Ortho sheet#13

Refier to slide #13

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Removable appliances

What are the types of orthodontic appliances? Fixed, removable and functional appliances . -

-What are the removable appliances made of? Acrylic and wires combined together to move teeth .

Fixed appliance : we stick it to the teeth , we will talk about it later.

-Do we use removable appliances in the lower arch? Generally removable appliances are limited to the upper arch because they are less tolerated by patients due to their encroachment upon tongue space and the lingual tilt of lower teeth make them more difficult to apply in the lower arch. But there are some cases we use removable appliances in the lower arch.

- Functional appliances : another type of removable appliances that use the force that is generated by stretching the periodontal ligament and muscles to move teeth and bone

The dr showed video about fuctional appliance that stretch the masseter and medial pterygoid musceles to stimulate the growth , to posture the mandible forward cause he had very large overjit . one type of functional appliances Is the 'Twin-block appliance', it is constructed in two parts, upper and lower, it stretches the periodontal ligament and periosteum to encourage the growth of the mandible forward. So this is actually one of the cases in which we use removable appliance in the lower arch.

in this lecture we will be discussing 'Removable appliances'

-What are the components of removable orthodontic appliances?

A active

R retentive

A anchorage

B base plate

Part one-Active components :

The part of the appliance that causes tooth movement .

There are Four types of active components:

Springs Elastics

Screws bows

Principles of springs design:

We need the lightest force that cause tooth movement

-force is proportional to deflection and radius (to the power of four) , and inversely proportional to the length

What does deflection means? The bend of the wire that activates the spring and causes tooth movement . (activation)

This mean if I increase the diameter by 2 mm the force will increase by 16.

-If we increase the radius of the wire we increase the force applied to the tooth , and that’s why we use 0.5mm wire. But we cant use a smaller radius , why? Because this will lead to distortion of the wire .

- in order to decrease the force applied on the tooth we have to increase the length of the wire and this is achieved by using 'Coils' (the coils is not for activation , it is for icreasing the length)

- the concept of ' The center of resistance' : the part of the tooth that would result in bodily movement if force was applied to it , and would result in tilting or rotation if force was applied further away from it. That’s why we need the springs to be more gingivally to achieve more bodily movement

- the active arm should be fully extended to control tooth movement and prevent rotation.

- how to prevent the distortion of the buccal canine retractor (made of 0.5mmwire) because it is free in the sulcus, any movement will make distortion ? we either use 0.7 mm(not indicated because the force will increase )or we do 'Tubing of 0.7' to the wire near the retentive arm , and that’s will give us the strength of 0.7 and the force of 0.5

Principles of screws design

Consists of two halves on a threaded central cylinder turned by means of a key which separates the two halves by a predetermined distance of .25mm . opening should be done twice a week .(once they open they separate from each other)

It causes moving teeth 'in blocks' when a number of teeth are to be moved together at once (main advantage)

Is expantion is the only type of movement that screws can do? No , I can control the screws direction , so if we reverse them they will cause proclination that I can use in class3 .

We need at least 3 point of retention (two posterior and one anterior), and when iam using screws I need 4 points .

In the spring I can't use retentive componenet on the teeth that I want to move cause this will prevent the movement , but in the screws I can cause the whole acrylic will move (i.e I can put south end clasp"which is retentive component" on a tooth iam going to move when iam using screws put I can’t in the case of using springs), this is one of the advantages, in pt with mixed dentioin

What are the disadvantages of screws? Patient cooperation ,more expensive than wires , more bulky.

Principles of bows design :

-Robert's retractor : when a patient comes after extraction and we need to close the space with a removable appliance . its used for retraction of anterior teeth.

-The other type is called labial bow, the difference between them is that there is no coil and just a U loop. So we activate it by squeezing the U loops.

Range of tooth movement: the amount of tooth movement that i can do

-Roberts retractor has biggerrange of tooth movement (cause it has coil) so we use it when we have a large overjet, for small overjet we use the labial bow.

Principles of Elastics design :

In order to understand elastics lets discuss this case :

The dr showed a case of a 16 years old boy. The Lateral incisor is totally displaced and the radiographs showed that the canine is resting against the root of the lateral (buccally impacted) . if we used a fixed appliance to move the canine vertically it will cause resorption of the root , so we have to achieve horizontal movement of the canine distally first and then move it vertically down"you can't obtain oblique movement cause this will lead to lateral root resorption". Its hard to do this with a fixed appliance , so we refer the patient to surgery, open a flap and put a gold chain on the canine ,close the flap so that only the gold chain is apparent, and we design a removable appliance for the patient with a hook on adam's clasp, attach an elastic to the gold chain so that the force is directly applied to the canine to move it distally .

Part two : Retentive component

It’s the part of the removable appliance that functions to resist vertical displacement

Adam's clasp is used on posterior teeth engaging the undercut regardless of the level of the gingiva.

