

ABSTRACTS

OF LECTURES

(Poster presentations will appear in the October issue of the Journal)

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1 EVALUATING THE LONG-TERM EFFECTS OF CHIN-CAP TREATMENT

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AIM: To clinically investigate temporomandibular joint (TMJ) symptoms following chin-cap therapy of Class III patients, 5 to 10 years after treatment.

SUBJECTS: A total of 32 skeletal Class III patients (18 females, 14 males) with a mean age of 18.5 years treated with a chin-cap comprised the treatment group. The control groups were 271 individuals (153 females, 118 males) with a mean age of 14.3 years in need of orthodontic treatment (malocclusion group) and 53 randomly selected individuals (29 females, 24 males) with a mean age of 19.2 years. Rakosi's functional analysis was applied to all groups, and symptoms such as pain, clicking, crepitation and deviation/deflection were investigated for each subject. Each group was then divided into symptomatic and asymptomatic subgroups and TMJ symptoms were evaluated in the symptomatic groups.

METHODS: Symptomatic and asymptomatic individuals in each of the three groups and the symptoms of TMJ disorders were investigated using the Z-test.

RESULTS: The percentage distribution of symptomatic and asymptomatic individuals was found to be similar between the malocclusion and chin-cap groups and was significant between the malocclusion and random groups ($P < 0.01$). The difference between the chin-cap and random groups was borderline ($Z = 1.54$). Clicking and deviation/deflection parameters showed similarity between the symptomatic groups. Pain symptoms were significantly different ($P < 0.01$) between the malocclusion and random groups. Crepitation was found significant between the malocclusion and other two groups, as it was determined only in the malocclusion group.

CONCLUSION: Chin-cap appliances used for correction of skeletal Class III malocclusions do not carry a clinical risk of temporomandibular dysfunction in the post-retention period.

2 CLASS II DIVISION 2 MALOCCLUSION REVISED: A CLASS OF ITS OWN!

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AIM: Despite numerous articles published on craniofacial characteristics, some malocclusions, such as Class II division 2, are still not well defined. The present work presents data from a series of papers on Class II division 2 craniofacial characteristics and associations with congenital tooth anomalies.

MATERIAL AND METHODS: The lateral cephalograms, orthopantomograms and dental casts of 267 (161 females, 106 males) Class II division 2 subjects were examined and analysed.

RESULTS: The analysis of the skeletal characteristics: SNA, NA-FH, BaA: BaN% showed a correct anteroposterior

position of the maxilla. SNB, NPog-FH, BaPog: BaN% revealed mandibular retrusion in all age groups. Moreover, the mandible appeared well developed with excess ramus height, low angulation of the body and low anterior face height. Other angular measurements revealed a mild skeletal Class II and a hypodivergent growth pattern for all age groups, high interincisal angle, and a tendency to anterior drift of the buccal segments. Analysis of the data on the association of Class II division 2 with congenital tooth anomalies showed that 56.6 per cent of the patients exhibited some form of congenital tooth anomaly, 13.9 per cent presented agenesis of the upper lateral incisors, 7.5 per cent peg-shaped upper laterals and 20.6 per cent impacted canines. Transpositions were found in 1.1 per cent, while no subject exhibited a supernumerary tooth.

CONCLUSIONS: The present data showed that Class II division 2 represents a class of its own and it should be examined separately from other Class II malocclusions. Moreover, direct comparison of the present results with existing data on the percentage of congenital tooth anomalies of the general population and other malocclusions revealed that Class II division 2 is the malocclusion closely associated with congenital tooth anomalies.

3 PAIN ASSESSMENT IN ORTHODONTICS

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AIM: To assess pain experiences during orthodontic treatment and relate these assessments to motivational and psychological factors.

SUBJECTS: Forty-two patients (12–18 years of age) starting treatment due to crowding.

METHODS: Interviews assessed background, motivational and psychological factors, and perception of general and dental pain. Molar elastic separators were inserted bilaterally, and telephone interviews were carried out during the same evening and every second evening for one week. Pain intensity was assessed on a 100 mm visual analogue scale (VAS) ('no' to 'worst pain ever'). The duration and character of pain, and pain medication were recorded.

RESULTS: Thirty-nine patients (93 per cent) reported pain on the first day (VAS mean 28.8; median = 18.0). The highest intensity of pain was reached during day 2 (VAS mean = 44.2; median = 39.0). At day 7, 46 per cent of the patients still reported pain. Pain medication was used by 24 per cent of the patients during the first two days, while no subject used analgesia during the last days of the follow-up. Girls reported higher pain ratings during the later phase of the follow-up week. The perceived pain from separators was milder than previous general and dental pain experiences. Some statistically significant relationships were found between pain reports and psychological factors, and between 'late' VAS assessments and reported levels of previous general pain experiences.

CONCLUSION: Pain is common after a simple procedure such as placement of molar separators. The experience of pain varied substantially among subjects. One-quarter of the patients used pain medication during the first two days. The intensity of pain was gradually reduced, but half of the group still reported some pain after one week.

4 TEMPOROMANDIBULAR JOINT DYSFUNCTION BEFORE AND AFTER ORTHOGNATHIC SURGERY

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AIM: To assess the influence of orthognathic surgery on the temporomandibular joints (TMJ).

SUBJECTS: Thirty-nine patients (14 with Class II division 1, six with Class II division 2, 17 with Class III and two with laterognathia only) were examined pre- and 6 months post-surgically to evaluate signs and symptoms of TMJ dysfunction.

METHODS: TMJ dysfunction was graded according to Helkimo's index. Additional information was collected by a manual examination method developed by Bumann and Groot Landeweer.

RESULTS: Angle Class II division 1: Symptoms were found in 10 subjects (71 per cent) pre- and in eight (57 per cent) post-surgically. After surgery, four of the symptomatic patients were asymptomatic, four still had the same level, one had less and one developed more symptoms. Two of the asymptomatic patients showed post-surgical dysfunction.

Angle Class II division 2: Pre-surgically three (50 per cent) and post-surgically five (83 per cent) of the 16 patients showed TMJ disorders. Two of the three asymptomatic patients developed TMJ dysfunction post-surgically.

Angle Class III: TMJ dysfunction was shown in 10 patients (59 per cent) pre-surgically and in seven patients (41 per cent) post-surgically. After surgery, six of the symptomatic patients were asymptomatic, three were still at the same and one on a higher level. Three asymptomatic patients developed dysfunction after surgery. Laterognathia: The two patients had symptoms pre- and post-surgically.

CONCLUSION: Orthognathic surgery has an effect on the TMJs, but the post-surgical result can only be predicted at a low statistical level.

5 NATURAL HEAD POSTURE—CONSIDERATIONS OF REPRODUCIBILITY

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AIMS: 1. To assess the reproducibility of natural head posture (NHP). 2. Establish which statistical method best

represents clinical findings of reproducibility. 3. Compare repeatability of NHP using different protocols. 4. Devise a time-efficient method for auditing repeatability of NHP without the use of ionising radiation.

MATERIALS AND METHODS: Part 1 (n = 16) retrospectively assessed reproducibility of NHP. Part 2 (n = 12) compared method repeatability between radiographs and photographs. Part 3 (n = 37) investigated reproducibility of different protocols of head posture using the photographic method. Statistics: 1. Method error (ME) (Dahlberg, 1940); 2. Coefficient of reproducibility/Limits of agreement (Bland and Altman, 1986); 3. Intra-class correlation coefficient (Fleiss, 1979); 4. Student's *t*-test.

RESULTS AND CONCLUSIONS: The initial repeatability of NHP was poor (ME: 2.99 degrees). However, repeatability was improved by simplifying the protocol for achieving NHP (ME: 1.40 degrees). This means that the limit of reproducibility (the area in which 95 per cent of the values lie) is ± 4.0 degrees. Therefore although Dahlberg's formula is a statistically valid method, the use of a single figure giving a mean value is not representative of clinical practice. Because of the substantial variation in the data, which included patients with nasal obstruction, cleft lip and palate etc., the use of Fleiss' coefficient of repeatability also did not appear to be useful. The results show that graphic presentation of data and Bland and Altman's limits of reproducibility represent clinical findings well and are useful tools for assessing repeatability of NHP. Photography is useful for the training of radiographers during the introduction phase of NHP. Reproducibility can be audited after a short time without unnecessary radiographic exposure of patients.

6 MANDIBULAR ADVANCEMENT DEVICE—CRANIOFACIAL AND DENTOALVEOLAR CHANGES

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AIMS: Snoring and obstructive sleep apnoea (OSA) is related to narrowing of the upper airways. A mandibular advancement device (MA) increases the hypopharyngeal dimensions and may reduce the number of apnoeas as well as snoring. The MA device is similar to an activator. Sagittally the mandible is advanced 50 per cent of the total protrusion ability. Vertically there is a distance of 5 mm between the incisors. The aims were to study possible craniofacial and dentoalveolar effects of the MA device after more than one year of wear.

SUBJECTS: Fifty-four individuals (mean 50.3 years) who had been using a MA device regularly for 1–4 years (mean 21.8 months).

METHOD: Lateral cephalograms and study casts obtained prior to treatment and at follow-up were digitized and measured with a digital calliper. The differences between the registrations were compared statistically.

RESULTS: The comparisons showed that there was a significant reduction in overjet, overbite and in incisor

proclination (II/III). The reduction was correlated to the length of wear. A significant posterior rotation of the mandible was also noted.

CONCLUSION: As OSA is progressive and may result in life threatening disorders, the small craniofacial and dento-alveolar changes registered may be regarded as a minor problem in relation to the improved quality in sleep and health.

7 THREE-DIMENSIONAL ANALYSIS OF THE MAXILLA IN INFANTS WITH UNILATERAL CLEFT LIP AND PALATE

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AIM: For the investigation of three-dimensional (3D) morphological changes in the maxilla of infants with unilateral cleft lip and palate (UCLP), a 3D digital computer-aided procedure was developed to visualize and metrically analyse the growth of the edentulous maxilla of these patients.

MATERIAL: Chronological consecutive casts of the maxilla obtained at the age of one week, as well as three, six and 12 months of 10 patients with complete UCLP.

METHODS: The casts were measured optically with the 3D digitizing instrument, Micromesure 700®. The casts were then computer-reconstructed, aligned and superimposed using the software, Orthosurf®. The following steps were automated using a specially designed program: 1. Identification of reference points; 2. Alignment of the cloud of points in a system of co-ordinates and 3. Identification of the alveolar crest. The distances between the surfaces were measured. Additionally, the surfaces were segmented perpendicular to the alveolar crest at reference points Cl, Cl', C2, C2' and I. The volume of the resulting segments was determined and compared.

RESULTS: The new method enabled visualization of the extent and direction of morphological changes of the mucosal surface. Additionally, a reproducible quantification of these changes via the determination of changes in the volume of defined alveolar segments was possible. The increase in volume was distinctly marked in the molar segment, and nearly constant in the canine segment.

CONCLUSION: The 3D analysis presented permits comprehensive 3D measurement of casts of the edentulous maxilla of infants with cleft lip and palate.

8 CLINICAL CRITERIA TO ACCOMPLISH AN ASYMMETRIC HEADGEAR EFFECT

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AIM: To measure clinically the forces and moments transferred to the molar teeth by symmetric and asymmetric headgear (HG) and to determine the difference in the

outer arm length required to accomplish an asymmetric effect.

MATERIALS AND METHODS: A special fork transducer was designed with a strain gauge rosette attached. Using an Instron machine and torque meter, the fork transducer was calibrated for antero-posterior forces (A-P) and moments (e.g. mesio-buccal M-B), respectively. Two transducers were threaded on both free ends of the HG inner bow posterior to the stops. The HG was then inserted in the molar tubes so that each transducer was located between the HG stop and the mesial aspect of the molar tube. Three different HGs were studied: symmetric and two asymmetric with a 20 and 40 mm difference in outer arm lengths in a laboratory *in vitro* model and on 10 patients when the neck strap was stretched at 5 N loading.

RESULTS: Equal A-P forces (2.5 N) and M-B moments (3.2 Ncm) were developed on both sides of the symmetric HG. Asymmetric HG with a 20 mm outer arm difference developed 40 per cent higher A-P forces on the long than the short arm, but these were not significant. However M-B moments were similar (2.7 Ncm). Asymmetric HG with a 40 mm difference resulted in significantly higher A-P force (70 per cent of the applied force) on the longer than the shorter arm, as well as 2.75 times higher M-B moments (4.2 versus 5 Ncm). Positive correlation ($R = 0.65$) was found between the outer arm length and M-B moments.

CONCLUSION: Clinically, an asymmetric HG effect can be achieved only when the difference in length between the outer arms is greater than 20 mm.

9 INTERDISCIPLINARY TREATMENT OUTCOME IN PATIENTS WITH CHRONIC OROFACIAL PAIN

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AIM: To assess the results of a controlled interdisciplinary treatment study involving patients with chronic orofacial pain.

SUBJECTS: Sixty patients were randomly divided into five groups with different treatment rationales: group 1-no treatment (control group); group 2-chiropractic treatment only; group 3-orthopaedic splint therapy only; group 4-orthopaedic splint therapy initially followed by subsequent chiropractic treatment; group 5-simultaneous treatment by a chiropractor, orthodontist, physiotherapist and an osteopath on a daily basis over a period of three weeks.

METHODS: Clinical assessment parameters included: reproducibly provokable pain during 'joint play techniques', mobility of the joint capsule and changes in condylar positions. The clinical findings were registered before and after treatment (3 weeks to 3 months) and 3 months later.

