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EXPLORING FIXED FUNCTIONAL CLASS II CORRECTORS

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ABSTRACT

Since the 1930s, practical appliances have been in use. Class II malocclusion treatment is still a significant problem for orthodontists in their daily clinical work. For patients who are not complying, fixed functional offers one of the greatest non-extracting treatments. These were installed with attachments in the maxillary cuspid of lower arch. Despite this relatively long history, there is still a lot of misunderstanding with their use. The way these appliances are used changes how different muscle groups interact to affect how the mandible functions and where it is positioned in relation to the basal bone. Orthodontic and orthopaedic alterations arise from changing the mandibular posture sagitally and vertically, which often generates these muscle forces. Removable and fixed functional appliances are the two broad types into which functional appliances have been separated. Patients with fixed functional appliances are noncompliant with detachable appliances and patients whose active growth period has ended.

Keywords: Fixed functional, Remodelling, Protraction, Spring, Elastics

INTRODUCTION:

The phrase "Myofunctional appliance" mention a number of devices made to change positioning of different muscles which affect the function of maxilla

/mandible. One of the most prevalent orthodontic issues is class II malocclusion, which affects around one in every three people. Numerous bone and dental variables, as well as other contributing factors, can cause Class II malocclusion. Although mandibular retrusion and maxillary protrusion have been identified as potential causal causes, mandibular retrusion has been reported to be the most prevalent feature in a class II sample population **[1]**. Targeting the origin and attempting to change the rate of mandibular growth are the optimum treatments for class II individuals with retrognathic mandibles. Class II malocclusion is the most common type of malocclusion we see every day in our clinics. Management for class II malocclusions rely on a number of variables, including the malocclusion and age of patient when they first present for care. When there is a growth phase, the options for non-treatment are either functional appliances or fixed functional options when there is a deceleration phase or when the growth is finished. There are numerous orthodontic procedures and devices available to correct the Class II malocclusion **[2]**. Fixed functional appliances were created as a result of these elements working together with the unparalleled desire for maximising growth **[3]**.

Table 1: Appliance With Inventor and Year of Invention

S. No.	Name of Appliance	Name of Inventor	Year of Introduction
1.	Herbst Appliance	Dr. Emil Herbst	1990
2.	Jasper Jumper	Dr. James Jasper	1987
3.	MARS (Mandibular advancing Repositioning Splint)	Dr. James A McNamara	1982
4.	MPA (Mandibular Protraction Appliance)	Dr. Coelho Filho	1995
5.	Adjustable Bite Corrector	Dr. P Richard	1995
6.	Eureka Spring	Dr. JP DeVincenzo	1997
7.	Churro Jumper	Dr. Ricardo Castanon	1998
8.	Ritto Appliance	Dr. A.A.K. Ritto	2000
9.	MARA (Mandibular Anterior Repositioning Device)	Dr. D Toll	1994
10.	Klapper Spring	Dr. Lewis Klapper	1997
11.	Forsus Fatigue Resistant Appliance	Dr. William Vogt	2006
12.	Powerscope	Dr. Andy Hayes	2000
13.	Advansync 2	Dr. Terry and Bill Dischinger	2008

MATERIALS AND METHODS

(Literature Search Strategy)

This narrative review was conducted following a structured and systematic approach to literature selection.

Databases Searched

- PubMed/MEDLINE
- Scopus
- Web of Science
- Google Scholar

Inclusion Criteria

- Human clinical studies, randomized controlled trials, systematic reviews, and meta-analyses
- Studies evaluating fixed functional Class II correctors

- Articles published in English

Exclusion Criteria

- Case reports with fewer than 10 subjects
- Animal studies
- Non-English publications
- Abstract-only articles

Fixed Functional Appliances: Overview and Clinical Effects

1. Herbst Appliance-

A brilliant individual who was years ahead of his time, Dr. Herbst. In the 1900s, Herbst invented the first appliances. In 1909, Herbst debuted the original banded design device. It is an apparatus for fixed-bite leaping. The Herbst appliance **(Figure 1)** received very little attention after 1934. Contemporary studies demonstrate that Herbst therapy produces a combination of skeletal mandibular advancement, dentoalveolar compensation, and vertical changes. Recent evidence suggests that skeletal effects are more pronounced during growth, while dentoalveolar changes predominate in post-adolescent patients **[4-6]**.



