

Does Orthodontics Damage Faces?

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Abstract: With the increasing provision of orthodontic care in this country, certain practitioners have raised concerns regarding the use of elective extractions and retraction mechanics, especially the effects on the facial profile and the TMJ. The non-extraction versus extraction debate spans the history of orthodontics, and the concepts of facial attractiveness are subject to change as fashions change. Within the realms of evidence-based practice, there is little or no evidence to suggest that the philosophies and mechanics of contemporary orthodontics, in the vast majority of cases, cause damage to the profile or are directly linked to the development of TMJ dysfunction.

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Clinical Relevance: The reader should understand that there is absolutely no scientific evidence to suggest that extractions for orthodontic purposes damage the face, harm the TMJ or compromise stability of the case.

Media attention has recently focused on the adverse effects of orthodontic treatment on the facial appearance, particularly the effect of extractions on retraction of upper incisor teeth. This concern is by no means new and the media invariably seizes upon the views expressed from time to time by a small number of concerned general practitioners. Television programmes and articles in the popular press do not provide valid scientific evidence in support of these views, and highly emotive headlines such as 'Extractions damage faces' cause alarm among patients receiving conventional orthodontic treatment and confuse well-meaning practitioners. This article

endeavours to look at the effects of orthodontic treatment on facial aesthetics and the temporomandibular joint (TMJ).

HISTORICAL BACKGROUND

Contemporary practice of orthodontics in the UK involves the increasing use of fixed appliance therapy, often with the extraction of permanent teeth. The extraction versus non-extraction debate is as old as orthodontics itself, and has resulted in many quite vitriolic and angry encounters between the warring factions. Angle, the father of modern orthodontics, in the later part of his career was an advocate of non-extraction therapy. He did not base this on research but rather on his clinical experience and the observations of his mentor, an art historian, Professor Wuerpel, who stated that facial beauty in itself was immeasurable due to the tremendous variety in human faces. Angle was also influenced by the

philosophy of Rousseau, who emphasized the 'perfection of man'. From this, Angle deduced that the relationship of the dentition to the face, and with it the aesthetics of the lower face, would vary, but that for each individual, ideal facial aesthetics would occur when all the teeth were placed in an ideal occlusion. Angle also studied the teachings of the German physiologist, Wolff, who stated that bone would remodel in response to functional loading. And so Angle became the original 'arch developer', stating that 'Every individual has the potential to have 32 teeth in the normal (ideal) occlusion' and that the key to maintenance of tooth position was proper function of the dentition.

The views of Angle's new school predominated during the early part of the twentieth century but were challenged in 'The Extraction Debate of 1911' by the 'rational school' of Calvin Case, who felt that, although the dental arches could be expanded to include all the teeth, this was not a guarantee of long-term stability – let alone aesthetic improvement. Case felt that the cause of malocclusion was primarily inheritance, and the argument that arose took on the form of evolution versus creationism – those who believed in Darwin's theories as opposed to those who believed in special creation and the perfectibility of man.¹ Case expressed a desire to accept biological variation rather than the absolutes that were being expounded by the followers of Angle. However, the non-extraction argument won,² and in the USA in the 1920s and 1930s very few teeth were extracted (Figure 1).

The pendulum swung the other way in

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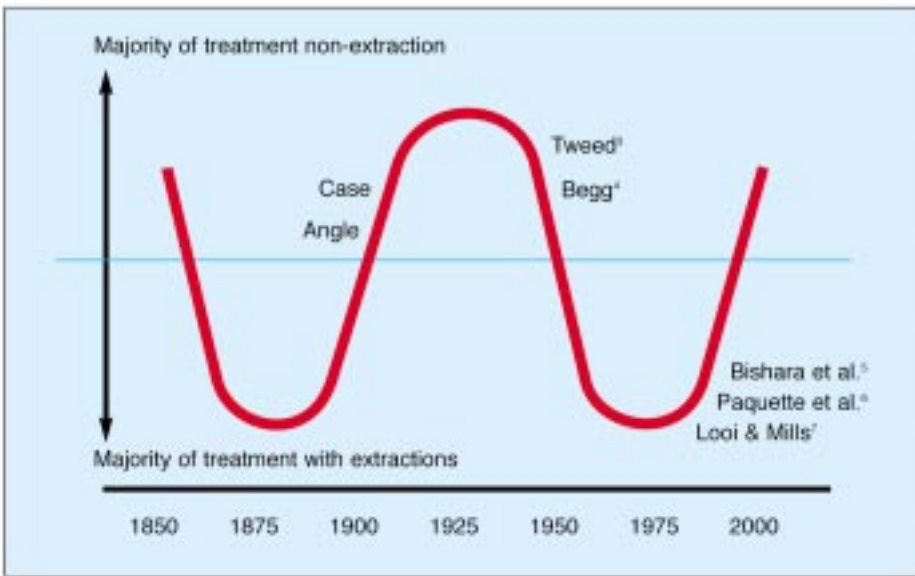


