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## “REMOVABLE MYOFUNCTIONAL APPLIANCES - WHICH, WHEN, WHY”

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**Abstract:** Myofunctional appliances have enjoyed almost 96 years of existence. The goal of functional dental orthopedics is to utilize the functional stimulus generated by orofacial musculature and channelize it as far as tissue, jaws, condyles and teeth are concerned. The aim of this review article is to give an insight of removable myofunctional appliance. The timing of orthodontic treatment to coincide with the pubertal growth period is an important part of correcting any skeletal disharmony that may exist in an individual's dentofacial complex. Using the period of accelerated growth, myofunctional appliance can be given to carry out early improvement of an individual's maxillomandibular relationship. Different authors have given different myofunctional appliances, which appliance when to use and why to use, these information is reviewed in this article.

**Index Terms - Myofunctional appliance, Pubertal growth spurt, Removable.**

### I. INTRODUCTION

Early diagnosis and successful treatment of developing malocclusions can have both short-term and long-term benefits while achieving the goals of occlusal harmony and function and dentofacial esthetics. During the transition stage of dental development there are great opportunities to guide the growth and intercept malocclusion. The influence of natural forces and the functional stimulation on form were first reported by Roux in 1883. Later, Karl Haupl saw potential of Roux hypothesis and explained how functional appliances worked through the activity of orofacial muscles.<sup>1</sup> The 'functional matrix' of Melvin Moss is a contemporary evaluation supporting the premise that function modifies anatomy.<sup>2</sup> Malocclusion is frequently associated with unfavorable occlusal contacts and aberrant muscle behavior which results in negative proprioceptive stimulus to normal growth and development.

The term 'Myofunctional appliances' and 'Functional appliances' earlier have been used synonymously. However, there are subtle differences between the two, Myofunctional appliances are those appliances, which harness the muscle pressure to their advantage and thereby affect tooth movement. Functional appliances are those appliances, which elicit certain natural functions of the orofacial region and thereby affect results. However, with the understanding and sharing of ideas of both the continents, the appliances, now is dictated by differential morphogenetic, functional, growth and sex linked factors.<sup>3</sup>

### II. BASICS FOR FUNCTIONAL APPLIANCE

“The three M's- Muscles, Malformation and Malocclusion”- By Graber, 1963- described effects of function and malfunction.

- The Functional Matrix Hypothesis by Melvin Moss.
- Identification of certain cartilages (eg. Condylar cartilage) as secondary cartilages.
- Servosystem (or Cybernetic) Theory, 1980, by Petrovic and associates.
- Growth Relativity Theory (Vodouris and associates).

**III. (A) INDICATIONS FOR FUNCTIONAL APPLIANCE**

Although functional appliances have been designed to treat all types of malocclusions, they are most effective in treating dental and skeletal Class II malocclusions, particularly in cases with mandibular deficiencies.

- 1) Patient should be in growing age.
- 2) Well aligned dental arches.
- 3) Posteriorly positioned mandible.
- 4) Severe skeletal discrepancy.
- 5) Lingual tipping of mandibular incisors.
- 6) Favourable growth pattern

**(B) CONTRAINDICATIONS FOR FUNCTIONAL APPLIANCE**

- 1) Class II skeletal due to maxillary prognathism.
- 2) Vertically directed grower.
- 3) Labial tipping of lower incisors.
- 4) Crowding.

**(C) LIMITATIONS OF MYOFUNCTIONAL APPLIANCE**

1. Functional appliances are typically associated with maxillary and mandibular molar extrusion. Although this is helpful in eliminating a deep overbite, it also can result in an unfavorable increase in lower anterior facial height, which explains why any additional mandibular growth is primarily expressed vertically and not horizontally. Therefore functional appliances are contraindicated in backward mandibular rotators with minimal overbite.

2. Individual tooth movements are difficult with functional appliances. Therefore a final phase of fixed appliance therapy should be considered to achieve bodily and rotational tooth movements and optimal functional occlusion.

