylar width (NR > DDR > DDNR). Anterior condylar angle was larger in condyles with NR than those with DDR or DDNR (NR > DDR > DDNR). Condyles with NR or DDR showed smaller horizontal condylar angles than those with DDNR (NR > DDR < DDNR). However, no significant difference in medial angle was found among the TMJ groups. Interestingly, changes in
the condylar dimensions associated with TMJ disc displacement were not significantly different between men and women, although condylar height and width were larger in men than in women.

CONCLUSION: The findings suggest that condylar dimensions are significantly influenced by TMJ disc displacement. In particular, altered condylar dimensions become more severe as TMJ disc displacement progresses and condyles with DDNR may show three-dimensionally reduced dimensions, irrespective of gender.

SP 152 WHEN TO EXTRACT FIRST PERMANENT MOLARS WITH POOR PROGNOSIS TO ACHIEVE FAVOURABLE SPONTANOUS SPACE CLOSURE? – A PROSPECTIVE CLINICAL STUDY
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AIMS: To evaluate when to extract first permanent molars (FPM) with a poor prognosis to achieve favourable spontaneous space closure in children.

SUBJECTS AND METHOD: Thirty healthy children (9 females, 21 males) with FPM of poor prognosis were consecutively recruited. Indications for extraction were severe molar incisor hypomineralisation, severe caries or unsuccessful endodontic treatment. Before extractions, the patients were documented by extra- and intraoral photographs, panoramic and cephalometric radiographs and study casts. Additional photographs and casts were obtained during annual examinations for three years. Vertical and transversal relationships, space closure, rotations, midline deviation, space conditions, Little’s irregularity index (LII) and dental stage of the second permanent molars (SPM) were analyzed. The dental stage was assessed according to Demirjian’s method.

RESULTS: The patients were divided into two groups; early extractions (n = 15); aged between 7.6 and 9.12 years; late extractions (n = 15); aged between 10.0 and 13.4 years. Thirty-five maxillary and 28 mandibular FPMs were extracted. Forty-four FPM were extracted because of severe MIH, 17 because of severe caries and two because of poor endodontic treatment. In the early extraction group 16 SPM were in dental stage C, 24 in D, 16 in E and eight in F. In the late extraction group, four SPM were in dental stage C, four in D, 16 in F and 28 in stage G. Two patients, dropped-out. There was no change between the groups in overjet and overbite after three years. Spontaneous space closure was achieved in a higher number in the maxilla (n = 18) than in the mandible (n = 2). In both groups, LII was lower 3 years after extraction, both in the maxilla and mandible, compared to before treatment. No difference in cephalometric diagnosis was observed between the groups before extraction.

CONCLUSION: Spontaneous space closure was more favourable in the maxilla compared to the mandible in both groups 3 years after extraction in both groups. Overjet and overbite were stable.

SP 153 WHAT IS THE EVIDENCE OF ROOT RESORPTION AFTER ORTHODONTIC TREATMENT WITH FIXED APPLIANCES? A SYSTEMATIC REVIEW
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AIMS: To assess evidence on the occurrence and severity of external root resorption after treatment with fixed appliances.

MATERIALS AND METHOD: The systematic review was conducted in accordance with the Preferred Reporting Items of Systematic reviews and Meta-Analyses (PRISMA), and Centre for Reviews and Dissemination (CRD) guidance for undertaking systematic reviews and registered in PROSPERO (ID=CRD42018084725). Publications were identified by searching three electronic databases (PubMed, Scopus and Cochrane Library). Two authors independently read titles and full abstracts of the publications found, to assess if they accorded with eligibility criteria. One author manually searched the reference lists of included publications. Randomised clinical trials (RCTs) and observational studies published in peer-reviewed journals assessing root resorption by means of cone beam computed tomography or periapical radiography were included. Studies with sample
size <40 individuals for observational studies and <15 per group for RCTs and follow-up time <6 months were excluded. Studies were then assessed for high, unclear or low risk of bias for four domains (sample selection, orthodontic treatment, identification of root resorption and analyses of outcomes) using a protocol based on Cochrane, CRD and QUADAS-2 (Quality Assessment for Diagnostic Accuracy Studies). Data from included full-text publications was extracted independently by two authors.

RESULTS: Two RCTs and 12 observational studies, of which eight were retrospective, were included. The most frequent shortcomings of excluded full-text articles were insufficient description of orthodontic treatment and identification of root resorption. Sample size ranged from 40 to 171 individuals and the mean age varied from 12 to 17 years. The mean follow-up time ranged between 6 and 29 months. Root resorption was assessed by periapical radiography in 11 studies and by CBCT in three studies. The two studies assessed to have low risk of bias in all domains were comparing Damon self-ligating and conventional brackets showing no difference in root resorption. Results of further analyses of included studies will be reported.

CONCLUSION: Based on the preliminary results there is need to improve study design and reporting of orthodontic treatment and how root resorption is analyzed. Inadequate reporting can lead to misleading findings with consequences for patient care.

SP 154 EFFECT OF LOW-LEVEL THERAPY ON ORTHODONTIC TOOTH MOVEMENT AFTER EXTRACTION OF PREMOLARS: A SINGLE BLIND CLINICAL STUDY

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AIMS: To evaluate the effect of a 940 nm low-level laser on the rate of orthodontic tooth movement.

SUBJECTS AND METHOD: A randomized mouth split design consisting of 12 patients. The treatment plan included extraction of first or second premolars. The experimental group was randomly assigned and the laser Epic X (Biolase, Irvine, California, USA) was applied at two points at the buccal and two at lingual/palatal. Application was undertaken once every month for a period of 1, 2 and 3 months. The retraction was realized with a Sentalloy closed-coil spring with a force of 300 g. Silicone impressions of the extraction spaces were made at each visit and the amount of tooth movement was measured with a digital electronic calliper.

RESULTS: The 940 nm produced statistically significantly more movement in the first and second month. Improvement in the third month was not relevant. Gender and the maxillary dentition could not be assessed due to the small sample studied.

CONCLUSION: The findings suggest that application of a low-level laser could accelerate tooth movement during orthodontic treatment. A larger sample would be interesting to study more variables.

SP 155 ACCORDANCE OF INCISOR INCLINATION AND POSITION ASSESSED BY DIFFERENT CEPHALOMETRIC ANALYSES AND ORTHODONTIC CAST ANALYSIS

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AIMS: To retrospectively evaluate the agreement of diagnostic interpretations of four cephalometric analyses (Tweed, Steiner, Ricketts, Hasund) and orthodontic cast analysis (Korkhaus) concerning sagittal incisor inclination and position.

MATERIALS AND METHOD: Lateral cephalograms and orthodontic casts of 92 orthodontically untreated patients (10-11 years of age) were randomly selected and analysed. To assess lower and upper incisor inclination, the analyses according to Ricketts and Steiner were used, for lower incisor inclination additionally to Tweed. Analyses according to Steiner, Ricketts, Hasund and Korkhaus
were applied to determine upper and lower incisor position. Accordance of diagnostic interpretations regarding incisor inclination and position derived from these analyses was calculated in percent and using Cohen’s Kappa.

RESULTS: There were conspicuous incongruities between the results of the different cephalometric analyses. According to Ricketts, 75 per cent of patients had their upper incisors in an anterior position, whereas according to Hasund this was the case for only 47.8 per cent. The highest diagnostic agreement (84.8%) was found regarding upper incisor position as assessed according to Steiner and Ricketts. The poorest agreement was observed for the Ricketts and Korkhaus analyses evaluating lower incisor position (30.4%). In general, accordance among the applied dentobasal cephalometric analyses was higher than with the dentoalveolar orthodontic cast analysis.

CONCLUSION: The considerable discrepancies between the results of different analyses to evaluate upper and lower incisor inclination and position suggest that diagnostic interpretations in this regard should not be based on a single analysis, especially when far-reaching therapeutic consequences are to be drawn. In particular, dentoalveolar cast analysis by itself does not seem to be sufficient due to the manifest discrepancies in the dentobasal cephalometric results observed.

SP 156 THE ROLE OF UNSTABLE OCCLUSION ON TEMPOROMANDIBULAR DISORDERS IN THE NORTHERN FINLAND BIRTH COHORT 1966
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AIMS: The aetiology of temporomandibular disorders (TMD) is multifactorial. The aim was to investigate the effect of an unstable occlusion on TMD in the Northern Finland Birth Cohort (NFBC) 1966.

SUBJECTS AND METHOD: The NFBC 1966 is a research programme concerning subjects born in 1966 in two northern provinces in Finland. Altogether 1964 cohort subjects (1052 women, 912 men; age 46 years) responded to questionnaires and participated in a clinical medical and dental examination. The stomatognathic examination followed a modified protocol of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). The association between TMD signs and diagnoses with occlusal disturbances i.e. malocclusions (overjet, overbite, anterior and lateral crossbite, scissor bite) and occlusal interferences, was examined. The experience of orthodontic treatment (information collected with a questionnaire) was compared with TMD signs and diagnosis as well as with the amount and distribution of occlusal interferences. The prevalence of occlusal disturbances was calculated and the significances between the genders was tested by chi-square test. Statistical significance was determined at $P < 0.05$. Binary logistic regression models were used to analyze the association between TMD signs and occlusal factors. The odds ratios (OR) and 95 per cent confidence intervals (95% CI) were adjusted for gender. Pearson’s chi-square and Fisher’s exact test were used to calculate differences in TMD signs and diagnoses as well as in occlusal interferences between orthodontically treated and untreated groups.

RESULTS: A statistically significant association was found between myalgia and lateral scissor bite and between arthralgia and lateral deviation in the retruded contact position and intercuspal contact position (RCP-ICP) slide. Pain in the masticatory muscles was associated with a negative overjet and the amount of RCP-ICP slide. Arthralgia was significantly more common in subjects who had had orthodontic treatment compared with untreated subjects.

CONCLUSION: TMD signs were associated with an unstable occlusion, especially the amount and lateral deviation in RCP-ICP slide as well as negative overjet. Arthralgia was more common in subjects who had had orthodontic treatment compared with untreated subjects.

SP 157 EVALUATION OF CANINE ERUPTION THROUGH AUTOLOGOUS GRAFTED BONE IN CHILDREN BORN WITH A CLEFT LIP AND PALATE: A CONE BEAM COMPUTED TOMOGRAPHY STUDY
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AIMS: To examine the tooth development and eruption path of the maxillary canine through the grafted alveolar bone in children born with a cleft lip and palate. The null hypothesis is that there is no difference between the canine on the cleft and non-cleft sides with regard to vertical eruption, volumetric development, and angulation.

SUBJECTS AND METHOD: Thirty subjects with non-syndromic unilateral cleft lip and/or palate. Low dose cone beam computed tomographic scans were taken for the maxilla before and after the alveolar bone graft surgery for each patient. Angular and linear measurements were taken on three-dimensional modelling software (Materialise 3-matic) after superimposing the pre- and post-operative scans to assess the difference in the canine angulation, vertical eruption, and the volumetric development of the canines between cleft and non-cleft sides. A paired t-test was performed to test the hypothesis.

RESULTS: There was no significant difference between cleft and non-cleft side canines in terms of the amount of vertical eruption (cleft side mean: 5.3 mm, non-cleft side mean: 4.9 mm, \(P = 0.132\)), and volumetric development (the mean growth in cleft side canine was 79.4 mm\(^3\), the mean growth in non-cleft side canine 85 mm\(^3\), \(P = 0.662\)). While there was a significant difference in the post-operative angulation related to the mid-sagittal plane (cleft side canine mean: 16.5°, non-cleft side mean: 6.1°, \(P = 0.001\))

CONCLUSION: The null hypothesis cannot be rejected regarding vertical eruption and volumetric development. Even after bone augmentation, canine angulation on the cleft side remains significantly higher than on the non-cleft side.

SP 158 AN AUDIT OF ORTHOGNATHIC SURGERY CANCELLATIONS AT KING’S COLLEGE HOSPITAL
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AIMS: To determine the number and reasons for orthognathic surgical cancellations at King’s College Hospital (KCH) in order to establish a cancellation protocol.

MATERIALS AND METHOD: A retrospective audit undertaken at KCH orthodontic department. Gold standard: 100 per cent of patients with same day cancellations for non-clinical reasons should have their operations rescheduled within 28 days of the original date. Assessment of patient notes and theatre diaries for patients who underwent orthodontic treatment and pre-surgical work up at KCH, and surgery between 1/1/2014-31/12/2017. Reasons for cancellation, rescheduling timeframe and effects on surgical work-ups were evaluated. Findings were analysed using descriptive statistics.

RESULTS: Overall, 43 cancelled operations out of 126 undertaken were identified, with 29 patients affected. Thirty five per cent of those operations were cancelled on the same day due to non-clinical reasons. Overall, 49 per cent of all cancelled operations were rescheduled within a 28 day period of the original date and 58 per cent of the same day non-clinical cancellations met the standard. Eighty eight per cent of patients who had any delay in their surgery date had no effect on their surgical work-up.

CONCLUSION: Data capture was limited by the quality of note taking and location of information relating to cancellations. An orthognathic cancellation protocol has been developed to enable better communication between the hospital trust, orthodontic and surgical clinicians, laboratory technicians and patients.

SP 159 A MULTICENTRE AUDIT OF PATIENT SATISFACTION ACROSS NORTH-WEST ENGLAND
Majed Kahale\(^3\), Amir Rezvani\(^2\), Joanna Dancer\(^2\), \(^1\)Rotherham General Hospital, Sheffield and \(^2\)Blackburn NHS Teaching Hospital, U.K.

AIMS: To assess patient satisfaction with orthodontic treatment so as to highlight and mitigate areas of dissatisfaction.
MATERIALS AND METHOD: A prospective and expanded audit undertaken across both primary and secondary care centres in Lancashire and South Cumbria. This was a follow-up to an initial audit carried out at Lancashire Teaching Hospitals during 2016. Gold standard: A 90 per cent or greater positive response rate per question, and a 95 per cent or greater positive response rate overall. A standardised patient satisfaction questionnaire was given to existing patients undergoing orthodontic treatment across 15 primary and secondary care centres during 1/10/2017-31/12/2017. Fourteen different domains relating to the quality of care received were assessed. This included interaction with staff, communication, cleanliness of the department, and the available facilities.

RESULTS: One thousand four hundred and sixty seven responses were received from the 15 centres. The average satisfaction rate across the 14 domains was 92 per cent. The area of least satisfaction was patient perception of departmental organisation, which scored 84 per cent. However, on average 100 per cent of patients rated the overall care they had received as being ‘excellent’.

CONCLUSION: Patients were generally pleased with their orthodontic treatment, particularly with the care and respect they had received. Following discussion at the regional orthodontic managed clinical network meeting, changes have been implemented across the whole of Lancashire and South Cumbria.

SP 160 ACCURACY OF DIGITAL MODELS GENERATED BY AN INTRAORAL SCANNER COMPARED TO PLASTER MODELS
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AIMS: Intraoral scanners offer the advantage of obtaining three-dimensional digital models without the need for impressions. The aim of this study was to determine the reliability of arch parameters measured on digital models created using an intraoral colour scanner compared to measurements on plaster models.

MATERIALS AND METHOD: The study sample comprised maxillary and mandibular digital and stone models of 26 patients. Alginate impressions were used to make stone models, and each patient’s maxillary and mandibular arches were scanned with a 3Shape Trios intraoral scanner. Digital models were generated from intraoral scans. The measurements on the plaster models were made using a digital calliper, whereas Ortho Analyzer software was used for measuring digital models. Forty parameters were evaluated in each group. Tooth measurements included mesiodistal crown widths of maxillary and mandibular teeth. Arch measurements included maxillary intercanine distance, intermolar distance and arch depth. Additionally, Hays-Nance and Bolton analysis, arch length, overjet and overbite parameters were evaluated. Shapiro-Wilk and independent t-tests were used statistically.

RESULTS: No statistically significant differences were found between the conventional and digital models (P > 0.05) for any of the parameters.

CONCLUSION: Measurements made on digital models using Ortho Analyzer software were reliable compared with measurements made on plaster models.

SP 161 WHOLE-EXOME SEQUENCING IN A JAPANESE FAMILY WITH MANDIBULAR PROGNATHISM
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AIMS: Mandibular prognathism is a phenotype of facial deformity seen in populations around the world, but with a higher incidence among East Asian populations. Five genome-wide non-parametric linkage analyses and a genome-wide association study to identify susceptibility loci of the phenotype have shown inconsistent results. The aim of this study was to explore variants related to mandibular prognathism, whole-exome sequencing in a Japanese family was carried out.
SUBJECTS AND METHOD: The family was ascertained as having mandibular prognathism. The pedigree comprised 15 individuals from four generations. Four affected individuals across two generations and five unaffected individuals were chosen for whole-exome sequencing. Exon capture was performed with the Agilent SureSelect v6+UTRs kit, followed by massive parallel sequencing on Illumina HiSeq2500 platform. ClustalW was used to compare multiple alignments of annotated protein sequences across species.

RESULTS: Five non-synonymous single-nucleotide variants (SNVs) of UBASH3B, OR6M1, OR8D4, OR8B4, and BEST3 genes were detected in all four affected individuals, but in none of the five unaffected individuals. A non-synonymous SNV (c.C1816A, p.L606I) of the BEST3 gene was identified as novel missense variant. L606 was conserved across six species (human, macaque, mouse, phascolarctos, elephant, and medaka). BEST3 is located on chromosome 12q15 and encodes bestrophin 3 from the bestrophin family of anion channels. BEST3 is expressed in human cartilage. The four other non-synonymous SNVs of UBASH3B, OR6M1, OR8D4, and OR8B4 were not considered plausible candidates for mandibular prognathism.

CONCLUSION: Whole-exome sequencing implicates a novel non-synonymous SNV of BEST3 as a candidate for mandibular prognathism in this Japanese family.

SP 162 GINGIVAL THICKNESS ASSESSMENT AT THE MANDIBULAR INCISORS OF ORTHODONTIC PATIENTS WITH TWO DIFFERENT PROBING SYSTEMS. A CROSS-SECTIONAL STUDY

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AIMS: To assess gingival thickness (GT) at the mandibular incisors of orthodontic patients through gingival translucency with two different methods, and to determine if methods are comparable and applicable as diagnostic tools for assessing periodontal anatomy.

SUBJECTS AND METHOD: The sample consisted of 94 consecutive orthodontic patients. The method of probe trans-gingival translucency does not directly measure GT, but classifies gingival phenotype based on the visibility of a periodontal probe through the gingiva, when the probe is inserted for 1 mm in the gingival sulcus. GT was evaluated at both central mandibular incisors, mid-facially on the buccal aspect, with two probes: a) a standard periodontal probe and b) a colour-coded periodontal probe. Pearson's chi-square test was used to test for the association of measurements between gingival phenotype assessments through the standard probe (2 groups: visible, not visible) and the colour-coded probe (4 groups: white, green, blue, none).

RESULTS: No statistically significant relationship between the two measurement techniques was evident either for tooth 31 (n = 94, P = 0.739) or tooth 41 (n = 94, P = 0.478) or when all the measurements were pooled (n = 188, P = 0.402).

CONCLUSION: In the context of the present study, measurements with the colour-coded probe did not seem to follow the relevant measurements with the standard periodontal probe.

SP 163 TREATMENT EFFICACY IN DIRECT VERSUS INDIRECT BONDING OF BRACES IN ORTHODONTIC PATIENTS. A SYSTEMATIC REVIEW

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AIMS: To assess the available evidence for the difference in treatment efficacy with direct versus indirect bonding of orthodontic brackets.

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 and 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 Risk of Bias and Robins-I tool.

RESULTS: After application of the eligibility criteria, seven studies were included in this systematic review. One was RCT, three were prospective, one was retrospective and two were in vitro studies. Risk of bias ranged from low to high. Due to substantial clinical and methodological heterogeneity, a meta-analysis was not feasible. There was considerable agreement among studies that indirect bonding provided faster and better placement of brackets. On the other hand direct bonding was superior as far as gingival inflammation and costs were concerned.

CONCLUSION: Although the quality of evidence varied among the included studies, there is considerable amount of evidence suggesting that the two tested techniques have marked advantages and disadvantages, when different clinical aspects are evaluated.

SP 164 SKELETAL MATURITY OF THE CERVICAL VERTEBRAE AND THE HAND-WRIST IN PRECOCIOUS PUBERTY PATIENTS

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AIMS: The onset of puberty is accelerating and the prevalence of central precocious puberty is rapidly increasing. The aim of this study was to compare bone maturation of subjects with central precocious puberty and a control group using lateral cephalograms and hand-wrist radiographs and to investigate the discrimination of the maturity indicators.

SUBJECTS AND METHOD: The central precocious puberty group included 70 girls (mean age, 8.58 ± 0.5 years) and the control group 48 girls (mean age, 8.67 ± 0.7). The cervical vertebrae maturation index, skeletal maturation indicators and Tanner-Whitehouse 3 were chosen to evaluate bone maturity assessment.

RESULTS: In case of skeletal maturation indicators and Tanner-Whitehouse 3 bone age, there were significant increases in bone age in the central precocious puberty group than in the control group (P < 0.01) while the cervical vertebrae maturation index showed a lower increase (P = 0.087). Spearman correlation coefficients between groups were 0.72 (P < 0.01) in skeletal maturation indicators and 0.339 (P < 0.01) in Tanner-Whitehouse 3 bone age, while 0.150 (P = 0.105) in the cervical vertebrae maturation index.

CONCLUSION: In central precocious puberty patients, bone maturation is accelerated and skeletal maturation indicators and Tanner-Whitehouse 3 are clinically useful maturity indicators rather than the cervical vertebrae maturation index.

SP 165 CTX-1 AND PINP LEVELS IN GINGIVAL CREVICULAR FLUID AND SERUM OF ORTHODONTIC PATIENTS AFTER BONDING OF FIXED ORTHODONTIC APPLIANCES

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AIMS: Orthodontic treatment is known to promote bone formation and resorption processes. The International Osteoporosis Foundation and International Federation of Clinical Chemistry have recommended C-terminal telopeptide of type I collagen (CTX-I) and N-terminal propeptide of type I procollagen (PINP) as a reference for bone turnover markers. The aim of the present study was to compare CTX-1 and PINP values in gingival crevicular fluid (GCF) and in serum of orthodontic patients and a matched control group.
MATERIALS AND METHOD: GCF samples were collected from four mandibular incisors with PerioPaper® GCF Collection Strips from 20 orthodontic patients at four time points: a) at baseline (exactly before bonding) b) 5 days after bonding of the upper and lower jaw, c) 14 days after baseline and d) 6 months after baseline. GCF samples were also collected at baseline from 20 untreated controls of a similar range of age and gender. The Periopapers were thawed for 15 minutes and a proteinase-inhibitor cocktail buffer was then added to the pooled samples. At the same time points, blood was taken from the patients. Frozen sera were thawed on ice. Samples were diluted 1:10 in sample diluent buffer. Quantitative determination of each selected biomarker was performed in duplicate with ELISA kits.

RESULTS: No statistically significant differences between the means of the variables, at the 95 percent confidence interval, were observed, at any time-point. Further, no clear pattern of PINP and CTx biomarkers level alteration was recorded over time either in the GCF or in the serum of the patients.

CONCLUSION: In the frame of the current study, orthodontic treatment with fixed appliances did not interfere with physiological bone turnover processes as determined by the response in GCF or in serum.

SP 166 CHLORHEXIDINE MOUTHWASH FOR GINGIVITIS CONTROL IN ORTHODONTIC PATIENTS. A SYSTEMATIC REVIEW

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AIMS: To assess the available evidence for the effects of chlorhexidine mouthwash in treating gingivitis during treatment with fixed orthodontic appliances.

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 Risk of Bias and Robins-I tool.

RESULTS: After application of the eligibility criteria, eight studies were included in this systematic review. Four were RCTs and four were prospective studies. Risk of bias ranged from low to high. Due to substantial clinical and methodological heterogeneity, a meta-analysis was not feasible. There was considerable agreement among studies that chlorhexidine mouthwash successfully controls gingivitis, as it reduces plaque and gingival indices. Pocket depth seems to decrease, along with bacterial counts in gingiva.

CONCLUSION: Although the quality of evidence varied among included studies, there is a considerable amount of evidence suggesting that chlorhexidine mouthwash successfully restricts orthodontically induced gingivitis.

SP 167 A NOVEL GEOMETRIC MORPHOMETRIC ANALYSIS FOR MANDIBULAR FOSSA SHAPE DESCRIPTION

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AIMS: To present a method for quantitative and comprehensive description of fossa’s shape in three-dimensions.

MATERIALS AND METHOD: In order to ensure a comprehensive description of the fossa’s shape, one anatomic curve was traced and 10 and 105 sliding semi-landmarks on the curve and on the surface, respectively, were located. 'Fossa curve' was digitally traced on the periphery of the fossa’s depression outlining the anterior fossa border (articular eminence) and the posterior border
(petrotympanic fissure). The curve, together with the points on it, constituted a peripheral border around the mandibular fossa and served as the foundation for the sliding of the remaining surface semilandmarks. Points on fossa curve were located equidistantly. 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 tomographic radiographs of non-pathological joints randomly selected from the records of a private clinic.

RESULTS: Inter- and intraobserver error assessment showed that the method is reproducible, with no systematic error and random error corresponding to a small percentage of the total variance of the sample. The three first PCs described 70.5 per cent of the total shape variability (PC1 described 34.8 per cent, PC2 21.1 per cent and PC3 14.6 per cent). PC1 and PC2 primarily described differences in height to width ratio. PC3 described angular and shearing shape differences.

CONCLUSION: In cases of non-pathological joints, the above methodology can be successfully applied for a quantitative and comprehensive description of the shape of the mandibular fossa.

SP 168 AUTOMATIC DETECTION OF LANDMARKS ON CEPHALOGRAM IMAGES BY MEANS OF ARTIFICIAL INTELLIGENCE (DEEP LEARNING SYSTEM) – TWO STEP DETECTION
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AIMS: Artificial intelligence (deep learning system: AI) is now commonly used for supporting an excellent interface for human and machine. Especially, Keras, with a backend program (ex. Tensorflow), enables fast and easy development of an AI model. For the establishment of automatic detection of landmarks on cephalograms, the aim of this research was to try and produce an AI system that detects the precise point in two steps.

MATERIALS AND METHOD: Graphics Processing Unit (GPU; Nvidia G-Force 1080 Ti) with a boost clock of around 1.6 GHz and 11 G byte on board memory was used for the training of AI. OS is Ubuntu (ver16.04.4 LTS Xenial Xerus). Python is adopted as a programming language, and the AI model was scripted on Keras with the backend of Tensorflow. Seven thousand cephalometric images with the data of landmarks that were marked by a skilled orthodontist were fed into this system. The AI model was constructed with six convolutional and two affine layers. The original images of the cephalograms were approximately 1000 × 800 pixels. Fourteen landmarks (S, N, Or, A, B, ANS, Gol, L1, U1, L1R, U1R, Me, PNS, Pog) were detected simultaneously previous research (first step), and using this AI model; the landmarks were cropped by 100 × 100 pixels. Precise detection of Nasion (N) was tried in this experiment (second step).

RESULTS: Training time for the AI was 4.5 hours. The newly developed AI model showed 95 per cent accuracy, and the error from the exact points was, on average, less than four pixels of the original images of 1000 × 800 pixels. This AI took less than 1 second to estimate point N on a new cephalometric image, and it worked not only on Ubuntu but also on Macintosh.

CONCLUSION: The newly developed AI based on Keras with Tensorflow had a capability to detect point N precisely, and to detect other important landmarks on cephalograms will be easily achieved with this same method.

SP 169 IN VITRO/IN VIVO DEGRADATION PERFORMANCE AND BIOCOMPATIBILITY OF AZ31 MAGNESIUM ALLOY IMPLANTS: A MICROCOMPUTED TOMOGRAPHIC STUDY IN RATS
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AIMS: To investigate degradation characteristics and biocompatibility of AZ31 magnesium alloy, compared with titanium alloy (TiA), pure magnesium and poly-L-lactic acid, in order to consider the feasibility of AZ31 magnesium alloy for orthodontic miniscrew implant (MSI) and bone fixation plate application.

MATERIALS AND METHOD: ASTM B348 Gr5 TiA, AZ31 magnesium alloy (MgA), pure magnesium (Mg) and poly-L-lactic acid (compatible with ISO13485; PLA) with a diameter of 1.6 mm and a length of 4.0 mm were used in the present study. Each sample was immersed in simulated body fluid (SBF) for 14 days to determine the pH change of the solution and degradation rate of the sample (mm/year). Each sample was implanted into femoral bone of Wistar rats to examine its in vivo degradation performance for 12 weeks. The retrieved bone implant samples were scanned using a microcomputed tomographic (μCT) system (inspeXio SMX-225CT, Shimazu, Japan), providing a scan resolution of 7 µm. Bone density (BV/TV, %) and bone-implant contact (BIC, %) were determined in the peri-implant bone. Results were compared using ANOVA and Tukey’s test, with P set at < 0.05 for statistical significance.

RESULTS: The pH values increased greatly by immersion of MgA and Mg in SBF, although immersion of TiA and PLA did not influence their pH values. The in vitro degradation rate of MgA was around 0.81 mm/year measured by immersion test, which was significantly lower than Mg (2.50 mm/year) and higher than PLA (0.43 mm/year). Degraded three-dimensional images for the MgA maintained structural integrity during 12 weeks. μCT analysis (implanted for 12 weeks) showed similar BV/TV and BIC values were obtained for all specimens, with the slight exception of Mg (BV/TV). The MgA implant and the surrounding bone were well integrated within 12 weeks, implying good biocompatibility and osteoconductivity.

CONCLUSION: These results suggested that AZ31 MgA has great potential as a material for MSI and bone fixation plates.

SP 170 FEATURES OF THE SOFT PALATE IN PRESCHOOL AND EARLY SCHOOL CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA

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AIMS: To evaluate cephalometric findings of soft palate features in preschool and early school children with obstructive sleep apnoea (OSA).

SUBJECTS AND METHOD: A total of 17 preschool children [mean age, 4.6, standard deviation (SD) 0.7 years] with OSA (PS-OSA) and 26 early school children (7.7, SD 1.2 years) with OSA (ES-OSA) were recruited. Subjects were monitored at home during nocturnal sleep for three nights by their parents, using portable polysomnography. All OSA children were diagnosed by a paediatric otorhinolaryngologist. The control subjects included 11 preschool children (mean age, 4.7, SD 0.8 years) without OSA (PS-CON) and 13 early school children (7.6, SD 0.8 years) without OSA (ES-CON). Lateral cephalometric radiographs were taken for orthodontic treatment in all subjects. A 5 mm tongue blade with BaSO4 contrast medium was used as a marker and displayed on the surface of the soft palate. The soft palate length and thickness were measured. The differences between PS-OSA and PS-CON, ES-OSA and ES-CON, PS-OSA and ES-OSA and PS-CON and ES-CON were calculated using the Mann-Whitney U test.

RESULTS: PS-OSA had a long (P = 0.005) and thick (P = 0.036) soft palate compared to PS-CON. However, compared to ES-CON, ES-OSA had a thick (P = 0.009) but not a long (P = 0.364) soft palate. Additionally, ES-CON had a long (P = 0.004) and thick (P = 0.019) soft palate compared to PS-CON, and ES-OSA had a long (P = 0.013) and thick (P = 0.012) soft palate compared to PS-OSA. Thus, OSA and older children demonstrated growth in the size of soft palate.

CONCLUSION: Increased soft palatal length and thickness in PS-OSA and increased soft palate thickness in ES-OSA were related to the incidence of sleep apnoea. Thus, it is very important to
evaluate for a large and/or thick soft palate in children with OSA. The soft palate thickness was especially important for the incidence of OSA. It may be necessary to surgically control the feature of soft palate in clinical management of OSA in preschool and early school children.

SP 171 AUDIT ON UNSCHEDULED ORTHODONTIC APPOINTMENTS IN A SECONDARY CARE SETTING
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AIMS: To reduce the percentage of unscheduled orthodontic appointments to improve patient care.

MATERIALS AND METHOD: A two-cycle audit was undertaken at Chase Farm Hospital to assess the frequency and reasons for attendance of unscheduled orthodontic appointments. Changes were implemented. Each audit cycle was completed over a 3-month period (1st cycle: 01/11/17-01/01/18, 2nd cycle: 15/04/17-15/07/18). All patients attending unscheduled orthodontic appointments were included. Data collection forms were designed using a tick box system. The standard set was from The Royal College of Surgeons of England 2000 ‘less than 5 per cent of visits by patients under treatment should be unscheduled.’

RESULTS: 1st cycle: Of the 1132 orthodontic appointments booked, 64 (6%) were unscheduled. The set standard was not met. The most frequent presenting complaint was a sharp wire (28%) followed by a broken bracket (23%). Seventy two per cent of patients presenting due to sharp wires had attended their previous scheduled appointment within 4 weeks. The grade of clinician treating patients at their previous scheduled appointment were specialty doctors (65%), consultants (32%) and registrars (3%). The findings were shared at the orthodontic department clinical governance meeting. The following changes were implemented: Clinicians to recheck for sharp wires at the end of each appointment. Nurses to provide patient information leaflets on appliance care. Posters placed in the orthodontic waiting room reminding patients of fees associated with broken/lost appliances. 2nd cycle: Of the 1319 orthodontic appointments booked, 45 (3%) were unscheduled. The set standard was met. The most frequent presenting complaint was a broken bracket (33%) followed by a sharp wire (15%). Eighty per cent of patients presenting due to sharp wires had attended their previous scheduled appointment within 4 weeks. The grade of clinician treating patients at their previous scheduled appointment were consultants (47%), specialty doctors (44%) and registrars (9%).

CONCLUSION: The implementation of rechecking wires for sharpness halved the percentage of patients attending unscheduled appointments. It is recommended that wires are re-checked for sharpness after each appointment. An implementation of change with regards to diet advice and a third cycle audit to reassess whether this reduces broken brackets would be beneficial.

SP 172 LAUNCH OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND ‘CHILDREN’S ORAL HEALTH ADVICE’ E-LEARNING MODULE
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AIMS: This e-learning module aims to educate professionals and the general public on children’s oral health; including prevention of malocclusion secondary to habitual aetiological factors.

MATERIALS AND METHOD: With an ever-increasing use of online searches for medical information by the general public there is a great need for free, accessible and reliable children’s oral health advice. This would also benefit professionals including pharmacists, given recent changes in scope for pharmacists in the United Kingdom for delivering oral health advice. Evidence based dentistry was utilised to create a learning platform delivered through digital technology accessible through search engines and the Royal College of Surgeons of England website. Published guidelines including the ‘British Orthodontic Society’, Department of Health ‘Delivering Better Oral Health
Toolkit’ and ‘International Association for Dental Traumatology’ were incorporated. Content was approved by Public Health England.

RESULTS: This easy to use learning module is freely available and includes a printable pdf summary. Hyperlinks and references are included to allow readers to explore various topics further. Content includes advice on dental development, allowing early recognition of abnormalities to dental eruption patterns. This aims to facilitate earlier presentation for orthodontic treatment planning. Advice on dental trauma management will allow for appropriate actions to be taken improving prognosis of affected teeth. This allows for increased scope in orthodontic treatment options of such cases. Information on the impact of dummy/thumb sucking on tooth position is explained in order to cater for timely cessation. Further topics on fluoride use, toothbrushing, diet and erosion are discussed to ensure holistic oral health care.

CONCLUSION: Providing oral health information to key stakeholders including teachers, healthcare professionals, parents and the general public is a key element of knowledge translation. This knowledge base will allow for better children’s oral health.

SP 173 WISDOM IN THE DECISION OF ROUTINE EXTRACTION OF THIRD MOLARS
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AIMS: To present the possibilities for early diagnosis of impaction of the third molars
MATERIALS AND METHOD: Dental pantomograms (DPT) OF 300 subjects (127 males, 173 females). The inclusion criteria were age over 12 years and germs of third molars present and visible radiographically. Radiographs from the first consultation were reviewed one year later. The dental panoramic was enlarged and compared with the mesiodistal diameter of M1 or M2 on casts measured on the panoramic radiograph. Analysis of the position and dimensions of the third molars on the DPT were carried out using angular and linear parameters: the retromolar space, the mesio-distal dimension of the third molar, the distance from the pterygoid vertical plane to the distal surface of the upper first molar, the distance from the projected Xi point to the most distant point of the lower second molar and the alpha angle.

RESULTS: If the ratio of the retromolar space / volume of the third molar (RMS/ ØM3 ratio) is greater or equal to 1, the probability of eruption of the third molar increases. In cases where the distance (PTV-M1) or (XI-Mi2) was greater than or equal to 25 mm did not guarantee the eruption of the third molar s. An alpha angle less than 40 degrees did not indicate a good prognosis for the evolution of third molars.

CONCLUSION: The results showed that the measured dimensions of the third molars, the alpha angle and the distance to the pterygoid vertical plane are relevant indicators for predicting possible impaction and guidelines for orthodontic treatment.

SP 174 DENTOSKELETAL EFFECTS OF BONE ANCHORED MAXILLARY PROTRACTION IN THE TREATMENT OF CLASS III MALOCCLUSION
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AIMS: To explore the dentoskeletal effects of modified bone anchored maxillary protraction (BAMP) in the treatment of subjects with a Class III malocclusion in comparison to an untreated control group.
SUBJECTS AND METHOD: Eight subjects (4 girls, 4 boys) in the age range from 9.2-12.8 years (average 10.9 ± 1.2 years). The control group consisted of untreated subjects matched by age and gender. The treatment group received a hybrid Hyrax (anchored on two palatal mini-implants and permanent first molars) in the maxilla and mentoplate in the mandible, in combination with Class
III intermaxillary elastics. Lateral cephalograms were analysed for every subject before the start (T0) and at the end (T1) of treatment; for the control group, two lateral cephalograms with a time span similar to the treated matched pairs were analysed. The average treatment time (T1-T0) was 1.7 ± 0.5 years. The AudaxCeph v. 5.0.2 software (Audax, Ljubljana, Slovenia) was used for cephalometric analyses according to Björk, Odegaard and Viazis. The t-test for two samples was used for analysis of the changes between the treated and control groups; reproducibility was tested on repeated measurements in a one week interval (SPSS v. 22, IBM, Armonk, USA).

RESULTS: There were significant differences in the T1-T0 changes between the treated and control group in the following variables: SNA angle (2.1 ± 0.6), ANB angle (3 ± 0.5), Wits (4.2 ± 0.6), VerT-A (3 ± 1), VerT-Pr (4.3 ± 1.3), VerT-U1i (3.4 ± 1.4), VerT-U6i (5.2 ± 1.5), all at P < 0.05. Dentoskeletal effects were associated with forward growth stimulation of the maxilla, while mandibular growth was unaffected by reciprocal force generated by the Class III intermaxillary elastics. Intraclass correlation coefficient was excellent for SNA and ANB angles, Wits and VerT-A; good for SNB, VerT-Pr and VerT-U1i; and moderate for VerT-U6i.

CONCLUSION: Skeletal treatment of Class III with modified BAMP induced significant advancement of the maxilla, in comparison to changes induced by growth alone. The growth of the mandible was unaffected, despite the backward traction via Class III elastics anchored on the mentoplates.
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AIMS: Taking high-quality impressions in the periodontally compromised dentition, e.g. for aligner treatment is challenging due to large interdental undercuts. Therefore, the ability of conventional and intraoral scanning techniques to display interdental spaces should be compared.

MATERIALS AND METHOD: A total of 60 impressions (n = 10 per group) were taken from a periodontally compromised test model (A-PZ, frasaco GmbH, Tettnang, Germany) with three different techniques: one conventional impression (EXA\textsuperscript{\textregistered}lence, GC, Tokyo, Japan (CVI)) and two digital impressions with the intraoral scanners Trios III (3Shape, Copenhagen, Denmark (TIO)) and True definition (3M Espe, Seefeld, Germany (TRU)). To investigate the upper (up) and lower (lo) jaw. The three groups were divided into two subgroups each. STL datasets were created for the two digital groups, whereas for the CVI group type-IV dental casts were manufactured. Afterwards, each digital and conventional model was categorized (yes/no) for the number of closed interdental areas (IA). Statistical analysis was carried out by the median test.

RESULTS: For all groups and regardless of the upper or lower jaw, statistically significant differences between the three impression techniques were observed (P < 0.001). Only TRU displayed all interdental areas in both jaws. Compared to CVI (mean 7.1 ± 1.2 closed IA), TIO exhibited a significantly lower number of closed interdental areas (mean 2.4 ± 1.18, P < .001). A significant difference between the upper and lower jaw (up: 3.3 ± 1.4 closed IA, lo: 1.4 ± 0.96, P < .005) was seen for TIO only.

CONCLUSION: Within the limitation of this in vitro study, intraoral scanners and especially that based on the Wavefront sampling technique (TRU) can be recommended for the reproduction of interdental areas with large undercuts in periodontally compromised patients.

SP 177 THE EFFECTS OF SANDBLASTING OF ZIRCONIA WITH VARIOUS SURFACES ON SHEAR BOND STRENGTH

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AIMS: To investigate the effect of sandblasting and zirconia primer treatment with or without thermocycling on zirconia, glazed zirconia, and porcelain veneered zirconia.

MATERIALS AND METHOD: The experimental group was zirconia based ceramic, which is a restoration of zirconia. Forty specimen pieces of zirconia, glazed zirconia and porcelain veneered zirconia were prepared. Each group was divided into subgroups by sandblasting and thermocycling. Shear bond strength (SBS) was measured using a universal testing machine. The surface of each specimen was observed by scanning electron microscopy and energy dispersive spectroscopy before and after sandblasting and after SBS measurement. The data were analyzed by one-way ANOVA to compare the SBS between the groups.

RESULTS: The SBS of all experimental groups, regardless of thermocycling and primer treatment, was statistically higher with than without sandblasting. SBS decreased in all specimens during thermocycling. However, in the case of specimens treated only with zirconia primers on zirconia, there was no statistically significant decrease of SBS, but all other specimens were significantly decreased.

CONCLUSION: The findings suggest that proper surface treatment is necessary for this specific type of zirconia restoration and that sandblasting treatment under all conditions will help increase SBS.

SP 178 TRANSFER ACCURACY OF A CAD/CAM BASED INDIRECT BONDING TECHNIQUE: A CLINICAL IN VIVO STUDY
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AIMS: To investigate the precision of a CAD/CAM based indirect bonding (IDB) technique which is embedded in a fully digital workflow.

SUBJECTS AND METHOD: Twenty patients in the permanent dentition and in need of orthodontic therapy with a fixed orthodontic appliance received an intraoral scan (Trios®, 3Shape, Copenhagen, Denmark). The bracket positions were then planned digitally on the retrieved three-dimensional (3D) models using the FA-bonding-module in the Onyx Software (Image Instruments GmbH, Chemnitz, Germany) and finally sent to CA Digital GmbH (Hilden, Germany) for production of the Individua® IDB tray. After transferring the brackets with these trays into the patient’s mouth and eliminating composite residues, a second scan was performed to record the actual intraoral bracket position. The transfer accuracy was then analyzed between pre- and post-bonding bracket position via virtual superimposition in a 3D inspection and processing software (Geomagic Control®, 3D Systems, Inc., Rock Hill, South Carolina, USA) using a modified local best-fit alignment resulting in three linear and three angular measurements for each bracket.

RESULTS: More than 80 per cent of the linear and angular measurements were within the clinically acceptable range of 0.2 mm and 5 degrees, respectively. The largest errors in the linear measurements occurred in the vertical dimension. For angular measurements torque showed the biggest error. Furthermore, there were significant differences between the tooth groups in which the molars showed the worst results.

CONCLUSION: The use of the Individua® transfer tray in the IDB technique provides clinically acceptable transfer accuracy and is a fully digital alternative to conventional IDB techniques. However, despite very acceptable results, on average, a relevant percentage of the transferred brackets are not perfectly positioned.

SP 179 LINEAR AND VOLUMETRIC CHANGES INDUCED BY VIBRATION ON THE TOOTH ROOT, PERIODONTAL LIGAMENT AND PULP: A MICROCOPUTED TOMOGRAPHIC STUDY IN A RAT ANIMAL MODEL

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AIMS: The effects of vibration on developing tooth and periodontal tissues have not been investigated. The aim of this study was to assess the effect of vibration on developing calcified and uncalcified tooth structures namely tooth root, pulp and periodontal ligament (PDL).

MATERIALS AND METHOD: Twenty four, 5-week old Wistar rats were divided into four groups and were allocated to control ©, orthodontic tooth movement (OTM; 50 gm force applied from nickel titanium closed coils attached to the incisor and first molar), vibration (V; 3 0Hz applied for 15 minutes per day, 5 days per week for 30 days) and OTM+V interventions. Three-dimensional (3D) microcomputed tomographic analysis was performed to determine the volume of the dental mineralized and pulpal tissues. Root length, root width, and PDL area were also measured. One-way analysis of variance (ANOVA) with the Bonferroni adjustment was used in order to identify differences between groups.

RESULTS: Statistically significant reductions in tooth volume were observed in the OTM (P = 0.046) and OTM+V groups (P = 0.021) when compared to controls. A weak trend towards increased pulp volume was evident in the groups receiving V, OTM and the combination of V+OTM; however, this did not reach statistically significant levels. The overall root length did not exhibit significant changes and differences between groups. The PDL area was significantly increased in the OTM (921.165 μm²) and OTM+V (926.038 μm²) groups compared to controls (633. μm²) while the PDL area of the V only group showed the lowest values (541.891 μm²).
CONCLUSION: OTM and OTM+V interventions resulted in a statistically significant reduction in tooth volume while they increased the PDL area of developing rat molars. The addition of vibrational stimuli to teeth undergoing OTM resulted in greater volumetric reductions of their calcified tissues than OTM alone. The lower PDL area value of the V only group may indicate shrinkage of the PDL possibly due to stimulated bone remodelling and ossification processes taking place in the walls of the alveolar socket.

SP 180 AN AUDIT OF HYPODONTIA REFERRALS
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AIMS: To assess referrals to the multidisciplinary hypodontia clinic at the Eastman Dental Hospital to determine if they are appropriate and seen within the 18 week referral-to-treatment guideline. MATERIALS AND METHOD: This prospective audit was conducted by reviewing records of all patients seen on eight consecutive hypodontia clinics from 18th January 2017 to 26th April 2017. A data collection sheet was developed to gather the relevant information (source of referral, whether appropriate radiographs were included, reason for referral, patient demographics and attendance), and piloted at an earlier clinic session in November 2016. The gold standard employed was that all referrals are appropriate (patients with hypodontia requiring multidisciplinary management) and seen within 18 weeks. RESULTS: There was approximately equal distribution of new (48.6%) and follow-up (51.4%) patients with a mean of 13.6 patients booked per clinic and a failed attendance rate of 1.5 patients per clinic. Only 76.2 per cent of referrals were appropriate. Inappropriate referrals included those with missing teeth not due to hypodontia, incorrect bookings and direct referrals without first being seen by a specific department. Most patients were referred by their general dental practitioner (GDP; 32.7%) but some were from specialist orthodontists (17.3%) and neighbouring hospital consultants (7.7%). The majority of referrals also included radiographs (93.5%). The gold standard of 18 week referral-to-treatment was met, with an average waiting time of 15 weeks for new patients and 13 weeks for patients requiring a pre-debond check.

CONCLUSION: The hypodontia clinic is well-attended and patients are seen within the stipulated 18 week referral-to-treatment guideline. However, not all referrals were appropriate. As a recommendation, new patient referrals to the hypodontia clinic should be limited to either external specialists or internal/external consultants requesting an opinion. The triaging process for referrals to the clinic has been revised and GDP referrals will be sent to either the paediatric, restorative or orthodontic departments in the first instance and subsequently referred to the hypodontia clinic if required. This will enable full records to be available during the session to ensure maximum efficiency. A re-audit is planned to review the process in 2019.

SP 181 CHANGE IN ROOT MORPHOLOGY AFTER SECOND MOLAR PROTRACTION COMBINED WITH CORTICOTOMY
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AIMS: To investigate the change of mandibular second molar root length after mesial movement into the mandibular first molar edentulous ridge, accelerating with corticotomy and bone grafting. SUBJECTS AND METHOD: Fourteen patients (12 females, 2 males,) with a mean age at the start of treatment of 26.07 ± 5.78 years (range from 20 to 35 years) with loss of the mandibular first molar with resorption of the alveolar ridge and the mandibular second molars were mesialised into the atrophic alveolar ridge of the mandibular first molar using segmented loop mechanic. The corticotomy with bone grafting at the first molar ridge was performed 2 weeks before mesialization of the second molar. Cone beam computed tomograms before treatment (T0) and after space closure (T1) were taken (Veraviewepocs J Morita MPG; 80 Kv, 5 mA). The root length at the midpoint of the mandibular second molar from the cementoenamel junction (CEJ) to the root apex was measured with the One-volume viewers program. The lateral cephalograph was used to assess
the amount of molar movement. A paired t-test was used to analyze the difference of pre- and post-treatment root length change.

RESULTS: The average of mandibular second molar movement was 4.98 ± 1.24 mm, (range 3.5 to 9.4 mm). The mean treatment time was 4.35 ± 1.34 months (range 3 to 6 months). Paired t-tests revealed significant root resorption ($P < 0.05$) after space closure, mean 0.16 ± 0.23 mm.

CONCLUSION: Mesialization of the mandibular molar could be achieved using segmented loop mechanics and accelerated with corticotomy and bone grafting. The treatment duration was acceptable to close the deficient ridge space. The root length change was on average 0.1 mm from the CEJ to root apex of second molar.

SP 182 OCCURRENCE OF TOOTH FAILURE IN PATIENTS WITH A CLEFT PALATE
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AIMS: To examine disturbances related to dental irregularities in children with a cleft palate.
MATERIALS AND METHOD: Dental radiographs of 1525 subjects treated orthodontically (634 girls, 891 boys) aged 6-15 years. For 300 children, cone beam computed tomographic images were also analyzed.
RESULTS: Dental abnormalities were detected in 1319 patients (86.5%). The majority of cases (603 subjects, 45.9%) were related to tooth decay. The teeth most often absent were in the area of the cleft. In 41 patients, inheritance was related to eight teeth. In 164 cases, four teeth were missing.
CONCLUSION: The number of tooth disorders most often concerned the area of a cleft. The most common missing teeth were: 12, (90%) regardless of the type of cleft. In patients with tooth transposition, the supra abdominal tooth was 12 or 22.

