ABSTRACTS OF LECTURES

AND POSTERS

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Oral presentations

1 CINE-MAGNETIC RESONANCE IMAGE EVALUATION OF TONGUE MOVEMENTS DURING DEGLUTITION IN OPEN BITE SUBJECTS

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AIM: To evaluate tongue movements in subjects with anterior dental open bites during deglutition, using real time balanced turbo field echo cine-magnetic resonance imaging.
SUBJECTS AND METHOD: The subjects were divided into two groups depending on the presence of an anterior open bite (at least 2 mm). The open bite group (OBG) comprised 18 patients (14 females, 4 males) with a mean age of 14.5 ± 2.7 years. The control group (CG) comprised 10 patients (5 females, 5 males) with a mean age of 14.5 ± 2.6 years. Deglutition was evaluated during three stages: oral (1), pharyngeal (2) and oesophageal (3).
RESULTS: In the OBG from stage 2 to 3, the anterior portion of the dorsum of the tongue lowered while the mid-portion elevated. In the CG, the posterior portion was elevated from stage 2 to 3 and the tongue tip was positioned more anteriorly at stage 2 than at stage 1. In the OBG, the tongue tip moved more anteriorly at all stages of deglutition than in the CG.
CONCLUSION: The results of this study indicated compensatory tongue functions in patients with anterior dental open bites.

2 EXTRACTION VERSUS NON-EXTRACTION: AN EVALUATION BY DIGITAL SUBTRACTION RADIOGRAPHY

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AIM: The controversy concerning the detrimental effects on the facial profile as a result of extracting teeth has not yet resulted in any consensus. Currently there exists no reliable means to clarify this dilemma. The purpose of this alternative cephalometric study was to investigate the facial profile changes of patients treated with and without extractions of four first premolars by novel computer based digital subtraction software.
MATERIALS AND METHOD: An algorith, performing manual and automated image reconstructions and contrast correction, was developed for manipulation of the radiographic images. Pre- and post-treatment radiographic images of 25 extraction and 24 non-extraction Class I patients were obtained and the subtraction analyses performed using the software. Linear measurements of determined differences registered at various anatomical landmarks were made on subtracted 'resultant images' by calibrating a line of known length. Mean differences between the two groups were evaluated by independent sample *t*-tests. To further determine whether any variables were related to upper and lower lip changes, regression analyses were performed.
RESULTS: The main soft tissue differences between two groups were at labrale superius, labrale inferius and sulcus inferius points, with the extraction patients showing significantly more retruded upper and lower lips ($P < 0.05$). However, the mean differences between the two groups for these variables did not exceed 1 mm. According to regression analyses, changes at labrale superius and labrale inferius were associated with the sagittal movement of the maxillary ($r = 0.549$) and mandibular ($r = 0.630$) incisor midpoints. Changes at sulcus inferius were associated with both sagittal and vertical displacement of the mandibular incisor edges ($r = 0.676$).
CONCLUSIONS: Some dentofacial alterations were found but the extent of the changes was such that there is no major evidence to suggest that extraction therapy should be avoided.

3 CONDYLE-DISC RELATIONSHIP BEFORE AND AFTER MAXILLARY EXPANSION: A MAGNETIC RESONANCE IMAGE STUDY

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AIM: To assess, prospectively, temporomandibular joint (TMJ) condyle-disc positions in the sagittal and coronal planes, using magnetic resonance imaging (MRI) before and after rapid maxillary expansion (RME).
SUBJECTS AND METHOD: Eighteen subjects (11 females, 7 males) with a mean age of 12.54 years with uni- and bilateral posterior crossbites, including at least three posterior teeth. The clinical and radiographic assessment of the TMJ was carried out before (T1) and 18 weeks after (T2) RME. A Haas type expansion appliance was used for an average treatment time of 3.5 weeks.

RESULTS: A visual descriptive analysis of the pre-treatment condyle-disc positions showed that eight TMJs had medial, three antero-medial, and two lateral disc displacements. The disc positions remained unchanged at T2 except in one subject who developed a unilateral anterior disc displacement. Unilateral joint sounds developed in three subjects without a change in disc position.
CONCLUSION: A posterior crossbite can be considered as a minor risk factor for temporomandibular disorder (TMD) but RME is neither a risk factor nor a prevention of TMD. Coronal MRIs contribute complementary information for optimal diagnosis of TMD.

4 CONTROVERSIES IN ORTHODONTIC CONCEPTS**

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KEYNOTE ADDRESS

An orthodontic force system will be shown which has biological sensibility in terms of a dynamic biologic system, thus allowing the physiologic adaptation of bone and tissue during orthodontic tooth movement. This treatment system utilizes very light forces of high technology low friction brackets as well as archwires. Therefore the technique increases the quality of therapy through improved clinical control, patient comfort, and decrease in treatment time. This biologically sensible system allows for an increase in non-extraction orthodontic treatment with improved facial aesthetics.

5 LONG-TERM RECORDINGS OF MIGRATION OF AUTOTRANSPLANTED THIRD MOLARS

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AIM: To investigate tooth migration after transplantation of immature third molars and to determine the influence of an additional orthodontic adjustment.
MATERIALS AND METHOD: One hundred and forty five autotransplanted immature third molars with a mean follow-up period of 4.4 years (range 1.8 to 7.3 years). Orthodontic treatment was performed for 49 of the transplants but the remaining transplants received no further treatment. Study models were obtained for all patients at the final follow-up and the American Board of Orthodontics Objective Grading System for scoring dental casts was adapted for evaluation of the final transplant position according to the following six criteria: alignment, marginal ridges, buccolingual inclination, occlusal contacts, overjet and interproximal contacts. Clinical evaluation of occlusal and interproximal contacts was also noted. Occlusal contacts were registered using a silicon-based impression material to obtain occlusal records and the presence of interproximal contacts was determined with unwaxed dental floss.
RESULTS: Orthodontically treated transplants showed significantly better alignment ($P < 0.001$), marginal ridges ($P = 0.009$), buccolingual inclination ($P = 0.007$), occlusal contacts ($P = 0.006$), and interproximal contacts ($P < 0.001$). Clinically, almost 30 per cent of the orthodontically untreated transplants showed an absence of occlusal or interproximal contacts. For the orthodontically treated transplants, at least one occlusal contact was present in all of the examined teeth.
CONCLUSIONS: Not all transplanted teeth have the eruption potential to reach the occlusal plane. Therefore, subsequent orthodontic treatment is an appropriate method for obtaining a better position of the autotransplanted teeth.

6 IMPROVING THE RELIABILITY OF MINI-IMPLANTS IN ORTHODONTICS

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AIM: Mini- and microscrews are frequently used in orthodontic therapy. However, different success rates are reported and there are no clear guidelines for the procedure. This study aimed to develop some guidelines for clinical use.
SUBJECTS AND METHOD: In a prospective clinical trial 255 mini- and microscrews were inserted in 92 patients. The design and parameters of the implants varied for different locations. The patients were seen at regular intervals and clinical outcome and implant stability were monitored. The success rates for the first 133 mini-implants were analyzed and the clinical protocol was modified according to these results and those of an animal experiment. The success rate of subsequently used mini-implants was compared with the results of the first series.
RESULTS: High failure rates were seen when thin microscrews were used in the mandible. Miniscrews with a diameter of 2 mm showed better results in the mandible. On the palatal side of the maxilla, the use of thicker screws resulted in fewer failures. On the vestibular side of the maxilla, thin implants showed higher success rates. High failure rates were seen when the implant lacked primary stability, when the lever arm outside the bone was too long, or when there was contact with a neighbouring tooth. The failure rate for the first series of mini-implants was 23 per cent. After modification of the surgical protocol, the failure rate was reduced to 5 per cent.

CONCLUSIONS: Mini-implants can be used with high reliability when the choice of the implant is made carefully according to the clinical situation and when the surgery is performed according to a standardized protocol. Success is sensitive to details of the surgical procedure.

7 RESONANCE FREQUENCY ANALYSIS OF EARLY LOADED PALATAL IMPLANTS: A CLINICAL STUDY

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AIM: To investigate the behaviour of early loaded palatal implants observed with resonance frequency analysis (RFA).
SUBJECTS AND METHOD: Twenty patients (7 males, 13 females, mean age 26.4 years) received one palatal implant each (length: 4 mm, diameter: 3.3 mm; Orthosystem®, Institut Straumann, Switzerland) for maximum orthodontic anchorage. The stability of the implants was observed by RFA. After removing the superstructure, the measurements were carried out by connecting the L-shaped transducer with the Osstell™ measuring device at the time of surgery, after first orthodontic loading, and subsequently once a week over a period of 12 weeks.
RESULTS: Two palatal implants were lost but the other 18 remained stable. The average period from insertion to first loading was 6.7 ± 0.8 days. The mean orthodontic force applied was 272.2 ± 73.2 cN. The implant stability quotient (ISQ) at the time of surgery averaged 69.4 ± 3.9. The mean ISQ value 6.7 days after insertion was 69.8 ± 3.6. Twelve weeks post-surgery the mean ISQ value was 69.8 ± 3.5. A statistically significant decrease in stability was observed after 2 and 3 weeks post-surgery ($P = 0.005$ and $P = 0.04$, respectively).
CONCLUSION: The early loaded palatal implants showed an initial decrease in ISQ values. However, from 6 weeks post-surgery onwards the ISQ values increased. Within the limitations of this study, the results suggest that the healing time of palatal implants reported in the literature (12 weeks) should be discussed. An orthodontic loading of palatal implants 6 weeks post-surgery with a force up to 400 cN seems to be justified. Further investigations are however necessary to evaluate the behaviour of early loaded palatal implants for periods over 12 weeks.

8 MMPS AND TIMPS IN THE HEALTHY AND DISEASED PERIODONTIUM

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AIM: Periodontal tissues remodel rapidly, which enables their adaptation during function of the teeth. Matrix metalloproteinases (MMPs; e.g. gelatinases) are involved in these remodelling processes and their activity is controlled by tissue inhibitors of metalloproteinases (TIMPs). In orthodontic tooth movement the remodelling activity is increased and, in periodontitis, overactivity of MMPs results in pathological tissue degradation. Moreover, when subjected to orthodontic forces, teeth with an inflammed periodontium show increased tissue destruction. The aim of this study was to quantitatively and qualitatively analyze gelatinases and TIMPs in healthy and diseased periodontal tissues.
MATERIALS AND METHOD: Gingiva and periodontal ligament (PDL) samples were derived from healthy controls (gingiva: n = 16, PDL: n = 15) and periodontitis patients (gingiva: n = 11, PDL: n = 18). The gelatinases (MMP-2 and MMP-9) and TIMPs were extracted by homogenization and heat extraction, and subsequently analyzed by gelatine and reverse zymography. Immunohistochemistry was performed on gingiva sections to visualize MMP-9 and TIMP-2.
RESULTS: In gingiva and PDL, active MMP-2, pro-MMP-2, and MMP-2 complexes were found. Only the intermediate form and the pro-form of MMP-9 were present. Both tissues also contained TIMP-1 and TIMP-2. Healthy gingiva and PDL contained more intermediate MMP-9 than diseased tissues. Healthy PDL contained more active and pro-MMP-2 than diseased PDL, and also more TIMP-2. Both MMP-9 and TIMP-2 were also detected by immunohistochemistry in gingiva.
CONCLUSION: Surprisingly, the healthy periodontal tissues contained more gelatinases than the diseased tissues. In healthy tissues this seems to be balanced by a high TIMP content. In diseased tissues, other MMPs might be more involved in tissue destruction. The analysis of MMPs and TIMPs in periodontal tissues is promising for the development of therapies to control tissue degradation in periodontitis. Future chair side tests for MMPs or TIMPs would be helpful to examine periodontal health before orthodontic treatment.

9 ORTHODONTIC MOVEMENTS OF SINGLE AND MULTI-ROOTED TEETH ASSESSED BY FINITE ELEMENT ANALYSES

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AIM: Orthodontic tooth movement is achieved by (re)modelling processes of the alveolar bone, which are triggered by alterations in the stress/strain distribution in the periodontium. According to the classical theory, fixed values for the moment-to-force ratio (M/F) have been associated with specific types of orthodontic tooth movements. However, the given M/F values do not account for the complex mechanical properties of the PDL and the morphology of the alveolar bone.
MATERIALS AND METHOD: Segments taken from human mandibles and maxillae obtained from autopsy were micro-CT scanned. The resulting scans were used for the generation of anatomically correct finite element models comprising both single and multi-rooted teeth. The material behaviour of the periodontal ligament (PDL) was considered to be non-linear and non-symmetric, and the alveolar bone was modelled according to the real morphology as obtained from the microcomputed tomographic scans. By varying the moments and forces at the brackets, different orthodontic movements were simulated and the loading conditions in the alveolar support structures were analysed.
RESULTS: Different values of the M/F generated different types of tooth movement. However, due to the non-linear behaviour of the PDL, it was also observed that the same M/F, yet with different force magnitudes, resulted in different types of movement. The stress distribution in the alveolar bone was dependent on its anatomical morphology. Distinct areas of tension and compression could not be detected as secondary load transfer mechanisms were activated.
CONCLUSION: Analysis of the stress-strain distribution in the periodontium confirmed that the classical ideas of the distribution of compressive and tensile areas in relation to different types of displacement could not be confirmed. M/F values generally advocated to obtain a prescribed orthodontic tooth movement should be used only as a guideline, therefore tooth movement should be monitored and the outcome compared with the predicted tooth movement.

10 THE INFLUENCE OF RAPID MAXILLARY EXPANSION ON AIRWAYS AND AUDITORY FUNCTION

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AIM: To describe the morphological and functional changes of the upper airways and the middle ear after rapid maxillary expansion (RME).
SUBJECTS AND METHODS: In seven patients (average age 8.7 years, 2 females, 5 males) RME was performed using a hyrax screw. Three patients served as a control group (average age 8.3 years, 1 female, 2 males). Exclusion criteria were: acute or chronic respiratory diseases, allergies, cleft lip and palate or missing adenoids. Ear, nose and throat status, a lateral cephalogram, anterior rhinomanometry, tympanometry and a posterior rhinoscopy were performed for each child at baseline and 6 months after the start of treatment.
RESULTS: Rhinomanometry showed a correlation between the radiological size of the nasal pharyngeal area and nasal airflow. Endoscopic evaluation of the size of the adenoids correlated with the measurements on the lateral cephalogram. The size of the adenoids did not change after maxillary expansion. The largest adenoids were observed in children with maxillary constriction. These children showed a negative pressure in the middle ear, which was reduced after RME.
CONCLUSION: A correlation exists between maxillary deficiency and otorhinologic structures. RME can induce otorhinological changes.

11 FLUORIDE RELEASE AND CARIOSTATIC POTENTIAL OF ORTHODONTIC ADHESIVES

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AIM: To evaluate the fluoride release profiles and cariostatic potential of four commercially available orthodontic adhesives: conventional glass ionomer cement (Ketac Cem), resin-modified glass ionomer cement (Fuji Ortho LC), polyacid-modified composite resin (Light-Bond) and conventional composite resin (Transbond XT) with and without daily fluoride exposure.
MATERIALS AND METHOD: Peribracket enamel demineralization was modelled using brackets bonded on bovine enamel with each adhesive (n = 10) and subjecting them to alternate cycles of demineralizing solution (pH 4.55) and remineralization solution (pH 6.8). Non-bracketed enamel samples served as the control. Five samples from each group were immersed in a 250 ppm fluoride mouthrinse for 1 minute each day. Fluoride release was measured at regular intervals over a 28 day period. The mineral distribution and topography of peribracket enamel after pH and fluoride cyclings were quantified by transversal microradiography.
RESULTS: Fuji Ortho LC released the greatest quantity of fluoride and showed, overall, the best cariostatic properties. Transbond XT afforded the least protection. Fluoride release profiles of Ketac Cem, Fuji Ortho LC and Light-Bond demonstrated the characteristic initial 'burst effect' after the first 24 hours and reached a constant level after two weeks. All adhesives tested demonstrated recharge and re-release potential except for Fuji Ortho LC.

CONCLUSION: Within the limitations of this study, bonding of orthodontic brackets with resin-modified glass ionomer cement resulted in less peribracket enamel demineralization with and without extrinsic fluoride application. Additionally, the common use of composite resin as an orthodontic adhesive should be supplemented with the use of a daily fluoride mouthrinse to prevent excessive enamel demineralization.

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12 SIGNIFICANT INCREASE IN STABILITY OF EARLY LOADED IMPLANTS OVER 22 MONTHS

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AIM: To investigate the behaviour of early loaded palatal implants observed by resonance frequency analysis (RFA) after a mean follow-up period of 22 months, and to compare the implant stability quotient (ISQ) values obtained with the Osstell™ device and the new Osstell™ mentor instrument.
SUBJECTS AND METHOD: In 16 patients (mean age 27.9 ± 9.2 years) with one palatal implant each (length: 4 mm; diameter: 3.3 mm; Orthosystem®, Institut Straumann, Switzerland), the implants were loaded at an early stage (average period from insertion to first loading: 6.7 ± 0.8 days). Stability was assessed in a previous study by RFA after a post-insertion period of 3 months. The measurements were translated into an ISQ value that averaged 69.8 ± 3.5. Implant stability was re-evaluated 22 months later by two measuring techniques. The first was carried out by connecting the L-shaped transducer with the Osstell™ measuring device and the second set was recorded by the Osstell™ mentor device with a small magnet attached to the implant (Smartpeg™). The probe connected to the measuring instrument was held at a distance of 2 mm from the top of the Smartpeg™. All values obtained (two for each implant, one with ISQ Osstell™ and one with ISQ Osstell™ mentor), were compared with the ISQ Osstell™ value observed 3 months post-insertion.
RESULTS: The average ISQ value at follow-up was 72.4 ± 4.0. Compared with the mean ISQ value measured after 3 months, a statistically significant increase was observed ($P = 0.042$). The mean ISQ value calculated by the Osstell™ mentor instrument was 56.2 ± 0.3. On average, the difference between these two values was 16.2 ± 3.7.
CONCLUSIONS: Early loaded palatal implants showed a statistically significant increase in their mean ISQ value (+2.6). However, this amount may not be clinically significant. In order to compare the ISQ values of the two different measuring instruments, a conversion table needs to be established.

13 EVALUATION OF ROOT RESORPTION WHEN USING THERMOPLASTIC CLEAR ORTHODONTIC APPLIANCES

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AIM: To evaluate the amount of root resorption produced by 'invisible braces' and compare to it with the amount of root resorption caused by controlled light and heavy forces produced by orthodontic springs.
MATERIALS AND METHOD: Fifty-four human upper first premolar teeth from 27 patients. The subjects were randomly allocated to one of the following three groups. group I, ClearSmile® appliance treatment on one premolar for buccal movement of 0.5 mm/two weeks and the contralateral premolar served as a control (i.e. no movement); group II, ClearSmile® appliance treatment on one premolar for buccal movement of 0.5 mm/two weeks and the contralateral premolar received a buccal force of 225 g (heavy force) from a ß-titanium molybdenum alloy (TMA®) 0.017 × 0.025 inch cantilever spring); group III, ClearSmile® appliance treatment on one premolar for buccal movement of 0.5 mm/two weeks and a buccal force of 25 g (light force) on the contralateral premolar from a TMA® 0.017 × 0.025 inch cantilever spring. The duration of the experiment was 8 weeks (56 ± 1 day). The roots of the extracted teeth were scanned using an X-ray microtomograph (Sky Scan-1072, SkyScan, Aartselaar, Belgium) and volumetric measurements of root resorption craters were undertaken.
RESULTS: The light orthodontic force group showed ×5 greater volume of resorption than the control teeth. The 'invisible braces' group showed ×6 greater volume of resorption than the control teeth ($P < 0.947$). The heavy force group showed ×9 greater volume of resorption than the control teeth.
CONCLUSIONS: Micro-CT analysis reveals that the orthodontic induced root resorption with the ClearSmile® appliances (constructed to produce a tipping movement of 0.5 mm of every two weeks) was low and not statistically different to the resorption induced by a light continuous cantilever tipping force of 25 g.

14 MOLAR DISTALIZATION WITH MINIPLATE SKELETAL ANCHORAGE**

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AIM: To evaluate, prospectively, the effects of molar distalization in combination with skeletal anchorage.
SUBJECTS AND METHOD: Fourteen consecutive patients (mean age 23.3 ± 9.7 years) presenting with a Class II malocclusion in whom 24 miniplates were fixed by three miniscrews on the infrazygomatic crest of the maxilla. Two weeks after surgery an elastic force of 150 cN was applied between a sliding hook and the bone anchors. A partial fixed edgewise appliance (0.018 inch slot) was placed only in the upper arch. Part of the incisors, both canines but no premolars were bonded. Twenty-four first molars were distalized by sliding mechanics along a 0.016 × 0.016 inch archwire. Impressions for dental casts were taken at the start of treatment and when molar distalization was complete. Linear measurements were carried out on digitized computer-based study models.
RESULTS: Distalizing forces were applied for a mean period of 6.3 ± 1.8 months and the molars were moved over a mean distance of 4.4 ± 2.0 mm. All molars were placed in an overcorrected Class I occlusion at the end of traction. No single bone anchor was lost and no signs of infection or increased mobility were observed. The premolars and canines showed some spontaneous movement as the molars distalized. In subjects without contact between the upper and lower incisors at the start of treatment, the overjet was also reduced, a mean distance of 2.5 ± 1.2 mm. Migration of the teeth mesial to the molars was attributed to friction in the molar tubes created by binding at the tube-archwire interface that pulled the archwire posteriorly.
CONCLUSION: Molar distalization using skeletal anchorage is efficient, predictable and not compliance dependent. The beneficial effects from friction in the molar tubes improve Class II biomechanics.

15 EFFECTS OF ANGIOSTATIN ON BONE TISSUE DURING EXPERIMENTAL TOOTH MOVEMENT

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AIM: To evaluate the effects of local administration of purified human angiostatin on orthodontic tooth movement.
MATERIALS AND METHOD: Right and left first molars of 30 young adult male Sprague-Dawley rats were moved mesially using a nickel titanium coil spring, suspended between the mandibular first molars and the incisors, exerting a force of 60 g. Angiostatin injections were administered into the sub-periosteum area adjacent to the mesial root of the lower molar twice daily during the experimental period. 1 μg/20 μl, 3 μg/20 μl, and 10 μg/20 μl angiostatin was injected in the first, second, and third groups, respectively. In the fourth group, 20 μl per cent 0.9 NaCl solution was injected, while in the fifth group force was administered without any injection. Groups 4 and 5 served as the controls. On the seventh experimental day, the rats were killed and the mandibles dissected. Tissue sections were obtained from the coronal, middle and apical thirds of the interradicular area. Bone volume and trabecular number, width, separation and thickness were compared.
RESULTS: Angiostatin is an anti-osteoclastic agent and 3 μg angiostatin is the minimal effective dose for inhibition of bone resorption.
CONCLUSION: Angiostatin may be a promising agent for anchorage control and for reduction of the number of osteoclasts on the pressure side of the alveolar bone.

16 A RANDOMIZED TRIAL OF THE EFFECT OF CHLORHEXIDINE VARNISH IN ORTHODONTIC PATIENTS

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AIM: To evaluate the influence of the application frequency of 40 per cent chlorhexidine varnish (EC40®) on *Mutans streptococci* (Ms) counts in the plaque of orthodontic patients with fixed appliances.
SUBJECTS AND METHOD: Sixty patients between 12 and 15 years of age, in treatment for at least 3 months with full fixed appliances, were included in this pilot study and randomly divided into three groups: group 1: EC40® application monthly; group 2: EC40® application bimonthly, and group 3: EC40® application every 3 months. Plaque around the brackets was sampled monthly for a period of 6 months. Baseline values were determined before application. After application, the patients refrained for three hours from oral hygiene activities. The plaque samples were plated for total bacterial counts on blood plates and for Ms counts on selective Ms plates (TSB20). To deal with the influence of unweighted collecting of the amount of plaque, the Ms counts were proportionally divided over the total bacterial counts of the same plaque sample.
RESULTS: No significant Ms reduction was found within or between the three groups at any time point. Compared with baseline data, a significant reduction in Ms counts was observed for groups 1, 2 and 3 combined ($P = 0.04$), 1 month after the first EC40® application.
CONCLUSIONS: Chlorhexidine varnish, EC40®, decreases the number of Ms in orthodontic patients. No conclusion could be drawn concerning the most effective application frequency.

17 INTERRELATIONSHIP BETWEEN PERIODONTICS AND ORTHODONTICS

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SHELDON FRIEL MEMORIAL LECTURE

There is a wide range of indications for orthodontic tooth movement aimed at improving the prognosis of malpositioned teeth in the mixed dentition and of periodontally involved teeth. New regenerative periodontal procedures (membrane technique, application of enamel matrix derivates) have provided greater opportunities for gaining new attachment and have improved pre-orthodontic conditions for moving teeth into infrabony defects or for vertical movement of teeth with reduced bone support.

The benefits and problems of a combined periodontal/orthodontic treatment approach will be discussed with respect to pre-orthodontic mucosal grafting, guided tissue regeneration, loss of interdental gingiva, correction of crowding, reorientating of migrated and flared incisors, and gaining new abutment teeth by distalizing free-end premolars.

18 ORTHODONTIC ALGINATES AND DIMENSIONAL STABILITY: AN *IN VITRO* STUDY

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AIM: To assess the influence of three different storage conditions on the dimensional stability of three contemporary orthodontic alginates.

MATERIALS AND METHOD: The following materials were tested: Jeltrate fastset, Dentsply Caulk (mJT); Orthotrace, Cavex (mOT) and Tetrachrom, Kaniedenta (mTC). Eighteen specimens per material were fabricated using a stainless steel mould according to ADA Specification No. 18 (ISO 1563). Six specimens per material were stored in a humidifier (HF), wrapped in a wet tissue inside a plastic bag (PB) and exposed to ambient temperature and relative humidity (TH). The dimensional change was determined by measuring the distance of the vertical d-lines on the alginate impressions, using a travelling microscope (M420, Leica, ×25 magnification) at baseline and after a storage time of 1, 2, 4, 24, 48 and 72 hours for HF and PB. The dimensional change for TH was measured at baseline and after processing for 15, 30, 45 and 60 minutes. The percentage of dimensional change was calculated from the values obtained.

RESULTS: In the HF, dimensional change ranged from –0.18 to –8.28 per cent. When stored in the PB, dimensional change ranged from –2.8 to 1.95 per cent. All materials showed a high dimensional stability at baseline (<–0.4 per cent). When stored in the PB, mTC showed an expansion, while mOT and mJT contracted. After storage for 1 hour in the PB, dimensional change was significantly higher ($P < 0.05$) for mTC (1.77 per cent) compared with mOT (–0.09 per cent) and mJT (0.05 per cent). After 72 hours storage in the HF, dimensional change was significantly lower ($P < 0.05$) for mOT (–5.87 per cent) compared with mJT (–7.38 per cent) and mTC (–8.28 per cent). Surprisingly, dimensional change was less when the specimens were stored in the PB compared with the HF.

CONCLUSIONS: Storage in a PB results in large dimensional stability for up to 4 hours for mOT and mJT. mTC was the alginate most affected by storage conditions.

19 OSSEOINTEGRATED VERSUS CONVENTIONAL ANCHORAGE TECHNIQUES: A RANDOMIZED CONTROLLED TRIAL

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AIM: To evaluate and compare the capacity of four different anchorage techniques, the Orthosystem, Onplant system, headgear, and transpalatal bar, during the alignment phase after premolar extractions.

SUBJECTS AND METHOD: After a sample size calculation, 83 patients (aged 13-19 years) were randomly allocated to receive reinforced anchorage with the Orthosystem, Onplant system, headgear, or a transpalatal bar. The inclusion criteria were patients in the permanent dentition, premolar extraction therapy in the maxilla, full fixed appliances, and anchorage reinforcement required on the maxillary first molars. The main outcome measures were time of alignment, cephalometric analysis of maxillary first molar movement, maxillary incisor movement, and sagittal growth changes of the maxilla.

RESULTS: No significant difference in alignment time was found between the groups (mean between 7.1 and 8.0 months). For the Orthosystem and Onplant groups the maxillary first molars were stable within the maxilla. In the headgear group a mean distal molar movement of 0.6 mm was found, whereas in the transpalatal group the first molars moved forward an average of 0.9 mm, i.e. anchorage loss. A significant difference ($P < 0.001$) in molar position was found between the transpalatal group and the other three groups. The maxillary incisors moved backward between 1.2 and 1.6 mm and the maxilla moved forward between 0.5 and 0.7 mm. No significant differences were found between the groups.

CONCLUSIONS: The Onplant and Orthosystem provided stable anchorage during the alignment phase, and the headgear even moved the molars distally. However, the transpalatal bar resulted in insufficient anchorage during the alignment phase.

20 COMPARISON OF THE INITIAL FORCE SYSTEMS PRODUCED BY DIFFERENT LEVELLING ARCHWIRES

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AIM: Orthodontic treatment with straightwire appliances usually begins with the insertion of a fully ligated levelling archwire. In contrast to a segmented approach, the force systems found in multi-tooth geometry are indeterminate and difficult to predict. Since many patients report pain during the initial phase of orthodontic therapy, it is assumed that the magnitude of the applied force systems must be high. The purpose of this study was thus to determine and compare the forces and moments produced by 50 levelling archwires in dental arches with different degrees of crowding.
MATERIALS AND METHOD: From 250 patients, three maxillary and three mandibular casts representing mild, moderate and severe crowding were selected. Each cast was fitted with brackets and the initial force systems produced by 50 levelling archwires were measured using a three-dimensional force moment sensor. An ambient temperature of 37˚C was established to measure the forces and moments on all incisors, canines and premolars.
RESULTS: The force systems generated by most archwires were found to exceed the force magnitudes recommended in the literature, particularly for extrusive and intrusive tooth movements. Only six archwires delivered vertical forces constantly lower than 1 N, which, however, did not correlate with the degree of crowding. Only superelastic NiTi archwires with a very small diameter, as well as certain multi-stranded archwires, produced force systems that could be considered physiological.
CONCLUSIONS: Archwires with small diameters and low stiffness, such as most multi-stranded and superelastic archwires, are believed to deliver comparatively light force systems. The findings of this study demonstrate that the actual measured force systems produced by most archwires cannot be considered adequate and are likely to cause damage such as root resorption.

21 LONG-TERM CHANGES OF UPPER LIP POSITION RELATIVE TO THE INCISAL EDGE

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AIM: To establish the long-term change in upper lip position relative to the incisal edge from 16 to 44 years of age.
MATERIALS AND METHOD: The records of 36 females and 18 males were selected from the Post-Retention Study, University of Washington, based on the following criteria: good quality cephalograms taken post-treatment (T2; mean age 16.3 years), at least 10 years post-retention (T3; mean age 31.5 years), and at least 20 years post-retention (T4; mean age 44.4 years). Linear measurements: anterior and posterior face heights, nasion-incision superius, nasion-apex superius, nasion-stomion superius and the angular measurements: inclination of mandibular plane, inclination of upper and lower incisors and interincisal angle were measured on each cephalogram. The position of the upper lip relative to the incisal edge was calculated by subtracting nasion-stomion superius distance from nasion-incision superius distance. To test the change in each measurement and the differences between males and females, *t*-tests were carried out.
RESULTS: From T2 to T3, anterior and posterior face heights increased resulting in anterior rotation of the mandible in both males and females. The changes in the male group were more pronounced. From T2 to T3, the stomion superius–incision superius distance decreased by 1.3 mm in males and by 0.3 mm in females. From T3 to T4, craniofacial growth was limited and similar in both genders. Stomion superius-incision superius distance decreased by 1.3 mm in males and females.
CONCLUSIONS: The upper lip elongates from the age of 16 to 44 years in both genders. From T2 to T3 the elongation of the upper lip is compensated by eruption of the maxillary incisors, but only in females. From T3 to T4 minimal craniofacial growth does not compensate for lip elongation thus resulting in a decrease of stomion superius-incision superius distance in both genders.

22 EVOLUTION AND AGEING OF MAN AND INDIVIDUAL VARIATION: CAN WE DELAY AGEING?

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KEYNOTE ADEDRESS

The question as to whether we can delay ageing has been raised since the beginning of time and answers have always conflicted with reality. Modern medicine has failed to prevent ageing, but can we delay ageing? Currently the process of ageing can neither be stopped nor delayed by any drug available, tested in large study populations with clear knowledge

of side-effects. Evidence based anti-ageing medicine has regarded the problem in a different manner: man has been designed genetically to live up to an age of about one hundred years. Numerous environmental factors account for individual variation and reduce life span to an average of 70-80 years in the industrialized world. Modern anti-ageing medicine looks for a reduction in these ageing factors and disorders and for early detection of chronic life shortening disorders such as hypertension, hyperlipidemia, diabetes, etc. This attenuates discrepancies in individual variation of life expectancy. In summary, modern medicine can delay advanced ageing and improve the quality of life during its later phase.

23 AETIOLOGICAL RELATIONSHIPS BETWEEN OCCLUSION AND TEMPOROMANDIBULAR JOINT DISORDERS

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AIM: To determine the aetiological relationships between occlusal factors and temporomandibular joint disorders (TMD) in adults using the population-based 'Study of Health in Pomerania, Germany' (SHIP-0) and the follow-up, SHIP-1.
SUBJECTS AND METHOD: A representative sample of 4,310 males and females aged 20 to 81 years (response rate 68.8 per cent) was investigated for TMD signs, malocclusion, functional occlusal factors, and socio-demographic parameters. Multiple logistic regression analysis, adjusting for gender, age, and socio-economic status, was used. The follow-up study, SHIP-1, has been running since October 2002. All available subjects from SHIP-0 were re-invited for a second examination after five years. More than 3000 adults have been re-examined to date. In the first quarter of 2006 the follow-up examinations will be completed.
RESULTS: In SHIP-0, a bilateral open bite up to 3 mm [odds ratio (OR) 4.0], edge-to-edge bite (OR 1.5), disto-occlusion of one or more premolar width (OR 1.4) and posterior crowding (OR 1.3) were shown to be associated with TMD signs as well as gender, age and school education. The longitudinal analysis will show whether the risk markers (and possibly additional parameters) found in the cross-sectional study (SHIP-0) can be confirmed as risk factors in the longitudinal study SHIP-1. It allows a contribution to be made to the question of the aetiological factors leading to TMD.

24 MOVING ROOTS THROUGH THE MAXILLARY SINUS USING PALATAL IMPLANTS

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AIM: Space due to missing or extracted teeth may be treated by orthodontic movement of the remaining teeth to close the space. However, the behaviour of the alveolar bone with such a procedure may be unpredictable. The aim of this investigation was to evaluate the amount of alveolar bone following posterior protraction of molars through the maxillary sinus.
MATERIALS AND METHOD: Ten clinical examples from 172 treated patients with skeletal anchorage and posterior spaces due to missing or extracted teeth were selected. Orthodontic space closure, against palatal implants (Straumann, Switzerland) as anchorage points, was performed only in one direction in an *en masse* protraction. Diagnostic three-dimensional images (3D Accuitomo) were available for every patient, since conventional two-dimensional images or computed tomograms may be difficult to interpret in these circumstances.
RESULTS: Tooth movement through the maxillary sinus was possible with orthodontic movement against stabilized anchor units. Alveolar bone augmentation was visible in all subjects.
CONCLUSIONS: Space closure may be a suitable alternative to a sinus lift and regular dental implantation. Third molars, if present, may be used for replacement due to protraction of the whole lateral segment. One potential disadvantage is the time-consuming nature of the procedure. However, where orthodontic treatment is already planned (including in growing patients), the additional encumbrance is negligible.

25 EVOLUTION AND AGEING OF MAN AND INDIVIDUAL VARIATION

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KEYNOTE ADDRESS

Current theoretical and empirical findings suggest that mate preferences are mainly identified by visual, vocal and chemical cues that reveal health, including developmental health. Attractive features have evolved over many years in plants and animals due to sexual selection, and such preferences and standards provide evidence for the claim that human beauty and obsession with beauty are mirrored in analogous traits and tendencies.

Human beauty standards reflect health assessment in mate choice by analyses of the attractiveness of the face and the body, but also of vocal and olfactory signals. The basic signals are a youthful appearance, averageness, symmetry and sex hormone markers. Although beauty standards may vary between cultures and at different times, the underlying selection pressures, which shape the standards, are basically the same. The constructed beauty ideals are also universal across cultures. This gives scope for considerable interindividual variation in beauty ideals and in traits perceived as being beautiful. These findings have implications for medical, social and biological science, especially for facial surgery that changes a person's perception. The obsession with beauty and youth will lead to equivocal cultural developments.

26 ORTHODONTIC TREATMENT PRIORITY INDICES: VALIDITY AND RELIABILITY

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AIM: To evaluate, in a systematic review, the validity and reliability of orthodontic treatment priority indices, assessing morphological as well as aesthetic indices.
MATERIALS AND METHOD: A search strategy was evolved and performed in co-operation with an information specialist at the Swedish Council on Technology Assessment in Health Care. Articles fulfilling the inclusion criteria were evaluated by two orthodontists according to a written protocol. The value as evidence was graded in three steps: high, moderate or low.
RESULTS: The search strategy resulted in 111 articles published in dental journals from 1966 to 2004. Seventy-seven articles were excluded and 34 papers were reviewed and graded. Thirty-two articles were considered to have a low value and two were regarded as having a moderate evidence value. No study was considered to have a high value.
CONCLUSIONS: Evidence is lacking regarding the validity of morphological treatment priority indices. There is insufficient evidence regarding the validity of aesthetic treatment priority indices.

27 MYOSIN HEAVY CHAIN mRNA – A MARKER OF MUSCLE ADAPTATION AFTER ORTHOGNATHIC SURGERY

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AIM: Orthognathic surgery leads to changes in jaw position and requires muscle adaptation. A temporary or permanent change of the expression of mRNA for the myosin heavy chain (MyHC), as well as a mutation of the muscle fibre type composition, can be expected and may be used as evidence of adaptation. However, some patients show no improvement in jaw position, or relapse after treatment. The aim of this prospective study was to determine the functional status of the human masseter muscle before and six months after surgery on the basis of the relative expression of MyHC mRNA isoforms for different fibre types, and to compare this with the change of occlusal contacts.
SUBJECTS AND METHOD: Thirty orthognathic patients, with prognathic or retrognathic mandibles (mean age 23.5 years). Two hundred and forty muscle biopsies were taken pre-surgery and six months after orthognathic surgery from the anterior and posterior parts of both sides of the mandible. Analysis of specific mRNA MyHC was performed by real-time PCR to quantify the isoforms I, IIa and IIx/d. Occlusal contacts were measured on study casts.
RESULTS: There was a shift in the relative content from type I (45 per cent before, 37 per cent after surgery) to type IIa (29 per cent before, 41 per cent after surgery). This shift corresponded with the number of teeth in occlusion (35 per cent before and 68 per cent after surgery) and indicated a change in muscle quality. An increase of fast twitch fibres (IIa) indicated a higher muscle force.
CONCLUSION: An improvement in the occlusion following surgery leads to an increase in masticatory force and efficient chewing of food. The stability of the results of orthognathic surgery depends on optimal sagittal and vertical jaw positions, maximum occlusal contacts and fast physiotherapeutic rehabilitation such as force training.

28 PRIMARY TOOTH WEAR IN FUNCTIONAL LATERALITIES

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AIM: To explore sidedness of primary tooth wear facets between left and right sides of the dentition among two types of functionally lateralized (hand, foot, eye) individuals, true-right sided children (TRS) and those who were non-right sided (NRS) at 4 years of age.
SUBJECTS AND METHOD: Eight hundred and fifty-five children with signs of wear of the primary teeth on the dental casts (n = 1,720) from the Genetic Odontometric Study of the Collaborative Perinatal Project, carried out in the 1960s in the USA by the National Institute of Neurological Disorders and Stroke in a cross-sectional manner at varying ages, in 95 per

cent of the subjects from 6.9 to 12.7 years (40 per cent Caucasian, 60 per cent Afro-American). Statistical comparison was carried out using Chi-square analysis.
RESULTS: Tooth wear was identified from dental casts in approximately 50 per cent. Wear was symmetric (equal on the right and left) in 49.5 per cent of these dentitions, while asymmetric wear was found in 50.5 per cent. Left sided extra wear was slightly more common (26.2 per cent) than right sided (24.3 per cent). However, statistically significant unilateral wear was found among TRS Caucasian boys on the right side of the dentition, and in NRS Caucasian boys left side extra wear was more common than right ($P < 0.03$). In Caucasian girls the same relationship appeared but the difference was not significant ($P < 0.11$). In Afro-American children an opposite relationship was seen, but the differences were not statistically significant.
CONCLUSIONS: Unilateral primary tooth wear is a result of early right/left unbalanced mastication (chewing, bruxism). It may appear associated with general structural and functional lateralities and should be considered in the various phases of occlusal development and early asymmetric malocclusions.

29 TEMPOROMANDIBULAR DISORDERS, OCCLUSION AND ORTHODONTIC TREATMENT

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KEYNOTE ADDRESS

Signs and symptoms of temporomandibular joint disorders (TMD) are relatively common in children and adolescents and can increase in frequency and severity during the second decade of life. During this period, approximately 20-30 per cent of western European children and adolescents receive orthodontic treatment. In view of the prevalence of signs and symptoms of TMD in young individuals, it is likely that patients receiving orthodontic treatment might experience TMD before, during, or after orthodontic treatment. Signs and symptoms of TMD during orthodontic treatment must therefore be seen in the light of normal longitudinal changes in subjects of the same age with similar but untreated malocclusions, preferably also in subjects without malocclusion.
This presentation will include a review of the literature and data concerning the epidemiology of TMD and a discussion about aetiological factors for TMD. Short and long-term results from prospective and longitudinal studies investigating TMD in relation to orthodontic treatment will be presented. The following issues will be discussed: current controversies in TMD, prevalence of different signs and symptoms of TMD in orthodontically treated and untreated groups, the functional occlusion during orthodontic treatment with fixed orthodontic appliances compared with untreated subjects, and the need and demand for stomatognathic treatment in orthodontically treated and untreated groups.

30 OROFACIAL DEVELOPMENT OF PREMATURE INFANTS

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AIM: Premature infants account for 5 per cent of all live births in Western societies. The aim of this prospective longitudinal comparative cohort study was to test the hypothesis that, due to their immaturity, the orofacial development of premature infants differs from that of full-term children.
MATERIALS AND METHOD: Two hundred and thirty three dental casts of the upper arch were obtained from a total of 84 subjects in the first year of life: 48 premature infants (30 males, 18 females with a mean age at birth of 30.8 weeks, SD: 3.1), and 36 full-term children, (16 males, 20 females with a mean age at birth of 39.4 weeks, SD: 1.39). The casts were touchlessly scanned with a three-dimensional white light-scanner (precision 20 μm), aligned in a Cartesian object co-ordinate system with specially designed software, and sliced virtually. Neonatal, biometric and functional parameters of the children were recorded using a standardized questionnaire.
RESULTS: The maximum measurement error was 3.6 per cent. Palatal volume differed significantly between the groups until 40 weeks gestation ($P = 0.001$). The maximum palatal width differed significantly until the corrected age of two months, inclusive ($P = 0.004$). The intergroup differences in palatal depth and palatal index were not significant.
CONCLUSION: The results do not indicate a need for early orthodontic care or any protective appliances to stabilize the immature palatal structures of premature infants against positional or functional moulding forces. Initial differences in the palatal dimensions resolved over time. These results are reassuring with regard to implications on orthodontic care costs in premature infants.

31 MECHANICAL BEHAVIOUR OF THE HYALINIZED PERIODONTAL LIGAMENT

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AIM: To describe the mechanical characteristics of the periodontal ligament (PDL) during the hyalinization phase of orthodontic tooth movement.
MATERIALS AND METHOD: Five young adult male beagle dogs (age 1.0-1.5 years). After extractions and placement of implants, custom-made orthodontic appliances were placed bilaterally in the mandible to distalize the second premolars with a standardized continuous force of 100 cN. The initial period of force application lasted for one week, after which the force was removed and the PDL was allowed to relax for 24 hours. A measurement device was then placed on the implant that enabled sampling of tooth displacement with a frequency of 1 Hz and an accuracy of 0.5 μm. At the start of the measurement session a force of 100 cN was again applied to both second premolars and tooth displacement was sampled for 5 hours. At the end of the measurement session, force application was continued with a standardized force of 100 cN.
RESULTS: Time displacement curves showed that three dogs were in the hyalinization phase, while the other two were not. All dogs showed a similar initial response, a fast displacement of the tooth lasting for a few seconds. Thereafter a creep response was found. The dogs in the hyalinization phase showed a rapidly decreasing creep rate while that in the two dogs that had not yet reached the hyalinization phase decreased more slowly.
CONCLUSIONS: The mechanical characteristics of the hyalinized PDL are different from a non-hyalinized PDL. The structures responsible for the viscoelastic characteristics in normal tissues, e.g. the vasculature and collagen fibres, are changed in necrotic hyalinized tissue. These changes lead to a decrease in viscoelasticity, which could explain the decreased creep rate in the hyalinized PDL.

32 LONG-TERM RESULTS IN ADVANCEMENT AND SETBACK BILATERAL SAGITTAL SPLIT OSTEOTOMIES

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AIM: A long-term follow-up study on the stability of the hard and soft tissues of the mandible in advancement and setback patients after bilateral sagittal split osteotomy with rigid internal fixation.
SUBJECTS AND METHOD: The advancement group consisted of 16 patients and the setback group of 17 patients. The follow-up was 12.7 years post-operatively. The patients also had records taken prior to surgery and at a number of earlier post-surgical time points. The lateral cephalograms were manually traced but digitized and evaluated with the Dentofacial Planner Program®. The *x*-axis for the system of co-ordinates ran through sella (point zero) and the NSL line minus 7 degrees.
RESULTS: Relapse at point B 12.7 years post-surgery was –2.4 mm or 50 per cent of the initial advancement, and 0.9 mm or 15 per cent of the initial setback. At pogonion the relapse was –3.2 mm or 60 per cent of the initial advancement, and 1.5 mm or 21 per cent of the initial setback. The mean net effect on the labial fold (soft tissue point B) was 94 per cent of the advancement and 101 per cent of the setback at point B. For soft tissue pogonion, it was 119 per cent of the advancement and 82 per cent of the setback at pogonion. The net effect on the lower lip (labrale inferior) was 55 per cent of the advancement and 113 per cent of the setback at incision inferior.
CONCLUSIONS: The amount of surgical advancement of the mandible is responsible for long-term relapse. The initial soft tissue profile, the initial growth direction, and remodelling processes at the hard tissues must be regarded as other aetiological factors in long-term relapse. Normal growth positively influenced the long-term results for females in the setback group as further distalization of the mandible was observed after 12.7 years. The long-term results with mandibular setback are more stable than with mandibular advancement.

33 BONY INTERDIGITATION OF THE MID-PALATAL SUTURE

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AIM: To assess age-related morphological differences in the mid-palatal area with reference to horizontal (HI) and vertical (VI) interdigitation on human autopsy material.
MATERIALS AND METHOD: Twenty-two palatal bone specimens from subjects with an age range of 18 to 63 years. Nineteen specimens were from males and three from females. The sample was divided into two age-related groups (group 1: ≤25 years; group 2: >25 years) and histomorphometric measurements were taken for HI and VI within different mid-palatal suture areas (anterior, middle and posterior). The specimens were prepared for histomorphometric measurements in the transversal plane using a sawing and grinding technique.
RESULTS: The following median mid-palatal values were found: 867.83 μm (HI) and 680.52 μm (VI) in the anterior area, 1104.86 μm (HI) and 1584.86 μm (VI) in the middle area and 969.70 μm (HI) and 714.36 μm (VI) in the posterior area. No significant differences were found within the examined areas (anterior, middle, posterior) regarding bony interdigitation (HI

and VI). Age-related measurements revealed 163.33 μm VI for group 1 and 185.89 μm for group 2: there were no significant differences.
CONCLUSION: Two- and three-dimensional bony interdigitations (HI and VI) in the mid-palatal suture of adults cannot be regarded as the reason for increased transversal resistance to rapid palatal suture widening.

34 ADULT FACIAL TEMPLATES: A NEW PERSPECTIVE IN THREE DIMENSIONS

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AIM: To describe the use of adult facial templates in gender specific facial analysis.
SUBJECTS AND METHOD: Eighty adults, mean age 24.5 years. Laser scanned images of the subjects were obtained under a reproducible and controlled environment with two Minolta Vivid 900 (Osaka, Japan) optical laser-scanning devices assembled as a stereo-pair. A set of left and right scanned images was taken for each subject, with an average scan time of 2.5 seconds. These scanned images were processed and merged to form a composite three-dimensional soft tissue reproduction of the subjects using commercially available reverse modelling software. The differences in facial morphology were measured using shell deviation colour maps. The facial template was used to compare differences between male and female groups and two subjects with facial disproportions.
RESULTS: The difference between the male and female facial templates was 1.28 ± 1.02 mm. The areas of greatest deviation were at the nasal and zygomatic areas and the lower jaw line. The results of the surface deviation maps between the templates and subjects with facial disproportion showed that the results could be applied for orthodontic diagnosis.
CONCLUSIONS: Construction of adult facial templates provides an interesting perspective to measure changes in groups of patients and also acts as a useful template for the comparison of skeletal disproportion.

35 GOLDEN PROPORTIONS IN ADOLESCENT FACES

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AIM: To investigate the common belief that facial attractiveness is correlated with 'golden proportions' of the face (Ricketts, 1982), in an adolescent population.
MATERIALS AND METHOD: Pre-treatment sets of standardized photographs (one frontal, one three-quarter smiling and one lateral view, shown simultaneously) of 64 Caucasian orthodontic patients, 10 to 16 years of age, were selected at random with stratification for gender and Angle classification. A panel of 76 adult laypersons evaluated the attractiveness of the individuals shown on these sets of photographs, on a visual analogue scale (VAS) from 0 (very unattractive) to 100 (very attractive). The facial aesthetic value of each patient was calculated as the mean VAS scores of the panel members. All frontal photographs were digitised and three observers recorded the position of 13 landmarks included in the putative golden proportions. The accuracy of the measurements was tested. Nineteen proportions, based on the golden proportions, were determined, and the deviation of each proportion from the golden target (1.618) was calculated. This deviation was related to the VAS scores. According to Ricketts, the smaller the deviation, the higher the VAS scores.
RESULTS: The mean correlation coefficients for all variables between the three observers ranged from 0.69 to 0.94. Determination of point Trichon appeared to be the least accurate. From the 19 Pearson correlations between the deviation from the golden target and the VAS scores, only five had the correct (negative) sign, and only four of these were significant. Together, these variables accounted for 16 per cent of the variance ($P = 0.001$, $r = 0.40$).
CONCLUSION: Only four golden proportions, derived from Ricketts' work, showed a significant correlation with facial attractiveness in adolescents. Their explained variance, however, is too small to be of clinical importance.
Ricketts R M 1982 The biologic significance of the divine proportion and Fibonacci series. American Journal of Orthodontics: 351-370

36 OCCLUSION AND TEMPOROMANDIBULAR DISORDERS

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KEYNOTE ADRESS

The mainstream scientific opinion on occlusion and temporomandibular disorders (TMD) is that the aetiological significance of occlusal factors is small or insignificant. Consequently, occlusal therapy for TMD is not recommended. These conclusions are based on a large body of literature. However, a critical look at the methodology used in the studies referred to gives reason to suspect that several unaccounted for confounding factors could cause false negative results. Studies acknowledging the

possibility that aetiological factors could be universal, but not necessarily sufficient causal factors, in TMD have disclosed a consistent association between variation in occlusion and the incidence of TMD. Moreover, clinical trials designed to avoid bias from the universal presence of occlusal aetiological factors have shown that the elimination of such factors is efficient therapy.

37 PREDICTION OF SOFT TISSUE CHANGES FOLLOWING MANDIBULAR ADVANCEMENT SURGERY

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AIM: Pre-surgical prediction has now become an integral part of the orthognathic treatment process, aimed at providing a realistic estimate of the anticipated outcome of treatment for both clinician and patient. Prediction is difficult due to variability in the nature of the soft tissues and differences in soft tissue displacement compared with osseous translation. It is the lips that appear to be the least predictable of all facial features following orthognathic treatment. This retrospective cephalometric study aimed to provide more precise information concerning how the various soft tissue characteristics and skeletal changes affect the post-surgical soft tissue drape, and to provide a more accurate soft tissue planning tool for future use.

MATERIALS AND METHOD: The pre- and post-surgical lateral cephalograms of 64 patients, who had undergone mandibular sagittal split advancement, were scanned and then digitised using customised software. Multiple regression analyses were used to create a prediction equation for soft tissue changes at soft tissue pogonion, inferior labial sulcus, labrale inferius and stomion inferius following mandibular advancement.

RESULTS AND CONCLUSIONS: This method of using multiple independent variables appears to be useful in the prediction of soft tissue changes. It was possible to explain up to 99 per cent of the variation in soft tissue response for soft tissue pogonion and 96 per cent of the variation for inferior labial sulcus, labrale inferius, and stomion inferius. This is more than has been possible previously using simple ratios. Importantly, when the prediction equation was applied to an independent sample, the results appeared to be clinically useful, especially for lower lip prediction, which is problematic with current prediction methods.

38 HISTOLOGICAL CHANGES OF ANTIGEN-INDUCED TEMPOROMANDIBULAR JOINT ARTHRITIS IN RABBITS

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AIM: To evaluate: (1) the immunomodulatory effect of intraarticular steroid injections in antigen-induced temporomandibular joint (TMJ) arthritis in young rabbits and (2) the correlation between the results obtained using different histological methods.

MATERIALS AND METHOD: Arthritis was induced in the TMJs of 30 rabbits by four repeated intraarticular injections of ovalbumin. One group was left untreated (15 animals) while another group (15 animals) additionally received intraarticular injections of corticosteroid. Seven rabbits from the arthritis group and three from the corticosteroid group died during the study. A placebo group was included who received saline intraarticular injections (5 animals). An untreated control group was additionally included (7 animals). Histomorphometry consisted of scoring: (1) the synovial lining and inflammation in the subsynovial connective tissue (SSCT) semi-quantitatively; (2) synovial thickness by orthogonal intersections, and (3) fractional surface of the synovial lining using line-grids. Stereological tools were used to estimate the volume of the SSCT and to count the number of plasma cells in the SSCT.

RESULTS: Histomorphometry showed synovial proliferation in both the arthritis and steroid groups. Counting of plasma cells in the SSCT showed that corticosteroid reduced, but did not eliminate, the inflammation. There was no difference in the thickness of the synovial lining or SSCT volume between the groups.

CONCLUSION: The optical fractionator proved to be a superior tool compared with semi-quantitative assessments when evaluating the inhibitory effect of intraarticular corticosteroid injections. Scoring of synovial proliferation and the amount of subsynovial tissue demonstrated low sensitivity regarding immunomodulation in chronic antigen-induced arthritis. Corticosteroid intraarticular injections reduce but do not eliminate the inflammation.

39 DOES REMOVAL OF THE ORIGINAL PULP TISSUE BEFORE TRANSPLANTATION INFLUENCE REVASCULARIZATION?

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AIMS: Cryopreservation of teeth causes irreversible damage to the pulp tissue. If the original pulp tissue is removed before cryopreservation and transplantation, teeth can be transplanted at a later stage without endodontic treatment if the apical

foramen is large enough. However, in some cases revascularization fails. The aim of this study was to determine the extent to which removal of the original pulp tissue influences revascularization.
MATERIALS AND METHOD: Twenty-nine single-rooted teeth, with complete development, from three dogs. The apex was cut open in all teeth. The apical foramen ranged from 0.24 to 1.52 mm after apicectomy. Holding the tooth by the crown with extraction forceps, the pulp tissue was totally removed from the apical side in 14 teeth. All teeth were immediately reimplanted following these procedures. After a period of 90 days the experimental teeth, together with the surrounding tissue, were removed and analyzed histologically.
RESULTS: Seven teeth showed total revascularization, one of which had the pulp tissue removed. Fourteen teeth showed little or no revascularization; the pulp tissue had been removed in 11 of these teeth.
CONCLUSIONS: Revascularization of an empty pulp chamber is possible, but the success rate is decreased compared with revascularization when the original pulp is left *in situ*. It is possible that necrotization of the original pulp tissue, after transplantation or reimplantation, stimulates migration of cells from the surrounding tissues into the apical pulp. This results in ingrowth of new blood vessels and the formation of a new pseudo-pulpal tissue. These findings are in agreement with those reported in the literature.

40 WHY NOT EXTRACT FIRST MOLARS?
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AIM: To evaluate orthodontic treatment based on first molar extraction, analysing: the duration of treatment; if treatment had an impact on basal vertical relationship; if there was relapse in the extraction sites; and if third molars subsequently erupted.
SUBJECTS AND METHOD: Thirty-six individuals (26 females, 10 males) with extraction of all four first molars, followed by upper and lower fixed appliances. Records were taken prior to treatment, mean age 16.4 years (T1); end of active treatment, mean age 18.7 years (T2) and at least two years after debonding, mean age 22.7 years (T3). At T3 all subjects still had bonded lower 3-3 retainers. Records: lateral cephalograms, dental pantomograms and study models. Cephalometric analysis at T1, T2, and T3 was undertaken. The dental pantomograms were digitized at T2 and T3 to study second molar angulation. Study models at T3 were used to evaluate spacing at the extraction sites and third molar eruption. A clinical interview was undertaken at T3 to investigate if eruption of the third molar had been symptomatic.
RESULTS: The mean treatment duration was 24.9 months (sd 4.8; maximum 37.1; minimum 18.3). There were no significant changes in any vertical skeletal variables between T1-T2, T1-T3 and T2-T3. At T3, three subjects had extraction spaces in the lower jaw, two mesial to the lower second right molar of 1 and 1.5 mm, and the third of 0.5 mm mesial to the lower left second molar. In these subjects, at T2, the angulation of the second molar was significantly above average. All third molars were erupted. None of the individuals reported pain related to third molar eruption.
CONCLUSIONS: The mean treatment time of 25 months was equivalent to orthodontic treatment duration with other extraction patterns. Extraction of four first molars did not decrease the skeletal vertical relationship, which questions the assumption that extraction of posterior teeth reduces a 'skeletal open bite'. Space reopening did not occur in the upper arch. In the lower arch, only three subjects had minor relapse of extraction space closure and, in all of these patients, the second molar had an adverse angulation at the end of treatment, illustrating the need to take panoramic radiographs and carefully check the root position of the second molar prior to debonding. All third molars had erupted asymptomatically and were in function. Although four teeth were extracted, all subjects had, at T3, 20 fully functioning teeth.

41 EFFECTS OF MANDIBULAR SYMPHYSEAL DISTRACTION ON THE TEMPOROMANDIBULAR JOINT
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AIM: To evaluate the effects of mandibular symphyseal distraction osteogenesis (MSDO) on the mandibular condyle and disc using submentovertex (SMV) radiographs and magnetic resonance imaging (MRI).
SUBJECTS AND METHOD: Eighteen patients with an age range between 15.8 and 23.3 years (mean: 20.01 ± 2.25 years) at the start of treatment. A custom-made, intraoral rigid bone- and tooth-borne distraction device was designed and used. After a latency period of 7 days following surgery, the device was activated twice a day by a total of 1 mm per day. The device was maintained in position for approximately 90 days after surgery. SMV radiographs and bilateral MRIs of the temporomandibular joints were taken at the start of distraction, at the end of bony consolidation (94.95 ± 5.79 days after surgery) and at the follow-up period (24.08 ± 4.18 months after surgery). Temporomandibular joint dysfunction (TMD) and signs were recorded in all of the study subjects. The data was analyzed statistically using the repeated measure analysis of variance (RANOVA) and paired *t*-tests.

RESULTS: SMV analysis demonstrated that the intercondylar angle was increased and the distance between the condyles was decreased significantly at the end of the consolidation period ($P < 0.001$). No significant differences were found in disc position (posterior, medial, and anterior angles) or condyle shape (alpha angle; $P > 0.05$) indicating that the relationship between the mandibular condyle and disc was not significantly changed following MSDO. Moreover, no significant increases were observed in TMD signs and symptoms after MSDO.
CONCLUSION: The long-term findings indicated no positional or configurational changes in the temporomandibular disc and condyle, nor any increase in TMD symptoms after MSDO.

42 SOFT TISSUE CHANGES IN CLASS II DIVISION 1 SUBJECTS TREATED WITH AND WITHOUT EXTRACTIONS

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AIM: To evaluate the effects of two different orthodontic treatments and two different techniques on the soft tissue facial profile of adult patients; to examine the relationship between the changes in lip form and lip thickness; and to determine the correlation between tooth movement and lip response.
MATERIALS AND METHOD: Pre- and post-treatment records of 100 extraction and non-extraction subjects treated by two experienced orthodontists with two different techniques (straightwire and two-dimensional). All adult patients presented with a Class II division 1 malocclusion and a minimum overjet of 7 mm. To determine intra-examiner tracing error, 20 randomly selected post-treatment radiographs were retraced and all variables re-measured. The mean error for linear measurements was between 0.1 and 1.2 mm, and for angular measurements between 0.4 and 1.6 degrees. To compare profile changes at T1 and T2, between group differences were assessed using one- and two-sample *t*-tests for unpaired data (independent samples). For comparison of the extraction and non-extraction groups, *t*-tests with *P*-values less 0.05 were considered significant. In order to reduce the possibility of some *t*-tests achieving significance due to change alone, Holm corrections (and other test-corrections) were carried out.
RESULTS: Only two variables were considered significant between the two treatments at the end of therapy, and these were the thickness of lower lip and upper incisor movement.
CONCLUSION: There was no significant difference in soft tissue profile between subjects treated with or without extractions.

43 KINETICS OF LIGHT-CURE BRACKET BONDING: FAST OR EFFICIENT?

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AIM: The efficiency of light-cure bracket bonding depends on the energy density (power density × exposure duration) of the cure. Recent technological advances have provided the possibility to increase light power density in an effort to reduce exposure duration. It was hypothesized that the relationship between bracket bond strength and exposure duration for the same energy density is not linear.
MATERIALS AND METHOD: Stainless steel brackets were bonded on bovine incisors using a calibrated powerful halogen lamp that allowed modification of power density from 300 to 3000 mW/cm^2. Eight groups of 20 incisors were included, using different combinations of power densities and exposure durations in order to obtain three levels of energy density (6000, 12000, and 24000 mJ/cm^2). Another group of 20 incisors served as a positive control using a powerful halogen lamp (1000 mW/cm^2) for 40 seconds. After storage for 24 hours at 37°C in water, bracket shear bond strength (SBS) was measured.
RESULTS: Bracket SBS mainly depends on the energy density of the light cure. All groups with an energy density of 6000 mJ/cm^2 showed a significantly lower SBS than the groups with higher energy densities ($P < 0.01$). The dependence of SBS on exposure duration for the same energy density was found to follow a non-linear regression model: $y = x/[a+b*x+c*sqr(x)]$, ($r^2 > 0.98$).
CONCLUSION: The kinetics of polymerization is complex and curing of the composite between the metallic bracket base and the tooth surface increases this complexity. The relationship between bond strength and exposure duration for the same energy density is not linear. An exposure time of less than 4 seconds, even in conjunction with the most powerful light source currently available (3000 mW/cm^2), cannot guarantee efficient bracket bond strength. On the other hand, a weak light source (e.g. 300 mW/cm^2) can achieve sufficient bond strength if used for 40 seconds. There seems, however, to be an advantage of power density over exposure duration.

44 THE LENGTH OF THE NASAL BONE IN CLEFT LIP AND PALATE SUBJECTS

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AIM: To analyze human nasal bone length in newborns and male adults with cleft lip (CL), cleft palate (CP), and unilateral cleft lip and palate (UCLP), and to compare the results with previous findings in prenatal material. This study was a radiographic profile cephalometric cross-sectional analysis.
MATERIALS AND METHOD: Profile radiographs from 60 newborns with a male to female ratio of 1:1 in each group (20 CL, 20 CP, and 20 UCLP) and 60 male adults (20 CL, 20 CP, and 20 UCLP). Nasal bone length (n-na) was measured with digital callipers on the profile radiographs. To compare n-na in the different cleft groups, Student's *t*-tests, at a significance level of 5 per cent, were performed.
RESULTS: In male adult patients with CL, n-na was significantly shorter compared with those with CP. A borderline significance was seen in the comparison of male adult patients with CL and UCLP. Furthermore, in newborns, n-na was significantly shorter in those with CL (2 months) compared with those with UCLP (2 months). There was no significant difference in n-na between patients with CP and UCLP, in either the adult males or the newborns.
CONCLUSIONS: Nasal bone length is significantly shorter in subjects with a CL compared with those with a CP. The results show that a CL is associated with a deviation in the upper midface.

45 RETENTION OF FIRST MANDIBULAR MOLARS: THE PROGNOSIS FOR ERUPTION
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AIM: 1) To describe the aetiology behind primary retention of first permanent mandibular molars by comparing the affected molar region with the contralateral region, and 2) To follow-up the retained molars in order to determine whether they erupted.
MATERIALS AND METHOD: Dental pantomograms from 29 subjects (17 male, 12 female) sent to the Department of Orthodontics, Copenhagen Dental School, from Danish public dental clinics for treatment guidance (Part 1). Questionnaires were later sent to the dentists for follow-up on the eruption of the teeth (Part 2).
RESULTS: Part 1: Aetiological evaluations: On each radiograph, the number and location of the molars, the maturity of individual molars and the occurrence of morphological deviations were recorded. The findings showed that in an affected region disruption of normal dental development and dental eruption had occurred, causing delay in dental maturity as well as arrested eruption of the first molar. Part 2: Follow-up on eruption: Completed questionnaires and available radiographs were returned for 25 subjects. In 10 patients, eruption had occurred, six after surgical removal of the mucosa covering the retained first molar. In eight patients, the molar had been removed and, in seven subjects, the observation time from first diagnosis was too short for evaluation of eruption. The results indicated that retained first mandibular molars have the ability to erupt.
CONCLUSIONS: A unilateral retained first permanent mandibular molar appears to represent a temporary delay in eruption rather than permanent arrest.