3. The results of treatment are totally dependent on patient cooperation.

4. These appliances are of very limited use in the correction of anteroposterior discrepancies in non-growing persons.<sup>4</sup>

**(D) TIMING FOR TREATMENT**

A key principle in dentofacial orthopedics is in the timing of its application. It is widely accepted that for treatment to be effective, it should be timed to include the pubertal growth spurt (Franchi L et al<sup>5</sup>, Fishman L<sup>6</sup>, Hagg and Pancherz<sup>7</sup> Malmgren et al<sup>8</sup>; Omblus et al<sup>9</sup>, Baccetti et al<sup>10</sup>). Baccetti et al evaluated the role of treatment timing in non-extraction comprehensive Class II therapy. They found that the greatest amount of favorable skeletal correction (i.e. enhanced mandibular growth) occurred in patients treated during the pubertal growth spurt.

The age at which functional appliance therapy is instituted is of major importance for the successful correction of Class II malocclusions. Functional appliance treatment should be coincident with periods of active growth. Most agree that it should be initiated during the middle to late mixed dentition. It can also be used earlier if the patient can cooperate in wearing the appliance<sup>11</sup>.

**(E) ADVANTAGES OF FUNCTIONAL APPLIANCE**

1. It is used to manage certain types of malocclusions given during the mixed dentition period or early permanent dentition period make use of growth potential and bring about changes mainly in dental arches and improve the profile of the patient.
2. It is used to eliminate the abnormal perioral muscle function which interferes the normal bone growth.
3. Treatment can be started as early as in mixed dentition stage.
4. These do not have any side effects of mechanotherapy such as enamel decalcification, chronic inflammation of gingival.
5. It is easier to maintain oral hygiene with these appliances.

**(F) DISADVANTAGES OF FUNCTIONAL APPLIANCE**

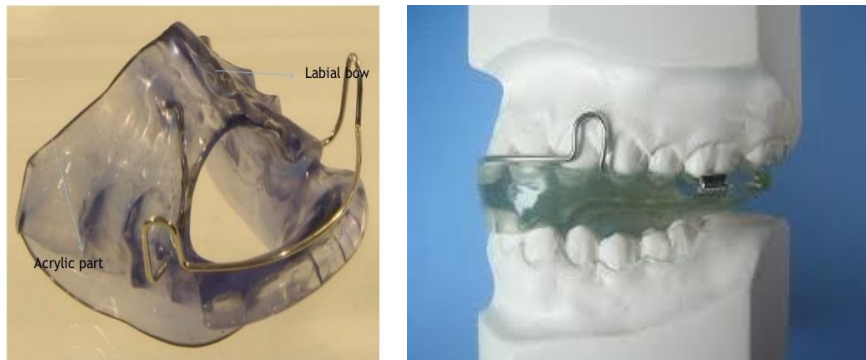
1. It is not useful in managing adult patients where the active growth period is completed.
2. Patient's ability to cooperate in following the instructions and wearing the appliance is of vital importance in management of such cases.
3. It can be used to correct basal bone arch relationships only. And hence cannot correct dental malocclusions like rotations, crowding etc.
4. Fixed appliance therapy may be required for final detailing or final tooth position.

5. They have tendency to increase the lower facial height and hence they cannot be used in patients with backward rotating mandible.

## DIFFERENT REMOVABLE MYOFUNCTIONAL APPLIANCES:-

### 1) Activator

#### ➤ Design



➤ **Inventor** : Viggo Andresen in 1908

➤ **Mode of action**: Force Application

#### 1. Re-education of the musculature

Continually holding the mandible forward in Class II cases the muscles would be obliged to learn a new functional pattern. Gradually the teeth and jaws would adapt to the new jaw relationship prescribed by the appliance.

#### 2. Lateral pterygoid muscle stimulation

Obligatory mandibular protrusion has been found, in experimental animals, to be associated with increased electromyographic activity in the superior head of the lateral pterygoid muscle. Coordination of electromyographic readings with measurements of condylar growth reveals a close relationship, indicating that skeletal adaptation proceeds until muscle activity is restored to normal levels. (McNamara et al, 1975)<sup>12</sup>.

