

## Fixed functional appliance-A Bird's Eyeview

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**Abstract-**Functional orthopedic treatment seeks to correct malocclusions and harmonize the shape of the dental arch and oro-facial functions. Conventional orthodontic appliances use mechanical force to alter the position of teeth into a more favorable position. However, the scope of these fixed appliances is greatly limited by certain morphological conditions which are caused due to aberrations in the developmental process or the neuromuscular capsule surrounding the orofacial skeleton. To overcome this limitation, functional appliances came into existence. Functional appliances do not replace fixed attachments. Indeed combined use of brackets, bands and extraoral force has the potential for the best possible and most stable long term results .When properly used, they can be valuable additions to the armamentarium of the experienced orthodontic clinic.

It is important to note that functional appliance therapy is to be generally followed by the traditional full banded techniques for optimum results; since they deal more with the gross changes in the intermaxillary relations and arc not designed for precise individual tooth movement.

**Key words-**Fixed functional Appliances, Class II correctors, AdvanSync, musculature.

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### I. Introduction

Functional orthopedic 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 favourable 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 multibanded fixed appliances, lingual or transpalatal 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.

Usually removable functional appliances are very bulky, have unbalanced fixation, absence of tactile sensibility, comfort, apply pressure on the mucosa (causing gingivitis), cause problems in deglutition, speech and reduce space for the tongue & commonly affect facial appearance. The variation in the position of mandible creates more difficulties. These contrary effects make the adaptation and acceptance of these appliances more difficult for patients.

In 1900 first fixed functional appliances appeared. Emil Herbst<sup>4</sup> (Herbst E., 1910) presented his appliance at the Berlin International Dental Congress. There were few publications on herbst till 70s. Many published articles on the Herbst of Hans Pancherz<sup>5</sup> (Pancherz H., 1979) brought the subject back into discussion. In last few years many new fixed appliances have make their headway in field of orthodontics to accomplish enhanced results in non-compliant patients.

Fixed functional appliances are normally known as "non-compliance Class II correctors" giving incorrect idea about the assistance necessary during treatment. However, good assistance is essential, for effective treatment, especially in case of skeletal modifications instead of dentoalveolar compensation.

Fixed functional systems have few benefits over removable systems. They are used full day, which implies continuous incentive for mandibular growth. They are smaller in size allowing better adaptation to perform such functions like swallowing, mastication, speech and inhalation.

Name itself distinguishes them from removable appliances as it is not an easy task for the patient to remove them. Now the appliance we have allow greater control as they are fixed on both the arches.

Since the direction and application of force is directly transferred to the teeth via supporting system, the main drawback that come in acknowledgement is dental movement taking place during treatment. While trying to stay away from this undesirable dental movement and as a way of finding an appliance that allows easy adaptation by the patient, various fixed functional appliances have appeared in recent years.

