SCIENTIFIC SECTION

Commentary

Frictional resistance in plastic preadjusted brackets ligated with low-friction and conventional elastomeric ligatures

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Friction is sometimes considered to be the holy grail of modern orthodontic treatment mechanics. If we can reduce the friction generated by the components of orthodontic appliances then we can use lower forces. If we can use lower forces this might mean a better biological response leading to quicker and smoother tooth movement, because blood vessels do not get crushed and cells are recruited locally from the periodontal ligament rather than from the surrounding bone. Lower friction might lead to less binding of archwires and free movement of wire through bracket slots speeding up alignment and space closure. Lower forces might also mean less pain and mobility of the teeth for the patient. The problem is that the competing demands of aesthetic appliances and treatment that is carried out as quickly, efficiently and cheaply as possible are not always compatible.

Friction is generated between the archwire and the bracket slot and between the archwire and the means of keeping the archwire in the bracket slot. Aesthetic materials such as ceramics generally lead to greater friction than less aesthetic materials such as metal. Self-ligating brackets have been shown to generate less friction in the laboratory setting, but are relatively expensive when compared with elastics that are cheap, but generate a great deal of friction. The authors of this paper have examined the frictional forces produced by an aesthetic plastic bracket when used with conventional elastomeric ligatures and compared this with a new 'low friction ligature' that simply completes the open surface of the bracket without impinging on the archwire. They have examined the forces at different degrees of archwire deflection, as might be encountered during initial alignment, and found the 'low friction ligature' demonstrated considerably lower friction than the conventional elastomeric ligature. As the authors point out, the advantage of a system like this is that you can use the low friction elastic when you want to align teeth and close residual space, but you can still use the conventional elastomeric in the latter stages of treatment, when you want to bind a full size archwire in the slot for expression of torque and tip.

Although it is very difficult, if not impossible to reproduce within the laboratory, the complex array of forces present during orthodontic tooth movement, *in vitro* studies such as this do give the practising clinician some idea of the forces acting on patients during fixed appliance treatment.

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Comparison of the Botton Standards to longitudinal cephalograms superimposed on the occipital condyle (I-point)

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Broadbent, in his famous 1931 publication 'A new X-ray technique and its application to orthodontia' made it clear from the onset that his application intended 'to measure the [growth] changes in the jaw in relation to the rest of the head.' He concluded that 'areas of non-growth in the cranial base ... permitted us to precisely relate the pictures and measure the changes in the other parts.' And because this non-growing anterior cranial base (ACB) is located above the growing maxilla, a cephalometric picture of a downward forward growing face emerged. The world quickly embraced the new X-ray technique together with the ACB reference. Coben, in 1952, was the first one of very, very few to challenge the ACB dogma, arguing that superimposition was better registered on basion and, as a consequence, that the face grew upward and forward.

Upward or downward, or, why do we look for one single preeminent superimposition reference structure? Let it be clear from the onset that measuring growth in millimetres or degrees is independent from any reference structure. What depends on a reference structure, though, is our interpretation of the processes and mechanisms that contributed to growth. The role of the palatal plane in the growth of upper face height may serve as an illustration. Superimposing two tracings on the ACB, it looks like a downward displaced maxilla carried the palatal plane with it. However, to analyze the role of the palatal plane itself, a reference inside the

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maxilla is needed and the profession had to wait for Björk's implant studies to get precise answers on sites, direction, and amount of maxillary growth. One of Björk's findings was an unanticipated 5 mm downward remodeling of the palatal plane during the growth period. As a consequence, there had been 5 mm less downward displacement of the maxilla and the compensating upward growth at the maxillary sutures also was 5 mm less than what up to that time had been assumed. The analysis of the role of the palatal plane in the growth of upper face height required a superimposition on two fundamentally different reference structures: one disclosing displacement and the other disclosing remodeling.

Upward or downward, is it about semantics? No, it is not. Superimposition on the ACB shows a picture of considerable downward movement of the palate and of the orbital floor. None of these features are compatible with facts revealed by Björk's implant studies. What it shows nicely, however, is the changing horizontal position of the maxilla underneath the ACB. Superposition on structures close to the Foramen magnum, on the other hand, shows a picture of a vertically constant or slightly downward position of the palate and an upward remodeling of the orbital floor. All these features are compatible with Björk's implant studies. In addition, the caudal superimposition reference nicely demonstrates the effect of growth in the spheno-occipital synchondrosis, separating the posterior and anterior cranial base, an effect that is obscured in the ACB superimposition. Apparently interpretation of growth is reference specific and thus we must learn to choose the reference closest to the question posed.

This article analyzes maxillary growth from a superimposition on the occipital condyles, taking into consideration a wealth of information from outside the orthodontic literature. The authors have started an uphill battle and deserve our support. It is time to break the ban.

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From alginate impressions to digital virtual models: accuracy and reproducibility

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In the current practice of orthodontics, there is a gradual shift from the old methods of archiving patients' records into two-dimensional or three-dimensional (3D) digital form of records. Several clinical benefits have been shown in earlier publications when 3D virtual study models are used for orthodontic patients.[1] However, some questions still arise regarding the accuracy of these 3D models as well as the reproducibility of performing some measurements on them. The production of a 3D virtual model is dependent on scanning of a plaster model poured from a silicon or alginate impression. It is strongly advisable to pour alginate impressions as soon as they are taken to guarantee dimensional stability and to avoid any possible post-setting shrinkage. Is it really accurate to send alginate impressions by mail to OrthoCAD™, O3DM™ or any other company in a route that may take 3–5 days before creating the 3D digital models?

