

**Fixed functional appliances - A general review**

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**Abstract**

Functional appliances have been used since the 1930s. Despite this relatively long history, there continues to be much confusion relating to their use, method of appliances alters the arrangement of various muscle groups that influence the function and position of the mandible in order to transmit forces to the dentition and the basal bone. Typically, these muscular forces are generating orthodontic and orthopedic changes. Functional appliances have been broadly divided into two categories removable and fixed functional appliances. Fixed functional appliances have patients who are non-compliant to removable appliances and in patients after the active growth phase has been completed. Treatment of class II malocclusion has always been an enigma to the orthodontic fraternity. Noncompliant correction of class II malocclusion using fixed functional appliances at the deceleration stage of growth has gained tremendous popularity in the recent times. Aim of the illustrated article is to demonstrate the efficacy of a fixed functional appliance in correction of class II malocclusion. The purpose of this review was to overview the different fixed functional appliances available till date for the treatment.

**Keywords:** Functional Appliances, MPA, MARA.

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**Introduction**

Functional orthopaedic treatment tries to compensate malocclusions and harmonize the shape of the dental arch and Oro-facial function. Conventional orthodontic appliances apply mechanical force to change the location of teeth into a more favorable position. However, the extent of these functional appliances is enormously restricted to certain morphological conditions which are triggered due to distortion in the neuromuscular capsule or developmental process adjoining the orofacial skeleton. The Functional appliance introduce to deal with these limitations.<sup>1,2</sup> The appliances used in adjustment

of angle's Class II presents some common characteristics.<sup>3</sup> The forces is used either to bring forward the mandible or to distalize the molars is produced by fixed auxiliaries, either inter- or intramaxillary. Almost always, they require dental and/or palatal anchorage such as multiband Ed fixed appliances, lingual or Tran's palatal arches, and modified palatal buttons. Various appliances and especially those used for distalization of molar, there is much use of resilient wires, such as titanium molybdenum alloys and nickel-titanium. However, anchorage loss often occurs during molar distalization with these modalities and represents a major negative aspect of their application.

### **Indications of fixed functional appliances<sup>1</sup>**

It is a quite known fact that for successful completion of fixed functional appliance therapy patient's compliance is must. The fixed functional appliance is the most important weapon against non-compliance offered by the patient. 1) The correction of skeletal anomaly in young developing individuals. a) In skeletal class II cases with retrognathic mandible. b) In skeletal class III cases with retrognathic maxilla. 2) Making use of the residual growth left in neglected post-adolescent patients who have passed the maximal pubertal growth and are too old for removable functional appliances. 3) In adults patients - Used in upper molars distalization to correct dental class II molar relationship. -Used to enhance anchorage. - Used as mandibular anterior repositioning splint in patients having Temporomandibular joint disorders. -Post-surgical stabilization of class II / class III malocclusion. 4. Functional midline shifts can be corrected by using the appliance unilaterally.

**Depending on their mode of action and type of anchorage, all these appliances can be classified into two categories:**

### **Intermaxillary noncompliance appliances**

Which derive their anchorage in an intermaxillary manner, act in both maxillary and mandibular arches in order to advance the mandible, the Herbst appliance, Jasper Jumper, Eureka Spring and Adjustable Bite Corrector.

### **Intramaxillary noncompliance appliances,**

Which derive their anchorage in an intramaxillary or absolute anchorage manner, act only in the maxillary arch in order to move molars distally for example: - Pendulum Appliance, Distal Jet, repelling magnets and Jones Jig.