46 NASOLABIAL AESTHETICS IN UNILATERAL CLEFT LIP AND PALATE SUBJECTS: AN INTER-CENTRE COMPARISON
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AIM: To evaluate the nasolabial appearance of patients with unilateral cleft lip and palate (UCLP) treated in Nijmegen and to compare them with the six centres from the Eurocleft study with the aim of selecting patients with the best treatment outcome for the international good practice archive (part of the Eurocran project). Relationships between ratings of nasolabial aesthetics and dental arch relationships were also investigated.
MATERIALS AND METHOD: The nasolabial appearance of 42 consecutive Nijmegen UCLP patients was assessed by applying the aesthetic index of Asher-McDade *et al*. (1991). This index, which was used in the Eurocleft study, comprises four different components (nasal deviation, nasal form, vermillion border, nasal profile), which are scored separately on a 5-point scale and subsequently averaged to an overall aesthetic score (also on a 5-point-scale with 1 = very good nasolabial appearance to 5 = very poor nasolabial appearance). Nijmegen dental arch relationships were evaluated with the well-established, 5-point-scale Goslon Yardstick, which was also used in the Eurocleft study. Possible relationships between aesthetic ratings, Goslon ratings and treatment protocols were investigated for the Nijmegen patients.
RESULTS: The mean of the overall aesthetic rating for the Nijmegen patients was 2.7. Regarding the overall aesthetic rating, Nijmegen showed similar treatment outcomes with Eurocleft centres A, D, E and F. Nijmegen scored better than Eurocleft centre C but worse than Eurocleft centre B ($P \leq 0.05$). Comparisons of treatment protocol could not explain the differences in treatment results. No significant correlations between aesthetic ratings and Goslon ratings could be established for the Nijmegen patients.

CONCLUSIONS: The six centres showed differences in nasolabial appearance that could not be explained by their treatment protocols. The current study is supportive in the selection of patient records that are suitable for the 'good practice archive'.

47 SATISFACTION IN BILATERAL CLEFT LIP AND PALATE PATIENTS

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AIM: To assess satisfaction with facial appearance, function and health related quality of life in bilateral cleft lip and palate (BCLP) patients.
SUBJECTS AND METHOD: Forty-three treated adult BCLP patients (30 males, 13 females; mean age 28 years, sd: 7.8 years) were compared with a group of 43 adults without clefts (30 males, 13 females; mean age 28 years, sd 8.0 years) matched for age, gender and socio-economic status. Outcome measures included a self-administered questionnaire assessing health related quality of life (Rand-36) and satisfaction with facial appearance (upper lip, nose, teeth, jaws and total facial appearance) and function (speech, intelligibility, hearing, nasal breathing and drinking). Additionally, both groups were invited to comment on facial appearance and function.
RESULTS: BCLP patients were significantly less satisfied concerning the appearance of the upper lip, the nose and nasal breathing compared with the control group. BCLP patients reported remarks on the appearance of the upper lip, the nose and total facial appearance significantly more often when compared with the control group. Similar findings were noted with respect to function, speech, intelligibility, hearing, nasal breathing and drinking. Health related quality of life was significantly higher in the BCLP group with regard to physical functioning, vitality and pain compared with the control group. In the BCLP group satisfaction with facial appearance and function was positively correlated with health related quality of life.
CONCLUSIONS: BCLP patients were less satisfied about the appearance of the upper lip, the nose and nasal breathing compared with matched controls. BCLP patients also reported remarks on facial appearance and function significantly more often. In BCLP patients, satisfaction with facial appearance and function was positively correlated with health related quality of life. It is suggested that quantitative scoring methods are limited in revealing persisting problems in BCLP patients.

48 MAINTENANCE OF A DEEP BITE PRIOR TO SURGICAL MANDIBULAR ADVANCEMENT

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AIM: To measure the effect of a deep bite in combined orthodontic and surgically treated Class II patients on chin prominence, vertical face height and profile. The results from patients where the deep bite was maintained prior to orthognathic surgery were compared with subjects with a normal overbite prior to surgery.
SUBJECTS AND METHOD: Thirty-four adults with a Class II skeletal dental base. All received orthodontic treatment followed by surgical mandibular advancement carried out by the same orthodontist and surgeon. In 21 patients the deep bite was preserved in the pre-orthodontic phase, while in 13 subjects there was a level curve of Spee prior to surgery. Linear and angular measurements were made on the pre-surgical and post-treatment cephalometric radiographs. The differences between the groups were assembled on the basis of face height. Statistical evaluation using *t*-tests was carried out.
RESULTS: Statistical evaluation confirmed differences in lower anterior face heights (sp-me) between the two groups prior to surgery. In deep bite subjects the mean lower face height was 4.5 mm smaller ($P < 0.05$). At the end of treatment face height increased for both groups, but the mean increase for lower face height (sp-me and SN/ML) was greater in the deep bite subjects ($P < 0.05$ and $P < 0.001$, respectively). The ratio of posterior to anterior face height (s-go/n-me) decreased in both groups but was greater in the deep bite subjects ($P < 0.05$). The mean forward movement of soft tissue pogonion was smaller in the deep bite group when compared with the normal overbite group ($P = 0.05$).
CONCLUSION: The maintenance of a deep bite prior to mandibular advancement surgery can lead to an increase in lower face height without chin prominence markedly increasing. This is valuable for the profile in those patients with a reduced lower face height.

49 EFFECTS OF ORTHOGNATHIC TREATMENT ON PATIENTS´ FUNCTIONAL AND PSYCHOSOCIAL WELL-BEING

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AIM: To evaluate subjective treatment outcomes in patients following bilateral sagittal split osteotomy (BSSO), and to determine whether signs and symptoms of temporomandibular dysfunction (TMD) and changes in occlusion are related to patient satisfaction.
SUBJECTS AND METHOD: Fifty-three females and 29 males (mean age 32 years, SD 11.1) who underwent surgical-orthodontic treatment. Sixty-four had advancements and 18 setbacks of the mandible. During the first examination, occlusion and signs and symptoms of TMD were registered. Approximately 1.8 years (SD 0.5) after BSSO the subjects were re-examined clinically and asked to complete a questionnaire about the influence of the treatment on their masticatory function and symptoms of TMD, as well as their satisfaction with the treatment outcome.
RESULTS**:** The majority of the subjects (73 per cent) were very satisfied with the treatment outcome and nobody expressed dissatisfaction. Surgical-orthodontic treatment improved chewing ability in 61 per cent of the subjects, and reduced TMD symptoms, especially in facial and temporomandibular pain (56 and 40 per cent, respectively). Multiple logistic regression analysis showed that a high satisfaction with the outcomes was expressed, especially for subjects with improved mastication and self-confidence, as well as for those without long-term neurosensory deficit. Altogether, patients with mandibular setback were more pleased with the effects of orthognathic treatment outcome than those with mandibular advancement.
CONCLUSIONS: Surgical-orthodontic patients generally benefit from the treatment both functionally and psychosocially. These findings indicate that besides functional and morphological reasons it is important to also emphasize psychosocial factors when planning treatment and comparing the alternative treatment approaches.

50 CRITICAL EVALUATION OF THE EVIDENCE PRODUCED BY META-ANALYSIS OF ORTHODONTIC STUDIES

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AIM: To investigate the evidence in the orthodontic literature derived from high quality studies such as meta-analyses, to evaluate the methods used, and to critically analyse their results.
MATERIALS AND METHOD: The following electronic databases were searched: Pubmed, Cochrane Database of Systematic Reviews, Cochrane Database of Methodology Reviews, NHS Economic Evaluation Database, and DARE. Hand-searching was also performed. Ninety-eight studies were initially retrieved. The criteria for considering studies for inclusion were: (a) the research papers should have discussed an orthodontic related subject, and (b) the studies should not only have been cited as a meta-analysis by the corresponding databases but they also should have contained appropriate meta-analytical statistical procedures. After applying the above criteria, 17 orthodontic-related articles were identified as meta-analysis studies.
RESULTS: Not all of these 17 studies presented adequately supported evidence, a fact that could be attributed to the limitations and problems addressed in the methodology they followed. However, in some studies sound evidence could be produced regarding maxillary protraction treatment, prevention of posterior crossbites, reliability of some variables in lateral cephalometric analysis, correlation between anterior tooth injuries and magnitude of overjet, prevalence of tooth agenesis, and correlation of external apical root resorption with treatment-related factors and type of tooth movement.
CONCLUSIONS: More high quality studies should be conducted in orthodontic-related subjects in order to produce strong evidence regarding the effectiveness of the various treatment approaches used in daily practice.

51 LOAD APPLICATION INDUCES CHANGES IN THE EXPRESSION LEVELS OF SOX9, FGFR3 AND VEGF IN CONDYLAR CHONDROCYTES

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AIM: Research data and clinical observations have shown that mechanical loading has a modulating effect on the development and maintenance of normal cartilage architecture. During the past decade numerous pivotal factors controlling cartilage development and growth have been identified, such as Sox9, fibroblast growth factor receptor (FGFR) 3 and vascular endothelial growth factor (VEGF). The aim of this study was to examine the involvement of these factors in the signalling pathway of mechanical loading in mandibular condylar cartilage by altering the dynamics of the transmitted load via changes in food hardness.
MATERIALS AND METHOD: One hundred, 14-day-old, female Wistar rats were divided into two groups: one group was provided with hard food and the other with soft food. On day 21 (weaning day and initiation day of the experiment), 10 animals from each group were sacrificed after 2, 6, 12, 24 and 48 hours. Their condyles were dissected and cartilage tissue processed for immunostaining using antibodies against Sox9, FGFR3 and VEGF.

RESULTS: In the proliferating zone, statistical differences were observed in stain intensity for both Sox9 and FGFR3 in relation to time, while in the early hypertrophic zone statistical differences in stain intensity were evident in relation to food type and time for Sox9, FGFR3 and VEGF.
CONCLUSIONS: Different mechanical loading conditions in condylar chondrocytes trigger differentiation/maturation related processes by affecting the expression levels of crucial factors for chondrocyte proliferation and differentiation, Sox9, FGFR3 and VEGF. The data imply that condylar cartilage loading ultimately influences condylar cartilage growth.

52 IMPACT OF ORTHODONTIC ATTACHMENTS AND CHLORHEXIDINE-CONTAINING VARNISH ON GINGIVAL INFLAMMATION

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AIM: This prospective randomized clinical trial aimed to compare the severity of clinical inflammation parameters and the rate of the inflammatory mediator, IL-1β, during orthodontic movement of premolars using brackets and bands within a split-mouth design. Additionally the effect of a chlorhexidine-containing varnish (Cervitec) was investigated.
SUBJECTS AND METHOD: Three hundred teeth, in 40 healthy children who required orthodontic treatment for crowding. The orthodontic attachments were randomly allocated to the test teeth. Twenty children received Cervitec during treatment while the remaining children served as the controls. Before treatment and at 4, 8, 12, 16, 20 and 24 weeks the probing depths were measured. In addition the gingival (GI) and the plaque (PI) indices (Löe and Silness) were evaluated. Gingival crevicular fluid was collected using sterile filter paper strips at each appointment. A quantitative enzyme-linked immunoassay technique was used to detect differences in the amount of IL-1β induced by the application of the two different orthodontic attachments. Furthermore, the observed IL-1β levels for the children that received the chlorhexidine containing varnish and the control group were compared.
RESULTS: Regarding probing depths, it was found that teeth with brackets showed a highly significant reduction in depth when compared with teeth treated with bands ($P = 0.0001$). This was also evident for the GI ($P = 0.001$). The IL-1β levels confirmed these findings ($P = 0.001$). In contrast, the PI showed higher values when brackets were used ($P = 0.001$). Cervitec application produced no significant difference between brackets and bands for the clinical observations ($P > 0.05$) and the IL-1β levels ($P = 0.743$).
CONCLUSION: The clinically observed inflammation parameters, as well as the IL-1β levels, reflect the higher impact of bands on gingival health and showed a significant decrease after application of Cervitec. However, the PI showed higher values for teeth with brackets.

53 CRANIOFACIAL ANATOMY AND PHARYNGEAL DIMENSIONS IN SUBJECTS WITH OBSTRUCTIVE SLEEP APNOEA

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AIMS: This prospective, case controlled, study evaluated (i) the craniofacial anatomy and the pharyngeal dimensions in dentate, Caucasian adult subjects and (ii) the impact of gender on these anatomical variables.
SUBJECTS AND METHOD**:** Ninety-nine subjects, (78 males, 21 females) with a confirmed diagnosis of obstructive sleep apnoea (OSA) and a similar number of control subjects, matched for age and gender, with no history of respiratory disease, snoring or excessive daytime sleepiness. Each subject's neck circumference, height and weight were recorded together with a dental examination. An upright lateral cephalogram was obtained, at the end of expiration, with the subject in the natural head position, teeth in maximum intercuspation, and a layer of barium sulphate applied to the dorsum of the tongue to obtain a clear radiographic view. Cephalometric skeletal (n = 16) and soft tissue (n = 21) landmarks were traced and digitized by a single operator (SP).
RESULTS: Subjects with OSA demonstrated significant morphological abnormalities in both craniofacial and pharyngeal dimensions. All antero-posterior skeletal measurements, including mandibular length ($P < 0.001$) were reduced with a corresponding reduction in the intermaxillary space ($P < 0.001$). The nasopahryngeal airway was narrower ($P < 0.001$), tongue size increased ($P = 0.005$) and the soft palate was longer and thicker ($P < 0.001$). When comparing differences between male and female OSA subjects matched for age, males exhibited a significantly larger neck circumference, an inferiorly positioned hyoid ($P = 0.001$), and larger soft palate and tongue dimensions ($P = 0.001$), whilst, female OSA subjects demonstrated an increased body mass index, smaller necks, a larger gonial angle ($P < 0.001$) and a larger maxillary-mandibular planes angle ($P = 0.007$).

CONCLUSION: Significant differences in craniofacial anatomy and pharyngeal dimensions exist between OSA and control subjects irrespective of gender. Furthermore, male and female OSA subjects themselves demonstrate morphological differences.

54 IGF-I AND IHH EXPRESSION IN CONDYLAR CARTILAGE FOLLOWING ALTERED MASTICATION

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AIM: To study: (1) the expression of insulin-like growth factor I (IGF-I) and Indian hedgehog (Ihh) in mandibular condylar cartilage during normal growth, and (2) the possible changes in the expression induced by a change in the masticatory function.
MATERIALS AND METHOD: From weaning at 21 days, 16 Sprague-Dawley female rats were fed normal pellet food (hard diet) and 16 rats a soft diet. Eight animals of both groups were sacrificed at 30 and 50 days. In addition, 10 control animals were sacrificed at weaning (21 days). Under a stereomicroscope, condylar cartilages were removed, total mRNA isolated using a Trizol kit, cDNA prepared and loaded to TaqMan real-time PCR to quantify relative mRNA amounts of PCNA (indicative of cell proliferation), IGF-I and Ihh.
RESULTS: During normal growth with a hard pellet diet, cell proliferation (PCNA mRNA expression) reduced gradually from 21 to 50 days. The same tendency occurred with IGF-I mRNA expression. The expression of Ihh, indicative of mechanotransduction, reduced from 21 to 30 days, but seemed to level off from then on. At 30 days, the hard diet rats showed relative over-expression of PCNA and Ihh mRNA, whereas, IGF-I mRNA was under-expressed compared with the soft diet rats.
CONCLUSION: Intensive mastication leads to enhanced condylar cartilage growth (higher cell proliferation) compared with less intensive mastication. This is probably mediated by concomitant over-expression of Ihh. When previous histomorphometric studies on condylar cartilage thickness, immunohistochemical studies on location of IGF-I receptors and *in situ* hybridization studies of IGF-I mRNA expression are combined with the present findings, it can be proposed that IGF-I regulates cell differentiation in the condylar cartilage.

55 CORRECTION OF POSTERIOR CROSSBITE – A RANDOMIZED CONTROLLED TRIAL

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AIM: This randomised, controlled, trial investigated the treatment effects of a quadhelix, an expansion plate, and occlusal composite onlays for correction of posterior crossbites in the early mixed dentition.
SUBJECTS AND METHOD: After undertaking a sample size calculation, 44 patients (aged 7-9 years) were recruited from the clinics of Public Dental Service in Malmö and Trelleborg, Skane County Council, and the Department of Orthodontics, University of Malmö, Sweden. They were randomly allocated to receive treatment with a quadhelix, an expansion plate, occlusal composite onlays, or to an untreated control group. The inclusion criteria were a posterior crossbite in the early mixed dentition, no other malocclusion, and a non-extraction treatment plan. Over a 12-month period the main outcome measures to be assessed in the trial were correction of crossbite, and maxillary intermolar and intercanine expansion.
RESULTS: Quadhelix treatment showed the highest success rate for correcting the crossbite, followed by the expansion plate ($P = 0.045$). A small number of crossbites were corrected with the occlusal composite onlays but no crossbite corrected spontaneously in the untreated control group. A mean intermolar expansion of 4.5 mm was found in the quadhelix group and 3.0 mm in the plate group ($P < 0.05$), but only 0.3 mm expansion in the onlay and untreated control group. A significant intercanine expansion was produced in all three intervention groups: 1.7 mm in the quadhelix group, 2.3 mm in the plate group, and 0.7 mm in the onlay group. In the untreated control group the intercanine distance increased, on average, by 0.3 mm.
CONCLUSIONS: Since treatment with a quadhelix was the most effective in correcting a posterior crossbite in the early mixed dentition, this is the method of choice for the clinician.

56 CHEWING PATTERNS IN CHILDREN WITH A CROSSBITE BEFORE AND AFTER THERAPY

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AIM: To analyze chewing patterns in children with a unilateral posterior crossbite before and after therapy with a functional appliance (the function generating bite).
SUBJECTS AND METHOD: Twenty-two children, aged 7 to 11 years (mean age 8.6 ± 1.3 years) with a posterior unilateral crossbite were evaluated to determine the percentage of reversed-sequence chewing cycles when chewing on the crossbite and on the non-crossbite side, before and after therapy. They were invited to chew pre-masticated chewing gum (soft bolus) and a wine-gum (hard bolus) deliberately on the right and on the left side, repeated three times, with each set lasting 10

seconds. Mandibular motion was recorded with a kinesiograph K6-I Myotronics and the chewing pattern was analyzed with dedicated software.
RESULTS: There was a statistically significant difference between the percentage of reversed-sequence chewing cycles in children with a crossbite when chewing on the crossbite side before versus after therapy, both with the soft ($P < 0.001$) and hard ($P < 0.001$) bolus. There was also a statistically significant difference between the percentage of reversed chewing cycles in children with a crossbite when chewing on the crossbite versus the non-crossbite side ($P < 0.001$, soft bolus; $P < 0.001$, hard bolus).
CONCLUSIONS: Children with a unilateral posterior crossbites exhibit an uncommon chewing pattern on the affected side only, characterized by a greatly increased frequency of reserved-sequence chewing cycles, which significantly decreased after functional appliance therapy. The results reported in the literature show that, after therapy with fixed appliances and rapid palatal expansion, reversed-sequence chewing cycles do not significantly decrease. The neural and muscular control of mastication is known to be closely involved in this malocclusion and the characteristics of the appliance appear important to achieve not only anatomical but also functional correction.

57 RAPID MAXILLARY EXPANSION IN CHILDREN EVALUATED WITH COMPUTED TOMOGRAPHIC SCANNING

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AIM: The principle of rapid maxillary expansion (RME) as a method to expand the transverse dimension of the palate and maxillary dental arch is by no means new. While the effects of the method have previously been studied on antero-posterior cephalograms, direct measurement based on computer tomographic (CT) scanning has not been previously reported. The aim of this study was to quantify and evaluate changes at the skeletal and dentoalveolar level, taking place in connection with RME as a part of comprehensive orthodontic treatment in a series of young patients.
SUBJECTS AND METHOD: The effect of a hyrax splint appliance activated to an expansion of 7.0 mm was studied in a group of nine growing children [6 females, 3 males (average age: 8 years 1 month, minimum: 6 years 1 month, maximum: 9 years 9 months)]. Changes were evaluated on pre- and post-treatment CT scans taken using a low dosage protocol.
RESULTS: There was a clear appliance-induced effect in all patients, although the relative contribution of dental, alveolar and skeletal varied from subject to subject. The total average expansion measured at the molar crowns was 3.6 mm whereas actual sutural opening, the main aim of RME, was as low as 1.6 mm.
CONCLUSION: The findings raise doubt as to the efficiency of the hyrax appliance and further comparative studies are required to evaluate other methods of maxillary expansion.

58 TRANSPLANTATION OF PRIMARY CANINES TO REPLACE LOST OR ANKYLOSED PERMANENT INCISORS**

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AIM: Permanent upper incisors that had been lost or were ankylosed due to traumatic injuries were replaced by transplantation of primary canines. In view of the risk of pulp necrosis, immediate, extraoral endodontic treatment was performed by retrograde insertion of titanium posts. After removal of the splint, the crowns of the transplants were reconstructed using composites to mimic the form and colour of the incisors.
MATERIALS AND METHOD: Twenty-six primary canines transplanted in 23 patients with a mean age of 9.2 years (7.6-12.4 years). The median observation period was 26.4 months (6.7-54.6 months).
RESULTS: Initially all transplants exhibited functional healing. Five transplants were lost due to further trauma; in two subjects another transplantation of primary canines was performed. The root of one transplant was completely resorbed within 6.7 months following initial functional healing. One primary canine was resorbed by the developing permanent canine and lost after 26 months. The mean expected survival according to Kaplan-Meier analysis was 39.2 months. Survival was significantly shorter for teeth that were lost due to external reasons (log-rank-test; $P < 0.05$).
CONCLUSIONS: Transplantation of primary canines following loss or ankylosis maintains alveolar bone and soft tissues and enables the continuation of alveolar growth. The high incidence of further traumatic incidents seems to be problematic and relevant for the prognosis.

59 BONE TO SCREW CONTACT OF ANCHORAGE SCREWS IN MINIPIGS

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AIM: Stability of anchorage screws and their resistance against orthodontic forces generally depend on bone to screw contact. Recently, FAMI screws have been introduced as anchorage devices in orthodontics. The aim of this study was to quantify the bone to screw contact of FAMI screws in the alveolar process of minipigs.
MATERIALS AND METHOD: After drilling pilot holes, six FAMI screws were inserted into the premolar region of the mandibular alveolar process of four juvenile minipigs. Following a healing period of 12 weeks without loading, all 24 screws were removed together with the surrounding bone. Undecalcified thin bone sections of the region were made and stained with toluidine blue, using the Donath technique. Bone to screw contact was investigated microscopically and quantified in the cortical and cancellous layer.
RESULTS: All 24 screws healed without complication, providing high primary stability. Bone to screw contact was 69.8 ± 11.7 per cent in cortical and 38.3 ± 9.5 per cent in cancellous bone, indicating a high degree of osseointegration. The structure of the cortical bone was dense; in contrast, large hollow spaces were found in the cancellous bone. Consequently, contact between bone and screw was limited in these areas.
CONCLUSIONS: The amount of bone to screw contact being comparable with that of implants used in restorative dentistry should allow high stability and resistance against the far lower orthodontic forces. As contact in the cortical layer was greater than in cancellous bone, this represents the decisive parameter for screw stability. Although immediate loading is generally recommended, even a delay of 3 months seems to provide comparable stability for FAMI screws.

60 COMPLEXITY OF AGEING AND ITS MODULATION FROM WITHIN

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KEYNOTE ADDRESS

Ageing is a highly complex and individual phenomenon. Variability of ageing and longevity can be observed at the level of species, individual organisms, different organs and tissues in a body, different cell types in an organ and different macromolecules in a cell.
Biological causes of ageing lie, not in any specific gerontogenes, but in a progressive failure of maintenance and repair, such as DNA repair, antioxidative capacity and responsiveness to stress. The consequences of a progressive failure of maintenance include increased vulnerability and probability of various diseases and eventual death.
Since ageing is not a disease to be cured, the focus of anti-ageing research has shifted to finding ways of slowing down and preventing the failure of maintenance. It has been suggested that if cells and organisms are exposed to brief periods of stress so that their stress response-induced gene expression of repair pathways are improved, then anti-ageing effects may be observed. This effect is known as 'hormesis'. Low level stresses with anti-ageing effects include temperature shock, irradiation, heavy metals, pro-oxidants, acetaldehyde, alcohol, hypergravity, mechanical stress, ultrasound, exercise and calorie restriction, including fasting. The aim is to develop this strategy of hormetic challenge to improve and maintain the biochemical and physiological performance of cells, tissues, organs and organisms for achieving a healthy old age.

61 TISSUE REACTION DURING ORTHODONTIC THERAPY

Y Ren, Department of Orthodontics, Groningen University, The Netherlands

KEYNOTE ADDRESS

Orthodontics is still a discipline based on empirical treatment and little is known about the basic biological mechanisms involved in tooth movement. Research to answer specific questions involving a combination of *in vitro*, animal and human studies is more likely to yield the most relevant outcome for scientists and clinicians.
This lecture will address the following aspects, based on a series of studies: What is a good animal model for setting up research? What is the optimal force for orthodontic tooth movement? What is the efficiency of tooth movement in the context of age effect? What are the profile changes of osteoclasts and periodontal ligament during standardized tooth movement? What is truth and bias on root resorption? What is the role of periodontal vasculature during tooth movement? Finally, the potential of gingival crevicular fluid as a diagnostic tool in orthodontics will be discussed. A basic knowledge of biological processes is a necessity for understanding orthodontics and the development of rational treatment mechanics.

62 MISSING MAXILLARY LATERAL INCISORS: HOW TO OPTIMIZE SPACE CLOSURE TREATMENT OUTCOMES

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KEYNOTE LECTURE

The main challenge in treating patients with missing maxillary lateral incisors is not deciding whether to close or open spaces, but how to achieve the best result with either solution. While osseointegrated implants may have inherent difficulties in obtaining natural looking results, the problems associated with the placement of canines into the lateral incisor space have decreased the popularity of space closure alternatives.
This presentation provides new suggestions to maximize outcomes in space closure treatment. This approach combines aesthetic dentistry and carefully detailed orthodontic finishing procedures. The implant alternative will also be discussed in some detail leaving the choice of two alternatives, both of which can provide excellent results.

63 PERIODONTAL MORPHOTYPE

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AIM: To demonstrate, radiographically, the association in widths between attached gingiva and the underlying bone labial to the lower incisors, and to establish a correlation between clinical examination of the gingiva and bone width.
SUBJECTS AND METHOD: Forty-five patients [36 females (SD 28 ± 5.5 years)] and [14 males (SD 32.7 ± 9.3 years)] were classified into three possible categories: A_1, A_2, B (Müller and Eger), according to a clinical assessment of the attached gingiva. The criteria were: 1) at least 20 years of age or older, 2) the presence of all lower incisors, 3) no periodontal disease, 4) no Class III patients with retroclined lower incisors, 5) no dental or traumatic lesions affecting the lower incisors, and 6) absence of gingival inflammation. An occlusal radiograph was taken for all patients, perpendicular to the lower incisors using the parallelism technique XCP (Rinn), with a metallic strip placed labial to the attached gingiva of the lower incisors. The measurements assessed were the width of bone labial to the most prominent incisor root 2 mm below the cementoenamel junction (WB) and the width of the gingiva (WG) anterior to it.
RESULTS: Group A_1 demonstrated the thinnest WB (0.3-0.5 mm) followed by group A_2 (0.4-0.7 mm); both groups displayed similar WG values. In contrast, group B possessed a markedly wider WB (0.8-1.2 mm) in relation to WG, as noted radiographically. These results revealed a significant difference between groups, highlighting the importance of considering these variables when predicting future recession in orthodontic treatments.
CONCLUSIONS: This is a quick and reliable method to predict possible future gingival recession. There is a clear association between bone width and the attached gingiva. The classification of Müller and Eger is of value in predicting WB.

64 TOOTH MOVEMENTS WITH LIGHT FORCES AND MINI-IMPLANT ANCHORAGE

P E Rossouw, S E Owens, P H Buschang, Baylor College of Dentistry, Dallas, USA

AIM: To experimentally evaluate tooth movements with mini-implant (MI) anchorage: 1) the timing of force application on MI; 2) the amount of force applied to the teeth; and 3) the location of the teeth.
MATERIALS AND METHOD: A randomized split-mouth design was used in seven skeletally mature male beagle dogs. Second premolars were distalized into extraction spaces using sectional orthodontic appliances. In the maxilla the effect of timing was tested under constant force (25 g). In the mandible the effect of force (25 versus 50 g) was tested on immediately loaded MIs. All experimental MIs had a corresponding unloaded control. Tooth movements were measured intra-orally every 3 weeks over 15 weeks with a digital calliper between reference points indexed on the canines and second premolars. Periodontal pocket depths were measured circumferentially around all teeth that were moved.
RESULTS: Wilcoxon signed rank tests showed no significant ($P > 0.05$) differences in tooth movement associated with timing of force application (immediate versus delayed), amount of force applied (25 or 50 g) or regional location (maxilla versus mandible). The mean overall rate of tooth movement was 31 and 36 μm/day for the maxilla and mandible, respectively. The rates of tooth movement increased over time. No significant changes in periodontal pocket depths were noted during the study.
CONCLUSIONS: Clinically relevant amounts of tooth movement can be obtained with light forces, irrespective of the amount of force applied or its location.

65 TISSUE REACTION DURING ORTHODONTIC THERAPY

S Ruf, Department of Orthodontics, University of Giessen, Germany
KEYNOTE ADDRESS

Every orthodontic or orthopaedic force application to the teeth or jaws is intimately associated with events at both cellular and molecular levels. These events have been intensively studied over the past decades, thus expanding our knowledge and understanding of what different cells are capable of and which factors regulate the activities of these cells. But how do the teeth, jaws, alveolar bone, joints and sutures understand the orthodontist and *vice versa*? To what extent do cells and the orthodontist speak the same language? How does this knowledge influence our daily clinical practice?

66 EVOLUTION AND AGEING OF MAN AND INDIVIDUAL VARIATION
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KEYNOTE ADDRESS

Four million years ago hominids appeared in East Africa whose post-crania indicated adaptation to bipedal locomotion. The gender of this hominid influenced the difference in size, suggesting that the social behaviour of this ancestor might have been similar to chimpanzees, gorillas, and orang-utans. A new species appeared 1,800,000 years ago: homo ergaster, characterized by a post-cranium fully adapted to bipedalism, less sexual dimorphism, and a substantially larger neurocranium. Ergaster is considered the first real member of the genus homo. The enlarged endocranium indicates the evolution towards homo sapiens. The earliest remains of homo sapiens, dating from 180,000 years ago, are in Ethiopia from where emigration led to the settling of the 'old world'. Writing was developed 6,000 years ago, but it was in the 19th century that mankind created the conditions for a further biological revolution: the advances in hygiene and medicine that raised human life expectancy from prehistoric to modern values. Modern creative intelligence needs to develop innovative strategies of social behaviour. Medicine has to understand evolutionary processes, and cope with human individuality, overpopulation, and life extension. How do homo sapiens proceed to deal with this biological revolution in the present and future?

67 'EFFECTIVE' TEMPOROMANDIBULAR JOINT AND CHIN POSITION CHANGES IN CLASS II MULTIBRACKET TREATMENT
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AIM: To determine the amount and direction of 'effective' temporomandibular joint (TMJ) and chin position changes during multibracket (MB) appliance treatment with Class II elastics.
SUBJECTS AND METHOD: Twenty-four Class II division 1 subjects treated with MB appliances and Class II elastics were compared with 40 activator and 98 Herbst subjects. To assess effective condylar growth (Creekmore, 1967) using an arbitrary condylar (Co) point and chin position changes (Pg point), lateral head films from before and after treatment were evaluated. Anterior cranial base and mandibular superimpositions of the headfilms were performed according to the method of Björk and Skieller (1972) using stable bone structures.
RESULTS: During treatment, Co-point in the MB group moved 1.2 mm anteriorly and 2.9 mm less superiorly than in the activator group, and 3.2 mm anteriorly and 1.7 mm less superiorly than in the Herbst group. The Pg-point in the MB group moved 3.6 mm posterior and 0.8 mm less inferiorly than in the activator group, and 3.1 mm superiorly and 2.1 mm less inferiorly than in the Herbst group.
CONCLUSION: In comparison with activator and Herbst subjects, the amount of effective TMJ and chin position changes in the MB subjects was less and the direction was more vertically orientated.
Creekmore T D 1967 Inhibition or stimulation of the vertical growth of the facial complex: its significance to treatment. Angle Orthodontist 37: 285-297
Björk A, Skieller V 1972 Facial development and tooth eruption: an implant study at the age of puberty. American Journal of Orthodontics 62: 339-383

68 HEAD POSTURE RELATED TO THE MORPHOLOGY OF THE CERVICAL COLUMN
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AIM: To examine the associations between head and neck posture and the morphology of the cervical column in subjects with neutral occlusion and normal craniofacial morphology.
SUBJECTS AND METHOD: Twenty-one subjects: 15 females aged 23-40 years (mean: 29.2 years) and six males aged 25-44 years (mean: 32.8 years). For each individual, a lateral cephalogram was obtained in a standardized head posture (the mirror position) and a visual assessment of the morphology of the cervical column was performed.
RESULTS: Head posture: The cervico-horizontal (OPT/HOR, CVT/HOR) angles were statistically larger in females than in males ($P < 0.01$ and $P < 0.05$, respectively). No statistically significant age differences were found. Cervical column: 13.3 per cent of the females had morphological characteristics of the cervical column as fusion anomalies or posterior arch deficiency. In males, morphological characteristics occurred in 16.7 per cent but only as fusion anomalies. In all individuals the fusions were between the second and third cervical vertebrae. No statistically significant gender differences were found in the occurrence of morphological characteristics of the cervical column. Associations: In females, cervical lordosis (OPT/CVT; $P < 0.01$) and inclination of the upper cervical spine (OPT/HOR; $P < 0.05$) were significantly positively correlated with fusion of the cervical column. In males no associations between head posture and morphological characteristics of the cervical column were found.

CONCLUSION: The associations between head posture and morphology of the cervical column in adults with neutral occlusion and normal craniofacial morphology have not been previously described. The results can be used in future studies as normal reference material in the description of the cervical column and head posture in cranio-cervical aberrations and syndromes in adults.

69 TBC 3214 – A SELECTIVE ET_A ANTAGONIST DECREASES ORTHODONTIC TOOTH MOVEMENT IN RATS

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AIM: Endothelin, one of the biochemical messengers, is probably involved in the process of remodelling of the alveolar bone and the periodontal ligament during orthodontic tooth movement. The role of endothelin in the process of orthodontic tooth movement has been partly explained using tezosentan, an ET_A/ET_B endothelin antagonist in rats. Tezosentan enhances orthodontic tooth movement. The aim of this study was to determine the effect of TBC 3214, a selective ET_A endothelin antagonist, on orthodontic tooth movement in rats.
MATERIALS AND METHOD: Thirty male Wistar rats, 11-12 weeks of age, divided into three groups. A closed coil spring was used in the first group who were treated daily with 0.1 ml of TBC 3214. In group 2, a closed coil spring was used together with a daily injection of a placebo, while in group 3 only a placebo was used. The closed coil spring (25 cN) was applied between the upper left first molar and upper left incisor. The distances between the teeth were measured with a digital calliper (precision 0.01 mm) on days 0, 7, 14, 21, 24, 27, 32, 37 and 40. Differences in distance between the teeth were calculated to determine the amount of tooth movement.
RESULTS: The distance between the upper left first molar and the upper left incisor decreased in all appliance groups. In the first group of animals treated daily with TBC 3214 tooth movement was significantly smaller ($P < 0.001$) on days 32, 37 and 40 compared with the control appliance group. In the third group the distance between the upper left first molar and the upper left incisor increased during the study ($P < 0.05$).
CONCLUSIONS: Tooth movement was decreased by TBC 3214.

70 MANDIBULAR GROWTH IN RABBITS WITH ANTIGEN-INDUCED TEMPOROMANDIBULAR JOINT ARTHRITIS

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AIM: To study the effects of intraarticular (ia) corticosteroid injections (triamcinolone hexacetonide) in the temporomandibular joint (TMJ) on mandibular development in growing rabbits with antigen induced TMJ arthritis.
MATERIALS AND METHOD: Forty-two, 10-week-old, rabbits were randomly divided into four groups: a control group (no injections), a placebo group (repeated ia TMJ saline injections), an untreated arthritis group (with TMJ arthritis induced) and a steroid group (induced arthritis plus treatment with ia corticosteroid injections). All animals had two 1.0×0.33 mm tantalum implants inserted in the bone on one side of the mandible prior to a computed tomographic (CT) scan session serving as landmarks for later growth analysis. Two CT full head scans were obtained at 14 and 26 weeks of age. Absolute and relative intra- and inter-group growth variations were evaluated during the growth period by comparing the two CT-scans. Paired and two sample *t*-tests together with a one-way ANOVA were used for statistical evaluation.
RESULTS: At 26 weeks of age, the animals in the control group had greater sagittal and vertical mandibular growth compared with the other three groups. Relative mandibular growth was significantly smaller in the steroid-treated animals.
CONCLUSION: TMJ arthritis causes diminished mandibular growth. However, the findings of this study do not indicate a promising long-term outcome of the use of ia TMJ steroid injections as a beneficial treatment modality against TMJ inflammation in growing individuals. The findings demonstrate greater mandibular growth retardation in the steroid treated animals compared with the placebo and untreated arthritis animals.

71 SOFT TISSUE HEALING OF AUTOTRANSPLANTED TEETH AFTER 5 YEARS

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AIM: To evaluate the soft tissues of autotransplanted teeth.
MATERIALS AND METHOD: Eighty-one autotransplanted (tx) teeth and 81 contralateral control teeth (tc) were included. Attached gingiva, papilla height (PH) and patient satisfaction were investigated. The attached gingiva was examined and

coded (–1 = reduced, 0 = normal, +1 = hyperplasic) (Lindhe 1999, Newman 2002). For PH, the mesial and distal papilla were investigated (0 = no papilla present, 1 = reduced to 50 per cent, 2 = normal to 100 per cent, 3 = hyperplastic) (Jemt 1997, Chang 1999). Patient satisfaction was evaluated (0 = no, 1 = yes).
RESULTS: The attached gingiva had a value of 0 in 69.23 per cent of tx teeth and in 72.31 per cent of tc cases. A value of –1 was found in 24.62 per cent (tx) versus 16.92 per cent (tc), value 1 was 6.15 per cent (tx) versus 10.77 per cent (tc). PH had a value of 2 in 46.15 per cent (tx) and in 70.77 per cent (tc). PH value 0 = 6.15 per cent (tx) versus 0 per cent (tc); value 1 = 47.69 per cent (tx) versus 29.23 per cent (tc). No group had a value of 3. Satisfaction with treatment outcome was expressed by 98.46 per cent of the patients.
CONCLUSION: The greatest difference between the transplanted teeth and the control teeth was in PH. Morphological differences between the autotransplanted tooth and the non-transplanted tooth might explain the variation. However, overall the morphology of the soft tissues was very similar between tx and tc.

72 CONDITIONED MEDIUM FROM MECHANICALLY STIMULATED OSTEOCYTES AND OSTEOBLASTS INHIBIT OSTEOCLASTOGENESIS

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AIM: Remodelling of bone is essential during orthodontic tooth movement. Osteocytes are the predominant bone cells, and it is generally accepted that they are the 'professional' mechanosensors of bone. A strain-derived fluid flow through the lacuno-canalicular porosity seems to mechanically activate them, resulting in the production of signalling molecules. It was hypothesized that these molecules modulate osteoclast formation, thus affecting bone resorption. The aim of this study was to investigate if mechanically stimulated osteocytes could affect osteoclastogenesis via soluble factors.
MATERIALS AND METHOD: Osteocytes, osteoblasts, and periosteal fibroblasts were isolated from foetal chicken calvariae via enzymatic digestion. Prior to the isolation of osteocytes and osteoblasts, the periostea were separated from the calvariae to obtain periosteal fibroblasts. Mab 7.3, an antibody specific for osteocytes, was used to separate osteocytes from osteoblasts by immunomagnetic separation. Cells were mechanically stimulated for 1 hour with pulsating fluid flow (PFF: 0.70 ± 0.30 Pa) at 5 Hz, or kept under static conditions. Conditioned medium was collected after 60 minutes. The effect of conditioned medium on osteoclastogenesis was tested on mice-derived bone marrow cells in the presence of macrophage colony stimulating factor and receptor activator of NF-κB ligand. After 6 days of culture, osteoclast formation was determined as the number of tartrate-resistant acid phosphatase (TRAP) positive multinucleated cells.
RESULTS: The conditioned medium from osteoblasts (n = 4) and osteocytes (n = 4), which were subjected to 1 hour of PFF, inhibited formation of TRAP-positive multinucleated cells by 47 and 81 per cent, respectively, compared with the conditioned medium from osteoblasts and osteocytes kept under static control conditions. The medium of the periosteal fibroblasts (n = 4) did not affect osteoclastogenesis.
CONCLUSIONS: Conditioned medium from mechanically stimulated osteocytes and osteoblasts inhibit osteoclastogenesis, with the strongest effect obtained by conditioned medium from osteocytes. This suggests that osteoclastic attack is inhibited by fluid shear stress-derived osteocyte and osteoblast signals.

73 VASCULAR ENDOTHELIAL GROWTH FACTOR STIMULATES BONE FORMATION IN EXPANDING THE MID-PALATAL SUTURE

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AIM: Vascular endothelial growth factor (VEGF) is an intensive regulator for angiogenesis, which is essential for new bone formation. It was hypothesized that local administration of VEGF could stimulate bone formation when expanding the mid-palatal suture.
MATERIALS AND METHOD: Twelve female Sprague Dawley rats, 35 days of age, were allocated to three groups: a control group that received VEGF only; an experimental group that had mid-palatal expansion and VEGF induction, and a group that underwent expansion and received a normal saline injection. A single dose of human recombinant VEGF was injected into the mid-palatal suture 24 hours after expansion. Calcein green was injected immediately, and 6 days after expansion. The animals were sacrificed on days 3, 5 and 7. The width of each calcein label was measured to evaluate the amount of new bone formation along the suture with bone histomorphometry.

RESULTS: In the experimental groups, bone formation during the 7-day expansion period was significantly stimulated ($P < 0.05$), compared with that in the control and saline injected groups. More osteoblasts were identified along the expanded suture in the experimental groups on days 3 and 5.
CONCLUSION: VEGF plays an important role in bone formation at the active site of the suture in response to rapid palatal expansion, and application of VEGF during the early stages may induce rapid bone formation.

74 INFLUENCE OF CRYOPRESERVATION ON HUMAN PERIODONTAL LIGAMENT CELLS *IN VITRO*

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AIM: Autotransplantation of teeth can be useful and has many indications in dentistry. Cryopreservation of teeth may create new possibilities, when, for example, the recipient site is too small at the appropriate time for transplantation and orthodontic treatment is required to gain space. The purpose of this study was to examine the effect of cryopreservation using a standardised procedure (Tissue Bank, Ghent University Hospital) on human periodontal ligament (PDL) cell cultures. For frozen and unfrozen cells, the ideal circumstances for cryopreservation were also investigated, in order to optimise the cryoprofile.
MATERIALS AND METHOD: Human PDL fibroblasts of 11 patients were cultured and divided into two groups. The experimental group was frozen and cultured after thawing. The control group was cultured without cryopreservation. In 21 cell lines, a comparison was made between the frozen and non-frozen cells. To evaluate a possible difference in the characteristics of the fibroblasts, the cells in both groups were tested for viability, growth capacity, and alkaline phosphatase (ALP) expression. Wilcoxon's test was used for paired comparison of each characteristic between the frozen and non-frozen cells.
RESULTS: Viability of the cells was not influenced by cryopreservation. There was no statistically significant difference between frozen and control cells concerning growth capacity. Non-frozen cells showed slightly greater expression of ALP, but the difference was not statistically significant.
CONCLUSION: Cryopreservation does not influence the properties of human PDL cells *in vitro*. The standardised procedure used for cryopreservation meets the expectations.

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75 NON-SYNDROMIC CLEFT LIP AND PALATE: HUNTING FOR MUTATIONS

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AIM: Cleft lip and palate (CLP) in humans is a common congenital malformation (1/700 live births), either as a component of syndromes or most commonly non-syndromic (NS). Combined genetic and/or environmental factors are known to be aetiological factors in NSCLP. The aim of this investigation was to search for the existence of specific allelic variants or mutations in some selected genes in NSCLP: in this preliminary investigation the TWIST gene.
SUBJECTS AND METHOD: Ethical approval, conforming to French regulations, was obtained from the Comité Consultatif de Protection des Personnes dans la Recherche Biomédicale for this research. The intention was to enrol 100 patients. Thirty-eight patients with NSCLP have so far been recruited. For each patient genomic DNA was extracted either from blood samples or from tissues obtained during surgery. PCR amplification, followed by direct sequencing was performed.
RESULTS: This first examination covered the entire transcription unit of TWIST, the majority of the coding sequences of MSX1 and regions of DLX5, DLX6, and FGFR4. Sequence variations at TWIST were noted in three of the 38 subjects (7 per cent), and allelic frequency distortions were found for FGFR4, MSX1 and DLX6.
CONCLUSIONS: TWIST may, in some circumstances, be a contributing gene in the genesis of NSCLP. Extending this research to a wider sample and to other genes should help to cluster patients with similar sequence alterations and lead to improved understanding of the pathogenesis and transmission of the malformation. Such knowledge might improve genetic counselling.

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76 ARE BLUE CURING LIGHTS SAFE FOR ORTHODONTISTS?

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AIM: Orthodontists utilize blue curing lights in their daily practice. These light sources deliver light in visible and invisible wavelengths, both of which can be detrimental to corneal and retinal tissues. However, the effect of the scattering blue light radiation on the operator's visual capacity is often ignored. The aim of this study was to evaluate the tritan colour contrast sensitivity of orthodontists who have been using blue light sources for more than 2 years.
SUBJECTS AND METHOD: Group 1 comprised 11 orthodontists or orthodontic residents aged between 23-44 years (28.9 ± 6.22 years) who had been using blue light sources for at least 2 years, had 6/6 Snellen visual acuity, but no systemic or ocular abnormality. Group 2 was a control group and comprised 10 dentists working in the Oral Diagnosis Department. Both groups underwent a colour vision test using computer graphics to obtain quantitative estimates of colour contrast sensitivity measured along a tritan colour confusion line as a percentage of maximum colour separation available within the system (T0). Further measurements were taken 1 year after the initial testing (T1).
RESULTS: The orthodontists had an average sensitivity measurement of 3.66 ± 1.03 and 3.46 ± 0.93 per cent, respectively, at T0 and T1. The average measurements for the control group were 3.60 ± 1.11 and 3.51 ± 0.91 per cent, respectively. Wilcoxon and Mann-Whitney *U* tests revealed no statistically significant colour contrast sensitivity differences either between the groups or at different times ($P > 0.05$).
CONCLUSION: Routine use of blue curing lights does not adversely affect the colour contrast sensitivity of orthodontists within 2-3 years. However, it may be useful to undertake further measurements to clarify the safety of these light sources on clinicians' colour vision.

77 IS HERBST TREATMENT MORE EFFICIENT IN ADOLESCENTS THAN IN ADULTS?
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AIM: To answer the question whether or not Herbst treatment is more efficient in adolescent than in adult Class II division 1 subjects.
SUBJECTS AND METHOD: All Class II division 1 patients with a full permanent dentition, treated with a Herbst appliance between 1990 and 2000, were assessed. The complete records were available for 77 patients. According to their skeletal maturity, as assessed on hand-wrist radiographs, the subjects were divided into adolescent (MP3 F-MP3 H; n = 49) and adult (R IJ-R J; n = 28) groups. Pre- and post-treatment dental casts were evaluated using the Peer Assessment Rating (PAR) Index. The PAR score reduction of the two groups was compared.
RESULTS: Before treatment, both groups had severe Class II division 1 malocclusions. The average PAR score of the adolescent patients was slightly lower (27.8) than that of the adult patients (28.8). After treatment, good results were achieved for both groups and the average PAR scores of the two groups were comparable (adolescents: 4.5; adults: 4.8). The average PAR score reduction was 82.7 per cent (23.3 points) for the adolescent group and 82.9 per cent (24.0 points) for the adults, resulting in a great improvement for both groups.
CONCLUSION: Good treatment results and an improvement of the pre-treatment situation were achieved in both groups. Thus, Herbst treatment can be considered equally efficient in adolescent and in adult Class II division 1 subjects.

78 REGENERATIVE CAPACITY OF PALATAL CELLS FROM CLEFT PALATE PATIENTS
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AIM: Cleft palate (CP) repair is often hampered by a shortage of soft tissue, which leaves open wounds in the palate. The healing of these wounds is accompanied by wound contraction and scar formation, which may impair dento-maxillary development. A suitable mucosal substitute might prevent these complications occurring. However, it is not clear whether palatal cells from patients have the same regenerative capacity as cells from control subjects. The aim of this study was to compare the morphology, proliferation and differentiation of palatal cells from CP patients and age-matched controls in cultured mucosa equivalents.
MATERIALS AND METHOD: Biopsies from the hard palatal mucosa of eight non-syndromic CP patients (1-2 years of age) were obtained during primary closure of the cleft. Biopsies from eight age-matched controls were obtained from patients undergoing tonsillectomy. Three biopsies from both groups were processed for haematoxylin and eosin staining and immunohistochemistry. Five biopsies from both groups were used to culture fibroblasts and keratinocytes. Mucosa equivalents were prepared by seeding fibroblasts in de-epidermized human dermis (DED). After one week, the keratinocytes were seeded on top of the DED and cultured for another 14 days. The equivalents were also prepared for histology.
RESULTS: General histology showed that the equivalents prepared from patient and control cells were very similar: both possessed several differentiated epithelial layers and a cornified layer. The number of cell layers was always less than in native mucosa. All equivalents expressed the cytokeratins 5, 10, and 16, and the basal membrane marker heparan sulphate,

similar to native mucosa. The expression of the proliferation marker, Ki67, was lower in the equivalents than in the native tissue.
CONCLUSIONS: The morphological and immunohistochemical characteristics of equivalents prepared from patient and control cells are similar. Therefore, cells from CP patients may be suitable for tissue engineering purposes.

79 ORTHODONTIC TOOTH MOVEMENT INTO THE MAXILLARY SINUS: AN EXPERIMENTAL STUDY
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AIM: To analyse the histological findings following orthodontic tooth movement (OTM) in the maxillary sinus of the dog.
MATERIALS AND METHOD: Five fully-grown foxhounds (3 years of age). The first and second maxillary incisors were extracted bilaterally. Following a five-month alveolar healing period, impressions were taken to fabricate the orthodontic appliance. One month later the orthodontic appliances were inserted and the third incisors were moved mesially for a period of 5 months. Periapical radiographs were obtained before and at the end of tooth movement to examine the initial and final tooth root/sinus relationship. At the end of the experiment the animals were sacrificed and the specimens prepared for histologic investigation (transversal plane) according to the microsection method of Donath (1988).
RESULTS: Two different radiological findings were observed at the end of OTM: (1) the whole tooth root projecting below/outside the maxillary sinus (control, n = 4) and (2) part of the tooth root projecting into the maxillary sinus (test, n = 6). Histological findings: (1) Control: The tooth roots revealed superficial root resorption on the pressure sides which were restricted to the cementum layer; (2) Test: Resorptions were more pronounced over those parts of the tooth roots positioned in the sinus, extending up into the dentine. Either residual parts of the cortical sinus bone or complete loss of the sinus bone were observed. In the latter areas the tooth root was covered by the former periosteum and no Sharpey fibres were observed.
CONCLUSION: Compared with OTM inside the alveolar bone, OTM through the maxillary sinus border may be associated with a higher amount of root resorption and intra-antral attachment loss.

80 EFFECTS OF FOOD ON COLOUR STABILITY OF AESTHETIC BRACKETS
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AIM: To investigate the effect of food on the colour stability of aesthetic brackets made of different materials.
MATERIALS AND METHOD: For 5 days, seven types of tooth coloured brackets (10 brackets each) were immersed in seven different food solutions (deionised water, tea, coffee, red wine, orange juice, curry, cress) at 37°C, or underwent accelerated photo-ageing with a UVA-light at 150 KJ/m². Measurements were taken before testing and daily after ultrasound cleaning, rinsing and drying. The Easyshade spectrophotometer was used to determine CIE LCh co-ordinates (lightness L, chroma C and hue h). The colour changes were calculated and a Mann-Whitney *U* test was performed.
RESULTS: Most of the colour changes occurred during the first day of exposure. Immersion in curry caused the greatest colour change for specimens made of polyoxymethylen (C: $P < 0.01$). The influence of red wine was not seen on the ceramic brackets at the beginning (L: $P < 0.01$), but all types were affected at the end of testing. Cress did not cause any colour changes in any brackets; tea showed no significant differences in ceramic brackets (C: $P < 0.01$). Coffee and orange juice discoloured non-ceramic brackets first (h: $P < 0.01$), but later all types.
CONCLUSIONS: This *in vitro* testing can only simulate the intraoral situation, but the results seem to show that consumption of different food greatly influences the amount of colour change of tooth coloured brackets. An ongoing *in vivo* study is being carried out to substantiate these results by questionnaire and intraoral colour measurements.

81 MMP-9 EXPRESSION DURING ORTHODONTIC TOOTH MOVEMENT
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AIM: MMP-9 is an important protease for extracellular matrix (ECM) breakdown. It plays a dual role in orthodontic tooth movement. Firstly, it enables (pre-) osteoclasts to move through the ECM, and secondly it is secreted by osteoclasts and degrades bone matrix. This study was performed to investigate sequential and spatial expression of MMP-9 during orthodontic tooth movement.
MATERIALS AND METHOD: Forty, 6-week old, male Wistar rats were divided into eight groups. In all animals, standardized orthodontic appliances were placed unilaterally to move the maxillary molars together mesially with a force of 10 cN. The contralateral side served as a control. After 6, 12, 24, 36, 48, 72, 96 and 120 hours of force application, the animals were perfused, and processed for immunohistochemical staining for MMP-9. The number of positive multinucleated

cells in the periodontal ligament (PDL), including root and alveolar bone surfaces, were counted on sagittal sections and statistically processed by Kruskal-Wallis one-way ANOVA on ranks.
RESULTS: On the control sides, the mesial PDL was almost devoid of MMP-9 positive multinucleated cells throughout the experimental period whilst on the distal sides a stable number of MMP-9 positive multinucleated cells were found. After force application the compressed mesial PDL showed a statistically significant increase in the number of MMP-9 positive multinucleated cells from 24 hours on, compared with the control sides ($P < 0.05$). This increase reached a maximum at 96 hours and remained stable until 120 hours. At the same time, the PDL of the tensional distal sides (experimental side) showed a significant decrease in the number of MMP-9 positive multinucleated cells from 6 hours on, compared with the controls ($P < 0.05$).
CONCLUSION: Force application induces up-regulation of MMP-9 positive multinucleated cells at the compression sides while it induces a decrease of the pre-existing MMP-9 positive multinucleated cells at the tension sides.

Poster presentations

82 INVESTIGATION OF MINI-IMPLANTS USED FOR ORTHODONTIC ANCHORAGE

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AIM: A finite element analysis of different types of mini-implants or microscrews used for orthodontic anchorage and comparison of their biomechanical characteristics.
MATERIALS AND METHOD: The following mini-implants were included in the study: Aarhus Anchorage System® (Medicon, Ormco), Absoanchor® (Dentos), Dualtop® (Promedia), Lomas® (Mondeal), Ortho Implant® (Imtec), as well as tomas® (Dentaurum). The mini-implants were provided in different lengths (7, 8, 9, 10 and 12 mm) and diameters (1.1, 1.4, 1.5, 1.6, 2.0 mm). A total of 19 different implants were inserted monocortically in pig bone segments and subsequently loaded with maximum forces and torques of 5 N/10 Nmm by connection to a high resolution biomechanical measuring system (Hexapod Measurement System). The resulting displacements were registered with a non-invasive three-dimensional optical system with a resolution of 0.7 µm. For numerical simulations, realistic finite element models were generated based on reconstruction of the implant geometry and surrounding bone using sectional views of micro-computed tomogram scans (Skyscan 1072). The specially designed software ADOR-3D was used for this task. Calculations were performed with the program MSC.Marc/Mentat 2005r2. The following material parameters were used for numerical simulation: Young's modulus = 0.5 GPa for spongious bone, 16 GPa for cortical bone, 110 GPa for the implants (titanium alloy) and Poisson's ratio = 0.3 for all materials.
RESULTS: The resulting deflection of the loaded implants was found to be in the range of 10 to 100 µm. The maximum strain values, determined as a result of implant displacement in the surrounding bone, were approximately 1,000 µ strain for the different designs, which is within physiologic limits.
CONCLUSION: Biomechanically, the mini-implants proved to be suitable for anchorage control for orthodontic tooth movement. There were only minor differences between the bone loading patterns due to the varying screw designs. The decisive factors for initial stability seem to be the experience of the clinician and bone quality.

83 IMPLEMENTATION OF A NEW METHOD FOR DIGITAL SUBTRACTION RADIOGRAPHY IN ORTHODONTICS

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AIMS: Digital subtraction radiography (DSR) emphasizes the differences between pairs of radiographs by reducing 'structural noise' and displaying these as a neutral background in the subtracted 'resultant image'. The aims of this study were twofold: to present a new method for dental DSR, and to determine the efficiency and reliability of the method on lateral cephalograms.
MATERIALS AND METHOD: To determine the reliability of the software, 20 pairs of pre- and post-treatment lateral cephalograms of patients who had undergone orthodontic therapy with significant retraction of maxillary incisors, were used. The mid-point of the central incisor was established as the control point and the difference between the pre- and post-treatment locations of this point was determined both by measuring the distance PTV-U1_Mid conventionally and by measuring only the subtracted 'resultant' difference occurring at this point provided by the software. Independent sample *t*-tests were used for statistical comparisons.
RESULTS: The subtracted resultant images of the lateral cephalograms could clearly be constituted, visualized and measured by the utilization of this new software. The mean differences determined for conventional and DSR methods were –1.51 and –1.57 mm, respectively ($P = 0.92$), indicating that the new software may be used for DSR in orthodontic practice.

CONCLUSIONS: The new DSR software is a viable tool for the evaluation of subtle radiographic changes by removing all anatomical structures other than those of immediate interest.

84 A NEW APPROACH TO ORTHODONTIC BOND STRENGTH TESTING

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AIM: To determine the shear bond strength (SBS) at the cement-enamel interface, the button-cement junction, the button-cement-enamel system and the cement itself, using three different orthodontic cements.
MATERIALS AND METHOD: Cement or bovine enamel was used as the bond substrate. The cements used were: Transbond XT (3M Unitek), Fuji Ortho LC (GC), and Fuji IX Fast (GC), which were applied in accordance with the manufacturers' instructions. The bonding area of the cylindrical shaped cement specimens was 3.1 mm^2. The stainless steel buttons (Ortho Organizers Inc.) had a bonding area of 9.6 mm^2. The shear strength (n = 8) was determined in a universal testing machine after 72 hours storage in 37ºC water. SBSs were analysed using two-way ANOVA and Tukey HSD *post hoc* tests ($P < 0.05$).
RESULTS: The cement-button interface of Transbond XT (45.7 ± 3.7 MPa) showed significantly the highest SBS. The strength of the cement (36.4 ± 7.7 MPa) and the cement-enamel interface (31.8 ± 11.4 MPa) were comparable, while the button-cement-enamel system (23.7 ± 6.5 MPa) gave significantly the lowest results. Fuji Ortho LC showed a similar pattern; the weakest bond was at the button-cement-enamel system (15.3 ± 3.2 MPa). The cement-enamel interface (15.8 ± 4.1 MPa) was not significantly stronger, while the cement (26.2 ± 4.3 MPa) and the cement-button (34.9 ± 4.4 MPa) junctions were significantly stronger. Fuji IX Fast also showed the highest bond values at the button-cement interface (23.0 ± 5.7 MPa), although there was no significant difference compared with the cement group (17.1 ± 2.9 MPa). The cement group also did not differ significantly from the button-cement-enamel group (14.2 ± 5.0 MPa). Both groups were stronger than cement-enamel bonding (4.9 ± 1.5 MPa).
CONCLUSIONS: The three materials show, compared with each other, different bond strength patterns. This might be explained by the difference in E-moduli and filler load of the materials.

85 EPIDEMIOLOGY AND CLEFT SEVERITY IN 994 SUBJECTS

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AIM: To describe individuals with a cleft palate (CP) in relation to cleft severity, Pierre Robin (PR) sequence, associated anomalies, syndromes and congenitally missing teeth.
MATERIALS AND METHOD: The data of 994 subjects (542 females, 452 males) were collected retrospectively from the archives of the Oslo Cleft Team (OCT).
RESULTS: During the study period, 1960-2002, the annual number of individuals with CP referred to the OCT increased both overall and within each cleft severity subgroup. More children with CP were born in March than during the other months of the year. Among all CP, 76 individuals (7.6%) had recognized syndromes, and associated congenital anomalies were found in 30.5 per cent. Six hundred and fifteen individuals (61.9%) had CP only (without associated anomalies, sequences or syndromes). Among these a female predominance was observed both in general as well as in each cleft severity subgroup. A submucous CP was diagnosed in 25.1 per cent, 45.9 per cent were diagnosed with a cleft of the soft palate only, and 6.1 per cent with a total cleft. Of the 277 children over 10 years of age with CP only, hypodontia was found in 88 children (31.8%). One hundred and sixteen children (11.7%) were recorded with PR sequence. Among children with PR sequence only, hypodontia was recorded in 44.1 per cent, which was more frequent in the lower jaw (80.8%).
CONCLUSION: A large proportion of individuals with CP had associated anomalies or syndromes.

86 INTERMAXILLARY RELATIONSHIP OF DENTAL ARCH FORMS THROUGH THE FACIAL AXIS POINTS

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AIM: To evaluate the relationship between upper and lower dental arch forms passing through the facial axis (FA) points by applying fourth-order polynomial equations.
MATERIALS AND METHOD: Dental casts of 40 subjects (20 males, 20 females, average age 23 years 2 months) with 'normal' occlusions selected from the total population of 4,000 dental university students. A three-dimensional (3D) laser-scanning system (Surflaser VMS-250R, Unisn Inc., Osaka, Japan) was used to measure the dental casts. The FA points of the

incisors, canines, premolars, and molars were digitized on the 3D image of the dental casts according to Andrew's original definition. The horizontal co-ordinates (*x, y*) of the 14 FA points of each dental arch were analyzed by an original program using Microsoft Excel 2003 (Microsoft, Inc., Washington, USA). A fourth-order polynomial equation in the form of ($y = ax^4 + bx^3 + cx + dx + e$) was calculated to the set of the *x*-*y* co-ordinates on each dental arch by the least squares method.
RESULTS: Pearson's correlation coefficient (r) of the fourth- (a) and second- (c) order coefficients of the polynomial equations between the upper and lower arches was 0.74 and 0.76, respectively. Statistically significant ($P < 0.01$) positive correlations between the upper and lower arches were found for both (a) and (c) polynomial coefficients.
CONCLUSION: An intermaxillary positive correlation between dental arch forms passing through the FA points was found. Therefore, the maxillary arch form of individual patients can be estimated mathematically from the mandibular arch form by applying a fourth-order polynomial equation.

87 EFFECTS OF A FIXED FUNCTIONAL APPLIANCE ON DENTOFACIAL STRUCTURES IN CLASS II MALOCCLUSION SUBJECTS

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AIM: To investigate the dentofacial changes contributing to Class II correction in patients treated with a fixed functional orthodontic appliance (Forsus Nitinol Flat Spring, 3M Unitek), and to compare the results with those of untreated Class II subjects.
SUBJECTS AND METHOD: Fifty patients (28 females, 22 males) with an Angle Class II division 1 malocclusion with an overjet greater than 4 mm. All patients were in the pubertal growth period, with a mean age 12.9 years. Twenty-five (14 female, 11 male) patients were treated with a Forsus Nitinol Flat Spring, which was integrated with fixed orthodontic appliances, for a mean period of 6.4 months. The other 25 patients had no treatment during this time and were used as the control group. Cephalometric lateral radiographs in habitual occlusion were taken just before placement and after removal of the Forsus appliances. At the same time intervals, records were also obtained for the control group. Using cephalometric angular and linear measurements, these records were used to evaluate skeletal and dental changes. Parametric and non-parametric statistical analyses were used to determine any significant differences either within or between the groups at the 95 per cent confidence level.
RESULTS: Although treatment with the Forsus appliance resulted in a Class I dental arch relationship in all patients, this was mainly due to dental changes (73 per cent dental effects). Retroclination and extrusion of the maxillary incisors ($P = 0.001$), proclination and intrusion of the mandibular incisors ($P = 0.000$), distalization and intrusion of the maxillary molars ($P = 0.001$), mesialization of the mandibular molars ($P = 0.001$), elimination of the excess overjet ($P = 0.000$), reduction of overbite ($P = 0.005$), and a decrease of convexity of the soft tissue profile were found in the Forsus appliance group.
CONCLUSIONS: The Forsus is efficient in the correction of a Class II division 1 discrepancy, and, as with many other appliances, the lower incisors can be proclined.

