Australian Society of Orthodontists

THE UNIVERSITY OF SYDNEY

Removable Orthodontic Appliances

Creating Brighter Futures

Removable Orthodontic Appliances

Removable appliances are designed to be easily removed from the mouth by the patient for cleaning, activation and when required.[1]

History

Removable appliances began to be routinely used in the 19th century. In the United States, early examples consisted of vulcanite bases and precious metal or nickel-silver wires, with even hickory wood pegs being utilised for its ability to expand when exposed to saliva in the oral cavity. In the early to mid 20th century orthodontic practice in Europe continued to be based largely on removable appliances. Expanding social welfare systems together with shortages of precious metals during wartime led to limited orthodontic care based largely on removable appliances. Early devices lacked stainless steel components and it was only until well after World War II, and precious metal supplies had recovered, that they were able to be used in removable appliances.

More complex removable appliances, utilising expansion screws and springs evolved in the early part of the 20th century. In general, the use of conventional removable appliances has declined over the last few decades as more efficient fixed appliances have been developed and become more widely available. Nonetheless, removable appliances maintain an important place in contemporary orthodontic practice. They are utilised primarily as an adjunct to fixed appliance therapy, growth modification and retention. Modern removable appliances are generally made with acrylic baseplates and stainless steel componentry and wires.[2]

Mode of action of Removable Appliances

Generally, removable appliances are used to perform relatively simple tooth movements such as tipping of teeth and limited expansion.[3]

Dental tipping

While fixed appliances can control tooth movement in all three dimensions, including root movement, removable appliances exert their action by achieving a single point contact with a tooth or group of teeth, tipping about a fulcrum point roughly half way down the root (Figure 1). Favourable pre-treatment root angulation is vital to their success, allowing individual teeth or groups of teeth to be tipped into improved positions.

Overbite reduction

When used at the appropriate stage of facial development, an anterior bite plane allows a reduction in overbite by allowing differential eruption of posterior teeth. This can be a simple and effective way of reducing a deep anterior overbite in a growing patient.

Crossbite correction

Some anterior and posterior crossbites can be corrected with a screw or spring mechanism incorporated within a removable appliance (Figure 2). As this mechanism produces only tipping movements it is only suitable for crossbites of dental and not skeletal origin.

Extrusion and Intrusion

A spring or elastic from a removable appliance can be placed under a fixed attachment on a tooth to extrude it. Similarly, these can be applied over a fixed attachment and provide Intrusion. Good appliance retention is required to provide intrusion as the reactive force will tend to unseat the appliance.

You may wish to share this issue of Brighter Futures with your hygienists and other staff members.

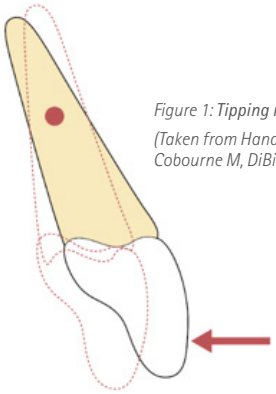

Figure 1: Tipping movement
(Taken from Handbook of Orthodontics, Cobourne M, DiBiase A 2010)

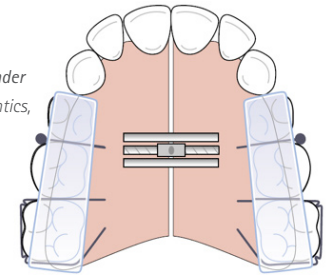

Figure 2: Removable palatal expander
(Taken from Handbook of Orthodontics, Cobourne M, DiBiase A 2010)

Components and materials

In general, removable appliances consist of four main components:

1. Active Components

Springs

Springs are one of the most commonly used active components in removable appliances. These are constructed of at least 0.5mm stainless steel wire. A variety of spring designs exist to suit various clinical situations and these are selected according to the type of movement required. They often require reactivation and adjustments monthly to maintain clinical efficiency.

