FEATURES SECTION

Evidence-based orthodontics

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A clinical comparison of the quadhelix appliance and the nickel titanium (tandem loop) palatal expander: a preliminary prospective investigation.
Donohue VE, Marshman LAG, Winchester LJ.

Objectives: To compare the maxillary expansion efficacy and rate of expansion brought about by quadhelix appliance (QH) and a nickel titanium palatal expander (NiTi).

Design: A controlled clinical trial with allocation alternating between patients.

Setting: East Grinstead, UK.

Participants: Thirty three consecutive patients in the late mixed or permanent dentition with a unilateral or bilateral crossbite.

Interventions: Quadhelix: a custom-made appliance made out of 0.8mm heat-treated blue Elgiloy® expanded by one molar's width posteriorly. *NiTi expander*: a pre-formed removable appliance with two 0.8mm stainless steel palatal arms connected to a 0.9mm NiTi tandem loop that was cooled to facilitate insertion.

Outcome measures: Efficacy (E_{max}), rate (m_{max}) and variance (V_E and V_m) of maxillary expansion; discomfort and cost-effectiveness.

Results: Twenty-eight patients (85%) completed maxillary expansion. There were no significant differences between E_{max} and m_{max} or V_E of either group across the molars or premolars (p=0.16–0.98). There were significant differences between the E_{max} (p=0.001) and m_{max} (p=0.0001) with the QH across the molars compared with the premolars but not the NiTi (p=0.11). V_m for the NiTi expander was significantly greater than the QH across the molars (p=0.004) and premolars (p=0.009). The QH and NiTi expander caused similar amounts of discomfort except on days 6 (p=0.04) and 7 (p=0.03) after the second activation when the NiTi expander was significantly less uncomfortable. None of the QH group and eleven of the NiTi expander group required more than one appliance.

Conclusions: The QH and NiTi expander produced similar amounts of maxillary expansion. The QH appeared to produce more consistent expansion and needed only one appliance to produce the expansion but was more painful when reactivated.

Implications: This study suggests that the custom-made QH was as effective at producing maxillary expansion as the pre-formed NiTi expander but the QH produced more consistent expansion and was more cost-effective.

European Journal of Orthodontics 2004; 26:449–454.

A 12-month clinical study of bond failures of recycled versus new stainless steel orthodontic brackets.
Cacciafesta V, Sfondrini MF, Melson B, Scribante A.

Objectives: To compare the clinical performance of recycled with new stainless steel brackets.

Design: A split-mouth randomised controlled trial.

Setting: Aahus, Denmark.

Participants: Twenty patients requiring upper and/or lower fixed appliance therapy who were free of caries, hypoplasia, restorations and occlusal interferences

Interventions: Teeth in contra-lateral quadrant were bonded with either recycled or new Orthos# stainless steel brackets. Recycling involved the brackets being washed in non-acid solution, dried and heated to 350°C for 24 hours then rewashed twice, dried and electro-polished for 20 seconds and finally sterilized at 250°C.

Outcome measures: Bond failure rate and time to bond failure.

Results: Overall, in 12 months there were 9 (5.8%) failures of the new brackets and 11 (7.1%) of the recycled ones. This was not statistically significantly different (p=0.65). There were also no statistically significant differences between the failure rate of the each bracket type when comparing upper and lower arches (p>0.33) or anterior and posterior teeth (p>0.33). There was no significant difference in terms

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of bracket failure risk over 12 months between the two bracket types (hazard ratio 0.77 95% CI 0.31–1.93).

Conclusion: The results of this study suggest that the bond failure rate and survival of the recycled brackets was similar to the new brackets.

Implications: It appears that this recycling method did not have an impact on bond failure rate or survival over a 12-month period. However, this study did not address other outcomes that may have been affected by the recycling process e.g. effects of slot or base distortion. Recycling may have economic and ecological advantages but clinicians need to be aware of the problems that may occur with recycling and patients informed of the type of bracket they are being treated with.

[#] Orthos, SDS/Ormco, Glendora, CA, USA.

European Journal of Orthodontics 2004; 26:515–522.

Adaptive condylar growth and mandibular remodelling changes with bionator therapy – an implant study.
Araujo AM, Buschang PH, Melo ACM.

Objectives: To describe condylar growth and mandibular remodelling with bionator therapy.

Design: A randomised controlled trial.

Setting: Unclear.

