

Removable Orthodontic Appliances

Removable orthodontic appliances are so-called because they are designed to be fitted and removed by the patient.

- **The main advantages of removable appliances are:**

1. The appliance could be removed by the patient, therefore; can be readily cleaned. The dentition and oral structures can also be maintained in a clean and healthy state during appliance therapy.
2. It is difficult to apply severely excessive forces to the teeth with removable appliances, such forces being dissipated by dislodgement of the appliance.
3. Short chair side time (because it is fabricated in the laboratory rather than in patient's mouth).
4. Its components are relatively cheap.

- **Disadvantages of removable appliances are:**

1. They can bring about only a limited type of tooth movement (tipping movement) which is the main movement possible with this type of appliance. Rotational movements can also be achieved by using force couples. simultaneous multiple tooth movements are therefore more difficult with removable appliances than with fixed appliances.
2. Anchorage of tooth movement is sometimes difficult, since anchor teeth cannot be prevented from tilting. This is somewhat countered by the fact that only tilting movements are being achieved by the appliance.
3. Retention of the appliance is more difficult than with fixed appliances.
4. A high degree of cooperation and a certain amount of skill is required from the patient, who has to remove, clean and replace the appliance at frequent intervals.

Indication:

1. Limited tooth movements (tipping).
2. It may be used for space maintenance or habit breaking.
3. Correction of individual tooth malposition.
4. Dental arch expansion.
5. Retention appliances after orthodontic treatment with fixed appliance.

Types of removable appliance

1. Active removable appliance: Those appliances will produce a desired tooth movement.
2. Passive removable appliance: as retainer and habit breaker.

Components of removable appliances

Removable appliances must have the following component:

1. Active components: produce force for tooth movement.
2. Retentive components: responsible for holding the appliance inside the mouth.
3. Anchorage: imaginary component resisting the unwanted tooth movements.
4. Acrylic base plate (Connecting framework)

Retentive components

The success of a removable appliance mainly depends upon a good retention of the appliance, which is achieved by incorporating wire components that get engaged to the undercuts on the teeth. These wire components that help in the retention of a removable appliances are called clasps:

1. **Adam's clasp (universal clasp)**: it's the major retentive component that provide excellent retention, found almost in all removable appliances.
2. **Fitted labial arch (FLA)**: prevent tilting of the appliance incisally, so make the molars and incisors one unit and thus reinforce anchorage.

3. Circumferential clasp (c-clasp): it's mainly used on deciduous teeth as a supporting clasp, it's made of 0.7-0.8 mm round stainless steel, it should be kept clear of occlusal contact.

4. Ball end clasp: mainly used in conjugation with fixed appliance or in quite special situation such as in the twin block functional appliance around the lower incisors.

Active components

Active components of removable appliance are responsible for producing the desired tooth movement. They can be categorized as springs, bows, screws. The active component could be subdivided according to the direction of the tooth movement into the following:

1. Labial (buccal) movement:

- Z-spring
- Recurved z-spring
- T-spring

2. Palatal (lingual) movement:

- Hawley arch (can be used as a retentive component)
- Roberts retractor (simple and sleeve): it consists of two buccal canine retractors joined anteriorly at the central midline.

Components of Roberts retractor:

1. Smooth curve labial bow
2. Two mesial limbs
3. Two coils
4. Two distal limbs
5. Two retentive tags

The Roberts retractor is constructed from 0.5 mm HSSW with sleeving of the distal limbs and retentive tags by 0.5 mm internal diameter SS tube, or it could be constructed from 0.7 mm HSSW without the need for a sleeve, in this condition the force will be heavy so it needs lighter activation.

Uses: for retraction of the incisors when the overjet is more than 6 mm.

Activation: every 3-4 weeks by closing the coils so that the mesial limbs move 2-3mm backwards on each side (in addition to 2 mm trimming of the acrylic behind the incisors). For the Roberts retractor which is made of 0.7 mm, the amount of activation is half that for sleeved type and it is done every 2-3 weeks.

3. **Mesio-distal movement:**

- Finger spring (simple and modified)
- Buccal canine retractor

4. **Couple force system:** it's used to derotate incisors less than 90°, it's a combination of labially directed force (z-spring or recurved z-spring) and palatally directed force (Hawley arch).

5. **Screws:** they are used to provide intermittent forces in removable appliances. They have the advantage that they are easier for the patient to manage than springs, and are therefore useful for the less skillful patient. The screw is adjusted by the patient or parent at intervals, *in most cases twice a week (slow expansion)*. A further advantage of the screw is that it has fewer tendencies to dislodge the appliance than springs, and it therefore provides a more stable appliance for moving several adjacent teeth in the same direction. *Most screws produce approximately 0.2 mm movement per quarter turn.*

- Jack screw is the most commonly used screw, it consists of two halves threaded central cylinder, turned by means of a key which separates the two halves by a distance, usually about 0.2 mm each quarter turn. Jack screw is mainly used for arch expansion:

A. Anterior expansion of maxillary incisors: one of the simplest uses of an active plate for expansion is to correct a maxillary anterior crossbite, the appliance needs posterior bite plane.