RESULTS: (1) No treatment for three months did not change the clinical findings significantly ($P < 0.05$). (2) Depending on the treatment protocol it was possible to reduce the number of

painful joint structures between 18.2 and 76.4 per cent. The simultaneous treatment (group 5) was the most successful rationale. (3) The capsule mobility improved in all groups where direct or indirect manual manipulation techniques were used. (4) Sagittal condyle position changes were not related to pain reduction, whereas vertical condyle position changes were significantly ($P < 0.05$) related to objective pain reduction.

CONCLUSION: The results suggest that the condylar position changes and the outcome of pain treatment in patients with chronic orofacial pain are significantly related to the type of interdisciplinary care.

10 PATTERNS AND PATTERNING OF CRANIOFACIAL BIOLOGY

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KEYNOTE ADDRESS

The principle of patterns and patterning is the theme of this address. It should be deeply enmeshed in today's world of developmental and craniofacial biology, and in the approaches toward the clinical delineation and treatment of craniofacial malformations. The emphasis on craniofacial malformations is well-placed in that facial clefting disorders are among the most common human birth defect. That is, 75 per cent of all malformations seen at birth affect the head, face, and neck, and have patternable phenotypes seen clinically as either isolated or syndromic events.

The principle of patterns and patterning will be kept to the fore as this address brings the worlds of classical developmental biology together with developmental craniofacial biology, which itself is in the midst of a period of revolutionary change. An early focus of this presentation will be on the progressive patterns of expression among differentiating cell types within identifiable embryonic 'craniofacial development fields' including those of the lip, jaw, and temporomandibular joint. This picture of development field patterns will be focused further by correlations with patterns of pathogenesis seen in a range of clinical conditions from orofacial clefting to the condition of Treacher Collins. Meshed into this emerging picture will be one of the most exciting discoveries in developmental biology, which shows that there is a pattern of major gene expression that determines body shape in lower animals such as the *Drosophila*. Learning from this world of the fruitfly, this address will highlight known and hypothesized ways in which craniofacial morphogenesis are set in motion by molecular events occurring in the early embryo, events that are linked to the patterns of expression of Hox and other signalling genes. This address, emphasizing patterns and patterning in craniofacial morphogenesis, will have achieved its purpose by showing that (1) the biological principle of patterns and patterning is operable in both laboratory and clinical settings; (2) much continues to be learned about basic patterning through the explosion of new biological information (e.g. molecular biology, imaging technology); and (3) the full understanding and implications of the principle of

patterns and patterning in craniofacial morphogenesis is indeed complex but still remains elusive. Guided by this principle, the international community of craniofacial scientists and care providers may be in the best position ever to understand the aetiology, pathogenesis and phenotypes of a variety of birth defects in general.

11 ROOT RESORPTION IN PREMOLARS AFTER APPLICATION OF CONTINUOUS TORQUE

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AIM: To investigate the presence, location and extension of root resorption during continuous torque.

MATERIAL: Twenty-eight first upper premolars from 14 patients orthodontically indicated for extraction were used for analysis by scanning electron microscopy.

METHODS: A continuous force of different magnitudes (300 and 600 cN/mm) using a precise biomechanical model with superelastic wires (NiTi-Se) was conducted. The teeth were divided into one control group (unmoved), and two experimental groups (300 and 600 cN/mm), extracted after 1, 2, 3, and 4 weeks of movement. After extraction, the teeth were fixed, treated with 2 per cent sodium hypochloride solution for 6 hours in order to remove organic components, dehydrated, and metal-coated, in Balzers SCD 050 apparatus. **RESULTS:** Analysis in a scanning electron microscope (Jeol 61001) at 10–15 kV, revealed many concavities (resorption lacunae), which were mostly found on the lingual surface of the apical third of the roots. However, they were also found on the buccal face of the cervical third. All the orthodontically moved teeth showed areas of resorption.

CONCLUSION: Teeth moved for a long period and with a higher magnitude of force show a higher degree of resorption, both in width and in depth.

12 SOFT TISSUE AND DENTOALVEOLAR CHANGES DURING AND 20 YEARS AFTER BIONATOR TREATMENT

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AIM: Evaluation of the short- and long-term effects of Bionator therapy on the integument and the incisor position during and 20 years after orthodontic treatment.

SUBJECTS: Thirty-four patients (17 males, 17 females) with Class II malocclusions, who underwent Bionator treatment 20 years prior to this study and for whom cephalograms were available between 6 and 36 years of age, were investigated.

METHODS: Cephalometrics were performed to evaluate short- and long-term soft-tissue and dental changes of the Bionator treatment and compared with a matched control group of the Bolton Brush Growth Study.

RESULTS: The region of the lower lip showed prominent changes. The lower lip became more retruded in relation to the aesthetic line during treatment. This trend continued during the follow-up period. Nose length and prominence progressively increased after treatment. The mentolabial angle showed a minor opening during therapy but was reduced with increasing age. All patients showed alterations of the dentoalveolar regions. During Bionator treatment the patients exhibited a minor protrusion of the lower incisors, which protruded further during the subsequent fixed appliance period. This result was not present after the 20 year follow-up period. Twenty years after treatment the lower incisors showed a retruded position behind the pre-treatment status.

13 A NEW SCALE TO ASSESS RADIOGRAPHIC SUCCESS OF SECONDARY BONE GRAFTS

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AIM: To determine if an 8-point radiographically based scale of teeth adjacent to the cleft line could be used between operators to reliably assess the success of secondary alveolar bone grafting.

SUBJECTS: All patients who had secondary alveolar bone grafts from 1985–1999 were included. There were a total of 66 patients with a total of 70 grafted sites.

METHODS: The study was retrospective with the operators blind to patient identity. Radiographs were examined twice by two operators with a one-week interval. Upper anterior occlusal radiographs were taken at 70 degrees to the horizontal through the line of the cleft. All radiographs were assessed under controlled conditions. The bone graft site was radiographed prior to grafting. The radiograph was repeated post-operatively at a mean of 51 months after surgery. The roots of the teeth adjacent to the cleft, were divided into four. The cleft was divided vertically in the midline. If bone was present to the midline mark, a score of 1 was given to that segment. A score of 0.5 if bone present but < midline and 0 if no bone present. Depending on the position of bone within the cleft, six categories were used to assess success.

RESULTS: Overall, 59 per cent of grafts achieved grade A, 20 per cent B, 6 per cent C, 3 per cent D, 3 per cent E and complete failure in 9 per cent. There was good intra- and inter-observer concurrence (0.69 to 0.65 kappa statistic).

CONCLUSION: The above scale may be used to assess the position of bone within the cleft site and it may provide a method to evaluate the position of bone and the success of alveolar bone grafting. It demonstrated good intra- and inter-observer concurrence.

14 THE CENTRIC RELATION SPLINT—A DIAGNOSTIC AND THERAPEUTIC APPLIANCE FOR TEMPOROMANDIBULAR PROBLEMS

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(KEYNOTE ADDRESS)

The use of occlusal appliances has been advocated by clinicians who treat patients with disturbances of the stomatognathic system. A variety of appliances have been reported in the literature, and all claim some success in addressing several pathological conditions.

The most commonly used appliance is the centric relation splint which is very successful in relieving neuromuscular pain and at the same time providing valuable diagnostic information. An analysis of the principles guiding the fabrication of appliances indicates that splints must be simple to make, require minimum chairtime and provide optimum occlusion for the patients.

The centric relation splint is preferably fabricated in two phases: in the first phase a template which covers the maxillary teeth and includes a deprogrammer is placed for a period of 1–2 weeks in order to relax the muscles and reposition the mandible. For the second phase acrylic is added to the template, providing occlusal contacts on the posterior teeth and establishing anterior guidance on the anterior portion of the appliance. The patient wears the splint for 6 months and the splint must be corrected and adjusted every 10–15 days.

This centric relation splint can be used to correct the vertical dimension, to establish treatment position and to provide information on how the patient will respond to the new therapeutic occlusion. The splint can be easily modified to meet the needs of orthodontics, restorative dentistry and periodontics.

15 SIGNIFICANCE OF TOOTH SIZES IN THE AETIOLOGY OF THE COVER-BITE

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AIM: Angle's designation of the Class II division 2 malocclusion recognizes a unique combination of overbite, retroclination of the upper incisors and sagittal discrepancy. There is a severe Class II division 2 phenotype characterized by concealment of the mandibular incisors in occlusion. The aim of this study was to analyse if the pronounced retroclination of the incisors may be caused by a general tooth width reduction in the upper and the lower arch, or by a reduction in tooth widths of certain groups of teeth.

SUBJECTS: Patients with a distinctive cover-bite malocclusion (n=170) and those with a Class I occlusion and a normal anterior relationship (n = 190) were analysed.

METHODS: The following determinations were made three-dimensionally on the plaster casts: 1. Width of each tooth in the upper and the lower arches (third molars

excluded). 2. Relationship between the anterior and the lateral dental segments. 3. Bolton-discrepancies (overall and anterior ratio). Furthermore an attempt was made to find a correlation between the relatively constant cephalometric measurement N-S and the overall tooth widths.

RESULTS: A systematically reduced tooth-size was found as a trait associated with a cover-bite malocclusion, particularly for mesiodistal tooth diameters for the maxillary and mandibular incisors.

CONCLUSION: These findings of a characteristic pattern of tooth size in Class II division 2 cover-bite malocclusions indicate the presence of strong genetic influences, leading to the retrognathic dento-alveolar position of the maxillary and mandibular dental arches in the facial profile sustained by the functional properties of the perioral tissues.

16 SURFACE CHARACTERIZATION OF RETRIEVED NiTi ARCHWIRES

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AIM: To examine the structure and morphological condition of retrieved NiTi orthodontic archwires and identify possible alterations in the surface composition of the alloy following intra-oral exposure.

MATERIALS AND METHODS: Seventy NiTi wires (Bio-force and Neosentalloy, GAC, German Orthodontics, Ormco) of various cross sections with a mean intra-oral exposure period of 6 months (range 1–9 months) were collected through a retrieval protocol and were subjected to multitechnique characterization. Representative specimens were metallographically analysed after polishing and etching with concentrated hydrofluoric, nitric and acetic acids at a 1:1:1 volume ratio, to reveal the martensitic structure of the alloy.

RESULTS: Optical microscopy revealed islands of amorphous precipitants and accumulated microcrystalline particles. Micro MIR-FTIR investigation of the retrieved samples demonstrated the presence of a proteinaceous biofilm, the organic constituents of which were mainly amide, alcohol, and carbonate. SEM and X-ray microanalysis showed that the elemental species precipitated on the material surface were Na, K, Cl, Ca, and P, forming NaCl, KCl, and Ca-P precipitates. Atomic force microscopy revealed dramatically increased surface roughness for the retrieved specimens. Increased intra-oral exposure was consistently associated with the presence of a mature film, whereas evidence of alloy delamination, pitting, and crevice corrosion as well as a notable reduction in the alloy grain size, were also observed.

CONCLUSION: Intra-oral exposure of NiTi wires altered the topography and structure of the alloy surface through surface attack in the form of pitting or crevice corrosion and formation of integuments. The results of this investigation emphasize the necessity for adopting *in vivo* approaches in the study of the corrosion resistance of NiTi wire alloys, potential for Ni leaching, and bracket-archwire friction variants.

17 TREATMENT OF CLASS II DIVISION 2 SUBJECTS WITH DEEP OVERBITE, AND TEMPOROMANDIBULAR DISORDERS

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AIM: To investigate the effect of bite opening on pain and dysfunction in patients with Class II division 2 malocclusions, deep overbite and temporomandibular disorders (TMD).

SUBJECTS: Fifteen adult patients (11 women, 4 men) whose chronic symptoms of TMD had not been relieved by conventional stomatognathic treatment.

METHODS: Bite opening was carried out with a maxillary fixed lingual arch with an anterior bite plane. The occurrence of headache, pain in the masticatory muscles, and mandibular function was recorded before, during, and after treatment.

RESULTS: The patients experienced a relief in the pain symptoms as early as one week after insertion of the bite opening appliance. After 3–4 weeks, mandibular mobility had improved and the occurrence of muscle tenderness and pain during chewing had been reduced. With one exception, joint sounds, the prevalence of all TMD symptoms had been significantly reduced at the end of the bite opening treatment. In order to secure a favourable long-term prognosis it is also necessary to correct the Class II division 2 malocclusion in these subjects.

CONCLUSION: In patients with TMD in combination with a Class II division 2 malocclusion and deep overbite, bite opening with a maxillary lingual arch with anterior bite plane results in relief of headache and pain and tenderness in the masticatory muscles, and in improved mandibular mobility.

18 CRITICAL ANCHORAGE: PARASAGITTAL PALATAL IMPLANTS, HORIZONTAL BICORTICAL SCREWS AND CANTILEVER MECHANICS

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AIM: To report on the diagnostic requirements, mechanics, and force systems of cantilever based mechanics in combination with intraosseous implants and screws for maximum anchorage control.

SUBJECTS: Thirty-one adolescents and adults requesting orthodontic space closure in critical anchorage situations. In 22 patients palatal parasagittal implants (Brånemark type) were placed, while nine patients had bicortical screws inserted horizontally (Leibinger) between the roots of the teeth of the anterior segment.

METHODS: After conventional orthodontic diagnosis the placement of the screws and implants was planned together with the oral surgeons in order to determine the bone quality and point of orthodontic force application.

RESULTS: Computed tomographic scans are indicated to assess the bony support of the palate. Even if loaded directly, no implant was lost. The depth of the mucolabial fold in the lower jaw was a limiting factor for screws. From a total of 30 screws, three were lost due to impingement of the screw's head into the buccal mucosa. After healing, a new insertion site was successfully chosen.

