

Fixed orthodontic appliances

Fixed orthodontic appliances include orthodontic devices, which have attachments that are fixed to the tooth surface, and forces that are exerted by these attachments using archwires and/or other auxiliaries. The control achieved with fixed appliance is far greater as compared to removable appliances and the teeth can be moved in all the three planes of space.

Advantages of fixed appliances:

1. Precise control over force distribution to individual teeth.
2. Multiple tooth movement can be performed simultaneously.
3. It is more comfortable than removable or myofunctional appliance, and does not depend on the patient wear since it is fixed in his mouth.

Disadvantages of fixed appliances:

1. Expensive.
2. Might be esthetically unacceptable to some of the patients
3. Require great skill.
4. There is a possibility of producing adverse tooth movement.
5. It takes more chair time.
6. It needs good oral hygiene.

Indications of fixed appliances:

1. Correction of mild to moderate skeletal discrepancies.
2. Intrusion and extrusion of teeth.
3. Correction of rotation.
4. Overbite and overjet reduction.
5. Multiple tooth movement.

Limitations of fixed appliances:

1. ***Attitude of the patient:*** Lack of motivation on the part of the patient is one of causes of failure in orthodontics; the orthodontist should discuss the treatment aims with the patients, without the parents being present.
2. ***Oral hygiene:*** An excellent standard of oral hygiene must be maintained throughout the treatment, if oral hygiene is poor there is a great possibility of decalcification, caries is increased and periodontal problems will be more severe.

3. Implications for appliance wear: it's unfair to cement a fixed appliance without first explaining to the patient what the appliance is like, how it feels and how long it will have to be worn.

4. Cooperation: Cooperation of the patient throughout the treatment is essential, the patient must understand the necessity for carrying out special instructions, if he is unwilling or unable to do this then he is not suitable for orthodontic treatment.

5. Medical history: The patient's general medical condition must be taken into account before any orthodontic treatment.

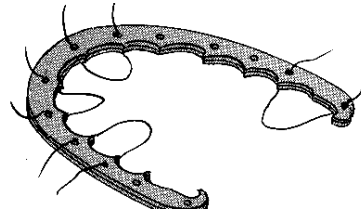
History of fixed appliance:

The orthodontic profession has gone through an evolving process to reach the current bracket system.

Dr. Edward Angle is considered the father of modern orthodontics, from early 1900 developed four major appliance systems.

1- E-arch

Depend on rigid framework to which the teeth were tied so that they could expand to the form dictated by the appliance.



2- Pin and tube.

By placing bands on the teeth and soldering tube into which soldered pin from smaller wire was placed.

3- Ribbon arch.

Vertically positioned rectangular slot. Gold ribbon arch placed into the slot and held with pins.



4- Edgewise

Where angle reoriented the slot from vertical to horizontal and inserted a rectangular wires.

Another popular system developed in 1920 by Dr. Begg, which was a modification of ribbon arch, his technique is based on differential force application and the use of the pin and tube appliance to move the teeth.

In early 1970, Dr. Andrews introduced straight wire appliance based on his concept of normal occlusion. He incorporated the details of final tooth position in

the bracket itself. A number of modifications in the angulation and torque were introduced based on his concept.

Components of fixed orthodontic appliances:

The components which form any fixed orthodontic appliance could be of the following two types depending upon ability to generate forces:

1- Active components:

- Archwires
- Separator
- Springs
- Elastics (extra and intraoral) and ligature elastics

2- Passive components:

- Bands
- Brackets
- Ligature wires
- Lingual attachment (button, cleats)

Bands

These are metal rings attachments that are cemented to individual teeth and provide space for attachment of other auxiliaries like buccal tubes, lingual buttons, mostly used on molars and it can be used on any tooth, especially in these cases:

- 1- Frequent failure of bonded attachment.
- 2- De-rotation (couple force system), correction of crossbite (buccal and lingual attachment).

Before banding, teeth needed to be separated, tight interproximal contacts make impossible to properly seat a band, so separators must be used before banding. Although separators are available in many varieties, the principle is the same, a device to force or wedge the teeth apart is left in place long enough for initial tooth movement to occur so that teeth are slightly separated before banding. Sometimes bonded tubes are used.

Cementing orthodontic band is similar to cementing cast restoration but it differs in important detail, that in restorative dentistry most if not all of enamel is removed and the cement contact the dentin, while in orthodontics the cementation is entirely on enamel. Cementation could be done using any of the luting cements, adequate moisture control is essential during cementation, zinc polycarboxylate or glass ionomer cements (preferably) can be used.

Brackets

Brackets are passive components, which provide a means of transferring tooth moving forces from archwires, elastics and other active components of fixed appliance.

They can be classified into:-

A. According to the material used for manufacture

- ***Stainless steel:*** They were an esthetic improvement over the previously used bands, they are made from corrosion resistant stainless steel alloys, they are easy to manufacture, tough and cheap.
- ***Plastic brackets:*** The first type of plastic was made of polycarbonate and plastic molding powder, their main disadvantage is discoloration. Advantage is esthetic.
- ***Ceramic brackets:*** They are mainly composed of aluminum oxide, they are bonded to enamel by mechanical and chemical retention and they have advantage of being esthetically acceptable.
- ***Titanium brackets:*** They have good properties such as resistance to corrosion, low density, high strength, and biocompatibility with biological tissues. But they are very expensive.