This article addresses the previous issues by evaluating three sets of alginate impressions taken from twelve randomly selected orthodontic graduate students. Two sets of plaster models were poured immediately, while the third set, was wrapped in moist gauze, put in a sealed bag and mailed for 3–5 days. Upon return to the School of Dentistry in Aarhus, the plaster models were poured. Six linear measurements were taken directly on plaster models and then compared with the same measurements performed on the corresponding 3D digital models. Intra-observer and inter-observer variation were also assessed using Dahlberg's formula.[2] The results of this paper were really interesting in two aspects: the high stability of alginate impressions after being in transit for several days and the higher measurement reproducibility obtained on 3D digital models (using virtual software-based measuring tools) when compared with conventional plaster models (using callipers). Despite the small sample size and the type of subjects included in the study (i.e. postgraduate students instead of orthodontic patients), this paper provides an invaluable contribution to our knowledge of the accuracy and reproducibility of 3D digital models and provides a foundation for future research work in this field.

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A Systematic Review of Clinical Trials of Aligning Archwires

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As clinicians we want to offer the best treatment for our patients based on the highest quality scientific evidence. It is therefore always sobering to realize, however, how little of our clinical practice is in fact evidence based. This is highlighted yet again by another systematic review published in this edition of the Journal of Orthodontics this time looking at aligning arch wires. Alignment is an integral part of most orthodontic treatment, and most orthodontists would say it has been revolutionised by the introduction of superelastic nickel titanium wires over the last two decades. But is there evidence for this claim? Well according to this systematic review, there is insufficient data to make recommendations regarding the most effective arch wire for alignment. So why bother reading this paper when there are no results or conclusions that can be drawn? Well for any of us who undertake research or read peer-reviewed journals this article gives an excellent overall critique of the research in this area and its short comings. It will hopefully therefore help potential researchers to structure future clinical research so bias is reduced and comparison can be made between studies. We will then hopefully start getting some answers so evidence based practice can be properly implemented in orthodontics. This will then allow us to offer the best treatment for our patients based on more than just the claims of manufacturers.

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Structured abstracts: Do they improve citation retrieval from dental journals?

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Structured abstracts were developed with two aims: (1) to improve citation retrieval; (2) to improve the information provided in abstracts (both in the quality of information provided and ease of its interpretation). Previous studies have demonstrated that the quality of abstracts is indeed improved with the structured format and this is clearly demonstrated in the two versions of the abstract produced in Fig. 1. Many people logically assume that structured abstracts would also improve retrieval from electronic databases, this article tests this premise.

This study looked at the electronic retrieval of RCTs/CCTs which had been published in six dental journals, between 1995 and 1998, but extended to 2002 for the *Journal of Orthodontics*, due to an editorial delay in implementing the change in format (this extension could have introduced an element of bias as the study period was doubled for this journal, with a disproportionate period before the change in abstract format). Three journals had changed to the structured abstract during the test period, the other three had not and therefore acted as a control. MEDLINE was used to identify the RCTs/CCTs published in these journals over the study period and this was compared to the 'known' number of RCTs/CCT's from the OHG's Register after it had been updated by one of the authors. Unfortunately, this method does rely on the quality of the handsearching previously conducted to establish the OHG's Register, and as this paper highlights, although handsearching is the 'gold standard', it is not 100% effective.

Interesting, the study could not show that the introduction of structured guidelines improved retrieval of abstracts from MEDLINE. It could be argued that these results are due to the relatively small numbers of RCTs/CCTs published during the observation period and so the authors have attempted to address this by reanalysing the data with increasing sample sizes based on the differences achieved in this study. They found that an increase in the number of trials by a 100 fold was required before a statistical difference was found.

The study highlights the need for multiple methods of identifying relevant articles when conducting literature and systematic reviews as no method on its own is 100% effective. It also demonstrated the need for studies in subject areas where there is no rigorous evidence, but where perceived wisdom allows clinicians to feel they confidently know the answer, as sometimes our logical assumptions are wrong!

I also agree with the authors that the adoption of structured abstracts should be as proposed by the *Annals of Internal Medicine*, which include a 'limitations' section as this will further improve the quality of the information the abstract provides for the readers and encourage authors to be more thorough in the critical appraisal of their work.

As clinicians, we want to offer the best treatment for our patients based on the highest quality scientific evidence. It is therefore always sobering to realize, however, how little of our clinical practice is in fact evidence based. This is highlighted yet again by another systematic review published in this edition of the *Journal of Orthodontics* this time looking at aligning arch wires. Alignment is an integral part of most orthodontic treatment, and most orthodontists would say that it has been revolutionized by the introduction of super-elastic nickel titanium wires over the last two decades. But is there evidence for this claim? Well, according to

this systematic review, there are insufficient data to make recommendations regarding the most effective arch wire for alignment. So why bother reading this paper when there are no results or conclusions that can be drawn? Well, for any of us who undertake research or read peer-reviewed journals, this article gives an excellent overall critique of the research in this area and its short comings. It will hopefully therefore help potential researchers to structure future clinical research so bias is reduced and comparison can be made between studies. We will then hopefully start getting some answers so evidence based practice can be properly implemented in orthodontics. This will then allow us to offer the best treatment for our patients based on more than just the claims of manufacturers.

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