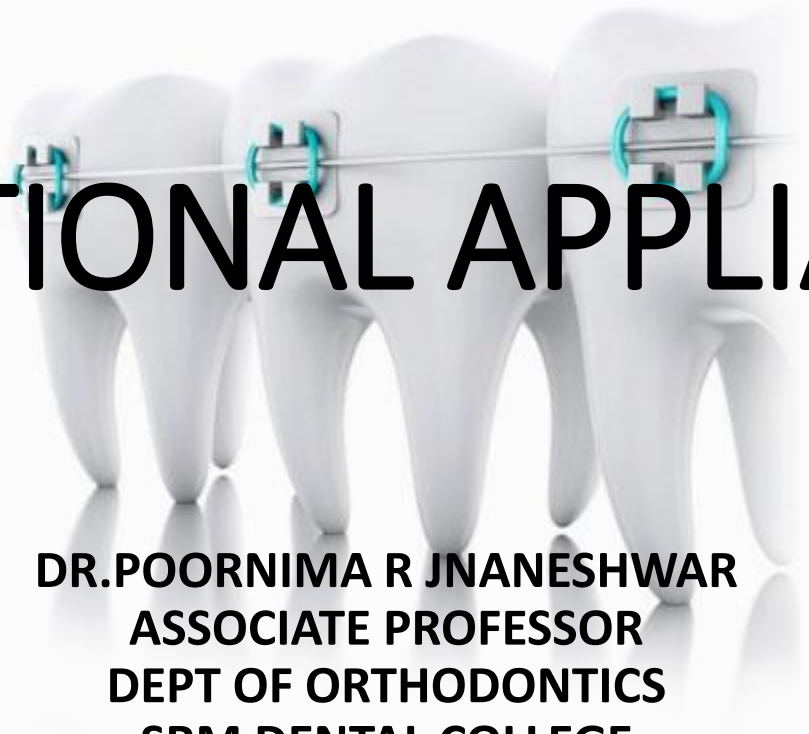
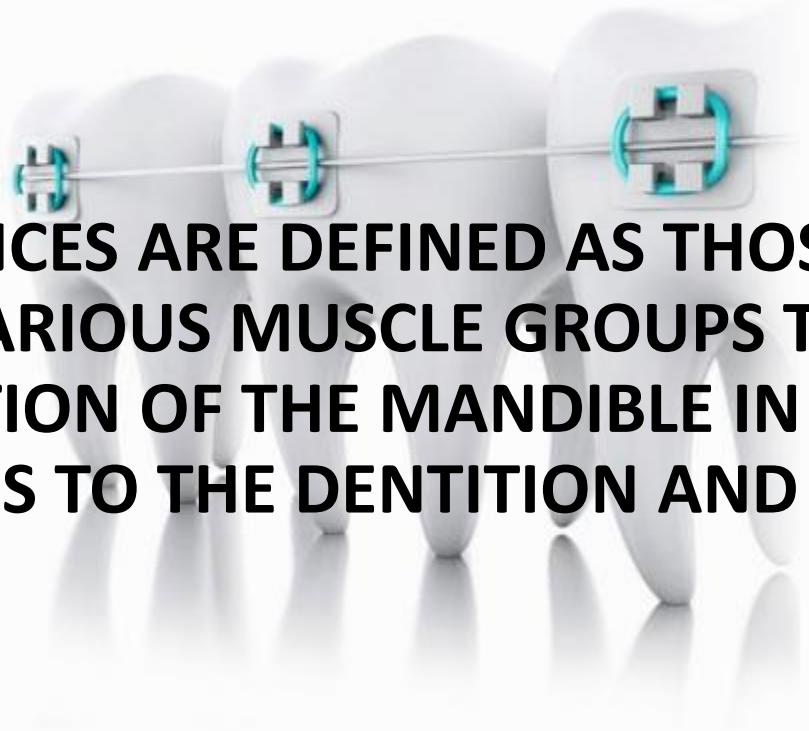


# FUNCTIONAL APPLIANCES

**DR.POORNIMA R JNANESHWAR**
**ASSOCIATE PROFESSOR**
**DEPT OF ORTHODONTICS**
**SRM DENTAL COLLEGE**

# DEFINITION



**FUNCTIONAL APPLIANCES ARE DEFINED AS THOSE THAT ALTER THE ARRANGEMENT OF VARIOUS MUSCLE GROUPS THAT INFLUENCE THE FUNCTION AND POSITION OF THE MANDIBLE IN ORDER TO TRANSMIT THE FORCES TO THE DENTITION AND THE BASAL BONE**

# Classification of functional appliances

**Removable appliances**

- Activator
- Bionator

**Fixed functional devices**

- Herbst
- Forsus

# Classification of functional appliances

- Tooth borne active- expansion screw
- Tooth borne passive- activator, bionator
- Tissue borne passive- Frankel

# CLASSIFICATION

- ***TOOTH BORNE PASSIVE APPLIANCES***
  **Andersen Haupl activator, Herren activator Bionator, Harvold Woodside activator**
- ***TOOTH BORNE ACTIVE APPLIANCES***
  **Elastic open activator, Bimler's appliance, Modified bionator, Kinetor, Stockfish appliance**
- ***TISSUE BORNE PASSIVE*** **- Frankel**

**Group I- transmit muscle forces directly to teeth-**

- Oral screen, inclined place

**Group II- reposition mandible and muscle force is transmitted to teeth**

- Activator, bionator

**Group III- reposition mandible – area of operation - vestibule**

- Frankel, vestibular screen

# CLASSIFICATION BY TM GRABER

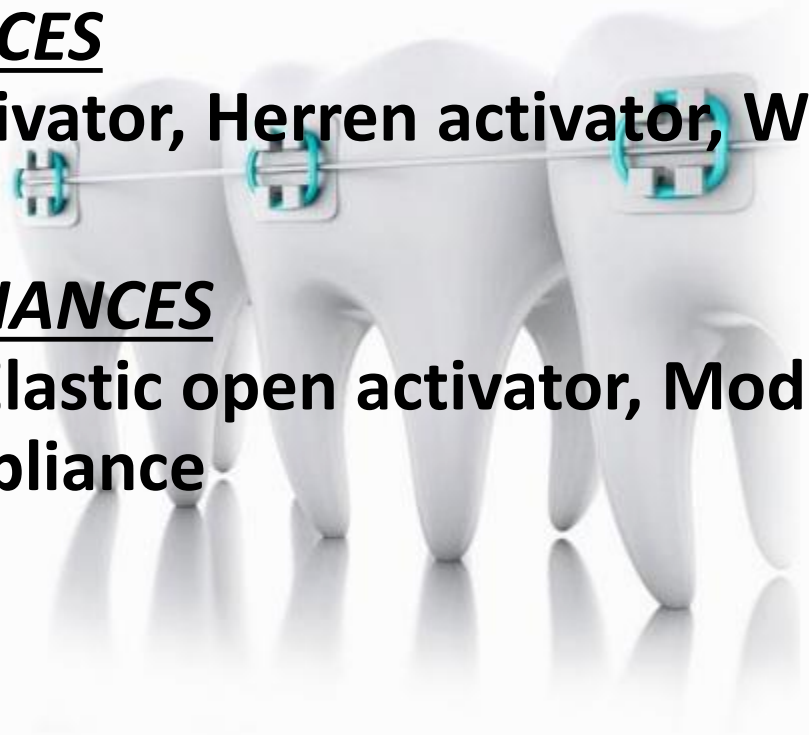
- **GROUP A**
  **TEETH SUPPORTED APPLIANCES**
  **INCLINED PLANES, CATALANS APPLIANCES**
- **GROUP B**
  **TEETH/ TISSUE SUPPORTED APPLIANCES**
  **ACTIVATOR, BIONATOR, TWIN BLOCK**
- **GROUP C**
  **VESTIBULAR OR TISSUE SUPPORTED APPLIANCES**
  **VESTIBULAR SCREEN, LIP BUMPERS, FRANKEL APPLIANCE**

**Myotonic appliances- depend on muscle mass for their action**

**Myodynamic appliances- muscle activity for their action**

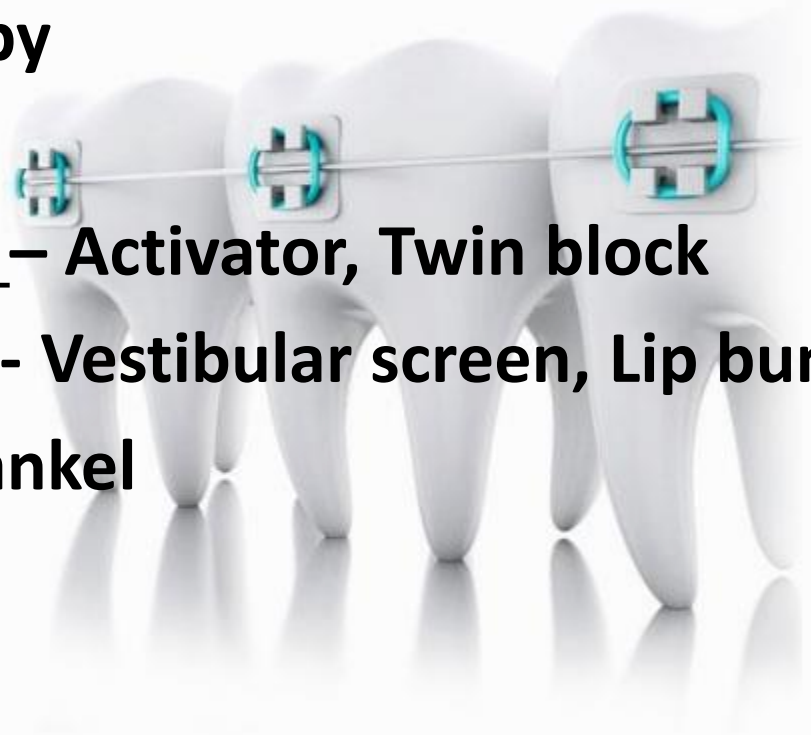
# CLASSIFICATION

- ***MYOTONIC APPLIANCES***
  **Andersen- Haupl activator, Herren activator, Woodside activator, Balters bionator**
- ***MYODYNAMIC APPLIANCES***
  **Bimler's appliance, Elastic open activator, Modified bionator, kinetor, stockfish appliance**



# classification based on force

- **Appliances that act by**



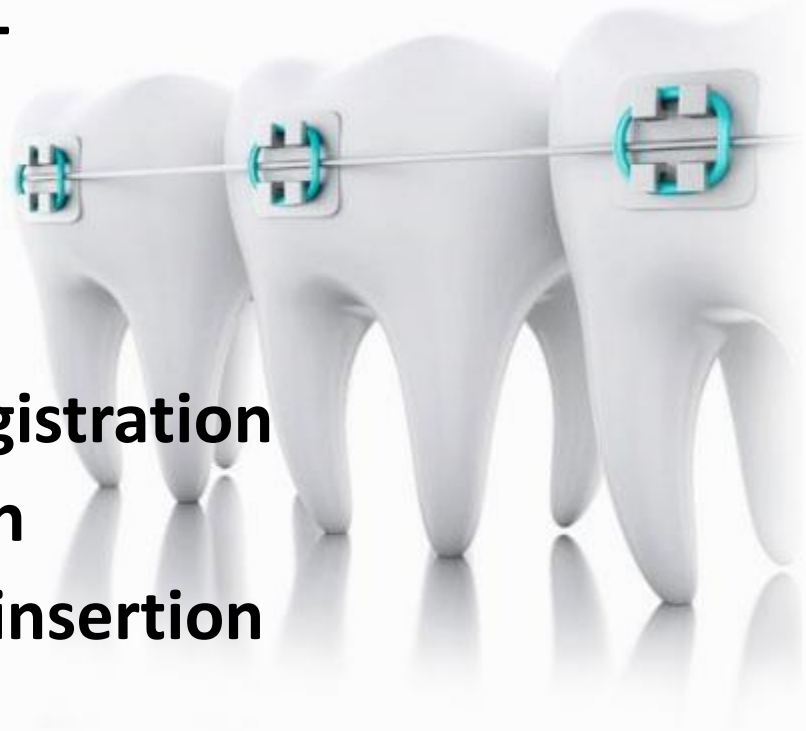
- ***FORCE APPLICATION*** **– Activator, Twin block**
- ***FORCE ELIMINATION*****- Vestibular screen, Lip bumper**
- **BOTH – Bionator, Frankel**