CONCLUSIONS: The clinical use of such mechanics has augmented the possibilities of orthodontic treatment either in juveniles or adults for three reasons: first the clinician is provided with a device for optimal control of the anchorage; second the force systems are statically determinate, and third the total treatment time is reduced as space closure is commenced during the preliminary alignment phase.

19 FAVOURABLE MAXILLARY GROWTH AFTER DELAYED HARD PALATE REPAIR IN CLEFT PATIENTS

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AIM: To compare, on a long-term basis, maxillary growth in two samples of patients with complete unilateral cleft lip and palate (UCLP).

SUBJECTS: In one group of 30 subjects the cleft of the soft palate was repaired at 7 months of age while the hard palate closure was delayed and performed together with the bone grafting procedure at about 8.5 years [the delayed hard palatal closure (DHPC) group]. Another sample of 30 patients had their palatal clefts repaired in a conventional way. The hard palatal cleft in this latter group was closed with a vomer flap at 3 months and the remaining velar cleft was closed with Wardill-Kilner push-back technique at about 22 months of age (the 'conventional' group).

METHOD AND RESULT: Comparisons of the patients' longitudinal cephalometric radiographs up to 16 years of age indicated significantly better maxillary development, both horizontally and vertically in the patients treated with DHPC. In addition, other cephalometric measurements, e.g. increase in length of the maxilla, indicated improved midface growth after the DHPC routine.

CONCLUSION: The results of the present study contradict the opinions of earlier reports. Midfacial growth of UCLP subjects can be enhanced if using DHPC. A separate speech study of the same patients showed that this can be achieved without compromising long-term speech development.

20 THE INCIDENCE OF CANINE IMPACTION TO OTHER DENTAL ANOMALIES

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AIMS: To identify other related dental features in patients with canine impaction.

SUBJECTS: The sample consisted of 254/8,556 patients attending the Orthodontic Department, University of Freiburg i. Br., with at least one impacted canine, i.e. a prevalence of 2.97 per cent. The study group (112 males, 142 females; 8.16-32.33 years; \bar{x} = 14.92 years) was compared with a control group without canine impaction (123 males, 131 females; 6.75-20.16 years; \bar{x} = 10 years).

METHODS: For each patient panoramic radiographs and plaster casts were evaluated according to the following criteria: further dental impactions, tooth aplasia, peg-shaped or hypoplastic upper laterals, tooth rotation, malocclusion. The data were statistically analysed using the Chi²-test and an analysis of variance.

RESULTS: According to the odds ratio, in the case of the simultaneous appearance of a peg-shaped lateral on one side and an aplasia of I₂ on the contralateral side, the incidence of canine impaction was significantly increased on the side of the hypoplastic tooth. Canine impaction was characteristic for those with coverbite and linguoversion of the upper centrals 'Deckbiss'. No correlation could be established with Angle malocclusions.

CONCLUSIONS: Patients with aplasia of upper laterals, congenitally missing teeth, hypoplastic or peg-shaped laterals and impaction of other teeth bear a significantly higher risk of developing canine impaction. Retardation in upper lateral incisor development seems to be more disturbing for physiologic canine eruption than aplasia of the neighbouring I₂.

21 OROFACIAL MUSCLE ADAPTATION AFTER SURGICAL CORRECTION OF SEVERE ANTERIOR OPEN BITE

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AIM: To evaluate the adaptive changes and the functional behaviour of soft tissue and orofacial muscles after surgical correction of skeletal open bite and to show their influence on occlusion and their contribution to relapse.

SUBJECTS: Thirty-seven patients, 16 males, 21 females, aged 18 to 36 years, 19 with skeletal Class III and 18 with skeletal Class I malocclusions. All patients originally had an anterior open bite without vertical overlap of the central incisors. Twenty-seven had undergone bimaxillary orthognathic surgery; 10 patients only a Le Fort I osteotomy.

METHODS: Anterior and posterior tongue position, lip competence, lip-incisor relationship, masticatory muscle activity and breathing mode were assessed. The results demonstrated a statistically strong correlation between anterior and posterior tongue position and occlusion. Lack of anterior contact and strong interdigitation allowed tongue interpositioning. The activity of the masticatory muscles and habitual mouth posture were correlated with open bite, overjet and overbite.

RESULTS: The lower lip and the tongue had more effect on the position of the incisors than the upper lip. The improvement of breathing mode was probably due to the increase in lip competency. The interlabial distance was significantly correlated with mentalis muscle activity.

CONCLUSION: After surgical correction of anterior skeletal open bite, the adaptive changes in the orofacial complex of adults contribute to relapse. The occlusion should be as stable and optimal as possible to eliminate reasons for relapse.

22 CRANIOFACIAL GROWTH IN PATIENTS WITH UNILATERAL CLEFT LIP AND PALATE: AN INTER-CENTRE STUDY

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AIM: The Milan surgical protocol includes the use of a gingivo-alveolo-plasty (GAP) at 18-36 months as an alternative to later bone grafting. Cephalometric radiographs from the Milan CLP Center were compared with those from the Oslo CLP Center in order to evaluate the effect GAP may have on subsequent facial growth.

SUBJECTS: Both samples consisted of non-syndromic and consecutively treated patients with UCLP. In the Milan sample there were 41 patients (average age 5.4 years) born between 1988 and 1991 with unilateral cleft lip and palate (UCLP). The Oslo sample consisted of 48 patients (average age 5.9 years). The Milan protocol includes pre-surgical orthopaedics, a Delaire lip closure at 6 months, and hard palate closure with GAP at 18-36 months. The Oslo sample had had a Millard lip closure and an anterior palate closure by a single layer vomer flap at 3 months and a von Langenbeck soft palate closure at 18 months.

METHOD AND RESULTS: The radiographs were traced by one individual. Thirty-seven measurements were carried out to compare the lateral cephalometric radiographs of the two groups. The Student's *t*-test was performed. Sixteen variables were statistically significantly different ($P < 0.05$). The measurements all indicated that the maxilla in the Milan sample was more retruded (SNA: Oslo 80.5 ± 3.8 , Milan 78.7 ± 3.6), also from the soft tissue standpoint (Upper lip to E line: Oslo 3.1 mm, Milan 0.9 mm). Cranial base and divergence measurements in the two samples were not statistically different.

CONCLUSION: The results show a statistically significant difference in maxillary protrusion between the two samples at age 5. It is acknowledged however, that digitizing the anterior surface of the maxilla in 5 year-old children with UCLP can be unreliable because of rotated, unerupted incisors. Furthermore there may be inherent differences in the two populations. Long-term data is needed in order to reach a definitive conclusion on the effect of early GAP on facial growth.

23 DIFFERENTIAL EXPRESSION OF MYOSIN HEAVY CHAIN mRNA MASTICATION DURING FUNCTIONAL ADVANCEMENT OF THE MANDIBLE

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AIM: Functional appliances for treatment of Class II malocclusions should improve orofacial function by adaptation and training of muscle capacity, which is connected with a change of muscle fibre type proportion. The aim of this investigation was to analyse myosin heavy chain (MHC) proportion for fibre type I (slow twitch/ST) and type II (fast twitch/FT) with the polymerase chain reaction (PCR) during sagittal advancement of the mandible in animals.

SUBJECT: Twelve pigs (6 experimental, 6 controls) 10 months of age were investigated following mandibular advancement.

METHODS: Six pigs received acrylic build-ups for permanent sagittal advancement of the mandible. Tissue was taken from several different regions of the masseter, temporalis, medial pterygoid and geniohyoid muscles. The 84 samples were used for histological fibre differentiation with ATPase staining and for total mRNA isolation. For determination of the two MHC isoforms PCR was used for amplification of cDNA (mRNA transcribed).

RESULTS: In comparison with the controls, there was a remarkable percentage increase of type I fibre in some muscle regions of the treated animals. The histological findings corresponded with the molecular biological results. In the anterior region of the masseter the amount of ST fibres increased from 14.54 per cent in controls to 26.80 per cent in treated pigs and in the posterior region of the temporalis from 9.97 to 18.90 per cent. In the medial pterygoid and in the geniohyoid muscle there was no significant change of fibre proportion.

CONCLUSIONS: Functional advancement of the mandible in pigs causes, after 28 days, an increase of ST fibres up to 12 per cent in comparison with FT fibres. The genetic analysis of MHC with the PCR is sufficient to determine the status of muscle adaptation during functional treatment. This method can be used in orthodontic patients since the amount of tissue required is small and can be obtained with a normal injection needle.

24 SKELETAL CLASS II THERAPY—EFFECTS OF BIONATOR AND TEUSCHER APPLIANCES

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AIM: To compare the effects of the Bionator and Teuscher appliance in Class II therapy.

SUBJECTS AND METHODS: Forty-six patients (25 males, 21 females), mean age 10.6 years, with dental and skeletal Class II malocclusions were analysed. Sixteen patients were treated with the Bionator (group I) and 18 patients with the

Teuscher appliance (group II). Twelve patients served as a control group (group III). The treatment period was 24 ± 6 months. Standardized lateral cephalograms were obtained before treatment (T1), at the end of treatment (T2) and after an observation period of 3 years (T3). Skeletal and dental changes were calculated according to the Milan cephalometric system. The patients were instructed to wear the removable appliance 12–14 hours a day. In group II the headgear was worn at night.

RESULTS: In all patients undergoing treatment the sagittal relationship was corrected. Twenty per cent of patients in group I demonstrated a posterior rotation of the mandible during treatment. No change in growth rotation was observed in 70 per cent of the patients of group I between T1 and T3. In group II improved control of facial height and restriction on maxillary forward growth was observed. Upper molar distal tipping and intrusion was found to be significant during combined headgear therapy. These effects remained stable during the follow-up period in almost all patients. Measurement of SNA and SNB angles underline that the change in basal relationship with both appliances was due to restraint of maxillary growth.

CONCLUSIONS: Correction of Class II malocclusions was successful in all subjects. These results suggest that both types of appliances are equally effective in maxillary growth restriction. However the Bionator treatment produces posterior rotation of the mandible. The Teuscher treatment seems to be more effective in high angle cases due to greater control of the vertical dimension.

25 CELLULAR AND MOLECULAR INTERACTIONS DURING BONE REMODELLING

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AIM: Cellular and molecular biology of bone has become important in understanding tooth movement. The aim of this research was to shed light on the cellular and molecular interactions that occur during bone remodelling by determining the role of bone marrow and marrow derived cells in parathyroid hormone (PTH) regulation of osteoclastogenesis.

MATERIALS: Mice, marrow and cell cultures.

METHODS: The presence of functional PTH receptors (PTHr) was tested using specific PTH radioligand binding, expression of PTHr mRNA transcripts (by RT-PCR) and stimulation of cyclic AMP (cAMP) accumulation and IL-6 secretion in bone marrow and marrow derived cells. The above tests are in line with previous investigations, which have shown that when an established clonal stromal cell line (GBLneo) is co-cultured with putative osteoclast progenitors and PTH is added osteoclastogenesis is enhanced.

RESULTS: Evidence of PTHr in primary murine whole bone marrow cultures and in the non-adherent cell population isolated from these cultures was obtained. Those

experiments provided no evidence for the presence of functional PTHr in the selected bone marrow stromal cell line alone (GBLneo). Subclones of GBLneo stromal cells stably transfected with functional PTHr were also established. These subclones exhibited expected patterns of binding of human PTH and PTHrP and dose-dependent cAMP accumulation but no stimulation of IL-6 secretion in response to PTH.

CONCLUSIONS: These results suggest that either local interaction between stromal cells and putative osteoclast progenitors is necessary to induce expression of functional PTHr on the stromal cells or, alternatively, that one or more cell types within the non-adherent cell population may be the PTH responsive cell and that the action of PTH on this cell requires the presence of the stromal cells to affect osteoclastic differentiation. These engineered cells should provide the basis for a new model system for the study of the mechanism of action of PTH in marrow and marrow derived cells.

26 ISOLATED SOFT TISSUE CLEFT LIP: THE INFLUENCE ON THE NASAL CAVITY AND SUPERNUMERARY LATERALS

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Cleft lip is often used in the literature as a synonym for clefts of both lip and alveolar process (primary palate). From a clinical point of view, however, it is of interest to separate an isolated cleft lip from a cleft lip/alveolar process.

AIM: To estimate the vertical deviation of the nasal floor and to register dental disturbances i.e. hypo- and hyperdontia in patients with an isolated soft tissue cleft lip.

SUBJECTS: Thirty patients with isolated cleft lips were randomly selected from the files of the Department of Maxillo-Facial Surgery and Jaw Orthopedics. As a matched control group, 30 patients were selected from the files of the Department of Orthodontics.

METHODS: Panoramic radiographs were analysed and the lowest point of the floor of the left and right nasal cavity was measured to the nearest 0.5 mm. The presence of supernumeraries (deciduous or permanent) or missing laterals was recorded from the patients' files.

RESULTS: The vertical position of the nasal floor differed significantly between the cleft and the non-cleft side ($P < 0.001$). Supernumerary, deciduous and/or permanent laterals were recorded in 73 per cent of the subjects in the cleft lip group (22 cases). In the control group no differences were found between the position of the nasal floor on the left and right side and no supernumerary laterals were recorded. Missing laterals were not noted in any of the individuals investigated.

CONCLUSIONS: Isolated cleft lips were in most cases associated with (1) lowering of the nasal floor on the cleft side (2) supernumerary primary and/or permanent lateral

incisors on the cleft side. Panoramic radiographs can be used to detect differences in the vertical position of the floor of the nasal cavity in patients with isolated cleft lips and to diagnose supernumerary laterals.