B. According to the technique for which it is used

- Ribbon arch brackets
- Begg's modified ribbon arch brackets
- Edgewise brackets
- Straight brackets
- Self-ligation brackets
- Lingual brackets

C. According to slot size of the bracket

- 0.018" X 0.025" inch
- 0.022" X 0.028" inch

Bonding a brackets

Orthodontic bonding is used to describe the attachment of the brackets using resins to the enamel surfaces. A successful bonding material must be dimensionally stable, it must be quite fluid, so that it penetrates the enamel surface, it must have excellent inherent strength; and it must be easily manipulated.

It involves the following steps:

- 1- Polishing with pumice and rubber cup, rinsing and dryness.
- 2- Acid etching for 20-30 seconds. Then rinsing and dryness.
- 3- Bonding with chemical or light cure composite.

Orthodontic bonding techniques:

1. Direct bonding:

In which direct attachment of orthodontic appliances to etched teeth using chemically or light cure composite. It is most popular due to its simplicity and reliability.

2. Indirect bonding:

In this technique the brackets were first positioned on study casts with water soluble adhesive and then transferred to mouth-with a custom tray.

Advantages of bonding over banding:

1. More esthetic
2. Faster and simpler
3. It is more comfortable to the patient
4. Oral hygiene procedure can be performed more easily
5. No band space is left after debonding
6. Used in partially erupted teeth

Disadvantages of bonding over banding:

1. A bonded attachment is weaker as compared to a cemented band
2. Re-bonding is more complex as compared to re-cementing of bands
3. De-bonding is more complex and time consuming than de-banding

Arch wires

The amount and type of force applied to individual tooth can be controlled by varying cross-sectional diameter and form of the wire, and/or material of its construction.

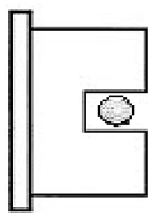
Types of wires:

1) According to the material made of

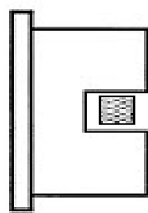
- Precious metal alloy (gold).
- Stainless steel
- Nickel titanium: NiTi alloys have two remarkable properties that are unique in dentistry-shape memory and super elasticity.
- Beta titanium.
- Composite.

2) According to the cross section:

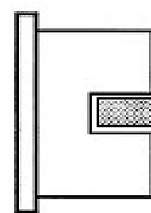
- Round.
- Square.
- Rectangular.
- Multistranded



Round wire



Square wire



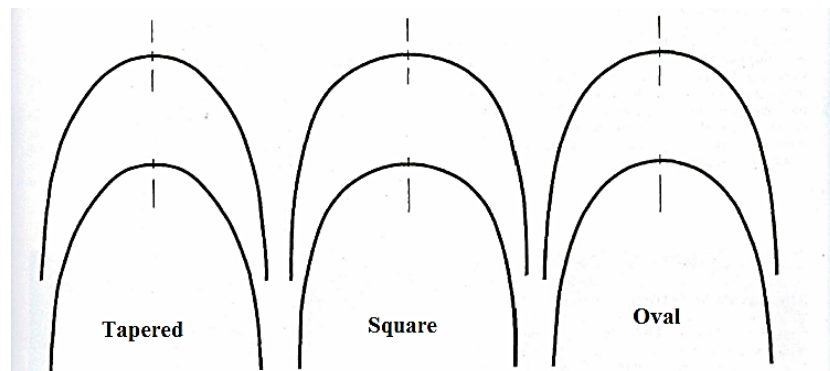
Rectangular wire



Multistranded

3) According to the arch form:

- Oval.
- Taper.
- Wide (square)



Requirements of orthodontic wire:

1. Non toxic
2. Resistant to corrosion, fatigue and fracture.
3. Easily formed.

4. Economic.
5. Controlled and reproducible force delivery.

Auxiliaries

They are used in conjunction with base arch wires to produce tooth movements, the following are some of the auxiliaries that used in combination with fixed appliance:

- Elastics (elastic chain, intraoral or extraoral elastics).
- Coil spring.
- Ligature elastics, or ligature wires that used to ligate the wire to the brackets.
- Hyrax and Quadhelix for maxillary expansion.
- Palatal and lingual arches.
- Headgear for distal control of maxilla and maxillary molars in class II malocclusion.
- Face mask for treatment of maxillary retrognathia in class III malocclusion.
- TADs – MiniScrews.

Contemporary orthodontic appliances

- **Lingual fixed appliance**

Uses brackets that bonded to the lingual/palatal surfaces of the teeth and specially configured arch wires. Esthetic but uncomfortable for the patient (pronunciations difficulties occurs after insertion).The technique is difficult and time consuming.

- **Clear Aligner Therapy**

Clear aligner initially used as a retainers .Nowadays Aligners used as device for treatment of mildly displaced teeth for adults or adolescents in whom growth modification were not needed, clear aligner therapy has an advantage of making the orthodontic appliance invisible or minimally visible.

Common postoperative complaints in case of fixed orthodontic appliance:

1. ***Irritation (ulceration) of lips and cheek:*** relief wax is available and can provide comfort until the patient adapted to the appliance.
2. ***A bracket is knocked off during eating:*** a visit to the orthodontist is necessary to repair this type of problem.
3. ***Protruding wire:*** it is better to go to the orthodontist to fix it.

GOOD LUCK

**Q\ Regarding Hawley arch how to be
adjusted or activated?**