# Basic components of a functional appliance

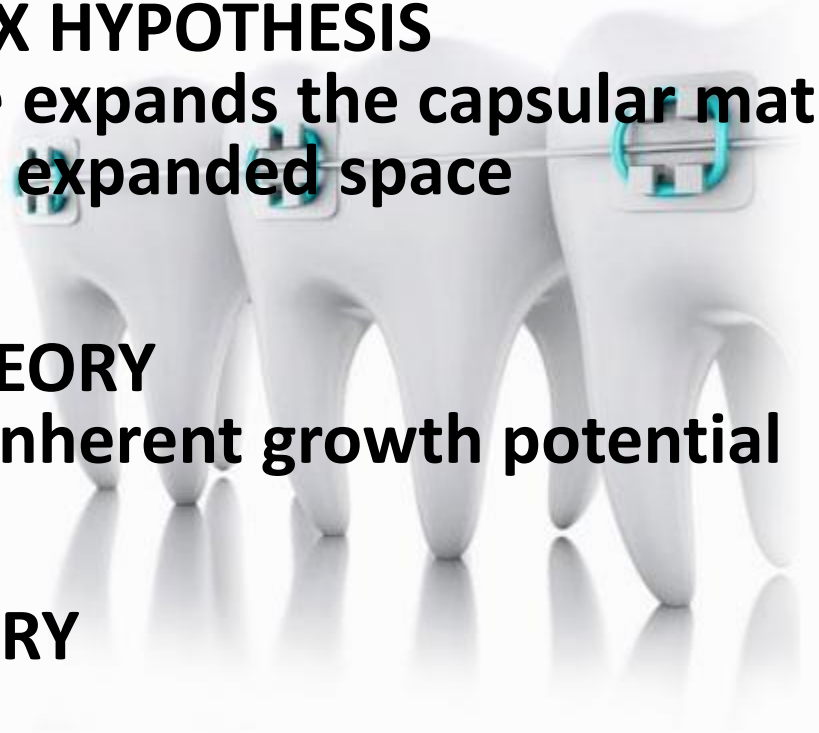
| | | |
|---|---|---|
| Eruption | Bite planes | |
| Linguofacial muscle balance | Shields | Screen |
| Retentive | Acrylic plate | Ball end clasp |

# Steps in functional appliance treatment

- Clinical examination-
- Clinical VTO
- Impression
- Working model
- Construction bite registration
- Appliance fabrication
- Appliance delivery/ insertion
- Instructions
- Follow up



# MODE OF ACTION OF FUNCTIONAL APPLIANCES



- **FUNCTIONAL MATRIX HYPOTHESIS**
  **Functional appliance expands the capsular matrix so that the bone remodels in the new expanded space**

- **CARTILAGENOUS THEORY**
  **Primary cartilage – inherent growth potential**

- **SERVOSYSTEM THEORY**

# SERVO SYSTEM

**FUNCTIONAL APPLIANCE**

↓

**INCREASED CONTRACTILE ACTIVITY OF LPM**

↓

**INTENSIFICATION OF THE REPETITIVE ACTIVITY OF RETRODISCAL PAD**

↓

**INCREASE IN GROWTH – STIMULATING FACTORS**
**Enhancement of local mediators**
**Reduction of local regulators**

↓

**Condylar trabecular orientation**
**Additional growth of condylar cartilage**
**Additional superiosteal ossification of the posterior border of the mandible**

↓

**SUPPLEMENTARY LENGTHENING OF THE MANDIBLE**

# INDICATIONS FOR COMMON FUNCTIONAL APPLIANCES

- CONVEX PROFILE
- POSITIVE VTO
- MILD TO MODERATE CLASS II SKELETAL CASES
- CLASS II SKELETAL BASE DUE TO RETROGNATHISM OF MANDIBLE AND NORMAL MAXILLA
- CLASS II MOLAR AND CANINE RELATION
- INCREASED OVERJET
- DEEP OVERBITE

- REQUISITE FOR FUNCTIONAL JAW ORTHOPEDICS

  PATIENT ‘S GROWTH SHOULD NOT BE COMPLETED / UTILISATION OF PUBERTAL SPURT WILL BRING ABOUT SKELETAL CORRECTION

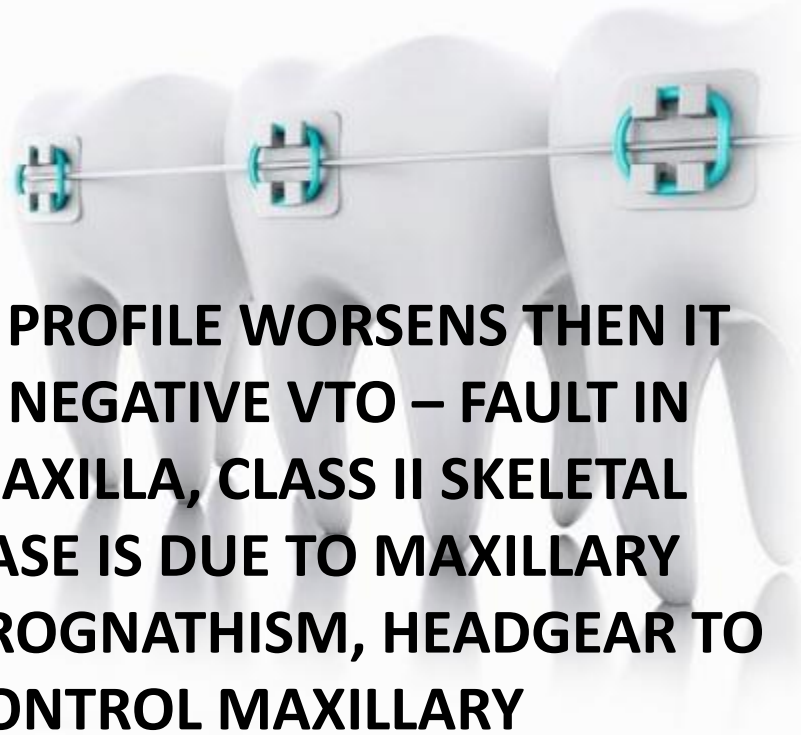
# CLINICAL VISUALIZED TREATMENT OBJECTIVE

- **VTO IS AN IMPORTANT STEP IN THE DECISION FOR CASE SELECTION FUNCTIONAL APPLIANCE**
- **PATIENT IS ASKED TO PROTRUDE THE MANDIBLE FORWARD**

# POSITIVE VTO

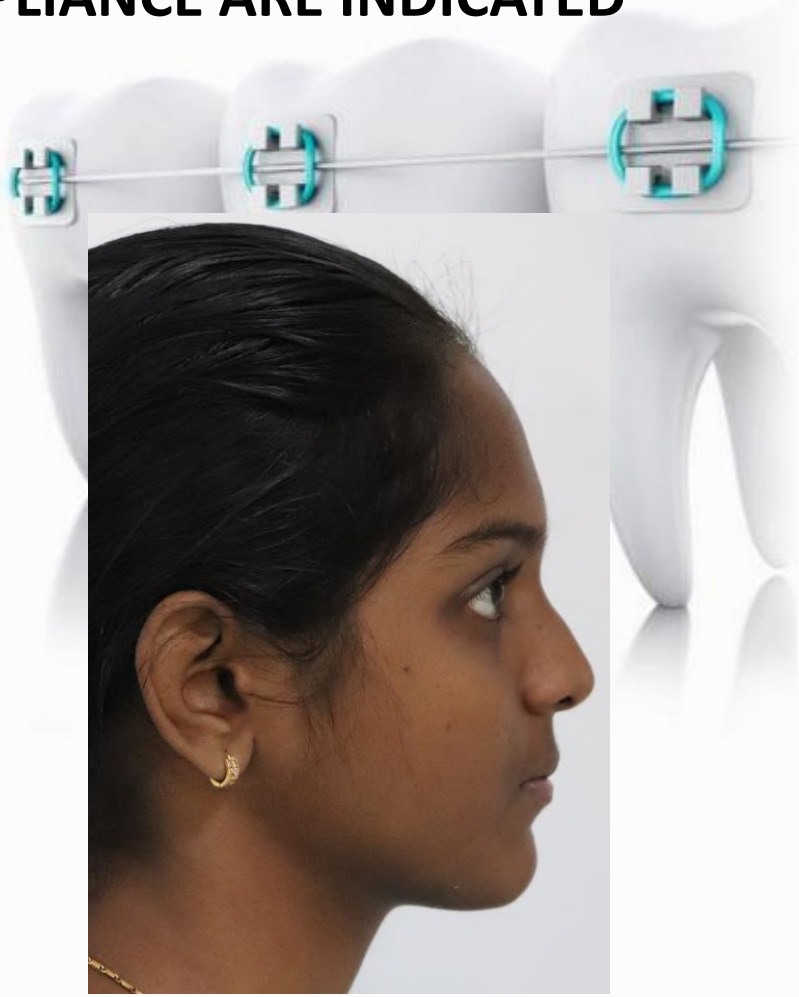
IF THE PROFILE IMPROVES WITH FULL EDGE TO EDGE ADVANCEMENT, THEN IT IS POSITIVE VTO- FAULT IS IN MANDIBLE/ CLASS II SKELETAL BASE IS DUE TO MANDIBULAR RETROGNATHISM INDICATED FOR FUNCTIONAL APPLIANCE

# NEGATIVE VTO

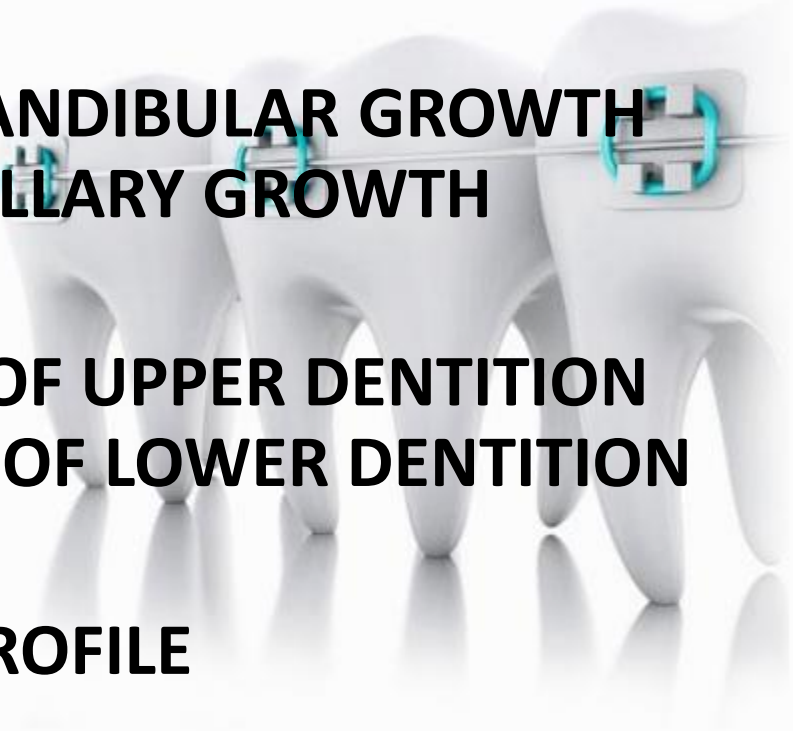


**IF PROFILE WORSENS THEN IT IS NEGATIVE VTO – FAULT IN MAXILLA, CLASS II SKELETAL BASE IS DUE TO MAXILLARY PROGNATHISM, HEADGEAR TO CONTROL MAXILLARY GROWTH IS INDICATED INDICATED**

# IF PROFILE IMPROVES HALF WAY THROUGH, THEN BOTH MAXILLA AND MANDIBLE ARE AT FAULT, CLASS II SKELETAL BASE IS DUE TO MAXILLARY PROGNATHISM AND MANDIBULAR RETROGNATHISM THEN HEADGEAR AND FUNCTIONAL APPLIANCE ARE INDICATED



