

FEATURES SECTION

Relevant research from non-orthodontic journals

This section is designed to draw the attention of readers to papers that have been published in non-orthodontic journals, but which may be of interest. The abstracts have been selected and edited by Joanne Collins and Professor Nigel Hunt.

Imaging

Comparison of cephalometric radiographs obtained from cone-beam computed tomography scans and conventional radiographs. *J Oral Maxillofac Surg* 2009; 67: 92–97

van Vlijmen OJC, Berge SJ, Swennen GRJ, Bronkborst EM, Katsaros C, Kuijpers-Jagtman AM

Objectives: To evaluate whether measurements on conventional cephalometric radiographs are comparable to measurements on cone-beam computed tomography (CBCT) constructed cephalometric radiographs taken from human skulls.

Methodology: The CBCT scans and conventional cephalometric radiographs were made using 40 dry skulls. With I-Cat Vision software (Imaging Sciences International, Inc, Hatfield, PA) a cephalometric radiograph was constructed from the CBCT scan. Standard cephalometric software was used to identify landmarks, and calculate distances and angles. The same operator identified 15 landmarks on both types of cephalometric radiographs on all images 5 times with a 1 week interval.

Results: Intraobserver reliability was good for all measurements. The reproducibility of measurements on cephalometric radiographs obtained from CBCT scans was better, compared with the reproducibility of those on conventional and constructed cephalometric radiographs.

Conclusions: Measurement on CBCT constructed cephalometric radiographs are comparable to conventional radiographs, and are therefore suitable for longitudinal research.

Comment: The use of CBCT is generating a large amount of interest in orthodontic circles. This research adds another facet to the role of CBCT in modern patient management with particular emphasis on longitudinal research. The paper clearly identifies the merits as well as limitations of this new imaging technique and suggests some areas for future research.

Surgically assisted rapid palatal expansion

Relapse and stability of surgically assisted rapid maxillary expansion: an anatomic biomechanical study. *J Oral Maxillofac Surg* 2009; 67: 10–14

Koudstaal MJ, Smeets JBJ, Kleinrensink G-J, Schulten AJM, van der Wal KGH

Objectives: This anatomic biomechanical study was undertaken to gain insight into the underlining mechanism of tipping of the maxillary segments during transverse expansion using tooth-borne and bone-borne distraction devices.

Methodology: An anatomic biomechanical study was performed on 10 dentate human cadaver heads using tooth-borne and bone-borne distraction devices.

Results: The amount of tipping of the maxillary halves was greater in the tooth-borne group, but the difference was not significant. Four of the specimens demonstrated an asymmetrical widening of the maxilla.

Conclusions: Segmental tipping was seen in both study groups. In this anatomic model, tooth-borne distraction led to greater segmental tipping compared with bone-borne distraction. Keep in mind, however, that this anatomic model by no means depicts a patient situation, and any extrapolation from it must be done with great care. The fact that the tooth-borne group demonstrated greater tipping might reflect the general opinion that bone-borne distraction causes less segmental angulation than tooth-borne distraction. Some tipping was seen in the bone-borne group, suggesting that over correction to counteract relapse will be necessary with this treatment modality.

Comment: This study attempts to investigate an area which is clinically difficult to evaluate. The authors acknowledge the limitations of their anatomic study from the outset. It was interesting to see that asymmetric expansion occurred in 4 of the 10 cadaver set ups involving both the tooth-borne and bone-borne devices. The authors attempted to outline the rationale for this

complication. Although an interesting paper to read its usefulness in the clinical setting is limited due to the nature of the study design.

Orthognathic surgery

How accurate is model planning for orthognathic surgery? *Int J Oral Maxillofac Surg* 2008; 37: 1089–93

Sharifi A, Jones R, Ayoub A, Moos K, Walker F, Khambay B, McHugh S

Objectives: The purpose of this study was to evaluate the accuracy of model surgery prediction after orthognathic surgery and to identify possible errors associated with the prediction process.

Methodology: The study included 46 patients who had undergone orthognathic surgical procedures; 22 in Group A who had had a Le Fort I osteotomy; and 24 in Group B who had had a Le Fort I osteotomy and mandibular setback surgery. The immediate postoperative and preoperative lateral cephalograms were analyzed to calculate surgical changes; these were compared with those obtained from model surgery prediction and a statistical analysis was undertaken.

Results: The maxilla was more under-advanced and over-impacted anteriorly than predicted by model surgery. The amount of mandibular setback was more than that predicted by model surgery. None of the differences between prediction planning and actual surgical changes was statistically significant at $P < 0.05$. Inaccuracy with the face bow recording, the intermediate wafer, and auto-rotation of the mandible in the supine or anaesthetized patient would appear to be the principal reasons for errors.