27 APICAL ROOT RESORPTION IN PATIENTS TREATED WITH COMPREHENSIVE ORTHODONTICS

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External apical root resorption (EARR) is a common, but seldom extreme, consequence of orthodontic treatment. Incisors are most at risk, perhaps because of their single roots and because they typically are moved further than other teeth.

AIM: To examine prospectively the EARR in individuals who had undergone orthodontic treatment.

SUBJECTS: A cohort of patients ($n=153$) treated with comprehensive orthodontics was followed in this study.

METHODS: EARR was scored on the upper incisors with a qualitative 5-grade ordinal scale.

RESULTS: There was no EARR at the start of treatment, but most (>80 per cent) exhibited slight to moderate EARR by the end of treatment (i.e. a mean loss of 1–2 mm). Patients treated with premolar extractions experienced more EARR because their incisors were retracted further. However, the sum of the effects of the patient's sex and age, and severity of the malocclusion, and the mechanics used accounted for little of the overall variation in EARR.

CONCLUSION: It is not possible at present to identify prior to treatment those individuals who will experience excessive EARR.

28 MANDIBULAR MOBILITY IN CHILDREN WITH ANGLE CLASS II DIVISION 2 MALOCCLUSIONS

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AIM: Correction of the occlusion in Angle Class II division 2 patients is often more complicated and tedious than Class II division 1 cases. The aim of the study was to compare the mandibular mobility of children presenting with Angle Class II division 2 with that in eugnathic controls, with functional status revealing the appropriate age for incisor uprighting and adjustment of the occlusion.

SUBJECTS: The investigations covered 32 probands with Angle Class II division 2 malocclusions and 45 with eugnathic occlusion. The mean ages were 10.7 years and 10.5 years, respectively.

METHODS: Three-dimensional (3D) tracing of mandibular movements was performed axiographically, using a String-Condylcomp LR3 system. This is a close-to-joint recording

procedure providing optoelectric data transmission and allowing no touch recordings of mandibular motion.

RESULTS: Overall it was demonstrated that the probands in the deep bite group had more leeway for temporomandibular joint movement. Comparison with eugnathic age peers revealed increased mobility mainly in mandibular protrusion. The angle of condylar path inclination was higher in the Class II division 2 group, i.e. the slope was steeper. The differences found for 3D movement reached 4.5 degrees for protrusion ($P<0.001$), 6.0 degrees for opening ($P<0.001$) and 4.3 for mediotrusion ($P<0.001$), but the condylar path inclination was less pronounced at that age than in adult patients.

CONCLUSION: Contrary to information in earlier reports, Class II division 2 patients between 8 and 12 years of age show higher mandibular mobility than their eugnathic age peers. Age-dependency demonstrated for the typical joint morphology in deep bite patients and the incisor inclination governing this functional adaptation early treatment during the mixed dentition period is justified.

29 ADENOIDAL INVOLUTION PATTERNS AND VELOPHARYNGEAL COMPETENCE IN CLEFT PALATE PATIENTS

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AIM: (1) To examine the differences of the adenoidal involution patterns between cleft palate patients and a non-cleft control group, and (2) To investigate the relationship between adenoidal involution and the nasality of speech in cleft palate patients

SUBJECTS: Seventy-seven patients with cleft palate or cleft lip and palate, and 64 orthodontically treated patients without clefting (control group).

METHODS: The lateral cephalograms of the patients were analysed concerning the size and localization of the adenoids. The radiographs were taken longitudinally from 8 to 19 years of age. Hypernasality was chosen as a parameter for velopharyngeal insufficiency and measured using the Nasometer 6200. The nasalance scores were related to the adenoidal involution patterns (Pearson's correlation).

RESULTS: The amount of adenoid tissue atrophy was comparable in the two groups, whereas the direction of the involution was different in the cleft palate group and the residual adenoid tissue was localized more frequently at the level of velopharyngeal closure. In the cleft palate group the velopharyngeal function was strongly affected by the amount as well as direction of adenoidal involution.

CONCLUSION: The adenoid tissue plays an important role in velopharyngeal competence. It could be demonstrated that the direction of involution as well as the amount of the residual tissue was important for the velopharyngeal competence in cleft palate patients.

30 UPPER CERVICAL SPINE MALFORMATIONS IN CLEFT LIP AND PALATE PATIENTS

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AIM: As the period of formation of cleft lip and palate (CLP) covers the same *in utero* time span as development of the cervical spine, it was the aim of this study to assess the incidence of CLP and malformations of the cervical spine.

SUBJECTS: Two hundred and forty-six patients with CLP and cervical spine abnormalities (group 1) were compared with a matched control (group 2, n=246) aged between 6 and 20 years.

METHODS: Twenty-four different kinds of osseous alterations of the cervical spine were analysed radiologically using standardized lateral cephalograms. Differences between the two groups were tested statistically with *t*- and Chi-square-tests at a level of $P < 0.05$.

RESULTS: Overall, the CLP-group showed significantly more osseous malformations of the cervical spine (74.4 per cent, $P = 0.001$) than the control group (54.9 per cent). In the atlanto-occipital region a double contouring of the occipital condyles were found in 5.7 per cent of CLP patients compared with the control group ($P = 0.4$). In the region of C2/C3 a hypertrophic odontoid was identified more often in CLP subjects than in unaffected cases (CLP: 4.5 per cent, $P = 0.01$) often resulting in a basilar impression. Similar results were found concerning the fusion of C3 and C4 (CLP 8.6 per cent, $P = 0.01$) and a subdental epiphysis (CLP: 15.5 per cent, $P = 0.05$).

CONCLUSIONS: Morphological alterations of the upper cervical spine are more often found in patients with clefts of the lip, alveolus and palate than in the normal population. This may play a major role in patients with palatopharyngeal incompetence. Although the risk of instability is rare, nevertheless, this condition should be taken into account as a possible complication when treating these patients.

31 INTRA-ORAL MAXILLARY UNILATERAL MOLAR DISTALIZATION WITH SLIDING MECHANICS—THE MOLAR SLIDER

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AIM: To develop and investigate a new appliance which would avoid distal tipping of Class II maxillary first molars and minimize patient co-operation (no headgear, elastics or removable appliance).

SUBJECTS: Fifteen patients (8 males, 7 females) with a mean age of 13.32 years, were selected for unilateral molar distalization. Dentally, all the patients presented a unilateral Class II molar relationship in the permanent dentition. The second molars were erupted and the lower dental arch was well aligned.

METHOD: For maxillary molar distalization a new intra-oral appliance, the molar slider was developed. It consisted of two premolar and two molar bands and the anchorage unit was a wide Nance button. On the palatal side, the point of distal force application was carried towards the centre of resistance of the maxillary first molar in order to achieve bodily distal movement. A Ni-Ti coil spring was used and 200 g of distal force was applied to the first molars. Lateral cephalograms and cast models were taken and analysed before and two months after molar distalization.

RESULTS: The results showed that the Class II molars distalized bodily on average 4.9 mm ($P < 0.001$). Anchorage loss of 1.3 mm ($P < 0.05$) at the first premolar was observed. There was 1.8 mm of incisor protrusion ($P < 0.05$) and 3.2 degrees ($P < 0.05$) of incisor proclination. The overbite reduced 3.1 mm ($P < 0.001$) and overjet increased 2 mm ($P < 0.01$). During the two-month stabilization period with the Nance button the overjet reduced, and with the help of the transeptal fibres the first premolars drifted distally.

CONCLUSION: Unlike other molar distalization mechanics this newly developed device achieves bodily distal movement of Class II first molars with minimum anchorage loss. This appliance can be used unilaterally or bilaterally in the treatment of patients with Class II division 1 and 2 malocclusions.

32 CRANIOFACIAL MORPHOLOGY IN PATIENTS WITH A MEDIAN MAXILLARY CENTRAL INCISOR

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AIM: The occurrence of a solitary median maxillary central incisor (SMMCI) is a very rare condition and might be a sign of a mild degree of holoprosencephaly. The purpose of this study was to evaluate the clinical characteristics and craniofacial morphology in a group of patients with a SMMCI.

MATERIAL AND METHOD: Oral photographs, study casts, profile radiographs and orthopantomograms from 10 patients, 9 girls and 1 boy, with a SMMCI (8 to 17 years of age) registered in orthodontic clinics were examined and analysed.

RESULTS: This group of SMMCI patients had an indistinct philtrum, an arch-shaped upper lip, absence of the fraenum of the upper lip, a complete or incomplete midpalatal ridge, and nasal obstruction or septum deviation. The craniofacial morphology showed a short anterior cranial base, a short, retrognathic and posteriorly inclined maxilla, and a retrognathic and posteriorly inclined mandible. Furthermore, the sella turcica had a deviant morphology in five subjects.

CONCLUSION: The presence of a SMMCI should not be considered as a simple dental anomaly, since it is associated with other clinical characteristics and more complex

craniofacial malformations. It is suggested that the SMMCI condition in future studies is classified according to clinical symptoms and craniofacial morphology,

33 CRANIOFACIAL MORPHOLOGY AND DENTAL MATURITY IN SHORT STATURE CHILDREN

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AIM: To study the craniofacial morphology, dental occlusion, dental maturation and tooth eruption in healthy short stature boys with growth hormone (GH) secretion ranging from low to high.

SUBJECTS: Forty-eight boys with short stature were examined. Twenty boys (mean age 12.1 years) were classified as GH-deficient and 28 boys showed a slow growth rate during postnatal life.

METHODS: Lateral and postero-anterior cephalograms, plaster models and photographs were taken for studying craniofacial morphology and dental occlusion. Dental maturity was recorded on panoramic radiographs, and rated in accordance with the method described by Demirjian *et al.* (1973). Tooth eruption was assessed on plaster models.

RESULTS: All linear measurements of the facial structures, except for the anterior cranial base and the mandibular corpus, were significantly smaller. A disproportionate growth in the cranial base structures as well as in the jaws, especially the mandible, resulted in facial retrognathia, a proportionally smaller posterior than anterior facial height, and an increased vertical inclination of the mandible. Dental crowding was more common and the overbite was decreased compared with the population. Dental maturity and tooth eruption was delayed on average 1.2 and 1.3 years, respectively, which was less than the average delay of 1.8 years for the bone age. No significant differences between the non-GH-deficient and the GH-deficient group for any of the above mentioned variables were found.

CONCLUSION: Although most of the cephalometric variables measured differed significantly from the average, the facial appearance of the boys is not conspicuous and is of minor clinical importance. However, the short stature boys might have a greater need for orthodontic treatment due to the higher percentage of dental crowding.

34 MANAGING ORTHODONTIC TREATMENT IN PATIENTS WITH PERIODONTAL PROBLEMS

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(KEYNOTE ADDRESS)

Most orthodontic patients have an 'intact' dentition and a healthy periodontium. As a result, orthodontists are often complacent and overlook the importance of a periodontal

examination. After all children and adolescents are generally not susceptible to periodontal bone loss, so why take the time to assess the periodontium. However, if this complacent attitude is used to treat adult patients, the periodontal health could be compromised. Interproximal cratering, furcation defects, hemispetal defects, two- and three-wall defects, and isolated and generalized advanced attachment loss can be improved substantially during orthodontic treatment if the clinician recognizes the problem and institutes the appropriate tooth movement.

Since most orthodontists now treat between 25 and 40 per cent of adults, and since orthodontists do not generally keep up to date on recent advances in periodontal therapy, it is important to occasionally review the current philosophy regarding management of the periodontal patient. This presentation will use many clinical examples to describe the treatment options for various common periodontal problems found in adult orthodontic patients.

35 SIMULTANEOUS LIP-VELAR CLOSURE IN UNILATERAL CLEFT PATIENTS—MAXILLARY MORPHOLOGY AND OCCLUSION

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AIM: To investigate the impact of simultaneous lip repair and velar closure on dentoalveolar development, occlusion and maxillary morphology of complete unilateral cleft lip and palate (UCLP) patients at different ages.

SUBJECTS: Twenty-nine Brazilian and 30 Caucasian children with complete UCLP but no other craniofacial anomalies were studied. The first group was operated on for lip-nose repair and velar closure concomitantly (mean age: 8 months). The second group was operated on at three separate sessions: lip adhesion (mean age: 2 months), soft palate closure (mean age: 6 months) and final lip-nose reconstruction (mean age: 18 months). All the surgical procedures were performed by the same team from Sahlgrenska University Hospital, Göteborg, Sweden.

METHODS: Maxillary morphology, dentoalveolar development and occlusion were measured with sliding callipers and a simple three-dimensional technique from a series of stone casts obtained at different ages. Statistical differences between the groups were tested with unpaired *t*-tests for continuous and with a Chi-square test for nominal variables.

RESULTS: Significant differences found between the groups were in accordance to the pre-operative differences between them. Maxillary arch width seemed to be influenced more during the immediate post-operative period in the group with simultaneous closure but later returned to the initial differences. Maxillary arch length appeared to be influenced more by the early complete reconstruction in the Brazilian group. The residual cleft was also found to be significantly larger in this latter group. No significant differences were found either in crossbite incidence or in occlusal development.

CONCLUSION: Early simultaneous lip reconstruction and soft palate closure in UCLP patients does not seem to have any negative effect on the maxillary growth potential when compared with the result after the staged approach. The advantage of combining three surgeries into one procedure is obvious both from the point of economy and patient care.

36 THREE-DIMENSIONAL CHANGES OF CONDYLAR POSITION DURING PRE-ORTHODONTIC SPLINT THERAPY

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AIM: To demonstrate three-dimensional (3D) changes of condylar position during initial splint therapy before orthodontic treatment and the consequences for orthodontic treatment planning.

