Removable Appliance

It is the appliance that is fabricated mainly from acrylic and stainless steel wire, it's action confined to a single arch to move teeth, and can be removed from the mouth by the patient. The functional appliances of the same materials but differ in their work as they exerting intermaxillary forces.

Most removable appliances are made for the upper arch, because patients generally poorly tolerate the lower appliance. This is due in part to their encroachment on tongue space, also the appliance retention is compromised by lingual tilting of lower molars makes retentive clasping difficult in addition to action of the tongue and lips which tending to unseat the appliance.

Mode of Action

- It basically performs the tipping movement (labio-lingual or mesio-distal) because it applies a single-point contact force to crown of tooth. It can correct tooth rotation less than 90° (couple force system).
- Movement of block of teeth. Because removable appliances are connected by acrylic baseplate, they are more efficient at moving block of teeth than fixed appliance, e.g. arch expansion.
- It can influence the eruption of opposing teeth by a modification of baseplate to cover either anterior teeth e.g. anterior bite-plane or posterior teeth, e.g. posterior bite-plane.

Advantages

1. It can be removed for tooth- brushing, so it does not compromise the oral hygiene.
2. Palatal coverage increase the anchorage.
3. It take a short chairside time because it fabricated in the laboratory and it is easy to adjust.
4. It's components are relatively cheap.
5. Less risk of iatrogenic damage (e.g. root resorption) than fixed appliance.

Disadvantages

1. It applies a single point of force application to the crown, so it only limited for tipping and simple rotation.
2. Heavily dependent on the patient compliance.
3. It is uncomfortable to the patient, as it is bulky and affects speech.
4. Usually inefficient for multiple individual tooth movements.
5. The patient has to have certain amount of dexterity and skill to be able to remove and replace the appliance to get a successful treatment.
Components of Removable Appliance

Four components need to be considered for every Removable Appliance:

1. **Active components**, which produce force for tooth movement.
2. **Retentive components** responsible for holding the appliance in the mouth.
3. **Baseplate** as a major connector connecting the components.
4. **Anchorage**, imaginary component resisting unwanted tooth movement.

**Active components**

These include the components of the Removable Appliance, which apply forces to the teeth to bring about the desired tooth movement. The active components include:

a) Springs-made up of 0.5, 0.6 or 0.7 mm diameter stainless steel wire.
   b) Screws.
   c) Elastics.

**Springs**

They are the most commonly used active component. Wide varieties of springs are available for incorporating in the Removable appliances. Their designs can be adapted to the need of clinical situation. Springs can be broadly classified according the following:

- **based on the presence of helices into:**
  - Simple springs no helix present.
  - Compound springs contain helix (coil) or U loop as alternative.
Based on the mode of support provided to maintain the integrity of the spring:

- Self-Supported springs: these springs are made up of thicker wire to avoid distortion by the patient.
- Supported springs: these springs are made up of thinner wire and therefore to protect these delicate springs, a guidewire may be provided. Alternately, they may be supported by an additional sleeve or 'boxed' by acrylic to ensure adequate stability.

Based on the position of springs:

- Palatally positioned: like the finger, Z and Recurved Z springs.
- Labially positioned: like buccal canine retractor, Hawley arch and Robbert retractor.

Spring Material

The most suitable material for orthodontic springs is stainless steel wire, as it combines elasticity and malleability in excellent proportions, is tasteless and immune to corrosion by oral secretions. In scientific terms, there is a relationship between the length, diameter and amount of deflection of a spring, which is expressed as:

\[ F \propto \frac{d \chi r^4}{L^3} \]

F : the force exerted by the spring.

d : the deflection of the spring.

r : the radius of wire.

l : the length of wire.

According to this formula, the delivered force by spring is directly proportional to the deflection (i.e. activation) of spring and the radius (i.e. diameter) of steel wire, while inversely proportional to length of wire. So we can change in these three factors to get an appropriate magnitude of force.

The force commonly needed for tooth movement by removable appliance is relatively small (30-50g only). So to apply such force, a thin wire and/or long wire should be used. Practically there are restrictions upon the length and diameter of wire used.

