

Fixed Orthodontic appliances

It is an appliance fixed to teeth by attachments through which force application is by arch wires or auxiliaries.

A large number of fixed appliance techniques are available, and the type of mechanism used will determine the nature of the tooth movement achieved.

Advantages of fixed appliances:

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

Disadvantages of fixed appliance:

1. Expensive.
2. Require great skill.
3. It takes more chair time.
4. It needs good oral hygiene



Limitations of fixed appliances

1. Attitude of the patient

Lack of motivation on the part of the patient is a main cause 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 of appliance wear

It is unfair to cement a fixed appliance without first explaining to the patient what the appliance is like, how it feel and how long it will have to be worn.

4.Cooperation

Cooperation of the patient through out the treatment is essential, the patient must understand the necessity for carrying out special instruction, 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 take into account before any orthodontic treatment.

Indications of fixed appliances

1. Correction of mild to moderate skeletal discrepancy of adult patient.
2. Intrusion and extrusion of teeth.
3. Correction of any rotation.
5. Multiple tooth movement with precise control.

History of fixed appliance

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

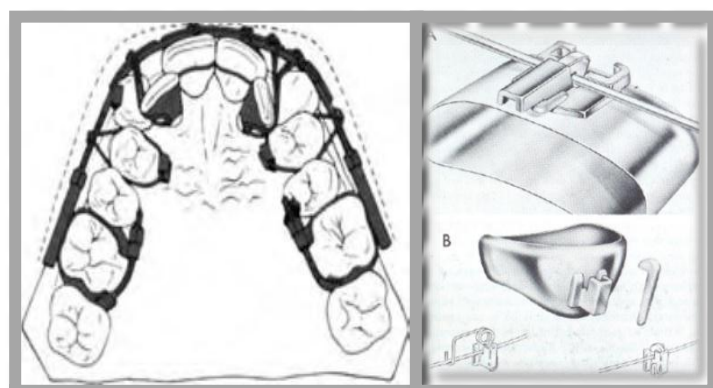
Dr.Edward Angle is considered the father of modern orthodontics, from early 1900 developed four major appliance system:

A)E(expansion)-arch.(left)

B)Pin and tube.(right)

C)Ribbon arch.

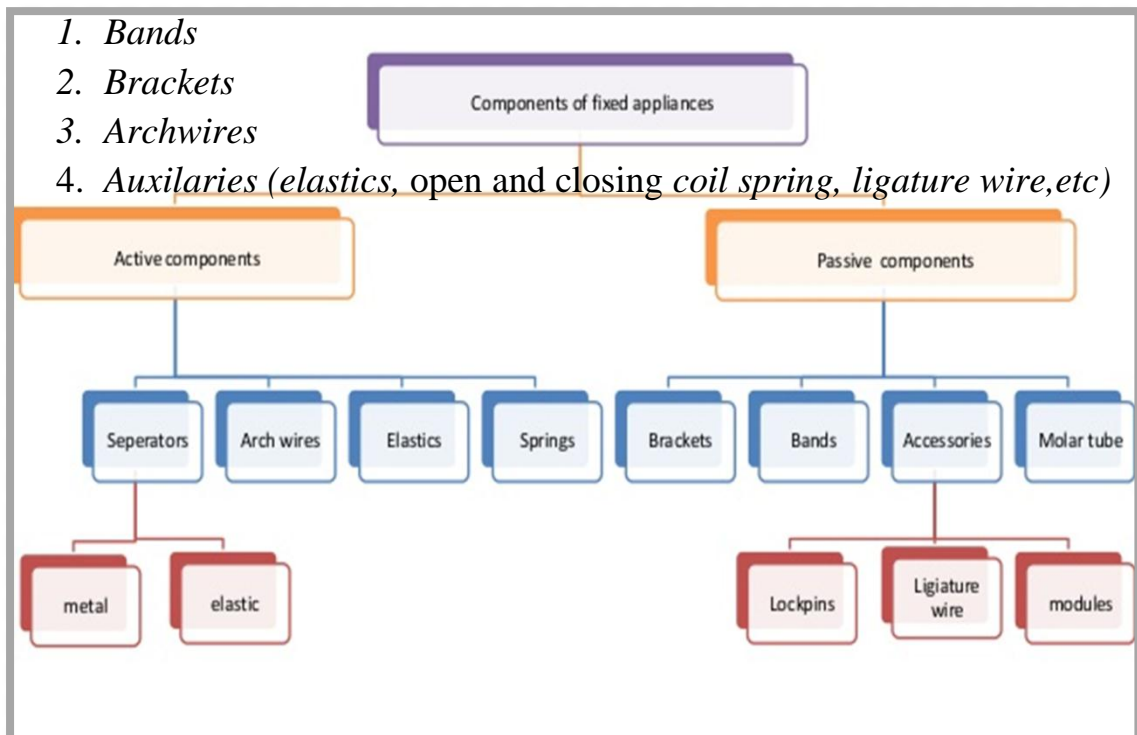
D)Edgewise.



