Fixed orthodontic Appliances

They are devices which have attachments that are fixed onto the tooth surface, and forces are exerted via these attachments using archwires and /or other auxiliaries. The appliances cannot and should not be adjusted or removed by the patient.

ADVANTAGES OF FIXED ORTHODONTIC APPLIANCES

1. Precise tooth control is possible.
2. Multiple tooth movements are possible.
3. Patient cooperation is reduced in comparison to removable appliance
4. All types of tooth movements are possible.

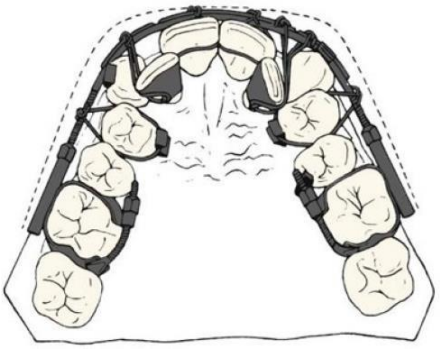
DISADVANTAGES OF FIXED ORTHODONTIC APPLIANCES

1. Oral hygiene requirement.
2. Esthetics.
3. Special training for operator.
4. Increased cost of treatment.
5. Increased chair side time.
6. Anchorage control is more difficult.
7. The possibility of producing adverse tooth movement.

INDICATIONS FOR THE USE OF FIXED APPLIANCES

1. Correction of mild to moderate skeletal discrepancies. As fixed appliances can be used to achieve bodily movement it is possible, within limits, to compensate for skeletal discrepanciesand treat a greater range of malocclusions.
2. Intrusion/extrusion of teeth.
3. Correction of rotations.
4. Overbite reduction by intrusion of incisors.
5. Multiple tooth movements required in one arch.
6. Active closure of extraction spaces, or spaces due to hypodontia.

The development of contemporary Fixed Appliances

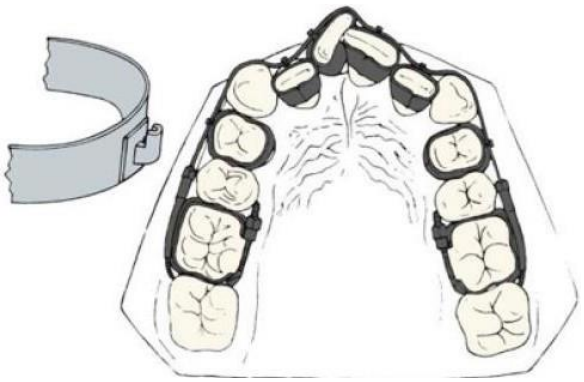


Edward Angle's position as the "father of modern orthodontics" is based not only on his contributions to classification and diagnosis but also on his creativity in developing new orthodontic appliances.

E-Arch:

Edward Angle's E-arch from the early 1900s. Ligatures from a heavy labial arch were used to bring malposed tooth to the line of occlusion.

Ribbon Arch



Angle's ribbon arch appliance, introduced about 1910, was well-adapted to bring teeth into alignment but was too flexible to allow precise positioning of roots. It was the first introduction of brackets. Used a gold wire of 10x20.

Edgewise

To overcome the deficiencies of the ribbon arch, Angle reoriented the slot from vertical to horizontal and inserted a rectangular wire rotated at 90 degrees to the orientation it had with the ribbon arch, thus the name "edgewise"



Begg Appliance



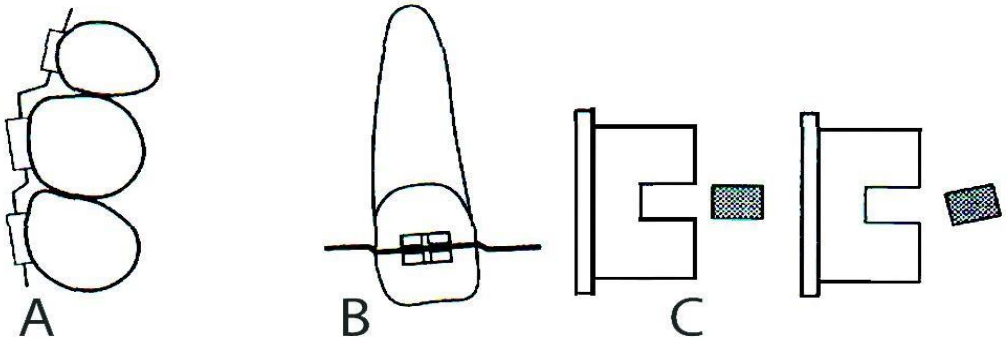
The Begg appliance used a modification of the ribbon arch attachment, into which round archwires were pinned. A variety of auxiliary archwires were used in this system to obtain control of root position.

