Functional Appliances

An Overview in Using Functional Appliances in Treating Class II

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Skeletal Class II

- Maxillary (upper jaw) protrusion
- Mandibular (lower jaw) retrusion
- Combinations of both
- The majority of the Class II malocclusions have normal maxilla and retruded mandible

(McNamara 1981; Pancherz et al. 1997)
Skeletal Class II treatment

- Growth adaptation
  - Children/adolescents
- Camouflage-orthodontics
  - Post adolescents
- Surgical correction
  - Adults
(Pancherz 2000)
Orthodontic Appliances

• Fixed appliances
• Removable appliances
• Functional appliances
  - Removable (activator, bionator)
  - Fixed (Herbst appliance)
Definition

• A functional appliance is an appliance that produces all or part of its effect by altering the position of the mandible.

• It is one that changes the posture of the mandible, holding it open or open and forward.

• Nearly all functional appliances are removable.
Functional appliances

- They do not act primarily on teeth like conventional appliances (springs, elastics)

- They transmit, eliminate or guide natural forces

- Natural forces that can be controlled by functional appliances are: muscle activity from the tongue and check, tooth eruption, and growth and development
Functional appliances

- Removable (activator, bionator, Fränkel II)
- Fixed (Herbst appliance)

- Affecting mandibular growth & position
**Functional Appliance**

- Performed during the main growth period around puberty
- The most favorable age for therapy
  - 8-11 years for girls
  - 10-13 years for boys
  
  (Pancherz 2000)
Types

- Tooth-borne passive
- Tooth borne active
- Tissue borne
Tooth-borne passive

- No intrinsic force generating capacity from springs or screws and depend only on soft tissue stretch and muscular activity to produce treatment effects
- Andersen Activator
- Woodside and Harvold Activator
- Bionator
- Herbst appliance
Tooth Borne Active

- Modified Activator (many named types)
- Expansion Activator
- Orthopedic corrector
- Stockli headgear Activator
Tissue Borne

- Frankel Appliance
The Anderson Activator

- Fits loosely
- Advances the mandible forward
- Uses moderate opening of vertical dimension
- Incorporate a labial bow for control of maxillary anterior teeth
- An acrylic cap over lower incisors
- Facets cut in the acrylic help direct eruption of posterior teeth
The Woodside & Harvold Activator

- Increase vertical opening to help maintain the appliance in the mouth during sleep by stretching the soft tissue
- The mandible is advanced so that the incisors are in edge-to-edge relationship
- Maxillary teeth are prevented from eruption
- Mandibular teeth are free to erupt upward and forward
Tooth-Born Active Appliances

- These are largely modifications of activators and bionators
- It include expansion screws, springs to provide intrinsic forces for transverse and anterioposterior changes such as expansion activators, orthopedic corrector
The Expansion Activator
The Orthopedic Corrector
The Stockli-type Activator

• Tooth-borne appliance that attempts to reduce undesirable dental changes with the addition of high pull headgear and torquing springs

• Vertical anterior torquing springs to reduce lingual tipping of maxillary incisors
The Stockli-type Activator

• Headgear will restrict the horizontal growth of the maxilla
• The acrylic prohibits posterior maxillary eruption and allow mandibular eruption
Functional Appliance Components

Functional components

• Lingual pad or flanges
• Lip pads
• Buccal and lingual shields
• Occlusal or incisal stops
• Sliding pin and tube
• Facets or flutes
• Displacing springs
Functional Appliance Components

Active components

- Labial bow
- Headgear tube
- Torquing springs
- Expansions screw and spring
Functional Appliance Effects on Teeth (in general)

- Tipping of mandibular incisors facially
- Retract maxillary incisors
- Allow of eruption and mesial movements of mandibular molars
- This result in increase lower facial height
Bionator

- Developed first by Wilhem Balters (1964)
- The most commonly used removable functional appliance today
- It is a generic term that refers to a family of appliances used to treat malocclusions, characterized in part by mandibular deficiency
Bionator

• The bionator produces a forward positioning of the lower jaw
• The acrylic parts of the bionator contact the teeth and supporting structures, thus creating changes in the skeletal, dentoalvelor and muscular environment of the craniofacial region
Bionator

- It is a cut down activator
- Less bulky than activator
- Easily accepted by parents and patients than activators
Bionator

