

IN BRIEF

- Much current treatment appears to be empirical rather than scientific.
- There is little consensus on the cause of malocclusion.
- Most treatment corrects the symptoms, crooked teeth, rather than addressing the cause.
- We are unlikely to achieve a cure until we can convert vertical growth to horizontal.

Science versus empiricism

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Few debates within dentistry have aroused such strong feelings as the issue of orthodontic growth guidance. Most orthodontists consider that appliances have little influence beyond the teeth and alveolus. If there is not room, it is argued, extractions are inevitable. Despite this a sizable minority, mostly of general dentists, believe that it is possible to influence skeletal form significantly. Why is there such lack of consensus?

The debate has continued for over 100 years. On the one hand innumerable studies have failed to show that Growth Guidance appliances, variously known as Functional, Orthopaedic or Orthotropic, can produce a significant change; on the other hand, there have been many anecdotal reports of their effectiveness and some scientific evidence to show that such appliances can change skeletal structures, even in adults.¹ While anecdotal reports can sometimes point the way ahead, they should always be viewed with caution as they may represent a selected group of successful cases, ignoring those that failed. However, it is equally dangerous to conclude that because something has not been shown to be true, it must necessarily be untrue.

Most orthodontists accept that orthodontic treatment can damage both the face² and teeth,³ and that orthodontic

alignment tends to relapse to an unacceptable extent.⁴ Lysle Johnston, possibly the most influential man in world orthodontics today, believes that regardless of the technique, clinical practice is '*At bottom largely an empirical process that is little influenced by theory inferred from any of the life sciences*'⁵ but he singles out functional appliances to say '*Our newfound enthusiasm for elderly European therapies is still something of a monument to expediency and wishful thinking*'.⁶

Are orthodontists driven by science or empiricism? The literature provides conflicting information enabling each side to quote references in its favour. As Shakespeare wrote in *The Merchant of Venice*, 'even the devil can cite scriptures for his purpose'. The problem with research in orthodontics is that wide variations are present both before and after treatment. This often results in negative findings and many randomised clinical trials often provide only marginally significant results, to the point that we should ask if they are appropriate for orthodontic treatment.⁷

Around the start of the twentieth century, most treatment involved extractions, but the scene changed following the 'Great Extraction Debate' of 1911, largely because

of the influence of Edward Angle⁸ who rejected extractions in favour of '*achieving the ideal intended by Nature*'. However, 30 years on Tweed,⁹ a student of Angle's, demonstrated that the non-extraction approach was frequently bedeviled by relapse and recommended a return to extractions. For this challenge to the establishment he was thrown out of the American Orthodontic Society. Subsequently, at the Second Extraction Debate of 1938, extractions again became the 'correct' treatment, to a point that a clinician would be discredited if he did not extract teeth. It is important that we do not just dismiss these dramatic swings as history, because this issue remains unresolved.

At the extraction debate held by the British Orthodontic Society in 2000 it was agreed that we just do not have the evidence to say whether, on balance, extractions are beneficial or not. I personally agree with the view of Kevin O'Brien, Dean of Manchester Dental School, who felt that the extractions were less likely to cause damage, than inappropriate treatment.

In the early days, changes in viewpoint were based largely on clinical opinion and it was not until the last quarter of the twentieth century that the need for scien-

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tific research became generally accepted. The possibility of facial damage was investigated by Lundstrom and Woodside,¹⁰ who suggested that the high incidence of backward growing mandibles reported in orthodontic practice could be 'partly explained by inappropriate orthodontic treatment'. They rationalised that treatment could increase vertical growth, causing the 'facial aesthetics to deteriorate'. However other clinical papers¹¹ have found little sign of facial damage, although they accept that 'Premolar extraction reduces soft and hard tissue convexity by 2 to 3 mm'. Many orthodontists feel that their job is to straighten teeth and that 'the need for extractions may outweigh the chance of a slightly negative effect on the profile'.¹² Some papers have negated the risk of facial damage altogether but may have been inappropriately selective.¹³ Facial damage, like TMD, is an emotive issue and as Behrents said of the American Orthodontic Establishment:¹⁴ 'can an institution investigate itself?'

A major but understandable problem is the natural tendency for all of us to dismiss the failures of the past because we have learned from these and have 'now got it right'. Although few orthodontists believe that they can influence jaw size to an appreciable extent, there has recently been a tendency in the UK to extract fewer teeth.¹⁵ There seems to be little evidence to show that fewer extractions provide improved results or to show that new techniques are able to reduce the need for extractions, and so this poses the question 'are we about to enter another period of non-extraction by consensus?' It is hard to answer this question, as space is often provided by distalisation, which is almost certain to result in the loss of the second and/or third molars later in life. Is this extraction treatment or not?

It would seem that everyone is on the move and most orthodontists will admit to extracting either more teeth, different teeth or fewer teeth than they used to and it may well be that we are all just at different positions on the same roundabout. We have to accept the real possibility that either there is no cure for malocclusion or that we have not yet found it.

The problem is that it is relatively easy to straighten teeth and many orthodontists prefer to concentrate on an empirical correction rather than the application of science to the aetiology of malocclusion. General practitioners are criticised for dabbling in orthodontics, but in my experience most of them are genuinely anxious to avoid the long-term orthodontic failures that they see in their practices and we must not forget that the current swing to non-extraction treatment (be it right or wrong) was largely

led by general practitioners, as was the earlier swing to functional appliances. This is the conflict that spills into the correspondence columns of the journals and more recently has led to malpractice charges by the General Dental Council.