SUBJECTS: Thirty patients attending the Department of Orthodontics suffering pre-orthodontically from acute or chronic craniomandibular disorders (CMD).

METHODS: Impressions were taken by the pressureless method. With centric recordings, axiographic measurements and individual facebows, the casts were mounted in Girsch Reference-i articulator. The *x*, *y* and *z* co-ordinates of condylar position were measured (IP, CR etc.) during treatment in a newly constructed computer-based condyle-position-analyser (CPA). The measurements were calculated in Excel 97 (Micro-Soft Corp.) and interpreted by SPSS 7.5 (SPSS, Inc.).

RESULTS: The dorso-cranial condyle position (IP:CR) was changed by initial splint therapy ($P < 0.01$). However this position does not remain stable for long. Changes can be measured at the first 5 to 6 recall sessions. As treatment progresses the changed condylar position often returns to its position at the beginning of treatment. The *x*- and *z*-positions at the end of initial treatment were changed statistically significantly compared with the start positions ($P < 0.02/P < 0.001$).

CONCLUSION: Condylar position changes during initial functional therapy with splints in orthodontic patients with CMD. The alteration of position sometimes changes the occlusal relationship so that initial orthodontic treatment planning has to be adapted to the new condylar position.

37 TREATMENT OF ADULT CLASS II MALOCCLUSIONS: HERBST VERSUS ORTHOGNATHIC SURGERY

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AIM: To compare the effect of the Herbst appliance and surgical sagittal split osteotomy on the facial profile

in the treatment of adult subjects with Class II malocclusions.

SUBJECTS: Twelve Herbst (mean age 18 years) and 16 surgery (mean age 25 years) patients were evaluated. The average total treatment time for both groups including the post-Herbst and post-surgery fixed appliance period was 2 years. All Herbst and surgery subjects were treated to Class I dental arch relationships with normal overjet and overbite. **METHODS:** Pre- and post-treatment lateral head films were analyzed with respect to sagittal jaw base relationship, interjaw base angle, skeletal and soft tissue profile convexity, and upper and lower lip position.

RESULTS: (1) The sagittal jaw base relationship improved by the same amount in both groups. (2) The interjaw base angle opened in the surgery and closed in the Herbst group. (3) Skeletal profile convexity was reduced comparably in both groups. (4) Soft tissue profile convexity decreased more in the surgery than in the Herbst group. (5) The upper lip became more retrusive in the surgery than in the Herbst group. (6) The lower lip was retruded in the surgery group, while it remained unchanged in the Herbst group.

CONCLUSION: In adult Class II patients Herbst treatment improved the facial profile similar to that seen in orthognathic surgery. Thus, Herbst therapy could be an alternative to surgical Class II correction.

38 AXIOGRAPHIC EVALUATION OF TEMPOROMANDIBULAR JOINT FUNCTION AFTER ORTHOGNATHIC SURGERY

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AIM: To compare the temporomandibular joint (TMJ) tracings of patients who had undergone orthognathic surgery with healthy individuals without any TMJ symptoms.

SUBJECTS AND METHODS: The orthognathic surgery group consisted of 50 patients (mean age 22.4 years); 8 with maxillary impaction and mandibular advancement, 29 with maxillary impaction and mandibular setback, 13 with mandibular setback only. All operations were performed by the same plastic surgeon. The control group consisted of 20 individuals (mean age 21.8) with a Class I skeletal relationship, normal overjet and overbite and no symptoms of temporomandibular dysfunction. The records of the surgery group were taken at least one year post-operatively (mean 20.7 months). Tracings of opening and protrusive movements of the mandible were recorded using the SAM axiograph and measurements were made on the recorded tracings. Data were analysed with a Student's *t*-test via SPSS software. The surgical groups were tested within and with the control group.

RESULTS: In the surgical groups opening and protrusive tracings were shorter than in the control group ($P < 0.05$). These two tracings were shorter also in the advancement group compared with the mandibular setback and control groups ($P < 0.05$). Reproducibility also decreased ($P < 0.05$).

in the advancement group presenting these patients as a risk group for TMD. On the other hand, in the mixed setback group, opening measurements were shorter with significantly less reproducibility compared with the controls. Reproducibility of protrusive measurement was also significantly less in the setback group ($P < 0.05$).

CONCLUSION: These results show that patients have short condylar tracings with both setback and advancement surgery even after 20 months. It was known that patients with a malocclusion have reduced chewing function before surgery. This study shows that the operation does not seem to improve it.

39 IS INFANT ORTHOPAEDICS EFFECTIVE IN UNILATERAL CLEFT LIP AND PALATE?

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AIM: To investigate the effect of infant orthopaedics (IO) in children with a complete unilateral cleft lip and palate (UCLP).

SUBJECTS: In a prospective randomized clinical trial 54 subjects with complete UCLP were randomized by computer to one of two groups, i.e. IO or no IO. The randomization procedure was concealed, the outcome assessment was blind. Ethical approval was obtained.

METHODS: The IO treatment was a modified Zurich approach. Timing, type and sequence of operations were standardized between the centres. A standard schedule of record taking was used in all centres. The following outcome variables were studied:

- A. General: influence on feeding, weight gain, parents' satisfaction
- B. Orthodontic: aesthetics, maxillary arch dimensions, maxillofacial growth
- C. Speech
- D. Cost-effectiveness

RESULTS: At 2.5 years of age only for speech and costs were significant differences between the two groups found. At that age the IO group obtained higher overall assessments for speech than the non-IO group, but speech in both groups was still worse compared with their non-cleft peers. A highly significant difference in costs was observed, infant orthopaedics being much more expensive than the alternative.

CONCLUSION: A randomized inter-centre prospective clinical trial is a strong design to investigate these two clinical alternatives in early CLP-treatment. At the age of 2.5 years the effect of IO seems to be limited. However, especially the effect on speech should be investigated further. At 6 years of age all children will be evaluated again for all variables.

40 PERIORAL ELECTROMYOGRAPHY AND LIP PRESSURE MEASUREMENTS IN CLASS II DIVISION 2 SUBJECTS

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AIM: To analyse perioral muscle activity and lip pressure on the upper central incisors in Angle Class II division 2 and Class I patients.

SUBJECTS: Seventeen Class II division 2 adult subjects with deep anterior overbite and 17 Class I adult subjects with normal anterior relationships.

METHODS: Myoelectric signals from the upper and lower orbicularis oris, depressor anguli oris and mentalis muscles were recorded simultaneously with new bipolar miniature surface electrodes (4 mm in diameter, distance centre to centre = 8 mm). For measuring the lip pressure, both upper central incisors were separately equipped with a newly developed capacitive miniature force sensor (5×4×1mm). The lower edge was positioned at the same vertical level as the incisal edge. The resting lip pressure has been reported to be the most relevant parameter. This value was determined as the difference in pressure between resting lip position and lip protrusion (no contact between lips and sensors) and was registered after swallowing and humming. The vertical relationship between the lip line and the incisal edge of the upper centrals was clinically determined.

RESULTS: Due to the high sensitivity of the methods it was possible to determine differences in resting lip pressures between the assessed groups. The Class II division 2 patients showed higher resting lip pressures against the upper centrals than the controls. The resting lip pressure correlated with the extent of coverage of the upper central incisors by the lower lip.

CONCLUSION: There is a special facial morphology in Class II division 2 patients, where the retroclination of the upper central incisors is the result of a relatively high resting lip pressure exerted by the lower lip onto these teeth.

41 EFFECTS OF ELECTRIC CURRENT ON HEALING OF PARTIALLY CONDYLECTOMIZED MANDIBLES IN GROWING RABBITS

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AIM: There has been considerable interest in the benefits of electrical stimulation during fracture healing, but it was unknown how the fibrocartilage of the mandibular condyle would respond. The aim of this study was to examine the effects of electric current on partially condylectomized mandibles in growing rabbits.

MATERIAL: The rabbits were divided into four groups, six animals per group. The groups consisted of a positive

(anode) group, a negative (cathode) group, a non-stimulation group, and a control group.

METHODS: A partial condylectomy was performed on the right temporomandibular joint (TMJ) of all rabbits. Platinum electrodes were implanted in all 18 rabbits of the three experimental groups (positive, negative, and non-stimulation). The positive and negative groups received a constant current of 25 μ A of electrical stimulation. The non-stimulation group had an electrode placed on the right TMJ, but received no electrical stimulation. The control group had a condylectomy performed on the right TMJ, but no electrode was placed on the condylectomized joint. Two vital dyes were administered at the 22nd (calcein) and 28th (tetracycline) day of the experiment.

RESULTS: Histomorphometric analysis revealed statistically significant differences ($P < 0.001$). The negative group was associated with more osteoblasts, fewer osteoclasts, and greater bone volume. The positive group was associated with fewer osteoblasts, more osteoclasts, and less bone volume.

CONCLUSION: These findings suggest a role of negative stimulation enhancing osteogenesis, and a role of positive electrical stimulation in bone destruction in the condylar caputulum.

42 LONG-TERM STATUS OF SELF-PERCEPTIONS AND OCCLUSAL, SOFT TISSUE PROFILE AND FUNCTIONAL OUTCOMES OF ORTHOGNATHIC SURGERY

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AIM: To assess the relationship between long-term status of self-perceptions and degree of malocclusion changes, soft tissue profile alterations, and long-term functional status of orthognathic surgery patients.

SUBJECTS: Thirty-nine patients who had orthognathic surgery 10-14 years previously were examined.

METHODS: Psychological evaluation using five questionnaires to assess body image, self-esteem, level of satisfaction and changes in function, health, appearance and interpersonal relationships was undertaken. The PAR index was used for measuring occlusal improvement between pre-treatment and long-term post-treatment study models. Soft tissue profile alterations during the same period were made by computerized cephalometry utilizing 13 variables. Evaluation of the stomatognathic functional status was carried out using Helkimo's anamnestic and clinical dysfunction indices. The patients were divided into three groups according to the percentage of improvement in the PAR index, the cephalometric analysis and

the Helkimo indices. The results were evaluated with the corresponding or relevant answers of the questionnaires by means of *t*-test or ANOVA.

RESULTS: A high level of satisfaction, a subjective estimation of improvement in function, appearance, health and interpersonal relationships characterized patients long-term after orthognathic surgery. There was no correlation between the objectively assessed changes and the corresponding subjectively evaluated ones.

43 ORTHOGNATHIC TREATMENT: EARLY SURGERY REDUCES ORTHODONTIC TREATMENT TIME

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AIM: To determine whether orthodontic treatment duration is altered by the timing of orthognathic surgery.

SUBJECTS: Eighty-four patients who had undergone orthognathic surgery, 61 at a teaching hospital and 23 at a regional specialist unit, were assessed 3-5 years after the commencement of treatment. The duration, timing of treatment and the number of visits were assessed. A patient satisfaction questionnaire and self-assessment were undertaken and a PAR score of the models before and after treatment was recorded.

RESULTS: Overall orthodontic treatment time was significantly different (mean 26 months) when surgery was undertaken earlier rather than later (mean 36 months). The post-operative treatment time was similar in both units as was the number of visits (8 and 6 months, respectively). The quality of the results was high, with a PAR index reduction of 83.9 and 82.7 per cent, respectively and a satisfaction level of 100 and 91 per cent, respectively in both groups.

CONCLUSIONS: Early surgery results in a shorter overall treatment time. Clinically this is probably related to more efficient patient management in association with accelerated tooth movement post-operatively.

44 LONG-TERM FOLLOW-UP OF MAXILLARY INCISORS WITH SEVERE APICAL ROOT RESORPTION

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AIM: To analyse the mobility of teeth with severe orthodontically-induced root resorption at follow-up several years after active treatment, and to evaluate mobility in relation to root length and alveolar bone support.

MATERIAL: Seventy-three maxillary incisors were examined in 20 patients, 10-15 years after active treatment in 13 patients (age 24-32 years) and 5-10 years after active treatment in 7 patients (age 20-25 years).

METHODS: Root and intra-alveolar root length was measured on intra-oral radiographs. Tooth mobility was assessed clinically according to Miller's index (0–4) and the Periotest method. Crestal alveolar bone level, periodontal pocket depth, gingival and plaque indices, occlusal contacts during occlusion and function, and occlusal wear were recorded.

RESULTS: There was a significant correlation between tooth mobility and root length and intra-alveolar root length. No correlation was found between tooth mobility or Periotest value and retention with twistflex retainers. None of the variables for assessment of periodontal status, occlusion and function were related to root length or tooth mobility. There is a risk of tooth mobility in a maxillary incisor that undergoes severe root resorption during orthodontic treatment if the remaining root length is <9 mm. The risk is less if the remaining root is length >9 mm, and the periodontium is healthy. Retention with a twistflex archwire does not prevent mobility of resorbed teeth.

CONCLUSIONS: The follow-up of teeth with severe orthodontically-induced root resorption is indicated, and for clinical assessment of stability the Periotest is an appropriate method.

45 SAGITTAL MOVEMENT OF MAXILLARY STRUCTURES IN CLEFT LIP AND PALATE PATIENTS DURING CRANIOFACIAL GROWTH

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AIM: To reveal whether or not active dorsal movement of maxillary structures is necessary during craniofacial growth in patients with complete unilateral (UCLP) and bilateral (BCLP) cleft lip and palate.

SUBJECTS: Fifty-six UCLP and 37 BCLP patients were selected according to the following criteria: complete clefting, entirely treated by the cleft palate team at Hannover Medical School from birth to early adulthood. During the course of treatment, no active retractive force was applied to the maxillary teeth or bony structures.

