FEATURES SECTION

Evidence-based orthodontics

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European Journal of Orthodontics

The effects of early headgear treatment on dental arches and craniofacial morphology: a report of a 2-year randomized study. *Eur J Orthod* **2004; 26: 59–64**
Mäntysaari R, Kantomaa T, Pirttiniemi P, Pykäläinen A

Objectives: To determine the effects of treatment with cervical headgear during the mixed dentition on the dental arch and craniofacial morphology.

Design: A randomized controlled trial.

Setting: Oulu, Finland.

Participants: Sixty-eight 7 year old children with moderate crowding and a Class II tendency.

Interventions Treatment: Cervical headgear worn for 8–10 hours a day during sleep for an average of 16 months. Control: Only interceptive procedures were carried out during the follow-up period.

Outcome measures: Dental and skeletal relationships measured from study models and lateral cephalograms at T_0 (baseline), T_1 and T_2 (mean 8.2 and 16 months, respectively).

Results: There were statistically significant increases in the headgear group in all study models measurements and the overbite ($p<0.001$), but no statistically significant difference in the overjet at T_1 and T_2. The mean gain in maxillary and mandibular arch length was 6.4 mm and 2.9 mm, respectively. At T_2 there were no statistically significant differences between the two groups in the changes in SNA, SN/NL, NL/ML, facial axis or LI/ML. By T_2 the decreases in ANB ($p<0.01$) and UI/LI ($p<0.001$) and increases in UI/SN ($p<0.001$), UI/NL ($p<0.001$) and NPog/LI ($p<0.05$) were statistically significantly greater in the headgear group.

Conclusions: The results of this study indicate that the use of cervical headgear in the mixed dentition gains space in both arches by widening them and proclining the incisors.

Implications: This study suggests that useful space (3–6 mm) can by gained by using cervical headgear in the mixed dentition. However, the long-term stability of this space gain has not been assessed.

Perception of pain during orthodontic treatment with fixed appliances. *Eur J Orthod* **2004; 26: 79–85**
Erdinç AME, Dinçer B

Objectives: To compare the characteristics and impact of the pain experienced by patients when using different dimensions of nickel titanium (NiTi) archwires.

Design: A randomized controlled trial.

Setting: İzmir, Turkey.

Participants: One hundred and nine adolescents receiving orthodontic treatment with 0.018 inch pre-adjusted fixed appliances.

Interventions: A 0.014 or 0.016 inch NiTi archwire.

Outcome measures: A 49 question questionnaire to determine the time at which pain was first felt; then, at 6 hours and daily for 7 days, whether they had pain, how bad it was (10 point VAS), where the pain was, whether they took pain killers and whether the pain affected their daily living.

Results: The most frequently reported time to have experienced pain by was 2 hours. About a third of patients in each group reported that they had pain by that time. The most severe pain was at 1 day post-insertion. From days 2 to 7 the pain decreased. The highest consumption of painkillers and the most impact on daily life was at 6 hours. There were no statistically significant differences in these results or the number of people in pain at each time point in each group.

Conclusions: The characteristics and impact of the pain experienced by patients treated with either a 0.014 or 0.016 inch NiTi wire were not statistically significantly different.

Implications: It appears that, from the point of view of the amount of pain experienced by patients, it doesn't

matter whether we use a 0.014 or 0.016 inch NiTi wire as our initial aligning archwire. It would be worthwhile finding out whether the rate of alignment of the teeth differed when using these archwires and whether the findings were the same when using a 0.022×0.028 inch bracket system.

American Journal of Orthodontics and Dentofacial Orthopedics

Comparison of 3 bonded lingual appliances by auditive analysis and subjective assessment. *Am J Orthod Dentofac Orthop* 2003; 124: 737–45
Hohoff A, Stamm T, Goder G, Sauerland C, Ehmer U, Seifert E

Objectives: To compare the impact of different lingual appliances on sound performance and oral comfort.

Design: A randomized controlled trial.

Setting: Muenster, Germany.

Participants: Twelve adults who were native speakers of standard German.

Interventions: Lower thermoplastic retainer alone or formed over (1) a bonded 0.0175 inch stainless steel retainer from canine to canine; (2) customized lingual brackets on all teeth and a 0.016 inch archwire or (3) prefabricated lingual brackets on all teeth and a 0.016 inch archwire. All appliances were worn for 24 hours at weekly intervals in a randomized order.

Outcome measures: Auditory assessments, by 3 blinded speech professionals, of the participants reading a standard German text on three separate occasions. Self-reported assessments of articulation and oral comfort were made.