Figure 1: Herbst Appliance

2. Jasper Jumper:

Dr. James Jasper first presented it in 1987. Force module and anchor units are two components that make up system. The Herbst bite's tube and plunger are comparable to the force module's flexible design. It is made of a spring coil made of stainless steel that is attached to stainless steel end caps at both ends **(Figure 2)**. This is hygienic and urethane covering that surrounds it. The modules are offered in seven lengths, with increments of 2 mm, ranging from 26 to 38 mm. Both sides of the dental arch can employ them, according to their design. Recent studies report improved patient comfort compared to rigid systems, though dental side effects such as lower incisor proclination remain a concern **[7-8]**.



Figure 2: Jasper Jumper

3. Mandibular advancing Repositioning Splint (MARS):

Ralph M. Clements came up with this in 1982 to replace intermaxillary elastics. After levelling and alignment, the appliance is set in place. The rectangular wire, or the wire which could fit inside the brackets, are where it is attached. arious modifications of the MPA have been developed to improve ease of fabrication and patient acceptance. Contemporary clinical reports highlight its cost-effectiveness and adaptability, particularly in resource-limited settings **[9-10]**.

4. Mandibular Protraction Appliance:

Carlos Martin & Coelho Filho created this appliance in 1995. It was created by the orthodontist in the lab to be swiftly built up **(Figure 3)**.

Various modifications of the MPA have been developed to improve ease of fabrication and patient acceptance. Contemporary clinical reports highlight its cost-effectiveness and adaptability, particularly in resource-limited settings **[11-12]**.

4.1 MPA-1:

An end of a 0.032" stainless steel wire has a little loop curved on both of the side at a 90° angulation. The patient is asked to protrude their mandible into the appropriate overjet and overbite posture in order to establish the tube's length. We measure the distance between the stop of the mandibular arch wire and mesial of maxillary tube. The other end of the.032-inch stainless steel wire is then turned into a tiny right-angle circular shape. One appliance circle, it is situated next to the molar tube and up against the maxillary arch wire, covers mandibular arch wire stop.

4.2 MPA-2:

0.032" SS wire was used to create the right-angles circle. One of the wires has a small bit of slipping coil slipped across it. Each wire's other end is then threaded through the loop at the other end. Compared to earlier variant, this one permits a broader opening of the mouth.

4.3 MPA-3:

When the lower jaw is in the right position, the length of the device is measured from the end of mandibular arch wire to the middle of the maxillary tube. This helps make the arch wireless stressed. It keeps mandible in a forward position and lets the mouth move in a wider range. The MPA IV is more comfy and easier to put together and put in place.



Figure 3: Mandibular Protraction Appliance

5. Adjustable Bite Corrector:

Richard P. West made the introduction. The assembly includes closed coil spring constructed of 0.018" ss thick **(Figure 4)**. The closed coil spring may be stretched by around 25% without permanently changing its shape. With just a simple 180° movement of the bottom end cap. Thus, the inventory is decreased. The push force is generated by the NiTi wire **[13]**.