METHODS: Lateral cephalograms taken at the beginning of the early mixed dentition and after complete eruption of the permanent dentition were evaluated. Sagittal (SNA, SNB, ANB) and incisor (IIs/NL, Ili/ML) angles were measured, mean values and standard deviations were compared. Paired *t*-tests were performed.

RESULTS: Patients with UCLP showed a significant reduction of SNA ($P < 0.05$) along with an unremarkable increase of SNB, resulting in a significant decrease of ANB ($P < 0.01$). The upper incisors were markedly protruded ($P < 0.05$). Similar results were observed for BCLP patients. SNA was significantly reduced ($P < 0.01$), SNB increased ($P < 0.05$) and ANB reduced ($P < 0.01$), along with proclined upper incisors ($P < 0.05$).

CONCLUSION: Despite the absence of retractive forces, the maxilla in cleft patients presents a lack of forward movement due to growth restrictions. This indicates that

active dorsal movement of maxillary structures is not desirable during the treatment of patients with complete cleft lip and palate.

46 COMPOSITE BONE GRAFTS FOR OROFACIAL SURGERY—A STUDY IN GOATS

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AIM: To evaluate the suitability of mixtures of particulated cortical or cancellous bone and bovine bone mineral (BBM) as implant material in orofacial surgery.

MATERIAL: Skeletally mature goats.

METHODS: In each goat four trephine holes (\varnothing 14 mm) were prepared in the bones overlying the frontal sinus. The mucosal lining was not avulsed. These critical size defects were filled at random with mixtures (1:1) of either particulated cancellous bone from the iliac crest and Bio-Oss®, a commercially available bovine bone mineral (BBM), or particulated cortical bone derived from the gonial angle and Bio-Oss®. Histological evaluation was performed at 3, 6, 12, and 24 weeks after implantation.

RESULTS: Cancellous/BBM: The defects were almost bridged by new bone at 6 weeks post-operatively (p.o.). Most of the BBM particles were surrounded by new bone emerging from the cancellous bone particles. Multinucleated osteoclast-like cells were attached to particles that were not incorporated. Bridging was complete at 12 weeks. The remaining BBM particles were subsequently integrated in young bone and took part in normal bone remodelling. Cortical/BBM: At 6 weeks p.o. BBM particles were only incorporated at the edges of the defect, where bone deposition took place. Multinucleated osteoclast-like cells were attached to most free BBM articles in the defect. At 12 and 24 weeks p.o. none of the defects was completely bridged. In the centre of the defect BBM and cortical bone particles were surrounded by fibrous connective tissue. Osteoclast-like cells still present at 12 weeks had disappeared at 24 weeks.

CONCLUSION: A mixture of particulated autogenous cancellous bone and BBM is a reliable graft material for the treatment of critical size defects in the orofacial region.

47 A GENETIC STUDY OF CLASS II DIVISION 2 MALOCCLUSIONS

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AIMS: To investigate the genetics of Class II division 2 malocclusions. The first part of the study was to determine the frequency of this malocclusion in general and family populations. The second part was an investigation of concordance-discordance rates for Class II division 2 malocclusions between monozygotic and dizygotic twins.

RESULTS: From 2,812 members of the general population, 231 (8.21 per cent) presented with the malocclusion, while from 442 members of a family population, 206 (46.61 per cent) presented with the malocclusion. There was a statistically high difference between these two populations. Such a finding indicated genetic aetiology of Class II division 2 malocclusions. The twin sample investigated consisted of 21 pairs of monozygotic (MZ) and 11 dizygotic (DZ) twins. All MZ pairs were concordant for the malocclusion, whereas out of the 11 pairs of DZ twins, 10 were discordant for the malocclusion, and only one concordant. Such a finding was highly indicative for genetic aetiology of Class II division 2 malocclusions.

CONCLUSION: Heredity seems to be the main aetiological factor of Class II division 2 malocclusions.

48 OCCLUSION IN BILATERAL CLEFT PATIENTS AFTER DIFFERENT PALATAL SURGERY

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AIM: To compare long-term results of dental arch morphology and occlusion of two groups of patients with bilateral cleft lip and palate (BCLP). The groups differed mainly in the routine for the palatal surgery, particularly with respect to timing of the hard palate repair.

SUBJECTS: The 'delayed hard palate repair' group consisted of 16 BCLP patients, most of them followed to early adulthood. They were operated on with early velar closure and delayed (mixed dentition) hard palate repair. The 'early hard and soft palate repair' group consisted of 12 BCLP, all followed to early adulthood. The cleft in the palate was repaired with a vomer flap anteriorly (hard palate) and with push back closure of the soft palate, both procedures before 12 months of age. All patients were Caucasians and had no other craniofacial anomalies. All were operated on by the same surgical team from Sahlgrenska University Hospital, Göteborg, Sweden.

METHODS: Two-dimensional pre- and post-operative maxillary morphology, dental arch morphology and occlusion documented by casts, were measured with a sliding calliper. The technique to measure the casts was found to be accurate according to the method error calculation. To test for any statistically significant differences between the groups, the Mann Whitney-*U* test was used.

RESULTS: Significant favourable differences were found for the 'delayed hard palate repair' group. Maxillary arch depth at age 1.5 years, upper and lower intercanine and upper first molar width, as well as overjet, overbite and crossbite score at age 3 years, and also crossbite score at age 10 years were better in this group. Superior occlusal dimensions for the 'delayed hard palate repair' group were also evident at other ages.

CONCLUSION: Delayed hard palate repair in BCLP patients results in improved maxillary morphology and occlusion than early hard palate repair, indicating less growth disturbance after the former surgical method.

49 SURGICAL INFLUENCE ON DENTOFACIAL MORPHOLOGY IN BILATERAL CLEFT LIP AND PALATE PATIENTS

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AIM: To examine the surgical influence upon dentofacial morphology in bilateral cleft lip and palate (BCLP) children.

SUBJECTS: Forty complete BCLP subjects with no other malformations. All patients were white males in the mixed dentition with an age range of 6 to 12 years. They were divided into two groups according to the surgical protocol. The first group comprised 14 unoperated subjects and other group 26 children whose operations were performed by the plastic surgery team of the HRAC-USP.

METHODS: Lateral head cephalometry.

RESULTS: Operated BCLP children, when compared with the unoperated group, showed a smaller ($P < 0.01$) and more retrusive maxilla ($P < 0.01$) associated with an upper incisor retroclination ($P < 0.01$) that improved facial convexity ($P < 0.01$), overjet ($P < 0.01$) and overbite ($P < 0.01$). No difference was found regarding lower incisor position, mandibular morphology, growth direction and facial heights.

CONCLUSIONS: Primary lip and palate surgery promotes beneficial changes in the dentofacial morphology of BCLP children. Changes in mandibular morphology, facial growth direction and facial heights usually observed in operated BCLP, cannot be attributed as a surgical consequence.

50 DENTOFACIAL MORPHOLOGY IN ADULTS WHO HAVE UNDERGONE ACTIVATOR TREATMENT DURING CHILDHOOD

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AIM: To study dentofacial morphology in adults whose Class II malocclusions had been successfully treated with the Bass activator during childhood.

SUBJECTS: Twenty-six adults who had been treated with the Bass activator at the approximate age of 11 years. Their adult dentofacial morphology was compared with that of 26 age- and sex-matched adults whose occlusion had developed normally without orthodontic treatment. The patients' pre-treatment cephalometric records were compared with the records of the 26 age- and sex-matched children with neutral occlusion.

METHODS: Lateral cephalometric head films were used for recording 32 skeletal and dental variables. The patients' pre-treatment and adult cephalometric records were compared with the records of their respective control group. Differences between patients and controls were tested for significance with the unpaired *t*-test.

RESULTS: Before treatment the patient and control groups differed with respect to several skeletal and soft tissue variables. Improved, but not normal dentofacial morphology, was achieved with the activator treatment

(Ömblus *et al.*, 1989). At adulthood, however, no differences between patients and controls were found.

CONCLUSION: After successful treatment of a Class II malocclusion with the activator, the subsequent dentofacial development seems to follow a normal path. At adulthood, 10 years after treatment, the former activator patient exhibits a dentofacial morphology that is comparable with that found in untreated adults with normal occlusion.

51 OUTCOME OF CLASS II DIVISION 2 AND CLASS II DIVISION 1 THERAPY USING DIFFERENT TREATMENT APPROACHES

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AIM: To assess the PAR-outcome of Class II division 2 and Class II division 1 therapy comparing the conventional treatment approach (removable and/or multibracket appliances) with the bite jumping approach (Herbst plus multibracket appliance).

SUBJECTS: Patients aged 10 to 15 years treated in the late mixed and permanent dentition. Conventional approach: Class II division 2 (n = 23); Class II division 1 (n = 75). Bite jumping approach: Class II division 2 (n = 14); Class II division 1 (n = 30).

METHODS: Analysis of dental casts from before and after orthodontic treatment using the PAR-Index as well as the PAR-components: overjet, overbite and lateral sagittal occlusion.

RESULTS: When using the bite jumping approach (BJ) the results were improved (percentage PAR reduction) than when using the conventional approach (C). This was true for both Class II division 2 (BJ = 76 per cent; C = 65 per cent) and Class II division 1 (BJ = 76 per cent; C = 68 per cent) subjects. In both malocclusion groups the overjet and overbite were normalized comparably, while lateral sagittal occlusion improved in the bite jumping sample.

CONCLUSION: The outcome of both Class II division 2 and Class II division 1 orthodontic therapy was better in subjects treated with the Herbst plus multibracket appliance than in subjects treated with conventional removable and/or multibracket appliances.

52 SIMULTANEOUS INTRA-ORAL DISTALIZATION OF MAXILLARY FIRST AND SECOND MOLARS

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AIM: To evaluate the dental, skeletal and soft tissue changes associated with the use of an intra-oral device for simultaneous distalization of the maxillary first and second molars.

SUBJECTS: Fourteen patients aged 10.5 to 16 years (mean age 13.4 ± 2.1 years) with a Class II molar relationship

received first phase orthodontic treatment by means of the intra-oral distalization device for approximately 17 weeks.

METHODS: Registrations were made by means of lateral cephalometric radiographs and study models taken before and after treatment. The tracings of the radiographs and the study models were electronically scanned and digitized using the program, Viewbox 2.5. Twenty-eight cephalometric and 38 model variables were utilized. A Student's *t*-test was used to assess differences between pre- and post-treatment measurements. The error of the method was determined by retracing and redigitizing of 14 radiographs and nine study models, both randomly selected.

RESULTS: The Class II molar relationship was corrected by means of the intra-oral appliance to Class I in an average period of 17 weeks, with a mean total distal movement of 2.78 mm (0.67 mm per month) and a distal tipping of 6.8 degrees of the first molar. The anchorage loss became evident by the mesial movement (1.75 mm) and tipping (4.1 degrees) of the second premolars and by an increase in overjet (0.95 mm). The upper lip protruded 1.3 mm relative to the aesthetic line as a result of the proclination of the maxillary incisors.

CONCLUSION: The intra-oral appliance used in this study seems to be effective and can produce rapid simultaneous distalization of maxillary first and second molars without patient co-operation. However, the anchorage loss expressed by the mesial movement of the anterior segment must be better controlled.

53 ERUPTION PATTERNS OF AUTOTRANSPLANTED PREMOLARS VISUALIZED BY RADIOGRAPHIC COLOUR-CODING

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AIM: To investigate the eruption pattern of autotransplanted premolars and contralateral non-transplanted control premolars and to determine if any correlation exists between the eruption pattern of autotransplanted and contralateral control premolars and root growth.

MATERIALS AND METHODS: A series of standardized radiographs of 14 randomly selected autotransplanted premolars and contralateral controls exposed to monitor initial healing processes, i.e. periodontal and pulpal healing, root growth and tooth eruption.

METHODS: Measurements were performed on radiographs that were colour-coded. To study root development in terms of root length, the distance between the tip of the cusp and the apex was measured digitally. In cases where the apex was open, the midpoint between the two edges of Hertwig's root epithelial sheaths was selected. On all radiographs the mesial and distal cemento-enamel junctions (CEJs) were marked for subsequent calculation of eruption of transplants and controls. In each colour-coded image a reference line was

added to represent the axis length of the first molar. To measure the eruption of transplanted premolars and contralateral controls relative to the first molar, the distance between the points of the mesial and distal CEJs on the baseline radiographs were corrected by the cosine between these distances and the reference line on the first molar. The magnitude of tilting of the premolars during eruption was indicated by differences in distances between the mesial and distal sides of the tooth.

RESULTS: Maximum eruption rates were found to occur 30 to 60 days after transplantation. There were no significant differences between transplants and contralaterals. Two distinct categories of eruption pattern were observed. One group showed a tendency for the transplant to erupt at an initial rate somewhat faster than the contralateral. The other group initially showed retarded eruption. There was no correlation between root growth and eruption of transplants or contralaterals (Spearman's correlation coefficient = 0.14). **CONCLUSIONS:** Transplanted premolars demonstrate the same development as their contralaterals with respect to eruption. Since no significant difference between transplants and contralaterals was observed, transplantation is, at least from a tooth development point of view, a sound treatment option for substitution of missing teeth.

54 TEMPOROMANDIBULAR JOINT CHANGES DURING VERTICAL DISTRACTION OSTEOGENESIS OF THE RAMUS

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AIM: To demonstrate displacement of the condyle in the temporomandibular joint (TMJ) in patients treated for mandibular asymmetry with vertical distraction osteogenesis of the ramus.

