

Orthodontics sheet # 15

Dr. Eyad

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(Note: The lecture was a bit complicated and unorganized, so I didn't follow the order the lecture was given in, I manipulated it a bit to be as understandable as possible. I also included some pictures to make it more imaginable, so I advise you to study it online to see the pictures.

I didn't include everything in the slides, so that you focus on what the Doctor focused on the lecture as he mentioned that certain details aren't necessary; you can refer to them if you want to. I hope you understand the lecture well. Good luck =D)

Fixed Appliances

This lecture is going to be just an introduction. As a general practitioner you are not expected to do any fixed appliances, but you need to have general information about it since it's the most commonly used orthodontic appliance used to fix most malocclusions.

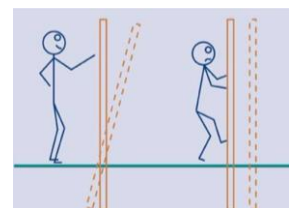
Definition

An appliance that is cemented or bonded (mainly) to the teeth in order to move them. This is done using brackets/ bands in conjunction with arch wires and other components

Fixed appliances produce a *bodily movement*, unlike removable appliances which can only create tipping movements

To create a bodily movement, force must be applied around the *centre of rotation*=*centre of resistance* of the tooth, which is usually located at the root about 40% from the apex of a single rooted tooth (*mostly inside bone*). Forces created by removable appliances, are usually around the centre of rotation, usually more coronally, and therefore produces only tipping movements.

how do we create a bodily movement in fixed appliances? All we need to know is that there is a force and a counter moment created through the bracket that's attached to the teeth. A counter moment can be achieved using a couple.



* You need to refer to the tooth movement lecture, also must revise the magnitude of force for each

Indications of Fixed appliances:

- Multiple tooth movements (example: generalized spacing and you want to move all teeth)
- Intrusion and Extrusion of teeth (can be done with removable appliances using bite plates)
- Rotations (difficult using removable appliances)
- Camouflage skeletal discrepancies
- Space closure in hypodontia

So fixed appliances can move teeth in any direction, but there are limits for the extent of movement.

Actually, there is no single appliance that can treat all cases, but a fixed appliance treat most of them. For example, some cases are so severe and might need a surgery instead of braces.

Treatment modalities in skeletal malocclusions:

- Accept the situation (if mild case or patient can't afford)
- growth modification using functional appliance or extra-oral traction (if patient is in the growing phase)
- OR camouflage using fixed appliance (if skeletal discrepancy is not severe)
- OR surgery

Components Of Fixed Appliances:

- **Attachments:** > brackets
> Bands and tubes

attachments are fixed to the teeth. Mainly we just use brackets nowadays, but because bracket failures seem to occur on the molars, bands are placed on them instead.

Brackets are bonded to the tooth and bands are cemented to them.

- **Arch Wires**

arch wire is the component that moves teeth, it can be made from stainless steel, NiTi, TMA.

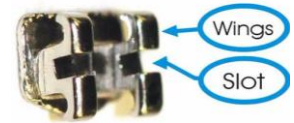
The wire is fixed to the bracket to move the teeth. When the wire is adjusted to be held in the bracket, it will deflect a bit according to the alignment of teeth, the wire will then start moving back to its original arch form and thus moving teeth with it.

- **Auxiliaries:** > Elastomeric and steel ligatures
 - > Coils and springs
 their function is to slide the teeth

Brackets

its parts:

- *base (part that touches the labial/lingual surface of tooth)
- *wings (to engage the wire to the bracket using different ligatures)
- *slots (for arch wire or holds springs)



they can be made of Stainless steel, Ceramic, NiTi, Gold.

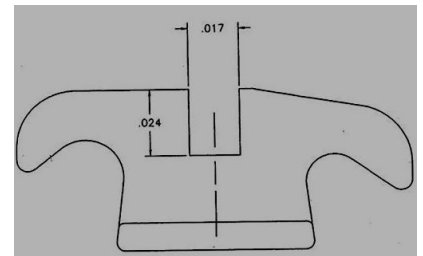
Brackets can be bonded to a tooth surface, or welded to a band.

