Fixed Versus Removable Appliances – Which One to Choose?

Abstract: The use of removable appliances in modern clinical orthodontic practice can generally be considered an out-dated treatment modality for managing malocclusions. Their use and popularity has declined considerably largely due to their inefficiency at achieving significant quality tooth movement. There are, however, a couple of specific indications where removable appliances come into their own. This article will present and discuss several clinical scenarios where one technique clearly has significant advantages over the other.

CPD/Clinical Relevance: Orthodontists and general dental practitioners (GDPs) should be aware of the situations where removable appliances provide a solution in modern clinical orthodontics practice, but also when the fixed counterpart will provide a much more efficient and effective method of moving teeth.

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The majority of removable appliances are advocated for starting orthodontic treatment in the mixed dentition, and are also used as an adjunct to fixed appliances in treatment.1 There are very few significant clinical benefits to the patient as a result of their use; and perhaps few that could not be done better and more efficiently with fixed appliances. In most instances the disadvantages of fitting removable appliances outweigh their potential advantages.

Advantages of removable appliances:
- They introduce the patient to the concept of appliance therapy;
- They can be used to help assess the patient’s compliance;
- They are easier to clean than fixed appliances as they are removable;
- Full palatal coverage provides supplementary anchorage;
- Overbite reduction is achieved;
- They can facilitate molar distalization and disimpaction.

Disadvantages of removable appliances:
- Treatment success is highly dependent on patient compliance;
- Motivating patients needs an operator with good communication skills;
- Removable appliances are frequently left out of the mouth by the patients;
- Only tipping movements are achievable;
- They may alter speech;
- Additional laboratory expense to fabricate the appliances;
- Intermaxillary traction is more difficult;
- They are generally inefficient for multiple tooth movements.1,2

Disimpaction of maxillary first permanent molars

Ectopic eruption of maxillary first permanent molars occurs in around 4% of the population. Radiographic examination can reveal the first permanent molar encroaching or impacting upon the distal aspect of the second deciduous molar and this clinical presentation is most commonly encountered in the maxillary arch, either unilaterally or bilaterally.3

This clinical scenario can often lead to:
- Extensive resorption on the distal surface of the second deciduous molars (Figure 1);
- Early loss of the associated second deciduous molar;
- Unfavourable eruption of the first permanent molar in a mesial position (Figure 2);
- Impaction of the second premolar during

Enhanced CPD DO C
A number of aetiological factors have been suggested as predisposing to/associated with the ectopic eruption or impaction of first permanent molars:
- Familial tendency;
- Crowded or shorter posterior maxilla;
- Mesially inclined first permanent molar;
- Cleft lip and/or palate;
- In association with other dental anomalies.4-8

Clinical examination reveals the mesial margin of the first permanent molar buried under the distal marginal ridge of the second deciduous molar, with a varying degree of mesial tipping. Radiographic examination often shows extensive resorption on the distal surface of the deciduous second molar, caused by the mesially impacted first permanent molar overlapping the resorbed aspect of the associated deciduous second molar.

Management
A number of techniques have been previously described in the literature for the management of this situation; among these are the Halterman appliance9 and the modified Halterman.10 These appliances derive anchorage from the second deciduous molars, where a band is placed around the maxillary second deciduous molar, incorporating an auxiliary wire extending distally to the impacted first molar, with a curved hook, which allows for attachment of an elastomeric chain attached to a bonded button on the occlusal surface of the impacted maxillary first molar. In many clinical situations, the second deciduous molars have experienced extensive resorption, which renders these teeth a poor choice to retain bands or provide anchorage support.

To overcome these clinical problems, a simple and effective removable appliance can disimpact the maxillary first permanent molars, and improve the prognosis of second deciduous molars.

Appliance design and mechanics
- A Southend clasp anteriorly and Adams clasps on deciduous molars will form the retentive components (Figure 3).
- Palatal springs mesial to impacted first permanent molars will comprise the active components of the removable appliance. These can be constructed in 0.5 mm stainless steel wire.