88 THREE-DIMENSIONAL IMAGING OF ORTHODONTIC MODELS: A PILOT STUDY

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AIM: To compare measurements made on three-dimensional (3D) digital models with those made on dental casts, in order to assess the accuracy and reproducibility of measurements made on digital models.
MATERIALS AND METHOD: Ten archived sets of dental casts were selected to represent Class I, Class II and Class III malocclusions with varying degrees of crowding and different occlusal features. Dental casts were scanned using the Arius 3D Foundation System, and digital models were produced using computer software (Pointstream). Two examiners individually measured 11 parameters on the dental casts using digital callipers and a metal ruler. The same parameters were measured on the digital models using the tools on the Pointstream Image Suite, a Windows application. All measurements were repeated no sooner than one month later. Intra- and inter-examiner measurements were evaluated in an error study.
RESULTS: When comparing measurements made using both methods, systematic errors were detected for five of the 11 parameters ($P < 0.05$). Random errors were a cause of concern for three of the parameters. The most accurate and reproducible measurements were lower intercanine width (mean difference between measurements 0.05 ± 0.32 mm) and overjet (mean difference 0.07 ± 0.33 mm). The least reliable measurement was upper arch length (mean difference 4.78 ± 2.48 mm), due to the inability of the software to produce a constructed point for this measurement. This difference would be clinically significant, but the mean difference between methods for measurement of the remaining parameters would be regarded as clinically insignificant.

CONCLUSIONS: 3D digital study models may be produced by linear laser scanning using the Arius 3D Foundation System. Most parameters on the digital models can be reliably measured, and digital models can potentially eliminate the requirement for the production and storage of dental casts, but this will depend on the cost.

89 QUANTITATIVE MEASUREMENT OF PLAQUE LEVELS IN PATIENTS WITH FIXED APPLIANCES

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AIM: Plaque control presents a significant challenge to patients undergoing orthodontic therapy. Standard measurements of plaque quantity include primary subjective techniques modified for orthodontic patients, such as the Quigley Hein index reported by Kossack and Jost-Brinkmann (2005). Patterns of plaque accumulation and retention may be better characterized by an objective methodology such as digital imaging. The present investigation reports on new applications of digital imaging assessments of plaque in children undergoing orthodontic therapy.
MATERIALS AND METHOD: With this technique, first described by Sagel *et al*. (2000), dental plaque is disclosed with a fluorescein solution that is then digitally imaged under long-wave ultraviolet (UV) light. UV illumination of fluorescein-disclosed plaque produces an image where the pixel of the image can be categorically classified based on colour into one of five classes, including the percentage of teeth covered with plaque. Eight patients with fixed orthodontic appliances were first imaged with standardized digital imaging followed by UV digital plaque imaging (DPI) with fluorescein disclosed plaque. The images were masked and the plaque coverage of the tooth was calculated.
RESULTS: Plaque coverage averaged up to 25 per cent of tooth coverage, excluding bracket areas. Patterns of plaque retention revealed difficulty in patient control of plaque formation in areas beneath brackets and wires and along the gumline.
CONCLUSION: In these preliminary assessments it would appear that DPI might be a useful *in vivo* tool for measuring plaque levels in patients undergoing fixed orthodontic therapy. DPI may also present opportunities in the design of hygiene aids and procedures for patients. In addition the images themselves may be used to educate patients on how to improve their personal oral hygiene to prevent the undesirable side-effects of orthodontic treatment.

Kossack C, Jost-Brinkmann P G 2005 Plaque and gingivitis reduction in patients undergoing orthodontic treatment with fixed appliances – comparison of toothbrushes and interdental cleaning aids. A 6-month clinical single-blind trial. Journal of Orofacial Orthopedics 66: 20-38
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90 GROWTH RELATED CHANGES IN TEMPOROMANDIBULAR JOINT KINEMATIC ANALYTICAL PARAMETERS

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AIM: To investigate the changes in horizontal condyle inclination (HCI) and Bennett angle that might accompany growth during the mixed dentition period.
SUBJECTS AND METHOD: One hundred and seventy-two children (90 girls, 82 boys) ranging in age from 6.5 to 12.9 years, divided into five groups with mean ages of 7.1, 8.0, 9.0, 10.0, 11.4 years, respectively. The control group consisted of 41 adults with a mean age of 28.1 years. All subjects had a neutral occlusion, normal joint function and no clinically obvious abnormal growth patterns. A series of five maximum protrusions, and three maximum right and three maximum left lateral excursions were recorded three-dimensionally using an ultrasound jaw-tracking device (JMA®). HCI and Bennett angle were calculated, stepwise for each millimetre distance, for the first 10 mm tracing paths of the right and the left condylar kinematic centres.
RESULTS: ANOVA showed significant differences among the five groups for the mean HCI angles of the first 9 mm of protrusion on both sides ($P < 0.01$). The mean HCI angle increased among the five groups with age. No significant differences were found between the right and left sides using an independent samples *t*-test. On the left side, females had a significantly larger HCI than males at 2, 3, and 4 mm protrusion. For Bennett angle, no significant differences were found between the groups for the entire movement path. In addition, the range of Bennett angle in children was similar to that in adults.
CONCLUSION: During the mixed dentition period, the HCI becomes symmetrically steeper on both sides with age. This can be explained by the increase in eminence height, which accompanies physical development during the same period. Bennett angle, however, reached its adult level almost at the beginning of the mixed dentition period.

91 EFFECTS OF PULSED ELECTROMAGNETIC FIELDS ON CONDYLAR GROWTH IN RABBITS.
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AIM: To examine the effects of low frequency pulsed electromagnetic fields (PEMFs) on mandibular condylar cartilage growth in rabbits.
MATERIALS AND METHOD: Eight, 2-month old, New Zealand rabbits exposed to PEMFs (15 Hz frequency) for 4 hours a day for a period of 2 months using an individual non-invasive emitter on one condyle (assigned randomly) and a non-working emitter on the other condyle (control side). After 2 months, all rabbits were killed, the mandibles were surgically removed and anthropometric measurements were carried out. Undemineralized sagittal sections (5-7 μm thick) of the mandibular condyle were used to measure the total thickness of the condylar cartilage (anterior, middle and posterior regions) and to evaluate the response induced by PEMFs. Statistical evaluation was undertaken using a Student's *t*-test. *P* values < 0.05 were considered to be significant.
RESULTS: No statistically significant difference was found between the stimulated and the control hemi-mandibles. Histologically, the prechondroblastic and chondroblastic layers of the stimulated condyles were relatively thick, indicating an active cartilaginous growth process, which was found to be most intense in the middle zone.
CONCLUSIONS: Although PEMFs caused histomorphological changes that indicate an increase in cellular activity, which was statistically significant ($P = 0.04$) in the middle zone of stimulated condyle, the results of this study are insufficient to support the hypothesis that application of PEMFs of 15 Hz have an effect on mandibular growth in rabbits.

92 COMPARATIVE ASSESSMENT OF THE MANDIBULAR GROWTH SPURT
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AIM: To evaluate changes in the mandibular growth spurt between Class I, II and III malocclusion subjects of both genders.
SUBJECTS AND METHOD: Seven hundred and fourteen subjects were consecutively chosen from a total cohort of 914 subjects (380 males, 534 females) aged 10 to 17 years. Three hundred and seventy eight were Class I, 307 Class II, and 29 Class III. As it was considered that the Class III sample was too small for the study, the next 200 Class III patients who attended the clinic were added. Mandibular growth was evaluated after dividing the subjects into seven groups based on age, each group covering 12 months. Teleroentgenograms were obtained and digitally analyzed and standardized with the Nemoceph program (Nemotec Co., Spain) using measurements from Harvold's cephalometric system (mandibular size, maxillary size and mx-md difference).
RESULTS: The greatest mandibular growth spurt was in the Class I males between 14 and 15 years of age, whereas in females it occurred between 13 and 14 years of age. Class II males had two growth peaks: from 11 to 12 years, and females from 13 to 14 years. In the Class III males the growth spurt occurred before that in the females, between 11 and 13 years, while in females it was from 12 to 14 years. After 15 years of age there was significant mandibular growth in both genders.
CONCLUSIONS: The mandibular growth spurt it is not only different between males and females, but also depends on Angle classification.

93 PREVALENCE OF TEMPOROMANDIBULAR JOINT DISORDERS AMONG STUDENTS AND THEIR RELATIONSHIP TO MALOCCLUSION
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AIM: To determine, in a descriptive, cross-sectional study, the correlation between the types of malocclusion and temporomandibular joint (TMJ) disorders among students.
SUBJECTS AND METHOD: Four hundred and twenty five randomly selected subjects (308 males, 117 females) aged 19 to 32 years, mean 26.1 years. SPSS software was used and statistical evaluation was carried out.
RESULTS: The correlation between malocclusion and TMJ discomfort at a level of $\alpha = 0.05$ was not significant. The highest level of correlation existed between temporomandibular dysfunction and a Class II malocclusion. The rate of TMJ discomfort in various types of malocclusion was: Class II > Class I > Class III. The correlation between TMJ discomfort and head, neck and back pain was significant ($P = 0.0298$). The ratio of females to males with TMJ discomfort was 1.6:1. Most patients with TMJ discomfort complained of joint noises, mainly clicking, and a small number reported symptoms such as pain, jaw opening limitation, and other symptoms of the disorder. TMJ discomfort accompanied by gastric disorders was significant ($P = 0.0214$).

CONCLUSION: There is no significant correlation between malocclusion and TMJ discomfort. The highest level of correlation, although not statistically significant, existed between temporomandibular dysfunction and a Class II malocclusion. The correlation between TMJ discomfort and head, neck and back pain was significant. Studies are required to determine the exact relationship between gastric disorders and TMJ discomfort.

94 THE TIMING OF ORTHODONTIC TREATMENT FOR PREVENTION OF DENTAL TRAUMA

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AIM: To investigate the frequency of dental trauma in different age groups and to determine the best time for preventive orthodontic treatment.
SUBJECTS AND METHOD: One thousand three hundred and sixty seven orthodontic patients (731 females, 636 males), with a mean age of 14.8 years (range 6.0 to 55.5 years). The frequency of previous dental trauma to the permanent incisors at the time of referral was determined retrospectively from the dental records made at baseline. These included a standardized questionnaire, the results of the pre-treatment clinical examination, study models and photographs. The patients were divided into four age categories: <11 years, 11 to 15 years, 16 to 20 years, and >20 years.
RESULTS: The prevalence of dental trauma increased from 5.9 per cent in the <11 years age group to 12.8 per cent in the 11 to 15 year olds, followed by a decrease in the next two age groups (16 to 20 years: 9.9 per cent, >20 years: 6.3 per cent). Significant differences were found between the age groups of <11 and 11 to 15 years ($P < 0.01$).
CONCLUSIONS: Preventive orthodontic treatment should be initiated and completed before 11 years of age, i.e. in the early to middle mixed dentition.

95 TRANSPALATAL DISTRACTION IN ADULT PATIENTS PRIOR TO ORTHOGNATHIC SURGERY

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AIM: To present the results after palatal expansion in adult patients with extreme maxillary micrognathia using a bone-borne transpalatal distraction device.
SUBJECTS AND METHOD: Six adult patients with extreme maxillary micrognathia who underwent transpalatal distraction with a bone-borne distraction device (TPD T, Surgi-tec, Brugge) prior to orthognathic surgery. For all patients, dental models were obtained prior to insertion, six months after removal of the distraction device, and after orthognathic surgery. The models were analysed to compare changes and stability in intercanine, interpremolar and intermolar width.
RESULTS: In all patients sufficient maxillary expansion of approximately 11 mm was achieved after 4 to 5 weeks. The expansion remained stable until the final follow-up.
CONCLUSIONS: Transpalatal distraction prior to orthognathic surgery offers the possibility of obtaining stable results even in subjects with extreme maxillary micrognathia. Further advantages of this method are a decrease in treatment time, prevention of periodontal membrane compression, buccal root resorption and fenestration.

96 POCKET PROBING DEPTHS AFTER ORTHODONTIC TREATMENT OF THIRD MOLAR TRANSPLANTS

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AIM: To investigate the influence of orthodontic extrusion or derotation on pocket probing depths (PPD) of autotransplanted third molars.
SUBJECTS AND METHOD: Eighty-eight patients with a total of 91 autotransplanted immature third molars. Three to six months after transplantation, 21 transplants had been extruded (extrusion group) and 28 had been derotated (derotation group) orthodontically to a correct position in the dental arch. Forty-two transplants with no orthodontic treatment need served as the controls. Routine follow-ups were performed in all transplants after 1, 3, 6, 9 and 12 months, and yearly thereafter until the final follow-up. For each transplant, PPD were measured at six locations with a periodontal probe to an accuracy of 1 mm, beginning at the 3-month follow-up. PPD up to 3 mm were defined as physiological.
RESULTS: The post-operative observation time averaged 4.0 years (range 1.2 to 7.1 years). The average PPD were 2.8 mm (range 1.0 to 6.0 mm, SD = 0.7) in the derotation group, 2.4 mm (range 1.0 to 4.0 mm, SD = 0.6) in the extrusion group, and 2.2 mm (range 1.0 to 5.0 mm, SD = 0.7) in the control group. Compared with the transplants in the control group, significantly deeper PPD were determined at the mesiobuccal ($P = 0.016$), buccal ($P < 0.001$), distobuccal ($P = 0.019$), and distolingual ($P< 0.001$) transplant surfaces in the derotation group. No significant differences were observed between the control and the extrusion, or the extrusion and the derotation groups.

CONCLUSIONS: Orthodontic extrusion does not seem to have a negative influence on PPD. In contrast, orthodontic derotation seems to increase PPD of autotransplanted third molars. However, the differences are only of minor clinical significance.

97 INFLUENCE OF ADDITIONAL SURGICAL PROCEDURES ON ROOT LENGTH OF TRANSPLANTS

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AIM: To investigate the influence of various additional surgical procedures on final root length and root length increment of autotransplanted immature third molars.
SUBJECTS AND METHOD: Ninety-six patients with a total of 100 autotransplanted immature third molars. Due to early loss of teeth with atrophy of the alveolar process, additional surgical procedures were performed for 58 transplants. Preparation of a new socket, or free bone autografts, were undertaken for 19 transplants and an osteotomy of the alveolar process for 20 transplants. The control group comprised 42 teeth transplanted into fresh extraction sockets without additional surgical procedures. Root development was evaluated using intraoral radiographs taken with a standardized right-angle, long-cone technique with a film-focus distance of 30 cm. Measurements were performed on radiographs taken immediately after transplantation and at the final follow-up.
RESULTS: No significant differences in final root length or root length increase were found between the control group and the prepared socket or bone autograft groups. In contrast, transplants in the osteotomy group showed a significantly reduced final root length ($P < 0.01$) and root length increase ($P< 0.01$).
CONCLUSIONS: Osteotomy of the alveolar process seems to have a negative influence on final root length and root length increment of autotransplanted immature third molars.

98 EFFECTS OF TOOTH-BORNE SYMPHYSEAL DISTRACTION IN THE TRANSVERSE PLANE

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AIM: To evaluate the effects of mandibular symphyseal distraction osteogenesis (MSDO) on dental and skeletal structures and the mandibular condyle in the transverse plane, using a tooth-borne distraction device.
SUBJECTS AND METHOD: Fifteen subjects (7 males, 8 females) with a skeletal Class I or Class II pattern. MSDO was performed with a tooth-supported distractor that consisted of a hyrax-type screw placed at the lingual side of the lower jaw. The amount of distraction for each patient was 1 mm (0.5 mm ×2) per day, a total of 7 mm. Standardized postero-anterior cephalometric radiographs were obtained before and after distraction. Anatomical landmarks were traced on these radiographs and the first and second tracings were superimposed. The distances and angular measurements between these two records were measured and compared using a Student's *t*-test for paired samples at the 95 per cent confidence level.
RESULTS: Statistically significant differences were found between the values measured before and after MSDO. There were different amounts of expansion at the basal and alveolar bone levels of the mandible (both $P = 0.01$), and the aperture of the distraction gap was V-shaped. The dental and the skeletal expansion effects were decreased from the anterior to the posterior.
CONCLUSION: MSDO increases the mandibular dimensions transversally and is preferable as a new approach especially in subjects where the profile would not be improved with dental extractions. Long-term skeletal effects of tooth-borne mandibular distraction should be evaluated.

99 MICROARRAY ANALYSIS OF ANGIOGENIC GENES IN CONDYLAR CARTILAGE

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AIM: Microarray technology allows the analysis of over 15,000 genes, some of which are expressed in the condyles involved in angiogenesis during growth. In this way, some angiogenic regulating factors involved in condylar cartilage growth could be identified. The aim of this study was to investigate the angiogenic gene expression changes in mandibular condylar cartilage under mechanical strain.
MATERIALS AND METHOD: Two hundred and eighty, 35 day old, female Sprague-Dawley rats randomly divided into seven experimental and seven control groups. The experimental groups were fitted with bite-jumping appliances. Each group of rats was killed on the following experimental days: 1, 3, 7, 9, 14, 30 and 33. Immediately after sacrifice, the condyles were dissected and total RNA was extracted to oligonucleotide microarray gene chips containing 15,923 genes. After a series of microarray data analyses, the genes that appeared absent at all time points in both groups were excluded.

All genes that were either unchanged or where the expression changed less than 2-fold in relation to the control group were excluded from further analyses. This selection resulted in a net of 1,082 genes; 666 were increased and 416 were decreased in expression, at least a 2-fold change. This group of genes was further analyzed using hierarchical clustering and self-organizing maps and resulted in the identification of numerous genes not previously known to be regulated in condylar cartilage during chondrogenesis under mechanical strain.
RESULTS: Ten genes were involved in angiogenesis.
CONCLUSIONS: Using microarray technology to analyze the gene expression of mandibular condylar cartilage under mechanical strain, some angiogenic regulating factors involved in condylar cartilage growth were identified.

100 PROGNOSTIC VALUE OF SAGITTAL CEPHALOMETRIC VARIABLES ON TREATMENT OUTCOME

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AIM: To determine methods for the prognostic evaluation of treatment outcome of sagittal cephalometric variables in Class II patients.
MATERIALS AND METHOD: Casts and cephalograms of 63 Class II patients taken at the beginning of treatment (mean age: 10.43, SD 1.97 years) and after an average treatment period of 4.52 (SD 2.49) years. For each cast an occlusal index was calculated summarizing the amount of distal occlusion in the molar and canine region at a ratio of 3:1.
RESULTS: There was no significant correlation between the occlusal index at the end and the sagittal cephalometric variables at the beginning of treatment. A cluster analysis was then performed using the vertical cephalometric variables at the beginning of treatment. Seventeen patients were sufficient for separate multiple regression analyses performed with the sagittal cephalometric variables as independent variables. These two vertical clusters differed in the inclination of the cranial base, the maxilla, the mandible and the occlusal plane as follows: 98.21 degrees (SD 4.42), 104.89 degrees (SD 3.29), 81.59 degrees (SD 2.64), 77.65 degrees (SD 3.75) and 92.71 degrees (SD 2.60), 86.80 degrees (SD 3.34), 108.26 degrees (SD 4.42) and 100.53 degrees (SD 3.24), respectively. The second cluster showed a prognostic valuable correlation of the occlusal index after treatment with the sagittal cephalometric variables (adjusted R^2 0.36). The position of the maxilla, measured by Se-N-A, was of great importance (regression coefficient –0.356, $P < 0.05$).
CONCLUSION: The prognostic value on treatment outcome of sagittal cephalometric variables in Class II patients is specific to different clusters performed with vertical cephalometric variables.

101 BIOMECHANICAL RESPONSE TO DIFFERENT LEVELS OF ALVEOLAR BONE LOSS

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AIM: To compare the behaviour of teeth with varying levels of alveolar bone loss during orthodontic movement.
MATERIALS AND METHOD: Using programmes based on the finite element method, six three-dimensional models were created of the upper central incisor. The first model corresponded to non-resorbed alveolar bone and the other five models to progressive resorption of alveolar bone of 2, 4, 6, 8, and 10 mm. Depending on the specific geometry, the discretization process lead to a different number of subdivisions. Orthodontic forces with different directions and intensities were applied. Movements and stress distribution were analysed and interpreted both quantitatively and qualitatively depending on the orthodontic force direction. Von Mises stress distribution was also analysed.
RESULTS: Alveolar bone resorption leads to an increase in the values of orthodontic movement. The stress, depending on the direction of the force in the periodontal ligament, increased gradually with alveolar bone resorption both at the apical and cervical level. Analysis of von Mises stress emphasized the values and the distribution of this type of stress on different areas of tooth, periodontal ligament and alveolar bone.

102 ORTHOGNATHIC SURGERY IN MENTALLY HANDICAPPED PATIENTS

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AIM: To analyse possible special features in the orthodontic and orthognathic surgical treatment of mentally handicapped patients, especially regarding intra- and post-operative complications and late results (disturbance of nerve function and skeletal relapse).
MATERIALS AND METHOD: The patient files, the results of two-point discrimination, and the cephalometric findings of 20 patients with a mental handicap (7 males, 13 females) and of 102 patients (36 males, 66 females), for the control group,

were evaluated retrospectively. Complications both during and after surgery, the results of nerve function tests, and relapse rate were assessed. Statistical analysis was carried out using binary logistic regression analysis ($P < 0.05$) with adjustment according to the diagnosis and type of surgery.
RESULTS: No significant differences ($P > 0.05$) were found between the mentally handicapped and non-handicapped patients. Only the nerve function test immediately post-surgery showed differences between the groups. The relapse rate in mentally handicapped patients was similar to non-handicapped patients. Forty-seven months after surgery a change in ANB angle of more than 0.5 degrees that reflected clinical relapse was observed in four patients.
CONCLUSION: Orthognathic surgical procedures in mentally handicapped patients can be carried out with a similar high success rate as in mentally healthy patients.

103 AGE-DEPENDENT STABILITY OF CLASS II DIVISION 2 TREATMENT WITH THE HERBST APPLIANCE

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AIM: To analyse the occlusal stability of adolescent and adult Class II division 2 Herbst patients.
SUBJECTS AND METHOD: Thirty-seven Class II division 2 subjects in the permanent dentition exhibiting a Class II molar relationship (MR) ≥0.5 cusps bilaterally or ≥1.0 cusp unilaterally were divided into three skeletal maturity groups: pre-peak/peak (n = 10), post-peak (n = 14), adult (n = 13). Study casts from before Herbst treatment (T1), after Herbst and fixed appliance treatment (T2) and after retention (T3) were analysed. The average retention period was 27 months. The MR was considered stable if a normal or overcompensated Class I relationship existed or if the occlusion was unchanged. A relapse ≤0.25 cusp widths was considered as insignificant relapse, whereas a relapse >0.25 cusp widths was considered as relapse. Concerning overjet (OJ) and overbite (OB), unchanged values or final values up to 3 mm were considered stable. Insignificant relapse was defined for final values of 3.1 to 4 mm. An increase in values of more than 4.0 mm was considered as relapse.
RESULTS: For the whole sample, MR after retention was stable in 82.8 per cent, OB in 75.7 per cent and OJ in 100 per cent. In the different skeletal maturity groups, the stability of MR, OB and OJ was: pre-peak/peak (95.0, 70.0 and 100 per cent, respectively), post-peak (92.8, 85.7 and 100 per cent, respectively), adult (61.5, 69.2 and 100 per cent, respectively).
CONCLUSION: Class II division 2 Herbst treatments show favourable long-term stability. Treatment in adolescents showed more stable results than treatment in adults.

104 OCCLUSAL STIMULI REGULATE INTERLEUKIN-1β EXPRESSION IN RAT PERIODONTAL LIGAMENT

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AIM: Occlusal hypofunction has been identified as a reduction in the number of vessels, a decrease in the thickness of the periodontal ligament (PDL), and disturbance of the functional arrangement of connective tissue fibres. On the other hand, these conditions are also reported to be recovered by occlusal stimuli. In order to investigate the mechanism of PDL remodelling under occlusal stimuli, the expression of interleukin-1beta (IL-1β) was observed immunohistochemically.
MATERIALS AND METHOD: Forty, 5-week-old, Wistar male rats divided into three groups: occluded, non-occluded, and recovery. In the non-occluded group, an anterior bite plate and metal cap were attached to the maxillary and mandibular incisors to eliminate occlusal forces at the molar region. At the end of each experiment, the animals were killed and the mandibles removed and fixed. The roots of M1 were then prepared for histological and immunohistochemical investigation.
RESULTS: In the non-occluded group, the PDL thickness appeared to be narrow and the arrangement of fibres disorganized. Immunohistochemical evaluation revealed significantly positive staining for IL-1β in the PDL cells, while the expression level was decreased as the occlusal stimuli was recovered.
CONCLUSIONS: Atrophic changes in the PDL caused by occlusal hypofunction may be connected to enhanced IL-1β expression, and occlusal stimuli may play an important role in recovery of this condition.

105 STABILITY OF PALATAL IMPLANT-SUPPORTED VERSUS TOOTH-CONNECTED ANCHORAGE IN ADOLESCENTS

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AIM: Clinical comparison of palatal implant (PI) supported anchorage with conventional dental anchorage (DA) for the two-phase retraction of maxillary anterior teeth requiring 'maximum anchorage'.

SUBJECTS AND METHOD: A randomized control trial (n = 18, mean age 14.16 ± 1.6 years) comparing the use of PI with conventional DA for maximal posterior anchorage was undertaken in patients following extraction of their maxillary first premolars. In the PI group, Orthosystem® implants were placed in the midpalate and in each case a transpalatal wire was fixed to the implant and to the first molar bands. In the DA group, anchorage was provided by a stainless steel (SS) utility arch combined with a transpalatal bar connected to the first molars. A super-elastic closed-coil spring was used for canine retraction (phase I). Sequential activation of the 'teardrop' closing loop of the SS contraction arch was used for *en masse* incisor retraction (phase II). The duration of phases I and II as well as for the total orthodontic treatment period was measured. The 6-PTV distances in both groups were noted on lateral cephalograms.
RESULTS: No significant difference was observed between the groups for duration of closure of the extraction space ($P = 0.975$) and first molar position ($P = 0.1$) during phase I. In the PI group, the duration of phase II was shorter than in the DA group ($P = 0.04$). A significant mesialization of the first molars ($P = 0.01$) was also observed in the DA patients. The duration for total orthodontic treatment was 7.5 months shorter in the PI group ($P = 0.03$), apart from the three month implant healing time.
CONCLUSION: A higher grade of anchorage stability and a predictable treatment outcome was achieved by fastening the anchorage teeth to a PI, compared with conventional DA.

106 EFFECTS OF NITRIC OXIDE SYNTHASE ISOFORMS DURING EXPERIMENTAL TOOTH MOVEMENT
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AIM: To evaluate the effects of nitric oxide synthase isoforms (iNOS) on osteoblastic and/or osteoclastic activity of bone tissue during experimental tooth movement.
MATERIALS AND METHOD: Sixty-six Sprague Dawley rats divided into 11 equal groups. The mandibular first molars of each rat were moved mesially by means of a closed coil spring for 7 days. In the first three groups, INOS inhibitor 1400 W dihydrochloride was administrated twice a day at 10 μG/20 μL, 30 μG/20 μL and 100 μG/20 μL doses, respectively. In groups 4, 5 and 6, the administration doses of eNOS inhibitor, L-NIO- dihydrochloride, were the same. For groups 7, 8 and 9, nNOS inhibitor, Nω-propil-L- arginin, was applied at the same dose and sequence. In group 10, 20 μL 0.9 per cent NaCl was administered, while group 11 served as the control. The rats were killed on day 7 and the parameters of trabecular volume, trabecular number and trabecular separation were evaluated histomorphometrically at the interradicular bone area of the mandibular first molars.
RESULTS: Only in group 5 (eNOS inhibitor 30 μg) were the results statistically significant. In this group, trabecular volume and trabecular number decreased, while trabecular separation significantly increased.
CONCLUSION: Isoenzyme eNOS during experimental tooth movement was responsible for a significant change in bone remodelling.

107 FRICTIONAL RESISTANCE BETWEEN ORTHODONTIC ARCHWIRES IN GOLDEN AND STAINLESS STEEL BRACKETS
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AIM: In full arch techniques, where straight (preformed) wires are used, the contact angle of the wire to the bracket is a factor that directly affects friction. As long as the angle between the bracket and wire increases, friction is also expected to increase. The purpose of this study was to test, *in vitro,* two types of golden brackets [Forever Gold 24K and Forever Gold (zirconia plated), American Orthodontics], which are manufactured for cosmetic preferences or for patients with a nickel allergy, and stainless steel (SS) brackets (Mini Master, American Orthodontics) in four different angles with respect to friction values in nickel-titanium (NiTi) and SS archwires.
MATERIALS AND METHOD: Since there are many factors affecting friction, all tests were performed in a dry environment and in a single dimension, without ligation, and with the use of an electronic angulation device and a universal testing machine. The crosshead speed was set at 1 mm/minute.
RESULTS: Statistical analyses showed that the primary effects of all three factors, i.e. bracket, wire, and angle, were significant ($P < 0.05$). However, when the angle was kept constant, the Forever Gold 24K and SS brackets demonstrated a similarity in terms of frictional force. The Forever Gold bracket showed higher friction values than the other two bracket types.
CONCLUSIONS: 1. Bracket type, archwire, and angulation had an effect on frictional forces. For the same bracket type, when the archwire diameter was held constant, frictional values increased linearly as the angulation increased. 2. The Forever Gold 24K bracket had statistically significantly lower friction than the other two brackets in terms of total friction values of the tested angulations and archwires. 3. Forever Gold 24K and SS brackets demonstrated similar characteristics

in four angles for the used archwires SS and NiTi in terms of friction values, Forever Gold brackets, plated with zirconia, exhibited differences from the other two bracket types and had the highest friction values.

108 DEVELOPMENT OF A MMP-8 CHAIRSIDE TEST FOR PERIODONTAL FOLLOW-UP IN ORTHODONTICS

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AIM: The number of adult orthodontic patients is continuously increasing. Thus, the prevalence of periodontally affected teeth is higher. Bacterial infection is necessarily correlated with an inflammatory tissue reaction. Important tissue-degrading enzymes are matrix metalloproteinases (MMP), especially MMP-8. MMP-8 is an excellent marker for this inflammatory process and it can be determined from gingival crevicular fluid (GFC). The aim of this study was to develop a precise and easy chairside test for the quantification of MMP-8 that can be performed in a very short time.
MATERIALS AND METHOD: Specific columns, with a porous polyethylene, were developed and coated with specific antibodies against MMP-8 (anti-h-MMP-8, clone 8708). With several dilution series, the lower detection limit was determined. In the second part of the study GFC was collected from 41 patients (19 healthy subjects or patients who were successfully treated and 22 patients diagnosed with different stages of periodontal disease). All GCF samples were loaded in a chairside procedure to a specific commercially available column. The individual concentrations for MMP-8 were determined with the newly developed Dentognostics-Analyzer® within 18 minutes.
RESULTS: A specific and easy chairside test for the quantification of MMP-8 was developed. The lower antigen detection limit of the assay was 0.02 ng/ml. The evaluation of the first 41 patients demonstrated that healthy or successfully treated patients showed MMP-8 levels between 0 and 6 ng/ml. In contrast, in all patients with periodontal disease the values ranged between 15 and 60 ng/ml.
CONCLUSIONS: Specific tests for the determination of MMP-8 have so far only been possible in laboratories with high-tech equipment. Since tissue-degrading enzymes are unstable, clinical samples had to be processed immediately. These assays were in the past unfeasible, because of the distance between the office and the laboratory.

109 SOFT TISSUE PROFILE CHANGES AFTER PREMAXILLARY ADVANCEMENT WITH DISTRACTION OSTEOGENESIS

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AIM: To evaluate the changes of the soft tissue profile after advancement of the premaxilla using distraction osteogenesis (DO).
SUBJECTS AND METHOD: Twelve subjects (7 females, 5 males) with an anterior crossbite and an Angle Class I molar relationship. The skeletal relationship was Class III (ANB = –2.5 degrees) due to a retrognathic maxilla. Premaxillary advancement with DO was planned to correct the skeletal discrepancy and the upper anterior crowding. An individual tooth-borne appliance, cemented during surgery, was used. After a latency period of one week, the screws were activated (0.8 mm/day). After a 6-week consolidation period, fixed orthodontic treatment was started. Lateral cephalograms in the relaxed lip position were obtained before treatment and after the consolidation period. Eighteen parameters were evaluated to determine soft tissue profile changes and 17 parameters to analyze the dentofacial structures.
RESULTS: Points representing the premaxilla (ANS, A) and upper incisors, moved anteriorly ($P < 0.001$). Points B and Pg moved posteriorly ($P < 0.01$). Significant increases in lower anterior face height and SN/GoGn angle were found ($P < 0.001$). Anterior movement of the tip of the nose and upper lip ($P < 0.001$), and an increase of upper lip length ($P < 0.05$) were significant. Posterior movement of soft tissue chin point was significant ($P < 0.01$). The thickness of the upper lip showed a significant decrease ($P < 0.01$), whereas that of the lower lip showed a significant increase ($P < 0.001$). The changes of the soft tissue points correlated with those of the underlying hard tissue points.
CONCLUSION: Anterior movements of the tip of the nose and the upper lip were effective for the correction of the soft tissue profile.

110 ORAL HEALTH-RELATED QUALITY OF LIFE AND MALOCCLUSION IN SCHOOLCHILDREN

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AIM: Data on oral health-related quality of life (OHRQoL) are important in order to determine subjective treatment need and to measure the outcome of treatment. The aims of this cross-sectional, observational, study were to determine the OHRQoL of schoolchildren in Amsterdam, The Netherlands, to assess the relationship between OHRQoL and malocclusion, and to determine their subjective treatment need.

SUBJECTS AND METHOD: Four hundred and sixty untreated, 10-12-year-old children in the seventh and eighth grades of public primary schools, completed a OHRQoL questionnaire and were asked to determine their malocclusion using the Aesthetic Component of the Index of Orthodontic Treatment Need (AC-IOTN).
RESULTS: The OHRQoL scores indicated that the subjects had a good quality of life. Small, but statistically significant differences were found between boys and girls. The majority of children had a low AC-IOTN score. Correlations between OHRQoL scores and AC-IOTN scores were low, but statistically significant for boys for the domains 'oral symptoms' and 'emotional well-being', and for girls for the domains 'functional well-being', 'emotional well-being' and 'peer interaction'.
CONCLUSIONS: Since correlations between malocclusion and quality of life are low, Dutch schoolchildren in Amsterdam are apparently not too concerned about their malocclusion, and therefore do not perceive a high subjective orthodontic treatment need. The subjects in this study can be viewed as a control group and their OHRQoL scores can be used as reference values for future research into, for example, the impact of craniofacial malformations on OHRQoL.

111 EXPRESSION OF TRANSGLUTAMINASES IN HUMAN CRANIOFACIAL SKELETAL MUSCLE

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AIM: Long-term success and stability of various orthodontic treatment modalities is dependent upon the adaptive response and remodelling of the craniofacial muscle extracellular matrix (ECM). In other tissues, remodelling and reorganization of the ECM utilizes contributions from the multi-enzyme family, the transglutaminases (TGases). There have been few previous *in vitro* studies investigating TGase expression during skeletal muscle development. The aims of this study were to culture primary myogenic cells derived from human masseter muscle using a laboratory based *in vitro* model, and to investigate TGase gene expression during the early developmental stages of human craniofacial skeletal myofibrillogenesis (myotube formation).
MATERIALS AND METHOD: Muscle cells were obtained from explants of biopsied human masseter muscle from adult patients undergoing elective orthognathic surgery or wisdom tooth removal. The techniques of qualitative and quantitative polymerase chain reaction (PCR) analysis using TGase-specific assays were employed.
RESULTS: Qualitative PCR data suggested the presence of TGases 2, 6 and 7. Quantitative analysis confirmed the presence and expression of TG2 during all stages of myotube development, with maximal expression during cellular proliferation and migration ($P < 0.05$). TG6 and TG7 isoforms were also expressed but at lower levels. Maximal TG7 expression appeared at the pre-fusion culture stage ($P < 0.05$). TG6 expression pattern was similar to TG7, but was not significant during myofibrillogenesis ($P > 0.05$).
CONCLUSIONS: There is inter-isoform variability in the pattern of TGase expression that is dependent on the stage of myotube formation. The expression patterns of TGases 2, 6 and 7 are similar to other ECM molecules involved in skeletal myogenesis. TGases represent another group of molecules that appear to have a role in masseter muscle ECM remodelling and development, and may contribute to muscle adaptation.

112 COMPARISON OF Er:YAG LASER AND PHOSPHORIC ACID APPLICATION ON BOND STRENGTH

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AIM: To assess the effect of shear bond strength (SBS) and failure site when enamel is etched with five different laser energy settings versus acid etching.
MATERIALS AND METHOD: One hundred and twenty-six human permanent premolars, randomly divided into six equal groups. In the laser treated groups the samples were irradiated with Er:YAG laser with five different laser energy settings (80, 100, 120, 150, 170 mj). Conventional surface conditioning was performed with a 38 per cent phosphoric acid gel. Six specimens in each group, which did not undergo bond testing, were prepared for observation with a scanning electron microscope (SEM). Stainless steel premolar brackets were bonded to the teeth with one adhesive system (Transbond XT Light Cure, 3M Dental Products). Shear forces were applied to the samples by a Zwick Universal testing machine. Bond strengths were measured in megapascals, and bond failure was analyzed using the adhesive remnant index (ARI).
RESULTS: When the results were statistically evaluated, the SBS of the four laser ablated groups were not significantly different from the acid etched group, while only one of the laser treated groups showed significantly lower values than the control group. ARI scores indicated that the failure sites were mainly at the enamel-adhesive interface in laser ablated groups. The failure sites of the acid etched specimens occurred within the adhesive. Under SEM, the laser treated specimens showed an uneven, irregular surface with micro-cracks while the surface of the acid etched specimen was more regular and homogeneous.

CONCLUSION: Whilst etching enamel within 100, 120, 150, and 170 mj/10 Hz/10 second laser power settings showed comparable results with the control group, nevertheless laser application can reduce chairtime.

113 EVALUATION OF A SELF-ETCHING PRIMER ON BRACKET BOND STRENGTH

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AIM: To evaluate, *in vitro*, the influence of a new self-etching primer (Adper Prompt L-pop; 3M Espe, St Paul, Minnesota, USA) on the shear bond strength of orthodontic brackets.
MATERIALS AND METHOD: Forty extracted human premolars randomly divided into two equal groups: group 1 (control), phosphoric acid plus Transbond XT primer (3M Unitek, Monrovia, California, USA) and group 2, Adper Prompt L-pop. Transbond XT adhesive paste (3M Unitek) was used in both groups for bonding. All products were used according to the manufacturers' instructions. An Instron Universal testing machine was used to apply an occlusal shear force directly to the enamel-bracket interface at a speed of 0.5 mm/minute. The groups were compared using a Student's *t*-test.
RESULTS: Mean results and standard deviation for the groups were: group 1 = 16.23 MPa (4.77), group 2 = 13.56 MPa (4.31). No significant difference was observed in the bond strengths of the two groups ($P = 0.069$). However, the adhesive remnant index was significantly less when conditioning the enamel with Adper Prompt L-pop compared with phosphoric acid ($P = 0.0003$). The results indicated that there was no difference in bond strength either with conventional etching and primer or Adper Prompt L-pop. The amount of adhesive on the enamel after debonding was significantly less when using Adper Prompt than when using phosphoric acid.
CONCLUSION: Adper Prompt L-pop is potentially adequate for orthodontic bonding.

114 MANDIBULAR POSTURE: NEUROMUSCULAR POSITION VERSUS BIMANUALLY MANIPULATED CENTRIC VERSUS INTERCUSPATION

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AIM: Comparison of intercuspal position (ICP), bimanual manipulation (BMCR) and a patient-generated non-manipulated mandibular posture (neuromuscular position NMP)
SUBJECTS AND METHOD: Eighteen subjects (11 males, 7 females, mean age 26.8 ± 3.2 years) with full dentitions, distinct intercuspation and no temporomandibular disorders underwent three recordings of BMCR and NMP at 2-week intervals. After neuromuscular deprogramming (maximum mouth opening and cotton roll for 7 minutes), BMCR was recorded on a double-layered beauty pink X hard wax. NMP was recorded after deprogramming by open-close movements from the rest position of 2-3 mm without occlusal contact on single-layered beauty pink and aluwax added for canine and molar impressions, all covered with zinc oxide-eugenol. Maxillary and mandibular casts were mounted into a SAM2 articulator (Porion determined arbitrary facebow). The casts were transferred to a condylmeter with six measuring gauges, yielding left and right condylar x, y and z-coordinates.
RESULTS: BMCR was the most posterior position, ICP the most superior (sagittal and vertical differences 0.1-0.5 mm) and NMP the most antero-inferior (right: 0.2 and 0.6 mm; left: 0.3 and 0.7 mm); transversely NMP was 0.15 mm more left than BMCR and ICP 0.23 mm more left than BMCR. The repeatability of BMCR was greater than NMP (Cronbach's $\alpha = 0.82$ versus 0.67). Statistically significant differences (Wilcoxon, $P < 0.05$) were observed between BMCR and NMP in all three directions; BMCR-ICP sagittally and transversely, NMP-ICP vertically.
CONCLUSION: The average NMP was more anterior and even more inferior than BMCR and ICP, transversely 0.15 mm more left than BMRC. NMP was less reproducible than BMRC. Proportionally large standard deviations emphasized individual variability of BMRC and even more for NMP.

115 AXIOGRAPHY AND MAGNETIC RESONANCE IMAGING: COMPARISON IN TEMPOROMANDIBULAR DYSFUNCTION PATIENTS

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AIM: To analyze the right and left temporomandibular joints (TMJ) of patients with signs and symptoms of temporomandibular disorders (TMD) using axiography and magnetic resonance imaging (MRI) of the TMJs. Correlation of the results of the two examinations was evaluated.
SUBJECTS AND METHOD: The TMJs of 104 patients with TMD, mean age 39 ± 3 years, and a control group of 20 subjects with normal occlusion, were examined using axiography (a condylocomp) and MRI, 1.5 tesla (General Electrics). Two hundred and eight pathological joints were evaluated.

RESULTS: The K index of correlation between the two examinations was very low (0.13). This low statistical correlation was probably due to the fact that axiography is a dynamic recording of the TMJ during border movements, while MRI is a static examination that shows TMJ morphology.
CONCLUSION: Axiography and MRI can be considered complementary and both necessary to obtain a useful diagnosis of the TMJs, both anatomically and functionally.

116 ROOT RESORPTION CAUSED BY ECTOPICALLY ERUPTING CANINES: A COMPUTED TOMOGRAPHIC STUDY

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AIM: To analyse the prevalence and characteristics of root resorption caused by ectopically erupting canines.
SUBJECTS AND METHOD: One hundred and forty nine patients [61 males, 88 females, between 10 and 50 years of age (mean 18 years)] with 184 ectopically erupting upper permanent canines. A computed tomographic examination was undertaken.
RESULTS: Thirty-four ectopically erupting canines (18.5 per cent) caused root resorption of adjacent teeth. The position of the canine cusp in relation to the roots of the adjacent teeth was buccal in 13 subjects (38 per cent), apical in four (12 per cent) and palatal in 17 (50 per cent). The lateral incisors were resorbed in 26 subjects (74 per cent), the first premolars in five (14 per cent) and the central incisors in four (12 per cent). The extent of the root resorption was evaluated as severe resorption. The pulp was exposed by the resorption in all subjects. The location of the root resorption was at the cervical and middle third of the root in two subjects (5 per cent) and at the middle and apical third in nine (26 per cent). Twenty-four resorbed adjacent teeth (69 per cent) showed apical shortening. Females were more often affected, the ratio was F:M = 1.75:1. Most resorption was seen between 11 and 15 years of age.
CONCLUSIONS: Root resorption due to ectopically erupting canines affects not only incisors but also first premolars. Its prevalence was 18.5 per cent in this sample. The number of resorptions was lower compared with earlier reported studies.

117 THREE-DIMENSIONAL TOOTH MOVEMENT IN RAPID MAXILLARY EXPANSION AND MAXILLARY PROTRACTION HEADGEAR TREATMENT**

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AIM: The application of three-dimensional (3D) reverse engineering technology to orthodontic model analysis has shown various possibilities that exceed the limitations of two-dimensional analysis. The purpose of this study was to evaluate the validity of assessment by 3D digital model superimposition compared with the cephalometric technique in subjects treated by rapid maxillary expansion (RME) and protraction headgear, which is supposed to change the shape of the palatal vault.
MATERIALS AND METHOD: The maxillary casts and lateral cephalograms of 24 patients, who underwent RME and maxillary protraction headgear treatment, were observed before and after treatment. The cephalometric analyses used to evaluate dental changes were modified from those described by Ricketts and Pancherz. Scanning of the maxillary dental casts was performed using a 3D scanner: Orapix® (Non-contact method 3D scanner, KCI Co., Ltd., South Korea) and 3D reverse modelling S/W (Rapidform 2002®, Inus Technology Inc., South Korea) and the superimposition was carried out using the best-fit method. 3D tooth movement was measured under a co-ordinate system modified from the proposal of Ashmore *et al*. A Wilcoxon matched pairs signed rank test was used to determine whether a significant difference existed between the cephalometric and 3D measuring techniques.
RESULTS: There were no statistical differences ($P > 0.05$) in the horizontal movement of the upper central incisor and first molar, but vertical movements were statistically different.
CONCLUSIONS: It is suggested that 3D superimposition cannot be used as an alternative for cephalometric analysis in patients treated using orthopaedic mechanics such as RME.

118 AESTHETIC EVALUATION OF ASIAN-CHINESE PROFILES FROM A CAUCASIAN PERSPECTIVE

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AIM: A recent population census has shown an increase in migration from Asian countries to the United States and Australia resulting in an increase in Asian patients seen in the orthodontic clinic. Management of patients of different ethnicity living in a multi-cultural, multi-ethnic society can be a challenge. The aim of this study was to establish baseline data for the assessment of Asian-Chinese profiles from a Caucasian perspective and to compare objective views from three different cohorts.

SUBJECTS AND METHOD: A total of 142 Caucasians (31 orthodontists, 31 dental students, and 80 laypersons from a mixed multi-ethnic metropolitan community) studied and ranked a series of adult male and female computer manipulated Asian-Chinese profiles describing seven different profiles: bimaxillary protrusion, protrusive mandible, retrusive mandible, normal profile (Class I incisor with Class I skeletal pattern), retrusive maxilla, protrusive maxilla, and bimaxillary retrusion. The facial anatomy that played the most important role in their decision-making was also noted.
RESULTS: All examiners preferred the normal Class I or bimaxillary retrusive profiles in both males and females; the least attractive male profile was that with a protrusive mandible, while the equally ranked least attractive female profiles were the protrusive and retrusive mandibular profiles. All assessors demonstrated fairly similar trends in ranking of the male and female profiles with few exceptions. The preferred profiles diverged from bimaxillary protrusive and Class III profiles (maxillary retrusion and/or mandibular protrusion), which are the usual norms for the ethnic Asian-Chinese. The upper lip, lower lip and chin had the most emphasis when the examiners were ranking the profiles. This finding was also common to all three groups.
CONCLUSION: There are strong cohesive trends in establishing ideal facial aesthetics of Asian-Chinese profiles evaluated by Caucasians living in a multi-ethnic metropolitan community.

119 PROFILE OF LINGUAL ORTHODONTIC USERS IN AUSTRALIA

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AIM: The use of lingual orthodontic appliances in Australia is largely unknown. The aim of this study was to investigate the profile of lingual orthodontic users in Australia.
MATERIALS AND METHOD: Four hundred and fifty questionnaires, consisting of 15 questions, were sent to orthodontists in Australia. The response rate was 61.8 per cent (278); of these returns, 6.1 per cent (17) were incomplete. Statistical analysis using SPSS was performed, and various outputs were obtained.
RESULTS: Twenty-three per cent of the positive returns were current lingual appliance users; 69.3 per cent were not, and 7.7 per cent were previous users but had stopped using the appliance. Of the current lingual users, 90 per cent were males and 10 per cent females. Most of the users were from New South Wales (35 per cent) while Tasmania had the least at 1.7 per cent. Forty per cent had attended lingual courses as part of their specialist training programme, while 73.3 per cent had attended lingual courses since graduation and 81.7 per cent would consider attending a lingual course in the future. Of the 60 per cent of current users that did not have a lingual component in their specialist training programme, 88.9 per cent had attended lingual courses since graduation. For the non-lingual users, only 13.8 per cent had attended lingual courses as part of their specialist training programme, while 28.2 per cent had attended lingual courses since graduation and only 37.6 per cent would consider attending a lingual course in the future. The main reason cited for non-lingual users was that lingual orthodontics could not be an integral part of the practice.
CONCLUSION: Most orthodontists were non-users of the lingual appliance with the majority of them having graduated more than 16 years previously from their postgraduate training. A quarter of all orthodontists currently use the lingual technique, with New South Wales having the largest number of orthodontists practicing the lingual technique. Only a fifth of them had a lingual component in their formal orthodontic training and approximately half had attended a lingual course after graduation. Almost half of orthodontists in Australia would consider attending a lingual course in the future. This survey provides a sound basis for course co-ordinators to plan for lingual orthodontics in the future.

120 SHAPE VARIATION OF CERVICAL VERTEBRAE AND RELATIONSHIP TO SKELETAL AGE

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AIM: To investigate the shape variation of the upper cervical vertebrae and assess the relationship between shape and skeletal age.
MATERIALS AND METHOD: Lateral cephalometric and hand-wrist radiographs of 40 subjects, average age 11.9 years (S.D. 2.3) were scanned. Skeletal age was evaluated from the hand-wrist radiographs, and a total of 118 landmarks on the C1, C2 and C3 vertebrae were digitized on the cephalogram. Procrustes superimposition and principal component analysis were used to extract the vertebral shape components. Statistical analysis, by multiple regression, was applied between the shape components and skeletal age.
RESULTS: Clear patterns of shape variability were detected not only for each vertebra, but also between related functional components of neighbouring vertebrae. The shape of the first three vertebrae, calculated individually, was found to be significantly correlated with skeletal maturity, correlation coefficients ranging from 0.70 to 0.86. Shape components showed that age was strongly related to the size and shape of the laminae and spinous process of C2, the curvature of the inferior

surface of the bodies of C2 and C3, the height/width ratio of the body of C3 and the relationship between the body of C3 and its spinous process and articular surfaces. Other parts of the vertebrae, such as the odontoid process of C2, were found to be significantly less associated with age. Multiple correlation, taking into account all vertebrae, showed that shape, as a whole, was strongly related to skeletal age, the correlation coefficient exceeding 0.90 ($r^2 = 81$ per cent).
CONCLUSIONS: Morphometric analysis of cervical vertebrae could provide a more accurate method of skeletal age assessment than conventional measurements or objective shape evaluation.

121 SPECTRUM AND MANAGEMENT OF DENTOFACIAL DEFORMITIES: AN ASIAN PERSPECTIVE
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AIM: To investigate the spectrum of dentofacial deformities, demographic profile, and management of orthognathic patients treated in the National Dental Centre in Singapore.
MATERIALS AND METHOD: Over a 3-year period (2001 to 2003), 212 patients with dentofacial deformities who had undergone orthognathic surgery were reviewed. Patients with a cleft lip and palate or syndromes were excluded.
RESULTS: The mean age (range: 16 to 58 years) of the patients was 24.0 (S.D. 6.4) and the ratio of females to males was 1.3:1. The predominant ethnic group was Chinese (91.5 per cent). The majority of the patients had a Skeletal III pattern (68 per cent). Asymmetry was diagnosed in 36 per cent of all cases and in 48 per cent of Skeletal III subjects. Vertical maxillary excess was diagnosed in 21 per cent of all subjects and in 47 per cent of Skeletal II cases. Bimaxillary surgery, involving Le Fort and bilateral sagittal split osteotomies, was performed in 84 per cent of Skeletal III patients and in 73 per cent of all cases. A segmental osteotomy and genioplasty was performed in 41 per cent of the cases.
CONCLUSION: The majority of the patients were young Chinese adults requiring bimaxillary surgery with genioplasty or segmental osteotomy. These findings may reflect the greater severity of dentofacial deformities in patients in this community.

122 A SURFACE PHYSICO-CHEMICAL MODEL CONTROLLING BIOFILM FORMATION ON ORTHODONTIC ADHESIVES
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AIM: Biofilm formation on orthodontic adhesives is a serious clinical problem, as it leads to enamel demineralization around fixed orthodontic appliances, often leaving white spot lesions after their removal. The aim of this research was to determine the influence of surface physico-chemical properties of four commonly used orthodontic adhesives (Concise™, Fuji Ortho™ LC, Ketac Cem M and Transbond™ XT) on early bacterial biofilm formation. In addition, the effects of two commercially available mouthrinses (0.05 per cent sodium fluoride and 0.2 per cent chlorhexidine gluconate) on these properties and biofilm formation were determined.
MATERIALS AND METHOD: Discs (5 × 1 mm) were fabricated from each adhesive and divided into three groups (no treatment, fluoride, and chlorhexidine treatment). The disc surfaces were characterized by measuring their hydrophobicities (water contact angles), surface roughness (three-dimensional optical profilometer) and elemental chemical compositions (X-ray photoelectron spectroscopy). Using a parallel plate flow chamber, the early biofilm formation by *Streptococcus sanguis* SK36 on these disc surfaces was studied. The biofilms were stained with Syto® 13 nuclei acid stain and image analysis performed using ImageJ software. All data were analyzed using multiple linear regression analysis to identify the factor most predictive of influencing early biofilm formation.
RESULTS: Water contact angles on the adhesives decreased after fluoride and chlorhexidine treatment, concurrent with an increase in carbon and a decrease in oxygen surface concentrations, except for Transbond™ XT. No fluorine was detected on any of the adhesive surfaces after fluoride treatment, while all surfaces showed chlorine after chlorhexidine treatment. Surface roughness of the adhesives was around 4 μm and found not to be a factor governing early biofilm formation.
CONCLUSION: Early biofilm formation on orthodontic adhesives is a multi-factorial phenomenon that could be explained in a model comprising hydrophobicity and the prevalence of oxygen- and nitrogen-rich components on the adhesive surfaces.
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123 THREE-DIMENSIONAL CHANGES IN THE POSITION OF UNOPPOSED MOLARS IN ADULTS
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AIM: Unopposed molars in adults over erupt to a different extent, but other movements (tipping and rotation) may also occur. The aim of this study was to examine, longitudinally, the changes in the three dimensions of the position of maxillary molars unopposed for more than 10 years in adults.

SUBJECTS AND METHOD: Twelve healthy mature adults (6 males, 6 females, mean age: 45 years 11 months) with unopposed molars were followed-up for at least 10 years (mean follow up time 10 years 7 months, SD: 16 months). Plaster casts were available from the beginning of the follow-up period and new casts were made at the last examination. In total the patients presented 22 unopposed maxillary molars and 14 posterior teeth with antagonists in both recordings. The later were used as controls, and there was at least one in each subject. After three-dimensional (3D) scanning of the plaster casts, the changes in the three dimensions of the centroid of the occlusal surface on the 3D models were measured.
RESULTS: Vertical displacement was found for 22 unopposed molars (median: 0.51 mm, range: 0.22-2.78 mm) and the controls (median: 0.30 mm, range: 0.19-1.13 mm). Unopposed teeth over erupted more than controls ($P = 0.03$). Palatal movement of the centroid was observed in both groups. For the unopposed teeth (median: 0.44 mm, range: 0.21-2.37 mm), it was significantly higher than in the control group (median: 0.30 mm, range: 0.19-0.73 mm) ($P = 0.03$). All teeth moved mesially nevertheless, a significant mesial displacement of unopposed molars occurred in the absence of a mesially adjacent tooth when compared with the respective controls ($P = 0.02$).
CONCLUSION: There is displacement of unopposed molars in the three dimensions in the long-term, although clinically insignificant in periodontally healthy teeth. This may be the result of late 'growth changes' and a consequence of an altered dental equilibrium following the loss of an antagonist tooth.

124 A TREATMENT DIFFICULTY INDEX FOR UNERUPTED MAXILLARY CANINES
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AIM: To produce a treatment difficulty index (TDI) that could be used to measure the difficulty expected during the alignment of an unerupted maxillary canine.
SUBJECTS AND METHOD: Fourteen consultant orthodontists assessed the pre-treatment records of 30 successfully treated subjects with an unerupted and impacted maxillary canine. Using the records, the consultants graded the perceived difficulty of aligning the impacted canine by allocating a score based on a scale from 1 (easy) to 5 (extremely difficult). The mean grade was calculated for each case. The examiners were also asked to select, from a list of 10 factors, up to four relating to the position of the canine that had contributed to the difficulty grading, and to place these factors in order of decreasing importance. A rank value from 4 (most important) to 1 (least important) was allocated to each factor according to its order in the list. The relationship between the grade and its contributory factors was examined using regression analysis, and weightings were derived for each factor. These weightings were then applied to each factor to produce a difficulty score total for each case.
RESULTS: Linear regression analysis of difficulty scores against consultant grades produced a R^2 value of 55 per cent, indicating a moderate level of agreement between the allocated difficulty grade and the calculated difficulty score.
CONCLUSION: Regression analysis indicated that the factors, in descending order of importance, that determine the difficulty of canine alignment are horizontal position, age of the patient, vertical height and bucco-palatal position. Treatment difficulty scores from the regression analysis showed moderate correlation with clinical judgements of a panel of 14 consultant orthodontists. A TDI could make a worthwhile contribution to treatment planning for impacted canines.

125 TRANSPOSITIONS: A CHALLENGE FOR THE ORTHODONTIST
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AIM: The literature on transpositions has focused on aetiology and epidemiology whereas treatment is only dealt with in case reports: correction of the anomaly is suggested only in few subjects, while acceptance of the transposition with 'camouflage' treatment or extraction of one or both involved teeth is the preferred approach. The purpose of this investigation was to demonstrate the results of an attempt to correct all the transpositions and to analyse the clinical results.
SUBJECTS AND METHOD: Six male and seven females aged 10-13 years, and one 52-year-old male. Nine patients presented with upper canine-premolar transposition and four with upper lateral-canine transposition. The treatment goal was to correct the transposition. A segmented appliance delivering the necessary force system was developed and used in 11 subjects.
RESULTS: For almost all patients the treatment goal was achieved with no significant detectable effect on the dentition or periodontium. In two subjects the transposed tooth was extracted because of periodontal reasons and dento-basal discrepancy. In one patient the transposition was accepted because the teeth had already been orthodontically aligned and correction of the anomaly would have been inappropriate from a cost-benefit point of view. All the patients, except one, were treated using bonded retainers. The remaining patient wore a removable retainer.
CONCLUSIONS: If the correct biomechanical system is applied, even these complicated problems can be solved with a treatment time within normal range and without having to accept a compromise.

126 A COMPARISON OF ORTHODONTIC PRIMERS USING DIFFERENT ENAMEL CONTAMINATION AFTER AGEING

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AIM: To verify the *in vitro* adhesion strength of light-cured composite resin (APC Plus) with three orthodontic primers (Transbond XT, MIP and SEP) in different environments (dry, soaked with water, and soaked with saliva) at 24 hours from bonding and after ageing.
MATERIALS AND METHOD: Two hundred and seventy incisor bovine teeth were prepared for bracket bonding (Victory series LP APC Plus). The samples were divided into 18 groups (n = 15). Conventional orthodontic primer (Transbond XT), hydrophilic primer (Transbond Moisture Insensitive Primer) and self-etching primer (Transbond Plus SEP) were used to assess the adhesion of the composite resin on dry, water-contaminated and saliva-contaminated enamel. After bonding the samples were stored in distilled water. A shear bond strength test was carried out to establish removal of the composite from the enamel after 24 hours (9 groups) and after thermocycling ageing (9 groups). Data was analyzed using the statistical software package, SPSS 11.0.
RESULTS: The best adhesion values were obtained for Transbond XT primer on dry enamel. For all orthodontic primers, dry enamel showed higher values compared with contaminated conditions, but statistically significant differences were found only for Transbond XT. No statistically significant difference was observed using the SEP as it showed similar results under all contaminated conditions. No statistically significant difference was observed between the groups after 24 hours and ageing for all conditions tested, suggesting that ageing does not seem to influence enamel adhesion.
CONCLUSIONS: Ageing does not influence the adhesive ability of orthodontic primers. The primers are more influenced by the nature of contamination of the enamel substrate. SEP was more efficient and showed more predictive results for all tested conditions.

127 SUCCESS RATE OF TITANIUM MINIPLATES UNDER ORTHODONTIC LOADING IN DOGS

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AIM: To evaluate the success rate of miniplates subjected to orthodontic forces in dogs.
MATERIALS AND METHOD: Eighty titanium miniplates designed for orthodontic anchorage (Surgitec, Brugge, Belgium) were inserted in the jaws of 10 male beagle dogs. In each quadrant, two miniplates were placed with two 5 mm screws. After surgery, the dogs were given antibiotics and anti-inflammatory drugs as well as a soft diet for 14 days. Two weeks after implantation, nickel-titanium coil springs generating a force of 125 g were fixed between the two miniplates of one upper quadrant and between those of the contralateral lower quadrant. The anchors of the other quadrants remained unloaded. The miniplates were brushed and checked 5 times a week during the loading period. The dogs were sacrificed 7 or 29 weeks after surgery.
RESULTS: All the dogs remained healthy during the experiment, without any loss of weight. Clinically, no or slight local inflammation was noted around the stable anchors, whereas inflammation was more important around the mobile miniplates. The total success rate, defined as the percentage of stable implants among the 80 miniplates, was 53 per cent. Mobility occurred on average 4.9 ± 2.8 weeks after surgery. The success rate was significantly higher ($P < 0.05$) for maxillary (70 per cent) than for mandibular (38 per cent) anchors, in the whole cohort as well as in the 7 or 29 week subgroups. No significant difference between loaded and unloaded miniplates was observed (57 versus 50 per cent, respectively).
CONCLUSION: The failure rate for mandibular miniplates was high, whereas maxillary ones showed a fair success rate. The success rate was not affected by loading. The degree of osseointegration will be quantified in future studies. These findings could be of clinical interest when miniplates are scheduled in orthodontic treatment.

128 CRANIOFACIAL FORM AND FUNCTION RELATED TO NASOPHARYNGEAL OBSTRUCTION

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AIM: To examine the effect of airway obstruction on craniofacial morphology in children with impaired nasal breathing, and to estimate the relationship between head posture and the position of the tongue and hyoid bone.
SUBJECTS AND METHOD: Fifty children (25 males, 25 females) with nasopharyngeal obstruction, between 8 and 14 years, were compared with a control group of 50 subjects without any respiratory problem, matched for age and gender. Lateral roentgenograms were obtained in a standing position with a natural head posture (Solow and Tallgren). Six angular and six linear variables were measured and analyzed: cranial base angle (NSBa), SNA, SNB, maxillo-mandibular plane angle (PP/MP), cranio-cervical angles (NS/OPT, NS/CVT), total and lower anterior face height (N-Me, PP-Me), distances

from the hyoid bone to the mandibular plane (hy-MP), to NS reference line (hy-NS), to the second cervical vertebra (hy-cv2ip), and the distance from the tongue to the palatal plane (dl-PP).
RESULTS: The craniofacial morphology of children with an obstructed upper airway showed bimaxillary retrusion (posterior positioning of the maxilla and mandible), a steeper PP/MP and increased total and lower face height. NSBa was significantly smaller and the length of the anterior cranial base was reduced, indicating a shortening of the antero-posterior dimension of the cranium and thus a more retruded face. A vertical elongation of the lower face with a retruded position of the chin was associated with a retruded position of the tongue. Hyoid position was found to be more inferior than normal in relation to the mandibular plane and SN reference line. The average cranio-cervical angles (NS/OPT, NS/CVT) were found to be extremely large, exceeding the average values in the control sample. A steeper PP/MP angle, palate-tongue distance (lowered tongue), and increased lower face height showed a positive correlation with an increased cranio-cervical angulation.
CONCLUSION: Postural change caused by impaired nasal breathing trigger changes in craniofacial form and function.

129 RECOMBINANT ADENO-ASSOCIATED VIRUS-MEDIATED GENE DELIVERY TO THE MANDIBULAR CONDYLE

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AIM: To investigate the expression of recombinant adeno-associated virus (rAAV) based vector mediated reporter gene (eGFP) in the temporomandibular joint.
MATERIALS AND METHOD: Sixty, 35 day old, female Sprague-Dawley rats were randomly divided into one experimental group, which was injected with rAAV-eGFP virus into both mandibular condyles, and a control group that received a phosphate buffered saline injection. Each group of rats was sacrificed on the following experimental days: 7, 14, 21, 30 and 60. *In situ* hybridization with WPRE probe was used to identify the localization of transgene, and total RNA was extracted from condylar cartilage and semi-quantitative RT-PCR was carried out to evaluate the transgene expression.
RESULTS: Using *in situ* hybridization and RT-PCR, EGFP expression was clearly detected in the deeper layer of the mandibular condyle as early as 7 days after injection, reaching a peak at 21 days and lasting for at least 60 days.
CONCLUSION: This is first study to confirm that rAAV mediated foreign genes can be transferred to mandibular condyles *in vivo*. It strongly suggests that rAAV gene delivery is a promising approach to induce some candidate genes to regulate mandibular condylar growth.

130 STABILIZATION SPLINT: EFFECT ON POSTURE IN TEMPOROMANDIBULAR DYSFUNCTION PATIENTS

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AIM: To evaluate the influence of a stabilization splint on posture in patients with temporomandibular dysfunction (TMD).
SUBJECTS AND METHOD: Ten patients (5 females, 5 males) with TMD. A stabilization splint with posterior contacts was constructed for each patient. To verify the static neuromuscular equilibrium of occlusion, electromyographic activity of the left and right temporal and masseter muscles was recorded and the activity (ratio between the activities of the temporal and masseter muscles) index was computed over a maximum voluntary clench test of 3 seconds. Muscular waveforms were also analysed computing a percentage overlapping coefficient (POC; an index of the symmetric distribution of the muscular activity determined by the occlusion) and a torque coefficient (TORS, to estimate the possible presence of a mandibular torquing). Once neuromuscular equilibrium was obtained, all patients underwent a postural examination using the Lizard postural platform. The analysis was made using the same conditions before and after splint therapy. Total electrical activity was measured immediately before and after splint insertion and the data compared using a paired Student's *t*-test.
RESULTS: Overall, the splint resulted in greater equality in electrical activity both between the left and right sides (larger symmetry in masseter and temporalis anterior muscles POC, $P < 0.05$) and the temporal and masseter muscles (activity index, $P < 0.05$) and between the right temporalis and left masseter, and left temporalis and right muscle couples (larger symmetry in TORS; $P < 0.05$). Data obtained with the postural platform, with or without the splint were not statistically different.
CONCLUSIONS: When masticatory muscle activity is equalised with a splint, there is no change in postural position.