# TREATMENT CHANGES WITH FUNCTIONAL APPLIANCES

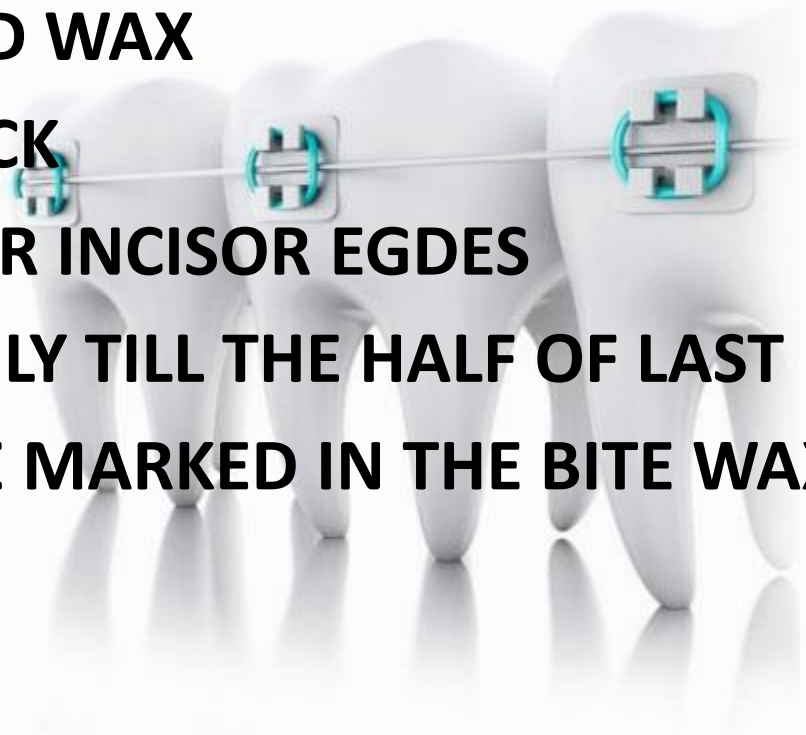


- ***SKELETAL:***
  **STIMULATION OF MANDIBULAR GROWTH**
  **INHIBITION OF MAXILLARY GROWTH**
- ***DENTAL:***
  **DISTAL MOVEMENT OF UPPER DENTITION**
  **MESIAL MOVEMENT OF LOWER DENTITION**
- ***SOFT TISSUE:***
  **IMPROVEMENT IN PROFILE**

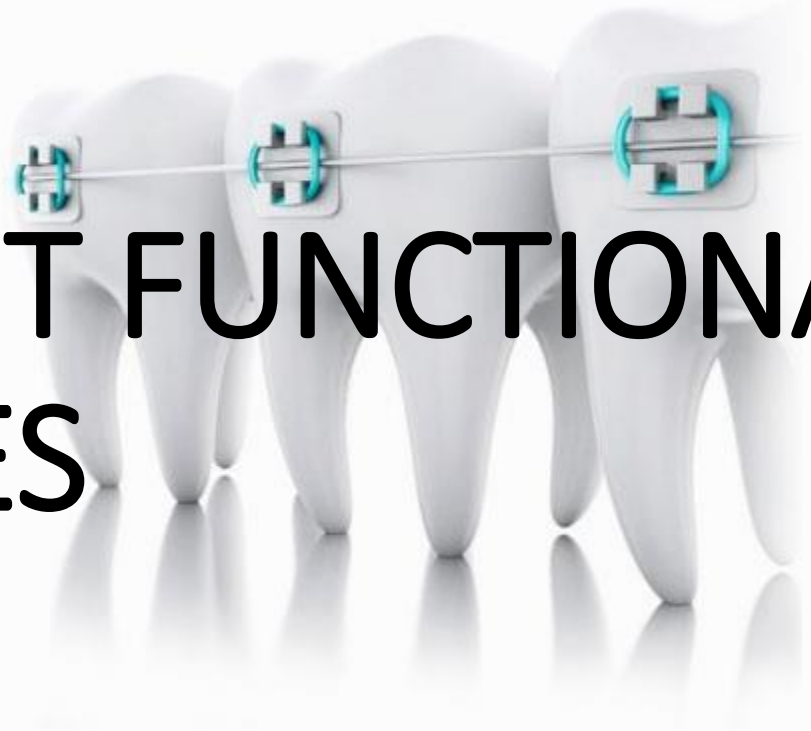
# CONSTRUCTION BITE

- **TRANSFERS THE ALTERED MANDIBULAR POSITION TO THE ARTICULATOR FOR CONSTRUCTION OF FUNCTIONAL APPLIANCE**
- **VERY IMPORTANT STEP IN FUNCTIONAL APPLIANCE CONSTRUCTION**
- **BITE REGISTRATION DONE WITH PATIENT BRINGING THE MANDIBLE DOWNWARD AND FORWARD**
- **PATIENT INSTRUCTED TO PRACTICE THE PREDETERMINED POSITION OF MANDIBLE**
- **IT IS CALLED *ESTABLISHING A NEW SENSORY ENGRAM***

# Construction Bite requisites



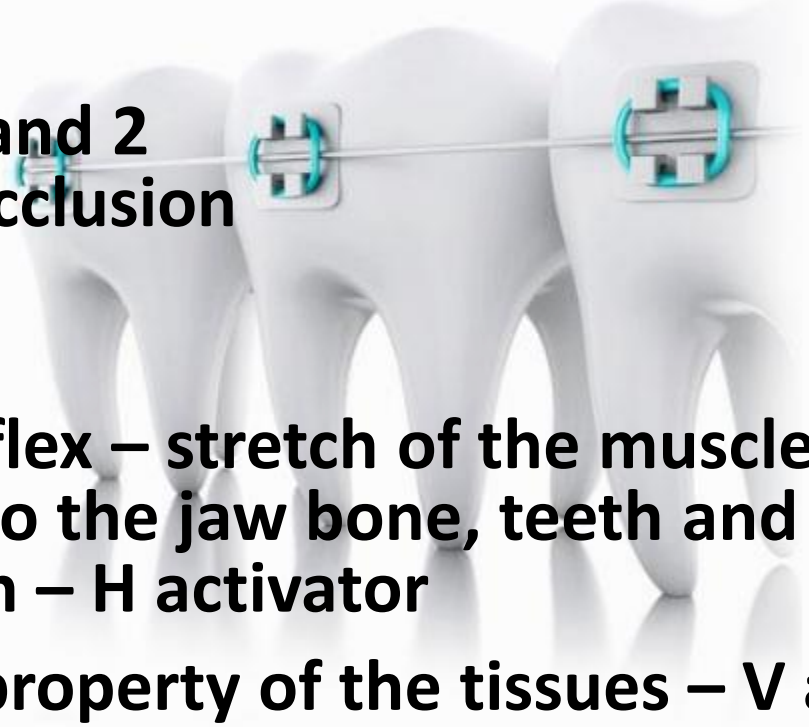
- HORSE SHOE SHAPED WAX
- LITTLE FINGER'S THICK
- CLEAR OF THE LOWER INCISOR EGDES
- SHOULD EXTEND ONLY TILL THE HALF OF LAST ERUPTED MOLAR
- MIDLINE SHOULD BE MARKED IN THE BITE WAX



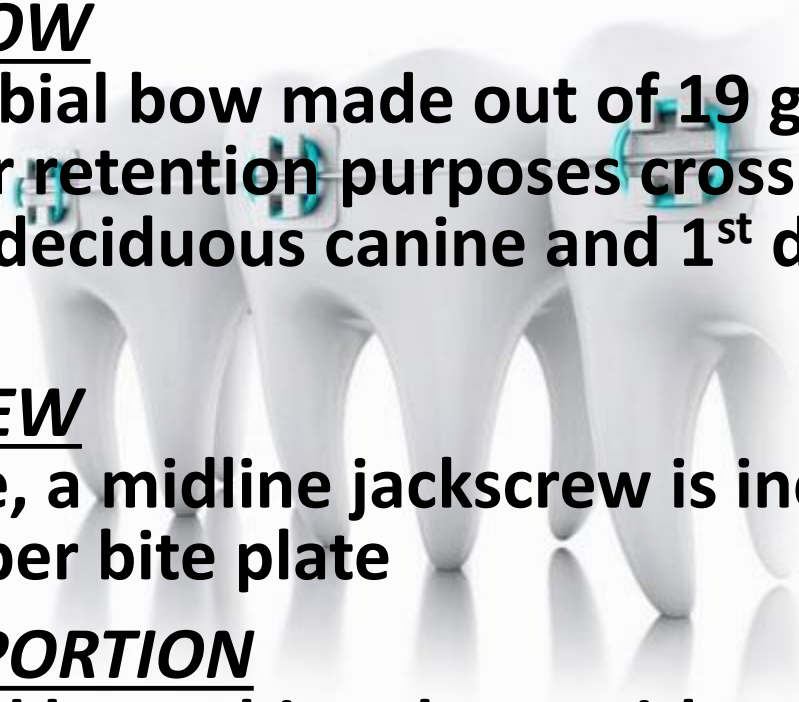
# IMPORTANT FUNCTIONAL APPLIANCES

# ACTIVATOR BY ANDERSEN

- **Monobloc appliance – single block of acrylic**
- **Indications**
  **class II div 1 and 2**
  **class III malocclusion**
  **open bite**
- **Philosophy**
  **Myotactic reflex – stretch of the muscle fibers is transmitted to the jaw bone, teeth and periodontium – H activator**
- **Viscoelastic property of the tissues – V activator**

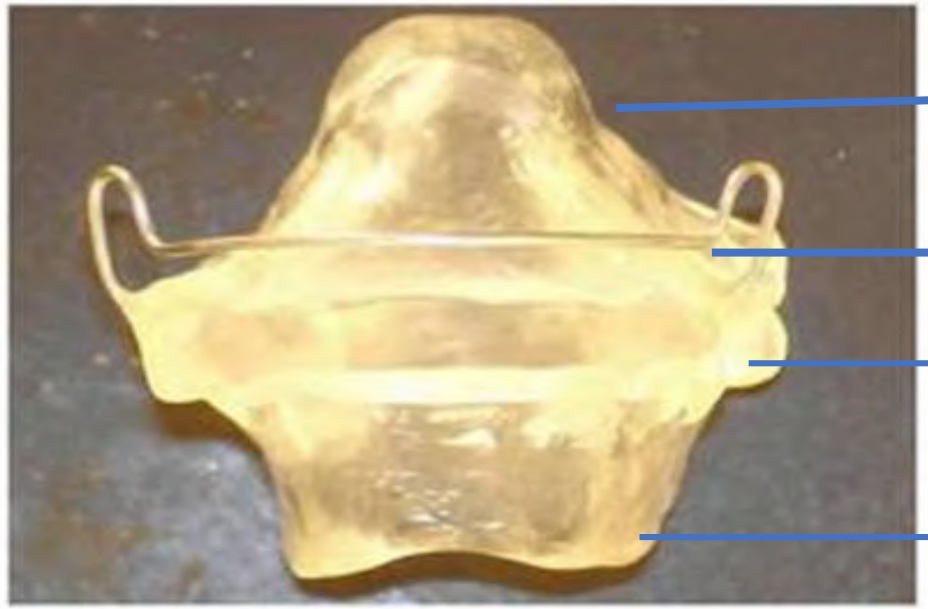


# COMPONENTS OF ACTIVATOR



- ***LABIAL BOW***
  **Passive labial bow made out of 19 gauge wire, mainly for retention purposes cross over wire between deciduous canine and 1st deciduous molar**
- ***JACK SCREW***
  **If need be, a midline jackscrew is incorporated in the upper bite plate**
- ***ACRYLIC PORTION***
  **Upper and lower bite plates with occlusal acrylic**