Buttons are bonded on the occlusal surfaces of the impacted first molars (Figure 4). The first molars rotate mesio-palatally around their palatal roots, therefore the buttons are often bonded on the disto-buccal cusp of the first molar. A force gently applied in a distal direction will lead to de-rotation as well as distalization of the first molar. Subsequent re-activation of the palatal spring after a few weeks should allow complete disimpaction.
Orthodontics

Figure 6. Mid-treatment panoramic radiograph. Note improvement in angulation of UR6 and UL6; and normal path of development of UR5 and UL5 can be seen.

Figure 7. (a) Pre-treatment intra-oral view showing an increased overbite. (b) Mini-Molds* in situ. Note simultaneous overbite reduction and mechanical traction of displaced canines. (c, d) Overbite reduction and mechanical traction of displaced canines was achieved in 8 months.

Overbite reduction using bite planes

Removable anterior bite planes

In malocclusions complicated by an increased overbite, removable appliances that incorporate an anterior bite plane are often used in orthodontic treatment in an attempt to achieve overbite reduction in a growing patient. Disadvantages of removable anterior bite planes:

- Patient compliance is absolutely essential for any meaningful change;
- Additional laboratory cost;
- Appliances are frequently lost or not worn.

Fixed anterior bite planes

In contrast to removable anterior bite planes, fixed anterior bite planes, constructed using glass ionomer cement (GIC) or composite in Mini-Moulds®, can be considered superior in terms of optimizing treatment efficiency and effectiveness. 11

A 16-year-old female presented with Class II division 2 malocclusion, complicated by the presence of palatally ectopic upper canines, increased overbite (complete to hard tissue), and crowding of both upper and lower arches (Figure 7a). Fixed bite planes were constructed using Mini-Molds*, permitting simultaneous use of upper and lower fixed appliances, thus maximizing treatment efficiency (Figures 7b, c). 11

In cases with an increased overjet, Mini-Molds® can be placed either slightly more gingivally to catch the lower incisal tips or, if placed incisally, a second Mini-Molds® (5 mm) extension can be bonded on top of the first. ‘Double’ Mini-Molds® start the overbite control in cases with larger overjets, again permitting simultaneous use of upper and lower fixed appliances (Figure 8).

Anterior open bite resolution

Digit-sucking (hay rake)

The presence of a persistent digit-sucking habit in the mixed or early permanent dentition can sometimes be hard to break and might have an impact on the developing dentition. Effects can typically present as (Figure 9):

- Proclination of maxillary incisors;
- Retroclination of mandibular incisors;
- Increased overjet;
- Reduced overbite or anterior open bite;
- Unilateral or bilateral posterior crossbite;
- Increased maxillary length and prognathism. 12

In general, if the habit stops before facial growth is complete then the anterior open bite usually resolves spontaneously and the overjet returns to normal. 13 Non-invasive methods are usually attempted for the first 3−6 months and these can occasionally be effective in eliminating the habit and improving the occlusion. Methods such as positive reinforcement by reward, or placement of bandages, plasters, gloves, or bitter-flavoured varnishes on the offending digit to make the habit less pleasing, are normally prescribed. Where a habit persists, intervention in the form of a ‘habit-breaking’ appliance is normally prescribed. Because of lack of patient compliance, the provision of removable appliances may not be the most effective method in such cases.

A hay rake fixed appliance should be cemented in place to a patient with a significant anterior open bite. In only 6 months, it can help to eliminate the habit and the open bite can markedly reduce (Figures 10a–d).
Anterior crossbite correction

The presence of an anterior crossbite in the mixed dentition can result in marked incisal wear of the anterior teeth and gingival recession associated with proclined lower incisors. An anterior displacement is also often associated with anterior crossbites, and its elimination often necessitates early orthodontic treatment. Anterior crossbite has, in the past, been successfully managed with removable appliances. However, the results are unpredictable as, once again, this is totally dependent upon appliance wear.

Young patients in the mixed dentition are often referred by GDPs concerned about a reverse overjet, gingival recession or an anterior displacement (Figures 11a, b). Utilizing a 2x4 appliance, comprising bands on the maxillary first permanent molars and bonds on the erupted maxillary permanent incisors, correction is an extremely rapid and predictable method of correcting this problem. The placement of stainless steel tubing (0.9 mm internal diameter) in the long spans between the lateral incisors and first permanent molar (Figure 12) increases the rigidity of this section of the appliance and reduces the chance of wire displacement or breakage. In this case, treatment was complete in only 5 months; alignment was subsequently maintained utilizing a bonded retainer (Figures 13a, b).

