Australian Society of Orthodontists

THE UNIVERSITY OF SYDNEY

# FACT OR FALLACY ?

## PART 2

Creating Brighter Futures

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# FACT OR FALLACY? PART 2

In this Part 2 of the series, we look at three more concepts that have been, and still may be, controversial among some academics and practitioners.

## 1. Functional appliances produce skeletal changes (grow mandibles)

Functional appliances are generally prescribed in the management of Class II discrepancies, aiming for orthopaedic change by influencing muscle groups and guiding mandibular growth. Designed to posture the mandible forward, the resultant soft tissue stretch transmits forces to the skeletal and dental tissues with, in theory, subsequent growth adaptation taking place by bone remodelling and tooth movement including[1,2]:

- Dentoalveolar changes of both the upper and lower dentition
- Differential growth between the maxilla and mandible
- Condylar, ramal and glenoid fossa remodelling
- Favourable redirection of mandibular growth.

Examples of functional appliances include the Bionator and Twin Block removable appliances and the Forsus and Herbst fixed functional appliances (Figs.1&2).

*Figure 1. TwinBlock Appliance*

*Figure 2. Herbst Appliance*

The potential for functional appliances to produce long-term skeletal change remains an area of contention. Some argue that skeletal growth can be modified by changing the function and environment, whilst others are adamant that mandibular growth is genetically pre-determined and functional appliances simply produce dentoalveolar changes.

Evidence from a series of prospective randomised trials of functional appliances supports a temporary effect during Phase I (mixed dentition) treatment, with the effects subsequently minimised in Phase II (permanent dentition) treatment due to reversion back to pre-treatment growth patterns[3-6].

The overall net effect was similar to those who received late functional treatment only. A Cochrane Review[7] also suggested that despite minor improvements to skeletal patterns with functional appliances in early adolescence, they do not appear to be clinically significant and there was no difference in final overjet between one phase and two phase treatment groups. Hence it has been suggested that the orthopaedic gain from functional appliances is questionable in relation to their clinical significance and long-term correction.

The efficacy of functional appliances in achieving orthopaedic effects has been shown to be heavily dependent on biological factors. Pre-pubertal (early) treatment results primarily in dentoalveolar change while optimal skeletal change, even though minimal, is associated with treatment commencing at puberty[8,9]. Individual patient morphology also contributes to great variation in responsiveness with the mandibular angle being proposed as a predictor for favourable responses[10].

Patients with low angle horizontally growing mandibles respond more favourably than high angle vertical growing patients.

Functional appliances are still invaluable appliances to improve occlusal relationships in suitable Skeletal Class II discrepancies and are an effective treatment modality. While functional appliances may not strictly ‘grow’ or increase the length of the mandible, they encourage mandibular translation for potential profile and occlusal improvements. The resulting outcome varies between individuals due to biological influencing and compliance factors.

**In summary the current view is that the inherent growth potential of the mandible is not changed by functional appliances, however forward repositioning of the mandible can result in the condyle adaption to this position. Orthopaedic interventions allow for a temporary acceleration of mandibular growth that contribute to Class II correction. Dentoalveolar changes still make up a large component of the Class II correction when treating with a functional appliance.**

## 2. Lower Third Molars cause crowding

Crowding of the mandibular anterior teeth is a common observation during post-adolescence in both orthodontically treated and untreated individuals. Controversially, lower third molars have often been cited as one of the causes for this development, claiming that they exert a mesial force contributing to mandibular crowding. (Fig.3)

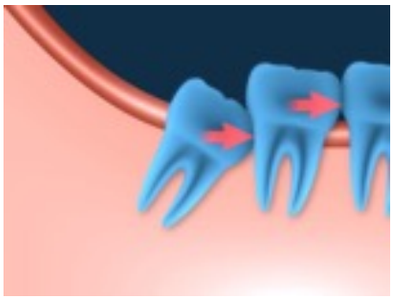

*Figure 3. Mesial force potentially indicated in causing mandibular incisor crowding.*

Bergstrom & Jensen[11], in 1961, examined unilateral third molar agenesis and found a greater degree of crowding in the quadrant where the third molar was present. While in a split-mouth study, reported in 1982, in 70% of cases an improvement in space was found on the extraction side compared to the non-extraction side[12]. Though the authors concluded that it could not be predicted which specific patients would react favourably with third molar removal, they still recommended their removal in cases of severe crowding.

