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Orthopedic Appliances in Orthodontics

There are essentially three alternatives for treating any skeletal malocclusions**:** **growth modification, dental camouflage** and **orthognathic surgery**. While the growth modification could be possible in growing patients, only the latter two options can be used in adults. Basically there are three types of orthodontic appliances that can be used for modifying the growth of maxilla and/or mandible; orthopedic appliances, functional appliances and inter-arch elastic traction. The appliances that produce skeletal changes by applying orthopedic forces are known as "**orthopedic appliances**", these employ heavy forces, adequate anchorage is gained by extraoral means using occipital, parietal, frontal cranial bones and cervical vertebrae.

Orthodontic Force vs. Orthopedic Force

There are two types of forces used in orthodontics:

1. Orthodontic force: when applied bring about dental changes. The orthodontic forces which are light forces (50-100) gm bringing about tooth movement.

2. **Orthopedic force:** when applied brings about skeletal changes. The orthopedic forces are heavy forces (300-500) gm per side that brings about changes in the magnitude and direction of bone growth.

Principles of using orthopedic appliances

Orthopedic appliances generally use teeth as "handles" to transmit forces to the underlying skeletal structures. The treatment result depends on the following:

- ***Magnitude of Force:*** the orthopedic appliances employ heavy forces (300-500) gm per side to be effective in producing skeletal change. Such heavy forces compress the

periodontal ligament on the pressure side and cause hyalinization, which prevents tooth movement.

- ***Duration of Force:***

1. Orthopedic changes are best produced by employing intermittent heavy forces. Intermittent forces of 12-14 hours duration per day appear to be effective in producing orthopedic changes
2. An increase in the duration of appliance wearing more than 16 hour/day and decrease in the magnitude below 400 gm will produce dental changes rather than skeletal changes
3. Thus intermittent forces employed in orthopedic appliances minimize tooth movement while still providing for skeletal changes. An intermittent heavy force is also less damaging to the teeth and periodontium than a continuous heavy force.

- ***Age of Patient:***

1. Orthopedic appliance therapy begins while patient is still in the mixed dentition period.
2. Treatment may have to be continued until the completion of growth to prevent relapse caused by the re-expression of patient`s fundamental growth pattern after the cessation of orthopedic therapy.

- ***Timing of Force Application:***

1. Optimum timing of extraoral force application is considered to be during evening and night. This is because an increased release of growth hormone and other growth-promoting endocrine factors has been observed to occur during the evening and night rather than during the day.
2. Evidence suggests that skeletal growth is associated with sleep onset and follows a circadian pattern. Thus patients are advised to wear the appliance in the evening after school hours and throughout the night, which is also advantageous in the terms of patient compliance.

Orthopedic appliances types

The following are the commonly used orthopedic appliances:

1. Chin cup appliance
2. Headgear
3. Protraction face mask
4. Rapid Maxillary Expansion RME

1. Chin Cup appliance

Chin cup is an extraoral orthopedic orthodontic appliance used to treat skeletal class III malocclusions due to mandibular prognathism. Chin cup appliance is aimed at restraining the forward growth of the mandible in order to obtain a better anteroposterior relation between the two jaws.

Effects of chin cup appliance

1. Re-direction of mandibular growth in a downward backward direction
2. Lingual tipping of lower incisors
3. Improvement in skeletal and soft issue profile.

Indications

1. patients with a mild to moderate skeletal Cl III malocclusion due to prognathism of mandible.

2. In case of decreased facial height

3. Patients with Cl III who has well aligned protrusive, but not retroclined mandibular incisors.

Components of chin cup

1. Chin cup covers chin
2. Head cap covers the head
3. Elastic strap connects the chin cup with the head cap.

Biomechanical Considerations

- ✓ ***Amount of Force***: a force of 300-600 gm/side is recommended. Initially a lower force level (about 150 gm) may be advised for the patient to get used to the appliance.
- ✓ ***Duration of Force*** 12-14 hours/day.
- ✓ ***Age of Patient:*** It is more effective in young children under age 8 years than the same treatment used later.

2. Headgear: mainly used in the management of skeletal class II malocclusion due to maxillary prognathism with good mandibular skeletal morphology.

3. **Face Mask (Protraction Face Mask):** facemask is also called as "protraction headgear." Face mask mainly used in the treatment of class III malocclusion with maxillary deficiency.

4. Rapid Maxillary Expansion RME: the RMA appliance produce its changes by splitting the mid-palatine suture. The rationale is that if extreme forces are applied to palatal shelves, the interlying suture splits and results in true skeletal changes. The teeth are generally used for the purpose of transmitting the forces to the maxillary bone proper.

Indications

RME appliances are ideally indicated in growing individuals with severely constricted maxillary arches, involving airway impairment or mouth breathing tendencies. They are also indicated in other cases of:

- Posterior cross bites.
- Cleft patients.
- A long with facemask therapy.
- Class III cases with minor maxillary deficiency.

- ✓ It may be banded or bonded fixed appliance. Hyrax is the most commonly used banded fixed rapid maxillary expander. Rapid expansion typically is done with two-turns-daily of jackscrew (0.5 mm activation) for 2-3 weeks. When expansion has been completed >>> 3 month period of retention with the appliance in place is recommended. After the 3 months retention period, the fixed appliance can be removed, but a removable retainer that covers the palate is often needed as further insurance against early relapse.

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