Conclusions: Inaccuracies are associated with the transfer of prediction planning to model surgery planning and prediction, which should be eliminated to improve the accuracy and predictability of orthognathic surgery.

Comment: This well conceived research highlights some weaknesses and potential sources of error in current clinical practice in the preparation of patients for orthognathic surgery. The authors make some useful suggestions which may help to minimize errors in the future. Although no statistically significant mean differences between the planned surgical position and the final outcome were identified, it was unfortunate that the authors were not able to encompass whether any deviation from the planned surgical position was clinically relevant. This will be an area for future research.

Body dysmorphic disorder

Body dysmorphic disorder screening in maxillofacial outpatients presenting for orthognathic surgery. *Int J Oral Maxillofac Surg* 2008; 37: 985–91

Vulink NCC, Rosenberg A, Plooij JM, Koole R, Bergé SJ, Denys D

Objectives: Body dysmorphic disorder (BDD) is a severe psychiatric disease with delusions about defects in appearance for which patients seek surgical help. This is the first European study to determine the half-year prevalence of BDD in a maxillofacial outpatient clinic.

Methodology: A total of 160 patients with maxillofacial problems completed a validated self-report questionnaire, while a staff member scored maxillofacial defects on a severity scale.

Results: Twenty-eight (17%) patients had excessive concerns about their appearance, which negatively influenced their psychosocial functioning; 16 patients (10%; 95%CI 5–15%) screened positive for BDD.

Conclusions: The high prevalence of problems related to psychosocial functioning and the occurrence of BDD in maxillofacial patients means that maxillofacial surgeons should take psychological concerns about physical defects into account.

Comment: The finding that 10% of patients included in this study tested positive for BDD is of concern to all clinicians offering orthognathic treatment. The paper supplies a useful checklist of clinical characteristics which should alert practitioners. What is also of concern is that when a diagnosis of BDD was suspected and referral to a psychiatrist was made, 75% of patients refused psychiatric assistance. This highlights how potentially difficult these patients can be to manage.

Occlusal cants

Measurement and interpretation of a maxillary occlusal cant in the frontal plane. *J Oral Maxillofac Surg* 2008; 66: 2498–502

Susarla SM, Dodson TB, Kaban LB

Objectives: A cant of the maxillary intermolar (M1–M1) plane is a reflection of facial asymmetry and can be measured on an anterior–posterior cephalogram in degrees relative to the true horizontal or directly on the patient as the difference in millimetres between the right and left medial canthi to canine distances. The purpose of this study is to measure the correlation

between the maxillary cant measured in degrees and measured in millimetres.

Methodology: It was hypothesized that the number of degrees of maxillary cant equals the millimetre difference between the lengths of the two sides of the maxilla, based upon the trigonometric relationship between the degree of cant, vertical length, and M1-M1 distance. To confirm this hypothesis, a range of M1-M1 distances were evaluated and computed the predicted vertical discrepancy between the two sides of the maxilla. Bivariate correlations were used to evaluate the association between the degree of cant and predicted vertical discrepancy.

Results: In the range of M1-M1 distances (47.5–61.1 mm) evaluated, cants ranging from 3 to 10 degrees are highly correlated with the vertical difference in millimetres ($r=0.96$, $P<0.01$). The mean error between the degree of cant and vertical difference was 9%.

Conclusion: The degrees of occlusal cant relative to the true horizontal measured cephalometrically in the frontal plane is equal to the linear millimetre difference between the right and left medial canthi to the right and left canine tips.

Comment: This succinct paper neatly identifies a mathematical link between the degrees of maxillary cant to the true horizontal and the millimetre difference between the two sides of the maxilla. This fact can be a useful adjunct to orthognathic planning.

Archwires

Improved orthodontic stainless steel wires coated with inorganic fullerene-like nanoparticles of WS₂ impregnated in electroless nickel-phosphorous film. *Dent Mater* 2008; 24: 1640–46

Redlich M, Katz A, Rapoport L, Wagner HD, Feldman Y, Tenne R

Objective: To reduce friction between orthodontic stainless wires and bracket by coating the wire with nickel-phosphorous electroless film impregnated with inorganic fullerene-like nanoparticles of tungsten disulfide (IF-WS₂) which are potent dry lubricants.

Methods: Coating was preformed by inserting stainless steel (SS) wires into electroless solutions of nickel-phosphorus (Ni-P) and IF-WS₂. The coated wires were analyzed by a scanning electron microscope (SEM) and an energy-dispersive X-ray spectrometer (EDS) as well as by tribological tests using a ball-on-flat device. Friction tests simulating archwire functioning of the

coated and uncoated wires were carried out by an Instron machine. The adhesion properties of the coated wires after friction were analyzed by a Raman microscope.

