A to Z ORTHODONTICS

Volume: 12

ORTHOPEDIC APPLIANCES

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ISBN 978-967-0486-01-7
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Orthopedic appliance

According to Sassouni (1972) orthodontic therapy is aimed at the correction of dento-alveolar malocclusion, without any skeletal deviation. ie; causes in which tooth movement along is derived.

Whereas orthopedic therapy is aimed at the correction of skeletal imbalance with the correction of any dento-alveolar malocclusion being of less important in which little or no tooth movement is desire.

There orthopedic force is heavier (400 gm) when compared to orthodontic force (50-100 gm).

Definition:

An extra oral heavy force of more than that 400 gm when applied to modify bone growth or change the direction of bone growth is called orthopedic force. It is generally applied by the help of extra oral anchorage.

This force may be two types:

First type:

Extra oral force to modify or change the direction of the bone growth.

Example; chin cap (for the correction of open bite or mandibular prognathism in the deciduous & mixed dentition).
Second type:
Extra oral force for movement of individual teeth. Example; face bow & occipital anchorage. The force exerted on each first molar range from the 300 gm to 900 gm.

The effect of orthopedic force:
These forces are interrupted or intermittent forces applied only for about 10–12 hours/ day. The tooth movement tendency is significantly reduced since the body restricts the normal circulation for about 12 – 14 hours / day. The total effect on the periosteal sutures & maxillary growth centers is not lost; the membranous bone has been restrictive force for about 10 – 12 hours / day.

Clinical application of orthopedic forces:

A. For class III malocclusions –

1. Chin cap is used restraining the forward growth of mandible.

2. Case of anterior cross bite, chin cap can be used along with removable orthodontic appliance for dental arch.

3. Reverse pull headgear can be given for the cases with the maxillary deficiency.
4. Class III malocclusion with narrow maxilla, rapid expansion can be given for correction of posterior cross bite along with the chin cap.

5. Vertical pull headgear along with chin cap is used to prevent vertical growth tendencies & open bite.

**B. For Cleft Palate Patients:**

To correct the maxillo mandibular relations in case of repaired cleft lip and cleft palate patients.

**C. For case with class II malocclusion:**

1. Cases with II malocclusions associated with maxillary prognathism can be treated with cervical pull head gear.

2. A combination of occipital pull and cervical pull can also be used to correct the class II malocclusion.

3. Class II malocclusion with mandibular retrognathism, associated with vertical growth pattern can be managed with activator & a headgear to control.

4. High pull headgear is used to restrain the anterior maxillary vertical component.
Basis of orthopedic appliances:
Orthopedic appliances make use of the teeth as a handle to transmit forces to the underlying skeletal structure.
Forces in excess of 400 gm should be applied to bring favorable skeletal change.

The treatment results depend upon the following:

1. Amount of force
2. Duration of force
3. Direction of force
4. Age of the patient
5. Timing of force application

Amount of force
The force magnitude should be high i.e., at least greater than 400 gm (40 – 600 gm) per side to a maximum total of 2-3 lb to make sure that only skeletal & no dental movement take place.

** High force produce hyalinization leading undermining resorption which prevent tooth movement thus only orthopedic movement seen.

Increased force – decrease blood supply – cell death. Produce avascular area / hyalinized area. So no tooth movement, bony change occurs.

Duration of force
Intermittent force produces skeletal changes where as continuous forces produce dental movement. Extra oral appliances should be worn for about 12 – 14 hours / days to bring the desire effect. Increasing he duration beyond the optimum range increases the dental effects.

An intermittent heavy force is less harmful to the teeth & periodontium than a continuous heavy force. Eg, headgear, chin cap, face mask.

**Direction of force**

The direction of force application should be such as to maximize the skeletal effect. A favorable skeletal affect seen when a force is directed posteriorly & superiorly through the center of resistance of the maxilla.

**Age of the patient**

Orthopedic appliances are most effective during the mixed dentition. Period as it takes advantage of the prepubertal growth pattern/ spurt. However treatment should be maintain till growth is completed as these appliances changes only the expression of growth & not the underlying growth pattern, which may later reassert.

**Timing of force application:**

There is evidence that an increase in the releases of growth hormones (name of hormone) more during the evening & night & is associated with
the sleep onset. Therefore it is advisable for the child to wear headgear in the evening & throughout the night. Appliance use time 12 16 hours / day.

Types of orthopedic appliances:

1. Headgear
2. Chin cap
3. Face mask

Headgear
The most common among all e horizontal orthopedic appliances. They are ideally indicated in patient with excessive horizontal growth of the maxilla with or without vertical changes along with some protrusion of the maxillary teeth reasonable good mandibular dental & skeletal morphology. They are most effective in the pre pubertal period. It can also be used to distalize the maxillary dentition along with the maxilla. They are an important adjunct to gain or maintain anchorage (reciprocal anchorage).