#### 3. Decreased biochemical feedback

Stutzmann and Petrovic (1979) found that the zone of functional chondroblasts in the rat condyle normally secretes a substance which retards mitotic activity of the stem cells. When the lateral pterygoid is activated by an appliance, the functional chondroblasts mature more quickly, consequently secreting less "negative feedback" substance. By removal of this biochemical "brake", acceleration of condyle growth is permitted.

#### 4. Unloading of the mandibular condyle

The mandibular condyle is normally subjected to pressure which is one component of the local homeostatic mechanism controlling its growth. When an appliance is used which distracts the condyle from the fossa this pressure restraint is removed, thereby facilitating an increased rate of growth.

#### 5. Transduction of visco-elastic force

Some authorities are skeptical of the efficacy of the muscle generated forces created by increased biting and swallowing when an activator is in place. Instead, they harness the passive tension arising from the inherent elasticity in muscle, skin and tendonous tissues and transmit this to the maxillary teeth engaged in the appliance. Accordingly, extreme vertical registrations are frequently employed. (Woodside, 1977)<sup>13</sup>.

#### 6. Differential Eruption

Harvold (1974) has shown that the divergent directions of eruption of the maxillary and mandibular molars can be altered by the appliance to create the molar relationship desired. For example, in Class II treatment, the acrylic platform can be adapted to arrest maxillary molar eruption, yet allow concomitant mandibular molar eruption into Class I relationship. In Class III activator treatment, the converse would be applied.

#### ➤ Indications

1. Dento-alveolar Class II malocclusions. The activator is employed as a form of Class II intermaxillary traction to initiate dento-alveolar remodelling.

2. Moderate skeletal dysplasias between the midfacial area and the mandible, where moderate amounts of maxillary incisor retraction and moderate amounts of mandibular growth would combine to yield a successful result.

3. Class II malocclusions resulting from environmental influences such as thumb sucking and chronic mouth breathing, providing some growth still remains and the oral habit can be eliminated.

4. Non-extraction deep overbite cases in which it is desirable or permissible to exert a forward pull on the lower dental arch. Many Class II division II cases belong in this category.

5. Class II cases complaining of temporomandibular joint pain and dysfunction associated with posterior displacement of the condyles.

➤ **Contraindications**

1. Non-growing patients.
2. Vertical growth patterns.
3. Intractable mouth breathing or digit sucking.
4. Poor cooperation.
5. Cross bite tendency.
6. Gross intra-arch irregularities and rotations.
7. Marked spacing of the upper incisors. Activators are not capable of parallel space closure.
8. Retroclined upper incisors.
9. Activators, along with other functional appliances, should not be used by clinicians who will not use cephalometric analyses to assist in establishing the nature of the facial morphology to be treated.

➤ **Types Of Activator**

1. Kinetor Activator (1951)
2. Bow Activator of A.M Schwarz (1956)
3. Herren's Activator (1953)
4. Elastic Open Activator of G. Klammt (1960)
5. Nite-Guide/Occlus-o-Guide/Ortho-T Activators
6. Harvold/Woodside Activator (1971)
7. Palate Free Activator (1974)
8. Propulsor (1980)
9. U Bow Activator
10. Wunderer Activator
11. Hamilton Expansion Activator
12. Cybernator or Reduced Activator
13. LM-Activator

➤ **Bite Registration**

The extent of forward positioning of mandible is related to amount of bite opening. The greater the bite opening, the less should be the planned forward movement of condyle.

- 1) In a forward positioning of mandible of 7-8mm, vertical opening must be slight to moderate (2-4mm)
  - 2) If forward positioning is no more than 3-5 mm, then vertical opening should be 4-6 mm.
- Lower midline shifts can be corrected by the activator only if there is actual lateral translation of mandible itself.

➤ **Rationale for selection of Activator**

**1. Skeletal features:**

- (a) There should be significant amounts of facial growth remaining.
- (b) The maxilla may exhibit mild prognathism but must not show any features of vertical maxillary excess.
- (c) The mandible should show mild to moderate skeletal retrusion.
- (d) The vertical facial proportions should err on the side of decreased lower face height.
- (e) The facial axis should be equal to, or greater than, 90 degrees.

