Fixed Functional Appliance- A Review

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ABSTRACT:

Fixed Functional Appliances was first introduced by Dr. Emil Herbst of Germany in 1909. It has come into practice since 1930s, way back a long history related to its use, method of action and its effectiveness. These appliances transfer their forces to the dentition and underlying basal bone. The resultant orthodontic and orthopedic changes are due to the net muscle forces that are delivered when the mandible shifts its position sagittally and vertically. Correcting class II malocclusion has always challenged an orthodontist owing to the complex and multifactorial aetiology. Age of patient and selection of the appliance plays an important role in the outcome of the treatment. Modifying the growth using functional appliances achieves stable results in class II patients. There are different types of fixed functional appliances available till date. A keen analyses of the patient and adopting the correct appliance helps in better results.

KEY WORDS:

Class II malocclusion, fixed functional appliances, displacement

INTRODUCTION:

Altering a patient’s profile is the most challenging part of an Orthodontist. Functional appliances refers to a variety of appliances designed to alter the arrangements of various muscle groups that influence the function and position of the mandible in order to transmit the forces to dentition and basal bone[1]. Class II malocclusion is a common condition where patients seek orthodontic treatment. Fixed functional appliance has come into use in recent years to achieve better results in non-compliant patients. The corrections consist of advancing the mandible to a forced anterior position to simulate growth and harmonize skeletal defects.

INDICATIONS:

• In young growing individuals for the correction of skeletal abnormalities
  a) In the skeletal class II patients with retrognathic mandible.
  b) In skeletal class III patients with retrognathic maxilla.

• In patients who have crossed their maximum pubertal growth and are too old for removable functional appliances
• In adult patients
  a) In dental class II molar relationship to distalize the maxillary molars
  b) Can be used to enhance anchorage
  c) Can be used as an mandibular anterior repositioning splint in patients having temporomandibular joint disorder
  d) In class II malocclusion patients for presurgical muscle conditioning of patients
  e) In class II / class III malocclusion patients for post surgical stabilization
• In adult patients for compensatory treatment of mandibular deficiency
• As an anchorage for space closure with mesialization of posterior teeth in cases of agenesis of mandibular premolars or extraction of mandibular first molars [2].

CONTRAINDICATIONS:
• Patients with periodontal issues.
• Patients with thin gingiva in mandibular anterior region.
• Patients with mandibular incisors anteriorly projected.
• Patients with marked gingival smile.
• Patients with a tendency to open bite.

TYPES:

Functional Appliances can be categorized broadly as

1. Fixed Functional Appliances- for patients who are non-compliant to removable appliances and in patients after the growth phase has been completed.

2. Removable Functional Appliances- for compliant patients and for those who are in growth phase.

Fixed Functional Appliances can be classified as: by Ritto A. Korrodi (2001) [3]

A) RIGID FIXED FUNCTIONAL APPLIANCES (RFFA)-
  1. The Herbst appliance and its modifications.
  2. The Mandibular Protraction Appliance (MPA)
  3. The Mandibular Anterior Repositioning Appliances (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
Herbst appliance introduced by Emil Herbst in the early 1900’s is a fixed bite jumping appliance. Bite jumping can be defined as a change in sagittal intermaxillary dental arch relationship by anterior displacement of the mandible. It comprises of telescopic mechanism with sliding pin and tube component which keeps the mandible in protruded position. The Herbst appliance is considered as the most effective fixed functional appliance over the past 100 years [4]. The Mandibular Protraction Appliance was designed by Coelho Filho in 1995. It is a handmade appliance and functions much similar to the Herbst Appliance apart from its small design. It is attached to the maxillary first molar headgear tube and to the mandibular rectangular archwire [5]. The treatment results produced by Mandibular Anterior Repositioning Appliances are very similar to the Herbst Appliance but with lesser head gear effect on the maxilla and less mandibular incisor proclination than observed in the Herbst treatment group. The Advansync appliance was introduced by Terry Dischinger. This appliance does not require much laboratory work. The attachments in this appliance are similar to hybrid between a molar band and a preformed crown [6]. The size of the AdvanSync 2 appliance is much smaller compared to the Herbst Appliance which allows the dentist to place the braces in all the teeth without interruption. The Jasper Jumper is a Flexible Fixed Functional Appliance which was introduced by J.J.Jasper in 1980. It produces both sagittal and intrusive forces which provide free movement of the mandible.

CONSIDERATION FACTORS FOR FIXED FUNCTIONAL APPLIANCE:

1. AGE FACTOR- it can be used in post-adolescent patients in whom very less growth is remaining
2. GROWTH CONSIDERATION- poor prognosis is seen in patients with hyper divergent facial growth pattern
3. ESTHETIC CONSIDERATION- they yield excellent results in patients with skeletal class II bases with retrognathic mandible who have a positive VTO. While fixed functional appliance is not considered for patients with negative VTO
4. COMPLIANCE- they do not demand patient compliance

MECHANISM OF ACTION:

The fixed functional appliance is tooth borne and transmits the forces developed which results in continuous forward posturing of the lower jaw. These appliances increase the contractile activity of the lateral pterygoid muscle which intensifies the retrodiscal pad by repetitive activity. This leads to increase in growth stimulating factors by enhancement of local mediators and reduction of local regulating factors. There is an additional growth of condylar cartilage and subperiosteal ossification of posterior border of ramus, leading to supplementary lengthening of mandible.

BIOMECHANICAL EFFECTS OF FIXED FUNCTIONAL APPLIANCES ON CRANIOFACIAL STRUCTURES:

1. Fixed functional appliance displaces the mandible anteroinferiorly with its main effects on the incisor region. The maximum displacement was seen in the parasymphysial and midsymphysial region of the mandible. However the maxillary dentition was displaced posteroinferiorly [8].
2. The dislodging was more in the dentoalveolar area when contrasted with the skeletal displacement.

3. Tensile stresses were experienced in all dentoalveolar region, except for anterior nasal spine and maxillary posterior teeth.

4. Most extreme tensile forces happened in the condylar neck and head.

**COMPLICATIONS WITH USES OF FIXED FUNCTIONAL APPLIANCES:**

1. Breakage of bands or splints.
2. Breakage of telescoping mechanisms
3. Loosening of bands or splints.
4. Trauma to buccal mucosa.

There was no significant difference in complications of treatment between male and female patients.

**CLINICAL CONSIDERATION:**

Mandibular incisor proclination is the most common dentoalveolar side effect seen with fixed functional appliance treatment. This is of concern because it increases relapse tendency and also limits skeletal and soft tissue correction. This could be prevented by securing the mandibular archwire and laceback within the mandibular arch and by incorporating progressive lingual crown torque within the mandibular anterior segment. Unwanted proclination of the anterior teeth could be prevented by including the second molar in the treatment for better anchorage [9]. In high angle patients, fixed functional appliances should be avoided, as this might increase the vertical dimension due to dextrorotation of the mandible.

**CONCLUSION:**

From a biomechanical standpoint, fixed functional appliances are more recommended to treat class II malocclusion as well as in dolicocephalic patients [10].

The displacement was predominantly dentoalveolar in nature.

Tensile stresses were found in the entire dentoalveolar structures except the anterior nasal spine.

**REFERENCES:**