Distalizing maxillary permanent molars

Maxillary molar distalization to gain space is often attempted in orthodontics for a number of reasons; relief of crowding, correction of a Class II molar relationship and space provision for missing teeth or reduction of an increased overjet. Several methods and devices have been described to distalize maxillary molars.

Using devices such as the removable 'Nudger' are, once again, highly dependent upon the patients. Devices such as the use of Temporary Anchorage Devices (TADs) will obviate the need for patient compliance with wear. Placement of TADs is considered a minimally invasive procedure; moreover it is a clinical technique that has proved to be versatile and reliable for maximum anchorage reinforcement.

A 14-year-old female had a congenitally missing UR2, a peg-shaped UL2, and a half unit Class II canine and molar relationship (Figures 14a, b). Following a
joint restorative/orthodontic consultation, a treatment plan was devised with a view to creating space to allow restorative replacement of a missing UR2 and restorative build-up of the diminutive UL2. With the use of TADs to provide indirect anchorage to stabilize the first premolars, molar distalization was obtained in a matter of only 6 months (Figures 15a–c). The treatment objectives would have been challenging if not impossible to achieve in a similar time period using removable appliances (Figures 16a−d) and, if successful, the molar teeth would have been significantly distally tipped because of the inherent lack of 3-dimensional control associated with these appliances.

Functional appliances

One of the more popular removable appliances is the modified Twin Block appliance. Since the introduction of the original Twin Block appliance by William Clark in 1978, it has, in the UK, become the appliance of choice in any growing patient with an increased overjet. Having been studied using RCTs, more than possibly any other functional appliance, it has been shown to achieve results as good as any other functional appliance and certainly as good as a fixed alternative, but without all the undesirable side-effects of the latter, ie increased breakages.16

Retention

Removable appliances still have a major role in retaining the results achieved with other appliance systems. In cases of severe hypodontia, where a definitive treatment plan includes restorations, it is essential to
ensure perfect retention of the result between completion of orthodontic treatment and provision of definitive restorative treatment. Where teeth are to be restored, removable retainers must include full-sized pontics as well as metal stops to the adjacent teeth and labial bows to prevent any tooth movement, to retain the redistributed spaces (Figure 17).

Conclusion

All removable appliances require patient motivation and total compliance for them to have any chance of success. Their removable nature often renders them the ‘least good’ option in modern clinical orthodontics, apart from a small number of specific clinical scenarios. Practitioners should be aware of these few situations where removable appliances provide a solution, but also when the fixed counterpart will provide a much more efficient and effective method of moving the teeth.

References


*The Editorial Board of Dental Update welcomes Professor Mike Lewis PhD, FDS RCPS, FDS RCS(Eng), FRCPath, FF GDP(UK), FHEA*

I am delighted to advise readers that Professor Mike Lewis has indicated that he is happy to join the Editorial Board of Dental Update. Professor Lewis is Professor of Oral Medicine at Cardiff University. He served as Dean of the School of Dentistry at Cardiff University from 2010–2017. He is also past Dean of the Dental Faculty of the Royal College of Physicians and Surgeons of Glasgow (when the idea of their Fellows and Members receiving a copy of the journal was hatched) and Director of the Clinical Board for Dentistry, Cardiff and Vale University Health Board.

Professor Lewis has published over 200 scientific articles and co-authored six medical textbooks. He has delivered more than 600 postgraduate lectures worldwide. In addition, he has been President of the British Society for Oral Medicine, President of the British Society for Oral and Dental Research, Dental Representative on the Advisory Council for Misuse of Drugs (Home Office) and Dental Representative on the Scientific Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection (Department of Health). From all of these attributes, readers will realize that Prof Mike Lewis is an outstanding addition to our Editorial Board. He has long been a supporter of Dental Update and I am advised that it is just over 33 years since his first paper in the journal was published, in May 1985!

Mike, you are very welcome. We look forward to your input to the journal via the Editorial Board.

**CPD ANSWERS**

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1. C  
2. B  
3. B  
4. D  
5. D  
6. C  
7. C  
8. B  
9. D  
10. C