SP 183 SECULAR CHANCES IN OCCLUSAL TRAITS IN CHILDREN 9-11 YEARS OF AGE
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AIMS: To assess possible changes in occlusal traits in Finnish children between the 1980’s and 2000’s.
SUBJECTS AND METHOD: Group 2000 comprised 196 girls and 209 boys from a population sample of children, whose ages ranged from 9.0 to 11.8 years at the time of examination. Matching age group was selected from the Group 1980 data ($n = 1579$), resulting in a sample of 206 girls and 187 boys aged 9.0-11.8 years. Molar occlusion, overjet, overbite, crossbite, and scissor bite were recorded according to the modified method of Björk et al. (1964). Chi-square or Fisher’s exact test was used to compare differences in the prevalence of occlusal traits between the groups. Differences in the amount of overjet and overbite (mm) were assessed by a Student’s t-test.
RESULTS: The mean overjet for the children of Group 1980 was 4.0 mm (SD 1.7) and for the children of the Group 2000 3.0 mm (SD 1.4; $P < 0.000$). Children in Group 1980 were more likely to have an increased overjet (> 5 mm) than the children in Group 2000 ($P < 0.001$, respectively). There were no statistically significant differences in other occlusal traits between groups.
CONCLUSION: The present findings show some differences in incisal occlusion between the 1980’s and 2000’s but do not reveal clinically important secular changes in the occurrence of occlusal traits at the phase of the mixed dentition.

SP 184 CORRELATION ANALYSIS BETWEEN BRUXISM AND SLEEP AND MOOD DISORDERS: A CASE-CONTROL STUDY.
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AIMS: To evaluate the correlation between bruxism and sleep, stress and anxiety disorders.
SUBJECTS AND METHOD: Three hundred post-pubertal patients (162 females; 138 males), with a mean age of 28 years. One hundred and thirty six of them showed muscle and/or articular pain,
dental wear or reported noise during sleep. All patients were clinically examined and three questionnaires were submitted to each one. The first was a translated version of the oral behaviour checklist in Italian, which was expanded by means of specific items assessing the quality of sleep. The second and third ones were a translated and reduced version of perceived stress scale and symptoms checklist-90 to evaluate stress and anxiety.

RESULTS: Clenching or grinding was shown by 53.6 per cent of cases from 1-3 nights up to 4-7 nights/week with 61.7 per cent of cases clenching from 1-3 times up to 4-7 times/week during wakefulness. A significant stress and anxiety score was present in 54.4 and 28 per cent of cases, respectively. Of subjects who reported sleep bruxism, 42.6 per cent mouth breathing from 1-3 nights up to 4-7 nights/week. Thirty three per cent of subjects who reported clenching while awake showed a significant stress score.

CONCLUSION: Sleep bruxism showed a relevant correlation with oral breathing. Moreover the significant association between awake bruxism and emotional stress makes individual psychosocial factors important for this condition.

SP 185 VACUUM-FORMED RETAINER VERSUS BONDED RETAINER 6 AND 18 MONTHS AFTER ORTHODONTIC TREATMENT IN THE MANDIBLE – A RANDOMIZED CONTROLLED TRIAL
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AIMS: To compare a vacuum-formed Essix C-retainer (VFR) with a bonded canine-to-canine retainer (CTC) with respect to retention of the dentition in the mandible 6 and 18 months after orthodontic treatment.

SUBJECTS AND METHOD: The patients were treated with fixed appliances, with and without tooth extractions, in both jaws. One hundred and four patients (mean age 17.1 years SD ±2.1 years) were randomized into two groups and stratified by gender. In the intervention arm patients received a VFR and in the active comparator arm of the study a CTC. Both groups received a VFR in the maxilla. Dental cast were obtained and digitized at the debond appointment (T1) and after 6 (T2) and 18 (T3) months. The retentive capacity was evaluated with Little’s irregularity index (LII) and changes in overbite, overjet, intermolar and intercanine width and arch length with non-parametric tests.

RESULTS: Changes in LII within both groups were statistically significant between T1 and T2 (VFR: median difference 0.30 mm, P < 0.001, CTC: median difference 0.30 mm, P = 0.001) and consequently also between T1 and T3 (0.44 mm, P < 0.001 and 0.34 mm, P = 0.001. Overbite increased significantly in both groups between T1 and T2 and was thereafter stable. The total increase in overbite was 0.55 mm, P < 0.001 and 0.39 mm, P < 0.001 for VFR and CTC, respectively. Arch length within groups decreased significantly between T1 and T2 and between T2 and T3 and the total amount during the observation period was –0.28 mm, P < 0.001 for VFR and –0.33 mm, P = 0.002 for CTC. Overjet, intermolar and intercanine widths within groups remained stable. There were no significant differences in LII, overjet, overbite, arch length, intercanine and intermolar widths between the groups after 6 and 18 months.

CONCLUSION: VFR and CTC have the same retention capacity in the mandible after 18 months. Relapse mainly occurs during the first six months of retention.

SP 186 IS BONE-BORNE RAPID MAXILLARY EXPANSION MORE EFFECTIVE THAN CONVENTIONAL TOOTH-BORNE EXPANSION?
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AIMS: To compare the efficacy and adverse effects of bone-borne or hybrid (tooth-bone-borne) rapid maxillary expansion (RME) with conventional tooth-borne RME in treating transverse maxillary deficiency.
MATERIALS AND METHOD: Nine databases were searched up to September 2018 for randomized clinical trials comparing bone-borne or hybrid tooth-bone-borne RME to conventional tooth-borne RME in patients of any age or gender. After duplicate study selection, data extraction, and risk of bias assessment with the Cochrane tool, random effects meta-analyses of mean differences (MD) and their 95 per cent confidence intervals (CIs) were performed, followed by assessment of the quality of evidence with GRADE.

RESULTS: A total of 12 papers on six unique trials with 264 patients (42.4% male; average age 12.3 years) were finally included. Limited evidence indicated that bone-borne RME was associated with greater suture opening at the first molars post-retention (1 trial; MD: 2.0 mm; 95% CI: 1.4 to 2.6 mm; moderate evidence quality) compared to tooth-borne RME, while no significant differences could be found regarding tooth inclination, nasal cavity width, and root resorption (very low to low evidence quality). Hybrid tooth-bone-borne RME was associated with less buccal tipping of the first premolar (2 trials; MD: –4.0°; 95% CI: –0.9 to –7.1°; moderate evidence quality) and lower nasal airway resistance post-retention (1 trial; MD: –0.2 Pa s/cm³; 95% CI: –0.4 to 0 Pa s/cm³; moderate evidence quality) compared to tooth-borne RME, while no significant difference could be found regarding skeletal maxillary width, molar inclination, and analgesic use (low to moderate evidence quality). The main limitations affecting the validity of the present findings were (a) imprecision due to the inclusion of few trials with limited sample sizes that precluded secure finding of existing differences and (b) methodological issues of the included trials that could lead to bias.

CONCLUSION: Limited evidence from randomized trials indicates that bone-borne or hybrid tooth-bone-borne RME might present advantages in terms of increased sutural opening, reduced tooth tipping, and lower nasal airway resistance compared to conventional tooth-borne RME. However, the limited number of existing studies and issues in their conduct preclude the drawing of definite conclusions.

SP 187 IMPLANTS PLACED AMONG NATURAL TEETH OFTEN END IN INFRAPOSITION AND LOSE THEIR CONTACT POINT LOSS TO THE ADJACENT TEETH
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AIMS: Craniofacial growth is deemed complete in adult patients, which makes them good candidates for implant placement. The aim of this systematic review was to evidence potential adverse effects of osseointegrated implants placed among natural teeth of a residual dentition, due to residual growth or mesial migration of the natural teeth.

MATERIALS AND METHOD: Seven databases were searched without restrictions up to January 2018 for clinical studies on implant infraposition (IIP) or proximal contact point (PCP) loss to the adjacent teeth. After duplicate selection, data extraction, and risk of bias assessment according to the Cochrane guidelines, random-effects meta-analyses of odds ratios (OR) or mean differences (MD) and their 95 per cent confidence intervals (CI) were performed, followed by meta-regression and sensitivity analyses.

RESULTS: A total of 27 non-randomized studies with 1,572 patients (mean age 42.2 years/51.2% female) followed up to 18.5 years after implant placement were included. The pooled percentage prevalence of IIP was 50.5% (nine studies; 95% CI = 26.3-74.5%), and the pooled IIP extent was 0.58 mm (six studies; 95% CI = 0.33-0.83 mm), while IIP > 1 mm was seen for 20.8 per cent of placed implants (five studies; 95% CI = 8.3-37.1%), and male patients were less prone to IIP than female patients (three studies; OR = 0.30; 95% CI = 0.10-0.88; P = 0.03). The pooled percentage prevalence of PCP loss was 46.3% (nine studies; 95% CI = 32.3-60.6%), with increase through observation time (two studies; OR = 1.09; 95% CI = 1.03-1.16; P = 0.004) and predilection for mesial PCPs (five studies; OR = 2.25; 95% CI = 1.06-4.77; P = 0.03). However, the quality of evidence was very low due to bias.

CONCLUSION: It seems that young or older adult patients are subject to slow growth and remodelling of the jaws, as well as a tendency for mesial migration of the teeth. Patients and
clinicians need to be aware of the long-term adverse effects of dental implants among natural teeth that can be observed as a result of such steady changes, which usually manifest as IIP and PCP loss to the adjacent teeth.

**SP 188 ASSOCIATION OF FACIAL SAGITTAL AND VERTICAL CHARACTERISTICS WITH FACIAL AESTHETICS IN THE NORTHERN FINLAND BIRTH COHORT 1966**

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**AIMS:** To explore the association of facial sagittal and vertical dimensions in relation to aesthetic assessment of three panel groups.

**SUBJECTS AND METHOD:** The study population comprised adult individuals from the Northern Finland Birth Cohort 1966 (NFBC1966). A clinical oral examination was performed including digital facial photographs. The study population was divided into subjects with lowest and highest values in soft tissue measurements in lower anterior face height percentage (LAFH%; 60 subjects) and antero-posterior jaw relationship (soft tissue ANB angle; 60 subjects) and a control group (30 subjects). Frontal and profile facial photographs were presented to three panel groups: five orthodontists, five dentists and five laypersons, who evaluated the photographs using the visual analogue scale (VAS). A paired samples t-test was selected to investigate the differences in aesthetic evaluation between the panel groups. Pearson correlation coefficient was used to test the association in aesthetic VAS scores between different panel groups. Associations between lower anterior face height (LAFH) and soft tissue ANB angle in relation to aesthetic assessment (VAS) of the three panel groups in female and male subjects were studied with quadratic regression models.

**RESULTS:** There were significant differences in VAS mean scores between the panel groups. Curve estimation revealed a significant quadratic association between aesthetic VAS evaluation and ANB angle for all panel groups. The association between ANB angle and perceived facial attractiveness was highest among orthodontists (R² = 0.276, P = 0.001 for males; R² = 0.285, P = 0.001 for females). However, no statistically significant association was found between facial attractiveness and lower anterior face height percentage.

**CONCLUSION:** Facial sagittal dimensions appear to influence facial aesthetics more than vertical dimensions in middle-aged adults. In their perception of facial aesthetics, orthodontists were more influenced by antero-posterior jaw relationships compared to dentists and laypersons. The overall perception of facial attractiveness related to facial dimensions appeared to differ between the panel groups for female and male faces.

**SP 189 FACTORS INFLUENCING DECISION-MAKING ON STARTING ORTHODONTIC TREATMENT: A RETROSPECTIVE, CASE-CONTROL STUDY**

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**AIMS:** Investigation of factors influencing decision-making on orthodontic treatment after attending an intake consultation or presentation with the treatment plan.

**MATERIALS AND METHOD:** Records of 302 patients referred for orthodontic treatment between 2012-2016 were selected and divided into two groups. Group 1: patients deciding to start treatment (n = 151), group 2: patients refraining from orthodontic treatment (n = 151). Evaluated parameters were: age, gender, type and severity of malocclusion (overjet, overbite, skeletal problems), complexity of treatment, the distance between residence and clinic, time point of refraining from treatment, interval between first intake and presentation of the treatment plan. Chi-square tests were used to assess significant differences between the groups.
RESULTS: No significant differences between the groups were found for gender, malocclusion features and distance from residence. Complexity of treatment plans, interval between first intake and presentation of the treatment plan and age had a significant effect on decision-making ($P < 0.005$). Noticeably, 27.8 per cent of the patients were not reachable after the intake and 5.3 per cent did not meet the demands of oral hygiene. Reasons for refraining from treatment were: not willing to undergo treatment (29.9%), preferring another orthodontist (25.9%), inability to afford treatment (13.4%), distance from residence (9.6%), interval between intake and presentation of the treatment plan (5.8%), complexity of treatment (4.8%) and other reasons (10.6%). Mostly, the first consultation was sufficient for decision making on starting treatment.

CONCLUSION: Malocclusion features were not determinants for the decision to start treatment. Information provided during the first consultation seems sufficient for most patients to opt for treatment. To avoid patients refraining from treatment, the interval between intake and treatment planning must be as short as possible. Older patients seem to be more reluctant to accept complex treatments. Providing more information to these patients, explaining risk and benefits of treatment could be helpful in decision-making.

SP 190 CYTOTOXIC EFFECTS OF VARIOUS MOUTH RINSE SOLUTIONS ON MOUSE FIBROBLAST CELLS AND PRIMARY HUMAN GINGIVAL FIBROBLASTS
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AIMS: During treatment with fixed orthodontic appliances, it is recommended to use fluoride mouth rinses for daily brushing. Especially in case of gingivitis, antibacterial mouth rinses are often recommended. Although antibacterial mouth rinses do not remove plaque, they significantly reduce the number of oral germs [e.g. chlorhexidine (CHX) at a concentration of 0.06-0.1%]. However, the use of CHX may cause tooth discolouration as well as oral irritation. Therefore, the purpose of this in vitro study was to investigate the cytotoxic effect of various mouth rinses on mouse fibroblast cells and primary human gingival fibroblasts.

MATERIALS AND METHOD: Gingival fibroblasts and the mouse cell line L929 were incubated with various conventional mouth rinses (CHX, Perio-Aid, Vitis, Curasept, Octenidol, Parodontax) for 1-5 minutes with and without saliva. Furthermore, a new mouth rinse solution containing cystatin (inhibitor of gingipains) was tested. CHX and cystatin were used in concentrations of 0.025 per cent and 1 per cent, respectively. Subsequently, the number of dead cells and the total luminescence were determined by the Cytotox-Glo assay (Promega).

RESULTS: When using CHX without concomitant use of saliva, even 1 minute incubation with a concentration of 0.075 per cent resulted in a 60 per cent reduction of living cells independent of the cell line. In contrast, the other conventional mouth rinse solutions only reduced the number of surviving cells by about 40 per cent. The cystatin mouth rinse did not affect the cells negatively, even after 5 minute incubation, regardless of the concentration used.

CONCLUSION: The mouth rinse solution containing cystatin shows a much better in vitro compatibility than the tested conventional solutions regardless of the antibacterial effect. For long-term use, the cystatin-containing mouth rinse is a better alternative than a supportive tool for the healthy oral hygiene of patients.

SP 191 RELATIONSHIP BETWEEN MAXIMUM TONGUE PRESSURE AND TONGUE PRESSURE DURING SWALLOWING AND EVALUATION OF PERIORAL MUSCLE PRESSURE IN CHILDREN
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AIMS: Perioral muscle functions are closely associated with the occurrence of malocclusion during childhood. Therefore, in this study, the aim was to clarify the effects of tongue functions on maxillofacial morphology in children by measuring tongue pressure and maximum lip-closing force (LCF) and to evaluate the relationship between perioral muscle functions and maxillofacial morphology based on skeletal classifications. Moreover, in order to show the utility of maximum
tongue pressure (MTP) measurement, the ratio of tongue pressure during swallowing (STP) to MTP was evaluated.

SUBJECTS AND METHOD: MTP and STP were measured on the anterior palatine rugae in 100 children (with stage IIIA-IIIC development according to Hellman’s dental stages) using a balloon-type tongue pressure measurement device. LCF was measured using an LCF measurement device. Lateral cephalograms were analysed to classify the subjects into Skeletal I, II and III groups. Correlations of skeletal classification with tongue pressure and LCF were examined. Correlations of lateral cephalometric measurements with palatal volume (PV), measured using a three-dimensional optical scanner, were evaluated.

RESULTS: MTP was significantly lower in the Skeletal II group than in the other groups. STP was significantly lower in the Skeletal II group than in the Skeletal III group. LCF was significantly higher in the Skeletal III group than in the other groups. STP was found to be positively correlated with MTP and PV. No difference due to skeletal classifications was observed in the ratio of STP to MTP and it was at a constant ratio.

CONCLUSION: MTP, STP, and LCF were significantly lower in the Skeletal II group than the Skeletal III group, indicating variations according to anteroposterior skeletal classification. Strong positive correlations were observed between MTP and STP, which indicated their usefulness in functional assessment. Positive correlations between STP and PV suggested that tongue pressure and functions play roles in palatal formation. Correlations observed between perioral muscle pressure and anteroposterior skeletal classification indicated the importance of quantitative assessments of oral functions.

SP 192 PERCEIVED TOOTH COLOUR CHANGES IN RELATION TO DIFFERENT INCISOR INCLINATIONS
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AIMS: To assess perceived tooth colour changes in relation to different incisor inclinations in Class II division 1 (Class II/1) and division 2 (Class II/2) malocclusions and to compare with a Class I control group.

MATERIALS AND METHOD: The intraoral frontal photographs of three adult patients. The first patient had an Angle Class I relationship with optimum incisor inclination, the second an Angle Class II/1 malocclusion and protrusive central incisors and the third a Class II/2 relationship with retrusive central incisors. Patients having any white spot lesions, enamel defects, crown/restoration on the central incisors, inadequate oral hygiene or crowding were excluded. The subjects were seated in standardized light conditions. Natural head position (NHP) was determined and stated as 0 degrees. The photographs were taken with a polarization filter at NHP, +15 degrees (upward) and −15 degrees (downward) of head angulation simulating anterior torque movements. Twenty one orthodontists evaluated the photographs and colour changes were determined from light to dark. Statistical evaluations were done by Chi-square test and Monte Carlo simulation. P < 0.05 was considered as significant.

RESULTS: In each malocclusion group, +15 degrees of head position, which represents incisor proclination, were found to be darker (P < 0.0001) whereas −15 degrees of head position, representing incisor retroclination, were perceived lighter (P < 0.0001).

CONCLUSION: Retroclination of upper incisors were perceived as lighter compared to proclined incisors. While planning torque values of incisors it should be taken into consideration that orthodontic treatment may result in changes in the perceived colour of incisors which may affect aesthetic outcomes.

SP 193 CONFOCAL MICROSCOPY EVALUATION OF THE SURFACE OF LINGUAL BRACKETS AFTER DEBONDING
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AIMS: To evaluate the permanence of resin and enamel remnants on lingual brackets (Incognito System, 3M Unitek) at the end of orthodontic treatment and after debonding. This is the first study to evaluate resin remnants on customized lingual brackets.

MATERIALS AND METHOD: The lingual brackets were bonded according to the manufacturers' instructions. At the end of treatment they were removed with the appropriate plier. A total of 82 lingual brackets (22 incisors, 20 canines, 21 premolars, 19 molars) were analyzed with a confocal laser microscope (OLS4000) because of the curved surface of these customized brackets. After scanning, the surface of the brackets and the area of resin remnants were measured with the software of the microscope (LEXT). The values were calculated as the percentage between the total area and the resin surface as an index of quantity of adhesive on enamel after debonding. Statistical analysis was made using the Shapiro-Wilk test to test the normality of the distribution of the outcome. A P value was considered statistically significant if lower than 0.05.

RESULTS: Eleven bracket showed no resin on the surface meaning no adhesive on the brackets, 24 brackets had less than half of the adhesive on the surface, 39 brackets more than half of adhesive on the surface and eight brackets all the surface covered with adhesive. Canine brackets had the lowest remnants of resin followed by premolars, incisors and molars.

CONCLUSION: The median percentage of bracket surface covered by resin was 41 per cent.

SP 194 FORCES GENERATED BY INDIVIDUALIZED LINGUAL AND LABIAL BRACKET SYSTEMS WITH THE USE OF RECTANGULAR WIRES
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AIMS: To determine the forces generated by various individualized lingual appliances and labial brackets combined with rectangular wires of different alloys.

MATERIALS AND METHOD: Fully customized lingual brackets of two brands were examined: 1) Incognito™ (3M Unitek, Monrovia, Minnesota, USA), 2) WIN (DW Lingual Systems, Bad Essen, Germany). The labial Discovery classic and Discovery smart bracket systems (Dentaurum, Ispringen, Germany) were used for reference. Impressions of the initial mandibular malocclusion of a patient under treatment were sent to certified laboratories in order to construct set-up models and customized archwires. Six identical resin models were constructed from the set-up model. From each model, the tooth under examination was removed and replaced with a sensor. Three teeth were examined [a lateral incisor (42), a canine (33) and a premolar (45)]. The orthodontic measurement and simulation system was used for experimentation. Stainless steel and beta-titanium wires of 0.18 × 0.25 inches were examined and each measurement was repeated five times, each time with a different piece of the same type of wire. Intrusion/extrusion and orovestibular movements were performed in a range of 0.5 mm and forces were recorded for each 0.1 mm of movement. Mean values and standard deviations were calculated for all measurements and t-tests and ANOVA were performed for statistical analysis.

RESULTS: In general forces ranged between 0.92 and 8.84 N for all bracket types combined with the beta-titanium wires and 0.7 and 11.87 N for all bracket types combined with stainless steel wires. Statistically significant differences were observed between the four types of bracket systems. The ratio between the forces generated from the use of beta-titanium wires and stainless steel wires was higher than expected. Differences between the two lingual brackets were observed mostly during orovestibular movements.

CONCLUSION: Different bracket systems can produce divergent forces when combined with the same type of wire due to the dissimilarity of the bracket or wire properties. Wires with large cross sections are not suitable for large-scale movements.

SP 195 STABILITY AFTER ORTHODONTIC-SURGICAL TREATMENT: A RETROSPECTIVE STUDY
AimS: Stability is a considerable challenge of orthodontic treatment. The aim of this investigation was to evaluate the stability of orthodontic treatment combined with orthognathic surgery.

Subjects and Method: Patients who had undergone orthognathic surgery (bimaxillary osteotomy, sagittal split ramus osteotomy, Le Fort 1 osteotomy, associated or not with genioplasty) during the period 2010 at 2016. Out of 351 patients, 136 patients were selected (38 males, 88 females aged 15-52 years (± 29.1 years). Clinical parameters (occlusal/functional) and lateral cephalograms were obtained at three time points: immediately before surgery, after surgery and at least one year after surgery (range 1-6 years). The cephalograms were digitized and analysed with a logiciel Odrade. The variables investigate were FMA, SNA, SNB, ANB and Ao-Bo to identify skeletal change. The data were analysed by repeated measures analysis of variance and two-way ANOVA to compare groups (skeletal Class, different types of treatment/clockwise and counterclockwise bimaxillary).

Results: Statistical analysis showed significant differences of some variables, but the maximal mean of different of 1.5 or 1.2 mm was insignificant in the clinical context. Clinical relapse was observed for five patients associated with persistence of lingual dysfunction.

Conclusion: Orthognathic surgery offers skeletal and occlusal stability. The reasons for relapse are mainly functional. The findings show that to be clinically successful, an interdisciplinary approach between the orthodontist and maxillofacial surgeon and good functional follow-up are essential.

SP 196 Gelatinolytic Activity in Gingival Crevicular Fluid and Saliva in Growing Patients with Marfan Syndrome: A Case-Control Study

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Aims: To evaluate saliva and gingival crevicular fluid (GFC) gelatinolytic activity in a sample group of Marfan subjects.

Subjects and Method: Twenty eight subjects (17 males, 11 females) with Marfan syndrome. Inclusion criteria were: genetic assessment of Marfan syndrome and Caucasian ancestry. Exclusion criteria were: post pubertal stage (CS5-CS6), orthodontic treatment. The second sample, 23 subjects (12 males, 11 females), was collected using the following inclusion criteria: Caucasian ancestry, no previous orthodontic treatment, no post pubertal vertebral maturation (CS5-CS6). To collect saliva and GFC, a 28 mm sterile endodontic paper cone was used. Both biological liquids were then transferred to a sterile test tube and stored frozen at −20°C until analysis. Saliva and GCF were extracted by centrifugation at 9000 rpm for 5 minutes in 50 ml of elution buffer. Gelatin substrate zymography was used for evaluation and characterization of saliva and GFC proteinases. Samples were mixed with a five-fold excess of sample buffer and electrophoresis was run on 12 per cent sodium dodecyl sulphate-polyacrylamide gel electrophoresis gels containing 1 mg/ml of gelatine. A computer database containing all data measured was created. Statistical software (Prism 6 ver. 6.01, GraphPad Software) was used. Regression analysis, correlation test and Student’s t-test were used. All results were expressed as the mean plus standard deviation.

Results: In all samples different gelatine-degrading activities were observed. Two bands that could be related to gelatinase B (MMP-9) corresponding to the molecular weights of pro-MMP-9 and active MMP-9, respectively, were detectable in 100 per cent of Marfan and control samples. Similar results were seen for the active form of MMP-9, which was elevated in Marfan versus control samples, but this difference was not significant.

Conclusion: Saliva and GFC fluid are useful indicators of matrix metalloproteinase (MMP) activity. Members of the MMP family catabolize fibrillin molecules and disrupt fibrillin-rich microfibrils. Degradation of fibrillin substrates by MMP-2, MMP-3 and MMP-13 suggests that these enzymes may contribute to physiological fibrillin remodelling.
SP 197  COMPARISON OF ERUPTION POTENTIAL OF UNOPPOSED MOLARS IN GROWING VERSUS ADULT RATS
Aikaterini Lagou, Balazs Denes, Domna Dorotheou, Stravros Kiliaridis, University of Geneva, Switzerland

AIMS: Unopposed teeth tend to overerupt but the rate of eruption and how it varies over time is unclear. The aim was to investigate longitudinally the over-eruption pattern of unopposed molars in growing and adult rats by measuring the distance and velocity of the post-emergent eruption.

MATERIALS AND METHOD: Fifty-six 4-week old (growing) and 21-week old (adult) male Wistar rats were followed longitudinally. In each age-group, 16 rats were included in the experimental group, where the right maxillary molars were extracted and the other 12 rats served as controls. This resulted in three categories of molars: unopposed right molars and overloaded left molars in the experimental group and control molars in the control group. All the rats were scanned during 12 weeks at regular intervals by in vivo microcomputed tomography. The eruption rate of the first mandibular molars and the surrounding bone was measured with the reference point at the mandibular canal.

RESULTS: There was no statistically significant difference between the weight of the experimental and control groups. At the end of the 12-week period, the over-eruption of the unopposed molars compared to the contralateral ones was 1148 µm (±195) in growing rats and 413 µm (±332) in adults. The overall eruption velocity of the molars in growing rats was higher 17 µm/d (±3) than molars in adult rats. The eruption velocity of the unopposed molars peaked at 172 µm (±67) in the first days compared to the overloaded molars that experienced intrusion on the third day, −14 µm (±46.7). These differences were most apparent in the first days and progressively deceased during 3 weeks, after which no difference in velocity was observed between control, unopposed and overloaded molars. The buccal and lingual bone level was increased around the unopposed molars compared to the overloaded and the control molars.

CONCLUSION: Overeruption of unopposed rat molars is most marked during the first days after extraction and gradually resumes normal rhythm after three weeks. The contralateral molar is overloaded during the first days and its eruption is impeded but regains a normal rate more quickly. The overeruption rate was significantly increased in growing rats compared to adults.

SP 198  RETENTION AFTER ORTHODONTIC TREATMENT: WHAT OUR PATIENTS KNOW AND EXPECT
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AIMS: To assess the level of knowledge, expectations, and attitude of people enrolled for orthodontic treatment about procedures used after fixed appliances treatment to retain the treatment result.

MATERIALS AND METHOD: This cross-sectional study was based on a self-developed questionnaire on tooth stability, orthodontic relapse, need of retention, and retention procedures, which was distributed consecutively to orthodontic patients (aged ≥16 years) or their legal guardians, prior to their first consultation at the orthodontic clinic of the local university. Results were analyzed with descriptive statistics and Fisher’s exact tests with significance set at 5 per cent.

RESULTS: From the 227 questionnaires distributed, 96.9 per cent (n = 220) were completed and returned by the participants, of whom 81 (37.3%) were male and had an average age of 37.1 ± 11.9 years. Among responders, only 46.3 per cent (n = 99) were aware that retention appliances are used post-treatment, whereas 52.8 per cent (n = 113) believed a perfect result could guarantee a stable result. With 77.8 per cent (n = 168), most of the participants were aware that teeth can also move without orthodontic appliances. Regarding the expectations of the responders, a minority of 48.8 per cent (n = 104) believed long-term retention (>3 years to lifelong) was needed, 67.2 per cent (n = 133) favoured bonded retainers over removable ones, and 72.9 per cent (n = 153) thought it was appropriate to charge for recall visits. Interestingly, statistically significant differences in both
level of knowledge and expectations regarding retention were noted according to the patient’s gender, age, education and nationality ($P < 0.05$).

CONCLUSION: The level of knowledge and expectations regarding post-orthodontic retention vary considerably among people enrolled for orthodontic treatment, and only a minority seems to know that tooth retention is needed for many years after treatment. Although lack of knowledge and misconceptions about stability and retention time prevail, patients appear to be willing to participate actively in post-orthodontic procedures.

SP 199 ORTHODONTIC RETENTION: DO FOUNDATION DENTISTS UNDERSTAND THEIR RESPONSIBILITIES?
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AIMS: In recent years the amount of orthodontic teaching delivered at undergraduate level has decreased in the United Kingdom (UK). As a result many new graduates may lack the knowledge or confidence required to monitor and maintain the retention phase of orthodontic treatment in general practice. A questionnaire was designed to evaluate the knowledge and confidence of newly qualified Foundation Dentists (FDs) in the North East of England in using, repairing, replacing and prescribing orthodontic retainers. Delivery of additional teaching aimed to improve both their clinical confidence and their understanding of orthodontic retention.

MATERIALS AND METHOD: During a regional dental teaching day, the questionnaire was issued to 14 FDs who had recently graduated from five different universities within the U.K. An 11-point Likert scale (0 = no confidence, 10 = very confident) was used to score 6 questions investigating knowledge of retainer options, understanding of retention regimens, and confidence in repairing and replacing retainers. There was also the option to provide a written response in free-text boxes. At a subsequent teaching day, a lecture summarising retainers, retention protocols, and repair methods was delivered before the questionnaire was re-issued to the same FDs.

RESULTS: Pre-lecture responses indicated that FDs considered the retention phase to be the responsibility of the patient and/or the orthodontist who provided the orthodontic treatment. Confidence scores were lowest for clinical questions which involved the FD carrying out treatment, such as; ‘I feel confident to repair or replace a retainer’ (mean score 2.64, standard deviation 2.31), and ‘I am aware of the laboratory costs involved in making retainers’ (mean score 2.57, standard deviation 2.41). Post-lecture confidence scores improved for all questions, however the clinical questions showed the greatest improvement, (mean scores 6.69 and 8.50, respectively). Both pre- and post-lecture questionnaires collected a range of informative free-text responses from FDs.

CONCLUSION: Prior to receiving additional training the FDs generally lacked confidence in using and prescribing retainers, and viewed the retention phase as the orthodontist’s responsibility. Although the FDs benefited from improved confidence scores following additional teaching, the improvements were not statistically significant and further assessment with a larger cohort of FDs is recommended.

SP 200 IN VIVO OPTICAL ASSESSMENT OF RHODIUM-COATED ORTHODONTIC ARCH WIRES
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AIMS: To investigate in vivo the optical properties of rhodium-coated archwires compared to conventional archwires and their influence on visual perception according to the International Commission on Illumination (CIE) $L^a^*b^*$ colour space system.

SUBJECTS AND METHOD: Thirty new patients seeking orthodontic treatment were randomly allocated to three groups for each brand of ceramic bracket: Clippy-C, Damon Clear and Clarity. Brackets were placed on tooth surfaces and colour measurements were performed using a spectrophotometer at three stages: (1) after bracket bonding without any archwires inserted, (2) after ligating a conventional wire, and (3) after ligating a rhodium-coated wire. Colorimetric parameters were recorded according to the CIE Lab system and colour change was evaluated using
National Bureau of Standards (NBS) units. Statistical differences were investigated using two-way analysis of variance and Tukey’s post hoc test.

RESULTS: All colorimetric parameters and colour changes were not influenced by the type of archwire, and the results converted into NBS units indicated insignificant differences between the two types of archwires. Among bracket types, Clarity showed lower L* values compared to Damon Clear and Clippy-C, while Clippy-C showed lower b* and ΔE* values compared to the other two types of brackets.

CONCLUSION: There was no statistically significant difference between ∆E*CW and ∆E*RW values, which indicated no difference in colorimetric parameters of conventional wires and rhodium-coated wires. Direct comparison by ∆E*SP values showed invisible colour difference to the human eye for 68.1 per cent of measurement.

SP 201 AUTOMATIC SIMILAR CASES SEARCHING PROCESS FOR ARTIFICIAL INTELLIGENCE ORTHODONTIC DIAGNOSIS
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AIMS: To provide a searching algorithm for the development of an artificial intelligence diagnostic program, and to assist in the establishment of diagnosis and treatment planning, by referring to the treatment duration and method of similar cases.

SUBJECTS AND METHOD: A total of 500 orthodontic patients with good treatment outcomes were collected. According to the position of the maxillary and mandibular six anterior teeth, the types of malocclusion were classified. Based on this classification, the searching algorithm was constructed using datasets for similarity and filtering techniques, and then evaluated.

RESULTS: When data from new 50 patients were tested, the result was 100 per cent, as expected. From among 500 data, the most similar case was searched by this algorithm and, the information of similar cases was provided.

CONCLUSION: Using this algorithm, it is expected that information on treatment plan and treatment duration will be obtained, and this searching algorithm will be applied to the development of an artificial intelligence diagnosis program in the future. If more databases are accumulated, it will assist in more accuracy in establishing a diagnosis and treatment plan.

SP 202 TRANSVERSE DENTAL COMPENSATION RELATED TO SAGITIAL AND TRANSVERSE SKELETAL DISCREPANCIES IN SKELETAL CLASS III PATIENTS
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AIMS: To compare buccolingual inclinations of the posterior teeth in skeletal Class III patients with and without facial asymmetry with those of skeletal Class I patients, and to investigate their relationships with sagittal and transverse skeletal discrepancies.

SUBJECTS AND METHOD: Sixty three skeletal Class III adult patients were divided into two groups according to the degree of menton deviation: a symmetry group with deviation of less than 2 mm (n = 30), and an asymmetry group with a deviation greater than 4 mm (n = 33). The control group comprised 25 skeletal Class I patients. The buccolingual inclinations of the posterior teeth measured on cone beam computed tomography images were compared among the three groups, and regression analysis was performed to investigate the relationships between the inclinations and the sagittal and transverse skeletal discrepancies.

RESULTS: The symmetry group showed greater buccal inclinations of the maxillary posterior teeth and lingual inclinations of the mandibular second molars than the control, and this was correlated with the ANB angles. The deviated sides in the asymmetry group showed the greatest transverse dental compensation, which was correlated with menton deviation, whereas the non-deviated sides showed no significant transverse dental compensation.
CONCLUSION: Transverse dental compensation is closely related to sagittal and transverse skeletal discrepancy in skeletal Class II patients.

SP 203 PATTERN OF MAXILLARY AND MANDIBULAR PROXIMAL ENAMEL THICKNESS IN THE MONGOLIAN POPULATION
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AIMS: To measure the proximal enamel thickness (PET) at the mesial and distal contact areas of the complete permanent dentition using microcomputed tomograph (μCT) scans to evaluate the maximum Interproximal reduction for each tooth and the vertical position of the adjacent contact area.

MATERIALS AND METHOD: μCT scans of 182 intact teeth were obtained after marking the mesial and distal contact areas with fluid resin. Cobra (Exxim Computing Corporation, Pleasanton, California, USA) was used to reconstruct the image data and Inveon Research Workplace was used to measure and analyze the image data. Seven parameters were measured.

RESULTS: The PETs of the central and lateral incisors were between 0.5 and 1.0 mm at both the mesial and distal contact areas; the PETs of the canines, first and second premolars, and the first and second molars were between 1.0 and 1.5 mm. The sum of the PETs from the second molar to the contralateral second molar of the maxillary dentition was 31.54 mm, and that of the mandibular dentition was 27.04 mm. The contact area was located closer to the cementoenamel junction in the posterior than in the anterior dentition. The PET at the mesial and distal contact areas was positively correlated with the tooth width between the mesial and distal contact areas.

CONCLUSION: In this study, μCT was used to measure the PET. The method is accurate and reliable. The measurement results have significance in guiding IPR.

SP 204 DOES A MOBILE TELEPHONE REMINDER IMPROVE COMPLIANCE DURING RETENTION WITH A REMOVABLE RETAINER? – A RANDOMIZED CONTROLLED TRIAL
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AIMS: To evaluate if a mobile telephone reminder improves compliance during retention with a Jensen retainer.

SUBJECTS AND METHOD: Twenty three healthy adolescent patients (14 females, 9 males) received a Jensen retainer after treatment with fixed appliance. The patients were randomized into two groups: group 1) mobile telephone reminder and group 2) no mobile telephone reminder. The patients were instructed to wear the retainer day and night for the first month (T0-T1) and every night for another 20 weeks (T1-T3). Wear time was assessed by a TheraMon microsensor (Gschladt, Hargelsberg, Austria) placed in the acrylic base of the retainer. The compliance of the patients in wearing the retainer was assessed during regular check-ups by measuring the average wear time of the retainer in hours per day (h/day). The measurements were performed after four (T1), 14 (T2) and 24 (T3) weeks. In addition, study casts were produced after 10 months in order to assess the irregularity index of the maxillary anterior teeth.

RESULTS: The mean age was 16.9 years in group 1 and 17.8 years in group 2. One patient dropped-out in the reminder group. After 4 weeks the patients in group 1 used the retainer for 16.3 h/day and those in group 2 for 14.1 h/day. Between T1 and T2, the patients in group 1 used the retainer for 9.5 h/day and those in group 2 for 6.9 h/day. Between T2 and T3 patients in group 1 used the retainer for 7.7 h/day and in group 2 for 6.2 h/day. An irregularity index of >2.0 mm was seen in one patient after 10 months.

CONCLUSION: A mobile telephone reminder increased the wear time during retention. During the first month of retention the patients seemed to wear the retainers less than instructed. However, compliance with the retainers was better after 4 to 24 weeks of retention.
SP 205 QUANTITATIVE EVALUATION OF THE PROGRESSIVE WEAR OF POWERED INTERPROXIMAL REDUCTION SYSTEMS AFTER MULTIPLE APPLICATIONS: AN IN VITRO STUDY
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AIMS: To evaluate the residual surface roughness of five common diamond coated interproximal reduction (IPR) systems after consecutive in vitro applications in relation to system, diamond grain size and instrument thickness.

MATERIALS AND METHOD: IPR was performed on 80 extracted human incisors using motor-driven strips and discs under predefined conditions. The IPR auxiliaries were applied at five consecutive sessions of 20 seconds on intact interproximal surfaces, and surface profile (Ra, Rz, Rmax) was analyzed at baseline and after each session with an optical profilometer.

RESULTS: No overall significant difference in roughness values was found between systems (P = 0.07 for Ra, P = 0.33 for Rz, and P = 0.48 for Rmax). There was a significant average decrease of Ra, Rz and Rmax for all systems for every unit increase in time by −0.17 μm (P < 0.001), −3.297 μm (P = < 0.001) and −2.788 μm (P = 0.001), respectively. Ra, Rz and Rmax values increased significantly, i.e. by 0.194 μm (P = 0.003), 5.890 μm (P = 0.001) and 5.319 μm (P = 0.010) as instrument thickness increased by one unit. No significant reduction in Ra, Rz, and Rmax was observed across grain sizes, viz. −0.008 μm (P > 0.05), −0.244 μm (P > 0.05), −0.179 μm (P > 0.05), respectively. There was no evidence of interaction between system and time as the P values for Ra, Rz and Rmax were 0.88, 0.51 and 0.70, respectively.

CONCLUSION: All IPR materials presented a significant gradual decrease of surface roughness after repeated applications. There were no significant roughness changes among auxiliaries of different grain sizes. Thinner auxiliaries showed significantly more roughness reduction, possibly requiring more frequent replacement than thick auxiliaries in clinical practice.

SP 206 THREE-DIMENSIONAL STEREOPHOTOGRAMMETRIC EVALUATION OF FACIAL SOFT TISSUE ASYMMETRIES FOLLOWING BIMAXILLARY SURGERY IN SKELETAL CLASS III PATIENTS
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AIMS: Symmetry is a major aesthetic factor in orthognathic surgery planning. This study aimed to analyze and document changes in the soft tissues following bimaxillary surgery in Class III patients on a three-dimensional (3D) stereophotogrammetric base, based on 3D face scans.

MATERIALS AND METHOD: 3D images were obtained from 10 patients undergoing orthognathic surgery at the following time intervals: before orthognathic surgery (T1), 6 months after orthognathic surgery (T2). 3D stereophotogrammetric images were obtained using the 3dMDface two-pod imaging system (3dMDface; 3dMD). The study used a landmark-independent analysis of the asymmetry levels, based on determination of a symmetry plane from mirroring and superimposing the two hemifaces. This analysis created a value for the degree of facial asymmetry from the evaluation of the total facial surface, which is operator-independent and reproducible.

RESULTS: The facial surfaces were observed to be more symmetric and harmonic at T2. There was an increased amount of asymmetry correction in the lower facial third and no significant difference in the midfacial soft tissue area between T1 and T2.

CONCLUSION: Following orthognathic surgery, facial asymmetry of soft tissues was improved, especially in the mandibular region. 3D facial scanning is a valuable method to assess soft tissue changes.

SP 207 CHILDREN’S AND YOUTH’S TREATMENT EXPERIENCE AN ORTHODONTIC CLINIC
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AIMS: Patient’s experience of orthodontic treatment and caretaking has gained great amount of interest in recent times. The aim of this study was to evaluate how children and youths experienced their treatment at the orthodontic clinic in Falun (Sweden) and assess if this was influenced by gender, age, and whether the treatment was done in one or both jaws. The presented work was done as part of the clinic’s quality assurance efforts.

SUBJECTS AND METHOD: This cross-sectional study involved all patients between 13 and 21 years of age whose treatment had ended and attended for their first control after debonding during the period of October 2016 to January 2017. Patients that had been treated with removable devices, received orthognathic surgery or were transferred from another clinic were excluded from the study. The anonymous survey consisted of 11 Likert-scale type statements regarding attention, respect, caretaking, pain/discomfort, quality of information before and during treatment, opportunity to participate in the therapy’s decisions, and patient’s expectations regarding pain/discomfort and treatment time.

RESULTS: The sample consisted of 102 patients (65 females, 37 males) who participated in the survey resulting in a 94 per cent response rate. Between 97 and 99 per cent of the respondents strongly agreed or agreed in seven of the statements regarding good information and treatment quality. Somewhat less positive results included answers about pain/discomfort, involvement in the therapy, and patient’s expectations. Three indices were formed combining statements that reflected various aspects of the same dimension. A larger proportion of the younger patients had experienced a good treatment in general. Female patients seemed to be more pleased with communication with the staff. These differences were statistically significant, but too small to have clinical relevance.

CONCLUSION: Most patients were very pleased with the treatment they received. However, it is important to improve the degree of engagement of the patients and give them more opportunities to decide on their therapy. It is also important to inform them more accurately to create realistic expectations and thereby improve the orthodontic treatment of children and youths in the clinic.

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SP 208 EFFICACY OF THE ANDRESEN ACTIVATOR BEFORE PEAK GROWTH IN CLASS II PATIENTS
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AIMS: To analyze the treatment efficacy of a Class II malocclusion due to mandibular hypodevelopment before peak growth.

SUBJECTS AND METHOD: Fourteen subjects with a Class II relationship of the skeletal bases and cervical vertebrae maturation stage 1 or 2 were enrolled in the study. Cephalometric analyses were carried out using landmarks derived from the analyses of Pancherz, Ricketts, Tweed and Steiner.

RESULTS: A significant decrease ($P < 0.05$) in ANB angle was found ($–2.29 ± 3.05°$) after treatment, which was expression of an improvement in maxillo-mandibular sagittal skeletal relationships. There was also a significant reduction of overjet after treatment ($–4.44 ± 2.36$ mm; $P < 0.001$), indicating a vestibularization of the mandibular incisors, a palatoversion of the maxillary incisors, and a correction of the molar relationship.

CONCLUSION: The favourable effects of the Andresen activator for the correction of mandibular defects can be found even prior to peak growth; the achieved Class I relationship maintains a correct mandibular position, ensuring correct skeletal growth.

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SP 209 EFFECTS OF CLEAR ALIGNERS ON SLEEP BRUXISM: A RANDOMIZED CONTROLLED TRIAL
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AIMS: The possible effects on sleep bruxism (SB) of clear aligners in orthodontics are unknown. This study was conducted to analyze the effects of clear aligners (CAT) on SB.

SUBJECTS AND METHOD: Ethical approval was obtained (#0089211). The research protocol was designed in accordance with the Helsinki Declaration. This trial was registered at ISRCTN.com (ISRCTN12654415). Sixty subjects needing orthodontic treatment with SB (33 males, 27 females, 20 ± 5 years) were randomly assigned to one of the following three groups: 20 were given CAT (12 males, 8 females, 19 ± 5 years), 20 occlusal splints (MOS; 9 males, 11 females, 22 ± 5 years) and 20 a placebo splint (PMS; 12 males, 8 females, 24 ± 3 years). All groups were followed for six consecutive months and monitored for SB with a portable electromyographic-electrocardiographic device (Bruxoff®, OT Bioeletronica, Torino, Italy).

RESULTS: MOS subjects reduced masseter contractions after six months of treatment (MD = −29.11, std. error 11.74, P = 0.017) but increased phasic contractions related to SB after three months of treatment (MD = 4.73, std. error 2.36, P = 0.048) and tonic contractions during all six months of treatment when compared to PMS. CAT subjects increased phasic contractions related to SB during the first (MD = 3.94, std. error 2.27, P = 0.04) and third (MD = 4.62, std. error 2.36, P = 0.046) month of treatment when compared to PMS. No significant differences were found for SB index at any time for all three groups.

CONCLUSION: Although MOS and CAT affected electromyographic signals during sleep time differently, they did not influence the overall SB index.

SP 210 THE GENOME OF THE ORAL MICROBIOTA AS A PREDICTOR FOR SKELETAL MALOCCLUSION
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AIMS: To identify the genome of the microbiota as a predictor for skeletal malocclusion.

SUBJECTS AND METHOD: A total of 45 patients (median age: 10 years, range 6-14 years), with Class I, II and III skeletal malocclusions were evaluated. This research conformed to STROBE guidelines for observational human studies. A sample of microbioma was taken. The genome of the microbiota in the different group of patients was studied. Next generation sequencing was performed. DNA was extracted from specimens after two consecutive incubations with lysozyme and proteinase K, in order to ensure an indiscriminate Gram+ and Gram– bacterial lysis. Once extracted, DNA was purified through a silica spincolumn (Sigma-Aldrich, St Louis, Missouri, USA). Statistical descriptive analysis was performed using IBM SPSS Statistics 21 software. The statistical analysis of microbiological characterization was performed on relative quantity calculated as ratios between the amount of each bacterial species (absolute quantity) and the total quantity of the germs. ANOVA was used to study correlation between microbioma and malocclusions.

RESULTS: The absolute and relative amount (compared to the total charge) of each bacterium, in addition to the total change were detected in the samples. Oral microbioma samples revealed normal to pathological load of different bacteria including certain germs associated with different malocclusions (P < 0.005). In particular, Porphyromonas gingivalis (absolute amount 629 and relative amount 1.14%), and Tannerella forsythia (absolute amount 650 and relative amount 1.05%) were detected. Microbiological evaluation also showed an increase of Fusobacterium nucleatum (absolute amount 1484 and relative amount 1.89%), that is reported to contribute to the onset of periodontitis.

CONCLUSION: The genome of the microbiota needs further study and could be used as a predictor for skeletal malocclusion.

SP 211 RADIOGRAPHIC EVALUATION OF THE ACCURACY OF ORTHODONTIC BRACKET PLACEMENT IN DIRECT VERSUS INDIRECT BONDING
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AIMS: To retrospectively compare two techniques in terms of accuracy of axial bracket placement in two cohorts of patients undergoing buccal orthodontic treatment.

SUBJECTS AND METHOD: A total of 60 patients were included in the study, half treated with direct bonding (group 1, n = 30) and half with indirect bonding (group 2, n = 30). In both groups bonding was performed by an orthodontist with more than 30 years' experience. For every bonded tooth, the presence and clinical severity of root angulation errors on the mid-treatment panoramic radiograph examination was assessed and scored (ABOtip) according to the 2012 American Board of Orthodontics (ABO) grading system. Differences in error rates by patient and single teeth between the two groups were analyzed using Fisher’s exact test or Pearson’s χ2 as appropriate. Total ABOtip scores were compared using a non-parametric Mann-Whitney U test. The association between the presence of errors and several variables was investigated using a binary logistic regression model.

RESULTS: A total of 45 out of 60 patients (75%) showed at least one root angulation error. This proportion varied significantly between groups 1 and 2 (56.7% versus 93.3%, \( P = 0.002 \)). In all, 5.1 per cent of directly bonded teeth had a root angulation error compared to 9.9 per cent of indirectly bonded teeth (\( P < 0.001 \)). The greatest differences were found for the upper lateral incisors. The total ABOtip score was significantly lower in group 1 compared to group 2 (41 versus 78, \( P = 0.004 \)).

CONCLUSION: Direct bonding proved to be more accurate than indirect bonding for axial bracket placement when performed by an expert orthodontist. Such results may provide valuable information for the scientific community and warrant further investigation.

SP 212 T LYMPHOCYTES ENHANCE THE ANABOLIC EFFECT OF INTERMITTENT PARATHYROID HORMONE ON CEMENTOBLASTS
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AIMS: To investigate whether the anabolic effect of intermittent parathyroid hormone (iPTH) on cementoblasts would be enhanced under interaction of T lymphocytes.

MATERIALS AND METHOD: CD4+T cells were isolated from the wild type mice and purified by flow cytometry. Immortalized mouse cementoblasts cell line OCCM-30 was chosen to establish the CD4+T cells/ OCCM-30 cells coculture system in vitro by 6-well plate with 3um pore size transwell inserts. In the control (monoculture) groups, only 1640 medium (no T cells) were contained in the inserts. The co-culture system was exposed to 50 ng/ml PTH (1-34) for the first 6 hours in each 24 hour incubation cycle, and cultured for the remainder of the cycle without PTH. OCCM-30 cells were collected and examined after one and two cycles of treatment. Cell Counting Kit-8 was used to examine proliferation of OCCM-30 cells. Real-time polymerase chain reaction and Western blot was used to examine the expression of skeletogenic makers [alkaline phosphatase (Alp), osteopontin (Opn)] and osteogenic transcription factors Runx2 on gene and protein level. Quantitative ALP assay, Alizarin red S staining and quantitative calcium assay were performed to investigate the effects of T cells interaction on mineralization of OCCM-30. Statistical analyses were conducted with an independent samples t-test between experiment and control groups, and \( P < 0.05 \) was considered statistically significant.

