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# **Functional Appliance for CL II Malocclusion**

A project Submitted to  
The College of Dentistry, University of Baghdad, Department of  
Orthodontic in partial Fulfillment for the Bachelor of Dental Surgery

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### **Certification of the Supervisor**

I certify that this project entitled "**Functional Appliance for CL II Malocclusion**" was prepared by the fifth-year student Naqaa Khaled Abed under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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## **Dedication**

I dedicate this project to my mother and my sister ,dedicate my soul father , and friends for their love&support along this journey...

## **Acknowledgements**

First and foremost, I would like to extend my full thanks and reverence to Allah for His support and source of strength and the reasons for all my success.

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## INTRODUCTION

The term functional appliance refers to a variety of orthodontic appliances designed to induce a change in activity of the various muscle groups that influence the function and position of the mandible in order to transmit forces to the dentition and the basal bone. Altering the sagittal and vertical mandibular position generates these changes in muscular forces and results in orthopedic and orthodontic changes(**Bishara ,1989**) . The term „functional appliance“ is used, because it was once believed that these appliances corrected abnormal function around the dentition, leading to a change in growth response. Although we now believe that function probably has little to do with the treatment effect(**Dolce, .2007**).There are many different types of functional appliances, but most work by the principle of posturing the mandible forwards in growing patients. They are most effective at changing the antero posterior occlusion between the upper and lower arches, usually in patients with a mild to moderate Class II skeletal discrepancy. They are not as effective at correcting tooth irregularities and improving arch alignment, so treatment often involves a phase of fixed appliances (**Tulloch, 2004**).

Myofunctional appliances utilize forces of the orofacial musculature to modify or change the direction of growth in a still-growing patients (**Kumar et al., 2021**).

In this project we“ll be viewing the different types of myofunctional and orthopedic appliances, along with other treatment modalities that can be used in growing patients for early correction of skeletal/dental components of class II malocclusion.

## **AIMS OF THE STUDY**

- Evaluate different types of functional and orthopedic appliances used to correct class II malocclusion in growing patients.
- Identify the ideal treatment time and case selection for treatment with class II functional appliances.
- Recognize the positive and negative factors of early orthodontic intervention in class II malocclusion.

# **Chapter One**

## **Review Of Literature**

# Chapter One

## Review Of Literature

### 1.1. Defination of Functional appliances

Functional appliances utilize, eliminate, or guide the forces of muscles of mastication, tooth eruption, and growth to correct a malocclusion( **Dolce,2007**).

### 1.2 Indications

- Immediate alteration of the profile, smile and facial expressions that helps to improve psychologic problems.
- Improvement of skeletal disharmony.
- Periodontal problems caused by deep overbite can be prevented.
- Traumatic injuries on upper incisors have less opportunity to occur.
- Sucking habits immediately disappear.
- Labial competence is established and mastication is improved.
- Oropharyngeal space is increased, as well as space for the tongue.
- Functional problems like mouth breathing and speech difficulties
- To correct cII Malocclusion and cIII Malocclusion(**Ritto , 1998**).

### 1.3 Contraindications

- CL II skeletal by maxillary prognathism
- Vertically directed grower
- Labial tipping of lower incisors Crowding (**Laura Mitchels,2007**).

## **1.4 Keys to normal occlusion**

Described an ideal occlusion rather than a normal occlusion; the ideal occlusion described by Angle and Andrews serves as a paragon of occlusal excellence that gives clinicians a treatment goal to which they can aspire (**Bishara, 2001**):

1. Molar relationship: The mesiobuccal cusp of the upper first molar occludes with the groove between the mesiobuccal and middle buccal cusps of the lower first molars and the distobuccal cusp of the upper first molar contacts the mesiobuccal cusp of the lower second molar.
2. Crown angulations: (Mesiodistal tip) All teeth crowns are angulated mesially.
3. Crown Inclination: Inclination refers to the labiolingual or buccolingual inclination of the crown of the teeth.
4. Rotation: Rotations are not present.
5. Spaces: Spaces are not present.
6. Occlusal plane: is either flat or slightly curved.

## **1.5 CL II Malocclusion**

### **1.5.1 Classification of Class II Malocclusions A.Skeletal**

#### **Class II Malocclusions:**

This term indicates that the Class II malocclusion is resulting from an anteroposterior disproportion in size or discrepancy in position of the jaws rather than malposition of the teeth relative to the jaws (retrusion of mandibular teeth or protrusion of maxillary teeth or both) which is commonly associated with Class II dental malocclusions. Typically, some natural dental compensation is observed in

the presence of the skeletal discrepancy. This compensation tends to make the dental discrepancy less severe than the skeletal discrepancy and is exhibited most often as protrusive mandibular incisors and less frequently as retrusive maxillary incisors. Another typical compensation is a maxillary dental arch that is narrower or constricted than normal because it is in occlusion with a narrower part of the mandibular dental arch. This transverse dental compensation is characterized further by mesiolingual rotation of the maxillary first molars. Skeletal Class II malocclusions can be subdivided conveniently into those comprised of either mandibular deficiency or maxillary excess or combination of both skeletal discrepancies (**Spalding, 2001**).