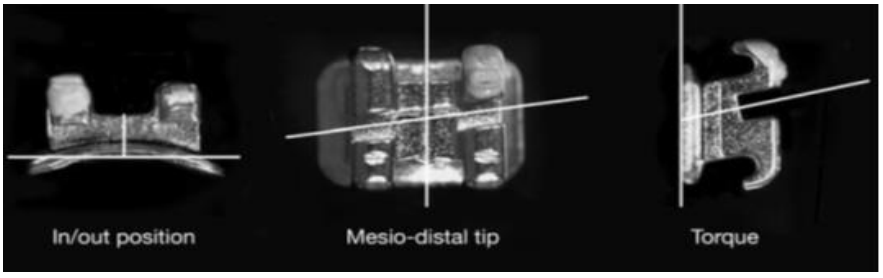
Contemporary Edgewise

The Begg appliance became widely popular in the 1960s because itwas more efficient than the edgewise appliance of that era, in the sense that equivalent results could be produced with less investment of the clinician's time. Developments since then have reversed the balance; the contemporary edgewise appliance has evolved far beyond the original design while retaining the basic principle of a rectangular wirein a rectangular slot, and now is more efficient than the Begg appliance,which is the reason for its almost universal use now, known as:

Straight-Wire Appliance

Angle used the same bracket on all teeth, as did the other appliance systems. In the 1980s, Andrews developed bracket modifications for specific teeth to eliminate the many repetitive bends (first, second andthird order bends) in archwires that were necessary to compensate fordifferences in tooth anatomy, and bonding made it much easier to havedifferent brackets for each tooth. The result was the “straight-wire” appliance. This was the key step in improving the efficiency of the edgewise appliance.

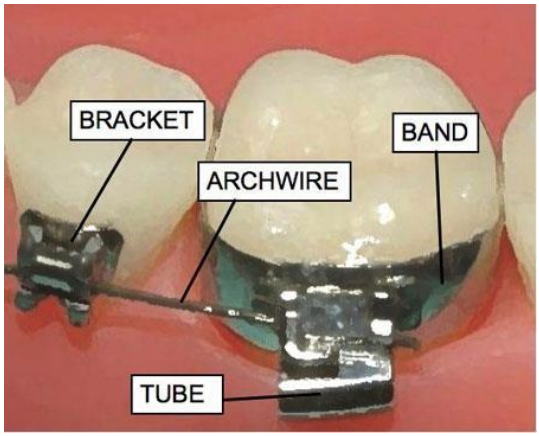




Features of the brackets of straight wire appliance:

- Variable distance from base of slot to base of bracket for correct in/outposition.
- Pre-angulated slots for correct mesiodistal tooth angulation or tip;
- Bracket bases inclined for correct inclination or torque.
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Components of Fixed orthodontic appliance



they can be broadly classified into:

1. **Attachments**
2. **Archwie.**
3. **Auxiliaries.**

I- Attachments:

These include:

A. Bands
B. Brackets.
C. Other attachments: Buccal tubes, Buttons, eyelet, sheath, cleat, ….etc.

The attachments may be welded to bands, or directlyplaced on the tooth surface.