Figure 1. The fluctuation in the use of extraction in orthodontics through the nineteenth and twentieth centuries.

the late 1930s and 1940s, with the work of Charles Tweed and Raymond Begg. Tweed, a student of Angle, became increasingly unhappy with the results he was getting with non-extraction therapy, and re-treated a number of his patients by extracting the first premolars. The publication of his results had a dramatic effect on the practice of orthodontics in the USA at that time, and extraction therapy was slowly reintroduced.³ Begg, another of Angle's students, looked at the dentition of the Aborigines in Australia, who had a low incidence of dental crowding, and came to the conclusion that the increase in malocclusion in Western societies was due to the refinement of the diet, which led to a lack of attrition of the teeth.⁴ He therefore advocated extraction therapy to remove the same amount of tooth substance that our diet and attrition would have done for us. The appliance system that he developed, and bears his name, was thus designed for use with extraction-based treatments. Also, with the advent of cephalometric radiology, the consensus view was that facial growth was genetically determined and that orthodontics had little or no effect on the outcome. So the orthodontist came to operate within the bounds of

genetic control and accept the discrepancies of jaw position as well as overcoming crowding. Hence extraction therapy became the vogue.

In recent years there has been a move back towards non-extraction-based treatment (Figure 1). Practitioners have begun to realize that extracting teeth does not guarantee a stable result.^{8,9} In addition, interest has been growing, especially in the USA, in growth-modification or dentofacial orthopaedics, treatment techniques that arose mainly in Europe during the mid to late twentieth century. Fashions and trends change,¹⁰ and orthodontists are increasingly aware of 'protecting' the profile to create a fuller, more protrusive appearance which is equated with youth, for with age the profile tends to become more retrusive.¹¹

Today the debate goes on both in Europe and the USA, and still appears as far from resolution as it was in the 1920s. The same accusations are being made, with little or no evidence to back them up. Unfortunately, the arguments do get tainted with emotive language (which patients pick up), and all attempts at an objective approach then are lost. The claims that are levelled against 'conventional' orthodontics (and especially at the extraction of teeth) is that it leads to damage of the skull and face, and gives rise to jaw pain, headaches, back pain and sore limbs. These are opinions held by a very small number of dentists, and are not borne out by valid scientific evidence.¹² Furthermore, they are supported by only a few anecdotal cases – the weakest form of scientific evidence.

We must, however, recognize that the scientific evidence for much of orthodontic practice is not as complete as would be desired, as evidenced by the paucity of meta-analyses in medicine generally and dentistry in particular (Table 1). Much of the research that is published is often beset with problems such as poor research design.^{14,15} The level of evidence must be taken into consideration when assessing the value of any scientific study (Table 2).¹⁶ As research methodology and the analysis of results becomes more sophisticated many of these questions will be answered – but until then the burden of proof must be on those making such unsubstantiated claims.

FACIAL AESTHETICS

The way in which society judges what is beautiful has changed throughout the ages, although an aesthetic ideal for

	Dentistry	Medicine
Articles per year	10 240 (±178)	27 028 (±1746)
Meta-analyses per year	8 (±4)	37 (±50.01)
Percentage of meta-analyses	0.08 (±0.04)	0.13 (±0.02)

Table 1. The evidence upon which dental care is based is poor, and may be even less than that found in other medical specialties. Evidence taken from journals 1996–1998. (After Niederman and Badinovac.)¹³

- Strong evidence from at least one systematic review of multiple, well-designed randomized controlled trials

- Strong evidence from at least one randomized prospective clinical trial

- Strong evidence from at least one published, well-designed trial without randomization

- Evidence from well-designed experimental studies from one or more centre or research group

- Opinions of respected authorities based on clinical evidence, descriptive studies or reports of expert consensus committees

Table 2. Levels of evidence (after Richards and Lawrence¹⁶).

every age can often be found in sculpture and art.¹⁷ Angle himself favoured the classical Greek profile immortalized by the statue of the Apollo Belvedere from the fourth century BC,¹ and later in Michelangelo's David. To apply objective measurement to what is subjective and based on visual perception is very difficult – as the Scottish philosopher David Hume famously said: 'Beauty is in the eye of the beholder, each mind perceives a different beauty'. Although an individual's idea of beauty is influenced by their environment, racial background and upbringing, there is a consensus that balanced proportions and a harmonious arrangement of facial form are necessary for facial beauty.¹⁸ The public's judgement and perception, however, often appear to vary from those of the dental profession, being less critical.¹⁹ There is also a tendency to favour the retention of juvenile features,²⁰ which may explain the recent explosion of anti-ageing treatments available – people in Western society favouring a fuller, more protrusive facial profile,^{10,17} something they associate with youth.