### 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.

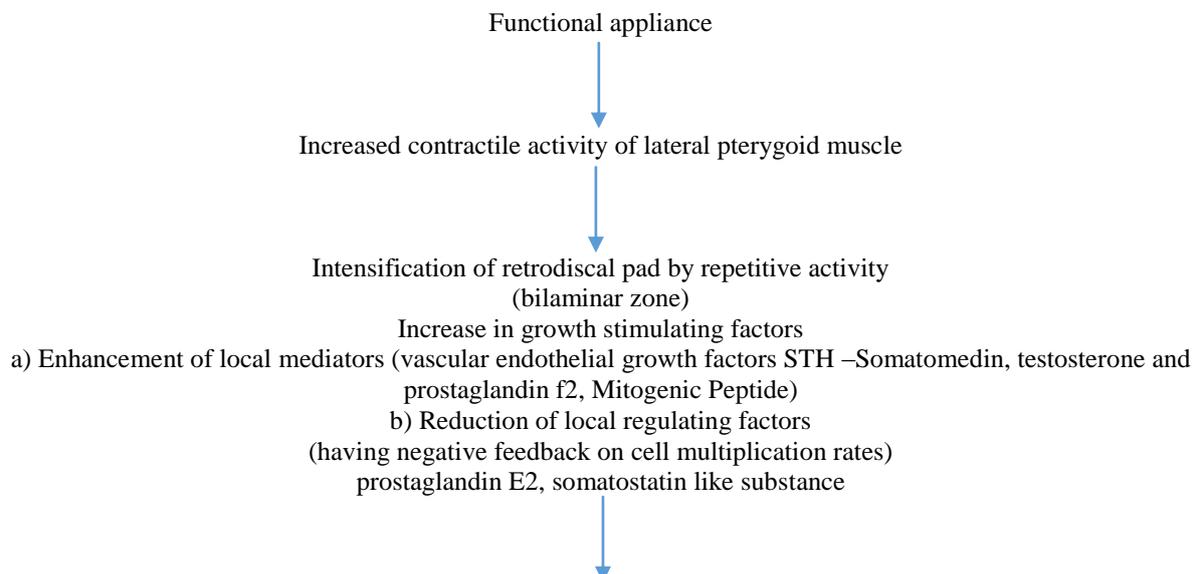
### Mode of action<sup>1</sup>

The mechanism of mandibular adaptation to the forward posturing by fixed functional appliance is the similar as that seen in removable functional appliance. The appliance is tooth borne and exerts its effects to the underlying bone via teeth by transmitting the forces developed as a result of the continuous forward posturing of the lower jaw. (Graber *et al.*, 1997)

- In spite of the various disparity in concept, the general mode of action is one or combination of the following.

- Mandibular growth stimulation
- Maxillary growth restriction
- Dentoalveolar changes
- Adaptive changes occur in Glenoid fossa location to more vertically and anterior.
- Changes in neuromuscular structure and function that induce bone remodelling.

Typically, the outcomes obtained by functional appliance in correction of class II malocclusion consists of combination of dentoalveolar (60-70%) and orthopedic (30-40%) effects. (Graber *et al.*, 1997)



Additional growth of condylar cartilage and subperiosteal ossification of ramus occur



Additional lengthening of mandible

**Flow chart: Mechanism of action of the fixed functional Appliances**

**Biomechanical Effects of Fixed Functional Appliance on Craniofacial Structures**

- 1) Fixed functional appliances advance the whole mandible anteroinferiorly, with maximum displacement observed in the midsymphysal and parasymphysal regions. The anteroinferior movement of the mandibular dentition was more marked in the anterior region, while the maxillary dentition was displaced posterosuperiorly.
- 2) The changes were more pronounced in the dentoalveolar region as compared to the skeletal displacement.
- 3) All dentoalveolar structures experience tensile stresses, except for maxillary posterior teeth and anterior nasal spine.
- 4) Maximum tensile stress and von Mises stresses occurred in the condylar neck and head.

**-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 Anterior Repositioning Appliance (MARA)
3. The Mandibular Protraction Appliance (MPA)
  - Type I Coelho Filho (1995)
  - Type II Coelho Filho (1997)
  - Type III Coelho Filho (1998)
  - Type IV Coelho Filho (2001)
4. The IST-Appliance
5. The Rick - A - Nator
6. The Biopedic Appliance
7. The Ritto Appliance
8. The Advansynce 2

**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
8. The Flex developer

**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

### 1 - The Herbst Appliance<sup>3,4</sup> (Herbst E., 1910; Pancherz H., 1979) .

At the Berlin Dental Congress Emil Herbst in 1905 described first Herbst appliance. After that very few articles written on this appliance until the end of the 70s. The series of publication of Hans Pancherz brought back this topic in discussion<sup>4, 38, 39</sup>.

The Herbst appliance comprises of two plungers, two tubes, screws and axles. The original appliance is a banded Herbst design. In seventies Herbst has maintained its original shape only few modifications take place with regard to methods of application (Type I, II and IV).

**Type I** is defined by a placing of bands or crowns through the use of screws. It is most common type. It is compulsory to join the axles to the crowns or bands and then fit the tubes and plungers with the screws

**Type II** it fits onto the archwires through the use of screws. This system of application has the difficulty of causing constant breakages in the archwires. Due to rigidity it cause difficulty in lateral movements and the tension placed on the archwires through activation causes breakages, especially in the mandibular arch.

**Type IV** it has a ball attachment, which allows greater elasticity and free mandibular movement. It need brakes to stabilize the joint. The breakage are small and sometime difficult to fit. When a breakage occurs, the appliance becomes loose. The ball joint is alternative to screws.

