

A Journey through the World of Fixed Functional AppliancesDr. Olavo Neil¹, Dr. N. G. Toshniwal², Dr. Sumeet Mishra³, Dr. Somit Das⁴, Dr. Pooja Firake⁵¹Post Graduate Student, Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, PIMS (DU), Loni.²Professor and H.O.D., Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, PIMS (DU), Loni.³Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, PIMS (DU), Loni.⁴Post Graduate Student, Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, PIMS (DU), Loni.⁵Under Graduate Student, Rural Dental College, PIMS (DU), Loni.**Corresponding Author:** Dr. Olavo Neil, Post Graduate Student, Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, PIMS (DU), Loni**Type of Publication:** Original Research Paper**Conflicts of Interest:** Nil**Abstract**

Fixed functional appliances are non-compliant Class II corrector appliances that were first brought into the orthodontic arena by Emil Herbst. Ever since, several inventors have introduced their own appliances. Through this article, an attempt is done to give a brief review of the fixed functional appliances.

Introduction

Class II malocclusion due to mandibular retrognathism with the resultant sagittal discrepancy is one of the most frequently encountered types of malocclusion¹⁷. A large number of removable and fixed appliances are available for growth – related correction of the distal dental base relationship¹⁶.

While elastics, headgears and removable functional appliances are used to treat Class II malocclusions, none can match the efficiency of fixed functional appliances since they work twenty four hours a day, round the clock,

to enhance forward growth of the mandible by remodeling the glenoid fossa and by restricting the growth of the maxilla.

Emil Herbst first introduced his fixed functional appliance (Herbst appliance in 1909). Since then and up to the seventies, very little was known about it¹⁵. It was at that time that Hans Pancherz, brought the subject back into discussion with the publication of several articles on the Herbst appliance. It was only in the eighties that several systems derived from Herbst's work started to appear. A number of fixed functional appliances have gained popularity in recent years to help achieve better results in non-compliant patients.

Fixed functional appliances are effective in the management of Class II malocclusions¹⁷. This is the only successful bite - jumping treatment for non-compliant, post – pubertal patients that do not require orthognathic surgery at a later stage.

Fixed functional appliances have been reported to correct Class II skeletal malocclusions by encouraging mandibular growth and by eliciting dentoalveolar effects¹⁶.

Classification of Fixed Functional Appliances

Fixed functional appliances are classified into four categories, depending upon the features of force system used to advance the mandible²³:

- Rigid Fixed Functional Appliances.
- Flexible Fixed Functional Appliances.
- Hybrid Appliances.
- Appliances acting as substitute for elastics.

Rigid fixed functional appliances include the following:

- Herbst Appliance.
- Ritto Appliance.
- Mandibular Protraction Appliance (MPA).
- Mandibular Anterior Repositioning Appliance (MARA).
- Functional Mandibular Advancer (FMA).

Flexible fixed functional appliances include the following:

- Jasper Jumper.
- Amoric Torsion Coils.
- Adjustable Bite Corrector.
- Klapper Superspring II.
- Churro Jumper.

Hybrid fixed functional appliances include the following:

- Eureka Spring.
- Forsus Fatigue Resistant Device.
- Twin Force Bite Corrector.

Appliances acting as substitute for elastics include:

- Calibrated Force Module.
- Alpern Class II Closers.

Rigid Fixed Functional Appliances

These appliances are different from flexible ones in two respects: They are not easily fractured; however, they are not elastic nor flexible; after fitting and activation, they do

not allow the patient to bite in maximum intercuspation as usual. This means that the mandible is in forward position 24 hours a day, thereby providing more stimulus for growth. This group of fixed functional appliances results in mandibular protraction.

Rigid appliances work on the basis of a telescopic mechanism, which stimulates anterior repositioning of the mandible while the patient bites in occlusion. Skeletal effects produced by these appliances are greater than those produced by flexible ones.

Examples of rigid appliances include: Herbst¹⁵, AdvanSync 2¹⁴ and MARA¹³.

Flexible Fixed Functional Appliances

Flexible fixed functional appliances consist of an intermaxillary coil spring or a fixed spring. Elasticity and flexibility are typical of these appliances. They permit satisfactory free mandibular movements, with lateral guidance being easily performed. The amount of force varies and can be controlled by the clinician.

Their major drawback is the likelihood of both appliance and supporting system fractures '*especially in the mandible*'. On one hand, flexibility is an advantage; on the other hand, it really tends to produce fatigue of springs.

It is important to advise the patients to avoid opening their mouths too widely because it could result in breakage of the appliance. Additionally, they are not very aesthetic appliances. If spring curvature is considered, protuberances may appear in patient's cheeks.

Examples of flexible appliances include: Jasper Jumper²⁵ and Jasper Vektor²⁴.

Hybrid Fixed Functional Appliances

Hybrid appliances are a combination of flexible and rigid appliances. They are rigid appliances with spring systems. The purpose of these appliances is to move teeth by applying continuous elastic force 24 hours a day. This

replaces conventional Class II elastics. Use of open spring to produce force is typical of this type of appliance. Force produced varies from 150 g to 260 g.

The main purpose of hybrid appliances is not to reposition the mandible in forward position. It is possible to claim that flexible and hybrid appliances produce greater tooth movement during treatment, in comparison to rigid ones. This is probably due to not moving the condyle from the glenoid fossa.

Examples of hybrid appliances include: Forsus¹⁸, Twin Force Bite Corrector¹⁰ and Powerscope²¹.