# PARTS OF ACTIVATOR



Upper acrylic plate

Labial bow

Occlusal acrylic

Lower acrylic plate

# Types of activator

**H activator**

- Horizontal activator
- Horizontal growth pattern

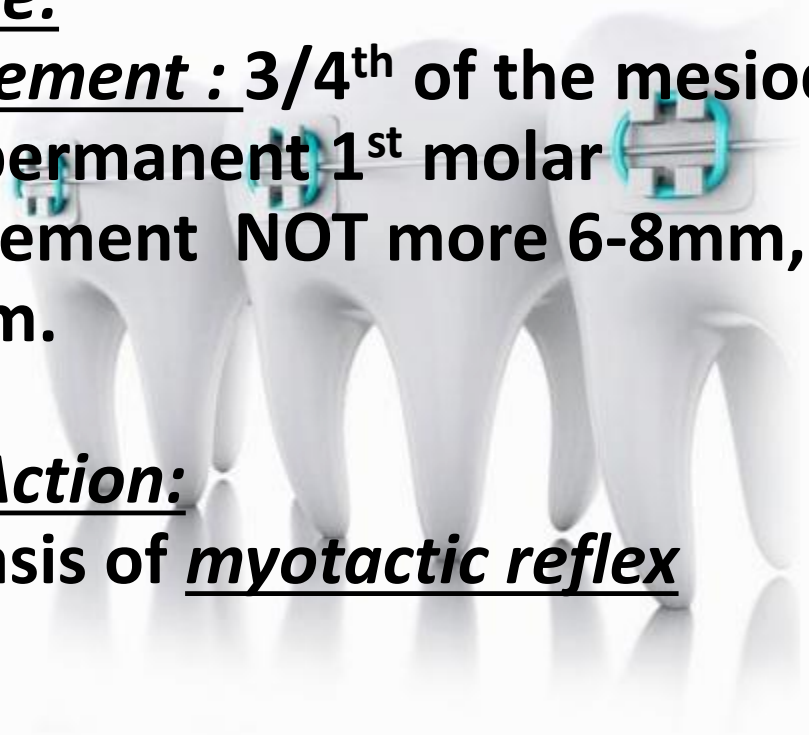
**V activator**

- Vertical activator
- Vertical growth pattern

# H ACTIVATOR

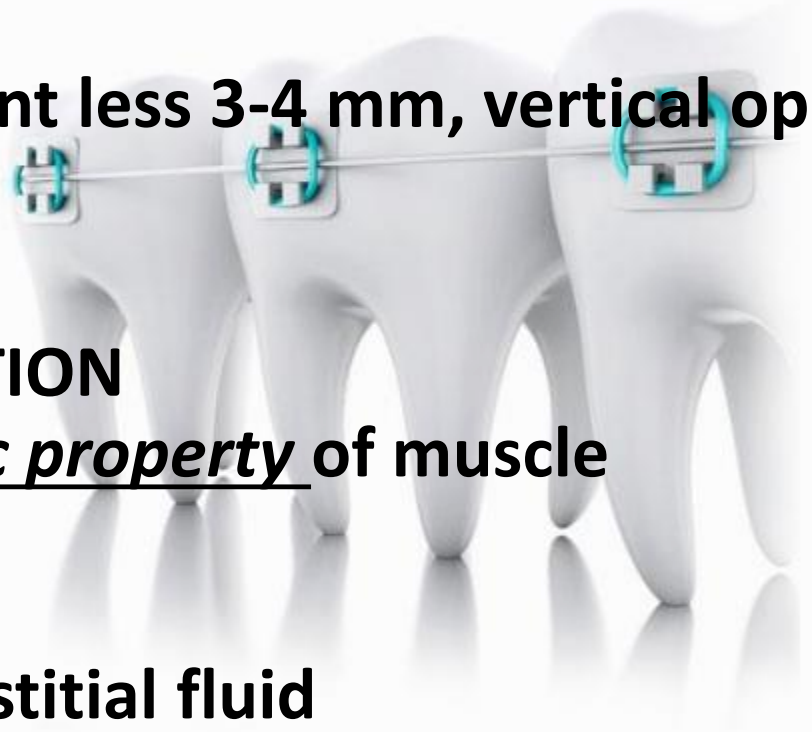
- ***Construction bite:***
  ***Sagittal advancement :*** **3/4$^{th}$ of the mesiodistal width of mandibular permanent 1$^{st}$ molar anterior advancement NOT more 6-8mm, *Vertical opening:* 2-3 mm.**

  ***Mechanism of Action:***
  **works on the basis of *myotactic reflex***



# V ACTIVATOR

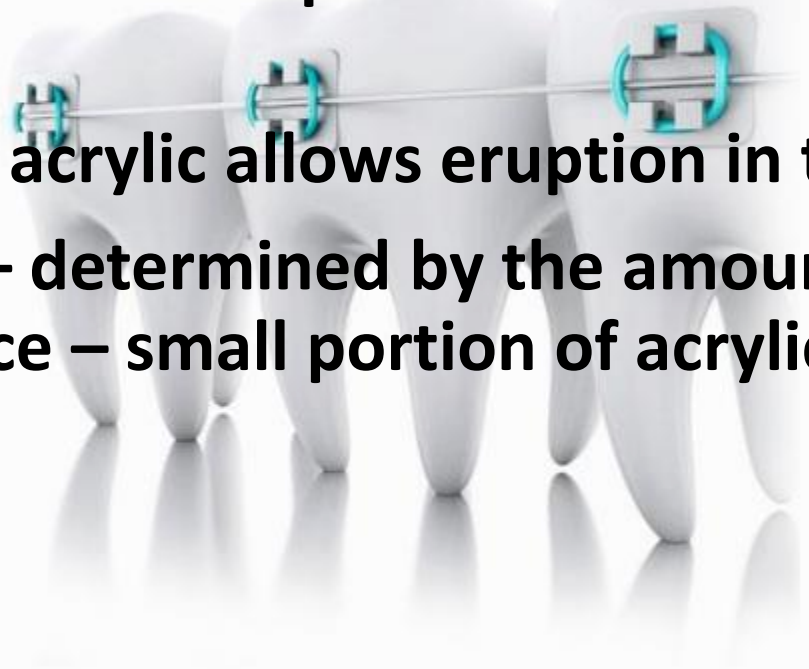
- ***Vertical activator***
  ***Construction bite :***
  **Anterior advancement less 3-4 mm, vertical opening 6 mm beyond the PRP.**



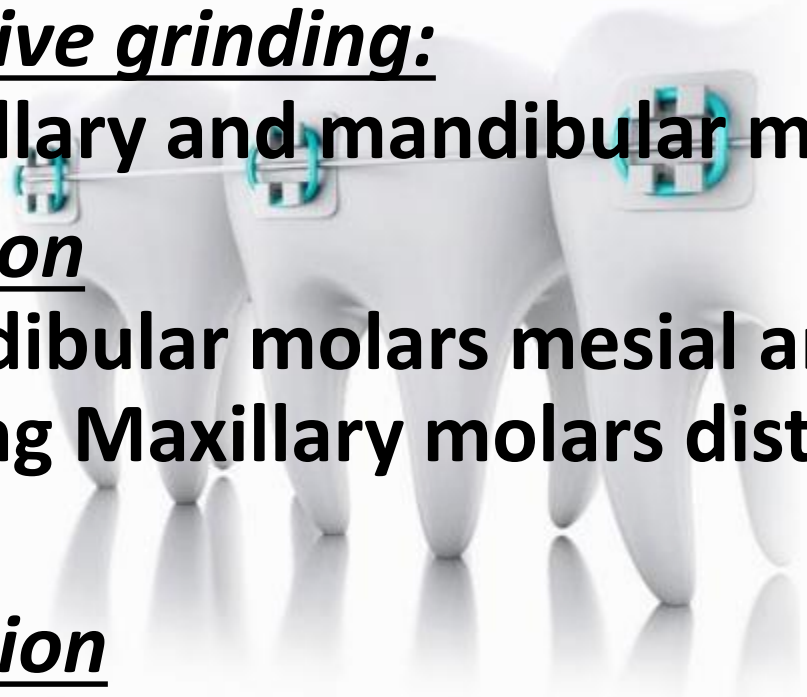
- **MECHANISM OF ACTION**
  **works by *viscoelastic property* of muscle**
  **Events :**
  **emptying of vessels**
  **pressing out of interstitial fluid**
  **stretching of fibers**
  **elastic deformation of bone**
  **bioplastic adaptation**

# TRIMMING OF ACTIVATOR

- **Trimming is undertaken to erupt the teeth into predetermined position**
- **Selective grinding of acrylic allows eruption in the desired direction**
- **Magnitude of force – determined by the amount of acrylic contact with the tooth surface – small portion of acrylic greater force and vice versa**



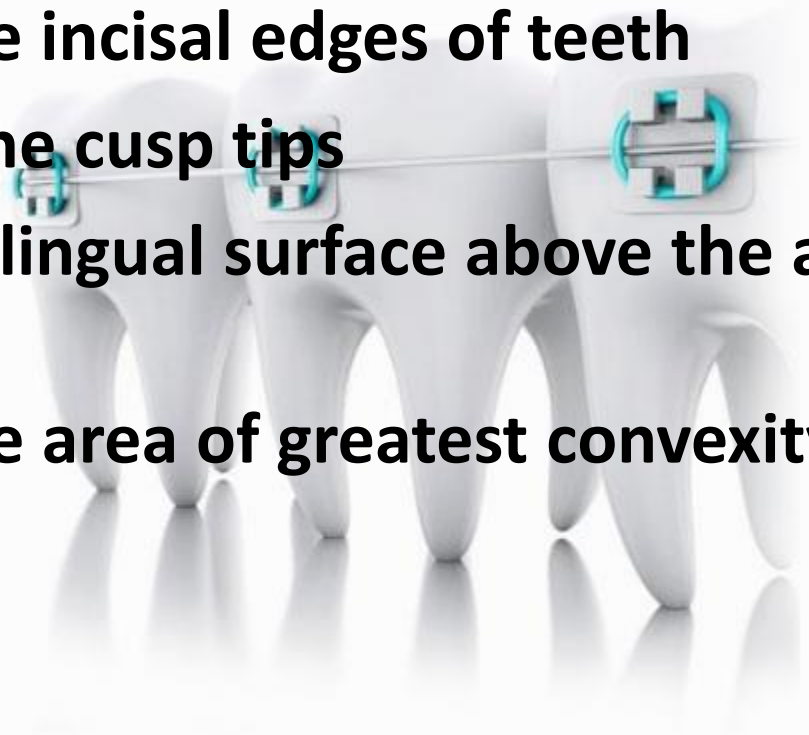
# SELECTIVE GRINDING



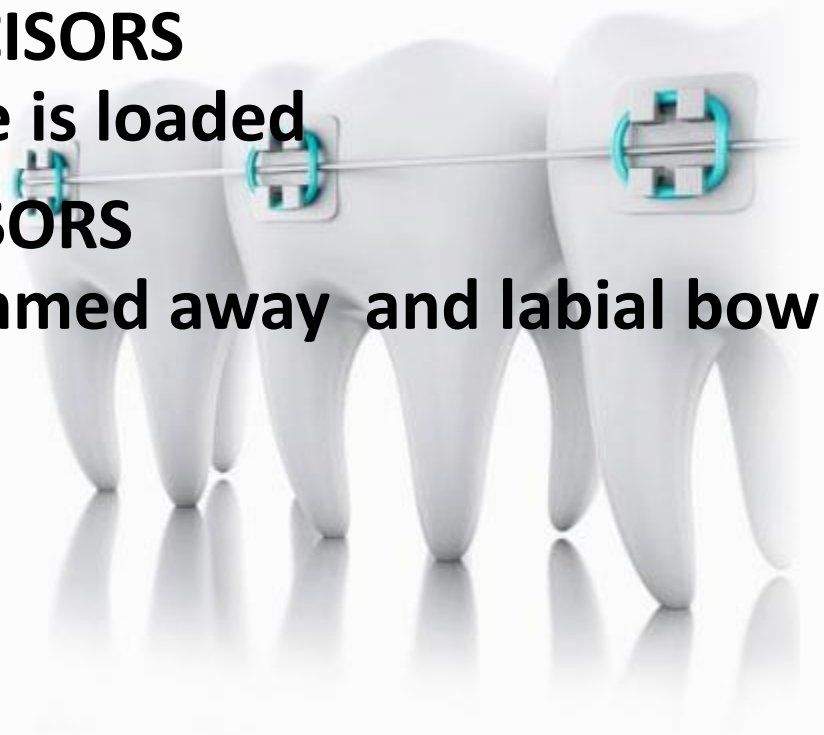
- ***First step in selective grinding:***
  **Erupting the maxillary and mandibular molars**
- ***Class II malocclusion***
  **Erupting the mandibular molars mesial and occlusal**
  **Holding or erupting Maxillary molars distal and occlusal force**
- ***Class III malocclusion***
  **Erupting the maxillary molar mesial and occlusal**
  **Holding or erupting the mandibular molar distal and occlusal force**

# INTRUSION AND EXTRUSION

- **Intrusion Loading the incisal edges of teeth**
- **MOLARS – load on the cusp tips**
- **Extrusion – load the lingual surface above the area of greatest convexity in maxilla**
- **Labial bow above the area of greatest convexity**