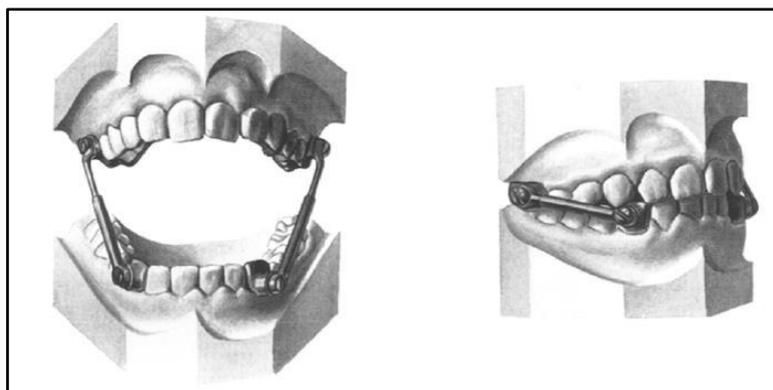


Fig1.The original Herbst appliance

### 2- The Cantilevered Bite Jumper (Mayes mid 1980s)<sup>3</sup>

In recent times, cantilever has been proposed. Herbst appliance is fitted directly to the mandibular molar bands through a cantilever arm is the main difference. This means that crowns has to be fitted maxillary and mandibular molars. The cantilever secured to the mandibular SS crowns has a disadvantage is the thickness of the screw mechanism which impinge on the patient's cheek. Available in kit form with pre-welded screw mechanisms and cantilever arms on crowns of 7 different sizes.



Fig 2. Upper crowns with axles and lower crowns with cantilever arms

### 3- MALU Herbst Appliance(Schiavoni et.al 1996)

The MALU – Mandibular Advancement Locking Unit is a newly developed attachment device for the Herbst. It consists of two maxillary "Mobee" hinges with ball pins and two mandibular key hinges with brass pins two

plungers, two tubes. The main advantages its less price, no lab required, flexibility and easily used with edgewise therapy<sup>24,35</sup>. Each maxillary Mobee hinge is inserted into the hole at the end of the MALU tube and secured in the first molar headgear tube with ball pin. Each mandibular key hinge is inserted into the hole at the end of the plunger and locked to the base arch, distal to the cuspid, with the brass pin.



**Fig 3. Mandibular Advancement Locking Unit**

#### **4 – Flip-Lock Herbst Appliance (Robert miller (1996)3**

This is III generation of ball-joint Herbst appliances. The I generation was made from a dense polysulfone plastic but breakage occurred due to force generated within the ball-joint attachment. In the II generation, the plastic was exchanged with metal. But, fracture problems was still there. The horse-shoe ball joint is III generation. This system has proved to be more capable than the earlier models, both in terms of application as well as its resistance to fracture<sup>40</sup> (Miller R., 1996). It is thinner and smaller which means greater patient comfort. It is beneficial over other similar appliances with a ball joint.

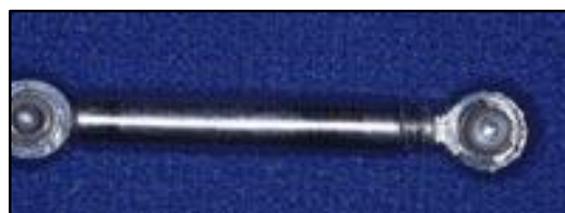


**Fig4. Ball Joint attachment**

#### **5 – The Ventral Telescope(Racine Wisconsin)<sup>3</sup>**

It was the first single unit telescopic RFFA i.e. it does not come apart on maximum opening. It is existing in two sizes and fitting is attained through ball attachments. It is easy to activate. The process is simple and is done by unscrewing the tube thus allowing an activation of approx 3 mm.

It is relatively dense and suffers from fractures to the brake which stabilizes the joint. In other appliances fitting is achieved through ball attachments, great accuracy is necessary with respect to the welding of components and inclination.



**Fig5. Ventral Telescope**

#### **6 - The Magnetic Telescopic Device<sup>7</sup>(Ritto A.K., 1997)**

This consists of two plungers and two tubes with a half circular section and with Neodymium magnets placed in such a way that a repulsive force is exerted. Fitting is attained by using the MALU system. This appliance has the advantage of linking a magnetic field to the functional appliance. Its main demerit are its bulkiness, the lab work necessary to prepare it and the covering of the magnets.



Fig6. Magnetic Telescopic Device

7- **The Mandibular Protraction Appliance**<sup>8-10</sup> (MPA) (Filho C., 1995, 1997, 1998)

It is easy to make in the laboratory. It is easy to fabricate, low price, occasionally fractures, patient comfort and rapid fitting.

