**Orthodontics**

**Sheet: # 14**

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**Functional Appliances**

Last lecture we talked about types of orthodontic appliances we said we have 1) removable 2) functional 3) fixed orthodontic appliances, we talked about removable and today we are going to talk about functional appliances.

**Definition of functional appliances:** they are either fixed or removable that utilizes, eliminate, or guide the forces of muscle function, tooth eruption and growth to correct malocclusion, so the end result is that I want to correct malocclusion, how? By using muscle function.

The doctor showed us a patient with retruded mandible (retrognathic mandible) and we gave her a functional appliance, what happened is with the use of FA the mandible will be forced to posture forward in this case the lateral pterygoid muscle is stretched so we are utilizing muscle function to correct malocclusion.

**History:**

We have something called pierre robin syndrome, the baby will be born with a small mandible and the problem is that this will occlude the airways and they usually die. So what they did is that they gave the baby the appliance to open the airways from here came the idea that we can posture the mandible forward. Andresen used this principle of forward posturing of the mandible and developed the activator, the first functional appliance.

**Overview:**

The doctor showed us a case with diastema and on the lateral ceph. she had a massive overjet, she was 15 years old. So we treated her with a twinblock functional appliance for 4-5 months after that period she had a reduced overjet while the median diastema is not yet closed so we need another phase of treatment which is fixed appliance to close the diastema.

So basically functional appliance reduced the overjet only!

**Timing of treatment:**

The patient must be in a growing phase more specifically in growth spurt period. Growth spurt is an increase in growth in a short period of time.

How can I determine if patient is in growth spurt? First method is that I use a chart and I keep measuring patients growth until I notice an increase in growth then he’ll be in the growth spurt however this is not practical, the Second method is to know the average ages for growth spurt in general it’s 12 years, Third method is to take lateral ceph and measure cervical vertebrae maturation however this is not really accurate.

In conclusion we don’t really know when is the growth spurt we try as much as we can to catch the patient in this period but this is not always possible.

They came up with a new concept which is **Early treatment**, instead of treating patient at 12 years we treat him at 8, they thought that 1) they’ll get more skeletal effect than late treatment 2) they wanted to reduce the risk of trauma to centrals 3) Improve patients’ appearance.

Should we follow this concept? They did a randomized clinical trial (a clinical study where I get a big number of patients then I randomly allocate them to two groups and apply different treatments and finally I inspect different results) so what they did is that they brought a big number of patients with class2 div1 and they divided them to early treatment group (8yrs) and late treatment group (12yrs)

Results: little difference if any was detectable between the early and late treatment regarding quality of final result meaning early treatment is not necessary and not only that starting treatment early resulted in a prolonged treatment and they needed to attend more appointments. Now regarding trauma, it is more likely to be associated with the child himself than overjet meaning if I have a child who is interested in playing kickboxing and karate then he’ll be more likely to experience trauma to his teeth so the evidence of starting treatment early to reduce trauma is a bit shaky. Finally appearance, in the same study we talked about randomized clinical study, they found that child’s self esteem will be increased after treatment meaning psychology is a good indication for starting treatment early.

**Conclusion:**

1) Increase skeletal effect is it a justification for early treatment? **NO**

2) Reduce trauma? It’s a bit **shaky** as we said.

3) Appearance and psychological effect? **YES** it is a justification for starting treatment early.

**Types of malocclusion to be treated with functional appliances:**

1. **Class II division I**
2. **Class II division II**
3. **Class III**

Note: All cases are from the book (Laura Mitchell)

 **Class II division I**

Case 1 : (ideal case of treatment with a functional appliance)

Patient has a retrognathic mandible, however a well aligned dentition intra orally. The only problem the patient has is an increased overjet. This overjet is reduced with the use of a functional appliance.

Note: Case I Is a perfect scenario for using a functional appliance; however not all patients have a well aligned dentition. Those patients need a functional appliance (twin block) as a first stage followed by fixed appliance as a second stage.

**Class II division II**

**Case 2:** Patient with Retrognathic mandible. I have to posture the mandible forward. Retroclined incisors intraorally. We can’t advance the mandible while the incisors are retroclined, so I need to change the patient into a class II division I and then use a functional appliance. So,

Stage 1: URA to procline the upper incisors

Stage 2: Functional appliance

We can use a modified twin block which combines the URA with the functional appliance by placing a Z-spring in the functional appliance. Hence, the patient is improving his/her anterior/posterior relationship and the incisors are proclined.