The span of a spring is usually constrained by the size of arch and depth of sulcus. Therefore incorporating coil or loops into the design of a spring increases the length...
of wire and in turn result in application of a light (physiological) force for a given deflection.

Use of small diameter wire in spring construction is favored, but this small diameter will be liable to distortion or breakage and can cause trauma to the oral soft tissues, therefore the spring either protected with acrylic and guard or strengthened by being sleeved in tubing. The spring made from thinner wire generates less force and has greatly increased flexibility, thus, remaining active over a longer period.

The effect of wire diameter upon the force delivered by a spring can be appreciated by considering the amount of activation required to deliver the light favorable force level for the same spring design. As example the spring composed of 0.5 mm wire require an activation of 3 mm, while for the same spring composed of 0.7 mm an activation of 1 mm is needed.

In general, main parts of the spring are:

- Retentive tag, the part that impeded in acrylic.
- Coil or U-loop as a site of activation.
- Active arm, the part touch the tooth surface.

**Screw**

Screws are less versatile than springs, as the direction of tooth movement is determined by the position of the screw in the appliance. They are also bulky and more expensive. However, a screw appliance may be useful when it is desirable to utilize the teeth to be moved for additional clasping to retain the appliance. This is helpful when a number of teeth are to be moved together (for example in an appliance to expand the upper arch) or in the mixed dentition where retaining appliance is always difficult.

The most commonly used type of screw consists of two halves on threaded central cylinder turned by means of a key while separates the two halves by a predetermined distance usually about 0.25 mm for each quarter turn.

Activation of a screw is limited by the width of the periodontal ligament, as to exceed this would result in crushing of the ligament cells and cessation of tooth movement. One-quarter turn opens the two sections of the appliance by 0.25 mm.
Elastics

Special intra-oral elastic are manufactured for orthodontic use. These elastic are usually classified by their size ranging from 1/8 inch to 3/8 inch (i.e. 3.2mm to 9.5mm), and the force that they are designed to deliver usually 2.5oz, 4.5oz, or 6.5oz (i.e. 71g, 128g, or 184g). Selection of the appropriate size and force is based upon the root surface area of the teeth to be moved and the distance over which the elastic is to be stretched. The elastic should be changed every day.

Retentive components

These components help to retain the appliance in place and resist displacement due to active components. The effectiveness of the active components is dependent on retention of the appliance. Good fixation will help patient compliance, anchorage and tooth movement.

These retentive components commonly made from 0.7mm St. Wire. In the most Removable Appliances, the retentive components are the clasps such as Adams' clasp, ball end clasp, C-clasp.....etc.
Baseplate

It forms the major part of removable appliance. It acts as a major connector connects the other individual components of removable appliance, and also distributes the reaction forces to the anchorage areas. The material most often used for baseplate is cold or heat cure acrylic. It can be passive, when used as a major connector or active component in removable appliance by modifying it as anterior or posterior biteplane.

Modifications of baseplate

- **Anterior bite-plane**

Increasing the thickness of acrylic behind the upper incisors forms a bite-plane onto which the lower incisors occlude. Anterior bite-plane is required either for overbite reduction by over-eruption of posterior teeth or for elimination of occlusal interferences to allow tooth movement to occur.

Anterior bite-plane is usually flat. Inclined one sometimes used to procline the lower incisors.
Posterior bite-plane

It is prescribed when the occlusal interferences need to be eliminated to allow tooth movement to be done. It is produced by carrying the acrylic over the occlusal surfaces of posterior teeth and has the effect of separating the incisors apart.

Delivery of Removable appliance

At the time the appliance is to be delivered, a number of things should be checked:

1. Prior to placing the appliance, the clinician should check for any minute pimples due to blowholes in the cast that could irritate the mucosa and the free edges should be rounded and smooth.

2. The base plate may need some trimming while fitting the appliance in the mouth.

3. Once the appliance is inserted, check for the position of the active and retentive components. The wire components should not irritate/impinge on any soft tissues. Clasps should fit the teeth accurately.

4. Show the patient in a mirror how to insert and remove the appliance.

5. The patient should be called for a recall visit every 3 weeks.