Another advantage - Any time it can be fabricated. When there has been a failure in the availability of other commercially available appliances or if the orthodontist practices in an area where it is difficult to quickly obtain certain other alternatives. There are 3 different types of MPA

**MPA I** – Each side of the appliance is made by bending a small loop at a 90 degree angle to the end of .032" SS wire. The length of the appliance is determined by protruding the mandible and another small 90 degree angle circular bent in reverse direction. The appliance slides distally along the mandibular archwire and mesially along the maxillary archwire. Premolar brackets must be deboned. The main disadvantage is less mouth open.

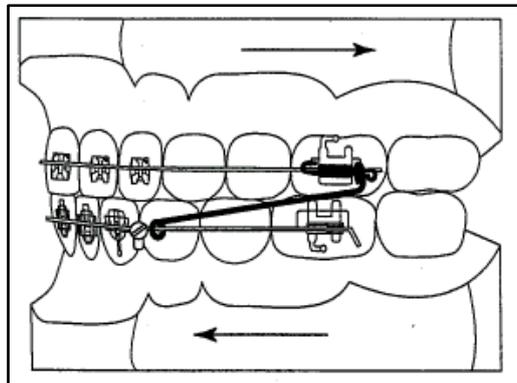


Fig 7aMPA 1

**MPA II** – It is made by making circles in two pieces of .032" SS wire which is perpendicular to one another. A stainless tubing is slipped over one of the wires. This version allows the mouth to open wider than MPA I.

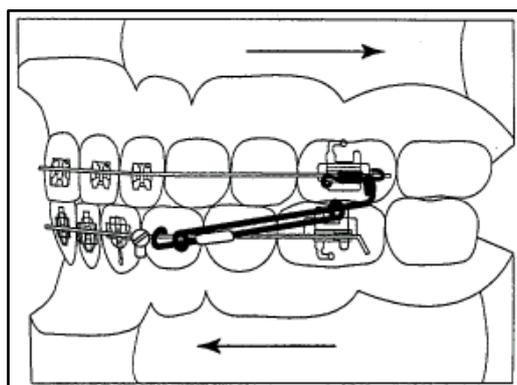


Fig 7b MPA 2

**MPA III** –It eradicates strain of archwire that occurs with the MPA I and II. It freely move the jaw while keeping the Mandible advanced position. It can be used with class II or class III malocclusions both. It is similar to Herbst by joining a telescoping mechanism but it is smaller in size. It requires more time in fabrication and a good electronic welder that does not darken or weaken the wire.

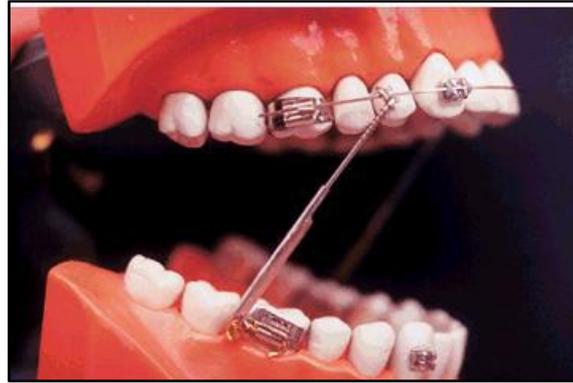


Fig 7c. MPA 3

#### MPA IV

The latest version, the MPA IV, is made up of the following parts:

- "T" tube
- Upper molar locking pin
- Mandibular rod
- Mandibular archwire

This fourth version seems to be as efficient as its antecedents, but is much more practical to construct, easy to manipulate, and comfortable for the patient

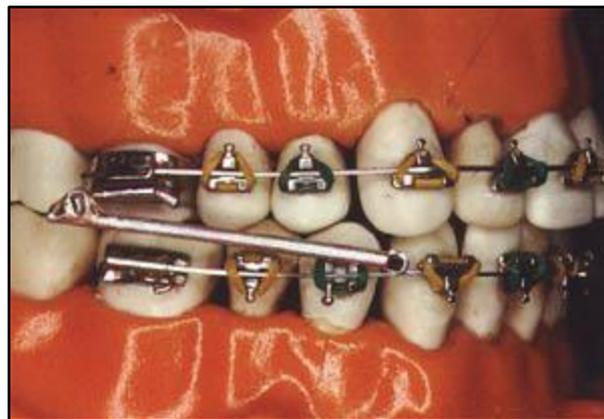


Fig 7d. MPA 4

#### 8-The Universal Bite Jumper<sup>11</sup>(UBJ) (Calvez X., 1998)

This is similar to Herbst but small in size and more multipurpose – it can be used in every stages of treatment both mixed or permanent dentition, Class II or III malocclusions. If required an active coil spring can be added. No lab preparation is required. It is fitted in the patient's mouth and for the desired mandibular advancement cut the appropriate length. Activations are done by crimping 2-4 mm splint bushings onto the rods. UBJs with nickel titanium coil springs do not need reactivation.