Results: SEM/EDS analysis of the coated wires showed clear impregnation of the IF-WS₂ nanoparticles in the Ni-P matrix. The friction coefficient measured by the ball-on-flat tribometer was significantly reduced (from 0.25 to 0.08). The friction forces as measured with the Instron on the coated wire were reduced by up to 54% ($4.00 \text{ N} \pm 0.19$ uncoated vs $1.85 \text{ N} \pm 0.21$ coated). Raman spectra showed that even after extensive friction tests the Ni-P with the IF-WS₂ nanoparticles is attached to the underlying stainless steel wire.

Conclusions: It is proposed that the wires coated with these nanoparticles might offer a novel opportunity to substantially reduce friction during tooth movement. A few tests undertaken to evaluate the toxicity of the fullerene-like nanoparticles have provided indications that they might be biocompatible.

Comment: Although within the confines of an *in vitro* experiment the initial findings of this report appear promising as another attempt is made to reduce friction during orthodontic treatment. However, biocompatibility still needs to be confirmed.

Dental aesthetics

Esthetics and smile characteristics from the layperson's perspective: a computer-based survey study. *JADA* 2008; 139: 1318–27

Ker AJ, Chan R, Fields HW, Beck M, Rosenstiel S

Objectives: To quantify the ideal and maximum acceptable deviations for smile characteristics.

Method: A survey of laypersons using a digital image editing software package, which enabled raters to manipulate intra-oral photographs featured in the survey. Smile characteristics were altered in photos of a gender-neutral face showing nasal tip to mentolabial fold. The survey was conducted in Boston, Columbus, Ohio and Seattle. An interactive interface allowed raters to select the ideal for each smile characteristic presented and identify the range of acceptability for the variables.

Results: Raters were reliable ($\kappa=0.34$ – 0.88). Survey location was not significant except that raters from the West accepted a broader smile than did those from the Midwest and the East. Raters identified ideals and thresholds for the following smile characteristics: smile arc; buccal corridor; gingival display; canine and

posterior crown torque, ideal and large corridor; maxillary midline to face; maxillary to mandibular midline; overbite; maxillary central incisor gingival height discrepancy; maxillary lateral incisor gingival height discrepancy; maxillary central to lateral incisal step; maxillary central incisor crown width-to-height ratio; maxillary central-to-lateral incisal ratio; and occlusal cant. Generally, the values for ideal paralleled existing data, and new guidelines for some variables emerged. The ranges of acceptability were large.

Conclusions: The ideal and an acceptable range for each smile characteristic can be identified reliably.

Comment: The novel interactive approach used in this study design adds weight to already established principles of smile aesthetics but did challenge some currently accepted ranges of acceptability. The study highlights a wide range of acceptability by lay people and reminds us that at the finishing stages of treatment it is important we interact with our patients to ensure their new smile is acceptable to them.

Miniscrews and anchorage

Biomechanical comparison of four different miniscrew types for skeletal anchorage in the mandibulo-maxillary area. *Int J Oral Maxillofac Surg* 2008; 37: 948–54

Mischkowski RA, Kneuert P, Florvaag B, Lazar F, Koebke J, Zöllner JE

Objectives: This study compared four miniscrew types for skeletal anchorage (Aarhus, FAMI, Dual Top and

Spider) regarding their biomechanical properties contributing to primary stability.

Methodology: Insertion torque measurements and pull-out tests in axial (0°) as well as in the 20° and 40° direction were performed. Stiffness of the screw–bone construct was calculated from the load–displacement curve.

Results: Conic FAMI and Dual Top screws had higher insertion torques. Insertion torques were raised by drill-free insertion of FAMI and Dual Top screws. Statistically significant differences were found between the four screw types in pull-out tests. The highly significant differences between the four screws for peak load in the axial (0°) and 20° direction were not apparent in 40° angular loads. For the conical screws, peak load values increased in angular compared with axial load. The Dual Top screw achieved the highest values for peak load and stiffness. Twelve Dual Top and one Spider screw heads fractured in the pull-out tests.

Conclusions: A conical drill-free screw design achieves higher primary stability compared with cylindrical self-tapping screws. This effect was more obvious in insertion torque estimations rather than in pull-out tests. The Dual Top screws, although biomechanically superior to other screw types, were most prone to fractures.

Comment: Largely in vogue at present, this study will be of interest to those who have recently started, or are considering, using temporary anchorage devices. With such a large array of products, choosing a new system can be confusing. This detailed paper explores one of the key issues central to their successful use.