**B. Dental Class II Malocclusions:** Depending on Angle's classification system for malocclusions which describes anteroposterior relationships of the permanent first molars and categorized the Class II malocclusions as having a distal relationship of the mandibular teeth relative to the maxillary teeth of more than one-half the width of the cusp. Angle divided the Class II malocclusions based on the inclination of the maxillary central incisors into :

- Class II Division 1 malocclusions: are described as having labially inclined maxillary incisors, an increased overjet with or without a relatively narrow maxillary arch and overbite range from a deep to an open bite(**Proffit, 2007**).

(Figure 1).

The Class II Division 2 malocclusions: are described as having excessive lingual inclination of the maxillary central incisors overlapped on the labial by the maxillary lateral incisors (Fig 2). In some cases, both the central and the lateral incisors are lingually inclined and the canines overlap the lateral incisors labially. The Class II Division 2 malocclusion is often accompanied by a deep

overbite and minimal overjet. In cases with extreme overbite, the incisal edges of the lower incisors may contact the soft tissues of the palate. In a few Class II Division 2 cases, the mandibular labial gingival tissues may be also traumatized by the lingually inclined maxillary incisors, particularly in the absence of an overjet. With Class II Division 1 or 2 malocclusions, the molar relationship may be unilateral or bilateral. Unilateral cases are classified as a “subdivision” of the affected side (**Bishara, 2006**).

### **Angle’s classification**

(**Mitchell and Carter, 2000**) Stated that Angle’s classification was based upon the premise that the first permanent molars erupted into a constant position within the facial skeleton, which could be used to assess the anteroposterior relationship of the arches.

Angle describes three groups:

- Class I or neutroclusion: The mesiobuccal cusp of the upper first molar occludes with the mesiobuccal groove of the lower first molar; discrepancies of up to half a cusp width either way were also included in this category.
- Class II or distocclusion: The mesiobuccal cusp of the lower first molar occludes distal to the class I position, this is also known as a post normal relationship and subdivided into:
  - Class II division 1: Where the maxillary incisors are proclined
  - Class II division 2: Where the maxillary incisors are retroclined
- Class III or Mesiocclusion: The Mesiobuccal cusp of the lower first molar occludes mesial to the class I position.

## **Incisor classification**

The British Standards Institute Classification of Incisor Relationship is as the following (**BS4492, 1983**):

- Class II: The lower incisor edges lie posterior to the cingulum plateau of the upper incisors; there are two divisions to Class II malocclusion:
  - o Division 1: The upper central incisors are proclined or of average inclination with an increased overjet.
  - o Division 2: The upper central incisors are retroclined.

## **Canine's Classification**

Class II: Distal slope of the maxillary canine occludes or contacts the mesial slope of the lower canine. (**Siegel,2002**)

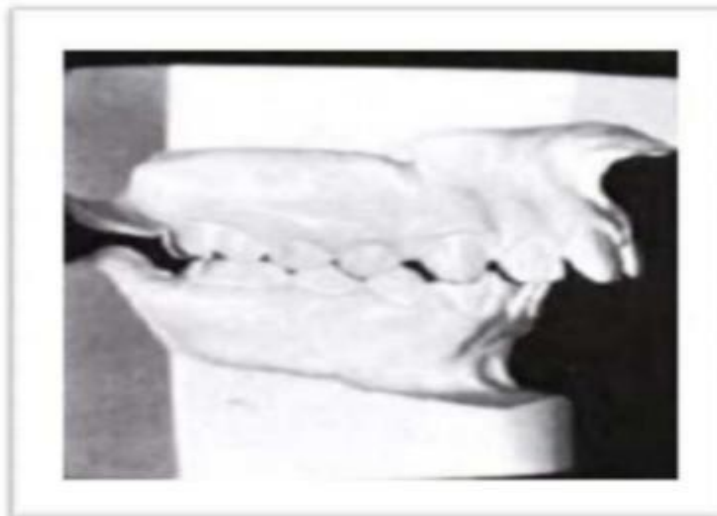


Figure 1: Class II Division 1 Malocclusion with proclined maxillary central incisors (**Proffit, 2007**).





**Figure 2:** Class II Division 2 Malocclusion with retroclined maxillary central incisor teeth(Bishara, 2006)

## **1.6 Appliances used for treatment of CL.II**

The options for correction of class II malocclusion in growing patients consist of two principal categories: intraoral appliances and extra oral appliances .