Fig 8. Universal bite jumper

**9-The BioPedic Appliance(Collin J. marketed GAC International,1997)<sup>3</sup>**

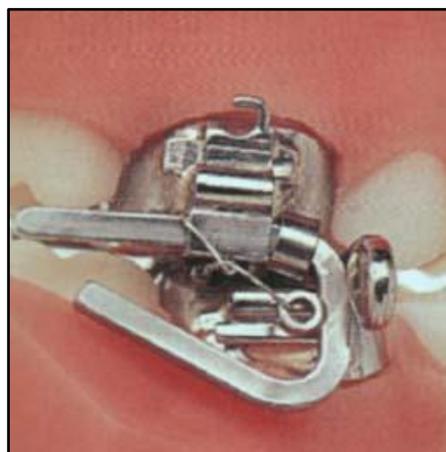
It is a bite jumping appliance which is attached on the upper and lower molars, using a cantilever like system. It is then attached to a biopedicbuccal tube. Activation is done by sliding the appliance along the buccal tube and fitting the screw. It is universal in sized for both sides. When the patient opens his mouth, two pivots on the ends allow the appliance to rotate.



**Fig 9.The biopedic appliance**

**10 –The Mandibular Anterior Repositioning Appliance<sup>12</sup> (MARA) -It was created by Douglas Toll of Germany in 1991.** It is a lab manufactured appliance consisted of cams on the molars which direct the patient to bite into forward position. The SS crowns covers upper molar and the patient pulls his mandible backward to a Class II position, but unpleasant sensations are produced due to improper cuspatation. Apart this orthodontist prefer bands instead of crowns, to prevent breakages failures. The appliance permits for use in conjunction with braces. It is used for Class II treatment and for TMJ problems.

In our opinion, this appliance has simple features which allows good hygiene during the improvement stage. By the use wire and composite a small modification to the original design can be done, and very interesting appliance can be created for finishing treatment of a Class II malocclusion treated with a functional appliance.



**Fig 10.Mandibular anterior repositioning appliance**

**11 – The IST – Appliance (HinzGermany)<sup>3</sup>**

The Intraoral Snoring-Therapy Appliance is a fresh device to treat patient suffering from inhalation problems during sleep, e.g. obstructive sleep apnea. According to the creator, the IST appliance overturns snoring by moving the mandible forward that reduce the obstruction in the pharyngeal area.

The device offers two very important advantages:

- The telescope is attached so the operator can change the protrusion on each side separately up to 8mm.
- An end stop in the guiding sleeve prevents the telescope from disengaging.
- The appliance is available in two more lengths.



**Fig 11. IST (Intraoral Snoring Therapy) Appliance**

**12 –The Ritto Appliance<sup>6,13-15</sup> (Ritto A.K., 1998)**

- It can be defined as a telescopic process that is both small and versatile. It has been created an efficient appliance of simplified intra-oral application
- It is a single piece device with telescopic action. It is used on both side due to its Jingle format.
- Total length of appliance when closed is 25mm and at maximum opening is 33mm.



**Fig 12. Ritto appliance**

**13 – Rick - a - nator (designed by Gallaher)<sup>3</sup>**

- The Rick-A-Nator is a very non creative appliance, consisting of two upper 1st molar bands attached to an anterior bite plate via two 0.040" connector wires. This incisal ramp advance the mandible correcting Class II molar relationship to Class I and thus reduce the overjet.



**Fig 13. Rick- A- nator**

**14- Advansyn 2 OrmcoCorp, orange, calif<sup>16</sup>**

- An evolution in Herbst 1 class II therapy, it is designed to advance the mandible to class I occlusion within six to nine months. While patient has been bonded upper and lower 2<sup>nd</sup> premolar to 2<sup>nd</sup> premolar.
- It provides maximum comfort and range of movement and reduces the necessity for patient compliance.
- It is placed with first bonding synchronizing class II treatment with orthodontic therapy.
- Provide constant activation.
- It facilitates the mandible forward thus creating constant orthopedics changes as tested and demonstrated by clinical researches
- Simple and streamlined designed, easy to deliver for doctor.
- No TPA and lingual arches required
- Allow freedom of process mesial to the molar crowns
- Built inactivation –no need to change the arms for final activation.