Head gear : takes its support from the head of the patient , has inner bow attached to six's to retract them or hold them in place . A tube is soldered onto the bridge of adam's for extraoral bows.

When the removable appliance comes from the lab, Adam's is perfectly engaging the undercut, , if not you adjust it from the arrow head and this is the last time you touch the arrow head, but with continuous wearing and removal of the appliance by the patient , the fly over area becomes straightened and the arrow heads move out from the undercut and so the appliance loses its retention, so that’s when we need to activate Adam's by using Adam's plier on a point that’s near the arrow heads(from the fly over) and bend it in to engage the undercut.

Another retentive component is the ball end clasp, here we have a ball soldered to the wire this clasps are designed to engage the undercut interproximal (in the embrasure), and it's used only with lower incisors.

Another retentive component is the plint clasp .used to retain the removable appliance in the case of using both a removable and fixed appliance at the same time (we're going to take lec. About this) .it's used to engage under the tube assembly on a molar band.

( when using removable appliances alone we can get the retention on the molars by Adam's clasp , but if you're using both fixed and removable the molars have bands from fixed so you can't put adam for the retention of the removable ; here you have to use the plint clasp.

Incisors are always proclined , so when the labial bow rest on the middle third of the crown , the proclination of the upper incisors will create an undercut preventing the bow from going down so it will act as a retentive component. So in other words labial bow is a retentive component but sometimes we activate it by squeezing and then it would act as an active component.

That's why we're using labial bow mainly for retention rather than active tooth movement , that's the difference between labial baw and Robert's retractor which used mainly for active tooth movement .

so for small tooth movement use labial bow … large tooth movement use robert's retractor.

Part three: anchorage

Anchorage is defined as resistance to unwanted tooth movement . it’s the third law of Newton which implies that for every action there's a reaction equal in magnitude and opposite in direction .

For example, If I want to distalise the canine the reaction would be mesial movement of posteriors , so here for canine distalisation I'm going to extract the 2 premolars I need the whole space and I don’t want the molars to move at all because they're going to take from the space that I've created , so the resistance of the molar movements is called anchorage , so I will use the head gear attached to the six's .

Part four : base plate

It's the part that haid all the components together

Base plate is made of acrylic, we use the cold cure acrylic.

Heat cure acrylic's durability is better but we don’t care about durability because the appliance will be used for a limited period of time so its easier to use cold cure acrylic.

Why do we design the base plate so that it engages all the teeth? ( benefits of base plate )

1 } For anchorage

If I want to move the six distally the reaction would be proclination of incisors and increase in overjet , so I distribute the force on all teeth and the palate by using the base plate by the fact of engaging of the indentation of this base plate to all the teeth from 5 to 5 distributing the reaction on them ( one unit against the 6 ), and this is one of the advantages of removable appliances is that we can use the plate for anchorage.

2 } pts with deep over bite ..

Increasing the thickness of acrylic behind the upper incisors forming a flat anterior bite plane onto which lower incisors occlude and cause separation posteriorly and the posterior teeth will overerupt ( passive extrusion which is different from the active extrusion)\* and lead to reduction in overbite . This flat anterior bite plane should be straight and not inclined because then it will cause deflection when the patient bites on it and the lower incisors will tip lingualy .

\*Active axtrusion: I put wires on teeth and bring them down .

\*Passive extrusion : I'm just making a space between teeth and let them erupt alone

3 } posterior bite plane used to cause disocclusion .

Posterior bite plane is made by covering the occlusal planes of teeth with acrylic this will cause separation of the anterior teeth , that will NEVER lead to over eruption of incisors since in the normal occlusion ( class 1 ) U&L incisors are separated they don't touch each other and they don't overerupt so they reached the max. eruption unlike the molars that were in occlusion in the normal situation so once we separate them by ant. Bite plane that will lead to over eruption .

So post. Bite plane used when we want to avoid occlusal interferences ; in pts with class 3 for example if I want to procline the upper incisors every time I procline the uppers they will hit the lowers and this will prevent their movement so I have to open the bite using posterior bite plane (( Disocclusion ))

Same applied if I want to make expansion in case of crossbite lower molars will prevent upper expansion so I have to put post. Bite plane to release the occlusion .

And we are done with the components.

Mode of action of the removable appliances

What are the things I can achieve using the removable appliances?

1)Tipping movement : by applying force away from the center of resistance we cause tipping movement and rotation around the center of resistance.

Center of resistance : is the point of the tooth where if applied force on this point all the tooth structure will move in the same direction with the same speed .

Center of resistance for ant. Teeth is in the middle of root that's impeded inside the bone ( see the pic in the slides ) so can I apply force directly on the center of resistance that's impeded in bone here ? NO that's impossible , so I have to apply the force of the active component on the occlusal third , so there's a distance between the center of resistance and the point of force application so as a result tipping movement will occur .