### **1.6.1 Intra-oral Appliances**

#### **1.6.1.1 Removable intra-oral appliances**

##### **A-Activator**

Elements: Labial bow and retention thorns 0.8 mm spring hard

Function: Mandibular advancement and opening of the vertical dimension

Description: By this passive and loose appliance functional stimuli are transmitted to the bone tissue via muscle activity for example during swallowing.



Figure 3: Activator Appliance (**Ursula Wirtz,1984**)

The classical activator according to Andresen and Häupl is still one of the main appliances for changing the position of the mandible and for the opening of the vertical dimension. It can also be used for the lateral side shifting of the lower jaw. This appliance, originally called Monobloc, does not have any elements that can be activated and is designed as delicate as possible. The retention thorns only anchor the molars maximally, not the appliance, whose ideal function is as an exercise device( **Ursula Wirtz, 1984**).

### **Indications**

- a. Class I malocclusion with deep bite.
- b. Class I malocclusion with open bite.
- c. Class II division 1 malocclusion.
- d. Class II division 2 malocclusion after aligning the incisors.
- e. Class III malocclusion (reverse activator).
- f. Serves as space regainer in mixed dentition where acrylic is extended into the space of missing tooth.

g. Used for treating patients who snore during sleep(Bishara & Ziaja ,1989).

### **Contraindications ( Bishara & Ziaja ,1989).**

- a. Crowded arch.
- b. Increase lower facial height.
- c. Extreme vertical mandibular growth.
- d. Severe proclined lower incisors.
- e. Retroclined upper incisors.
- f. Crossbite tendency.
- g. Gross intra-arch irregularities.

### **Advantage ( Bishara , Ziaja ,1989).**

- Appointments can be delayed over 2months .
- Tissues not injured .
- Worn at night time only .
- Helps to eliminate abnormal habits .
- Oral hygiene is maintained.

### **Disadvantages ( Bishara , Ziaja ,1989).**

- Fully rely on patient cooperation .
- Little value in cases with crowding .
- Force on individual tooth can not be controlled .

- Little or no response in older patients .
- Bulky and uncomfortable

## Timing of treatment

The patient is asked to wear the activator at least 10-12 hours in a day at the beginning, and few hours in a day when patient is used to the appliance .( **Bishara , Ziaja RR.,1989**)

## B-Bionator

The bionator was originally designed to modify tongue behaviour, using a heavy wire loop in the palate. We now know that the tongue is unlikely to be the cause of the increased overjet, but the lack of acrylic in the palate makes it easy to wear. A buccal extension of the labial bow holds the cheeks out of contact with the buccal segment teeth, allowing some arch expansion( **Kelly, 1997**).

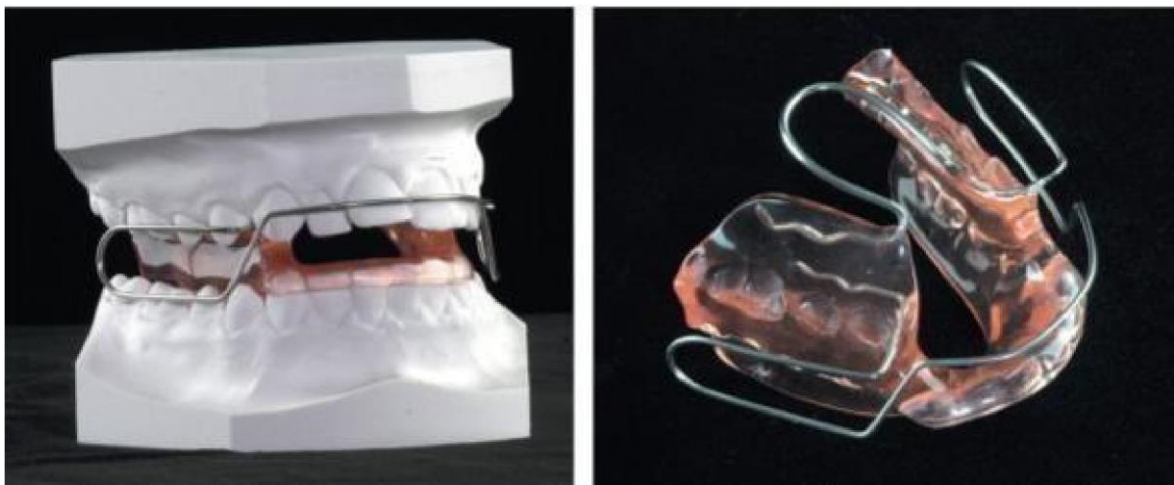


Figure4: Bionator Appliance(**Kelly ,1997**)

## Indication

1. Class II malocclusion.
2. Class III malocclusion.
3. Deep bite cases.
4. Open bite cases.

### **Timing of treatment**

Was observed for a period of 13 months (range 10 months to 2 years 1 months) The patient were instructed to wear the appliance 24 hours a day with exception of eating and playing. (**Bolmgren ,1986**).