RESULTS: In the co-culture system, the mRNA and protein expression of Alp, Opn and Runx2 were increased at both one and two cycles. Quantitative ALP assay showed an increasing ALP activity in the co-culture system. However, the increase of proliferation of OCCM-30 and mineralization had no statistical significance between co-culture and monoculture groups, and it might because of the short interaction time(48 hours).

CONCLUSION: CD 4+T cells could amplify the anabolic effect of iPTH on OCCM-30 in vitro, indicating there might be a crosstalk between CD4+T cells and cementoblasts during cementum regeneration.

SP 213 THREE NOVEL GENES TIED TO MANDIBULAR PROGNATHISM IN EAST-MEDITERRANEAN FAMILIES
AIMS: To identify the inheritance pattern and genes/loci involved in the development of mandibular prognathism (MP) in Eastern Mediterranean families and to evaluate the dentoskeletal characteristics of affected individuals.

SUBJECTS AND METHOD: Fourteen out of 51 Eastern-Mediterranean families with individuals affected by MP had data/biospecimen collection: clinical examination, lateral cephalography (on subjects with Class III malocclusion) and 5 cc of blood drawn from the consenting affected and non-affected relatives. Next generation sequencing (NGS) was performed on eight families (7 Lebanese, 1 Lebanese/Syrian) including the largest number of affected individuals over many generations and the most severe conditions, by application of whole exome sequencing.

RESULTS: Most pedigrees suggested autosomal dominant inheritance with an equal number of affected males and females. Affected individuals had macrognathic and prognathic mandibles with dentoalveolar compensation. Genetic screening did not correspond with previously reported MP-linked genes, but yielded three novel genes (C1orf167, NBPF8, NBPF9) on chromosome 1 potentially responsible for mandibular development and macrognathism.

CONCLUSION: In this first genetic study using NGS on the largest reported number of families with MP, novel genes (C1orf167, NBPF8, NBPF9) were associated with familial MP in the Eastern-Mediterranean population.

SP 214 COMPARISONS OF FACIAL SOFT TISSUE FEATURES IN ADULT PATIENTS WITH VARIOUS MANDIBULAR DIVERGENCE PATTERNS

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AIMS: To evaluate the association between mandibular divergence and facial soft tissue (FST) features in adults.

SUBJECTS AND METHOD: Non-growing patients seeking orthodontic treatment (n = 90; 45 females, 45 males), who had an average age of 28.18 years (range = 18-53.8 years), were stratified into three subgroups (n = 30 each) based on pretreatment cephalometric mandibular plane inclination to anterior cranial base (MP/SN): hypo (1): MP-SN ≤27°; normo (2): 27°<MP-SN<37º; hyper (3): MP-SN ≥37°. FST thickness, length and position were measured at glabella, nose, upper and lower lips, chin, and throat. Group differences were evaluated with two-way analysis of variance and a Student’s t-test. The Pearson product moment correlation gauged associations between parameters.

RESULTS: Major differences existed within the lower third of the face. Differences were characteristic in group 3 compared to group 1: lips were more elongated; upper lip was longer by 3.27 mm (P < 0.001), lower lip by 5.12 mm (P < 0.001), the soft tissue chin was thinner at the level of gnathion (P < 0.001) and menton (P = 0.002). The nose was further tipped up with increased in divergence. No major gender differences were observed in the FST features.

CONCLUSION: Adapting to a more vertical growth of the underlying hard tissues, the lips and chin are thinner/more elongated in subjects exhibiting mandibular hyperdivergence. The adaptation may represent a constitutional limitation to orthodontic treatment outcome in these patients, favouring a combined orthodontic/orthognathic/plastic treatment.

SP 215 ANTERIOR TOOTH ROOT MORPHOLOGY PREDICTION AS DERIVED FROM DIGITAL MODELS: A COMPARATIVE STUDY OF PLASTER CASTS AND NATURAL TEETH FROM DRY SKULLS

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AIMS: To assess the accuracy and reliability of digital images of dental models generated by commercially available software in predicting root morphology characteristics in comparison to corresponding natural teeth.

MATERIALS AND METHOD: A total of 55 permanent teeth derived from 14 dry human skulls (11 mandibles, 3 maxillae) were evaluated. Dental arch impressions were taken and plaster models were fabricated. The plaster models were scanned using the Ortho Insight three-dimensional (3D) laser scanner. Using the Ortho Insight 3D software (version 4.0.6), measurements, to the nearest 0.01 mm, were recorded by locating relevant landmarks using the intrinsic linear measurement function of the software. Based on these landmarks, the software produced virtual roots for the selected teeth. Both the scanned casts and their root predictions were exported into stereolithography files. All corresponding 55 natural teeth were removed from the jaws and scanned using the identical extraoral white-light scanner in order to calculate their actual root morphological characteristics. The accuracy of the digital models generated by the Ortho Insight 3D laser scanner in predicting root morphology characteristics was assessed by comparing these results to the corresponding measurements of the 55 natural teeth. The long axes of the tooth models obtained from the software prediction and scanning of the actual teeth were computed and the discrepancy between them evaluated.

RESULTS: The error of the method, evaluated by repeating the measurements on 14 teeth, showed acceptable accuracy. The predicted tooth angulation was found to differ significantly from the actual angulation, both statistically and clinically. The angle between the predicted and actual long axes ranged from 2.0 to 37.6 degrees (average: 9.7°; median: 7.4°).

CONCLUSION: The degree of error is higher for mandibular central incisors and maxillary lateral incisors, and lower for maxillary central incisors and mandibular lateral incisors. Further investigations and improvements of the software are needed before it can be considered clinically effective.

SP 216 TELEDENTISTRY AND ORTHODONTICS: A LITERATURE REVIEW
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AIMS: To examine if teledentistry is evidence-based, as effective and applicable, to orthodontic assessment and treatments. This is an important area to consider especially with some large orthodontic organisations and dental providers advertising do-it-yourself orthodontics directly to the public, as well as offering remote treatment monitoring.

MATERIALS AND METHOD: PubMed database was used to review the literature on this topic. The search that was conducted using ‘teledentistry and orthodontics’ revealed 18 articles.

RESULTS: After reviewing the content of the articles based on these criteria, 15 were selected for this study. Teleconsultation through teledentistry for orthodontics can take place via a ‘real-time consultation’, a ‘store-and-forward method’ or a ‘remote monitoring method’. Many benefits were identified such as potentially improving access to dental care for rural and underserved populations, or interceptive orthodontic treatment planning when attending an orthodontist is not possible. Teledentistry could also be a significant factor in reducing inappropriate referrals. Risks discussed included patients not being accepted on the teledentistry system who would benefit from a full clinical examination. General dental practitioners (GDP’s) and UK orthodontic consultants support the concept of using teledentistry for referrals and sharing advice. GDP’s were concerned about the impact on them regarding set-up expenses, time in the surgery and appropriate remuneration, as well as data security, confidentiality and consent.

CONCLUSION: Teledentistry and orthodontic assessment and treatment are currently being provided in many countries. Further research studies should consider the long-term benefits such as reduced costs for providers and patients, as well as the risks including potentially ineffective disease monitoring without radiographs or an inefficient clinical examination. Data security, with the recent changes in the General Data Protection Regulation, will likely require further consideration for providers.
SP 217 IS THERE ANY DIFFERENCE BETWEEN CONVENTIONAL, PASSIVE SELF-LIGATING AND ACTIVE SELF-LIGATING BRACKETS? A SYSTEMATIC REVIEW AND NETWORK META-ANALYSIS
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AIMS: To test the null hypothesis that there is no difference in treatment efficiency between therapies undertaken with conventional (CBs), passive self-ligating (PSLBs) or active self-ligating (ASLBs) brackets.

MATERIALS AND METHOD: An electronic search was performed in three databases (PubMed, Web of Science, Cochrane Library) from their origin up to September 2018. Additional references were hand searched. Search was strictly restricted to randomized controlled trials (RCTs) and split-mouth design studies (SMDs). When RCTs and SMDs were available, these were initially processed separately and subsequently combined in the meta-analysis. A network meta-analysis was implemented to obtain multiple comparisons between therapies undertaken with the three bracket types. Thirty seven variables were investigated and concerned: treatment duration, number of visits, alignment efficiency, rate of space closure, perception of discomfort during the initial phase of treatment, pain experience during wire insertion or removal, time to ligate in or to untie an archwire, bond failure, occlusal indices, transverse arch dimensional changes, incisor position modification with and without extractions, loss of anchorage, root resorption, periodontal outcomes and oral health-related quality of life.

RESULTS: Thirty RCTs and nine SMDs were finally included. Out of the 37 variables, only 12 revealed statistically significant differences. Total treatment time did not show any difference between the three bracket types. There was no difference in the number of visits between CBs and PSLBs. However, a significantly reduced number of days was required to achieve mandibular alignment with ASLBs compared to PSLBs, but there was no difference for this variable between CBs and PSLBs, nor between CBs and ASLBs. It was definitely quicker to insert and remove archwires from ASLBs compared to CBs, and it was more painful to insert and remove a 0.019 × 0.025 inch stainless steel rectangular wire in/from PSLBs compared to CBs. Finally there was less bleeding on probing 4-5 weeks after bonding with PSLBs compared to CBs brackets.

CONCLUSION: The vast majority of the studied variables did not show any significant difference between CB, PSLB and ASLB.

SP 218 FRACTIONAL PHOTOTHERMOLYSIS IN ADOLESCENTS AND YOUNG ADULTS WITH CONSTRUCTION OF THE UPPER JAW
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AIMS: To increase the effectiveness of orthodontic treatment of adolescents and young adult patients with constriction of the maxilla using the technique of fractional photothermolysis.

SUBJECTS AND METHOD: Twenty five patients with maxillary constriction (mean age 17.5 years) divided into two groups, group 1, 15 patients who underwent rapid palatal expansion (RPE) using a tooth-borne expander and group 2, 10 patients who underwent RPE using a tooth-borne expander with the procedure of fractional photothermolysis (Biolase Waterlase iPlus). A cone-beam computed tomograph (CBCT) was obtained for all patients before and after treatment and immediately after the procedure. Cephalometric analysis of the maxilla before and after RPE was undertaken for all patients.

RESULTS: Based on the CBCT analysis, the study revealed positive changes in the shape of the dentoalveolar process in both groups. In group 1 the angle of inclination of the first premolars was 7.9 ± 0.5 degrees; the angle of inclination of the first molars was 8.9 ± 0.3 degrees; expansion of the hard palate 3.1 ± 0.9 mm; expansion of the alveolar process 6.2 ± 0.4 mm; expansion of the roots of the abutment teeth 3.1 ± 0.3 mm and expansion of the most prominent area of the crowns of the
abutment teeth 7.4 ± 0.5 mm. In group 2 the angle of inclination of the first premolars was 3.7 ± 0.5 degrees; the angle of inclination of the first molars was 2.9 ± 0.3 degrees; expansion of the hard palate was 6.8 ± 0.6 mm; expansion of the alveolar process 7.2 ± 0.4 mm; expansion of the roots of the abutment teeth 5.7 ± 0.3 mm and expansion of the most prominent area of the crowns of the abutment teeth 6.1 ± 0.5 mm.

CONCLUSION: The method of fractional photothermolysis allows stable expansion of the maxilla in the transverse direction, shortens the treatment period, minimizes complications and reduces relapse in orthodontic treatment of adolescents and young adult patients with a diagnosis of maxillary constriction.

SP 219 WHAT DO HUMAN STUDIES REVEAL REGARDING THE IMPACT OF MEDICATIONS ON THE RATE OF ORTHODONTIC TOOTH MOVEMENT AND ROOT RESORPTION? A SYSTEMATIC REVIEW

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AIMS: The consumption of any medication may theoretically influence the intricate pathways that are related to events leading to orthodontic tooth movement and root resorption. The aim of this study was to systematically investigate and appraise the quality of the available evidence regarding the effect of systemically and locally administered medication on the rate of orthodontic tooth movement and root resorption in humans.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. Data from controlled human studies investigating the effect of systemic and locally administered medications on the rate of orthodontic tooth movement and root resorption were reviewed. Relevant data were extracted and the risk of bias was assessed.

RESULTS: Eight human studies, involving various pharmacologic and orthodontic interventions, were finally identified. Increased fluoride consumption and local administration of prostaglandin and vitamin D were found to augment the rate of orthodontic tooth movement. Ibuprofen and loxoprofen did not show any significant effects on the rate of orthodontic tooth movement, while indomethacin, ketorolac, morphine and high doses of etoricoxib were found to decrease it. Inconsistent or conflicting effects were noted after the administration of

SP 220 DOES LONG-TERM USE OF PAIN RELIEVERS HAVE AN IMPACT ON THE RATE OF ORTHODONTIC TOOTH MOVEMENT? A SYSTEMATIC REVIEW OF ANIMAL STUDIES

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AIMS: Pain relief drugs are used and misused widely and may theoretically affect events leading to orthodontic tooth movement. The aim of this study was to investigate whether long-term use of analgesics may have an effect on the rate of orthodontic tooth movement in animals.

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 administration of analgesics for at least 2 weeks on the rate of orthodontic tooth movement were reviewed. Relevant data were extracted and the risk of bias was assessed using the Syrcke’s Risk of Bias Tool.

RESULTS: Fourteen studies were finally identified, the majority of which were at risk of bias. Ibuprofen and loxoprofen did not show any significant effects on the rate of orthodontic tooth movement, while indomethacin, ketorolac, morphine and high doses of etoricoxib were found to decrease it. Inconsistent or conflicting effects were noted after the administration of
acetaminophen, acetylsalicylic acid, celecoxib, meloxicam and tramadol. The quality of the available evidence was considered at best as low.

CONCLUSION: Long-term consumption of pain relievers may affect the rate of orthodontic tooth movement. The orthodontist should be capable of identifying patients taking pain relief independently of orthodontic treatment and consider the possible implications.

SP 221 EVALUATION OF THE POSSIBILITIES OF COMPENSATORY MECHANISMS IN PATIENTS WITH A CLASS III MALOCCLUSION DUE TO JAW ANOMALIES
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AIMS: Improvement of diagnostic methods in patients with a Class III malocclusion due to jaw anomalies.

SUBJECTS AND METHOD: Fifty patients with a Class III malocclusion were examined. Cone beam computed tomography was performed. The parameters of the dentition and jaws, as well as structural features of the temporomandibular joint (TMJ) were evaluated.

RESULTS: Structural features and compensatory mechanisms were identified in patients with a Class III malocclusion. Differences were found in patients with hyperdivergent and hypodivergent types of the facial skull structure. The combination of anomalies of occlusion of the dentition in the anterior and lateral regions was determined. The features of the structure of the TMJ and the severity of its dysfunction in the presence of occlusal anomalies in the vertical and transverse directions were revealed.

CONCLUSION: This topic is very relevant today, as the number of patients who wish to undergo combined treatment aimed at improving the aesthetics of the face and function increases. It is necessary to take into account the structural features of all structures of the maxillofacial region to achieve a positive result.

SP 222 ANOMALIES OF THE LATERAL INCISOR ON THE CLEFT SIDE IN 160 PATIENTS BORN WITH A UNILATERAL CLEFT LIP WITH- OR WITHOUT CLEFT ALVEOLUS
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AIMS: To describe dental anomalies in the primary and permanent dentition in patients born with a unilateral cleft lip with or without cleft alveolus (CL±A) in relation to cleft severity and laterality.

SUBJECTS AND METHOD: One hundred and sixty children with unilateral CL±A without syndromes and associated anomalies, born between 1988 and 1997. The data were collected retrospectively from the archives of the Oslo Cleft Lip and Palate Team where all orthodontic patient notes, dental casts, and panoramic and intraoral radiographs from the study period 1988-2004 were examined.

RESULTS: Among the 160 children, 66.9 per cent (n = 107; 27% female, 73% male) were diagnosed with a cleft lip only (CL), and 33.1 per cent (n = 53; 42% female, 58% male) with a cleft lip and alveolus (CL+A). Records from the primary dentition were found of 95.3 per cent (n = 102) in the group with CL, and 94.3 per cent (n = 50) in the group with CL+A. Differences were found in the permanent dentition in both groups. The lateral incisor in the cleft area was investigated. In the primary dentition the lateral incisor was found to be missing in 0 per cent (CL) and 4.0 per cent (CLA), one lateral incisor in 68.0 per cent (CL) and 42.0 per cent (CLA) and a supernumerary lateral incisor was found in 32.0 per cent (CL) and 54.0 per cent (CLA). In the permanent dentition the lateral incisor was found to be missing in 4.7 per cent (CL) and 34.0 per cent (CLA), one lateral incisor in 71.0 per cent (CL) and 37.7 per cent (CLA) and a supernumerary lateral incisor was found in 24.3 per cent (CL) and 28.3 per cent (CLA).

CONCLUSION: The findings provide a reference for dental anomalies in CL±A.
Influence of First Premolar Orthodontic Extraction Treatment on Second and Third Molar Angulation and Position

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AIMS: To evaluate angular and positional changes of mandibular and maxillary second and third molars.

MATERIALS AND METHOD: Panoramic radiographs of patients treated with extraction of the first premolar (n = 60) and non-extraction (n = 60), selected before orthodontic treatment (T0) and after completion of orthodontic treatment with fixed multibracket appliance (T1). The groups were matched for gender and age. The third molars (3M) presented at least a stage 4 according to Demirjian’s classification at T0. Patients treated with active distalisation mechanics were excluded from the study. Angle classification, growth pattern, crowding, inclination of incisors and dental midline deviations were registered. The palatal plane (PP) and the interorbital plane (IOP) were used as references for the measurements. Pre- and post-treatment panoramic radiographs were traced, and the following measurements were made for second molars (2M) and 3M: 2M/IOP, 2M/PP, 3M/IOP, 3M/PP. Furthermore, the third molars were classified according to the Winter’s and Pell and Gregory’s classification. Forty randomly selected radiographs were evaluated for inter- and intraobserver reliability. The changes in the 3Mr position and angulation relative to the IOP and ITP and to the second molar long axis from T0 to T1 were compared with the Mann-Whitney U-test and Wilcoxon test (P < 0.05).

RESULTS: Inter- and intraobserver reliability was ranged from 0.80-0.93. Range, mean, standard deviation and the confidence interval (CI) of 95 per cent of the mean of each magnitude studied before and after treatment were determined. There was a statistically significant difference between the extraction and non-extraction groups in the median 3M angulation after completion of the orthodontic treatment (P < 0.05). Upper 3M also showed a favourable angulation change from T0 to T1, nevertheless without statistical significance (57.1% of upper 3M presented a score 3 according to Archer’s vertical classification, whereas at T1 this number increased to 71.4%).

CONCLUSION: The results suggest that premolar extraction therapy may lead to favourable angulation changes of the mandibular 3M in orthodontic patients.

Dental Arch Form in Young Adult Saudis Determined by the Finite Element Method

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AIMS: To determine which of the commercially available archwire forms mostly suits the dental arch form of young adult Saudis using the finite element method and to monitor the coincidence between upper and lower dental arch forms in the same individual within the sample. Then each model was meshed using a two-dimensional (2D) beam element.

MATERIALS AND METHOD: The sample consisted of 100 young adult Saudis with an age range of 18-24 years without previous orthodontic treatment. Direct intraoral scans were taken directly from the patient’s mouth to obtain three-dimensional digital models. A point 1.5 mm in diameter, representing the bracket position for each tooth, was marked. A spline of curves (constructed arch) was drawn connecting points labially tangent to the bracket point. Three commercially available archwire forms were selected to be tested to fit the constructed arch form using the finite element analysis (FEA). A 2D geometric model of each archwire form was constructed using the COSMOS/M software. The next step in modelling of the archwire was to set the material properties. The properties set for nickel-titanium alloy were Young’s modulus and Poisson’s ratio.

RESULTS: In the male group, the most frequent arch from was ovoid (44% and 46% for the upper and lower, respectively) followed by tapered (28% for both upper and lower) and square (28% and 26% for the upper and lower, respectively). In the female group, the most frequent arch form was
ovoid (46% and 52% for the upper and lower, respectively) followed by tapered (34% and 32% for the upper and lower, respectively) then square (20% and 16% for the upper and lower, respectively). Coincidence between upper and lower arch forms in the same individual presented a high percentage for both males (76%) and females (70%).

CONCLUSION: FEA is a reliable new method for studying and determining dental arch form. When treating Saudi patients, one should expect to use the preformed ovoid arch form orthodontic wires in a high percentage of patients.

SP 225 DENTAL ARCHES DIMENSIONS IN 5-6 YEAR OLD CHILDREN AFFECTED BY OBSTRUCTIVE SLEEP APNOEA. AN OBSERVATIONAL STUDY
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AIMS: Obstructive sleep apnoea (OSA) can be clinically managed in small children in the late primary dentition. The rationale of this approach is to prevent several morphological changes in the craniofacial structure of children. At that age, OSA is already associated with some abnormal skeletal and soft tissues features, that also involve the oral region, and it is assumed that the severity of this disease could have a considerable influence on the appearance and the severity of anatomical changes. To better illuminate this influence, there are no specific data on the anatomy of oral region in subjects with OSA at late primary dentition stage. Thus, the aim of this study is to investigate the dimensions in the upper and lower arches in children affected by OSA with different levels of obstruction severity.

SUBJECTS AND METHOD: Twenty seven Caucasian children (14 males, 13 females; mean age 6, range 5.2-6.1 years) with a diagnosis of OSA made by polysomnographic analysis were enrolled. The dimensions of the dental arches were measured by adopting the Moorrees’ method on the upper and lower dental casts, and data were compared among children affected by severe, moderate and mild OSA.

RESULTS: Average values of intermolar (Im) and intercanine (Ic) widths were significantly higher in children with severe OSA than in those with moderate, or mild OSA.

CONCLUSION: Comparing data with normal ranges, OSA seems not to severely affect the dental arches dimensions in this age range (late primary dentition stage). However children affected by a severe level of OSA tend to show a higher intermolar diameter compared to the moderate and mild groups, and a higher intercanine diameter compared to the moderate group. These observations give strength to the rationale of clinical management of OSA in children in the late primary dentition, to preserve their normal dental arch dimensions before subsequent abnormal changes due to OSA, mostly expected for children affected by severe disease (AHI >10).

SP 226 EVALUATION OF SKELETAL MALOCCLUSIONS IN HYPODONTIA
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AIMS: Early diagnosis of hypodontia and of associated skeletal malocclusions is crucial for successful and stable final rehabilitation. The objective was to compare the cephalometric findings of patients with hypodontia of 1 to 4 teeth with the measurement results of a control group without tooth agenesis.

MATERIALS AND METHOD: The lateral radiographs of 41 patients with agenesis of 1 to 4 teeth were selected from subjects referred for orthodontic treatment within a two years period and evaluated. The results were compared with the values of an age and gender matched control group.

RESULTS: The bilateral upper incisor and lower premolar were missing in most of the hypodontia subjects. When looking at the NSGn angle predicting the growth direction of the mandible, statistically significant differences were found between the male (P = 0.012), the anterior tooth
agenesis ($P = 0.010$), the hypodontia group ($P = 0.024$) and the control group. Regarding ANB angle, which shows the sagittal position of the maxilla to the mandible, statistically significant differences were found between the subgroups (females, males, anterior or posterior hypodontia) and the control group. 

CONCLUSION: A larger number of skeletal deep bite tendencies and skeletal Class III malocclusions were observed in the hypodontia group.

SP 227  A STUDY OF THE STABILITY OF ORTHODONTIC MINI-IMPLANTS
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AIMS: To examine in different ways the stability of mini-implants as temporary anchorage devices.

MATERIALS AND METHOD: The study was based on a dental clinic’s database that contained patient files from 2002 to 2014 from which the records of 60 patients were randomly selected (14 males, 46 females, mean age 29 years) who received orthodontic miniscrews. In this retrospective study 121 self-drilling miniscrews (40 palatal, 45 upper buccal, 36 lower buccal) were counted. These micro-implants were examined in multiple ways using several factors: (1) Implant related factors: insertion method, the type, diameter and length of the miniscrew, loading force and time; (2) Patient related factors: gender, age, oral hygiene, orthodontic diagnosis, placement sites and bone density.

RESULTS: From the 121 micro-implants that were immediately loaded with a force of 50 g, 10.74 per cent failed, 9.09 per cent loosened and 1.65 per cent fractured. Of those that were loose, 72.72 per cent were palatal and 27.27 per cent upper buccal miniscrews.

CONCLUSION: The failure rate was 10.74 per cent due to poor oral hygiene, the displacement direction of the teeth, overloading of anchorage, the low density of the bone and possibly osseointegration of the micro-implants. The overall success rate of 89.26 per cent showed that the miniscrews can be used as orthodontic anchorage consistently in routine orthodontic practice. To reduce the failure rate, clinicians should motivate patients to improve their oral hygiene.

SP 228  OBSTRUCTIVE SLEEP APNOEA
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AIMS: To evaluate the dentofacial features in children with obstructive sleep apnoea (OSA) before and one year after adenotonsillectomy and to compare it with a control group.

SUBJECTS AND METHOD: One hundred and forty three OSA patients between the ages of 3 and 10 years diagnosed with OSA from February 2007 until March 2018. Adenotonsillectomy was practiced. Polysomnography, radiographic-lateral radiographs, model cast, routine physical examination and a clinical diagnosis were performed for all patients before (T0) and one year after (T1) surgery. Statistical analysis was done with Statgraphics®.

RESULTS: Both dental features, intercanine width and intermolar width, differed at T0 from those in the control group. ($P < 0.01$). OSA children presented narrower arches. Also both intercanine and intermolar width after the adenotonsillectomy differed from the healthy group ($P < 0.01$). No statistically significant differences were observed in sagittal and vertical patterns. Narrow arches were maintained after surgery.

CONCLUSION: OSA has a significant relationship in the development of dentofacial structures. Adenotonsillectomy is therefore recommended as the first line of treatment. The maxilla and mandible still remain narrower after surgery. An early diagnosis and orthodontic treatment associated with adenotonsillectomy is mandatory.

SP 229  REGULATION OF AUTOPHAGY MARKER SEQUESTOSOME 1 IN PERIODONTAL CELLS AND TISSUES BY BIOMECHANICAL LOADING
AIMS: Sequestosome 1 (p62) is a well-known marker for autophagy, which is an important cellular mechanism of adaptation. The aim of this study was to investigate if biomechanical loading, as applied during orthodontic tooth movement, can lead to regulation of autophagy marker p62 in periodontal cells and tissues.

MATERIALS AND METHOD: Periodontal ligament (PDL) fibroblasts were exposed to biomechanical loading in three different settings: low cyclic tensile strain, low static tensile strain and high static tensile strain. In previous experiments an array-based approach was used to identify and select p62 for further investigation via reverse transcription polymerase chain reaction and immunoblotting. Furthermore, p62 mRNA expression was analyzed in gingival biopsies of rats after 1 day of orthodontic tooth movement and compared to control animals. In addition, histological sections of the entire periodontium of rats after 1 day of orthodontic tooth movement and control animals were examined by immunohistochemistry. For statistical analysis, ANOVA and post-hoc tests were applied.

RESULTS: P62 was upregulated by all different settings of biomechanical loading. Regulatory effects on p62 were mediated by the JNK pathway. Moreover, upregulatory effects of biomechanical loading on p62 expression were abolished by an autophagy inhibitor. A significantly elevated p62 expression was determined in gingival biopsies of rats after 1 day of orthodontic movement as compared to control animals. These findings were confirmed at the protein level as evidenced by a stronger immunoreaction to p62 in periodontium of histological sections after 1 day of orthodontic movement as compared to periodontal tissues of control animals.

CONCLUSION: The findings suggest that autophagy could play a key role in the adaption to biomechanical loading in PDL cells. Additionally, autophagy might be important in the initiation of orthodontic tooth movement.

SP 230  SOLUTIONS FOR DIMINISHING BRACKET BOND FAILURES
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AIMS: Bracket bonding is essential in orthodontic treatment with fixed appliances. It is not only bracket placement that is important but perhaps more so, the quality of bracket bonding. However, in everyday orthodontic practice we are often confronted with bracket bond failure. Accidental bracket debonding increases the length of treatment for the patient, but also chair time for the practitioner. The aim of this study was to find an alternative to bracket bonding agents that are currently on the market and possibly an alternative with an increased bond strength.

MATERIALS AND METHOD: A formulation for a bracket bonding agent with graphene in its composition has been developed. Why graphene? Because it is a semi-metal, a form of carbon, that is one of the strongest materials ever tested, it is nearly transparent and has been tested for other applications in dentistry but not for orthodontic bonding purposes. This experimental material was compared with three commercial bonding systems from a biological and mechanical point of view. Cytotoxicity tests, shear bond strength tests as well as Adhesive Remnant Index scores were undertaken and interpreted.

RESULTS: Innovative materials can compete with those commercially available and improving chemical formulas with innovative particles such as graphene can be an advantage of the new materials. However further studies are required before the experimental material is ready for clinical use.

CONCLUSION: Improving chemical formulas with innovative particles such as graphene can be an advantage of the new materials. The importance of a correct and durable bracket bonding is the
key for fixed orthodontic treatment success and therefore more research should be done in this field.

SP 231 ADULT PATIENTS FROM OVER 40 YEARS OF AGE IN MODERN ORTHODONTICS MALOCCLUSION: TREATMENT NEED, PERIODONTAL BONE LOSS
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AIMS: In adult orthodontic therapy not only young adults (in their twenties) but also patients 40+ years of age are consulting the orthodontist nowadays. Therefore the aim of this study was to quantify in patients from 40 years of age and upwards the malocclusion and the orthodontic treatment need in relation to the periodontal bone loss.

SUBJECTS AND METHOD: In a cross-sectional observational study 120 orthodontic patients (40 years of age; 41-72 age range) were enrolled. The patients were classified according to their periodontal bone loss [clinical attachment loss (CAL)] based on the American Academy of Periodontology/Centers for Disease Control and Prevention Surveillance Working Group: group I - severe periodontal bone loss: >2 interproximal sites with CAL >6 mm and Pocket Depth >5 mm, group II - moderate periodontal bone loss: >2 interproximal sites with CAL >4 mm or PD >5 mm, group III - control group: neither moderate or periodontal bone loss. Digital dental parameters were analysed and compared to periodontal clinical parameters on each tooth from canine to canine in the upper and lower jaw: Digital dental cast parameters: overjet/overbite, irregularity index in the upper/lower jaw; Periodontal clinical parameters: six point probing pocket depth, CAL, recession. Additionally the treatment need was analyzed using the Dental Component of the Index of Orthodontic Treatment Need (IOTN/DC).

RESULTS: The degree of malocclusion stepwise increased in all three groups. Digital dental parameters were significantly more severe and associated with periodontal bone loss: overjet was 27 per cent higher in patients with moderate periodontal bone loss and 67 per cent higher in patients with severe periodontal bone loss compared to the controls (P < 0.001). Also the IOTN/DC was significantly increased from 3 (moderate) to 4/5 (very/very great treatment need). Moreover in patients with severe periodontal bone loss more than 30 per cent were classified with grade 4/5 (P < 0.001).

CONCLUSION: According to diversification of modern orthodontics in adult therapy a special focus is needed on patients 40+. In the treatment of these patients an interdisciplinary orthodontic/periodontics concept has to be emphasized. In the near future the high treatment need in patients 40+ will broaden the orthodontic spectrum.

SP 232 THE ROLE OF PERSONALITY IN THERAPY WITH MANDIBULAR ADVANCEMENT DEVICES: NEW INDICATIONS FOR PROPENSITY TO USE
Luca Mezofrancio¹, Alberto De Stefani¹, Giovanni Bruno¹, Francesca Milano², Antonio Luigi Tiberio Gracco¹, ¹University of Padova and ²Private practice, Bologna, Italy

AIMS: Obstructive sleep apnoea (OSA) is a common respiratory syndrome caused by repetitive collapse of the upper airway. Treatment possibilities include oral devices such as mandibular advancement devices (MAD) which hold the lower jaw and tongue forward thus creating more space for breathing. Because the potential benefits of MAD depend on high compliance, it is important to have indications on the propensity to use. This study aimed to look for indications on the propensity of a generic subject to use a MAD for OSA and snoring therapy.

SUBJECTS AND METHOD: One hundred and forty eight participants were enrolled in the study and were asked to complete questionnaires. They were evaluated with the Need for Closure (NFC), openness to new experiences (PER), STAI-Trait and STAI-State questionnaires (Spielberg’s State-Trait Anxiety Inventory). The propensity to be treated with dental devices for a general health problem such as OSA and snoring was evaluated with a specific questionnaire (MAD-W).
RESULTS: A favourable opinion on MAD and its benefits was associated with higher PER and lower MAD-W; the main advantages of MAD could be better sleeping and breathing quality, prevention of general health problems and comfort. The main disadvantages could be discomfort/pain, cost and aesthetic issues. A positive opinion about treatment of snoring and OSA using dental devices was associated with higher PER, while lower STAI-Trait was associated with a positive opinion on treatment of snoring using dental devices. Eighty per cent of the sample would accept the use of dental devices at night for the solution of a health problem or for treatment of a disease that does not affect the teeth and have a lower STAI trait than those that do not they would do.

CONCLUSION: The results suggest that there are relationships between personality traits and the propensity to use a MAD. Knowing how to investigate specific psychological resistance should be part of the expertise of the expert in sleep disorders.

SP 233 PALATAL THICKNESS AND LENGTH IN SKELETAL DEEP BITE AND OPEN BITE PATIENTS COMPARED TO CONTROLS
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AIMS: To analyze the thickness and length of the palate in patients with skeletal deep bite and skeletal anterior open bite compared to a control group

SUBJECTS AND METHOD: Three groups were included: 1) Adult orthodontic patients with a skeletal deep bite (n = 22, aged 17-45 years, mean 26.4 years) and 2) skeletal anterior open bite (n = 21, aged 17-39 years, mean 22.4 years) and 3) a healthy control group with normal craniofacial morphology (n = 24, aged 22-53 years, mean 30.4 years). Thickness and length of the palate were measured on lateral cephalograms. The thickness was measured as the distance between the palatal and nasal floor surfaces of the cortical bone perpendicular to the nasal-line by eight linear measurements from the foramen Incisivum and repeated every 3 mm posteriorly. Length was measured as the distance between the spinal point and the pterygo-maxillare. Differences between the groups were tested by general linear model adjusted for age and gender

RESULTS: The palate was significantly thicker and longer in men compared to women in all groups (P < 0.01 and P < 0.001, respectively). Only the palatal thickness at the foramen Incisivum was significantly thicker in the skeletal open bite group compared to the skeletal deep bite group (P = 0.012). The palate length was significantly shorter in the deep bite group compared to the controls (P = 0.007)

CONCLUSION: Gender differences and differences in palatal thickness and length between the groups are new findings and the results may prove valuable for the decision of concerning the location of the insertion of mini-implants in the maxilla, particularly in patients with a skeletal open bite

SP 234 MINISCREW PRIMARY STABILITY LOSS IN THE FIRST MONTH: A RANDOMIZED CLINICAL TRIAL
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AIMS: To measure the in vivo primary stability trend over the first 30 days after miniscrew placement.

SUBJECTS AND METHOD: A single centre randomized clinical trial. Patients undergoing orthodontic treatment and needing mini-screws were enrolled in the trial. Two locations were separately considered (the maxilla and the mandible). For each patient, maximum insertion torque was evaluated at baseline and miniscrews were immediately loaded. The screw torque was measured again after 2 weeks in group 1 and after 4 weeks in group 2. At the end of treatment, maximal removal torque was evaluated in group 3. Torque variation with respect to insertion time was considered as the primary outcome. Baseline and longitudinal differences among groups were tested using one-way repeated measures ANOVA. Differences, with a P-value less than 0.05, were selected as significant.
RESULTS: The sample that received the intended treatment was 51 patients and 80 miniscrews. The miniscrews were 27 for group 1, 30 for group 2, and 23 for group 3, respectively, and a separate analysis for the mandible and the maxilla was performed. No significant baseline differences were observed among groups ($P > 0.05$). Group 1 showed significant longitudinal differences in torque recordings in the upper arch ($P = 0.0036$).

CONCLUSION: In the maxilla miniscrews showed a significant primary stability loss two weeks after placement.

SP 235 LABIAL FRENECTOMY IN ORTHODONTIC PATIENTS PERFORMED WITH CONVENTIONAL SURGERY AND DIODE LASER: A COMPARATIVE STUDY
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AIMS: To make a comparison between pre-, trans- and post-operative parameters of frenectomy performed with conventional surgery and diode laser.

SUBJECTS AND METHOD: Thirty six patients were included, all with an orthodontic indication of frenectomy. They were divided into two experimental groups: EG1, treated with the conventional surgical method, and EG2, treated using a diode laser. The level of pre-operative fear, post-operative pain and discomfort were noted using a numeric rating scale (NRS-11). The surgical time and extent of intraoperative bleeding were also registered. Clinical assessment of the surgical wound healing was made on the 3rd, 7th and 14th day by recording the level of hyperaemia, presence of fibrinous coating, formation of new epithelial tissue (re-epithelialization). Statistical analysis was performed with the statistical programs Statistica 7.1 and SPSS 17.0.

RESULTS: The duration of the surgery was 11.6 ± 2.3 minutes in EG1 and 6.1 ± 1.9 minutes in EG2, which was statistically significant according to the Mann-Whitney U test ($P < 0.05$). The average score for pre-operative fear of patients in EG1 was 6.0 ± 2.4, and of those in EG2 4.6 ± 2.9, which was a statistically insignificant difference for $P > 0.05$ ($t = 1.580581$, $P = 1.580581$). There was an association between the type of frenectomy and the subjective perception of pain (Pearson Chi-square: 10.7532, df = 2, $P = 0.004625$). The average score for post-operative discomfort was 4.20 ± 2.2 (EG1) and 1.1 ± 1.2 (EG2), with a statistically significant difference for $P < 0.05$ ($t = 5.202108$, $P = 0.000009$). Clinical evaluation of the surgical wound showed more prominent hyperaemia, a higher quantity of fibrinous coating and slightly slower epithelization in the EG2 group.

CONCLUSION: Labial frenectomy in orthodontic patients executed with diode laser eliminates intraoperative bleeding and suturing, significantly shortens surgical time and results in less post-operative pain and discomfort, while, conventional surgical frenectomy results in faster healing of the surgical wound.

SP 236 PERCEPTION OF SMILE AESTHETICS AMONG DENTAL STUDENTS, ORTHODONTISTS AND LAYPERSON
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AIMS: To determine the perception of smile aesthetics among dental students, orthodontists and layperson with respect to different elements of smile characteristics (buccal corridor, amount of maxillary gingival display, anterior tooth visibility, and smile arc).

MATERIALS AND METHOD: A set of frontal smile photographs were shown to three groups of raters (dental students, orthodontists and layperson), each consisting of 30 persons. Each smile characteristic was altered digitally and presented with slider technology. The photographs were shown and changed in every 10 seconds or until the examinee clicked on the photograph. The examinees assigned scores of different variables ranging from very unattractive to very attractive. Buccal corridors were modified in 5 per cent increments, from 0 to 25 per cent, maxillary gingival
display from –3 to 4 mm, three shapes of smile arc, and four different levels of maxillary anterior tooth visibility. The data collected were statistically analyzed with one-way analysis of variance with the Tukey post-hoc test and the unpaired Student’s t-test.

RESULTS: There was no significant difference in rating the effects of smile characteristics between the male and female raters for all three groups, as well as between the group of dental students and layperson. However, significant differences were found in aesthetic scores between the group of orthodontists and two other groups. The results showed that the most attractive smile parameters were: 15 per cent visibility of buccal corridor, no gingival exposure, positive smile arc and one-third of anterior tooth visibility.

CONCLUSION: Both dental students and layperson preferred a broader smile and increased smile height, while orthodontists found a narrow smile and medium smile height more attractive. These smile characteristics should be considered by clinicians to develop more satisfying treatment plans for their patients, given the fact that orthodontists are more sensitive in detecting deviations from ideal than the general public.

SP 237 DIMENSIONAL DENTAL VARIABILITY IN PATIENTS WITH TOOTH AGENESIS
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AIMS: To evaluate the mesiodistal and buccolingual crown size of the permanent teeth in patients with hypodontia (excluding third molars) compared with a complete permanent dentition control group.

SUBJECTS AND METHOD: Fifty six patients with hypodontia divided into three groups: 20 patients with one congenitally missing tooth; 24 patients with two congenitally missing teeth; 12 patients with ≥ 3 congenitally missing teeth. Fifty six age and gender matched patients with a complete dentition served as the controls. The age range for the hypodontia and control samples was 10-23 years (mean 14.63 years). The largest mesiodistal and buccolingual crown dimensions were recorded by measuring all existing permanent teeth (except second and third molars) on dental casts with a digital calliper. Statistical evaluation was performed using the analysis of variance model (ANOVA) to test for differences in the mesiodistal and buccolingual dimensions between all hypodontia and control groups. Additional Tukey-Kramer’s multiple comparisons tests were used for the range of means if the probability of significance was < 0.05. Significance was assessed using a P-value threshold level of 5 per cent.

RESULTS: The most common congenitally missing teeth were the lower second premolars (35.2%), followed by the upper lateral incisors (25%). Significant intergroup differences in the mesiodistal dimension were found for the upper central incisors, lateral incisors and canines. Regarding mesiodistal reduction in the hypodontia groups, the most affected tooth was the maxillary lateral incisor. The buccolingual crown size was significantly reduced for the central and lateral incisors in both dental arches. The teeth with the greatest reduction of the buccolingual dimension were the mandibular lateral and central incisors.

CONCLUSION: Patients with hypodontia present a dimensional variability of the existing teeth, especially in the anterior region of the dental arches. Paradoxically, the most important changes, expressed as tooth size reduction, were observed for the groups comprising patients with one or two congenitally missing teeth, rather than in the group with more than two congenitally missing teeth.

SP 238 PAST CYTOTOXIC DRUG TREATMENT IN CANCER-SURVIVORS INFLUENCE SIGNIFICANTLY THE STABILITY OF ORTHODONTIC TREATMENT – A CASE CONTROLLED STUDY
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Krakow, The Specialist Orthodontic Practice, Szczecin and Department of Orthodontics, Medical University of Warsaw, Warszawa, Poland

AIMS: To compare the stability of orthodontic treatment in cancer survivors compared with a control group of healthy subjects.

SUBJECTS AND METHOD: Fifty eight cancer-survivors treated orthodontically between 2008 and 2015 (33 males, 25 females; median age 19.4 years). All had received cytotoxic drugs in the period of permanent tooth development. Fifty eight healthy control subjects matched for age, gender, and malocclusion served as the control group. Thirty five patients had a skeletal Class II, eight a skeletal Class III and 15 skeletal Class I. The Peer Assessment Rating (PAR) Index, the Index of Complexity, Outcome and Need (ICON) and patient satisfaction score were assessed before and after treatment and at the 3-year follow-up. A repeated ANOVA was used to test the statistical relationship of the scores.

RESULTS: An appropriate ideal occlusion was achieved in all patients with mean PAR scores of 4.3-6.0 in both study groups. The reduction in PAR score was on average 81.2 per cent and 80.1 per cent in the control and cancer-survival patient groups, respectively. At follow-up, the average PAR score reduction was insignificantly lower (78.2; P = 0.4) for the control group (relapse in three patients classified as ‘improved’ and in one patient classified as ‘greatly improved’). At the same time, the average PAR reduction significantly decreased (71.3; P < 0.05) for the cancer-survivor group with relapse in seven and three patients classified as ‘improved’ and ‘greatly improved’). Similarly, there was an insignificant increase (9.5 versus 10.1; P = 0.2) in the mean ICON score in the control group and a significant increase (10.4 versus 16.2; P < 0.05) in the cancer-survivor group comparing the time after treatment and at the 3-year follow-up. There was no significant change in patient satisfaction score.

CONCLUSION: The results of properly conducted orthodontic treatment of cancer survivors do not differ significantly from those of treatment of healthy subjects. However, there was a significant worsening of treatment stability during the follow-up of the cancer survivors, particularly in the first 12 months.

SP 239 LOCAL INJECTION OF REVEROMYCIN A CONTROLS EXPERIMENTAL TOOTH MOVEMENT IN WILD TYPE MICE
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AIMS: Anchorage is indispensable for controlling tooth movement in orthodontic treatment. Tooth movement involves the resorption of alveolar bone by osteoclasts on the pressure side and its formation by osteoblasts on the tension side, leading to alterations of the surrounding tissue. Optimal tooth movement, which is dependent on osteoclastic and osteoblastic activity, is important for successful orthodontic treatment. Reveromycin A (RMA) has recently been identified as a unique agent that prevents tooth movement by acting on osteoclastic activation. The aim of this study was to identify the effects of local injection of the osteoclast-specific inhibitor RMA in periodontal tissue using an experimental tooth movement model analyzing mice.

MATERIALS AND METHOD: Tooth movement distance was examined in eight-week-old male wild type mice (n = 6). The orthodontic force was induced using a closed-coil nickel-titanium spring which was connected between the maxillary first molar and maxillary central incisor for 14 and 21 days. RMA sodium salt (1.0 mg/kg) was administered by local injection in the buccal mucosa of the maxillary first molar twice daily beginning 3 days before appliance insertion. Some groups of mice were administered RMA for 14 days (14/RMA+), or for 21 days (21/RMA+). Other groups were administered an identical volume of physiological saline for 14 days (14/RMA-), or for 21 days (21/RMA-). After sacrifice, the shortest intervals between the first and second molars was measured using microcomputed tomographic image analysis software and then histological analysis was performed.
RESULTS: In the 21/RMA- group, tooth movement distance was significantly greater relative to the 14/RMA- group. The 21/RMA+ group showed a significantly smaller tooth movement distance than the 21/RMA- group. Histological findings in representative haematoxylin-eosin stain indicated that in the 21/RMA+ group, there was a significantly lower level of prominent alveolar bone resorption in the trabecular bone of furcation and interradicular septum around the maxillary first molar than in the 21/RMA- group.

CONCLUSION: These results suggest that local injection of RMA controls experimental tooth movement in wild type mice.

SP 240 CHARACTERIZATION OF PROLIFERATING/RESTING CELLS IN THE PERIODONTAL LIGAMENT DURING ORTHODONTIC TOOTH MOVEMENT
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AIMS: The periodontal ligament (PDL) is a non-mineralized tissue, existing between two mineralized tissues, cementum and alveolar bone. It is evident that PDL cells contribute to maintaining not only PDL but also adjacent mineralized tissues. Therefore, PDL harbours two distinctive types of cells, osteogenic and non-osteogenic. It has been shown that the high proliferative activity of PDL cells enables the orthodontic tooth movement (OTM). While the proliferating activity of PDL-derived cells in vitro has been studied extensively, that in vivo is still not well studied yet. Particularly, the type and distribution of proliferating cells in PDL in response to orthodontic force remain elusive. In this study, the aim was to histologically investigate the cell cycle dynamics of PDL cells during OTM.

MATERIALS AND METHOD: Eight-week-old male Fucci2 mice were used. Nickel titanium coils (25 gf) were placed between the maxillary left first molar and incisors to initiate OTM. Periodontal tissues were harvested after 24, 36 and 72 hours. 5-ethynyl-2′-deoxyuridine (EdU) was injected intraperitoneally 6 and 12 hours before harvesting the tissues. Paraffin embedded tissue samples were prepared, and Fucci-derived fluorescence protein together with cell-lineage markers were detected by immunohistochemistry.

RESULTS: In the PDL of 8-week-old Fucci2 mice, red fluorescence, representing resting cells, was clearly detected mainly at the surface of both cementum and alveolar bone. However, green fluorescence, representing proliferating cells, was not detected. Therefore, EdU was injected directly to label the proliferating cells and then the Fucci2/EdU system was utilized to analyze the proliferating/resting cells in PDL. In the control, resting cells were detected throughout the tissue, mainly at the mineralized tissue interface, while a negligible number of proliferating cells were detected. After 36 hours of OTM, proliferating cells increased to 41 per cent and resting cells decreased to 24 from 52 per cent, compared to the control. After 36 hours of OTM, 28 per cent of proliferating cells were also positive for Osterix, an osteogenic-lineage marker, indicating that the majority of proliferating cells were non-osteogenic cells.

CONCLUSION: The Fucci2/EdU system enables clearly to segregate the proliferating/resting cells in PDL. The results demonstrated that the majority of the proliferative cells in PDL during OTM were non-osteogenic cells.

SP 241 EFFECT OF FASHION BRACES ON ORAL HEALTH RELATED QUALITY OF LIFE
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AIMS: Orthodontic treatment is necessary and beneficial for treating malocclusions and improving aesthetics. However, due to its higher cost, fixed appliances have become a sign of financial prosperity. Therefore, nowadays, people wearing braces for fashion only are seen more frequently.
Those people are not aware of the effect appliances may have on oral health. The aim of this study was to investigate the effect of fashion braces on oral health related quality of life (OHRQoL).

MATERIALS AND METHOD: This was a cross sectional study in which a questionnaire was distributed through social media in Saudi Arabia. A group of patients with fashion braces (fashion group), another group with braces for orthodontic treatment (treatment group) and a control group of untreated subjects with a similar age range were compared for OHRQoL using the Oral Health Impact Profile (OHIP-14). OHIP-14 scores, analyzed using Kruskal-Wallis, Mann Whitney and Wilcoxon tests, were used to compare differences between the groups; the higher the score, the poorer the OHRQoL.

RESULTS: Eight hundred and fourteen subjects (47.6% males, 52.4% females; average age, 27.1 years; SD 7.7 years) participated in the study. Of those 3.4 per cent reported wearing braces for fashion purposes and 28.8 per cent due to treatment purpose while approximately 67.8 per cent reported that they had never worn braces. Significant overall changes in the summary scores of OHIP were observed between all three groups ($P < 0.001$; 95% confidence interval). Individual domain analysis revealed that the control group scored the highest for ‘psychological disability and discomfort’. The social disability and handicap domains showed the highest mean value for the control group, followed by the fashion group and then the treatment group. The treatment group scored highest in the domains of the physical pain and disability. However, the domain analysis of functional limitation revealed the highest score for the fashion group (3.65 ± 2.24) followed by the treatment group (3.35 ± 1.44) and then the control group (3.05 ± 1.52).

CONCLUSION: Changes in OHRQoL occur when wearing braces for fashion purposes only. This study should serve as an educational tool for the public.

SP 242 DOES ROOT RESORPTION INCREASE IN OVARIECTOMIZED ANIMALS: A SYSTEMATIC REVIEW OF ANIMAL STUDIES

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AIMS: Orthodontically induced root resorption constitutes an undesired multifactorial pathological consequence of orthodontic treatment. Metabolic changes associated with the menopause may alter bone turnover and influence its severity. The aim of this study was to systematically review and evaluate the quality of the available evidence from animal studies, regarding the effect of ovariectomy-induced menopause on root resorption.

MATERIALS AND METHOD: A search without restrictions in eight databases and hand searching were carried out. Controlled studies investigating the effect of ovariectomy-induced menopause on root resorption were reviewed. Following study retrieval and selection, relevant data was extracted and the risk of bias was assessed using the Syrcle’s Risk of Bias Tool.

