Journal of Orthodontics, Vol. 33, 2006, 52–56

FEATURES SECTION

Evidence-based orthodontics

Jayne E. Harrison
Liverpool University Dental Hospital, UK

This is the last of the current series of Evidence-based Orthodontics abstracts. The *Journal of Orthodontics* wishes to thank Dr Jayne Harrison for her significant contribution to the Journal, especially over the last four years.

American Journal of Orthodontics and Dentofacial Orthopedics

Assessment of mandibular growth and response to orthopedic treatment with 3–dimensional magnetic resonance images. *Am J Orthod Dentofacial Orthop* 2005; 128: 16–26
Cevidanes LH, Franco AA, Gerig G, Proffit WR, Slice DE, Enlow DH, Yamashita HK, Kim YJ, Scanavini MA, Vigorito JW

Objectives: To determine the 3D interrelationships of craniofacial bones at the beginning of the pubertal growth spurt and in response to treatment with a Fränkel appliance.

Design: A randomized controlled trial.

Setting: São Paulo, Brazil.

Participants: Fifty-three children (28 boys, 25 girls), aged 9–12 years old, with a Class II division 1 malocclusion, 3/4 unit Class II molars and an overjet of 4.5–10 mm.

Interventions: Treatment with a Fränkel Regulator II appliance ($n=28$) or observation ($n=25$) for 18 months. *Outcome measures:* Comparison of the 3D volumetric data of the mandibular rami obtained from MRI scans of the head taken at T1 (pre-treatment) and T2 (after 18 ± 1 months).

Results: There were statistically significant differences (<0.001) in mandibular growth between the treated and untreated groups with the treated group showing increased vertical and more forward growth of the mandibular rami relative to the posterior naso-maxilla and middle cranial fossa.

Conclusions: These methods of 3D assessment of mandibular growth allowed visualization of significant differences, between the treated and non-treated individuals, in the dimensions of the mandibular rami, and their position relative to the middle cranial fossa and naso-maxillary complex.

Implications: These 3D methods of assessing craniofacial growth add another dimension to our ability to assess the impact of the treatment that we provide. From this study, it appears that significant changes, in the 3D size and position of the mandibular rami, occur as a result of treatment with the Fränkel appliance. We await the long-term results of this study to see whether these gains are maintained.

Comparison of relative mandibular growth vectors with high-resolution 3-dimensional imaging. *Am J Orthod Dentofacial Orthop* 2005; 128: 27–34
Cevidanes LH, Franco AA, Gerig G, Proffit WR, Slice DE, Enlow DH, Lederman HM, Amorim L, Scanavini MA, Vigorito JW

Objectives: To assess the 3D displacement/remodeling of the mandibular rami at the beginning of the pubertal growth spurt and in response to treatment with a Fränkel appliance.

Design: A randomized controlled trial.

Setting: São Paulo, Brazil.

Participants: Fifty-three children (28 boys, 25 girls), aged 9–12 years old, with a Class II division 1 malocclusion, ¾ unit Class II molars and an overjet of 4.5–10 mm.

Interventions: Treatment with a Fränkel Regulator II appliance ($n=28$) or observation ($n=25$) for 18 months. *Outcome measures:* Comparison of the positions of 3D anatomical landmarks obtained from MRI scans of the head taken at T1 and T2 (after 18 ± 1 months treatment or observation) to determine the relative repositioning/remodeling that had occurred.

Results: There were statistically significant differences (<0.001) in the 3D relative displacement/remodeling vectors at gonion and the pterygo-maxillary fissure between the treated and untreated groups. In the treated

DOI 10.1179/146531205225021393

group growth was directed more vertically and anteriorly at gonion and more posteriorly at the pterygo-maxillary fissure relative to condylion and middle cranial fossa.

Conclusions: This study found significant differences, between the treated and non-treated individuals, in the displacement/remodeling of the gonion and the pterygo-maxillary fissure relative to condylion and the middle cranial fossa.