### **C-Twin Block Appliance**

The twin block appliance was introduced by a Scottish orthodontist, William Clark,<sup>127</sup> in 1977 as a two-piece or split activator using separate maxillary and mandibular appliances with occlusal acrylic portions that serve as inclined guide planes and bite blocks to determine the extent that the mandible is postured downward and forward Although this appliance provides for more range of mandibular movement and is adjusted and modified more easily than other functional appliances, it has a greater tendency to protract mandibular incisors. The twin block appliance also can have active components incorporated similar to the other removable tooth borne functional appliances(**Clark , 1982**).

## **Indications ( Dolce,2007).**

- Mandibular retrognathia.
- Mesofacial or Braquifacial.
- Dental Class II, 1; Dental class II,
- Deep bite, open bite.
- Growing patient.

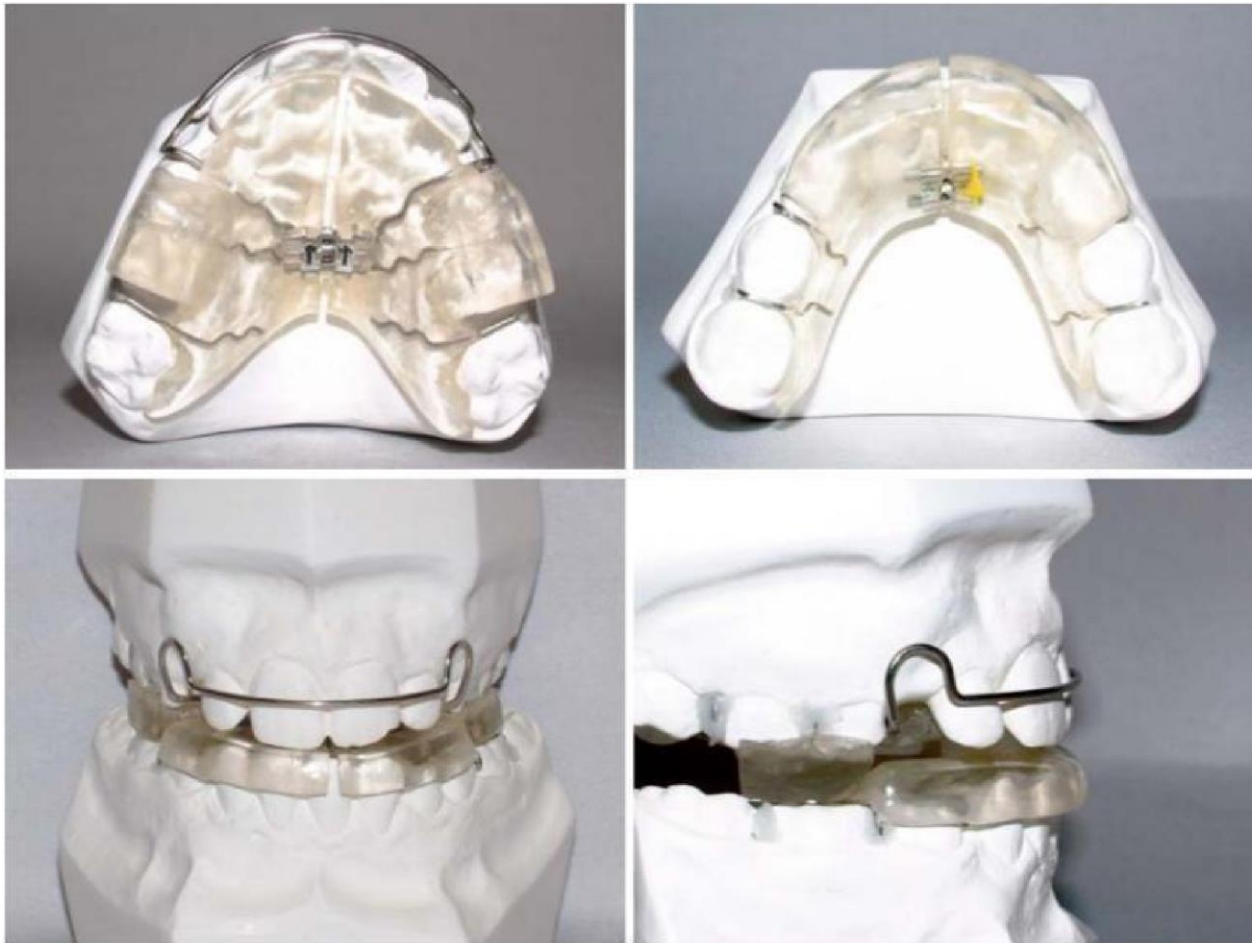


Figure5: Twin block Appliance (Clark,1982)

### **Contraindications**

Residual posterior lateral open bites at the end of the functional phase. This is seen particularly in cases initially presenting with a deep overbite. The posterior teeth are prevented from erupting by the occlusal coverage of the bite blocks. (Dolce,2007).