EXTRACTION OF TEETH

The main reasons for the elective extraction of teeth in orthodontics include the relief of crowding and correction of the incisor relationship to Class 1. The accusation that has been

levelled against the extraction of teeth is that it dishes in the profile and makes the lips retrusive, so giving an ageing appearance to the face. Although anecdotal cases are often shown to illustrate this, most evidence does not support this point of view. There is certainly a relationship between the retraction of upper incisors and the distal movement of the upper lip but this is complex and difficult to predict.^{7,21–23} One study showed a ratio of approximately five to one for incisor to lip retraction (i.e. the upper incisors would have to be retracted 5 mm for the lips to move 1 mm).²² This implies that quite substantial tooth movements are required to produce a clinically significant change to the soft-tissue profile.

The most important finding from all these studies is the high level of individual variation that occurs and the futility of attempting to treat to ideal cephalometric values.²⁴ Other studies that have looked at the soft-tissue profile imply that mid-arch extraction, if based on sound diagnosis, does not make the profile worse but rather appears to improve it.^{5,6,25–28} If the effects of extraction of first premolars are compared with those of extraction of second molars the soft-tissue changes are still very variable but, on average, identical.²⁹

Does the extraction of teeth lead to 'shrinking' of the dental arches, creating a less attractive, narrower smile with 'dark buccal corridors' as has been claimed?³⁰ A study in which lay judges compared smiles of patients who had or had not undergone extraction found no evidence of this.³¹

FUNCTIONAL APPLIANCES

A further criticism that has been levelled at orthodontics is the under-use of functional appliances. Their use has been claimed to result in a better facial appearance and functional occlusion. However, comparisons of the effects of functional appliances with those of other appliances over the last decade have shown that the use of functional appliances brings little extra skeletal or

soft-tissue benefit.^{32–35} Studies comparing well-matched groups of patients, half of whom had been treated with functional appliances and half with other appliances, have shown that, in the vast majority of cases, it was impossible to tell from the facial appearance which patient had been treated with what appliance.^{32,36}

Of course it is not a straightforward choice between extracting teeth or using a functional appliance. Most orthodontists who use functional appliances and understand the significance of scientific studies will frequently recommend the extraction of teeth as part of an integrated treatment consisting of functional appliances followed by fixed appliances.

TEMPOROMANDIBULAR JOINT DYSFUNCTION

There have been suggestions (notably by Witzig and Spahl³⁰ and Bowbeer³⁷) that extraction of premolars leads to a number of problems, notably:

- reduction in the vertical dimension;
- over-retroclination of the upper incisors;
- deepening of the bite; and
- anterior incisal interference.

It has been claimed that, because of these problems, distalization of the mandible and posterior displacement of the condyles occurred, resulting in problems with the TMJ and TMJ dysfunction. However, reliable scientific studies have shown that orthodontic treatment involving extractions has no adverse effects on the TMJ.^{38–45} Despite this, extractions have declined in popularity in the USA – but this has been based more on fashion and anecdotal opinion than scientific evidence.

Many scientific researchers have investigated these problems and the findings of their studies are summarized below.

Research Evidence

Larsson and Rönnerman³⁸ looked at 23

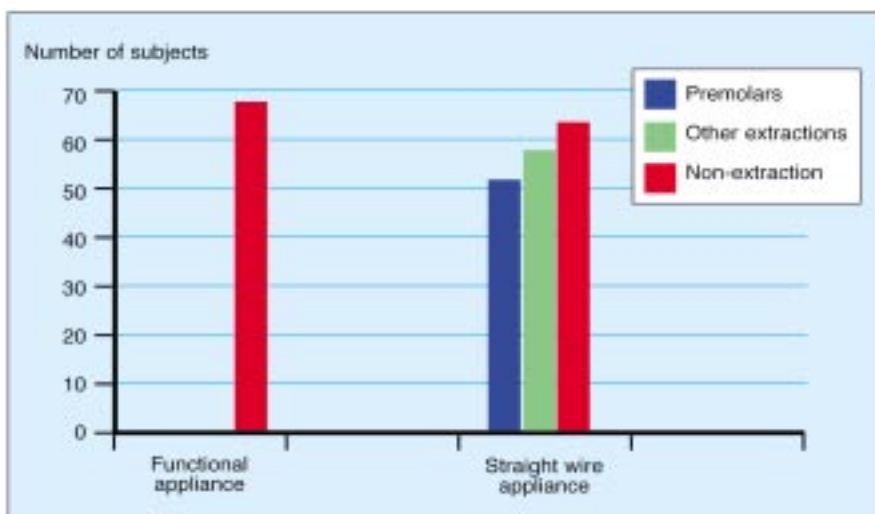


Figure 2. Evaluation of patients who had undergone orthodontic treatment for TMJ dysfunction (after Dibbets and van der Weele).⁴¹

patients 10 years after orthodontic treatment, investigating Helkimo clinical dysfunction index (impaired movement of mandible, impaired TMJ function, mandibular pain, muscle pain, and TMJ pain). They found no relationship between orthodontic treatment and TMJ dysfunction.