[www.ormco.eu](http://www.ormco.eu) / [www.ormco.i](http://www.ormco.i)

**Advantages of AdvanSync2:**

1. Class II correction in Class I.
2. Tooth movement from 2nd premolar to 2nd premolar can be carried out simultaneously
3. Jaw position improvement is immediate
4. Constant force is delivered, thus patient compliance is eliminated
5. Lateral jaw movements is not hampered
6. Two-phase treatment is eliminated, thus treatment time can be shortened.
7. Appliance can be given during mixed-dentition phase
8. Step-wise mandibular advancement can be done to achieve more skeletal effect, thus minimizing dental effect.

**The clinical steps are:**

1. Adequate separation of molars.
2. Proper band selection (Sizes of bands are 4, 5, 6 and 7 respectively)
3. Cementation of lower bands and placement of lower archwire
4. Attachment of telescopes (right and left sides respectively) in the distal casing of upper band. This has to be performed extra-orally, after which the bands are cemented and upper archwire is placed.
5. Guide the patient to get the mandible forward, to align the lower telescopic mechanism in the mesial casing and then place the screw.

**Appliance placement:**

Upper- Distal Casing / Lower- Mesial Casing

Appliance activation:

Upper- Distal Casing / Lower- Distal Casing

**The appliance activation protocol is:**

**- On the day of placement:**

Telescopic mechanism is placed in distal casing of upper band and mesial casing of lower band. This gives approx 4 mm activation.

**- 1st activation:**

After around 6-8 weeks, patient is re-called for next activation. The screw from the lower mesial casing is shifted to the distal casing, thus producing around 2 mm activation.

**- Subsequent activations:**

Patient is again recalled after 6-8 weeks to check the correction of mandibular advancement. If required, the spacers (1 or 2 mm are placed) for further activation. Spacers are needed unilaterally- to correct midline discrepancy, if any.

**Placement of spacers:**

Ask the patient to open the mouth. Slide the spacer (1 or 2 mm) as required.

Crimp the spacer tightly with the help of Ormco-C spacer plier.

**Multi-step advancement over single-step advancement helps to achieve better skeletal effect and soft-tissue adaptation. Dental effect is minimized. Condylar adaptation is better achieved**

**Following are the indications of AdvanSync2:**

1. Growing patient (To be evaluated by CVMI & secondary sexual features)
2. Mandibular retrognathism (as per facial profile and cephalometric values)
3. VTO positive
4. Non-compliant cases

**Biomechanical advantages of the appliance:**

1. AdvanSync2 is a molar to molar Class 2 corrector. The tooth movement mesial to the 1st molar can be carried out simultaneously, thus eliminating the need of two-phase treatment.
2. Step-wise advancement of the appliance brings better skeletal effect. AdvanSync2 is not attached directly on the wire and also the telescopes are shorter, thus they do not exert more horizontal vector of force leading to lower incisor proclination.

There is posterior open-bite observed in pre-molars and the molar segment when the appliance is removed. However, this is correctable either by:

- a) Gingival re-positioning of the brackets
- b) Banding of 2nd molars
- c) Settling elastics

The above mentioned methods help in achieving better inter-digitation.

#### The Retention Protocol After Debonding

The cases in which AdvanSync 2 is used can be best retained using a removable retainer with an anterior inclined plane. This helps in retaining the corrected mandibular position. Removable retainer should be worn daily for a maximum duration to retain the treatment result.

#### The clinical problems & emergencies associated are:

##### a) De-cementation of the appliance:

This problem can be prevented by proper isolation during appliance placement. Hard and sticky food must be avoided during the course of the appliance. Proper counseling should be done with the patient before and after the placement of the appliance.

##### b) Un-screwing of the appliance:

The un-screwing of the telescope becomes a serious emergency. High attention care needed while placing the appliance. The screw should be placed perpendicular to the band and should be placed tightly to avoid the un-screwing.

Over-correction is desirable to counteract some relapse of mandibular anterior repositioning, just like any other fixed functional appliance. It is advisable to correct till edge-edge incisor relation to counter-balance the relapse tendency.