**Classification of fixed functional appliances:** By Ritto A. Korrodi (2001)<sup>6</sup>

### **A) Rigid Fixed Functional Appliances (RFFA)**

1. The Herbst Appliance and its modifications.
2. The Mandibular Protraction Appliance (MPA)
3. The Mandibular Anterior Repositioning Appliance (MARA)
4. The Ritto Appliance
5. The IST-Appliance
6. The Biopedic Appliance

### **B) Flexible Fixed Functional Appliances (FFFA)**

1. The Jasper Jumper
2. The Adjustable Bite Corrector
3. The Churro Jumper.

4. The Amoric Torsion Coils.
5. The Scandee Tubular Jumper
6. The Klapper Super Spring
7. The Bite Fixer

**C) Hybrid Fixed Functional Appliances (HFFA)**

1. Eureka Spring
2. FORSUS- Fatigue Resistant Device
3. The Twin Force Bite Corrector.
4. Alpern Class II Closers
5. The Calibrated Force Module

**Rigid fixed functional appliances**

Sn.	Appliance name	Introducer	year	Description
1	THE HERBST APPLIANCE <sup>4</sup> & Its modifications (fig 1). MODIFICATIONS A) Bonded Herbst Appliance. <sup>15</sup> (fig 1A) B) Acrylic splint Herbst appliance. <sup>16</sup> (Fig 1 B). C) Integrated Herbst appliance. <sup>17</sup> (fig 1C). D)Mandibular Advancement Locking Unit (MALU) Herbst appliance. (Fig 1D). E) Flip locked Herbst appliance. (Fig 1E).	Introduced by Emil Herbst Reintroduced by Hans Panerz  Raymond P. Howe  James A. McNamara  Paul Haegglund and Staffan Seger Dall  TP Orthodontics	1979   1982  1988  1997	The Herbst appliance is an artificial joint between maxilla and mandible. A telescope mechanism on either side of the jaw, attached to orthodontic bands, keep the mandible continuously in an anterior jumped position during all mandibular functions. The telescopic tube was attached to the maxillary permanent first molar band and the telescope plunger to the mandibular first premolar band. A) The principal difference between the original and the bonded appliance is that the paired telescoping elements, which has been attached to the lower bicuspid bands, are now attached to the entire lower dental arch by an acrylic bite splint. B) Maxillary and mandibular acrylic splints are placed. Maxillary acrylic splint is made with cusp tips perforating the acrylic. And mandibular with posterior cusp tips perforating and anterior occlusal coverage. C) It is an integration of the Herbst appliance with conventional upper and lower fixed appliances. A lower auxiliary archwire with the Herbst pistons attached is used to distribute the force from the appliance to the main mandibular archwire, thus reducing the possibility of bracket loosening and wire

				<p>breakage.</p> <p>D)It consists of two tubes, two plungers, two upper "Mo bee" hinges with ball pins and two lower key hinges with brass pins.</p> <p>E) It Is a horse-shoe ball joint Herbst appliance. Since the ball joint is smaller in size as compared to previous appliances it give more patient comfort.</p>
2	Mandibular advancing repositioning splint (MARS). <sup>7</sup>	Clements & Jackson	1982	<p>It is a fixed functional device, attached to the archwires of a multiband Ed orthodontic appliance. The function of the MARS appliance is similar to that of the Herbst appliance in that the mandible is maintained in a continuous protruded position via compressive struts.</p>
3	Mandibular protraction appliance (fig 2). <sup>18</sup>	Coelho Filho	1995	<p>There are four types of MPA (I - IV).</p> <p>The first type of MPA<sup>32</sup> requires stainless steel edgewise appliance in both arches. It is used for the treatment of skeletal class II deformity. Sufficient overjet reduction has been seen in period as short as 4 months. The result may be due to mandibular growth promotion and dentoalveolar changes. Dentoalveolar changes include distalization of maxillary molars, retraction of maxillary anteriors, mesialization of mandibular molars without retraction of mandibular anteriors. This appliance was developed to overcome the costly laboratory procedures associated with the Herbst appliance and the jasper jumper.</p>
4	<p>Functional orthopedic magnetic appliance (FOMA).<sup>19</sup></p> <p>FOMA II - Correction of class II skeletal relations</p> <p>FOMA III - Correction of class III</p>	Vardimon et al.	1989	<p>Appliance can be classified as a fixed functional appliance using rare earth magnets in an attractive mode to constrain the mandible in an advanced sagittal posture. The mode of force application is different from the conventional appliances. Most of them use some form of rigid or flexible "pushing" modality to posture the mandible forward; which are termed as passive appliance. FOMA II is an active appliance that direct is inherent magnetic forces to the</p>