Examples include: Finger springs (Figure 3)
Z-springs (Figure 4) T-springs and Coffin springs

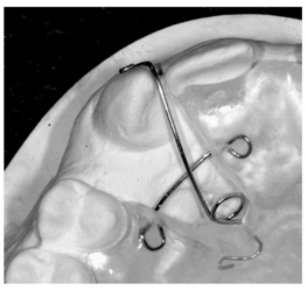

Figure 3: Palatal finger spring
(Taken from Handbook of Orthodontics, Cobourne M, DiBiase A 2010)

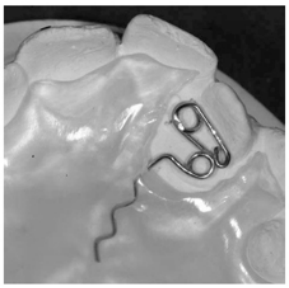

Figure 4: Z-spring
(Taken from Handbook of Orthodontics, Cobourne M, DiBiase A 2010)

Screws

Screws are less versatile than springs as the direction of the movement is dependent on the position of the screw. These are embedded within the acrylic baseplate between two segments of acrylic and the patient activates the screw by turning the central cylinder with a key. Each quarter turn activation usually separates the segments by 0.25mm, and activation frequency is normally 1-2 turns per week. Relatively higher forces are produced by screws relative to springs, however they are dissipated relatively quickly as the teeth move in the desired direction.

The most common application is the correction of posterior crossbite with a midline screw separating two halves of an appliance (Figure 5).

Figure 5:
Upper Expansion appliance with midline screw
(Taken from Handbook of Orthodontics, Cobourne M, DiBiase A 2010)

Bows

Although usually a retentive feature of removable appliances, an active labial bow can be used to reduce an increased overjet by tipping the teeth in a palatal direction if the upper incisors are proclined and spaced (Figure 6).

Figure 6: Labia bow
(Taken from Handbook of Orthodontics, Cobourne M, DiBiase A 2010)

Elastics

Elastomeric forces can be applied from a removable appliance to generate tooth movement using light forces (Figure 7). Various size and force combinations are available to suit many clinical situations depending on the span between anchor points and the force levels required. Inter-arch configurations are generally avoided as these generally compromise appliance retention.

Figure 7. A removable plate used to retract spaced upper anterior teeth with an elastic. Illustrations show pre-treatment (top), appliance inserted (centre) and post-treatment (bottom).

BRIGHTER FUTURES

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2. Retentive Components

Clasps and bows

Various clasps have been designed to help retain removable appliances when being used. Usually fabricated from 0.7mm stainless steel, they generally function by engaging dental undercuts and can be adjusted to increase or decrease retention when required. Common examples include:

- Adams clasps – generally used on posterior deciduous or permanent teeth, the arrow-head of these clasps engages mesio-buccal and disto-buccal undercuts. The bridge connecting the arrowheads can be used by the patient with pressure from the fingertips to dislodge the appliance (Figure 8).
- Southend clasps – these claps pass along the gingival margin of anterior teeth, usually incisors and engage the undercuts below the contact point.
- Ball clasps – These use the undercut provided by the embrasure and provides effective retention and are easily adjusted.
- Plint clasps – These clasps are used when a combination of fixed appliances and a removable appliance is used. They engage the buccal tube attachment found on maxillary molar bands (Figure 9).

*Figure 8. **Adams clasps** (Taken from An introduction to Orthodontics, Mitchell, L 2010)*

*Figure 9. **A plint clasp engaging the area underneath a molar band attachment** (Taken An introduction to Orthodontics, Mitchell, L 2010*

3. Anchorage Component

Anchorage for a removable appliance is obtained from either an intraoral or extraoral source. Intraoral anchorage is primarily derived from the palatal mucosa and dentition. Extra oral anchorage can be provided from headgear attached to the appliance.

It is the aim of the appliance to move small segments of teeth whilst keeping the rest stationary, and this can be achieved by keeping forces light and incorporating as many teeth as possible in the stationary unit along with the palate. In cases where reciprocal anchorage is desired, for example in an expansion plate, anchorage loss is less of a concern.

4. Base Plate Component

The baseplate can be either an active or passive component of the appliance, and it generally has 3 main functions:

Acts as a connector – baseplate acrylic connects all components of the appliance and forms a protective housing for screws and a rigid anchor point for wires, springs and claps.

Acts as a bite plane – the acrylic baseplate can also serve as bite plane anteriorly or posteriorly, aiding in opening of the bite. This can be useful in deep bite cases where posterior eruption is desired to increase the vertical dimension, or posteriorly as buccal capping to disclude anterior teeth during anterior crossbite correction.

Assists with anchorage – the baseplate contacts the palatal mucosa and teeth to distribute the reactive forces and provide anchorage against the active components of the appliance.

References upon request