131 A LONGITUDINAL STUDY OF SKELETAL EFFECTS INDUCED BY RAPID MAXILLARY EXPANSION

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AIM: To verify the long-term effects of rapid maxillary expansion (RME) on the vertical plane.

SUBJECTS AND METHOD: Thirty patients with maxillary constriction (20 females, 10 males, age range: 8-16 years) who underwent RME were compared with an untreated age-matched control group selected from the records of the University of Michigan Elementary and Secondary School Growth Study. Radiographs were taken at the start and end of treatment (average 2 years). To analyse variations in the maxillary vertical plane, the following angles were measured: S-Go/N-Me; Go-Gn/S-N; Ba-N/Pt-Gn; Fh/Go-Me; S-Go-Me; ANB; N-S-Gn and NL//Go-Me, and analysed with a paired Student's *t*-test.
RESULTS: The only angle in the RME group that showed a statistically significant difference was N-S-Gn ($P < 0.001$), indicating an increase in skeletal divergence. There were no significantly different variations in angles S-Go/N-Me; Go-Gn/S-N; S-Go-Gn; Ba-N/Pt-Gn; ANB; NL/Go-Me ($P > 0.05$). Using the same analysis and time period in the control group highlighted the statistically significant variations ($P < 0.05$) with a decrease of the angles that indicate a reduction in vertical skeletal growth.
CONCLUSIONS: RME does not cause changes in the vertical plane but when the data is compared with that of subjects who have not undergone treatment, an increase in the vertical skeletal dimension can be observed.

132 CALCIUM RELEASE FROM ENAMEL FOLLOWING EXPOSURE TO SOFT DRINKS AND FRUIT JUICES

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AIM: To investigate the effects of the consumption of Coca-Cola®, and cherry and apricot juice on etched and sealed enamel.
MATERIALS AND METHOD: Eighty teeth, each separated into four equal pieces. For the experiment, three pieces of each tooth were randomly selected and stored in Coca-Cola®, cherry or apricot juice. The remaining piece of tooth was immersed in artificial saliva and served as the control. After cleaning the enamel surface, the teeth were etched and sealed. A thermocycling apparatus was designed to simulate oral conditions and to keep the teeth in the drinks. The apparatus was used to keep the teeth in simulated saliva for 2 hours and in soft drinks at room temperature for 15 minutes, three times a day. After 5 days, the amount of enamel calcium release was measured by atomic absorption spectrophotometry.
RESULTS: The amount of calcium release into the drinks was statistically significant ($P < 0.001$). This was greatest for Coca-Cola® followed by cherry juice and then apricot juice.
CONCLUSION: Although the whole experiment was completed after 5 days, the amount of calcium release was significant. Patients undergoing orthodontic treatment should be advised to avoid the consumption of soft drinks and fruit juice.

133 LONG-TERM STABILITY OF COMBINED ORTHODONTIC-SURGICAL TREATMENT OF SKELETAL OPEN BITE SUBJECTS

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AIM: To study long-term skeletal and dentoalveolar stability, at least 15 years after surgical-orthodontic correction of a skeletal anterior open bite (AOB).
SUBJECTS AND METHOD: Ten patients (8 females, 2 males) with an AOB who had undergone orthodontic therapy in combination with bimaxillary surgery. All underwent Le Fort I osteotomies combined with bilateral sagittal split osteotomy (osteosynthesis with plates and screws in the maxilla and wire-osteosynthesis in the mandible). The cephalometric records of these patients were examined at different time points, i.e. at the start of the orthodontic treatment, and before, immediately after, shortly after (average 1.5 years), and after long-term (average 15 years) surgery. Index, ML-NL, NL-NSL, ML-NSL and overbite were evaluated.
RESULTS: AOB patients treated with orthodontics and bimaxillary surgery exhibit, 15 years after surgery, a neutral occlusion and good skeletal stability but with a slight change of inclination of the palatal plane compared with the situation pre-surgery.
CONCLUSION: In the long-term, orthodontic-surgical treatment with bimaxillary surgery is a good choice for correction of a skeletal open bite deformity.

134 SIZE REDUCTION OF MAXILLARY PERMANENT LATERAL INCISORS

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AIM: A reduction in tooth crown size can be an indication of future agenesis. A clinically diminutive size of the lateral incisors can impair aesthetics and can contribute to palatal impaction of permanent canines. The aim of this study was to determine the incidence of microdontia relative to maxillary lateral incisors.

MATERIALS AND METHOD: Two hundred and fifty eight diagnostic models of 159 girls and 89 boys, all with the permanent incisors fully erupted. Measurements of crown height and width were obtained with sliding callipers to the nearest 0.5 mm, and the results were analyzed statistically using a Chi-square test.
RESULTS: Narrow teeth with widths from 3.5 to 6.0 mm, were identified, with a frequency of 11.6 per cent in girls and 7.1 per cent in boys, but without a statistically significant difference between them. Asymmetry in crown width in contralateral teeth was more frequent in girls than in boys. In comparison with mandibular lateral incisor crown widths, maxillary laterals were narrower in approximately 25 per cent of the children, equally in boys and girls. On the basis of crown height, the teeth were classified as short (5-6.5 mm), average (7-8 mm) and long (8.5-11 mm). Statistical analysis confirmed significant difference in the prevalence of short teeth in girls and long teeth in boys.
CONCLUSIONS: There is a relatively frequent reduction in the size of maxillary lateral incisors. To improve anterior aesthetics, reconstruction of crown size is recommended after orthodontic preparation. In children with very narrow maxillary laterals, special attention should be paid to avoid palatal impaction of the neighbouring permanent canine.

135 TREATMENT DECISIONS IN ADULT CLASS III PATIENTS

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AIM: Orthodontic treatment, or orthognathic surgery with orthodontic therapy, are the options for the treatment of Class III malocclusions, and the decision is difficult, especially in borderline cases. The purpose of this study was to establish criteria for more precise decision making in subjects with a skeletal Class III malocclusion.
SUBJECTS AND METHOD: Seventy patients with skeletal Class III malocclusions. Two groups were formed: group 1 comprised 35 orthognathic surgery patients and group 2, 35 orthodontic patients. Pre-treatment lateral cephalograms were collected and 35 measurements (13 linear, 19 angular and three proportional) were undertaken by the same investigator. A forward stepwise method (likelihood ratio) with logistic regression analysis was performed.
RESULTS: The classification values were determined using a determinant function model including 97.1 per cent of the orthognathic surgery group and 94.3 per cent of the orthodontic group. Age, mandibular symphysis horizontal, S-Go/N-Me ratio, nasolabial angle, SNGoGN angle, distance between lower lip and the Steiner line, mandibular symphysis vertical and Go-Me length values were found to be statistically significant and the following formula was structured: $Z = -5{,}998 + 0.577 \times \text{age} - 1.058 \times (\text{mandibular symphysis horizontal}) - 0.314 \times (\text{ANB}) + 0.87 \times (\text{SNGoGn}) - 0.38 \times (\text{Go-Me}) = 0.04001$.
DISCUSSION AND CONCLUSION: According to the formula, if the Z value is less than 0.001 the patient could be treated successfully by orthodontic therapy. If the Z value is greater than the limit value then the patient should be treated orthognathically. The formula was derived from patients who required only mandibular surgery. It can be improved by including patients with underdeveloped maxillae and prognathic mandibles who require combined surgical treatment.

136 THREE-DIMENSIONAL CEPHALOMETRICS IN CRANIOFACIAL GROWTH ANALYSIS

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AIM: Ferrario *et al*.'s model of a computerized analysis of a mesh-diagram that offers a quick and independent quantification of the craniofacial form and dimension and of the soft tissues in three-dimensional (3D) space was used.
MATERIALS AND METHOD: The anthropometric charts of a group of 220 healthy children investigated for 5 years between the ages of 7 and 11 years were statistically analyzed to determine locational and variational indicators for 35 craniofacial and soft tissue parameters: six for vertical growth, seven for transverse craniofacial growth, eight for sagittal growth of the cranial base, maxilla and mandible, four for the width and height of the ear, and four for the soft tissues.
RESULTS: The average and variational limits obtained were used to create normal mesh-diagrams that allowed 3D comparative analyses of the parameters, differential analysis between genders and patient analysis for orthodontics, dentofacial orthopaedics and orthognathic surgery.
CONCLUSIONS: The method is superior to conventional cephalometrics that separately analyze linear and angular dimensions and the correlation between distances. The proportional relationship between facial structures can be evaluated; it is a 3D method that allows quantitative and qualitative evaluation with separate vectors in all three spatial co-ordinates which permits individualization of the structures that are most deviated from other 'normal' parts; it is non-invasive.

137 FACEMASK THERAPY WITH AND WITHOUT RAPID PALATAL EXPANSION: SOFT TISSUE ANALYSIS

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AIM: To evaluate and compare soft tissue changes with a facemask, with and without rapid palatal expansion (RPE).
SUBJECTS AND METHOD: Thirty-six Class III subjects (16 males, 20 females) were evaluated and separated into three groups: group 1 (n = 12, mean age 11.01 ± 1.38 year) treated with a facemask and RPE; group 2 (n = 12, mean age 10.04 ± 1.22 years) treated with only a facemask as described by Delaire, and group 3 (n = 12, mean age 9.86 ± 1.24 years) a control group of untreated individuals with a similar malocclusion. The study was carried out on lateral cephalograms taken pre- and post-facemask application for the treatment groups and pre- and post-observation for the control group. A Kruksal Wallis test was used for statistical analysis
RESULTS: When compared with the control group, H angle showed a significant increase in the treated groups ($P < 0.05$), but there was no significant difference between these groups. For both treatment groups, B-VP and Pg-VP moved backward, and soft tissue Si and PgS followed these points. While the lower jaw rotated backward, Ii-VP distance decreased and the lower incisors retroclined. For both treatment groups the upper lip came forward (Ls-Steiner S line; $P < 0.05$).
CONCLUSION: The concave profile in both treated groups became more balanced and both upper and lower lips showed good improvement.\

138 EFFECTS OF TWO FACEMASKS ON THE TEMPOROMANDIBULAR JOINTS USING THE MANDIBULAR POSITION INDICATOR METHOD
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AIM: Protraction headgear has been used to correct maxillary deficiency and/or mandibular prognathism. In general an orthopaedic force of 700-800 g is used to protract the maxilla with 70-75 per cent of the force transmitted to the temporomandibular joint (TMJ). The effect of this heavy intermittent force on the TMJ has not been investigated in detail. The aim of this study was to compare the effects of Delaire and Grummons protraction facemasks on the TMJ using a new articulator system (Amtech MG1) that has the ability to record condylar positions.
SUBJECTS AND METHOD: Eighteen patients treated with the Delaire facemask and 16 with the Grummons facemask. The observation periods were 8.5 and 10 months, respectively. Articulator mountings using the Amtech MG1 articulator and mandibular position indicator (MPI) recordings were obtained and evaluated before and after protraction facemask therapy.
RESULTS: MPI recordings of the sagittal plane revealed a forward and downward movement from centric relation to maximum intercuspal position of both condyles at the beginning of treatment for most of the patients. After treatment, the discrepancy between centric relation and maximum intercuspation was reduced, more in the Delaire group than in the Grummons group. However, more compression was observed in the Delaire group. At the end of treatment, no statistically significant changes were noted in either group in the transverse plane.
CONCLUSION: Evaluation of condylar position using the MPI method with the Amtech MG1 articulator provides valuable three-dimensional data in contrast to conventional two-dimensional imaging techniques.

139 EVALUATION OF UNITED KINGDOM POSTGRADUATE EDUCATION IN ORTHODONTICS
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AIM: Curriculum design undoubtedly affects the student experience with different curriculum framings resulting in students graduating with a range of perspectives, attitudes and competences (Biggs, 2002). Therefore, it was the intention of this research to focus on the process of curriculum design and implementation of the Joint Committee for Specialist Training in Dentistry, Specialist Advisory Committee in orthodontics curriculum in the MSc orthodontic programme in the United Kingdom (UK).
MATERIALS AND METHOD: The study was exploratory and descriptive based on a quantitative and qualitative approach. The findings reported are based on a survey of the postgraduate course leaders in each of the UK dental school (n = 15) and semi-structured interviews with some of the course leaders (n = 6). A pilot study (n = 3) was carried out to finalise the questionnaire prior to posting.
RESULTS: Responses were received from 13 course directors (87% of those approached). The findings revealed that there were similarities and differences between the academic orthodontic programmes. Regarding assessment methods, essays were the most commonly used method, but varied greatly amongst both institutes and modules. It was most frequently used in module 20 (fixed appliances) with six (46%) centres using this method. In terms of teaching techniques, tutorials were the most common method in modules 2 (facial growth) and 11 (diagnostic assessment, treatment, objectives and treatment planning). Surprisingly, some modules were not taught at all in some institutes: module 3 (physiology and pathophysiology of the stomatognathic system) in five (39%) centres, module 27 (psychology) in four (31%) and modules

37-44 to a varying degree. The results confirm that networking between institutes has become one of the unique strategic aspects of postgraduate orthodontic education in the UK, e.g. Greater London programme, North University Courses and similar scheme started in Scotland.
CONCLUSION: The different postgraduate orthodontic programmes are judged to be well into a process of design and development that reflects changes in knowledge, professional practice and individual needs. These are changes which impact on all curricula in the health care professions. One area that could receive greater coverage is the development of knowledge and skills in financial and human resource management.
Biggs J 2002 Aligning teaching and assessment to curriculum objectives. (http://www.ltsn.ac.uk/genericcentre/index.asp?id=17269)

140 EPIDEMIOLOGY OF TEMPOROMANDIBULAR DYSFUNCTION IN DENTAL STUDENTS

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AIM: To determine the epidemiology of temporomandibular dysfunction (TMD) in dental students.
SUBJECTS AND METHOD: A descriptive study was undertaken on 279 male and female students, 18 to 25 years of age. Sound, deviation and joint movement was examined during opening and closing of the jaw. Masticatory and neck muscles were assessed for pain. Maximum opening was recorded using digimatic callipers, less than 40 mm was considered for limited jaw opening. The time of onset, type, pattern and history of pain, ear ache, headache, premature contacts, tooth wear, missing teeth, bruxism, clenching, prominent restorations, prosthesis, type of occlusion, overbite, overjet, open bite and crossbite were recorded. Enhancing factors for TMD such as cold and hard food, and new dental treatments were studied. The prevalence of TMD was assessed at the 95 per cent level of confidence.
RESULTS: One hundred thirty students (46.5 per cent) had TMD (55.5 per cent female, 38.7 per cent male). The confidence interval was 41-52. The prevalence of clicking, pain and limited jaw movements (LJM) were 22, 12.2 and 4.7 per cent, respectively. A history of pain and other TMD symptoms was reported for a period of between 1 and 72 months. Ten per cent of males and 17.21 per cent of females with pain had 60 and 41.6 per cent premature contacts. For the students, 30.65 per cent with clicking showed 45.23 per cent premature contacts, 11.9 per cent an increased overjet, 4.75 per cent crossbite and 2.38 per cent an open bite and reversed overjet. For the 21.28 per cent of students with LJM, 30 per cent showed a deep overbite, 4.65 per cent an open bite and 2.35 per cent an anterior crossbite. For the 52.6 per cent of students with at least one TMD symptom, dental treatment was a predisposing factor to start TMD. Stress was an enhancing factor for 7.27 per cent to experience pain and 1.8 per cent clicking. Chewing hard food caused clicking in 11 per cent and pain in 5.5 per cent. Cold caused pain in 3.65 of the students with TMD.
CONCLUSIONS: There was a higher prevalence of TMD in females than in males. Pain was observed more often with premature contacts, LJM with a deep overbite and clicking with an increased overjet. Dental treatment was a predisposing factor for the onset of TMD.

141 SATISFACTION AND DISSATISFACTION AMONG PATIENTS THREE YEARS AFTER ORTHOGNATHIC SURGERY**

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AIM: To examine patients' responses to treatment involving orthognathic surgery, and identify factors that may cause dissatisfaction.
SUBJECTS AND METHOD: Seven hundred and forty-one patients monitored by the orthognathic surgery team at the University of Oslo between 1990 and 2002 and who attended a 3-year follow-up examination. Surgery was performed at the University Hospital in Oslo, and all patients had rigid fixation. In addition to clinical recordings, questionnaires were used to assess patients' attitudes to treatment.
RESULTS: Satisfaction with the result of treatment was reported by 93 per cent of the patients, and 87 per cent answered that they would have re-elected surgery. Significantly more females than males were dissatisfied (10 versus 3 per cent, $P < 0.001$). Dissatisfaction was reported significantly more frequently by patients undergoing mandibular advancement surgery compared with other surgical procedures (15 versus 4 per cent, $P < 0.001$), and among those reporting temporomandibular joint problems (26 versus 5 per cent, $P < 0.001$) and concern about impaired neurosensory function (10 versus 3 per cent, $P < 0.001$).
CONCLUSIONS: A high proportion of all patients expressed satisfaction with the result after orthognathic surgery. Mandibular advancement, however, resulted in an increase in the relative number of dissatisfied patients, and the associated factors identified in this research require further investigation.

142 THE EFFECT OF FLUORIDE VARNISH ON ENAMEL DECALCIFICATION ADJACENT TO BONDED BRACKETS

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AIM: To evaluate, *in vivo*, the effect of a fluoride varnish on enamel demineralization adjacent to bonded brackets.
SUBJECTS AND METHOD: Fifteen patients in whom one premolar was considered as the test tooth and other as the control. Brackets were bonded and T loops were engaged to all premolars, but only the test teeth were varnished. The teeth were extracted after 85-95 days and 50-70 μm thick buccolingual sections of the teeth were evaluated using polarized light microscopy. The mean depth of demineralization in each lesion was measured three times on photographs in a blind situation. The correlation coefficient of ×3 measuring was 97 per cent.
RESULTS: The mean lesion depth for the test teeth was 57.02 ± 5.51 μm and for the control teeth 94.35 ± 6.76 μm. There was a significant reduction in the depth of demineralization (approximately 40 per cent) in the test teeth ($P < 0.01$).
CONCLUSION: Fluoride varnishes can be beneficial as a preventive adjunct to reduce demineralization adjacent to brackets, particularly in patients with poor oral hygiene.

143 SUPPORTING DENTAL TISSUE CHANGES DURING ORTHODONTIC RELAPSE IN RAT MOLARS

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AIM: To investigate the remodelling of the alveolar bone and related periodontal (PDL) structures during orthodontic relapse processes in rat molars.
MATERIALS AND METHOD: Twenty-nine rat maxillary right first molars moved mesially by a fixed orthodontic appliance. Following 10 days of orthodontic tooth movement (OTM) all appliances were removed and five animals sacrificed. The remaining animals were then killed 1, 3, 5, 7, 14 and 21 days after appliance removal. Before demineralization, standardized radiographs of the right and left maxillary molars were taken. The jaws were sectioned and stained with haematoxylin and eosin and tartrate resistant alkaline phosphatase (TRAP). The dental supporting structures of the first, second and third molars were evaluated under a light microscope. The amount of OTM and the number of osteoclasts was registered and statistically analysed using one-way ANOVA.
RESULTS: One day after appliance removal, the first right maxillary molar relapsed almost 50 per cent of the achieved OTM at 10 days of active treatment. The molars steadily relapsed to 75 per cent of the achieved OTM at 21 days. The number of osteoclasts in the PDL of all three molars was highest at the end of active treatment and significantly and successively reduced during the relapse period. During the active period, osteoclasts were most numerous at the pressure, usually mesial, side of the PDL. After 7 days of relapse, a high number of TRAP-positive cells were registered at both the pressure and tension sides of all molars. After 14 days, these cells were concentrated in the distal parts of the PDL of all three maxillary right molars, and achieved a more even distribution at 21 days of relapse.
CONCLUSIONS: Remodelling of the PDL and alveolar bone is an important factor in the relapse processes of not only actively moved, but also adjacent teeth.

144 CLASS II DIVISION 2 MALOCCLUSIONS AND DEVELOPMENTAL DEFECTS OF THE DENTITION

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AIM: To detect signs of developmental instability of the dentition in patients with Class II division 2 malocclusions.
MATERIALS AND METHOD: The consecutively obtained records of 53 females and 44 males with a Class II division 2 malocclusion. The following developmental abnormalities of the teeth were recorded from the patient's dental casts and panoramic radiographs: hypo- or hyperdontia, tooth impaction or transposition, ankylosis of primary teeth, shape abnormalities such as taurodontism, small or peg-shaped upper lateral incisors, short roots, dilacerated or curvilinear roots.
RESULTS: Developmental instability of the dentition was detected in 74.2 per cent of the group. Missing upper lateral incisors were seen in 1 per cent, and supernumerary teeth in 5.1 per cent. Impaction of maxillary canines was observed in 12.6 per cent and taurodontism in 13.4 per cent. The prevalence of a combined small or peg-shaped upper lateral incisors reached 17.7 per cent. Short roots characterized 13.5 per cent of the sample while curvilinear roots existed in 38.1 per cent. Taurodontism and impacted maxillary canines were more prevalent in this study compared with orthodontic or army recruit samples ($P < 0.01$).
When compared specifically with the investigation of Basdra *et al.* (2000), this study showed a higher prevalence for taurodontism, impacted canines, supernumerary teeth ($P< 0.01$) but a lower prevalence for missing incisors ($P < 0.01$).

CONCLUSION: The high prevalence of dental aberrations in this Class II division 2 group supports the presumption of a genetic disturbance in the control of dentofacial development.
Basdra E K, Kiokpasoglou M, Stellzig A 2000 The Class II division 2 craniofacial type is associated with numerous congenital tooth anomalies. European Journal of Orthodontics 22: 529-535

145 ONE-STAGE REPAIR IN UNILATERAL CLEFT LIP AND PALATE CHILDREN

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AIM: To determine, retrospectively, the effect of a one-stage repair of the lip and palate on growth of the craniofacial structures in subjects with a unilateral cleft lip and palate (UCLP) compared with those with a normal craniofacial skeleton.
SUBJECTS AND METHOD: Twenty-three consecutive children [6 females, 17 males with an age range from 6 to 8 months at the time of surgery (mean = 7.1 months)] who presented with non-syndromic UCLP and underwent a one-stage closure of the lip and palate performed by the same surgeon. To minimize formation of granulation tissue and scarring, all soft tissues covering the palate were completely sutured during closure. No pre-operative orthodontics was performed. During the observation period only limited orthodontic treatment with removable appliances was carried out. The morphology of craniofacial structures was evaluated cephalometrically on lateral headfilms taken at 10 years of age. The measurements obtained were compared with age-matched normals.
RESULTS: Both the maxilla and mandible were smaller relative to the norm. The maxilla was on average 7.1 mm shorter (Ar-point A) and rotated anteriorly in comparison with the control group. The mandible was 7.5 mm shorter (Ar-Pog) and rotated posteriorly. The maxillo-mandibular relationship did not differ from the control group: ANB angle, Wits analysis and Mn-Mx length showed no statistically significant difference. Four children had a negative overjet ranging from –0.7 to –4.7 mm. Nineteen children had positive overjet ranging from 0.5 to 6.3 mm.
CONCLUSIONS: One-stage closure of the lip and the palate resulted in the development of a hypoplastic maxilla and mandible. However, the maxillo-mandibular relationship was satisfactory, with only four children out of 23 (17.4 per cent) having a reverse overjet.

146 EARLY AND IMMEDIATE ORTHODONTIC LOADING OF MINI-IMPLANTS FOR SKELETAL ANCHORAGE

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AIM: To determine the most suitable timing of orthodontic loading of titanium miniscrews to obtain rigid skeletal anchorage for tooth movements.
SUBJECTS AND MATERIAL: Four study groups were assessed. In 44 patients 84 mini-implants were inserted with a healing period of 4, 8, 12, 16 weeks, used for orthodontic anchorage from 8 to 12 months.
RESULTS: No differences among the 4, 8, 12, 16 loading periods were observed. No mini-screws loss, anchorage failure, or abutment loss occurred. Peri-implants and mucosal inflammations were noted in two patients who smoked.
CONCLUSIONS: If there is good quality bone and optimal oral hygiene, mini-implants are able to successfully resist relatively high forces and it is possible for them to be immediately loaded without waiting for osseointegration. The use of mini-implants produces a satisfactory result in a short period of time with two minimal surgical procedures, and enables insertion of an appliance in any aimed position.

147 DEFORMATION DOWN-REGULATES RANKL AND UP-REGULATES OSTEOPROTEGERIN BY CALVARIAL OSTEOBLASTS

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AIM: Mechanical stress is known to play a role in bone remodelling during orthodontic tooth movement and orthopaedic treatment. It has been suggested that osteoprotegerin (OPG) and receptor activator of nuclear factor-κB (RANKL) play important roles in the regulation of bone remodelling. However, their role in mediating mechanically induced bone remodelling is poorly understood. The aim of this study was to examine the response of murine osteoblasts in monolayer culture to intermittent tensile strain with respect to OPG and RANKL production.
MATERIALS AND METHOD: Neonatal mouse calvaria from Balb/c mice were dissected free from adherent soft tissue, washed in Ca^{2+}- and Mg^{2+}-free Tyrode's solution (10 minutes) and sequentially digested with 1 mg/ml trypsin. Released cells were cultured in F-12/ Dulbecco's modification of Eagle's medium, containing 20 per cent foetal calf serum and

antibiotics and grown to confluence at 37°C in a humidified atmosphere of 5 per cent CO_2/95 per cent air. After reaching confluence, the cells were detached and plated at a cell density of 10^4/dish in 3.5 cm Petriperm dishes and a tensile strain applied to the cells intermittently for 6 seconds every 90 seconds for 2, 24, 48, and 72 hours. Culture supernatants were stored and assayed for OPG and RANKL by enzyme-linked immunosorbent assays.
RESULTS: There was a down-regulation of RANKL from 2 to 24 hours, and an up-regulation of OPG from 24 to 48 hours by deformed cells compared with controls.
CONCLUSION: Mechanical deformation has significant and contrasting effects on RANKL and OPG production by murine osteoblasts, which suggests an important role for these cytokines in bone remodelling and orthodontic tooth movement.

148 IMPROVED NASAL AIRFLOW FOLLOWING RAPID MAXILLARY EXPANSION TREATMENT

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AIM: To prospectively investigate whether nasal airflow can be improved by only orthodontically achieved rapid maxillary expansion (RME).
SUBJECTS AND METHOD: Thirty-three children aged 8 to 14 years. For these children, a previous orthodontic clinical and technical examination had indicated the use of RME due to transverse constriction. A clinical history of habitual open mouth breathing was found for all these children. Prior to treatment with RME anterior rhinomanometry was applied. Directly after opening of the midpalatal suture (T1) a further rhinomanometric examination was performed. Other measurements were made directly after completion of sutural opening (T2) and 6 weeks subsequent to the placement of the appliance (T3). At this time the Hyrax screws had been passive for about four weeks and the mean opening value was approximately 5.2 mm transversally.
RESULTS: Comparison of the flow values (ccm per second at 150 MPa) as a parameter for the nasal air passage demonstrated significant differences before and after RME treatment. In 32 subjects air passage volume was improved (before treatment: MV = 831 ccm/s, SD = 104; after treatment MV = 924 ccm/s, SD = 74). These results were highly significant ($P < 0.001$). Even at opening of the midpalatal suture, a highly significant improvement of nasal airflow was measurable. Between T2 and T3 no significant difference was observed. The benefit of RME treatment concerning the flow rates was greater for patients with severe obstructive problems than for those with mild obstructive problems.
CONCLUSIONS: RME should not only be considered for orthodontic reasons, but also from an otorhinolaryngological point of view.

149 CHANGES IN RHINOPHARYNGEAL SPACE AFTER RAPID MAXILLARY EXPANSION

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AIM: To prospectively investigate whether changes occur in the rhinopharyngeal space following orthodontically achieved rapid maxillary expansion (RME).
SUBJECTS AND METHOD: Twenty-nine subjects between 8 and 19 years of age. A previous orthodontic examination suggested the use of RME due to transverse deficiency. A clinical history of habitual open mouth breathing could be found for all these children. Lateral cephalograms were obtained pre-treatment (T0) and one year later (T1). The radiographs were traced on acetate paper and the distances between the following points, suggested by Linder-Aronson, were measured: So, the middle between Sella (S) and Basion (Ba), ad1 [intersection of the posterior nasopharyngeal barrier and the pterygomaxillare (Pm)-basion line)] and ad2 (intersection of the posterior nasopharyngeal barrier and the Pm-So line). As physiological changes in growth of the lymphatic tissues have been observed at 12 years of age, two groups were formed: G1 (age <12 years) and G2 (age >12 years). The changes between T0 and T1 were compared in the two groups.
RESULTS: The distances, ad1-pm and ad2-pm, increased in both groups between T0 and T1 (ad1-Pm at T0: MV = 18.48 mm, SD = 5.67, at T1: MV = 20.45 mm, SD = 4.80; ad2-pm at T0: MV = 15.33 mm, SD = 4.38, at T1: MV = 16.97 mm, SD = 4.46). Both differences were highly significant ($P < 0.002$). There were no differences between the two groups except that the distance ad1-Pm did not increase in the older group during RME treatment.
CONCLUSIONS: Improved nasopharyngeal airflow seems to reduce adenoid constriction.

150 THE EFFECTS OF ORTHODONTIC FORCE ON CYTOKINES DURING CANINE DISTALIZATION

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AIM: The initial biological response to orthodontic force is characterized by secretion of local inflammatory mediators such as cytokines, prostoglandins and growth factors that are responsible for resorption and remodelling of local alveolar bone. The aim of this study was to determine the effects of different force levels on interleukin-1 beta (IL-1β) and interleukin-10 (IL-10) production in gingival crevicular fluid (GCF) during canine distalization.
SUBJECTS AND METHOD: Six adolescent patients all of whom underwent a session of professional oral hygiene treatment and received oral hygiene instruction. Orthodontic mechanics exerting a distalizing force of 75 g on the right (E1) and 150 g on the left (E2) side of each patient were used. GCF was collected from the mesial and distal sides of the canines as the test teeth and the central incisors as the controls before orthodontic appliance placement (T_0), and 24 (T_{24}) and 72 (T_{72}) hours after force application. IL-1β and IL-10 levels were evaluated by ELISA in all GCF samples.
RESULTS: The forces of 75 and 150 g did not have any significant effect on IL-1ß and IL-10 levels compared with the controls at T_{24} or T_{72}. However, at the distal side, IL-1ß levels showed an elevation both at E1 and E2 at T_{24} hours and then decreased at T_{72}. At the distal side at T_{24}, IL-10 levels increased for E2 but decreased for E1. At T_{72}, IL-10 levels reached the baseline levels for E2.
CONCLUSION: Immune competent cells in the periodontium play an important role in canine distalization by producing pro- and anti-inflammatory cytokines. The application of different force levels may lead to increased cellular response at the compression side.

151 SKELETAL DIFFERENCES BETWEEN PATIENTS WITH UNILATERAL CLEFT LIP AND PALATE TREATED WITH OR WITHOUT OSTEOPLASTY
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AIM: To determine if skeletal differences exist between juvenile patients with unilateral cleft lip and palate (UCLP) treated with and without a secondary osteoplasty and between these and subjects without a cleft.
SUBJECTS AND METHOD: Thirty-nine patients with UCLP (mean age 15.8 years) treated with (n = 21) and without (n = 18) a secondary osteoplasty were compared with a control group of patients without clefts (mean age 15.1 years, n = 21). Lateral radiographs were obtained and standard variables for the sagittal and vertical planes, as well as for incisor position and the soft tissues, were used in the cephalometric analysis.
RESULTS: No significant skeletal differences were found between either of the cleft groups. The main differences, compared with the control group, were a posteriorly positioned maxilla, a skeletal open bite, a retroclined position of the upper and lower incisors, and a flat mid face.
CONCLUSION: A secondary osteoplasty showed no remarkable influence on craniofacial growth of UCLP patients. Regarding the sagittal and vertical skeletal configuration, both patient cleft groups did not differ distinctly from each other. The known advantages of a secondary osteoplasia (e.g. positioning of teeth in the cleft area, stability of the dental arch) seem not to be opposed by inhibitory skeletal growth effects caused by this type of osteoplasty.

152 ELECTROMYOGRAPHIC CHANGES WITH MANDIBULAR ADVANCEMENT SPLINT THERAPY
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AIM: Obstructive sleep apnoea (OSA) has been described as a potentially life threatening breathing disorder characterised by the repeated collapse of the upper airway during sleep, with the cessation of breathing (Young *et al*., 2002). Mandibular advancement splints (MAS) are a recognised form of therapy for OSA. It has been postulated that the mechanism of action of oral appliances include: Anatomical: increased upper airway calibre and decreased upper airway compliance; Physiological: activation of upper airway dilator muscles (Ryan *et al*., 1991). There is limited evidence to support a physiological mode of action. The aim of this prospective cohort study was to evaluate the impact of MAS on the genioglossus (GG), geinohyoid (GH) or masseter muscle (MM) activity through electromyographic (EMG) investigation.
SUBJECTS AND METHOD: Fifty patients with a confirmed diagnosis of OSA. Ethical approval and informed consent was obtained. Each subject received a custom-made removable Herbst MAS appliance. EMG analysis of GG, GH and MM was performed at baseline (T1) and with the MAS *in situ* (T2). Bipolar surface electrodes in awake, upright subjects were used. The lower splint was modified to facilitate the placement of the intra-oral bipolar surface electrodes used to record GG EMG activity. Error of measurement was performed and showed good repeatability between analysis of the measurements.
RESULTS: There was a highly significant increase in EMG activity between T2 and T1 for all muscles investigated ($P <$ 0.001 for GH and MM and $P < 0.041$ for GG).
CONCLUSION: MAS appear to have a highly significant impact on GH, GG and MM activity. These findings reject the null hypothesis and provide evidence to support a physiological role to their action.

153 CORRELATION BETWEEN SAGITTAL MALOCCLUSIONS AND POSTURAL ANOMALIES

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AIM: To study the influence of posture on facial parameters in children with a sagittal malocclusion.
SUBJECTS AND METHOD: Sixty-two children (age range 6 to 12 years) with a sagittal malocclusion, 32 Class II and 30 Class III. Computer optical topography (COT) was used to diagnose postural and vertebral column anomalies. The results of cephalometrics and COT were used to determine whether a correlation existed between postural anomalies and anomalies of the parameters of the face.
RESULT: Patients with a Class II malocclusion predominantly showed sagittal postural anomalies while those with a Class III malocclusion demonstrated various degrees of scoliosis. The degree of lordosis, kyphosis and body posture influenced the size and position of the jaws, angulation of the teeth, dentoalveolar height and overjet. Patients with a Class III malocclusion showed a correlation between body posture and <Sum Björk (r = 0.81), <SNB (r = –0.59), A´-Snp (r = –0.62), Co-Go (r = –0.53) and overjet (r = –0.62). The Class II malocclusion subjects showed a correlation between body posture and <SNB (r = 0.81), Pg-Go (r = 0.66), kyphosis and <Sum Björk (r = –0.54), <SNA (r = 0.80), <SNB (r =0.77) and overjet (r = 71).

154 FACEMASK THERAPY WITH AND WITHOUT WITH RAPID PALATAL EXPANSION: SKELETAL AND DENTOALVEOLAR COMPARISON

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AIM: To compare skeletal and dentoalveolar changes after facemask therapy with and without rapid palatal expansion (RPE).
MATERIALS AND METHOD: Lateral cephalograms of 36 patients (16 males, 20 females) with Class III malocclusions were evaluated. The subjects were divided into three groups: group 1 (n = 12, mean age 11.01 ± 1.38 years) was treated with a facemask and RPE; group 2 (n = 12, mean age 10.04 ± 1.22 years) with only a facemask as described by Delaire, and group 3 (n = 12, mean age 9.86 ± 1.24 years) comprised the control group and consisted of untreated individuals with a similar malocclusion. The study was carried out on 72 lateral cephalograms taken pre- and post-facemask application for the treatment groups and pre- and post-observation for the control group. A Kruksal Wallis test was used for statistical analysis.
RESULTS: Sagittal discrepancy was decreased in both treatment group (ANB and Wits measurement), but the difference was not statistically significant ($P > 0.05$). There was a statistically significant difference in anterior face height parameters (N-ANS, ANS-Me and N-Me) between the treatment groups ($P < 0.05$). Total anterior face height increased more in group 2 than in group 1. The lower incisors were retruded 2.29 ± 3.6 mm in group 1 and 4.58 ± 1.68 mm in group 2, but the difference was not statistically significant ($P > 0.05$).
CONCLUSION: Whilst both treatment groups showed similar improvements in the sagittal plane, individual vertical growth should be carefully considered.

155 OCCLUSAL RELATIONSHIPS AND FUNCTIONAL STATUS IN THE PRIMARY AND MIXED DENTITIONS

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AIM: To analyse the causal relationship between static and dynamic functional disorders and occlusal findings.
SUBJECTS AND METHOD: Two orthodontists examined 3,041 children in the primary (DD; n = 766, mean age: 4.5 years) and early mixed (EMD; n = 2,275, mean age: 8.3 years) dentitions in a cross-sectional study. The anterior and posterior occlusal relationships were analysed. Thirty-seven functional tests were carried out to record open mouth posture, tongue position at rest, swallowing pattern, phonetics articulation, oral habits, etc. Statistical analysis was performed using Pearson's Chi square test ($P < 0.05$).
RESULTS: An increased maxillary overjet (>0 mm) was diagnosed in 46.5 per cent of DD. The increase in the EMD group was highly significant. A bilateral distal occlusion was found significantly more often ($P < 0.001$) in the EMD compared with the DD group (31.2 versus 25.9 per cent). The prevalence of unilateral and bilateral crossbites increased from DD to EMD (7 versus 12.6 per cent). An open mouth posture was found in 38.6 and 43.1 per cent of DD and EMD, respectively. Tongue thrust swallowing was diagnosed in 62 per cent of the entire sample. The prevalence of children with functional disorders increased significantly in the EMD group. The prevalence of functional disorders was significantly increased in children with maxillary overjets >2 mm, crossbites, open bites and Class III tendency malocclusions.

CONCLUSIONS: Functional disorders and occlusal relationships in DD and EMD are significantly related and determine prognosis for dental development. Taking into consideration occlusal relationships and functional status, the risk of abnormal dental development can be well defined.

156 LONG-TERM RESULTS OF MAXILLOFACIAL GROWTH FOLLOWING DISTRACTION OSTEOGENESIS

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AIM: To evaluate the influence of distraction osteogenesis (DO) and its long-term stability in adolescent patients with midface deficiencies and unilateral mandibular disorders.
SUBJECTS AND METHOD: Six adolescent patients with a cleft lip or palate and/or craniofacial syndromes (group A) and six patients suffering from hemifacial microsomia (group B). Photographs, lateral cephalograms and, in individual cases, three-dimensional computed tomograms were evaluated pre- (T1), post- (T2) and on average 22 month after removal of the distraction devices (T3). DO was carried out using enoral devices in group A, and intra- and extraoral devices in group B.
RESULTS: A mean improvement of the facial convexity of 16 degrees was observed in group A at T2 followed by a mesial decrease of 7.5 degrees at T3. SNA angle increased from 75.4 to 78.4 degrees during distraction. The mean increase in CD-A was 5.5 mm at T2 and 1.3 mm at T3. ANB angle changed, on average, from –4.7 (T1) to 0 (T2) to –0.9 (T3) degrees. In group B a mean prolongation of the ramus on the hypoplastic side to 6 mm was achieved at T2 but only 2 mm at T3. This resulted in an increase in facial asymmetry.
CONCLUSIONS: In subjects with midface DO, further growth of the maxilla can generally be expected within individual genetic limits. In patients with unilateral mandibular DO, good initial results were found, which corresponded with the harmonization in facial proportions. Individual long-term stability seems to be highly related to the severity of deformity of the temporomandibular joints and ramus.

157 MASTICATORY MUSCLE ACTIVATION VARIES WITH CHANGES OF BURST NUMBERS

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AIM: Muscle activation varies depending on the time of the day. The aim of this study was to investigate the mechanism responsible for this variation and to examine whether it differs between muscles, or changes with the level of neuromuscular activation.
MATERIALS AND METHOD: A fully-implantable four-channel radio-telemetry device was used in six adult male rabbits for continuous recording of long-term electromyograms (EMG) of the superficial and deep masseter, medial pterygoid and digastric muscles during normal daily activity. A detailed analysis of concurrent EMG recordings was performed to determine the relative duration of muscle activity (duty time), and numbers and lengths of bursts per hour in relation to multiple predefined levels of peak activity. The duty times were correlated with the numbers and the mean lengths of bursts in order to assess the relationships in the variations of these EMG variables.
RESULTS: Muscles differed significantly in duty times and burst numbers only at levels above 50 per cent of the peak-EMG, showing that, during concerted functional use the activation patterns of jaw muscles have marked similarities. Contrasting the large intraday variation of duty time and burst number, the mean burst length was relatively constant in each individual animal. It differed significantly, however, between animals suggesting inter-individual differences in habitual control of the motor system. The correlation between duty times and burst numbers was higher than between duty times and burst lengths. Moreover, it increased with rising activity levels, whereas the correlation between duty time and burst length decreased with increasing activity levels.
CONCLUSIONS: In rabbit masticatory muscles the variations in muscle activation are accomplished mainly by changes of the burst numbers rather than by alterations of the burst lengths. This mechanism varies with the level of neuromuscular activation.

158 PLACEMENT TORQUES FOR MINI-ANCHORAGE PINS DEPENDENT ON PILOT HOLE SIZE

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AIM: Orthodontic miniscrews are being increasingly used for anchorage during orthodontic treatment. The failure rate seems to depend on the initial stability at the time of insertion. The purpose of this experimental study was to determine the influence of pilot drill diameter, thickness of cortical bone and pin length on the placement torque of the temporary

orthodontic mini-anchorage system (tomas®). The aim was to develop helpful directions for the orthodontist to increase the initial stability of miniscrews.
MATERIALS AND METHOD: One hundred and eighty pieces of pig hipbone were prepared and divided into three groups of different cortical bone thickness (1.0, 1.5 and 2.0 mm). The bone was prepared with three pilot-drills (diameter: 1.0, 1.1 and 1.2 mm; length 8 and 10 mm) and one tomas® pin (diameter: 1.6 mm, length: 8 and 10 mm) for each bone was inserted manually. During pin insertion, the last 1.5 mm before the pin came into contact with the surface of the bone was analysed by a torque-measuring instrument (Dentaurum, Germany) and the placement torques were determined as a function of the angle of rotation.
RESULTS: Torques varied from 3 to 249 Nmm depending on bone quality and preparation: the thicker the cortical bone, the higher the torques and the dispersion of values. The values for the 10 mm pin were lower than 8 mm pin. There was no statistically significant difference using a drill with a diameter of 1.0 or 1.1 mm, while for the 1.2 mm drill diameter the values were the smallest in each cortical bone group.
CONCLUSION: The place of insertion and bone quality has a positive influence on the initial stability of miniscrews by choosing the correct pilot drill and pin length. The findings, however, are limited as the investigation carried out on pig-bone.

159 TREATMENT TIMING FOR FUNCTIONAL TREATMENT OF CLASS II DIVISION 1 MALOCCLUSIONS
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AIM: The effects of Class II division 1 activator treatment on dentofacial structures were evaluated considering three pubertal growth periods.
MATERIALS AND METHOD: Pre- and post-treatment lateral cephalograms and hand-wrist films of 36 individuals (group 1: 12 pre-pubertal, group 2: 12 pubertal and group 3: 12 post-pubertal) with a Class II division 1 malocclusion. Grouping was undertaken considering growth periods according to hand-wrist maturation criteria. All treatment was carried out using a conventional type Class II division 1 activator. Comparison of the skeletal and dentoalveolar responses of treatment between the groups was evaluated using analysis of variance (ANOVA) and Tukey tests.
RESULTS: The reduction in ANB angle was similar in all groups. A remarkable increase in lower posterior alveolar height was observed in group 2 (mean 2.4 mm). The largest reduction in overjet was also in group 2, which was significantly different from the other groups ($P < 0.01$). An increase in mandibular length (Co-Pg) was found in all groups, but this was not statistically significant. The subjects in group 2 showed the greatest increase in mandibular length (mean 4.8 mm).
CONCLUSION: The most appropriate time for functional treatment on dentofacial structures is during the maximum pubertal growth period.

160 COMPARISON OF TWO BONDING APPROACHES IN TERMS OF BOND STRENGTH
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AIM: To compare the shear bond strength (SBS) of the APC II adhesive coated appliance system with that of Transbond XT composite resin.
MATERIALS AND METHOD: Forty sound premolars, extracted for orthodontic reasons, and randomly divided into two equal groups. Each tooth was mounted vertically in a self-cure acrylic block so that the crown was exposed. The buccal enamel surfaces of the teeth were cleansed and polished with non-fluoridated pumice and rubber prophylactic cups, rinsed with water and dried in order to eliminate soft tissue remnants and calculus. A 37 per cent phosphoric acid gel was used for acid etching of the premolars for 15 seconds. In the APC group, the bonding procedure was performed according to the manufacturer's instructions using Transbond XT primer. In the Transbond XT group, Transbond XT primer was applied to the etched surface in a thin film, then, Transbond XT adhesive paste was applied to the bracket base. Following bracket placement, the adhesive was light cured from the mesial and distal for 10 seconds each (total time 20 seconds). The SBS test was performed with a universal testing machine.
RESULTS: The bond strength was found to be greater in the Transbond XT group than in the APC group.
CONCLUSION: Although the SBS value for the APC group was found to be smaller than that of the Transbond XT group, the APC II system has been proven to be timesaving and efficient for clinical use.

161 MICROARRAY ANALYSIS OF CHONDROGENIC GENES IN CONDYLAR CARTILAGE
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AIM: To investigate chondrogenic gene expression changes in mandibular condylar cartilage under mechanical strain.

MATERIALS AND METHOD: Two hundred and eighty, 35-day-old, female Sprague-Dawley rats randomly divided into seven experimental and seven control groups. The experimental groups were fitted with bite-jumping appliances. Each group of rats was killed on the following experimental days: 1, 3, 7, 9, 14, 30 and 33. Immediately after sacrifice, the condyles were dissected and total RNA was extracted to oligonucleotide microarray gene chips containing 15,923 genes. After a series of microarray data analyses, genes were excluded if absent across all time points in both groups. All genes that were either unchanged or whose expression was changed less than ×2 in relation to the control group were excluded from further analyses. This selection resulted in a net of 1,082 genes, 666 were increased in expression, and 416 decreased in expression, at least a two-fold changed. This group of genes was further analyzed using hierarchical clustering and self-organizing maps, and resulted in the identification of numerous genes not previously known to be regulated in condylar cartilage during chondrogenesis under mechanical strain.
RESULTS: Sixteen genes were involved in chondrogenesis. To focus on these genes that were more specific to chondrogenesis, the results were validated by both RT-PCR and immunostaining.
CONCLUSIONS: Using microarray technology to analyze the gene expression of mandibular condylar cartilage under mechanical strain, some chondrogenic regulating factors involved in condylar cartilage growth were identified.

162 DETECTION OF EROSIONS IN THE TEMPOROMANDIBULAR JOINT USING CONE-BEAM COMPUTED TOMOGRAPHY

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AIM: To investigate the occurrence of early radiographic changes in the temporomandibular joint (TMJ) using cone-beam computed tomography (CT), and to determine whether these are related to TMJ pain, inflammatory activity or plasma level of glutamate (GLU) in early rheumatoid arthritis (RA). The radiographic sign of erosion is generally considered to be an indicator of active bone destruction in rheumatic diseases. Radiographic involvement of the TMJ occurs in 45-71 per cent of RA patients but very little is known about how early such changes appear. In addition, the relationship of these changes to pain, inflammatory activity and the excitatory amino acid GLU in early RA is unknown. GLU is an agonist for the pain-mediating NMDA receptor, which also is involved in modulating osteoclast activity.
SUBJECTS AND METHOD: This study comprised patients with RA diagnosed within 6 months. The extent of radiographic signs of bone erosion in the TMJ were recorded semi-quantitatively (score 0-24), using cone-beam CT (New Tom). TMJ pain intensity was determined on a numeric rating scale. Systemic inflammatory activity was assessed by the inflammatory markers erythrocyte sedimentation rate and C-reactive protein. The GLU levels were analysed in plasma. Median and inter-quartile ranges were used for descriptive statistics.
RESULTS: The majority of the patients showed erosions in the TMJ without pain. Erosions and inflammatory markers co-existed. GLU levels did not show any apparent relationship with early bone tissue changes, but patients that showed erosions and pain had high levels of GLU.
CONCLUSIONS: The preliminary results of this study suggest that erosive radiographic signs in the TMJ are common and occur early in patients with RA. These changes seem to be related to systemic inflammatory activity rather than to TMJ pain or GLU.

163 THE NASO-OROPHARYNGEAL AIRWAY DURING PUBERTY IN SKELETAL CLASS II SUBJECTS

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AIM: To evaluate naso-oropharyngeal airway dimensions in skeletal Class II division 1 and division 2 subjects (ANB >5 degrees) during the pubertal growth period.
MATERIALS AND METHOD: Sixty-seven lateral cephalograms obtained from 15 pre-pubertal, 15 pubertal and 15 post-pubertal Class II division 1 and 10 pre-pubertal, five pubertal and seven post-pubertal, Class II division 2 subjects requesting orthodontic treatment. Naso-oropharyngeal and craniofacial measurements were carried out using the Pordios computer program. The means and standard deviations were calculated and variance analysis and Duncan's test were used to compare the differences between the groups.
RESULTS: The pre-pubertal group demonstrated the narrowest naso-oropharyngeal airway space both in the Class II division 1 (21.3 ± 5.1 mm) and Class II division 2 (21.2 ± 4.6 mm) groups, which showed a statistically significant increase towards the post-pubertal group (up to 26.6 ± 4.4 mm and 27.6 ± 3.6 mm, respectively) ($P < 0.05$). On the other hand, oropharyngeal airway space, which was measured at the level of the tip of the soft palate was 10.1 ± 2.7 mm, 8.1 ± 2.3 mm and 8.8 ± 2.2 mm in the Class II division 1 subjects and 9.1 ± 2.9 mm, 9.4 ± 1.2 mm and 9.3 ± 2.0 mm in the Class II division 2 group. The epiglottis did not show a statistically significant difference during the pubertal growth periods in either group.

CONCLUSION: Oropharyngeal airway space remains almost steady, while nasopharyngeal airway space increases during the pubertal growth periods in Class II division 1 and 2 subjects.

164 THREE-DIMENSIONAL EVALUATION OF SURGICALLY ASSISTED IMPLANT BONE-BORNE RAPID MAXILLARY EXPANSION

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AIM: To analyse, three-dimensionally, the changes in tooth position, alveolar processes and skeletal structures caused by bone-borne implant-supported rapid maxillary expansion following the distraction method Dresden (DMD), in comparison with tooth-borne expansion methods.
SUBJECTS AND METHOD: Ten patients, mean age 25.3 years, treated with DMD examined by axial computer tomography before and 9 months after expansion. Anatomical reference points at the cranial base as right and left auditory external superior meatus, right and left foramina spinosa and foramen magnum created reference planes and the triple-zero-point ELSA (Lagravere *et al*., 2005). Distances in all three dimensions were calculated for 38 points according to ELSA.
RESULTS: The Hyrax screw was expanded 7.25 mm, increasing the transverse diameter of the alveolar crest by 7.52 mm in the premolar region and by 7.17 mm in the molar region, causing 11.3 and 11.1 degrees, respectively, of buccal tipping. The lower dental tipping of the premolars (3.5 degrees) and molars (3 degrees) resulted in an increase in width of 6.72 and 6.44 mm, respectively. The dental arch showed a V-shape, indicating tooth protection. These findings are contrary to previous studies. If forces are transferred via teeth the progressive increase of skeletal resistance from an anterior to a posterior direction leads to dental tipping.
CONCLUSIONS: DMD is a suitable minimal invasive tooth-independent bone-borne expansion method, protecting teeth and causing skeletal as well as dental effects with less tipping, a pre-condition for stable post-surgical occlusion.

165 CROSSBITE IN PREMATURELY BORN CHILDREN

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AIM: To examine the possible influence of premature birth on the prevalence of crossbite.
SUBJECTS AND METHOD: Three hundred and thirty one prematurely born (<37 gestational weeks) Caucasian and Afro-American children and 1,780 control children, who participated in the Collaborative Perinatal Project (USA) in the 1960's and 1970's. Dental examinations were carried out cross-sectionally, with dental casts made in a standardized fashion at 6-12 years of age. The arch dimensions and occlusal variables, including crossbite, were recorded by examining and measuring the hard stone casts using a modified version of the methods of Björk *et al*. (1964) and Laine and Alvesalo (1986). The premature and comparison groups were divided by gender and race. Statistical analysis was carried out using Chi-square analysis.
RESULTS: Significant differences in the prevalence of crossbite were found between the gender and ethnic groups and between the premature and control groups. Afro-Americans had significantly more crossbites than Caucasians ($P < 0.04$). The prevalence of a posterior crossbite was significantly increased in girls compared with boys ($P < 0.002$). The premature children had significantly more posterior crossbites than the controls ($P < 0.03$). The prevalence of an anterior crossbite was also increased in premature children, but the result was not statistically significant.
CONCLUSIONS: Prematurely born children may be more predisposed to aetiological factors for the development of a crossbite, respiratory infections, other medical problems, mouth breathing and oral habits.

166 ASYMMETRIC MASTOID PROCESSES IN JAW DEFORMITY PATIENTS WITH MANDIBULAR DEVIATION

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AIM: The sternocleidomastoid muscle, which is the largest muscle among the lateral cervical muscles and runs from the sternum and clavicle to the mastoid process and the occipital region of the head, not only acts during bilateral circling and antero-posterior flexion of the head region, but also has a continuous kinetic function to retain the position of the head. In this study, focusing on the mastoid process at the insertion of the sternocleidomastoid muscle, differences between the amount of mandibular deviation and the position of the mastoid processes were investigated using three-dimensional computed tomography (3D-CT).

SUBJECTS AND METHOD: The subjects were jaw deformity patients with mandibular deviation. 3D-CT images were taken and processed. Horizontal, frontal and median reference plane were defined. Measuring the data obtained, the ratios of the vertical distance from the reference plane to the bilateral mastoid processes, the antero-posterior minimum distance, and the right-left minimum distance were calculated. Furthermore, the mandibular deviation angle in the external cranial basal view was measured. Correlation and multiple regression analyses were performed on the data.
RESULTS: Correlation analysis: the mandibular deviation angle showed a significant correlation with the vertical ratio of the bilateral mastoid processes ($P < 0.01$). Multiple regression analysis: a multiple regression equation suggesting a significant correlation between the mandibular deviation angle and the vertical and right-left ratios of the bilateral mastoid processes was obtained.
CONCLUSIONS: The vertical distance became larger in the mastoid process on the deviated than on the non-deviated side with the increase in the amount of mandibular deviation in jaw deformity patients.

167 ANALYSIS OF SUTURAL STRAIN IN MAXILLARY PROTRACTION THERAPY

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AIM: To examine the strain in the sutures of the midface and cranial base with maxillary protraction therapy, and to clarify whether such stretching suggests a skeletal effect of the apparatus employed for that purpose.
MATERIALS AND METHOD: Using a finite element model, maxillary protraction therapy was simulated with various force levels and vectors and the strains appearing at the sutures (μstrain) were measured at the midface and cranial base. The simulation model employed consisted of 53,555 individual elements, the simulated forces were 2×3 N and 2×5 N, while the vectors of the applied forces were in an anterior and anterior-caudal direction.
RESULTS: The maximum measured strains were, on average, below 10 μstrain, while higher values were only measured at the nasal bone and at cranial base at the oval and spinous foramina with anterior directed force vectors (26.4 μstrain). With an anterior-caudal force vector, the measured values were usually lower.
CONCLUSIONS: The measured strains were on average approximately one hundredfold lower than the Frost thresholds (2000 μstrain). Even when assuming that growing bone reacts more sensitively to strain, it does not seem probable that the strains occurring with maxillary protraction therapy are sufficient to stimulate any additional bone growth. The good clinical efficacy of maxillary protraction therapy is apparently based, for the most part, on dental effects while its skeletal effects still remain doubtful.

168 EVALUATION OF NEW GENERATION SELF-ETCHING ADHESIVES FOR ORTHODONTIC USE

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AIM: To determine the suitability of new generation self-etching adhesives for bracket bonding. Shear bond strength (SBS) was evaluated for Clearfil Protect Bond, Clearfil SE Bond, Clearfil S3 Bond, Xeno III, Adhese, iBond and Experimental Bond and compared with the orthodontic bonding agents, Transbond XT Primer used with the total etch technique, and Transbond SE Primer.
MATERIALS AND METHOD: Bovine incisors were embedded into Alpha Die Top. All adhesives were applied on flat, pumiced enamel surfaces and light cured. The upper left incisor edgewise bracket (Ultratrimm) was bonded using Transbond XT composite. A thin composite layer was ensured and excess material was removed. The Transbond XT was light cured, 20 seconds each, from the occlusal and gingival using an Elipar Trilight device (800 mW/cm²). The light probe was positioned at 45 degrees and 5 mm from the bracket. The specimens were stored in distilled water for 24 hours before measuring SBS. For all specimens, the Adhesive Remnant Index (ARI) was assessed and a *t*-test was used for statistical analysis.
RESULTS: The findings were: Transbond SE Primer 19.9 ± 4.5, Clearfil SE Bond 16.5 ± 2.9, Xeno III 16.3 ± 4.3, Clearfil Protect Bond 16.1 ± 4.5, Adhese 15.7 ± 4.0, Clearfil S3 Bond 14.4 ± 5.1, iBond 8.5 ± 2.4 and Experimental Bond 7.3 ± 2.2. Transbond XT Primer, used with the total etch technique, achieved the highest SBS (21.0 ± 5.2), followed by Transbond SE Primer. Both were significantly ($P < 0.05$) above the other materials tested. All other materials did not differ significantly except for iBond and Experimental Bond. Nevertheless iBond showed results above the minimum value required for sufficient bracket adhesion.
CONCLUSION: Most self-etching adhesives were able to reach SBS data slightly below those obtained with established phosphoric acid etching products, but clearly above the minimum for bracket bonding. The SBS of all tested self-etching products (without experimental bond) allows application for orthodontic use. Further evaluations are required to investigate the micro-enamel structure after debonding.

169 MATHEMATICAL MODELLING OF ORTHODONTIC TOOTH EXTRACTION AND NON-EXTRACTION DECISIONS

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AIM: To develop an optimal decision-making model for orthodontic tooth extraction.
SUBJECTS AND METHOD: Fifty orthodontic patients with a reduction in Peer Assessment Rating index score greater than 70 per cent between pre- and post-treatment (age: 10 years 11 months to 26 years 10 months, mean: 18 years 6 months). Thirty-eight were Skeletal I and 12 Skeletal II. They were classified into two categories; i.e. extraction (n = 33) and non-extraction (n = 17) according to the actual treatment. From their pre-treatment records, 16 orthodontic measurements were obtained from three-dimensional digital dental cast data using a non-contact laser-scanning method (Surflacer VMS150R-D, Unisn Inc., Osaka). Nine orthodontic indices were obtained from cephalograms. Each orthodontic measurement was transformed into candidates for vector elements (CVEs) by a non-linear transformation function that was developed on the basis of the expert knowledge. The 255 combinations of CVEs were arbitrarily selected to optimize vector representation. In a vector representation space, template matching was carried out to determine a system output. Each vector was utilized as an input, while the remaining 49 vectors as templates in a performance test, resulting in 50 inputs. When the system output coincided with the category of an input, it was assigned to 'succeeded'. By calculating the rate of coincidence in each vector representation, the model was optimized.
RESULTS: The rate of coincidence of the optimized model was 86 per cent.
CONCLUSIONS: The model developed for extraction and non-extraction treatment decision-making was found to be reliable for possible clinical use.

170 INFLUENCE OF POSTURE ON TONGUE MOVEMENT DURING SPEAKING SEQUENCES

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AIM: It is important to examine tongue movements more closely to clarify the aetiological significance of orofacial malfunctions for malocclusions and speech disorders. The aim of this study was to analyse the influence of posture on the movement of the tongue during speaking sequences using electromagnetic articulography to find objective parameters for the diagnosis of tongue thrust.
SUBJECTS AND METHOD: Tongue movements were measured in 25 adults without any orthodontic or functional deviation, using an electromagnetic articulograph developed at the University of Tübingen. The subjects were monitored during 10 repetitions of a German sentence with the target utterance 'ta'-consonant-'at' in the middle. Six different types of target utterances were used (tasat, taschat, tatat, talat, tanat, takat). The records were taken during two different postures (upright, relaxed). Three receiving coils, one at the tip of the tongue and the others 2 and 4 cm further dorsal, were adhered in place. Tongue movement during these utterances was analysed according to geometric and time variables. Therefore, the target utterances were divided into four sections (t-a, a-consonant, consonant-a, a-t).
RESULTS: All types of utterances showed that the two /t/s were suitable markers for analysis. However each /t/ was spoken with a different tongue position. The maximum of the amplitude of the vowel /a/ corresponded with the most inferior position of the tongue. The dimensions of the four sections were dependent on the type of utterance and the posture during recording. The dimensions of the distances of all types of utterance were significantly larger when speaking in an upright posture than in a relaxed position.
CONCLUSION: Posture influences the dimension of articulatory movements. Thus the opportunity arises for an objective diagnosis of tongue thrust by electromagnetic articulography.

171 BACTERAEMIA AFTER TOOTH BRUSHING IN ORTHODONTIC PATIENTS

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AIM: To investigate the occurrence of bacteraemia after tooth brushing in orthodontic patients following the use of 0.2 per cent chlorhexidine gluconate mouthwash, antimicrobial toothpaste, and normal toothpaste.
SUBJECTS AND METHOD: Forty healthy adult patients with fixed appliances and good oral hygiene divided into four equal groups. For group 1 bacteraemia was measured after tooth brushing without any toothpaste. In group 2, 0.2 per cent chlorhexidine gluconate mouth rinse was used before brushing with no toothpaste. The subjects in group 3 brushed with a toothpaste commonly used in Turkey, while in group 4, an antimicrobial toothpaste was used. Pre- and post- brushing blood

samples were obtained using a strict aseptic technique; the post-brushing blood samples were taken within 2 minutes after brushing. All samples were microbiologically evaluated using blood culture bottles.
RESULTS: All samples taken before brushing were negative for bacteria. In the control group, post-brushing bacteraemia was detected in 20 per cent of the group. In group 2, no bacteraemia was detected after brushing. Bacteraemia after brushing was not found in group 4. In the normal toothpaste group, there was a 20 per cent prevalence of bacteraemia after brushing.
CONCLUSION: Application of 0.2 per cent chlorhexidine mouthwash and the use of antimicrobial toothpaste results in a decrease in the prevalence of bacteraemia after tooth brushing in orthodontic patients, but this is not statistically significant. Brushing with normal toothpaste had the same effect as brushing with no toothpaste on the prevalence of bacteraemia.

172 IMPROVEMENT OF THE OCCLUSION AFTER ORTHOGNATHIC TREATMENT

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AIM: To evaluate the effect of surgical-orthodontic treatment on the occlusion measured by the Peer Assessment Rating (PAR) index, and to test the repeatability of the PAR index.
SUBJECTS AND METHOD: Fifty-three females and 29 males who underwent bilateral sagittal split osteotomy (BSSO) between 1998 and 2004. Sixty-four subjects had advancement, and 18 a setback of the mandible. The mean age of the subjects was 32 years (range 16-53 years). The improvement in occlusion was assessed by comparing baseline and post-retention dental casts using the PAR index. Multiple regression analysis was used to estimate the associations between reduction of the PAR index (pre-treatment minus post-treatment index score) and direction and amount of the BSSO. The effects of age and gender were also considered. Intra-examiner reproducibility of the PAR index was assessed using intraclass correlation coefficients (ICC).
RESULTS: PAR score reduced significantly as a result of treatment. When the results were expressed in terms of treatment outcome, 69 per cent of the patients were allocated to the 'greatly improved' group, 31 per cent to the 'improved' group, while no cases were classified as 'worse or no different'. Multiple regression analysis showed that improvement in the PAR score was most remarkable in subjects with mandibular setback. The values of the ICC were high for most of the measurements, ranging from 0.79 to 0.96. Only for buccal occlusion was the value weak ($r = 0.44$).
CONCLUSIONS: Orthognathic treatment significantly improved the patients' occlusions. Especially in subjects with mandibular hyperplasia/prognathia the treatment was highly beneficial. In the analysis, the buccal segments of occlusion proved to be difficult to assess and repeat using the PAR index, most likely because of some missing posterior teeth in the present sample.

173 NO RELATIONSHIP BETWEEN POSTERIOR CROSSBITE AND TEMPOROMANDIBULAR JOINT DISC DISPLACEMENT

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AIM: A unilateral posterior crossbite has been considered as a risk factor for temporomandibular joint (TMJ) clicking, with conflicting findings. The aim of the present study was to investigate a possible relationship between posterior crossbite and TMJ disc displacement, in a large sample of subjects.
SUBJECTS AND METHOD: Young adolescents were recruited using population-based sampling. The sample included 1291 subjects (708 males, 583 females) with a mean age (± SD) of 12.3 ± 1.1 years. All subjects underwent an orthodontic and functional TMJ examination performed by two independent examiners.
RESULTS: A unilateral posterior crossbite was found in 175 (13.6 per cent) of the subjects. Fifty-three (4.1 per cent) were diagnosed as having anterior disc displacement of the TMJ. Chi-square testing and logistic regression analysis failed to reveal a significant association ($P > 0.05$) between unilateral posterior crossbite and TMJ disc displacement (OR = 1.14).
CONCLUSIONS: A posterior unilateral crossbite does not appear to be an important risk factor for joint clicking, at least in young adolescents.