Many of the world's scientific heavyweights share my concern about the lack of science in current clinical practice.^{5,6-18} In the early days of orthodontics people such as Roux,¹⁹ Helman,²⁰ and Westin Price²¹ and many, many others, used both scientific logic and comparative studies to suggest that malocclusion was an environmental disease resulting from civilisation (disopoly). Unfortunately, although their reasoning might have been sound, their material was largely anecdotal and as such, was discounted by the more technically minded clinicians who rightly or wrongly held and still hold the balance of power.

Harvold²² was probably the first person to provide truly scientific evidence on the cause of malocclusion. He showed that all monkeys that had their nose blocked or their tongue displaced from their palate²³ developed severe malocclusion. At the time (1968), his findings had a major impact on clinicians, however it was subsequently argued that monkeys were different from humans in that they have a shorter neck and a pre-maxillary suture. These points were used to marginalise his work, which now has little impact on clinical treatment although there is no doubt that open mouth postures and tongue dysfunction have similar effects on humans.²⁴⁻²⁶

Subsequently Bjork²⁷ was brave enough to experiment on humans, using implants to demonstrate that facial growth involves complex movements of many bones. He also found that after this movement had taken place the bones tended to remodel back to their original form, so 'disguising much of the true change'. His conclusions were well supported by others.²⁸ These doubts about the ability of using radiographs to analyse small skeletal changes have been confirmed by more recent work,^{29,30} but many academics (perhaps inappropriately) currently claim that radiographs demonstrate that treatment has little effect on the facial skeleton.

More recently Corruccini³¹ used science to support what Westin Price and the others had seen with their eyes. His recent book combines his own widespread research, with that of many others to make an overwhelming case for malocclusion being a disopoly, which infers that it could be avoided by changes in life style. There is much conflicting evidence but it remains important that orthodontic opinion is logic led and not evidence led. Research can inform and confirm but only logic can explain.

At times of uncertainty it is best to stick to simple principles, and one of the best is 'there is a reason for everything and with hindsight it is usually obvious'. Interestingly all authorities agree that the soft tissues control the position of the teeth and alveolus, although there is less consensus on how far their influence might extend to basal bone. This latter uncertainty is surprising as there are many examples of major skeletal change following muscle para-function or paralysis.³² Although clinicians in many countries recommend exercises to correct oral posture and function, treatment based on this approach has never proved popular here. This is probably because of the unpredictability of muscle training, rather than because the soft tissues are thought to have little influence. Unless or until we can reliably change soft tissue posture we will never know.

Most cephalometric research has been done on older patients and few clinicians would expect much bony change to be seen after puberty. This must prompt the question of 'why not treat earlier?' Large random trials suggest that early treatment has few benefits, however Tulloch *et al.* in their paper expressed satisfaction with the initial changes, which sadly were not maintained after fixed appliances were fitted and felt that 'other (yet-unidentified) clinical factors also must affect treatment outcomes'. More recent publications suggest that these clinical factors may be related to oral posture rather than function³⁴ and that treatment should start before eight years old if much skeletal change is required.³⁵

In 1895 the German orthodontist Roux¹⁹ said: 'the fundamental principle of functional orthopaedics is to learn new neuromuscular performance patterns and to provide security and ease in their performance by muscle exercises and training' (translated from German). In 1999 Corruccini³¹ forecast 'If there is eventually to be the possibility of steps involving masticatory exercise to prevent or mitigate cranio-facial disorder, these more likely will employ appliances and artificial alveolar stimulation rather than dietary alteration'. In the 1960s I reached the same conclusion and ever since then have based treatment on my perception of the cause of malocclusion, aiming to encourage horizontal growth of the facial bones, by means of good muscle tone and a tongue to palate resting posture with the mouth closed, in the belief that in these circumstances the teeth will align themselves. This is in contrast to the mechanical approach of most orthodontists which innumerable papers have shown tends to increase vertical growth. Children often fail to comply with muscle training, and I have – as Corruccini

suggested – designed appliances that correct posture automatically, but the system is still heavily dependent on the patient wearing uncomfortable appliances as instructed. I am convinced that until we can convert vertical growth to horizontal there will be no ‘cure’ for malocclusion.

As far as treatment is concerned, we have to balance the merits of those that are ‘clinically effective’ against those that are ‘clinically efficacious’. Which would be best, a method that could reliably produce straight teeth but had a questionable long-term success ratio and risked some iatrogenic damage to the face and teeth, or a method that was unreliable but sometimes provided a permanent cure? In these days of ‘clinical governance’, only the former would survive. To say growth guidance appliances often don’t work is not helpful because we need to explore why they sometimes do and why in these instances the results go beyond what can be achieved with existing appliances. Is not the nature of progress to probe the limits of achievement, in the hope of developing techniques that will one day become routine?

As Frankel said of current treatment mechanics:³⁶ ‘*such an approach treats a symptom, not the cause*’. Corruccini³¹ concludes ‘*much greater research and funding emphasis should go on disuse and its ramifications rather than towards invasive experiments that have only corrective not preventive significance*’. Unfortunately an industry has now developed around the provision of convenient non-cooperative mechanical techniques, creating an impetus that will be hard to deviate. In my opinion a long-term cure for malocclusion will not be found until the influence of the environment on oral posture is accepted and it will ultimately evolve from the application of scientific principles, not from current empirical mechanics.

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