- **PROTRUSION OF INCISORS**
  **Entire lingual surface is loaded**
- **RETRUSION OF INCISORS**
  **Lingual acrylic is trimmed away and labial bow is activated**



# MODIFICATIONS OF ACTIVATOR

- **Karwetzky activator**
- **Cybernator of Schmuth**
- **Bow activator of AM Schwarz**
- **Wunderer’s modification**

# BALTER'S BIONATOR

- ***Balter's philosophy***
  **Equilibrium between the tongue and the circum oral musculatrue is the responsible for determining the arch form intercuspation**
  **Tongue is the most important factor in deciding the the growth**
- **Tongue dysfunction is the etiology for certain types of malocclusion**

**Posterior displacement**
**Class II malocclusion**

**Anterior displacement**
**Class III malocclusion**

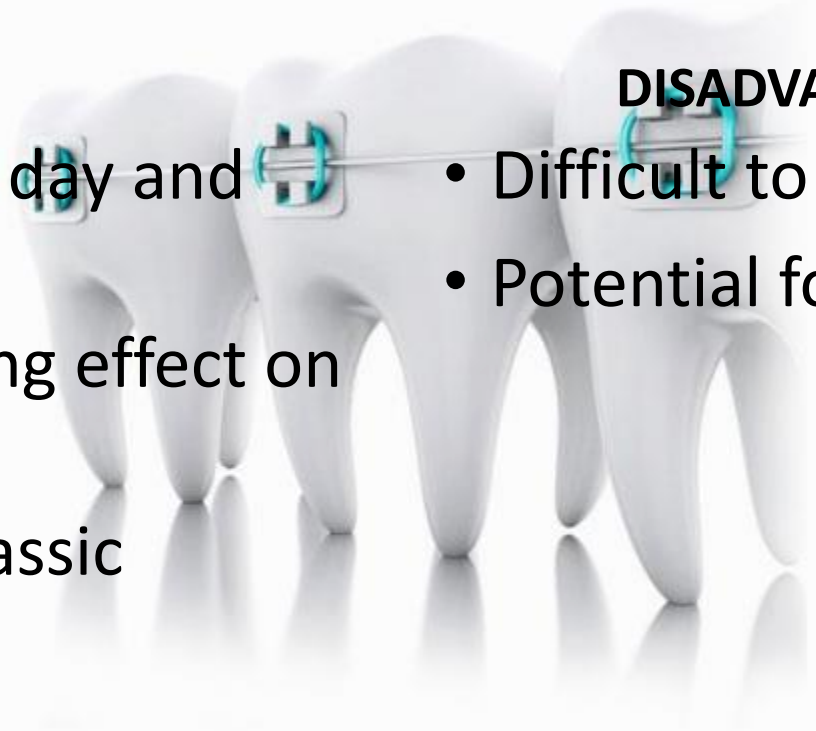
# BALTER'S MODIFICATION

- Tongue should be free to allow normal growth
- Main disadvantage of activator is the restriction of tongue space
- Bionator design – palatal acrylic is cut out

# ADVANTAGES & DISADVANTAGES OF BIONATOR

**ADVANTAGES**

- Reduced size – worn day and night
- Labial bow – screening effect on perioral muscles
- Faster action than classic activator



**DISADVANTAGES**

- Difficult to manage
- Potential for distortion

# CONSTRUCTION BITE

**Sagittal**

**Till 9mm overjet , edge to edge advancement**

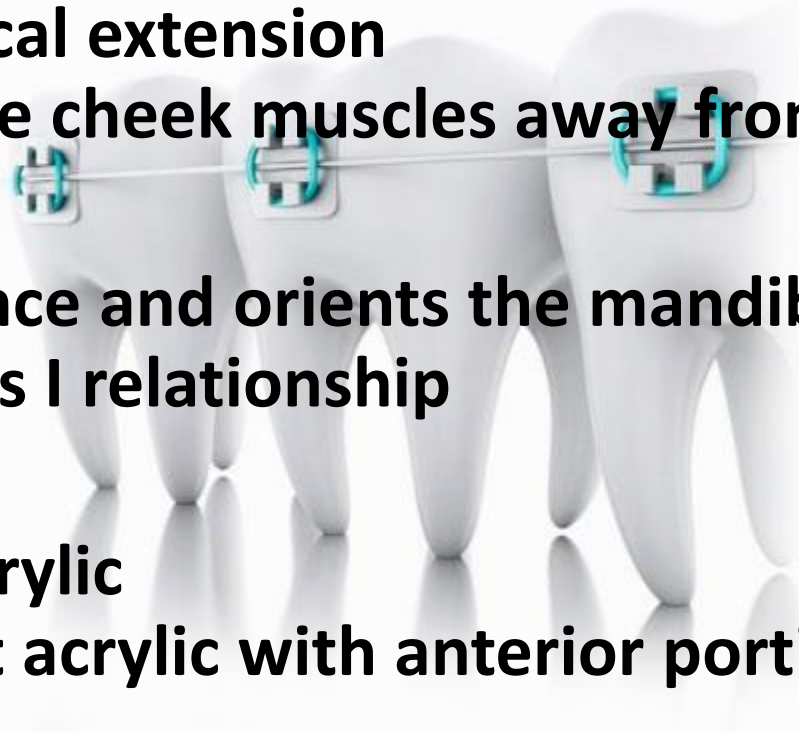
**More than 9mm overjet, stepwise advancement**

**Vertical opening**

**In the incisor region edge to edge with no vertical opening**

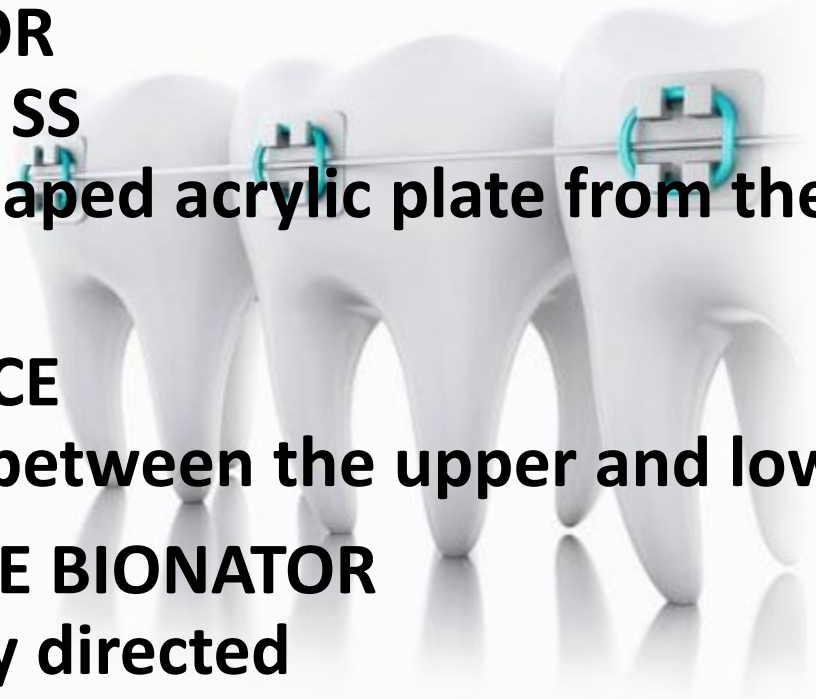
**Premolar region: the clearance achieved by edge to edge incisal relationship**

# PARTS OF BIONATOR



- **Labial bow with buccal extension**
  **Buccal wire keeps the cheek muscles away from the dentition**
- **Palatal bar**
  **stabilizes the appliance and orients the mandible and tongue anteriorly to get class I relationship**
- **Acrylic**
  **Lower horse shoe acrylic**
  **Upper palatal cutout acrylic with anterior portion open from canine to canine**

# TYPES OF BIONATOR



- **STANDARD BIONATOR**
  **Labial bow – 0.9mm SS**
  **Lower horse shoe shaped acrylic plate from the distal of last erupted molar**
- **OPEN BITE APPLIANCE**
  **Labial bow extends between the upper and lower incisors**
- **CLASS III OR REVERSE BIONATOR**
  **Palatal bar forwardly directed**
  **Labial bow runs in front of lower incisor rather than the upper incisor**

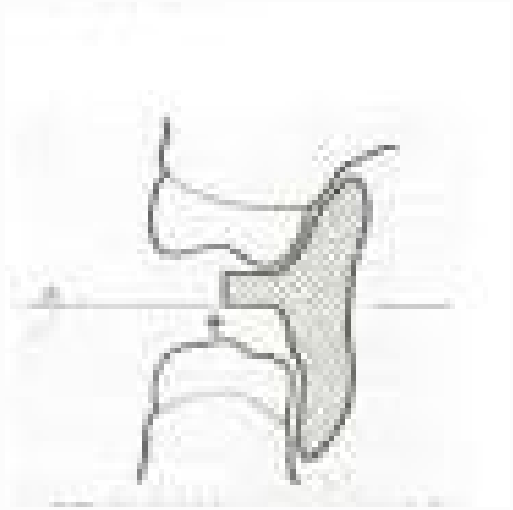
# TRIMMING OF BIONATOR

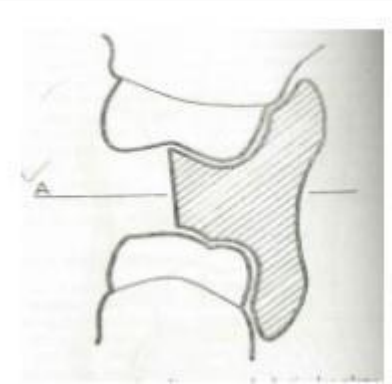
**LOADING AREA**

- **Palatal or lingual cusp of the deciduous molar and permanent molars are relieved in the acrylic- enhances anchorage**