Slots can be of two sizes: 0.018×0.025

OR 0.022×0.028 (more common)

The slot size determines the maximum wire size to be placed in the slot.

Slots can be horizontal or vertical. All brackets now have horizontal slots, vertical slots have been used only in the past like in robin arch appliance.



** Wires are held into the slots by ligatures.

Self-ligating Brackets:

this type of brackets eliminated the need for ligatures to hold the wire into the slot.

Its main advantage is that it reduced friction on the wire produced when using ligatures.

Also changing the wire on each visit takes less time than when using the conventional ligatures (but not a great difference in a fast dentist).

Yet, there are no other scientifically proven advantages despite what manufacturers propagate.

They represent a normal bracket but with a clip on the slot that closes it, that obviates the need for conventional elastomeric or stainless steel ligatures.

*Most commonly used self-ligating brackets are Damon self-ligating brackets, that's because they are user friendly with easy opening and closing of slots,



other systems may need special pliers to close the slot.

Bands and Tubes:



Historically, bands were used on all teeth before the introduction of bonding techniques. Now, bands are mainly only used on molars with brackets soldered on them rather than brackets alone, since bracket failure is very common over molars due to high occlusal forces.

Tubes are another alternative to brackets on molars. The difference between brackets and tubes is that the slot of the tube is covered and the wire enters through it, unlike slots of conventional brackets which has the frontal surface of the slot open. Also as a modification, the base of the tube is wider for the sake of better bonding to the molar teeth.



We choose to use bands or tubes according to the case and the patients occlusion. Yet, tubes are a bit easier to use than bands.

Arch Wires:

Arch wires are the most important component in movement of the teeth. They are called arch wires because the wires are pre-formed into the arch shape. They mostly come ready made in different forms for different age groups and different populations and countries. The wire is supposed to engage all the slots of all the brackets, either using by using ligatures or a self-ligating bracket.

Basically, the idea is just that the wire will deflect when engaging the mal-aligned teeth, and will tend to return back to its original form over time, moving the teeth with it to the original arch wire form.

* commonly used wires are stainless steel and NiTi (more flexible).

wires can be Rounded in cross-section or Rectangular in cross-section.

- # Rounded can be found in the following sizes: 0.012 inch (0.30mm)
- 0.014 inch (0.35mm)
- 0.016 inch (0.40mm)
- 0.018 inch (0.45mm)
- 0.020 inch (0.50mm)

0.012 and 0.016 are the most commonly used. If too much crowding and deflection, we prefer to use smaller wires, because we don't want high forces.

- # Rectangular can be found in the following sizes: 0.016×0.022 inch (0.41×0.56mm)
- 0.017×0.022 inch (0.43×0.56mm)
- 0.017×0.025 inch (0.43×0.64mm)
- 0.019×0.025 inch (0.48×0.64mm)
- 0.021×0.025 inch (0.53×0.64mm)

The first phase of treatment usually starts with round NiTi flexible wires to just align the teeth to the arch form until the teeth become "straight", and then the second phase we switch to stainless steel rectangular wire, also known as "*Working Arch Wire*" in this phase we move the teeth, close the gaps, slide the teeth and do expansions.

If the bracket slot is 0.018×0.025 inch, we use the 0.016×0.022inch rectangular S-S wire. If the slot is larger 0.022×0.028 inch, we use the 0.019×0.025 inch rectangular S-S wire.

Auxillaries:

1. Ligatures

These tie the wires into the brackets. Previously they were made of stainless steel, now they are mostly made of elastomeric modules. Elastomeric modules must be changed every month.