Fig14.AdvanSync2

#### Flexible fixed functional appliances

##### 1. Jasper Jumper-(Jasper & McNamara 1995)<sup>17,18</sup>

- In an effort to overcome the stiffness problem of the Herbst Appliance, James Jasper developed a new pushing device that is flexible. It is called as Jasper Jumper. It can be attached between the upper and lower arches to produce both sagittal and intrusive forces which may be either "head-gear like", "activator like forces" or mixture of both.



Fig15. Jasper jumper

## 2. Adjustable bite corrector (Dr. Richard west 1995)<sup>19</sup>

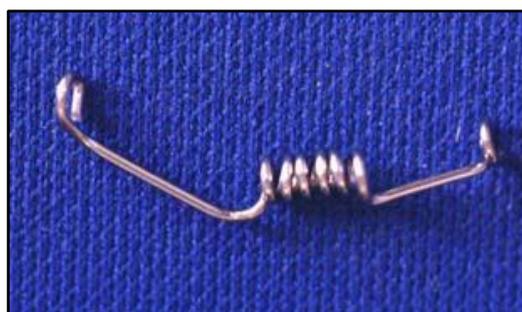
- The appliance is same as Jasper Jumper but then includes several useful features. It consists of a stretchable closed-coil spring with internally threaded end caps at both ends. This allows added range of opening with no risk of breakage or accidentally changing its length.



**Fig 16.Adjustable bite corrector**

## 3 Churro Jumper (Ricardo castanon et.al. 1998)<sup>20</sup>

- The name comes from a Mexican cinnamon twist. It functions similar to Jasper Jumper.
- In class II relation it is seen that jumper binds to the upper molars by a pin that passes first through a distal end of circle and then through the distal end of the headgear tube one by one. It is preserved by bending the pin down on the mesial end of the tube.



**Fig17.Churro jumper**

## 4. Amoric torsion coils (Amoric N. 1994)<sup>21</sup>

- Composed of two intermaxillary springs, one inside the other.
- It is specifically available in one size and is bilateral. The amount of force exerted by the appliance is proportional in accordance with the fixing points on arch.



**Fig 18.Amoric torsion coils**

## 5 .Scandee tubular jumper (Saga dental AS, 2201, Kongsvinger, Norway)<sup>3</sup>

- Highly coated inter-maxillary torsion spring placed in a kit consisting of spring, the connectors, the covering, the ball pins and the glue. There is no differences can be recognised between left and right side.
- The covering can be of different colours making it more attractive for patients.



Fig 19.Scandee tubular jumper

**6 The Bite fixer (Awbrey1999) ormco<sup>3</sup>**

- It is a fixed flexible intermaxillary functional appliance.
- It's a coil spring properly fixed and crimped to the fitting end thus preventing fracture between the spring and the fitting end.



Fig 20. Bite fixer

**7 Super Spring II. (Lewis Klapper 1999)<sup>22</sup>**

- The super spring II is a flexible spring that attaches between the upper molar and lower 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 useful in variety of class II cases, from hyperdivergent to brachyfacial patterns with shallow and deep overbites respectively. These springs are commonly used with fixed mechanotherapy.

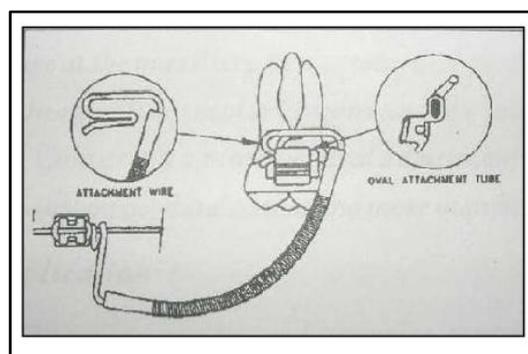


Fig 21. Super Spring II

**Hybrid fixed functional appliances.**

**1. Eureka spring (John Devincenza 1997)<sup>23</sup>**

- This is also a fixed intermaxillary force delivery system same as fixed Herbst appliance, used in non-compliant class II patients.
- Minimal patient co-operation is required.
- It is less bulky and lack its prominence in the buccal vestibule. Hence it is aesthetically acceptable, fracture resistant and also tissue friendly.



Fig22. Eureka spring

**2 Forsus (fatigue resistant device) William Vogt marketed by (3M Unitek Corporation 2006)<sup>24-26</sup>**

- The Forsus (also known as the Forsus Fatigue Resistant Device [FRD]) is a semi-rigid telescoping system incorporating a nickel-titanium coil spring that can be assembled chair-side, and it can be used in combination with fixed mechanotherapy.
- 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 any Class II cases with convex profiles, except those with normal mandibles and prognathic maxilla, or with protrusive or overly large mandibles relative to the other skeletal structures.