RESULTS: Four studies were finally identified, most of which showing that orthodontically induced root resorption was greater in ovariectomized animals. Regarding the risk of bias, various problems were noted in diverse domains.

CONCLUSION: Ovariectomy-induced menopause may lead to an increase in orthodontically induced root resorption, a finding to be considered when treating women potentially into menopause. Periodic monitoring of these patients could be of benefit to avoid any unwanted side effects.

SP 243 EFFECT OF OVARIECTOMY-INDUCED MENOPAUSE ON THE RATE OF ORTHODONTIC TOOTH MOVEMENT: A SYSTEMATIC REVIEW OF ANIMAL STUDIES

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AIMS: Menopause may theoretically affect biochemical events leading to orthodontic tooth movement (OTM). The aim of this study was to investigate whether ovariectomy-induced menopause-related metabolic changes may affect its rate.

MATERIALS AND METHOD: A search without restrictions in eight databases (PubMed, Central, Cochrane Database of Systematic Reviews, Scopus, Web of Science, Arab World Research Source, ClinicalTrials.gov, ProQuest Dissertations and Theses Global) and hand searching until April 2018 took place. Controlled studies investigating the effect of ovariectomy-induced menopause on the rate of OTM were reviewed. Following study retrieval and selection, relevant papers were identified.

RESULTS: Thirteen studies were finally identified. The rate of OTM was shown to increase in ovariectomized animals in comparison to the control group. Regarding the risk of bias, various problems were noted in diverse domains.

CONCLUSION: Ovariectomy-induced menopause may affect the rate of OTM. Although the overall quality of evidence provides the clinician with a cautious perspective on the strength of the relevant recommendations, the orthodontist should be capable of identifying such patients and consider the possible implications.

SP 244 THE IMPACT OF PREGNANCY AND LACTATION ON THE RATE OF ORTHODONTIC MOVEMENT AND ROOT RESORPTION: A SYSTEMATIC REVIEW OF ANIMAL STUDIES

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AIMS: Clinical practice has shown that the rate of orthodontic tooth movement (OTM) tends to vary among individuals and might be influenced by factors such as nutrition, hormones, supplements, medications, and conditions. The aim of this review was to systematically investigate and appraise the quality of the available evidence from animal studies regarding the effect of the metabolic changes that occur during pregnancy and lactation on the rate of OTM and the risk of root resorption.

MATERIALS AND METHOD: A search without restrictions in eight databases (PubMed, Central, Cochrane Database of Systematic Reviews, Scopus, Web of Science, Arab World Research Source, ClinicalTrials.gov, ProQuest Dissertations and Theses Global) and hand searching were conducted. Controlled animal studies investigating the effect of pregnancy and lactation on the rate of OTM and the associated risk of root resorption were reviewed. Following the retrieval and selection of studies, collection of related data was performed and the risk of bias was assessed using the Sycle’s Risk of Bias Tool.

RESULTS: Five studies were finally identified. Conflicting results were retrieved about the impact of pregnancy on the rate of OTM. Lactation coupled with calcium deficiency was associated with an increase in the rate of OTM and root resorption. Regarding the risk of bias, various problems were noted in diverse domains.

CONCLUSION: The metabolic changes occurring during pregnancy and lactation may have an impact on the rate of OTM and the associated risk of root resorption. Although the overall quality of evidence provides the clinician with a cautious perspective on the strength of the relevant recommendations, safe practice would suggest that it is important to consider the impact of these hormonal changes during clinical practice and the possible implications.

SP 245 CORRELATION BETWEEN CLEFT VOLUME AND ARCH DIMENSIONS IN PATIENTS WITH A UNILATERAL CLEFT LIP AND PALATE

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AIMS: A cleft lip and palate (CLP) is the second most common congenital abnormality with several functional, aesthetic and psychosocial problems. Alveolar bone grafting is essential in the overall management of patients with an alveolar cleft. Three-dimensional volumetric analysis of the alveolar bone defect can provide useful information for surgical planning and selection of a donor site for an alveolar bone graft. The aims of this study were 1) to determine the mean volume of alveolar defects in complete unilateral cleft lip and palate (UCLP) patients and 2) to assess the correlation between cleft volume and maxillary arch dimensions as well as clinical cleft dimensions.

MATERIALS AND METHOD: Cone beam computed tomographs (CBCT) of 51 patients with UCLP aged 6 to 14 years. All patients were treated in Iran with CLP repair surgery within the first 3 and 18 months after birth. CBCT scans were obtained after the orthodontic expansion and before alveolar grafting. Cleft volume, maxillary anterior and posterior arch widths, maxillary arch depth and the clinical width and surface area of the alveolar cleft were measured using Mimics software. Pearson correlation analysis was used to evaluate the correlation among variables. Multiple linear regression was used to determine the regression equation.

RESULTS: The average volume was 632.4 mm$^3$. There was no significant correlation between cleft volume and maxillary arch dimensions. Multiple regression analysis showed a significant correlation between the cleft surface in the plane passing through the cemento-enamel junction (CEJ) of the teeth and cleft volume. This significant correlation was also observed between the cleft surface area, measured clinically, and the cleft surface area in the plane passing through the CEJ. Two regression equation formulas were derived to estimate cleft volume from the cleft area in the clinic.

CONCLUSION: These results suggest that clinical measuring of the alveolar cleft surface can be used as an aid for indirect estimation of alveolar cleft volume in UCLP patients.

ACKNOWLEDGMENT: This study was extracted from a postgraduate thesis at the School of Dentistry and financially supported by the Dentofacial Deformities Research Center, Research Institute of Dental Sciences, Shahid Beheshti University of Medical Sciences.

SP 246 AUTOTRANSPLANTATION OF TEETH WITH INCOMPLETE ROOT FORMATION UNDER ORTHODONTIC SPECIALIST CARE: A CASE SERIES
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AIMS: Autotransplantation of teeth with complete root formation has been commonly performed in association with orthodontic treatment in Japan. A survival rate of 86.8 per cent was reported, however, root canal treatment was required. While autotransplantation of teeth with incomplete root formation (ATI) seems to provide even better results, this procedure needs to be performed in a limited time window to ensure sufficient root length, periodontal and pulpal healing. In addition, long-term orthodontic care is essential especially for the patients treated from the mixed dentition. This report presents the results of orthodontic treatment in association with ATI as well as discussions about the treatment progress.

MATERIALS AND METHOD: The medical records and stored material of 17 transplanted teeth in 13 consecutive patients (12 years 9 months of age) who were under orthodontic specialist care in a private orthodontic office were retrieved retrospectively. All autotransplantation was referred to oral surgeons. Nine of these patients had a cleft lip and palate, and all patients had an average of 2.9 congenitally missing teeth (CMT) and persistent primary teeth. Of the patients 76.9 per cent had two or more CMT in a dental quadrant.

RESULTS: Eleven premolars were transplanted in nine patients and six third molars in four patients. All autotransplanted teeth had incomplete root formation. One upper third molar with a short root exfoliated within 1 month after transplantation, while all other teeth remained clinically normal and required no root canal treatment. Third molars frequently tended to have short roots. Orthodontic treatment combined with ATI at the first phase of treatment was performed for nine
patients, in the second phase of treatment for the other. The first-phase orthodontic treatment was mostly performed with premolars while the second-phase orthodontic treatment was commonly performed with third molars. The average overall survival rate of 2 years 10 months was 94.1 per cent.

CONCLUSION: ATI can provide good outcomes if an appropriate timing, surgical procedure, selection of patients and organized orthodontic care are managed. In case of patients with two or more CMT in a dental quadrant, the application of ATI with premolars in mixed dentition should be considered as a part of long-term orthodontic care.

SP 247 CEPHALOMETRIC EVALUATION OF PATIENTS WITH A BILATERAL AND UNILATERAL CLEFT LIP AND PALATE
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Aims: A cleft lip and palate (CLP) is one of the most frequent congenital deformities of the oral and facial area. A cleft is a failure of closure or an incomplete closure of the superior lip and palate, which can be unilateral or bilateral. The aim of this study was to retrospectively examine the cephalometric analysis of patients with a unilateral (UCLP) and bilateral (BCLP) CLP and to verify if there are associations or differences between the data.

Materials and Method: Lateral radiographs were used to undertake the cephalometric evaluation. All radiographs were evaluated by the same operator. Ninety eight patients between 5 and 15 years of age were evaluated: 22 with a BCLP, 33 with a UCLP on the right side and 43 with a UCLP on the left side. The cephalometric parameters analyzed were: saddle angle, articular angle, gonial angle, upper gonial angle, lower gonial angle, anterior cranial base, posterior cranial base, ramus height, corpus length, SNA, SNB, FMA, anterior face height, posterior face height, overbite, overjet, IMPA, U1-SN and U1-FH. Statistical analysis was performed using Pearson’s correlation coefficient and a Student’s t-test. The level of significance was set at 0.05.

Results: Compared to normal values, patients with a CLP (both unilateral and bilateral) had lower values for the anterior cranial base, posterior cranial base, ramus height, corpus length, SNB, anterior face height, posterior face height and a retroclination of the upper and lower incisors (U1-SN, IMPA). Data showed that between patients with a UCLP and those with a BCLP, there was not a large dissimilarity of values.

Conclusion: There are no important differences between the data of the groups examined. Instead, the number of parameters of all patients with a CLP (both unilateral and bilateral) are very different compared to normal values.

SP 248 AUDIT OF PATIENT SATISFACTION WITH AN ORTHODONTIC CASUALTY SERVICE
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Aims: Patient satisfaction and patient-centred outcomes have become important measures of quality of healthcare. Improving patient experience is a key priority of the National Health Service England (Health and Social Care Act, 2012). Although many surveys have looked at satisfaction with orthodontic treatment in general, there is currently no data on patient satisfaction with emergency/casualty orthodontic services. The aims of this study were: to assess overall patient satisfaction with and experience of the orthodontic casualty service and to identify specific areas of satisfaction and dissatisfaction. The gold standard was that 90 per cent of patients are satisfied with the service overall.

Materials and Method: Following a brainstorming session and considering patient and public feedback, a questionnaire was developed and piloted in the orthodontic department at the Eastman Dental Hospital. Following this, amendments were made. The questionnaire was given to 50 consecutive patients during a 3-week period in July 2018.

Results: The gold standard was met and overall 90 per cent of patients were satisfied with the emergency orthodontic service. When asked to mark on a scale from 0 to 10 (10 representing very
satisfied), 80 per cent of patients scored the service 7 or more out of 10. Sixty six per cent of patients attended the emergency orthodontic service because of problems with a ‘fixed metal brace’ and specifically, 56 per cent attended due to ‘brackets coming off/loose’. On average patients in this department have attended an additional 3-4 emergency appointments. Many positive comments were written in the comments section on the questionnaire including, ‘very useful service’, ‘efficient and professional’ and helpful suggestions.

CONCLUSION: Overall patients were satisfied with the emergency orthodontic service and viewed it as an efficient and useful service. Areas for improvement such as informing patients about the emergency orthodontic service including its opening times at the start of their treatment, reinforcing diet advice to reduce breakages, aiming for patients to be seen within 30 minutes and explaining that they may require additional emergency appointments during the course of their treatment for breakages as part of the informed consent process were identified. A re-audit is planned in the near future to ensure high standards of care are maintained.

SP 249 METABOLIC EFFECTS OF TWO TYPES OF PROPOLIS ON PRIMARY FIBROBLASTS AND OSTEIOBLASTS
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AIMS: Honey bees mix saliva and beeswax with exudate gathered from tree buds, sap flows, or other botanical sources. Propolis, the resulting resinous mixture, has different chemical compositions depending on the source. Its antiviral, antifungal and antibiotic effects make propolis also interesting for applications in orthodontics. The aim of this study was to investigate the effect of propolis on primary fibroblasts and osteoblasts.

MATERIALS AND METHOD: The effect of different dilutions (1:1, 1:2, 1:10, 1:50 and 1:100) of two types of propolis on fibroblasts (PromoCell; n = 4 × 4) and osteoblasts (PromoCell; n = 1 × 4) was investigated after 24 hours of cultivation (37°C, 5% CO2). Cell cultivation was performed in 96-well plates with 100 μl/well and a cell density of 3 × 10⁵-4 × 10⁵ cells/ml. Cell types without addition of propolis and with tamoxifen and oestradiol, respectively, served as controls. The metabolism of the cells (pH value, lactate and glucose) was tested during the test runs. Using high performance liquid chromatography, a partial breakdown of the propolis substances was achieved. Cell activity (CellTiter-Glo® luminescent cell viability assay; Promega), cell apoptosis (Caspase-Glo® 3/7 Assay; Promega) and cytotoxicity (CytoTox-Glo™ cytotoxicity assay; Promega) were determined by Glomax®96 Microplate Luminometer. Proliferation rates (cell proliferation kit; Roche) were recorded as well. Data were analyzed with GraphPad Prism Version 6.01 (GraphPad Software, Inc.) using two-way ANOVA. P ≤ 0.05 was considered statistically significant.

RESULTS: In contrast to osteoblasts, viability of fibroblasts increased significantly at 1:100 dilution. Lower dilutions (1:1, 1:10) led to decreased viabilities in both cell types (P < 0.05). Similar to viability, proliferation declined with lower dilutions. A dilution of 1:100 in propolis type A increased proliferation in fibroblasts (P < 0.05), whereas osteoblasts showed reduced values for both types of propolis. The type of propolis influenced viability of both cell types. A dilution of 1:10 showed significant lower values in propolis type A when compared to type B.

CONCLUSION: With increasing dilution, propolis has a stimulating effect on the cell metabolism of primary fibroblasts and osteoblasts. This may support the process of wound healing. These characteristics of propolis might be useful in patients displaying intraoral injuries or periodontal bony defects during orthodontic treatment.

SP 250 ASSOCIATIONS OF CRANIOFACIAL MORPHOLOGY AND ORTHODONTIC TREATMENT WITH TEMPOROMANDIBULAR DISORDERS IN CHILDREN (THE PANIC STUDY)
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AIMS: To investigate associations of craniofacial morphology and orthodontic treatment with temporomandibular disorders (TMD) in 8-10-year-old children.

SUBJECTS AND METHOD: The participants were a population sample of 397 children (194 girls, 48.9%, and 203 boys, 51.1%) participating in the Physical Activity and Nutrition in Children (PANIC) Study. TMD examination (pain in masticatory muscles and temporomandibular joints, joint sounds, pain and deviation in mandibular movements and limited mouth opening) and orthodontic examination (molar relationship, crowding, spacing, cross-bite, overbite, overjet, lower facial height and facial profile) were carried out. The data were analyzed using $\chi^2$ -test for dichotomic and nominal variables and multivariate logistic regression for continuous variables to determine associations between occlusal or orthodontic factors and TMD status.

RESULTS: The prevalence of TMD, according to the RDC-TMD criteria (Dworkin and LeResche 1992), was 41.8 per cent. Neither age nor gender was associated with the prevalence of TMD signs. Children with an Angle II occlusion had more joint sounds than children with a neutral occlusion (17.8 versus 12.6%, $P = 0.020$). A greater overbite was associated with a lower risk of pain during mandibular movements [odds ratio (OR) 0.732, 95% confidence interval (CI) 95% 0.561-0.956, $P = 0.022$] and deviation in opening or closing movement of the mandible (OR 0.848, CI 95% 0.735-0.977, $P = 0.023$). Other malocclusions and overjet did not correlate with TMD signs. Children who used orthodontic headgear were more likely to have joint sounds than other children (33.3% versus 13.4%, $P = 0.029$).

CONCLUSION: An Angle II molar relationship, overbite and orthodontic headgear treatment seem to be related to TMD signs. Occlusal factors need to be considered when assessing children’s TMD status and diagnosis.

SP 251 THE RELATIONSHIP BETWEEN MALOCCLUSION AND DENTAL HEALTH IN DENTAL PROFESSIONALS

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AIMS: A study on the dental health in individuals aged ≥80 years who had >20 natural teeth revealed that almost none of the patients displayed crowding, an open bite, or mandibular prognathism, and most of them had a normal skeleton. That study has drawn attention to the relationship between malocclusion and oral health. However, in dental clinical practice, there are patients with conditions other than those above, who have a number of missing teeth, and the significant effect of oral care and socio-environmental factors on dental health is undeniable. Thus, this study examined occlusion and oral conditions in dentists and dental hygienists who had professional knowledge of oral care to elucidate the relationship between dental health and occlusion.

MATERIALS AND METHOD: A multiple comparison test was performed in 23 dentists or dental hygienists aged ≥40 years using cephalometric radiographs and oral photographs to compare three groups, namely skeletal Class I (2° < ANB < 4°), skeletal Class II (ANB > 4°), and skeletal Class III (ANB < 2°), and the presence or absence of >3 mm crowding, overjet, overbite, and dental health. RESULTS: The participants aged ≥50 years displayed an associative tendency between malocclusion and dental health, while no significant and clinically noticeable differences were found. CONCLUSION: The dental professionals had significantly better oral environment than the non-professionals. Further studies are needed in order to reveal the causal relationship between malocclusion and dental health.

Acknowledgment: This work was supported by the Interdisciplinary Orthodontic Society and Mishima City Dental Association.
SP 252 KNOWLEDGE AND ATTITUDE TOWARDS DIGITAL ORTHODONTICS AND THREE-DIMENSIONAL PRINTING OF APPLIANCES AMONG ORTHODONTISTS WORKING IN SWITZERLAND – A PRELIMINARY SURVEY

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AIMS: To determine (a) the perceptions of the usefulness of digital technology in improving the daily practice in orthodontics, (b) the willingness to use digital technology and (c) the predisposition to use three-dimensional (3D) printing of orthodontic appliances.

MATERIALS AND METHOD: An anonymous, self-administered survey of orthodontists working in Switzerland was conducted with the participants at the Swiss Orthodontic Society Conference 2018. The participants (180) were informed about the ongoing survey and a QR code was displayed at the congress venue to facilitate the digital access to the survey.

RESULTS: The response rate was 35 per cent (63/180). Of the 63 respondents three (5.1%) were in full time academic positions, 21(35.6%) were working in single orthodontic offices and 17 (28.8%) working in dental offices. More than 64.4 per cent (38) were using intraoral scanners in their clinic in daily practice. About 61 per cent (36) were willing to consider complete digital orthodontic workflow in their clinic in the future. More than 87 per cent (56) felt that 3D printing will influence orthodontic practice. More than about 87 per cent (56) were interested in enhancing their knowledge about digital orthodontics in future.

CONCLUSION: Currently, there are few orthodontic offices which have a completely digital workflow and the reasons attributed are due to expensive equipment. However, the majority of the participants are considering in having a completely digital workflow in their offices and in improving their knowledge in digital orthodontics. The participants also foresee an increase in 3D printing of orthodontic appliances.

SP 253 BIOMECHANICAL ANALYSIS OF MUCOPERIOSTEAL TISSUE STRAINS DURING TREATMENT OF CLEFT PALATE DEFECTS

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AIMS: To evaluate biomechanical loading of the mucoperiosteal tissue during tissue expansion in the cleft palate of newborns with unilateral and bilateral clefts.

MATERIALS AND METHOD: Finite element (FE) models of the maxilla of a newborn with a unilateral cleft and one with a bilateral cleft were created using dedicated image analysis software from available three-dimensional (3D) computed tomography scans in the database. Based on previous in vitro experiments, the external loading conditions were simulated by attraction forces generated by magnetic strips across the palatal defect area. The force-distance relationships were experimentally determined for a number of small dental magnets separated by various thicknesses of soft tissues. The strains in the bone and the periosteum surrounding the palatal cleft were analyzed for different preparations of magnetic force.

RESULTS: Experimentally determined force-distance relationships of the dental magnets showed that the presence of soft tissue had no significant influence on the magnitude of the magnetic force. FE analyses of the unilateral and bilateral cleft models showed that the periosteum and underlying bone had prominent strain distribution on application of varying magnetic forces. The obtained strains in these analyses were in the order of the adaptive and bone gain windows of Frost’s mechanostat theory. The influence of strains increased as the distance between the two opposing magnets was reduced.

CONCLUSION: The experimental and numerical analyses suggest that the strains in the periosteum and underlying bone in the palate generated by attractive forces are compatible with adaptive bone formation.
SP 254 OCCLUSAL CHARACTERISTICS AND SEVERITY OF THE MALOCLUSION IN THE NORTHERN FINLAND BIRTH COHORT 1966
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AIMS: To investigate, in a cross sectional study, the occlusal characteristics and severity of malocclusion in the Finnish adult population.

SUBJECTS AND METHOD: The study population comprised of subjects (n = 1885) from the Northern Finland Birth Cohort 1966. Clinical oral and dental examination, including digital three dimensional dental models, was carried out in 2012 as part of the 46-year follow-up study. Occlusal characteristics and severity of the malocclusion were measured from a randomly selected sample of subjects (n = 733) using the Peer Assessment Rating (PAR) index. The mean values of PAR components were assessed for both genders separately, and statistical significance of the differences between genders was evaluated with t-test.

RESULTS: The mean PAR total score was 21.5 (SD = 10.4). Of the study population, 12.4 per cent had a good occlusion (PAR total score ≤10), and 48.6 per cent had a PAR total score of >20. Men had higher mean scores compared to women in PAR components of the anterior segment 3.71 (P = 0.003), anterior lower segment 3.71 (P = 0.002), negative overjet 0.39 (P = 0. 008) and overbite 0.77 (P = 0.050).

CONCLUSION: There is a large variation in the occlusal characteristics, and the mean PAR total score was relatively high in this Finnish adult population. Almost half of the population were considered to have orthodontic treatment need. Significant male dominance in certain occlusal characteristics was observed.

SP 255 A RETROSPECTIVE AUDIT TO MEASURE THE EFFECTIVENESS OF MANDIBULAR ADVANCEMENT DEVICES ON EXCESSIVE DAYTIME SLEEPINESS
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AIMS: To report the success rates of mandibular advancement devices (MAD) in obstructive sleep apnoea (OSA) patients via use of the Epworth Sleepiness Scale (ESS) as a measuring tool. A departmental standard of 75 per cent of results was been set to demonstrate an improvement on excessive daytime sleepiness (EDS) following MAD provision and use. From a recent meta-analysis, data displayed a mean difference of −1.76 reduction in ESS, which was thus used as a standard to demonstrate clinically significant results.

MATERIALS AND METHOD: Data was accumulated from 29 patients attending the orthodontic clinic in a 2-year period. The ESS scores were noted pre- and post-treatment to assess an improvement.

RESULTS: Overall results were very positive with 86 per cent (n = 25) of the cohort of patients showing a decrease in ESS, 4 per cent (n = 1) showing no change and 10 per cent (n = 3) showing an increase following MAD provision. Ninety per cent (n = 9) of female subjects and 80 per cent (n = 16) of male subjects showed a decrease in ESS following MAD provision. Having compared the results to the standard determined in the meta-analysis, 72 per cent (n = 18) of the patients showed a decrease in ESS, which was clinically significant.

CONCLUSION: The set standards were met in the first cycle of this audit. ESS is one type of measurement for EDS thus further studies are warranted to provide conclusive results.

SP 256 IN VITRO TESTING OF THE MINI-IMPLANT SUPPORTED BY A DISTALISING APPLIANCE – RECOMMENDATIONS FOR ADEQUATE ACTIVATION AND CONTROL OF OCCURRING COLLATERAL FORCES
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AIMS: Distalization of maxillary molars using skeletal anchorage has considerably enhanced the possibilities for orthodontic Class II correction. The aim of this study was to experimentally evaluate the six force-moment (F/M) components exerted on the first molars by the Distalslider appliance described by Wilmes and Drescher.

MATERIALS AND METHOD: Digital upper jaw models from 30 consecutive orthodontic Class II patients were used to determine a representative reference model. It comprised two coupled mini-implants in the anterior palate and the two palatal sheaths of the first molar bands. The measurement set-up was equipped with two three-dimensional F/M sensors at the first molars. Five passive Distalsliders were experimentally evaluated with bilaterally activated compression springs. Experimental results were compared to F/M components determined analytically for identical distalizing force vectors and an identical appliance geometry.

RESULTS: The two nickel titanium coil springs provided with nominal values of 240 cN and 500 cN showed linear force-deflection curves. Bilateral activation of the Distalslider using two 240 cN or two 500 cN coil springs resulted in a distalizing force per side of 3.58 ± 0.07 N and 5.31 ± 0.13 N, respectively. Experimental results for the Distalslider with 240 cN coils showed collateral expansive and extrusive forces of 1.06 ± 0.37 N and 1.1 ± 0.46 N which were not calculated by the analytical approach.

CONCLUSION: Considering a force decrease due to sliding friction of approximately 50 per cent, a force magnitude ranging between 1.8 and 4.2 N can be considered as adequate for simultaneous distalization of the first and second molars. Under this assumption, it is recommended using a Distalslider with two nominal 240 cN coils for this therapeutic task. However, these ‘light’ coils may lead to overloading when only the first molars have to be distalized requiring 1.0-2.4 N as an adequate force range. Experimental testing of the Distalslider revealed clinically significant collateral expansive and extrusive forces. Depending on the initial overbite and transverse molar relationship, preactivation of the guiding wire by defined small bends, if these effects are contraindicated, is recommended.

SP 257 NATURAL HEAD POSTURE IN ORTHODONTIC AND ORTHOGRNATHIC TREATMENT PLANNING
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AIMS: Establishing easily recognisable and reproducible reference points and planes is necessary in cephalometric analysis. Most analyses use the sella-nasion line or the Frankfort horizontal plane. These intracranial reference planes vary greatly compared to natural head posture (NHP) i.e. the extracranial reference plane that uses the true vertical and horizontal planes. Thus the application of intracranial reference planes is questionable in orthodontic and especially in orthognathic treatment planning.

SUBJECTS AND METHOD: Seventy patients were examined to compare their intracranial reference lines to their true horizontals. All subjects were healthy, free of craniomaxillofacial discrepancies and had not been treated orthopaedically previously. Photographs and cephalometric radiographs were superimposed in AdobePhotoshop and the angle between the intracranial reference planes (sella nasion, Frankfort horizontal) and the horizontal plane were measured. Lines were included which represented the true vertical axis in the background of the photographs.

RESULTS: The mean angle between the SN line and the true horizontal line was 7.09 degrees with a standard deviation of 5.89 degrees. The lowest angle was −5.9 degrees and the highest 17.8 degrees which gives a 23.7 degrees range of variation. The mean angle between the Frankfort horizontal and the true horizontal line was −2.38 degrees with a standard deviation of 4.58 degrees. The lowest angle was −13.4 degrees while the highest was 7.8 degrees thus the range of variability was 21.2 degrees.

CONCLUSION: The number of software products that make not only cephalometric and photographic analysis and documentation possible but enable resizing and superimposing photographs and cephalometric radiographs is increasing. With visual indication of the true horizontal or vertical lines NHP gives a real reference plane for orthodontic or orthognathic
treatment planning. By increasing the sample size it becomes possible to measure the relationship of NHP and different facial types.

SP 258 CRANIOFACIAL MORPHOLOGY IN CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA AND ASSOCIATED SEVERE OBSTRUCTION
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AIMS: To examine craniofacial morphology, pharyngeal airway space and hyoid bone position in children with obstructive sleep apnoea (OSA) and associated severe obstruction.

SUBJECTS AND METHOD: Twenty three children [mean age, 6.8 years; standard deviation (SD) 1.8 years] with OSA and severe obstruction (OSA-S) and 19 children (6.3 years, SD 1.7 years) with OSA and non-severe obstruction (OSA-N). All subjects were monitored at home during nocturnal sleep for three nights by their parents, using portable polysomnography. Severe tonsillar hypertrophy and/or severe or slight obstruction in nasal turbinates was determined in OSA-S using postero-anterior cephalograms, whereas mild tonsillar hypertrophy and/or slight obstruction in the nasal turbinates in OSA-N. All OSA children were diagnosed by a paediatric otorhinolaryngologist. The control subjects were 25 children (mean age, 6.7 years; SD 1.4 years) without OSA or obstruction of the upper airways. Lateral cephalometric analysis variables of the skeleton, pharyngeal airway space and hyoid bone position were measured. The differences between OSA-S and OSA-N, as well as OSA-N and control were calculated using a Student’s t-test.

RESULTS: Compared to OSA-N, OSA-S displayed an undergrowth of the mandible, a large lower face height and an antero-superior hyoid bone position. Additionally, OSA-N displayed a narrow pharyngeal airway space compared to the control. Thus, children with both OSA and severe obstruction had an abnormal growth of the mandible and hyoid bone position. Moreover, in children, it was important for the diagnosis of OSA to determine an association with a narrowed pharyngeal airway space.

CONCLUSION: Although evaluation based on mandibular shape and position and hyoid bone position does not necessarily distinguish between OSA-S and OSA-N, important differences were found in the pharynx between children with and without OSA. Additionally, a frontal cephalogram, which is a postero-anterior cephalogram, might be helpful for the selection criterion of obstruction.

SP 259 THREE-DIMENSIONAL ANALYSES OF SHORT- AND LONG-TERM EFFECTS OF RAPID MAXILLARY EXPANSION ON NASAL CAVITY AND THE UPPER AIRWAY: A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: To evaluate, in a systematic review, the three-dimensional (3D) changes that occur at short- and long-term follow-up after rapid maxillary expansion (RME) treatment on the nasal cavity (NC) and upper airway (UA) in growing patients.

MATERIALS AND METHOD: A literature search, with no language restriction, of three bibliographic databases (Medline, Embase, Central) and manual search up to June 29, 2018, was performed. According to the PICO schema, randomized and non-randomized clinical trials as well as cohort studies comparing, in a paediatric population, the short- and long-term effects of RME on NC and UA using 3D analyses based on computed tomography, cone-beam computed tomography, and magnetic resonance imaging were included. The risks of bias of the included randomized and non-randomized studies were assessed using the Cochrane Collaboration's risk of bias tool and a customized tool that was developed for this systematic review. The random-effects meta-analyses of the mean differences and 95 per cent confidence intervals (CIs) of NC and UA volume changes were carried out, followed by subgroup analyses.
RESULTS: Twenty-four studies were eligible for qualitative synthesis, and 16 were selected for quantitative synthesis. Most of the included studies were non-randomized, did not include a control group, had a small sample size, and showed a high level of heterogeneity in some outcomes. Immediately after expansion, the volume in the upper part of the UA, including the nasopharynx and oropharynx, increased significantly ($P = 0.000$ and $P = 0.023$, respectively), while the lower part of the upper airway showed a not significant minimal increase. However, three months after expansion, the volume increase at all levels, was not significant, except at the NC level ($P < 0.000$).

CONCLUSION: The existing evidence confirmed only the short-term positive effect of RME on extending the volume of the NC and the upper part of the UA. However, long-term stability could not be statistically demonstrated. The results of this systematic review should be considered with some caution due to the low quality of evidence reported.

SP 260 BONE FORMATION AND ITS STABILITY OVER TIME: OUTCOMES OF RETROSPECTIVE STUDY
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AIMS: This study follows the research from 2007, where changes of the alveolar ridge were measured in patients with missing upper lateral incisors (Nováčková et al., 2011). The aim of the present study was to assess long-term stability of the created bone after another 10 years (12/15 years after orthodontic treatment).

SUBJECTS AND METHOD: From an original sample of 79 patients with 128 missing lateral incisors this research comprised 60 patients with 93 missing lateral incisors. They were examined at the beginning (T1) and end of treatment (T2), and 2/5 years (T3), and 12/15 years (T4) after treatment. The vestibular width of the alveolus was measured on casts at the level of the bone ridge and 5 mm apically from the alveolar ridge. Canine inclination to the alveolar ridge was recorded, as well as the height of the alveolar ridge.

RESULTS: In time T1-T4 the alveolar ridge width was reduced by 8.4 per cent, and the height decreased by 1.16 mm; between T3-T4, the alveolar ridge reduction was 2.2 per cent on average, with individual variances, and height decreased by 0.75 mm on average. No correlation was found between canine inclination or between the canine distance from the central incisor at T1 and the amount and stability of the bone created by orthodontic movement.

CONCLUSION: The bone created through orthodontic tooth movement was stable in both the horizontal and vertical directions.


SP 261 SOFT TISSUE EVALUATION IN CHILDREN WITH DISTAL MALOCCLUSION
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AIMS: To determine changes in the soft tissue profile in children with distal malocclusion.

SUBJECTS AND METHOD: One hundred and sixty eight children (83 girls, 85 boys) aged between 10 and 14 years with distal malocclusion of skeletal origin. Lateral cephalometric radiographs were obtained from the patients and analyzed. Patients with craniofacial deformities and orthodontic treatment were not included in the study.

RESULTS: The upper lip-E distance was found to be $1.13 \pm 2.46$ mm in girls and $0.96 \pm 2.62$ mm in boys for soft tissue measurement. The values were statistically insignificant among the gender groups. Nasolabial angle was $118.73 \pm 13.64$ for boys and $119.12 \pm 11.63$ for girls. It was found that the upper lip N-FH perpendicular parameter was affected by torque of the upper incisor teeth. Lower lip-E distance showed normal values in girls of $1.00 \pm 2.68$ mm and $0.68 \pm 2.59$ mm in boys.
In distal malocclusions, the mental area was positioned at the back; that is the soft tissue line was also moved back. Labiomental angle was around the norm (110-130) in girls and boys. The interlabial distance was 3.66 ± 3.09 mm in girls and 2.32 ± 2.36 mm in boys.

CONCLUSION: All soft tissue values were statistically insignificant among boys and girls. According to the findings, skeletal distal malocclusion, has shown that soft tissue in children is not significantly deteriorated in the sagittal direction. The sagittal relationship between the upper and lower lip is directly related to overjet size. In distal malocclusion, lip deficiency is very common in the vertical direction.

SP 262 CEREBRAL HAEMODYNAMIC DISORDERS IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION

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AIMS: To conduct a literature review to evaluate the negative impact of temporomandibular joint dysfunction (TMD) on cerebral haemodynamics.

MATERIALS AND METHOD: A bibliographic search was performed in the electronic databases eLibrary, PubMed, Web of Science and Google Scholar. The following keywords were used in the search: ‘temporomandibular joint’, ‘TMJ’, ‘cerebral hemodynamics’, ‘brain blood supply’, ‘temporomandibular joint dysfunction’, ‘TMD’ and manual search. The articles which mentioned the relationship between the changes in cerebral haemodynamics and the presence of TMD in patients were included in the analysis.

RESULTS: After reviewing the content of the articles, seven publications fulfilled the inclusion criteria. However, only one study was statistically significant. This article determined the negative impact of TMD on cerebral haemodynamics.

CONCLUSION: Although the negative influence of TMD on brain blood supply is described it becomes obvious that, more case studies where this problem will be observed in detail are necessary.

SP 263 THE INFLUENCE OF TEMPOROMANDIBULAR JOINT DYSFUNCTION ON THE DEVELOPMENT OF MALOCCLUSION IN GROWING CHILDREN

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AIMS: To explore the influence of temporomandibular joint (TMJ) disc displacement on mandibular growth in growing children.

MATERIALS AND METHOD: PubMed and Google Scholar databases were used to review the literature of this topic. The proper internal arrangement of the TMJ and its normal anatomy, TMJ disc displacement and mandibular and condylar growth were investigated in the review. In addition, impaction of excessive loading on growth of the condylar processes was considered.

RESULTS: Very few patients had a correct position of the TMJ. A large prevalence of TMJ disc displacement in both adults and children was observed. Data on the inhibitory effect of disc displacement on condylar growth was published by some authors. Even partial disc displacement leads to mandibular growth inhibition. Also, a large number of published studies confirmed that excessive loading of the TMJ inhibits cartilage ability in proliferation, and consequently, growth of the condylar process. The condition of joint overload can be observed, for example, in bruxism

CONCLUSION: Ideal TMJ stability is observed only in a limited number of post-orthodontic cases. Many patients already have disc displacement and degenerative joint disease of the TMJ before initiation of orthodontic therapy.

SP 264 ETHNIC DIFFERENCES IN CRANIOFACIAL AND UPPER SPINE MORPHOLOGY BETWEEN EUROPEAN AND ASIAN CHILDREN WITH A SKELETAL CLASS III MALOCCLUSION
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AIMS: To determine ethnic differences in craniofacial and upper spine morphology between European and Asian children with a skeletal Class III malocclusion.

SUBJECTS AND METHOD: A total of 60 skeletal Class III children (19 Danes, 41 Koreans) were included. Upper spine morphology, atlas dimensions and craniofacial morphology, including posterior cranial fossa and growth prediction signs, were assessed on lateral cephalograms. Differences and associations were analyzed by multiple linear and logistic regression analyses adjusted for age and gender.

RESULTS: In craniofacial morphology, the inclination of the maxilla (NL/NSL, \(P < 0.05\)) and the shape of the posterior cranial fossa (s-d, d-p, p-iop, \(P < 0.01\) and \(P < 0.0001\), respectively) were significantly different when comparing the two ethnic groups. There was no significant difference in upper cervical spine morphology and atlas dimensions between the groups. Fusion of the upper cervical spine was significantly associated with the sagittal jaw relationship (\(P < 0.05\)), and total upper spine deviations were significantly associated with growth prediction signs in a backward direction (\(P < 0.05\), \(P < 0.01\)). Atlas dimensions were significantly associated with prognathia of the mandible (\(P < 0.05\)), posterior cranial fossa (\(P < 0.01\), \(P < 0.0001\)) and some growth prediction signs (\(P < 0.05\), \(P < 0.01\)).

CONCLUSION: Morphological upper spine deviations and atlas dimensions are significantly associated with growth of the jaws and the morphology in children with a Class III malocclusion. It may be valuable to include upper spine morphology in addition to the growth prediction signs by Björk in orthodontic diagnosis and treatment planning for growing children with a Class III malocclusion.

SP 265 THE SHEAR BOND STRENGTH WITH CHEWING SIMULATION OF METAL AND CERAMIC BRACKETS. A COMPARATIVE STUDY

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AIMS: Shear bond testing in vitro works as an effective way of testing bond strength of orthodontic adhesives. Despite many published articles on shear bond strength (SBS) of adhesives for orthodontic brackets, there have been relatively few studies for effects of a chewing simulator. The aim of this study was to investigate the SBS of orthodontic metallic and ceramic brackets with a chewing simulator using the traditional acid etch technique.

MATERIALS AND METHOD: Eighty extracted human premolar teeth were randomly divided into two equal groups with metallic brackets (MC; American Orthodontics Mini Master Series) and ceramic brackets (CC; 3M Clarity Advanced Ceramic Brackets) as follows: CC group: ceramic brackets, control group, bonded with acid etching, MC group: metallic brackets control group bonded with acid etching, CA group: ceramic brackets group controlled with a chewing simulator bonded with acid etching and MA group: metallic brackets group controlled with chewing simulator and bonded with acid etching. The SBS of these brackets was measured and recorded in megapascal (MPa). Both metallic and ceramic brackets were divided into two subdivision groups: one group was investigated with chewing simulator together with thermal cycling and the other group was a control. Data were analyzed with the analysis of variance, Tukey and Chi-square tests. The level of significance was set at \(P < 0.05\).

RESULTS: The mean SBS values (MPa ± standard deviation) were CC group = 13.56, MC group = 12.45, CA group = 8.3, and MA group = 8.09. Bond strength differences between groups CC and MC (\(P = 0.063\)) and between CA and MA (\(P = 0.091\)) were not statistically significant. There were significant differences between CC and MC groups and CA and MA groups (\(P < 0.05\)). Insignificant differences were found in Adhesive Remnant Index scores among all groups.

CONCLUSION: The findings indicate that the CC and MC groups had higher bond strengths in comparison with the CA and MA groups. In addition, the MA group showed fewer bonds compared
with the CA group. This study sheds light on testing the materials and the conditions that mimic the oral environment.

SP 266 THE EFFECT OF CIGARETTE SMOKE ON THE SHEAR BOND STRENGTH OF METALLIC AND CERAMIC ORTHODONTIC BRACKETS
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AIMS: To investigate the effects of cigarette smoke on the shear bond strength (SBS) of orthodontic brackets bonded to enamel

MATERIALS AND METHOD: The sample consisted of 60 sound adult teeth divided into four groups of n = 15, ceramic brackets without smoke exposure, metallic brackets without smoke exposure, ceramic brackets with smoke exposure, and metallic brackets with smoke exposure. Smoking exposure was simulated using a tobacco exposure chamber (Curbridge Engineering, Hampshire, UK). The number of cigarettes was standardized to 10 per day for 4 weeks with smoke exposure of 2 minutes simulating the behaviour of a smoker. After a 2 week period of smoke exposure, metallic and ceramic brackets were bonded to the enamel using conventional acid etching technique. The bonded sample was then exposed to cigarette smoke again for the remaining 2 week period. SBS was tested using a universal Instron testing machine (ElectroPuls™ E3000, Instron Industrial Products, Grove City, Philadelphia, USA) at a constant crosshead speed of 1 mm/minute until failure. The load of bracket failure was calculated using a computer connected to the testing machine in Newtons. SBS values were calculated in megapascals by dividing the debonding force (Newton) by the bonding area, which is the area of the bracket base. A Kolmogorov-Smirnov test was used to test the normality of the measurements of SBS in the four groups. One-way analysis of variance (ANOVA) was used to compare the means of SBS between the four groups. Post hoc with least significance difference was used to perform a pairwise comparison between means. Statistical significance was determined at \( P < 0.05 \).

RESULTS: The highest SBS corresponded to the ceramic brackets bonded to a non-smoking sample followed by the metallic bracket bonded to a non-smoking sample. Lower values corresponded to the ceramic bracket bonded to a smoke exposed sample while the lowest values were related to the metallic brackets bonded to the smoke exposed sample; the difference was statistically significant.

CONCLUSION: SBS values were significantly lower in the smoke exposure groups with the lowest values occurring in the metallic brackets bonded to cigarette smoke exposed sample.

SP 267 PREVALENCE OF PERIODONTAL DISEASE IN ADULT PATIENTS WITH CHIEF COMPLAINT OF MALOCCLUSION
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AIMS: The number of adults seeking orthodontic treatment has increased in recent years, and there has been a growing number of opportunities to provide orthodontic treatment to patients suffering from periodontal disease. However, orthodontic specialists often fail to fully examine the periodontal tissue before treatment. The present study was therefore conducted to investigate the importance of a correct examination of the periodontal tissue and initial periodontal therapy before orthodontic treatment, by assessing the prevalence of periodontal disease in patients with the chief complaint of malocclusion.

SUBJECTS AND METHOD: Eighty patients in their 20’s to 50’s to were admitted for orthodontic treatment. The subjects were split into four groups: 20’s, 30’s, 40’s and 50’s or older and examined to determine whether or not they had periodontal disease. They were examined for periodontal
disease by a comprehensive assessment of alveolar bone level and intrabony defects from panoramic radiographic photographs, periodontal pocket depth, whether or not they had bleeding on probing (BOP), whether or not they had furcation area lesions, the attached gingiva width. A multiple comparison test between each of the groups was used to compare each item.

RESULTS: About 90 per cent of all adult orthodontic patients in their 30's or older were found to have periodontal pockets measuring 4 mm or larger, a significantly greater number than for those in their 20's. The groups in their 40's and their 50's and older were also found to have significantly more missing and restored teeth.

CONCLUSION: There is a very high prevalence of periodontal disease in adult patients admitted for orthodontic treatment, suggesting that it is important to examine for periodontal disease and provide initial periodontal therapy before orthodontic treatment.

This work was supported by Interdisciplinary Orthodontic Society (IOC).

SP 268 TOOTH MOVEMENT ACCELERATION USING LOW LEVEL LASER THERAPY. A SPLIT MOUTH STUDY
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AIMS: To assess whether low level laser therapy with certain parameters is effective to accelerate orthodontic dental movement.

SUBJECTS AND METHOD: Fourteen orthodontic patients were selected to participate in this study. The canines were retracted, after the upper first premolars were extracted, with fixed orthodontic appliances and maximum anchorage. The retraction force of 150 g was carried out with a coil. The upper quadrants of the patient's mouth were divided randomly into two groups: experimental side and control side. Laser radiation (diode laser, radiofrequency 980 nm and mean radiation 100 mW) application was done on 10 points of the canine on the experimental side on the same day retraction began and on the days 3, 7 and 14 of the first month and on the 15th day of the second and third month of retraction. The distance between the canine cusp and the mesiobuccal cusp of the upper first molar was measured on the cast models. Impressions of the patient’s mouth were obtained at four different times.

RESULTS: There were significant statistical and clinical differences between the groups. The distance between the canine and the first molar was shorter and the canine moved a mean of 1 mm/ month faster than in the control group at the end of the third month of retraction. No secondary effects were reported.

CONCLUSION: The laser could be an effective method to accelerate the movement in orthodontic treatment. Although this study showed positive results, it is necessary to carry out studies with larger sample size, so different laser radiation doses can be analysed to evaluate which dose range enhances orthodontic movement. This also would help to standardize the parameters of laser application.

SP 269 IN VITRO INVESTIGATION OF THREE-DIMENSIONAL PRINTED SPRINGS IN ORTHODONTICS
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AIMS: Three-dimensional (3D) printing is emerging in orthodontic treatment using CAD/CAM and additive manufacturing technologies. Consequently, new flexible transparent printable material was developed to widen the orthodontic treatment possibilities.

MATERIALS AND METHOD: For mechanical investigation the behaviour of printed- and steel alloy was compared using three different diameters for each group with identical geometry. For the experimental design, springs were designed and printed (MAX, Asiga, Australia) using printable experimental flexible material (Code: BM2008, GC, Tokyo, Japan). Steel alloy was used in the control. Mechanical testing using a universal testing machine (Zwick/Roell, 2010, Ulm, Germany) was performed and statically analyzed ($P < 0.05$)
RESULTS: For all investigated groups significant differences were observed for material as well as design comparing compression to force ratio. The design directly affects the mechanical properties for printable orthodontic resins.

CONCLUSION: The study demonstrated that the CAD/CAM printable experimental flexible material brings out new treatment options in orthodontics. Further investigations are necessary for optimization of the geometry and individualization for clinical application.

SP 270  THE EFFECT OF ROTATION ON DENTAL STRUCTURE COMPONENTS FOLLOWING APPLIANCE PLACEMENT
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AIMS: To evaluate, using the finite element method (FEM) analysis, the effects of rotation movement on complex dental structures subjected to an external load through an orthodontic fixed appliance, in orthodontic movements tipping, translation, root displacement, intrusion-extrusion and rotation.

MATERIALS AND METHOD: Evaluation of the rotation effects on the tooth structure was performed through FEM analysis: the progressive action of a fixed device on three teeth (first molar, second premolar, first premolar) was modelled and simulated, with the components placed in centre of the buccal and palatal surfaces. The values relevant for the study were: Von Mises equivalent, main maximum stress/main minimum stress with the effect of expansion/compression of the structure tissue and the shearing effect stress, relevant for the pulp. A two-dimensional plane model was created, representing a vertical median section of the structure. The characteristics of the material were: Young’s E modulus and Poisson’s ratio for the modelled structure components.

RESULTS: The elements of the structure were mainly stressed in fibre compression in the direction of the moment’s action. This was given by the forces from the dental device components and fibre stretching in the opposite direction of the couple’s action. To simulate as real as possible, the loading of the model was performed through a nodal force applied at a height of the crown - the bracket position, in the plane Oyz, on the buccal or lingual surface, of various amplitudes, progressively increasing: F = 1-4 N (100-400 g). A rotation of the root only, without the displacement of the crown’s upper position, was difficult to produce, since the tooth is embedded in the bone at the apex, with relatively little movement. Force values higher than 1,5-2 N (150-200 g) are to be avoided.

CONCLUSION: The most stressed elements of the structure were the pulp and the ligament. The maximum values of stress were in the pulp, in the centre of resistance or around it, thus the accumulated stress effect becomes dangerous. One can notice that related to other possible orthodontic movements given by dental devices the phenomena which occur in dental rotation are the most dangerous.

SP 271  COMPARATIVE EVALUATION OF DENTOSKELETAL CHANGES WITH HERBST AND TWIN BLOCK APPLIANCES AND THEIR INFLUENCE ON THE PROFILE – A PERCEPTION STUDY
Sridevi Padmanabhan, Department of Orthodontics, Chennai University, India

AIMS: To assess the perception changes in the soft tissue profile by comparing the facial profile silhouettes before and after treatment with the Herbst and Twin Block appliance and correlate this with the observed dentoskeletal changes.

MATERIALS AND METHOD: Profile silhouettes of 15 patients treated with the Herbst and Twin Block appliance were generated and shown to orthodontists and orthodontic residents who rated them using a visual analogue scale. The cephalometric data was analyzed and four selected parameters were considered, Anteroposterior changes indicated by the sagittal position of maxilla and mandible, vertical changes indicated by the mandibular plane angle, dentoalveolar change indicated by the
upper incisor to point A and lower to A-Po and changes in skeletal convexity were assessed. These were correlated to the perception changes to evaluate whether perception of improvement in profiles is correlated to conventional cephalometric indicators of dentoskeletal changes.

RESULTS: Treatment with both Herbst and Twin Block resulted in positive changes in profile perception with no significant difference. Lay persons gave the highest scores.

CONCLUSION: The magnitude of pre- and post-treatment changes were small and not statistically significant.

SP 272 THE INFLUENCE OF TOOTH SHADE ON ORTHODONTISTS’ PERCEPTIONS OF DENTAL ATTRACTIVENESS AND ORTHODONTIC TREATMENT NEED
Sabrina Pahal, Cardiff University, U.K.

AIMS: To analyse how altering tooth shade affects orthodontists’ perception of dental attractiveness and orthodontic treatment need.

MATERIALS AND METHOD: An online survey delivered to members of the British Orthodontist Society. Participants scored the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) and rated dental attractiveness (DA) for 18 anterior dental images. Images were derived from six photographs, each digitally manipulated to VITA shades 1 (light), 2 (mid) and 4 (light). IOTN AC and DA scores for different shade pairings were compared using Friedman tests and Wilcoxon signed-rank tests.

RESULTS: A total of 199 clinicians responded. Orthodontists’ scoring showed no trend for a change in shade gradient to influence the IOTN AC scored. Orthodontists scored lighter shades of teeth as more attractive when compared to darker shades, scoring five out the six images (P < 0.05) DA differently as shade changed. Post hoc analysis of IOTN AC and DA scoring showed that differences between light and dark shade scoring was most common (P < 0.017).

CONCLUSION: Overall orthodontists perceive lighter shaded teeth as more attractive than darker shades. IOTN AC scoring is not influenced by shade changes. Orthodontists could consider an assessment of aesthetics which includes shade in the future.

SP 273 CLINICAL EFFECTIVENESS AND PREDICTABILITY OF MAXILLARY EXPANSION AND INTERCUSPAL CONTACTS DURING CLEAR ALIGNER TREATMENT
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AIMS: To retrospectively investigate the predictability of maxillary expansion and the accuracy of intercuspal contacts simulated by ClinCheck using Invisalign aligners on the basis of the new material, SmartTrack.