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.

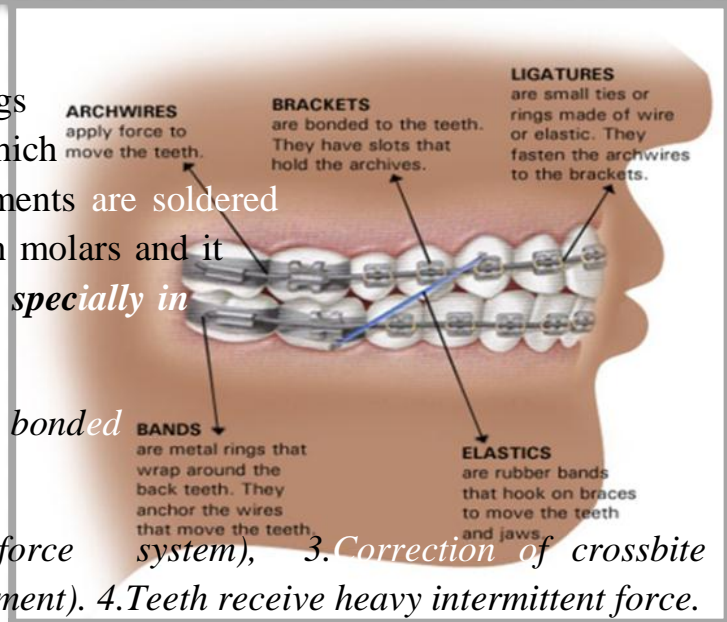
Components of fixed orthodontics appliances:



Bands: These are rings encircling the tooth to which buccal and lingual attachments are soldered or welded, mostly used on molars and it can be used on any tooth, *specially in these cases:*

1. Frequent failure of bonded attachment.

2. De-rotation (couple force system), 3. Correction of crossbite (buccal and lingual attachment). 4. Teeth receive heavy intermittent force.



Sometimes bonded tubes are used . Before banding teeth are needed to be separated, tight interproximal contacts make impossible to properly seat a band , so separators must be used before banding.

Three main methods of separation are available:

1. *Brass wire*, which is twisted tightly around the contact and left in place for 5-7 days.
2. *Separating springs* which exert a scissor action above and below the contact.
3. *Elastomeric separatos* (mostly used)

Cementation

Cementing orthodontic band is similar to cementing cast restoration but it differs in impotant detail, that in restorative dentistry most if not all of enamel is removed and the cement contact the dentin, while in orthodontic the cementation is entirely on enamel . Zinc phosphate or glass ionomer (with flouride) cements can be used.

Brackets

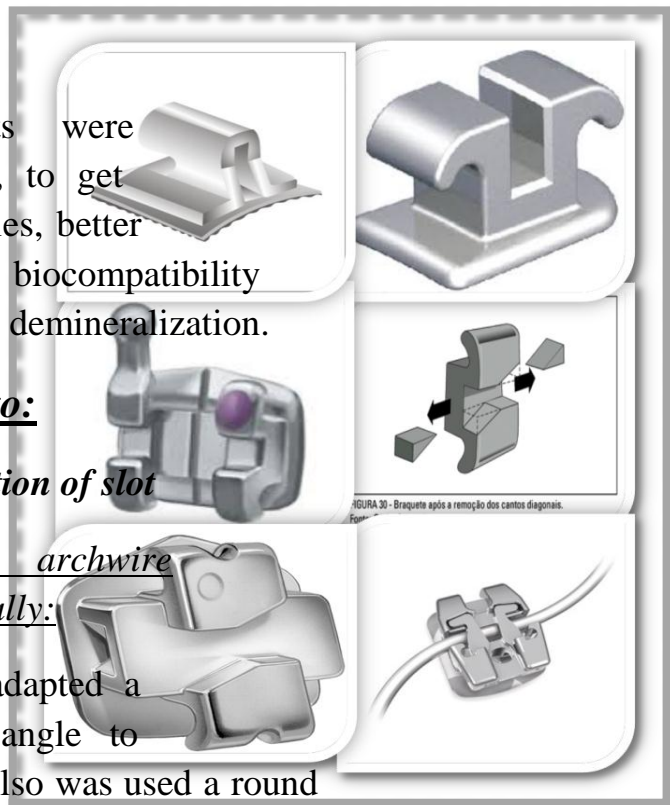
Many types of brackets were introduced over the years , to get better biomechanical properties, better esthetic appearance, better biocompatibility with the oral hygiene and less demineralization.

