

# FIXED FUNCTIONAL APPLIANCE THERAPY FOR CORRECTION OF CLASS II MALOCCLUSION - A REVIEW OF THE AVAILABLE TECHNIQUES

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## ABSTRACT

The correction of Class II malocclusions by use of headgear, elastics, or removable functional appliances often fail to attract patient cooperation to a very significant extent, which has long been recognized as an important factor in outcome of orthodontic treatment. Failure to adhere to prescribed schedules of appliance wear; result in slow treatment response or no response at all. Fixed functional appliances minimize the need for such co-operation and attempt to maximize the predictability of results. This article reviews and describes the types of appliances used, and their mode of action-based on the current available research.

**Keywords:** Fixed Functional Appliances, Review.

## INTRODUCTION

Successful orthodontic treatment relies heavily on patient co-operation. Unfortunately due to their bulk and inconvenience, the removable functional appliances fail to attract patient cooperation to a very significant extent, which has long been recognized as an important factor in outcome of orthodontic treatment. Failure to adhere to prescribed schedules of appliance wear; result in slow treatment response or no response at all. To overcome these problems with the removable appliances, the fixed functional appliances were developed. Placing the treatment outcome under the control of the orthodontist is likely to produce more predictable results.

## HERBST APPLIANCE



At the international dental congress in Berlin in 1909, Herbst presented a fixed bite jumping device called Scharnier, or joint. In 1934, Herbst and Schwartz presented a series of articles on their experiences with the appliance. In 1977, Pancherz resurrected the Herbst appliance for use as an experiment tool in clinical research<sup>1</sup>. In the October 1979 issue of the American Journal of Orthodontics, Pancherz called attention to the possibilities for stimulation of mandibular growth by means of the herbst appliance<sup>2</sup>. The Herbst appliance consists of a bilateral telescopic mechanism that maintains the mandible in a protruded position. The Herbst can be a banded, cast, acrylic splint or cantilever bite jumper. The cast appliance and bite jumper designs are cemented and worn full time negating the need for co-operation.

## Effects of the Herbst Appliance

The Herbst appliance can have a restraining effect on maxillary growth and a stimulating effect on mandibular growth. Sagittal growth may be increased whereas the vertical growth is unaffected by treatment. At least 52 percent of class II correction comes from dentoalveolar changes with the rest resulting from mandibular

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growth.<sup>2</sup> Dento-alveolar changes include lower incisor proclination and maxillary molar distalization and intrusion. The changes are similar to those produced by high pull headgear.<sup>3</sup> Vertically, the overbite is reduced. This occurs by intrusion of lower incisors and enhanced eruption of lower molars. The long-term effect on mandibular growth is uncertain and may only have a short term effect on skeletal growth pattern<sup>4</sup>. Hansen et al. found that the appliance did not have any adverse effects on the temporomandibular joint (TMJ)<sup>5</sup>.

The Herbst appliance is indicated in Class II division 1 growing patients with well-aligned arches, post-adolescent patients, mouth-breathers, uncooperative patients, and those that do not respond to removable functional appliances. It can also be used as part of a two-phase treatment, the first being the orthopaedic phase and the second orthodontic phase involving correction of crowding and alignment with fixed appliances. The optimal time for treatment is at or just after the pubertal growth spurt, and when the permanent dentition is established. Because of shedding of primary molars it is not recommended in primary dentition. The appliance is prone to breakage and is limited to use in patients who can tolerate proclination of mandibular incisors.

#### Indications

1. Dental Class II malocclusion.
2. Skeletal Class II mandibular deficiency.
3. Deep bite with retroclined mandibular incisors.

#### Contra-Indications

1. Cases predisposed to root resorption.
2. Dental and skeletal open bites.
3. Vertical growth with high maxillomandibular plane angle and excess lower facial height.