**2. Dental features:**

- (a) The dental arches should be free of crowding and individual tooth irregularities such as rotation and poor axial inclination.
- (b) A deep incisor overbite is preferable to an open-bite tendency.
- (c) The mandibular dental arch should be retruded on the basal bone and preferably should show spacing rather than crowding.
- (d) The maxillary incisors should be slightly proclined.
- (e) A slight scissor bite tendency is favourable.

**3. Social-behavioural features:**

As with other systems of orthodontic treatment, a well adjusted, motivated and cooperative patient will be more likely to enjoy a successful resolution of their problem.

### ➤ Limitations

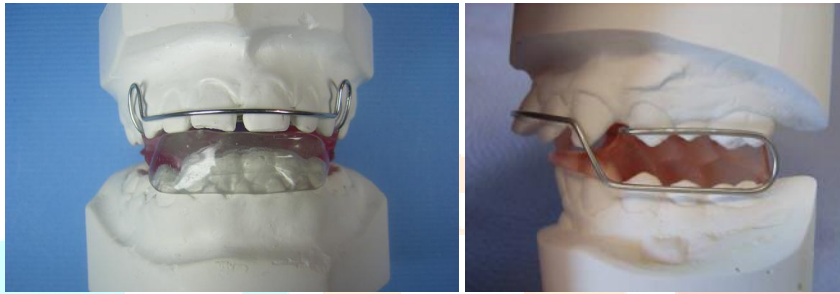
1. The bulk of the appliance renders full-time wear difficult, and with night-time wear only, the threshold for adaptive remodelling at the condyles may not be reached in all cases. Apart from a reduction in the time of application of the stimulus, there is reduced protractor muscle activity during sleep (Witt, 1973) and there may also be reduced mitotic activity in condylar prechondroblasts. (Petrovic, 1975)<sup>12</sup>. The increasing clinical use of minimal bulk activators, such as the Bionator, which can be worn on a full-time basis, may furnish evidence of a truly orthopaedic effect.

2. Since the activator is tooth-borne, in contrast to the Functional Regulator, tooth movement may lead to occlusal correction before the desired skeletal changes have been achieved. Continued pursuit of the skeletal goals would produce a Class III dental malocclusion.

3. Inappropriate case selection or improper appliance manipulation can lead to a posterior rotation of the mandible.

## 2. Bionator

### ➤ Design:



➤ **Inventor:** The Bionator is an Andresen type activator and was introduced by Professor Wilhelm Balters of Bonn in early 1950.

➤ **Mode of Action:** Force application

1. Bionator establishes a muscular equilibrium between forces of tongue and outer neuromuscular envelope which influence the form and shape of dental arches.
2. The main advantage of bionator is its reduced size, so it can be worn day and night time. Constant wear makes its action faster than activator and also results in more rapid sagittal adjustment of musculature to forward mandibular posture.
3. Freedom of movement in the oral cavity is important and fixation by clasps or extra-oral attachments would be detrimental to the mode of action.
4. It is designed to have a specific effect on tongue function, which is viewed by Balters as the primary morphogenetic influence on the growth, development and relationship of the dental arches.
5. According to Balters' philosophy, Class II malocclusions are the result of a backward position of the tongue, which in turn, generates faulty deglutition and mouth breathing. The main objective of Class II treatment with the Bionator is to bring the tongue forward. This is achieved partly by stimulation of the distal aspect of the dorsum of the tongue by the posteriorly directed palatal arch wire, and partly by anterior development of the mandible induced by the edge-to-edge construction bite.
6. Class III malocclusions, conversely, are ascribed to a forward position of the tongue and therefore, in the Class III Bionator the palatal arch is inverted, with the round bend directed anteriorly.
7. The other wire element is the vestibular arch, which has a labial segment and bilateral buccinator bends. The buccinator bends are intended to perform functions similar to the vestibular shields of the Frankel appliances:
  - (a) They prevent the soft tissues of the cheeks from intruding into the inter-occlusal space, thereby facilitating eruption and occlusal plane levelling in the buccal segments.
  - (b) They hold the internal surfaces of the oro-buccal capsule laterally, encouraging transverse expansion of the maxillary dental arch<sup>3</sup>.