They can be classified into:

A)According to the specification of slot

1-brackets in which the archwire channel is narrow mesiodistally:

Developed by *Begg*, who adapted a ribbon arch appliance of angle to achieve better root control. Also was used a round archwire held by locking pin.



2- brackets in which the archwire channel is wide mesiodistally:

a) Edgewise (EW) bracket: introduced by *Angle* as he reoriented the slot of his ribbon arch appliance from vertical to horizontal and inserted rectangular wire:

- 1) Single edgewise brackets
- 2) Siamese (twin) edgewise brackets.

b) Andrews brackets

These brackets are invented by *Lawrence Andrews*, who invented the straight wire appliance (SWA), that eliminates or at least minimize dimensional bending adjustments of archwire to detail tooth position.

c) Tip Edge brackets

By removing predetermined, diagonally opposed corners from the conventional (EW) slot, the tip edge is created.

d) Self ligated brackets

B) According to the slot size

EdgeWise brackets are identified by the occluso-lingual dimension of the channel, commonly used sizes are 0.018 inch and 0.022 inch. While the labio-lingual dimension is usually 0.028 inch.

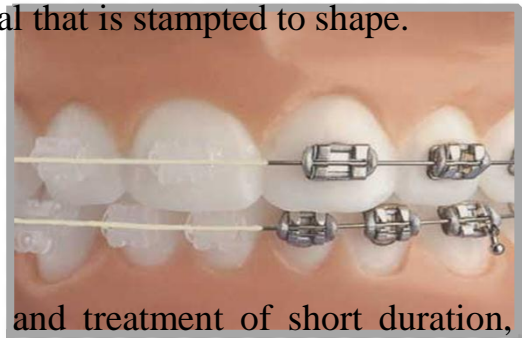
C) According to the bracket material

1) Stainless steel brackets

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. Moreover, they can be produced by casting or from thin metal strip material that is stamped to shape.

2) Plastic bracket

The 1st type of plastic was made of polycarbonate and plastic molding powder. So pure plastic bracket may be useful in minimal force situation and treatment of short duration, their main disadvantages is discoloration, but it is more esthetic.



3) **Ceramic bracket....** They are mainly composed of aluminum oxide, they are bonded to enamel by mechanical and chemical retention, they have advantage of being esthetically acceptable but their major disadvantages are fracture, friction within the bracket slot and enamel damage from its removal.

4) **Titanium bracket**

They have good properties such as resistance to corrosion, low density, modulus, high strength, and biocompatibility with biological tissues, But are very *expensive*.

Bonding a bracket

It involves the following steps

1-Polishing with pumice and rubber cup, rinsing and dryness .

2-Acid etching for 20-30 seconds with 35% to 50% of unbuffered phosphoric acid. Then rinsing and dryness.

3-Bonding with chemical or light cure composite.

