REVIEW ARTICLE

Comparison of Different Skeletal Class II Correctors: A Review

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Abstract

The fixed or removable orthodontic appliances mostly use intrinsic or stored force to move teeth. The force is exerted by the appliance and is dissipated against the teeth and supporting structures. The functional appliances reposition or screen off the aberrant muscle components of the mandi- ble. Despite their relatively long history, there continues to be a debate about their mode of action and effectiveness. The skeletal class II corrector evolved from the various modification of the orig- inal activator. These types of appliances fall in the category, where in the reposition of the mandible is downward and forward, activating the attached and associated muscle. The resultant force cre- ated is transmitted not only to the teeth but also to other structures of maxilla and mandible. Functional appliances have been broadly divided into two categories removable and fixed func- tional appliances. Fixed functional appliances are advised for non-compliant patients and patients nearing growth completion. (2020, Vol. 04; Issue 01: Page 46 - 50)

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Introduction

The functional appliances are designed to al- ter the arrangements of various muscle groups of the mandible, mainly the lateral pterygoid muscle that influences the forward position of the mandible (1). The Functional orthopaedic treatment corrects malocclusion, harmonizes the shape of the dental arch and oro-facial functions (2). The fixed functional appliance can be used sequentially with nec- essary pre-functional orthodontic treatment to reduce the fixed retention period. Fixed functional appliances are normally described as “Non-compliant class II correctors” (3). Alt- hough for a successful treatment patient co- operation is always required.

Historical aspect

In 1879, Kingsley described a bite plate that had an inclined plane with a projection below to hold the lower incisors. His objective was to not protrude the lower teeth but to jump the bite in cases having retruded lower jaw. The term “jumping the bite” has been synon- ymously used today with forwarding the posi- tion of mandible with functional appliances. However, the applied term of “jumping the bite” was meant to let the mandible “jump” into the finally intended occlusion and to in- duce it to stay there. In 1908 Viggo Andersen developed an appliance that was meant for the purpose to serve functional retention and to prevent mouth breathing for Class II Divi- sion I patients for summer vacations. He found that there was an improvement in the patient profile during this period. He and

Haupl later developed the basics of a func- tional appliance. The first fixed functional ap- pliance was introduced by Dr. Emil Herbst at the 5th International Dental Congress in Ber- lin in 1909, Germany. He presented the use of HERBST appliance in a series of articles in the "ZAHNAZTLICHE RUNDSCHAU" (4-6).

Hans Panchez et al (1979) popularized the Herbst appliance with some modification. James J. Jasper (1987) introduced a new type of flexible, fixed tooth-borne functional appli- ance that allowed lateral movements of the mandible. Hans Panchez showed sagittal mandibular growth was accelerated by con-tinuous bite jumping. During treatment the appliance promoted growth in mandibular length. The influence of bite jumping on max- illary growth appeared to be reversible. There- fore, the SNA angle significantly gets reduced during treatment but during the follow-up pe- riod maxillary growth follows the normal ge- netical pattern and the SNA angle returns to almost pre-treatment values. Clements & Ja- cobson (1982) introduced the MARS (Mandi- ble Advancing Repositioning Splint). It is a fixed functional appliance. These appliances force the patient to maintain the mandible in a protruded position for 24hrs a day. The ap- pliance does not hinder the function of the jaw and allows maximum mouth opening and closing as well as mandibular lateral excur- sive movement (3).

Mode of action

The fixed functional appliance is a tooth- borne appliance and exerts its effects via teeth to the underlying bone. It transmits the forces by continuous forward posturing of the lower jaw (4). The mode of action is one or a combi- nation of the following:

a) Mandibular growth induction
b) Maxillary growth restriction
c) Dentoalveolar changes
d) Glenoid fossa relocation
e) Changes in neuromuscular anatomy and function.