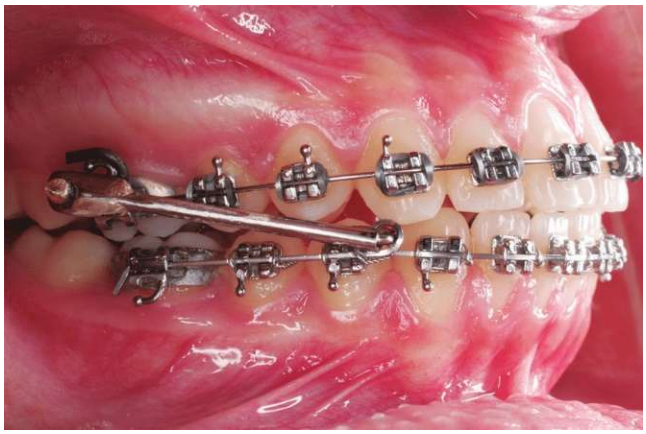

Figure 4: Adjustable Bite Corrector

6. Eureka Spring:

It was initiated by Steve Prins and John DeVincenzo. It is connected to upper arch where the molar band is and to the lower arch where the canine is. It is a three-part telescopic device **(Figure 5)**. Open coil spring enclosed in the plunger assembly serves as the major part of the Eureka spring.

ecent comparative studies have demonstrated that the Eureka Spring produces effective overjet reduction primarily through dentoalveolar changes, with skeletal effects comparable to other fixed functional appliances such as the Forsus fatigue-resistant device. Lower incisor proclination and upper incisor retroclination remain the most commonly reported side effects, reflecting anchorage demands associated with continuous force delivery **[14]**.



Figure 5: Eureka Spring

7. Churro Jumper:

It was given by Larry White, Mario S. Valdes, and Ridhardo Castanon. This alternate force system for the anterior-posterior is efficient and affordable. It was created as an upgrade to Coelho's MPA. The far end is pinned to upper teeth, and the near end is held by the lower arch wire and the canine bracket **(Figure 6)**. Currently, this is the only adaptable functional appliance that an orthodontist can make, which lowers the cost. Recent studies evaluating indigenous fixed functional appliances have reported that the Churro Jumper effectively reduces overjet predominantly through dentoalveolar adaptations, including lower incisor proclination and upper incisor retroclination. Skeletal effects are generally modest and are influenced by patient growth status and treatment timing **[15]**.

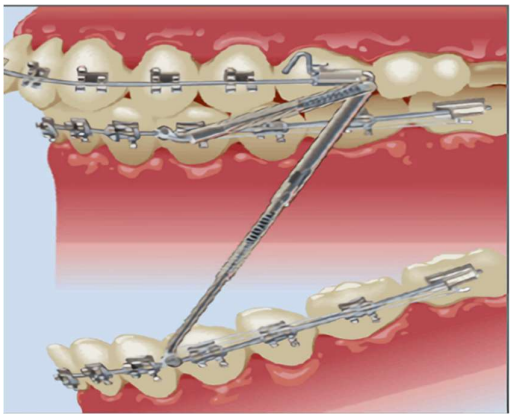

Figure 6: Churro Jumper

8. Ritto Appliance:

The Ritto Appliance **(Figure 7)** is a simpler intraoral application and activation telescopic compact device. It has a ventral telescope mechanism without any disengagement. Comfortable, adaptable, economical, aesthetically pleasing, and damage resistant. It is helpful in mixed dentition when the maxillary and mandibular molars are conventionally banded and mandibular incisor is fitted with brackets. Comparative analyses suggest that the Ritto appliance demonstrates clinical efficiency and patient acceptance comparable to other fixed functional appliances such as the Herbst and Forsus devices, with the added advantages of reduced appliance bulk and improved oral hygiene maintenance. However, anchorage loss and dental side effects remain notable considerations, emphasizing the need for appropriate case selection and anchorage control strategies. Further prospective clinical trials are required to assess long-term stability and soft-tissue outcomes associated with the Ritto appliance **[16]**.