Participants: Twenty-five patients, with Class II division 1 malocclusions, aged 6.9–11.2 years with minimal crowding (<1.5mm) and no crossbites.

Interventions: Both groups: Three mandibular implants were placed; one in the symphysis and one either-side proximal and inferior to the first permanent molar. Participants were randomly allocated to either no treatment or bionator treatment and followed-up for one year.

Outcome measures: Implant displacement, mandibular growth and rotation measured cephalometrically.

Results: The bionator group showed statistically significantly more posterior growth and remodelling at posterior gonion ($p=0.018$) and condylion ($p=0.025$) than the control group. There were no statistically significant differences between the two groups in the amount of vertical growth occurring ($p=0.147$–0.701). The total changes were only significantly different at posterior gonion ($p=0.033$) with the bionator group experiencing more growth. Significantly more horizontal displacement ($p=0.04$–0.01) of the all the implants and vertical displacement if the anterior implant ($p=0.012$) occurred in the bionator group. However, significantly less forward rotation of the mandible ($p=0.014$) took place in the bionator group.

Conclusions: This implant study suggests that the bionator induces greater amounts of posterior growth and remodelling in the gonial and condylar regions; displaces the mandible forwards but limits the amount of forward rotation.

Implications: It appears that anterior posturing of the mandible encourages remodelling at the angle and condyle that results in the mandible being displaced anteriorly, its forward rotation being limited, thus helping to reduce the overjet and overbite in Class II division 1 malocclusions.

European Journal of Orthodontics 2004; 26:553–560.

The effects of argon laser curing of a resin adhesive on bracket retention and enamel decalcification: a prospective clinical trial.
Elaut J, Wehrbein H.

Objectives: To compare argon laser-curing of a light-activated resin adhesive (Transbond XT, 3M Unitek, Monrovia, California, USA) with conventional light-curing.

Design: A controlled clinical trial.

Setting: University department and private practice in Belgium.

Participants: Forty-five patients, with a total of 742 teeth, requiring two arch fixed appliance therapy ± extractions.

Interventions: Alternate teeth were cured using either conventional light-curing for 40 seconds (Curing light XL3000, 3M Unitek, Monrovia, California, USA) or argon laser-curing for 10 seconds (Flexilas Argon laser, ARC Laser GmbH, Eckental, Germany). The brackets were placed on the control teeth before the experimental teeth. Aluminium shielding appliances were used to avoid laser irradiation of the control teeth.

Outcome measures: Bond failure rate, decalcification and plaque scores over 14 months.

Results: Significantly fewer ($p=0.038$) bond failures occurred in the argon laser-cured group (9/371, 2.4%) than the conventional light-cured group (21/371, 5.7%). There were no significant difference in the

amount of decalcification occurring or the plaque scores ($p>0.05$).

Conclusions: This study suggests that argon laser-curing of an orthodontic resin reduced the bond failure rate and did not affect the amount of decalcification occurring or plaque scores when compared with conventional light-curing.

Implications: It appears that curing orthodontic resin with an argon laser may have benefits in terms of a reduced bond failure rate and time. However, there may be added hazards, in terms of potential for retinal damage, when using the laser.

American Journal of Orthodontics and Dentofacial Orthopedics 2004; 126:194–199.

Plasma arc versus halogen light-curing of adhesive-precoated orthodontic brackets: A 12-month clinical study of bond failures.
Cacciafesta V, Sfondrini MF, Scribante A.

Objectives: To compare the clinical performance of adhesive pre-coated stainless steel brackets (APC brackets, 3M Unitek, Monrovia, California, USA) cured with either a plasma arc light or a conventional halogen light.

Design: A split-mouth randomised controlled trial.

Setting: Orthodontic practice, Italy.

Participants: Thirty patients, with a total of 600 teeth, requiring single or two-arch fixed appliance therapy non-extraction therapy who had no caries, hypoplasia, fillings or occlusal interferences.

Interventions: APC brackets in contra-lateral quadrants were cured using either a conventional halogen light for 20 seconds or a plasma arc light for 5 seconds.

Outcome measures: Bond failure rate over 12 months.

Results: There was no significant difference between the bond failure rate of the APC brackets cured with the halogen (12/300, 4%) or plasma arc (21/300, 7%) lights ($p=0.09$). There was also no significant difference in the bracket failure risk between brackets cured with each of the two lights (hazard ratio 0.56, 95% CI 0.29, 1.13).