Janson and Hasund³⁹ studied 60 patients 5 years out of retention. The group was divided into 30 first premolar extractions and 30 non-extractions (30 untreated patients were studied as a control group). They concluded that there were no risks of TMJ dysfunction from orthodontics, with or without extractions.

Sadowosky *et al.*⁴⁰ studied 160 patients before and after orthodontic treatment. They found no statistically significant difference in joint sounds between the extraction and non-extraction groups and concluded that orthodontic treatment was therefore not a causative factor in this aspect of TMJ dysfunction.

Dibbets and van der Weele⁴¹ evaluated 172 patients who had undergone orthodontic treatment for TMJ dysfunction: 40% with functional appliances and 60% with straight wire appliances. First premolars had been extracted from 30% of the study group, 37% had had no extractions and in 34% other extraction patterns were followed (Figure 2). All patients were subjected to a 15-year follow up. The researchers

found absolutely no relationship between extraction and non-extraction, or extraction of first premolars (or any other teeth), and pain registration, movement limitation, joint sounds or radiological changes.

Kurdinger *et al.*⁴² radiologically studied condyles of 29 patients whose first premolars had been extracted and compared them with 29 untreated patients. None of the patients had any evidence of TMJ dysfunction. They also found no radiological differences between the two groups in condyle position.

Kremenak *et al.*⁴³ studied 65 patients for TMJ dysfunction before and following orthodontic treatment: over a 10-year period they found only very small differences between orthodontic and non-orthodontic cases.

Gianelly *et al.*⁴⁴ studied 12 patients whose upper first premolars only were extracted. They found that the condyles of these patients lay in an anterior position similar to those in untreated controls.

Luecke and Johnston²³ studied 42 patients with Class II division 1 malocclusion who underwent extraction of upper first premolars. On average, the upper incisor retraction was 5 mm, but lip retraction was much less marked: 70% showed net forward displacement of mandibular basal bone. Any condylar changes were associated with changes of the buccal segment and not due to

major labial segment retraction. The data did not support the assertion that premolar extractions and incisor retraction lead to unsightly faces or distal mandibular displacement.

In a follow up of the above study Beattie *et al.*⁴⁵ recalled patients who had undergone treatment for Class II malocclusions that represented 'borderline cases' (they could have been treated by either extraction or non-extraction) an average of 14 years after they finished orthodontic treatment and examined them for signs of TMJ dysfunction. They found no significant difference between non-extraction and extraction treatments.

The concern over extractions and the development of TMJ dysfunction in the USA led the American Orthodontic Association in 1992 to devote an issue of *The American Journal of Orthodontics and Dentofacial Orthopaedics* (1992; **101**: 1) entirely to this topic. Little evidence was found to suggest any association.

Against this wealth of scientific evidence we have the opinions of one or two dentists based upon a few anecdotal case reports.

CONCLUSIONS

Arch development (expansion) has been around since the days of Angle in the latter part of the nineteenth century. Because of the widespread periodontal breakdown and large amount of relapse associated with non-extraction our forebears, some 50 years ago, abandoned this approach for all orthodontic cases. Recent studies have shown that the highest incidence of relapse associated with the lower incisors following orthodontic treatment occurs in patients who have undergone expansion in the mixed dentition.⁴⁶

It would make orthodontic treatment a lot easier if malocclusion was simply a matter of environmental factors. Treatment plans could be prescriptive and failure could be blamed solely on the patient's lack of compliance. But, as with many aspects of biological development, there is a complex interaction between the environment

and genetics and this gives rise to a wide range of individual variation, which we do not fully understand. One day we may have all the answers, but until that time the majority of orthodontists in the UK and the USA quite rightly advocate clinical practice based on the best available scientific evidence.

Unfortunately, in our media-conscious society, anecdotal case reports are used to document and prove anything – which makes them at best useless and at worst deceptive. Media reports generally do not represent a random sample, do not control or examine confounding variables and are not subject to statistical analysis.

When assessing the so-called ‘alternative orthodontic treatments’, we have to ask:

- Do they result in a better facial appearance?
- Are they more stable?
- Are we convinced that they are significantly better for the health of the temporomandibular joints?

The answers to all these questions from the available evidence has to be ‘no’.

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