*Power chains are continuous elastomeric modules used to close the gaps & spaces



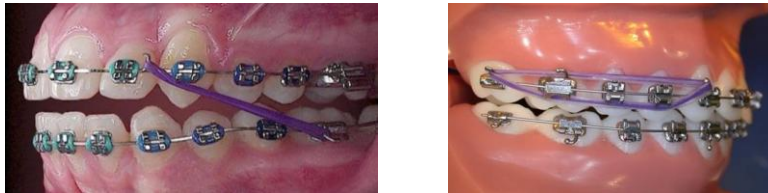
2. Coil spring

have coils that are used to open the spaces or maintain a gap, they are made of NiTi, therefore they provide continuous force without decaying of the force



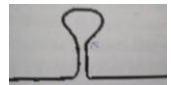
3. Elastics

we use Inter-arch elastics (between maxilla and mandible) to help in providing anchorage. We can also have intra-maxillary elastics



** To close spaces:

Option 1: In the past they used to use *closing loop mechanics*, they used to create a loop in the wire and close it, which would cause teeth to come closer to each other. The advantage of this mechanism is the lack of friction. Its disadvantage is that wire bending takes time, and its activation is uncontrolled.



Option 2: Now we mostly use *Sliding mechanics*, using coils and power chains, we slide the teeth over the "Working arch wire". Its disadvantage is increased friction, to decrease the friction the wire must be stainless steel and the teeth aligned, and that's why as we mentioned sliding the teeth occurs in the Working arch wire phase of treatment after the teeth have been aligned using the round NiTi wire.

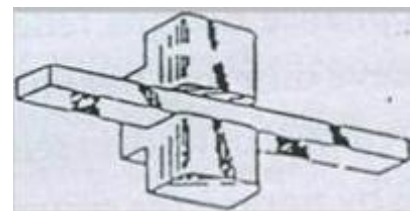
History



teeth follow the arch form.

At the beginning of the last century in 1928, Angle first used fixed appliances. They used to use bands on all teeth since there was no bonding, made of gold and a ribbon arch, known as "*Ribbon Arch Appliance*". A single arch wire was tied to all teeth, so that

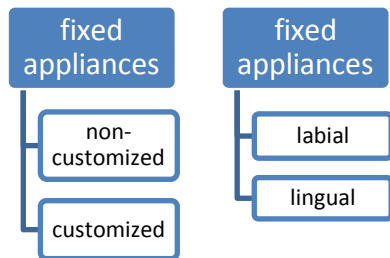
He modified the ribbon arch appliance to overcome its problems and named it edgewise appliance. (He placed the slot in the centre and oriented the slot from vertical to horizontal and inserted a rectangular wire into the rectangular slot *edgewise*, in the narrow dimension of the rectangle.



In 1955 Bonoucore and in 1965 Newman, introduced and modified enamel bonding techniques and adhesion, therefore modified the use of whole bands around teeth into the bonding of small brackets to teeth.

In 1976, Andrews introduced the *Pre-adjusted edgewise appliance*, as a modification to the edgewise appliance, also known as the *straight wire appliance*. Andrews also is the one who introduced the 'six keys of occlusion'

Classifications



~~Fixed appliances can be divided into customized and non-customized. A non-customized appliance is for example a bracket that's created on average values to fit everybody. A customized appliance is created for a specific patient according to his/her teeth anatomy. Non-customized appliances are still used now, but the trend is moving towards customization with the evolution of CAD/CAM systems and other systems. Effectiveness of customized appliances is higher, and that's because every person has different teeth anatomy and different arch forms, and modifying the non-customized appliance, won't provide as efficient treatment as the already customized one.

Customized Orthodontic appliances:

INCOGNITO

SURESMILE (customized arch wires)

INSIGNIA

CLEAR ALIGNERS

~~Another classification is according to the position of the appliance. It can be either Labial or lingual. Most commonly used ones are the labial appliances. Yet, due to increased esthetic demands and due to more adults seeking orthodontics treatment, lingual appliances were introduced as a form of an invisible treatment. Brackets are placed on the lingual surface, and this is more difficult due to the presence of the tongue and the variable anatomy of the lingual surface, though the biomechanics are the same of both labial and lingual braces.