Conclusions: This study found that the bond failure rate of the APC brackets cured with the conventional halogen light was lower that with the plasma arch light but that this difference was not statistically significant. However, this may be the effect of the relatively small sample size.

Implications: It appears that curing APC brackets with a plasma arc light may be as effective as a conventional halogen light and have benefits in terms of a reduction in time needed to bond-up. However, a larger study, powered to detect the difference found in this study, is required to verify these findings.

American Journal of Orthodontics and Dentofacial Orthopedics 2004; 126:200–206.

Comparison of bond strength between a conventional resin adhesive and a resin-modified glass ionomer adhesive: An in vitro and in vivo study.
Summers A, Kao E, Gilmore J, Gunel E, Ngan P.

Objectives: To compare the survival rate and mode of failure of orthodontic brackets bonded with a resin modified glass ionomer (RMGI) and a conventional resin adhesive.

Design: A split-mouth randomised controlled trial.

Setting: University department, West Virginia, USA.

Participants: Twenty-two patients, in the permanent dentition, receiving comprehensive orthodontic treatment who had no decalcification and good oral hygiene.

Interventions: Brackets in contra-lateral quadrants were bonded with either Fuji Ortho LC RMGI or Light Bond resin adhesive (both from Reliance Orthodontic Products, Itasca, Illinois, USA).

Outcome measures: Bond failure rate and adhesive remnant index (ARI).

Results: The mean observation time was 1.32 years (max 1.82 years; min 0.59 years). There were no significant differences between the bond failure rate of the brackets bonded with Fugi LC RMGI (13/199, 6.5%) and Light Bond (10/199, 5%) adhesives ($p<0.41$) or the ARI score for each adhesive ($p<0.52$).

Conclusions: This study found that the bond failure rate of the brackets bonded with the RMGI was higher and the ARI score lower than those bonded with the conventional resin adhesive but that these differences were not statistically significant. However, this may be the effect of the relatively small sample size.

Implications: It appears that the bond failure rate and adhesive remnant index score of Fuji LC RMGI were similar to a conventional resin adhesive suggesting that the bond strength of this RMGI was adequate for clinical use. However, a larger study is required to verify these findings.

American Journal of Orthodontics and Dentofacial Orthopedics 2004; 126:325–330.

Fluoridated elastomers: Effect on the microbiology of plaque.
Benson PE, Douglas CWI, Martin MV.

Design: A split-mouth, cross-over, randomised controlled trial.

Setting: University departments, Liverpool and Sheffield, UK.

Participants: Thirty patients with good oral hygiene who were about to receive fixed orthodontic treatment and were not pregnant or diabetic; using an anti-microbial mouthwash or had not taken antibiotics in the last two months.

Interventions: Fluoridated or non-fluoridated elastomeric ligatures were used to ligate contra-lateral maxillary incisors and the opposite mandibular canine. After six weeks the elastomers were removed and the plaque collecting on them sent for laboratory analysis. Non-fluoridated ligatures were placed for six weeks as a washout period and then the opposite configuration of elastomers were placed for a second experimental period.

Outcome measures: Strepococcus count expressed as a percentage of the total aerobic count.

Results: Twenty-seven patients completed the trial. There were no significant differences in the streptococcal count ($p=0.29$) or total anaerobic count ($p=0.23$) between the plaque collected from fluoridated and non-fluoridated ligatures.

Conclusions: This study found that the incorporation of fluoride into elastomeric ligatures did not reduced the microbial load of the plaque collecting on them.

Implications: Fluoridated ligatures are not effective at reducing the streptococcal or anaerobic growth in locally forming dental plaque.

American Journal of Orthodontics and Dentofacial Orthopedics 2004; 126:354–362.

Three-dimensional assessment of morphologic changes in the maxilla: A comparison of 2 kinds of palatal expanders.
Oliveria NL, Da Silveira AC, Kusnoto B, Viana G.

Objectives: To evaluate the differences in outcome between the Haas and Hyrax appliances.

Design: A randomised controlled trial.

Setting: Three university departments and one private practice, Chicago, USA.

Participants: Nineteen patients requiring rapid maxillary expansion to correct a uni- or bilateral crossbite.

Interventions: A Haas[#] (tissue borne) or Hyrax* (tooth borne) appliance. Expansion at a rate of 2 quarter turns (0.5mm) per day until adequate over expansion was achieved.

Outcome measures: Skeletal and dental variables measured from antero-posterior cephalograms. Dental and palatal variables measured from study models by a non-contact surface laser scanner*[#].