### **Timing of treatment**

Full time wearing of twin block appliance, including during eating and the duration of treatment usually is about (9-12) months(Clark ,1988).

### **D-Frankle Appliance**

The other type of functional appliance is the removable tissue-borne one that is represented by only one appliance . Named the functional corrector or functional regulator by its German developer, Rolf Frankel this appliance was created in an attempt to minimize unwanted tooth movement and to re contour the facial soft tissue adjacent to the teeth as well as posture the mandible downward and forward. A mandibular lingual acrylic flange positions the mandible forward . Whereas mandibular labial acrylic lip pads and large acrylic buccal shields hold the lip and cheek pressure away from the teeth and provide soft tissue support for the appliance. These acrylic components are held together with a wire framework that includes a labial bow and trans palatal wire. This appliance has a greater influence on arch expansion than the more traditional functional appliances without active expansion screws(**Frankle ,1969**).

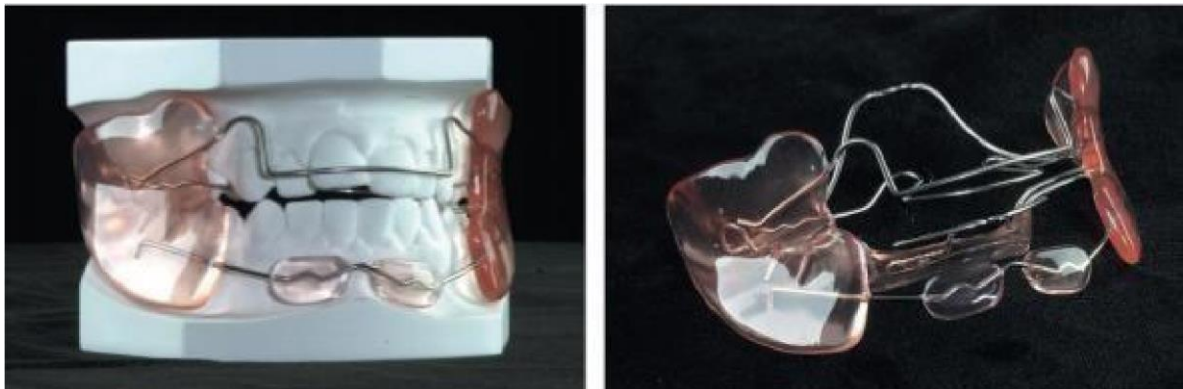


Figure6: Frankle Appliance (**Frankle , 1969**)

### **Indications (Falck&Frankle,1989)**

- Treating Angle's class I malocclusion with deep bite.
- Treating the cases of Angle's class II division I malocclusion where overjet does not exceed 5 mm.



- Treating the cases of the Angle's class II division 1 malocclusion where the overjet is more than 7 mm.
- Treating cases of Angle's class II division 1 malocclusion and class II division 2 malocclusion.
- For Angle's class III malocclusion .
- For treating bi maxillary protrusion and open bite.
- It is used with headgear.

### **Timing of treatment**

Middle or late mixed dentition. Duration of treatment is usually 18-24 months of full time appliance wear( **Falck , Frankel ,1989**).

#### **1.6.1.2 Fixed functional appliances**

A major problem with any removable functional appliance is compliance, because they do not work unless they are worn for the required number of hours each day .This can be overcome by the use of a fixed functional appliance. The most wellknown and popular fixed functional appliance is the Herbst appliance( **Pancherz H,1982**).

#### **A-Herbst Appliance**

Is a fixed intermaxillary appliance known to be an effective device for this purpose. Emil Herbst developed his appliance in the early 1900s consists of a bilateral telescopic mechanism attached to orthodontic bands on the maxillary first permanent molars and mandibular first premolars, which maintains the mandible in a continuous protruded position or, in other words ,in a continuous anterior jumped position(**Langford,1981**). Bands can also be placed on the first maxillary premolars

and first mandibular permanent molars, while a lingual bar is used to connect the maxillary or mandibular premolars with the molars.