If we procline the incisors without the use of a functional appliance, the overjet will increase and this is not favorable, so we procline the incisor while fixing the overjet to compensate for that increase.

**Class III**

We need to posture the mandible backward here. However the challenge here is the presence of the retrodiscal tissue behind the condyles. The retrodiscal tissue is full of nerves and so if I posture the mandible backward the patient will experience severe pain. Hence basically the functional appliance is used in class III for dentoalveolar movement and cant be used for patients with skeletal class III. Protraction headgear could be used in these cases.

**Types of Functional Appliances:**

1st classification: Tooth borne vs Tissue Borne

Tooth borne: Presence of clasp, example: adam’s clasp on the molar

Tissue borne: the teeth are not touched, instead the appliance is applied on the soft tissue

2nd classification: Active vs Passive

Active: an intrinsic force generation arrangement must be present. Example: presence of a Z-spring.

If such a component is not present then it is a passive functional appliance

**TYPES:**

Most common type in the UK:

1. **Twin Block**

Made of two blocks one upper one lower, the patient can speak, eat and wear it 24 hours. However the main disadvantage is the open bite. No overeruption of the posterior teeth due to the presence of two blocks. Hence when patients are done with the treatment the orthodontist is left with a huge overbite that he has to deal with.

1. **MOA (medium opening activator)**

Made of one unit (block), the patient is forced to posture his/her mandible forward to fit into the incisor cap for him/her to bite. The patient cannot speak, eat, and cannot wear it 24 hours. There is a whole for breathing. Main advantage: posterior teeth are always exposed and the problem with the overbite in the twin block is not present here.

Most common type in the US:

1. **Herbst:** Fixed-functional

There is a section attached to the upper buccal segment and a section attached to the lower buccal segment teeth. These sections are joined by a rigid arm that postures the mandible forward. Main advantage: no need for patient’s co-operation since it is a fixed functional and it is also a faster treatment. Main disadvantage: breakage inside the patient’s mouth and is much more expensive compared to the twin block.

1. **Frankel** **Appliance**:

Purely tissue borne (the only type). All its retention comes from the soft tissues. Recall that the teeth are in balance due to the forces of the tongue (pushing the teeth forward) and the lips (pushing the teeth backwards), by removing one of these forces, I can move the teeth and this is the principle of Frankel.

Used for class II (put on the lower lip)- called Frankle II : used to procline the teeth

If we put the appliance on the upper lip – the teeh will procline to correct Class III – called Frankel III

Disadvantages: difficult to wear, expensive to make and is troublesome to repair. We don’t really use it anymore.

**Note:**

Whenever we use functional appliance, we need to expand the maxilla.

Patient biting in class I, ask the patient to posture the mandible forward, the patient will have crossbite. Why? As I advance the mandible (the wider part moves)and it will occlude on the narrow part of the maxilla which will result in crossbite. Hence, we need to expand the maxilla whenever we use a fixed appliance.

You must read the clinical management if functional appliances from the book (chapter 19) and it will be discussed in the lab.

**How do functional appliances work??**

It is not clear what proportion of the treatment effects are due to dental changes and what are due to skeletal changes. When the mandible is postured forward I am assuming that the mandible itself is moving forward (acceleration of the growth of the mandible) and at the same time the maxilla is restrained (because the mandible is taking its space as it grows). This is called restrained maxillary growth. They discovered this by animal studies however, these studies are not accurate because animals wore the appliances all the time, their anatomy is different from ours.

Dent alveolar effect: with the twin block, the lower is resting against the upper. All the lower segment comes forward, hence proclination of lower incisors and mesial movement of buccal segment. At the same time, retroclination of the upper incisors and distal movement of the buccal segment.

Upon clinical trials it was found that (one group wore the appliance, the other group did not):

* The changes caused by the functional appliances are due to dentoalveloar changes. (80%)
* Some minor skeletal changes occurred (20%)
* Results are variable

Child with very severe class II: I might treat the patient but I must explain to him and his parents that the treatment is variable

Failure of functional appliances: 20% why?

* Patient related problem (doesn’t wear it)