	skeletal relations			jaws and thereby constrains the lower jaw forward.
5	Ritto Appliance (fig 3). <sup>20</sup>	Dr. A Koroddi Ritto	1999	It can be described as a telescopic system that is both miniature and versatile. It has been developed with a goal of creating an efficient appliance of simplified intra-oral application It is a one-piece device with telescopic action. It comes in a Jingle format which allows it to be used on both sides. Total length of appliance when closed is 25mm and at maximum opening is 33mm.
6	Intraoral snoring therapy appliance (IST appliance). (Fig 4).	Hinz		Is a new device designed by Hinz in order to treat patients who suffers from breathing problems during sleep e.g., obstructive sleep apnea. The IST appliance suppresses snoring by moving the lower jaw forward reducing the obstruction in the pharyngeal area.
7	Universal bite jumper. <sup>21</sup>	Xavier Calvez	1998	It is a mandibular propulsion appliance the UBJ uses a Telescoping mechanism. In its normal configuration, the UBJ is attached to the maxillary headgear tube with a ball pin. This pin is bent so it can be tied with a ligature wire to the hook on the molar band It can be used at any stage of treatment-In the early mixed dentition to obtain an immediate mandibular advancement before any dental alignment or in the permanent dentition for fixed functional treatment. It is simple, sturdy, and inexpensive and can be used in both class II and class III.
8	MARA (Mandibular anterior repositioning appliance)	Douglas toll	1991	The MARA is a functional appliance because it postures the patient's lower jaw in a forward direction. It consisted of cams on the molars that guided the patient to bite into Class I. The appliance was low in bulk and easily tolerated by the patient.
9	Rick-A-Nator Appliance. (Fig 6). <sup>22</sup>	Rondeau B.H.	1990	It is a simple appliance consisting of two maxillary 1st molar attached to an anterior bite plane via .036" connector wires. This inclined encourages mandible to come forward which corrects class II molar relationship to class I and eliminates overjet.

10	The ventral telescopes The Professional Positioners			This was the first telescopic RFFA that appeared as a single unit i.e. upon reaching maximum opening it does not come apart. This appliance is available in two sizes and fixing is achieved through ball attachments.
11	Magnetic telescopic device	A. K. Ritto		This consists of two tubes and two plungers with a semi-circular section and with Nd Feb. magnets placed in such a manner that a repelling force is exerted. Fitting is achieved by using the MALU system. Main disadvantages are its thickness, the laboratory work necessary to prepare it and the covering of the magnets.
12	Cantilevered bite jumper	mayes Mid –	Mid-1980s	It is a rigid fixed functional appliance. Is a Herbst-style appliance; fitted directly to the lower I molar bands through a cantilever arm.
13	Fixed Magnetic Appliance	Varun Kalra	1989	Used For patients having mandibular retrusion and increased lower facial height and large interlabial gap. The appliance consisted of upper and lower acrylic splints that were bonded on the occlusal halves of the permanent first molars, deciduous molars or premolars, and canines.

**Flexible fixed functional appliances**

Sn	Appliance name	Introducer	year	Description
1	Jasper Jumper. (Fig 7). <sup>23</sup>	Jasper & McNamara	1995	In an attempt to overcome the rigidity problem of the Herbst Appliance, James Jasper developed a new pushing device that is flexible. It is termed as Jasper Jumper. It can be attached between the maxillary and mandibular arches to produce both Sagittal and intrusive forces which may be either "head-gear like", "activator like forces" or combination of both.
	Adjustable bite corrector. <sup>24</sup>	Dr. Richard west	1995	The appliance is similar to Jasper Jumper but incorporates several useful features. It consists of a stretchable closed-coil spring with internally threaded end caps at both ends. This allows additional range of opening with no risk of breaking the appliance or accidentally changing its length.
	Churro Jumper.	Ricardo cast	1998	The name has been taken from a Mexican cinnamon twist. It