The following characteristics are typical of this new generation of appliances:

- Springs are inserted into the telescopes, to avoid hurting the patient's cheeks and to prevent food from accumulating during meals.
- Reduced size, to provide more comfort and favour patients adaptation.

Indications for Fixed Functional Appliance Use

- As Class II mechanics.
- Cases of Class II with mandibular retrusion. (Preference is given to rigid appliances).
- Cases of Class II with maxillary protrusion.
- Residual Class II correction after treatment with extractions.
- Class II, Subdivision, with no extraction treatment.
- As anchorage after distalization of maxillary molars.
- As anchorage in cases with extractions.
- As anchorage for space closure with mesialization of posterior teeth in cases of agenesis of mandibular second premolars or extraction of mandibular first molars.
- Compensatory treatment of mandibular deficiency in adult patients.

Contraindications for Fixed Functional Appliance Use

There are some clinical situations in which the clinician

needs to avoid the use of mandibular protraction appliances, namely:

- Patients with periodontal issues.
- Patients with mandibular incisors tipped or anteriorly projected.
- Patients with marked gingival smile.
- Patients with a tendency to open bite.

Use of Fixed Functional Appliances in Cases of Asymmetrical Malocclusions

There is a tendency towards treating Class II Subdivision cases with fixed functional appliances. In such cases, the activated appliance should be actively placed on the Class II side. A non – activated appliance should always be placed on the Class I side as it will help to maintain the occlusal plane and to guide the mandible during closure.

In case, the appliance is placed only on one side, then there is a chance of causing an inclination of the occlusal plane.¹⁶

Comparison between Class II Elastics and Mandibular Protraction Appliances for Class II Treatment

Because Class II elastics and fixed functional appliances are both used to treat Class II malocclusion, a number of clinicians believe they are the same thing. However, they are not. In terms of force, elastics perform intermittent action, while fixed functional appliances perform continuous action.

Elastics exert traction, while fixed functional appliances exert impulsion. Vertical component of traction might extrude maxillary incisors and mandibular molars as a result of using elastics. Consequently, effect on the occlusal plane is clockwise rotation, with resulting downward and backward mandibular rotation.

In Class II Dolichocephalic patients with increased mandibular plane angle, the mechanics tending to extrude posterior teeth is not recommended. Fixed functional appliances use impulsion over the occlusal plane, that is,

they push while separating appliance insertion points. The effect of occlusal plane rotation decreases. Thus, fixed functional appliances maintain the mandibular plane inclination as compared to elastics. This mechanics might be beneficial to treat vertically growing patients.¹⁶

Class II Compensatory Treatment

Many adult patients with mandibular retrusion and recommendation for surgical treatment prefer not to undergo orthognathic surgery. In such cases, the possibility of compensatory treatment is considered, either with extraction of maxillary premolars or by the use of

fixed functional appliances.

The extraction of maxillary premolars, followed by retraction of maxillary incisors, increases the chances of flattening the facial profile, especially in cases with a normal nasolabial angle.

Hence, in such cases preference is given to fixed functional appliances as it will result in little distalization of maxillary teeth and mesialization of mandibular teeth.¹⁶

Chronology of Development Of Fixed Functional Appliances

Sr. No.	Inventor(S)	Appliance	Year
1	Emil Herbst	Herbst appliance ¹⁵	1909
2	James Jasper	Jasper Jumper ²⁵	1987
3	Michel Amoric	Amoric Torsion Coils ²²	1994
4	Carlos Coelho Filho	Mandibular Protraction Appliance ¹¹	1995
5	Richard P. West	Adjustable Bite Corrector ⁸	1995
6	Terry Dischinger	Edgewise Herbst Appliance ¹²	1995
7	Robert A. Miller	Flip Lock Herbst Appliance ³	1996
8	Raffaele Schiavoni, Carlo Bonapace, Vittorio Grenga	Modified Edgewise Herbst Appliance ⁶	1996
9	John Peter DeVincenzo	Eureka Spring ¹⁹	1997
10	Paul Haegglund, Staffan Segerdel	Swedish-Style Integrated Herbst Appliance ²	1997
11	Xavier Calvez	The Universal Bite Jumper ⁷	1998
12	Ricardo Castanon, Mario S. Valdes	Churro Jumper ⁴	1998
13	Lewis Klapper	Klapper Superspring ⁵	1999
14	A. Korrodi Ritto	Ritto Appliance ¹⁷	1999
15	James J. Awbrey	The Bite Fixer ²⁰	1999
16	Gero Kinzinger	Functional Mandibular Advancer ⁹	2002
17	Jeff Rothenberg, Eric Campbell	Twin Force Bite Corrector ¹⁰	2004
18	William Vogt	Forsus ¹⁸	2006
19	Terry Dischinger, Bill Dischinger	AdvanSync ²⁶	2012
20	Andrew Hayes	Powerscope ²¹	2014
21	James Jasper	Jasper Vektor ²⁴	2015

Heroes of Fixed Functional Appliances



Lewis Klapper



Michel Amoric



Emil Herbst



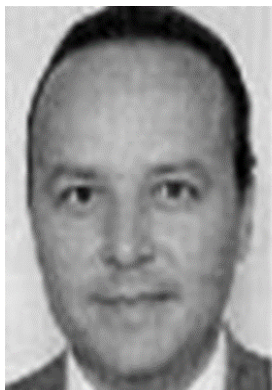
A. Korrodi Ritto



John P. Devincenzo



William Vogt



Ricardo Castanon



Terry Dischinger



Jeff Rothenberg

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