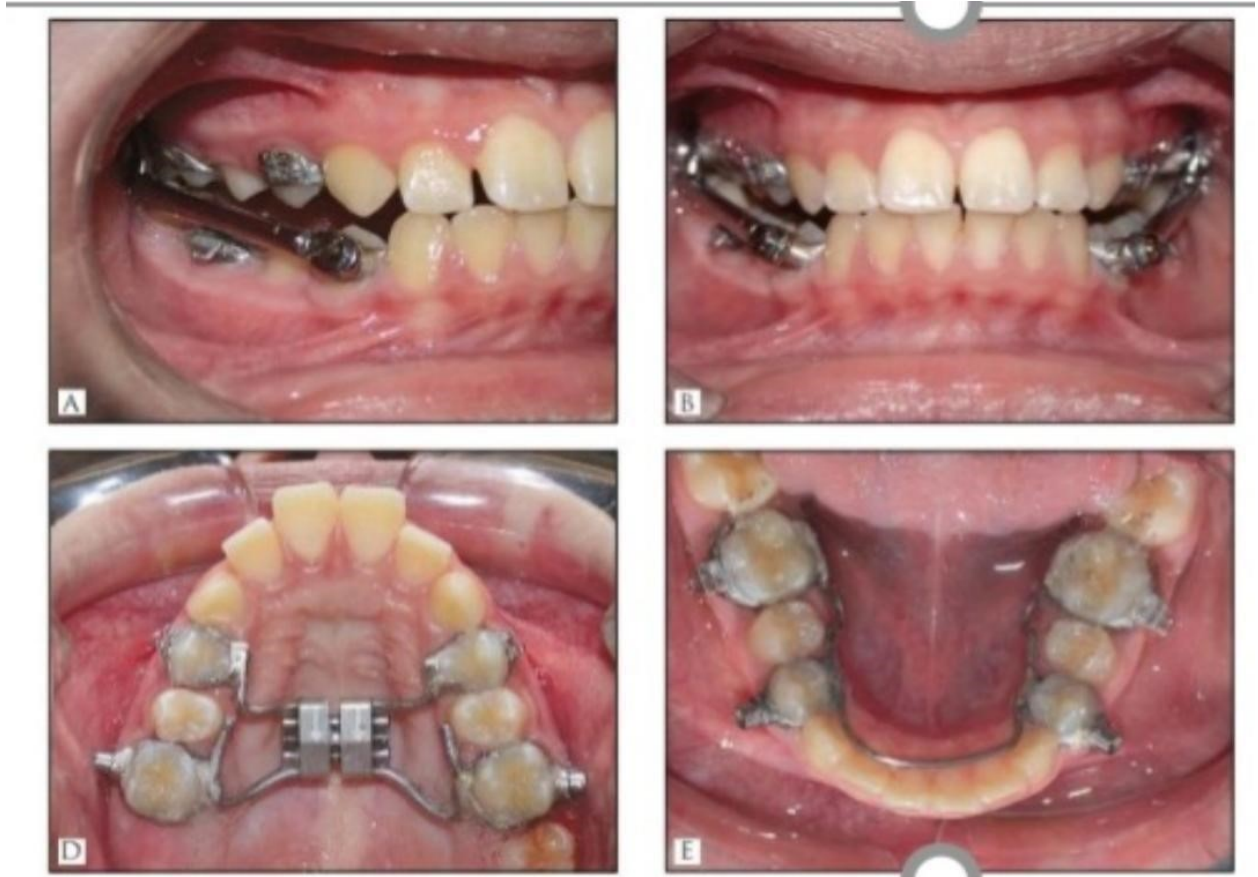


Figure 7: Herbst appliance (Langford,1981)

### Indications (Paulsen,2000)

- Noncompliance treatment of Class II skeletal discrepancies, mainly in young patients.
- In high angle patients due to the increase in sagittal condylar growth.
- In patients with deep anterior overbite.
- In cases of mandibular midline division .

- In mouth breathers and in patients with anterior disk displacement.
- Most suitable for the treatment of Class II malocclusion in patients with retrognathic mandibles and retroclined maxillary incisors.
- Used in patients suffering from obstructive sleep apnea.

### **Contraindications (Rogers,2002)**

- Unfavorable growth, unstable occlusal conditions, and oral habits that persist after treatment are potential risk factors for occlusal relapse
- In autistic children and in patients with severe bruxism.

### **Advantage (Pancherz,1985)**

- Is able to work 24 hours a day. In addition, the duration of treatment is relatively short (6–8 months), while the removable functional appliances usually require 2– 4 years.
- The short and standardized treatment duration, the easy acceptance, and patient tolerance.
- Improvement in the patient's profile immediately after placement.
- The maintenance of good oral hygiene.

### **Disadvantages (Pancherz,1982)**

- Include anchorage loss of the upper (diastemas between the upper canines and first premolars) and lower teeth (proclination of the lower incisors during treatment .
- Chewing problems during the first week of the treatment, soft tissue impingement, breakage or distortion of the appliance, bent rods, loose or broken bands some cases broken or loose screws.

## **Timing of treatment**

The Herbst appliance is fixed to the teeth and thereby is able to work 24 hours a day. In addition, the duration of treatment is relatively short (6–8 months), while the removable functional appliances usually require 2–4 years, thus making the Herbst appliance suitable for postpubertal patients and young adults( **Hans U. Paulsen,2006**).