#### JASPER JUMPER



The Jasper Jumper consists of two vinyl coated auxiliary springs fitted to fully banded upper and lower fixed appliances. The flexible springs are attached to the maxillary first molars posteriorly and to the mandibular archwire anteriorly with the springs resting in the buccal sulcus. The springs hold the mandible in a protruded position and produce rapid inter-arch changes similar to those produced by the Herbst appliance. The Jasper Jumper can be used for patients with Class II malocclusions with deep bites. Cope et al. quantified the action of the Jasper Jumper showing that the majority of the action was due to dental, rather than skeletal change, although the maxilla underwent significant posterior displacement and the mandible clockwise rotation.<sup>6</sup>

The Jumper springs, are available in a number of pre made sized, paired left and right. They are attached to the maxillary first molar headgear tube with a soft wire with a ball on one end. The amount of mandibular advancement is adjusted by lengthening or shortening the maxillary connection wire. The jumper mechanism fits over the lower arch wire. A lateral bayonet bend is placed distal to the lower canines and usually the brackets on the lower first premolars are removed. A jig is available which avoids the need for the bayonet bend and removing the bracket on the first premolar. A small acrylic ball is placed adjacent to the bayonet bend and then the archwire is placed through the hole on the anterior portion of the jumper.<sup>7</sup>

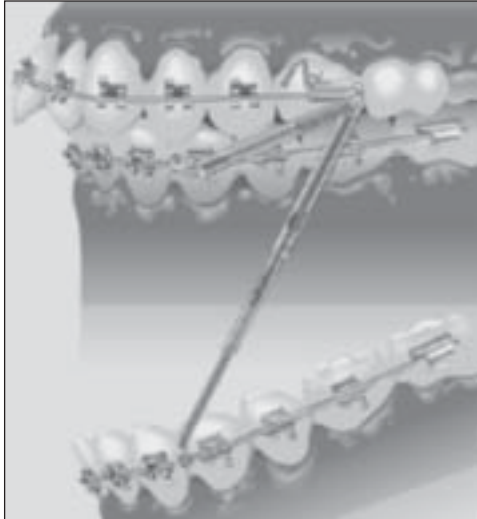
A heavy archwire with lingual root torque is used in the mandibular arch to enhance lower anchorage. The archwire is tied back to prevent lower incisor proclination. When fully extended, the Jasper Jumper produces an anterior positioning of the lower jaw in a manner similar to the Herbst appliance, but with more flexibility. Usually, 6-9 months of appliance wear is necessary in order to correct a mild Class II problem in patients with some remaining growth. Additional treatment time may be required in patients with more severe problems.

#### The Adjustable Bite Corrector

The Adjustable Bite Corrector appliance functions in a similar way to the Herbst appliance and the Jasper Jumper. The advantages include

universal left and right sides, an adjustable length, stretchable springs, and easy adjustment of the attachment parts. No long-term studies have been carried out on this appliance in the present literature to date.

### The Eureka Spring:



Devincenzo (1997) described the Eureka Springs which is a fixed inter-maxillary force delivery system.<sup>8</sup> It is esthetically acceptable due to small size and lack of protuberances into the buccal vestibule. It avoids tissue irritation and promotes good oral hygiene. The main component of the spring is an open wound coil spring encased in a telescoping plunger assembly. The springs rest in the buccal sulcus and attach posteriorly to headgear tubes on the upper first molars, and anteriorly to the lower archwire distal to the cuspids. A triple telescoping action allows opening of the mouth to 60mm before disengaging. The spring exerts 16g for every millimetre of ram compression. The appliance is designed to be used in conjunction with fully banded upper and lower fixed edgewise appliances with heavy rectangular lower arch in place. Labial root torque to the lower incisors needs to be applied to match the anchorage requirements and buccal root torque should be applied to the upper first molars. The appliance should only be used in conjunction with a transpalatal bar. The mechanics of the appliance has the opposite effect to the of Class II elastics in that it acts to intrude both the lower incisors and the upper molars. The effects of this appliance are entirely dentoalveolar, and no orthopaedic or

bite jumping effects are claimed by the clinicians who have developed the appliance. The dentoalveolar effects achievable with this appliance include maxillary molar distalization or advancement of the lower anterior teeth in Class II cases.