174 IMPLANTATION OF COLLAGEN SCAFFOLDS IN THE PALATE AND THE SKIN

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AIM: Cleft palate surgery often leaves open wounds on the palate due to a shortage of tissue. The healing of these wounds impairs dento-maxillary development by contraction and scarring. The implantation of suitable scaffolds might reduce

contraction and scarring, and thus prevent growth disturbances. The aim of this study was to evaluate the tissue reaction to collagen scaffolds after implantation in the palate and the skin.
MATERIALS AND METHOD: Scaffolds (Ø 3 mm) composed of cross-linked collagen were implanted submucosally on the palate, and subcutaneously on the skulls and backs of 25 rats. Groups of five rats were killed at 1, 2, 4, 8, and 16 weeks. Tissue samples containing the implants were processed for histology. Sections were stained with haematoxylin and eosin and with antibodies against leucocytes (ED1), myofibroblasts (anti-ASMA), and blood vessels (anti-col IV). The inflammatory response, the ingrowth of cells (especially myofibroblasts), the formation of new blood vessels, and the degradation of the matrices were investigated.
RESULTS: One week after implantation, ingrowth of cells had started and a mild inflammatory response was observed around the scaffolds, which ceased after four weeks. Only on the skin on the back did a stronger inflammatory response occur. The ingrowth of blood vessels started after two weeks. After four weeks, the matrices were completely populated by host cells, and resorption had started. Myofibroblasts appeared in the scaffolds after one week, increased up to two weeks, but had disappeared again after four weeks. Far more myofibroblasts were present in the palatal wounds than in the skin wounds.
CONCLUSIONS: The scaffolds were well tolerated in the palate and the skin. Distinct differences were found in tissue reaction, which might be related to the mechanical conditions. Collagen scaffolds might be used to deliver growth factors into palatal wounds to reduce scarring.

175 MINISCREWS AND SKELETAL ANCHORAGE IN ORTHODONTICS – A REVIEW

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AIM: To review the current literature on skeletal anchorage with regard to failure and success rates.
MATERIALS AND METHOD: Literature searches were conducted for the period 1966 to 2005 (Medline, Pubmed and Cochrane Collaboration) of animal and human studies dealing with skeletal anchorage used for orthodontic treatment. Publications presented in abstract form, and case reports were not included. For osseointegrated orthodontic implants, the search revealed 20 articles on animal, and seven on human studies. There where a further three animal studies and seven human studies on min-screws, and two animal and seven human studies on miniplates.
RESULTS: Despite the species difference and small numbers involved, the conclusion in animal studies was that mid-palatal implants were reliable anchorage devices, showing a 73-100 per cent success. According to these criteria, in human clinical studies a success rate varying from 84 to 100 per cent was reported. Few long-term studies on miniscrews were found, but from analysis of the animal data, the success rate varied from 87 to 100 per cent. This was similar in human clinical trails (75-100 per cent success) for miniscrews inserted through attached buccal and palatal mucosa, although a high failure rate was reported in non-keratinized mucosa. Miniplates showed a 100 per cent success in the animal studies reviewed, and this high success rate was also seen in human clinical studies (85-100 per cent).
CONCLUSION: Miniscrews loaded immediately after insertion (up to 4 N) provides a satisfactory method of anchorage control. Delayed loaded anchorage devices (mid-palatal and bone plate implants) seem less likely to fail, but no firm conclusions could be drawn between the two systems from the current surveyed literature. Failure occurred due to peri-implant infection, loosening and eventual loss.

176 TREATMENT RESULTS AND STABILITY IN CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To analyze treatment results and long-term post-treatment changes in Angle Class II division 1 subjects, and to compare patients with and without prolonged retention.
MATERIALS AND METHOD: Plaster study models and lateral cephalograms of 26 successfully treated orthodontic patients (13 males, 13 females) with an Angle Class II division 1 malocclusion. Records were obtained at three stages: before treatment (T1), at the end of active treatment (T2) and, on average, 17.7 years after the end of active treatment (T3). At T3, 18 of the patients had not worn a fixed or removable retention appliances for at least 7 years (mean: 14.7, SD: ± 4.2, range: 7.0-21.2 years). In eight patients a lower lingual fixed retainer was still in place, so two subgroups were established a no retainer (NR) and a retainer (R) group.
RESULTS: Changes (T1-T3), whole sample: Overjet reduction: 3.3 mm (58 per cent); overbite reduction: 1.9 mm (49 per cent). Space conditions: No changes in lower incisor alignment but changes towards spacing in the upper anterior segment. Significant cephalometric changes: SNA and ANB reduction of 2.0 and 2.8 degrees, respectively. Significant changes

between the NR and R groups: Overbite reduction: 3.4 mm (87 per cent) and 1.2 mm (30 per cent), respectively. Space conditions at T3: Lower jaw: –0.1 mm in the R group and –1.6 mm in the NR group.
CONCLUSION: As registered at T3, the stability of a good treatment result was in general acceptable. Significant differences in long-term stability as regards crowding in the lower incisor segment were found between subjects with a fixed retainer and those where the retention had been discontinued earlier. A lingual lower retainer gave a more stable result regarding overbite and lower anterior crowding.

177 LONG-TERM EFFECT OF ORTHODONTIC TREATMENT ON DENTAL HEALTH

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AIMS: To assess the long-term effect of orthodontic treatment on dental health by scoring the number of restored surfaces on dental pantomograms (DPTs).
SUBJECTS AND METHOD: In this retrospective study, 133 patients were selected from a sample of 800 subjects who finished active orthodontic treatment between 1972 and 1991. The selection criteria were: availability of a DPT at the end of active treatment and a second DPT at least 3 years after the end of retention, at least 10 years after the end of active treatment. Two subgroups were defined: group 1 with a time span of 10 to 20 years between the two DPTs [n = 75, M/F ratio 24/51, mean age 30 years, (range 23-40 years)] and group 2 with a time span over 20 years between the two DPTs [n = 57, M/F ratio 19/38, mean age 39 years, (range 33-47 years)]. The untreated control group consisted of individuals who sought orthodontic treatment at an adult age with similar malocclusions as the treated group [n = 40, M/F ratio 18/22, mean age 33 years (range 23-45 years)]. For all groups, restorations, crowns or bridges and endodontic treatment were assessed on the DPTs. Any missing teeth were excluded disregarding the cause of the loss of that specific tooth. Restorative data was obtained on 304 DPTs of 172 patients.
RESULTS: Group 1 showed lower ratings on both DPTs. The control group showed ratings between those of groups 1 and 2. Only for endodontic treatment was there a higher frequency in the control group than in both treated groups. For both treated groups the number of large restorations increased with time.
CONCLUSION: Orthodontic treatment appears to have little influence on long-term quality of the dentition.

178 ASSOCIATIONS OF CERVICOVERTEBRAL MATURATION AND MANDIBULAR GROWTH IN HEADGEAR PATIENTS

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AIM: To investigate the effect of cervical headgear treatment on mandibular length, and to examine cervicovertebral anatomy as an indicator of mandibular growth.
SUBJECTS AND METHOD: Sixty-eight children, aged 7.6 years (SD 0.3). The subjects, who had a Class II tendency in occlusion and moderate crowding, were randomly divided into two equal sized groups. In the first group, headgear treatment was started immediately and lasted 16 months. In the control group, only minor interceptive procedures were performed during the first 2 years. During the 8-year follow-up, normal orthodontic procedures were carried out when required. The 98 follow-up cephalograms of 49 children were taken at the mean ages of 11.6 and 16.5 years. Mandibular total length and cervicovertebral anatomy were measured on the cephalograms, using the methods of McNamara (2002) and Mito *et al*. (2002).
RESULTS: Mandibular length change correlated significantly with all metric measurements made on the size change of C3 and C4. The highest correlations were found when using the method of Mito *et al*. (2002) for C3 (r = 0.610). In the headgear group, the mandibular length increase was larger than in the control group ($P = 0.042$).
CONCLUSIONS: The use of cervical headgear has a positive effect on mandibular length growth in patients who have a Class II tendency in occlusion. The definition of the cervicovertebral maturation stage is a good predictor for mandibular growth potential.

179 LOAD-ROTATION BEHAVIOUR OF ORTHODONTIC ANCHORAGE IMPLANT SUPPORTED SUPRASTRUCTURES

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AIM: To (i) measure the load-rotation behaviour of orthodontic anchorage implants (Orthosystem, Straumann, Basel, Switzerland) between implant abutment and fixation cap, (ii) evaluate the load limit of the abutment to fixation cap connection, and finally (iii) show the clinical relevance of the results.

MATERIALS AND METHOD: Three different biomechanical test series (A, B, C), two with 20 (A and B) and one with 10 (C) palatal implants each with corresponding fixation caps, were performed. The orthodontic implants were placed in a holding device prior to attaching the fixation caps (A) without tightening the titanium fixation screws and minimally loaded alternately with 0.04 Nm and (B) with application of the recommended tightening torque of 0.15 Nm. They were then loaded with a linear increasing torque moment (0.2-0.7 Nm). For series C, 10 transpalatal bars (length: 150 mm; dimension: 0.21 × 0.21 mm; stainless steel) were laser-welded to each of 10 corresponding fixation caps. Occlusal screws were then applied and loaded according to series B.
RESULTS: The maximum theoretical degree of rotation of the abutment to fixation cap was approximately 3.2 degrees, varying under a load of 0.04 Nm from 2.41 to 3.01 degrees (series A). Measurements of series B showed load-rotation behaviour between 0.60 and 2.11 degrees, and of series C between 0.79 and 0.87 degrees. These results revealed that in practice the exact orientation of the implant abutment to the fixation cap connection cannot be determined. Therefore, according to the fabrication tolerance, anchorage loss must be assumed. The load limit of the abutment to the fixation cap connection was 0.6 Nm.
CONCLUSION: Orthodontic anchorage, by means of palatal implants, must incorporate a rotational movement with respect to the abutment. This can be compensated for by pre-activation of the orthodontic wire.

180 BASAL ARCH WIDTH USING A THREE-DIMENSIONAL LASER-SURFACE SCANNING SYSTEM
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AIM: Model analysis has been used to diagnose a discrepancy between the dentition and basal bone in each jaw, but not in the molar region. However, this seemed to be insufficient to diagnose the intermaxillary relationship. Furthermore, basal arch width (BAW) measurements might not, in some cases, be reproducible, as these are measured by callipers from a three-dimensional (3D) model on an unclear apical base. The purpose of this study was to investigate intermaxillary co-ordination between BAW and the dentition in the intercuspal position using a 3D laser-surface scanning method.
MATERIALS AND METHOD: Plaster casts of 10 Japanese (6 males, 4 females aged 20 to 29 years) with individual normal occlusions who had not undergone orthodontic treatment were registered with a laser-surface scanner (Unisn, VMS-150-RD). The two planes perpendicular to the clinical occlusal plane passing through the maxillary mesio-buccal cusps of the first molars and the buccal cusps of the first premolars were set on software (Raindrop Geomagic, Inc.). After measuring BAWs in both jaws, the distances between the maxillary buccal cusps (MxD1 and MxD2) and between the supra-buccal points of the mandibular crowns (MnD1 and MnD2) in each plane, BAW ratio (BAWR: maxillary BAW/mandibular BAW) and dental arch width ratio (DAWR: MxD/MnD) were calculated.
RESULTS: BAWR in the premolar and molar region was 1.03 ± 0.07 and 1.03 ± 0.05, respectively. The ratios for both the premolar and the molar region showed a similar tendency: DAWR 1.20 ± 0.03 and 1.14 ± 0.02, respectively. DAWR in the premolar region was larger than in the molar region.
CONCLUSIONS: Normal relationships in arch widths were found in the first premolar and the first molar region.

181 VERTICAL RELATIONSHIPS BETWEEN SKELETAL AND ALVEOLAR COMPONENTS**
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AIM: The vertical proportions of the face play an important role in orthodontics. Several descriptions of the facial structure have been used, such as skeletal open and deep bites, short and long face syndromes, high and low angle types. The purpose of this study was to investigate the vertical relationship between the skeletal and alveolar components of the face and to examine the relationship with the Frankfort mandibular angle (FMA), applying a simple assessment of the vertical dimension of the face in Japanese adults.
MATERIALS AND METHOD: One hundred lateral cephalometric radiographs chosen as the attractive profiles. These were selected of subjects whose upper and lower lips were within the soft tissue E-line. The main measurements used in the analysis were: N-Me line, S-Go line, Me perpendicular to the palatal plane, Ar-Go and FMA. The proportions of S-Go/N-Me were investigated as an assessment of the skeletal component, Ar-Go/Me perpendicular to the palatal plane as the alveolar component, and whether the FMA was associated with two components. The attractive face was divided into five types according to the degree of FMA. The proportions of Ar-Go/Me perpendicular to the palatal plane were related to the proportions of S-Go/N-Me and FMA in all groups.
RESULTS AND CONCLUSIONS: The most acceptable proportions of the alveolar component ranged from 25~32 degrees of FMA, indicating that they are coincident with the majority of beautiful Japanese faces. Seventy-two per cent of the proportion for the dental component was the best selected figure to maintain facial balance. The proportion of Ar-Go/Me perpendicular to the palatal plane, as well as FMA, can be used when judging the individualized treatment target.

182 PI3-K AND MAPKs SIGNALLING ON OSTEOCLAST DIFFERENTIATION**

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AIM: Phosphatidylinositol 3-kinase (PI3-K) is critical to the activation of cellular functions, which operate through activation of mitogen-activated protein kinases (MAPKs). Although a receptor activator of NF-κB ligand (RANKL) regulates osteoclast differentiation by activating MAPKs kinase, these molecular mechanisms of RANKL-regulated osteoclast differentiation have not been fully established. The aim of this study was to investigate the role of PI3-K on RANKL-mediated differentiation of mouse leukaemic monocyte cell line RAW264 into osteoclasts.
MATERIALS AND METHOD: RAW264 cells were incubated with 50 ng/ml RANKL, with or without the presence of various inhibitors, during 5 days, following which differentiation of RAW264 cell into osteoclasts was analyzed by tartrate-resistant acid phosphatase staining.
RESULTS: RANKL-mediated RAW264 cell differentiation was inhibited by PI3-K inhibitor LY294002 and p38 MAP kinase inhibitor SB203580. In contrast, MEK1/2 inhibitor U0126 enhanced RANKL-mediated differentiation of RAW264 cell. In order to analyze RANKL-mediated RAW264 cell differentiation using western blotting, RAW264 cells were incubated in the same manner. RANKL also phosphorylated p38, p44/42 and the PI3-K-dependent enzyme Akt on RAW264 cells, each peak at 15 minutes. LY294002 inhibited the phosphorylation of Akt, but not p44/42. In contrast, LY294002 enhanced the phosphorylation of p38 induced by RANKL. SB203580 blocked the phosphorylation of Akt and p38, however, it enhanced the phosphorylation of p44/42. U0126 inhibited the phosphorylation of p44/42, but not Akt or p38.
CONCLUSIONS: RANKL-mediated differentiation of RAW264 cell into osteoclasts depends on PI3-K and MAPKs, and each inhibitor regulates the signalling of PI3-K, p38 and p44/42. As it appears that these various responses to differentiation of RAW264 cells into osteoclasts by various inhibitors reveal the different pathways of phosphorylation of each kinase, these pathways are presently being investigated.

183 CINE-MAGNETIC RESONANCE IMAGE ANALYSIS OF DEGLUTITION AND TRANSIT TIMES

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AIM: Recently, dynamic magnetic resonance imaging (MRI) has become available for the evaluation of swallowing. The aim of this study was to compare the timing of events in subjects with an anterior open bite (AOB) and a normal overbite during swallowing.
SUBJECTS AND METHOD: Thirty-four patients, with no history of swallowing disorders or other chronic illnesses. Two groups were constructed according to the presence of an AOB. The open bite group (OBG) consisted of 22 patients with a mean age of 13.19 ± 2.97 years and a mean overbite of –5.22 ± 1.81 mm. The control group (CG) comprised 12 patients with a mean age of 14.37 ± 2.32 years and with a normal overbite of 1.75 ± 0.62 mm. Deglutition times from stages 1 to 2 and 2 to 3 were determined in the OBG and CG.
RESULTS: Real time balanced turbo field echo cine-MRI generally provided clear images. Morphological parameters were clearly visualized using this technique. No differences were found for the time measurements from stage 1 to 2 between the groups. However, the elapsed time from stage 2 to 3 was significantly longer in the CG. This increase also elongated the total deglutition time and was longer in the CG than OBG.
CONCLUSION: This technique has the advantage of being non-invasive and providing clear dynamic images of oral, pharyngeal and deep tissue structures without using a contrast material. The disadvantage is the high cost that may limit wide application as a diagnostic tool. Deglutition time is shorter in open bite patients due to the faster transfer of water from the pharynx to the oesophagus.

184 NITINOL FLAT SPRING AND CLASS II TREATMENT

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AIM: To compare the effects of a Forsus Nitinol Flat Spring (FNFS) and a Jasper Jumper (JJ) in the correction of Class II division 1 malocclusions.
SUBJECTS AND METHOD: Forty-eight adolescents, who had a normal or horizontal growth pattern and a retrognathic mandible. The patients were randomly divided into three equal groups: group 1 were treated with the FNFS; group 2 with a JJ appliances, while group 3 comprised the controls. Lateral cephalograms and study models were obtained after the levelling phase and on appliance removal.
RESULTS: Cephalometric analysis revealed that both appliances stimulated mandibular growth, increased anterior face height due to the increase in the lower face, and elongated posterior face height due to growth of the temporomandibular

joint. The maxillary central incisors were extruded, retruded and distally tipped while intrusion, protrusion and labial tipping were observed at the mandibular central incisors. Distal movement and intrusion of the maxillary first molars, and mesial movement and extrusion of the mandibular first molars were the other dental alterations. The overjet and overbite were decreased and a Class I molar relationship and improvement in the profile were obtained in both groups. Cast model analysis showed expansion of the maxillary and mandibular dental arches.
CONCLUSION: Both appliances were effective in the treatment of Class II malocclusions and revealed nearly same alterations in the skeletal, dental and soft tissue parameters.

185 MANDIBULAR GROWTH IN CLASS II DIVISION 2 SUBJECTS TREATED WITH AN ANTERIOR BITE PLANE

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AIM: To investigate the effects of an anterior bite plane (ABP) on mandibular growth during pubertal growth.
SUBJECTS AND METHOD: Sixteen patients at the beginning of the pubertal growth period (Sesamoid stage, MP3=) with Class II division 2 malocclusions. A removable appliance, with an ABP and a screw was used to decrease the overbite and to protrude the upper incisors. The patients were divided into two groups at the pubertal peak (MP3cap): group A comprised seven subjects demonstrating spontaneous correction of the Class II malocclusion and group B the remaining nine subjects presenting non-spontaneous correction. In group A, a removable appliance with an ABP was used, whereas in group B an activator was used to stimulate mandibular growth for one year during the post-pubertal peak. To observe mandibular growth, lateral cephalograms were obtained at the beginning of treatment, at the pubertal peak, and one year post-pubertal peak. Forty-five parameters were measured to analyze the changes on lateral cephalograms. Comparisons of pre-treatment, pubertal peak and post-pubertal peak values were made with Wilcoxon and Mann-Whitney *U* tests.
RESULTS: In group A, a forward and upward rotation of the mandible was observed. In group B the increases in posterior and anterior face heights were more pronounced. Deep bite correction was noted for both groups, due to extrusion of the upper and lower molars.
CONCLUSION: Mandibular forward and upward rotation resulted in the significant difference in group A. The factors causing this were the increases of posterior and anterior face heights in group B.

186 ORTHODONTIC BOND STRENGTHS OF SELF-ETCHING PRIMERS AT 6 MONTHS

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AIM: Comparison of the shear bond strength of three modern self-etching primers (SEP) used in orthodontic application at 6 months.
MATERIALS AND METHOD: Seventy-two freshly extracted human third molars had their roots removed and the crowns embedded with acrylic into the tooth test cups of the Bencor Multi T test system with the buccal surfaces exposed. The enamel was cleaned with a pumice and water slurry and orthodontic buttons (Ormco) were bonded to the enamel, adhering strictly to the manufacturers' instructions. The teeth were randomly divided into three groups of 24 teeth and had their enamel surfaces prepared with either Transbond SEP (3M/Unitek), One Coat SE Bond (Coltène Whaledent), or iBond (Heraeus Kulzer). The buttons were subsequently bonded with Transbond XT (3M/Unitek) light cured adhesive. The bonded samples were stored in distilled water at 37°C and 100 per cent relative humidity in an incubator for 6 months. They were then tested to failure in a Zwick machine (Ulm, Germany) with a 1 kN loadcell and a crosshead speed of 0.5 mm/minutes. The resultant data was analyzed via the ANOVA single factor test.
RESULTS: iBond produced the highest bond strength (19.0 ± 3.6 MPa), followed by Transbond SEP (17.6 ± 4.1 MPa), and then One Coat SE bond (14.6 ± 3.3 MPa). No statistically significant differences existed between the three SEPs ($P < 0.01$). Most samples bonded with Transbond SEP produced mixed adhesive/cohesive fractures, however with iBond and One Coat SE Bond most of the adhesive remained on the enamel surface.
CONCLUSION: All SEPs displayed acceptable long-term bond strengths at 6 months, however Transbond SEP was found to be the most user-friendly material.

187 CONFIGURATION OF FACIAL FEATURES INFLUENCES SUBJECTIVE EVALUATION OF FACIAL TYPE

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AIM: Clinical assessment of facial type and proportions is an important element of orthodontic diagnosis and subsequent treatment planning. Due to the subjective nature of this procedure, it is important to identify those factors that could affect

final judgment. One such factor that may affect facial perception in general, is the configural relationship among internal parts of the face. The aim of this study was to assess whether configural changes in a face affect the subjective evaluation of facial type.
MATERIALS AND METHOD: The frontal photographs of two 12-year-old Caucasian males with harmonious faces were used. The photographs were computer manipulated to produce photo-realistic images of faces with various configural relationships of the internal features. The modifications were: inter-ocular distance was enlarged by 3 mm or reduced by 3.6 mm, mouth width was enlarged by 4.5 mm or reduced by 4.2 mm, and the mouth was moved vertically upwards or downwards by 2.8 mm. Two images with a true change in anterior face height of 4 mm were also produced. The images were presented, in pairs, to 20 experienced orthodontists. Each judge evaluated 36 pairs of images (including pairs of identical images), all belonging to the same patient, presented in a random sequence. The judges were unaware of the changes that had been made to the photographs and were asked to evaluate which of the two faces appeared longer.
RESULTS: The judges were able to correctly identify pairs of identical images with an accuracy of 42 per cent. Reduction of inter-ocular distance, as well as downward movement of the mouth, caused the illusion of a longer face. The converse changes had the reverse effect. Enlargement of the width of the mouth did not appear to influence the subjective impression of facial type. On the contrary, reduction of mouth width had a statistically significant effect, giving the impression of a longer face.
CONCLUSIONS: Configural relationships among the constituent features of the face can influence judgment about external facial proportions. Given the importance of these factors in treatment planning, it seems that clinical evaluation of faces should be accompanied by objective assessment (measurement) of photographs, so that any visual illusory effects can be identified.

188 EVALUATION OF OCCLUSAL PLANE ROTATION

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AIM: To develop a method to evaluate rotation of the occlusal plane.
MATERIALS AND METHOD: Occlusal plane position was analyzed on 30 lateral cephalograms of subjects aged 19-25 years with a normal occlusion. Anterior occlusal height (La-N), as a distance between NSL and a perpendicular to the OcP from point N, and posterior occlusal height (Lp-S), as a distance between NSL and OcP perpendicular to OcP from point S, were measured. The occlusal plane position was also characterized by the proportional coefficient of occlusal heights (KL) that shows the relationship of anterior occlusal height with posterior occlusal height.
RESULTS: In subjects with a normal occlusion, La-N constituted 83.68 ± 1.32 mm, posterior –69.78 ± 1.11 mm, and their proportional coefficient was equal to 1.20 ± 0.01. The following pattern was observed: the occlusal proportional coefficient changed in parallel with the angle between the anterior cranial base and the occlusal plane. KL coefficient indicated the occlusal plane position: if KL was less than or equal to 1.21 the occlusal plane had a high position, if KL was more than or equal to 1.22 it had a low position. La-N was always larger than the posterior so the occlusal plane normally had a positive inclination. With a high occlusal plane position, La-N was larger and the posterior smaller, and *vice versa*. However, the KL of these heights was not stable: it increased with a high occlusal plane position and decreased in a lower position which means that the rotation point was located outside the dentition.
CONCLUSIONS: Occlusal heights entirely reflect occlusal plane rotation. The extent and the parallelism of occlusal height changes determine the location of the occlusal plane rotation point.

189 EFFECTS OF HERBST APPLIANCE THERAPY ON THE DENTOFACIAL COMPLEX IN CLASS II MALOCCLUSION SUBJECTS

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AIM: To investigate and evaluate maxillary and mandibular skeletal and dentoalveolar changes induced by the Herbst appliance in patients with skeletal Class II malocclusions.
SUBJECTS AND METHOD: Seventeen subjects (10 females, 7 males) chosen from a general clinical intake, according to the following characteristics: skeletal Class II, a dental Class II division 1 malocclusion, retrognathic mandible, pubertal growth period and functional orthodontic therapy indicated (with no temporomandibular joint symptoms). Subjects with the same malocclusion and in the same growth period but for whom functional orthodontic therapy could not be performed, were chosen for the control group. The Herbst appliance, together with fixed orthodontic appliances, were used in the experimental group for six months. Lateral cephalograms taken before and after 6 months were analyzed.
RESULTS: The Herbst appliance inhibited maxillary growth while mandibular growth was stimulated and increased. This increase was statistically significant when compared with the control group ($P = 0.01$). Sagittal intermaxillary jaw

relationship improved. The Class II molar relationship was changed to a Class I. Overjet and overbite were significantly decreased in the treated group ($P = 0.001$). The maxillary molars moved distally ($P = 0.001$) in comparison with the control group, whereas the mandibular molars moved mesially. B' and Pog' points moved forward, the soft tissue profile convexity decreased, the upper lip became retrusive, while the lower lip remained, on average, unchanged.
CONCLUSION: The integrated Herbst is an effective appliance in the treatment of skeletal Class II division 1 malocclusions when used together with fixed orthodontic appliances.

190 AN EPIDEMIOLOGICAL STUDY OF TEMPOROMANDIBULAR DYSFUNCTION AND OCCLUSION BASED ON BRUXISM

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AIM: Controversy continues to exist concerning the role of occlusion as a cause of craniomandibular dysfunction, especially bruxism, in the aetiology of temporomandibular disorders (TMD). Although numerous studies have examined the relationship between bruxism and TMD, it has not been clearly established. The aim of this research was to investigate the actual occlusal condition relative to mandibular dysfunction and to determine its prevalence in the general population.
SUBJECTS AND METHOD: Dental examinations were undertaken of 1,347 subjects (1179 males and 168 females, mean age 42.1 years) by 15 calibrated examiners to assess the relationship among occlusion and TMD. A questionnaire concerning occlusion and temporomandibular joint (TMJ) function was completed, and a clinical examination (palpation) was performed. The Cadiax system was used to evaluate condylar movements, such as protrusion/retrusion, mediotrusion and open/close. The BruxChecker, a specially developed device, was used to register the occlusal grinding areas during sleep. It consists of a 0.1 mm-thick polyvinyl chloride sheet, painted with a red marker. The BruxChecker was placed on the maxillary dentition, and the subjects used it during two nights. The grinding pattern was shown as transparent areas.
RESULTS: Based on the grinding pattern, the laterotrusive side was classified into four patterns, IC (incisor, canine), ICP (to premolar), and ICPM (to molar). From the questionnaire, subjects with an ICPM pattern showed significantly higher self-awareness of sleep bruxism and TMJ pain than those with IC. The Cadiax system showed that sagittal condylar inclination was significantly steeper with IC.
CONCLUSION: Some evidence concerning the significance of occlusal factors, especially sleep bruxism, consistently associated with TMD, and the appearance of cervical lesions has been provided.

191 CONTRACTILE FORCES – AN AID TO FORMATION OF THREE-DIMENSIONAL MYOTUBE CULTURES

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AIM: The adaptation of cells/fibres and connective tissue of the facial muscles is a fundamental requirement in the stability of orthodontic treatment. A simple and improved model/system is required in order to make investigation of these changes possible. The aim of this research was to develop a system/model to culture and observe the strained state of myotubes, and to investigate levels of gene expression of selected contractile and extracellular matrix components (MHC1, MHC6, MMP2) as contractile activity develops.
MATERIALS AND METHOD: Various materials were used with different modifications until construction of a three-dimensional (3D) system was developed. The model consisted of a $2.5 \times 7.3 \times 1.5$ cm well mould made of hard plastic, collagen lattices (rat-tail type I collagen) and floating meshes fixed to two points with a specially designed frame. The cells, derived from explants of the human masseter muscle, were cultured in the system and tested. Gene expression of MHC1, MHC6 and MMP2 was investigated.
RESULTS: Cells were successfully cultured in the 3D system. It was established that myoblasts could grow in the constructed method, and could be encouraged to differentiate into myotubes. MMP2 and MHC1 were expressed in differentiated myogenic samples exposed to cell-induced contractile forces. No expression of MHC6 in the cultured samples under strain was observed.
CONCLUSION: A solid 3D system for the study of myogenic cells in an active environment was successfully designed, constructed and tested. Cell-induced contractile forces induced expression of MMP2 and MHC1 in masseter muscle derived cell cultures.

192 ANCHORAGE IN THE MIDPALATAL REGION IN LINGUAL ORTHODONTICS

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The development of the absolute anchorage has changed the conventional concepts of orthodontics. Anchorage control has become simple compared with extraoral anchorage which requires patient co-operation.

When determining the most suitable anatomical place for miniscrew insertion, the thickness and density of the cortical bone, the type and thickness of the soft tissue and the presence of roots, nerves, and blood vessels should be considered. If the quality of the cortical bone, the abundance of the attached connective tissue, and the absence of the anatomical structures are sufficient, the requirements for ideal implantation, the posterior part of the maxillary midpalatal suture has become the most preferred site for miniscrew implantation.
The midpalatal absolute anchorage system (MAAS) devised by Hong, combines the advantages of the midpalatal suture and miniscrews. It comprises two miniscrews (diameter: 1.6 mm, length: 6 mm) implanted in the midpalatal suture, the 0.032 × 0.032-inch bracket, and the 0.032 × 0.032-inch stainless steel (or TMA) power arm. Because the miniscrews are implanted in the midpalatal suture, the MAAS provides both a safe implant place and rigid anchorage. With the functional power arm almost any tooth movement can be performed.

193 FRACTURE RESISTANCE OF CERAMIC BRACKETS TO ARCHWIRE TORSION**

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AIM: To evaluate the fracture resistance of commercially available ceramic brackets to torsional force interacting with the archwire, and the characteristics of bracket fracture.
MATERIALS AND METHOD: Lingual root torque was applied to maxillary central incisor brackets with 0.022 inch slots by means of a 0.0215 × 0.027-inch stainless steel archwire. A custom designed apparatus attached to an Instron machine was used to test seven types of ceramic bracket in sample groups of 15. The torque value and torque angle at fracture were measured. In order to evaluate the characteristics of failure, the fracture sites and failure patterns of the brackets were examined with a scanning electron microscope.
RESULTS: Inspire and InVu brackets showed the greatest resistance to fracture, while 20/40 was the least resistant during archwire torsion. Monocrystalline alumina (Inspire) brackets showed significantly greater resistance to torsional force than polycrystalline alumina brackets, except for InVu. There was no significant difference in fracture resistance during archwire torque between the metal slot inserted ceramic bracket and the ceramic bracket. All Clarity brackets partially fractured at the incisal aspect of the slot base; the others at various locations.
CONCLUSION: The fracture resistance of ceramic brackets during archwire torsion appears to be adequate for clinical use.

194 PHOTOKILLING OF *STREPTOCOCCUS MUTANS* ON TiO_2 FILM OF TiAg

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AIM: To compare whether TiO_2 photocatalyst may be used in the manufacture of orthodontic appliances, by testing the antibacterial effect on *Streptococcus mutans*.
MATERIALS AND METHOD: To compare the antibacterial effect of two crystalline forms of TiO_2, rutile and anatase, thermal oxidation (TO) and anodic oxidation (AO) were applied. The antibacterial effect of TiO_2 film on TiAg with that on Ti was compared. Bacterial solutions (*S. mutans*) were pipetted onto the coated specimen, illuminated with UVA for 100 minutes, and the reaction solutions were incubated and the colony forming units counted.
RESULTS: After AO, comparatively stable anatase type structures were identified on the surface of both Ti and TiAg specimens. The survival rates of all Ti and TiAg specimens decreased with time after irradiation. Ti and Ti (TO) showed a low sterilization rate, constant at the first step, but with a rapid decline from the second step. For Ti (AO), the rate was constantly high from the first step, greatly reducing the survival rate. For all TiAg specimens, the survival rate showed a rapid decline from the first step and, in particular, TiAg (AO) had the highest rate constant of 4.8 at the first step with most germs killed in 20 minutes.
CONCLUSION: The antibacterial effect of the TiO_2 film formed by AO was superior to that of the TiO_2 film formed by TO. The antibacterial effect of the TiO_2 film formed on the TiAg specimen was superior to that of the TiO_2 film formed on the Ti specimen.

195 PHOTOCATALYTIC ANTIBACTERIAL EFFECT OF TiO_2 FILM ON *LACTOBACILLUS ACIDOPHILUS*

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AIM: To assess whether TiO_2 photocatalyst may be used in the manufacture of orthodontic appliances by testing the antibacterial effect on *Lactobacillus acidophilus*.

MATERIALS AND METHOD: To compare the antibacterial effect of two crystalline forms of TiO_2, rutile and anatase, thermal oxidation (TO) and anodic oxidation (AO) were respectively applied. The antibacterial effect of TiO_2 film on TiAg with that on Ti was also compared. Bacterial solutions (*L. acidophilus*) were pipetted onto the coated specimen and illuminated with UVA for 100 minutes and the reaction solutions were incubated and the colony forming units were counted.
RESULTS: After photocatalytic reaction, the survival rates of Ti, Ti (TO) and Ti (AO) were 30.2, 35.2 and 27.0 per cent, respectively, and antibacterial activity of TiO_2 coated specimens was not different from that of the uncoated group. The survival rates of TiAg, TiAg (TO), TiAg (AO) were 30.7, 38.8 and 29.8 per cent respectively, and the antibacterial activity of TiO_2 coated specimens was also not different from that of the uncoated group. The survival rates of all Ti and TiAg specimens decreased slowly with time after irradiation. Ti and TiAg specimens were almost sterilized after 100 minutes irradiation, while Ti (TO), Ti (AO), TiAg (TO), and TiAg (AO) were completely sterilized.
CONCLUSIONS: The antibacterial activity of TiO_2 coated specimens was similar to that of the uncoated group. The antibacterial activity of TiO_2 coated specimens of TiAg was not different from that of Ti specimens.

196 MAXILLOMANDIBULAR WIDTH CHANGES IN CHILDREN WITH SKELETAL CLASS I MALOCCLUSIONS

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AIM: To investigate maxillomandibular width changes in children with a skeletal Class I malocclusion in correlation with skeletal maturity of the hand-wrist.
MATERIALS AND METHOD: Hand-wrist radiographs and posteroanterior (PA) cephalograms of 465 males and females from 7 to 19 years of age diagnosed with a Class I malocclusion. The subjects were grouped according to Fishman's skeletal maturity indicators (SMI), and maxillofacial widths on the PA cephalograms.
RESULTS: The maxillary and the mandibular widths of the males were greater than those of the females for all SMI except SMI 2, SMI 9 for the maxillary width and SMI 2 for the mandibular width ($P < 0.05$). Both tended to increase as SMI increased. There was no statistically significant gender difference in SMI for maxillomandibular difference or between upper and lower intermolar width ($P > 0.05$). The width ratios had no gender difference for most SMI.
CONCLUSION: The maxillomandibular difference increased according to SMI (SMI 1: 19.6, SMI 11: 23.0), but there was no statistically significant gender difference. The ratio of maxillary to mandibular width was 0.75 to 0.77.

197 DIFFERENCES IN PAIN PERCEPTION WITH VARIOUS DEBONDING METHODS

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AIM: The fear of pain is one of the key factors that may discourage a patient from seeking orthodontic treatment. The aim of this study was to compare various debonding techniques to determine which debonding method was the more painful to patients and more difficult for clinicians by means of questionnaires.
SUBJECTS AND METHOD: The patients were divided into four groups by age: 25 juvenile males (>17 years of age); 25 juvenile females (>17 years of age); 29 adult males (<17 years of age); 34 adult females (<17 years of age). They completed the questionnaire form before debonding. Four debonding methods were used: 1. squeezing; 2. squeezing with a wax bite; 3. twisting; 4. twisting with a wax bite. Each method was randomly used in each quadrant.
RESULTS: (1) The patients reported discomfort in the following descending order: method 3, 4, 2, 1; (2) In the comparison of pain perception among the four groups, the juvenile female group reported more discomfort than the other groups; 3. In comparison of difficulty experienced by the clinicians, the difficulty in descending order was method 4, 3, 2, 1.
CONCLUSION: Debonding performed with a wax bite appears to reduce pain discomfort. The twisting method is more painful for patients and more difficult for clinicians than the squeezing method.

198 CHANGES IN PERIODONTAL PATHOGENS AND CLINICAL PARAMETERS AFTER DEBANDING

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AIM: To evaluate clinical and microbiological changes in periodontal tissues around molars after debanding.
SUBJECTS AND METHOD: Twenty patients, aged 14 to 26 years, treated with fixed appliance, with clinical signs of gingival inflammation at appliance removal. Probing depth and bleeding frequency were measured and plaque samples

were collected from the banded last molar in all quadrants of each patient. All data were collected immediately following debanding and 1 month thereafter.
RESULTS: Using PCR based on 16S rDNA, the presence of *Porphylomonas gingivalis, Tannerella forsythia* and *Treponema denticola* were detected. Probing depth, bleeding frequency and *P. gingivalis, T. denticola, T. forsythia* were reduced after debanding. The improvement in periodontal health had a positive relationship with the reduction of clinical gingivitis following removal of orthodontic bands.

199 IMMUNOHISTOCHEMICAL EXPRESSION OF p63 IN HUMAN PRENATAL TOOTH PRIMORDIA
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AIM: To investigate the expression of the p63 gene in normal human tooth buds from different gestational stages. This is the first detailed study of p63 expression in normal human prenatal tooth primordia.
MATERIALS AND METHOD: Sections of the midaxial tissue block from the cranial base of three human foetuses of gestational ages 11, 15 and 21 weeks. The sections included tooth primordia representing the cap and bell stages of human tooth morphogenesis. Immunostaining was carried out using the primary antibody, monoclonal mouse anti-human p63 protein, clone 4A4. The sections were counterstained with haematoxylin Mayer. p63-immunoreactivity was identified by microscopy.
RESULTS: There was a positive reaction of p63 both in the cap and bell stages. Positivity was observed in the cells of the oral mucosa, the inner and outer enamel epithelium, and in the primary and secondary dental lamina. In the early cap stage, there was a strong positive reaction to p63 in the enamel knot. This positivity was not present in the late cap stage.
CONCLUSION: It is suggested that p63 may have an important regulatory function in the enamel knot.

200 EVALUATION OF THE LINGUAL ORTHODONTIC BRACKET WITH PASSIVE LIGATION
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AIM: During orthodontic treatment with sliding mechanics, a frictional force produced at the bracket/archwire interface tends to impede the expected movement; this also applies to lingual appliances due to narrow interbracket distances. STb lingual orthodontic brackets (Ormco) used with passive ligation, reduce frictional forces. The aim of this study was to evaluate the frictional force of STb lingual orthodontic brackets.
MATERIALS AND METHOD: STb lingual orthodontic brackets were compared with standard edgewise brackets. All brackets were stainless steel (SS) and had a nominal slot size of 0.018 inch. Four different sizes of NiTi orthodontic wires, 0.012, 0.014, 0.016, 0.018 inches, were used. Fourteen orthodontic brackets from the maxillary second molar to second molar were bonded to an acrylic plate cut out as a simulated arch form. The effect of ligation with elastic modules and 0.008 inch stainless steel ligature wires was also examined. Each test unit was attached to a testing machine and pulled in a vertical direction by a wire end. Frictional force was measured throughout 1 mm transition of the wire at a crosshead speed of 1 mm/minute. Each wire/bracket/ligation method combination was tested 10 times.
RESULTS: An increased wire size was associated with significant increases in friction. STb lingual orthodontic brackets and 0.012 inch NiTi wire tied SS ligature wire showed the lowest frictional force. The frictional force of the elastic module was significantly higher than that of stainless steel ligature wire.
CONCLUSION: Many factors, such as archwire and bracket material, dimensions, and ligation method, influence frictional forces. STb lingual orthodontic brackets tied with SS ligature wires generated less frictional force than elastic modules.

201 DENTAL HEALTH, DENTAL DEVELOPMENT, AND MYOFUNCTIONAL STATUS IN SPEECH DISORDERED CHILDREN
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AIM: To evaluate the relationship between dental health, dental development and primary dysfunctions in children with speech disorders.
SUBJECTS AND METHOD: One dentist and one speech therapist clinically examined 198 randomly chosen children from the School of Logopedics and Speech Pathology in 2004. Forty-five dental, anomaly-specific and functional parameters were recorded. The functional status was evaluated using reproducible tests (e.g. oral stereognosis and Payne technique). A group of 3,042 schoolchildren of the same age and from the same city served as one control group. A second control group

comprised 197 patients in the mixed dentition prior to orthodontic treatment. Statistical analysis was carried out using the Chi square test ($P < 0.05$).
RESULTS: Significantly higher DMF-T values were found in the study sample. The co-existence of two and four different myofunctional disorders was found significantly more often in children with speech disorders. Of the 198 children with speech disorders, 196 presented malocclusions. The prevalence of primary and secondary dysfunctions was 100 per cent in the study group associated with specific anomalies (open bites 100 per cent, reverse overjet 53 per cent, constricted upper arch and crowding 34 per cent).
CONCLUSIONS: The difficulty in providing logopedic therapy to speech disabled children from a specialized centre is evident from the high prevalence of myofunctional disorders and their impact on dental development and dental health. The increased rate of caries in these subjects indicates that social factors are involved. During the process of speech rehabilitation the problem must be approached through interdisciplinary diagnosis and therapy.

202 THERAPEUTIC EFFECTS OF NEURAL THERAPY IN MUSCULOSKELETAL PAIN PATIENTS

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AIM: To demonstrate the effects of therapeutic local anaesthesia (TLA) in patients with occlusal disturbances.
SUBJECTS AND METHOD: From 580 patients, 348 were diagnosed manually, by means of functional screening, with craniomandibular disorders. Approximtely 40 per cent of the patients required immediate pain relief. Before construction of an occlusal splint, TLA was performed. The visual analogue scores were documented before, shortly after, and 4 weeks after TLA.
RESULTS: Almost all patients treated with TLA reported an immediate relief of pain. Thirty-eight subjects did not require splint therapy folowing TLA. At the 6 month recall, those patients without splint therapy reported pain, which appeared days to weeks after TLA. After provision of a splint, the pain disappeared.
CONCLUSION: TLA is an effective tool in early pain relief. If occlusal disturbances are left untreated, the pain will re-appear. The combination of initial TLA in patients with severe pain and occlusal splint therapy is a treatment option that should be considered.

203 EFFECTS OF OSTEOCLASTIC ACTIVITY ON ROOT RESORPTION IN MICE

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AIM: Root resorption is a major side-effect of orthodontically induced tooth movement. This study aimed to clarify the role of osteoclasts in root resorption.
MATERIALS AND METHOD: Under general anaesthesia, a dental expansion device (0.016 inch TMA) was fixed between the molars in 8-week-old mice. The device was activated for two weeks. To clarify the role of osteoclasts, osteoclastic activity was selectively inhibited in a second group of mice by the continuous application of alendronate sodium (Merck Research Laboratories, Rahway, New Jersey, USA). Implant position and the dynamics of transversal expansion were controlled by contact radiography (X-ray cabinet, Faxitron). For three-dimensional histomorphometry and visualization of the dental effects, the jaws were scanned in a µCT40 scanner (Scanco Medical) at a resolution of 6 µm. Histological analysis and cellular histomorphometry were performed after undecalcified preparation on 5 µm toluidine blue and von Kossa stained serial sections. Tartate resistant acid phosphatase staining was used for enzymatic detection of osteoclasts.
RESULTS: Rsesorption areas were observed radiologically and histologically on the buccal side of the roots. Histomorphometry confirmed these findings to be linked with an increase in the number of osteoclasts and eroded surfaces. In the alendronate group, the amount of tooth movement and root resorption was significantly reduced. This was linked to a significant lower number of osteoclasts.
CONCLUSION: Osteoclasts are indeed of importance in root resorption. These data might open new avenues in testing therapeutic strategies, such as anti-resorptive agents in order to prevent root resorption.

204 LASER DOPPLER EVALUATION OF GINGIVAL MICROCIRCULATION DURING ORTHODONTIC TOOTH MOVEMENT

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AIM: Orthodontic treatment is accompanied by microcirculatory changes in the periodontium. Laser Doppler analysis is one of the most effective methods for gingiva microcirculation evaluation. The aim of this investigation was to study marginal gingiva microcirculation during orthodontic tooth movement using laser dopplerography.

SUBJECTS AND METHOD: Six patients, aged 15 to 18 years, with anterior spacing treated with fixed orthodontic appliances with elastic chain fixation from the upper right to the upper left first molar. To exclude poor oral hygiene and the effect of periodontal disease, PMA (Parma, 1960) and OHI-S (Green and Vermillion, 1964) were determined. The Doppler signal was registered at the middle of the central and lateral incisor labial marginal gingiva. Registration was carried out before and two and four weeks after elastic chain fixation and space closure (after chain removal). The microcirculation index (MI), that characterizes tissue blood perfusion rate, and the microcirculation efficacy index (MEI), was evaluated.
RESULTS: Elastic chain fixation produced strong microcirculation disturbances in the periodontium of moved teeth. MEI and MI values decreased by approximately 50 per cent. After tooth alignment, normalization (elimination of spaces) the chain loosened and the microcirculation intensified. MEI and MI values increased and approached initial values within two weeks of chain removal.
CONCLUSIONS: Orthodontic tooth movement results in microcirculatory changes and, therefore, requires precise amounts of applied forces. Laser Doppler flowmetry can be successfully used to evaluate and control periodontal blood vessel status during orthodontic treatment.

205 TEMPOROMANDIBULAR JOINT EVALUATION IN PATIENTS WITH SKELETAL CLASS III MALOCCLUSIONS

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AIM: To evaluate temporomandibular joint (TMJ) status in patients with skeletal Class III malocclusions.
SUBJECTS AND METHOD: Thirty-one patients, aged 16 to 36 years, with a skeletal Class III malocclusion due to mandibular macrognathism. To evaluate TMJ status, a standard clinical examination, computer axiography and magnetic resonance imaging (MRI) of the TMJ were conducted.
RESULTS: Most patients had some clinical symptoms of TMJ dysfunction: different types of noise, clicking or crepitation. In three patients pain and mouth opening limitation were observed. MRI revealed degenerative changes of the articular disc in all but two patients (93 per cent). Twenty-three patients (74 per cent) had articular disc dislocation (mainly medial) and four (13 per cent) had changes in the condyle head. Computer axiography showed some joint hypermobility in all subjects.
CONCLUSIONS: Patients with skeletal Class III malocclusions have MRI signs of TMJ dysfunction, although often without obvious clinical manifestations, which have to be considered in orthodontic and surgical treatment planning.

206 LONG-TERM STABILITY OF ANGLE CLASS II EXTRACTION TREATMENT

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AIM: To examine long-term stability following treatment of Angle Class II division 1 malocclusions after four premolar extractions.
SUBJECTS AND METHOD: Forty-three patients (27 females, 16 males) with an excessive overjet (mean: 9.5 mm), treated by one orthodontist, who attended a long-term follow-up examination. The malocclusion was scored from study casts obtained pre-treatment (T1), post-treatment (T2), and at least 3 years post-retention (T3). The weighted Peer Assessment Rating (PAR) Index was used to measure the improvement obtained during treatment and the potential subsequent relapse.
RESULTS: At the start of treatment the mean age of the subjects was 12.6 years and the mean PAR score 32.8. On average treatment lasted 29 months and the post-retention period was 6.7 years. Treatment reduced the malocclusion, on average, by 87 per cent. During T3 some relapse occurred, as the reduction was 71 per cent, however, in some (12 per cent) improvement was observed. At follow-up, 35 per cent of the patients could be allocated to the category ‘improved’, and 65 per cent to ‘greatly improved’. No patients were allocated to the ‘worse-no different’ category (T2, T3).
CONCLUSIONS: Generally good long-term stability was observed in the present group of patient with Angle Class II division 1 malocclusions after four premolar extraction treatment.

207 FACTORS INFLUENCING LONG-TERM PATIENT SATISFACTION AFTER MANDIBULAR ADVANCEMENT SURGERY

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AIM: Of all patients monitored by the orthognathic surgery team at the University of Oslo between 1990 and 2002, 741 presented at the 3-year follow-up examination. Although only 7 per cent of these patients expressed dissatisfaction with the treatment result, the dissatisfied were over-represented among those who had mandibular advancement surgery. The aim of

the present study was to examine outcomes in terms of stability and patient satisfaction in skeletal Class II patients who had undergone a bilateral sagittal split osteotomy, and to analyze factors that may influence patient dissatisfaction.
SUBJECTS AND METHOD: Forty-one consecutive patients (24 females, 17 males) operated at the University Hospital in Oslo. Mandibular advancement was the only surgical procedure performed. Treatment changes and stability were assessed from lateral cephalograms obtained pre-treatment, pre- and post-surgery, and at the 3-year follow-up. A questionnaire survey was undertaken to examine the patients' attitudes to the treatment and the result.
RESULTS: Pre-treatment facial patterns differed significantly between genders, as the females were more retrognathic and had an increased mandibular plane angle. The overjet was similar in both groups (mean 8.0 mm). At surgery the mandible was advanced on average 5.5 mm, and the mean skeletal relapse and relapse in overjet was 1.9 mm. Satisfaction with the treatment result was expressed by 75 per cent of the patients. Significantly more females than males were dissatisfied, 39 and 6 per cent, respectively. Statistical analyses revealed significant associations between satisfaction and some morphological variables: pre-treatment overbite, amount of treatment change in SNB and ANB angles, skeletal relapse of the advancement, and overjet after 3 years. In addition, the dissatisfied individuals more frequently reported temporomandibular joint (TMJ) problems and concern about neurosensory function.
CONCLUSIONS: Mandibular advancement surgery implied an increased risk for dissatisfaction among female patients showing relapse and being concerned about TMJ problems and sensory dysfunction.

208 RELATIONSHIP BETWEEN TOOTH ANGULATION AND THE CURVE OF SPEE
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AIM: To assess the long-term relationship between the mesiodistal angulation of M1, P2, P1 and C, and the depth of the curve of Spee in extraction and non-extraction treatment.
MATERIALS AND METHOD: Dental casts of 111 patients, originally with moderate Class II division 1 or Class I malocclusions, from the start of orthodontic treatment T1 (mean age 12.4 ± 2.4 years), after treatment T2 (14.7 ± 2.3 years) and at least 3 years out of retention T3 (31.4 ± 4.3 years). Thirty-four subjects were treated non-extraction, 39 with extraction of four first premolars and 38 with extraction of only the upper first premolars. In 31 patients the mandible remained untreated. The mesiodistal angulations of M1, P2, P1 and C and the curve depth were assessed on standardized photographs of the dental casts. Correlation coefficients and regression analyses were carried out to investigate the relationships between curve depth and the mesiodistal angulations according to the treatment modalities at different timepoints. ANOVA was performed to detect differences in dental angulation in the upper arch between the treatment groups.
RESULTS: At T1 only the angulation of the lower first molars correlated with curve depth. At T2 the angulation of the left first molar and canine and the right first premolar and canine in the untreated lower arches correlated with curve depth. At T2 and T3 no relationship was found in the upper arch between the angulations and any of the treatment modalities. At T3 only the angulations of the lower first molars and of the right lower canine were associated with curve depth. At T3 treatment modalities were not associated with the mesiodistal angulations.
CONCLUSION: Only the angulation of the lower molars shows some association with curve depth over time. Treatment modalities seem to have little influence on tooth angulations.

209 FACTORS FOR DISCOMFORT IN THE RETENTION PERIOD
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AIM: To determine patients' perceptions of the retention period of orthodontic treatment.
SUBJECTS AND METHOD: Thirty-six patients divided into two groups: group 1 comprised subjects at the end of active orthodontic treatment, and group 2 those in the retention stage. The subjects in group 1 were asked for their opinion regarding retainer construction and the length of the retention period, while those in group 2 recorded comfort, hygiene and aesthetic factors of their retainers.
RESULTS: At the end of orthodontic treatment 68.1 per cent patients wanted to use removable retainers. Thirty-three per cent of males preferred fixed retainers; permanent wear was accepted in 18 per cent of patients; 62.5 per cent of females and 15 per cent of males were concerned about wearing a retainer several hours a day and all night. The expectation of the duration of retention varied from 6 month to 2 years. The patients in group 2 considered fixed retainers as the most comfortable in conjunction with a removable clear plastic retainer.
CONCLUSIONS: Most patients in the retention period would prefer to use removable retainers at night. Adolescents do not want to 'waste their time' in taking care of retainers. Most patients found plastic retainers to be the most comfortable to wear, and easy to maintain.

210 LOWER INCISOR STABILITY 5-YEARS AFTER ACTIVE ORTHODONTIC TREATMENT

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AIM: To determine lower incisor stability 5-years after orthodontic treatment.

MATERIALS AND METHOD: Orthodontic records of 78 subjects treated using the edgewise technique, who had pre-treatment, end of treatment and post-treatment records after 5 years. Lower incisor stability was determined from lateral cephalometric radiographs using the six lower incisor cephalometric indicators [LI/NB (mm and degrees); LI/Apo (mm and degrees); IMPA; Holdaway ratio]. For measurements on study casts, electronic callipers were used to determine the irregularity index (Little, 1975) and mandibular intercanine width. A repeated measures ANOVA was used to analyze the data.

RESULTS: Lower incisor inclination relapsed between 39 (1.92 degrees) and 48 (2.45 degrees; $P < 0.05$) per cent, but still showed a net gain of between 52 (2.73 degrees) and 61 (2.96 degrees; $P < 0.05$) per cent. LI/APo relapsed 25.44 (1.95 degrees) and 33.52 (0.74 mm) per cent linearly ($P < 0.05$), but had a net angular gain of 74.56 per cent (5.71 degrees; $P < 0.05$) and a linear gain of 66.48 per cent (1.48 mm; $P > 0.05$). Little's irregularity index relapsed 29.12 per cent (1.51 mm; $P < 0.01$) and intercanine width 45.65 per cent (0.3 mm), but this was not statistically significant due to the very small linear change observed ($P > 0.05$).

CONCLUSION: Statistically significant changes in most lower incisor cephalometric positioning parameters and highly significant crowding (irregularity), was observed 5 years after active orthodontic treatment. However, clinically these values may be of little significance since the angular relapse was only in the magnitude of 1.9 to 2.5 degrees, and the relapse varied between 0.3 and 1.5 mm for all linear measurements.

211 COMPARISON OF THREE LIGHT SOURCES FOR BONDING PRE-COATED CERAMIC BRACKETS

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AIM: To compare the shear bond strength and adhesive remnant index (ARI) between pre-coated ceramic brackets and enamel after adhesive curing using three different curing lights.

MATERIALS AND METHOD: Sixty sound human premolar teeth divided into three equal groups. A 0.022-inch APC™ Plus Clarity™ ceramic bracket was bonded to each tooth and the adhesive was cured using three different light curing units for the appropriate time following the manufacturers' instructions (10 seconds for the halogen light, 5 seconds for the light emitting diode, and 3 seconds for the plasma curing light). Shear bond testing to failure was performed using a custom-made testing jig in an Instron Universal testing machine with a crosshead speed of 1 mm/minute. The Adhesive Remnant Index (ARI) score was assessed at ×10 magnification. This was repeated three times and the mode score was determined.

RESULTS: Kaplan-Meier survival probability, log-rank and Cox proportional hazards tests showed no statistically significant differences in bond strength between the three different lights. Analysis of the ARI scores, using the Kruskal-Wallis test for single ordered data, indicated that there was no significant difference in distribution of ARI between the three different lights ($P = 0.16$), showing that the curing lights did not affect the locus of bond failure.

CONCLUSIONS: All three types of light curing units can be used in orthodontics since similar bond strengths and ARI scores were obtained. The tie-wings of four brackets fractured during the study, but no enamel fractures were observed.

212 TRANSVERSE FACIAL PROPORTIONS IN YOUNG POLISH ADULTS

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AIM: According to Farkas (1981), the total width of the face should be equal to the sum of five widths of an eye in a given individual. The aim of this study was to test the validity of the 'rule of fifths' in a group of young Polish adults with attractive faces.

SUBJECTS AND METHOD: From a cohort of 140 young Poles, 123 subjects were selected after exclusion of those who were overweight and obese, i.e. when the body mass index value exceeded 25. For each individual, *en face* digital photographic images were taken. Facial attractiveness was evaluated by 10 judges using a visual analogue scale. Twenty-two individuals with the lowest score were excluded. Subsequently 101 records of 81 females and 20 males were accepted for further study. Six vertical lines were used to divide the face into five equal transverse segments. Assuming possible asymmetry for the size of the eyes, the width of the right eye was established as a reference for the size of the remaining segments.

RESULTS: The widths of left and right eyes were the same for over 67 per cent of subjects, while in the remaining 33 per cent the differences were minimal. The middle fifth was wider in almost half of the individuals, indicating a tendency for

hypertelorism. The outer fifths exceeded the width of the eyes and the gonial angles were always located laterally in relation to the outer canthus of each eye.
CONCLUSIONS: Application of the rule of fifths in young Polish adults showed a tendency for hypertelorism, wider than normal outer fifths of the face and a large intergonial distance, which can be ascribed to ethnic features in faces commonly accepted as attractive.

213 INFLUENCE OF HABITS ON FACIAL GROWTH REGULATION
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AIM: The aim of this research was not to investigate the influence of sucking habits on facial morphology, but more precisely to study the influence of sucking habits on morphogenesis of the face.
MATERIALS AND METHOD: One hundred and seventy one teleradiographs of patients distributed into a control group without known sucking habits, and four groups with thumb or dummy-sucking habits stopped or continued after 6 years of age. All patients were classified according to Lavergne and Petrovic (1985), which allows groups to be defined where subjects are morphogenetically and anatomically alike, and are growing alike. Moreover, it is possible to differentiate between the different ways of functioning of the regulatory system of facial growth. Broadly speaking the system may be: working correctly and achieving a good interjaw relationship; working correctly but not achieving a good interjaw relationship (overloading of the system); not working; working on a wrong referential and generating a malocclusion; adding two of the previous causes of malocclusion. In this study only three groups were taken into consideration: working, not working, error.
RESULTS: The incidence of failures in the facial growth regulating system increased with all sucking habits. If the habit ceased before 6 years of age, dummy or thumb sucking were more or less equivalent (considering the teleradiography). After 6 years of age, thumb sucking resulted in more problems than dummy sucking: thumb sucking induced a greater lack of regulation than dummy sucking at an early age.
CONCLUSION: Sucking habits result in malocclusions through perturbation of the facial growth regulating system; either the regulating system is not working at all, generating relatively mild malocclusions or is working on a wrong referential and generating more severe malocclusions.

214 EVALUATION OF THE COMPUTED TOMOGRAPHY SCANOGRAM FOR ASSESSMENT OF CRANIOFACIAL MORPHOLOGY
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AIM: To investigate, in a prospective, controlled, experimental study, the suitability of the computed tomography (CT) scanogram as an alternative to conventional or storage phosphor digital lateral cephalograms.
MATERIALS AND METHOD: Twenty intact, adult sized, dry human skulls. Each skull was fixed in a custom-made plastic box and imaged in each radiographic machine: CT (scanogram), conventional and storage phosphor. After randomization, all the hard copy radiographs were directly digitized using a customized cephalometric program (GELA) and all skulls measured with an external calliper. The digitizations and measurements were carried out twice with an interval of two weeks. *A priori* ranges were tabulated in advance for all the craniofacial parameters. All cephalometric linear measurements were corrected for radiographic magnification. Coefficients of repeatability were calculated to assess repeatability between the first and second readings. Limits of agreement and paired *t*-tests were used to assess the level of agreement and systematic error, respectively, between direct skull, conventional, storage phosphor digital and CT cephalometric measurements.
RESULTS: All direct skull measurements, anterior face height measurements, SN, SNA, SNB and ANB (except CT) were repeatable but not PLFH, TPFH, UIMx, LIMn and CT posterior face height measurements. SBa and BaN were not repeatable for either conventional or storage phosphor.
CONCLUSION: Depending on the clinical situation and the degree of precision required, the CT scanogram is a viable alternative to lateral cephalometry (conventional and storage phosphor) for the assessment of SN, all anterior face height measurements, SnMx, MxMn, SNA, SNB and ANB but not for SBa, BaN, all posterior face height measurements and incisor angulations. The storage phosphor digital cephalogram is interchangeable with the conventional lateral cephalogram for the assessment of SN, all anterior face height measurements, PUFH, SnMx, MxMn, SNA, SNB, ANB and incisor angulations but not for SBa, BaN and posterior face height measurements based on gonion.

215 EVALUATION OF FRICTION IN AESTHETIC BRACKETS**
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AIM: To evaluate how friction, which occurs during sliding movements of archwires through aesthetic brackets, is affected by bracket material, slot design, and archwire tip angulation.

MATERIALS AND METHOD: Eight types of 0.022 inch slot brackets (composite, composite with metal slot, ceramic, ceramic with metal slot, and metal). In each group, 0.020 and 0.018-inch stainless steel (SS) wire was tested in artificial saliva. The wire tip angulations were controlled as 0, 4 and 8 degrees.
RESULTS: The conventional ceramic bracket significantly showed the lowest frictional force with all wire tip angulations. The conventional ceramic bracket demonstrated the highest statistically significant frictional force with wire tip angulations of 0 and 4 degrees, and SP (composite bracket with metal slot) at 8 degrees. When compared with metal slot brackets, the ceramic bracket with a gold slot produced the least friction, followed by the SS bracket. The ceramic bracket with a SS slot ranked third according to angle, but there were no significant differences among three brackets. The polyoxymethylene resin bracket had significantly less frictional force than the polycarbonate resin bracket with a metal slot but there was no significant difference between the metal brackets. Friction was increased as the wire tip angulations were increased, but notching of the bracket and archwire was not found.
CONCLUSION: Friction is not a significant concern in new aesthetic brackets when using sliding mechanics.

216 IMPACT OF FIXED ORTHODONTIC APPLIANCES ON ORAL CARRIAGE OF CANDIDA

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AIM: To determine the oral prevalence of Candida species in patients before fixed orthodontic appliance therapy, and sequential candidal carriage rates after insertion of the appliance.
SUBJECTS AND METHOD: One hundred and twelve consecutive Chinese patients (43 males, 69 females; mean age: 17.7 ± 5.8 years). Baseline data (T0) of oral carriage of Candida species was obtained prior to appliance insertion by collecting salivary samples using the oral rinse technique. Colony forming units (CFU) per millilitre of the original samples were calculated. Fixed appliances were subsequently inserted, and salivary samples were obtained on three sequential visits an average of six weeks apart: T1, T2 and T3 for repeat mycological studies.
RESULTS: Oral prevalence of Candida at T0 was 28 per cent. Of the 53 patients with at least three visits after appliance insertion, average candidal carriage rates were: T1 = 36 per cent, T2 = 39 per cent, T3 = 45 per cent. Fifteen per cent had consistently shown candidal carriage rates at all visits. Six per cent converted into consistent candidal carriers after insertion of the appliance. There was an increase in the number of CFU per ml of Candida recovered with increasing duration of appliance wear.
CONCLUSIONS: (1) The oral prevalence of candidal carriage rate prior to appliance insertion was comparable with that of previous studies from Hong Kong. (2) The number of candidal carriers increased after appliance insertion, and the amount of candidal carriage rate also increased. (3) The data indicated that fixed orthodontic appliances foster oral candidal colonization possibly by offering them a fixed nidus for colonization and biofilm formation.

217 LONG-TERM EFFECTS AND DENTO-SKELETAL STABILITY AFTER HEADGEAR-ACTIVATOR TREATMENT

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AIM: To analyze the long-term effects of combined activator-headgear treatment on skeletal and dental structures in Class II patients.
SUBJECTS AND METHOD: Twenty-six patients (10 girls, 16 boys). All had a Class II molar relationship, an overjet of at least 6 mm and an overbite of at least 5 mm. They were treated with combined activator and headgear appliances. Lateral cephalometric radiographs and dental study casts were taken before treatment (T0, mean age 11.9 years), at the end of activator-headgear treatment (T1, mean age 15.9 years) and 12-15 years out of retention (T2, mean age 28.6 years). All radiographs were digitally traced using a modified Oslo analysis with 10 linear and 17 angular measurements. Additionally, nine variables were evaluated from the dental casts. A paired-sample *t*-test was used to determine the treatment and post-treatment changes.
RESULTS: At T1 the majority of the cephalometric measurements showed statistically significant changes. ANB was significantly reduced by 2.3 degrees ($P < 0.05$) mainly due to a significant increase in SNB angle ($P < 0.05$). The interincisal angle increased by 6.4 degrees ($P < 0.05$) as a result of significant retroclination of both maxillary ($P < 0.05$) and mandibular ($P < 0.01$) incisors. All patients achieved a Class I molar relationship and significant reduction of overjet (4.4 ± 1.7 mm) and overbite (2.3 ± 1.0 mm). At T2 the treatment results showed only slight relapse from T1, however, the relapse did not compromise the significant improvement in almost all of the cephalometric and dental variables.
CONCLUSION: Combined activator-headgear treatment improves skeletal and dental conditions and the results remain stable long after the end of active treatment and retention.