The biomechanical effects of the fixed func- tional appliance are such that it moves the entire mandible forward and downward, with maximum displacement observed in the para-symphyseal and mid symphyseal region. The displacement is more pronounced in the den-toalveolar region as compared to the skeletal displacement. All dentoalveolar structures ex-perience tensile stress except for anterior na- sal spine and the maxillary posterior teeth. Maximum tensile stress & Von Mises stresses occurred in the condylar neck and head. The results obtained by the functional appliance in the correction of class II malocclusion con- sist of a combination of orthopedic (30-40 %) and dentoalveolar (60-70%) effects (4).

Figure 1: FEM stress model

Herbst appliance

The Herbst appliance was introduced in 1909 by Dr. Emil Herbst of Germany. In 1982, the Herbst bite-jumping appliance had the most effective result in the treatment of class II malocclusion (6). It stimulates mandibular growth, redirection of maxillary growth and mesial tooth movement (7). The Herbst appli- ance acted as an artificial joint between max- illa and the mandible. It functions as a for- ward displacement mechanism on either side of the jaw, attached to the molar bands. This mechanism positions the mandible anteriorly during functions. The tube of the Herbst ap- pliance is attached to the maxillary perma- nent first molar band and the telescopic plunger to the mandibular first premolar band (8). Anchorage in the upper dental arch consists of lingual or buccal sectional arch- wires connecting the first molar to the first premolar. In the lower arch anchorage is es-tablished by lingual wire premolar-to- premo- lar / extending to the first molar as shown in Fig 2.

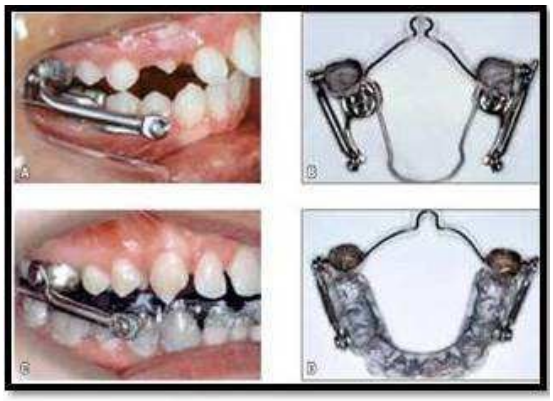

Figure 2: Herbst appliance

Jasper jumper

The Jasper Jumper is a flexible fixed appli- ance that delivers light, continuous force. It can be used to move a single tooth, units of teeth, or an entire arch. It can deliver func- tional, bite jumping forces, headgear-like forces, elastic-like forces or a combination of these (9).

The Jasper Jumper can be easily placed, ac- tivated and removed. It can be used simulta- neously with other treatment mechanics as space consolidation, extraction treatment, or non-extraction treatment, and it enhances mandibular arch leveling. It can be used with bite planes, J-hook headgear, and various elastic combinations for comprehensive or- thodontic treatment (Fig 3).

The effects of using the Jasper Jumper appli- ance are:

1. Intrusion and simultaneous distalizai- ton of the upper molars, with the occa- sional opening of the posterior bite similar to that seen with a Herbst ap- pliance.
2. Increase in condylar growth.
3. Anterior migration of the mandibular teeth through alveolar bone.
4. Intrusion of the lower incisors.
5. Buccal tipping of the upper molars, can be prevented by constricted maxil- lary archwires and/or transpaltal bars.

The treatment time is usually less than a re- movable functional appliance because of 24- hour-per-day wear having an uninterrupted force application. According to Dr. James Jas- per six months has been recommended for leveling and anchorage preparation, six to nine months for Jasper Jumper use, and 12 months for finishing. Leaving the Jumper passively in place for three to four months en- hances the stability of the results (10, 11).