### Indications

1. Dental Class II malocclusion.
2. Deep bite with retroclined mandibular incisors.
3. Deep buccal overbites or posterior crossbites.
4. Extremely tight buccal musculature.
5. Minimal buccal vestibular space.

### Saif Springs

These are long nickel-titanium closed coil springs that are used to apply Class II inter-maxillary traction when fully banded fixed appliances are in place. The springs are tied in place with steel ligatures and are worn in place of inter-maxillary elastics. The springs are available in to lengths of 7 and 10mm. No longitudinal research studies on this auxillary are available in the literature to date. The prerequisites for successful treatment are as follows:

- Prior correction of deep bites;
- Stabilization of each arch with a large rectangular archwire;
- Direction of force as horizontal as possible;
- Sufficient resistant torque (lower incisor lingual crown torque);
- Proper placement of hooks for spring attachments.

### The Mandibular Anterior Repositioning Appliance



The Mandibular Anterior Repositioning Appliance was introduced in 1998 by Ormco/A company after extensive development and testing by Douglas toll of Germany and James Eckhart of the united states. Figure shows cams made from 0.060 square wire attached to tubes (0.060 square)

on upper first molar bands or stainless steel crowns. A lower first molar crown has a 0.059 arm projecting perpendicular to its buccal surface, which engages the cam of the upper molar. The appliance is adjusted so that when the patient closes, the cam on the upper first molars guides the lower first molars and repositions the mandible forwards into a Class I relationship. There have been no studies to date documenting results achieved with this appliance. The developers of the appliance recommend a 12-month treatment time to achieve a bite jumping or orthopaedic effect. Stabilization of the lower molars is assisted by the fitting of a lingual arch and on the upper arch a transpalatal bar to stabilize the upper molars is placed. This appliance does not require the placement of attachments on teeth other than the first molars.

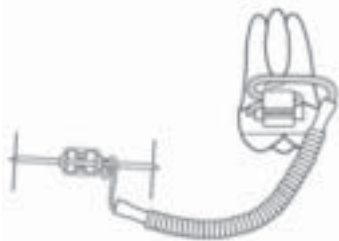
#### Indications

1. Skeletal Class II with mandibular deficiency.

#### Contra-indications

1. Dolichofacial growth pattern.
2. Cases predisposed to root resorption.
3. Dental and skeletal open bites.
4. Vertical growth with high mandibular plane angle and excess lower facial height.

#### The Klapper Super Spring



This appliance is an auxiliary which is fitted to fully banded upper and lower fixed appliance. The appliance consists bilaterally of a length multi-flex nickel-titanium which is bent back on itself attaching to the upper first molar tube and attaching to the lower archwire by means of a helical loop. The springs lie in the buccal vestibule. The effect of the spring is to place a distalizing and intrusive force to the upper first molar. The appliance comes in two sizes, a 27mm primarily designed for extraction cases and 40mm for non-extraction cases. The springs are paired

for left and right sides. The latest design of the spring requires a special oval tube to be fitted to the upper first molars. This facilitates buccolingual adjustment of the springs in the vestibule and aids patient comfort. The springs can be readily removed for adjustment or activation. There have been no studies to date documenting results achieved with this appliance.

#### CONCLUSION

The awareness, popularity and usage of the fixed functional appliances have ever been on an increase although the controversies regarding their potential and modus operandi still linger around unsettled. They neither are the panacea nor the wholesome solution for all malocclusions; nevertheless they definitely are one of the most powerful weapons in the arsenal of the orthodontist that can accomplish things not possible without such appliances. The appliance selected for treatment should be adapted to the type of growth pattern, direction and amount of growth required. Therefore, the diagnosis and case selection are critical for successful treatment.

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