**TOOTH BED**

- **Acrylic in the articular plane is ground away**

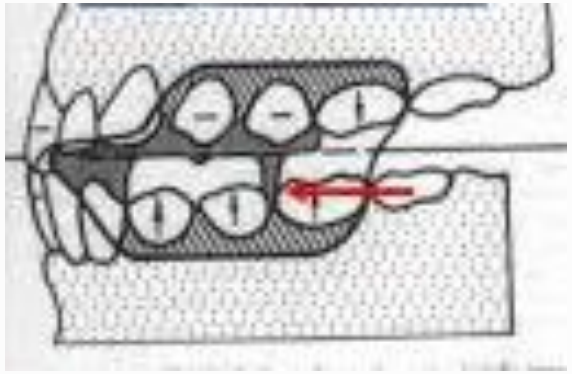




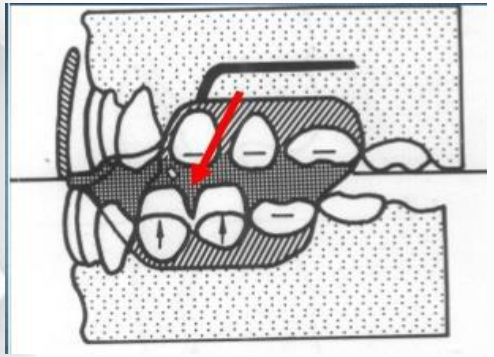
**ARTICULAR PLANE**

**runs parallel to the ala tragal line**

## NOSE



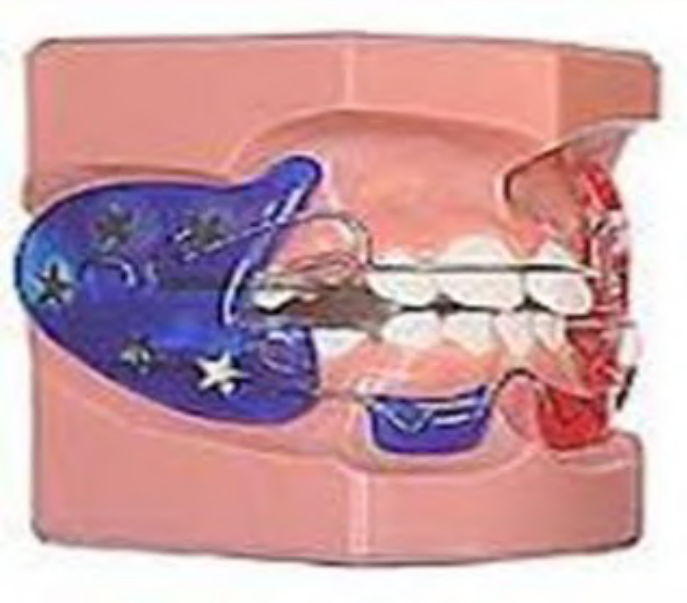
## LEDGE



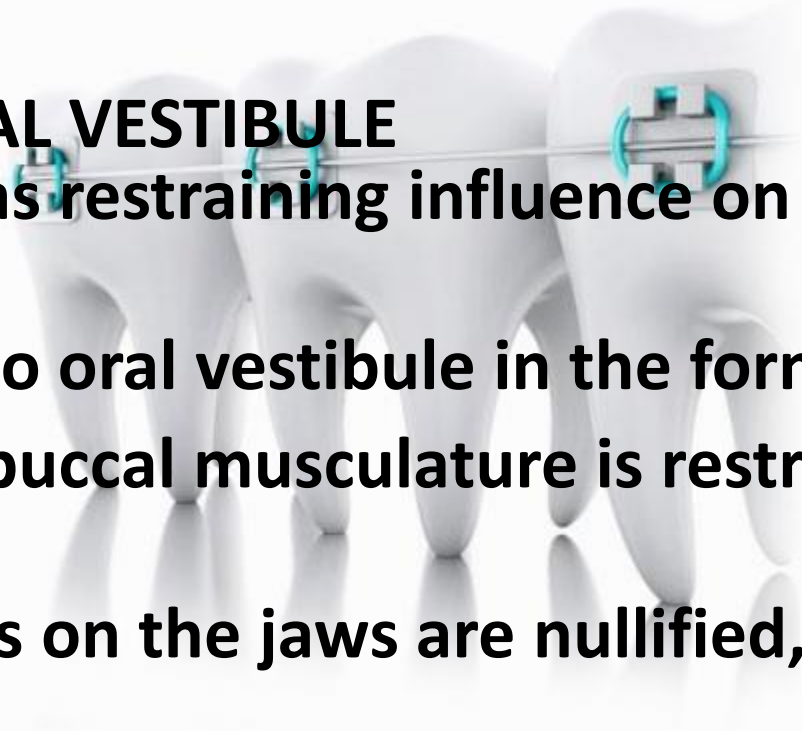
Acrylic finger like projections – guidance of eruption mostly in the mesial margin of the 1st permanent molar

Reduced nose – between the premolars

# FRANKEL'S FUNCTIONAL REGULATOR

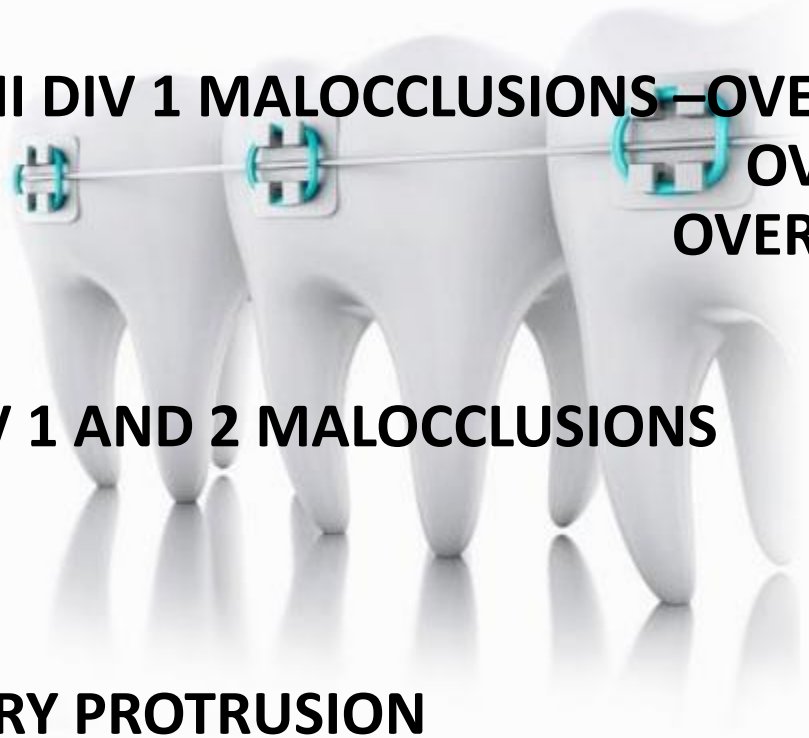


# FRANKEL'S FUNCTIONAL REGULATOR



- **FORCE ELIMINATION**
- **ACTS FROM THE ORAL VESTIBULE**
  **Muscle and tissue has restraining influence on the optimal growth and development**
- **Appliance confined to oral vestibule in the form of buccal shields**
- **Forces of labial and buccal musculature is restrained from the teeth and the dental arch**
- **Deforming influences on the jaws are nullified, thus promoting optimal growth**

# TYPES OF FRANKEL

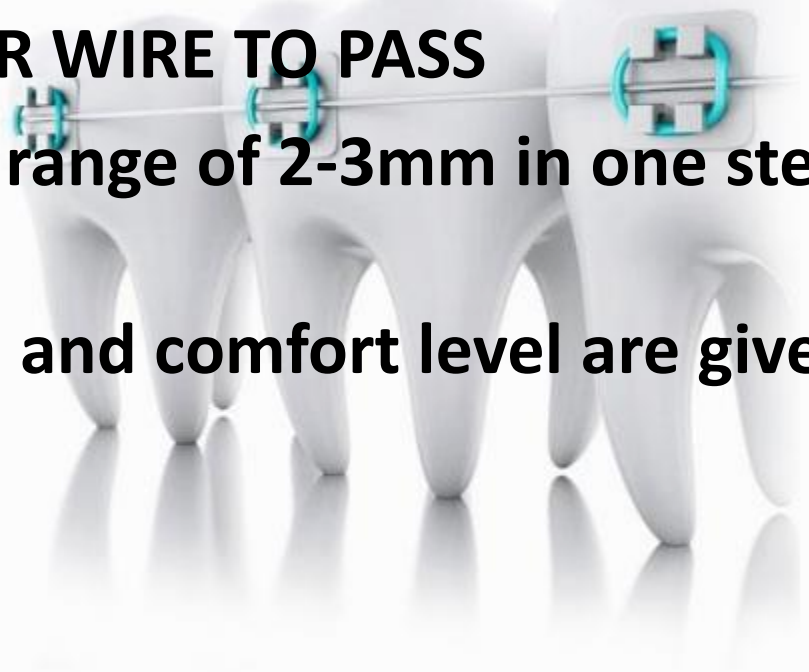


- **FRANKEL I**
  **IA CLASS I AND CLASS II DIV 1 MALOCCLUSIONS –OVERJET LESS THAN 5MM**
  **IB CLASS II DIV 1 WITH OVERJET 5 -7MM**
  **IC CLASS II DIV 1 WITH OVERJET MORE THAN 7MM**

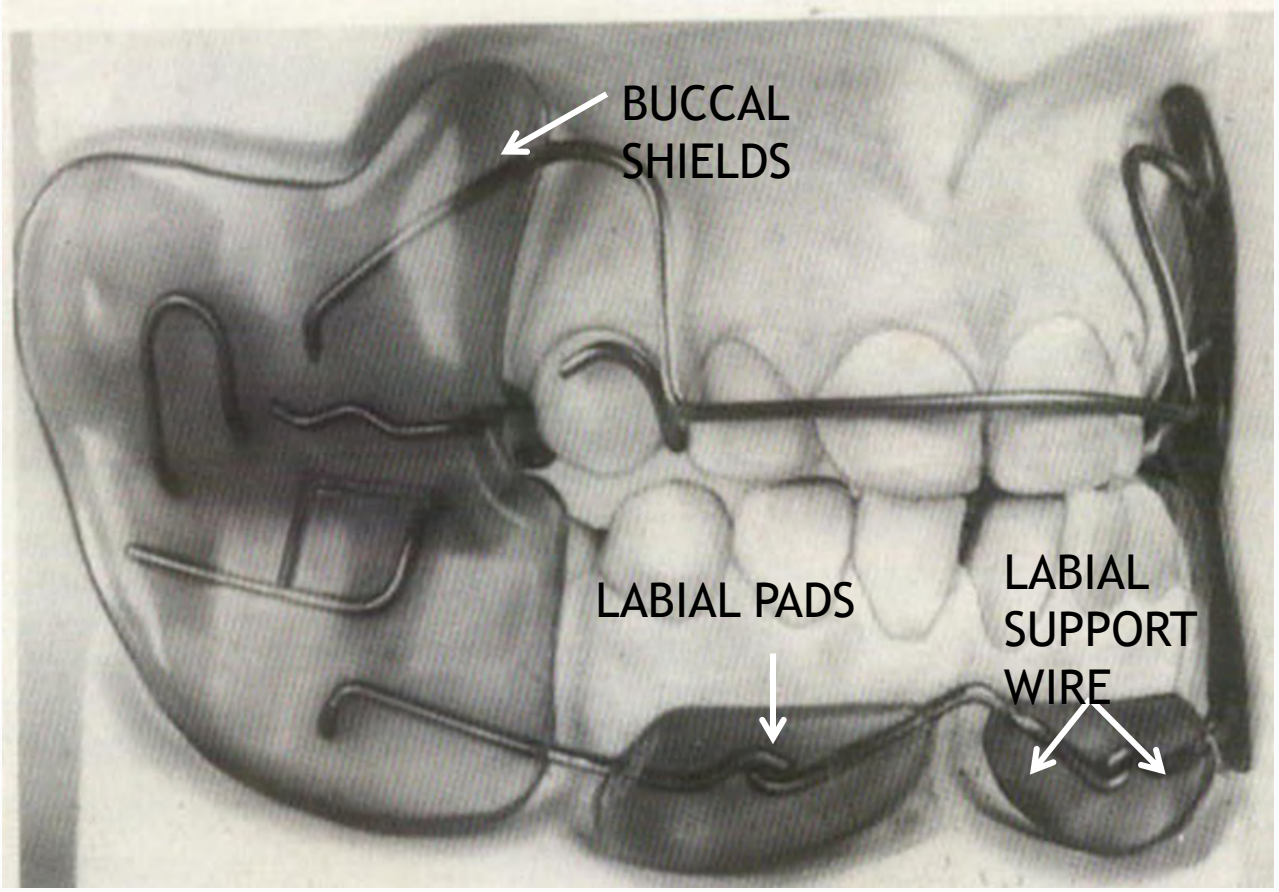
- **FRANKEL II CLASS II DIV 1 AND 2 MALOCCLUSIONS**
- **FRANKEL III CLASS III**
- **FRANKEL IV OPEN BITE**
- **FRANKEL V BIMAXILLARY PROTRUSION**