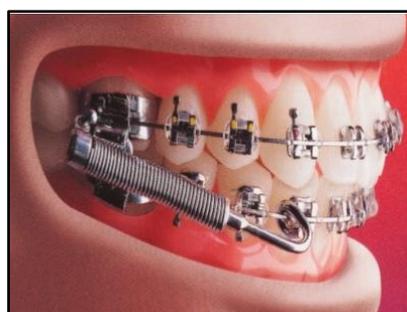


Fig 23.Forsus (fatigue resistant device)

**3 Alpern Class II corrector(GA C International Inc.)<sup>3</sup>**

- This appliance was designed as a substitute for elastics. It consists of a small telescopic device with an inner coil spring and hooks for fixing.
- It works same as elastics and is fixed to the mandibular molar and to the maxillary cuspid. Its telescopic action enables a comfortable opening of the mouth.



Fig 24.Alpern Class II corrector

**4 Calibrated force module (The Cor Mar Inc. 1988)<sup>3</sup>**

- It was a fixed appliance designed to replace class II elastics.
- It is applied to the mandibular arch close to molars and fixed by a screw, and mesial or distal to upper canines, and also fixed to the arch. Its coil spring produced a force between 150 and 200 gm

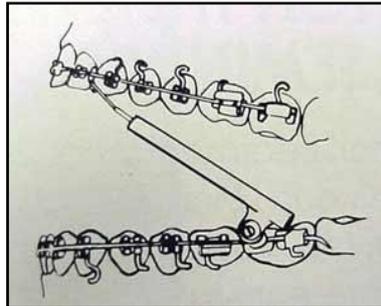


Fig 25. Calibrated force module

5 **Power scope (Dr. Andy Hayes)** <sup>27,28</sup>

- Indicated for orthodontic treatment of both growing and non-growing patients of Class II Malocclusions. Use standard treatment protocols for Class II Correction when using appliance.
- Power Scope is contraindicated for patients having history of severe allergic reactions to nickel, compromised periodontal condition, or absence of complete permanent dentition.



Fig26. power scope

**Modification in fixed functional appliance** <sup>29</sup>

**Requirements:**

- Fixed functional appliance e.g. Forsus
- Molar bands for upper and lower first molars
- 1mm stainless steel wire
- Soldering unit

Mandibular arch impression is made with molar bands in position. Lingual arch is made with 1 mm SS wire is soldered mandibular bands with very slight contact with the lingual surface of lower incisors. Buccal arch is also made with 1 mm SS wire and soldered buccally after inserted in headgear tubes. Moreover breaks are made in the buccal arch distal to the canines or first premolar, depending on the choice of operator. Modification is complete and ready to cement.

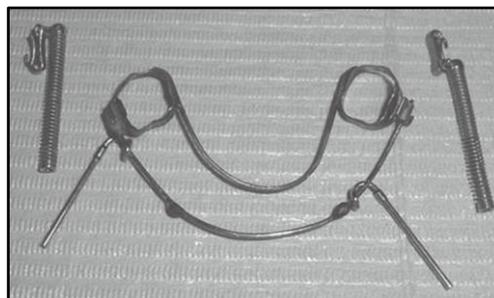


Fig27. Modified functional appliance component

**Advantages**

- Lower anterior are not bonded and involved so there is minimal force on teeth to proclined them.
- The mandibular arch is not involved so no cellular activity occur in response to orthodontic force which in turn increases their anchorage value.

- Treatment can be started earlier even the cuspid and bicuspid are not there. As the force trajectory is forward and downwards therefore there is also increase in lower facial third and frankfort mandibular angle, sometimes required in Class II cases.

#### Disadvantages

- Lower molars get tipped mesially
- Buccal arch can be traumatic to gingiva and need modification in every visit

## II. Conclusion

Functional appliances do not replace fixed attachments. Definitely combined use of brackets, bands and extraoral force has the potential for the best possible and most stable long term results .When correctly used, they can be valuable additions to the armamentarium of the experienced orthodontic clinic.

Functional appliance therapy is to be generally followed by the traditional full banded techniques for best results; since they deal more with the major changes in the intermaxillary relations. Selection of fixed functional appliance is important for patient depending on whether anterioposterior dental effects, or orthodontic and orthopedic changes has bring out.

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