Figure 3: Jasper Jumper appliance

Forsus fatigue resistant device

The Forsus Fatigue Resistant Device [FRD], a semirigid telescoping system, is a super-elas- tic nickel-titanium coil spring that can be as- sembled chair-side; and can be used in con- junction with complete fixed orthodontic ap- pliances (12, 13). The FRD is attached to the buccal tube of maxillary first molar and onto the mandibular archwire, distal to either the canine or first premolar bracket (the latter op- tion making the appliance less visible and more comfortable) (14). The FRD appliance produces about 200g of force when fully com- pressed. The forsus appliance displaces the mandible in the forward direction which is a predominant factor contributing to the suc- cess when treating Class II patients (Fig 4) (15).

Figure 4: Forsus FatigueResistant appliance

Powerscope

Powerscope for class II malocclusion correc- tion has been developed by Dr. Andy Hayes in

association with American Orthodontics. It is available as a single size appliance for Class II malocclusion treatment. It can easily be ad- justed according to the treatment need. It is a pre-assembled appliance with attachment nuts for quick and easy chairside applica- tions. It is a hybrid fixed functional appliance and has an archwire-to-archwire installation with a hexagonal screw. The appliance has a ball and socket joint to maximize the lateral movement improving the patient comfort. The appliance functions are similar to the tele- scoping mechanism as the inner shaft/push rod, middle and outer tubing. The Nickel-tita- nium spring delivers constant 260g force to advance the mandible in a forward position. The appliance has dot marks, which show the activation level, which can be altered using crimpable shrims for further activation if needed.

The advantages of using a powerscope are:

- Increased patient comfort
- Eliminates the need for a headgear tube as it can be directly attached to the archwire
- Can be used with either banded/ bonded molar tubes
- One size appliance for class II maloc- clusion with retrusive mandible

This appliance is attached mesially to maxil- lary first molar and distal to mandibular ca- nine generating more of a horizontal force (Fig 5) (16).

Figure 5: Powerscope appliance

MARA

The MARA appliance (Mandibular Advance- ment Repositioning Appliance) was created by Dr. Douglas Toll, an orthodontist from Ger- many. The MARA appliance is a fixed func- tional jaw orthopaedic appliance, which im- proves the profile when the mandible is repo- sitioned forward. The appliance consists of four stainless steel crowns on the first molars. In the upper crown a large square tube is at- tached into which a large wire called an “el- bow” fits. A large round wire, attached to the lower crown, projects buccally towards the cheek from the mesial part of the stainless steel crown. The buccal projection is called the “arm”. The upper elbow is designed such that the patient can only close their mouth if they move their lower jaw forward so that the arm is in front of the elbow. The stainless steel crown has been used to withstand the forces generated by the two attachments (17).

The MARA induces a significant elongation in the total length of the mandible. The appli- ance can be immediately placed in the patient mouth without the need to reach a relatively rigid archwire dimension. This appliance has an advantage from other appliances to treat class II skeletal malocclusion (Fig 6) (18).

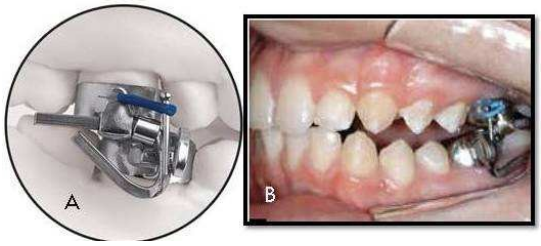

Figure 6: A- MARA appliance, B- MARA placed intraorally

Advansync

An Advansync appliance is a molar-to-molar attachment. This appliance has reduced the bulk of the Herbst appliance. The advantages of using an advansync are (17, 18):

- The appliance can be immediately placed in the patient’s mouth without the need to reach a relatively rigid archwire dimension.
- It can be used at the late end of the growth spurt,
- It reduces the treatment time as it can be started along with leveling and

aligning phase of orthodontic treat- ment.

- Better oral hygiene and patient motiva- tion are achieved by early correction of a sagittal discrepancy.
- The attachment increases the vertical component of a force and less inclina- tion of mandibular anteriors.

Figure 7: Advansync appliance

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