MATERIALS AND METHOD: Four digital casts (initial clinical cast MT1, final clinical cast MT2, initial ClinCheck cast CCT1 and final ClinCheck cast CCT2) of 30 patients were measured on 13 transversal parameters. The measurement was performed by two investigators to verify the error of the method. Analysis of both measurements and the comparison were conducted with the statistical program SPSS. Screenshots of 30 patients with occlusal contacts of MT2 and CCT2 were visually compared for investigation of the occlusion. The results were analysed statistically by SPSS.

RESULTS: The planned maxillary expansion achieved a low accuracy for the canine (CCW 50%), for the premolar (PmCW 21.8%) and also for the molar (MCW 34.7%). The chosen measurement method showed non-significant differences between the data of both investigators. Clinically well performed interocclusal contacts achieved a middle accuracy of 59.1 per cent. Besides a high amount of heavy contacts in the simulated ClinCheck cast benefited the appearance of those contacts.

CONCLUSION: An overcorrection of the appropriate expansion parameters in ClinCheck should be considered for Invisalign treatment with SmartTrack aligners in order to achieve the treatment goal. For simulation of the occlusion an overcorrection should be considered as well. The simulated heavy occlusal contacts should not be removed because they increase the quantity of well performed occlusal contacts at the end of the treatment.
SP 274 EVALUATION OF LATERAL INCISOR RESORPTION CAUSED BY IMPACTED MAXILLARY CANINES BASED ON CONE BEAM COMPUTED TOMOGRAPHY: A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: To assess the scientific evidence published during the last decade, concerning lateral incisor root resorption (RR) caused by impacted maxillary canines based only on cone beam computed tomography (CBCT).

MATERIALS AND METHOD: The present systematic review followed criteria specified by the PRISMA statement. The electronic databases PubMed, Scopus, Science Direct and Cochrane Library were searched. Two authors independently reviewed relevant articles for eligibility. Risk of bias assessment was performed using the National Heart, Lung, and Blood Institute Tool.

RESULTS: A total of 4900 records were initially screened. Only six articles were finally eligible for further analysis. RR of maxillary lateral incisors in patients referred for CBCT examination due to impaction of maxillary canines was common (58.4%). RR of mild severity was more common (53.7%), more frequently located in the middle (46.8%) and apical (47.5%) thirds of the root. The most commonly affected tooth in the adjacent incisor and premolar areas was the lateral incisor (59.7%).

CONCLUSION: CBCT is a useful tool for evaluating lateral incisor RR in patients with impacted maxillary canines. There is a high incidence of lateral incisor RR in the aforementioned cases. However, the high variance detected in its incidence, indicates the need for further research.

SP 275 ENAMEL GLOSS CHANGES INDUCED BY ORTHODONTIC BONDING
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AIMS: To assess enamel gloss changes induced by orthodontic bracket bonding with a light-cured composite or a light-cured resin-reinforced glass ionomer cement.

MATERIALS AND METHOD: A total of 20 extracted upper human first premolars were included in this study and each tooth served as a control for itself. Their buccal surfaces were subjected to a 60 degree angle gloss measurement (G%60) with a standardized and secure repeated analysis of the same site. After baseline evaluation, a bracket was bonded on the buccal surface of each tooth. Half of the specimens were bonded with acid-etching and a light-cured composite whereas the other half with a light-cured resin-reinforced glass ionomer cement without prior enamel conditioning. Gloss measurements were repeated after bracket debonding and removal of the composite/glass ionomer cement with an 18-fluted carbide bur. Gloss differences between the two measurement conditions (baseline and post-debonding) were analyzed through linear regression with standard errors derived using the bootstrap method. The level of significance was set at a < 0.05.

RESULTS: A statistically significant difference was detected between the tested groups for the outcome of interest. Teeth bonded with light-cured composite exhibited larger enamel gloss changes as compared to resin-reinforced glass ionomer cement (β = 0.74; 95% confidence intervals: 0.10, 1.38; P = 0.02).

CONCLUSION: Bracket bonding with two common bonding protocols (acid-etching with a light-cured composite versus no etching with resin reinforced glass-ionomer cement) and subsequent debonding and adhesive removal with an 18-fluted carbide bur induced enamel gloss changes.
SP 276 A GENOME-WIDE ASSOCIATION STUDY IDENTIFIES NEW SUSCEPTIBILITY LOCI FOR NON-SYNDROMIC CLEFT PALATE IN A CHINESE POPULATION
Yongchu Pan, Nanjing Medical University, China

AIMS: To identify novel risk factors of non-syndromic cleft palate only (NSCPO), a genome-wide association study (GWAS) in a Chinese population was performed.

SUBJECTS AND METHOD: One hundred and eighty five NSCPO cases and 515 controls were included and genotyped using Illumina arrays. Functional annotations including expression quantitative trait loci (eQTL) analysis and network analysis were used to predict functions of the lead single-nucleotide polymorphisms (SNPs). Weighted genetic risk score (wGRS) based on the odds ratios of the five most significant NSCPO susceptibility loci from the GWAS data was created.

RESULTS: Five SNPs exhibited a suggestive significant association with NSCPO ($P < 1E-05$), with rs3826795 at 19q13.32 had the strongest association ($P = 5.54E-07$, OR $= 2.07$). The eQTL analysis of rs3826795 mapping for 44 tissues which were obtained from GTEx dataset demonstrated that the association with multiple tissues are significant at expression level, especially in tibial nerve tissues. rs3826795 A allele was related to higher expression levels of HIF3A ($P = 4.3E-07$). The mean (standard deviation) of the wGRS was 2.82 (1.21) for NSCPO cases and 2.34 (1.07) for controls ($P < 7.26E-07$) respectively, which showed a clear separation between them.

CONCLUSION: The study identified rs3826795 as a novel locus of NSCPO in a Chinese population.

SP 277 NON-PHARMACOLOGICAL FORMULATIONS FOR GINGIVITIS CONTROL IN ORTHODONTIC PATIENTS. A SYSTEMATIC REVIEW
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AIMS: To assess the available evidence for the effects of non-pharmacological formulations in treating gingivitis during treatment with fixed orthodontic appliances.

MATERIALS AND METHOD: Electronic database searches of published and unpublished literature and hand searches of the eligible studies were performed. The following electronic databases with no language and 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 Risk of Bias and Robins-I tool.

RESULTS: After application of the eligibility criteria, six studies were included in this systematic review. Four were randomised controlled trials and two were prospective studies. Risk of bias ranged from low to high. Due to substantial clinical and methodological heterogeneity, a meta-analysis was not feasible. Antioxidant essential oils, chamomile, aloe vera, honey and probiotics were evaluated in the included studies. There was considerable agreement among studies that the tested non-pharmacological formulations successfully control gingivitis, as they reduce plaque and gingival indices.

CONCLUSION: Although the quality of evidence varied among included studies, there is a considerable amount of evidence suggesting that non-pharmacological formulations may successfully restrict orthodontically induced gingivitis.

SP 278 ASSOCIATION OF VISUAL GINGIVAL THICKNESS ASSESSMENT AT THE INCISORS OF ORTHODONTIC PATIENTS WITH ULTRASOUND MEASUREMENTS. A CROSS-SECTIONAL STUDY
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AIMS: To investigate the association of visual gingival thickness (GT) assessment at the mandibular incisors of orthodontic patients through gingival translucency, with ultrasound estimation, and to determine at which cut-off point the visibility of the probe meets the ultrasound measurements.

SUBJECTS AND METHOD: The sample consisted of 77 consecutive orthodontic patients. Two methods were utilised: a) The method of probe trans-gingival translucency. This method does not direct measurement of GT, but classifies gingival phenotype based on the visibility of a periodontal probe through the gingiva, when the probe is inserted for 1 mm in the gingival sulcus. b) Ultrasound estimation. GT was evaluated at both the central mandibular incisors, mid-facially on the buccal aspect, with an ultrasound device.

RESULTS: Linear regression models applied to the data showed a significant association between ultrasonic measurements and standard probe assessments for tooth 31 \( n = 77, \beta = 0.12, 95\% \text{ confidence interval (CI)}: 0.03, 0.20; P = 0.009 \), tooth 41 \( n = 77, \beta = 0.12, 95\% \text{ CI}: 0.04, 0.198; P = 0.004 \) and pooled assessments \( n = 154, \beta = 0.12, 95\% \text{ CI}: 0.06, 0.18; P = 0.001 \). For pooled assessments, the estimated marginal mean ultrasonic measurement was 0.65 mm \( 95\% \text{ CI}: 0.61, 0.69 \) when the standard probe was visible, and 0.77 mm \( 95\% \text{ CI}: 0.73, 0.81 \) when it was not.

CONCLUSION: In the context of the present study, there was a statistically significant difference between ultrasound values that corresponded to visible versus those that corresponded to non-visible standard probe assessments.

SP 279 ORTHODONTIC TREATMENT AND TEMPOROMANDIBULAR DISORDERS: A QUALITY ANALYSIS OF EXISTING EVIDENCE
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AIMS: To assess the quality of existing high-level evidence regarding the potential association between orthodontic treatment and temporomandibular disorders (TMDs).

MATERIALS AND METHOD: TMDs is a term used to describe a combination of clinical signs and symptoms manifested in the orofacial system including the masticatory musculature, the temporomandibular joints or both. Even though the exact cause of TMDs has not been thoroughly understood, it is believed that various factors contribute to their onset and/or progress. As far as occlusion and orthodontic treatment are concerned, ambiguities seem to exist regarding their potential influence in TMDs prevalence or management. Hence, several guidelines and expert opinions have been published in the literature, which however are restricted in the simple provision of general instruction for the clinician.

RESULTS: Ten papers were eventually selected. According to the results of the Amstar-2 evaluation, the quality of most included studies was judged as ‘critically low’. Furthermore, the majority of the proposed methodological domains included in the Prisma statement and in the respective abstract extension were under-reported or not reported at all in the assessed reviews.

CONCLUSION: The significantly low quality combined with the incomplete reporting of existing systematic reviews does not allow the provision of safe conclusions regarding the possible association between various types of orthodontic treatment and TMDs.

SP 280 A VALIDATION STUDY OF THE CHILD PERCEPTIONS QUESTIONNAIRE TO MEASURE ORAL HEALTH-RELATED QUALITY OF LIFE IN YOUNG GREEK INDIVIDUALS WITH MALOCCLUSION
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AIMS: Both the Child Perceptions Questionnaire (CPQ11-14) and its short version (CPQ11-14 ISF-16) were found to be in many countries valid and reliable instruments to assess Oral Health-Related Quality of Life (OHRQoL) in adolescents. The aim of the present study was to translate, culturally adapt and validate the short version of this questionnaire (CPQ11-14 ISF-16) in a sample of Greek adolescents with different types of malocclusion.

MATERIALS AND METHOD: After translation according to current guidelines, the comprehensiveness of the Greek version of CPQ11-14 ISF-16 was verified in a pilot study of 20 Greek adolescents. The current main study was undertaken in a sample of 200 native Greek speakers aged 10-16 years presenting for an initial consultation at the Postgraduate Orthodontic Clinic of the Aristotle University of Thessaloniki. The Oral Health Impact Profile (OHIP-14) questionnaire, which had already validated for Greek adolescents, was used to investigate criterion validity. Forty adolescents completed the same questionnaires (CPQ11-14 ISF-16 and OHIP-14) again after 3 weeks in order to test the repeatability of the measurements. Cronbach’s alpha was used to test the internal consistency/reliability and Spearman’s rho for the criterion validity. Test-retest reliability was assessed using intraclass correlation coefficient (ICC). Statistical tests were undertaken using SPSS (v. 24, IBM Corp., New York, USA).

RESULTS: The CPQ11-14 ISF-16-GR presented high internal consistency (Cronbach’s alpha = 0.848 > 0.70) and very satisfactory discrimination index (0.47 > 0.30). Moreover, the CPQ11-14 ISF16 showed excellent criterion validity with OHIP-14 (rho = 0.719, P < 0.001) and test-retest reliability was at high levels (ICC = 0.719, P < 0.001).

CONCLUSION: The CPQ11-14 ISF-16-GR may exhibit good psychometric properties in terms of validity and reliability and seems to be a reliable instrument to assess OHRQoL in Greek adolescents. Further testing of the measure is required in a variety of environments.

SP 281 HOW OFTEN DO MINISCREWS, MINIPLATES AND PALATAL IMPLANTS USED FOR ANCHORAGE REINFORCEMENT DURING ORTHODONTIC TREATMENT FAIL IN CLINICAL USE?

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AIMS: It is known that the various systems used for orthodontic anchorage reinforcement have different clinical failure rates. The aim of the present systematic review with meta-analysis was to critically appraise clinical evidence about the failure rate of orthodontic anchorage systems (miniscrews, miniplates, or palatal implants) and to identify significant risk factors for failure.

MATERIALS AND METHOD: Eight databases were searched without restrictions up to July 2018 for randomized clinical trials, prospective/retrospective non-randomized studies assessing failure of different orthodontic anchorage systems in human patients with at least 100 miniscrews, miniplates, or palatal implants. After duplicate selection, data extraction, and risk of bias assessment according to the Cochrane guidelines, random-effects meta-analyses, followed by subgroup, meta-regression, and sensitivity analyses were performed.

RESULTS: A total of 76 studies with at least 100 miniscrews, miniplates, or palatal implants were included in the quantitative analysis. Considerable variation was found among the failure rate of miniscrews [65 studies; 9298 patients; 21088 miniscrews; failure: 12.0%; 95% confidence Interval (CI) 10.6-13.5%], miniplates [13 studies; 1843 patients; 3478 miniplates; failure: 4.9%; 95% CI: 3.0-7.1%], and palatal implants [2 studies; 382 patients; 384 palatal implants; failure: 4.7%; 95% CI: 2.7-7.1%], with significant differences among them (P < 0.001). As far as failure of miniscrews is concerned, patient gender, age, oral health, gingiva type, jaw, insertion side of the alveolar process, root contact, and re-instalment after primary failure were identified as significant risk factors (P < 0.05).
CONCLUSION: Evidence from large clinical studies using various anchorage reinforcement systems indicated that they fail clinically with different frequency, with palatal implants being the most fail-proof, followed closely by miniplates, and then miniscrews. The identified risk factors might be used clinically to keep the risk of failure as low as possible for each patient.

SP 282 ANTEROPosterior AND VERTical HYOID BONE POSITION IN SKELETAL CLASS III INDIVIDUALS ACCORDING TO THEIR FACIAL BIOTYPE
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AIMS: To compare the position of the hyoid bone in the anteroposterior and vertical plane, in skeletal Class III patients, dividing them according to their biotype (mesofacial, dolichofacial or brachyfacial) and observe if the biotype is related to protrusion, retraction, ascent or descent of this.

MATERIALS AND METHOD: Lateral cephalometric radiographs in the natural head position of 50 Class III skeletal individuals were obtained from the database of the clinic. The patients were classified according to their biotype and measured with specific cephalometry created for the study. The hyoid triangle of Bibby and Preston was used to determine the hyoid position. All data were analysed with the Statistical Package for Social Science (IBM Corp., Armonk, New York, USA). The differences between the measurements in the three biotypes were analysed; one-way ANOVA was used in cases where normality was met in all three groups and the non-parametric Kruskal Wallis test for the variables where normality of the data was not met.

RESULTS: Significant differences were found in the variables in $H-H'$ (F = 3.325, $P = 0.045$), and in $FH-H$ (Chi = 6.825, $P = 0.033$); that is, the only significant data relating the different biotypes with the vertical position of the hyoid were found.

CONCLUSION: No significant differences were observed in the anteroposterior position of the hyoid bone between the different biotypes. Hyoid position was lower in the dolichofacial patients than in the mesofacial and brachyfacial ones. Hyoid bone was placed more anteriorly and lower in males than in females. Regarding age, hyoid bone was in a more posterior and lower position among elderly patients.

SP 283 EVALUATION OF THE CONDYLAR POSITION AFTER THE SURGERY-FIRST APPROACH IN MANDIBULAR PROGNATHISM PATIENTS
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AIMS: To compare condylar displacement in surgery-first patients between symmetry and asymmetry groups using cone beam computed tomographic (CBCT) generated cephalograms.

SUBJECTS AND METHOD: The subjects consisted of those with mandibular prognathism with and without facial asymmetry who underwent mandibular setback surgery using sagittal split ramus osteotomy and had CBCT taken before, about 1 week, and 7 months after surgery. The condylar position was measured. Descriptive, repeated-measures analysis of variance, Wilcoxon signed rank test, Mann-Whitney U-test and Spearman correlation analysis were performed.

RESULTS: There were statistically significant changes at all three time points in both groups. The condylar angle showed statistically significant changes between the lesser and greater setback sides in the asymmetric group. Comparison of condylar displacement according to the times showed that on the lesser setback side, there was a statistically significant change of condylar angle between the groups. The amount of the condylar angle was larger in the asymmetric than in the symmetric group. Only the lesser setback side/greater setback side difference showed positive correlation with the surgical change and total change of condylar angle in the lesser setback side, whereas ramus width and ramus angle did not correlate with any condylar displacement.

CONCLUSION: In surgery-first patients, the condylar position after mandibular setback was statistically significantly different in both groups and these condylar displacements remained 7
months after surgery. However, the patterns of condylar displacement were different between the symmetry and asymmetry groups.

SP 284 ASSOCIATION BETWEEN THE 5-YEAR-OLD INDEX AND ANTERIOR CLEFT SPEECH CHARACTERISTICS IN PATIENTS WITH A UNILATERAL CLEFT LIP AND PALATE
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AIMS: To evaluate whether or not there is an association between the 5-year-old index and anterior cleft speech characteristics of dentalisation, lateralisation and palatalisation in patients with a unilateral cleft lip and palate (UCLP).

MATERIALS AND METHOD: This was a retrospective evaluation of study models and speech assessments taken from patients at the age of 5 years with a non-syndromic UCLP between the years of 2009 and 2016. The study models were scored against the 5-year-old index externally at the annual scientific conference of the Craniofacial Society of Great Britain and Ireland. The scores were then condensed into traffic light red/amber/green groups. Speech sample assessments were also collated for the same cohort of patients. These had previously been assessed by a minimum of three speech and language therapists trained in the use of the Cleft audit protocol for speech. The association between these two categorical variables was then determined with a chi-squared test.

RESULTS: One hundred and one patients with complete data were identified with an average age of 5 years months. Sixty nine patients were male and 32 female. The most frequent study model score given was 2 indicating a good outcome to primary palatal surgery. The study model scores were then compared with the cleft speech characteristics of dentalisation, lateralisation and palatalisation in turn. The most significant association found was for dentalisation (P = 0.067) however this was not deemed to be statistically significant. Statistically significant findings were found between the 5-year-old index score and dentalisation (P = 0.018) when the sample size was reduced by excluding patients with a history of speech therapy and velopharyngeal insufficiency.

CONCLUSION: Outcomes of surgery in 5-year-old patients with a UCLP were varied but the most common score given equated to a good surgical outcome. The results show that there is a positive association between the 5-year-old index and dentalisation only. These results should be interpreted with caution due to the small sample size. It is likely that the development of normal speech in cleft lip and palate patients in multifactorial.

SP 285 ORTHOGNATHIC FUNCTIONAL TREATMENT NEED IS A LESS POWERFUL PREDICTOR OF PATIENTS' DECISION TO ACCEPT ORTHOGNATHIC SURGERY THAN ORTHODONTIC TREATMENT NEED
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AIMS: Some patients with pronounced skeletal malocclusions and altered facial aesthetics refuse orthognathic surgery suggested by orthodontists and the reasons are often not known or understood. Therefore, the aim of this study was to investigate factors influencing patients' decisions to accept surgery.

SUBJECTS AND METHOD: Ninety five subjects with skeletal malocclusions (65% female), aged 17-45 years (median 21, interquartile range 19-25). Suggested surgery was accepted by 58 subjects while refused by 37. Their psychosocial issues and treatment needs were evaluated with the Orthognathic Quality of Life Questionnaire, Index of Orthognathic Functional Treatment Need (IOFTN) and Index of Orthodontic Treatment Need - Dental Health Component (IOTN DHC). Differences between groups of subjects accepting and refusing surgery were analysed by t-test and logistic regression.

RESULTS: The odds of accepting orthognathic surgery was ×3.4 higher in subjects with high facial aesthetic concern compared to those with low concern. It was ×3.9 higher in people with a high
IOFTN score and ×7.7 higher in those with high IOTN DHC score \((P ≤ 0.006)\) in univariate analyses. However, when controlling for age, gender, oral function impairment, awareness of facial deformity and inhibitions in social contacts only IOTN DHC and facial aesthetics concerns were significant predictors of orthognathic surgery acceptance increasing the odds for acceptance to \(×5.8\) \((95\% \text{ CI}: 1.6-21.3; P = 0.009)\) and \(×3.7\) \((95\% \text{ CI}: 1.1-12.4; P = 0.032)\). A high IOFTN is not significant predictor of a decision to accept surgery.

CONCLUSION: Facial aesthetic concern is very important factor in the decision making process of accepting orthognathic treatment for skeletal malocclusion. Functional orthognathic treatment need is a less important predictor than orthodontic treatment need.

SP 286 ALTERED EXPRESSION OF PLURIPOTENT AND OSTEOBLAST MARKERS IN THE HUMAN PERIODONTAL LIGAMENT ON APPLICATION OF ORTHODONTIC LOADING

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AIMS: Periodontal ligament stem cells (PDLSCs) and osteoblasts play important roles in the periodontal ligament (PDL) remodelling process during orthodontic tooth movement (OTM). However, little is known about the time sequencing of their expression in human periodontal tissue. Therefore, a better understanding of the molecular mechanism of both cells might elucidate the biological process of OTM. The aims of this study were to determine and monitor the expression of octamer-binding transcription factor 4 (Oct4), runt-related transcription factor 2 (RUNX2) and alkaline phosphatase (ALP) proteins in human periodontal tissue upon application of loading force for different periods of time.

SUBJECTS AND METHOD: Ten patients who required extraction of four first premolars for their orthodontic treatment were included in this study. Premolars in the control group \((n = 10)\) received no force application, whereas those in the experimental groups \((n = 30)\) were subjected to light levelling orthodontic force for one, two or four weeks. All teeth were extracted using the forceps technique. The total protein was isolated from PDL tissue below the cervical third of the root. The expression of Oct4, RUNX2 and ALP, normalized by that of beta-actin, was analyzed using immunoblotting and the relative ratios of expressions were compared between groups. Friedman and Wilcoxon signed ranks tests were used for statistical evaluation.

RESULTS: The expression levels of Oct4, RUNX2 and ALP increased significantly at different time periods compared to the control group \((P < 0.05)\). The Oct4, RUNX2, and ALP expression levels were significantly different from the control \((P < 0.05)\) at the first week, first and second weeks, and second and fourth weeks, respectively.

CONCLUSION: Orthodontic loading clearly upregulated PDLSC and osteoblast markers at different times. Both of these might reflect the time sequencing of the PDL remodelling process in humans.

SP 287 CONDYLAR STRUCTURAL, DIMENSIONAL AND POSITIONAL CHANGES IN ORTHOGNATHIC SURGERY PATIENTS

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AIMS: To investigate the long-term effects of orthognathic surgery on condylar structural, dimensional and positional changes, using cone beam computer tomography (CBCT).

SUBJECTS AND METHOD: The database of all patients who underwent orthognathic surgery was revised. After application of exclusion criteria, 97 patients were invited for evaluation of temporomandibular joint status after orthognathic surgery. Fifty-seven participants attended for the check-up and 44 (14 males, 30 females) agreed to a CBCT examination. The mean age at surgery was 22.1 ± 2.8 years. The study group comprised 11 patients with a skeletal Class II and 33 patients with a skeletal Class III malocclusion. Single-jaw surgery was performed in 36.4 per cent and bimaxillary surgery in 63.6 per cent of cases. The mean follow-up period was 4.8 ± 0.8 years.
Structural and positional changes of the condyles were assessed on CBCT images. The criteria of Ahmad et al. were used to assess and classify condylar bony changes. To evaluate condylar positional changes, the method of Pullinger and Hollender was used. Three-dimensional models of the condyles were constructed and superimposed using the cranial base of the pre-surgery scans as a reference to evaluate condylar remodelling by the means of colour-coded maps. Chi square and Wilcoxon signed-rank tests were performed using IBM SPSS Statistics 22.0 software. Continuous variables were expressed by means, medians and standard deviations.

RESULTS: The total score for condylar bony changes was statistically significantly ($P = 0.000$) increased for both sides. Overall remodelling of the condyles after orthognathic surgery did not exceeded 1.0 mm. Only two patients exhibited significant condylar resorption at long-term follow-up. Four years after surgery the condyles were at the same position within the glenoid fossa as before surgery.

CONCLUSION: The incidence of radiologically detected features of condylar structural changes increased after orthognathic surgery at a long-term follow-up. Notable resorption of the condyles may be expected in approximately 5 per cent of cases.

SP 288 ORTHODONTIC TREATMENT NEED IN SOUTHERN THAILAND: AN INSTITUTION-BASED STUDY
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AIMS: To determine demographic data and orthodontic treatment need among patients seeking orthodontic treatment from 2007-2017
MATERIALS AND METHOD: The study included all orthodontic consultation records of patients seeking for orthodontic treatment from 2007-2017 at the Prince of Songkla University, which is the tertiary care institution of Thailand’s oral health system. After screening all records, incomplete or illegible data were excluded from the study. All parameters including demographic data and malocclusion characteristics were extracted from the records. A treatment need analysis form was constructed from the Dental Health Component (DHC) criteria of the Index of Orthodontic Treatment Need (IOTN) to identify the level of orthodontic treatment need. The data was recorded in the Microsoft Excel program and 10 samples were randomly rechecked 1 in every 50 recording sequences. SPSS was then used for descriptive analysis and analysis of the IOTN (DHC) level. Demographic parameters in this study included age, gender, chief complaint and malocclusion, while the level of treatment need parameter was grade 1-5 of IOTN (DHC).
RESULTS: The total samples comprised of 2,008 records. After excluded incomplete data, the final sample was 1,746 [454 males (25.7%) and 1,313 females (74.3%)]. The number of patients aged under and over 12 years was 291 (16.5%) and 1,476 (83.5%), respectively. The most common chief complaints were crowding, anterior protrusion, spacing and referral from dentists. According to IOTN (DHC), the level of treatment need demonstrated grade 5, 4, 3, 2 and 1; 114 (6.5%), 787 (44.5%), 297 (16.8%), 569 (32.2%) and none for grade 1, respectively
CONCLUSION: In this tertiary care institution, females sought orthodontic treatment about 3 times more often than males (25.7% male, 74.3% female). Most of the patients in the mixed dentition period were almost totally referred from paedodontists concerned about lack of space for permanent tooth eruption, crowding, protrusion and anterior crossbite, likewise patients in the permanent dentition mostly came regarding crowded teeth and protrusion issues. Orthodontic treatment need indicated almost the same amount of ‘Need’ (grade 4-5; 51%) and ‘No need’ (grade 1-3; 49%) of treatment.

SP 289 PREDICTABILITY OF VERTICAL MOVEMENTS IN UPPER INCISORS TREATED WITH THE CLEAR ALIGNER SYSTEM
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AIMS: To evaluate the predictability of the vertical movements included in the treatment plan of the ClinCheck® comparing to the real outcome of treatment and to answer the clinical question ‘does the attachments absence/present influence the difference between expected and real results?’

SUBJECTS AND METHOD: Eighteen patients were selected on a consecutive treating order; all treated with Invisalign®. The initial (S1) and final (S2) STL models were superimposed using the custom tool of Viewbox®, with the palatal vault as reference. The superimposition tool was set to find a 95 per cent correspondence and repeated three times. Digitization of an occlusal point and gingival point of all upper teeth from the first molar to first molar was done using a customized algorithm. A common reference occlusal plane was set on the S1 model and used to measure vertical displacement of the digitized points. All the values obtained from the measurements were compared to ClinCheck movement table. Right and left homologous teeth were coupled after testing for differences between the two sides (skewness close to zero). A 95 per cent confidence interval of the mean of torque and vertical displacement was calculated, together with standard deviation. An unpaired t-test ($P < 0.05$) and linear regression analysis were used to analyze the data and assess any significant changes resulting from treatment.

RESULTS: The $t$-test showed no significant difference between predicted and real values concerning laterals both for torque and intrusion values, while it was strongly present for centrals. The regression for laterals was 56 per cent, while for the centrals was only 31 per cent. The torque of the laterals differed only by $\pm 2.5$ degrees from prediction, while lateral incisor intrusion differed $+0.3$ mm more extruded from the prediction, which were not statistically significant. For the centrals the difference was $-6.6$ degrees and $+0.7$ mm and was significantly different.

CONCLUSION: The torque movements showed a high level of predictability, contrary to the pure vertical movements such as intrusion/extrusion. The lateral incisors showed better results for both type of movements. The attachments had a slightly positive influence, but this was not significant, in the expression of intrusion/extrusion; nevertheless, regarding torque, they showed a significant negative influence for the central incisors.

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**SP 290 ACCURACY OF DIGITAL MODELS DERIVED FROM TWO INTRAORAL SCANNERS COMPARED WITH PLASTER MODELS***

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AIMS: To determine the accuracy of nine parameters of the dental arches derived from two intraoral scanners compared to plaster models taken from subjects with malocclusions and patients previously completed orthodontic treatment.

SUBJECTS AND METHOD: Fifteen subjects with Peer Assessment Rating (PAR) scores ≥24 were included (Group 1). Group 2 comprised 15 subjects who had previously completed orthodontic treatment and had PAR scores ≤9. Three sets of dental models from each subject were obtained by three different methods (plaster models by Alginate® impression, digital models by Trios® (3Shape A/S, Copenhagen, Denmark) and Cerec Ortho® (Sirona, Dental, Thailand) intraoral scanners. Nine parameters on the plaster models were measured using a digital Vernier calliper. The digital models were measured by three-dimensional digitization processing software (MeshLab, Italy). The nine parameters (in mm) were: 1) Upper intercanine width; 2) Upper anterior arch width; 3) Upper posterior arch width; 4) Lower intercanine width; 5) Lower anterior arch width; 6) Lower posterior arch width; 7) Midline deviation; 8) Sagittal overjet and 9) Vertical overbite. Surface distance deviation of digital models derived from the two intraoral scanners was determined by superimposing the surfaces using colour mapping. Comparison of all parameters was assessed by two-way ANOVA using SPSS version 20.0 and with a level of significance of $P < 0.05$. Reliability of the measurements was tested by randomly selecting 25 per cent of the samples and repeatedly measuring at least two weeks apart. This study was approved by the Faculty Human Ethic Research Committee (No. DENTSWU-EC17/2560).
RESULTS: Paired t-tests showed no significant difference and there was a high correlation of each repeated measurement. All nine dental arch parameters from the plaster models and the two sets of digital models did not differ significantly in either group. The midline deviation of the Trios® digital models was the parameter that showed the most mean difference from the plaster models (mean 0.13 ± 0.27 mm; P = 0.620).

CONCLUSION: The digital models derived from the two intraoral scanners showed no significant difference in terms of two-dimensional arch parameters from the plaster models.

SP 291 EFFECTS OF KHON KAEN UNIVERSITY PRE-SURGICAL NASOALVEOLAR MOULDING DEVICE ON MAXILLARY MORPHOLOGY: A FULL PROTOCOL EVALUATION
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AIMS: To determine maxillary dimensional changes after using the Khon Kaen University presurgical nasoalveolar moulding (KKU-PNAM) prior to primary lip surgery.

MATERIALS AND METHOD: Twenty four maxillary ridge casts of infants with a unilateral complete cleft lip and palate (UCLP) were investigated post-KKU-PNAM treatment at three-time points: initial treatment (T1), two weeks after the first visit (T2) and before cheiloplasty (T3). Landmark identification and direct measurement of four linear variables, including alveolar cleft width, arch length, arch circumference, and midline deviation, were performed by one experienced investigator. Intraobserver reproducibility was verified via intraclass correlation (ICC). The data were analyzed via a repeated measure ANOVA.

RESULTS: The average pre- and post-treatment ages of the participants were 16.33 ± 17.36 and 123.21 ± 32.76 days respectively with a total treatment time of 105.29 ± 33.98 days. Alveolar cleft width and midline deviation significantly reduced over time from T1 to T3 (P = 0.00). Arch circumference continuously increased at all time points (P < 0.05). In contrast, there was no significant difference in arch length at T2 and T3 (P > 0.05).

CONCLUSION: The severity of the alveolar cleft width was reduced significantly post-application of the KKU-PNAM. At the first two weeks, the labial tipping effect played a major role and continuously decreased the cleft defect following adding a contraction-screw plate until cheiloplasty. Not only did the protocol decrease the alveolar cleft gap but also improved the positions of the maxillary segments allowing improved outcomes prior to cheiloplasty. Thus, presurgical orthopaedics with KKU-PNAM should be started as soon as possible.

SP 292 OXIDATIVE STRESS DURING ORTHODONTIC TREATMENT WITH FIXED APPLIANCES – A PILOT STUDY
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AIMS: To assess the level of systemic oxidative stress, defined as the imbalance between reactive oxygen species (ROS) and antioxidant defence (AD) in favour of the former, during the first week of orthodontic treatment with fixed appliances.

SUBJECTS AND METHOD: The treatment group (TG) consisted of 27 adult males (aged 24.6 ± 1.7 years) needing orthodontic treatment with fixed appliances. To exclude the influence of other external factors, which could affect the level of oxidative stress, a control group (CG) of healthy males, matched for age (24.7 ± 1.7 years) and having a very similar lifestyle as the TG was included. Capillary blood was collected at baseline, and 6 hours, 24 hours and 7 days after archwire insertion. At the same time points, capillary blood was retrieved in the CG. In order to determine the oxidative stress, both the ROS formation as well as the AD potential were measured using free oxygen radicals testing and free oxygen radicals defence (equivalent to antioxidative defence) testing, respectively. Furthermore, the ratio between ROS and AD (ROS/AD) was calculated and data analyzed using non-parametric tests.
RESULTS: At baseline, neither the ROS (1.74 ± 0.50 and 1.75 ± 0.41 for the TG and CG, respectively), AD (1.12 ± 0.45 and 1.14 ± 0.56 for the TG and CG, respectively) nor ROS/AD levels (2.11 ± 1.79 and 2.06 ± 1.35 for the TG and CG, respectively) were significantly different (P > 0.05). After 24 hours, the ROS level significantly increased in the TG (2.04 ± 0.55) and was significantly higher compared to the CG ROS level (1.72 ± 0.41; P = 0.025). While for the AD level, no significant between and within group differences were detected. A significant change of the ROS/AD ratio was observed over time only within the TG (P = 0.026). Moreover, a significantly higher ROS/AD ratio was detected 24 hours after archwire insertion in the TG compared to the CG (2.94 ± 1.88 and 1.84 ± 0.70, respectively), followed by a significant decrease.

CONCLUSION: Orthodontic treatment with fixed appliances might induce systemic oxidative stress, but only in the short-term, since ROS levels and the ROS/AD levels are normalized within 7 days after archwire insertion due to adaptive endogenous antioxidative response. However, intermittent changes of the ROS and AD levels during orthodontic treatment (i.e. at each archwire re-activation) could not be excluded.

SP 293 PERIODONTAL LIGAMENT ENHANCEMENT DURING ORTHODONTIC TOOTH MOVEMENT IN HUMANS
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AIMS: The application of orthodontic force to a donor tooth prior to tooth autotransplantation (TAT) leads to increased periodontal ligament (PDL) width, simplified extraction, and reduced risk of root resorption after TAT. The mandibular third molar is frequently used for TAT. The objective of this study was to directly examine the amount of proliferative PDL tissue on the root surface of extracted third molars following the application of orthodontic force.

MATERIALS AND METHOD: Thirty partially-erupted third molars with mesio-angulation, which were planned for removal during orthodontic treatment or before its completion, were included. The experimental molars (n = 15) received orthodontic force using an appliance connected to a single miniscrew anchorage as a means of orthodontic extraction, whereas the control teeth, the contralateral mesio-angular impacted third molars (n = 15), received no force application. Alterations in angulation and position of the third molars were monitored using panoramic radiographs. The extracted teeth were stained with toluidine blue to determine the amount of remaining PDL on the root surface under stereomicroscopy. The percentages of stained PDL areas were compared between experimental and control teeth using the independent t-test.

RESULTS: The mean percentage of remaining PDL tissue on loaded teeth was significantly greater than that on unloaded teeth (P < 0.05). On each side of the root, the mean proliferative PDL was significantly increased on the buccal, mesial and distal sides of loaded teeth, whereas the mean proliferative PDL on the lingual side was not significantly increased. When considering each part of the root, the mean proliferative PDL in the cervical and middle parts of loaded teeth was greater than that on unloaded teeth, whereas it was not significantly increased in the apical part. The most profound difference between the loaded and unloaded teeth was observed in the middle part of the root, followed by the cervical and apical parts.

CONCLUSION: Orthodontic loading before extraction increases the amount of PDL tissue on the whole tooth. Therefore, the findings suggest that orthodontic tooth movement enhances the PDL of impacted third molars.

SP 294 THREE-DIMENSIONAL ASSESSMENT OF FACIAL MOTION IN ORTHOGNATHIC SURGERY PATIENTS – A NOVEL APPROACH TO MONITOR POST-OPERATIVE ADAPTATION
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AIMS: Facial motion and expression are a significant part of daily communication and social interaction. Variations in facial shape such as dentofacial deformities or severe malocclusions are known to affect those movements, which may affect non-verbal communication negatively. For objective, quantitative assessment of facial motion, four-dimensional (4D) imaging is necessary (3D+time). The aim of this study was to evaluate stereophotogrammetry as a means to investigate facial motion in healthy control subjects and in patients undergoing orthognathic surgery.

SUBJECTS AND METHOD: This pilot study, with an exploratory prospective design, included 15 subjects (5 controls: Class I, 10 patients prior to orthognathic surgery, 5 Class II, 5 Class III). The subjects were asked to perform three facial expressions (maximal smile, cheek puff and lip purse) starting from a rest position while being recorded with a three-dimensional (3D) camera system. Soft tissue landmarks were digitized on each image. The magnitude of the facial expressions was measured and compared between controls, Class II and III patients.

RESULTS: Recording facial expressions using 3D, non-invasive imaging was feasible. A protocol for capturing and measurement of the expressions’ magnitude could be established. Facial motion was subject-dependent and differed between the Classes.

CONCLUSION: This non-invasive approach for 3D assessment of facial motion is a first step for developing 4D analysis in orthognathic treatment in the near future. This may be useful for pre-operative planning of orthognathic surgery as well as for monitoring functional post-operative adaptation or detection of early relapse tendencies.

SP 295 COMPARISON OF SOFTWARE PACKAGES IN MEASURING GEOMETRIC FEATURES OF ORTHODONTIC MINISCREWS
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AIMS: To compare four software packages in measuring linear and angular measurements of geometric features of orthodontic miniscrews from scanning electron microscope (SEM) images.

MATERIALS AND METHOD: Ten miniscrews from each of four different manufacturers. Four different types of software packages were included in this study. The miniscrews were scanned with scanning electron microscope (SEM). The shafts were magnified to ×45-55 magnifications. Measurements were done with each of the software packages. Measurements included; pitch depth, pitch width, flank, and thread, insertion, and lead angles. All measurements were carried out twice at two time points separated by three weeks. Testing the normality of data distribution resulted in normally distributed data that was then analyzed with ANOVA and post hoc test. Intraclass correlation coefficient (ICC) was used to measure reliability.

RESULTS: Pairwise comparison showed that flank was the only feature that showed a significant difference (P ≤ 0.05) in its measurement obtained by each software package for each of the four miniscrew types. ICC of measurement-remeasurement reliability showed a high degree of interrater reliability for all the seven geometric features with all the four software programs, the value of ICC ranged from (0.9-1.0).

CONCLUSION: The findings do not give superiority to one software package over the others. Even digital measurements might be influenced by the rater who uses the software.

SP 296 CLINICAL OUTCOME OF ORTHODONTICALLY TREATED PATIENTS WITH MAXILLARY CANINE IMPACTION
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AIMS: To evaluate the clinical outcome of different treatment procedures of maxillary canine impaction and to investigate the relationship between the impaction parameters and the choice of treatment and between these parameters and the outcome.

MATERIALS AND METHOD: The database records of patients with at least two panoramic radiographs, taken between the ages of 7 and 14 years, with a minimum 1 year and maximum 3 year interval (T1 and T2) were selected. Determination of impaction was made at T1 using the
sector and canine to midline angle (3\(^{\text{ML}}\)). From the 2361 records, 572 impactions were selected at T1. Of those, 266 patients were treated or in treatment at T2. After screening of this sample 196 patients remained. A distinction was made between surgical and non-surgical treatment and between expansion and space gaining techniques. The clinical outcome was evaluated at the end of treatment. The aesthetic outcome was assessed by defining the maxillary canine aesthetic index (MCAI), colour and midline deviation. The status of the pulp and the periodontal ligament were checked during clinical examination.

RESULTS: The MCAI score was on average 0.78 higher in patients receiving maxillary expansion when compared to those where space gain was performed (\(P = 0.0199\)). Besides, there was a trend towards more discolouration in the expansion group. There was a significantly greater risk of undesirable pulpal vitality (\(P = 0.0045\)) and a higher sector and 3\(^{\text{ML}}\) for the surgical group (\(P < 0.0001\)). The treatment of choice was open exposure when the vertical position of the canine was higher (\(P = 0.0087\)). A higher level of the vertical position of the canine was associated with an increased chance of a higher MCAI score (\(P = 0.0297\)). A greater sector score gave a major chance of an abnormal pulpal diagnosis (\(P = 0.0309\)).

CONCLUSION: Non-surgical eruption and surgical exposure with orthodontic alignment have minor effects on the outcome. Ultimately, the choice of treatment may depend on the clinical indications, the patient's and the orthodontist's preferences. Ideal management of an impacted canine is a complex process involving a multidisciplinary approach. Evidence-based diagnosis, treatment planning and appropriate technique can result in a highly successful outcome.

SP 297 MAXILLARY PROTRACTION: DENTAL ANCHORAGE VERSUS SKELETAL ANCHORAGE. LITERATURE REVIEW
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AIMS: To determine the main differences, in terms of skeletal and dentoalveolar effects produced by maxillary protraction assisted by temporary anchorage devices (TADS) versus conventional dental rapid palatal expanders.

MATERIALS AND METHOD: A literature review was carried out in the following databases: PubMed, Cochrane or Web of Science. The keywords used were 'Class III', 'TAD', 'maxillary protraction' and 'rapid palatal expansion'.

RESULTS: Maxillary protraction is an effective treatment of Class III with maxillary deficiency. Greater skeletal effects were found when skeletal anchorage was used, and good skeletal results at ages close to the peak of growth can be found. Likewise, dentoalveolar effects are reduced. There is a slightly greater advance of point A when using skeletal anchorage, as well as a reduction in the proclination of the upper incisor. Retroclination of the lower incisors was a common finding with the use of the face mask.

CONCLUSION: The use of skeletal anchorage in protraction treatment of the maxilla improves skeletal changes and reduces dentoalveolar effects, especially at the level of the upper incisor.

SP 298 FREE RADICAL PRODUCTION IN GASTROINTESTINAL TRACT CELLS INDUCED BY TITANIUM AND NICKEL IONS FROM ORTHODONTIC ALLOYS
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AIMS: To investigate the oxidative stress in human cells of gastrointestinal tract in the presence of metallic ions released by corrosion of nickel-titanium (NiTi) alloy.

MATERIALS AND METHOD: The dynamics of nickel and titanium ions release from 18 samples of NiTi archwires (0.020 \(\times\) 0.020 inch\(^1\)) immersed in artificial saliva (pH 4.8, 37°C) for a period of two weeks was recorded. Induction of free radicals was assessed in commercial cell lines of human...
tongue CAL 27, liver HEP G2 and colon Caco-2 after exposure to real concentration of corrosion products, ×5 concentration and dilutions of ×0.5 and ×0.1. Influence of each metal separately was performed by exposing cells to only nickel or only titanium ions. Cells were monitored for 24, 48 and 72 hours.

RESULTS: There was a significant increase in free radicals in all cell lines after 24 and 48 hours, when the concentration of both metals was at least 162 µg/L and comprised a combination of 75.5 µg/L Ni and 86.5 µg/L Ti or 128 µg/L Ni and 44.9 µg/L Ti (P < 0.001). The effect was lower after 72 hours. Shorter exposure induced more free radicals (24 hours, 30-100%) than longer exposure (48 and 72 hours, 10 to 40%). More oxidative stress was present in tongue cells. The concentration of 30.4 µg/L Ni and 17.3 µg/L Ti, was the highest recorded in saliva during 14 days, or the concentration of both metals together with at least 42.3 µg/L induced mostly <50 per cent of the radicals, both at the shorter and longer exposure periods. Nickel and titanium are equally important predictors of radical production.

CONCLUSION: Corrosion of NiTi alloys in low pH saliva induce higher oxidative stress in tongue cells than in liver and colon. Lower oxidative stress after longer exposure implies a high reparatory ability of cells.

SP 299 PATHOHISTOLOGICAL CHARACTERISTICS OF GINGIVAL TISSUE IN ORTHODONTIC PATIENTS WITH NICKEL AND TITANIUM ALLERGIES
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AIMS: Nickel (Ni) and titanium (Ti) are constituent elements of orthodontic alloys and both can cause contact allergic stomatitis. The spectrum of signs and symptoms of oral contact allergy is wide. There is no single pathognomonic sign or specific clinical picture. The aim of this research was to assess the pathohistological changes in gingival tissue in orthodontically treated patients with an allergy to Ni and/or Ti.

SUBJECTS AND METHOD: Patients undergoing orthodontic therapy with gingival hyperplasia were subjected to initial periodontal therapy. In those with persisting gingival enlargement after initial periodontal therapy, an external gingivectomy was performed (N = 29). Gingival fragments were processed with the paraffin-embedding histological technique and stained with haematoxylin-eosin. Allergy to Ni and Ti was diagnosed after performing a patch test on the upper arm skin. Allergens included nickel sulphate, titanium, titanium dioxide, titanium oxalate, titanium nitride and petrolatum as the control.

RESULTS: An allergy was present in 35 per cent of the subjects. The gingiva of allergic subjects demonstrated a slightly higher severity of inflammation and fibrosis, somewhat more frequently epithelial changes (mild hyperplasia, spongiosis but also colliquation of basal layers), and focal inflammatory infiltrates. Also, in allergic subjects inflammation was often localized near the basal membrane. Lymphocytes, histiocytes, plasma cells, eosinophils and neutrophils were present. However, the majority of pathohistological findings did not differ between groups at a statistically significant level. Pronounced exocytosis and band-like inflammatory infiltrates were significantly more often present in allergic subjects (P < 0.05).

CONCLUSION: The presence of exocytosis and band-like inflammatory infiltrates appear to be the most characteristic signs of allergy to Ni and Ti in gingival tissue.

SP 300 IMPROVING ORAL HYGIENE IN ORTHODONTIC PATIENTS BY APPLYING MOTIVATIONAL INTERVIEWING ACCORDING TO THE TRANSTHEORETICAL MODEL STAGES OF CHANGE
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AIMS: To assess the improvement in oral hygiene in orthodontic patients wearing fixed appliances after a single session of motivational interviewing (MI) regarding the stage of change of the transtheoretical model. It was hypothesised that MI is useful to improve oral hygiene behaviour in orthodontic patients presenting poor oral hygiene at baseline and identified with the contemplation stage of change (when a person starts to consider modifying the behaviour by weighing the pros and cons of changing).

SUBJECTS AND METHOD: Seventy one orthodontic patients, aged 13 (12-16) years, wearing fixed appliances in both arches, recruited from September 2016 to December 2017. At baseline, they were categorised according to the transtheoretical model of Prochaska and Diclemente, a model to determine health-related behaviour based on people’s readiness to change habits, hygiene was evaluated using the plaque index (PI; Löe and Sillness) and they received a single session of motivational interviewing focused on facilitate their movement towards a desired improvement of oral hygiene change behaviour. At the 6 month follow-up, oral hygiene was evaluated using the same PI. To compare the PI at the two time-periods separately regarding the baseline stage of change, the Chi2 test or Fisher’s exact test were used. Analyses were conducted with Stata 14.0.

RESULTS: A total of 31 participants (44%) who presented poor oral hygiene at baseline (PI > 1) improved their oral habits at the 6 month follow-up (PI <= 1). According to the baseline stage of change, 42 per cent were identified with the contemplation stage, 39 per cent with the preparation, 16 per cent with the action stage and 3 per cent with the maintenance stage. This association was statistically significant ($P = 0.033$).

CONCLUSION: Participants with poor oral hygiene wearing fixed appliances showed an improvement of their oral habit behaviour after a single session of MI, which was more effective in those identified with the less advanced stages of change as the contemplation one.

SP 301 ECTOPIA ERUPTION PATTERN OF THE PERMANENT MAXILLARY CANINE – TO FOLLOW OR TREAT?

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AIMS: To describe initial starting points for treatment planning based on the initial Rotational Tomogram (RT) in the case of displaced maxillary canine in the developing permanent dentition. The incidence of dental anomaly patterns in the study population evaluated (Peck, 2009).

MATERIALS AND METHOD: The study approach was cross-sectional and longitudinal. The data consisted of 1424 RTs taken of the developing permanent dentition of both girls and boys. The average age was 9.3 years (girls 9.2, boys 9.4). The RTs were taken as part of dental check-ups in Health Center in Eastern Finland. In the study 136 cases that showed displaced maxillary canine on the RT were analyzed. The maxillary canine was considered displaced if the crown overlapped more than a half of the root of the lateral incisor and/or if the inclination on the long axis of the canine to the maxillary midline exceeded 25 degrees. More information was collected from the dental records and radiographs taken later during follow-up or orthodontic treatment. Due to missing records the final number was 113 (51 girls, 62 boys). All the information was gathered in Microsoft Excel and SPSS was used for statistical evaluations.

RESULTS: Seventy per cent of the maxillary canines that were considered displaced based on the initial RT erupted normally, and no treatment of any kind was needed. Another result was that in the study data almost one-third of the patients also had other dental anomalies, that frequency being higher than for eruption disturbances of only a single tooth.

CONCLUSION: Although, the eruption route of the permanent canine is long and variable usually it is positioned in the right place in the dental arch. Regardless of the result, it is abnormal for a maxillary canine to be shown displaced of this degree in the RT. Thus, it is important to keep an eye
on the development of the permanent dentition with appropriate follow-ups, which allows quick orthodontic intervention and treatment when necessary.

**SP 302 EFFECTS OF IMMEDIATE CANINE RETRACTION FOLLOWING PREMOLAR EXTRACTION**
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**AIMS:** To 1) evaluate the amount and rate of maxillary canine movement after immediate canine retraction following premolar extraction, and 2) to evaluate the change in angulation of the canine after retraction for four months.