• Many modifications have been introduced to the bionator.
• Due to limited amounts of acrylic used in construction in comparison to the activator, more normal speech patterns can be maintained by the patient compared to wearing activator appliances.
Bionator

• Vertical control is present
• Uses a lingual flange to regulate the posture of the mandible and usually incorporates a buccinator wraparound or labial bow
• The design can include posterior facets or acrylic occlusal stops to control amount and direction of eruption
Advantage of the Bionator

- Less prone to breakage
- Relative ease of fabrication
- Relative ease in clinical handling
- It could be used with simultaneous fixed appliance Tx
- Not as effective with patients suffering from significant neuromuscular imbalance where FR-2 is indicated
Types of Bionator

- Bionator to open the bite
Bionator to close the bite
Bionator to maintain the bite
Rick-a-nator

-Designed by Gallaher
-To Tx patients who are non-compliance
-Or who have difficulties in wearing removable appliances
-It consists of maxillary inclined plane, which hold the mandible in the desired AP position
Frankel II

- In Tx of Cl II malocclusion characterized in part by mandibular skeletal retrusion
- Greatest effect on skeletal dentoalveolar and muscular component
- Unique by been tissue-borne rather than tooth-borne
- Base of operation is the maxillary and mandibular vestibule
- Direct and primary effect on the neuromuscular system
first is used as an exercise device in retraining the associated musculature and indirectly producing changes in skeletal and dentoalveolar relationship by reprogramming the CNS

interrupts abnormal patterns of muscle activity
ultimately produces an environment in which skeletal and dental arch changes occurs

- increase in mandibular length
- increase in transverse dimensions of dental arches
- appliance of choice in the TX of patients with severe neuromuscular imbalances and skeletal discrepancies
- tissue-borne appliance - maximum skeletal changes archived with minimal unwanted tooth movement
- protecting effect of vestibular shield on dentition - spontaneous expansion in both arches occurs
- optimizing the development of the orofacial structures, in part, by "removing restrictions or retarding in the accomplishment of growth pattern"
FR_2

Anteroposterior dimension

- Max skeletal position
  - no or minor influence

- Max dentoalveolar position -
  - horizontal molar movement-slightly restricted
  - vertical molar movement-unaffected
  - slight lingual tipping of U1
FR_2

- **Mand dentoalveolar position**
  - additional vertical molar movement
  - lower incisors proclination (freed from behind the lower lip)
Mand skeletal position
- Pog moves forward
- mandibular growth
- increase in posterior facial height
- Y-axis closed - more horizontal vector of growth

Vertical dimensions
- increase in lower anterior facial height

Transverse dimensions
- average in expansion of dental arches:
  max  4-5mm
  mand  3-4mm
TWIN BLOCK APPLIANCE

• Developed by Clark in 1977
• Has no direct effect on musculature
• Perceived by most clinicians to be easier to manipulate than FR-2
• Class II correction can achieved readily within a 6-9 months period
• Easy for the patients for adaptation
TWIN BLOCK APPLIANCE

• Composed of removable MAX and MAND separates unattached plates that fit tightly against the teeth, alveolus and supporting structure

• Full time appliance (including during meal)

• Control of vertical dimensions
TWIN BLOCK APPLIANCE

- **MAX plate**, with one or two midline screw
  - if expansion needed
- Bilateral bite blocks are located: posterior
  - in the maxillary appliance and anterior -
  in the mandibular appliance
- The inclined planes of the posterior bite blocks are oriented at 70 degrees to the occlusal plane to initiate functional shift of the mandible and to open the closed bite
TWIN BLOCK APPLIANCE

• The 2 screws - gives a stability for appliance ( specially for patients with significant expansion needed )

• Clark : saggital screw if retroclination of Max incisors
Original (Clark’s) design

- Horseshoe of acrylic that extends posterior to the mandibular second premolars
- Molars not contacted by acrylic to allow for eruption
- Ball clasps
Modified (McNamara’s) design

- Labial bow placed anterior of mand incisors
- Posterior extension to the first and second molars but not occlusal coverage
- Mand block originate in the mand canine region
- Gradually increase in height posterior
- Occlusally – to 2\textsuperscript{nd} premolars
TWIN BLOCK APPLIANCE
EFFECT OF TREATMENT