SUBJECTS AND METHODS: Nine patients with a unilateral short ramus caused by growth disturbances as consequence of damage to the TMJ treated with vertical distraction. A splint, gradually increased in thickness, together with distraction was used to avoid loading and displacement of the condyle. Lateral and frontal cephalograms taken before and after distraction served to compare the position of the condyle before and after treatment. The contralateral ramus and condyle were also examined. The condyles were traced on the first cephalogram, and the tracing used as a template defining the condyle on the second cephalogram. The midpoint of the condyle was defined as the midpoint of the largest distance medio-lateral or antero-posterior on the first cephalogram and transferred to the second. The position of the condyle was related to the nasion-sella line on the lateral cephalogram. On the frontal cephalogram the line between the latero-orbital points and its perpendicular was used.

RESULTS: The position of the ipsilateral condyle changed to a more cranial position and the inclination of the ramus

decreased. The condyle was displaced medially or laterally. On the contralateral side the position of the condyle changed in a horizontal direction and the inclination of the ramus became larger.

CONCLUSION: Unilateral, vertical distraction osteogenesis of the ramus causes changes in condylar position on both sides. Using a splint together with careful treatment planning of the distraction vector is essential to limit the displacement.

55 CONDYLAR RESPONSE TO FORWARD MANDIBULAR POSITIONING

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AIM: To examine condylar growth in response to mandibular forward positioning. Type X collagen is expressed in the hypertrophic chondrocytes of articular cartilage and its expression precedes the onset of endochondral ossification. The expression of type X collagen was used as a marker for endochondral ossification.

MATERIAL: One hundred female Sprague-Dawley rats, 35-day-old, were randomly divided into five experimental groups (15 rats each) and five control groups (5 rats each).

METHODS: In the experimental groups, functional appliances were used to create continuous forward mandibular advancement. The rats were sacrificed after 3, 7, 14, 21 and 30 days. Tissue sections of 7 µm were cut through the mandibular condyle and were processed for *in situ* hybridization and immunohistochemical analysis. Type X collagen expression was quantified using the Leica Qwin system.

RESULTS: (1) Both type X collagen mRNA signal and type X collagen molecules were localized to the hypertrophic zone of the condylar cartilage, with experimental groups showing significantly higher levels than the controls. (2) The amount of type X collagen mRNA signals and type X collagen molecules in experimental and control groups reached the highest levels at days 14 and 21, respectively, indicating that an increase in endochondral ossification of the condyle occurred after 21 days of advancement.

CONCLUSION: Mandibular advancement triggers endochondral ossification of the condyles that seem to be elicited by changes in the extracellular matrix of connective tissues of the condylar cartilage. Type X collagen was shown to be a good marker for monitoring condylar growth.

56 ORAL APPLIANCES IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA—POLYSOMNOGRAPHIC OUTCOME

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AIM: To examine the effect of a mandibular protrusive appliance in patients with obstructive sleep apnoea (OSA)

with respect to the sleep stages and respiratory parameters.

SUBJECTS AND METHODS: Seventy-seven male patients with the polysomnographic diagnosis of mild to moderate OSA, who were treated with a modified adjustable activator. Approximately 6 weeks after insertion a second polysomnographic sleep recording in a sleep laboratory was performed.

RESULTS: The initial apnoea index (AI) of $10.0 \pm 9.2/h$ decreased to $4.7 \pm 6.9/h$ and the apnoea/hypopnoea index of $20.8 \pm 13.5/h$ to $10.4 \pm 9.7/h$ after appliance treatment. The basal oxygen desaturation decreased from 19.8 ± 17.9 to 12.8 ± 12.8 per cent. While the basal oxygen saturation remained constant (93.8 ± 1.7 versus 94.0 ± 2.0 per cent), the minimal oxygen saturation increased significantly from 79.0 ± 9.6 to 83.0 ± 7.5 per cent. The therapy did not alter sleep efficiency (80.5 ± 13.6 versus 80.6 ± 14.0 per cent) but there was a shift in the percentage of time in each sleep stage in the control study. A significant decrease of stage 1/2 and an increase of deep sleep stage 3/4 were measured. REM sleep also increased from 13.3 ± 9.4 to 14.8 ± 7.2 per cent.

CONCLUSION: The study confirms that the appliance used is effective in the treatment of patients with mild to moderate OSA. The respiratory parameters and the percentage of sleep stages are improved with this type of therapy.

57 EARLY ORTHODONTIC TREATMENT OF THE CLEFT PALATE PATIENT—VARIATIONS AND CONSEQUENCES

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Primary orthodontic treatment depends on different surgical approaches concerning the method and timing of surgery. The main goals are to achieve an improvement in the position and function of the tongue as soon as possible by creating an artificial palate. At the same time, growth, especially of the maxillary segments, can be guided by passive and active orthodontic shaping to prevent asymmetric tendencies and to reduce the width of the cleft. Usually the impressions can be taken without anaesthesia immediately after birth, if there are no contraindications. Shortly after the palate can be inserted which helps to normalize the position and function of the tongue and mostly improves sucking, thus easing food ingestion before lip closure.

Growth of the alveolar and palatal processes is guided by different plate designs with the aim of achieving a relatively harmonious intermaxillary fitting of the dental arch. In unilateral clefts it is an uprighting of the larger segment that is rotated outwardly; in bilateral clefts space is created between the segments of the maxilla. Depending on the phenotype of the cleft palate a choice exists between fixed and/or removable appliances.

The indications and handling of these appliances are responsible for the success of the treatment.

58 DOES BITE-JUMPING DAMAGE THE TEMPOROMANDIBULAR JOINT?

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AIM: To assess the effect of Herbst appliance treatment on the articular disc and the bony structures of the temporomandibular joint (TMJ).

SUBJECTS: Sixty-two consecutive Class II malocclusion subjects treated with the Herbst appliance for an average period of 7.2 months. In all patients Herbst treatment resulted in a Class I or overcorrected Class I dental arch relationship.

METHODS: Magnetic resonance images (MRI) were taken before, and after, as well as one year after Herbst treatment. The MRIs were evaluated metrically to assess the articular disc position and visually to detect possible structural bony changes.

RESULTS: Herbst treatment (1) did not have an adverse effect on disc position, (2) resulted in a stable repositioning of the disc in subjects with a pre-treatment partial disc displacement with reduction, (3) could not recapture the disc in subjects with a pre-treatment total disc displacement with or without reduction and (4) reduced the prevalence of structural bony changes.

CONCLUSION: On a short-term basis, bite jumping using the Herbst appliance did not have a deleterious effect on TMJ function and did not induce temporomandibular dysfunction.

59 THE INCISOR-LIP RELATIONSHIP IN HERBST TREATMENT OF CLASS II DIVISION 2 MALOCCLUSIONS

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AIM: To examine the effect of the Herbst appliance on the incisor-lower lip relationship in the treatment of Class II division 2 malocclusions.

SUBJECTS: Fifteen Class II division 2 malocclusions treated to Class I dental arch relationships with the Herbst appliance followed by a multibracket appliance.

METHODS: Lateral head films were analysed on three occasions, before (T1) and after Herbst multibracket appliance (T2) treatment and 1 year later (T3).

RESULTS: Treatment (T1-T2) changes: (1) Lower lip overlap on the upper incisors was reduced (-1.7 mm; $P < 0.001$). (2) Upper and lower incisors were proclined (upper incisors: $+15$ degrees; lower incisors: $+9$ degrees; $P < 0.001$). (3) Overbite was reduced from 7.1 to 1.6 mm ($P < 0.001$). (4) Sagittal jaw base relationship (Wits) improved from $+3.3$ to $+0.3$ mm ($P < 0.001$). Post-treatment (T2-T3) changes: (1) Lower lip height remained unchanged. (2) Lower incisors retroclined (-3.9 degrees; $P < 0.01$). (3) Overbite increased ($+1.3$ mm; $P < 0.001$). (4) Sagittal jaw base relationship remained unchanged.

CONCLUSION: The incisor-lower lip relationship was improved by Herbst/multibracket appliance treatment and remained stable during a one-year period after treatment in spite of minor relapses in incisor tooth relationships.

60 EUROPEAN UNION BIOMED PROGRAMME ON CLEFT LIP AND PALATE 1995–2000

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AIM: The aims of the EU Biomed II (1995–2000) were establishment of a register of cleft teams in Europe including protocols and research capability. Agreement on policy statements and practice guidelines designed to promote minimum levels of care for all affected European children, and recommendations on record taking as part of a European quality improvement programme. The promotion of inter-centre comparisons and multicentre clinical trials.

SUBJECTS: All cleft teams in the EU and the Central and Eastern European States.

METHODS: Surveys and consensus conferences.

RESULTS: A total of 186 cleft teams responded and revealed considerable diversity of organization and practices. The 186 teams used 175 different protocols for UCLP: 5 per cent close the whole cleft in one operation, 65 per cent use two operations, 29 per cent use three and 1 per cent use four. Despite this, consensus was achieved on all other issues.

CONCLUSIONS: European collaboration will be essential for improving the care of children in Europe and beyond.

61 PREVALENCE OF CONGENITAL ABSENCE OF PERMANENT TEETH IN CHILDREN AFFECTED WITH CLEFT LIP AND PALATE

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AIM: To determine the prevalence of congenitally missing permanent teeth, excluding third molars, in cleft lip and palate children, both inside and outside the cleft site. In addition the possible association between cleft side and missing teeth was studied.

SUBJECTS. Two hundred and seventy-eight cleft lip and/or palate children selected from four cleft palate centres in New York City metropolitan region. It included 158 males and 20 females, 5 to 18 years of age (mean age 10.4 years).

METHODS: Panoramic, periapical and occlusal radiographs of the entire dentition of the children were examined for missing teeth excluding third molars. Chi-square statistical analysis was used to determine the significance of the findings.

RESULTS: A high prevalence of missing teeth, 77 per cent, was found for the total sample. This was statistically significantly higher than the approximately 10 per cent reported for non-cleft children, and considerably higher than the 45 per cent reported earlier for cleft children. The maxillary lateral incisors were the most frequently missing teeth on the cleft side. This condition was found to be more common than that encountered on the non-cleft side. An even greater difference was found between the cleft side and non-cleft individual. The second most frequently missing tooth was the maxillary second premolar on the left side, exceeding its absence on the non-cleft side maxilla and mandible by 3:1 and 2:1, respectively.

CONCLUSIONS: Congenital absence of permanent teeth was considerably more frequently on the left side, in both the maxilla and mandible, the same side where more clefts occurred. A recurring observation on the predominant left side involvement (3:2 ratio) for these dental anomalies awaits further explanation.

62 MANDIBULAR CONDYLE LESIONS IN CHILDREN WITH JUVENILE CHRONIC ARTHRITIS

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AIM: To assess the prevalence of radiographically detectable destruction of the temporomandibular joints (TMJs) in children with juvenile chronic arthritis (JCA) and to study the possible relationships between condylar destruction and type and duration of the disease, as well as type of occlusion.

SUBJECTS: Sixty-six children with JCA (27 boys, 39 girls) with a mean age of 11.9 years (range 6–19 years), diagnosed and being treated for the main disease at the Department of Pediatrics, Aristotle University of Thessaloniki.

METHODS: A total of 132 dental panoramic radiographs were taken (two radiographs from each JCA patient, one in normal position and one with open mouth), in order to examine the TMJs and the possible presence of condylar destruction. The registrations made included presence and localization (unilateral or bilateral) of the destruction, type and duration of JCA, sex, and type of malocclusion. The statistical evaluation was performed by means of frequencies, Student's *t*-, Chi-square and ANOVA tests.

RESULTS: Thirty-three (50 per cent) of the JCA children showed some form of condylar destruction. A statistically significant correlation was found between the type of JCA and the condyles affected. In polyarticular JCA 27 (75 per cent) of the children presented affected condyles and 20 (55.6 per cent) of them showed lesions bilaterally. In pauciarthral JCA condylar destruction was detected only in 6 patients (20 per cent). The condylar affection generally was found to be independent of sex, although females showed a tendency to bilateral lesions. In children with unilateral destruction, the right condyle was affected four times more frequently than the left. The duration of JCA

seems to be significantly correlated to condylar destruction and especially to bilateral destruction.

CONCLUSION: Children with JCA present a remarkable prevalence of condylar destruction, which is correlated to the type and duration of the disease.

63 CRANIO-CERVICAL POSTURE: A FACTOR IN THE DEVELOPMENT AND FUNCTION OF DENTOFACIAL STRUCTURES

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(SHELDON FRIEL MEMORIAL LECTURE)

Many practitioners will recognise that subjects with a large mandibular plane inclination are characterized by an extended head posture and a forward inclined cervical column, i.e. an extended cranio-cervical posture. It is also typical that subjects with a short-face morphology often carry their heads somewhat lowered, and have a markedly backward-curved upper cervical spine – a cervical lordosis. The aim of this lecture is to link together the findings of a series of studies that attempt to clarify this relationship, and to bring into focus cranio-cervical posture, which is a functional factor that seems to be involved in many clinical problems that may be problematical to the orthodontic practitioner.

To provide a background, the concept of a standardized posture of the head and the cervical column will be developed, and the procedures for recording this posture as well as the categories of variables that express the different postural relationships will be presented.

Findings that relate cranio-cervical posture to upper airway obstruction, to craniofacial morphology and to malocclusion will be surveyed, and a postnatal developmental mechanism that explains the findings and leads to further questions will be discussed. Recent findings of a relationship between extended cranio-cervical posture and the occurrence of signs and symptoms of temporomandibular disorders further emphasise the biological importance of this functional parameter.

64 TEMPOROMANDIBULAR DISORDERS RELATED TO CRANIOFACIAL DIMENSIONS, HEAD POSTURE AND BITE FORCE

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AIM: To examine the associations between craniofacial dimensions, head posture, bite force and symptoms and signs of temporomandibular disorders (TMD).