**MATERIALS AND METHOD:** Twenty maxillary canines were observed in this study. After the levelling phase, the maxillary first premolars were extracted, and the canines were immediately retracted using nickel titanium closed coil springs (50 g). Three-dimensional (3D) intraoral scans were recorded before and after canine retraction monthly for four months. The lateral cephalograms were recorded before and after four months of canine retraction. The amount and rate of canine movement each month was measured and calculated from superimposition of the 3D models. The change in angulation of the canines was evaluated from superimposition of the lateral cephalograms. One-way ANOVA was used to compare the mean rate of canine movement between each month.

**RESULTS:** After canine retraction for four months, the mean rate of canine movement was 0.91 mm/month. The mean rate in the first month was 0.88 ± 0.35 mm and increased to 1.02 ± 0.57 mm in the second month. The mean rate in the third month was similar to that in the second month (1.02 ± 0.47 mm) and decreased to 0.73 ± 0.39 mm in the fourth month. The rate between each month was not significantly different. The mean change in angulation of the canines was 8 ± 2 degrees.

**CONCLUSION:** Immediate canine retraction following premolar extraction can be performed with light continuous force. The rate of canine movement increases in the second month and then decreases in the fourth month to less than that in the first month. The change in angulation of the canines is acceptable and can be controlled.

**SP 303 UPPER AIRWAY CHANGES FOLLOWING MANDIBULAR ADVANCEMENT SURGERY IN SKELETAL CLASS II PATIENTS**
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**AIMS:** Correction of anatomic abnormalities of the upper airways by surgical advancement of the mandible, have been reported at varying degrees and continues to be debated nowadays. The purpose of this study was to evaluate the immediate changes in superior posterior airway space (SPAS) in skeletal Class II patients that underwent mandibular advancement surgery.

**MATERIALS AND METHOD:** The records of 37 patients with a skeletal Class II were selected from the database. A cephalometric evaluation was performed pre-operatively (T0), up to 1 month before surgery and post-operatively (T1), up to 1 month after surgery. Cephalometric analysis was performed using Dolphin Image & Management Solutions according to the of Arnett/Gunson FAB Surgery method. The differences due to the surgical intervention were assessed with a Student’s t-test and a principal component analysis (PCA) was used to evaluate the relationship between mandibular advancement and SPAS variables. A Mann-Whitney test was used to evaluate anti-clockwise and clockwise rotation of the occlusal plane in both groups. The statistical analysis was conducted in SPSS and R assuming a 0.05 level of significance.

**RESULTS:** As an effect of mandibular advancement, an anteroposterior statistically significant increase in SPAS (P < 0.001) was perceived at all points measured. No statistically significant differences were observed between patients who underwent anti-clockwise rotation or clockwise rotation of the occlusal plane. The PCA performed on the mandibular advancement and SPAS variables, indicated that two dimensions accounted for 81.4 per cent of the variance and the
difference in point A is at the same dimension of the mandibular advancement, whereas the other variables mostly contribute to an orthogonal dimension.

CONCLUSION: Mandibular advancement surgery is a valid option to achieve widening of the SPAS in patients with skeletal Class II morphology.

SP 304 DESCRIPTIVE STUDY COMPARING A RAPID MAXILLARY EXPANDER AND QUADHELICES IN FACEMASK THERAPY IN PATIENTS WITH SKELETAL CLASS III
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AIMS: To compare the dentoalveolar and skeletal effects of a facemask and rapid maxillary expander (RME) versus a facemask and quadhelix (QH).

SUBJECTS AND METHOD: Twenty six patients with a skeletal Class III (13 males, 13 females) treated with face mask therapy, were divided into two groups. The first group was protracted by a RME and the other group by a QH. A lateral skull radiograph was obtained with X-MindPanoD+, before and after therapy. Using NemoCeph software (Nemotec, Madrid, Spain), a series of cephalometric variables were used to compare the changes produced. Statistical comparisons were performed with the SPSS statistics program using the Student t-test.

RESULTS: Similar changes were found in RME and QH groups, except in some variables that showed different effects in the mandibular bone (SNB: +0.13 and −0.7; Tweed: −1.12, +0.1°, respectively), and in some intermaxillary relationships (ANB: +1.44, +2.2°, Wits: +0.79, +1.9 mm, respectively; P < 0.05).

CONCLUSION: Both intraoral mechanisms are efficient to treat skeletal Class III malocclusions, with facemask protraction therapy. The QH appliance produces a more unfavourable effect in patients with a vertical growth pattern because the QH opens the bite, and as a result there is posterior mandibular rotation.

SP 305 ORTHODONTIC MINISCREW FAILURE RATE AND ASSOCIATED RISK FACTORS
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AIMS: To retrospectively determine the failure rate of miniscrews placed in orthodontic patients between 2013 and 2018.

MATERIALS AND METHOD: Based on previous studies it was expected to find a failure rate of around 15 per cent, assuming an accuracy of ±7 per cent and a confidence level (1−α) = 95 per cent. Therefore, a sample of 100 miniscrews placed in 63 orthodontic patients were evaluated. The variables studied were classified as (1) patient-related factors: age, gender and craniofacial skeletal pattern; (2) location-related factors: bone (maxilla or mandible) and area, (3) Temporary anchorage device-indication (intrusion/retroversion with maximum anchorage, canine traction). In these comparisons, the Student’s t-test was used in dichotomous variables and the one-way ANOVA test in variables with more than two categories. Survival analysis was performed using the Kaplan Meier technique and the survival time was compared according to different variables with the log rank test (Mantel-Cox). By means of the chi-square test, an association between the location (maxillary/mandible) and the causes of the failure of the mini-screw was studied. In all comparisons, a significance level of α = 0.05 (type I error) and a statistical power of 0.80 (type II error = 0.20) were used. The analysis was carried out with SPSS V22.

RESULTS: A total failure rate of 18 per cent was observed. There was no statistically significant difference in failure regarding gender, age, craniofacial pattern, and location factors (maxilla/mandible).

CONCLUSION: In this sample the 18 per cent failure rate is consistent with previous studies. Gender, age, craniofacial pattern and location do not seem to play a role in the success of miniscrew stability
SP 306 PALATAL EXPANSION PERFORMED BY BONE-BORNE EXPANDERS SUPPORTED BY FOUR VERSUS TWO MINISCREWS. A BIBLIOGRAPHIC REVIEW
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AIMS: A bibliographic review was carried out to analyze the changes produced at the skeletal, dental and facial levels after rapid palatal expansion with bone-borne expanders supported by two or four miniscrews.

MATERIALS AND METHOD: The databases used in the search were PubMed, Embase and SciverseDirect; in all languages. Clinical trials, cohort studies, case-control studies, cross-sectional studies, retrospective and prospective studies investigating changes in skeletal, dental and facial structures after palatal expansion with bone-borne expanders from 2010 to 2018 were included. These studies should have cone beam computed tomographic images taken before and immediately after treatment. Case reports, animal studies, finite element studies, in vitro tests, combined appliances studies with bone-borne expanders, studies with surgically assisted palatal expansion, subjects with syndromes and/or systemic pathology with craniofacial malformation, comments or letters of editorials were excluded.

RESULTS: From the 1035 initial articles, only 10 were finally included in the review. 1. Both bone-borne expanders produced successful opening of the midpalatal suture. The difference between them relied not on the number of miniscrews but on the miniscrew insertion sites and whether they were also anchored to teeth. 2. Bone-borne expanders supported by two miniscrews for pure skeletal expansion were usually placed more occlusally to get more support, causing greater alveolar bending. 3. Bone-borne expanders supported by four miniscrews were placed in the middle and back of the palate in a sagittal direction and vertically high in the palatal vault, so in this group there was less alveolar bending, but to have a good stability they were anchored to the tooth causing an increase in dental side-effects.

CONCLUSION: The desirable expander, would be a bone-borne expander supported by four miniscrews without dental support for pure skeletal expansion, in which the miniscrews are placed as posterior as possible, close to the centre of resistance (CR) of the palate and as high as possible in the palatal vault close to the CR of the two halves of the maxilla.

SP 307 TREATMENT OF ADOLESCENTS: REINFORCING FOLLOW-UP USING ARTIFICIAL INTELLIGENCE AND REMOTE MONITORING***
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AIMS: Good control of treatment progress is a necessity. This is even truer for adolescents, not only because of recurrent problems with hygiene, compliance, or elastic wear, but also because of the high variability and unknowns of growth. In the model of the new telemedicine, can remote monitoring and artificial intelligence offer the orthodontist, new possibilities to earlier intercept many issues and timely adapt treatment mechanics?

SUBJECTS AND METHOD: More than 1500 adolescents in Europe, North America and Australia from 2015 to 2018, treated by interception, braces or aligners were monitored using intraoral photographs, taken every two weeks with a mobile app and controlled by dental monitoring. These photographs were analyzed by artificial intelligence and a clinical team. Protocols had been predefined for basic instructions to be automatically sent to the patient. Daily reports were sent to the clinicians for all notifications of events requiring a review and teleconsultation.

RESULTS: Many clinical events were detected early and intercepted, such as gingivitis, white spots, gingival recession, appliance damage, debonding, archwire breakage, occlusal interferences, tooth abrasion, insufficient elastic wear, overtreatment or side effects with maxillary expanders, Herbst rods, Carriere Motion, aligner mandibular advancement, evolution of impacted teeth, lingual dysfunction, crossbite or open bite development.
CONCLUSION: For adolescent treatment, artificial intelligence and first experiences of remote monitoring demonstrate new perspectives of reinforced follow-up, with early interception of many issues and timely adaptation of treatment mechanics.

SP 308 AUDIT OF MEDICAL RECORD KEEPING FOR ORTHODONTIC CASUALTY PATIENTS IN A TEACHING HOSPITAL – A MOVE TOWARDS PAPERLESS NOTES?
Chloe Rolland, Shirley Cox, Department of Orthodontics, Royal London Dental Hospital, U.K.

AIMS: To investigate compliance with record keeping requirements for patients seen on the orthodontic casualty clinics. At the Royal London Hospital, notes for all patients used to be requested prior to patients being seen for both routine and unplanned visits. The note storage system has changed in the last few years meaning that notes are stored off-site and may not be available on the day of request.

MATERIALS AND METHOD: A retrospective two-cycle audit was undertaken at the between June 2017 and February 2018. Each cycle examined the notes of all patients seen in the orthodontic casualty clinic over the course of one week and assessed their compliance with national guidelines for record-keeping.

RESULTS: The first cycle, with all notes recorded on temporary paper notes, yielded 7 per cent compliance with national standards explained by logistical difficulties in the medical records department, preventing merging of temporary folders with clinical notes. The second cycle, following implementation of an electronic record of orthodontic visits, yielded an improved result of 70 per cent compliance.

CONCLUSION: The move to electronic note-keeping in a department still heavily reliant on paper notes can be a difficult transition for clinicians, highlighted by the incomplete uptake of the method (70%). The result still shows a vast improvement which will go towards improving the care of patients seen by multiple teams and clinicians.

SP 309 ESTIMATION OF THE ANXIETY LEVEL OF ORTHODONTIC PATIENTS: A LONGITUDINAL PILOT STUDY
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AIMS: To quantify and compare the anxiety level of adult patients undergoing orthodontic treatment and to assess any possible differences between patients treated in the National and Kapodistrian University of Athens and in a private orthodontic office, both located in Athens, Greece.

MATERIALS AND METHOD: The Greek version of the State-Trait Anxiety Inventory for adults (STAI-AD) was used to assess the anxiety level of adult patients undergoing an orthodontic treatment. The study sample was divided in two groups: one consisted of patients treated in the University’s postgraduate clinic and the other patients treated in private practice. Patients were asked to answer the questionnaire in the waiting room before the orthodontic appointment. Patients should be aged more than 16 years and have answered the questionnaire only once in order to meet with the study’s elimination criteria. The data from the filled questionnaire forms were grouped using MS Excel (2013) Software. In this pilot study each group consisted of five patients.

RESULTS: When referring to the scores gained from the University’s clinic, the average score was 34.8 for STAI Form Y-1, 40 for Form Y-2 and 74.6 for the total scale. The average scores for the patients treated in the private orthodontic office were 39.8 for Form Y-1, 41.6 for Form Y-2 and 81.4 for the total scale.

CONCLUSION: The results indicate that the patient group treated in the private orthodontic office marked closer scores to the average scores for the general Greek population in all three categories of the STAI, than the patient group treated in the University clinic. Further studies should be conducted between the two groups on a larger scale.
SP 310 LEPTIN REDUCES IN VITRO CEMENTOBLAST PROLIFERATION AND PROMOTES PROSTAGLANDIN E\textsubscript{2} EXPRESSION
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AIMS: Juvenile obesity is a complex clinical condition that is present more and more frequently in daily orthodontic practice. Over-weight patients have an impaired bone metabolism, due in part to their increased levels of circulating adipokines. Particularly leptin has been reported to play a key role in bone physiology promoting osteoclast formation and bone resorption. Leptin is ubiquitously present in the body, including blood, saliva and crevicular fluid. If, and to what extent, it could influence the reaction of cementoblasts during orthodontic induced forces, is yet unknown.

MATERIALS AND METHOD: OCCM mouse cementoblast cells (Prof. M. Somerman/ NIDCR Bethesda, Maryland) were cultivated until confluence. To promote calcification, 50 µg/ml ascorbic acid and 10 mM ß-glycerophosphate was added to the cell culture media. Cells were cultivated under compressive forces of 1.2; 2.4 and 4.8 gr/cm\textsuperscript{2} using different concentrations of mouse leptin (Prospec. Cat. CYT-351). Alkaline phosphatase enzymatic activity was analyzed using an established protocol. Alizarin red staining was employed to visualize calcification. The relative mRNA expression of Leptin Receptor, Runt-related transcription factor 2, Osteoclastin, Rank-Ligand, Sclerostin, Caspase 3, Caspase 8 and Caspase 9 were analyzed by real-time polymerase chain reaction test. Quantitative western blots were employed to analyze Extracellular Signal Regulated Kinases (ERK) 1/2 and p-ERK protein expression. The ERK1-2 antagonist (FR1802014. Calbiochem-Merck) was used and further the release of Prostaglandin E\textsubscript{2} (PGE\textsubscript{2}) was analyzed by Elisa. The results were compared using the Mann-Whitney-U test. A value of \( P < 0.05 \) was considered statistically significant.

RESULTS: In vitro, when compressive forces are applied, Leptin promotes ERK 1 and 2 phosphorylation, as well as upregulates PGE\textsubscript{2} and Caspase 3 and Caspase 9 on OCCM cells. These findings were accompanied by impaired calcification and reduced alkaline phosphatase enzymatic activity in a dose dependent manner for Leptin. Blockade of ERK 1 and 2 impairs leptin induced PGE\textsubscript{2} secretion and reduced Caspase 3 and Caspase 9 expression.

CONCLUSION: Leptin decreases cell proliferation and has a pro-inflammatory and pro-apoptotic effect on cementoblast and could thus play a role in orthodontically induced root resorption.

SP 311 EVALUATION OF SKELETAL AND OCCLUSAL CHARACTERISTICS IN CASES OF CONGENITALLY ABSENT MAXILLARY LATERAL INCISORS
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AIMS: Regardless of the third molars, the maxillary lateral incisors (MLI) have the highest prevalence of congenital absence. The aim of the present study was to evaluate the occlusal and cephalometric characteristics of patients with missing MLI.

MATERIALS AND METHOD: Pre-treatment dental casts and cephalometric radiographs of 26 adult patients who had unilateral or bilateral MLI missing and had been treated in were selected according to the inclusion criteria. The following occlusal features were measured: upper and lower arch width in the canine and molar area, arch length, overjet and overbite and any anomalies or missing other teeth of both jaws. Cephalometric measurements included the sella nasion A angle (SNA), sella nasion B angle (SNB), the ANB angle and the Wits analysis. The findings of dental casts were compared with a control group with normal occlusion and the cephalometric measurements were compared with standard cephalometric norms.

RESULTS: Among the studied 26 patients, eight subjects had bilateral and 18 patients unilateral MLI missing. In the cases of unilateral missing MLI, 66.67 per cent (12 cases) had MLI missing on the right side. In 12 cases out of 26 (46.15%), the missing MLI was associated with other dental anomalies or congenitally absent teeth. In comparison with a control group, the overjet was
significantly less \((P < 0.05)\) and the upper intercanine width smaller. Both ANB angle and Wits were significantly decreased in the MLI missing group \((P < 0.05)\).

CONCLUSION: Congenital absence of a MLI was highly correlated with other tooth anomalies. Most cases with absent MLI demonstrated some collapse in the maxillary arch and had some features of a skeletal and dental Class III malocclusion.

SP 312 THE EFFECT OF DIFFERENT TYPES OF PALATAL EXPANSION APPLIANCE ON PALATAL DIMENSIONS AND THE STRESS DISTRIBUTION IN ALVEOLAR BONE OF THE ANCHOR TEETH
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AIMS: Palatal constriction is one of the common occlusal discrepancies and there are two nonsurgical available treatments for it: Slow palatal expansion (SPE) or rapid palatal expansion (RPE). The aim of this study was to compare the effect of these treatments on palatal dimension and to evaluate the stress induced in the apical and crestal alveolar bone of the anchor teeth.

SUBJECTS AND METHOD: Twenty four patients (aged 10-16 years) with palatal constriction who were candidates for palatal expansion treatment were selected. Palatal expansion treatment was done with the SPE protocol by acrylic removable appliances (RA) at the rate of 0.5 mm expansion per week or with the RPE protocol by banded fix appliances (FA) at the rate of 0.25 mm expansion per day. Palatal measurements including intermolar width (IMW), intercanine width (ICW) and palatal depth (PD) were measured from dental casts, before and immediately after active treatment. To compare the stress induced in alveolar bone, two three-dimensional finite element method (FEM) models were designed of a mesio-distal slice of the maxilla containing the upper first molars and their periodontium and alveolar bone. One model was with RA and the other one with FA. The stress was evaluated after modelling of 0.2 mm expansion.

RESULTS: The mean increase of IMW was 6.13 mm in RPE and 5.00 mm in SPE; while the mean increase of ICW was 1.68 mm and 3.85 mm for RPE and SPE respectively. The difference between the increase of IMW and ICW was significantly higher in RPE than SPE \((P < 0.05)\). No significant changes in palatal depth were observed in either group. According to FEM analysis the level of stress induced in the PDL of anchor teeth in the RA and FA model was 40.00 e-2 and 4.88 e-2 MPa, respectively.

CONCLUSION: Both types of treatment resulted in more expansion in the posterior than the anterior area. However, the difference was less with the RA. FEM revealed that palatal expansion with RA induced more apical and crestal stress in the periodontium of the anchor teeth rather than palatal expansion with the banded FA.

SP 313 PERIODONTAL HEALTH STATUS WITH ORTHODONTIC BONDED RETAINERS IN THE LOWER ARCH. LITERATURE REVIEW
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AIMS: To perform a literature review regarding the periodontal health of orthodontic patients in retention with lower bonded retainers.

MATERIALS AND METHOD: A search of Embase, PubMed, Cochrane and grey literature databases was performed. Keywords: bonded retainers, vacuum-formed retainers, periodontal health outcomes, fixed retainers, periodontal disease and stability.

RESULTS: The presence of bonded retainers appears to increase the levels of plaque, gingival inflammation, calculus and gingival recession, when compared to patients using vacuum-formed retainers. However, the indices recorded in most part of the articles do not suggest clinically significant implications for periodontal health.

CONCLUSION: The mandibular bonded retainer is more effective at reducing post-treatment changes in the labial segment alignment. Bonded retainers are more likely to fail than vacuum-formed ones.
SP 314 THREE-DIMENSIONAL COMPUTED TOMOGRAPHY ANALYSIS OF AIRWAY VOLUME CHANGES IN GROWING CLASS II PATIENTS TREATED WITH THE FRÄNKEL APPLIANCE

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AIMS: To retrospectively investigate the effect of the Fränkel II growth modification appliance on dentoskeletal structures and airway volume in Class II patients.

SUBJECTS AND METHOD: Following IRB approval, the records of a convenience sample of 30 Angle Class II patients were collected from a private dental practice. Patients (mean age 9.9 ± 2.4 years) were scanned using i-CAT cone beam computed tomography (Imaging Sciences, Hatfield, Pennsylvania, USA) before treatment and 8 months after using the Fränkel appliance. A set of airway parameters, total airway volume, most constricted area and soft tissue thickness of the airway, maxillary width and dental arch width at the levels of first permanent molars, first premolars and canines were measured before and after treatment using Dolphin Imaging software v. 11.9 Premium (Dolphin Imaging, Chatsworth, California, USA). Intraclass correlations (ICC) and Bland-Altman plots were performed for reliability testing. Measurements before and after treatment were compared using Wilcoxon signed rank test. Significance was accepted at P ≤ 0.05 for all tests.

RESULTS: ICC values were ≥0.80 for all reliability measures. Airway volumes of nasal cavity, nasopharynx, oropharynx and hypopharynx, total airway and the most constricted area of the airway significantly increased after treatment. Significant increases were also found in maxillary, intermolar, interpremolar and intercanine widths. No significant changes were detected in the soft tissue thickness of the airway before or after treatment.

CONCLUSION: The Fränkel II appliance causes a significant increase in airway volume as well as maxillary width and dental arch width in Class II patients.

SP 315 WHAT DOES CONE BEAM COMPUTED TOMOGRAPHY TELL US ABOUT ORTHODONTICALLY INDUCED ROOT RESORPTION?

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AIMS: Orthodontically induced external root resorption (OIRR) is a pathological consequence of orthodontic tooth movement. However, the limitations of two-dimensional radiography suggest that cone beam computed tomography (CBCT) with its three-dimensional capabilities might be more suitable to assess OIRR. The aim of this study was to assess, in an evidence-based manner, data on linear or volumetric OIRR measurements of permanent teeth by means of CBCT, during and/or after the end of orthodontic treatment.

MATERIALS AND METHOD: Fifteen databases were searched without restrictions up to January 2017 for randomized clinical trials, prospective, and retrospective non-randomized studies assessing OIRR during and/or after orthodontic treatment using CBCT in human patients. After duplicate selection, data extraction, and risk of bias assessment according to the Cochrane guidelines, random-effects meta-analyses, followed by subgroup, meta-regression, and sensitivity analyses were also performed in order to evaluate factors that affect OIRR.

RESULTS: Thirty three studies (30 datasets) were eligible for inclusion in the qualitative analysis while data from 27 of them were included in the quantitative analysis. Comparisons made after data exclusion from randomized trials found that appliance-related factors had little to no influence on OIRR. Explorative analyses performed in non-randomized studies found a pooled OIRR of 0.79 mm based on all of them and 0.86 mm when OIRR was assessed at the end of orthodontic
treatment. OIRR was significantly associated with treatment duration with an additional 0.18 mm OIRR (95% confidence interval 0.01-0.36; \( P = 0.04 \)) for each additional 6 months of treatment. Tooth type, jaw position, inclusion of extractions, and diagnostic accuracy of the CBCT showed statistically significant differences in OIRR.

CONCLUSION: Based on the results of this study, CBCT seems to be a reliable tool to examine OIRR during or at the end of orthodontic treatment. Although the average OIRR measured with CBCT seems to lack clinical relevance, there are certain factors that may affect OIRR following orthodontic treatment. Nevertheless, due to data heterogeneity and low quality of the included studies, the corresponding results should be interpreted with some caution.

SP 316 A NEW PLANE DESIGNED FOR CONE-BEAM COMPUTED TOMOGRAPHY SCAN REORIENTATION
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AIMS: To describe a new method for reorientation of cone-beam computed tomography (CBCT) scans. It is essential to develop an alternative from the gold standard orientation reference, the Frankfort plane, since it relies on adequate porion visibility, which is not always available. Precise three-dimensional measurements depend on a CBCT orientation method.

MATERIALS AND METHOD: A new orientation plan was established using a reliable floating landmark and a new origin point. Then, the original dicoms were reoriented according to the new plane through these points. Twelve CBCT scans of patients were pinpointed with and without the reorientation and the results compared through the intraclass correlation coefficient (ICC) to assess the intraexaminer reliability with a 95 per cent confidence interval. The points assessed were chosen based on their poor reliability of assessment and their routine use on cephalometrics. They were: gonion, porion, nasion, sella, orbitale, mandibular fossae, root tip and pogonion.

RESULTS: Scores had higher reliability for all accessed landmarks when compared to the original ones. The non-orientatated CBCT had a mean ICC of 0.86 ± 0.023 standard deviation and a range of 0.82-0.90. The orientated CBCT had a mean ICC of 0.95 ± 0.025 and a range of 0.90-0.99. The mean difference increase of the ICC was of 0.092.

CONCLUSION: A higher reliability and reproducibility was observed after CBCT alignment with the newly proposed standard. Thus, the OFF-plane can be used as an alternative both clinically and for research in cases which porion identification is not possible.

SP 317 EFFECTIVENESS OF CORTICOTOMY IN ORTHODONTIC TREATMENT: A SYSTEMATIC REVIEW AND META-ANALYSIS
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AIMS: To evaluate the efficacy of corticotomy in reducing the duration of orthodontic treatment, and secondly to assess periodontal health, pain perceived by patients and long-term stability.

MATERIALS AND METHOD: Epistemonikos, a database sustained by multiple sources: Medline, Embase, Cochrane, among others, was used. Relevant reviews were identified and then the data from the primary studies reanalyzed. A meta-analysis and a summary of the findings table was constructed using the GRADE method.

RESULTS: Twelve systematic reviews were found that together included 23 primary studies, of which 13 corresponded to randomized trials.

CONCLUSION: According to the GRADE method, corticotomy probably reduces the duration of orthodontic treatment, with a moderate certainty evidence. Additionally, it would not worsen periodontal health; no differences were found regarding pain perceived by the patients, but the certainty of the evidence is low and very low, respectively. Long-term stability was not measured or reported as an outcome in the systematic reviews that were used.
SP 318 OPTOGENETIC MANIPULATION OF INTRACELLULAR CALCIUM BY BLUE LIGHT-ACTIVATED CA2+ CHANNEL SWITCH PROMOTES OSTEOGENIC DIFFERENTIATION OF MC3T3-E1 CELLS

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AIMS: Bone remodelling is maintained through the balance between bone formation by osteoblasts and bone resorption by osteoclasts. Previous studies have suggested that intracellular Ca2+ signalling plays an important role in the differentiation of osteoblasts. However, it remains unclear whether it is possible to control the differentiation of osteoblasts by manipulating intracellular Ca2+. To elucidate the effect of Ca2+ signalling in osteoblasts, a blue light-activated Ca2+ channel switch (BACCS) was used. This optogenetic tool was used to spatiotemporally control intracellular Ca2+ with blue light stimulation. The purpose of this study was to evaluate the optical control with BACCS as a simple method to regulate the differentiation of osteoblasts.

MATERIALS AND METHOD: Mouse C57BL/6 calvaria-derived osteoblastic cell line, MC3T3-E1, was used as the model of differentiation from pre-osteoblasts to osteoblasts. For characterization of the intracellular Ca2+ signalling during osteogenic differentiation, intracellular Ca2+ changes were observed in MC3T3-E1 cells under differentiation conditions with 50 µg/ml ascorbic acid and 10 mM β-glycerophosphate by a confocal laser microscope. Then, BACCS-transfected MC3T3-E1 cells were stimulated by blue light (488 nm). Changes in alkaline phosphatase (ALP) activity of the cells were measured to clarify the effect of BACCS-induced intracellular Ca2+ signalling on osteogenic differentiation. The mRNA levels of collagen Ia1 (Col Ia1), ALP and Osterix (Osx) were analyzed by real-time polymerase chain reaction (RT-PCR).

RESULTS: Ca2+ imaging analysis showed that intracellular Ca2+ signalling in MC3T3-E1 cells changed before and after osteogenic differentiation. Rhythmic blue light-stimulation created the pattern of intracellular Ca2+ waves in the BACCS-transfected MC3T3-E1 cells. RT-PCR analysis revealed that rhythmic light stimulation significantly increased Col Ia1, ALP and Osx mRNA expressions 3 days after photo-stimulation, compared to the non-stimulated control cells.

CONCLUSION: The findings provide the evidence that intracellular Ca2+ signalling leads to osteogenic differentiation of pre-osteoblast MC3T3-E1 cells. Optogenetic manipulation of the cellular Ca2+ channels by BACCS could be valuable to dissect the behaviour of specific cell types in health and disease and for tissue engineering.

SP 319 IMPRESSION MATERIAL ACCURACY FOR PALATAL ORTHODONTIC MINISCREWS

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AIMS: With current model scanners, dental casts and similar objects can easily be compared in three-dimensional (3D) reference programs. Orthodontic miniscrews have become an important tool in orthodontic practice. This study investigated the accuracy of abutment transfer with current impression materials and tries to give a compact overview, including other relevant factors, in order to enable clinicians to make an informed decision about the optimal impression for this treatment method.

MATERIALS AND METHOD: Ninety six impressions of a cadaver head with two orthodontic miniscrews in place were taken with four common impression materials by two observers (experienced, inexperienced) and using two methods of application. After pouring with a standard type IV stone and abutment transfer, all models and the upper jaw (which had been separated from the head) were scanned in a standard model scanner (Zirkonzahn S600 ARTI) and evaluated using a computer aided design program (GOM-Inspect). The deviations were measured at six points per screw and statistically evaluated with SPSS®.

RESULTS: Optimal values were obtained with biphasic Polyvinylsiloxane (PVS) while monophasonic PVS, alginate and polyether resulted in acceptable accuracy. Observer experience showed no effect and the method of application had a minor effect on accuracy.
CONCLUSION: Within the limitations of this study, it seems all impression materials are suitable for miniscrew abutment transfer, provided that methods of intraoral adaptation of the orthodontic appliance can be employed. If higher accuracy is needed and for inexperienced clinicians, a biphasic PVS impression with intraoral light body and heavy body application in the tray should be used (putty-wash) as this combination reduces setting time. The most cost-effective version, alginate, can be used if consequences of greater deviations can be handled. Alginate should not be used if sterilization is necessary, such as in highly infectious patients. Caution is advised with polyether if undercuts are present.

SP 320 CEPHALOMETRIC MEASUREMENTS OF PATIENTS WITH ß-THALASSEMIA MAJOR, LIVING IN AZERBAIJAN
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AIMS: To perform a comparative analysis of the cephalometric parameters of patients with ß-thalassemia major with similar data of a healthy group.

MATERIALS AND METHOD: The lateral cephalograms of 21 patients with ß-thalassemia (mean age 12.7 ± 0.6 years) and 23 Class I patients with dental crowding (mean age 13.3 ± 0.5 years) without any craniofacial deformities and somatic diseases were studied. Lateral cephalometric radiographs were obtained with the 3D Mid Planmeca X-ray machine, Finland using the standard technique. The beam of the X-rays was directed to the middle of the external auditory canal. Anthropometric parameters were evaluated using the Dolphin software (version 11.5) (Dolphin Imaging, Chatsworth, California, USA).

RESULTS: Cephalometric parameters of patients with ß-thalassemia major indicate the presence of a Class II skeletal pathology (<SNA = 79.0 ± 0.9°, <SNB = 72.4 ± 0.8° <ANB = 6.6 ± 0.7°). The prevalence of dentomaxillary changes in patients with ß-thalassemia major were mainly associated with a decrease in the size of the mandibular body length (GoGn = 63.9 mm). The cephalometric parameters indicated a significant increase in the angle of the mandible with respect to the base of the skull, which characterizes the tendency towards a vertical growth. Soft tissue analysis showed upper and lower lip proclination and a significant increase in the nasolabial angle in the main group. There were significant increases in the mean value of the cranial base angle (NSBa = 133.5 ± 1.0°) in the main group, which indicates a slight decrease in the size of the skull in patients with ß-thalassemia.

CONCLUSION: Analysis of the cephalometric data of patients with ß-thalassemia major revealed a significant difference from the norm of the 20 parameters that cause development of craniofacial changes. This change is associated with a general growth delay and impaired puberty as a result of somatic comorbid pathology caused by ß-thalassemia.

SP 321 EFFECT OF MAXILLARY INCISOR INCLINATION AND INCISAL AND GINGIVAL DISPLAY ON PERCEIVED SMILE ATTRACTIVENESS
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AIMS: To evaluate the effect of maxillary incisor inclination and incisal and gingival display on the perception of smile attractiveness.

MATERIALS AND METHOD: This cross-sectional study was conducted on three-dimensional (3D) smiling profile photographs of a female with an ideal smile and U1 to SN = 103 degrees on the lateral cephalometric radiograph using Planmeca Romexis 3D Ortho Studio software (4.5.2R). The participants included 48 raters (i.e., 24 orthodontists and 24 lay persons), who were asked to score the attractiveness of the smiles in the photographs. The model was superimposed on the lateral cephalometric radiographs to be adjusted on the SN plane. The inclination of the incisors was altered to 113, 108, 98 and 93 degrees relative to the SN plane. Afterwards, the images of the
normal state of the teeth and four alterations were inserted in the 3D photographs, producing +4, +2, 0, −2, and −4 mm gingival displays. The attractiveness level of each smile was evaluated using a visual analogue scale.

RESULTS: Photographs with a normal inclination of the maxillary anterior teeth and a gingival display of 0 to +2 mm obtained the highest scores of smile attractiveness in both groups, while the lowest scores were assigned to the photographs with maxillary anterior tooth inclination of 113 degrees and a gingival display of +4 mm by the orthodontists and -4 mm by the lay people. The evaluation of specific gingival display and different axial inclinations showed that the photographs with a maxillary incisor inclination of 103 degrees in all different gingival displays were given the highest aesthetic score by both groups. Moreover, in all different gingival displays, the photographs with a maxillary incisor inclination of 113 degrees obtained the lowest aesthetic smile scores in both groups.

CONCLUSION: The findings indicated that orthodontists had little tendency to see gingiva in all smiles with different axial inclinations of maxillary incisors. The lay persons did not prefer gingival display when the teeth were retroclined. They rated the gingival display of 0 mm with the maxillary incisor axial inclinations of 103 and 113 degrees as attractive. In general, normal axial inclination and then retroclination of the maxillary incisors were preferred in all gingival displays; on the other hand, smiles with proclined maxillary anterior teeth were considered as unaesthetic.

SP 322 EFFECT OF CANINE DISIMPACTION USING TEMPORARY ANCHORAGE DEVICES BEFORE COMPREHENSIVE ORTHODONTIC TREATMENT TO AVOID ROOT RESORPTION OF ADJACENT TEETH

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AIMS: To evaluate the movement of impacted canines away from the roots of neighbouring teeth before full-mouth bracket placement, performed by means of temporary anchorage devices to decrease undesired side effects on adjacent teeth.

MATERIALS AND METHOD: Thirty four palatally impacted canines, 19 in the experimental group and 15 in the control group. In the experimental group, before placement of brackets, the impacted canine was erupted by means of miniscrews. In the control group, after initiation of comprehensive orthodontics, canine disimpaction was performed by means of a cantilever spring soldered to a palatal bar. At the end of treatment, the volume of the lateral incisor and canine root resorption was measured and compared by means of a cone beam computed derived three-dimensional model. Visual analogue scale (VAS) score, bleeding on probing (BOP) and gingival index (GI) were recorded. Clinical success rate was also calculated.

RESULTS: The volume of root resorption of lateral teeth in the control group was significantly greater than in the experimental group ($P < 0.001$). At the end of treatment, VAS score, GI and BOP were not significantly different between the two groups.

CONCLUSION: Based on these results, it seems that disimpaction of canines and moving them into the arch can successfully be carried out with minimal side effects by means of skeletal anchorage.

SP 323 UNITED REFERENCE METHOD FOR THREE-DIMENSIONAL TREATMENT EVALUATION

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AIMS: Reproducible and descriptive three-dimensional (3D) treatment evaluation can enhance future treatment based on realistic results. The purpose of this study is to describe a new method for 3D treatment evaluation showing how to use fully-automated craniofacial superimposition of cone beam computed tomographic (CBCT) records combined with a reference system to obtain descriptive and comparable results. This new method was named ‘United Reference Method’ (URM).
MATERIALS AND METHOD: URM is a combination of automated 3D superimposition on the anterior cranial base surface anatomy and measurements based on the reference system. It was developed to show how to use fully-automated superimposition to obtain descriptive numerical comparable values. The method is based on: one main reference system for both superimposed CBCT records, semi-automation to increase accuracy, all measurements are projections and auxiliary references to aid in landmarks identification and measurements. The method steps can be described following a four-step approach: (1) Superimposition performed through a fully automated, voxel-wise, rigid registration considering only the cranial base as a stable structure; (2) Identification of reference landmarks once on the superimposed records for corrected Frankfort horizontal plane (C-FH) construction and a new semi-automated constructed Sella point to correct Orbital asymmetry; (3) Head orientation of superimposed CBCT images based on the C-FH; (4) Identification of landmarks affected by treatment with the aid of auxiliary reference planes. Evaluation of linear or angular changes derived by projection of the same pre- and post-treatment landmarks on the C-FH. Pre- and post-expansion CBCT scans of 20 unilateral cleft lip and palate patients were used to calculate intra and interrater reliability. (X, Y and Z) coordinates, mean, standard deviation (SD) and intraclass correlation coefficient (ICC) were calculated.

RESULTS: The proposed coordinates for C-FH construction showed ICC ≥ 0.998 and SD ranging from 0.064 to 0.242 mm. On the other hand, excluded coordinates due to expected natural craniofacial asymmetry had the lowest reliability ICC ≥ 0.742 and SD dramatically increased up to 1.112 mm.

CONCLUSION: URM showed adequate reliability so it can be used to produce 3D descriptive data of craniofacial structural changes.

SP 324 A UNIVERSAL THREE-DIMENSIONAL REFERENCE SYSTEM FOR CRANIOFACIAL DEFORMITIES
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AIMS: To construct a universal reliable and reproducible three-dimensional (3D) reference system not affected by craniofacial deformities.

MATERIALS AND METHOD: Cone beam computed tomographic records of 31 patients from department archives, 10 unilateral cleft palate (CP), 10 with a skeletal Class II and III, one with hemifacial microsomia (Hm) and 10 with impacted canines without any skeletal deviations. The records were imported in Viewbox for measurement. Traditional reference structures were checked as hypophyseal fossa (Hf), crista galli (Cg), foramen cecum (FC), Porion (Po), Orbitale (Or) and Nasion point (N) to determine the effect of skeletal deformities on reference structures. Twisting of the Hf was measured around a 3D Sella axis. Cg, the highest point deviation from its basal centroid, was measured and the distance from FC to right and left Po. Two C-Porion points were constructed as the point has Z and Y coordinates of Po and with X coordinates at equal distance from FC in a direction parallel to Porion axis connecting two Po. C-mid-Orbital point constructed as a point has Z and Y coordinates equal to mean of two Or and X coordinate of FC. A plane was constructed from these three points. The centre of the plane became zero point to create a coordinate system parallel and perpendicular to the constructed plane. Points were identified by three observers three times at weekly intervals. Mean, standard deviation (SD) and intraclass correlation coefficient (ICC) were calculated for all coordinates.

RESULTS: Twisting of the Hf ranged from 5 to 15 degrees around the fossa axis in CP subjects. Cg leaned by 3 to 6 degrees towards the side of cleft in CP subjects. N showed SD up to 0.2 mm. There was undeniable displacement of Po in the Hm subject. The FC distance to the right Po was equal to that on the left in all subjects. In Hm there was a groove which ended at original location of Po and had same relationship as the other side. So, the most stable points were FC and Po. Reference coordinates showed ICC ≥ 0.998 and SD ranging from 0.064 to 0.242 mm. Excluded coordinates were less reliable, ICC ≥ 0.742 and SD up to 1.112 mm.

CONCLUSION: The constructed 3D coordinate reference system can be used reliably and reproducibly in craniofacial anomalies.
SP 325  POST-OPERATIVE INSTRUCTIONS FOLLOWING BOND-UP: AN AUDIT  
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AIMS: Post-operative instructions are vital following bond-up to ensure patients know how to care for their appliance and to minimise any detrimental effects of appliances. This audit aimed to: 1. Assess the current post-operative instructions given to patients following bond-up. 2. Identify areas where information provision can be improved 3. Standardise post-operative instructions given to patients.

MATERIALS AND METHOD: A prospective questionnaire-based audit was carried out at the Eastman Dental Hospital from December 2017-April 2018. A 15-item questionnaire was developed and piloted prior to use. The questionnaire assessed if advice was given on the following areas after bond-up; oral hygiene instruction (OHI) including the use of adjuncts with demonstration, dietary advice, casualty information, advice on wax use with demonstration, what to expect following bond-up/adjustment, mouth guard use for contact sports, risks associated with non-compliance and whether patients were provided with British Orthodontic Society Patient Information Leaflets to support this information. Patients were also asked if they were given any other useful information and if there was any other information they would have liked to have received. The gold standard was that all patients should receive at least 90 per cent of the standardised information. Patients were recruited immediately following bond-up (1 or 2 arches) with no age or health restrictions. Patients who had previously had any orthodontic treatment were excluded. Forty patients completed the questionnaire from a range of clinician grades.

RESULTS: Seventy eight per cent of patients received at least 90 per cent of the information therefore the gold standard was not met. One hundred per cent of patients received advice on OHI, wax use, foods to avoid and what to expect following bond-up/adjustment. Improvement was required on advising which drinks to avoid and mouthguard use with only 85 and 70 per cent of patients being given this information, respectively. No other useful information or information patients would have liked was reported.

CONCLUSION: Information provision following bond-up could be improved in some areas. The audit results were presented at a departmental audit meeting and disseminated to all clinicians to improve the quality of post-operative instructions. A departmental leaflet is under consideration to standardise post-operative instructions and a re-audit is planned in 12 months.

SP 326  MOUTH BREATHING HABIT CORRECTION. INTERDISCIPLINARY LITERATURE REVIEW  
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AIMS: There are a number of aetiological factors for mouth breathing: various mechanical factors, including tonsils and adenoids hyperplasia, rhinitis, tumours, infectious or inflammatory diseases and nasal septum deviation and even when mechanical factors are removed, mouth breathing continues in most cases. The review aim was to assess how the mouth breathing habit can be corrected to a nose breathing pattern when the airway passage is no longer obstructed.

MATERIALS AND METHOD: The literature search began on 7 November 2018 with keywords: mouth breathing, nasal breathing, habit, correction, using the PubMed, Google Scholar, Medline databases. Articles were selected based on their relevance to the topic. Inclusion criteria were patients without any direct obstruction that caused mouth breathing.

RESULTS: Five articles were found (including 2 clinical trials, 2 pilot studies, 1 semantic scholar). Three techniques were indicated. Myofunctional treatment therapy consisting of habit elimination and behaviour modification, jaw stabilization exercises, repatterning the oral facial muscles and changing their function for optimal nasal breathing, oral rest position. Lip muscle training by way of a lip trainer mouth piece increased lip closure force and the patient switches from mouth to nose breathing during sleep. Lip muscle training for students also was helpful for lip closure force and
saturation of peripheral oxygen during sleep. Another study stated that all patients sleep with a closed mouth while using porous oral patches. In this study cephalometry revealed that the retropalatal space and retrolingual space increased statistically significantly. Nasal aeration promotes sensitization of the nasal cavity, nasal cleansing causes reduction of secretions present in the nasal cavity, therefore these techniques have proved to be effective in improving nasal patency.

CONCLUSION: The oral breathing mode can initiate facial deformities, poor positioning of the teeth and changes in upper airway space. After nasal breathing is initiated, it may take time before muscle tone returns to normal. There are very few scientific articles about how the mouth breathing habit can be eliminated. A combination of myofunctional therapy, use of porous oral patches and nasal cleansing can be helpful in changing a mouth breathing pattern to a nose breathing pattern.

SP 327 AN AUDIT ON ORTHODONTIC REFERRALS REQUESTING SURGICAL INTERVENTION FOR IMPACTED TEETH
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AIMS: To determine whether orthodontists requesting surgical intervention for impacted teeth in a local oral maxillofacial department provide sufficient clinical and radiographic information.
MATERIALS AND METHOD: The gold standard was defined as 100 per cent of referrals providing sufficient information to allow localisation of impacted teeth at the time of surgery. A retrospective audit was conducted of the records at Kingston Hospital NHS Foundation Trust between January and April 2018. Information was defined as the referring orthodontists providing the following: 1) an indication of tooth location 2) palpability 3) two radiographs in parallax where appropriate. Complications localising the impacted teeth during surgery were also noted.
RESULTS: A total of 75 orthodontic patients were included in the audit. Only 54 per cent of referred patients for surgical intervention of impacted teeth had sufficient information at the time of surgery. In addition, 4 per cent of patients faced complications during surgery as a result of insufficient information.
CONCLUSION: Inadequate referrals can result in last minute operation cancellation, repeat radiography or, in the worst cases, complications during surgery. It is recommended that the abovementioned concerns are raised in regional clinical governance meetings. Furthermore, that all orthodontic patients scheduled to undergo surgical interventions are reviewed by the oral surgeon prior to surgery. These simple measures can lead to significant improvements.

SP 328 AUDIT ASSESSING THE DURATION OF DIFFERENT ORTHODONTIC TREATMENTS PROVIDED IN A DENTAL AND MAXILLOFACIAL DEPARTMENT
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AIMS: Orthodontic treatment within secondary care often involves a multidisciplinary approach which influences overall treatment duration. Evaluating the average duration of various orthodontic treatments enables clinicians to provide patients and their families with estimates in treatment duration. Additionally, it allows clinicians to gain an insight into the various factors that influence treatment duration, in order to improve service provision. The overall aim of this audit was to assess the duration of orthodontic treatments at St. George's University Hospital.
MATERIALS AND METHOD: A retrospective audit was carried out of patients who completed treatment 01/03/2018. The treatment delivered to patients was divided into five categories, influenced by treatment involvement from another department: 1) Orthodontics only, 2) Restorative input, 3) Surgical input, 4) Orthognathic, 5) Multicomponent (involving more than one specialty). Analysis of patient records was completed to establish the duration in months between first orthodontic treatment and debond. The standard set was completion of treatment within 36 months.
RESULTS: Data from 38 patients were collected and analysed. All categories met the standard, apart from orthodontic treatment involving orthognathic surgery, which took an average of 46 months for completion. The median value for treatment involving orthognathic surgery was 45.5 months. Average treatment times for 1) Orthodontics only = 20 months, 2) Restorative input = 36 months, 3) Surgical input = 26 months, 5) Multicomponent = 35 months. The greatest variation in data was orthodontic treatment involving a surgical element with duration ranging from 14 to 74 months.

CONCLUSION: Data for orthognathic patients is limited and may not accurately represent the patients seen within the department. Patient factors, e.g. numerous cancellations, also affected the duration of treatment. A further audit is required to involve a larger proportion of orthognathic patients to establish whether this extended treatment time is an anomaly or requires review of clinical practice.

SP 329 THE INFLUENCE OF RESIN INFILTRATION PRE-TREATMENT ON ORTHODONTIC BONDING TO DEMINERALIZED HUMAN ENAMEL
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AIMS: To investigate, in vitro, the differences in shear bond strength (SBS) of molar tubes bonded with three different adhesives to demineralized human enamel pre-treated with a low viscosity resin infiltrant (Icon, DMG, Germany), as well as to compare the achieved bond strengths to those of sound enamel.

MATERIALS AND METHOD: A total of 48 freshly extracted third molars were randomly divided into four groups (n = 12). Group 1: sound enamel + Transbond XT (3M Unitek, Monrovia, California, USA); Group 2: demineralized enamel + Icon + Transbond XT; Group 3: demineralized enamel + Icon + Scotchbond Universal (3M Espe, St Paul, Minnesota, USA); Group 4: demineralized enamel + Icon + Assure Plus (Reliance Orthodontic Products, Itasca, Illinois, USA). All the teeth in groups 2, 3 and 4 were exposed to a demineralization procedure. Prior to adhesive application all the specimens were etched with 37 per cent phosphoric acid for 15 seconds. In all groups molar tubes were bonded with Transbond XT Paste. Prior to SBS testing, all specimens were thermocycled (10,000 times between 50°C and 550°C). SBS was measured in MegaPascals (MPa). Failure mode was assessed according to the Adhesive Remnant Index (ARI). One-way analysis of variance (ANOVA) and Tukey test for post hoc comparisons were applied to analyze SBS data. The Kruskal-Wallis ANOVA followed by a series of Mann-Whitney U tests was used to compare between-group differences in the ARI scores. In all the statistical tests significance level was set at P ≤ 0.05.

RESULTS: The highest bond strength (20.3 MPa) was measured for molar tubes bonded with Assure Plus on demineralized enamel and the difference was statistically significant (P < 0.05). No statistically significant differences were found among groups 1, 2 and 3. No statistically significant between-group difference was observed for ARI scores.

CONCLUSION: Pre-treatment of demineralized enamel with resin infiltrant does not impair the SBS of orthodontic tubes. Significantly higher strength to Icon pre-treated demineralized enamel was achieved using the Assure plus adhesive.

Acknowledgment: This study was funded by the Croatian Science Foundation, ‘Investigation and development of new micro and nanostructure bioactive materials in dental medicine’. Biodentmed No. IP-2018-01-1719

SP 330 PATIENT SATISFACTION WITH ORTHODONTIC TREATMENT: A PROSPECTIVE AUDIT
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AIMS: To audit patient experience with regards to the following areas in the orthodontic treatment process: patient-orthodontist relationship, access, waiting times, facilities and continuity of care.

MATERIALS AND METHOD: A 20 item questionnaire was completed by 100 patients during a 4 week data collection period. The questionnaire was developed de-novo based on a review of the literature, previous audits and patient feedback. This was piloted on 10 patients and minor amendments were made. Inclusion criteria were patients aged 18 years old and under who had fixed or removable appliances in situ for a minimum of 1 appointment. Hypodontia and orthognathic patients were excluded. The gold standards were 1. Eighty per cent of patients to be overall satisfied with the service, 2. Eighty per cent of patients to be ‘extremely likely’ or ‘likely’ to recommend the clinic to friends and family.

RESULTS: 1. Ninety eight per cent of patients answered ‘yes’ to being satisfied with the service (standard achieved). 2. Eighty per cent of patients answered ‘extremely likely’ or ‘likely’ to recommend the clinic to friends and family (standard achieved). In more detail, the following areas were well reported with over 90 per cent of patients agreeing that: they were treated with respect, the procedure was well explained, the clinician was friendly, they received sufficient information, staff worked well together, clinical areas and waiting room were neat/clean and there was good continuity of care. Patients reported dissatisfaction with the following areas: number of attendances due to breakages, inability to contact department and long waiting times in relation to scheduled appointments.

CONCLUSION: Since 2009, it has become mandatory in the UK to use Patient Reported Outcome Measures (PROMS) to report on the effectiveness of patient care from the patient’s perspective. The areas of dissatisfaction have been fed back to the department staff. Changes have been made as a result of the audit including the construction of a patient information leaflet on caring for appliances to minimise breakages and staff have been advised to tell patients when they arrive if clinics are running late. A re-audit has been proposed in 6 months.