218 LONG-TERM POST-TREATMENT STABILITY OF THE SAGITTAL OCCLUSION

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AIM: To assess the long-term stability of the sagittal occlusion following treatment of Class II division 1 malocclusions after extraction or non-extraction treatment.

MATERIALS AND METHOD: In this retrospective study, dental casts of 69 patients with a Class II division 1 malocclusion were obtained before orthodontic treatment T1 (mean age 12.2 ± 1.2 years), after orthodontic treatment T2 (mean age 14.7 ± 1.2 years) and at least 3 years out of retention T3 (mean age 27.7 ± 5.8 years). Thirty-nine patients underwent extraction of four first premolars while 30 had no extractions. All patients were treated with fixed appliances. Measurements of the sagittal occlusion of the canine, premolar(s) and first molars with the antagonist were assessed on standardized photographs of the dental casts. The sample was grouped according to extraction or non-extraction treatment. The changes in the sagittal occlusion after treatment were designated as relapse (<–0.5 mm), stable (–0.5-0.5 mm) and improvement (>0.5 mm). Correlation coefficients were calculated between the changes of sagittal occlusion during and after treatment.

RESULTS: During T2-T3 the sagittal occlusion showed a relapse of 17-24 per cent in the extraction group and 5-6 per cent in the non-extraction group. In the extraction group, 47-49 per cent of the subjects showed relapse, 13-17 per cent improvement and 35-39 per cent remained stable during T2-T3. In the non-extraction group the percentages were 29-35, 13-29 and 39-53, respectively. All changes in the sagittal occlusion during T1-T2 were negatively correlated with the changes during T2-T3 in the extraction group. In the non-extraction group no significant correlations were found in sagittal occlusion during T1-T2 and T2-T3.

CONCLUSION: There seems to be a tendency towards more relapse in sagittal occlusion after treatment of Class II division 1 malocclusions with extractions than without extractions.

219 A PRELIMINARY STUDY OF NON-SURGICAL TREATMENT OF SEVERE CLASS III MALOCCLUSION SUBJECTS

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AIM: To analyze the effects of non-surgical treatment on severe skeletal Class III deformity, and to evaluate dental and facial profile changes.

SUBJECTS AND METHOD: Eighteen patients with a severe skeletal Class III malocclusion, diagnosed with an indication for orthognathic surgery. The average age was 14.6 ± 2.5 years, range 12-20 years. Twelve patients were treated with the Tip-Edge technique and six with the Begg technique. The average treatment time was 2.5 ± 0.8 years. The selection criteria included: (1) mesial or superior mesial Class III molar relationship, with maxillary first molar occluding the buccal groove of the mandibular second molars; (2) no mandibular shift; (3) ANB <–1.5 degrees; (4) high angle cases with an average value of SN-MP of 34.9 ± 5.9 degrees, four subjects with an open bite; (5) concave facial profile; (6) originally classified as surgery cases. Lateral cephalograms taken at the beginning and end of treatment were analyzed using traditional cephalometric analysis. The mean and standard deviation were calculated for each variable. A paired *t*-test was performed to evaluate the treatment changes.

RESULTS: Normal overjet and overbite were established with proclination of the upper incisors and retroclination of the lower incisors. Inclination of the upper incisors was increased 5.9 degrees when measured by the angle of the upper incisor to SN plane ($P < 0.01$). Inclination of the lower incisors was decreased 6.6 degrees when measured with the angle of the lower incisor to mandibular plane ($P < 0.001$). A negative value for the difference in upper and lower lip distance to Sn-Pg' at the beginning of treatment changed to a positive value with a significant difference ($P < 0.001$).

CONCLUSION: Successful treatment effects can be obtained with non-surgical therapy of severe skeletal Class III malocclusion subjects in the permanent dentition. A remarkable soft tissue change was noted after treatment, and the concave facial profile changed to a straight profile.

220 CORRELATIONS BETWEEN SAGITTAL SPINAL POSTURE AND CRANIOFACIAL MORPHOLOGY IN ADULTS

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AIM: To analyse the correlation ratios between spinal posture (thoracic, lordotic and pelvic inclination) and craniofacial morphology.

SUBJECTS AND METHOD: Fifty-three healthy adults (32 females, 21 males, mean age 24.6 years). Six angular skeletal measurements (facial axis, inner gonial angle, mandibular plane angle, lower face height, facial depth and maxillary position)

were determined based on analysis of lateral cephalograms. Rasterstereography was used for precise reconstruction of the back sagittal profile. From the profile parameters, upper thoracic inclination, thoracic angle, lordotic angle and pelvic inclination were determined and the correlations with craniofacial morphology were calculated using Pearson and Mann-Whitney *U*-test.
RESULTS: Significant correlations were found with respect to facial axis and lordotic angle, facial axis and pelvic inclination, inner gonial angle and lordotic angle, inner gonial angle and pelvic inclination, mandibular plane angle and lordotic angle, and mandibular plane angle and pelvic inclination, as well as facial depth and pelvic inclination.
CONCLUSION: The correlations between craniofacial parameters and thoracic, lordotic and pelvic inclination suggest that there is some clinical evidence for a relationship between jaw position and body posture. The mandible seems to have a greater impact on posture than the maxilla. Further prospective studies are necessary to determine how changes in craniofacial parameters can affect the postural balance of an individual.

221 TREATMENT OF HEMIMANDIBULAR HYPERPLASIA – THE BIOLOGICAL BASIS OF CONDYLECTOMY

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AIM: Treatment concepts to correct skeletal deformities in patients with hemimandibular hyperplasia differ in various respects, especially with regard to the age when surgery should take place, as well as to the surgical procedure. To some extent, the differences can be attributed to the unknown biological basis of the disease. The aim of this study was to evaluate, clinically, the outcome of a surgical concept based on condylectomy of the affected side involved in orthognathic surgery.
SUBJECTS AND METHOD: Histological (Masson-Goldner staining), radiological (cephalometric analysis of postero-anterior radiographs), functional (Helkimo index) and nuclear medical (Tc^{99}-scintigraphic scanning) methods were used to obtain a more detailed insight into the rationale behind the surgical concept. Six patients with hemimandibular hyperplasia were treated by a combined orthodontic-maxillofacial treatment protocol. All underwent bignathic surgery including Le Fort I osteotomy and surgical removal of the affected joint. The histological morphology of the condylar specimens was compared with bone scinitigraphy to find a possible correlation between both methods.
RESULTS: Clinical evaluation revealed morphological and functional rehabilitation in all patients. During the two-year follow-up, the patients had a stable, symmetric, position of the mandible without any temporomandibular joint disturbance. The activity of joint remodelling as well as the destruction of the cartilage layer was accompanied by high bone scintigraphic activity.
CONCLUSION: Condylectomy can be used to correct hemimandibular hyperplasia even in patients with active condylar growth by removing the underlying pathology.

222 LONG-TERM STABILITY OF SURGICAL COUNTERCLOCKWISE ROTATION OF THE MAXILLOMANDIBULAR COMPLEX**

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AIM: The correction of high occlusal plane facial deformities by means of surgical upward and forward (counterclockwise) rotation of the maxillomandibular complex has traditionally been considered an unstable and unpredictable procedure. The aim of this study was to evaluate long-term stability in a group of high angle patients undergoing changes to the plane angulation by bimaxillary surgery.
SUBJECTS AND METHOD: Twenty adult patients (6 males, 14 females) who had undergone bimaxillary surgery (multiple-piece maxillary step osteotomies and bilateral mandibular ramus sagittal split osteotomies). All subjects had a high facial angle (mean SN^GoGn = 41 degrees), various types of sagittal facial deformities, but without signs or symptoms of temporomandibular joint (TMJ) disorders. Lateral cephalograms taken before surgery (T_0), immediately after surgery (T_1) and at a medium follow-up of 16 months (T_2), were superimposed on different anatomical landmarks.
RESULTS: The average surgical change (T_0-T_1) of the occlusal plane (5.11 degrees) was statistically significant ($P < 0.01$). The post-surgical changes (T_1-T_2) were statistically significant ($P < 0.001$). The average counterclockwise rotation of the occlusal plane was 1.04 degrees (20.2 per cent of the upward and forward rotation). Post-surgical (T_1-T_2) changes of mandibular advancement were also evaluated. Point B demonstrated a statistically significant mean relapse (2 per cent of the whole advancement).

CONCLUSIONS: Counterclockwise rotation of the maxillomandibular complex for correction of high angle facial deformities in patients with healthy TMJs can be a stable procedure when associated with correct treatment planning, appropriate pre- and post-surgical orthodontics, rigid fixation methods and surgery.

223 HISTOMORPHOMETRIC EVALUATION OF BONE HEALING AROUND IMMEDIATELY LOADED MINI-IMPLANTS

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AIM: To evaluate, in an animal model, by means of four parameters retrieved from bone histomorphometry, the bone healing pattern to immediate loading of orthodontic mini-implants.
MATERIALS AND METHOD: Fifty small titanium mini-implants were inserted in four adult male monkeys. Forty-two were immediately loaded with 50 g super-elastic coil springs at four time intervals, while eight were left unloaded. Intravital bone labelling fluochromes were administered and, after euthanasia, histomorphometric analysis was performed and the following parameters evaluated: bone volume (BV/TV), bone-to-implant contact (BIC), mineralizing surface (MS/BS) and erosion surface (ES/BS).
RESULTS: Four mini-implants were found to be mobile and were removed. All the data related to the histomorphometric analysis showed a wide variation between animals. BV/TV: slightly higher values were found at all four time intervals in the unloaded sample compared with the loaded sample. The data did not show any particular trend, although at three months higher values were found in the lower compared with the upper jaw. BIC: there was a trend to a decrease between the one week and one month observation periods, and a significantly progressive re-increase following the one month observation. MS/BS: higher values were found in the lower jaw when compared with the upper jaw. MS/BS increased significantly between one week and one month, and then decreased gradually. ES/BS: a decrease between one week and one month, and a progressive re-increase following the one month observation was observed.
CONCLUSIONS: BV/TV did not show any particular trend. BIC was a time-dependent factor. MS/BS AND ES/BS showed opposite trends during the healing period.

224 COUNSELLING AS A SUPPORT TREATMENT IN SUBJECTS WITH TEMPOROMANDIBULAR DISORDERS

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AIM: A protocol for patients with temporomandibular disorders (TMD) is particularly difficult to achieve due to the multivariate aetiology of this disease. The aim of this study was to investigate the role of counselling in TMD patients as a therapeutic strategy devoted to the subjective causes of TMD.
SUBJECTS AND METHOD: Twenty-four consecutive TMD patients. In order to evaluate the efficacy of this approach with respect to the symptoms of pain on quality of life, two surveys were used: a generic questionnaire, SF-36, commonly used to evaluate quality of life, and a disease-specific questionnaire, the Axis II of Research Diagnostic Criteria. The patients were asked to complete each questionnaire during the first consultation and two months after the beginning of therapy. Concerning therapy, the patients were randomly divided into two equal groups: one underwent counselling, the other gnathological therapy. During preliminary consultation, before treatment commenced, information, tailored in extent and quality for the individual patient, was provided and a relationship of mutual trust established. Fortnightly appointments were arranged for all patients.
RESULTS: Before therapy, the questionnaires showed high scores for depression in all TMD patients, related to a low level of quality of life, both in 'physical pain' and in 'physical function' aspects. Post-therapy the quality of life improved significantly, more so in group that underwent counselling than in the gnathological therapy sample for 'physical pain'.
CONCLUSIONS: Beside traditional gnathological treatment, counselling may represent a valid approach to the patients' real needs. Orthodontist-patient communication would represent an essential step in TMD treatment and, depending on the individual case, it could become the only therapy.

225 DIAGNOSIS, SCREENING AND TREATMENT OF ORTHODONTIC ROOT RESORPTION: GREEK AND SWEDISH PRACTICE

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AIM: To evaluate the awareness of orthodontic practitioners to the occurrence and prognosis for root resorption during orthodontic treatment, and to record the practitioners' approach to treatment.

MATERIALS AND METHOD: A total of 300 questionnaires were randomly sent to selected orthodontic practitioners in Greece (150) and Sweden (150). The response rate was 90 and 106, respectively. The questionnaires included questions concerning: i) pre-treatment recording of possible predisposing factors for root resorption; ii) radiographic monitoring of root resorption before, during and after treatment, and iii) treatment approach and protocols in patients where root resorption was discovered during treatment.
RESULTS: Both Swedish (47.1 per cent) and Greek (32.3 per cent) practitioners used panoramic radiographs to diagnose root resorption. In the anterior region intraoral periapical radiographs were used. Trauma, root form and oral habits were considered as predisposing factors for root resorption. The majority of the Swedish orthodontists carried out radiographic follow-up in the first 6 months, in contrast to the Greek orthodontists when it was performed after one year, or at the end of treatment. The approach when root resorption was diagnosed was to alter the treatment plan: the use of lighter forces was employed by both Greek and Swedish orthodontists. The Swedish orthodontists also suggested 'resting' periods, while Greek orthodontists tried to reduce total treatment time.
CONCLUSIONS: Since, there is no evidence-based approach in the prevention and management of root resorption, pre-treatment records, radiographic monitoring, and treatment strategies differ between orthodontic practitioners in different countries.

226 IS A UNILATERAL POSTERIOR CROSSBITE ASSOCIATED WITH LEG-LENGTH INEQUALITY?
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AIM: Clinical, anecdotal, reports suggest that transversal malocclusions (e.g. a unilateral posterior crossbite) may have a strong impact on body posture. This hypothesis was tested by means of a survey carried out in a large sample of young adolescents.
SUBJECTS AND METHOD: The subjects were recruited from three secondary schools in Naples using two-stage cluster sampling. The sample included 640 (54.5 per cent) males and 534 (45.5 per cent) females (mean age ± SD: 12.3 ± 1.0 years). All subjects underwent an orthodontic and orthopaedic examination performed independently by two orthodontists and two orthopaedists.
RESULTS: A unilateral posterior crossbite was found in 159 of the subjects (13.5 per cent); 82 (51.6 per cent) males and 77 (48.4 per cent) females. Leg-length inequality was found in 121 (10.3 per cent) subjects; 61 (50.4 per cent) males and 60 (49.6 per cent) females. Logistic regression analysis, controlling for potential confounding variables, indicated no association between crossbite and leg-length inequality (odds ratios ranged between from 0.90 to 1.08).
CONCLUSIONS: A unilateral posterior crossbite is not associated with leg-length inequality. Therefore, orthodontic correction of a unilateral posterior crossbite is not indicated for the treatment of leg-length inequality.

227 CRANIOFACIAL MORPHOLOGY IN CHILDREN WITH SLEEP DISORDERED BREATHING
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AIM: Obstructive sleep disordered breathing (SDB) is common in children. The aim of this study was to describe the differences in craniofacial morphology between children with obstructive sleep apnoea (OSA) and those with SDB (oral breathing, primary snoring and upper airway resistance syndrome).
MATERIALS AND METHOD: Lateral cephalograms of 14 Caucasian subjects (mean age: 5.3 ± 1.13 years) with a polysomnographic diagnosis of OSA were traced and compared with lateral cephalograms of 12 Caucasian subjects (mean age: 5.6 ± 1.23 years) with a polysomnographic diagnosis of SDB. The following variables were measured: SNA, SNB, NL^NSL, ML^NSL and NSBa. A two-tailed Student's *t*-test was used to compare the measurements.
RESULTS: OSA patients: SNA = 78.50 ± 4.35; SNB = 73.73 ± 4.02; NL^NSL = 6.95 ± 1.86; ML^NSL= 36.82 ± 5.34; NSBa= 135.18 ± 5.83. SDB patients: SNA= 79.75 ± 2.65; SNB = 75.80 ± 3.26; NL^NSL = 6.45 ± 3.83; ML^NSL = 38.80 ± 5.88; NSBa = 131.60 ± 4.76. According to the floating norms cephalometric analysis, both groups had an orthognathic face type. No statistically significant differences between the two groups were found. However, SNB in OSA children was decreased when compared with the same angle in SDB patients.
CONCLUSIONS: The non-significant differences in the cephalometric variables between the OSA and SDB groups, may be due to the young age of the sample. The results suggest that mandibular retrognathism is more evident in OSA patients compared with SDB patients, who show a higher value for mandibular inclination angle.

228 BRIDGING AND DIMENSIONS OF THE SELLA TURCICA IN ADULT CLASS III SUBJECTS
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AIM: To evaluate the incidence of sella turcica bridging, and to investigate the correlations between sella turcica dimensions and skeletal variables in adult skeletal Class III subjects.
MATERIALS AND METHOD: Pre-treatment lateral cephalograms of 84 adults (49 females, 35 males, mean age: 22.99 ± 3.97 years) with a skeletal Class III malocclusion. The radiographs were traced and 24 skeletal variables, including sella turcica dimensions, were measured. Intra-group comparisons were performed with a *t*-test, and correlations between the variables evaluated with Pearson's correlation test.
RESULTS: Bridging was found in 50 of the 84 subjects. Sella turcica dimensions and the incidence of bridging were not significantly different between the genders. Significant positive correlations were found between the depth and interclinoid distance of sella turcica and N perpendicular-A, N perpendicular-B, perpendicular-Pog distances and depth also showed significant positive correlation with N-PNS distance.
CONCLUSIONS: Sella turcica bridging was found in 59.53 per cent of adult skeletal Class III subjects. Sella turcica dimensions and maxillary and mandibular positional changes are significantly correlated.

229 PERCEPTION OF ORTHODONTICS: AN ENQUIRY INTO PATIENTS' SATISFACTION LEVELS**
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AIM: To examine patients' concerns about their initial malocclusion and how satisfied they were with the progress and results of their active treatment.
SUBJECTS AND METHOD: Ninety patients (54 girls, 36 boys) consecutively treated in the same private practice. The inquiry consisted of two distinct parts: the first dealt with the patient's original malocclusion retrospectively evaluated by both patient and investigator, and the second focused on the treatment itself using an original questionnaire.
RESULTS: Patients and orthodontists had correlated opinions about the severity of the initial malocclusion, with girls often tending to view the problem as more severe. Ninety-five per cent of the patients were satisfied with their treatment. Parents decided to initiate treatment in 52 per cent of the cases. Improving appearance of the teeth represented the main motivating factor (87 per cent). Seventy-seven per cent of the patient's relatives regarded the procedure with indifference, although they were envious of the perceived benefits to the patient in 18 per cent of the cases. Forty-four per cent of the patients complained of an excessive treatment time, 68 per cent reported that they had suffered pain during treatment, and 24 per cent had thought about discontinuing therapy. Of all the appliances, patients disliked full-banded set-ups the most. Ninety six per cent of the patients seemed to be aware of the aesthetic benefits therapy would confer upon them but only 16 per cent were conscious of psychosocial rewards. Eighty-nine per cent of the patients thought their treatment had been necessary and 70 per cent of them would do it all over again if needed.
CONCLUSION: In spite of its negative aspects, these patients were satisfied with their treatment, happy to begin it, and seemed to be motivated throughout its course. This study of patient satisfaction makes it possible to better discern stages of treatment when patients might need some reinforced support.

230 FOLLOW-UP OF CARIOUS LESIONS AFTER ORTHODONTIC TREATMENT USING QUANTITATIVE LIGHT-INDUCED FLUORESCENCE
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AIM: To monitor, with quantitative light-induced fluorescence (QLF), the natural behaviour of white spot lesions detected directly after treatment with fixed orthodontic appliances, and two years later.
MATERIALS AND METHOD: The buccal tooth surfaces of 51 subjects, 24 males and 27 females, were examined with QLF for the presence of caries directly after debonding (T0), and 6 weeks (T1), 6 months (T2) and 2 years (T3) thereafter. The fluorescence loss (dF per cent) and area (mm^2) of lesions was determined for all lesions found using dedicated software (QLF 2.0g, Research Systems BV). Using QLF, 370 carious surfaces were recorded at debonding.
RESULTS: During the study 19 lesions were lost from QLF analysis. Sixteen lesions (dF T0 = 7.6-39.2 per cent) in two subjects were restored and three teeth with lesions were extracted or crowned. This resulted in 351 lesions that were included in this study with an average dF at T0 of 10.0 per cent (SD 4.8 per cent). Lesions varied from incipient (dF <10 per cent, n = 227) to advanced (dF >25 per cent, n = 6). Overall, lesions showed improvement at T1 ($P < 0.01$) but no further significant improvement at T2 and T3. Thirty-five lesions became significantly worse after two years. The majority of lesions (n = 171) were considered to be stable and 145 lesions improved significantly, of which only 10 lesions improved to such an extent that they disappeared.

CONCLUSION: Lesions developed during orthodontic treatment have the ability to improve after appliance removal. Further research to investigate the potential of preventive measures to enhance lesion improvement is necessary.

231 TRANSVERSE AND VERTICAL CRANIOFACIAL EVOLUTIONARY TRENDS: THE LAST TEN CENTURIES

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AIM: To investigate transversal and vertical craniofacial evolutionary trends during the last 10 centuries in western Switzerland.
MATERIALS AND METHOD: Two groups of skulls excavated in a region close to Lausanne, Switzerland. The first group, from the early middle ages, consisted of 26 skulls, 16 males and 10 females (estimated age: 18 years to mature adulthood). The second group, from the modern period, consisted of 27 skulls, 19 males and 8 females (age: 16 to 59 years). Posteroanterior (PA) radiographs were taken with the skulls positioned upside-down in the cephalostat, the mandible positioned as correctly as possible, and the Frankfort plane parallel to the floor. The radiographs were then digitized and a customized PA cephalometric analysis was performed. The vertical morphology of the skulls was evaluated with caution because of the ambiguity of positioning the mandible in a correct position. Comparisons were performed with a multiple analysis of variance using gender as a covariate.
RESULTS: Transversal craniofacial dimensions were found to be significantly larger in the medieval group of skulls. The frontozygomatic width ($P = 0.01$), the zygomatic width ($P < 0.001$), the maxillary base width ($P = 0.001$), the intercondylar width ($P = 0.001$), and the intergonial distance ($P = 0.005$), were significantly larger in the medieval group. Both upper and lower anterior face heights were found to be significantly greater in the modern group of skulls ($P = 0.021$ and $P = 0.044$, respectively). The ratio, lower to total anterior face height, was also significantly larger in the modern group ($P = 0.009$).
CONCLUSIONS: Transversal and vertical craniofacial characteristics have changed significantly during the last 10 centuries. The human face has become narrower and longer. These morphological alterations may be related to changes in environmental factors.

232 EFFECTS OF INTERFERON-γ AND HYPERBARIC OXYGEN DURING EXPERIMENTAL TOOTH MOVEMENT

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AIM: To evaluate the effects of hyperbaric oxygen therapy (HBO) and/or interferon-gamma (INF-γ) on osteoblastic and/or osteoclastic activity of bone tissue during experimental tooth movement.
MATERIALS AND METHOD: Sixty Sprague Dawley rats randomly divided into 10 equal groups. A force of 60 g was applied with a nickel titanium coil spring for 7 days in order to move the molars mesially. INF-γ injections were performed into the sub-periosteum area adjacent to the mesial root of the molars. In the first three groups, 0.01 µg/20 µl, 0.02 µg/20 µl and 0.05 µg/20 µl doses of INF-γ were administered once a day at normobaric air conditions. In groups 4, 5 and 6, the same doses were administered once a day and the rats were exposed to HBO at 2.5 atmosphere absolute pressure for 60 minutes twice; just after and 12 hours following the administration. Group 7 underwent HBO treatment with an injection of 20 µl per cent 0.9 NaCl, while in group 8 only HBO treatment was carried out. Twenty µl per cent 0.9 NaCl was applied at normobaric air condition in group 9, and group 10 was used as the control. On experimental day 7, the rats were killed and the mandibles dissected. The parameters of trabecular volume, trabecular number and trabecular separation were histomorphometrically evaluated at the interradicular bone area of the mandibular first molars.
RESULTS: Anti-osteoclastic activity was greater in the INF-γ injected groups compared with the control group. The HBO treated groups showed more osteoblastic activity. However, in the INF-γ + HBO groups osteoblastic and anti-osteoclastic activities were significantly greater than in the other groups.
CONCLUSION: HBO enhanced bone formation during experimental tooth movement. Considering the potential immunoregulatory roles played by INF-γ, the data suggest that INF-γ is involved in bone remodelling during orthodontic tooth movement which strongly suppresses osteoclastogenesis.

233 USING ‘BEST RESULTS’ TO TEST THE EFFICACIOUSNESS OF GUIDING FACIAL GROWTH

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AIM: A malocclusion is associated with vertical growth. Horizontal growth is associated with straight teeth, good looking faces and long-term stability. The aim of this study was to assess the evaluation of facial attractiveness with respect to growth patterns.

MATERIALS AND METHOD: Fifty published lateral photographic profiles from journals and brochures were selected on the assumption that they represented the 'best results' of different methods of treatment. Six dentists, six orthodontists and six lay judges assessed the facial aesthetics, which was also related to the direction of facial growth. An error study was undertaken.
RESULTS: All assessors found that the horizontally growing faces and those who received postural training were the most attractive.
CONCLUSIONS: The best results method enables assessment of the potential of techniques that are unreliable because they require high co-operation.

234 SCANNING ELECTRON MICROSCOPIC EVALUATION OF THE BONDING MECHANISM OF A SELF-ETCHING PRIMER

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AIM: To analyze the effect of a self-etching primer (Transbond Plus SEP, 3M Unitek, Monrovia, California, USA) developed for orthodontic use, in the regularity and depth of adhesive infiltration in the enamel of human permanent teeth, and to compare it with phosphoric acid using scanning electron microscopy (SEM).
MATERIALS AND METHOD: Thirty premolars divided into two equal groups: group 1 (control) phosphoric acid plus Transbond XT primer (3M Unitek), and group 2, Transbond Plus SEP. Transbond XT adhesive (3M Unitek) was used in both groups for bracket bonding. All products were used according to the manufacturers' instructions. Dental fragments were decalcified and, for micromorphologic observation of the adhesive penetration in enamel, the resin replicas which remained at the base of the brackets were covered with a thin gold layer and examined by SEM. Three calibrated examiners evaluated the photomicrographs and gave scores from 0 = without penetration to 2 = deep penetration.
RESULTS: The Mann Whitney *U*-test ($P < 0.001$) showed a statistical difference between the two groups. The SEP was more conservative and produced a smaller amount of demineralization and less penetration of adhesive at the enamel surfaces when compared with the conventional phosphoric acid system.

235 RELATIONSHIP BETWEEN BITE FORCE AND MAXILLOFACIAL MORPHOLOGY IN NORMAL SUBJECTS

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AIM: It is considered that bite force is related to craniofacial morphology. The aim of this study was to investigate the relationship between bite force, volume and inclination of the masseter muscle, and craniofacial morphology.
SUBJECTS AND METHOD: Twenty male subjects with normal occlusion. Bite force was measured using an occluzer and the volume and inclination of the masseter muscle calculated from magnetic resonance images. Measurement indices of lateral and postero-anterior (PA) cephalograms were recorded to observe craniofacial morphology. On sagittal views, maximum bite force was measured and the average of volume and inclination of both sides of the masseter muscle were calculated. Mandibular morphology was measured on lateral cephalograms. On frontal views, the difference between both sides of bite force and both sides of mandibular morphology from the PA cephalogram was measured. The volume and inclination of the masseter muscle was calculated.
RESULTS: Bite force sequentially correlated with masseter muscle volume, ramus inclination, FMA and inclination of the masseter muscle. Bite force sequentially correlated with the difference in ramus length, ∠LOL-Ag.
CONCLUSIONS: Sagittally it is suggested that a large bite force affects the volume and anterior inclination of the masseter muscle and low angle tendency. Anteriorly it seems that the large difference in bite force on both sides force affected the small difference of both sides of ramus length, the small ∠LOL-Ag.

236 VERTICAL CHANGES WITH TWIN BLOCK APPLIANCES IN CLASS II AND DEEP OVERBITE MALOCCLUSIONS

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AIM: To enhance the skeletal effects of the Twin Block (TB) appliance in the vertical dimension.
SUBJECTS AND METHOD: Thirty patients, aged 8-10 years, treated with a TB. The two control groups (CG) consisted of 60 children with a Class II malocclusion (CG1 aged 8-10 years, and CG2 aged 10-12 years). For inclusion in a group, the patients had to satisfy the following criteria: Class II skeletal pattern with an ANB >6 degrees and an overbite greater than

4 mm. Pre- and post-treatment lateral cephalograms were obtained for the patients in the treatment group. For the CGs, radiographic investigations were carried out before the initiation of treatment. The pre-treatment data from the treated group were compared with the data from CG1 and the post-treatment data with CG2. The following parameters were measured: angular: SN/SpP and SN/Mp, linear: N-Me, S-Go, upper and lower anterior and posterior face heights.
RESULTS: The TB appliance was very effective in correcting the Class II malocclusions. It also corrected the deep overbite, by decreasing SN/SpP and increasing SN/Mp, N–Me, and lower anterior face height.

237 EFFECT OF FLUORIDE VARNISH ON SURFACE DECALCIFICATION AFTER ORTHODONTIC TREATMENT

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AIM: To determine, in a randomized clinical trial, the effect of fluoride varnish on improvement of white spots after fixed orthodontic treatment.
SUBJECTS AND METHOD: Twenty patients with at least two white spots after debonding were randomly divided into two equal groups. Group 1 received bifluoride 12 monthly for 4 months, while in group 2 no treatment was undertaken. No patient received special oral hygiene instruction. Oral hygiene was measured monthly according to Sillness and Löe. Intra-oral slides, taken before and after treatment, were superimposed, adjusted in size, and compared using Adobe Photoshop 7.
RESULTS: The two groups were equal for age and duration of fixed orthodontic treatment and oral hygiene. The mean size of the lesions in groups 1 and 2 were 8.3 ± 3.07 per cent and 7.7 ± 4.2 per cent, respectively. This reduced to 5.9 ± 2.9 per cent and 5.9 ± 3.6 per cent, respectively. There was no significant difference between the groups in white spot reduction ($P = 0.307$).
CONCLUSION: There is no necessity to use a fluoride varnish as an adjunct to reduce white spot lesions in patients with good oral hygiene.

238 CLASSIFICATION OF HUMAN LIP CONTOURS BASED ON THE VECTOR METHOD

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AIM: To classify lateral contours of the lips in human adults on the basis of the vector quantization (VQ) method, and to reveal morphological characteristics of each classified lip contour.
MATERIALS AND METHOD: Lateral facial images of 200 female adults (age: 18 years 8 months to 52 years 8 months, mean: 26 years 6 months) without maxillofacial impairment were arbitrarily selected. The positions of seven soft tissue landmarks: porion (po), exocanthion (ex), subnasale (sn), labiale superius (ls), labiale inferius (li), cheilion (ch) and stomion (sto) were visually located on each image with a mouse cursor. The lateral contour of the lip was also extracted by edge-detection and interpolation algorithms. The reference point 'g' was defined as the gravity point of po, ex and sn to provide a co-ordinate system, with ch as the origin and po-g line as the *x*-axis. The scale of the lip was normalized with respect to the length of ls-li. Fourteen variables that characterized the lateral lip contour were determined to generate feature vector representation. The lateral lip contours were classified in the vector representation space and the number of patterns was optimized on the basis of the VQ method.
RESULTS: The optimal number of patterns for the lateral lip contours was found to be five. The patterns were characterized by the thickness of the lips, the inclination and length of the lip commissure, and the sagittal relationship between the upper and lower lips.
CONCLUSION: The VQ consistently classifies human lateral lip contours.

239 CONGENITALLY MISSING MAXILLARY PERMANENT CANINES IN A REFERRED POPULATION

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AIM: Congenitally missing permanent canines are extremely rare. There are a few reported cases in the literature that mostly suggest a predisposition amongst Asian groups. The aim of this study was to investigate the incidence of congenitally missing permanent canines among patients referred for orthodontic treatment in Sabah, Malaysia.
MATERIALS AND METHOD: Clinical and radiographic records of patients referred for orthodontic treatment between November 2001 and October 2005 were assessed for the occurrence of congenitally missing permanent canines. The assessment included the number and location of the missing canine, the status of the retained primary canine, and other associated dental anomalies. Patients with a cleft lip and palate or other systemic syndromes were excluded.

RESULTS: Over the 4-year study period a total of 1,454 patients attended for orthodontic consultation. Of these, seven (0.48 per cent) had missing maxillary permanent canines (5 Chinese, 2 Malays) with a male to female ratio of 3:4. The mean age at diagnosis was 14.9 years (range: 8 to 20 years). Four subjects had solely missing maxillary permanent canines but three others had, in addition, other missing permanent teeth. Bilaterally missing maxillary canines occurred in four patients, which were unilateral in three, but all confined to the left side. Microdontia was noted in five subjects and retained primary canines were present in four patients. There was no case of missing mandibular canines in the study group.
CONCLUSIONS: The incidence of congenitally missing permanent canine was approximately 0.48 per cent, predominantly in Chinese and Malay racial groups. In unilateral cases, the occurrence was only on the left side of the maxilla.

240 NASAL RESPIRATORY RESISTANCE IN CLEFT CHILDREN

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AIM: To determine nasal respiratory resistance and airflow in subjects with a cleft lip and palate (CLP).
SUBJECTS AND METHOD: Ninety-eight patients subdivided into cleft lip (n = 19); cleft palate (n = 17); and combined CLP subgroups (n = 62). All children had undergone surgical procedures but not maxillary expansion. The control group consisted of 30 non-cleft children with a normal occlusion (Angle Class I), overbite and overjet, and no crossbite. The age range of the CLP subjects was from 7.0 to 13.0 years, mean 9.7 years, and for the control group 8.0 to 13.0 years, mean 10.0 years. Airflow and nasal airway resistance measurements were performed using the active anterior and posterior rhinomanometry technique with the use of Rhinomanometer ABC – Rhino according to the Board of the Standardization.
RESULTS: The average airway resistance in cleft children was usually higher, while nasal airflow was usually smaller than in non-cleft children. These results did not correlate with the age of the subjects. The highest airway resistance was found in the subgroup of unilateral CLP subjects in which a high level of nasal resistance existed on the cleft side equally as frequently as on the non-cleft side. This was due to the deviation of the nasal septum, where the bony part created an eminence directed toward the cleft, and the chondral part to the opposite direction.

241 TEMPOROMANDIBULAR DISORDERS AND ORTHODONTICS: A CROSS-SECTIONAL STUDY

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AIM: To find any relationship between temporomandibular disorders (TMD) and orthodontic treatment.
SUBJECTS AND METHOD: Three groups of age-matched subjects: a group of 50 patients undergoing active orthodontic treatment, 57 control subjects and 51 patients in retention. All completed a questionnaire modified by List and Wahlund and a comprehensive examination of the masticatory system was undertaken using the research diagnostic criteria for temporomandibular disorders (RDC/TMD). This is a dual-axis classification system that allows a physical diagnosis to be placed on one axis, and co-ordinated with an assessment of TMD-related parafunctional behaviour, psychological distress, and psychosocial dysfunction on a second axis.
RESULTS: Both genders exhibited a similar distribution of TMD diagnosis. No significant gender or between group differences were found for any of the groups. For TMD clinical cases no statistical differences were found between the groups. The treatment demand of approximately 4 per cent of the total sample was similar to the findings of List *et al.* who reported a perceived treatment need of 4 per cent in their study and with Henrikson and Nilner who reported a 3 per cent treatment need.
CONCLUSIONS: The mandibular range of motion in the three groups was normal. No differences were found between groups for mandibular opening, protrusive and laterotrusive excursions. No statistical differences were found in RDC/TMD diagnoses between the genders.

242 MASTICATORY ABILITY, BITE FORCE AND PSYCHOLOGICAL FACTORS IN FACIAL EXPRESSIONS DURING SMILING

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AIM: To examine if movements of the commissures of the mouth (COM) during smiling differ between individuals with different personality traits.
SUBJECTS AND METHOD: Forty arbitrarily selected Japanese adult females, aged 18 years 9 months to 31 years 8 months (mean 25 years 5 months) with no maxillofacial impairment) performed two types of smile, i.e. a 'photograph' smile and an exaggerated smile, five trials each. In a trial, three-dimensional positions of COMs were recorded as a function of time using the ProReflex Motion Capture Unit (Qualisys, Gothenburg, Sweden) at 100 Hz for six seconds. The

inter-COM distance (ICD) was measured. The difference between ICD (D-ICD) at peak (ICD-p) and ICD at rest (ICD-r) was calculated and ICD-p was normalized by ICD-r (N-ICD). According to the extroversion and the neuroticism scales from the Japanese version of the Maudsley Personality Inventory, the subjects were divided into three groups, i.e. high, normal and low for each psychological scale. The comparison of mean D-ICDs and N-ICDs, as the feature parameters of smile motions, between each group for each scale was carried out using the Mann-Whitney *U*-test ($P < 0.01$, $P < 0.05$).
RESULTS: The normal-extroversion-group (normal-EG) demonstrated significantly greater D-ICD and N-ICD ($P < 0.05$) than the low-EG for the photograph smile, while a significant difference was determined between subjects with a high- or low-EG for both D-ICD and N-ICD ($P < 0.01$), the normal-EG and the high-EG for V-ICD ($P < 0.05$), and the low-EG and the normal-EG for N-ICD ($P < 0.05$) for the exaggerated smile. The high neuroticism-group (NG) showed significantly greater N-ICD than the low-NG ($P < 0.05$) for the exaggerated smile.
CONCLUSION: Movements of the COM during smiling differ between individuals with different personality traits.

243 MICROBIAL EFFECTS OF MOUTHWASHES IN PATIENTS WITH FIXED ORTHODONTIC APPLIANCES
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AIM: The placement of fixed orthodontic appliances increases the number of plaque retention sites, reduces the possibility that vestibular areas will be self-cleaned and, at the same time, impedes oral hygiene, which can all contribute to the development of white spots, thus representing undesired effects in fixed orthodontic treatment, both from the point of view of oral health and facial aesthetics. The aim of this study was to assess the efficiency of preventive use of oral disinfectant substances (based on chlorhexidine and triclosan) in the reduction of cariogen bacteria (*Streptococcus mutans*, *lactobacillus spp*.), control of plaque through the level of oral hygiene, and the impact on gingival state.
SUBJECTS AND METHOD: Forty subjects divided into two equal sized groups. Group 1 was treated with a triclosan based substance and group 2 with a chlorhexidine-based substance. The impact of oral disinfectants on the level of *S. mutans*, *lactobacillus spp*., gingiva and oral hygiene were examined. Saliva samples and other clinical variables were collected at two examinations, a minimum of one month after the fixed orthodontic appliances were placed, and two weeks after the first control. The data were analysed statistically and included Wilcoxon's *W*, Mann-Whitney *U,* and other tests.
RESULTS: The chlorhexidine based substance showed better effects than that based on triclosan in the reduction of *S. mutans*. Statistical analysis showed borderline significance. No differences were found between the two mouthwashes in the level of reduction of *lactobacillus spp*, oral hygiene and gingival health.

244 EVALUATION OF CLASS III TREATMENT: CEPHALOMETRIC AND TENSOR ANALYSES
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AIM: Evaluation of dental and skeletal changes after early treatment of Class III malocclusions using two lateral cephalometric analyses.
SUBJECTS AND METHOD: Forty-two children with reverse overjet, aged 8.6 years (SD 1.7 years), treated with a functional regulator type III. At the end of dentofacial development (12.7 years, SD 2.4 years) the treatment effects were assessed. The control group consisted of 32 children with a normal occlusion. Lateral cephalograms were analysed at the beginning and end of treatment using the Bergen and tensor analyses. The software, ROTA 1 and SPSS, were used for statistical analysis and a Student's *t*-test with significance at the 5 per cent level.
RESULTS: The initial reverse overjet (–0.9 mm) was 2.3 mm at the end of treatment, even greater than in control group (1.9 mm). While the control group showed an ANB of 4.7 degrees and Wits appraisal of 0.1 mm, in the Class III group ANB (1.1 degrees) and Wits appraisal (–4.2 mm) were significantly different. Although the incisors showed a normal relationship at the end of treatment, ANB reduced by 1 degree. The Wits appraisal was almost unchanged. In comparison with the control group, tensor analysis showed significant mandibular growth inhibition in the treatment group (Go-Me-B and Ar-Go-Me). Midface growth in the treatment group was significantly less than in the control group (triangle SNA).
CONCLUSION: Using functional jaw orthopaedics makes it possible to significantly control and inhibit mandibular growth. Through early achievement of a normal overjet it is possible to indirectly stimulate maxillary growth. For evaluation of treatment success, cephalometric analysis was not completely reliable. Using tensor analysis, even small local growth changes could be recorded.

245 OTITIS MEDIA RELATED TO SUCKING HABITS AND FEEDING IN NORWEGIANS
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AIM: To investigate the relationships between the prevalence of otitis media (OM), feeding and sucking habits.
SUBJECTS AND METHOD: Sixty-nine, 3-year-old, girls were examined and the parents interviewed regarding the child's sucking habits, feeding and OM.
RESULTS: The prevalence of OM was 48 per cent. Fifty-one per cent of bottle fed girls had experienced OM compared with 38 per cent of the non-bottle fed girls. Fifty three per cent who used a pacifier had experienced OM, whereas 43 per cent of those who had not used a pacifier did not experience OM. Sixty-three girls were breastfed for 4 months or more, an average of 11.6 months. Forty-nine per cent of those breastfed for four months or more experienced OM. Thirty-eight (55 per cent) of the girls had been prescribed antibiotics once or more for upper respiratory diseases or OM. Eleven (16 per cent) had taken antibiotics three times or more and 10 of them had had one or more attacks of OM.
CONCLUSION: Regression analysis did not show any relationship between upper respiratory disease, the use of antibiotics, feeding habit, sucking habits and OM in these girls.

246 QUANTIFIED LIGHT-INDUCED FLUORESCENCE ANALYSIS OF BONDED TEETH

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AIM: Quantified light-induced fluorescence (QLF) is an intra-oral technique that can be used for the detection of white spots, fluorosis, plaque/calculus/bacterially infected caries. The red and green fluorescence induced by the blue-violet light of the QLF camera can be used to monitor overall oral health. ΔF (difference in fluorescence) and ΔQ (difference in fluorescence multiplied by the area) are parameters that are measured by the device. The aim of this study was to compare the fluorescence difference of teeth bonded using self-etching primer (SEP) and 37 per cent orthophosphoric acid, with the QLF method.
SUBJECTS AND METHOD: Thirty-eight patients who had been under fixed orthodontic treatment for an average period of 18 months were randomly selected. According to the procedure used during bonding, they were divided into two groups. Group 1 comprised 18 patients with 330 teeth bonded with SEP and group 2, 20 patients with 336 teeth bonded using 37 per cent orthophosphoric acid. Buccal views of the teeth were captured and QLF analysis was carried out.
RESULTS: There were statistical differences ($P < 0.05$) between the groups for both ΔQ and ΔF. When comparing the two groups in general, ΔQ was higher ($P = 0.009$) in group 2; in the comparison of upper and lower jaws, ΔQ value was higher ($P = 0.0001$) in the upper jaw and the anterior teeth also had higher ΔQ value ($P = 0.016$) than the posterior teeth.
CONCLUSION: The fluorescence difference in group 2 was higher and the anterior teeth were found to be more susceptible to demineralization and plaque accumulation.

247 RELATIONSHIP BETWEEN ORTHODONTIC ANOMALIES AND MASTICATORY PERFORMANCE IN ADULT SUBJECTS

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AIM: To assess to what extent masticatory function is affected by malocclusions.
SUBJECTS AND METHOD: Masticatory performance was evaluated by asking 101 young adults to chew a standard portion of Lasticomp® (a silicone impression material) for 20 chewing strokes. The resulting particles were dried, and passed through a series of seven sieves. The size distribution of the particle and the broadness of the distribution were computed using the Rosin-Rammler distribution function. The occlusal status of the subjects was assessed with the Index of Orthodontic Treatment Need (IOTN). The subjects were further divided into two subgroups according to their IOTN score i.e. those with an IOTN score of 1, 2 or 3 were classified as having no or slight need for orthodontic treatment, while those with an IOTN score of 4 and 5 were considered as having a definite treatment need. In both groups, masseter muscle thickness was recorded using ultrasonography together with cephalometric (mandibular angle and posterior face height) and anthropometric (height and weight) measurements.
RESULTS: The independent samples *t*-test revealed that the median particle size (MPS) was significantly larger in subjects needing orthodontic treatment in comparison with those without an orthodontic need ($P = 0.03$). The broadness of the particle distribution was also significantly different between the two subgroups ($P = 0.04$). Stepwise multiple regression revealed weight to be the explanatory variable most closely related to MPS, however; any explanatory variable was related to the broadness of the particle distribution. Adjusting for masseter muscle thickness, cephalometric variables, and height and weight, did not affect the group differences with respect to the masticatory parameters.
CONCLUSION: Masticatory function may be impaired in subjects with orthodontic anomalies serious enough to require treatment.

248 INVESTIGATION OF THE VERTICAL POSITION IN THREE BRACKET PLACEMENT METHODS

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AIM: The results of treatment with a straightwire appliance largely depend on bracket positioning. The purpose of this study was to investigate the vertical bracket position in three bracket placement methods.
MATERIALS AND METHOD: Forty plaster models with individual normal occlusion. Three-dimensional (3D) dental surface images were constructed using a 3D laser scanner. The captured images were processed using modelling software on a graphics station to construct 3D images of dental arches without blind areas. Bracket positions were established on the 3D images using the FA point, the marginal ridge, and the height methods. The vertical distances between bracket placement and the occlusal reference plane, determined by the upper and lower dentitions, and the angles of the least square plane formed by these serial bracket positions, were measured.
RESULTS: The upper bracket positions, determined for each method for the premolars and first molars, were situated occlusally to those for the anterior teeth and canines. The lower bracket positions for the first molars were situated occlusally to those for all other teeth. The upper and lower least square planes and the occlusal reference plane formed an outward cross angle of approximately 1.5 degrees, which did not significantly differ between the three bracket placement methods in either the upper or lower dentitions
CONCLUSION: The findings clarify the characteristics of the three bracket placement methods and provides useful clinical information for bracket positioning.

249 ANTIBACTERIAL EFFECT OF SEVERAL CURRENT ORTHODONTIC MATERIALS AGAINST *STREPTOCOCCUS MUTANS***

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AIM: To examine the antibacterial effect of several current orthodontic materials against *Streptococcus mutans*.
MATERIALS AND METHOD: The antibacterial activities of six orthodontic composite resins (Transbond LR, Light Cure Retainer, Light Bond, System 1+, Kurasper F, Transbond XT), two orthodontic bonding (Transbond XT and System 1+ activator) and two glass ionomer cements (Multicure and Ketac Cem) were evaluated against *S. mutans*. The hard materials were placed in a Teflon mould and the liquid materials on a paper disc. All were handled under aseptic conditions and plated. The plates were incubated at 5 per cent CO_2 and 37°C for 48 hours. Zones of bacterial growth inhibition, which included the diameter of the sample, were measured in millimetres.
RESULT: Multicure showed the highest antibacterial effect, but no inhibition zones were noted for Ketac Cem. The Light Bond adhesive of the Reliance orthodontic bonding system produced a high antibacterial effect against *S. mutans*, while the Reliance composite did not show any antibacterial effect ($P > 0.05$). Both the composite and primer of the Transbond XT system demonstrated a significant antibacterial effect against the test bacteria when compared with Transbond LR ($P < 0.05$). Kurasper F, Ormco system 1+ and System 1 activator showed slight or no inhibitory effect against the test bacteria.
CONCLUSION: In patients with a relatively high salivary levels of *S. mutans* before treatment, materials with high levels of antibacterial properties should be used.

250 A 10-YEAR FOLLOW-UP STUDY ON INTERDENTAL STRIPPING OF MANDIBULAR INCISORS

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AIM: To investigate whether interdental stripping leads to an increased incidence of caries, gingivitis, periodontal problems and tooth sensitivity, and also to evaluate the long-term outcome of the treatment in terms of stability of the orthodontic result.
SUBJECTS AND METHOD: Sixty subjects who received stripping of the lower incisors 10 or more years previously were examined by one author (LN). The examination consisted of one session where two intra-oral radiographs of the lower incisors were taken using the paralleling technique. Caries was examined with a transilluminator. Bleeding on probing was examined and pocket depth measurements were obtained. Impressions of the lower arch were obtained to measure the irregularity index and the index of Peck and Peck. Questions concerning tooth sensitivity were asked. Sixteen dental students and candidates specializing in orthodontics were used as a control group. Some of the participants in the control group had received orthodontic treatment, but no stripping of the lower incisors.
RESULTS: No new caries following interdental reduction was recorded. Three participants had a reduced bone level, all due to age. Three had gingival retraction due to age and one due to tooth brushing. One pregnant participant had gingivitis

and one had red and swollen gingiva related to 41 and 31. There was no obvious root pathology. Using a *t*-test, it was found that the distance between the roots of 42 to 41 and 31 to 32 were significantly shorter in the control group compared with the experimental group. One participant reported mild sensitivity of the lower incisors and one had, in general, sensitive teeth. Forty-seven of the 60 subjects had their bonded retainers still in place, making it difficult to determine stability. Measurements on the dental casts showed a mean irregularity index of 0.67 mm, and the Peck and Peck index were slightly lower than recommended standards.
CONCLUSION: Interdental enamel reduction of 0.25 mm at both the mesial and distal surface of the lower incisors does not result in an increased caries incidence, gingival problems, bone loss or a shortened distance between the lower incisor roots. Only one participant reported increased sensitivity in the lower incisors.

251 DO MASTICATORY FUNCTIONAL CHANGES INFLUENCE MANDIBULAR MORPHOLOGY IN ADULT RATS?

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AIM: To investigate the effect of masticatory functional changes on the lateral mandibular morphology in adult rats.
MATERIALS AND METHOD: Sixty young male rats who were fed a soft diet for a prolonged period so that they developed weak masticatory muscles. After 21 weeks, when growth had nearly ceased, the animals were divided into two groups: one group was fed a soft diet for six more weeks while in the other group it was changed to an ordinary (hard) diet with the aim of retraining their masticatory muscles (soft/hard diet). A third group of 16 male rats were fed ordinary food during the whole experimental period and served as the control. At the end of the experiment (27 weeks) the animals were killed and their left hemi-mandibles dissected, transilluminated, photographed, and digitized on a computer screen using customized cephalometric software to obtain a precise lateral outline of the mandible.
RESULTS: Comparison between the soft and hard diet groups revealed some statistically significant differences, confirming the results of previous studies. In the rats with a reduced masticatory functional demand (soft diet) the angular process was smaller, the condylar process was thinner and less steep, and the alveolar process was higher (all $P < 0.001$). No statistically significant differences were found between them and the rats whose diet was changed to a hard diet after growth had ceased. Retraining of the masticatory muscles did not have any effect on mandibular morphology.
CONCLUSIONS: It has been previously shown that masticatory functional alterations induce significant changes of the shape of the rat mandible during growth. This investigation determined that this effect was insignificant after growth had ceased. Masticatory muscle retraining did not have any effect on the studied measurements. This, however, does not exclude the possibility of internal bone structural changes.

252 EVALUATION OF RANDOMLY SELECTED CLASS I TURKISH ADULTS: BIMLER ANALYSIS

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AIM: To evaluate facial type and skeletal relationships of Turkish adults with a Class I occlusion using Bimler's cephalometric analysis.
SUBJECTS AND METHOD: Eighty-two randomly selected Class I young adults (42 females, 40 males). The age range was between 18-23 years. Lateral cephalometric radiographs were obtained under standardized conditions. Eight angular and five linear measurements were used to evaluate the lateral cephalometric radiographs. Cephalometric measurements, defined by Bimler, were used to determine Bimler's gnathic index, suborbital facial index and facial basic angles. Variance analysis (ANOVA) was used for statistical evaluation of the results.
RESULTS: The whole sample was found to be in the medium range according to Bimler. FMPA was 23.76 degrees, which was defined as medium by Bimler. No significant differences were found between males and females, except between GoGn/SN and height and depth values of the males and females. The suborbital facial index (H/D) did not reveal any significant differences between the genders.
CONCLUSION: Turkish adults show appropriate characteristics as defined by Bimler. Different structural characteristics were observed between males and females, but as seen from the non-significant differences between the genders concerning ratio, suborbital facial index (H/D), it can be interpreted that natural homeostasis has been achieved and reached, even though different craniofacial structures were present.

253 SPECTROGRAPHIC SPEECH MEASUREMENTS AND AUDIOLOGIC FINDINGS IN UNILATERAL CLEFT LIP AND PALATE CHILDREN

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AIM: To assess the audiologic and speech status of operated unilateral cleft preschool patients who have not undergone orthodontics, otologic, or speech therapy.
SUBJECTS AND METHOD: Twenty early operated patients with a cleft and a control group consisting of age and gender matched children. For hearing evaluation, pure tone audiometry and tympanometry were used. For the vowels, first and second formant frequency steady states, and the duration of steady states were measured. For the voiceless stop consonants, VOT and burst frequency were measured on wideband spectrography. Two experienced speech pathologists evaluated resonance and articulation.
RESULTS: Six subjects had normal hearing, seven had very slight, six had slight, and one had moderate hearing loss in at least one ear. The hearing of the seven patients was improved by medical treatment, only two patients required surgery. Speech assessment and the first formants of vowels /a/, /e/, and /o/ showed statistically significant differences whereas the second formants of vowel /i/ and /u/ did not show any difference. The VOT values [except /*P*/], and the burst frequencies of consonants, were statistically significant. Eight patients with a cleft palate demonstrated delays in speech sound development that required speech therapy.
CONCLUSIONS: Early surgery and team care is important to obtain normal speech, hearing, maxillofacial growth, and facial appearance. After surgery, an otologic examination must be performed and speech analysis of these patients carefully evaluated to determine their need for speech therapy.

254 RELIABILITY AND VALIDITY OF SPACE ANALYSIS WITH THE OCCLUSOGRAM
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AIM: With a combination of tracings of lateral cephalographs and occlusograms, the dental, skeletal segments can be displaced and the final interarch occlusal relationship predicted. In this investigation, Nance discrepancy and occlusogram space analysis were compared.
SUBJECTS AND METHOD: Thirty-eight subjects in the permanent dentition with a Class II division 1 malocclusion divided into two groups: group 1, comprised 24 patients, 12-13 years of age, with no posterior crossbite and group 2; 14 patients, all 14 years of age, with a posterior crossbite. For all subjects, study models, lateral cephalographs and a Xerox copy from each study models (occlusogram) was prepared. All cephalographs were combined with the occlusogram. For each subject the space required, the available space, and the differences in the upper and lower arch were calculated.
RESULTS: Space analysis, showed that for each 1 mm of incisor retrusion or protrusion there was a variation of 2 mm in arch length, which is an overestimation. With the occlusogram, space analysis for each 1 mm of incisor retrusion or protrusion, showed a decrease or increase of 1.45 mm in arch length. The reason for this finding may be due to factors such as arch circumference before and after incisor retrusion or protrusion or the posterior crossbite in subjects with a crossbite, which has not been considered previously.
CONCLUSIONS: With the occlusogram space analysis method, the sagittal, vertical and transversal dimensions appear to be a realistic approach in treatment planning.

255 THE EFFECTS OF LOWER JAW ROTATION ON MANDIBULAR MORPHOLOGY
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AIM: To investigate, the effects of different mandibular vertical growth and corresponding morphology.
SUBJECTS AND METHOD: Ninety skeletal Class I subjects with different mandibular vertical growth patterns divided into three equal groups: group 1: 23 girls and seven boys with horizontal growth; group 2: 20 girls and 10 boys with vertical growth and a control group of 19 girls and 11 boys with neutral vertical growth. For all groups, lateral cephalometric radiographs were obtained, the mandibular outline was traced and mandibular morphology was evaluated. ANOVA, Tukey, Chi-square and *t*-tests were used for statistical analysis.
RESULTS: Symphyseal depth in the deep bite groups was 1.47 mm more than in the normal group, and 2.9 mm more than open bite group. Symphyseal height in the open bite group was 5.8 mm more than in the deep bite group and 3.3 mm more than in the normal group. In the open bite group LAAH was 6.43 mm greater than in the deep bite group and 3.63 mm more than in the normal group. MBL in the deep bite groups was 3.53 mm more than in the normal group and 3.97 mm more than in the open bite group. SD, SH, LAAH, MBL and CH, were found to be significantly different between the three groups ($P < 0.05$).

256 NEURONAL MECHANISM(S) UNDERLYING PATIENTS' PERCEPTIONS OF MALOCCLUSION
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AIM: It has been suggested that malposition of the mandible results from either a malocclusion or incorrect occlusal reconstruction. However, little is known about the mechanism(s) underlying this phenomenon. The hypothesis tested is that this abnormality may be involved in the brain neuronal activities.
MATERIALS AND METHOD: Magnetic resonance (MR) imaging and a model of the oral cavity of intact humans was used to examine brain region activities during clenching in the retrusive mandibular position. Twelve healthy subjects with a normal occlusion (9 males, 3 females, aged 26 to 56 years, mean 37.66 years). The subjects were positioned in the MR scanner with normal or resin splints for the upper jaw. Using a computerized axiograph, the mandibular retrusive position, with the splint *in situ*, in which the bilateral heads of the mandible were shifted to the postero-superior direction during clenching, were determined.
RESULTS: The signals in the anterior cingulate cortex, the cingulate motor cortex, the amygdala, the insula, and the prefrontal area were significantly increased. In contrast, during clenching in the normal position, increases in signals were only seen in the prefrontal area and the insula, although their intensity was significantly lower than in the retrusive position.
CONCLUSIONS: A mandibular malposition may induce indefinite neural activity equivalent to emotion.

257 MOUTH TEMPERATURE DURING REMOVABLE ORTHODONTIC APPLIANCE WEAR

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AIM: A sensor module for detecting the presence of a removable orthodontic appliance in the oral cavity could also use, as one of the criteria, the temperature of the environment where the appliance is placed. The aim of the study was to detect mouth temperature during removable appliance wear.
MATERIALS AND METHOD: A sensor module for recording mouth temperature was built into a Fränkel appliance and into a removable plate and connected by a wire to a microprocessor to save the incoming data. The appliances were worn daily by two subjects (one with and one without a competent lip seal) for a period of one week. The temperature was registered under different conditions of appliance wear. The data from the sensor, transformed into degrees Celsius, were transferred every 12 hours to a computer for statistical analysis.
RESULTS: During appliance wear in the subject with a competent lip seal, the temperature varied from 36.35 to 37.8°C, and with an incompetent lip seal from 33.31 to 36.19°C. During removable plate wear the oral temperature with a competent lip seal varied from 34.49 to 37.07°C, and with an incompetent lip seal from 33.10 to 34.43°C. During removable appliance wear, the minimum and maximum mouth temperatures were 33.10°C and 37.67°C, respectively.
CONCLUSIONS: An activator, built in to a removable appliance, should switch on the sensor module at 33°C, and switch off the module at 38°C.

258 TONGUE PLATE APPLICATION FOR MAXILLARY DEFICIENCY TREATMENT IN GROWING PATIENTS

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AIM: To evaluate the effects of a tongue plate on maxillary complex advancement.
SUBJECTS AND METHOD: Twenty-one Iranian patients (13 girls and 8 boys with an average age 10.4 years) with a skeletal Class III malocclusion due to maxillary deficiency. The mean observation period was 19.7 months. Initial cephalometric radiographs, photographs and study models were obtained. A removable upper appliance, combined with tongue plate, was used to confine the tongue in order to transfer the tongue force to the maxillary complex during physiological and functional activity of the tongue, and to improve the malfunction and malposition of the tongue.
RESULT: Analysis of the initial and final cephalograms showed a considerable increase in the length of the antero-posterior dimension ($P < 0.05$) and in the angular measurement of SNA ($P < 0.03$).
CONCLUSION: Use of an intraoral appliance, such as the tongue plate, is more acceptable to patients and is successful in delivering force to the tongue.

259 THE ACCURACY OF PRE-OPERATIVE ORTHOGNATHIC PREDICTIONS

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AIM: The prediction of cephalometric changes as a result of orthognathic surgery still remain problematic during pre-surgical orthognathic treatment planning because of varying relative movements of the hard and soft tissues. The aim of this study was to investigate the accuracy of the manual cephalometric prediction method.

SUBJECTS AND METHOD: Eighteen adults (5 males, 13 females). Thirteen Class III subjects had undergone bimaxillary surgery, two Class III patients had only maxillary advancement, two Class III patients had sagittal split mandibular set-back surgery and one Class II patient a sagittal split mandibular advancement. Hard and soft tissue measurements were measured on pre-orthodontic, pre-surgical and post-treatment lateral cephalograms. In addition, the hard and soft tissue movements were simulated on the pre-surgical cephalograms using the manual prediction method, and cephalometric measurements of the prediction tracings made. All tracings were double digitized and the measurements undertaken on a computerized cephalometric measurement program (Pordios). Twenty-one angular, 33 linear and four proportional soft and hard tissue measurements were performed. The data was statistically evaluated using descriptive statistics and Pearson's correlation coefficients. The cephalometric measurements derived from the prediction tracings were compared with the actual outcome by *t*-test.
RESULTS: S-Ar-Go angle, B-FH length, Go-FH length, lower incisor-ML angle, lower incisor-FH angle, interincisor angle, overbite, subnasale-St, Sn-LLV/LLV-Me ratio and mentolabial angle measurements were all statistically significantly different.
CONCLUSION: Despite its low prediction accuracy in some areas of the craniofacial region, the manual cephalometric prediction tracing method provides useful information concerning surgical orthodontic treatment outcome.

260 COMPARISON OF WITS APPRAISAL WITH ANB AND PALATAL PLANE/A-B ANGLES
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AIM: To compare the assessment of sagittal maxillomandibular discrepancies measured with the Wits appraisal, with that of the palatal plane/A-B and ANB angles, and to determine the craniofacial regions that may be the aetiology of the probable discrepancy between these assessments.
MATERIALS AND METHOD: Fifty-four measurements were made on 203 lateral cephalograms of untreated adults and *z*-scores of Wits appraisal, palatal plane/A-B and ANB angles calculated in order to make these measurements comparable with each other. After subtraction of the *z*-scores of the Wits appraisal from the palatal plane/A-B angle and from the ANB angle, and conversion of the result of the subtractions again to *z*-scores; four groups were established: $-\infty<Z<-1$, $-1<Z<0$, $0<Z<1$, and $1<Z<\infty$. The craniofacial features of the four groups were then compared using variance analysis and Duncan's test.
RESULTS: All other maxillomandibular sagittal relationship measurements were in agreement with the classification when the PD/AB and Wits measurements were in harmony. Incisor positions, measured according to the A-Pg plane, had a tendency to give false results by increasing the sagittal discrepancy. Both ANB angle and the Wits appraisal were prone to vertical differences in craniofacial morphology.
CONCLUSION: When discordance exists between ANB and Wits appraisal, the use of overjet and palatal plane/A-B may provide guidelines for determining the correct sagittal maxillomandibular relationship.

SOFT TISSUE PROFILE CHANGES AFTER ACRYLIC SPLINT HERBST APPLIANCE THERAPY
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AIM: To evaluate the effects of acrylic splint Herbst therapy on the soft tissue facial profile in Class II division 1 adolescents.
SUBJECTS AND METHOD: Twelve skeletal Class II division 1 adolescents (7 males, 5 females), initial mean age 13.3 years (12.0-14.6 years), treated with the acrylic splint Herbst appliance for a mean period of 8.3 months (6.0-11.0 months). The structural changes were determined by analyzing serial lateral cephalograms. The first records were taken just before and the second after removal of the appliance, at the end of treatment. Anatomical landmarks were traced on the radiographs, and the first and second tracings superimposed. Twelve linear and four angular soft tissue measurements were carried out and compared using the Student's *t*-test for paired samples at the 95 per cent confidence level.
RESULTS: In all patients, the soft tissue profile was significantly improved which closely followed the underlying dentoskeletal changes. Significant increases were seen in the labio-mental angle, lower lip length, and soft tissue facial convexity angle (G-Sn-Pg') (all $P < 0.001$). The mean change in the labio-mental angle after treatment was an increase of 23.3 degrees. Lower lip, soft tissue B, and Pg points moved forward an average of 4.5 mm, 4.7 mm and 3.8 mm, respectively (all $P < 0.001$) according to the vertical reference line.
CONCLUSION: This appliance is efficient for improving soft tissue facial profile in skeletal Class II division 1 adolescents,

261 EFFECTS OF PREMOLAR EXTRACTIONS ON TOOTH SIZE DISCREPANCY IN SKELETAL CLASS III SUBJECTS
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AIM: To evaluate and compare tooth size discrepancies and the effect of hypothetical premolar extractions in adult skeletal Class III patients.
SUBJECTS AND METHOD: Thirty-one adult patients who had a skeletal Class III malocclusion (ANB = –4.29 ± 2.77 degrees). Tooth size analyses were performed on the pre-treatment orthodontic models with a digital calliper, and mesio-distal tooth size ratios were measured as described by Bolton. The following hypothetical premolar extractions were performed: all first premolars; upper first and lower second premolars; upper second and lower first premolars; all second premolars. Bolton's analysis was applied to the final measurements to determine whether a tooth size discrepancy had been created. The results were statistically evaluated.
RESULTS: The overall Bolton tooth size discrepancy was found to be significantly greater than the standards ($P < 0.001$). Statistically significant differences were found between Bolton tooth size discrepancy and all hypothetical premolar extraction groups ($P < 0.001$). All extraction groups were significantly lower than the overall Bolton ratio ($P < 0.001$) and were significantly different from each other ($P < 0.001$).
CONCLUSIONS: The first premolar extraction group showed the nearest value to the initial overall Bolton ratio. The upper first and lower second premolar extraction group showed the nearest value to the standards and could be the first choice in the treatment of adult Class III extraction cases to prevent further tooth size discrepancies.