Results: There were significant impairments in the speech of participants when wearing all the appliances whether assessed by the speech professional or self-reported ($p=0.012$; $p<0.0005$). All appliances caused significant irritation to the tongue ($p=0.039$; $p<0.0005$) and restricted total comfort ($p=0.017$; $p<0.0005$). There was some recovery in speech by T_3 in the thermoplastic retainer alone group, but in all other groups speech and oral comfort remained affected at T_3 ($p=0.026$; $p<0.0005$).

Conclusions: All lingual appliances had a significant impact on speech and oral comfort with the smaller appliances causing least impairment.

Implications: Patients need to be informed that any form of lingual appliance will affect speech and oral comfort,

and that little adaptation will occur over time. It would be worthwhile assessing whether children adapt to lingual appliances.

Clinical trials comparing plasma arc and conventional halogen curing lights for orthodontic bonding. *Am J Orthod Dentofac Orthop* 2004; 125: 30–5
Manzo B, Liistro G, De Clerck H

Objectives: To evaluate the clinical reliability of a xenon plasma light compared with a halogen light.

Design: A split-mouth randomized controlled trial.

Setting: Brussels, Belgium.

Participants: Forty-five patients requiring fixed appliance therapy.

Interventions: Appollo 95E xenon plasma light (Dental/Medical Diagnostic systems, Woodland Hills, Ca, USA) and Ortholux halogen light (3M Unitek).

Outcome measures: Bonding time, bond failure rate and survival.

Results: The bonding time with the xenon light was significantly shorter than the halogen light ($p<0.001$). The overall bond failure rates were identical (3.9%). There were significantly more failures in the posterior segments, when compared with the anterior segment in the halogen group ($p=0.005$), but not the xenon group ($p>0.05$). There was no significant difference between the groups in the mean survival time of 379 days ($p=0.996$).

Conclusions: The bonding procedure with the xenon light was significantly shorter than with the halogen light. The failure rates were identical and the survival times similar when using the two different lights.

Implications: This study suggests that the xenon light significantly reduces bonding time without prejudicing bond survival.

In vivo effect of a resin-modified glass ionomer cement on enamel demineralization around orthodontic brackets. *Am J Orthod Dentofac Orthop* 2004; 125: 36–41
Pascotto RC, de Lima Navarro MF, Filho LC, Cury JA

Objectives: To evaluate the effect of glass ionomer cement (GIC) on reducing demineralization around orthodontic brackets.

Design: A randomized controlled trial.

Setting: São Paulo, Brazil.

Participants: Fourteen patients who had 46 brackets bonded to premolars that were scheduled to be extracted for orthodontic reasons.

Interventions: Premolars brackets were bonded with either resin-modified GIC (Fuji Ortho LC; GC America, Chicago, Ill, USA) or composite resin (Concise; 3M Dental Products, St Paul, Mn, USA). Teeth were extracted after 30 days and stored in 2% formaldehyde. Three weeks prior to and during the experiment participants brushed with non-fluoridated toothpaste, but drank fluoridated water.

Outcome measures: Decalcification was assessed by analyzing the micro-hardness of the enamel surface at different positions and depths on the buccal and lingual surface of the extracted teeth.

Results: The micro-hardness of the enamel was dependant on the position ($p<0.00005$) and depth ($p<0.00005$) of the enamel sample and the material used ($p=0.02$). Demineralization was greatest in the Concise group cervically at depths of up to 200 μm ($p=0.00004$).

Conclusions: This study suggests that resin-modified GIC protects against demineralization, especially cervically, in the early stages of orthodontic treatment.

Implications: The protective effect of resin-modified GIC on demineralization, even after 30 days, should encourage clinicians to use it for bonding. However, this has to be balanced against any potential disadvantages of these cements, the fact that orthodontic treatment takes longer than 30 days and that fluoride release from resin-modified GIC diminishes over time. A longer study is therefore required to assess the full clinical implications of using these cements to bond orthodontic brackets.

Aspartate aminotransferase (AST) activity in pulp of orthodontically treated teeth. *Am J Orthod Dentofac Orthop* 2004; 125: 88–92
Perinetti G, Vavara G, Festa F, Esposito P

Objectives: To determine whether metabolic changes occur in the pulp of teeth during the early stage of orthodontic treatment with fixed appliances.

Design: A split-mouth randomized controlled trial.

Setting: Chieti, Italy.

Participants: Seventeen patients whose first premolars would be extracted for orthodontic reasons.

Interventions: All maxillary teeth were bonded and a unilateral 0.018 inch stainless steel wire was ligated to teeth on the experimental side to deliver a force of 30–90 g. No wire was placed on the contra-lateral (control) side. After 7 days 4|4 were extracted and the pulp samples removed. The samples were washed in ice-cold, heparinized sterile saline (to remove all blood that can show AST activity) and stored at $-80°C$ until the biochemical analysis to assess AST levels was undertaken. AST is an intracellular, cytoplasmic enzyme that is released on cell death be it as a result of normal cell turnover or necrosis.