(Fig 8). <sup>25</sup>	anon et.al.			functions more like the Jasper Jumper. In the class II mode, each jumper attaches to the maxillary molars by a pin that passes first through a circle on the distal end of the jumper and then through the distal end of the headgear tube. It is secured by bending the pin down on the mesial end of the tube.
Amoric torsion coils	Amoric N.	1994		Made up of two intermaxillary springs, one of which goes inside the other. It is marketed in one size only and is bilateral.
Scandee tubular jumper	Saga dental AS, 2201, Kongsvinger, Norway			This is a coated inter-maxillary torsion spring sold in a kit which includes the spring, the covering, the connectors, the ball pins and the glue. There is no distinction between left and right. The covering can be of different colors making it more attractive for patients.
The Bite fixer	Ormco			It is a flexible fixed functional appliance. Is an intermaxillary spring coil. The spring is attached and crimped to the end fitting to prevent breakage between the spring and the end fitting.
Super Spring II. (fig 9). <sup>26</sup>	Lewis Klapper	1999		The super spring II is a flexible spring that attaches between the maxillary molar and mandibular canine. It is designed to rest in the Vestibule, making it impervious to occlusal damage and allowing for good hygiene Uses: The spring can be used in entire range of class II cases, from vertical facial patterns with shallow overbites to brachyfacial patterns with deep overbites. It can be used with fully bracketed appliance.

**Hybrid fixed functional appliances**

S.No.	Appliance name	Introducer	year	Description
1	Eureka spring. (Fig 10). <sup>27</sup>	John DE Vincenza	1997	This is also a fixed intermaxillary force delivery system similar to fixed Herbst appliance, used in non-compliant class II patients. Advantages of eureka spring are that Minimal patient co-operation is required. The Eureka spring because of its small size and lack of protruberances into the buccal vestibule is almost invisible. Hence its esthetic acceptability is high. And it is Resistant to breakage. And causes minimal tissue irritation.
2	Forsus (fatigue resistant device). (fig 11).	William Vogt marketed by (3M Unitek	2006	The Forsus (also known as the Forsus Fatigue Resistant Device [FRD]) is a semirigid telescoping system incorporating a superelastic nickel-titanium coil spring that can be assembled

		Corporation)		chair-side, and it can be used in conjunction with complete fixed orthodontic appliances. The Forsus (FRD) can be used instead of Class II elastics in mild cases and instead of Herbst appliances in severe cases. Forsus springs work best in patients with convex profiles, but they are indicated in any Class II patients except those with normal mandibles and protrusive maxillae, or with protrusive or overly large mandibles relative to the other cranial structures
3	Alpern Class II corrector	(GA C International Inc)		This appliance was designed as a substitute for elastics. It consists of a small telescopic appliance with an interior copil spring and two books for fixing. It functions in the same way as elastics and is fixed to the lower molar and to the upper cuspid.
4	Calibrated force module	The Cor Mar Inc.	1988	It was a fixed appliance designed to substitute class II elastics. It is applied to the inferior arch close to the molars and fixed by a screw, and mesial or distal to upper cuspids, .and also fixed to the arch. Its coil spring produced a force between 150-200 gm.
5	5 Power scope. (Fig 12)	Dr. Andy Hayes (Marketed by American orthodontics)		Indicated for use in treating Class II Malocclusions during orthodontic treatment of both growing and non-growing patients with full permanent dentition. Use standard treatment protocols for Class II Correction when using appliance. Power Scope 2 Class II Corrector is contraindicated for use with patients who have a history of severe allergic reactions to nickel.
6	Advansync2 (Fig 13)	Terry Dischinger	2008	It is Fitted the same day that brackets are bonded. The mandible is advanced to an edge-to-edge position and is reactivated by 2-4 mm every twelve weeks. The molar brackets are bonded once the appliance has been removed. Reinforced Spiralock threading to optimise screw engagement. AdvanSync sits further back in the mouth and is virtually unnoticeable. Advanced metal injection molding provides a stronger and more durable appliance. Electropolished mechanisms provide smoother functioning. Upper and lower screw housing to have a more versatile treatment from start to finish. AdvanSync's arms are half the size of those in traditional Herbst appliances, resulting in greater patient comfort