SP 331 ORAL HEALTH-RELATED QUALITY OF LIFE COMPARISON BETWEEN CLEFT AND NON-CLEFT PATIENTS AFTER ORTHODONTIC TREATMENT
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AIMS: To evaluate oral health-related quality of life (OHRQoL) in patients with a cleft lip and/or cleft palate (CL/P) and in non-cleft patients after orthodontic treatment.

SUBJECTS AND METHOD: Two groups of patients were recruited. The control group consisted of healthy non-cleft patients in orthodontic retention after completing treatment. The cleft group consisted of non-syndromic patients with CL/P in their retention phase who had completed orthodontic treatment in the cleft clinic. Patients requiring a second phase of orthodontic therapy were excluded. Participants were asked to complete the Oral Health Impact Profile (OHIP)-14 questionnaire after orthodontic treatment. They reported the impact for each item using a five-point Likert-type scale. Patients were contacted by mail, telephone or approached in the clinic during their retainer review visit. They were directed to an online link to complete the questionnaire hosted by ‘Google Docs’. Evaluation of OHRQoL after orthodontic treatment in patients with CL/P and in non-cleft patients after orthodontic treatment was done using descriptive statistics. Secondary objectives to compare OHRQoL within the two patient groups with respect to the seven individual domains from OHIP-14 was done using the unpaired two-sample Wilcoxon rank-sum test.

RESULTS: A total of 104 patients were recruited, with 69 and 35 in the control and CL/P groups, respectively. The total mean OHIP-14 score for the control group was 5.78 ± 5.57 while that for CL/P group was 9.17 ± 10.30. There was no significant difference (P = 0.1828) in the mean total OHIP = 14 score between the cleft and control group. There was, however, a significant difference (P = 0.0002) between the mean score of the functional limitation domain between the two groups.
CONCLUSION: The study demonstrated no significant difference in OHRQoL between non-cleft and CL/P patients. However, OHRQoL scores may improve for CL/P patients if more emphasis is placed to address functional problems such as residual speech impairment after orthodontic treatment.

SP 332 PATIENT’S EXPECTATION OF ORTHODONTIC TREATMENT AND LEVEL OF PAIN AFTER ELASTIC SEPARATOR PLACEMENT
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AIMS: To investigate whether pre-treatment assessment of patient’s expectation of orthodontic treatment can predict the level of pain after elastic separator placement.

SUBJECTS AND METHOD: Eighty-seven patients (71 female and 16 male), aged 14 years and above seeking orthodontic treatment were enrolled in this study. The questionnaires were performed to evaluate expectation level of patients in seven aspects before treatment. Self-reported pain intensity in area of separator placement (mesial and distal side of first molar) was calculated using the Numerical Rating Scale (NRS 0-10) during the 7 days after treatment. The relationship between patient’s expectation of orthodontic treatment and pain from the elastic separator was analyzed using Pearson’s correlation analysis.

RESULTS: The maximum mean level of pain intensity occurred at day 2 after elastic separator placement (4.322 ± 2.859) and gradually decreased to normal levels at day 7. One-way repeated measure analysis of variance on ranks showed statistically significant difference of mean pain intensity at each time point but no significant difference in pain intensity between males and females (P < 0.05). Pearson’s correlation analysis found a positive association between patient’s expectation of aesthetic aspects and pain intensity 6 hours after elastic separator placement (P < 0.05). The high aesthetic expectation group (NRS 7 or above) rated mean pain intensity 3.16 ± 2.67 while 1.94 ± 2.21 in the mild to moderate aesthetic expectation group (NRS less than 7).

CONCLUSION: Patient’s expectation was useful in predicting the risk of developing high pain response 6 hours after elastic separator placement.

SP 333 THREE-DIMENSIONAL PREDICTION OF ROOT POSITION THROUGH CONE-BEAM COMPUTED TOMOGRAPHY/DIGITAL CAST SUPERIMPOSITION: A NOVEL METHOD
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AIMS: To evaluate the reproducibility and accuracy of a new method to merge three-dimensional (3D) data from cone beam computed tomographic (CBCT) scans with digital models in order to monitor and predict root movement during and after orthodontic treatment.

MATERIALS AND METHOD: Pre- and post-treatment digital models and pre- and post-treatment CBCT scans from a patient were retrieved. The post-treatment digital model (post-model) was set as the reference; pre- and post-treatment CBCT scans were aligned to the post-model through a biphase sequential registration procedure: three points on each pre-CBCT and post-cast crown were selected to perform a preliminary alignment; iterative closest point algorithm was then employed for final adjustments. The accuracy of the proposed method was assessed by comparing the average distance between the expected root position (ERP) set-up with the true position of the roots (TRP), from the post-treatment CBCT.

RESULTS: Analysis of the discrepancy between ERP and TRP showed that the accuracy of the root prediction was below 0.1 mm. 3D colour maps were generated to visualize both the distribution and the extent of the superimposition error between the two given 3D surface models.

CONCLUSION: The proposed digital workflow allows prediction, in an accurate and truly 3D way the final position of roots starting from an initial CBCT (if indicated), without the need for an extra
radiographic examination of the patients. The reduced need of the exposure to mid- and post-treatment radiographs is in accordance with the (as low as diagnostically acceptable) principle.

SP 334 COPPAS RANDOMISED CONTROLLED TRIAL: CONTROL OF PAIN FROM BRACES WITH PATIENT ADVICE SHEETS
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AIMS: To investigate whether acupressure resulted in the reduction of pain after orthodontic treatment procedures compared to non-steroidal anti-inflammatory drugs (NSAIDs). Primary objectives were to compare pain experience by assessing the effectiveness of advice to use acupressure or NSAIDs in controlling pain and discomfort by measuring the degree of pain after bonding of brackets to teeth and placement of an initial archwire. Secondary objectives, pain diaries were used to record the impact of orthodontic treatment and associated discomfort on sleep and diet at intervals ranging from 4 hours to 7 days after placement of the initial archwire.

SUBJECTS AND METHOD: A single centre randomised clinical trial with 36 participants recruited aged between 12-22 years. Inclusion criteria: i) aged 12-25 years, ii) malocclusion requiring treatment, iii) scheduled to begin orthodontic treatment, iv) requires fixed appliance in two arches, v) able to understand and follow advice sheets. Exclusion criteria: i) previous orthodontic treatment, ii) current use of analgesics, iii) contraindications to NSAIDs, iv) previous acupressure experience, v) pregnancy. In the acupressure group the participants were advised to use acupressure point LI4 on the back of the hand to control orthodontic pain. In the NSAID group the subjects were given an advice sheet and advised to take ibuprofen for the orthodontic pain. All subjects were given advice about the use of a rescue medication if their pain was not controlled using their current regime. Their responses were collected using visual analogue scale scores within a pain diary at the time-points ranging from 4 hours to 7 days. Data was analysed using a mixed group factorial analysis of variance (ANOVA).

RESULTS: The findings suggest that there was no clinically significant difference in control of orthodontic pain between acupressure and analgesics. There was no difference in sleep and diet between the acupressure and analgesic group.

CONCLUSION: Acupressure could be recommended as an alternative to analgesic use for post-bond up pain in orthodontic patients.

SP 335 A VALIDATED TRANSLATION OF THE PAEDIATRIC SLEEP QUESTIONNAIRE AND A PILOT STUDY ON SLEEP DISORDERED BREATHING IN AN ORTHODONTIC POPULATION
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AIMS: To generate a validated translation of the paediatric sleep questionnaire (PSQ); to apply it for screening sleep disordered breathing (SDB) in a paediatric orthodontic population in Denmark and to compare the results with those in the latest available literature.

MATERIALS AND METHOD: The PSQ was translated twice from English to Danish by different translators, merged into a single translation and this translation was translated back to English by two independent translators. These translations were then evaluated against the original questionnaire to assess similarity. Five cognitive script interviews were conducted twice to evaluate how well the translation was understood by the target group. Thirty parents were asked to answer the questionnaire twice to test for reliability. Finally, a pilot study was conducted in a public dental clinic, where 170 parents were asked to answer the questionnaire.

RESULTS: A valid translation, showing consensus between the original and the Danish version, was created through the back-forth translations and the cognitive script interview. The questionnaire was found to be reliable. The pilot study showed that 8.5 per cent of this paediatric population were at high risk of SDB. This is in agreement with the results published earlier this year in the
American Journal of Orthodontics and Dentofacial Orthopedics by Rohra et al. in a similar population.

CONCLUSION: A culturally adapted translation of the PSQ was created which will make it possible to screen a Danish population and compare Danish and international results.

SP 336 IMPACT OF PIEZO-CORTICISION-ASSISTED ORTHODONTICS ON ROOT RESORPTION AND ALVEOLAR BONE: A PROSPECTIVE OBSERVATIONAL STUDY

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AIMS: To assess the impact of orthodontic treatment combined with piezo-corticision (OTPC) on root structure and alveolar bone.

MATERIALS AND METHOD: Pre- and post-treatment cone beam computed tomographs of 12 adult patients treated with OT-PC were compared to investigate apical root resorption (ARR) and alveolar bone height and thickness changes in both jaws from the mesial of the first molar to the contralateral tooth. Differences between post- and pre-values were calculated and compared to zero using a one-sample t-test and a one-sample Wilcoxon signed-rank test.

RESULTS: ARRs were generalized and significantly more severe in both anterior sextants compared to posterior sextants. Bone thickness changes were only significant in the maxilla with a mean decrease of less than a millimetre at the mid-root and apex areas. While the majority of alveolar bone dehiscence occurred on the buccal aspect of the mandibular teeth at the mid-root level, it should be noted that 75 per cent of these dehiscences had a pre-treatment bone thickness of 0.3 mm. Bone height in the overall dentition decreased twice as much on the buccal aspect (1.43 mm, \(P < 0.001\)) compared to the lingual aspect (0.67 mm, \(P = 0.001\)), most significantly in the buccal aspect of the lower incisors, where the average median loss was 2.10 mm (\(P = 0.003\)).

CONCLUSION: OTPC causes minor negative effects on both alveolar bone and root resorption. Nevertheless, bone height loss was greater on the buccal aspect in the mandible and ARR was more significant in both anterior sextants. The majority of complete alveolar bone dehiscences occurred on the buccal cortical bone at the mid-root level of the lower teeth.

SP 337 ASSESSMENT OF ROUGHNES AND CRITICAL SURFACE TENSION OF CONTEMPORARY THERMOLASTIC MATERIALS

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AIMS: The characterization of surface roughness and wettability of contemporary thermoplastic materials used in manufacturing of orthodontic aligners.

MATERIALS AND METHOD: Four commercially available thermoplastic materials were tested: CA-medium (CAM; Scheu-Dental, Iserlohn, Germany), Copolyester (COP), Duran (DUR; Great Lakes Dental Technologies, Tonawanda, New York, USA) and Erkodur (ERK; Erkodent Erich Kopp, Pfalzgrafenweiler Germany). Five disks from each material were tested and subjected to a) optical profilometry for the estimation of Sa, Sz and Sq surface roughness parameters and b) contact angle measurements with a homologous series of liquids for the estimation of critical surface tension (\(\gamma_c\)) employing the Zisman method. The numerical results were statistically analyzed employing one-way ANOVA and Tukey multiple comparison test at \(\alpha = 0.05\).

RESULTS: The results of optical profilometry and critical surface tension classified the materials in the following descending order (mean value with standard deviation in parenthesis): Sa (nm): DUR: 18.9(4.9), CAM: 12.7(1.5), COP: 11.3(0.4), ERK: 10.9(1.0); Sz (nm): DUR: 784(235), CAM: 456(199), ERK: 419(159), COP: 332(74); Sq (nm): DUR: 32.8(10.2), CAM: 29.6(8.4), ERK: 18.7(2.8), COP: 16.4(1.1); \(\gamma_c\) (dyn/cm): ERK: 45.6(0.6), COP: 43.8(3.0), DUR: 43.2(2.4), CAM: 40.3(0.9). Groups without statistically significant differences (\(P > 0.05\)) are denoted in the results. Statistically significant differences were identified for Sa, Sq and \(\gamma_c\) while no differences were found for Sz among materials tested.
CONCLUSION: Given the abovementioned differences in surface roughness and critical surface energy, differences in the clinical behaviour of tested materials from the standpoint of intraflora retention and plaque retaining capacity are anticipated.

SP 338 ASSESSMENT OF TOOTH MOBILITY DURING ACTIVE ORTHODONTIC TREATMENT
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AIMS: Assessment of tooth mobility (TM) plays an important role in understanding the intrinsic relationships between biomechanics and the underlying biological processes. Therefore, the purpose of this study was to assess TM changes during active treatment.

SUBJECTS AND METHOD: Two hundred patients who had been treated with fixed appliances. Assessment of TM was performed at baseline (T0) and during the subsequent 10 month follow-up periods (T1-T10). Superelastic nickel-titanium wire (Tomy International, Tokyo, Japan) 0.016 inch wires were used as the initial archwire (T1-T3) followed by 0.016 × 0.22 inch wires (T4-T10). Assessment was performed with IMT-100 (AnyCheck, DMS Co., Ltd. Gangwon-do, Korea). This device uses the damping method which measures the time the tapping rod of the device contacts the tooth. The result of the measurement is displayed in implant stability test scale with higher scale representing greater stability or lower mobility. A paired t-test and one-way ANOVA were used to perform intra- and intergroup comparisons, respectively.

RESULTS: Assessment of baseline TM values demonstrated a distinct pattern between different groups of teeth. The highest TM values were recorded for the incisors of both the mandible (62.7 ± 6.0) and maxilla (67.2 ± 6.5). The lower first molar showed the lowest TM values (83.5 ± 4.3). Maxillary molars (78.8 ± 4.8) and canines (76.1 ± 5.5) demonstrated similar TM values. During T1-T10 a significant overall increase in TM (25 ± 5%) was observed. Moreover, TM was three times higher for the incisors compared to the molars. The greatest increase in TM was observed for the incisors (36%) followed by the canines (25%), premolars (20%) and molars (17%). A distinct pattern of TM increment was also observed. During T0-T1, the overall increment was 3 per cent, followed by a peak of 10 per cent during T1-T2, and a decrease to 2 per cent in T2-T3. Following the archwire change to a larger dimension, further peaks of 10 (T3-T4) and 11 (T4-T5) per cent were observed. From T5-T7, a gradual decrease to 5 and 3 per cent was recorded, reaching a plateau from T8-T10.

CONCLUSION: Assessment of TM is an effective diagnostic tool to determine conditions of tooth supporting structures during orthodontic treatment.

SP 339 ORTHODONTIC TWIN STUDIES
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AIMS: Twin studies could help elucidate the role of genetics and environment in craniofacial development and improve the understanding of what the causes of craniofacial anomalies are.

MATERIALS AND METHOD: A unique sample of orthodontic plaster models and cephalograms of 360 twin pairs, from which 68 pairs were monozygotic, was examined. The cohort was collected in the late 1960s, when ionisation protection was not as strict, and its potential has not yet been fully utilized. Zygosity was determined at the time when the sample was collected. The conformity in systems ABO, Rh-hr, MN, PP, SS, Kell-Cellano, Duffy, anthropologic and dermatoglyphic examination were used. The angular and linear cephalometric quantities were measured and monozygotic and dizygotic intrapair differences compared. The same was undertaken with similarity of profiles. Identical twins were examined repeatedly, which enables observation of the dynamics and type of growth. The dimensions and relationship of dental arches were studied on plaster models.

RESULTS: No matter what feature was examined, the intrapair differences in monozygotic twins were smaller; they were more similar to each other. However, the differences between mono- and dizygotic twins were not always statistically significant. Substantial differences were in the area of
cranial base, indicating that its structure is genetically influenced. On the other hand, the dimensions of dental arches probably respond more to functional impulses. The dynamics of growth was different in monozygotic twins, however the final result was that the growth type was very similar.

CONCLUSION: The findings are in agreement with the fact that craniofacial structures develop in a very complex way and the cause of orthodontic anomalies is multifactorial.

SP 340 DENTAL ARCH DIMENSIONS IN TWINS
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AIMS: A substantial part of orthodontic anomalies are complex disorders. Twin studies can help elucidate the role of genetics and environment on their origin. This study focused on comparison of arch dimensions in monozygotic and dizygotic twins.

MATERIALS AND METHOD: The collection of orthodontic documentation models of 40 pairs of monozygotic twins and 45 pairs (the same gender) of dizygotic twins was measured. The zygosity was determined at the time when the sample was collected. The conformity in systems ABO, Rh-hr, MN, PP, SS, Kell-Cellano, Duffy, anthropological and dermatoglyphical examination were used. The plaster models were scanned and the distances between upper canines and between the upper first molars were measured. The values of both twins were compared and the difference was expressed as a quotient of the sum of both distances. The average values for boys, girls, mono- and dizygotic twins were evaluated with the help of a t-test.

RESULTS: The average difference was smaller in monozygotic twins. Only intermolar distance was statistically significant in girls.

CONCLUSION: A relatively small difference between monozygotic and dizygotic twins indicates only a partial influence of genetics. The role of function on development of dental arches should be considered.

SP 341 THE PREVALENCE OF HYPODONTIA IN PATIENTS WITH VARIOUS TYPES OF CLEFTS
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AIMS: To compare the prevalence of hypodontia in cleft-affected patients with regard to all types of teeth in both jaws in the permanent dentition.

MATERIALS AND METHOD: This retrospective radiographic analysis included patients (60 male, 60 female) with various types of clefts treated orthodontically. The patients were divided into four groups according to the clinical extent of the cleft: unilateral (UCLP; n = 30 patients), bilateral (BCLP; n = 30) cleft formation (lip, alveolus and palate), isolated cleft palate (CP; n = 30) and cleft lip (CL; n = 30). The data was analyzed using descriptive statistics.

RESULTS: Hypodontia occurred in 45 per cent of the sample. The frequency of tooth agenesis was substantially highest in the UCLP group. Sixty six per cent of women and 80 percent of men from this group did not have at least one tooth bud. The most frequent anomaly was absence of two lateral incisors. In the UCLP group hypodontia was observed more often at the cleft side (70%) than at the non-cleft side (30%). A lack of four central incisors, 21 lateral incisors and eight premolars were identified (31 upper arch, only 2 lower). The number of patients with hypodontia in the CL group was eight females and two males (26.67% and 6.67%, respectively). The only missing buds were the lateral incisors. Lack of lateral incisors was observed in nine patients on the cleft side and in one patient on both sides. Hypodontia affected only four men in the CP group.

CONCLUSION: When orthodontic treatment of the oral cleft patients is planned, the high prevalence of hypodontia and its association with different cleft types should be taken into consideration. Tooth agenesis is associated with the side of the cleft. Hypodontia is a frequent anomaly in UCLP and BCLP patients.
SP 342  INFLUENCE OF TIPPING AND SALIVARY MEDIUM ON SLIDING BEHAVIOUR OF DIFFERENT ORTHODONTIC BRACKET/WIRE COMBINATIONS: AN IN VITRO STUDY
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AIMS: Wear can occur at the asperities of two loaded contacting materials subjected to a minute relative motion by vibration or some other force. That may be the case at the sliding bracket/archwire interface when performing orthodontic tooth movements. The wear pattern is affected by different variables such as bracket/wire materials, tipping between brackets and wires, clinical medium, etc. This in vitro study aimed to investigate the friction and wear characteristics of different bracket/archwire combinations tested under ambient dry and salivary conditions with and without tipping between brackets and wires.

MATERIALS AND METHOD: A stainless steel bracket with a 0.018 inch slot (Mini Uni-Twin™, 3M Unitek, Monrovia, California, USA) was coupled with different archwire materials (n = 400), using custom made reciprocating sliding equipment equipped with a rotation table. Under tipping of 0 and 3 degrees, the test materials were subjected to 20 reciprocating sliding cycles with a displacement amplitude of 200 µm and under a normal load of 2 N. Tests were performed under ambient humidity conditions (50% RH) at room temperature and under artificial saliva at 37°C. The frictional forces were measured and the resulting wear tracks were inspected by scanning electron microscopy.

RESULTS: Tipping resulted in a slight increase in frictional forces, which were different for different material combinations. Small-scaled, flexible wires showed better sliding behaviour when facing higher tipping degrees than larger, stiff wires. High friction was accompanied by more material damage and debris accumulation at the sliding area. Saliva led to a reduction in frictional force and debris accumulation on the sliding surfaces.

CONCLUSION: Clinically, it thus seems appropriate to achieve smooth efficient sliding to maintain the material integrity of the bracket-wire combination by using flexible wire materials such as nickel titanium under tipping, rather than using stiff wire materials such as stainless steel.

SP 343 EFFECTS OF FORCE MAGNITUDE ON THE UPPER MOLARS IN CERVICAL HEADGEAR TREATMENT – A PANORAMIC STUDY
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AIMS: To study the impact of different force magnitude in cervical headgear therapy (CHG) on the first and second upper molars.

SUBJECTS AND METHOD: Subjects with Class II or end-to-end molar relationship, mixed dentition and moderate crowding to be treated with CHG were recruited for the study. Patients were allocated to light (L, 300 g) or heavy (H, 500 g) force in the CHG. The force magnitude was set while the patient was sitting and looking straight ahead. 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 the CHG for 10 hours/day. CHG 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 the Smartgear (Swissorthodontics, Switzerland) module. A panoramic radiograph was taken before (T1) and after (T2) treatment. The angle between the long axis of first and second (right and left) upper molars to condylar line (the most superior point of right and left condyle) was measured twice; mean value was used in Wilcoxon test for statistical analysis. The
present study was based on 40 children (L: n = 22, H: n = 18, mean age 9.73 ± 0.74 years and 9.88 ± 0.73 years; respectively; 15 male, 25 female).

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, t = 0.002). At T1 no difference was seen between the groups in the angulation of the maxillary molars. After the study (T2) no statistically difference was found between the groups. In the L group change in the angulation during treatment (T1-T2) was not statistically significant. In the H group the first molars did not show statistically significant angulation change, but the second molars seemed to tip to distal direction, with great individual variability. On the right tipping was 8.3 ± 8.4 degrees (P = 0.001) and on the left 6.4 ± 8.6 degrees (P = 0.003).

CONCLUSION: According to this panoramic study, distal tipping of the permanent second maxillary molars seems to take place in CHG therapy with heavy force magnitude. This side effect was seen although the device was used less in the H than in the L group.

SP 344 SKELETALLY ANCHORED NON-COMPLIANCE CLASS III BITE CORRECTOR: A PROSPECTIVE CLINICAL TRIAL
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AIMS: Class III correction with growth modification has been revolutionized by the introduction of skeletal anchorage. The use of miniplates with elastics as introduced by De Clerck has made treatment more acceptable for patients than the protraction facemask. However good patient compliance with elastic wear is crucial to the success of treatment. In addition flap surgery is required both to place and remove the miniplates. The aim of this study was to evaluate the effects of a newly developed non-compliance miniscrew supported Class III corrector on growing Class III patients.

SUBJECTS AND METHOD: This was a prospective clinical trial. Sixteen patients with a skeletal Class III malocclusion that complied with the selection criteria were included. The age range was between 9-12 years with seven females and nine males. A cone beam computed tomograph was taken before commencement of treatment and after appliance removal. The appliance comprised a maxillary expansion appliance supported on the maxillary first molars and two Benefit miniscrews placed transsagittally in the anterior palate with a cantilever arm extended mesially from the maxillary molars. The lower component consisted of a lower lingual arch. The active component, a modified Powerscope spring (American Orthodontics) was connected from the maxillary cantilever arm to the mandibular first molar with a maxillary protraction force of 300 g. Shims were progressively placed to increase activation of the springs.

RESULTS: The Class III malocclusion was corrected in all subjects with a treatment time of 10-12 months. The appliance was well tolerated by the patients, however there was one frequent issue of the left spring becoming unattached and needing to be refitted. The correction of the skeletal pattern was achieved with maxillary advancement and some mandibular backwards rotation. There was significant improvement of ANB and Wits appraisal. Dentally there was a minimal change in upper incisor inclination while there was lingual inclination of the mandibular incisors.

CONCLUSION: The miniscrew anchored non-compliance Class III corrector was effective at correcting skeletal Class III malocclusions with minimal patient compliance. Further refinement of the design is required to minimise unscheduled repair appointments.

SP 345 SURVEY OF KNOWLEDGE OF UNDERGRADUATE DENTAL STUDENTS REGARDING CARIES RISK ASSESSMENT AND MANAGEMENT OF CARIES LESIONS IN MARBURG, GERMANY
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AIMS: The high prevalence of white spot lesions associated with fixed appliances represents a significant challenge in orthodontics. The International Caries Classification and Management
System (ICCMS) enables evidence-based, cost-neutral and non-invasive detection of changes in dental hard tissue. It can be used as an educational tool for incorporation of modern caries management concepts into the dental curriculum. The aim of this study was to investigate the knowledge of undergraduate students regarding the assessment of patient’s caries risk and the management of caries lesions in Marburg Dental School, Germany.

MATERIALS AND METHOD: Questionnaires were distributed among third-year students after attending a lecture about ICCMS. Twelve blinded orthodontic patient cases were included in the questionnaire, represented by clinical and radiographic sets of images and patient’s medical history. For each case either patient’s caries risk (low, moderate, high) and treatment planning option for one selected tooth (preventive, minimum intervention or restorative treatment) should be assigned. A consensus of two experienced dentists was determined as the reference standard. Statistical analysis was performed with SPSS, V24. Agreement of the students’ responses to the reference was determined using kappa statistics. Binomial tests were used to evaluate whether the students were more likely to over- or underestimate caries risk and management options (α = 0.05).

RESULTS: Questionnaires were completed by 26 out of 27 available students. The mean kappa values were 0.178 for caries risk assessment and 0.073 for treatment option. Regarding caries risk assessment, the percentage agreement of the students towards the reference was 51.3 per cent [95% confidence interval (CI): 45.6%; 57.0%], for treatment planning agreement was 40.7 per cent (95%CI: 35.2%; 46.4%). For risk assessment for the caries management options the percentage of responses differed significantly towards underestimation compared to the reference (P < 0.0001).

CONCLUSION: Definition of caries risk and the corresponding treatment options require high clinical experience. Due to the low agreement between undergraduate students and experienced dentists regarding caries risk assessment and management, the results suggest the need for integrating the ICCMS into the orthodontic curriculum in order to effectively prevent white spot lesions with fixed appliances.

SP 346 MICROBIAL ATTACHMENT AND BIOFILM FORMATION TO ALIGNER MATERIALS
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AIMS: To assess the initial bacterial adhesion and biofilm formation on aligner materials.
MATERIALS AND METHOD: Stimulated human saliva was obtained from six healthy volunteers. The saliva was stored at –80 °C prior to use, while after the bacterial adhesion tests the adherent salivary bacteria were cultivated under both aerobic and anaerobic conditions on Columbia blood agar plates (CBA, Becton Dickinson, Heidelberg, Germany) at 37°C and 5 per cent CO2 and in anaerobic jars (Anaerocult A; Merck, Darmstadt, Germany) on Schaedler PB503417 plates overnight, respectively. Colony forming units (CFUs): Three samples of each material surface were placed into multi-well plates. 1 ml of the salivary suspension was injected onto each sample surface for 2 hours and 3 days, respectively. The samples were then washed twice with 5 ml 0.9 per cent NaCl solution and non-adherent bacteria were removed. Finally, the adherent microorganisms were dislodged from the sample surfaces after ultrasonication for 4 minutes in 1 ml 0.9 per cent NaCl on ice and several dilutions thereof were inserted the CBA or SDA for determination of CFUs. This protocol was applied three times, obtaining an average of nine independent measurements for each material group.

RESULTS AND CONCLUSIONS: The differences between the materials and the materials and controls were not of statistical significance. Regarding bacterial attachment, the tested materials were comparable to enamel and can be therefore considered for clinical use.

SP 347 COMPARISON OF A LINGUAL AND A LABIAL SELF-LIGATING ORTHODONTIC APPLIANCES
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AIMS: To retrospectively compare a self-ligating fully customized lingual bracket system (Harmony, AO) versus a self-ligating pre-programmed labial bracket system (Empower, AO).

MATERIALS AND METHOD: Medical records of 70 patients treated with a fixed multibrackets orthodontic appliance were screened: Eighty patients treated with a Harmony appliance were included in the group GL and 24 treated with an Empower appliance in the GB group. The difficulties encountered by the operator in relation to the positioning of the two orthodontic appliances, the frequency of bracket breakage and bond failure rate, time for the initial orthodontic alignment and insertion time of different archwires, overall treatment duration and total visits number, oral discomfort and pain experienced by patients (evaluated with a visual analogue scale) were recorded and descriptive statistics were applied.

RESULTS: In the GB group there was a greater number of visits and a longer duration of treatment, the insertion time of the archwire was significantly shorter, especially with the first two archwires of the series ($P < 0.01$), the braces positioning was more difficult ($P < 0.01$). In the GL group there was a greater post-insertion pain perception ($P < 0.05$), assessed at 4 and 24 hours and 3 and 7 days, only during the days immediately following insertion of the third and the fourth arch. The lingual device was found to be more painful than the labial one in relation to general and dental pain ($P < 0.05$) and the patients perceived greater discomfort in relation to diet, phonetics and oral hygiene at home only after insertion of the first two archwires, and a nuisance to the tongue lasting all treatment. There were no significant differences in the opening and closing easiness of the brackets, in bond failure and bracket breakage rate and in the number of days to achieve alignment.

CONCLUSION: The present study indicates that there were no significant differences in the number of days needed to obtain a good correction of the malocclusion. The oral negative impacts decreased over time, although they were experienced during both self-ligating fixed orthodontic therapies.

SP 348 PSYCHOMETRIC VALIDATION OF A PRE-EXISTING QUESTIONNAIRE USED TO MEASURE PATIENT SATISFACTION FOLLOWING ORTHODONTIC TREATMENT IN A UK POPULATION
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AIMS: To determine the psychometric properties of a pre-existing orthodontic satisfaction questionnaire and to assess patient satisfaction of their orthodontic treatment with patient demographic variables; age, gender, ethnicity and malocclusion.

MATERIALS AND METHOD: This study was carried out at King’s College Dental Hospital, and Queen Mary’s Hospital, Sidcup. An expert panel assessed a pre-existing orthodontic treatment satisfaction questionnaire (Bos et al., 2003), for validity and readability. Revisions were made to the questionnaire, and it was distributed to 103 participants who were aged 12-15 years, on completion of their fixed orthodontic treatment (T1). Test-retest reliability of the questionnaire was assessed through completion of a second questionnaire by 17 participants, at a 2-week interval (T2). The questionnaire was assessed for reliability using Item-Total Correlations (I-T C), and Cronbach’s alpha. Factor analysis allowed exploration of the underlying factor structure of the questionnaire. Test-retest reliability was assessed using Cohen’s kappa coefficient. Subject demographic variables were analysed using multiple regression analysis to assess their association with satisfaction level of treatment.

RESULTS: Following validity and readability assessment by the expert panel, the questionnaire was revised. The reliability of the overall scale was found to be generally more reliable than the underlying sub-scales. Eleven items were removed following item analysis (with I-T ≤ 0.3). Factor analysis was deemed uninterpretable. The overall scale demonstrated greater reliability than the underlying sub-scales. Therefore, the sub-scales were removed, resulting in one scale which assessed overall orthodontic satisfaction, comprising 37 items, with a Cronbach alpha of 0.92.
Multiple regression analysis of subject demographic variables using total satisfaction score, found ethnicity to have a significant association with orthodontic treatment satisfaction ($P = 0.01$).

CONCLUSION: This study provides a valid and reliable measure to assess treatment satisfaction, for use within a United Kingdom population of 12-15 year olds on completion of fixed orthodontic treatment.

SP 349 ROOT RESORPTION AND PULP REACTION IN TRAUMATIZED INCISORS UNDERGOING ORTHODONTIC TREATMENT, A SYSTEMATIC REVIEW
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AIMS: To review the literature investigating the effects of orthodontic treatment and trauma on pulp and root tissues of maxillary incisors.

MATERIALS AND METHOD: Available data were identified in selected electronic databases: PubMed, Web of Science, Embase and Cochrane Clinical Trials, by combining: ‘Tooth trauma’ OR ‘Tooth injuries’ AND ‘Orthodontics’. The search included only articles published in English (last updated on 30 July 2018). The results were reported in accordance with the PRISMA guidelines. Risk of bias was assessed by Newcastle-Ottawa quality assessment checklist.

RESULTS: Two independent reviewers screened 2018 unique articles and data could be extracted from 11 articles. Six were of good quality, four fair quality and one poor quality. The exposed cohort was generally non-representative. In most of the studies there was a control group and except for one article, patients were under 18-years old. Pulp reactions were mostly evaluated by clinical examination (crown colour, pain, swelling, fistula), sensitivity and electrical tests and radiological examination (root development and periradicular radiolucency). Pulp necrosis seemed to be more frequent in mature teeth, but also when the risk factors ‘orthodontic treatment’ and ‘trauma’ were both present. Extrusive luxation and intrusion had the most detrimental effect on pulp vitality. The occurrence of pulp obliteration did not seem to be much affected. To score root resorption, the Malmgen index was frequently noted. Periapical radiographs were a common tool for possible root resorption detection, except for one article using cone beam computed tomography. There was contradiction in the literature whether a combination of orthodontics and trauma increased root resorption or not, rather than these factors seen independently.

CONCLUSION: Despite some controversies in these studies, a higher trend for pulp necrosis, and a normal to slightly increased pattern of root resorption probability seem to occur in traumatized maxillary incisors undergoing orthodontic treatment. According to the quality assessment, there is need for studies with a more representative exposed cohort.

SP 350 A VALIDATION STUDY OF THE MALOCCLUSION IMPACT QUESTIONNAIRE TO MEASURE ORAL HEALTH-RELATED QUALITY OF LIFE IN GREEK ADOLESCENTS WITH MALOCCLUSION
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AIMS: The malocclusion impact questionnaire (MIQ) is a specific Oral Health-Related Quality of Life (OHRQoL) assessment instrument, which was recently developed in the United Kingdom to assess OHRQoL in adolescents. The aim of the present study was to translate, culturally adapt and validate the MIQ questionnaire in a sample of Greek adolescents with different types of malocclusion.

MATERIALS AND METHOD: After translation according to current guidelines, the comprehensiveness of the Greek version of MIQ was verified in a pilot study of 20 Greek adolescents. The current main study was undertaken in a sample of 200 native Greek speakers aged 10-16 years presenting for an initial consultation at the Postgraduate Orthodontic Clinic of the
Aristotle University of Thessaloniki. The Oral Health Impact Profile (OHIP-14) questionnaire, which was already validated for Greek adolescents, was used to investigate criterion validity. Forty adolescents completed the same questionnaires (MIQ and OHIP-14) again after 3 weeks in order to test the repeatability of the measurements. Cronbach’s alpha was used to test the internal consistency/reliability and Spearman’s rho for the criterion validity. Test-retest reliability was tested using intraclass correlation coefficient. Statistical tests were undertaken using SPSS (v. 24 IBM Corp., New York, USA).

RESULTS: The MIQ-GR presented high internal consistency (Cronbach’s alpha = 0.887 > 0.70) and a very satisfactory discrimination index (0.53 > 0.30). A positive, strong, and statistically significant correlation was found between the total scores of the MIQ-GR scale and the OHIP scale (rho = 0.492, P < 0.001). Test-retest reliability was at high levels (ICC = 0.847, P < 0.001).

CONCLUSION: The MIQ-GR may exhibit good psychometric properties in terms of validity and reliability and seems to be a reliable instrument to assess OHRQoL in Greek adolescents. Further testing of the measure is required in a variety of environments.

SP 351 DYNAMIC DENTOFACIAL CHANGES IN A SURGERY-FIRST APPROACH TO MANDIBULAR PROGNATHISM WITH BILATERAL SAGITTAL SPLIT OSTEOTOMY AND SETBACK
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AIMS: To retrospectively assess and describe the dentofacial changes in mandibular prognathic patients having undergone a surgery-first approach to mandibular setback with bilateral sagittal split osteotomy (BSSO).

SUBJECTS AND METHOD: Forty-four patients (30 female, 14 male) treated with a standardised surgery-first procedure performed by a team of a single orthodontist and two surgeons were evaluated. Subjects aged 15.8 to 43.2 (mean 27.0) years with complete and diagnostic radiographic records were included. Lateral cephalograms taken at initial (T0), immediately after surgery (T1) and deband (T2) were digitally traced and superimposed using the cranial base method with QuickCeph®. Angular and linear measurements of dentofacial landmarks referenced to a horizontal reference plane (sella-nasion minus 7°) were reported descriptively using SPSS®.

RESULTS: Patients undergoing surgery-first treatment presented with a divergent skeletal Class III relationship and dental compensations of proclined upper and retroclined lower incisors (ANB -1.1 ± 2.6°; Wits -9.4 ± 3.4 mm; MPA 37.3 ± 5.9°). Immediate post-surgical results showed Class II open bite dental relationships (ANB 5.1 ± 2.0°; Wits 1.6 ± 3.2mm; overjet 8.3 ± 5.3 mm; overbite -1.8 ± 2.1 mm; MPA 41.1 ± 5.7°). T1 decompensation involving normalisation of the position of the dentition within the maxilla and mandible was achieved in all patients (ANB 2.9 ± 2.3°; Wits -1.8 ± 2.37 mm; MPA 37.8 ± 6.1°). The total treatment time was 412.6 ± 174.8 days with the mean sagittal setback (T0-T1) of the mandible at Pogonion being –12.8 ± 2.7 mm.

CONCLUSION: Dynamic dentofacial changes occur as part of a surgery first-approach to mandibular prognathism with BSSO and setback. A transition between Class III, Class II open bite and Class I skeletal relationships is observed with planned mandibular autorotation during post-surgical decompensation. In the surgery-first approach, the positional change of the mandible should be acknowledged and differentiated from that of surgical relapse.

SP 352 EVALUATION OF PROGNOSTIC CEPHALOMETRIC INDICES IN THE ORTHODONTIC TREATMENT OF CLASS III MALOCCLUSION
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AIMS: To identify key cephalometric parameters that could explain the differences in early morphology of a Class III malocclusion in patients with a good prognosis.

SUBJECTS AND METHOD: Fifty six patients with an Angle Class III malocclusion, aged between 9-14 years. The cephalograms were examined before treatment, after treatment, and during the long-
term retention period. Anterior open bites were corrected in all patients after orthodontic treatment. After an average 3-year monitoring period, all subjects were re-evaluated and divided into three groups, according to the occlusal status: good, average and weak occlusal stability. Five cephalometric variables were analyzed on lateral cephalograms, prior to treatment using unidirectional variance analysis and discriminant analysis in order to identify the key determinants for differentiation between the three groups.

RESULTS: Overall, statistical significance was found in subjects with a lower gonial angle and with a hypodivergent skeletal pattern, who had a good prognosis after early treatment of the Class III malocclusion. The discriminant analysis indicated a relatively high degree of correct classifications of patients with Class III malocclusions.

CONCLUSION: This study shows the importance of discriminant analysis that is clinically useful, particularly when deciding to use early orthodontic treatment, the actual orthodontic treatment or orthognathic surgery in patients with a Class III malocclusion.

SP 353 THE PSYCHOLOGICAL IMPACT OF DENTOMAXILLARY ANOMALIES ON THE QUALITY OF LIFE
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AIMS: To assess the level of dysfunction, discomfort and disability that seems to correspond to clinical conditions, to describe some medical-social aspects and to determine the psychological impact in patients with dentomaxillary abnormalities on the quality of life (QoL).

SUBJECTS AND METHOD: A conventional sample of 151 orthodontic patients was included in order to register statements regarding the psychological impact, based on a questionnaire. The questionnaire consisted of 49 questions. To highlight the adverse impact of oral disease, a transversal study was conducted which allowed description of the medical and social aspects and determination of the psychological impact in children with dentomaxillary abnormalities on their oral health and QoL.

RESULTS: According to the inclusion criteria and after obtaining the participation consent, the enrolled children were on average 16.8 ± 1.12 years of age (lower limit – 14 years and upper limit – 18 years). The cross-sectional research that was used via the questionnaire showed the levels of dysfunction, discomfort and disability that correspond to clinical conditions and the access to dental care. At this descriptive level, the results demonstrated some subtle differences to the conceptual dimensions of the impact with regard to functional limitation and physical disability. The psychological impact on respondents was manifested at varying rates, as an example, in dental problems (rn = 0.689), followed by sense of discomfort (rn = 0.667) and feeling tense (rn = 0.625). In the assessment of psychological disabilities, the greatest impact was manifested by affection (affectivity) (rn = 0.613), second place embarrassment (rn = 0.603) and third place depression (rn = 0.674). At the same time, oral cavity status had an impact on social disability. In first place was the feeling irritation towards other people (rn = 0.510), followed by difficulties in performing daily activities (rn = 0.479) and then low tolerance level towards family (rn = 0.453).

CONCLUSION: Based on the analysis of the data obtained in this study, the degree of medical-social impact of dentomaxillary abnormalities on the QoL in children, on which we can determine certain goals for the improvement of their life quality can be assessed.

SP 354 ASSOCIATIONS BETWEEN BOLTON RATIO AND SAGITTAL ANTERIOR RELATIONSHIPS – THE NORTHERN FINLAND 1966 BIRTH COHORT STUDY
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AIMS: To determine the anterior Bolton ratio for the Finnish adult population and to investigate associations between anterior Bolton ratio and deviations of overjet.

MATERIALS AND METHOD: This study is part of the Northern Finland 1966 Birth Cohort study. Clinical oral investigations were performed in connection with the 46-year follow-up for 1964 subjects. Clinical investigations included three-dimensional (3D) intraoral scannings and clinical
occlusion measurements. Subjects with clinically registered normal occlusion (overjet 2 mm, overbite 2 mm, no crossbite or scissor bite) were selected for further 3D analysis. The Dental Health Component (DHC) of the Index of Orthodontic Treatment (IOTN) was used to exclude the subjects with other deviations from the normal occlusion group (n = 164). Subjects with an extreme overjet ≥8 mm (n = 56), large overjet 6-7 mm (n = 107) and negative overjet (n = 19) were selected for further analysis. The mesiodistal widths of anterior teeth from canine to canine were measured from the upper and lower arch to evaluate the anterior Bolton ratio. Statistical differences between groups were tested using analysis of variance (ANOVA) and Tamhane’s T2 as a post hoc test.

RESULT: A mean anterior Bolton ratio of 78.7 [Standard deviation (SD 3.5)] was found for the normal occlusion group. The mean anterior Bolton ratios were in the extremely large overjet group 77.2 (SD 2.6), large overjet group 78.2 (SD 3.2) and negative overjet group 80.9 (SD 5.8). A statistically significant difference was found between the subjects with extreme and normal occlusion (P < 0.01).

CONCLUSION: The mean anterior Bolton ratio was larger compared to the original Bolton ratio. Tooth size discrepancy between upper and lower anterior teeth were related to overjet at least in subjects with extreme overjet. Possibility for tooth size discrepancy should be taken into consideration in orthodontic treatment, especially in cases of extreme overjet.

SP 355 ANALYSIS OF PALATAL BONE DENSITY TO DETERMINE AN OPTIMAL INSERTION POSITION AND ANGLE FOR ORTHODONTIC MINI-IMPLANTS
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AIMS: Orthodontic mini-implants are frequently placed in the anterior palate to provide extra anchorage for orthodontic appliances. In order to avoid anchorage loss, implants should be inserted at locations of sufficient bone quality. Bone height was found to be greatest in a ‘T-Zone’ in recent studies. Despite, bone density in this area has been sparsely investigated. The aim of the present study was to determine bone fraction in the anterior palate at different insertion positions and angles.

MATERIALS AND METHOD: Maxillary cone beam computed tomographic scans from 30 patients (m/f: 8/22, age: 18.6 ± 12.0 years) were analysed. To evaluate bone fraction in the anterior palate, a 25-reference point grid was defined: Five sagittal slices were extracted along the median plane, and bilaterally at 3 and 6 mm distant, respectively. Within each slice, five dental reference points were projected to the palatal curvature at the contact point between the canine and first premolar (C-PM1), mid of PM1, contact point between first and second premolar (PM1-PM2), mid of PM2 and between PM2 and the first molar (PM2-M1). In each slice histogram normalisation was conducted (air = 0, enamel = 255) and the lower threshold level was set to 33 per cent due to the most consistent segmentation. Bone fraction (5 mm thickness) was assessed with the volume fraction tool from the ImageJ Plugin BoneJ 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.

RESULT: High inter-individual variability was detected. Maximum bone fraction was found at all PM1 and PM1 MM2 points. Transverse and sagittal position both had a significant effect on bone fraction. At two insertion positions there was a significant impact of the insertion angle on the bone fraction. At C-PM1_R2 –20 degrees anterior tipping and at PM1-PM2_M –30 degrees anterior tipping was beneficial.

CONCLUSION: Within the limits of the study, optimal insertion positions were found at the height of all PM1 and PM1-MM2 points, two in the anterior palate. A significant impact of the insertion angle on bone fraction values was found at points C-PM1_R2 and PM1-MM2.

SP 356 THE EFFECT OF MANUAL LYMPHATIC DRAINAGE ON SWELLING AFTER ORTHOGNATHIC SURGERY
AIMS: Many patients report facial swelling to be one of their biggest concerns after orthognathic surgery. Despite being well-informed, it took them longer to recover from these inconveniences than expected. Notwithstanding the many tools used today to restrict swelling, additional techniques such as manual lymph drainage (MLD) are suggested to optimize the patients’ post-surgical comfort. Therefore, the aim of this study was to investigate the effect of MLD on post-surgical facial swelling, based on both objective [three-dimensional (3D) facial images] and subjective (questionnaire) measurements. Secondly, the differences in post-surgical pain levels were compared between groups.

SUBJECTS AND METHOD: Following positive ethical advice a randomized, single-centre, prospective, two-arm clinical trial with blinded end-point assessment was set up. All patients (n = 26) included in this study underwent a LeFort I and/or bilateral sagittal split osteotomy and met certain inclusion criteria. Both the intervention (n = 13) and control (n = 13) group received the same post-operative care, whereas the intervention group also underwent five sessions of MLD after surgery. 3D facial scans and questionnaires, using the visual analogue scale, were collected on days 3, 7, 14, 30, 90 and 180 post-operatively representing objective swelling and subjective swelling/pain, respectively. Independent samples t-tests and non-parametric Mann-Whitney U-tests were performed to investigate the effect of MLD. Statistical significance was assumed at the 5 per cent level.

RESULTS: Twenty-six patients (mean age 29 years; range 16-57 years) were included for statistical analysis. 3D facial scans showed a slightly faster decrease in swelling for the intervention group, but no statistically significant difference could be found for any time point ($P > 0.05$). The largest difference in swelling between the groups was found on post-operative day 30 in favour of the intervention group being 3.99 per cent (95% confidence interval –8.29; 16.28]. No statistically significant difference could be found between either group regarding the questionnaires.

CONCLUSION: Based on this study, no statistically significant difference could be found between patients treated with or without MLD after orthognathic surgery concerning swelling and pain.

SP 357 DENTAL DEVELOPMENT IN PATIENTS WITH A UNILATERAL CLEFT LIP AND PALATE: A RETROSPECTIVE STUDY
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AIMS: This retrospective study aimed to evaluate if the presence of a unilateral cleft lip and palate (UCLP) causes delay in dental age and tooth development, as suggested by recent research. Factors that may be related to the amount of delay; such as tooth position, tooth proximity to the cleft, age, gender and agenesis of teeth were also investigated.

MATERIALS AND METHOD: Dental pantomographs (DPT) of 189 non-syndromic patients (aged 6 to 20 years) with a UCLP were collected. The DPTs of the cleft group were compared to a control group, matched for age and gender (n = 189). A total of 378 DPTs were staged according to the validated methods developed by Demirjian and Willems. All present permanent teeth were investigated in this study. In order to evaluate the difference between UCLP and non-UCLP patients, a custom-made developmental score (DS) was used.

RESULTS: At all ages, dental age was significantly lower in the UCLP group, however, not at all ages was this difference statistically significant. DS was significantly lower in the UCLP group compared to the control group. In the cleft group, the teeth in the upper jaw were more delayed compared to the teeth in the lower jaw.

CONCLUSION: The presence of a UCLP needs to be taken into account for treatment planning in orthodontics. The delay in dental development in ULCP patients implies a delay in the start of orthodontic treatment. Moreover, chronological age can be underestimated in UCLP patients when using age estimation methods based on permanent tooth development.
SP 358 FACTORS INFLUENCING THE PERCEPTION OF FACIAL ATTRACTIVENESS IN PATIENTS OF DIFFERENT ETHNICITIES WITH CLASS III SKELETAL PROFILES

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AIMS: To determine the impact of race on facial attractiveness ratings in patients with Class III skeletal profiles.

MATERIALS AND METHOD: A prospective cross-sectional observational questionnaire was distributed to consultant and specialist orthodontists and oral and maxillofacial surgeons in the United Kingdom and Hong Kong using a mixed methods approach. The questionnaire contained lifelike average composite profile images of an adult male and female of Chinese and Caucasian ethnicities; four images in total. The profile images were manipulated to create skeletal Class III discrepancies of increasing severity from baseline (0 mm) in the mandible; (+2 mm, +4 mm, +6 mm), and the maxilla; (−2 mm, −4 mm, −6 mm). Respondents were asked ‘how do you rate the level of attractiveness of the profile?’ on a 7-point Likert scale. The factors influencing attractiveness ratings were investigated using multilevel linear regression analysis.

RESULTS: The response rate was 61 per cent (N = 306). Twenty five per cent of respondents were from Hong Kong and 75 per cent the United Kingdom. The most frequent ethnicity was white British (59.9%) followed by Asian Chinese (24.8%). Attractiveness ratings for all manipulated Class III profiles were statistically significantly different to baseline (P < 0.001). On average the −2 mm and +2 mm manipulations were rated as more attractive than baseline (P = < 0.001). Attractiveness ratings reduced with increasing severity of Class III manipulation with −6 mm maxilla being rated least attractive [regression coefficient: −2.17, 95% confidence interval (CI) −2.23, −2.10, P = < 0.001]. Maxillary manipulations were on average rated as less attractive than the mandibular manipulation with the same degree of discrepancy. Ethnicity was a statistically significant factor associated with attractiveness rating with Caucasian profiles rated more attractive than Chinese profiles for the same degree of manipulation (−0.23, 95% CI −0.26, −0.20, P = < 0.001). There was no statistically significant association with respondent gender, personal rating of importance of facial attractiveness, specialty, years since becoming a specialist or number of orthognathic cases treated a year on attractiveness ratings.

CONCLUSION: Patient ethnicity has a statistically significant impact on facial attractiveness with Caucasian profiles rated as more attractive than Chinese for the same degree of discrepancy. Mild Class III skeletal profiles are significantly more attractive than baseline for all genders and ethnicities with attractiveness decreasing with increasing severity of the Class III profile.

SP 359 CLINICIAN’S PERCEPTION OF THE BENEFIT OF ORTHOGNATHIC SURGERY IN PATIENTS OF DIFFERENT RACIAL BACKGROUNDS PRESENTING WITH A CLASS III SKELETAL DISCREPANCY

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AIMS: To investigate the impact of patients’ race on clinician’s perception of potential benefit from orthognathic surgery in patients with Class III skeletal profiles.