However, other evidence in the literature does not support third molars as a contributor to crowding. Post-retention relapse studies examining groups with fully erupted, impacted and missing third molars found no difference in the amount of lower anterior crowding between these three groups[13,14]. Relapse occurs regardless of the presence of third molars, and they do not appear to have a significant influence on post-treatment changes.

The exertion of a mesial force by the third molars, measured as the tightness of interproximal contacts, was assessed by Southard et al[15] following the unilateral removal of a third molar in a split-mouth study. There was no significant difference in relief of contact tightness between the extraction and non-extraction sides, hence the authors concluded there was no detectable mesial force by the third molars.

Removal of third molars to reduce the potential for crowding is not supported by more current literature. A 2020 Cochrane review[16] included a study by Harradine et al[17] evaluating the evidence for the removal or retention of asymptomatic, pathology-free impacted third molars. This randomised control trial investigated the effects of prophylactic third molar removal on late lower incisor crowding. Where third molars were extracted, a difference of 1mm in the reduction of lower incisor irregularity was found, which was not deemed to be clinically significant. The authors concluded that it was not justified to remove third molars on the grounds of preventing late adolescent crowding.

Mandibular crowding has a multifactorial aetiology so it has been difficult to identify a direct cause and effect relationship between this and third molars. Other factors that have been implicated in crowding include:

- Alteration of arch forms and widths during orthodontic treatment[18,19]
- Late mandibular growth and rotation[20,21]
- Physiological mesial drift
- Lack of interproximal wear, associated with the modern diet[22]
- Triangular crown morphology of incisors[23]
- Decreasing arch length with age[24 25]

**There remains a lack of evidence to conclusively draw a significant relationship between mandibular third molars and anterior crowding. Hence, the removal of third molars should not be recommended if the sole purpose is to reduce or prevent the development of mandibular crowding.**

## 3. Self-ligating brackets speed up tooth movement and treatment

Self-ligating brackets (SLB) were originally developed to decrease the time spent placing and changing elastic modules, hence reducing individual patient chair time. The brackets have an in-built mechanical device that holds the archwire in place. Passive designs hold the archwire loosely in the bracket slot, with no additional applied force. Active designs include a flexible spring-loaded clip that presses against the archwire to increase engagement. (Fig.4)


Figure 4. Example of passive and active self-ligating brackets.

In order for tooth movement to occur, friction between the archwire and bracket must be overcome by application of a force. Low friction implies that tooth movement will occur more readily with lower forces. Hence, it would seem logical to utilise appliances that promote low friction to reduce resistance to movement and improve anchorage conservation. The method of ligation can contribute to frictional forces, acting as a source of resistance to the movement of the archwire relative to the bracket.

SLB are promoted as low friction, enabling better sliding mechanics and more efficient tooth movement, a property that could improve the speed of tooth movement thus reducing overall orthodontic treatment duration[26]. However, these claims are based on laboratory studies[27–29], often with passive archwires placed in well-aligned brackets, not modelling the actual clinical situation. In a clinical scenario where teeth are misaligned at severe angulations, the resistance to sliding mechanics is more attributable to binding and less influenced by friction[30]. Hence, the overall effect and clinical significance of a 'low-friction' ligation method is reduced.

This has been demonstrated by numerous studies that have shown no significant difference in initial alignment, canine retraction and space closure time when comparing SLB and conventional brackets[31–36].

SLB have also been promoted for their shortened overall treatment times. However, a systematic review[37] found no difference in total treatment time and occlusal quality at the end of treatment between self-ligating and conventional brackets. DiBiase also found the bracket type did not influence the overall treatment duration or number of appointments needed[38].

**Current evidence relating to the increased tooth movement and duration of treatment indicates no clinically significant difference exists between SLB and conventional brackets. Claims relating to the increased efficacy of tooth movement with self-ligating brackets must be interpreted carefully, as often they are derived from marketing materials and conclusions drawn from in vitro studies rather than clinical situations.**

## References available upon request

**Past issues of Brighter Futures can be accessed at: www.aso.org.au/resources/brighter-futures-newsletters**



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