# CONSTRUCTION BITE

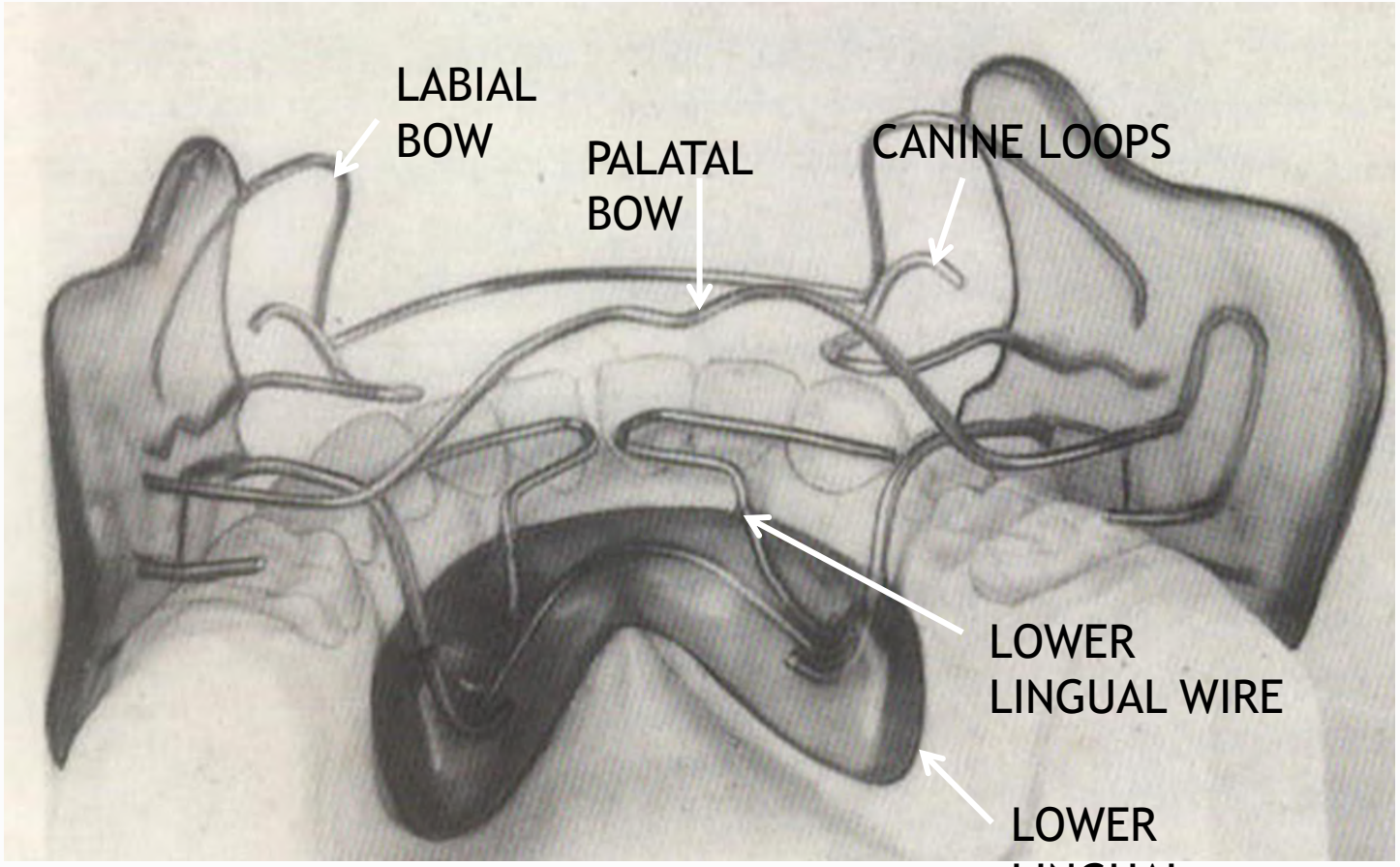
- **STEP BY STEP ADVANCEMENT WITH MINIMAL VERTICAL OPENING FOR THE CROSS OVER WIRE TO PASS**
- **Advancement in the range of 2-3mm in one step**
- **Reason:**
  **Patient's compliance and comfort level are given utmost importance**



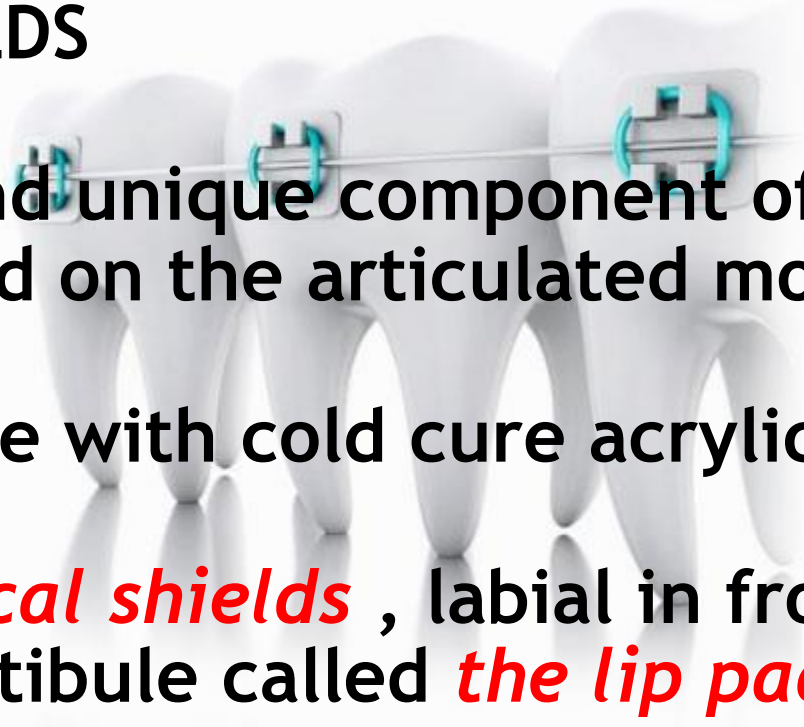
# Frankel Functional Regulator- Parts



# PARTS OF FRANKEL



# PARTS OF THE APPLIANCE

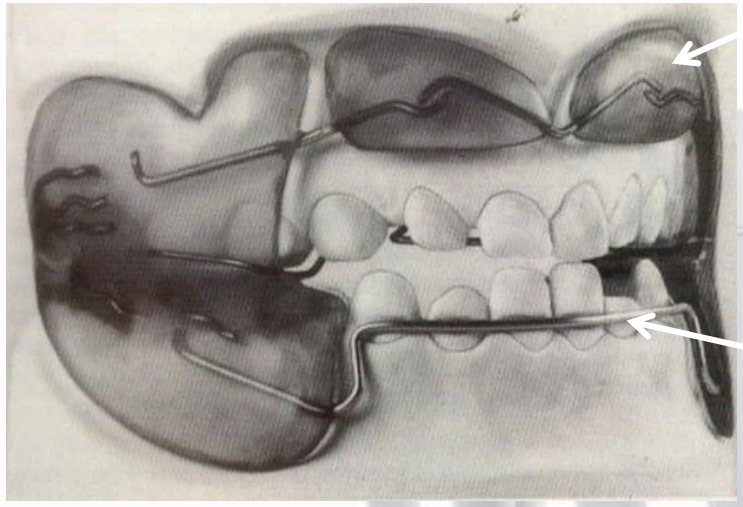


- VESTIBULAR SHIELDS
  Made of acrylic
  most important and unique component of vestibular shields
  Wax sheets molded on the articulated models in the buccal and labial aspects
  acrylisation is done with cold cure acrylic with salt and pepper technique
  Acrylic pads – *buccal shields* , labial in front of the lower incisors in the vestibule called *the lip pads* and *lingual pads*

- **Maxillary labial bow:**
  **0.9mm – Originates in the buccal shields**
  **In the middle of the labial surface of the incisors**
  **Canine loop – more gentle curve over the roots of the canine**
- **Canine loops:**
  **0.9mm – Canine loops are embedded in the buccal shield**
  **canine loops curves around the lingual surface of the canine**
- **Palatal bow:**
  **1mm thick Transpalatal bow across the maxillary molar's mesial marginal ridge, recurves to lie on the maxillary molars buccal cusps**

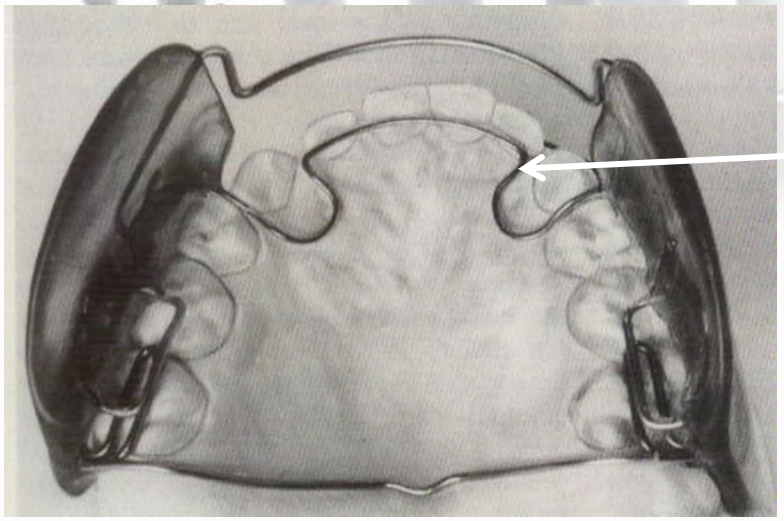
- **LOWER LABIAL WIRES:**
  **0.9mm wire for the support of lip pads**
- **Lower lingual springs:**
  **0.8mm wire on the lingual surface of the lower incisor**
- **Lower lingual support wire:**
  **0.051” support wire for the lower lingual pads**

# Functional Regulator III



UPPER LABIAL PADS

LOWER LABIAL BOW

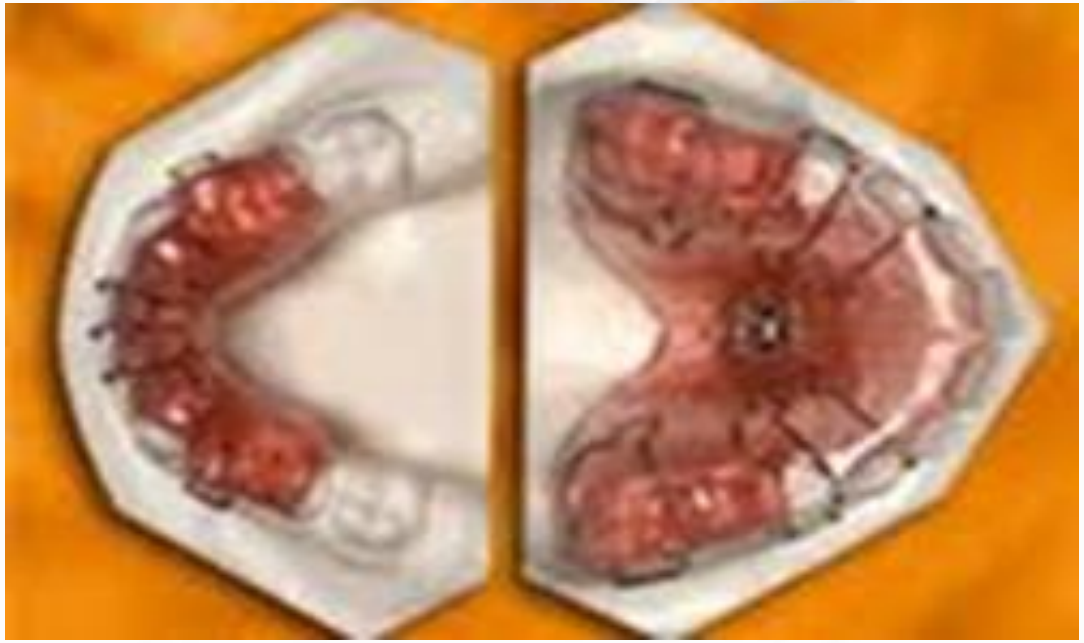


UPPER LINGUAL WIRE

# TWIN BLOCK

- **MOST COMMONLY USED FUNCTIONAL APPLIANCE**
- **GIVEN BY WILLIAM CLARK**
- **TWO BITE BLOCKS OCCLUDING AT AN ANGLE OF 70**
- **PRINCIPLE OF INCLINED PLANE**

# OCCLUSAL VIEW OF TWIN BLOCK



# STANDARD TWIN BLOCK

- UPPER AND LOWER ACRYLIC PLATES
- OCCLUSAL BITE BLOCKS BOTH TO THE UPPER AND LOWER ACRYLIC PLATES AT AN ANGLE OF 70°
- LOWER BITE BLOCKS END JUST DISTAL TO THE MESIAL MARGINAL RIDGE OF LOWER SECOND PREMOLAR
- DISTAL MARGINAL RIDGE OF THE LOWER SECOND PREMOLAR IS FREE
- UPPER BITE BLOCK STARTS FROM THE DISTAL MARGINAL RIDGE OF THE LOWER SECOND PREMOLAR

# RETENTION WIRE COMPONENTS

- **DELTA CLASPS**
  **FOR MAXILLARY 1ST MOLAR AND MANDIBULAR 1ST PREMOLAR**
- **BALL END CLASPS**
  **BETWEEN LOWER INCISORS**
- **TRIANGULAR CLASPS**
  **BETWEEN THE UPPER PREMOLAR**
- **IF NEED BE PASSIVE LABIAL BOW IN THE UPPER ARCH FOR ADDITIONAL RETENTION**

