



ORTHODONTIC RESEARCH

What it teaches us PART 1

Creating Brighter Futures

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 M₀K: ΔG₀ # 8398
 G₀: P₀ # 1111
 NX₁: G₂O₂ # 3283
 ΔG₀: G₂O₂ # 4949
 ΔE₁: P₀ # 9294
 MN₁: T₀ # 4838
 BB₀: G₂ # 4949
 J₁E: M₀ # 9398

Orthodontic Research - What it teaches us PART 1

This issue of Brighter Futures will review some of the latest orthodontic research being undertaken in the Orthodontic Departments of our Australian Universities, and what influence this research may have on future patient care.

Does Invisalign® torque teeth as effectively as fixed braces?

Optimal torque for anterior teeth is essential to achieve an ideal occlusal relationship, as well as for stability and smile aesthetics. Fixed appliances have been shown to treat malocclusions more effectively than clear aligners¹⁻³, in part due to their greater torque control. Research has questioned the reliability of torque expression achieved by clear aligners^{4,5}.



The torque of a tooth is defined as the labiolingual angulation of the tooth, with changes occurring as the crown and root move in opposite directions around the rotational centre point of the tooth (see Figure 1).

Fig 1. Hatched line shows a central incisor that is under-torqued or has too much lingual crown torque. The solid line shows the tooth with more normal (or more labial crown) torque.

The study by Gaddam et al at the University of Queensland looked at the accuracy of predicted ClinCheck torque versus the actual clinical outcome. The results showed significant under-expression of prescribed labial crown torque but over-expression of lingual crown torque. Although the individual results were variable, the mean upper central incisor torque expression was 61.4% (range: 15.5-116.3) of Clincheck prescribed torque. Lower incisors demonstrated a more reliable expression of torque than the upper incisors.

For upper central incisors, the under-expression of labial crown torque and the over-expression of lingual crown torque may result in anterior interferences that could contribute to the development of lateral open bites, poor intercuspatal interdigitation and a less than ideal aesthetic result.

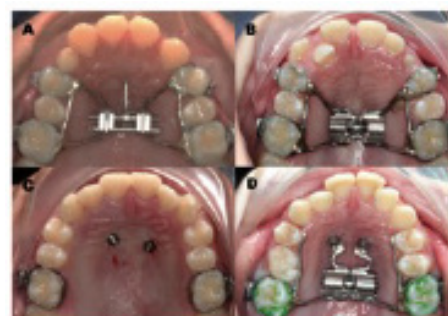
Based on these research findings, when managing an Invisalign® Clincheck, and upper incisor labial crown torque is prescribed, some over correction may be beneficial. Similarly, if upper incisor lingual crown torque is prescribed, some under correction should be considered. In addition, because of considerable individual variability, the amount of torque achieved should be closely assessed if and when a refinement is undertaken.

Reliability of torque expression by the Invisalign® appliance: A retrospective study. R Gaddam, E Freer, B Kerr, T Weir. Australian Orthodontic Journal 37.1 (2021): 3-13

Does rapid maxillary expansion significantly improve airway volume?

Rapid maxillary expansion (RME) appliances are effective in the treatment of maxillary transverse deficiencies. Depending upon the skeletal maturity of patients, both dentoalveolar and skeletal effects can be produced, to varying degrees¹. Studies have demonstrated the beneficial effects of RME on airway dimension and breathing function². RME is believed to increase the nasal width, subsequently resulting in enlargement of the upper airway volume and reduction in nasal resistance^{2,3}.

The aim of this randomised control trial by Cheung et al., from the University of Sydney was to assess, using three-dimensional cone beam computed tomography (CBCT), short term changes in the upper airway volume following RME with three different expanders. Patients aged 10 – 16 years of age were randomly allocated into either the conventional tooth borne (Hyrax), tooth – bone borne (Hybrid Hyrax) or Keles keyless expander groups.



Expander design used in this study: (A) Keles keyless expander, (B) Hyrax expander, (C) Temporary Anchorage Device placement prior to Hybrid Hyrax insertion, and (D) Hybrid Hyrax expander.

Maxillary expansion resulted in a relatively small increase in the total volume of the upper airway, raising doubts about RME's effectiveness in the management of patients with breathing disorders. The greatest changes were noted in patients with small baseline airway volumes and also in patients treated during pre-peak pubertal growth. These increases were more apparent in patients treated with a hybrid hyrax expander compared to the conventional hyrax expander.

Based on the research findings, when managing patients with maxillary transverse discrepancies, it is important to understand the limitations of maxillary expansion in increasing the total volume of the upper airway. Children with sleep disordered breathing must be assessed comprehensively by sleep physicians or ear nose and throat surgeons prior to commencing orthodontic treatment as airway obstructions may be caused by tonsil size, adenoids, mucosal and/or nasal conchae hypertrophy.

The upper airway volume effects produced by Hyrax, Hybrid-Hyrax, and Keles keyless expanders: a single-centre randomized controlled trial. Cheung et al. European Journal of Orthodontics 43.3 (2021): 254-264

What are the trends in managing patients with missing lateral incisors and premolars?

Hypodontia represents a significant clinical challenge for both the patient and the treating dental team. The patient is faced with two major treatment alternatives, orthodontic space closure or space opening for prosthetic replacement.

When deciding between closing or opening space - amongst many factors - the clinician must consider the existing dental and skeletal relationship, size and shape of the teeth, as well as the age and soft tissue profile of the patient. Space closure may offer the advantage of completing treatment during adolescence¹, having an occlusion that adapts to normal growth and maturation, and reducing the need for long term and significant prosthetic maintenance.