Outcome measures: Spectrophotometry was used to measure the AST activity/mg of pulp tissue.

Results: There was a statistically significant increase in AST activity in the experimental teeth ($p<0.01$).

Conclusions: Orthodontic forces induce enzymatic changes in the dental pulp that suggest that the pulp undergoes inflammatory changes in the early stage of tooth movement.

Implications: Further studies are required to assess the exact role of AST in early orthodontic tooth movement.

Effects of continuous and interrupted orthodontic forces on interleukin-1β (IL-1β) and prostaglandin E$_2$ (PGE$_2$) production in gingival crevicular fluid (GCF). *Am J Orthod Dentofac Orthop* 2004; 125: 168–77
Lee K-J, Park Y-C, Yu H-S, Choi S-H, Yoo Y-J

Objectives: To assess changes in IL-1β and PGE$_2$ in GCF following the application of a continuous or interrupted force.

Design: A split-mouth controlled trial.

Setting: Seoul, South Korea.

Participants: Ten patients whose first premolars had been extracted for orthodontic reasons.

Interventions: Brackets (0.022×0.028 inch), and tubes were bonded to canines and posterior segments. Experimental: (E1) a continuous force (100 g NiTi coil spring) or (E2) an interrupted force (expansion screw) was applied to retract the canine. Control: an antagonistic canine had no force applied. GCF samples were taken before active treatment started, 1 hour, 24 hours, and 7 days after initial activation, and the first and second reactivations of E$_2$.

Outcome measures: Primary: IL-1β and PGE$_2$ levels in the GCF measured using immunosorbent assays. Secondary: tooth movement.

Results: Significant increases in IL-1β and PGE$_2$, compared with the control, were first seen at 24 hours after both types of activation and again at 24 hours after the first reactivation in E$_2$. No significant difference in IL-1β, PGE$_2$ or the amount of tooth movement was found between E$_1$ and E$_2$ at any time point.

Conclusions: This study found that both types of force induced a significant increase in IL-1β and PGE$_2$ after 24 hours. This decreased over a week and then the IL-1β increased 24 hours after reactivation in E$_2$. Both types of force produced similar amounts of tooth movement.

Implications: Continuous and interrupted force applications are capable of initiating bone resorption. Reactivation of a force increases IL-1β levels again, but this was not accompanied by an increase in PGE$_2$ or enhanced tooth movement. However, this was a small study and may have lacked power to detect a statistically significant difference in treatment effect even if there had been one. Larger studies are required to investigate the relationship between force application and tooth movement.

The Angle Orthodontist

Use of skeletal maturation based on hand-wrist radiographic analysis as a predictor of facial growth: a systematic review. *Angle Orthod* 2004; 74: 118–24
Flores-Mir C, Nebbe B and Major PW

Objectives: To evaluate the prediction of facial growth from the skeletal maturity obtained from hand-wrist radiographs.

Design: A systematic review.

Data Sources: Medline, PubMed, Cochrane Database of Systematic Reviews, Embase, Web of Science and Lilacs databases were searched from their inception to October/November 2002.

Study selection: Cross-sectional or longitudinal studies assessing skeletal maturation using hand-wrist radiographs and facial growth through cephalometric radiographs were included.

Data extraction: Data on sample characteristics, selection and origin, method error and method of skeletal age analysis were recorded.

Data synthesis: No data synthesis was performed. The results were presented in narrative and tabular form.

Results: The search strategy identified 204 potentially eligible studies. Of these, 16 fulfilled the inclusion criteria, but 5 were subsequently excluded due to methodological problems. All the studies reported that overall facial growth velocity was well related to standing height velocity and skeletal maturity ($r=0.48$–0.83). Many studies reported significant correlations but of variable strength ($r=0.53$–0.79) between skeletal maturity and mandibular growth velocity. Growth in the length of the body ($r=0.71$) was more closely correlated to skeletal maturity than was the growth in the height of the ramus ($r=0.6$).

Conclusions: Overall horizontal and vertical facial growth velocity was related to skeletal maturity indicators determined by analysis of hand-wrist radiographs. Maxillary and mandibular growth velocities were also related to skeletal maturity but the correlations were weaker.

Implications: The use of hand-wrist radiographs to assess skeletal maturity may be a valuable orthodontic research tool, but the use of individual ossification events is of limited predictive use. I also question their use in light of the findings of recent randomized controlled trials that suggest that most of the effects of functional appliances and headgear are dentoalveolar, rather than skeletal, which I think reduces our need to predict accurately the timing of the pubertal growth spurt.

A systematic review of the consequences of premature birth on palatal morphology, dental occlusion, tooth-crown dimensions and tooth maturity and eruption. *Angle Orthod* 2004; 74: 269–79
Paulsson L, Bondemark L, Söderfeldt B

Objectives: To assess whether prematurity results in changes in palatal morphology, dental occlusion, tooth-crown dimensions and tooth maturation.