### ➤ Indications

1. It is useful in class II malocclusion with mandibular retrognathism, some open bite and class III cases.
2. The Bionator is useful in the treatment of Class II division I malocclusions in the mixed dentition, particularly those associated with habits and abnormal tongue function.
3. The Bionator has an important role as a retention appliance;
  - a) Following correction of a Class II malocclusion in the mixed-dentition with a Bionator, the same appliance is used for night time retention.
  - (b) After correction of Class II malocclusions by conventional fixed appliance therapy, the Bionator maintains and protects the dento-alveolar changes against disruption by post-treatment growth.



4. The Bionator has greater patient acceptance in this application than the activator, which, because of its bulk, looms as a major treatment phase.

➤ **Contraindications**

- 1) The Class II relationship which is due to maxillary prognathism.
- 2) A vertical growth pattern is present.
- 3) Labial tipping of the lower incisors is evident.
- 4) Deep overbite cases with a strong horizontal growth pattern.
- 5) Deep overbite caused by supra occlusion of the incisors .
- 6) Malocclusions with crowding.
- 7) Open-bite problems with skeletal etiology.
- 8) Children with neuromuscular disease.

➤ **Types of Bionator**

- 1) The standard Bionator (Bionator I) for the treatment of Class II, Division I.
- 2) The open bite Bionator (Bionator II) for the elimination of abnormal tongue activity in open bite cases.
- 3) The reversed Class III Bionator ( Bionator III) for the treatment of Class III.

➤ **Bite Registration**

The wax construction bite of the Bionator determines the relative position of the joined upper and lower acrylic parts of the appliance. The Bionator is supposed to give a three-dimensional effect; consequently, the construction bite must provide three-dimensional control .

1. In the sagittal plane, the mandible is positioned anteriorly no more than half a premolar width. If the patient is responding to treatment, another Bionator is fabricated after 6 to 8 months based on a new construction bite. Additional appliances may be necessary.
2. Vertically, an edge-to-edge incisal relationship or an opening of 2 mm between the incisors usually is recommended, depending on the curve of Spee.
3. In the transverse plane, the skeletal midlines of the mandible and the maxilla must coincide. The inclined planes in the posterior part of the appliance are trimmed as eruption facets. A combination of the force of eruption and the muscular pressure induced by the construction bite guide the premolars, and in some instances, the lower molars into a more favorable position.

1) **Standard type**

**Working bite** :If edge to edge incisal contact is possible, this should be registered by the working bite. With an exceptionally severe overjet, a more relaxed working position is used, based on correct canine relationships. In these cases, the lower incisors should be capped to prevent their further eruption and tilting. Later, the appliance should be re-made to an edge to edge bite, without capping.

2) **Open bite appliance**

**Construction bite-** is as low as possible with a slight opening for interposition of posterior bite blocks to prevent their eruption.

3) **Reverse appliance**

The working bite is taken in the most retruded position possible and allowing bare interincisal clearance for the correction of the anterior crossbite.

➤ **Rationale for selection of Bionator**

1. The rationale of Bionator is to train the tongue by proprioceptive stimuli to remain in a more retracted position.
2. Class II malocclusion with backwardly positioned tongue
3. Pseudo Class III problems with the upper incisors tipped lingually causing anterior mandibular displacement on closure from postural rest to habitual occlusion.

➤ **Limitations**

1. Bionator produces primarily dento-alveolar changes.
2. Difficulty in managing the appliance
3. Difficult to stabilize and selective grinding of the appliance
4. It is vulnerable to distortion, because less support in the alveolar & incisal region.