## **B-The Jasper Jumper Appliance**

Consists of two parts: the force module and the anchor parts. The force module is flexible and consists of a stainless steel coil spring that is attached to stainless steel caps at both ends. The spring core is surrounded by an opaque gray polyurethane material that covers part of the anchoring ends(**Weiland ,1997**). original design did not have this overlap, which led to frequent breakage of the modules. The modules are designed for use on the right or the left side of the arch. They are available in seven lengths, ranging from 26 to 38 mm in 2 mm increments. The sizes are marked on the maxillary end of the module( **Blackwood,1991**).



Figure8: The Jasper Jumper Appliance (**Blackwood , 1991**)

### **Advantages (Stucki&Invervall,1998)**

- Ease of insertion of activation .
- It generates intrusive forces on molars and incisors.

### **Disadvantages (Stucki&Inverall,1998)**

- It is more prone for breakage.
- Lack of force when the mouth is held open slightly, such as in sleeping mouth breather.

### **Indications**

Used in correction CL II Malocclusion evaluated the craniofacial changes.

(**Cope,1994**).

## **1.6.2Extra-oral Appliances**

### **A- The headgear Appliance**

Headgear intended for use in growth modification is designed to deliver an adequate extra oral orthopedic force to compress the maxillary sutures, modifying the pattern of bone apposition at these sites. Although posterior and superior extra oral orthopedic forces primarily are intended to inhibit anterior and inferior development of the maxilla, they also inhibit mesial and occlusal eruption of the maxillary posterior teeth. The goal of treatment is for this restriction of maxillary growth to occur while the mandible continues to grow forward an adequate amount to "catch up" with the maxilla.( **Firouz ,1992**).

### **Types of Headgears**

The first and most common type of headgear is the facebow, a large-gauge wire framework consisting of an outer bow for the extraoral attachment soldered to an

inner bow that attaches intraorally in tubes attached to the maxillary first permanent molar bands(**Brown ,1978**) The second type of headgear, commonly referred to as a J-hook headgear, is two separate, curved, largegauge wires that are formed on their ends into small hooks, both of which attach directly to the anterior part of the maxillary arch wire This type of headgear is more commonly used for retraction of canines or incisors rather than orthopedic purposes .The J-hook headgear is limited to use only with a maxillary fixed appliance with a continuous arch wire. It is preferable if all the maxillary teeth are incorporated in the fixed appliance,(**Firouz,1992**).



Figure9: The headgear Appliance (**Proffit ,1999**)

### **Indications**

1. Growth modification: Headgears can be used to treat a variety of skeletal class II problems. However, ideal circumstances to use the extraoral orthopedic effect of headgears is when skeletal class II malocclusion is caused by maxillary protrusion (anteroposterior excess of maxilla) with normal mandibular skeletal and dental

morphology, and when there is continued active mandibular growth in a forward direction.

2. For distalization of maxillary molars.
3. To reinforce intraoral anchorage.( **Poulton,1964**)





## **Chapter Two**

### **Discussion**

## **Chapter Two**

### **Discussion**

#### **2.1 Discussion**

Treatment of class II malocclusion in growing subjects is a challenging part of contemporary orthodontic practice. Many treatment approaches can be found in the literature regarding orthopedic and orthodontic treatment in class II malocclusion including intraoral and extra-oral appliances such as Activator and Bionater and Twin Block and Frankle and Jasper Jumper and headgear Appliances. The selection of an appropriate type of appliance and mode of treatment is highly dependent on accurate clinical assessment of the condition which includes: The age, growth, patient's compliance, cause of the malocclusion and, the severity of the skeletal problem. All of these along with the radiographical investigations (e.g. cephalometric analysis) are combined together in order to come up with the most suitable treatment approach.

Class II malocclusion is considered the most frequent problem presenting in the orthodontic practice, affecting 37% of school children in Europe and occurring in 33% of all orthodontic patients in the USA. Class II malocclusion may also involve

craniofacial discrepancies, which can be adjusted when patients are adolescent. The usual treatment options in growing patients include extraoral headgears, functional appliances and full fixed appliances with intermaxillary elastics and/or teeth extractions. In adults, moderate Class II malocclusion can be corrected with fixed appliances in combination with intermaxillary elastics and/or teeth extractions, and severe malocclusion with fixed appliances and orthognathic surgery. While the efficiency of these conventional treatment modalities has improved, particularly in growing patients, most require patient cooperation in order to be effective, which is often a major problem (**Moschos ,2015**) .