Figure 7: Ritto Appliance

Alpern Corrector:

This is a small telescoping gadget with a coil spring inside and two hooks for attaching. This is connected to the upper canine and lower molar elastics. The way it telescopes makes it easier to open your mouth. Comparative analyses suggest that the Alpern Corrector demonstrates clinical efficiency and patient acceptance comparable to other fixed functional appliances such as the Forsus and Herbst devices, with advantages including reduced appliance bulk and improved patient comfort. Nevertheless, anchorage loss and dental side effects remain important considerations, highlighting the need for appropriate case selection and adjunctive anchorage control strategies. Further prospective and long-term clinical studies are required to assess skeletal stability and soft-tissue outcomes associated with the Alpern Corrector appliance **[4, 9]**.

10. MARA (Mandibular Anterior Repositioning Device):

In 1991, German artist Douglas Toll invented this (fig.8). Shims are put on the teeth, and an elbow goes inside them to tell patient to bite into Class I. If patient pulls his jaw back to a Class II link, he won't be able to achieve intercuspation. This implies that mandibular teeth will come into direct touch with the metal, which will be uncomfortable. The appliance's design permits pairing with braces. Patient-reported outcomes suggest favorable acceptance due to the absence of bulky intra-arch components. However, anchorage loss and variability in skeletal response highlight the importance of appropriate case selection and growth assessment. Further long-term studies are required to evaluate post-treatment stability and soft-tissue adaptations following MARA therapy **[17-18]**.



Figure 8: MARA

11. Forsus Fatigue Resistant Appliance:

This three-telescopic device is novel since it has a coil spring on the outside **(Figure 9)**. In the first showing, the device is placed in mandible on round-segmented arch. Appliance moves lateral movements and the opening of the mouth along the arch. Considering that the force that results focuses more on the inferior and anterior sectors. Continuous arches utilised during the procedure cause no interference. The patient's mouth can open freely thanks to the gadget. The Forsus Nitinol Flat Spring is similar, but it has a flat wire made of Nitinol instead of a coil. The device looks and feels better because it has a smooth surface. The Forsus Nitinol Flat Spring is made of nitinol, which is very flexible, and is flat and thin. Force levels stay the same from the time they are first set up until they are taken away **[19-20]**.



Figure 9: Forsus Fatigue Resistant Device

12. Powerscope:

Its ready-to-use design does not require measurement, assembly, or appliance manipulation. It may be utilised with either banded or bonded tubes and does not require gingival headgear tubes or specific band assembly. It is one-size-fits-all, which lowers the need for inventory. It has a low profile, which contributes to its attractive appearance. Its rounded edges and smooth shape improve patient comfort. Because to its telescoping system features, unwanted emergency visits can be avoided throughout treatment. Since the piston does not extend distally, ulceration is not visible. 260 grammes of force are delivered by an internal NiTi spring mechanism for continual activation throughout treatment. The enclosed design prevents food trapping and painful pinching of the cheeks **(Figure 10)**. The lateral mandibular movement is assisted by the ball-and-socket joint, which enhances patient comfort and acceptability **[21-22]**.



Figure 10: Powerscope

13. Advansync:

The AdvanSync **(Figure 11)** combines the mandibular advancement and malocclusion correction phases of treatment **[23]**. By achieving bone and dental adjustments at the same time, it shortens the length of the treatment process. Since it has been fixed, patient cooperation is not required. Its small size offers the most comfort and mobility. It is applied concurrently with initial bonding, coordinating orthodontic treatments and Class II treatment **[23-24]**.



Figure 11: Advansync

CONCLUSION:

Instead of focusing on immediate results, it is more crucial to analyse the effect on the mandibular growth with the help of functional appliances. Long-term retention as well as significant mandibular growth are still up for debate. Some of the inconsistencies found in clinical research on humans may be explained by individual variances in growth rates and direction. This may also be a factor in explaining why condylar growth was reported to have grown in some cases but to have had little clinical significance in others. After functional appliance therapy, soft tissue alterations and adaptations are another area in which we currently need expertise. To find out if we can develop mandibles and keep them for life, we will need to do further long-term investigations and clinical trials with a control group.

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