Implications: These 3D methods of assessing craniofacial growth have given us insight into the differences in the relative displacement/remodeling of the craniofacial complex that occur during treatment and normal growth. Again, we await the long-term results of this study to see whether these gains are maintained and are clinically relevant.

Centrographic analysis of 1-phase versus 2-phase treatment for Class II malocclusion. *Am J Orthod Dentofacial Orthop* 2005; 128: 195–200
Dolce C, Schader RE, McGorray SP, Wheeler TT

Objectives: To evaluate the effects of 1-phase and 2-phase treatment for Class II malocclusion using the centrographic analysis developed by Fishman.[1]

Design: A randomized controlled trial.

Setting: Gainsville, Florida, USA.

Participants: Two-hundred children receiving treatment for or having observation of their Class II malocclusion.

Interventions: Treatment with a bionator appliance (n=66) or headgear and biteplane (n=69) until a bilateral Class I molar relationship or 2 years treatment was achieved, followed by a 1 year retention or observation period, or 2 years' observation (n=65).

Outcome measures: The centroid analysis as described by Fishman (*Am J Orthod Dentofacial Orthop* 1997; 111: 510–17) consisting of 4 triangles: cranial (Ba–S–N), maxillary (Ba–N–A point), mandibular (Ba–Gn–M) and facial (Ba–S–Gn).

Results: There were no differences between the groups at baseline. The facial and the mandibular areas were significantly larger in the bionator group at the end of phase 1 ($p<0.04$) and the end of retention ($p<0.01$), but the differences had been lost by the start of phase 2 and were not noticeable at the end of phase 2 ($p>0.05$).

Conclusions: The early gain induced by functional appliance treatment were not maintained beyond the end of the retention period following phase 1. By the end of phase 2, all differences in skeletal relationships had been lost.

Implications: It appears that in the long run a 2-phase treatment for Class II malocclusions has no advantages over a 1-phase treatment in terms of changes in the skeletal relationship.

True incisor intrusion attained during orthodontic treatment: a systematic review and meta-analysis. *Am J Orthod Dentofacial Orthop* 2005; 128: 212–19
Ng J, Major PW, Heo G, Flores-Mir C

Objectives: To quantify the amount of true incisor intrusion achieved as a result of orthodontic treatment and assess its clinical significance.

Design: A systematic review and meta-analysis.

Data sources: Several databases were searched using appropriate keywords.

Study selection: Two reviewers independently screened the titles and abstracts of potentially eligible studies for inclusion in the review. Full papers were obtained for all studies that appeared to meet the inclusion criteria of the review and those where there was insufficient information in the abstract to make a decision. The inclusion criteria for the review were that studies were human clinical trials (prospective or retrospective where allocation was random or non-random) and intrusion was determined by superimposition of lateral cephalograms. Articles that did not report true intrusion or take into account the growth occurring at the time were excluded.

Data extraction: Three reviewers independently evaluated the full papers for inclusion and extracted data.

Data synthesis: Combined mean estimates of intrusion using the segmental arch technique were calculated using a fixed-effects model with a weighting given to each study that was inversely proportional to its precision.

Results: The search strategy identified 161 potentially eligible studies of which 28 met the met the initial inclusion criteria. Twenty-four studies were then excluded as they did not report true intrusion or take into account the growth occurring at the time leaving 4 studies for inclusion in the review. Only 1 study was prospective; 3 studies used a non-random control and 1 was uncontrolled; 3 studies involved adult participants and 1 involved children. Two studies compared segmental versus continuous mechanics, 1 lingual

[1] Fishman LS. Individualized evaluation of facial form. *Am J Orthod Dentofacial Orthop* 1997;111:510-517.

appliances with reverse curve arch and 1 headgear + tandem appliance versus bionator. The combined mean estimate for the amount of incisor intrusion resulting from segmental mechanics was 1.46 mm (95% CI 1.05, 1.86) for the upper incisors and 1.90 mm (95% CI 1.22, 2.57) for the lower incisors.
Conclusions: From the results of the studies included in this review it appears that segmental orthodontic mechanics can bring about true intrusion of the incisors. However, the results of the review need to be treated with caution due to the methodological quality of the included studies.