Results: The groups were comparable at baseline ($p=0.12$-0.92). There were significant differences between the appliances in the intermolar width expansion achieved ($p=0.02$), total increase in intermolar perimeter ($p=0.01$) and change in palatal shelf angulation ($p=0.01$) with the Haas appliance producing more expansion and having less of an effect on the angulation of the palatal shelves than the Hyrax appliance.

Conclusions: It appears that the Haas appliance achieved maxillary expansion with more of an orthopaedic effect whereas the Hyrax appliance achieved expansion by dentoalveolar expansion.

Implications: It appears that when orthopaedic expansion of the maxilla is required the Haas expander may be the appliance of choice.

[#]Haas expanders: Summit Orthodontics, Munroe Falls, Ohio; USA.

*Hyrax expanders: Great Lakes Laboratories, Tonawanda, New York, USA.

*[#]Vivid700: Minolta, Ramsey, New Jersey, USA.

The Angle Orthodontist 2004; 74:480–486.

The role of high pull headgear in counteracting side effect from intrusion of the maxillary anterior segment.
Van Steenbergen E, Burstone CJ, Prahl-Anderson B, Aartman IHA.

Objectives: To test the null hypothesis that headgear has no effect on the steepening, extrusion and narrowing of the buccal segments or on the rate of incisor intrusion when using an intrusion arch.

Design: A randomised controlled trial.

Setting: Apeldoorn, The Netherlands.

Participants: Twenty patients needing maxillary central and lateral incisor intrusion of at least 2mm.

Interventions: All patients had initial levelling and aligning of the upper incisors and the buccal segments up to 0.018''x0.025'' stainless steel archwires. Then an intrusion arch was added to deliver 40g at the midline. Intervention: High-pull headgear, 200g per-side, for eight hours at night. Control: No headgear.

Outcome measures: The vertical movement of the central incisors (intrusion) and buccal segments and change in axial inclination of the buccal segment measured from cephalograms. Change in inter-molar width measured from study models. The rate of incisor intrusion (mm/week) was calculated.

Results: There were no significant differences between the headgear and no headgear group in terms of the amount of intrusion achieved ($p=0.71$); change in axial inclination of the buccal segments ($p=0.36$); vertical movement of the buccal segments ($p=0.32$) or rate of intrusion. There was significantly more molar expansion in the headgear group ($p=0.025$).

Conclusions: The high-pull headgear had no effect on the amount of intrusion achieved or the steepening and extrusion of the buccal segments. However, it did counteract the moment that tends to reduce arch width.

Implications: This study suggests that high-pull headgear is not as effective at counteracting the vertical side effects of the intrusion arch as expected but that it did counteract the lateral side effects. The addition of high-pull headgear when using an intrusion arch may therefore not be worthwhile as a transpalatal arch could be used to control the lateral dimension.

The Angle Orthodontist 2004; 74:581–586.

Two interceptive approaches to palatally displaced canines: A prospective longitudinal study.
Leonardi M, Armi P, Franchi L, Baccetti T.

Objectives: To compare the effectiveness of extraction of the deciduous canine (DC), with or without the addition of headgear, in patients with palatally displaced canines (PDC).

Design: A randomised controlled trial.

Setting: University Departments in Catania and Florence, Italy.

Participants: Fifty patients with uni- or bilateral palatally displaced canines

Interventions: Extraction of the deciduous canine corresponding to the PDC with or without the addition of cervical headgear after the extraction or observation only.

Outcome measures: Eruption of the PDC within 48 months of the extraction of the deciduous canine.

Results: There was no significant difference in the prevalence of successful cases between the extraction only group and the control group ($p=0.15$). The prevalence of successful cases in the extraction and headgear group was significantly greater than the extraction only group ($p<0.05$) and the control group ($p<0.00$). No significant difference was found between the intervention groups with respect to the time taken for the canine to erupt in the successful cases ($p=0.55$).

Conclusions: The extraction of the deciduous canine alone is not effective at increasing the rate of eruption of PDCs. However, the addition of cervical headgear, following the extraction of the deciduous canine, did increase the rate of eruption of PDCs but it did not effect the time taken for them to erupt.

Implications: This study suggests that the extraction of the deciduous canine alone is not enough to increase the rate of eruption of PDCs and that cervical headgear should be fitted following the extraction in order to increase the effectiveness of this interceptive treatment.