A. Bands:

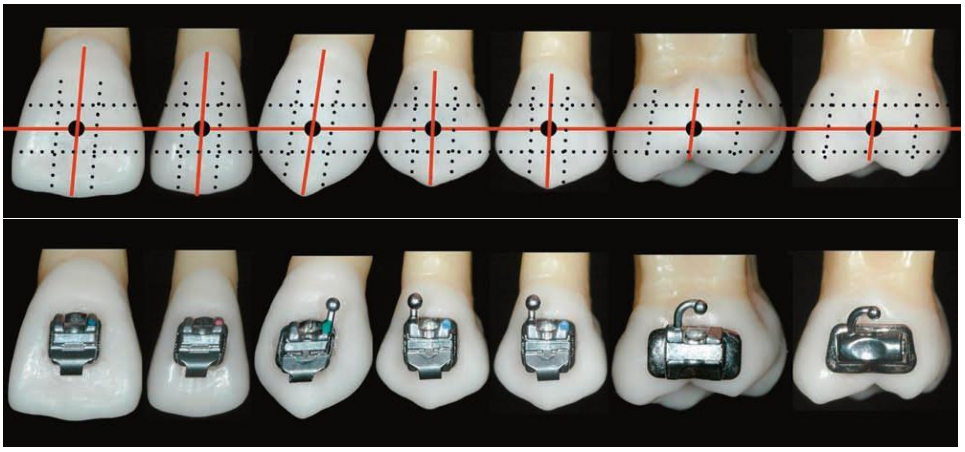


These are rings encircling the tooth to which buccal, and as required, lingual attachments are soldered or welded. Until the 1980s, the only practical way to place a fixed attachmentwas to put it on a band that could be cementedto a tooth.

B. Brackets:



Each bracket is made up of a bracket base, stem with bracket slot, tie-wings to retain the ligature as it secures the arch wire into the slot, and some form of hook used for intramaxillary or intermaxillary attachment of elastics or coils.

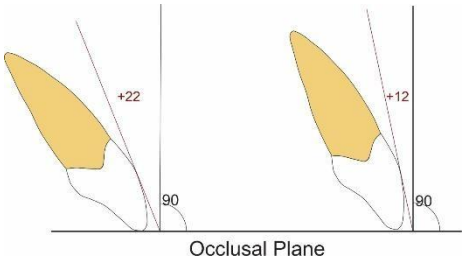


There are many bracket types, the basic ways to classify brackets are:1- According to material:



a. Metallic: e.g. Stainless-steel.
b. Non-Metallic (Esthetic): Composite,Ceramic, Sapphire.

2- According to prescription (the amount of built-in tip and torque):



a. Standard edgewise (zero tip andtorque).
b. Roth prescription
c. *McLaughlin, Bennett, & Trevisi (MBT) prescription, ….etc.*

3- According to slot size:

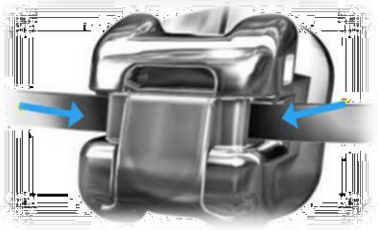


a. *18 mil (milli-inch) slot. (0.018 x 0.025inch, where 0.018 is the width, and 0.025 is the slot depth)*
b. *22 mil slot (0.022 x 0.028 inch, where*

0.022 is the width, and 0.028 is the slot depth)



4- According to ligation method
   a) Conventional ligating.
   b) Self-ligating brackets (which utilize a permanently installed, moveable component to entrap the arch wire).



C. Other attachments: including but not limited to:
- Buccal Tubes: Used on molars.
- Buttons: Small, mushroom-shaped orthodontic attachments that can be bonded directly onto a tooth or welded on a band. They are usually used on the palatal surface of the teeth (to provide a couple force), or on a partially erupted tooth.
- Eyelets: mostly on partially erupted teeth.







II- Archwires:

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

In the initial stages of treatment, a wire which is flexible with good resistance to permanent deformation is desirable (e.g. Nickel-titaniumarchwires), so that displaced teeth can be aligned without the application of excessive forces.