Implications: Segmental orthodontic mechanics may be able to bring about true intrusion of the incisors; however, the evidence for this is weak. Further prospective studies, with random allocation of participants to alternative methods of incisor intrusion, are required.

The effects of maxillary protraction therapy with or without rapid palatal expansion: a prospective, randomized clinical trial. *Am J Orthod Dentofacial Orthop* 2005; 128: 299–309
Vaughn GA, Mason B, Moon HB, Turley PK

Objectives: To quantify effects of maxillary protraction with or without palatal expansion.

Design: A randomized controlled trial.

Setting: UCLA, California, USA.

Participants: Forty-six children, age 5–10 years old, with an edge to edge or reverse overjet on 2 or more incisors, 1/4 unit Class III molar relationship or worse. In borderline cases, cephalometric variable were considered (ANB $\leqslant 0^{\circ}$, Wits' $\geqslant 3$ mm and nasion perpendicular to A-point $\leqslant 2$ mm).

Interventions: (A) facemask treatment with palatal expansion using banded jackscrew appliance, (B) facemask treatment with passive expansion appliance or (C) observation for at least 12 months then random allocation to A or B.

Outcome measures: Dental and skeletal variables measured from lateral cephalograms.

Results: There were no significant differences in any of the cephalometric variables between the 2 treatment groups, A and B. There were significant differences between these groups and the untreated group C ($p<0.05$) with the maxilla moving forward and rotating anticlockwise and the mandible being displaced backwards. These differences resulted in significant changes in the ANB angle and Wits' analysis ($p<0.001$).

Conclusions: Facemask treatment with or without expansion produced significant changes in the dentofacial complex that improved the Class III malocclusion.

Implications: This study suggests that the addition of an expansion when using facemask treatment is of no additional benefit in correcting the Class III relationship. Its use, in conjunction with facemask treatment, should therefore be determined by the need for maxillary expansion rather than to facilitate the Class III correction.

European Journal of Orthodontics

The effects of early headgear treatment on dental arches and craniofacial morphology: an 8-year report of a randomized study. *Eur J Orthod* 2005; 27: 429–36
Pirttiniemi P, Kantomaa T, Mantysaari R, Pykalainen A, Krusinskiene V, Laitala T, Karikko J

Objectives: To determine the long-term effects of early headgear (HG) treatment on the dental arches and craniofacial skeleton.

Design: A randomized controlled trial.

Setting: University of Oulu, Finland.

Participants: Sixty-eight children, 40 boys and 28 girls, mean age 7.6 years (SD 0.3 years) with moderate crowding and a Class II tendency.

Interventions: *Active*—cervical headgear with long outer arms bent up 10° and expanded inner arms worn 8–10 hours per night for an average of 16 months. *Control*—minor interceptive measures (extraction of deciduous canines) to improve anterior alignment.

Outcome measures: Dental and skeletal variables measured from study models and lateral cephalograms assessed before treatment (T0) after 2 years (T1) and 8 years (T2).

Results: Fifty-three of the 68 children (78%) who were randomized completed the follow-up to 8 years and had full records available. Significantly more children in the control group than the HG group needed extractions ($p<0.01$) and/or fixed appliance treatment ($p<0.05$) after phase 1. There were no significant differences in the cephalometric variables, measured at T2, between the HG and controls groups except for the angle SN/Mx plane ($p=0.008$) with it decreasing in the HG group and increasing in the control group. There was significantly less space loss in the maxillary ($p=0.0006$) and mandibular ($p=0.02$) arch length and more expansion

(max $p=0.003$, mand $p=0.0004$) in the HG group compared with the control group at T2. There was no significant difference in the PAR scores of the 2 groups at T2. The overall treatment time was longer for the HG group (25 months, 17 visits) than the control group (21 months, 14 visits).