262 RISK FACTORS FOR ORTHODONTICALLY INDUCED ROOT RESORPTION

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AIM: In a longitudinal retrospective study, to identify risk factors for root resorption during orthodontic treatment regarding anamnesis, treatment and radiological variables.
MATERIALS AND METHOD: The coefficient of variation between double measurements, image distortion and accuracy of measurements was defined by two pilot error studies. As a result, the inclusion criterion for the control group was determined to be ±1.3 per cent apical root resorption (ARR) for both central incisors. Forty-five Caucasians serving as a control group fulfilled this condition and the following inclusion criteria: finished orthodontic treatment, complete records, Class I sagittal molar relationship, and complete root formation prior to active treatment with fixed appliances. A similar group of patients with at least 7.3 per cent ARR was randomly selected (ARR group). The amount of ARR was measured using a dial calliper, the median cemento-enamel junction and the rule of three described by Linge and Linge. Tooth movement was calculated from measurements of superimposed pre- and post-treatment cephalograms.
RESULTS: The anamnesis parameters were neither significantly different [habits ($P = 0.69$), medical history ($P = 0.48$), medication ($P = 0.31$)] between the groups nor regarding tooth anomalies (taurodontism, pulp stones). The duration of treatment ($P = 0.27$) as well as the duration of treatment with rectangular wires ($P = 0.19$) showed no significant results. For the control group, the distance of the apex to the palatal cortical bone was significantly higher after treatment compared with patients with ARR ($P = 0.013$), although this distance was not significantly different between the two groups prior to tooth movement ($P = 0.56$). This was confirmed by the sagittal ($P = 0.004$), vertical ($P = 0.026$) and straight-line ($P = 0.011$) movements of the apices. Movement of the incisal edges showed no significant differences.
CONCLUSION: Movement of the apex, probably against the palatal cortical bone, showed significant differences within the investigated groups.

263 EFFECTS OF ULTRAVIOLET LIGHT ON THE DEGRADATION OF COMPOSITE RESIN.

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AIM: To investigate the effects of ultraviolet (UV) light on the properties of orthodontic composite resin, and to determine if the physical characteristics of the material can be changed. This in turn could be used to facilitate debonding of orthodontic brackets.
MATERIALS AND METHOD: Composite resin discs, 5.5 mm in diameter and 1 mm thick (Cool Bond Light Cure) were fabricated. Six groups containing 10 discs were exposed to UV light in the A and B spectrum for 0, 10, 20, 40, 80 and 840 minutes at a set distance of 230 mm from the source. The UV light was produced using an ultra high pressure mercury arc lamp and power supply. The discs were examined for colour change visually and with a colour meter, hardness, using a Vickers Hardness tester, and surface changes using a scanning electron microscope.
RESULTS: The material progressively darkened and at 840 minutes turned white. These colour changes were seen visually and were confirmed with the colour meter, indicating a change in the chemical composition of the material. The hardness of the material increased with increased exposure time ($P < 0.05$, $R^2 = 0.767$) suggesting a change in the physical properties of the material. Scanning electron micrographs demonstrated roughening of the surface with surface cracking at 840 minutes, suggesting a more brittle material and possible physical degradation.

CONCLUSIONS: UV light in the A and B spectrum is capable of altering the physical characteristics of composite resin. Further research is required to determine if this effect can be produced in a clinically acceptable manner. An important area of further development would be to alter the composition of the composite resin in order to make it more susceptible to degradation at a safer light wavelength.

264 RIGID VERSUS WIRE FIXATION: A COCHRANE SYSTEMATIC REVIEW

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AIM: To evaluate the impact of the method of fixation on skeletal and dental stability following mandibular advancement and setback.
MATERIALS AND METHOD: The following electronic databases were searched: the Cochrane Oral Health Group's Trials Register, the Cochrane Central Register of Controlled Trials, Medline and Embase. No language restrictions were applied. Hand searching of relevant journals was carried out. The most recent electronic search was carried out in June 2005. Trials were selected if they were reported to be randomised controlled trials, however, inclusion of cohort studies was considered where there were suitably matched groups. The interventions were rigid fixation (plates or screws) and wire fixation (skeletal wire fixation and intermaxillary fixation) and the primary outcomes of interest were skeletal and dental stability. Two reviewers extracted the data in duplicate, and evidence tables were collated. The number and heterogeneity of the included studies precluded meta- or sub-group analyses.
RESULTS: Eight studies satisfied the inclusion criteria. Six reported on the stability of mandibular advancement following bilateral sagittal split osteotomy and rigid or wire fixation. These were all successive reports of the same large-scale study carried out in the United States (first reported by Keeling *et al*., 2000). Two studies were identified which reported data on the stability of mandibular setback.
CONCLUSION: The limited number and rigour of the included studies were insufficient to allow reliable conclusions to be drawn with regard to the relative stability of rigid compared with wire fixation for stabilisation following mandibular advancement or setback.

265 HISTOMORPHOMETRY OF HUMAN CONDYLES AND ITS RELATIONSHIP TO CONDYLAR GROWTH

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AIM: To determine the possibility for adaptive growth in human condyles in a large sample of human autopsy condyles.
MATERIALS AND METHOD: Human condylar cartilage and bone were examined in autopsy material comprising 20 individuals aged 18-31 years. The condyles were embedded in methylmethacrylate, cut on a microtome and stained. Histomorphometry, scanning electron microscopy, and cartilage histology were used to analyse the tissue.
RESULTS: The fibrocartilage could clearly be identified in three zones, the hypertropic zone arranged in columns, the proliferative zone, and the fibrous zone with collagen fibres. Chondrocytes could be seen 'caught' in the underlying cancellous bone tissue with remodelling activity. There was a statistically significant correlation between age and fibrocartilage thickness, between age and hypertropic chondrocytes, and between age and hypertropic chondrocytes in bone.
CONCLUSIONS: Quantitative and qualitative investigations of the turnover activity in the fibrocartilage and bone tissue indicated condylar growth potential until 30 years of age. Growth activity seems to decline with age.

266 CHANGES IN THE CERVICAL SPINE OF CHILDREN WITH ARTHRITIS

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AIM: Involvement of the cervical spine might be present in children with juvenile idiopathic arthritis (JIA). The aim of this retrospective study was to evaluate whether plain lateral cephalometric radiographs in a neutral position could be used as a diagnostic tool to investigate JIA changes in the cervical spine.
MATERIALS AND METHOD: Lateral cephalometric radiographs of 51 children, 37 girls and 14 boys (8-16 years old), with JIA, taken primarily to evaluate facial development. They were compared with 51 matched controls. The changes investigated were erosions of the dens, and fusion of the apophyseal joints. Anterior atlantoaxial subluxation of the first vertebra onto the second vertebra was investigated by measuring the anterior atlantodens interval, and atlantoaxial impaction using the Sakaguchi-Kauppi method.
RESULTS AND CONCLUSION: Preliminary results showed erosion in six patients, fusion in one, and atlantoaxial impaction in three. The findings confirm that plain lateral radiographs are a suitable diagnostic tool in detecting arthritic changes in the spines of JIA children.

267 *IN VIVO* ASSESSMENT OF DEMINERALIZATION ADJACENT TO A NEW FLUORIDE CONTAINING ORTHODONTIC RESIN

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AIM: Incorporation of fluoride to bonding and filling materials aims to reduce the risk of developing caries in the surrounding area. The aim of this study was to compare the cariostatic properties of a new fluoride-containing bonding material with a fluoride-free material, and to assess differences in plaque microflora after *in vivo* bonding of orthodontic bands with the two materials.

SUBJECTS AND METHOD: Seventeen orthodontic patients, aged 10-15 years, requiring extraction of homologous premolars in the upper and/or lower jaw (altogether 27 pairs). A fluoride-containing bonding material (Super-Bond-F, SunMedical, Japan) was used to cement an orthodontic band on one side of the arch and a fluoride-free material (Super-Bond) was used on the other. A cariogenic void was created buccally beneath each band. Four weeks later, plaque was sampled from the cariogenic voids prior to extraction. The plaque was analysed for the number of *mutans streptococci* in relation to the total number of micro-organisms and demineralization of enamel was assessed by quantitative light-induced fluorescence.

RESULTS: A lower degree of demineralization was found under bands cemented with the fluoride-containing material compared with the non-fluoride material, both with respect to maximum and average change in fluorescence radiance ($P < 0.01$ and $P < 0.05$, respectively); the average change between the two materials was 6.2 per cent. *M. streptococci* were present in lower numbers in teeth bonded with the fluoride-containing material compared with the non-fluoride containing material.

CONCLUSION: Super-Bond-F, when bonding fixed appliances to teeth, may reduce the risk of demineralization to surrounding enamel.

268 SMILE PERCEPTION AND MORPHOMETRIC INDICES IN NORMAL OCCLUSION FEMALES

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AIM: A paramount objective of orthodontic therapy is the improvement of facial aesthetics. Orthodontic treatment can cause an attractive smile through a change in the position of the anterior teeth. Thus the purpose of this study was to determine the standards of beautiful smiles, and also the effects of non-extraction orthodontic treatment on smile aesthetics.

SUBJECTS AND METHOD: Sixty-three females, 30 with non-extraction orthodontically treated occlusions and 33 with normal occlusion. Five standardized black and white close-up images of their posed smiles were taken and the most natural photograph of each subject was selected. The selected photographs were evaluated by a panel of five males and five females with various vocations on a visual analogue scale to determine the attractiveness of the individual smile.

RESULTS: Both treated subjects and those with a normal occlusion had similar smile scores. Furthermore, the smile line ratio, buccal corridor ratio, symmetry ratio, upper lip height and upper lip curvature were not significantly different between the two groups. There was also no significant difference in smile morphometric indices between fair, good and very good smiles.

CONCLUSION: Smile line, buccal corridor, symmetry of smile, upper lip height and upper lip curvature do not influence smile aesthetics, as orthodontically treated subjects and those with a normal occlusion had similar smile aesthetics.

269 EPIDEMIOLOGICAL STUDY OF CROSSBITES – CLASSIFICATION AND POSTERO-ANTERIOR CEPHALOMETRIC EVALUATION

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AIM: To classify and determine the prevalence of different types of crossbite, a complex malocclusion that is quite frequent in the Italian population.

SUBJECTS AND METHOD: From a total of 5,373 orthodontic patients evaluated, 1,028 showed a crossbite. The following records were obtained for all the crossbite patients: a dental tomogram, teleradiograph plus latero-lateral cephalogram, teleradiograph plus postero-anterior (PA) cephalogram, casts, photographs, and classification of crossbite (following the Turin School standard form).

RESULTS: The prevalence of crossbite in this Italian orthodontic population was 19.13 per cent. Forty-eight per cent (500) showed a unilateral posterior crossbite (55 per cent on the right, 45 per cent on the left); 31 per cent (317) showed a bilateral crossbite and 21 per cent (210) an anterior crossbite. Latero-lateral compared cephalometry showed that subjects with a

unilateral posterior crossbite had an intermaxillary angle (SN^GoGn) = 32 ± 2 degrees, and a skeletal ANB angle = 5 ± 2 degrees; those with a bilateral posterior crossbite showed an intermaxillary angle SN^GoGn = 34 ± 3 degrees, and a skeletal angle ANB = 1 ± 2 degrees. PA cephalometry showed a very high percentage (70 per cent) of rotation of the mandibular axis to the left side, regardless of the type and side of the crossbite. Since the mandibular axis was calculated taking the head of the condyle and the gonions as reference points, this result may be the expression of a postural position of the mandible, probably independent of occlusion.
CONCLUSIONS: A crossbite is a complex malocclusion requiring careful diagnosis because it involves the stomatognathic system as well as function and posture of the mandible.

270 CEPHALOMETRIC EVALUATION OF CHILDREN WITH MELAS

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AIM: Mitochondrial encephalomyopathy, lactic acidosis and strokelike episodes (MELAS) is a maternally inherited mitochondrial disease that is most commonly caused by 3243A>G mutation in mitochondrial DNA. Mitochondrial diseases are characterized biochemically by a decreased capacity to produce adenosine triphosphate in the cell and clinically by considerable phenotypic variability. Children in families with MELAS were examined in order to find out whether their craniofacial morphology differs from that of unaffected children.
SUBJECTS AND METHOD: Seven children (3 girls, 4 boys) born to mothers harbouring the 3243A>G MELAS mutation. The mean age was 11.9 years (range 7-15 years). None of the children had undergone any orthodontic treatment. Standardized lateral cephalometric radiographs were taken in natural head posture. The controls comprised an age, and gender, matched group with a normal craniofacial structure.
RESULTS: The MELAS children differed significantly from the controls in the cephalometric values describing many of the facial structures: upper face height was shorter ($P < 0.01$) and the upper incisors were more proclined ($P < 0.05$) in the MELAS group. SNB value was larger ($P < 0.05$), and the Wits appraisal showed significantly smaller ($P < 0.01$), and, in all cases, negative values for the MELAS children.
CONCLUSIONS: Children belonging to MELAS families differed from the controls in the facial skeletal structures, especially in the midface area. The clinical features of MELAS are variable, but short stature is common. A short stature together with the present findings can be explained by a decreased rate of autonomous endochondral bone growth, which could be manifested as less midface growth.

271 AIRWAY CHANGES WITH A MANDIBULAR ADVANCEMENT DEVICE IN OBSTRUCTIVE SLEEP APNOEA

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AIM: To evaluate changes in airway and craniofacial structures with the mandibular advancement device (MAD) in Chinese adult subjects with obstructive sleep apnoea (OSA).
SUBJECTS AND METHOD: Fourteen subjects diagnosed with OSA were fitted with a MAD. The mean (standard deviation) baseline apnoea/hypopnoea index (AHI) was 38.4 (17.2) events/hour and the minimum arterial oxygen saturation (SaO_2) was 75.5 (11.1) per cent. Lateral cephalograms were taken prior to fitting of the appliance. After one month of satisfactory wear, lateral cephalograms were obtained in natural head posture with the appliance *in situ*. Three subjects dropped out of the study. The final sample wore the MAD for an average of 13.7 (7.2) months before the second polysomnogram. Variables were compared using Wilcoxon's signed rank test ($P < 0.05$) and intra-examiner agreement for the lateral cephalograms tracings using the Bland-Altman test. Changes in airway variables were correlated with the changes in AHI using the Spearman correlation test.
RESULTS: At the second polysomnogram, AHI was significantly reduced to 10.9 (14.7) events/hour and minimum SaO_2 was significantly increased to 86 (8.4) per cent. There was intra-examiner agreement for all the lateral cephalograms. Nasopharyngeal airway space was significantly increased with the MAD and the hyoid bone was significantly raised to the mandibular plane, which was significantly correlated with the reduction in AHI.
CONCLUSION: An increase in the nasopharyngeal airway and elevation of the hyoid bone towards the mandibular plane was observed for this sample of OSA subjects. The improvement in AHI may be due to elevation of the hyoid bone towards the mandibular plane.

272 A NEW INDICATION FOR A TONGUE GUARD APPLIANCE IN SUBJECTS WITH MAXILLARY DEFICIENCY

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AIM: One of the common treatments of Class III patients is maxillary growth modification. During the last three decades at Mashhad dental school, maxillary deficiency has been treated using a tongue guard appliance (TGA). The purpose of this research was to assess the skeletal and dental effects of the TGA in patients with maxillary deficiency.
MATERIALS AND METHOD: Pre- and post-treatment lateral cephalograms in natural head position of 14 Class III patients (9 females, 5 males) with a mean age of 9.7 years treated with a TGA were traced. The mean value and standard deviations of SNA, SNB, A to N-perpendicular, FMA, U1 to FH, U1 to PP, L1 to GoMe, PNS-A.P.Max/Go-A.P.Man, was calculated. SPSS software and a two-tailed Student's *t*-test at a level of significance of 0.05 were used for data analysis.
RESULTS: Highly significant anterior movement of the maxilla occurred with an increase in SNA and A to N-perpendicular ($P < 0.05$). FMA remained unchanged after treatment. The maxillary incisors were proclined, as indicated by an increase in U1 to the Frankfort plane and U1 to the palatal plane angles ($P < 0.05$). The mandibular incisors were retroclined and there was a decrease in L1 to GoMe angle ($P < 0.05$). Significant increases in maxillary length and maxillary to mandibular length ratio were observed.
CONCLUSION: The TGA is effective in the treatment of patients with maxillary deficiency. Since the TGA is a simple intraoral appliance, patients are co-operative and the treatment goals are achieved in an acceptable period of time. The appliance does not affect face height and therefore could be used in long face Class III subjects.

273 PREVALENCE OF MALOCCLUSION AND ACCESS TO CARE IN VENEZUELAN CHILDREN

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AIM: In many South American countries, such as Venezuela, orthodontic care is not available to the majority of children within the lower socio-economic income sectors. The aim of this study was to determine the percentage of developing malocclusions and access to care in a group of 9-10 year old children in Caracas, Venezuela.
SUBJECTS AND METHOD: Three hundred and four children (42 per cent male; 58 per cent female) 9-10 years of age, with limited access to dental care, from a socio-economically challenged neighbourhood of Caracas. The sample size was determined using Cochran's formula (1975). Informed consent was obtained, after which dental examinations were undertaken by a single dentist at nine different schools.
RESULTS: There was a majority of Class I malocclusions (42%), followed by Class II (11 per cent), and Class III (5 per cent), with 3 per cent indeterminable. Fourteen per cent showed a severe overjet (either negative or >7 mm) and 25 per cent had overbite problems. Crossbites were evident in the anterior (11%) and posterior (12%) regions, of which 9 per cent were unilateral and 3 per cent bilateral. Over one-third of children (>33%) had early loss of primary molars and 46 per cent had five or more teeth affected by caries. Whilst 60 per cent of parents felt that their children needed orthodontic care, over two-thirds of the children had either never been to a dentist, or attended less frequently than every 2 years, due to financial impediments.
CONCLUSION: The oral health status, occlusal status and access to care in this community are in need of improvement. The prevalence of caries is high and needs significant reduction. A community-directed, preventive and interceptive orthodontic programme for children in this community is recommended.

274 DENTAL CHARACTERISTICS IN PATIENTS WITH ECTODERMAL DYSPLASIA

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AIM: Ectodermal dysplasia is an inherited disease causing malformations of all tissues originating from the ectoderm. The significance of this disease results in severe hypodontia, dental hypoplasia, and accompanying atrophy of the alveolar process. The clinical situation is aggravated by significant xerostomia. It was the aim of this study to register the distribution of hypodontia and tooth malformation, and to elucidate the clinical impact of these findings.
SUBJECTS AND METHOD: Thirty patients (19 males, 11 females) with ectodermal dysplasia. Their ages ranged from 7 to 23 years. All were examined clinically and radiographically. For each patient, missing or malformed teeth together with retained primary teeth were registered. Additionally, the entire treatment procedure was assessed.
RESULTS: Third molars were missing in all patients. Aplasia of other permanent teeth ranged from 2 to 26. Most frequently, the mandibular central incisors were absent, followed by the maxillary lateral incisors. The most stable teeth were the maxillary central incisors, canines and first molars. However, the maxillary central incisors and canines were the teeth most affected by hypoplasia. Primary canines and second molars were the most often persisting teeth due to agenesis of the maxillary lateral incisors and the mandibular second premolars. In two-thirds of the patients the missing teeth were replaced by partial prostheses. Fifty per cent of the patients received orthodontic treatment.

CONCLUSION: Hypodontia and hypoplasia are regular dental characteristics in patients suffering from ectodermal dysplasia. The distribution of absent teeth deviates remarkably from the general population. Treatment requires an interdisciplinary approach including orthodontics, prosthodontics and oral surgery.

275 EFFECTIVENESS OF A REMINERALISING AGENT: AN *IN VITRO* BOVINE ENAMEL STUDY

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AIM: To investigate the remineralisation effect of a casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) product, GC tooth mousse, compared with a fluoride toothpaste slurry.
MATERIALS AND METHOD: GC tooth mousse is a water-based, sugar-free, cream containing Recaldent CPP-ACP, which has been shown to reduce caries activity. Twelve bovine upper incisors, sectioned into four and varnished to leave a 5×5 mm window, were exposed to an acetic acid, KH_2PO_4, $CaCl_2$, 0.05 ppmF, pH 4.5 demineralising solution for 72 hours. From each tooth, one of the four sections was allocated to a V, X, Y or Z regimen. V was stored as a demineralised control, X was dipped in artificial saliva, 0.05 ppmF, pH 7.2, Y was dipped in 10 per cent (w/v) GC tooth mousse in artificial saliva 0.05 ppmF, and Z was dipped in 10 per cent (w/v) 1050 ppmF NaH_2PO_4 in artificial saliva 0.05 ppmF. All sections were stored in artificial saliva except when dipped in X, Y or Z for 5-minute spells, no more than twice daily, and then rinsed. The experiment ran for 74 days with 9.5 hours cumulative dipping. Sections were imaged with quantitative light induced fluorescence (QLF) at day 0 and every 3 or 4 days with 23 images per section. Analysis was carried out using QLF V.2.00 software (Inspektor Research Systems, Netherlands). Data was tested for normality with Q-Q plots and Kolmogorov Smirnov tests, hypothesis testing with parametric mixed-model analysis test.
RESULTS: Remineralisation, measured by ΔF, showed increased fluorescence for all samples up to day 36, at its greatest for GC tooth mousse (Y). From 36-74 days ΔF reduced for all groups, but less in group Y. Transverse microradiography of one set of samples suggested that the baseline experimental lesions had both erosive and subsurface lesions.
CONCLUSION: GC tooth mousse is more effective than 1050 ppmF toothpaste in promoting remineralisation of bovine enamel *in vitro*. Initial erosive lesions may be a confounding variable.

276 LONG-TERM EFFECTS OF ORAL APPLIANCES FOR THE TREATMENT OF OBSTRUCTIVE SLEEP APNOEA

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AIM: To evaluate the long-term skeletal and dental adverse events on treating snoring and obstructive sleep apnoea (OSA) with a mandibular advancement device (MAD). In addition, the subjective effectiveness of the intraoral appliance on OSA was assessed.
SUBJECTS AND METHOD: Twenty-one males and six females with OSA who had used the MAD for at least one year. The baseline diagnosis of OSA was based on initial polysomnography, the mean oxyhaemoglobin desaturation index (ODI-4) being 13 (range 3–38). The mean body mass index of the subjects was 27 (range 23-36). Seventy-eight per cent used a one-piece monobloc appliance and the remainder a two-piece appliance. The occlusion and signs and symptoms of temporomandibular dysfunction were clinically registered and lateral skull radiographs were taken at baseline and after a follow-up period of approximately 2.6 years (range 12-58 months). The patients were asked about the influence of the MAD on their subjective symptoms of OSA.
RESULTS: Compliance for both devices was good, since 82 per cent of the patients used the MAD every night. At baseline 96 per cent of the patients had snoring, 78 per cent suffered from daytime sleepiness and 44 per cent had a headache in the morning. During the follow-up all these symptoms decreased. Sixty-seven per cent of the subjects were extremely satisfied with the MAD while the others were quite satisfied. No significant changes in occlusion, skeletal relationship or masticatory function were recorded.
CONCLUSIONS: After long-term treatment with the MAD, the dental and skeletal changes seem to be minimal and without clinical importance. Furthermore, the results indicate that the therapeutic efficacy of the MAD is maintained during the follow-up. However, because treatment of OSA with a MAD is likely to be a lifelong process, it is important to evaluate the effectiveness of the appliance both clinically and by polysomnography at long-term intervals.

277 INFECTION EFFICIENCY OF RAT CHONDROCYTES USING DIFFERENT HYBRIDS OF RECOMBINANT ADENO-ASSOCIATED VIRUS VECTORS

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AIM: To investigate the best serotype of recombinant adeno-associated virus (rAAV) that leads to optimum chondrocyte infection, in an endeavour to create an appropriate delivery system for future gene therapy to regulate condylar growth.
MATERIALS AND METHOD: rAAV2/1, rAAV2/2, rAAV2/5, rAAV2/6, and rAAV2/8 vectors expressing eGFP under the control of CAG (cytomegalovirus enhancer plus chicken β-actin) promoter were used to infect primary chondrocytes (isolated from rat mandibular condyles) at a multiplicity of infection of 5×10^4. The infection efficiency for these cells with different hybrids was identified using fluorescence microscopy and flow cytometric analysis.
RESULTS: All of the selected serotypes of RAAV infected rat chondrocytes and gave rise to GFP expression. The infection efficiency was RAAV2/2 > RAAV2/5 > RAAV2/1 > RAAV2/8 = RAAV2/6.
CONCLUSIONS: rAAV based vectors are capable of infecting rat chondrocytes. rAAV2/2 is the best serotype to infect chondrocytes *in vitro* and might thus be of interest for direct gene delivery to condylar cartilage *in vivo*.

278 THE EFFECT OF THE TWIN BLOCK SYSTEM ON THE TEMPOROMANDIBULAR JOINT

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AIM: Functional orthopaedic treatment of skeletal Class II malocclusions is a major area of debate. The aim of this study was to evaluate signs and symptoms in an accurate procedure using the axiograph, and mandibular position indicator (MPI). The aim of this study was to evaluate the effects of the twin block (TB) system (TB functional appliance and concord face bow) on the temporomandibular joint using the SAM-axiograph, SAM-MPI, and conventional cephalometric radiographs.
SUBJECTS AND METHOD: A treatment group comprising 17 patients and a control group of 15 subjects. All were skeletally and dentally Class II. Their average age was 12 years. For the treatment group, the TB system was used for six months until a Class I occlusion was achieved. At the beginning and end of treatment, cephalometric radiographs, axiograph and MPI records were obtained and evaluated. The same records were obtained for the control group without any treatment or intervention during this period. For the MPI records: 1) Δx is the difference between centric relation (CR) and centric occlusion (CO) in the anteroposterior direction in the condylar area; 2) Δz is the difference between CR and CO in the vertical direction in the condylar area; 3) Δy is the difference between CR and CO in the transversal direction in the condylar area; 4) Δh is the difference between CR and CO in the vertical direction in the incisal area; 5) ΔL is the difference between CR and CO in the anteroposterior direction in the incisal area. The results were evaluated and compared for the two groups.
RESULTS: Treatment with the TB system resulted in a decrease in ANB angle and a significant increase in SNB angle. Facial convexity significantly decreased, mandibular effective length increased by approximately 1.8 mm, the mandibular incisors were protruded and the maxillary incisors were retruded. For the axiographic record, maximum opening, and opening to the right and left of the mouth increased but not significantly. Condylar right protrusion inclination and left protrusion length significantly decreased. The results for the MPI records were: Δx and Δy decreased but not significantly, while Δy increased (ns). Δh and ΔL significantly decreased.
CONCLUSION: Functional orthopaedic treatment with the TB system is an effective and safe method to treat subjects with a Class II malocclusion.

279 RELIABILITY OF INSTRUMENTAL COLOUR MEASUREMENT OF VITAL HUMAN TEETH

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AIM: Reproducing colour remains one of the most challenging aspects of dentistry. A reliable method for intraoral quantification of tooth colour would be valuable. In clinical practice, the recording of tooth colour is based on the visual matching of tooth with standard shades. The results can be predicted by the reliability and validity of the matching. The aim of this study was to evaluate reliability and validity of colour matching using a spectrophotometer.
MATERIALS AND METHOD: The tooth colour of 10 subjects was measured with a spectrophotometer (Shade Inspector™, Schütz-Dental, Rosbach, Germany) by three different examiners. The measurements were undertaken twice with a time interval of 2 weeks. Each tooth was divided into three sites (incisal, middle, cervical). The spectrophotometer operates independently of lighting conditions, and measures the value of lightness, intensity and shade (value, chroma hue). The values are automatically converted into the code of the three-dimensional Master shade system. The examiners were blinded to each others' data. Cohen's kappa (κ) and intraclass correlation coefficient (ICC) were used for statistical analysis. ICC values above 0.75 are considered acceptable. The strength of agreement for the various range of κ has been described by Landis and Koch.

RESULTS: Intra-examiner reliability was substantial for value (ICC: 0.830 to 0.731) and partly substantial for chroma (0.661 to 0.761). κ values for hue varied between 0.396 and 0.471. Inter-examiner agreement between the two examinations was substantial for value (ICC: 0.705 to 0.756). κ values for hue varied between 0.329 and 0.485. κ values of hue showed fair to moderate agreement in both sessions, with improvements at the second session. ICC for value showed substantial agreement, with improvements at the second session.
CONCLUSION: To increase measuring accuracy in future studies, a second calibration is recommended.

280 DISTRACTION OF ANKYLOSED TEETH AND IMPLANTS**
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AIM: Ankylosis in the permanent dentition is considered to be one of the challenging problems in dentistry and usually has a poor long-term prognosis. The typical treatment of such cases usually involves repetitive luxation or removal of the involved teeth to prevent potential development of unwanted pathological conditions. Bone grafts/implants are normally required to restore form and function when ankylosed teeth are extracted. In order to maintain the ankylosed teeth and to limit the need for implantation, an alternative approach has been developed using the principles of distraction osteogenesis to move these teeth, together with the alveolar bone.
SUBJECTS AND METHOD: The ROD5 alveolar distractor was used in four adult patients to treat ankylosis of two upper central incisors, one upper canine and one upper molar. Treatment required one surgical procedure and two weeks of distraction. The teeth were distracted at a rate of 1 mm/day and a rhythm of two turns/day. The teeth were stabilized with orthodontic appliances following two weeks of distraction to allow for bony remodelling.
RESULTS: The teeth were distracted an average of 6 mm, and normal form and function was established at treatment completion. One year follow-up revealed no relapse.
CONCLUSIONS: Treatment of ankylosis by distraction with a tooth-borne distraction appliance provides a promising solution to a complicated problem without complications. Tooth-borne distraction devices are clinically acceptable to the patient and are easily managed by the dental surgeon.

281 EFFECT OF SURFACE CONDITIONING ON THE SHEAR BOND STRENGTH OF BRACKETS
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AIM: When brackets are adhered to the enamel, adhesion has two aspects namely, adhesion of the cement to the tooth and to the bracket surface. Recently, surface conditioning based on silica coating and silanization has been investigated for conditioning metals, ceramics and resin composites in restorative dentistry (Özcan *et al*., 2000) but not in orthodontics. The objectives of this study were to compare the shear bond strength of ceramic (Clarity™, 3M, Monrovia, California, USA) and metal brackets (MBT, 3M Unitek) to enamel surfaces with and without silica coating and silanization, and to evaluate the failure mode.
MATERIALS AND METHOD: Conditioned and as received ceramic and metal corresponding brackets (n = 40, 10 per group) were bonded to newly extracted first upper premolars using one adhesive (Transbond). The specimens were kept in water after bonding at room temperature for 8 weeks. All specimens were tested in a universal testing machine (crosshead speed: 1 mm/minute). The teeth were examined under ×10 magnification to determine failure mode.
RESULTS: Both the bracket type ($P = 0.0056$) and surface conditioning ($P < 0.0005$) had a significant effect on bond strength (two-way ANOVA). The mean bond strength for the non-silanized ceramic brackets (9.47 MPa) was significantly lower than for silanized brackets (16.96 MPa). While the non-silanized metal brackets showed a mean bond strength of 15.66 MPa, it was 18.71 MPa for the silanized metal brackets. The majority of the non-silanized brackets failed at the bracket-adhesive interface, whereas almost all of the silanized brackets failed at the adhesive-enamel interface.
CONCLUSIONS: Silica coating and silanization is an effective method to increase the bond strength of both metal and ceramic brackets. After surface conditioning, the crack propagation at the bracket tooth interface changed dramatically.

282 MANDIBULAR ARCH FORM: THE RELATIONSHIP BETWEEN DENTAL AND BASAL ANATOMY
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AIM: To investigate mandibular dental arch form both at the level of the clinically relevant application points of the orthodontic bracket, and at the level of the underlying anatomical structure of the apical base. The correlation of both forms was evaluated and examined to determine if the basal arch could be used to derive an individualized 'clinical' arch form.

MATERIALS AND METHOD: Thirty-five mandibular dental casts (skeletal and dental Class I) were laser scanned and a three-dimensional virtual model was computed. Two reference points (FA point, the most prominent part of the central lobe on each crown's facial surface, and WALA point, a point at the height of the mucogingival junction) were selected for each tooth from the right to the left first molars. The FA and WALA arch forms were compared, and the distances between corresponding points as well as the intercanine and intermolar widths analyzed.
RESULTS: Both arch forms were highly individual and tooth values scattered. Nevertheless, a highly significant relationship between the FA and WALA curves was found, especially in the canine (0.75) and molar (0.87) area.
CONCLUSION: Both FA and WALA point-derived arch forms were found to be very individual and, therefore, could not be defined by one generalized shape. WALA points proved to be a useful representation of the apical base and to be helpful in the predetermination of an individualized dental arch form.

283 EVALUATION OF THE INHERITANCE OF PRIMARY FAILURE OF TOOTH ERUPTION

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AIM: Primary failure of eruption is characterized by infraocclusion of the premolars and molars, and a lateral open bite in the involved alveolar process. This rare anomaly appears in one or more quadrants. At present the aetiology of the disease is not completely understood. In the literature, autosomal dominant inheritance without penetrance has been discussed. The hypotheses tested were: What is the clinical variance of the primary failure of eruption? Is the genetic pattern autosomal dominant without penetrance?
SUBJECTS AND METHOD: Eighteen patients with primary failure of eruption who had been treated orthodontically, as well as their families and relatives.
RESULTS: Twenty-eight subjects (19 females, 9 males) from the 18 different families were identified with primary failure of eruption. In 11 families the eruption failure appeared spontaneously. Additional family members with eruption failure were found in five different families. In two cases the failure of eruption was combined with different syndromes. In all cases there was a large clinical variation in the degree of the anomaly combined with a different expression of the developmental disturbance within the alveolar process.
CONCLUSIONS: In the majority of cases primary failure of eruption was not hereditary. In subjects with a hereditary dominant inheritance pattern, a reduced penetrance was assumed. In syndromes, the failure of eruption is a concomitant symptom.
The study was carried out in co-operation with the Departments of Orthodontics of the University of Graz and the University of Innsbruck, Austria

284 PERCEIVED ORAL HEALTH AMONG PATIENTS WITH SEVERE MALOCCLUSION

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AIM: To study whether the oral health impact (OHI) on patients with severe malocclusions changed while they were waiting for surgical-orthodontic treatment.
SUBJECTS AND METHOD: Forty-eight adult patients who had a severe, diagnosed malocclusion and were waiting for orthodontic or surgical-orthodontic treatment during 2003-2005. Their mean age was 38.2 years (range 22-63 years). All patients were invited to a clinical examination twice and were asked to fill out a questionnaire at both timepoints. The oral health impact profile (OHIP-14) was used for measuring OHI during the preceding month. Additionally, demographic variables were measured. The interval between the two examinations was approximately 1.3 years (range 0.9 to 1.8 years). Differences in OHI between the two examinations were evaluated using Wilcoxon's signed rank test.
RESULTS: There was no statistical significance difference in the reported impacts between the two measurements, except a change in functional limitation. At the first measurement two patients (1 per cent) reported a worsened sense of taste sometimes, fairly, or very often compared with 17 per cent of patients at the second measurement. Painful aching, being uncomfortable to eat and having trouble pronouncing words were reported slightly more often at the second than at the first measurement. When compared with the results of the National Health 2000 Survey among adult dentate Finns aged 30-44 years (Suominen-Taipale *et al*., 2004), the subjects in this study reported a two to eight fold frequency of OHI. They also reported life being in general less satisfying and diet being unsatisfactory 10 times more often, and difficulties in relaxing and doing their usual jobs 11 times more often than adult Finns.
CONCLUSION: OHI among patients with severe malocclusion seems to remain unchanged. However, an OHI was reported more often when compared with adult Finns.

285 THE EFFICACY OF A PLASMA ARC LIGHT IN ORTHODONTIC BONDING

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AIM: To evaluate, in a single centre prospective randomised controlled trial, the clinical performance of a plasma arc light (Ortho Lite™, 3M Unitek) against a conventional tungsten-quartz halogen curing light (Visilux 2, 3M Unitek) for direct orthodontic bonding.

SUBJECTS AND METHOD: Thirty-eight consecutive patients requiring fixed appliances. A split mouth technique was adopted with quadrants randomly assigned to either the plasma arc or the conventional tungsten-quartz halogen curing light. Each quadrant was bonded directly with APC® pre-adjusted edgewise brackets (3M Unitek). Following bonding of each quadrant, the teeth and bonded brackets were shielded from the alternative curing light used to bond the contralateral or opposing quadrants, with a pre-formed strip of aluminium foil. This ensured that no brackets could be exposed to both curing lights. The outcome measures investigated were, time taken to bond-up the appliances, patient sensitivity or discomfort during light curing, the adhesive remnant index (ARI) scores, time taken to replace any failed brackets, and the bracket failure rate at the completion of treatment.

RESULTS: No statistically significant differences in bracket failure rates were found between the plasma arc (6.9 per cent) and the conventional tungsten-quartz halogen (9.8 per cent) light at debond. The bond-up times were significantly reduced, by 208 seconds per patient, with the plasma arc light. There were no significant differences in patient sensitivity or discomfort during light curing, the ARI scores, or the time taken to replace any failed brackets.

CONCLUSION: The plasma arc light is a viable clinical alternative to the conventional tungsten-quartz halogen curing light. There is no difference in bracket failure rates but the plasma arc light has time saving benefits for both the clinician and patient.

286 EFFECTS OF PROTECTIVE ENAMEL SEALANT ON THE INCIDENCE OF DECALCIFICATIONS

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AIM: To determine whether a protective sealant around bonded brackets can decrease the development of decalcifications during fixed orthodontic treatment with a straightwire bracket system.

SUBJECTS AND METHOD: Seventy patients with a multibracket appliance (Alexander Signature Line Brackets, Ormco Inc., Glendora, USA) were examined before the insertion of the appliance and after debonding. In the study group, a light cured resin (Fluorobond, Ormco Inc.) was applied to the entire buccal tooth surface at the time of bonding, while in the control group the sealant was only applied to the enamel directly under the bracket base. Both groups were bonded with Enlight light cure adhesive (Ormco Inc.). The examination after debonding was performed by one orthodontist (AS). The data were statistically analysed.

RESULTS: Application of a protective resin around the brackets significantly decreased the development of decalcifications during fixed orthodontic treatment.

CONCLUSIONS: Using a protective enamel sealant in addition to a good oral hygiene programme can help to prevent decalcifications associated with multibracket treatment.

287 CHANGES OF INTERLEUKIN-6 LEVELS IN GINGIVAL CERVICAL FLUID DURING ORTHODONTIC TOOTH MOVEMENT

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AIM: To investigate the levels of IL-6 in gingival cervical fluid (GFC) during orthodontic tooth movement.

SUBJECTS AND METHOD: Fourteen orthodontic patients (9 females, 5 males, mean age 15.1 ± 2.5 years) with a Class I malocclusion who required premolar extractions. For each patient one maxillary canine was distalized with a NiTi push coil spring (DC). The contralateral canine (CC) was included in the orthodontic appliance but was not subjected to the orthodontic force, and one of the mandibular canines was used as control and was free from any orthodontic appliance (antagonist canine; AC). The concentrations of IL-6 were evaluated at baseline (T_0) and 14 (T_{14}) and 28 (T_{28}) days after intervention. GCF was obtained with periopapers from both the mesial and distal tooth sites before appliance activation and on days 14 and 28. The concentrations of IL-6 in DC, CC, and AC detected by ELISA were compared using repeated measures analysis.

RESULTS: No significant differences were found in concentrations of IL-6 between the mesial and distal sites at T_0, T_{14} and T_{28} for the AC or CC. IL-6 levels were elevated significantly at T_{14} and T_{28} compared with T_0. The maximum

concentrations of IL-6 were detected at both the pressure and tension sides of DC at T_{14}. At T_{28}, although IL-6 levels were significantly higher than at baseline, they were significantly less than at T_{14}.
CONCLUSION: The hypothesis that mechanical stimuli cause an inflammatory reaction within the periodontal tissues was confirmed.

288 APPLICATION OF A NEW THREE-DIMENSIONAL X-RAY SYSTEM IN ORTHODONTIC DIAGNOSIS

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AIM: To investigate the clinical use of a new three-dimensional (3D) X-ray system (Sirona Dental Systems, Bensheim, Germany), its application, and the use of software tools in dentomaxillofacial imaging.
MATERIALS AND METHOD: The images of 45 patients were taken with a tube voltage of 90 kV and 28 mAs. The duration of the scan was 14 seconds. The reconstructed 3D volume had a size of $15 \times 15 \times 15$ cm and a resolution of 2.5 line pairs per millimetre. The software provided sagittal, coronal and axial, as well as 3D volumetric views.
RESULTS: The 3D X-ray has the potential to visualize high contrast structures such as bone and teeth. Compared with computed tomographic scanners, it functions at a lower level of radiation exposure while reducing metal artefacts. When combined with application-specific software tools, the 3D X-ray can provide dentomaxillofacial practitioners with a complete solution for performing specific diagnostic and therapeutic tasks.
CONCLUSIONS: Because this emerging technology produces images with high resolution and a low radiation dose, it is ideally suited for dentomaxillofacial scanning and can offer orthodontists useful information. Pathological findings can be accurately diagnosed and the effects of orthodontic tooth movement and surgical procedures can be predicted.

289 DENTAL IMPLANT THERAPY FOR CHILDREN AND ADOLESCENTS WITH SEVERE HYPODONTIA

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AIM: To assess the outcome of implant supported prostheses in children and adolescents with congenital absence of all teeth in the lower arch, and to compare the results within the sample depending on the patient's age, the type of implant and the type and volume of the alveolar bone.
SUBJECTS AND METHOD: From a total of 67 subjects with oligodontia of the primary (n = 14.34) and permanent (n = 26.91) dentition associated with syndromal ectodermal dysplasia (ED) 17 of the most severe subjects were chosen, 10 with total absence of the teeth and seven with anodontia of the lower arch. The subjects were divided in to three age groups according to the period of the dentition: group 1 six patients (4 males, 2 females,) between 3 and 6 years of age in the primary dentition; group 2, seven patients (5 males, 2 females) 7-12 years of age in the mixed dentition and group 3, four patients (3 males, 1 female) 12-18 years of age in the permanent dentition. The alveolar ridge was examined clinically on diagnostic models and panoramic radiographs for sufficient alveolar width (aw) and height (ah) measured from the top of the alveolar ridge to the mandibular canal with computed tomography (CT) which provided three-dimensional images for accurate evaluation of bone morphology and bone density (bd) (according to Hounsfield). During the follow-up period from 2001 to 2005, a total 156 implants were inserted, including 67 one stage mini-implants and 89 two stage implants. The results were clinically evaluated 3, 6, 12, 18 and 24 months after treatment.
RESULTS: Group 1: bd = 1219 Hounsfield units i.e. first type bone structure by Misch (1993, 1999). For the lateral segments ah = 3-5 mm. For the anterior mandible aw = 2.75-3.5 mm and ah = 10.2-13.5 mm. Thus one stage temporary implants with a diameter of 1.8-2.0 mm were inserted in the intercanine mandibular region. Suture removal was performed on day 10 post-surgery, and on day 15 the overdentures with implant supports were placed. Analysis of the CT data in group 2 revealed 1016 Hounsfield units for alveolar bd and second type of bone structure (Misch). In the mandibular lateral segments ah was decreased from 3 to 5 mm. There were insufficient conditions for implant installation in the premolar and molar regions. In the anterior mandible aw was 3.5-4.3 mm and ah 10.2-13.5 mm. Thus in the mixed dentition period there was the possibility to use temporary mini-implants with a diameter 1.8-2.0 mm and also two stage implants with a diameter up to 3.5 mm and a length of 10 mm. Prosthetic treatment was performed according to implant type: on day 15 when using mini-implants or three month later after insertion of two stage implants. For group 3, bd = 1009 (second type of bone structure). In the mandibular lateral segment ah = 3.7-6 mm and in the mandibular anterior segment aw = 4.75-6 mm and ah = 13.5-16 mm.
CONCLUSION: Dental implants can be placed successfully in growing children with congenital total absence of teeth in the lower jaw. In children with anodontia, the mandibular anterior region is the single region where early placement of dental implants is indicated. Implant supported removable or fixed superstructures provide improved stability, retention and

function, including chewing and speech, the increasing secretion of saliva, and easy adaptation to the prosthesis. Improved facial aesthetics results in greater social adaptation of ectodermal dysplasia individuals and improvement in their quality of life.

290 CARIES AND WHITE SPOT LESIONS IN ORTHODONTICALLY TREATED ADOLESCENTS – A PROSPECTIVE STUDY

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AIM: To assess the effect of a strict prophylactic regimen for orthodontic patients in reducing the incidence of white spot lesions (WSL) and caries during fixed appliance treatment.
SUBJECTS AND METHOD: Eighty consecutive patients, 16 years of age or younger, scheduled for orthodontic treatment with fixed appliances in both jaws, treated by two postgraduate students. The subjects were compared with a non-orthodontic matched-control-group. The straightwire technique was used and the brackets were bonded with a non-fluoride adhesive. The hygiene regimen consisted of oral hygiene instruction, tooth brushing 2-3 times daily, flossing, a fluoride mouth rinse and plaque disclosing tablets. The patients were instructed to avoid carbonated soft drinks and acidic juices during treatment, and sweets were restricted to a maximum of once a week. The patients were not allowed to start treatment before the plaque index was below 10 per cent. The WSL index of Gorelick *et al*. (1982) was used. Caries scores were set according to the evaluation method of Espelid *et al*. (1997)
RESULTS: New WSL developed in 5.7 per cent of the labial surfaces in the orthodontic group. However, 50 per cent of the patients had a WSL of 1 or more grade II (= slight). For the control group the corresponding results were 0.4 per cent surfaces and 11 per cent of the individuals. New dentine caries were registered in 5 per cent of the patients in the orthodontic group (0.03 per cent of the surfaces), whereas 30 per cent of the controls (0.5 per cent of the surfaces) had new dentine caries.
CONCLUSION: The findings regarding WSL are in agreement with previous investigations. However, the caries prevalence in dentine was lower than earlier studies. This shows that a strict hygiene regimen does not prevent the development of new WSL but may reduce their severity and the incidence of dentine caries.

291 COMPARISON OF THREE POLISHING TECHNIQUES ON TWO ALL-CERAMIC MATERIALS

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AIM: To compare the surface roughness produced by three polishing techniques on two all-ceramic materials subjected to three different surface treatment techniques using a profilometer and a scanning electron microscope.
MATERIALS AND METHOD: Sixty-three feldspathic and 63 lithium disilicate ceramic specimens were divided into six groups. Three different surface conditioning methods were used: air particle abrasion (APA) with 25 μm aluminium trioxide; hydrofluoric (HF) acid gel (9.6 per cent) application; APA and HF acid application. Consequently each group was divided into three subgroups. The subgroups were subjected to three different polishing techniques: polishing kit; diamond paste; polishing kit plus diamond paste. The surface roughness was evaluated with a profilometer before and after polishing. The Ra mean difference (ΔRa) was analyzed using univariate analysis of variance and Tukey's multiple comparison test ($\alpha = 0.05$).
RESULTS: The highest mean ΔRa values were observed for both ceramics treated with APA preceding HF acid application and polished using a polishing kit plus diamond paste, or a polishing kit. No significant differences were detected among the groups using a polishing paste ($P > 0.05$). There was no significant difference among the groups treated with HF acid and polished using a polishing kit or a polishing kit plus paste ($P > 0.05$).
CONCLUSION: The smoothest surfaces were obtained with the combined application of a polishing kit and a polishing paste. The lithium disilicate ceramic specimens displayed smoother surfaces than the feldspathic ceramic.

292 MICROBIOLOGICAL CHANGES IN DENTAL PLAQUE DURING ORTHODONTIC FIXED APPLIANCE THERAPY

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AIM: To evaluate the quantity and type of aerobe and anaerobe micro-organisms in subgingival dental plaque of patients treated with fixed orthodontic appliances, and their influence on soft and hard dental tissues.

SUBJECTS AND METHOD: Forty-five patients of both genders, mean age 14 years 9 months, with Class II division 1 malocclusions. The patients had healthy periodontal tissues and no other general health conditions or diseases. Subgingival dental plaque smears were collected by paper points from the sulcus of teeth 16, 21, 24, 36, 41 and 44 before attachment of fixed orthodontic appliances, and after 1, 3 and 6 months. Plaque samples were transferred to liquid medium and then to primary isolation bases and specific bases: Kanamycin-Vankomycin-Blood Agar, TSVB, *Mitis Salivarius* and MRS agar.
RESULTS: The quantity of bacterial colonies and bacterial types in subgingival dental plaque increased after insertion of orthodontic appliances. This increase was gradual, constant, and reached its maximum in month 3. The quantity stagnated from month 3 to 6 and then decreased. Considering bacterial type, the increase of *Streptococcus mutans* was not significant; the increase of *Lactobacillus spp*. was constant and significant; *A. actinomycetemcomitans* was registered only in the early treatment stages and in very small amount. Very small quantities of *Prevotella intermedia* were found at the start of treatment, but increased during months 2 and 3 and then rapidly decreased after month 6. The group of characteristic black pigmented anaerobes was present from the start of treatment, the quantity increased constantly until month 4, when it decreased.
CONCLUSION: Fixed orthodontic appliances have an influence on the increase of pathogenic aerobe and anaerobe micro-organisms in dental plaque during early treatment stages. This increase is transitory, short-term and has no destructive influence on periodontal tissues. Positive correlation between clinical indices and the amount of *Lactobacillus spp*. indicates a small cariogenic potential of fixed orthodontic appliances.

293 LIGHT CURING THE PRIMER – BENEFICIAL WHEN WORKING IN PROBLEM AREAS?

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AIM: To investigate whether Transbond XT with MIP and Assure are affected by light curing the primers before contamination with blood or saliva.
MATERIALS AND METHOD: One hundred and eighty human premolars. The teeth were assigned into 12 groups of 15 specimens. Metal brackets were bonded to each tooth under five different enamel surface conditions: dry, contaminated with blood, or with saliva after primer application without light curing the primer, contaminated with blood, or with saliva after primer application and light curing the primer.
RESULTS: The shear bond strengths of the two adhesive groups were not significantly different from each other with the same surface conditions. There was no statistically significant difference between the groups bonded under dry conditions. On the other hand, curing the primer before adhesive application enhanced the bond strength in the contamination groups. Saliva and blood behaved similarly, showing higher bond strength values when the primer was light cured before contamination. However, bond strengths were of different magnitudes because of differences in the type and amount of inorganic and organic substances they contained.
CONCLUSIONS: Under ideal conditions, light curing the primers did not result in any advantages. However, curing the primer before contamination resulted in higher bond strengths. In order to minimize the negative effect of contamination on bond strength, it would be appropriate for clinicians to light cure immediately after application of the primer.

294 SCIENTIFIC EVIDENCE FOR THE VARIETY IN BITE JUMPING APPLIANCES

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AIM: During the last decade, non-compliance devices have become increasingly popular and a large number of different fixed bite jumping appliances have been marketed. The aim of this research was to undertake a survey of all available fixed bite jumping appliances, and to search for corresponding scientific evidence about their mode of action.
METHOD: Using Pubmed, orthodontic journals, orthodontic catalogues, homepages of the different orthodontic manufacturers, and dental exhibitions, the available fixed bite jumping appliances and their corresponding scientific evidence were searched. The appliances were classified by design and mode of force application.
RESULTS: Forty-three different fixed bite jumping appliances were identified. They could be assigned to six groups: rigid appliances (n = 21), flexible appliances (n = 11), rigid-flexible appliances (n = 4), oblique plain forces (n = 3), multi-telescoping appliances (n = 2) and fixed tension springs (n = 2). Of the 43, only five appliances (11.6 per cent) had been tested more or less extensively in scientific studies (Herbst, Jasper Jumper, Forsus Nitinol Flat Spring, Eureka Spring, MARA). Nine appliances (20.9 per cent) were described in case reports. For all other appliances (67.4 per cent), only the manufacturers' instructions and statements of their mode of action were available, or they just appeared in catalogues, on homepages and/or in advertisements.
CONCLUSION: Despite the large number of different fixed bite jumping appliances scientific evidence about their mode of action is available for only 11.6 per cent.

REPEATABILITY OF MEASUREMENTS ON PALATAL IMPLANT STABILITY

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AIM: To investigate the reproducibility of measurements on implant stability with resonance frequency analysis using the new Osstell™ mentor instrument.
SUBJECTS AND METHOD: Sixteen patients with one fully integrated palatal implant each (length: 4 mm; diameter: 3.3 mm; Orthosystem®, Institut Straumann, Switzerland) and aged 27.9 ± 9.2 years were observed from implant insertion over a period of 24.3 ± 6.4 months. The stability of these implants was measured after removing the superstructure and placing a Smartpeg™ magnet. The magnet was excited by a magnetic pulse from a probe. The probe was connected to the measuring instrument and held in close proximity to the top of the magnet. The measurements were carried out twice by three different investigators from two different directions (antero-posteriorly, and transversely from the right, total: 192 measurements).
RESULTS: Measurement deviation within one patient averaged 2.93 ± 1.4 (maximum 6; minimum 1). Differences between the average values the antero-posterior direction (55.8 ± 0.4) and the average values measured from the right side (56.4 ± 0.2) amounted to 0.6 and were statistically significant ($P = 0.0027$). The mean values for the first measurement (55.9 ± 3.1) compared with the second measurement (56.4 ± 0.2) were 0.5, and statistically significant ($P = 0.0032$). The average implant stability quotient values measured by the three investigators (56.2 ± 0.3; 56.2 ± 0.4; 55.8 ± 0.7) were not statistically significantly different ($P = 0.82$, intraclass correlation coefficient 0.85).
CONCLUSIONS: Lack of statistically significant differences between the data recorded by the three investigators and the clinically small variations between the first and second measurements (although statistically significant), suggest that the Osstell™ mentor instrument delivers reproducible results for assessment of the stability of palatal implants.

295 TRABECULAR BONE MODELLING FOLLOWING ALVEOLAR DECORTICATION

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AIM: Significant hard and soft tissue turnover increases are reported following bone injury but little is known about the effect of alveolar injury. Clinical orthodontics is 60 to 70 per cent more rapid following selective labio-lingual alveolar decortication but the biological rationale for rapid tooth movement remains obscure. The objectives of this study were to evaluate bone modelling in 1) trabecular bone, 2) periodontal ligament (PDL) and 3) first versus third molars as a function of time and proximity following decortication.
MATERIALS AND METHOD: Nine rats underwent selective bucco-lingual alveolar decortication adjacent to the left maxillary first molar in a split mouth design. The animals were sacrificed in groups of three at 3, 7, and 11 weeks, and the maxillae were removed, stripped, and prepared for decalcified histology using tartrate resistance acid phosphatase or haematoxylin and eosin staining. Bone modelling dynamics were histomorphometrically examined for osteoclast and/or precursor count (OC) within the geometric centre defined by the four most distal first molar roots, the two mesial roots of the third molar, and within the first molar PDL.
RESULTS: Kruskal-Wallis testing showed that trabecular bone OC at 3 weeks post-decortication (56.3) was significantly greater ($P < 0.02$) than in the control (26.3) and 7 week surgery group (29.7). At 3 weeks post-decortication, one-way ANOVA testing demonstrated that bone surface volume (4.4 mm^2) was significantly less ($P < 0.05$) than in the control (7.5 mm^2), the 7 week surgery (6.2 mm^2) and all other groups; PDL surface volume was greater (7.2 mm^2) than in the 3 week control (3.1 mm^2) and 7 week surgery (5.3 mm^2) groups. Moreover, regional acceleratory phenomena (RAP) was shown as PDL OC for 3-week surgery was greater than for all other groups, and the first molar 3-week surgery group had significantly greater OC than the third molar and all other groups.
CONCLUSION: Selective alveolar decortication in rats results in approximately a 50 per cent increase in catabolic modelling of alveolar trabecular bone adjacent to the surgery and RAP was demonstrated.

296 THE EFFECTS OF EARLY HEADGEAR TREATMENT ON THE INCLINATION OF THE MAXILLARY FIRST MOLARS

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AIM: To analyze the effects of early headgear treatment on the inclination of the maxillary first molars in children in the early mixed dentition.
SUBJECTS AND METHOD: Sixty-eight children (40 boys, 28 girls) aged 7.6 years (standard deviation 0.3 years). The children, who had a Class II tendency and moderate crowding in occlusion, were randomly divided into two groups of

equal size. Headgear treatment was initiated immediately in the first group. In the second group only minor interceptive procedures were performed during the first follow-up period of two years. Dental pantomograms were taken at four yearly intervals, and at 16 years of age, at the completion of growth. The angle between the line tangenting the lower most cusp tips of the first maxillary molars and the midline was measured bilaterally.
RESULTS: The crown of the maxillary first molar was more mesially inclined in the headgear group than in the control group. On the left side the difference was statistically significant after one year of headgear treatment and remained anteriorly inclined until the four year examination, while on the right side the inclination was significant only at the three and four year examinations. After growth, at 16 years of age, there was no significant difference between the groups.
CONCLUSIONS: Early headgear treatment seems to affect the position of the maxillary first molars by changing the inclination of the molar to a more mesial position. Mesial inclination is likely a consequence of the superiorly bent outer face bows that were used in the headgear group. An interesting finding was the clear side difference in mesial inclination. This could partly be explained by bilateral differences in the occlusal forces.

297 A CROSS-CULTURAL COMPARISON OF FACIAL PROFILE ASSESSMENT BY DENTAL PROFESSIONALS

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AIM: To compare the assessment of Chinese facial profile attractiveness between Asian and Caucasian dental professionals.
SUBJECTS AND METHOD: Thirty-one Asian dental professionals (20 orthodontists, 11 oral surgeons) and 31 Caucasian orthodontists. Facial profile photograph and lateral cephalometric radiographs of a Chinese male and female adult with a normal profile (Class I incisor relationship, Skeletal I pattern) were digitized. Computerised digital image manipulation of the photographs was performed to obtain seven facial profiles for each gender. The images were constructed by altering cephalometric skeletal or dental hard tissue Chinese normative values by two standard deviations in the antero-posterior plane. The seven profiles were: 1. bimaxillary protrusion; 2. protrusive mandible; 3. retrusive mandible; 4. normal (Class I incisor with Skeletal I pattern); 5. retrusive maxilla; 6. protrusive maxilla and 7. bimaxillary retrusion. Spearman ranked correlation analysis and Mann-Whitney *U*-test were performed.
RESULTS: The assessment of Chinese facial profile attractiveness by Asian and Caucasian dental professionals was highly correlated for both male ($r = 0.96$, $P < 0.001$) and female ($r = 0.89$, $P = 0.007$) profiles. There was no significant difference in the assessment of male profiles between Asian and Caucasian dental professionals. Asian professionals ranked female profile with a protrusive mandible to be less attractive ($P = 0.028$). The normal female profile was ranked less attractive by Asian professionals ($P = 0.014$). The female profile with bimaxillary retrusion was ranked less attractive by the Caucasian professionals.
CONCLUSIONS: The assessment of male profile attractiveness was similar between Asian and Caucasian dental professionals. Differences in the ranking of certain female profiles were found. A cross-cultural effect on the perception of Chinese facial profile attractiveness was observed.

298 TOOTH MOVEMENT BY A CLEAR PLASTIC APPLIANCE IN RATS

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AIM: There is limited information concerning the biology of tooth movement following orthodontic forces exerted by sequential invisible appliances. This preliminary study aimed to describe early histological changes of periodontal tissues in response to a clear plastic appliance as compared with a closed-coil spring in rats.
MATERIALS AND METHOD: Fifteen rats were randomly divided into three equal groups: group I served as the untreated controls. Group II received a clear plastic appliance made from a model in which the maxillary left first molar was set up mesially 0.5 mm from the origin. The appliance was bonded to the maxillary teeth on the contralateral quadrant and incisors. Group III had a closed-coil spring to move the molar mesially. Specimens were prepared in parasagittal sections in order to investigate early histological changes of the periodontal tissues on experimental day 1, 4 and 7 under light microscopy.
RESULTS: In group II after day 1, the periodontal ligament (PDL) was compressed in the bifurcation and apical area of the roots of the maxillary left first molar. By day 7, the PDL of apical and distal aspects of the roots and bifurcation was further compressed, resulting in a stretched PDL of the mesio-buccal root along the mesial side. Root resorption lacunae were seen as early as day 1. In group III, disorganized and compressed PDL in the mesial cervical half and apical area of the roots as well as the inter-radicular septum was observed from day 1, whereas the stretched fibres were observed at the distal aspects

of the roots after day 4 to 7. Hyalinization and superficial cementum resorption could be seen in areas of compression from day 1.
CONCLUSION: Early histo-biomechanics of tooth movement in response to the clear plastic appliances may result in intrusion and distal tipping despite the intended mesial movement.
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299 CHARACTERISTICS OF MSX1 GENE IN KOREAN NON-SYNDROMIC CLEFT LIP AND PALATE
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AIM: To identify the characteristics of the MSX1 (locus 4p16) in Korean non-syndromic cleft lip and palate (NSCLP) subjects, and to elucidate the role of MSX1 in orofacial clefting with hypodontia in the cleft region, which is assumed to be major candidate gene acting as a causal factor for NSCLP and hypodontia.
MATERIALS AND METHOD: Using PCR-based assay, the MSX1 gene was amplified, sequenced, and identified.
RESULTS: 1. The MSX1 gene of these Korean NSCLP individuals showed three patterns of sequence alignments. Pattern I was similar to the reference sequences (Genbank accession number AF426432). The sequence of patterns II and III were different from that of the reference and differed from each other. 2. In pattern I, no common phenotypes related to dental anomalies were found. Most subjects with patterns II and III had common phenotypes with peg-shaped laterals but no missing teeth inside the cleft region. 3. Common single nucleotide polymorphisms were found in pattern I. In the exon 1 of MSX1, nucleotide 'A' of 253 basepair region was substituted to 'G' and nucleotide 'G' inserted in the 255 basepair region. In exon 2, nucleotide 'C' of 11 basepair region was substituted for 'A' and 'T', or 'G' was inserted in the 351 basepair region and 'T' or 'A' was inserted in the 352 basepair region. 4. In one subject with pattern I with five missing teeth, 'Lys20Gln' missense mutation was found.

300 CLASS II MALOCCLUSIONS TREATED WITH THE PENDULUM APPLIANCE: GROWING VERSUS ADULT PATIENTS
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AIM: To compare dentoalveolar and skeletal effects in Class II malocclusion subjects after pendulum and fixed appliance treatment in growing and adult patients.
SUBJECTS AND METHOD: Group A comprised 15 growing subjects (8 males, 7 females, mean age at the start of treatment: 12 years 4 months) and group B, seven adult subjects (2 males, 5 females, mean age at the start of treatment: 21 years 3 months). All patients were treated first by means of molar distalization with the pendulum appliance (mean duration: 10 months) followed by fixed appliances (mean duration: 18 months). Lateral cephalograms were analysed before (T0) and at the end of all treatment (T1). Superimposition of T0 and T1 radiographs was performed.
RESULTS: The main differences between the groups were as follows: group A, the correction of the skeletal Class II malocclusion was mainly due to mandibular growth and repositioning. The molar distalization obtained during phase I was lost and the first molar was 1.6 mm mesial at the end of treatment in 70 per cent of the patients; group B, correction of the Class II malocclusion was obtained by dentoalveolar rather than skeletal compensation. Molar distalization (mean 2.6 mm) was achieved for all subjects.
CONCLUSION: In growing patients, a first phase of treatment with a pendulum appliance is useful to obtain a correct molar relationship. In adult skeletal borderline patients the pendulum appliance is an efficient tool to distalize upper molars and enhance Class II correction.

301 CONTROVERSY IN THE PREVALENCE OF MALOCCLUSION DUE TO DIFFERENT DIAGNOSTIC CRITERIA
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AIM: In order to evaluate the need for orthodontic treatment, the prevalence of malocclusion has been assessed in several studies. However, the divergence in prevalence of a specific malocclusion is often striking. Explaining factors may be differences in ethnicity, gender and age, but inconsistency in diagnostic criteria should not be excluded. Therefore, the aim of this study was to describe the prevalence of a specific type of malocclusion, for example, mesiocclusion, in a single group using different diagnostic criteria.
SUBJECTS AND METHOD: For this epidemiological study 1284 young adult male Swiss recruits were clinically examined. The prevalence of mesiocclusion was determined using different diagnostic criteria.

RESULTS: If the diagnostic criterion for mesiocclusion were solely anterior crossbite or edge-to-edge position, its prevalence would be 8.2 per cent for one, 3.5 per cent for two, and 0.7 per cent for all four upper incisors in lingual malposition. Prevalence decreased further if only teeth in crossbite were considered, 3.7 per cent for one, 1.9 per cent for two and 0.4 per cent for four upper incisors in crossbite. If the canine mesiocclusion was added as a further selection criterion, prevalence ranged from 0.2 to 1.8 per cent depending on the severity of the anterior crossbite (all upper incisors in crossbite versus two in crossbite or edge-to-edge position) and canine position (full cusp mesiocclusion on each side versus half cusp on both sides together). When the molars were additionally included, the prevalence ranged from 0.1 to 1.6 per cent, respectively.
CONCLUSIONS: The divergence in prevalence of mesiocclusion in a sample of individuals highlights the importance of exactly defining diagnostic criteria when performing epidemiological studies describing the prevalence of different malocclusions.