• Increase in MAND length
• Distalization of the MAX molars
• Eruption of the MAND molars
• Tipping of the anterior incisors: proclination - mandibular, retrusion - maxillary.
• Increase in anterior and posterior facial height
• Inhibition in MAX growth
Advantage of twin block therapy

- Ability to manipulate the vertical dimension
  - Improved patient cooperation
  - Easy for adaptation
The Herbst appliance

- Described first by Herbst (1900)
- It was one of the early attempts to produce mechanically "jumping of the bite"
The Herbst appliance

- Original banded design was introduced by Herbst at the International Dental Congress in Berlin in 1905
- Popularity diminished
- Reintroduction in 1979 by Pancherz
The Herbst Appliance

• Keeps the mandible continuously in a protruded position, both on jaw closure and when the teeth are not in occlusion
• Cast metal skeleton splints were cemented to both upper and lower arches
• Once placed by the operator, cannot be removed by the patient
**MAX skeletal**

- Minimal short term effect
- Inhibition of midfacial length (McNamara)

**MAX dental**

1. **Molars**: upward and backward vector of force
   - molars distalization
   - molar intrusion
   - distal crown tipping
2. **Incisors**: remains unchanged
• **Mandibular molars**
  - mesial movement (1-2mm)
  - extrusion
• **Mandibular incisors**
  - proclination
  - intrusion
• *The crown Herbst appliance produces greater proclination of lower incisors than acrylic splint Herbst appliance*
Advantage of the Herbst

- Fixed to the teeth and no co-operation from the patient is required
- It works 24 hours a day
- Treatment time usually short (about 6 to 8 months)
Wax Bite

- A proper wax bite must be provided
- The mandible must be brought forward until the lower anterior are labial to the upper anterior by 1-2 mm or edge to edge depending on the technique
- Posterior separation of 6-7mm to open bite
- Posterior separation 3-4mm to close or maintain bite
Before & After
Before & After
International Symposium on Early Orthodontic Treatment, Phoenix, AZ 02/02
(Turpin. AJO-DO April 2002)

• The range of possibility for correcting Class II problems remain fairly broad
• Proffit reported the results of the long-term prospective study of class II correction “there are no significant differences in the treatment results”
• Lysle Johnston supported these finding
• Bremen, Pancherz in AJO-DO Jan 2002 reported “Class II Div I treatment was more efficient in the permanent dentition than it was in the early or late mixed dentition” considering better outcome and shorter treatment time
Literature Review

• De Almeida et al. AJO 2002 reported in their study that The major treatment effects of bionator and FR-2 appliances were dentoalveolar, with a smaller, but significant, skeletal effect. Both appliances produced similar labial tipping and protrusion of the lower incisors, lingual inclination, retrusion of the upper incisors, and a significant increase in mandibular posterior dentoalveolar height.

• Mills CM et al. (AJO 2000) reported in their study of twin block with experimental and control group that the control group experienced a 2.3 mm increase in mandibular unit length during the 13-month observation period (annualized rate of 2.1 mm per year). In the posttreatment phase, the change in mandibular unit length for the Twin Block group was 6.0 mm over a 36-month period (annualized rate of change of 2.0 mm per year).
Literature Review

• A study comparing FR2 and twin block showed more extensive dentoalveolar adaptation that was observed with the tooth-borne Twin-block appliance than with the more tissue-borne FR-2. The Twin-block and FR-2 samples both showed significant retroclination and extrusion (eruption) of the maxillary incisors (Toth LR, McNamara JA Jr. 1999, AJO)

• Ghafari support a one-phase treatment starting in the late mixed dentition. “Earlier intervention in mid-childhood may be required in the presence of several developmental conditions, or when the dental and skeletal development deviate significantly in the individual patient” (Clin Orthod Res 1998)
Literature Review

• The Herbst method is most effective in the treatment of Class II malocclusions. Long-term stability seems to be dependent on a stable cuspal interdigitation. Marked mandibular morphological changes occur during therapy and sagittal condylar growth is increased. The appliance effect on the maxillary complex can be compared with that of a high-pull headgear. Without proper retention, however, this effect is of a temporary nature (Pancherz Seminar in Orthodontics 1997)

• Ghafari in his control study compared FR2 and headgear and found no difference. Treatment in late childhood was as effective as that in midchildhood (AJO 1999)
Thank You