SUBJECTS: Ninety-six children (51 F, 45 M) aged 7–13 years, sequentially admitted for orthodontic treatment of malocclusions entailing health risks.

METHODS: Symptoms and signs of TMD were assessed by 37 variables describing the occurrence of headache and facial pain, clicking, jaw mobility, tenderness of muscles and joints, and Helkimo's dysfunction indices. Craniofacial dimensions (33 variables) and head posture (nine variables) were recorded from lateral cephalometric radiographs taken with the subject standing with the head in the mirror position. Dental arch widths were measured on plaster casts, and bite force was measured at the first molars by means of a pressure transducer. Associations were assessed by Spearman correlations and multiple stepwise logistic regression analyses.

RESULTS: On average TMD was seen in connection with a marked forward inclination of the upper cervical spine and an increased craniocervical angulation. Muscle tenderness was associated with a 'long face' type of craniofacial morphology and a lower bite force ($P < 0.05$, $P < 0.01$, respectively). Headache was associated with a larger maxillary length and increased maxillary prognathism ($P < 0.05$, $P < 0.01$, respectively). A high score on Helkimo's clinical dysfunction index was associated with smaller values of a number of vertical, horizontal and transversal linear craniofacial dimensions and a lower bite force ($P < 0.05$, $P < 0.01$ respectively).

CONCLUSION: Symptoms and signs of TMD were related to head posture, craniofacial dimensions and bite force in pre-orthodontic children. The findings provide an insight into possible aetiological mechanisms and may be of importance for a better understanding of the occurrence of symptoms and signs of TMD in orthodontic patients.

65 CLASS II DIVISION 2 MALOCCLUSIONS AND TEMPOROMANDIBULAR DYSFUNCTION IN CHILDREN

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(KEYNOTE LECTURE)

The malocclusion characterized as Class II division 2 has some specific morphological traits that seem to dictate specific functional patterns: these may predispose to a dysfunction of the temporomandibular joint (TMJ).

This presentation aims at reviewing and specifying pertinent information about the possible relationship between Class II division 2 malocclusions and the prevalence of signs and symptoms of TMJ dysfunction in children.

Findings from an extensive literature review, as well as from specific related clinical studies, performed in the Department of Orthodontics, University of Athens, which investigated also the possible contribution of unpleasant psychological parameters, support the following main conclusions:

1. There is no significant difference in the prevalence of signs and symptoms of dysfunction between children exhibiting Class II division 2 and Class I malocclusions.

2. Divorce is by far the most unpleasant event in the life of children, and the tendency towards TMJ dysfunction is double in occurrence in children that have had such an experience.

66 THE SIGNIFICANCE OF THE SOFT TISSUE PROFILE ON FACIAL AESTHETICS

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AIM: To assess the relative contribution of the soft tissue facial profile to the overall attractiveness of the face, as evaluated from the profile view.

METHODS: Pre-treatment profile facial photographs of 20 female patients were scanned and the soft-tissue outline was digitized. The average outline of the 20 original photographs was calculated and used as a template for subsequently modifying the photographs using warping (morphing) computer methods. This resulted in 20 warped photographs, all possessing the same soft-tissue outline. In addition, three other photographs were constructed. The face in these photographs was the composite average face of the 20 original pictures, while the hair was different and was taken from three of the original pictures. All photographs were printed, divided into two groups and presented to 20 judges, 10 lay people and 10 orthodontists, for scoring as follows:

A) On the first occasion, the original photographs of 10 of the patients and the warped photographs of the other 10 patients were shown,

B) At the next session, the remaining 10 original and 10 warped photographs were shown. The three 'average' photographs were interspersed between the 20 pictures shown to the judges in each scoring session.

The judges were asked to score facial attractiveness on a scale of 0-10. All judges were ignorant of the computer modification of the photographs and the purpose of the study. **RESULTS AND CONCLUSIONS:** The three 'average' photographs were consistently given the highest scores. The modified photographs were given higher scores than their original counterparts. However, the score increase was not sufficient to reach an ideal value, especially in faces originally judged not attractive. The orthodontists were more influenced by the soft tissue outline than lay people. These results indicate that soft tissue outline form is not the sole determinant of facial aesthetics.

67 MOTIVATION AND MANAGEMENT OF THE ORTHODONTIC PATIENT

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AIM: To evaluate the motivation of patients during orthodontic therapy, the acceptance of the different orthodontic

appliances and to assess the oral hygiene behaviour of these patients.

SUBJECTS: One hundred and fifty randomly selected subjects attending the orthodontic department of the University of Munich.

METHOD: Questionnaires were distributed among these patients. After six months 121 questionnaires could be subjected to computer analysis using the program SPSS for Windows 6.13.

RESULTS: The majority of the patients undergoing orthodontic therapy were concerned about functional disorders as well as aesthetics, followed by those who only cared about aesthetics. Additional fluoridation of the teeth was still uncommon and oral hygiene was different between girls and boys. Furthermore, it could be proved that younger children wore the appliances more often than teenagers or adults. Also patients should be more incorporated in orthodontic therapy and a good doctor-patient relationship should be established.

CONCLUSION: Good compliance still is not self-evident but is dependent on many things such as age and sex. Among all orthodontic appliances, compliance with the headgear is not good. Knowing this orthodontists should consider the use of other appliances. More motivation for oral hygiene and additional fluoridation is necessary.

68 THE TEMPOROMANDIBULAR JOINTS—MANDIBULAR ASYMMETRIES:

MALOCCLUSIONS AND ORTHODONTIC CONCERN
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KEYNOTE ADDRESS

Potential linkage of the form and function of the temporomandibular joints (TMJ) and the occlusion is clearly demonstrable in extreme cases, such as condylar hyper- and hypoplasia. Demonstrating extremes can facilitate understanding the less definable 'in between' cases, which are more difficult to diagnose and probably more frequent in occurrence. An extreme aberration in TMJ form is the hyperplastic condyle, more evident when it involves one side—unilateral hyperplasia. A greater than normal increase in the dimension of one of the mandibular condyles can alter mandibular form and cause a more forward position of the mandible on that side. More evident in frequency is the other extreme, a mandible exhibiting unilateral inadequacy in mandibular growth correlated with a hypoplastic, atrophic, fractured or a congenitally reduced or missing mandibular condyle, as can be demonstrated in congenital hemifacial microsomia or in a subject who experienced unilateral condylar fractures at a comparatively young age. Clinically in cases of unilateral hypoplasia, the mandible on the affected side will grow less than on the unaffected side. With disparate growth of both sides of the mandible, both in hyper- and hypoplasia, mandibular skeletal asymmetry will become more overtly obvious.

In a paediatric population with radiographs and magnetic resonance diagnostic records confirming TMJ derangements, affected individuals exhibited a high incidence of mandibular chin deviation toward 'the smaller or more degenerated TMJ'. Other studies involving individuals with unilateral degenerative joint disease have also observed an effect on the size, position and form of the mandible. Adolescents with internal derangement have been shown to have facial patterns with increased anterior facial height, decreased posterior facial height, increased gonial and mandibular plane angles and reduction in mandibular body and ramal dimensions. Alteration in TMJ form and function during growth could progressively affect craniofacial structures causing facial asymmetries and changes in dental relationships—Class II-type molar relationships, open bites, shift in dental arch midline relationships, disparate posterior dentoalveolar vertical heights, differing occlusal plane heights and incorrect axial inclinations of teeth posteriorly and anteriorly. Realistically these are malocclusions that are difficult to treat; the orthodontists must try to control how and in what direction the affected jaws grow to permit acceptable placement of the dentition. Potential ways of interpreting radiographs for clues as to the possibility of an existent TMJ dysmorphology and suggested mechanisms for correction will be presented; care must be taken in the selection of appliances.

69 COMPREHENSIVE ORTHODONTIC TREATMENT OF CLEFT PALATE PATIENTS 9–15 YEARS

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KEYNOTE ADDRESS

Even if the same plastic surgeon performs all primary cleft lip and palate (CLP) repair by the same procedures and according to the same protocol, the individual outcome may vary from excellent to rather unsatisfactory. Why? All children are different and CLP children are more so, reflecting individual differences regarding craniofacial type and related growth patterns, on which the cleft is superimposed.

Thus, at 9 years of age, CLP patients may look very different, dependent on various factors such as cleft type, primary surgery technique, and skill of the surgeon, treatment protocol as well as individual craniofacial and dental growth and development. In addition, the significance of each factor may even vary in the individual. Generally maxillary growth is retarded in all CLP patients, but orthodontically the clinical relevance depends on the patient's face type, prognathism, growth pattern and growth potential. In fact, in skeletal Class II subjects maxillary growth inhibition may be beneficial while being extremely detrimental in those with skeletal Class III.

Thus a treatment protocol that considers individual long-term treatment planning is important. Indeed, the cleft

patient should have a nice dental smile as early as possible, and the final orthodontic treatment goal is the same as for the non-cleft patient, preferably without prosthodontics.

70 CONTACT POINTS TIGHTNESS IN EXTRACTION VERSUS NON-EXTRACTION TREATMENT

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AIM: Andrews' fifth key of normal occlusion requires tight contact points. This study examined the change in tightness of dental contact point (TDCP) during orthodontic treatment of extraction versus non-extraction patients.

MATERIALS AND METHODS: The TDCP was measured by a novel device developed at Tel Aviv University consisting of a bow jig with an attached 0.05 mm stainless steel strip. A sensor component (2 strain gauges in a 1/2 Wheatstone bridge) was linked to the bow jig base. During insertion of the strip into a contact point, the maximal deflection of the bow jig was recorded in gram-force units. Measurements were taken at T_0 -pre-treatment; T_1 -after extractions and insertion of fixed orthodontic appliances (3 months from T_0); T_2 -3 months from T_0 ; R_1 -3 months into retention; R_2 -6 months into retention and R_3 -1 year into retention. The sample consisted of 12 extraction (E) and 14 non-extraction (NE) subjects [10 with and four without headgear (HG)].

RESULTS: Group_{NE}—a 25 per cent reduction in TDCPs was found from T_0 to T_1 . At T_2 the mandibular values increased to higher levels than at T_0 . The HG group had initially higher TDCP values than the non-HG. As treatment progressed, maxillary TDCPs decreased while mandibular values increased. The decrease of the maxillary posterior segment in the HG group remained stable during the retention period. Group_E—after extraction, TDCP values decreased (67 per cent) and did not return to their original values. Mandibular TDCPs were two-fold higher after 1 year of retention than pre-treatment values.

CONCLUSION: The TDCP device is an accurate diagnostic tool to monitor changes in contact point tightness indicating stability of treatment results. For stable results extraction and HG are favourable (decrease in TDCP), while Class II elastics are unfavourable treatment modalities (increase in TDCP).

71 BITE FORCE MAGNITUDE, MASSETER MUSCLE THICKNESS, AND CRANIOFACIAL MORPHOLOGY

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AIM: To examine the relationship between bite force, masseter muscle thickness, and craniofacial growth pattern.

SUBJECTS: Ninety-one subjects, 8–17 years of age, without craniomandibular disorders or serious malocclusions.

METHODS: An ultrasound technique was used to measure the thickness of the masseter muscle. The maximum voluntary bite force magnitude was registered with a new intraoral method. A subminiature compression load cell in a force-measuring device was applied between the first molars. The craniofacial morphology was investigated by lateral cephalometry. The patients were divided into three groups with neutral, vertical, and horizontal facial growth pattern. Bite force moments and masseter muscle thickness were assessed and related to the craniofacial parameters, to the different growth groups, and to age.

RESULTS: Bite force and masseter muscle thickness related significantly positive with age (Student's *t*-test, $P < 0.05$). The group with a horizontal facial growth pattern showed the highest bite force values (average 375 N) and muscle thickness (average 11.9 mm). The percentage increase of masseter thickness after contraction (average 39.3 per cent) did not correlate with age, facial growth pattern, or gender ($P > 0.05$). Bite force related positively with masseter thickness ($P < 0.001$).

CONCLUSION: The magnitude of bite force and masseter muscle thickness correlated with craniofacial growth pattern and age.

72 GINGIVAL CONNECTIVE TISSUE CELL KINETICS DURING ORTHODONTIC TOOTH MOVEMENT

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AIM: To study proliferative response, cell cycle duration and migration of progenitor cells in mechanically stimulated gingiva.

MATERIAL AND METHODS: Orthodontic force was simulated by inserting 0.15 mm thick elastics between maxillary M1 and M2 of 8 week-old male rats that were immediately labelled with H³-TDR (S.A. 25Ci/mmol) and then killed in groups, 6–7 animals in each, together with equal-sized groups of labelled control animals at intervals between 1–168h. Autoradiographs of 2.5 µm mesiodistal plastic sections were used to determine percentages of H³-TDR-labelled cells, clustering indices and total and median grain counts for paravascular and extravascular compartments of the body of the papilla and the transseptal fibre region between M2 and M3. The results were tested for statistical significance using two-way ANOVA and pairwise comparison tests.

RESULTS: Mechanical stimulation led to a significant increase of cell division and reduction of grain counts in paravascular sites ($P < 0.05$) as well as a substantial decline of the cell cycle duration in all compartments, which were associated with a shift of the proportion of H³-TDR-labelled cells from the paravascular to the extravascular location.

CONCLUSION: Orthodontic force causes a rapid selective proliferative response in gingival connective tissue indicating an early initiation of tissue remodelling. Increased proliferation is based on faster progression of progenitor cells through the cell cycle, amplification of cell division in paravascular sites and migration of daughter cells into extravascular tissue domains.