B. Transverse expansion of the arch: the arch expansion is appropriate in a constricted maxillary arch with a tendency toward crossbite. An active plate

split in the midline will expand the arch almost totally by tipping the posterior teeth buccally, *not by opening the midpalatal suture and widening the maxilla itself*, for this reason, removable plates are not indicated for skeletal crossbites or for dental expansion of more than 4-5mm.

Anchorage component

"To every action there is an equal and opposite reaction"

Newton's third law of motion

It is an imaginary component resisting unwanted tooth movement, it's what stops the wrong teeth from moving. Anchorage in the removable appliance could be increased by:

1. Full extension of the acrylic to engage many teeth.
2. Adding retentive components (Adam's clasp and FLA) to adapt the acrylic to the teeth and palate.

Acrylic base plates

The design of the base plates varies with the type of removable appliance.

Uses of base plate:

1. It carries and units both the retentive and active components of the removable appliance into a single functional unit.
2. It helps in the retention of the appliance inside the mouth.
3. It helps in providing anchorage by resisting unwanted drift during tooth movement.
4. It protects the palatal springs against distortion in the mouth.
5. Bite planes can be incorporated into the base plate and used to treat a specific problems.

Modification of acrylic base plate:

- A. *Flat anterior bite plane*: a thickening of acrylic base plate behind the upper anterior teeth on palatal rugae extending usually till the canine, so that the anterior

teeth bite on it. The extension should be flat and parallel to the occlusal plane, the bite plane should be high enough to disocclude the posterior teeth by about 2-3 mm.

Usage:

1. It corrects deep bite by separating the molars allowing them to over-erupt, so decreasing the overbite.
2. It can be used to free or get rid of any cuspal interferences to correct posterior crossbite of a single tooth.

B. *Inclined anterior bite plane*: it is a modification of the anterior bite plate inclining downward and inferiorly used in cases where there is a retroclination of lower anterior teeth with increased overjet.

- ❖ The bite plate is inclined so that the lower anterior teeth are proclined as they contact the slopping bite plane, and the mandible is guided to be held in the forward position >>> thus may guide the mandible to grow forward like the myofunctional appliance.

Usage:

It corrects deep bite, and increased overjet by allowing the molars to over-erupt and proclining lower incisors.

C. *Posterior bite plane*: it is an extension of the acrylic base plate used to open the bite anteriorly and free posterior occlusion, it should cover all the premolars and molars to prevent their over-eruption.

Usage:

1. Opens the bite anteriorly to allow correction of anterior crossbite.
2. Corrects the unilateral or bilateral posterior crossbite.

Making a removable appliance

- 1- Do the necessary wire bending.
- 2- Fix the springs and clasps to the cast by wax on the occlusal and labial surfaces of the teeth, so that they don't move during fabrication of the acrylic. Wax is applied on the coils and arms of the z-spring, recurved z-spring and finger springs so that not to be embedded in the acrylic base plate.
- 3- Soak the cast in water for about 5 minutes until no air bubbles come out of the cast, this is done to prevent the monomer from entering inside the cast and fusing the acrylic with the stone of the cast.
- 4- Use orthocryl (cold cure acrylic) by sprinkle method (salt and pepper) to construct acrylic base plate by applying polymer and then monomer successively.
- 5- Cure in hydroflask under 2 bar pressure to eliminate porosity, the hydroflask contains water at 40' C to accelerate the curing reaction.
- 6- The wax is cleaned and the acrylic base plate is finished with a carbide bur and polished with pumice.

Advantages of sprinkle method:

1. The acrylic penetrates under the wires.
2. Does not dirty the fingers.
3. Less time consuming.

Advantages of using cold cure acrylic:

1. Easier technique (no waxing, wax elimination and packing).
2. Less time consuming as it cures within 10-15 min.

Advantages of using orthocryl:

1. Polymer composed of large particles which prevent the dripping of the acrylic.
2. Acrylic curing is accelerated under pressure and heat that gives a long working time and short curing time (10-15 min).
3. Suitable for people with allergies (free of methyl methacrylate and dibenzoyl peroxide).

Fitting removable appliance

A. Before inserting the appliance

1. Check that you have the correct appliance and design for the patient.
2. Show the appliance to the patient and explain how it works.
3. Check the fitting surface for any roughness.

B. Inserting the appliance

1. The appliance should be inserted into the mouth with the anterior part lightly into position and then press the acrylic base upwards until the molar clasps engages.
2. Adjust the retentive components and check the retention.
3. Activate the springs and check the teeth if they are free to move (trim acrylic if necessary).
4. Demonstrate to the patient how to insert and remove the appliance.

Instruction to the patient

1. you might face some discomfort during eating and speech in the first few days
2. you should wear the appliance during day and night.
3. you should clean your teeth and the appliance regularly.
4. you should insert the appliance correctly according to the doctor instructions.

How do you know that the patient is not wearing the appliance?

1. There is little or no tooth movement.
2. The appliance still looking new.
3. The patient has difficulty in removing and more importantly inserting the appliance.
4. Springs are still active and patient speech still affected.

Mistakes done by the doctor (if no tooth movement happens)

1. Improper way and amount of activation.
2. Presence of acrylic in the way of tooth movement.
3. Improper instruction to the patient.

GOOD LUCK