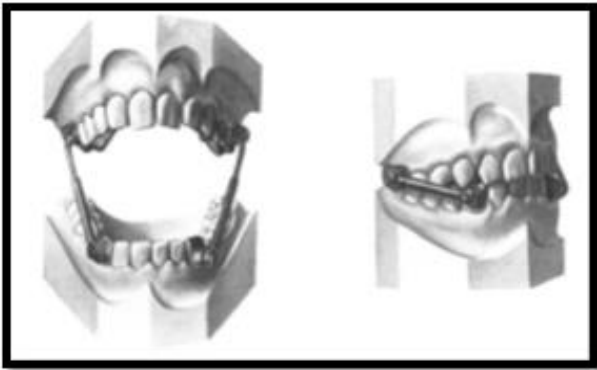


Fig 1: The Herbst appliance.



Fig 1-A: bonded Herbst appliance.



Fig 1-B: Acrylic splint Herbst appliance.



Fig 1-C: Integrated Herbst Appliance.



Fig 1-D: Components of MALU Appliance.



Fig 1-E: Flip locked Herbst appliance

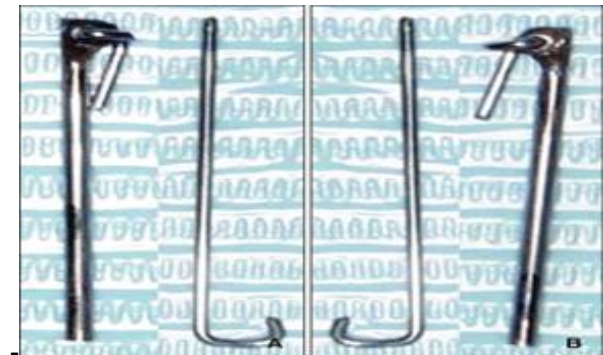


Fig 2: Mandibular protraction appliance (MPA).



Fig 3: Ritto Appliance.



Fig 4: Intraoral snoring therapy appliance.



Fig 5: The Biopedic Appliance.



Fig 6: Rick-A- Nator appliance.



Fig 7: Jasper Jumper.



Fig 8: Churro Jumper.

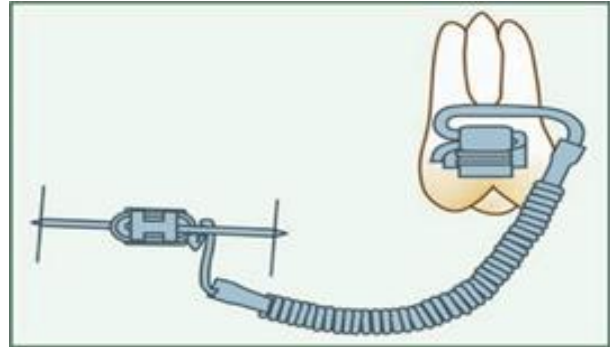


Fig 9: Supper spring (Klapper spring)



Fig 10: Eureka Spring

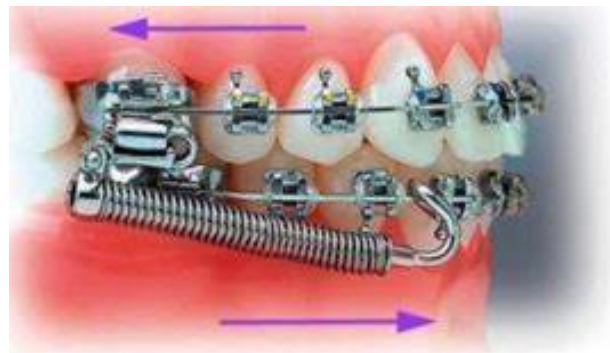


Fig 11: Forsus fatigue resistant device





Fig 12: Power Scope



Fig 13: AdvanSync 2

### Conclusion

Removable functional appliances are effective but rely heavily at the mercy of patient cooperation for achieving predictable results in a reasonable time frame. Patient cooperation is variable and is not always forth coming, with appliances such as headgear or removable functional appliances.

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