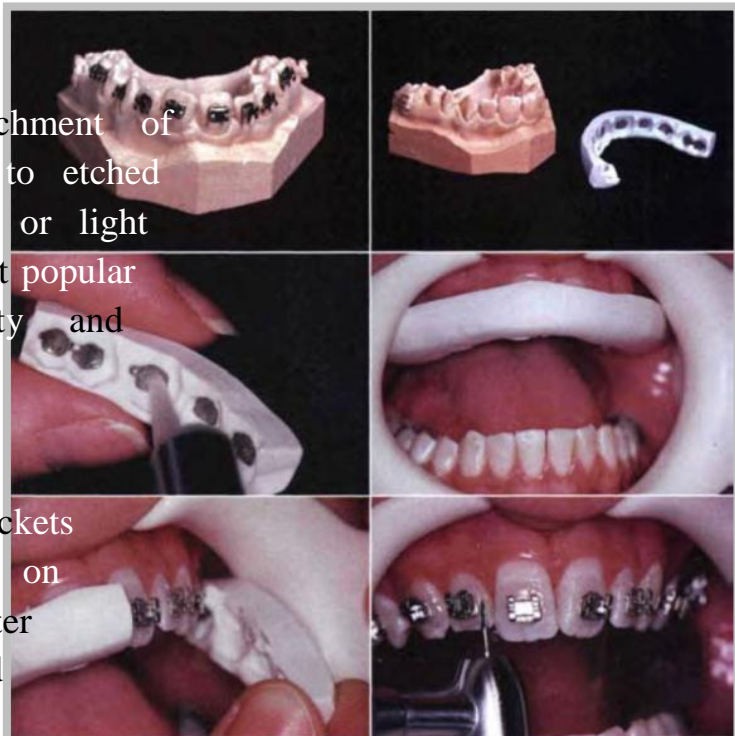
Orthodontic bonding techniques

1)**Direct bonding**

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

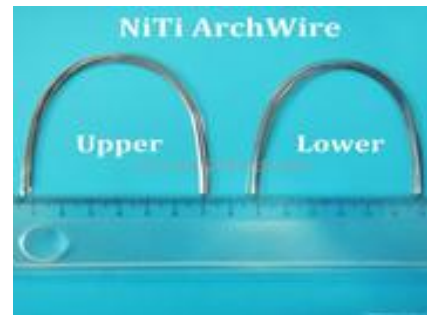
2)**Indirect bonding**

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



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.



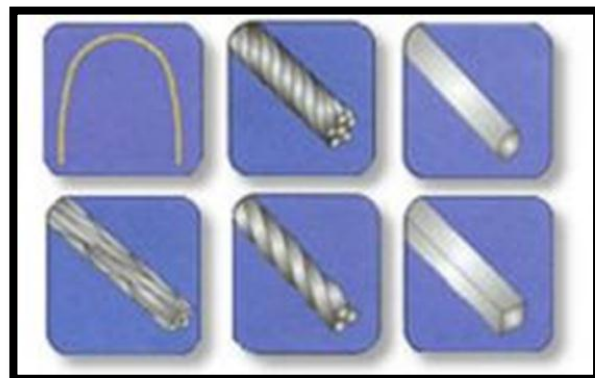
Types of wires

1)According to the material its made:

- ✓ Precious metal alloy (gold).
- ✓ Stainless steel
- ✓ Cobalt chromium
- ✓ Nickel titanium.
- ✓ Beta titanium.
- ✓ Composite.

2)According to the cross section

- Round.
- Square.
- Rectangular.



3) According to the arch form

Oval , taper , wide.

Requirement of orthodontic wire

- 1)Non corrosive. 2)Easily formed. 3)Maintain shape.
- 4)Controlled and reproducible force delivery. 5).....

Auxiliaries

They are used in conjunction with base arch wires to produce tooth movements are elastics (elastic chain, intraoral or extraoral elastics), coil spring, or used to ligate the wire to the brackets such as ligature elastics, or ligature wires.

Palatal or lingual arches

An arch which connects contralateral molars either across the palate or around the lingual aspect of the lower arch, which helps to prevent movement of the molars so reinforce anchorage.

Expansion by fixed appliance

1)Quadhelix appliance

Very efficient fixed slow expansion appliance, give an anterior and posterior expansion. Made of 1mm stainless steel wire and attached (soldering) to the teeth by bands cemented to the molars.

Deflected by.....?

2)Hyrex (Rapid expansion screw)

Very efficient fixed rapid expansion appliance, give posterior expansion, the screw is turned twice daily for a period of 2 weeks (active treatment), it is designed to open the midline suture and expand the upper arch by skeletal expansion bony infill will be of the expanded suture will happen, it is used in early teens patients before suture fuses. *Note:- each 1/4 turn = 0.35mm movement.*



Contemporary orthodontic appliances

A)Lingual appliance

Uses brackets bonded to the lingual/palatal surfaces of the teeth and specially configured arch wires. Esthetic, but uncomfortable for the patient and difficult to adjust



B)Clear Aligner Therapy

CA initially and till now used as a retainer. Nowadays Aligners used as a device for treatment of mildly displaced teeth (in a series of different devices) into alignment for adults or adolescents in whom growth modification were not needed & interested in making an orthodontic appliance invisible or minimally visible; but are?

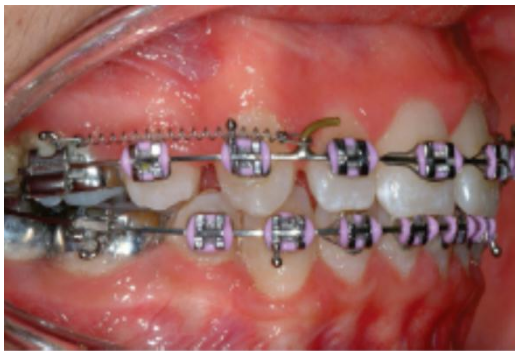


Stages of fixed appliance treatment:

▣ Levelling and aligning



▣ Space closure and overjet correction



▣ Finishing