Design: A systematic review

Data Sources: Medline was searched from January 1966 to November 2002 using appropriate MeSH terms.

Study selection: Two reviewers independently selected controlled studies, published in English as full-length articles, reporting quantitative data on the effect of premature birth (<37 weeks gestation or <2500 g birth weight) on the jaws, dentition, dental physiology and tooth abnormalities.

Data extraction: Two reviewers independently extracted data on the year of publication; definition of prematurity; sample size; material and age; methods and measurements; outcomes and authors' conclusions. Correlations between prematurity, intubation and sucking habits and deformity were noted. Studies were assessed for methodological quality.

Data synthesis: This was not possible due to heterogeneity of the data. The results were presented in narrative and tabular form.

Results: The search strategy identified 113 potentially eligible studies of which 13 were included. Four out of 5 studies found a positive correlation between palatal morphology and oral intubation. Conflicting data on the prevalence of crossbite were found. Five studies reported delay in tooth maturation and eruption, but when corrected age was considered no delay was found. Studies on tooth crown dimensions were inconclusive.

Conclusions: Premature children were found to have altered palatal morphology, in the short term, when compared with their full-term peers. Insufficient data were available to assess whether these changes were permanent. When corrected age was considered no delay in dental development or eruption was found. Evidence on dental occlusion and altered tooth crown dimensions was contradictory.

Implications: The literature gives no clear answers as to whether prematurely born children are at higher risk of malocclusion or not. Further well-designed, adequately controlled longitudinal studies, stratified according to gestational age and birth weight, are needed to clarify the situation.

Orthodontics & Craniofacial Research

Clinical comparison of an adhesive precoated vs. an uncoated ceramic bracket system. *Orthod Craniofac Res* 2004; 7: 15–20
Verstrynge A, Ghesquiere A, Willems G

Objectives: To compare the clinical bond characteristics of an adhesive pre-coated (APC) ceramic bracket with the non-coated version.

Design: A split-mouth randomized controlled trial.

Setting: A university orthodontic department, Leuven, Belgium.

Participants: Twenty patients receiving upper and lower fixed appliance therapy.

Interventions: The incisors, canines and premolars in two diagonally opposite quadrants had APC Clarity brackets (3M Unitek Dental Products, CA, USA) bonded to them. Non-coated Clarity brackets, bonded with Transbond XT (3M Unitek), were attached to teeth in the other two quadrants.

Outcome measures: In-treatment bracket failures and post-treatment adhesive remnant index (ARI).

Results: There were no bond failures during treatment or enamel fractures at debond in either group. One tie wing fractured in the APC group. There were no statistically significant differences in the ARI scores between the APC and non-coated Clarity bracket groups ($p > 0.01$).

Conclusions: No differences in the clinical bond characteristics of Clarity APC ceramic brackets and the non-coated version, bonded with Transbond XT, were found.

Implications: It appears that the APC and non-coated versions of Clarity brackets perform in a similar way, although this may be a reflection of the small sample size rather than a true effect.

Does the transition temperature of Cu-NiTi archwires affect the amount of tooth movement during alignment? *Orthod Craniofac Res* 2004; 7: 21–5
Dalstra M, Melsen B

Objectives: To compare the amount of tooth movement occurring during the alignment phase of orthodontic treatment, when teeth are ligated to an archwire with different transition temperatures.

Design: A split-mouth controlled clinical trial.

Setting: A university orthodontic department, Aarhus, Denmark.

Participants: Fifteen patients receiving upper fixed appliance therapy.

Interventions: Specially manufactured Cu-NiTi archwires with one side having a transition temperature of 27°C and the other 40°C. Teeth on opposite sides of the maxillary arch were ligated to either the section of wire with a 27°C or 40°C transition temperature.

Outcome measures: Tooth movement in the occlusal plane and rotation, occurring after 3–5 weeks, measured from calibrated intra-oral photographs.

Results: When considering all the teeth groups, there was statistically significantly more movement in total

translation (2.5 mm versus 1.9 mm) and in the A–P direction on the 40°C side than on the 27°C side ($p<0.05$). There were no statistically significant differences in the amount of rotation that occurred on either side ($p>0.05$).

Conclusions: It appears that the transition temperature of archwires does have an effect on the amount of tooth movement occurring during the initial phases of alignment with more movement occurring on the side with the higher transition temperature (40°C).

Implications: This study suggests that a higher transition temperature (40°C) increases the rate of tooth movement. Whether the added 0.6 mm, over an average of 4 weeks, is clinically significant is uncertain. A study of the long-term effects, including adverse ones, of this increased rate of movement may clarify the situation.