Conclusions: This study suggests that the use of cervical headgear in the mixed dentition reduced the need for extractions and fixed appliance treatment, had an anti-clockwise rotating effect on maxillary growth, reduced space loss and induced expansion in the maxillary and mandibular arches.

Implications: This study found that early HG treatment does have benefits in terms of dental changes and the need for extractions or fixed appliance therapy but has very little effect on the skeletal pattern. This implies that, from a dental point of view, early treatment with HG is of long-term benefit, but at the expense of increased treatment time.

An investigation into the use of two polyacid-modified composite resins (compomers) and a resin-modified glass poly(alkenoate) cement to retain orthodontic bands. *Eur J Orthod* 2005; 27: 489–93
Williams PH, Sherriff M, Ireland AJ

Objectives: To compare a polyacid-modified composite resin (Transbond™ Plus, 3M Unitek, St Paul, Minnesota, USA) and a resin-modified glass poly(alkenoate) cement (Intact, Orthocare UK Ltd, Bradford, UK) to retain orthodontic bands.

Design: A split mouth randomized controlled trial.

Setting: Hospital orthodontic department, UK.

Participants: Thirty patients requiring bands to be placed on their upper and lower first permanent molars who did not require additional banded appliances, e.g. quadhelix.

Interventions: Transbond™ Plus, a polyacid-modified composite resin and Intact, a resin-modified glass poly(alkenoate) cement to retain orthodontic bands to first permanent molars.

Outcome measures: Band failure over 12 months and the patients' perception of the taste of the cements.

Results: There were only 3 band failures (out of 120 bands placed) over the 12 months (2 Intact, 1 Transbond™ Plus). This was too few to allow statistical analysis. There was a statistically significant difference in the perception of the taste with Intact being judged to have the better taste ($p=0.001$).

Conclusions: There was very little difference between Intact and Transbond™ Plus in the band failure rate over 12 months, but patients found the taste of Intact least unpleasant.

Implications: With little difference between the bond failure rate of Intact and Transbond™ Plus other factors, including clinician and patient preferences, will determine which cement is used.

Recolonization of *mutans steptococci* on teeth with orthodontic appliances after antimicrobial therapy. *Eur J Orthod* 2005; 27: 274–85
Attin R, Thon C, Schlagenhauf U, Werner C, Wiegand A, Hannig C, Attin T

Objectives: To compare the recolonization pattern of *mutans streptococci* on teeth with and without orthodontic appliances after antibacterial treatment.

Design: A randomized controlled trial.

Setting: University hospital, Göttingen, Germany.

Participants: Ten patients who required fixed appliance therapy and were identified as having high levels of *mutans streptococci* in their saliva.

Interventions: All participants received scale and polish and oral hygiene instruction prior to the study. All teeth to be bonded/banded had a 40% chlorhexidine varnish (EC40®, Explore, Nijmegen, Netherlands) applied at baseline and 1 week later if they had still had a high level of *mutans streptococci* in their saliva. Orthodontic appliances were then placed randomly on either the maxillary or mandibular teeth with the opposite arch acting as the control. *Mutans streptococci* levels were then assessed 8 weeks following the placement of the appliances.

Outcome measures: Level of *mutans streptococci* in the saliva and in the plaque on the buccal surfaces of the teeth or adjacent to the brackets and bands.

Results: Compared with baseline measurements, at 8 weeks the levels of *mutans streptococci* found in the plaque adjacent to the brackets and bands was unchanged ($p=0.2$), but was significantly less in the plaque on the control teeth ($p=0.001$). These differences were statistically different ($p=0.02$).

Conclusions: This study showed that the chlorhexidine varnish reduced the recolonization of teeth by *mutans streptococci* that did not have orthodontic appliances on them, but not those with orthodontic brackets and bands attached.

Implications: This study suggests that it is not worthwhile applying chlorhexidine varnish to the teeth of patients at high risk of decalcification who are about to start orthodontic treatment because it does not prevent teeth with orthodontic brackets/bands attached from being recolonized by *mutans streptococci*.