So the only tooth movement that can be achieved with removable appliance is .. tipping movement , unlike the fixed appliance I can achieve bodily movement also which is done by applying couple force on the tooth . ( same as the pic in the slides .. pushing the door with one hand will cause rotation {as the removable appliance } , hand and foot - 2 points of force application- that leads to bodily movement { as the fixed appliance )

2) movement of block of teeth

3) influence the eruption of teeth ( the ant. Bite plane principle of action)

CONTAMPORARY use of removable appliance

Today we don’t use the removable appliance as much as it was used in the past due to the presence of the technology that we can bond the bracket to the tooth structure ( fixed appliance) .

Cases :

Case one : A kid in a mixed dentition state with an anterior cross bite.

Should we treat the cross bite? Yes , this is an interceptive treatment because ifit's not treated this will lead to Attrition of lower central incisors and recession in the periodontal ligament.

Can we use a fixed appliance? No, Because he has primary teeth.

Design : Z spring , adam's, posterior bite plane

We only want to procline the upper incisors , we don’t want to close the diastema bcz it's not the final treatment the pt still have primary teeth .

Case two : female with anterior cross bite with displacement and permanent teeth

If we used the fixed appliance and bonded brackets to the incisors, when the patient bites she will break them so I need to disocclude the teeth by using a posterior bite plane

Design : we need to procline the upper 4 incisors so we use double cantilever

retention: adam's on six's and one on premolar

anchorage: the unwonted movement is distal movement of posterior but since canines ,premolars and molars are stronger than the 4 incisors there's no need to worry about that.

Base plate: posterior bite plane to disocclude the teeth , all teeth engagaed in acrylic .

The patient presented with Diastema after treating the cross bite so we have to design another URA (upper removable appliance) to close the space by putting a palatal finger spring to move the two centrals mesialy and then another URA to move the laterals and then another one to move the canines so it will take a very long time and too many appliances to do proper finishing , and that’s why we need to finish up using a fixed appliance to move all wonted teeth bodily movement at the same time.

Case three

In case of cross bite with displacement

Patient bites cusp to cusp midline coincident , but when the patient continue bitting displacement happens to reach full occlusion , and the midline shifts . So to treat this case we have to expand the maxilla by using a screw in an URA.

Active component: expansion screw midsagital in the palate

Retentive: 4 points needed , 4 adam's on six's and premolar's

Anchorage : reciprocal reactionary force also causes expansion

Base plate: posterior bite plane to disocclude the teeth

Case four : canine class two (upper canine occluding in the embrasure between lateral and canine)

class one is when the upper canine occludes in embrasure between lower canine and premolar.

so we have to distalise the canine,so I want to push all the posterior segment back , starting with the 6's using palatal finger spring and the head gear , then we distalise the 4 & 5 with another appliance ( this is one of the limitation for removable appliances that we can't achieve all teeth movement with one appliance ) , then for the canine .

then we used a fixed appliance to complete the treatment , look at the slides and see the difference between the inclination of PMs and the canine befor the fixed and after , they were distally inclined due to the tipping movement of the removable appliance (root tipped mesialy the crown distally ) , then it's corrected by uprightening them using the fixed this is again one of the limitation of the removable .

the last use for the removable appliance is as a retainer holding the whole teeth together called hawley retainer which consist of labial bow and 2 adams . now we don’t use it that much bcz of the presence of vaccum formed retainer it's more esthetically acceptable than Hawley and it's as effective as the hawley .

#the next 2 topics you have to read about them from the book ( laura michell) :

1 . how to know that the pt is wearing the appliance ( usually it's an exam question )

2 . complications during the treatment

One of these complications is candidal infections due to the wearing the appliance for long time .

Please read the rest of the complications from the book .

Extra informations from last year's sheet \*\*

what's the first thing you have to do before delivering the appliance to the patient? First we have to make sure that this appliance is for this patient. Then We have to check the design , the presence of any sharp edges, then show the appliance to patient, then insert it.

We should measure the overjet , molar relationship and canine relationship to follow them up.

Oral hygiene instructions should be given to the patient to prevent candidal infections and plaque and calculus accumulation. Instruct the patient to wear it 24 hrs and remove it from adam's clasp and not anywhere else. You can also reassure the patient that ingiv and salivary flow will come back to normal with time .

Nudger appliance: used in conjunction with head gear to bands on the first molar teeth.it is usually used to achieve distal movement of the molar teeth when it is intended to go onto fixed appliances to complete alignment.

ingiv retainer : passive appliance used for retention following orthodontic treatment . it consists of a labial bow and adam's on six's.

if the patient comes for his appointment and you notice no improvement in the measures you took , first you have to make sure that the patient actually wears the appliance, you can know that by many signs, like when the appliance is still activated, or when the patient still have difficulty speaking clearly. Also if the appliance is too retentive and the patient cant take it out, all of these point out to the fact that the patient had not been wearing the appliance. Intraoral indentations in the ingival and palate indicate that the patient wears his appliance .

if the patient wears the appliance but there's still no improvement it can be poor design, poor activation or occlusal interferences .

Good luck ☺