Component of orthopedic appliances:

1. Force delivering unit (face bow- upper jaw, j hook- lower jaw)
2. Force generating unit (elastic)
3. Anchor unit (head cap, neck strap)
**Force delivering unit – Face bow**

One of the most important components, which help in delivering extra oral force to the posterior teeth.

The face bow consists of:

1. Outer bow
2. Inner bow
3. Junction

1. **Outer bow**:
   
   It is made of ss wire of 0.051” or 0.062” in dimension & contoured around the face. It may be short, median & long.

   1. Short: Outer bow short than inner bow.
   2. Median: Outer bow same length as the short inner bow.
   3. Long: Outer bow is longer than inner bow.

2. **Inner bow**:

   It is made of 0.045” or 0.052” round ss wire & insert the around buccal tube on the maxillary 1st molar. The inner bow is adapted according to shape of the arch. Stops in the form of U loop, bayonet bends, & friction stops are placed in the bow mesial to the buccal tube to prevent it from sliding too force far distally through the tube.
3. **Junction:**

   It is the point of attachment of inner bow & outer bow, which may be soldered or welded. It is usually positioned at the middle of the two bows.

**Force generating unit:**

   This connects the face bow to the anchor unit & delivers the force to the teeth & underlying skeletal structures. The force elements may be springs or elastics. Springs are preferred as they provide a constant force, whereas elastics undergo force decay.

**Anchor unit:**

   This is the form of a head cap or neck strap, which uses anchorage from the skull or back of the neck respectively.

   A combination of the two may be used. Occipital, parital bone used as anchor unit.

They can be divided as follows:

1. According to direction of force:
   
   a. Distal force
   
   b. Mesial force

2. According to location of anchor unit:

   a. Cervical-pull headgear
b. Occipital-pull headgear

c. High-pull headgear (parietal)


**Chin cap:**

It is an extra oral orthopedic device which is useful in the treatment of class III malocclusions that occur due to a protrusive mandible but a relatively normal maxilla. Chin cap therapy attests to retard or redirect the growth of the mandible in order to obtain a better anterior posterior relation between the two jaws.

**Philosophy of chin therapy:**

Mandible grows by apposition of bone at the condyle & along its free posterior border. Condyle is not a growth center & condyle growth is largely a response to translation of surround tissues. This contemporary offers a more optimistic view of the possibilities for growth restraint of the mandible, as with the chin therapy.

**Magnitude of force:**

Most authors recommended a force of 300-600 gm/side. Initially, a lower force level (about 150gm) may be advised for the patient to get used to the appliances.

**Duration of wear:**
A maximum of 12-14 hour/day of chin cap wear is recommended at evening & night due to releasing of growth hormone.

**Effects of chin cap:**

1. Redirected of mandibular growth in a downward & backward direction.
2. Remodeling of the mandible & decrease in mandibular plane angle & gonial angle.
3. Lingual tipping of lower incisors.
4. Improvement in/ of skeletal & soft tissue profile.

**Types of chin cap:**

1. **Occipital pull:**
   
   This chin cap derives anchorage from the occipital region. This is used in class III cases with mild to moderate prognathism, who can bring their incisors in an edge to edge position at centric relation. Patient with short anterior facial height benefited from this type of chin cap. This is the more commonly used of chin cap.

2. **Vertical pull:**
   
   This chin cap derives anchorage from the parietal region. It is indicated in high angle cases or long force patients as it helps to close the angle of the mandible & increase posterior facial height.
• **Face mask (Reverse-pull headgear, Protraction headgear, Face frame)**

Extraoral appliance that utilizes rests on the chin and forehead (and occasionally the cheek bones) as anchorage for elastic traction, with the purpose of orthopedically protracting the maxilla. This maxillary protraction is performed as an early treatment modality in Class III malocclusions associated with maxillary hypoplasia. The face mask also can be used as an orthodontic appliance, to provide extraoral anchorage for protraction of posterior teeth. Usual side effects of face mask treatment include elongation of the face (caused by extrusion of the teeth to which the elastic traction is applied) and proclination of the maxillary incisors, when the traction is applied to the maxilla. The appliance was designed by J. Delaire and subsequently modified by H. Petit and others.
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Dedicated To

My Mom, Zubaida Shaheen
My Dad, Md. Islam
&
My Only Son
Mohammad Sharjil
Acknowledgments

I wish to acknowledge the expertise and efforts of the various teachers for their help and inspiration:

1. Prof. Iida Junichiro – Chairman, Dept. of Orthodontics, Hokkaido University, Japan.
3. Asst. Prof. Kajii Takashi – Dept. of Orthodontics, Hokkaido University, Japan.
8. Prof. Amirul Islam – Principal, Bangladesh Dental college
9. Prof. Emadul Haq – Principal City Dental college
11. Asso. Prof. Lamiya Chowdhury – Chairman, Dept. of Orthodontics, Sapporo Dental College, Dhaka.
13. Asso. Prof. MA Sikder – Chairman, Dept. of Orthodontics, University Dental College, Dhaka.
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