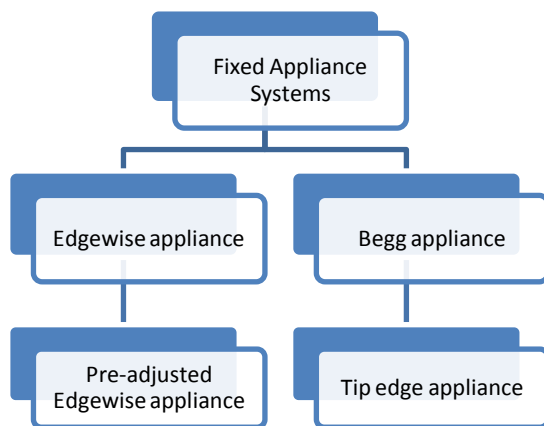
INCOGNITO

This is the most common and most accurate and the only fully customized lingual fixed appliance. Its created using *CAD/CAM* technology and made from *gold*, therefore its very *expensive*.



Some companies produce non-customized lingual brackets, which are cheaper, but these won't fit fully on the lingual surface of teeth. Therefore these need to be sent to the lab to adjust on them composite pads to compensate for anatomic variations from one person to another and the bucco-lingual dimension variations between adjacent teeth. Bracket failure is high in this type of lingual braces.

Fixed Appliance Systems



Again, Angles created the Edgewise appliance, which was modified by Andrews into the pre-adjusted edgewise appliance also known as "*The straight wire Appliance*" and it's what we use now.

In the 1950's Raymond Begg which is one of Angles students also came out with an appliance known as Begg Appliance, and was modified into Tip edge appliance. Tip edge appliance combines the Straight wire appliance with the Begg Appliance.

Pre-adjusted and Tip edge Appliances are the ones available now, though Begg Appliance is not very common.

#Ribbon Arch Appliance:

first fixed orthodontic appliance which was used by Angle's. It applied bands on all teeth, and each band had a vertical slot. A rectangular wire was used which was very wide.

Standard Edgewise Appliance

Angle's turned the wide rectangular wire Edgewise so that the smaller width of the rectangle is facing the tooth. He used standard brackets with horizontal slots and Rectangular stainless steel arch wire. In this system, we bend or deflect the wire to allow them to enter the slots, and as the wire returns back to its original form, it moves teeth with it.

Begg Appliance:

Angle's didn't believe in extractions and always fixed teeth without extractions. Begg which is his student, noticed relapses in the cases treated by Angles long time after his death, therefore he came out with this appliance.

Begg Appliance System depends on Extractions, vertical Slots and light forces using round stainless steel wires (to move teeth more easily and causes *tipping* of teeth), and inter-arch elastics.

It requires a lot of wire bending, therefore is not easy, and its out-dated now.

Tip edge Appliance:

A modification to the Begg Appliance, it took the advantage of using horizontal slots from the edgewise appliance edge and used the round wires with light forces to create tipping movements.

Straight Wire Appliance:

This was made by Andrews. He introduced the six keys of occlusion into the brackets, producing what so called *prescription brackets Or Programmed Brackets*, by varying the thickness of the bracket base and the angulations of the slots. This means that each tooth has a bracket specific for it, and that's because each tooth is differently angulated and inclined and has different torque according to the keys of occlusion (refer to that lecture). This way, each bracket provides the right torque, angulation and inclination normally associated with each tooth.

This reduced the need for wire bending, as he created more efficient brackets that would provide faster results with less frequency of wire bending and this made the treatment easier.

The characteristics he took into consideration and incorporated into each bracket for each tooth:

- *Mesio-distal tip (angulation)
- *Buccolingual inclination (Torque)
- *In- Out compensation (achieved through varying the base thickness)
- *Rotations

Good Luck ^_^

(يوما ما سيمر شريط حياتك أمام ناظريك... فاجعله جديرا بالمشاهدة)