#### 4. Frankel Appliances

##### ➤ Design:



➤ **Inventor:** Professor Rolf Frankel in 1950

➤ **Mode of action:** Force elimination

1. Corrects unphysiological spatial Conditions and muscular imbalance by mechanical expansion of the circumoral capsule by the buccal shields outside the alveolar processes the shape-changing action of the functional regulator is not based on application of pressure but on intervention in the epigenetic milieu.
2. Release of regional tension especially in the region of the nasolabial and mentolabial fold.
3. Physiotherapy effect by massaging and kneading the soft tissues over the shields during all functional movements of the perioral musculature (speech, swallowing, facial expression).
4. Orthopaedic training device: "forced exercise" of the labial and buccal musculature due to functional adaptation to the resin elements.
5. In Frankel's view, the main aim of functional therapy is to identify a faulty postural performance of the orofacial musculature and to correct it by orthopaedic exercises. The essential problem for him was to design and construct an "exercise device" that would interfere directly with the functional
6. Environment and result in the correction of the poor postural behavior.
7. Decrowding is a feature of all of the Frankel appliances.<sup>14</sup>

➤ **Indications**

- I. Angle class I and crowding
- II. Angle class II div 1 (distal occlusion) with normal overbite or open bite.
- III. Moderate labial inclination of the upper incisors.
- IV. Underdevelopment of the apical bases (primary crowding symptoms).
- V. Cases which required arch expansion, overbite reduction, muscle re-education and tongue habit appliance in thrust open bite cases.

➤ **Contraindications**

- I. Class II skeletal by maxillary prognathism
- II. Vertically directed grower
- III. Labial tipping of lower incisors
- IV. Crowding

➤ **Types**

- I. FR 1 – Class I and Class II div 1 malocclusion
  - A) FR1 a – Class I malocclusion with minor crowding, deep bite
  - B) FR1 b – Class II div 1 malocclusion with overjet less than 5 mm
  - C) FR1 c – Class II div 2 malocclusion with overjet more than 7 mm
- II. FR 2 – Class II div 1 and div 2 malocclusion
- III. FR 3 – Class III malocclusion
- IV. FR 4 – Open bite and Bimaxillary protrusion
- V. FR 5 – High mandibular plane and vertical maxillary excess

➤ **Bite Registration**

**FR1/II/III**

- Sagittal: slightly forced retrusive/protrusive (classIII/II respectively)condyle position.
- Vertical: minimal vertical occlusion that just allows anterior tooth transfer (greater occlusion would make lip closure unnecessarily difficult or impossible).

Transverse: note facial symmetry, ensure that the skeletal centre of the chin corresponds to the center of the face to fabricate a functional regulator type 1 or 2 the initial sagittal forward movement of the mandible should be 2 mm or 3 mm at most so as not to overtax the musculature to check occlusion, cut the wax rim free so that the buccal cusps are just visible and vertical occlusion can be assessed.

**FR4**

- Sagittal: in habitual occlusion
- Vertical: minimal locked occlusion of 1 mm in posterior region
- Transverse: adjust the skeletal chin centre to match facial centre

➤ **Rationale for Selection**

Faulty muscle posture is seen as having an adverse environmental effect on: 1. The spatial relationships of the maxilla and/or the mandible, that is, the sagittal, vertical and transverse basal arch relationships.

2. The development in space of the dento-alveolar structures. Frankel applies the functional matrix concept and terminology of Moss (1970) to explain the basis of design of his appliances. When faulty muscle posture is deemed to have compromised the spatial relationships of the maxilla and mandible in a growing child, the appliance is designed to alter the biomechanical conditions in the periosteal functional matrices of these bones.

a) The case of a deficient mandible the cause is considered to be a postural imbalance between the retractor and protractor muscles. The FR1 and FR2 appliances are constructed so that the patient is obliged to posture the mandible forward in order to achieve a comfortable jaw position. In this way the periosteal tissues related to the mandibular condyle are subjected to a biomechanical stimulus which favours an increased rate of bone deposition until a position of stability is reached, with the mandible relocated in a more anterior position.

(b) In the case of a deficient maxilla, the FR3 appliance is constructed so that periosteal tension is produced at the superior sulci. The vestibular shields and upper lip pads counteract the restricting effect of aberrant posture within the labial muscle groups and normal maxillary growth is restored.