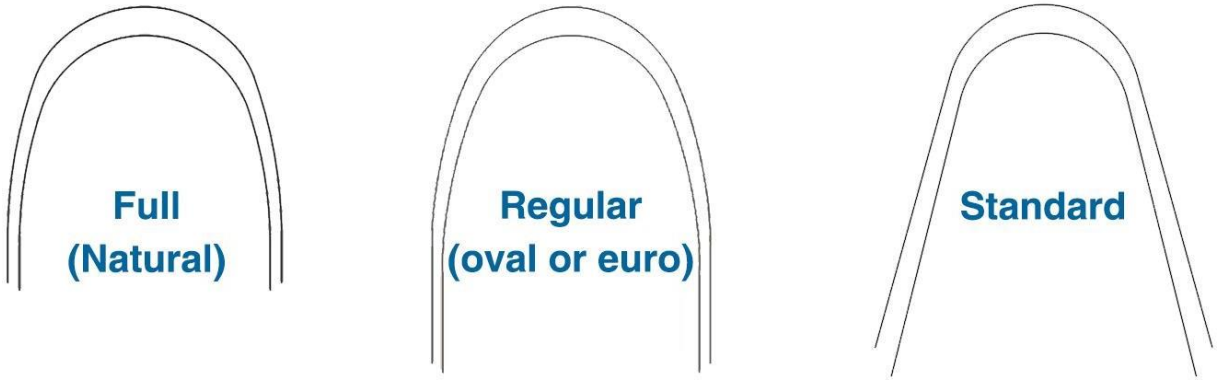
In contrast, in the later stages of treatment rigid arch wires are required to engage the archwire slot fully and to provide fine control over tooth position while resisting the unwanted effects of other forces, such as elastic traction (e.g. stainless-steel).

Archwires can be described according to their material, dimensions, and form.

Material: e.g. stainless-steel, Nickel titanium, Beta Titanium, Etc.

Dimensions: Usually archwire dimension is expressed in milli-inches(= 0.025 mm). A 16 milli-inch (0.016") is a round 0.4 mm wire, and a16x22 is a rectangular 0.4x0.55 mm wire.

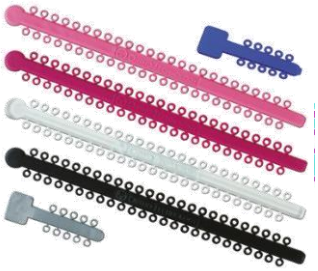
Form: It may be a full form, regular (or oval) form, or standard form.



III- Auxiliaries

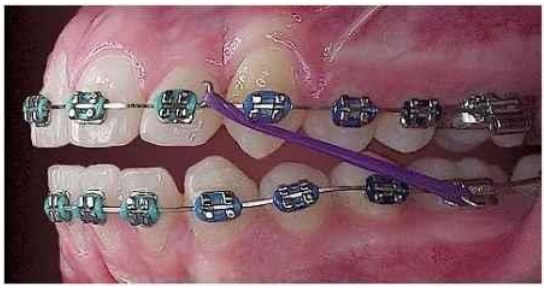
There are many auxiliaries used with fixed orthodontic appliance,among them are:

Ligatures: these are used to secure the archwire into the bracket. They include elastomeric modules and ligature wires.





Intra-oral elastics: available in different sizes and strength to provide intra and interarch traction. For most purposes they must be changed daily. Class II and Class III elastics are ways to describe these elastics according to their use.



Elastomeric modules (Elastomeric chain, orPower chain)

A chain of connected elastomeric rings used as a force-

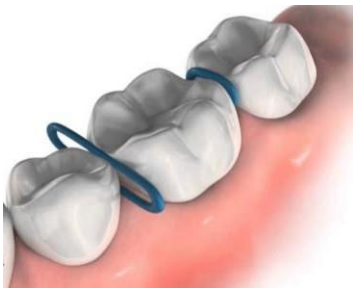




producing mechanism for orthodontic tooth movement. Elastomeric chains can be long, short, or closed, depending on whether or not there is a distance between the rings at its passive state.

Separators (Elastic separator)

Elastomeric rings of varying thickness that are placed around the interproximal contact point to create the necessary separation over time.



Lingual Appliances:

These are secured to the lingual surfaces of the teeth. There are some problems associated with them including some pronunciations difficulties that occur after insertion, the technique is difficult and time consuming, and the working position is awkward.