A study by Naoum et al at the University of Western Australia investigated the prevalence and distribution of hypodontia at a private orthodontic practice across three time periods: 2000, 2010 and 2017/2018 (during a 1-year period). The trends for either space closure or opening were also investigated.

Space opening was three times more likely to be performed in patients with missing teeth in 2000 compared to 2010 and 2017/2018. This may reflect a change in attitude toward prosthetic replacement options and/or greater advances with space closing strategies including the use of temporary anchorage devices.

Based on these research findings, we know that hypodontia occurs most frequently in maxillary lateral incisors and mandibular second premolars. The decision to open or close spaces with missing teeth, particularly anterior teeth, have changed with time with a trend towards more orthodontic space closure.

Trends in orthodontic management strategies for patients with congenitally missing lateral incisors and premolars. Naoum, S., Allan, Z., Yeap, C. K., Razza, J. M., Murray, K., Turlach, B., & Goonewardene, M. S. The Angle Orthodontist 91.4 (2021): 477-83

What is the quality of information regarding orthodontic retention on YouTube?

The internet has become a popular and accepted source for patients to access health information^{1,2}. The quality of this information varies significantly with potentially misleading or dangerous information accessible³⁻⁸. YouTube is the third most popular video streaming site in the world³⁻⁹ with significant numbers of orthodontic patients referencing it as a valuable source of information on retention^{10,11}.

The aim of the study by Meade et al., at the University of Adelaide was to evaluate the quality of video information uploaded to YouTube by dental professionals, regarding orthodontic retention and retainers.

The results demonstrated that the quality of information uploaded by dental professionals was deficient. Although appropriate information regarding the importance of retainers was present, the need for indefinite retention and retainer reviews was under reported. Current evidence-based practice indicates that indefinite retention is required to minimise the risk of relapse¹²⁻¹⁴. However, of the videos analysed, only 24% specifically advised viewers of this need. The necessity for regular retention reviews was even less often reported.

Clinicians should be aware of the importance of YouTube as an information resource for patients, and the information contained may be incomplete or inaccurate. The study recommended that professional dental and orthodontic societies take the lead in producing and posting high quality videos with evidence-based information.

Orthodontic retention and retainers: Quality of information provided by professionals on YouTube. Meade MJ, Sooriakumaran P and Dreyer CW., American Journal of Orthodontics and Dentofacial Orthopaedics 158.2 (2020): 229-236

Which is the best fluoride varnish to remineralise white spot lesions?

White spot lesions (WSL) can form during orthodontic treatment, with 72.9% of patients developing at least 1 new WSL during treatment¹. High concentration fluoride products such as varnishes have been advocated to help remineralisation. However, it is unclear whether this promotes subsurface lesion remineralisation, which is required for regression to translucency, or surface precipitation of a fluorhydroxyapatite phase².

The aim of this study by Shen et al from the University of Melbourne was to evaluate remineralisation of white spot lesions under dental varnishes in vitro, comparing MI varnish (GC Corporation) containing CPP-ACP (Recaldent™), with Duraphat varnish (Colgate).

Significantly greater remineralisation percentages were achieved with the MI varnish ($41.2 \pm 7.8\%$) than Duraphat varnish ($18.4 \pm 2.3\%$) in lesions covered by the varnish. MI varnish was also superior in remineralisation of the areas immediately adjacent to the varnish with ($23.0 \pm 5.6\%$) compared to the ($9.7 \pm 2.9\%$) remineralisation of Duraphat varnish. MI varnish produced significantly greater lesion fluoride uptake ($0.44 \pm 0.08 \text{ wt\%}$) compared with Duraphat ($0.24 \pm 0.03 \text{ wt\%}$) and the placebo varnish ($0.06 \pm 0.05 \text{ wt\%}$)

The MI varnish promotes enamel subsurface lesion remineralisation particularly in the body of the lesion by releasing more bioavailable calcium, phosphate and fluoride ions; this is important for the regression of white spots back to translucency. This makes it superior to Duraphat which remineralised predominantly at the surface layer.

Remineralization and fluoride uptake of white spot lesions under dental varnishes. Shen, McKeever, Walker, Yuan, Reynolds, Fernando, Chen, MacRae, Schneider, Reynolds. Aust Dent J. 2020;65(4):278-85

Orthodontic Research

Australian university orthodontic research projects are undertaken by a variety of people for a variety of reasons. By post-graduate students studying to become specialist orthodontists; practitioners or academics working towards attaining higher degrees such as a PhD; by academics and researchers fulfilling their employment requirements; and, by tutors, academics and practitioners simply pursuing their interests.

Undertaking research has always been an integral part of orthodontic specialist training both in Australia and globally. It is an important part of the education process, and a student cannot graduate without producing a thesis that reaches a certain standard and is defended by examination. This requirement brings with it a number of benefits. It is a significant driver of research leading to advancements in patient care and treatment. It also teaches a better and more critical understanding of published research articles, their study design, statistical analysis, and conclusions drawn.

The high standard of research carried out in Australian University Orthodontic Departments is acknowledged by the regular acceptance of this research for publication in some of the most respected and 'high impact' international journals. The next issue of Brighter Futures will summarise another 5 such publications.

The research and education undertaken within the five Australian university orthodontic departments is supported by the Australian Society of Orthodontists (ASO) through significant donations by the ASO Foundation for Research and Education, by donations from the national and state societies, and by members of the ASO who teach within the orthodontic programs, often pro bono.

[References available upon request](#)

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