(c) In skeletal open bite development, clinical relevance is placed on the poor postural performance of the muscles forming the external soft tissue capsule and of those suspending the mandible. Accordingly, therapy with the FR4 is directed at restoring a competent anterior oral seal and establishing a more superior postural position of the tongue and of the mandible. Subsequent skeletal and dento-alveolar remodelling mediated via the periosteal matrices will favour acceptable vertical, dental and facial relationships.

The second of Moss's concepts concerns the capsular functional matrix. Fankel sees the muscular portions of the walls of the oral and nasopharyngeal spaces as forming a capsular matrix, the volume of which has an important morphogenetic influence on the development of the dentoalveolar structures.

➤ **Limitations**

The appliane is bulky and the cooperation of the patient is essential.They cannot be used in adult patients where growth has ceased. Can not be used to bring about individual tooth movement and in cases of crowding

Fixed appliance therapy may be required at the termination of treatment for final detailing of the treatment.

**4.Twin Block**

➤ **Design**





- **Inventor:** On 7th September 1977, Dr. William J. Clark developed twin block appliance.
- **Mode of action:** Occlusal forces transmitted through the dentition provide constant proprioceptive stimuli to influence the growth rate and adaption of the trabecular structure of the supporting bone.

The proprioceptive sensory feedback mechanism controls muscular activity and provides a functional stimulus or deterrent to the full expression of mandibular growth. If a distal occlusion develops, the occlusion of the teeth represents a servo mechanism that locks the mandible in a distally occluding functional position. If the mandibular inclined planes are in a distal relation to that of maxilla, then the force acting on the mandibular teeth will have a distal force vector leading to a class II growth tendency. Twin block, bite-blocks effectively modify the occlusal inclined plane to induce favorably directed occlusal forces by causing a functional mandibular displacement<sup>15</sup>.

#### ➤ **Indications**

- I. Uncrowded permanent dentition with class 2 div 1 malocclusion
- II. To correct class 2 skeletal relationship, to correct molar relationship and to correct overjet.
- III. Patient should be in growing age for favourable skeletal change achievement.

#### ➤ **Contraindication**

- I. Cases with vertical growth pattern
- II. Crowding that may require extraction
- III. When VTO is not positive

#### ➤ **Types(modification)**

- A) Twin block for transverse development
- B) Twin block for sagittal development
- C) Twin block for transverse and sagittal appliance
- D) Twin block Crozat appliance
- E) Magnetic Twin block appliance
- F) Twin Block with a Spinner
- G) Fixed Twin Block
- H) Reverse twin block
- I) Twin block hybrid appliance

#### ➤ **Bite Registration:**

The Exactobite or Project Bite gauge is designed to record a protrusive bite for construction of twin block. The exactobite is a horse shaped device with anterior handle with various groves designed for accurate control in registering a protrusive bite and can be used with either wax or silicone bite registration materials. The exactobite are available in two different colors: blue or white and register 2mm or 4mm vertical clearance between incisal edges of upper and lower incisors respectively. The incisal portion of the bite gauge has three incisal grooves on one side that are designed to be positioned on the incisal edge of the upper incisor and a single groove on the opposing side that engages the incisal edge of the lower incisor. The appropriate groove in the bite gauge for bite registration is selected depending on the ease with which the patient can posture the mandible forwards<sup>44</sup>.

It is aimed at single registration of edge to edge with 2 mm interincisal clearance for an overjet of up to 10 mm. If overjet is more than 10 mm, then initial bite is taken with 7-8 mm advancement, then later the appliance is reactivated.

#### **Vertical activation**

The blocks should be of average 5 mm thickness in first premolar or first deciduous molar (i.e. a 2 mm interincisal distance) so as to ensure that the patient does not posture out of the appliance when the mandible is in rest position.

In case of an anterior open bite, greater interincisal distance is required at an average of around 4-5 mm<sup>16</sup>.

#### ➤ **Rationale for selection**

Class II div 1 malocclusion with well aligned upper and lower arches, having overjet of 10-12 mm with a deep bite. Patient should be growing actively preferably should be in pubertal growth spurt and have a positive VTO. To overcome the limitations modification have been introduced.

#### ➤ **Limitations**

- Proclination of the lower incisors.
- Development of posterior open bites.
- Poor patient cooperation.

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