MATERIALS AND METHOD: A prospective cross-sectional observational questionnaire was distributed to consultant and specialist orthodontists and oral and maxillofacial surgeons in the United Kingdom and Hong Kong. The questionnaire contained average composite profile images of adult male and female patients from two different racial backgrounds (Caucasian and Chinese) which had been manipulated to produce increasingly severe Class III skeletal discrepancies. The manipulations were in 2 mm increments from baseline (0 mm) on both the mandible; (+2 mm, +4 mm, +6 mm), and maxilla; (−2 mm, −4 mm, −6 mm). Respondents were asked whether they felt that ‘a patient presenting with this skeletal pattern would benefit from orthognathic surgery’.
Multilevel logistic regression was used to investigate factors influencing the decision to recommend surgery.

RESULTS: All manipulated Class III profiles had a significant benefit from surgery compared with baseline ($P = < 0.006, P < 0.001$). The odds of recommendation for surgery increased with the size of discrepancy. For equal manipulations the odds of recommending surgery for maxillary manipulations were greater than mandibular. There was a statistically significant difference in perception of benefit from surgery between orthodontists and oral and maxillofacial surgeons ($P = < 0.001$). Oral and maxillofacial surgeons were 3.94 times more likely to recommend surgery than orthodontists. The photographs’ race and gender were highly statistically significant factors for predicting perceived benefit from surgery ($P < 0.001$). The odds of clinicians perceiving benefit from surgery increased by 3.10 times for female images and by 2.09 times for Chinese images compared to Caucasian images. Years since becoming a specialist, specialty and the number of orthognathic patients treated per year were statistically significant factors in predicting perceived benefit from orthognathic surgery ($P = < 0.001$). Gender of the rater did not have a statistically significant association with the decision for benefit of surgery ($P = 0.489$).

CONCLUSION: Oral and maxillofacial surgeons are more likely to perceive benefit from surgery in patients with Class III skeletal profiles than orthodontists. Ethnicity significantly impacts decision making with Chinese profiles more likely to be perceived as having benefit from surgery than Caucasian profiles with the same degree of discrepancy.

SP 360 PERIODONTAL AND MICROBIAL CHANGES ASSOCIATED WITH ORTHODONTIC TREATMENT: A SYSTEMATIC REVIEW

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AIMS: To investigate microbial and periodontal changes before, during and after orthodontic treatment and determine if these parameters can be normalized once orthodontics has been completed.

MATERIALS AND METHOD: In order to elaborate the following systematic review, a search of information was carried out in PubMed and Medline databases. Inclusion and exclusion criteria were defined, as well as a variable to analyse the characteristics of the selected articles.

RESULTS: Nine of the articles reviewed showed that orthodontic treatment can affect the properties of the oral environment and alter the balance of the ecosystem, making it more pathogenic. In all studied patients, the levels of microbial pathogens increased during orthodontic treatment. Two other studies determined that aligners showed better results in terms of periodontal health, although the periodontal parameters also increased in the first months. In relation to the design of the bracket or the type of ligatures used, seven articles affirmed that there are no significant differences in terms of the increase of plaque and microbial changes.

CONCLUSION: The presence of fixed appliances produces a constant increase in the colonization rate of pathogenic bacteria but decreases once the orthodontic devices are removed. The studies carried out to date present certain limitations, for which additional studies are required to evaluate the microbial changes throughout the orthodontic process, both in fixed mechanics and especially in treatments with aligners.

SP 361 UPPER AIRWAY CHANGES FOLLOWING HIGH OBLIQUE SAGITTAL SPLIT OSTEOTOMY

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AIMS: Due to the fact that the commonly applied bilateral sagittal split osteotomy (BSSO) bears a risk for nerve injury during orthognathic surgery, some surgeons have proceeded to bypass the alveolar nerve by performing a high oblique sagittal split osteotomy (HSSO). The aim of this study was to evaluate volumetric and cross-sectional changes of the posterior airway space (PAS) following bimaxillary surgery with HSSO.
SUBJECTS AND METHOD: Twenty five Class II and 28 Class III patients (age 33.2 ± 13.0 years) underwent bimaxillary surgery with HSSO. Before (T0) and 6-12 months after surgery (T1) cone beam computed tomographs (CBCT) were taken and analyzed using three-dimensional software (Mimics® Innovation Suite 18.0; Materialise, Leuven, Belgium). The PAS was divided into three segments (superior, middle, inferior) by three planes parallel to the Frankfort horizontal plane intersecting at the posterior nasal spine, the velum palatinum and the epiglottis. Total (TPAS) and partial volumes (SPAS = superior, MPAS = middle, IPAS = inferior) were calculated. In addition the smallest cross-sectional area of the TPAS was measured.

RESULTS: For Class II patients a highly significant increase (P < 0.001) of the total, middle and inferior airway space (TPAS: +33.6%, MPAS: +43.1%, IPAS: +55.9%) was found, while the increase in upper airway space was not statistically significant (+5.4%, P = 0.074). The smallest cross-sectional area in the TPAS increased by 55.8 per cent. For Class III patients total, middle and inferior airway space increased statistically insignificantly (TPAS: +4.6%, P = 0.265, MPAS: +2.7%, P = 0.387, IPAS: +2.8%, P = 0.495), while the increase of upper airway space was statistically significant (+9.7%, P = 0.010).

CONCLUSION: Bimaxillary orthognathic surgery using the HSSO technique led to a significant increase of PAS for Class II patients but only an insignificant increase for Class III patients.

SP 362 INTRUSION OF MAXILLARY ANTERIOR TEETH: A FINITE ELEMENT ANALYSIS
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AIMS: To compare the pattern of initial tooth displacement and stress distribution between the miniscrew-supported iPanda and conventional buccal anchorage systems, and to define the anchorage situation on the posterior teeth using finite element (FE) analysis.

MATERIALS AND METHOD: An FE model of the maxilla with an iPanda was constructed. Two different conditions of intrusion mechanics were simulated. In the iPanda condition, the miniscrews (1.6 x 6 mm) were placed at the midpalatal suture and an archwire (0.9 mm) was bonded to the maxillary first molars as absolute anchorage. An intrusion arch (0.017 x 0.025 inches) was inserted into the bracket tubes on the maxillary first molars and applied the intrusion forces between the central incisors, mesial and distal to the lateral incisors. In the conventional buccal condition, the miniscrews (1.6 x 6 mm) were placed between the lateral incisors and canines. The force application was the same positions as above to miniscrew. In each model, under 20 gf of intrusive force, initial displacement of the individual anterior and first molar teeth was measured. Also, the von Mises stresses along the tooth were evaluated.

RESULTS: The anterior teeth underwent intrusion, accompanied by a labial tipping movement. The iPanda showed that the central and lateral incisors presented a similar initial displacement pattern, which was double that of canine. On the contrary, the buccal miniscrew showed the greatest initial displacement at a lateral incisor, which was triple that of the canine or central incisor. The maximum von Mises stress was evenly distributed across the central incisors, lateral incisors and canines, along the root surface in both models. Nevertheless, the first molars showed greater von Mises stress along the crown and root surface, with minimal displacement due to iPanda anchorage.

CONCLUSION: iPanda intrusion is an alternative treatment approach to effectively intrude anterior teeth without the need of additional miniscrews. Moreover, this mechanic can reduce the risk of extrusion of the maxillary first molars.

SP 363 CONE BEAM COMPUTED TOMOGRAPHIC SURVEY ON SURGERY FREE MAXILLARY EXPANSION IN ADULTS WITH ORTHODONTIC MINI-IMPLANTS. IS THERE A RISK OF CRANIO-BASAL FRACTURE? ‡‡‡
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Aims: The secure position of four force transmitting orthodontic mini-implants (OMI) in the anterior palate allows application of significant expansion forces via MICRO4 expander. This allows suture opening in adult patients. The aim of this longitudinal study was to investigate the skeletal and dental changes in adult patients before and after maxillary expansion with a pure bone-borne device (MICRO4-expander) using a force controlled and polycyclic protocol.

Subjects and Method: Twenty adult patients (14 females, 6 males) between 18 and 54 years (mean 26.2 ± 5.6 years). An expansion device (MICRO4-expander) was fixed with four OMI in the maxilla. A polycyclic expansion protocol was used to weaken and subsequently widen the midpalatal suture. Cone beam computed tomography (CBCT) was performed after placement of the four OMI and a second CBCT with the expander in place 3-5 months after maxillary expansion. Measurements were performed on the coronal and axial cross sections of the CBCTs with OsiriX software. Statistical evaluation was performed as appropriate.

Results: The mean expansion in the area of the anterior nasal spine width, maxillary tuberosity distance, infraorbital foramen distance, and the zygomatico-maxillary sutures distance was 6.0 ± 2.2 mm, 4.1 ± 2.3 mm, 2.0 ± 0.2 mm, and 1.4 ± 1.5 mm, respectively. These differences were statistically significant (P < 0.05). Expansion between the mesial walls of the optic foramina and the most caudal points of the external lamina of the pterygoid apophysis of the sphenoid bone was not statistically significant. The mean (± standard deviation) expansion between the cusps of the upper canines and the palatal cusps of the first molars was 5.8 ± 1.6 mm and 5.9 ± 2.3 mm, respectively. No signs of fracture of the sphenoid bone were observed.

Conclusion: A force controlled and polycyclic expansion protocol together with a pure bone-borne OMI fixed expander leads to significant expansion of the maxillary halves without expansion in the pterygoid region and the skull base. This therefore represents a viable treatment option for widening the maxilla in adult patients. It should always be used prior to surgically assisted rapid palatal expansion.

SP 364 Comparison of masticatory muscle activity and occlusal force distribution between anterior open bite and normal overbite

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Aims: To determine temporalis and masticatory muscle activity and relative occlusal force distribution in anterior open bite (AOB) in comparison with normal overbite (NOB) during maximum voluntary clenching (MVC).

Subjects and Method: Electromyographic activity (EMG) of the anterior temporal (AT) and masseter (MA) muscles was measured in 17 adults with an AOB (mean ages 25.2 ± 4.3 years) and 17 with NOB (mean ages 27.4 ± 5.4 years), in maximum clenching on cotton rolls and in MVC. The relative occlusal force distribution in each tooth was simultaneously evaluated during MVC under T-Scan monitoring. The values for maximum clenching on cotton rolls were used to standardize and normalize all MVC data. The mean and standard deviations of EMG values in each muscle and the mean and standard deviations of relative occlusal force in each tooth were compared between AOB and NOB using the two-sample t-test. The reliability of data was determined by intraclass correlation coefficient (ICC) analysis. A P-value of 0.05 was considered statistically significant.

Results: The mean muscle activity of TA and MA was significantly less in AOB than in NOB (P < 0.05). The mean relative occlusal forces were significantly less in AOB than in NOB (P < 0.05), except on the second molar, where the force was significantly greater in AOB (P < 0.05). The greatest force was concentrated on the second molar in AOB and on the first molar in NOB.

Conclusion: Masticatory muscle activity is weaker in AOB than in NOB. The concentration of occlusal force in the terminal teeth is greater in AOB than in NOB. This study supports the assumptions that masticatory muscle activity should be increased and the occlusal force in the
dental arch should be distributed anteriorly in order to prevent relapse after orthodontic treatment in AOB.

SP 365 A RETROSPECTIVE STUDY OF THE POSSIBLE EXTENT OF DISTALIZATION OF THE FIRST MOLARS IN CLASS II PATIENTS IN THE MIXED DENTITION
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AIMS: To measure the extent of distalization of the first permanent molars from the time before the eruption of the second permanent molars up to their eruption. Furthermore, the association between the distalization, the skeletal growth tendency, the influence of the distalization device, the stability and the limitations of distalization and the possible eruption difficulties of the second permanent molars in Class II patients were investigated.

MATERIALS AND METHOD: In this retrospective study the measured values were determined on the basis of existing cephalometric parameters and radiographic diagnosis. The archived records of 75 Class II patients in the mixed dentition were randomly selected and followed up until the permanent dentition. There were 38 females and 37 males aged from 8 to 12 years. Evaluation was done at the beginning, in the middle and at the end of treatment. The statistical depiction was performed by means of descriptive and explorative data analysis.

RESULTS: In eight cases distalization led to eruption difficulties of the second permanent molars. The average values of the PTV measurement of this group were noticeably smaller than those of the group without problems. There was also a relationship between growth tendency and distalization; patients with a horizontal growth type had higher average values of PTV measurements than the vertical growth type group. Regarding skeletal jaw position and distalization, retrognathic jaw positions showed a substantially shorter distance of the molars to the PTV-measurement line than orthognathic or prognathic jaw positions. Also age proved to have an influence, the group with 11 to 12 year olds had mainly the highest average values of PTV measurements. For gender, no significant correlations were found.

CONCLUSION: Despite the small number of problem cases, tendencies could be noted which influence distalization of the first permanent molars. On the one hand, the horizontal growth type and prognosis of the mandibular position positively favour distalization while on the other, between 11 and 12 years of age is the best possible treatment time. In addition, the position of the second permanent molar must be clarified.

SP 366 PAIN AND DISCOMFORT DURING THE FIRST WEEK OF TREATMENT WITH FIXED APPLIANCES: PRELIMINARY RESULTS FROM A RANDOMIZED CONTROLLED STUDY
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AIMS: To investigate and compare the experience of pain and discomfort in adolescents during the first week of treatment with a conventional or self-ligating bracket system
SUBJECTS AND METHOD: The total sample in this randomized controlled trial will include 200 participants from four different orthodontic clinics in Sweden. The present study is part of a larger project with the acronym CROWDIT (Crowding Displaced Teeth). Girls and boys aged 12 to 17 years with crowding and tooth displacement and in need of none extraction treatment with fixed appliance were included. Adolescents with craniofacial syndromes, previous orthodontic treatment, ongoing sucking habits and persisting primary teeth were excluded. The participants were randomized into two groups: One group with a conventional bracket system (Victory .022, 3M) and the other group with a self-ligating bracket system (Damon Q, .022, Ormco). The manufacturers’ recommendations regarding archwire materials and sequences were carefully followed. A questionnaire previously found to be valid and reliable (Feldmann et al., 2007) is used.
to assess patient perception of pain, discomfort and impact on daily activities. The questionnaires were filled in at baseline and during each evening the first week of treatment with fixed appliance. Chi²-test is used for statistical analysis.

RESULTS: So far, 80 participants have been treated and evaluated. In both groups the pain experience increased for the second day with fixed appliance. In the group treated with conventional brackets 50 per cent had unbearable pain from the anterior teeth on the second day compared to 39 per cent in the self-ligating group. The difference was not significant (NS) between the groups (Chi²). In the group treated with conventional brackets 76 per cent used analgesics on the second day compared to 61 per cent in the group with self-ligating brackets (NS). Impact on daily leisure and sleep disturbances were low in both groups.

CONCLUSION: It is important to be aware of the intensive pain adolescents may experience during the first days of treatment with fixed appliance. About 2/3-3/4 need to take analgesics. The preliminary results show some differences between the two groups, but in this limited material these differences were not significant.

SP 367 INITIAL DENTAL KNOWLEDGE SCORES OF FIRST YEAR ORTHODONTIC RESIDENTS COMPARED TO ORTHODONTIC KNOWLEDGE SCORES OF GRADUATING ORTHODONTIC RESIDENTS

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AIMS: As North American Dental Schools move towards a pass/fail system, it has become more difficult to select top performing candidates for orthodontic residency programmes. The aim of this study was to compare the initial cognitive dental knowledge scores with the final comprehensive orthodontic knowledge scores of the same graduating orthodontic residents, to determine if an initial knowledge examination predicted future didactic success at the end of the specialty programme.

SUBJECTS AND METHOD: Thirty three students from five accredited programmes in Canada and the USA, completed a 148 question multiple choice examination (MCE) consisting of basic dental science and clinical dentistry topics, at the start of their programme, providing the initial score, in addition to a comprehensive orthodontic specialty-based MCE providing the final score, at the end of the programme. As Shapiro-Wilk and Kolmogorov-Smirnov tests did not support normality, Spearman correlation and a Wilcoxon signed-rank test were applied to assess statistical differences between the scores.

RESULTS: The mean initial score percentage attained by the 33 subjects was 49.06 ± 6.52 per cent with a range of 33.1 to 61.5 per cent. The mean final score percentage was slightly higher at 52.40 ± 22.20 per cent, but with a much larger SD and range (13.39 to 76.38%). Wilcoxon’s signed-rank test indicated no statistically significant difference between the initial and final scores in raw values or percentage data (P > 0.05). The Spearman correlation analysis indicated no significant correlation between the initial and final scores (P > 0.05).

CONCLUSION: Orthodontic residents enter the programme with high grade point average scores and dental board scores, but retention of general dental knowledge is low. Performance was also poor on the orthodontic examination at the end of the programme, possibly due to their knowing that the results were anonymous. Orthodontic scores may have improved if the examinations were taken at the same time as the orthodontic board examinations. No correlation was found between initial dental knowledge and final orthodontic knowledge scores, confirming that dental board scores may not be good predictors for future didactic performance. Factors such as perceptual motor ability and personality testing may ultimately be better predictors for resident selection.

SP 368 COMPARISON BETWEEN PROPRIETARY AND GENERIC ORTHODONTIC BRACKETS WITH REGARD TO CELL TOXICITY

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Aims: To test the possible toxicity of extracts of orthodontic brackets purchased from differing sources using single cell tracking.

Materials and Method: Five different sets of ‘generic’ orthodontic brackets were obtained directly from China and two sets of ‘proprietary’ brackets were obtained from American Orthodontics and Rocky Mountain Orthodontics. Brackets were incubated in Dulbecco’s Modified Eagle Medium cell-culture medium for 60 days and resulting extracts analysed for metal content, while controls consisted of medium incubated in parallel alone. Human dermal fibroblasts were cultured in 50 per cent solutions of extracts or control media with fresh culture medium and 10 per cent bovine calf serum, for 7 day time-lapse recordings. Single-cell tracking was performed for 25 cells and their progeny using Nordon cell-tracking software in Matlab®, quantitating migration distance, division, circularity and cell-surface profile area. Mann-Whitney and Chi square tests were used to evaluate statistical significance.

Results: Nickel and copper were the predominant metals released, varying in concentration over several orders of magnitude. There was general suppression of fibroblast movement and cell division compared with controls. Significant differences \( (P < 0.05) \) were found between different brackets in relation to migration, circularity, cell-surface area profile and mitosis. There were no clear correlations between the metal concentrations parameters measured. Apoptosis was infrequent across all conditions.

Conclusion: Both proprietary and generic orthodontic brackets released metals into extracts, and this modified fibroblast phenotype.

SP 369 WORKPLACE-BASED ASSESSMENTS FOR ORTHODONTIC SPECIALIST TRAINING: USEFUL TOOL OR TICK BOX EXERCISE?
Christopher Wright, Grant McIntyre, Dundee Dental Hospital & School, U.K.

Aims: To investigate how Scottish orthodontic specialty training registrars view workplace-based assessments (WBAs) and how successfully WBAs have been integrated into their training programme.

Materials and Method: This was a prospective questionnaire-based study. A digital 20-item questionnaire was distributed to past and present orthodontic specialty training registrars (Strs) who entered specialty training in Scotland from 2014 to 2018. Reminder emails were sent after 7 and 14 days to non-responders. Descriptive statistics were used to provide context to the results based on measures of central tendency and measures of dispersion.

Results: There was an 80 per cent (12/15) response rate, with two non-responders and one individual opting out. It was noted that 67 per cent (8/12) of trainees reported that they had no formal training in completing WBAs. Trainees had ambivalent feelings towards WBAs accurately reflecting on their clinical abilities [mean Likert score 3.50; Mode 4; standard deviation (SD) 1.04]. WBAs were exclusively completed by consultants (100%; 12/12). Unfortunately, 50 per cent (6/12) of trainees have had a potential assessor refuse to carry out a WBA, with time constraints being the most commonly cited reason. Case based discussions were viewed as the most useful WBA (mean Likert score 4.45; Modes 4, 6; SD 1.50) and assessment of audit the least useful (mean Likert score 3.33; Mode 4; SD 0.94). Additional comments focussed on the desire for additional clarity on the required number and type of WBAs required at each stage of training.

Conclusion: WBAs provide a platform for ongoing trainee development and reflection. It is important to ensure that all trainees are provided with appropriate training in completing WBAs; highlighting their importance as an educational tool for formative assessment. Protected time for WBAs in consultants’ job plans may prevent WBA refusal, but it may be difficult to balance training requirements with service provision and additional duties.

SP 370 THE ROLE OF OSTEOCYTES IN REGULATING OSTEOCLAST DIFFERENTIATION UNDER THE OXIDATIVE STRESS
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AIMS: Oxidative stress has been demonstrated to contribute to the pathological bone loss induced by diabetes, oestrogen deficiency, ageing, abnormal stress, bacterial infections, etc. Osteocytes, especially impaired osteocytes, have been shown to contribute to osteoclast differentiation and the consequently bone loss. Since oxidative impairment, osteocytes and osteoclastogenesis were closely linked, the aim was to investigate the osteoclastogenic property of impaired osteocytes under an excess oxidative environment and their potential paracrine influence on their adjacent normal osteocytes.

MATERIALS AND METHOD: Hydrogen peroxide was used to simulate the local excess oxidative environment and induce impairment in MLO-Y4 osteocyte-like cells. Culture supernatants of impaired osteocytes in the early impaired stage and impaired recovering stage were collected to influence normal healthy osteocytes. The expression of osteoclast-related cytokines of the impaired and influenced osteocytes were detected by reverse transcriptase-quantitative polymerase chain reaction and Western blot. The osteoclasts, differentiated from RAW264.7 which were co-cultured with either impaired or influenced osteocytes were identified and quantified with tartrate resistant acid phosphatase staining.

RESULTS: The osteoclastogenic property of oxidative-impaired osteocytes were promoted in the early stage and then declined irreversibly. Additionally, osteocytes cultured with conditioned medium from impaired ones significantly increased the number of osteoclasts.

CONCLUSION: Oxidative impaired osteocytes may promote osteoclastogenesis by upregulating osteoclast-related cytokines expression of their adjacent osteocytes, while the osteoclastogenic property is deprived by oxidative stress and cannot be rescued.

SP 371 THE TYPE OF TOOTH MOVEMENT IN MOLAR DISTALIZATION WITH ALIGNERS
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AIMS: To evaluate the type of tooth movement of maxillary or mandibular molars in distalization with aligner orthodontics.

SUBJECTS AND METHOD: Eighteen non-extraction subjects were selected. Cephalometric lateral and panoramic radiographs were taken before and after orthodontic treatment. The distance of the maxillary and mandibular molar to PTV was obtained. Maxillary and mandibular molar inclination was evaluated through lateral and panoramic radiographs.

RESULTS: There was a statistical difference in the distance between molars and PTV. Distalization of the maxillary first and second molars was 1.28 ± 1.24 mm and 2.47 ± 1.77 mm, and for the mandibular first and second molars 1.77 ± 1.20 mm and 2.83 ± 1.39 mm. There was no statistical difference in mesio-distal inclination of molars during distalization treatment.

CONCLUSION: The molars underwent bodily movement during distalization with aligner orthodontics.

SP 372 VISCOELASTIC PROPERTIES OF THE HUMAN PERIODONTAL LIGAMENT: EFFECTS OF THE LOADING FREQUENCY AND LOCATION
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AIMS: To determine the viscoelastic properties of the human periodontal ligament (PDL) using dynamic mechanical analysis (DMA).

MATERIALS AND METHOD: This study was carried out on three human maxillary jaw segments containing six upper central incisor and four lateral incisors. DMA was used to investigate the mechanical response of the human PDL. The dynamic sinusoidal loadings with an amplitude of 3 N
were under a frequency between 0.5 and 10 Hz. All samples were grouped by tooth positions and longitudinal locations.

RESULTS: With the increase of oscillation frequency there was storage of the energy and loss moduli of the PDL. The storage modulus ranged from 0.808 to 7.274 MPa and the moduli loss from 0.087 to 0.891 MPa. The tanδ remained constant with frequency. The trends for storage and moduli loss were described by exponential fits. The dynamic moduli of the central incisor were higher than those of the lateral incisor. The cervical group showed the lowest storage and moduli loss than the middle group.

CONCLUSION: This study demonstrated the human PDL is viscoelastic through the range of the frequency tested, 0.5-10 Hz. The viscoelastic relationship changed with respect to frequency, tooth position and root level.

SP 373 EVALUATION OF UPPER CENTRAL INCISOR ALVEOLAR BONE WIDTH USING CONE BEAM COMPUTED TOMOGRAPHY IMAGES IN DIFFERENT DENTOFACIAL TYPES

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AIMS: To investigate the alveolar bone of the upper central incisors in skeletal Class I, II, and III adult patients using cone beam computed tomography (CBCT), and to develop recommendations for autotransplantation of orthodontic extracted premolars to replace missing or ankylosed central incisors.

MATERIALS AND METHOD: From a sample of 136 CBCT scans of subjects with no previous orthodontic treatment, 38 scans were selected to be included in the study. CBCT-synthesized lateral cephalograms were used to categorize patients into three groups. CBCT images of 12 Class I, 11 Class II, and 15 Class III patients were evaluated. Buccolingual alveolar bone width was measured using images of the maxillary central incisors at the alveolar crest and at 3, 6, and 9 mm apical level. Kruskal-Wallis and Mann-Whitney U-tests with Bonferroni adjustment, and Pearson correlation analysis were used for statistical analyses. The tests were performed at the 5 per cent significance level.

RESULTS: The Class III group showed significantly thinner alveolar bone compared to the Class I and Class II groups at most alveolar levels. Compared to the other two groups, the total buccolingual alveolar width was significantly less at the alveolar crest and at the 3 and 6 mm apical level in Class III subjects. Furthermore, the Class II group showed a larger buccolingual alveolar width but this was not significant. ANB angle showed positive correlations with buccolingual alveolar bone width in the maxillary central incisor region.

CONCLUSION: Skeletal Class III subjects showed thinner maxillary alveolar bone at most levels compared to Class I and Class II subjects. This would provide reference data that can be useful for clinicians attempting autotransplantation of a first premolar to the central incisor region. The buccolingual alveolar bone in Class III patients is thin and thus a risk factor for recipient site preparation.

SP 374 DEVELOPMENT OF A QUESTIONNAIRE TO ASSESS EXPERIENCE OF ORTHODONTIC TREATMENT IN ADULTS

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AIMS: To develop a questionnaire to investigate the factors influencing satisfaction with treatment experience in adult orthodontic patients.

MATERIALS AND METHOD: This was part of a mixed methods study investigating satisfaction with orthodontic treatment experience in adult patients. Qualitative data obtained from in-depth interviews with patients was utilised to develop and pilot a patient-centred questionnaire to assess the treatment experience. This involved the formulation of questions based on the themes from in-depth interviews and these were then categorised into distinct sections depending on the aspect of treatment being investigated. Questionnaire readability was assessed and the platform SurveyMonkey® was chosen to allow electronic distribution. An initial pilot was conducted with
clinicians and amendments made following feedback. A patient pilot study was then conducted to obtain feedback to further refine the questionnaire and to ascertain the preferred response scale format and the wording to be utilised in these response formats.

RESULTS: The questionnaire was piloted with 14 adult patients. The mean age of the respondents was 38 years, with a range from 21 to 63 years. The majority of patients preferred a 5-point Likert response scale as opposed to a 3-point Likert scale. All of the patients were satisfied with the length and content of the survey, commenting that everything relevant had been included. The readability assessment of the final questionnaire gave a Flesch-Kincaid Grade Level of 6.7, which is suitable for healthcare surveys. This mixed-methods research methodology ensured good content validity. The feedback from the patient pilot indicated strong face validity and construct validity, with no respondents indicating any questions to be superfluous and all of them stating that the responses allowed expression of their true opinions.

CONCLUSION: This questionnaire can be recommended as a widely applicable, robust assessment tool. It will now be used in a subsequent phase of this research programme investigating the treatment experience of adult orthodontic patients in both a national health service and private practice setting.

SP 375  AN AUDIT TO DETERMINE THE EFFECTIVENESS OF FUNCTIONAL APPLIANCES
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AIMS: To determine whether the initial aims of orthodontic treatment have been achieved using functional appliances.
MATERIALS AND METHOD: A retrospective audit was carried out at Prince Charles Hospital. Clinical records were obtained for all patients who underwent functional appliance treatment between January to December 2016. Data was collected pre- and post-treatment, which included the patients': age, gender, overjet, overbite, molar relationship, amount of wear, treatment time and failed treatment. Other relevant information such as breakage of appliance and reasons for not wearing the appliances was collected. Data were collected and analysed on Microsoft Excel. The standards were taken from a previous regional audit: 70 per cent of patients treated with a functional appliance should have a successful outcome, defined as: >7.5 mm overjet reduction, and/or >1.5 mm overbite reduction, and/or >0.75 units molar correction. Patients who did not achieve any of the above criteria were categorized in the ‘failed treatment’ group.
RESULTS: Twenty-nine patient records were retrieved and analysed (females 15, males 14). The age of patients ranged between 11 to 15 years with a mean age of 12.4 years. The treatment time range was between 7 to 17 months, average 10.5 months. There were more males (n = 4) who failed to wear the appliance than females (n = 2). There were also more males (n = 4) who only wore the appliance part-time than females (n = 2). Twenty-one patients had an overjet reduction of more than 7.5 mm post-treatment. Seventeen patients had both an overbite reduction of more than 1.5 mm post-treatment and more than 0.75 units molar correction post-treatment.
CONCLUSION: Overall, 21 patients (72%) had an overjet reduction of more than 7.5 mm and only 17 patients (59%) had an overbite reduction of more than 1.5 mm and more than 0.75 units molar correction post-treatment. The standard of 70 per cent was achieved in overjet reduction, however it was not met for overbite reduction and molar correction. Non-compliance was due to bullying, losing or breaking the appliances. It is recommended that full time wear and correct care of the appliances be emphasised to all patients.

SP 376  DIFFERENCE IN DEGREES OF SATISFACTION WITH ORTHOGNATHIC SURGERY AND ORTHODONTIC TREATMENT BETWEEN SKELETAL CLASS III AND CLEFT PATIENTS
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AIMS: To compare the degrees of satisfaction with orthognathic surgery and orthodontic treatment between skeletal Class III and cleft patients.
SUBJECTS AND METHOD: The samples consisted of Class III group (N = 25) and cleft group (N = 16). The modified orthognathic quality of life questionnaires, which had five domains [oral function (OF), awareness of dentofacial deformity (ADD), social relationship (SR), facial aesthetics (FE), and nose/lip aesthetics (NLE)], were evaluated with five rates [0 (very satisfactory) to 4 (very unsatisfactory)] at initial visit (T1), just before surgery (T2), 3~6 months after surgery (T3), and at debond or 1 year after surgery (T4). The scores at each stage, amount of change between stages, and effect size (ES) in the five domains were investigated.

RESULTS: Compared to the Class III group, the cleft group exhibited lower satisfaction scores of NLE domain during all stages (all \( P < 0.001 \)) and of SR domain and total domains at T4 stage (\( P < 0.05, P < 0.01 \)). The cleft group showed significant improvement of satisfaction scores in FE domain during T1-T2 (\( P < 0.01 \), in SR, FE, NLE, and total domains during T2-T3 (all \( P < 0.01 \)), in OF, SR and total domains during T3-T4 (\( P < 0.05, P < 0.01, P < 0.01 \)), and in all domains during T1-T4 (ADD, \( P < 0.05 \); OF, SR, and NLE, \( P < 0.01 \); FE and total, \( P < 0.001 \)). The cleft group exhibited a large improvement of ES only at SR and FE domains during T2-T3 (\( -0.81 \) and \( -1.09 \), respectively).

CONCLUSION: Due to lower satisfaction of NLE domain at all stages in cleft patients, clinicians should recommend adjunctive cosmetic surgery for nose and lip after completion of treatment.

SP 377 A VIRTUAL ORAL RADIOLOGY AND PATHOLOGY E-LEARNING PLATFORM: RESULTS OF A PROSPECTIVE LONGITUDINAL STUDY
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AIMS: Orthodontists regularly examine patients and thus play a key role in detecting pathologies on dental radiographs. However, in Germany diagnostic skills are not trained systematically at dental schools. Therefore, malignant pathologies may be diagnosed too late despite high incidences. A virtual e-learning platform VoRaPath was developed to provide undergraduate students with an interactive way to improve their radiological skills. The learning effects were evaluated within a prospective longitudinal study.

MATERIALS AND METHOD: Students in a clinical three-semester course for dental and craniofacial diseases were given access to the e-learning platform. At the beginning and end of each semester, electronic examinations were conducted using the Ilias platform to evaluate the improvement of students’ diagnostic skills. The questions were validated beforehand within a pilot and a test period in the winter semester of 2016/2017 and summer semester of 2017. The learn effect after using the platform in the winter semester 2017/18 and summer semester 2018 was tested using validated questions with discriminatory powers \( \geq 0.3 \). The tests were set up with the following distribution of item difficulties for the questions: 10 per cent: easy; 55 per cent: moderate; 20 per cent moderately difficult; 10 per cent difficult and 5 per cent: very difficult. The results were analysed using the statistics software R and a t-test (\( P < 0.005 \)). Students’ satisfaction with the platform was evaluated using opinion polls.

RESULTS: Within the winter semester of 2017/18 and summer semester of 2018 the reliability of the tests at the beginning and end of the semester was >0.8. The discriminatory powers were \( \geq 0.3 \) for all questions. In both, the winter and summer semesters, there was a significant improvement of students’ diagnostic skills. The opinion polls revealed high satisfaction with the platform, with 87 per cent (winter semester) and 80.4 per cent (summer semester) rating the platform eligible to improve their diagnostic skills. Additionally, 83 per cent (winter semester) and 77 per cent (summer semester) responded that the online tool would not replace regular lectures which reinforces that a combination of conventional lectures and e-learning is mostly desired.

CONCLUSION: The e-learning platform proved to be qualified for improving students’ diagnostic skills by showing a significant learn effect and high satisfaction.

SP 378 AGE AND FUNCTIONAL RELATED CORONAL CHANGES OF MAXILLARY ALVEOLAR BONE
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AIMS: To study the coronal surface differences of maxillary alveolar bone between young adult and mature rats, as well as the influence of the unilateral molar extractions on the ipsilateral and contralateral alveolar bone cross-sectional surface.

MATERIALS AND METHOD: Forty male Wistar rats (4-week-old and 12-week-old; 20 rats each) were randomly assigned into control (n = 10) and experimental (n = 10) groups. The experimental groups underwent unilateral upper right molars extraction at the beginning of the experiment. After 12 weeks, when all the rats reached either young adult or mature adult age, they were sacrificed and their skulls were scanned using microcomputed tomography. Both sides of the alveolar process cross-sectional areas (CSA) were measured using five transverse sections of the maxillary first molars.

RESULTS: The CSA of the young control adult animals was smaller (5.68 ± 0.36 mm²), in respect to the mature adult (8.38 ± 0.71 mm², P < 0.001). The extraction of the molars caused a decrease of the CSA of the edentulous region both in the young adult animals (2.64 ± 0.51 mm², P < 0.001) and mature animals (6.36 ± 0.81 mm², P < 0.001), while the contralateral to the extraction side was also decreased with respect to the controls both in the young adult animals (5.32 ± 0.47 mm², P < 0.05) and mature animals (7.82 ± 0.32 mm², P < 0.05). The reduction of the CSA 3 months after extraction was more extensive in the young adult rats than in the mature adults where broken root remnants after the extraction preserved part of the CSA of the maxillary alveolar bone.

CONCLUSION: The cross-sectional alveolar bone area of the rat molars increases during early adulthood. Unilateral loss of maxillary molars reduced their alveolar bone surface.

SP 379 OCCLUSAL AND LABIAL/BUCCAL APPROACHES FOR MEASURING MESIODISTAL WIDTH OF TEETH ON CHAIRSIDE DIGITALLY SCANNED MODELS
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AIMS: To evaluate the accuracy of measurements made on intraoral directly scanned three-dimensional (3D) digital models compared to stone model measurements using two approaches (from occlusal and labial/buccal aspect).

MATERIALS AND METHOD: 3D intraoral digital models and stone models were made for each patient in a sample that consisted of 20 randomly selected orthodontic patients. Mesiodistal teeth width and arch perimeter measurements on the digital models taken by occlusal and labial/buccal approaches were compared with those on the corresponding stone models.

RESULTS: There was no statistically significant difference regarding the mesiodistal width measurement of all the teeth between digital and stone models when using both measuring approaches. However, there was a significant increase in digital measurements for the maxillary posterior segments and for maxillary total arch perimeter only when measured by the occlusal approach. All arch perimeter measurements (segmented and total) showed a significant increase in digital measurements when compared with those taken manually, in both arches, when measured by the labial/buccal approach.

CONCLUSION: The mesiodistal width measurements of each tooth obtained with 3D intraoral chairside digital models and Cerec Premium software using occlusal or labial/buccal approaches are considered both accurate and reliable. Regarding the arch perimeter measurements, the occlusal measuring approach is better and more reliable than the labial/buccal approach for both stone and 3D digital models. The digital models are clinically acceptable and may be used as an alternative to gold standard stone models.
SP 380 ROOT RESORPTION AND MARGINAL ALVEOLAR BONE LEVEL CHANGE DURING ORTHODONTIC TREATMENT IN PERIODONTALLY COMPROMISED PATIENTS. A CONE BEAM COMPUTED TOMOGRAPHIC STUDY

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AIMS: To examine external apical root resorption (EARR) and marginal alveolar bone level (ABL) change after orthodontic treatment (OT) in patients with periodontal disease.

SUBJECTS AND METHOD: Fifty patients with periodontal disease, who had received periodontal-orthodontic treatment. OT was performed with a straightwire appliance. Micro-implants or implants were used for anchorage. Personal and professional oral hygiene was ensured before and throughout treatment. Cone beam computed tomographic examinations were performed before and after OT.

RESULTS: EARR after OT was observed at a median of 80.7 per cent [interquartile range (IQR) 22.02, range 40-100%] of teeth with a mean value of 1.2 mm (standard deviation 0.44). In 82.3 per cent of teeth EARR was ≤ 2 mm. Severe EARR was found in 8 per cent of patients and five maxillary incisors (< 1% of all teeth). A significantly higher extent of mean EARR was observed, if OT lasted >18 months. No significant mean ABL change (0.06 mm, 95% confidence interval: –0.07, 0.19) could be found after OT (P = 0.35). Small significant ABL gain was observed on the mesial and distal surfaces (P < 0.01). A small significant difference was found between mean ABL before and after OT in maxillary posterior teeth (–0.2 mm, IQR 0.69; P = 0.03).

CONCLUSION: ABL changes after periodontal and OT in patients with periodontal disease are small and not deleterious. A small ABL gain was observed mesially and distally. However EARR was found in about 81 per cent of teeth. Longer OT influenced the extent of EARR. Meticulous personal oral hygiene and optimal sub-gingival control of inflammation should be ensured before the start and throughout the combined treatment.

SP 381 COMPLICATIONS AND DIFFICULTIES DURING PRE-OPERATIVE NASOALVEOLAR MOULDING THERAPY

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AIMS: Pre-operative nasoalveolar moulding (PNAM) therapy is known to be an effective and standard tool prior to primary surgery in unilateral and bilateral cleft lip and palate patients. The aim of this prospective study was to analyze the complications of PNAM and their severity during moulding therapy.

MATERIALS AND METHOD: The following PNAM protocol was performed: 1. Alginate impression at the age of 1 week. 2. Insertion of the palatal guidance plate and initiation of non-surgical lip adhesion before the age of 2 weeks. 3. Addition of unilateral or bilateral nasal stents to the palatal guidance plate in combination with approximating the lip segments by taping on the cheeks. 4. Gradual adjusting of the nasal stents during the following weeks, until primary lip closure surgery.
5. Application of a silicone nostril retainer for 3 months post-operatively. A questionnaire was used to estimate the complications and difficulties of PNAM. Fifty nine parents were reached out of the 82 non-syndromic cleft patients treated with PNAM since 2010.

RESULTS: 1. There were no complications during impression taking. 2. In 47 cases parents experienced distinct improvement in feeding after inserting the palatal guidance plate. 3. In 45 cases there were no changes in sleeping habits. 4. Tapes did not cause any irritations in 17 cases, in six it was negligible, in 16 slight, in 11 moderate and in nine there was definite irritation on the cheeks. 5. Forty per cent of the children slept on their back, 32.2 per cent prone and 27.8 per cent
on their side. 6. In 10 cases the nasal stents caused difficulties in putting the child to sleep. 7. Fixing of the palatal plate caused difficulties only for 10 per cent of the parents. 8. In 10 cases there was mild ulceration of the inner nasal mucosa due to wrong positioning of the nasal stent, which healed entirely after adjustment.

CONCLUSION: No severe complications or difficulties in PNAM therapy were observed in this prospective study. Patients with PNAM and without a post-operative nostril retainer still showed better functional and aesthetic results than patients without any pre-operative treatment.

SP 382 EFFECT OF VIBRATORY STIMULATION ON TOOTH PAIN DURING ORTHODONTIC MOVEMENT
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AIMS: To investigate the effect of vibratory stimulation on orthodontic pain during the first 7 days of orthodontic tooth movement.
SUBJECTS AND METHOD: Twenty-eight orthodontic patients (10 males, 18 females) were randomly divided into an experimental and a control group. The experimental group used Acceleldent for 20 minutes every day, while the control group did not. Before the treatment (T0), 2 hours (T1), 24 hour (T2), 3 days (T3), 5 days (T4) and 7 days (T5) after the first 0.014 CuNiTi wire was placed, the patients were measured using a visual analogue scale (VAS) and pressure-pain threshold (PPT) at 6 time point.
RESULTS: There were no differences between the two groups for PPT at tooth 23 at T0 and T3 (P > 0.05). PPTs at tooth 23 were lower (more sensitive) in the control group than in the experimental group at T1-T2 (P < 0.05). There were no differences between the two groups for PPT of buccal attached gingival (P > 0.05). There were no differences in VAS values between the two groups at T0-T4 (P > 0.05). The VAS value was lower in the experimental group than in the control group at T5 (P < 0.05).
CONCLUSION: Vibratory stimulation can relieve orthodontic pain within 7 days of orthodontic treatment.

SP 383 EFFICACY OF MINISCREWS IN TREATMENT OF CLASS II DIVISION 2
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AIMS: To explore the clinical effect and mechanism of orthodontic treatment for Class II division 2 with miniscrews.
SUBJECTS AND METHOD: A total of 12 adult patients with retroclined maxillary incisors and a deep overbite were selected. The anterior teeth were intruded by miniscrews. The changes of the upper incisors on cone beam computed tomographic images were measured.
RESULTS: The inclination of the upper incisors returned to normal in 12 patients. The vertical distance from incisor edge to palatal plane decreased by 1.59 ± 2.05 mm, and incisors labially inclined 19.34 ± 7.96 degrees.
CONCLUSION: In the maxillary anterior region, miniscrews can simultaneously intrude and labially incline upper incisors.

SP 384 EARLY AGEING AND AGE-RELATED PATHOLOGIES OF THE MANDIBLE IN MICE DEFICIENT IN BMAL1, THE CORE COMPONENT OF THE CIRCADIAN CLOCK
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AIMS: Age-related changes frequently lead to impaired function of tissues. BMAL1 is the core circadian clock gene that regulates various physiological and pathological processes. In the skeletal system, BMAL1 can regulate bone homeostasis and maintain structural integrity, while abnormal
BMAL1 expression significantly reduces bone mass. This study investigated the age-related pathology of mandibular tissue with BMAL1 deficiency.

MATERIALS AND METHOD: Normal mandibular specimens from different age groups were collected and the expression of BMAL1 was determined. To confirm the effect of Bmal1 on bone homeostasis with age, Bmal1-/- mice were produced and bone metabolism was assessed in vivo using positron emission tomography-computed tomography and microarchitecture of trabecular and cortical bone with microcomputed tomography in 8-, 16-, and 24-week-old Bmal1-/- mice. Bone marrow mesenchymal stem cells (BMS5Cs) from wild-type and Bmal1-/- mouse were extracted, then the proliferation and osteogenic differentiation ability were examined. All data were displayed as the means plus standard deviation. Data were evaluated by the two-tailed Student’s t-test or by ANOVA with Tukey’s post hoc test for multiple comparisons.

RESULTS: With the increase of age, the bone mass of mandibular tissue decreased, and the expression of BMAL1 also decreased, suggesting that BMAL1 plays an important role in the homeostasis of mandibular tissue. Bone metabolism and bone density was lower in Bmal1-/- mice compared with wild type mice. The expression of senescence biomarker p16Ink4a was higher and proliferation-related Ki67 was lower in the mandibles of Bmal1-/- mice. The above results confirmed that the mandibular tissue of Bmal1-/- mice showed senescence symptoms compared with even- aged wild-type mice. Age-related pathologies were also observed in circadian-rhythm-disrupted mice. Given these findings, characterization of the underlying mechanism showed that the early ageing phenotype correlates with increased levels of reactive oxygen species in Bmal1-/- mice.

CONCLUSION: These findings may provide a mechanistic explanation for age-related pathologies in mandibular tissues with the absence of BMAL1. This research also provides new ideas for the prevention of early onset of age-related bone lesions.

SP 385 HOW DO TITANIUM MINISCREWS CONTAMINATE CLINICALLY? AN IN VITRO ELECTRONIC MICROSCOPIC PILOT STUDY
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AIMS: To evaluate the degree of refinement, the surface cleanliness, the degree of contamination after clinical handling and surface treatment of titanium orthodontic miniscrews.

MATERIALS AND METHOD: An in vitro three-part scanning electron microscope (SEM) study was carried out. It consisted of 60 titanium orthodontic mini-implants (OMIs) chosen from amongst the most currently used. Surface refinement as well as the original contamination of these OMIs were observed under SEM. Mass spectrometry was done to identify the present particles. OMIs were then manipulated with dry sterile gauze, sterile gauze soaked in chlorhexidine, and by latex and nitrile gloves to evaluate the contamination of these commonly used handling materials. Finally, OMIs underwent surface treatment: sandblasting, and sandblasting and anodic oxidation. They were inserted in a cow rib in vitro, removed and observed, to look for missing pieces. The bone, cut in half bicortically, was also viewed under SEM.

RESULTS: Machined miniscrews presented surface irregularities and were contaminated with manufacturing-process particles (carbon, plastic polyvinyl chloride, aluminium). Hand manipulated OMIs were also contaminated by the handling materials such as latex and nitrile gloves. Bone was contaminated by OMIs surface defects and extra particles.

CONCLUSION: OMIs surfaces are contaminated by manufacturing processes. Contamination degree is influenced by the quality of surface refinement. After clinical handling, the surface is additionally contaminated. The use of gauze soaked in chlorhexidine is recommended. After surface treatment, OMIs surface defects and extra particles are left in the bone. Further investigations would be interesting to study more variables and confirm the present results.

SP 386 PERCEIVED FACIAL CHANGES OF CLASS II DIVISION 1 PATIENTS AFTER FUNCTIONAL FOLLOWED BY FIXED ORTHODONTIC APPLIANCE TREATMENT
AIMS: To assess perceived facial changes in Class II division 1 patients treated with functional (activator or twin-block) followed by fixed orthodontic appliances.

MATERIALS AND METHOD: Pre- and post-treatment sets of frontal and profile full-face rest photographs of 12 (6 males, 6 females) Class II division 1 patients treated with an activator, 12 (6 males, 6 females) Class II division 1 patients treated with a twin-block, and 12 (6 males, 6 females) controls with normal profiles treated without functional appliances were presented in pairs to 10 orthodontists, 10 patients, 10 parents and 10 laypersons. The raters assessed changes in facial appearance on a visual analogue scale (VAS). Two-way multivariate analysis of variance was used to evaluate differences among group ratings.

RESULTS: The treatment groups were similar in gender distribution, age, and treatment duration. The activator and twin-block groups were also similar in facial convexity and pre-treatment overjet, but they differed significantly from the control group in these parameters. The internal consistency of the items of the questionnaire was generally acceptable both within and between groups and the different rater groups showed strong to excellent agreement in ratings. There were no significant differences among treatment groups (F = 0.91; P = 0.526; Wilks lambda = 0.93), among raters (F = 1.68; P = 0.054; Wilks lambda = 0.83), and when testing the combined effect of treatment group and rater on results (F = 0.72; P = 0.866; Wilks lambda = 0.85). Raters assessed changes induced by ageing and treatment as slightly positive in all treatment groups. The raters assessed slightly more positive changes in the activator and twin-block groups compared with the control group, regarding the lower face and lips, but these findings did not reach significance. Furthermore, their magnitude hardly exceeded 1/20th of the total VAS length at its highest value.

CONCLUSION: The perceived facial changes of convex profile patients treated with functional, followed by fixed orthodontic appliances, did not differ from those observed in normal profile patients, when full-face frontal and profile photographs were simultaneously assessed. Thus, orthodontists should be tentative when predicting significant improvement of a patient’s profile with this treatment option.

SP 387 BISPHOSPHONATE ADMINISTRATION DURING ORTHODONTIC TREATMENT: SEPARATING MYTHS FROM LEGENDS

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AIMS: To assess the efficacy of systematic bisphosphonate use in the treatment outcomes of orthodontic human patients.

MATERIALS AND METHOD: A systematic electronic search of 17 databases without restrictions, supplemented by additional hand searches was performed up to July 2018. Selection criteria: Studies reporting exclusively on human subjects of any age or gender, with a history of bisphosphonate administration, prior or during orthodontic treatment were included. Data collection and analysis: Data regarding the patients’ characteristics (age, gender, medical background), the exact drug administration protocol followed (exact type of drug used, dosage, duration and route of administration) as well as details of the orthodontic treatment performed (initial malocclusion, biomechanics, exact type of tooth movement accomplished) were extracted in pre-determined forms. Clinical, radiographic and patient-reported results were considered as the primary outcomes. Quality assessment was performed by implementation of the Robins-I tool for
the cohort studies as well as by a slightly modified checklist from the one proposed by Agbabiaka et al. for case reports.

RESULTS: Seven articles were included in the qualitative analysis of the present review, reporting on 122 subjects (29 patients, 93 controls) providing clinical and radiographic outcomes following orthodontic treatment of patients during or after bisphosphonate administration. The majority of the respective studies report on slow rates of tooth movement, prolonged treatment duration and rather compromising results. Regarding the radiographic findings, the main changes observed were mild to moderate root resorption, widened periodontal spaces and sclerotic changes of the surrounding alveolar bone. However, these results should be cautiously interpreted due to the small number and low quality of the eligible studies.

CONCLUSION: According to existing low quality evidence, bisphosphonate administration before or during orthodontic treatment seems to be associated with slow tooth movement, increased treatment duration and compromised outcomes, as well as moderate effects on the roots and surrounding periodontal tissues of the treated teeth.