302 A FIVE-YEAR STUDY ON PERIODONTAL TISSUE HEALING FOLLOWING TOOTH AUTOTRANSPLANTATION

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AIM: To study the periodontal tissues of autotransplanted teeth.
SUBJECTS AND METHOD: Sixty-five patients (female: 82.72 per cent, male: 17.28 per cent), aged between 13 and 54 years (average 20.33 years), with 81 transplanted teeth treated during a six-year period by transplantation of autologous teeth. The contralateral tooth was considered as the control. The teeth were examined at least 5 years after surgical treatment for periodontal pocket depth (PD) and bleeding on probing (BOP). The survival rate after 5 years was also evaluated. PD was measured with a Hu-Friedy-CP 12 Periodontometer, mesially, distally, buccally and lingually. A PD greater than 3 mm was considered as pathology (Lindhe, 1999). BOP was evaluated as 0 = bleeding, 1 = no bleeding (Lindhe, 1999).
RESULTS: The survival rate after 5 years was 88.89 per cent. Ninety-five per cent of the transplanted teeth had physiological pocket depths (<3 mm). In 97.69 per cent the contralateral teeth had physiological pocket depths (<3 mm). Forty-nine transplanted teeth (75.38 per cent) had no bleeding on probing. Fifty control teeth (76.92 per cent) had no bleeding on probing.
CONCLUSION: No differences were found between the autotransplanted teeth and their contralateral teeth regarding periodontal parameters. The autotransplanted teeth had a high survival rate as also reported in other studies (Galanter and Minami, 1968; Andreasen, 1990, 1993; Terheyden *et al*., 1995). Autotransplantation is a successful treatment option for the replacement of lost natural teeth.

303 CORRECTION OF TRANSVERSE MOLAR DISLOCATION WITH FIRST-ORDER BENDS

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AIM: To analyse the forces and moments, at the active and reactive units, when first-order bends are used to correct molar dislocation in the horizontal plane.
MATERIALS AND METHOD: According to Mulligan (1982), eight molar positions (rotated and/or buccally or lingually dislocated first molars) were reproduced on a mandibular fully dentate resin model. Six brackets (0.018 inch system, 0 degrees angulation and torque) were fixed onto the anterior teeth (from canine to canine) and two tubes (0.018 inch system, 0 degrees angulation and torque) onto the first molars. The anterior teeth were considered as the reactive unit, while the first molars were considered as the active unit. For correcting the molar dislocations, 10 stainless steel archwires (0.018 inch) were used and the corresponding recommended first-order bends (in-bend, out-bend, toe-in bend, toe-out bend, step-bends and centre-bends) were bent with an activation of 45 degrees. The eight different clinical situations were then sequentially transferred to a three-dimensional measuring device and the activated wires fixed by means of elastic modules into the brackets mounted on the device's sensors. A total of 80 measurements were carried out. The forces and moments in the sagittal as well as in the horizontal planes were analysed.
RESULTS: The essential results at the reactive unit were as follows: in-bend: moment = 3172.3 ± 238.5 cNmm; out-bend: moment = –5014.9 ± 1426 cNmm; step-bend (out-in): horizontal force = 325.2 ± 48.2 cN; step-bend (in-out): horizontal force = –226.1 ± 34.8 cN.
CONCLUSION: The concept of Mulligan is an effective method for correcting molar dislocations in the horizontal plane. Nevertheless it is important to point out that wires activated with first-order bends also produce unwanted and clinically not negligible forces and moments at the reactive unit.

304 VERTICAL FACIAL PHENOTYPE AND GENE EXPRESSION IN MASSETER MUSCLE

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AIM: With the knowledge that muscular adaptation is considerably reliant on variation in gene expression, the aim of this small pilot study was to investigate gene expression in the masseter muscle of both a range of myosin heavy chain (MHC) isoforms and extracellular matrix components to assess if differences exist between normal and long vertical facial forms.

MATERIALS AND METHOD: Masseter muscle biopsies were taken from female Caucasian subjects with normal (n = 6) and long (n = 3) vertical facial forms, categorized cephalometrically. The levels of expression of MHC isoforms MYH 1, 2, 3, 6, 7 and 8, together with the adhesion molecule, integrin αv, and the matrix metalloproteinases, MMP2 and MMP9, were compared in these patients using quantitative reverse transcriptase polymerase chain reaction analysis.

RESULTS: Levels of MYH 1 expression were possibly higher in patients with a normal vertical facial form compared with those with longer faces. There were no clear differences in the levels of the other proteins investigated and, in virtually all cases, there was marked individual variation in the levels of gene expression.

CONCLUSIONS: There were no obvious consistencies with regard to gene expression between the different vertical facial form groups. Marked individual variation of gene expression was evident.

305 DENTAL FINDINGS IN PATIENTS WITH CLEIDOCRANIAL DYSPLASIA

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AIMS: Cleidocranial dysplasia (CCD) is a congenital disease characterized by skeletal dysplasia, including clavicle hypogenesis and suture dysraphism of the cranium. Dental characteristics include delayed eruption and supernumerary teeth. An anterior crossbite is frequently observed. However the severity of the symptoms varies, and the prevalence is relatively low (0.5/100000 subjects). It is therefore difficult to appreciate the diagnostic criteria and treatment strategy.

SUBJECTS AND METHOD: Ten subjects (6 males, 4 females) with CCD. The items investigated were: age, oral examination findings at initial orthodontic record, and existence of clinical diagnosis.

RESULT: The patients were aged were from 11 years 2 months to 43 years. Six were in their teens, while others were over 20. Delayed eruption of the permanent teeth was apparent in all patients. Seven subjects appeared to have a partially hypodontic like dentition. Three of them exhibited a collapsed occlusion. One was a high school student and the others adults. A Class III malocclusion was observed in eight patients, with five being diagnosed as requiring surgical-orthodontic treatment. Four subjects were diagnosed before orthodontic consultation.

CONCLUSION: It is preferable for diagnosis to be made in the early stage of development because delay in permanent tooth eruption is easier to recognize.

306 TRABECULAR STRUCTURE OF THE MANDIBULAR CONDYLE – A MICROCOMPUTED TOMOGRAPHIC STUDY

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AIM: To study differences in the subarticular trabecular structure of mandibular condyles subjected to different functional conditions.

MATERIALS AND METHOD: Eleven dentate and 10 edentate mandibles from corpses at the Institute of Anatomy, Munich. The whole condyles (mean age 80.6 years, minimum: 55 years, maximum: 94 years) were microscanned in a micro-computed tomograph (Scanco 20, Bassersdorf, Switzerland). The measurements of interest were: bone volume, thickness, separation and number of trabeculae, and the degree of anisotropy. Anisotropy is defined as a measurement of trabecular orientation in three-dimensions.

RESULTS AND DISCUSSION: The edentate condyles showed a significantly lower degree of anisotropy than the dentate condyles. For the other parameters, considerable differences were found. In nearly all edentate mandibles cystic areas in the medial and lateral parts of the condyles were observed. In the dentate sample, while the main orientation of trabeculae in the vertical dimension was nearly the same as in the edentate condyles, the lower degree of anisotropy of the edentate sample implied a significant decrease of trabecular orientation in the vertical dimension. The bone adapts to the different functional condition in changing the orientation of the trabecular structure. However, the volume density of the mandibular head was comparable in both samples. It is presumed that the central part of the condyle was higher loaded as the trabeculae were orientated almost vertically in this area.

307 THE RESULT OF ORTHODONTIC TREATMENT EVALUATED WITH THE PEER ASSESSMENT RATING INDEX

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AIM: To evaluate the quality of orthodontic treatment in County Skåne.
SUBJECTS AND METHOD: One hundred and thirty two randomised patients who had completed two years' full fixed appliance treatment in both arches between the 1st January and 31st May, 2004. Twenty-seven orthodontists had treated the patients and their pre- and post-treatment study casts were scored and coded by an independent examiner. The study casts were intermixed in order to facilitate blind examination between pre- and post-treatment casts. The examiner had been calibrated in the use of the weighted Peer Assessment Rating (PAR) index before the start of the measurements.
RESULTS: Before treatment, 50 per cent of the patients had a PAR score between 28 and 43, and 25 per cent between 43 and 63. Most of the patients had a greatly increased overjet and/or pronounced crowding of the anterior teeth. Eight patients with a PAR score between 9 and 15 received treatment, since all had impacted canines or congenitally missing incisors. After treatment 75 per cent had a PAR score below 13. Thus, the majority of the patients were greatly improved. Five per cent had a post-treatment score between 17 and 20 due to co-operation problems, and in these subjects treatment was interrupted.
CONCLUSIONS: In general terms the outcome of orthodontic treatment in County Skåne was successful.

308 CONTRIBUTION OF NASAL PROMINENCE TO FACIAL PROFILE ATTRACTIVENESS

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AIM: Traditionally, in orthodontic treatment planning, profile outlines are used to assess facial attractiveness. The influence of the shape and size of the various facial structures outlining the profile on its perceived attractiveness is, as yet, unknown. The aim of this study was to investigate the contribution of nasal prominence to the attractiveness of the facial profile.
MATERIALS AND METHOD: A series of 30 consecutively selected silhouettes with variable nasal prominence, corresponding to the profiles of six clinical cases, were evaluated in random order. The cases included a representative Class I, II and III profile of a male and female patient. The images were modified using cephalometric software to produce various degrees of nasal prominence by adding to the aesthetic plane; all other factors were kept constant. Sixty randomly selected graduate dental students and 30 orthodontists were separately asked to rate the images with respect to their attractiveness on a scale of 1 to 10. Differences between the responses of the two groups were assessed, and their significance was tested using the Student's *t*-test.
RESULTS: Both groups of examiners assigned the greatest grades of attractiveness to the Class I profiles and the lowest grades to the Class III profiles. With increasing nasal prominence, lower grades of attractiveness were assigned to the profiles of all Classes. A greater variance and lower intra- and inter-examiner agreement was recorded for the group of graduate students.
CONCLUSIONS: Nasal prominence contributes to the attractiveness of the facial profile, irrespective of its convexity or concavity. In general, lower attractiveness scores are attributed to profiles presenting more prominent noses. Recorded variations in within-group ratings represent possible difficulties in evaluating the attractiveness of the profile of the silhouette without adequate training.

309 ATTRACTIVENESS OF FACIAL PROFILES OF ANCIENT GREEK MASTERPIECES OF ART

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AIM: From an historical perspective, concepts and theories regarding ideal facial aesthetics that constitute an integral part of modern-day orthodontics have been identified from the study of ancient Greek masterpieces of art. The aim of this investigation was to investigate the attractiveness of facial profiles of ancient Greek masterpieces, as assessed by a group of graduate dental students and a group of orthodontists.
MATERIALS AND METHOD: A series of silhouettes corresponding to 20 of the most readily recognized facial profiles of ancient Greek masterpieces, including frescoes, friezes, and sculptures, were evaluated in random order with 20 other silhouettes of Class I, II and III facial profiles of orthodontic subjects. Sixty randomly selected graduate dental students and 30 orthodontists were separately asked to rate the images with respect to their attractiveness, according on a scale of 1 to 10. Differences between the responses of the two groups were assessed, and their significance tested using the Chi-square test.

RESULTS: A greater grade of attractiveness was attributed to profiles pertaining to pieces of art of the classical rather than the archaic historical Greek period, and the least grade was assigned to the Minoan and Mycenaean periods. Class I profiles were attributed the greatest grade of attractiveness, and Class III the least. A greater variance and lower intra- and inter-examiner agreement was recorded for the group of graduate students for most profiles.
CONCLUSIONS: The ancient Greek art of the classical period remains a gold standard for the evaluation of profile aesthetics in modern orthodontics. However, in the present times, individual characteristics may be more important than proportions. Recorded variations within the group of dental students and differences between the two groups represent a possible difficulty in evaluating the attractiveness of the profile silhouettes without adequate training.

310 THE RELATIONSHIP BETWEEN MANDIBULAR SIDE SHIFT AND UNILATERAL POSTERIOR CROSSBITE

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AIM: The relationship between mandibular side shift and unilateral posterior crossbite has been poorly investigated. The purpose of the present investigation was to assess this relationship.
SUBJECTS AND METHOD: Data were obtained from 1291 schoolchildren (mean age = 12.3 years, SD = 1.1). The sample included 708 (54.9 per cent) males and 583 (45.1 per cent) females. Each child had been examined by two orthodontists to assess the presence of a unilateral posterior crossbite (from first permanent molar to canine) and of mandibular side shift >1 mm.
RESULTS: Mandibular side shift was found in 54 subjects (4.2 per cent). Forty of these (74.1 per cent) showed a unilateral posterior crossbite, whereas 14 patients (25.9 per cent) did not. On the other hand, a unilateral posterior crossbite was found in 175 subjects (22.9 per cent), with only 29.6 per cent of them showing a mandibular side shift. Fifty per cent of the patients showing a mandibular side shift and unilateral posterior crossbite had a Class II subdivision on the side of the mandibular shift. Chi-square testing revealed a highly significant association ($P < 0.001$) between lateral mandibular shift and unilateral posterior crossbite.
CONCLUSIONS: There is a strong association between mandibular side shift and unilateral posterior crossbite, but the frequency of lateral slides in unilateral posterior crossbite subjects is much lower than previously reported in selected samples of pre-orthodontic children.

311 TORSION PROPERTIES OF BETA-TITANIUM ALLOY ARCHWIRES

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AIM: The original patent protecting the formula for titanium-molybdenum archwires filed by Burstone and Goldberg in 1979, expired in 1999, and similar products have since been offered by a number of suppliers. The aim of this study was to compare the mechanical properties in torsion of currently available brands of beta titanium alloy archwires.
MATERIALS AND METHOD: Batches of 10 rectangular (0.017 × 0.025 inch) preformed archwires were tested. Ten brands currently on the market were selected, plus one batch of 10 stainless steel archwires for comparison. The section of each archwire was first checked with Mitutoyo's numerical sliding calliper. Measurements were made with an original bench (French patent N° 89/06840) to test wires in induced torsion under controlled conditions of moment and temperature (35°C to closely reproduce the intra-oral environment).
RESULTS: Differences between archwire sections from one brand to another were small and cannot explain the variations of behaviour of different archwires under torsion. Variations between wires of the same batch were also small, but large differences were seen from one brand to another. The stiffness of some beta titanium alloy archwires (TP Orthodontics® and RMO®) was close to stainless steel. Traditional TMA® (Ormco) was gentler, and Highland Metals® even more so. Differences in behaviour under torsion might reflect variations in alloy-composition as shown by Genin. Highland Metals® contain little molybdenum, and TP Orthodontics® none at all. However, very similar alloys can react differently according to brand and manufacturing procedures, which may also be of importance.
CONCLUSIONS: All beta titanium alloy archwires do not perform identically. Some are nearly as stiff as stainless steel. Orthodontists require gentle forces – they may have to choose.

312 EFFECTS OF POSTERIOR BITE BLOCKS ON THE MANDIBLE: GEOMETRIC MORPHOMETRICS

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AIM: To compare the effects of posterior bite blocks of different heights on the mandible in patients with a skeletal anterior open bite (AOB).

SUBJECTS AND METHOD: Twenty-four Turkish children with an Angle Class I or Class II division 1 malocclusion and an AOB that varied from –1.0 to –5.5 mm. The sample was divided into two groups. The first group consisted of 13 children with a mean age of 10.4 ± 1.20 years at the beginning of treatment with a passive 5 mm posterior bite block for approximately 7 months. The second group comprised 11 children with a mean age of 10.9 ± 1.85 years treated with a passive 10 mm posterior bite block, with a mean treatment time of approximately 8.5 months. Thirty-eight mandibular landmarks were digitized and mean mandibular configurations were computed using Procrustes' superimposition. Pre- and post-treatment configurations were compared using finite element scaling analysis (FESA), and 87 inter-landmark distances (J-links) were subjected to *t*-tests.
RESULTS: For the 5 mm group, FESA revealed 11-17 per cent increases in relative size localized in the mandibular condyle and supramentale regions. The J-links indicated significant increases in oblique mandibular length and in the anterior dentoalveolar region ($P < 0.05$). For the 10 mm group, FESA revealed a 10-16 per cent increase in size localized in the mandibular ramus but a 20 per cent decrease in the coronoid process. The J-links indicated significant increases in oblique mandibular length (22 per cent in the ramal angle region, $P < 0.05$) but none in the anterior dentoalveolar region.
CONCLUSIONS: Although clinically both groups showed resolution of the AOB, the developmental mechanisms appear to differ. A 5 mm posterior bite block appears to enhance condylar and anterior dentoalveolar developmental compensatory mechanisms, while a 10 mm bite block increases the gonial angle, thus relying on other craniofacial regions to achieve clinical correction, the premise of which remains as the basis for a further study.

313 ADDITION OF ZRO_2 AND TIO_2 ON POLY(ALKENOATE) CEMENT TO ENHANCE ITS MECHANICAL PROPERTIES

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AIM: To study the effect of adding fillers such as ZrO_2, or TiO_2 to enhance the shear bond strength (SBS) and mechanical properties of glass poly(alkenoate) cement.
MATERIALS AND METHOD: Eighty premolar teeth extracted for orthodontic reasons divided into eight equal groups. Group 1: the brackets were bonded using a no-mix composite; group 2: conventional glass poly(alkenoate) cement was used; group 3: glass poly(alkenoate) cement after enamel etching with 37 per cent ortho- phosphoric acid; group 4: the brackets were bonded with resin modified glass poly(alkenoate) cement; group 5: the brackets were bonded with 10 per cent ZrO_2 added to glass poly(alkenoate) cement; group 6: the brackets were bonded with 30 per cent ZrO_2 added to the glass poly(alkenoate) cement; group 7: the brackets were bonded with 10 per cent TiO_2 added to glass poly(alkenoate) cement; group 8: the brackets were bonded with 30 per cent TiO_2 added to the glass poly(alkenoate) cement. The adhesive remnant index (ARI) was evaluated visually.
RESULTS: The highest SBS was found in group 3 followed by group 5. The addition of ZrO_2 filler (10 per cent by weight) to glass poly(alkenoate) cement may be suitable to increase SBS, mechanical properties, and minimize the need for enamel etching. Increasing the concentration of ZrO_2 to 30 per cent by weight reduced the SBS. The addition of TiO_2 in concentrations 10 or 30 per cent had no effect in enhancing the mechanical properties of the glass poly(alkenoate) cement. The ARI showed that for all unetched groups, the locus of failure was at the enamel-adhesive interface, while for the etched groups, the site of failure was at the adhesive-bracket interface.

314 ENGINEERING GROWING BONE: THE FIRST STEPS

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AIM: While skeletal development can occur by either intramembranous or endochondral bone formation, all current tissue engineering approaches for bone repair and regeneration mimic intramembranous ossification. In this study, the aim was to create an *in vitro* cartilage template as the transient model for *in vivo* endochondral bone formation. The specific aims were: (1) to establish a method of growing chondrocytes in a well characterized macroporous biphasic calcium phosphate (MBCP®) scaffold, and (2) to induce maturation of chondrocytes and matrix deposition in this scaffold.
MATERIALS AND METHOD: Chondrocytes isolated from growth plates of 18-day chick embryos were cultured on MBCP® particles (Biomatlante, France) and treated with retinoic acid to induce chondrocyte maturation and extracellular matrix synthesis. Light and scanning electron microscopy were used to study chondrocyte attachment and proliferation. Alkaline phosphatase (ALP) activity was measured spectrophotometrically and proteoglycans deposition assessed using alcian blue staining. Levels of type X, type II and type I collagens, cbfa1 and ALP gene expression were studied by RT-PCR.
RESULTS: Growth plate chondrocytes attached and proliferated on the MBCP® scaffold. ALP activity and expression, proteoglycans synthesis, cbfa1 and type I collagen mRNA levels increased in the presence of retinoid. Type II and type X collagen gene expression decreased.

CONCLUSIONS: A method of growing and inducing chondrocyte maturation on a mineral template, MBCP®, has been successfully established. Further studies will be conducted to test the suitability of this template as an intermediate in endochondral bone formation.
This work was supported by the Departments of Biomaterials and Basic Sciences & Craniofacial Biology, New York University College of Dentistry.

315 INVESTIGATION OF THE RELATIONSHIP BETWEEN BRUXISM AND ORAL DISEASE
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AIM: The goal of orthodontic treatment is to establish an individualized healthy occlusion. However, excessive masticatory muscle activity by tooth grinding during sleep bruxism might give rise to problems such as relapse, destruction of tooth or periodontal tissues. The aim of this study was to investigate the relationship between oral diseases and sleep bruxism using a specially developed BruxChecker.
SUBJECTS AND METHOD: Fifty patients (22 males, 28 females, average age 41.2 years). Clinically, attachment level, mobility and hypersensitivity of each tooth were examined. The bruxism grinding area was recorded using the BruxChecker which was made of a 0.1 mm thick polyvinyl chloride sheet (Space Maintainer Foil, Scheu-Dental, Germany). This sheet was painted with red marker (BruxPainter, RMMC, Japan), heated at 220°C for 15 seconds and pressed on the maxillary stone cast using a pressure former. The sheet was then trimmed along the gingival margin. The patient wore the maxillary BruxChecker during sleep. The grinding pattern was classified as laterotrusive (LG) and mediotrusive (MG) grinding. Furthermore, LG was classified into three patterns, IC (incisor, canine), ICP (to premolar) and ICPM (to molar). Finally, there were six patterns (IC, IC+MG, ICP, ICP+MG, ICPM, ICPM+MG). The findings of each examination of tooth grinding were compared with each pattern.
RESULTS: The average attachment level, mobility and abfraction of ICPM and ICPM+MG for subjects who grind their teeth were greater than those of IC or ICP.
CONCLUSIONS: Molar grinding during sleep bruxism is detrimental to both tooth and periodontal tissues. The BruxChecker is easy to make and use, and provides a great deal of information. It can be used not only at the initial examination, but for confirmation after treatment.

316 FIXED-FUNCTIONAL TREATMENT FOR TEMPOROMANDIBULAR JOINT DISORDERS**
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AIM: To investigate if fixed functionals (FF) are capable of ameliorating or treating temporomandibular joint disorders (TMD).
SUBJECTS AND METHOD: One hundred and forty-one randomly selected patients (15 to 51 years of age) with TMD followed for 2.5 to 10 years after treatment (average 4.5 years) were studied to see if the FF mandibular anterior repositioning appliance (MARA) with simultaneous full mouth orthodontics could reduce or even eliminate TMD [muscle pain, temporomandibular joint (TMJ) clicking, headache, dizziness and tinnitus]. The following were available pre- and post-treatment: full orthodontic records, magnetic resonance images and clinical functional orthopaedic analysis of the TMJs. Treatment consisted of condylar antero-inferior repositioning with the MARA and bite raising with fixed pivot build-ups on the upper second molars. The patients had concurrent physiotherapy during most of the treatment. A prerequisite was to have 28 teeth including implants. The majority of the patients were retained with fixed ramps from the upper second to the lower second molars to prevent distal movement of the mandible and dorsal bruxism.
RESULTS: The symptoms in 27 per cent of the patients were totally eliminated, 31 per cent were considerably reduced, 18 per cent were reduced slightly, 21 per cent showed no change and 3 per cent became worse. Sixteen patients in the 'no change and worse groups' were given botulin toxin – 10 of them improved.
CONCLUSIONS: It appears that antero-inferior condylar repositioning can help TMD, especially if the mandible is locked anteriorly with permanent ramps after FF MARA treatment. Long-term studies with a larger number of patients should be carried out to determine the permanence of this treatment. It appears that the use of botulin toxin at the beginning of treatment could help in successful treatment of TMD.

317 TEMPOROMANDIBULAR DYSFUNCTION IN SUBJECTS WITH AND WITHOUT MALOCCLUSION
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AIM: To analyse occlusion in untreated subjects with and without a malocclusion, and to compare the frequency of their masticatory dysfunction.
SUBJECTS AND METHOD: One hundred and thirty subjects, aged 16-25 years, divided into two groups: group I comprised untreated subjects with different malocclusions, and group II those with a normal dental relationships. The following examinations were carried out: 1. Subjective, using Helkimo's 3-graded anamnestic dysfunction index; 2. Clinical analysis of the occlusion and temporomandibular joint (TMJ) function using Helkimo's clinical dysfunction index, bruxism and non-occlusal parafunction evaluation; 3. Instrumental examination of TMJ function. The data were statistically analysed. Arithmetic average, or average frequency, was used as the central tendency measurements, and variance, standard deviation and coefficient of variation as a measure of dispersion. Pearson's linear correlation coefficient was used to study characteristics covariation. To verify the static hypotheses, Fisher's Snedecora test was used.
RESULTS: Helkimo's anamnestic index had a high value in untreated subjects with (1.55) and without (1.44) malocclusions. A crossbite (0.21), Class II malocclusion (0.15), open bite (0.14) and buccal crossbite (0.11) were most frequent. Impaired habitual occlusion was a variable that significantly differentiated the groups, while centric relation showed no statistically significant differences. The untreated malocclusion group showed a higher frequency of habitual occlusal dysfunction (0.82). Helkimo's clinical index showed statistically significant differences in the groups – a higher value in the untreated malocclusion subjects (1.06). Increased muscle tension analysis showed significant differences only for lateral pterygoid. Pathological abrasion significantly differentiated the groups. Comparison of instrumental examination of TMJ function with dental and articulation guidance between groups showed no statistically significant differences.
CONCLUSION: Analysis of static and dynamic occlusion demonstrated an increased prevalence of dysfunctions in untreated malocclusion subjects. They had a higher frequency of masticatory dysfunction. A Class II malocclusion and crossbite were most frequent and showed statistically significant relationships with functional masticatory disorders.

318 THE RELATIONSHIP BETWEEN THE MANDIBULAR NOTCH AND THE MASSETER MUSCLE

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AIM: To measure the volume and inclination of the masseter muscles in three dimensions using magnetic resonance imaging (MRI), and to calculate the relationship of the masseter muscles and the depth of antegonial notch.
SUBJECTS AND METHOD: Twenty adult males with a normal occlusion. After establishing the FH plane, MRI was used to assess thickness, and the three-dimensional co-ordinates were determined for the inclination of the masseter muscles.
RESULTS: The depth of the antegonial notch increased with the increase in masseter muscle volume.
CONCLUSION: If the volume of a masseter muscle is large the antegonial notch is increased.

319 PREVALENCE AND TREATMENT OF ERUPTION DISTURBANCES OF PERMANENT SECOND MOLARS

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AIM: To analyze the prevalence of impaction, ectopic, and late eruption, as well as agenesis, of the permanent second molar. Furthermore, the accomplished treatment of the eruption disturbances was evaluated.
MATERIALS AND METHOD: After a sample size calculation, dental records, including radiographs, of 1,432 patients (671 girls, 761 boys) were retrospectively analyzed. The records were examined for all individuals from 10 to 16 years of age, and the time of eruption, the prevalence of impaction, ectopic, and late eruption as well as agenesis of the permanent second molars, was documented. The accomplished treatment of the eruption disturbances was also recorded.
RESULTS: The prevalence of ectopic eruption was 2.0 per cent, late eruption 2.5 per cent, impaction 0.8 per cent and agenesis 0.8 per cent. Ectopic eruption was more common in girls ($P = 0.006$) and in the mandible ($P = 0.001$). Late eruption was more frequent in the maxilla ($P = 0.001$). No difference in disturbances was observed between the left and right sides of the mouth. Those with eruption disturbances had 1 to 3 years delayed eruption of their other erupted second molars compared with the individuals without eruption disturbances. For most subjects no treatment was carried out, instead spontaneous correction of the disturbances was awaited and correction frequently occurred.
CONCLUSIONS: Eruption disturbances of permanent second molars are relatively common and, in most cases, treatment is not necessary since spontaneous correction of the disturbances often occurs.

320 EFFECT OF THE RAPID MAXILLARY EXPANSION ON PRIMARY NOCTURNAL ENURESIS – A CLINICAL STUDY

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AIM: To evaluate the effect of rapid maxillary expansion (RME) on primary nocturnal enuresis.
SUBJECTS AND METHOD: Nineteen patients, aged 6-15 years, with resistant primary nocturnal enuresis, treated using a banded Hyrax expander for a period of 10-15 days. Initially seven patients were used as a control group to exclude the placebo effect of the appliance. Computed tomographic scans were used to diagnose any nasal obstruction and to evaluate the increase in nasal cavity width at the level of the inferior choncha. Rhinomanometry was used to assess nasal airflow and nasal airway resistance, and plasma osmolality was measured to evaluate plasma antidiuretic hormone. All these parameters were undertaken before and 2-3 months after expansion.
RESULTS: At the end of the study period there was a significant increase in intermolar, interchonchal distances, and nasal airflow. Plasma osmolality decreased and antidiuretic hormone secretion significantly increased, which caused a decrease in urine production.
CONCLUSION: Following RME most of the patients showed complete dryness while others demonstrated a notable improvement in nocturnal enuresis.

321 RELIABILITY OF 16-CHANNEL ELECTROMYOGRAPHY

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AIM: To verify inter- and intra-session reliability of superficial 16-channel electromyography (EMG) for future exploration of masseter muscle function in patients undergoing orthodontic therapy.
MATERIALS AND METHOD: The 16-channel EMG Myosystem 2000, software for recording EMG data (MyoClinical 2001, Neurodata), software for EMG analysis (Myomap 2005, Neurodata) and statistical software SPSS 10.0 were used. Six volunteers were investigated in five recording sessions separated by an interval of 24 hours. To compute intra-session reliability, two similar recording trials without removing the electrodes during the second session were undertaken. Electromyographs were registered monopolarly and simultaneously. A sensing frequency of 1000 Hz was used. Sixteen electrodes were placed on the subject's right cheek. The volunteers performed three exercises in each recording session: clenching, chewing and protrusion. From the baseline EMG curves the fragments of stationary signal were selected and limited with markers. Via fast Fourier transformation, the average EMG amplitude spectra were calculated and displayed in an EMG activity myomap (Myomap 2005, with a frequency range 15-496, 1 Hz). Cronbach's alpha was used to calculate the reliability from the mean values of amplitude spectra computed for each electrode and exercise.
RESULTS: Inter-session reliability was: clenching 0.90; chewing 0.87; protrusion 0.89. Intra-session reliability was 0.98, 0.95 and 0.96, respectively. No significant differences were noted in reliability between female and male subjects, or between healthy volunteers and those with malocclusions.
CONCLUSION: The highest reliability was measured during clenching with maximal biting force, this measurement is therefore recommended as the most relevant. Sixteen-channel EMG is an inter- and intra-session reliable method with adherence to a standardized protocol.
This study was supported by Forschungsgemeinschaft Dental e.V.

322 ^{31}P-MR SPECTRUM OF THE MASSETER MUSCLE IN PATIENTS WITH MALOCCLUSIONS

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AIM: To investigate differences in phosphate in masseter muscles dependent on muscle volume in patients with different vertical and sagittal jaw relationships.
MATERIALS AND METHOD: Magnetom Sonata 1.5T whole-body MRI/MRS system (Siemens AG); dual-tuned head-coil (^{31}P and ^{1}H) and surface-coil, tuned to ^{31}P (Rapid Biomedical) were used. Six volunteers with malocclusions participated in this study. Individual dental splints were used to hold the jaw position during the investigation. For the first survey, images (Flash 3D sequence, T_R 1900 ms, slice thickness 1 mm) of the patient's head were recorded and the masseter muscle volume was computed. The volume of interest was then chosen on the localization images. ^{31}P-chemical shift imaging spectroscopy was performed for the right and left masseter with each of 16 phases encoding in two dimensions (T_R 750 ms, VOI 200 × 200 mm², slice thickness 25 to 50 mm). The amount of phosphate metabolites in each spectrum was expressed as a percentage and compared with muscle volume and ML/NL and ANB angle.

RESULTS: A significant positive correlation was found between the percentage phosphocreatine content and masseter volume ($P = 0.05$). A significant negative correlation was found between muscle volume and ML/NL angle ($P < 0.001$) and between percentage phosphocreatine content and ML/NL angle ($P < 0.01$). No correlation was found between any phosphate metabolite, muscle volume and ANB angle.
CONCLUSION: There is a correlation between percentage phosphocreatine content, ML/NL angle and masseter volume. ^{31}P-CSI is able to detect the functional status of masticatory muscles.
This study was supported by Forschungsgemeinschaft Dental e.V.

323 INVESTIGATION OF SKELETAL CLASS III PATIENT SATISFACTION FOLLOWING ORTHODONTIC TREATMENT
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AIM: To investigate the long-term satisfaction rate of skeletal Class III patients after orthodontic/orthopaedic correction.
MATERIALS AND METHOD: The records of 300 skeletal Class III subjects (ANB <–1 degree, with skeletal Class III profiles) treated using an orthodontic/orthopaedic approach i.e. chin cap or Class III activator and fixed mechanics. A survey that included 28 questions grouped as: 1. Decision for orthodontic treatment; 2. Satisfaction following treatment; 3. Psychosocial benefits; 4. Difficulties during treatment; 5. Treatment results, was posted to each patient, a minimum of five years after completion of treatment. Satisfaction rate was analysed statistically.
RESULTS: Forty-two questionnaires were returned. Forty per cent of the patients expressed a 'profile complaint' and 37 per cent a 'dental complaint' before initiating orthodontic treatment. Satisfaction was expressed by 92.8 per cent following orthodontic treatment. However, the remaining 7.2 per cent were not satisfied. The reasons given were: relapse 63.6 per cent, dissatisfaction with orthodontic treatment results 18.2 per cent. The percentage of patients 'happy' with their final facial aesthetic profiles was 95.2. However, 4.8 per cent of them were unhappy with the results while 50 per cent of them identified a 'prognathic mandible' as the main problem. For 83.8 per cent of the patients the major complaint about orthodontic treatment was the 'long treatment time'.
CONCLUSION: The majority of the skeletal Class III patients were satisfied with the orthodontic/orthopaedic treatment approach for achieving an aesthetic profile. However 4.8 per cent of patients were unhappy with their profile aesthetics.

324 ELECTROMYOGRAPHIC ACTIVITY OF MASTICATORY MUSCLES IN DIFFERENT VERTICAL FACIAL PATTERNS
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AIM: To evaluate bilateral electromyographic (EMG) activity of the superficial masseter and anterior temporalis muscles in skeletal open/deep bite subjects during swallowing, chewing, and maximum intercuspation (MI).
SUBJECTS AND METHOD: Sixteen individuals with a skeletal open bite between 2.31-18.23 mm (7 males, 8 females, 6 pre-peak, 10 post-peak subjects), 15 individuals having a skeletal deep bite between 4.93-12.27 mm (10 males, 5 females, 7 pre-peak, 8 post-peak subjects) and 10 individuals with a normal skeletal and dental relationship (4 males, 6 females, 6 pre-peak, 4 post-peak). EMG records of the superficial masseter and anterior temporalis muscles were acquired during swallowing, chewing and MI using bilateral surface disc electrodes (Nihon Kohden Neuropack-8, Japan). Skeletal and dentoalveolar measurements were assessed on initial lateral cephalometric radiographs. The mean amplitudes for each group and for all functions were analysed using repeated measurements analysis of variance to reveal inter-group differences. Cephalometric measurements were also compared by *t*-test in the open/deep bite groups.
RESULTS: Superficial masseter and anterior temporalis muscle activity was statistically insignificant during swallowing in the open/deep bite and control groups. For chewing and MI, superficial masseter and anterior temporalis muscle activity was statistically significantly different between the groups. Dentoalveolar measurements: UAAH (upper anterior alveolar height), UPAH (upper posterior alveolar height), LPAH (lower posterior alveolar height), TAAH (total anterior alveolar height), TPAH (total posterior alveolar height); skeletal measurements GoGnSN, Jarabak, upper gonial angle, lower gonial angle and the ratios TPAH/TAAH, UPAH/TAAH, UPAH/TPAH were statistically significant in the open/deep bite groups.
CONCLUSION: Masticatory muscle activity differs in subjects with different vertical facial patterns. Skeletal and dentoalveolar heights, except lower anterior alveolar height, and LPAH were also found to be different for both vertical facial patterns.

325 EVALUATION OF STRESS LEVELS IN YOUNG PATIENTS SEEKING ORTHODONTIC TREATMENT
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AIM: To determine the stress levels in children and adolescents who required orthodontic treatment.
SUBJECTS AND METHOD: Two groups of children and adolescents: 41 children and adolescents (41.46 per cent male, 58.54 per cent female) aged 10 to 14 years [average: 12.31 years, standard deviation (SD) 2.99] requesting orthodontic treatment from March to October 2005 and a control group of 43 subjects (46.52 per cent male, 53.48 per cent female) aged 10 to 14 years (average 12.36 years, SD 2.50) attending a school in Oradea. The control children were examined in October 2005, during a period when they were not completing any school assignments. In order to evaluate the perception level of stress, the perceived stress questionnaire (Levenstein *et al*., 1993) was used and the subjects allocated to one of the following categories of stress: low, moderate or high. The data were processed with the SPSS program for Windows 10.0. In order to compare the average level of stress in both groups, a Student's *t*-test was used.
RESULTS: For the patient group the average stress level score (mean: 75.024, SD: 15.310) was statistically higher ($P < 0.001$) than in the controls (mean: 59.536, SD: 10.332).
CONCLUSION: The increased level of stress perception of patients seeking orthodontic treatment is a possible justification for some ameliorating measures to decrease the stress level, in order to enhance treatment compliance and to improve the doctor-patient relationship.

326 SHEAR BOND STRENGTH OF A NEW ORTHODONTIC BRACKET BASE DESIGN

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AIM: To evaluate the bond strength of a new metallic bracket with a circular base.
MATERIALS AND METHOD: Two different bracket base designs were tested: a new circular-concave base and a mesh base. The brackets were bonded to bovine teeth using a paste to paste adhesive. The teeth were stored in a saline solution, and, after 24 hours, the brackets were debonded. A testing machine was used to evaluate torsional and shear bond strength. The adhesive remnant index was used to record the amount and location of the residual adhesive. Bond fracture surfaces were examined with a scanning electron microscope (SEM) and an energy dispersive X-ray spectrometer (EDS).
RESULTS: The results for torsional test were: 0.36 ± 0.14 Nxm (mean value ± SD) for circular base brackets and 0.13 ± 0.06 Nxm (mean value ± SD) for mesh bases, whereas the shear test results were: 260.50 ± 112.10 N (mean value ± SD) for circular bases and 107.75 ± 35.75 N (mean value ± SD) for mesh bases. Following debonding (shear test), and SEM+EDS examination, small amounts of enamel were found adhered to both bases.
CONCLUSIONS: Shear stress could have damaging effects on the enamel, regardless of base design.

327 INFLUENCE OF BRACKET DESIGN ON MICROBIAL AND PERIODONTAL PARAMETERS *IN VIVO*

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AIM: To compare plaque formation on teeth bonded with different types of orthodontic brackets with unbonded control teeth, via an experimental gingivitis protocol over a seven-day period.
SUBJECTS AND METHOD: A randomized controlled trial of 16 dental students using a split-mouth design. In each subject the sites for Speed® (S) and GAC® (G) brackets and the control sites were investigated. Clinical periodontal parameters such as crevicular fluid flow, probing depth and bleeding on probing were recorded at baseline and on days 3 and 7. Microbiological samples were taken from the brackets and the teeth on days 3 and 7.
RESULTS: Aerobe colony forming units (CFU) were significantly higher at S- than G-sites ($P = 0.02$). The shift from aerobe to anaerobe was observed earlier at S- than G-sites. The ratio of aerobe/anaerobe CFU was significantly lower at the S- than G-sites ($P = 0.01$). On day 3 the crevicular fluid flow was significantly higher at the S- than control sites ($P = 0.01$). On day 7, S- and G-sites showed a significantly higher flow than the control sites (both $P < 0.001$). Periodontal pockets were deeper at S-sites than G- or control sites (both $P = 0.05$). No significant differences for bleeding on probing were seen for any sites.
CONCLUSIONS: Brackets, as well as their design, had an important impact on bacterial load and on the measured periodontal parameters in this experimental gingivitis model.

328 THE IMPORTANCE OF EFFECTIVE DISINFECTION OF ORTHODONTIC APPLIANCES: AN *IN VITRO* STUDY

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AIM: To evaluate, *in vitro*, the disinfecting efficacy of Medical Junior™ against *Candida albicans*, *Escherichia coli, Pseudomonas aeruginosa*, *Streptococcus mutans* and *Streptococcus pyogenesis*.

MATERIALS AND METHOD: Micro-organisms were incubated at 37°C in the presence or absence of the tablets and analysed for survival after 8 and 15 minutes, and 1, 5 and 12 hours by colony counts.
RESULTS: No growth of any micro-organism was observed after 8 minutes of incubation in the presence of the sterilizing tablets, compared with negative (uncontaminated) and positive controls.
CONCLUSION: Medical Junior™ is highly effective against *C. albicans*, *Escherichia coli*, *Pseudomonas aeruginosa*, *S. mutans* and *S. pyogenesis* at 8 minutes of contact. These data confirm the findings of Glass *et al.*, where contaminated fragments of methylacrylate dentures incubated with target organisms including *S. aureus, Pseudomonas aeruginosa,* herpes simplex 1, and *C. albicans* were also completely eliminated with the use of a single tablet. Currently ongoing clinical trials will provide further evidence of the efficacy of tablets for the disinfection and subsequent beneficial effects in the prevention and treatment of denture stomatitis.

329 TRIGEMINAL MOTOR EXCITABILITY IN ORTHODONTICALLY TREATED SUBJECTS

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AIM: To assess the excitability of the masticatory neuronal circuitry in subjects treated with the Invisalign technique, using neurophysiological testing based on 'recovery cycle' of the masseter inhibitory reflex (MIR).
SUBJECTS AND METHOD: Thirteen healthy subjects (mean age 28.7 ± 6.8 years) were examined by evaluating the recovery cycle of the MIR obtained with paired electrical and magnetic stimuli at different interstimulus intervals (ISIs). The neurophysiological evaluation was performed at the beginning of treatment and after a mean period of 7 months both with and without the appliance *in situ*. Attention focused on the degree of suppression of the late silent period (SP2) obtained at the second stimulus (test), in comparison with SP2 from the first stimulus. Statistical significance was determined using the non-parametric Wilcoxon test for paired data.
RESULTS: There was no difference in the degree of suppression of SP2 either with or without the appliance, both for electrical and magnetic stimulation, at all ISIs. Furthermore the degree of suppression did not differ in the same subject when the first and the second neurophysiological evaluations were compared. The Invisalign technique, which has a minimal intercuspal layer, could interfere with neuromuscular control of mastication by modifying brainstem interneuronal excitability.
CONCLUSION: The data confirm the absence of any alteration of the neuronal masticatory brainstem circuitry with the use of Invisalign technique.

330 SOFT TISSUE RESPONSE TO EARLY ORTHODONTIC TREATMENT WITH CERVICAL HEADGEAR

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AIM: To determine the long-term changes in the soft tissue profile during orthodontic therapy, when treatment is started with headgear in the early mixed dentition.
SUBJECTS AND METHOD: Sixty-eight children (40 males, 28 females, mean age 7.6 years, standard deviation 0.3 years), who had a Class II tendency in occlusion and moderate crowding, randomly divided into two groups. In the headgear group, treatment was initiated immediately. In the control group, only minor interceptive procedures were performed during the first follow-up period of 2 years. During the 8-year follow-up, orthodontic treatment, if needed, comprised fixed appliances and possible extractions in both groups. Twenty-four linear and five angular soft tissue measurements were registered from lateral cephalograms taken immediately before treatment and after follow-up-periods of 2, 4 and 8 years.
RESULTS: At the 8-year follow-up, lower lip and soft tissue thickness at pogonion were significantly greater in the headgear group. The mentolabial sulcus was also deeper in the headgear group. The linear distance from soft tissue pogonion to the vertical reference line showed a tendency to be larger in the headgear group. For other measurements there were no significant differences between the two groups.
CONCLUSIONS: Early headgear treatment has only minor effects on the soft tissue profile. The main effect is on the thickness of the soft tissue chin and the contour of the lower lip. The reason for this is, as yet, unknown, but could be explained by the higher rate of extractions in the control group. It seems that early headgear treatment does not flatten the soft tissue profile.

331 THE EFFECT OF ORTHODONTIC FORCE ON THE ERUPTION RATES OF RAT INCISORS

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AIM: Several studies have examined the role of age, diet, drugs, vertically applied force, and shortening of rat incisors on their eruption rates. The aim of this study was to determine the effects of an activated orthodontic appliance on the eruption rate of rat incisors.
MATERIALS AND METHOD: The eruption rate of incisors was recorded in 20 male Wistar rats, using calibrated graticules in microscope eyepieces. A super-elastic closed-coil spring (25 cN, GAC International, Japan) was inserted between the left first maxillary molar and the maxillary incisors in 10 animals (coil spring group) under general anaesthesia, while the 10 rats without appliances served as the control. Seven days from the beginning of the experiment in both the control and coil spring group, marks were created on the labial surfaces of the incisors under general anaesthesia. The distance from the gingival reference point to the mid-point of the mark was measured at 2-day intervals for the next 10 days. The eruption rate was expressed as the distance that the cut mark had travelled per day.
RESULTS: The eruption rates of all the incisors in the coil spring group were significantly lower ($P < 0.05$) at all times, except for the maxillary left incisor on day 15 compared with the control group. The mean eruption rate of the maxillary left incisor was 0.37 ± 0.05 mm/day in the control group and 0.27 ± 0.13 mm/day in the coil spring group and for the mandibular left incisor 0.48 ± 0.09 and 0.21 ± 0.09 mm/day, respectively. There were no significant differences between the maxillary or mandibular left and right incisors within the same group.
CONCLUSIONS: The orthodontic appliance diminished the eruption rates of the maxillary and mandibular incisors.

332 A NEW TRANSFER METHOD FOR INDIRECT BONDING

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AIM: To investigate both the bond strength of indirectly bonded brackets and the accuracy of the transfer. The bond strength of directly bonded brackets was also measured.
MATERIALS AND METHOD: For the indirect bonding, a working model with embedded teeth was prepared. From this model, a transfer model, made of plaster, was replicated. Transfer of the brackets from the plaster model to the working model was carried out with the Aptus bonding device. The brackets were bonded with Transbond light curing adhesive. Direct bonding was carried out in two experimental arrangements: a) brackets were bonded on the plaster teeth using Concise and on the working model using Transbond; b) brackets were bonded directly on the enamel surfaces of the embedded teeth using Transbond. The bond strength of the brackets on the enamel was determined by shear testing with an Instron measuring device. The precision of the positioning of the indirect bracket transfer was assessed by superimposing photographic details and three-dimensional (3D) measurement of the bracket positions on the working and plaster models using a 3D laser scan.
RESULTS: Bond strength, using indirect and direct bonding with the same experimental arrangement, showed no significant differences. For direct bonding with Transbond, lower values were achieved; they were only statistically significant in the premolar group. The clinically required minimum bond strength was achieved in all groups. The results of the 3D measurement of the positions of the brackets only yielded small deviations (0.15 mm along the *x*-axis in the centre, and 0.17 mm along the *y*-axis).
CONCLUSION: The bond strength of indirect bonding using the new transfer method is sufficient.

333 MECHANICS WITH MINI-IMPLANTS**

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AIM: Mini-implants are frequently used to provide maximum anchorage in orthodontic therapy. The aim of this prospective clinical trial was to evaluate mini-implants.
SUBJECTS AND METHOD: Ninety-two patients treated with one or more mini-implants for skeletal anchorage. Different mechanics were analysed for the clinical outcome and for their success in achieving the treatment goal.
RESULTS: In the maxilla, using one mini-implant on each side of the dental arch proved to be efficient for treatment progress. Direct loading of the implant with elastics was an easy clinical procedure and showed good results. Transversal side-effects were observed. Their direction was opposite in vestibular and lingual treated subjects. Correction of these side-effects was easy. Especially in treatment of Class II malocclusions, incisor torque is important for clinical success. In the mandible direct loading of the mini-implant with an elastic was only suitable when a small power-arm was added to the mechanics to avoid vertical vectors. Indirect use of the mini-implant showed more reliable treatment results. Indirect mechanics were also useful in subjects where irritation of the peri-implant tissues led to compromised viability of the mini-implant.
CONCLUSION: Orthodontic mechanics are important when treating patients with mini-implants.

334 IMPACT OF BONE QUALITY ON PRIMARY STABILITY OF ORTHODONTIC MINI-IMPLANTS

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AIM: Anchorage, by mini-implants, has widened the treatment options in orthodontics. The rate of implant loss is among factors associated with primary stability and hence bone quality. Furthermore there is risk of screw fracture when bone compacta is thick. The aim of the present study was to analyse the impact of bone quality on insertion torque and primary stability of mini-implants.

MATERIALS AND METHOD: Six ilium bone segments of pigs were embedded in resin. For each bone, five Dual-Top-Anchorscrews (Jeilmed Corp., Korea, diameter: 1.6 mm; length: 8 mm) were inserted and the insertion torques were measured. Thickness of compacta and bone density of spongiosa and compacta was determined on microcomputed tomographic scans.

RESULTS: Insertion torques (31.2 to 295.5 Nmm) correlated strongly ($R^2 = 0.8346$) with thickness of bone compacta (0.4 to 2.6 mm). The quality of spongious bone (bone volume/trabecular volume: 0.18 to 0.44) did not have a significant impact on primary stability. Torque moments larger than 200 Nmm resulted, in some cases, in implant fracture.

CONCLUSIONS: Bone quality and thickness of compacta have a strong influence on primary stability and risk of implant fracture. Depending on the region of insertion and local bone quality, correct combinations of drilling depth and diameter for each implant design are crucial.

335 INFLUENCE OF FACIAL GROWTH ON VERTICAL CEPHALOMETRIC PARAMETERS

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AIM: Morphological traits identified from cephalometric parameters are widely used in orthodontic diagnosis, treatment planning, and determination of biomechanics. Age related changes in these dynamic parameters could affect orthodontic outcomes. The aim of this study was to evaluate the effect of growth and ageing on vertical cephalometric parameters.

MATERIALS AND METHOD: The cephalometric radiographs of 74 subjects from the Burlington Growth Study with normal facial proportions who had not undergone orthodontic treatment were digitized (Dolphin software program) and analyzed (paired *t*-test) at three age intervals: 9, 12 and 20 years. Single operator systematic error was determined using 10 per cent of the sample (paired *t*-test).

RESULTS: The mandibular plane angle (MPA) decreased significantly ($P < 0.05$) by 4.41 degrees from 9 to 20 years, whereas lower face height (LFH) (0.46 degrees) and *Y*-axis (0.01 degree) also decreased, but not significantly ($P > 0.05$). Facial angle (FA) in contrast, increased by 4.14 degrees and the facial axis (FAx) by 0.84 degrees ($P > 0.05$). Measurement error was significant for FAx (0.31 ± 1.17 degrees), MPA (0.56 ± 0.67 degrees) and FA (0.55 ± 0.85 degrees; $P < 0.05$), but not for *Y*-axis or LFH ($P > 0.05$).

CONCLUSION: MPA and FA have a strong and significant horizontal growth tendency with increasing age (4.1 degrees), as do LFH and FAx, but to a much lesser and insignificant extent (<1 degree). *Y*-axis is the most stable reference angle, as are FAx and LFH, which show almost no age related change between 9 and 20 years.

336 MEDIAN DISTRACTION OF THE LOWER JAW WITH A TOOTH-BORNE APPLIANCE**

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AIM: Median distraction of the lower jaw to correct a lack of space is performed either with tooth- or bone-borne appliances. The aim of this prospective study was to minimize tissue side-effects, shorten treatment time, and increase patient comfort using minimal invasive surgery combined with a tooth-borne expansion device.

SUBJECTS AND METHOD: Nine patients (mean age: 9.3 years) with lack of space in the region of the lower anterior teeth. Pre-treatment study models, radiographs and treatment simulations with set-ups were obtained. The splint type expansion appliance had a curved, lingually positioned, expansion screw to avoid expansion in the temporomandibular joint (TMJ) region. It was attached with glass ionomer cement and additionally fixed with four spring-locked connecting pins. A median osteotomy was performed under analogue sedation (Remifentanyl and Propofol) through a 10 mm vertical incision in the vestibulum. After a latency period of 5 days, the expansion rate was 0.6 mm per day. Following retention for 60 days, the fixed appliance was removed. Additionally the maxilla was expanded. TMJ clinical examinations and magnetic resonance image analysis were carried out pre- and post-retention.

RESULTS: In all patients the lack of space was resolved without the need for extractions. The mean expansion was 6.4 mm. No subject experienced TMJ problems and there was no dental trauma. Subjectively the patients were free of pain 2 days after the osteotomy.

CONCLUSIONS: This standardized method of mandibular distraction osteogenesis is very efficient with virtually no side-effects. It should be preferred to extraction of teeth in subjects with lower anterior crowding.

337 HMGCo-A REDUCTASE INHIBITORS IN BONE FORMATION

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AIM: A well-rounded alveolar ridge is required for orthodontic tooth movement. Statin, a HMG-CoA reductase inhibitor, has been shown to turn on the gene for bone formation by blocking the mevalonate pathway in cholesterol production. Naringin is a flavonoid commonly available in citrus fruits, which is also a HMG-CoA reductase inhibitor. The aim of this study was to compare the amount of new bone produced by HMG-CoA reductase inhibitors, statin and naringin, in collagen matrix carrier with that of collagen matrix carrier alone.
MATERIALS AND METHOD: Twenty bone defects were created in the parietal bone of 12 New Zealand white rabbits. In the experimental groups, five defects were grafted with statin solution mixed with collagen matrix carrier and five with naringin solution mixed with collagen matrix carrier. In the control groups, five defects were grafted with collagen matrix carrier alone (positive control) and five were left empty (negative control). The animals were killed on day 14 and the defects were dissected and prepared for histological assessment. Serial sections were cut across each defect. Quantitative analysis of new bone formation was made on 150 sections (50 sections for each group) using image analysis.
RESULTS: A total of 308 and 490 per cent more new bone was present in the defects grafted with statin in collagen matrix carrier and naringin in collagen matrix carrier, respectively, than those grafted with collagen matrix carrier. No bone was formed in the passive control group.
CONCLUSIONS: HMGCo-A reductase inhibitors, such as statin and naringin in collagen matrix carriers, have the effect of increasing new bone formation locally and can be used as bone graft materials. This has potential, as statin is a commonly prescribed cholesterol-lowering drug, whereas naringin is commonly available in edible fruits.

338 CERVICAL VERTEBRA MATURATION IN SOUTHERN CHINESE SUBJECTS

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AIM: To evaluate the validity of cervical vertebra maturation (CVM) as an indicator of skeletal age during the circumpubertal period by correlating CVM to hand-wrist maturation.
MATERIALS AND METHOD: Randomly selected contemporary hand-wrist and lateral cephalometric radiographs of 400 southern Chinese patients. The age range for the females was between 10 and 15 years and for the males between 12 and 17 years so that they were within the circumpubertal period. The cervical vertebral skeletal age was assessed using the method of Franchi *et al.* (2000) and the hand-wrist skeletal age using the method developed by Hägg and Taranger (1982). They were correlated using Spearman rank correlation analysis.
RESULT: Cervical vertebral skeletal age was significantly correlated with hand-wrist skeletal age (Spearman r: male = 0.9521, female = 0.9408). The method error was insignificant.
CONCLUSION: In the circumpubertal period, cervical vertebral skeletal age assessed using the method of Franchi *et al.* (2000) is closely correlated with hand-wrist skeletal age and can be used for maturity assessment.

339 A COMPARISON OF ONE- AND TWO-STAGE TREATMENT IN MATCHED SKELETAL CLASS II SUBJECTS**

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AIM: To compare skeletal, dentoalveolar, and soft tissue changes between one- and two-stage treatment in matched skeletal Class II subjects.
SUBJECTS AND METHOD: Fifty-three skeletal Class II patients with an age range of 11 to 13 years. Twenty-six were treated with one-stage treatment and 27 with two-stage treatment. The cephalometric records were examined and skeletal, dentoalveolar, and soft tissue changes evaluated.
RESULTS: Both one- and two-stage treatment resulted in slight inhibition of maxillary growth, but no significant difference was found between the groups. Mandibular growth in the two-stage subjects was larger than in the one-stage subjects, and the difference was significant. Dental compensation was found in both groups. The lower incisors were proclined more in the one- than in the two-stage group.
CONCLUSION: There is more improvement in soft tissue profile following two-stage treatment. Two-stage treatment is recommended for adolescent skeletal Class II patients with mandibular retrognathia.

340 COMPARISON OF EXTRACTION VERSUS NON-EXTRACTION ORTHODONTIC TREATMENT

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AIM: To evaluate the outcome of extraction and non-extraction fixed appliance therapy in a representative sample of borderline patients of Chinese ethnicity.
MATERIALS AND METHOD: End of treatment records of 39 borderline patients for whom orthodontic treatment had been completed were retrospectively evaluated by five university educated associate professors. Each judge evaluated the records independently for tooth alignment, overbite, overjet, midline symmetry, lateral occlusion, and facial profile on a scale from 1 to 5. Sixteen patients had been treated non-extraction, while in 23 extraction of the four first or second premolars had been carried out.
RESULTS: The only statistically significant difference between the extraction and non-extraction groups was for facial profile. For that variable, the extraction group scored 4.5 ± 0.3 compared with 4.2 ± 0.3 in the non-extraction group ($P = 0.001$; ranked sum test). Fifteen soft tissue cephalometric measurements were analysed to try to identify this finding. The results showed that six of the 15 measurements were statistically significantly different between the extraction and non-extraction groups. When pre- and post-treatment profile changes were compared, the significant difference of treatment-associated changes between the extraction and non-extraction subjects were all related to the lower lip and chin.
CONCLUSION: Chinese clinicians had a statistically significant preference for the facial profiles of the extraction patients, but no statistically significant extraction/non-extraction preferences as regards tooth alignment.

341 AGGRECANASE-1 AND TIMP-3 EXPRESSION IN THE RAT MANDIBULAR CONDYLAR CARTILAGE

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AIM: Aggrecanase-1, Aggrecan degrading enzyme, and (TIMP-3), the tissue inhibitor of metalloproteinase-3, are important regulatory factors of cartilage extracellular matrix (ECM). The hypothesis that Aggrecanase-1 and TIMP-3 are involved in the matrix degradation process during altered loading of the mandibular condylar cartilage during the early growth stage was tested.
MATERIALS AND METHODS: One hundred female rats were randomly assigned to two groups: 50 animals fed with soft diet and 50 fed with hard diet. Ten soft and 10 hard diet rats were killed 6, 12, 24 and 48 hours and 9 days after initiation of the experiment at 21 days of age.
RESULTS: The immunohistological expression of TIMP-3 in the hard diet group was at a significantly higher level than in the soft group at 6 hours, and the expression of Aggrecanase-1 was higher in the hard diet group at 12 and 24 hours. Western blot analysis confirmed the results of the immunohistochemical findings.
CONCLUSIONS: The differing temporary change in Aggrecanase-1 and TIMP-3 expression reflects the complex interaction of these enzymes in the physiologic range and response to loading altered by different diets. Mechanical loading is an important factor in influencing growth of the mandibular condyle.

342 CORRELATIONS OF MASTICATORY ABILITY, BITE FORCE AND DENTOFACIAL MORPHOLOGY

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AIM: To investigate the relationship of masticatory ability and bite force to dentofacial morphology.
SUBJECTS AND METHOD: Fifty adults (25 males, 25 females). Colour-changeable chewing gum was used to evaluate masticatory ability. The chewing gum was tinted with red by mastication, and the colour of the chewed gum was measured and transformed using the CIE-LAB colouring system. The Dental Prescales-Occluzer System was used to evaluate bite force and occlusal contact area. Measurement indices of lateral cephalograms and study models were recorded to determine dentofacial morphology.
RESULTS: 1. The mean values of masticatory ability, bite force and occlusal contact area was higher in males than in females; 2. Masticatory ability was significantly correlated with bite force and occlusal contact area in both males and females ($P < 0.05$); 3. Masticatory ability was correlated with the angle of convexity, A-B plane angle and curve of Spee in females; 4. Bite force was correlated with SNA, mandibular plane to SN and gonial angle in males. In females, bite force was correlated with SNA, A'-Ptm', mandibular plane to SN, mandibular plane to FH plane (FMA), occlusal plane to FH plane, upper dental arch width (3-3), upper dental arch length (1-6) and curve of Spee.
CONCLUSIONS: The antero-posterior position of point A and the curve of Spee influence masticatory ability and bite force.

343 AXIS CORRECTION OF MESIALLY TIPPED TEETH WITH REDUCED PERIODONTAL SUPPORT

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AIM: To examine the effects of the axis correction of mesially tipped teeth with reduced periodontal support using various orthodontic methods.

SUBJECTS AND METHOD: Twelve patients with reduced periodontal support. Clinical interdisciplinary examination and radiographic information (pre- and post-treatment) was used to illustrate the benefits of different treatment methods on the periodontal tissues. For patients with favourable vertical bone loss, surgical techniques were used in addition to autogenous bone graft, allografts and guided tissue regeneration. Orthodontic treatment commenced 3-6 months after periodontal surgery. For distal tipping of the molars, an uprighting spring (Sander), a segmental arch and implant anchorage were used.

RESULTS: The periodontal status improved during orthodontic treatment at the same time as correction of the tooth axis.

CONCLUSIONS: Use of low forces and uprighting NiTi spring are recommended for distal tipping of periodontally affected teeth.

344 ORAL HEALTH RELATED QUALITY OF LIFE DURING FIXED APPLIANCE THERAPY

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AIM: To determine changes in oral health related quality of life (OHRQoL) during fixed orthodontic appliance therapy.

SUBJECTS AND METHOD: A prospective cohort study involving a consecutive sample of 217 orthodontic child patients receiving fixed orthodontic appliance therapy. The subjects self-completed the 37-item child perception questionnaire (CPQ) at five points in time: prior to treatment (T_0), and after insertion of fixed appliances at 1 week (T_1), 1 month (T_2), 3 months (T_3) and 6 months (T_4).

RESULTS: The response rate was 91 per cent (198/217). There were significant changes in the overall CPQ, oral symptoms, functional limitation, and emotional well-being scores (all $P < 0.001$) over the study period (6 months). There were significant differences in certain CPQ domain scores at T_1, T_2, T_3, and T_4 compared with T_0 ($P < 0.05$). Significant changes in certain CPQ domain scores also occurred between T_1 and T_2 ($P < 0.05$) and T_2 and T_3 ($P < 0.05$). However, there were significant changes in social well being scores ($P < 0.05$).

CONCLUSIONS: Changes in OHRQoL occur following insertion of fixed orthodontic appliances, especially during the first month of treatment. Oral symptoms and functional limitations deteriorated, whereas emotional well being improved.

345 CORRELATION OF OVERJET AND PREMOLAR RELATIONSHIP

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AIM: Overjet value does not always reflect the relationship of the dental arches in the sagittal plane. The aim of this study was to determine the correlation between overjet values and the first maxillary premolar buccal cusp-mandibular premolars embrasure distance (Katz's method) in Class I, II and III patients.

SUBJECTS AND METHODS: Six hundred and fifty randomly selected patients. Eighty-six fulfilled the selection criteria (permanent dentition, no aplasia, no missing or supernumerary teeth and no previous orthodontic treatment). According to the study cast measurements, the subjects were divided into Class I (n = 30), Class II (n = 30) and Class III (n = 26) malocclusion groups. Overjet and premolar buccal cusp-embrasure distances were measured and the correlation coefficient (r) between the parameters was calculated.

RESULTS: The mean overjet value was: Class I 3.8 ± 2.00 mm, Class II 5.7 ± 2.8 mm and Class III 0.0 ± 2.9 mm. The mean value for the premolar buccal cusp-embrasure distance was 0.4 ± 0.8, 2.8 ± 2.0 and –4.0 ± 3.4 mm, respectively. A statistically significant positive correlation ($P < 0.01$) was found between overjet and premolar buccal cusp-embrasure distance values on the left (r = 0.634) and right (r = 0.643) sides.

CONCLUSIONS: The increase in overjet increases the cusp-embrasure distance and *vice versa*.

346 PREDICTION OF SKELETAL RELATIONSHIPS FROM OVERJET VALUE

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AIM: It has been shown that the value of the overjet is not a reliable measurement of jaw relationship in the sagittal plane. The aim of this study was to investigate the correlation between overjet values and the parameters ANB angle, Wits appraisal and facial convexity, and to assess overjet as a predictor of skeletal relationships.
SUBJECTS AND METHOD: Six hundred and fifty randomly selected patients were examined and 86 fulfilled the selection criteria (permanent dentition, no aplasia, no missing or supernumerary teeth, and no previous orthodontic treatment). According to the relationship of the first permanent molar, the subjects were divided into Class I (n = 30), Class II (n = 30) and Class III (n = 26) groups. ANB angle, Wits appraisal and facial convexity were measured on lateral cephalograms and overjet on study casts. For statistical analysis the correlation coefficient (r) between the overjet and cephalometric parameters was tested. The overjet as a predictor of skeletal relations was defined using linear regression (R^2).
RESULTS: A statistically significant positive correlation ($P < 0.01$) was found between overjet and ANB angle (r = 0.691), Wits appraisal (r = 0.749) and facial convexity (r = 0.610). In the Class III patients overjet value was not a good predictor to determine the value of ANB angle ($R^2 = 0.051$), Wits appraisal ($R^2 = 0.098$) or facial convexity ($R^2 = 0.047$). For the Class I and II patients the values of the measured cephalometric parameters can be predicted by the overjet value ($P < 0.01$), except Wits appraisal in Class I subjects.
CONCLUSIONS: Despite the significant positive correlation between overjet and the measured cephalometric parameters, sagittal skeletal relationships in Class III malocclusion subjects cannot be predicted by overjet value alone.