Many treatment options are available for the correction of Class II malocclusion, depending on what part of the craniofacial skeleton is affected. In general, treatment of Class II malocclusion can include growth modification in terms of mandibular advancement (to treat patients with mandibular skeletal retrusion), maxillary retraction (to treat patients with maxillary skeletal protrusion), and maxillary molar distalization (to treat patients with maxillary dentoalveolar protrusion). Treatment approaches include the use of functional or removable appliances, extraoral traction by means of headgears, and fixed appliances combined with Class II elastics. Successful orthodontic treatment using these modalities often relies heavily on the patient's willingness to wear the suggested appliance. For example, regarding the wearing of headgear, apart from the discomfort and the extraoral appearance of the patient (factors that can reduce their cooperation), there is also a risk of the headgear causing eye and facial tissue damage. In addition, the elastic cervical strap puts a nonphysiologic strain on the cervical spine and on the neck muscles and in some patients it causes irritation of the skin(**Moschos ,2015**).

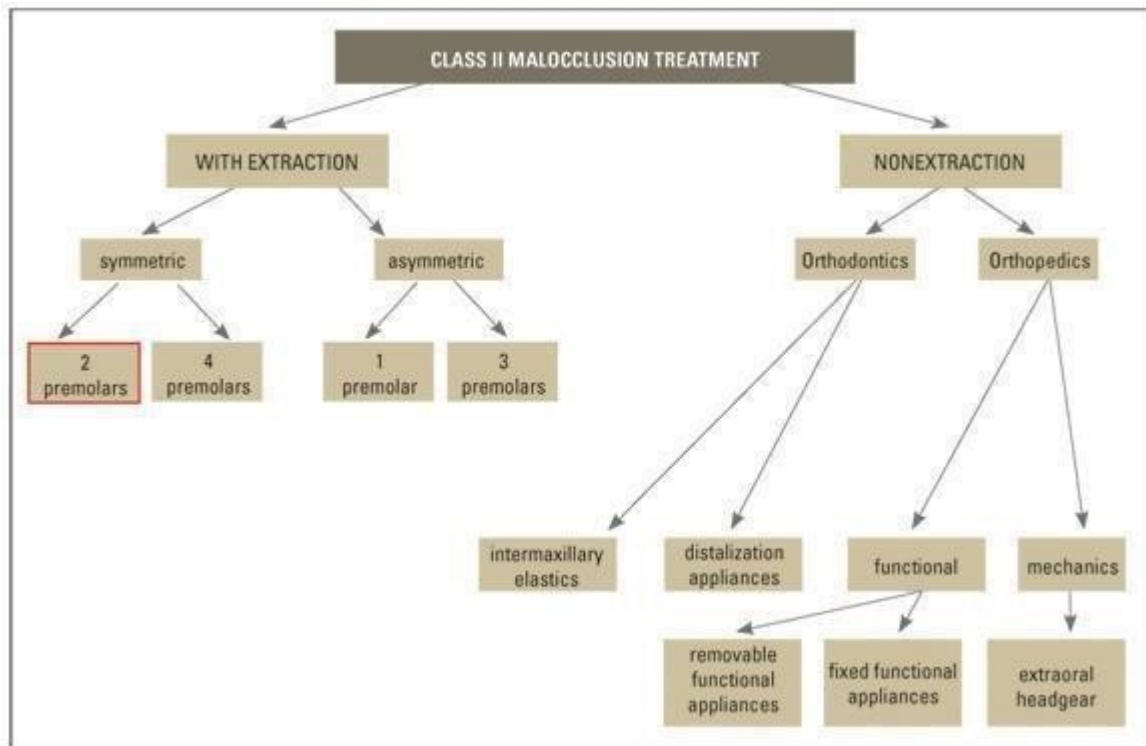


FIGURE 1 - Treatment protocols and clinical resources frequently employed to correct Class II malocclusion.

Figure 10 :Treatment of class II malocclusion ( DE FREITAS,2004)

The main objective of treatment CL II malocclusion :

- Correction of proclination of upper and lower anteriors.
- Reduction of overjet and overbite.
- Decrowding and arch alignment.
- Correction of midline.
- Achieve Class I molar and canine relationship.
- Enhance facial esthetics.

Therefore, Myofunctional appliances can be used for early correction of class II malocclusion in growing patients and according to their effects on dental/skeletal tissues as follows:

- In cases of open bite and deep bite successfully can be treated with Activator and Bionater Appliances .
- In cases of skeletal class II malocclusion due to mandibular deficiency can be treated with Twin Block Appliance.
- In cases of skeletal CL II malocclusion due to maxillary deficiency can be treated with Frankle Appliance and headgear.



## **Chapter Three**

### **Conclusion & Suggestions**

# **Chapter Three**

## **Conclusion & Suggestion**

### **3.1. Conclusion**

Myofunctional appliances for class II malocclusion include different types of devices and their new modifications that have proved their efficacy in the early management of growing class II patients. However, the decision of choosing a specific appliance over another is highly dependent on the origin of malocclusion and the proper evaluation of each case by the orthodontist.

All the appliances described in this paper can be useful when the clinicians use them in correct manner.

### **3.2. Suggestions**

Some of the appliances mentioned in this project have little based evidence in clinical trials, so further research and investigations are recommended to prove their efficacy.



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