# CONSTRUCTION BITE

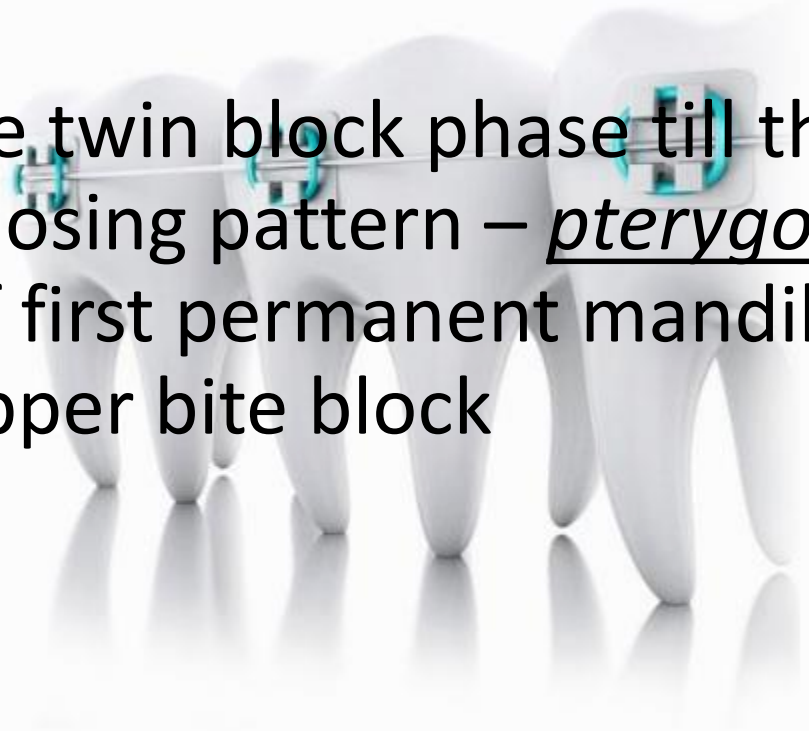
- **SAGITTAL**
- **if overjet upto 10mm then single step advancement**
- **if overjet morethan 10mm step wise advancement**

- **VERTICAL OPENING:**
  **2mm of interincisal clearing**
  **4-5 mm in premolar region**
  **2-3 mm in molar region**

# ADVANTAGES

- FULL TIME WEAR – 24 HRS
- PATIENT CAN EAT AND TALK WITH THE APPLIANCE IN THE MOUTH – LESS INTERFERNCE WITH NORMAL FUNCTION
- RAPID CORRECTION OF THE MALOCCLUSION WITH FULL USAGE OF GROWTH POTENTIAL
- PROFILE IS DRASTICALLY IMPROVED WITH TWIN BLOCK IN THE MOUTH – EXCELLENT PATIENT MOTIVATION
- INDEPENDENT CONTROL OF UPPER AND LOWER ARCH WIDTH
- CAN INCORPORATE FIXED ORTHODONTICS SIMULTANEOUSLY

# PHASES OF TWIN BLOCK THERAPY

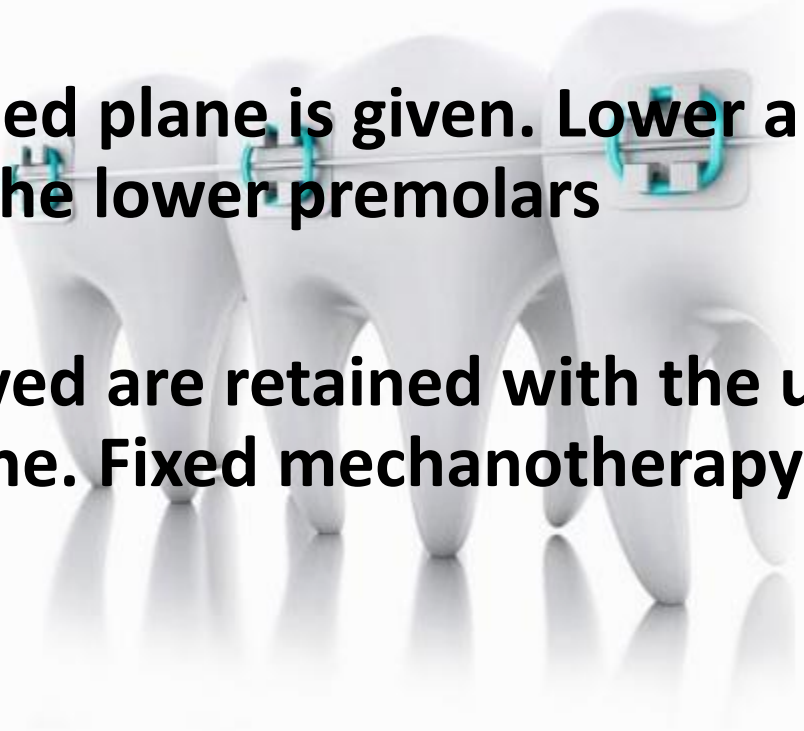


- ***ACTIVE PHASE***

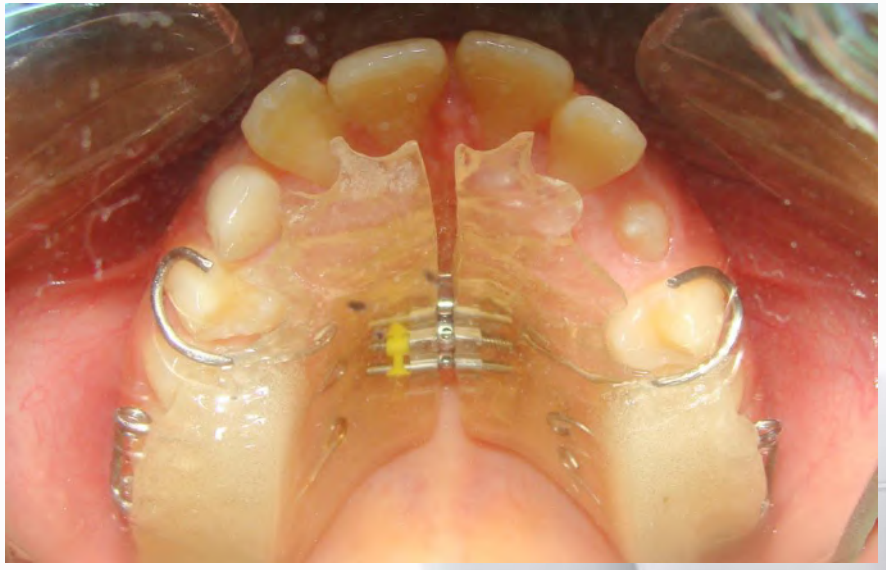
  STEP 1 Involves the twin block phase till the achievement of new mandibular closing pattern – *pterygoid response*

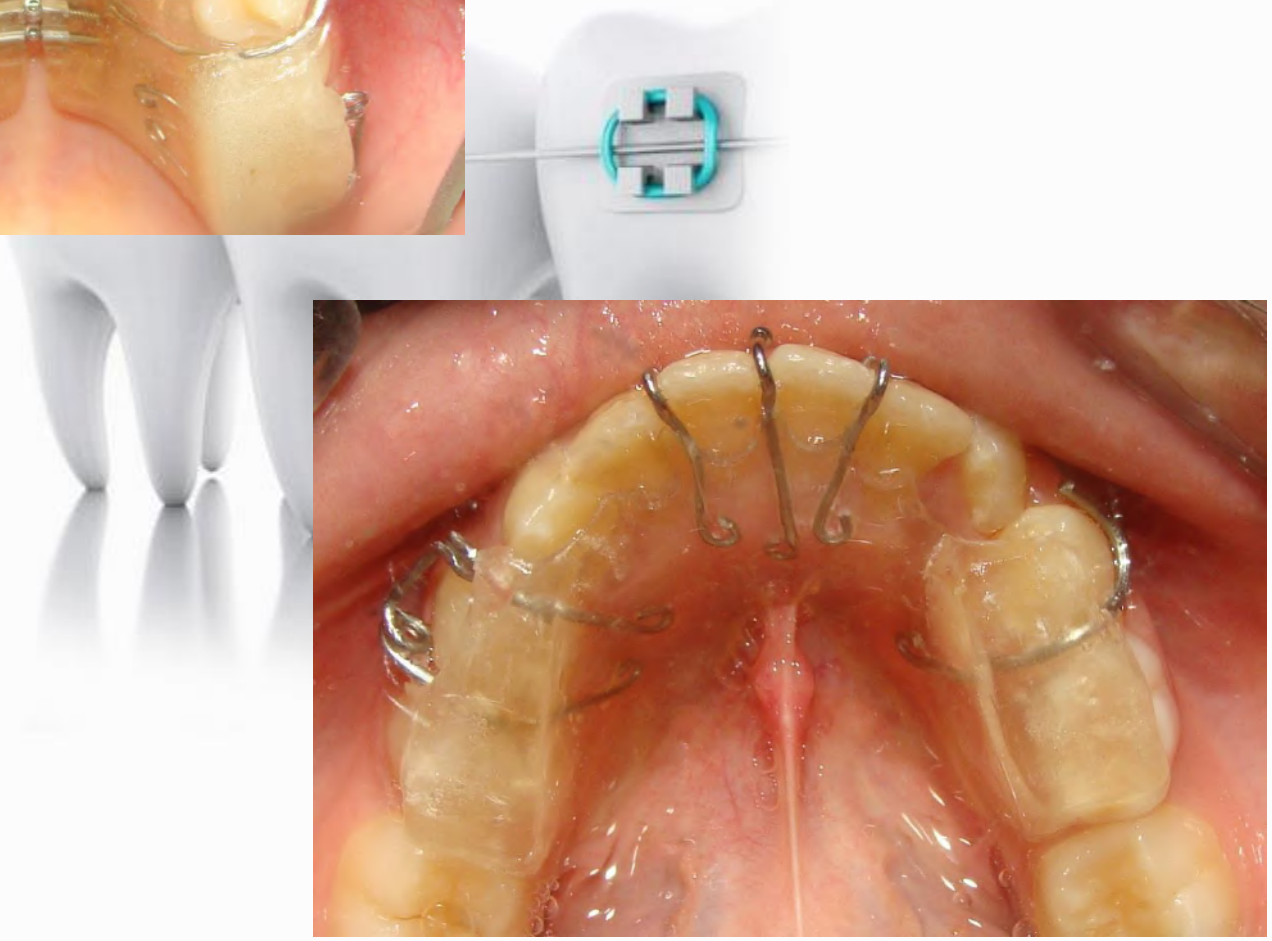
  STEP 2 Eruption of first permanent mandibular molar by trimming of the upper bite block

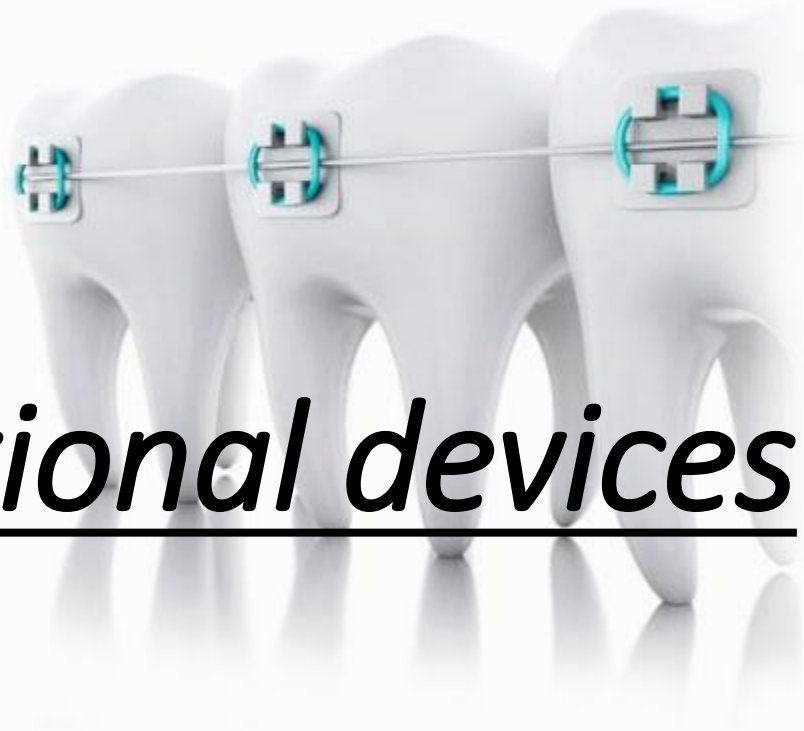
# PHASES OF TWIN BLOCK TREATMENT



- ***SUPPORT PHASE***
  **Upper anterior inclined plane is given. Lower appliance is kept off the mouth to erupt the lower premolars**
- ***RETENTION PHASE***
  **the correction achieved are retained with the use of upper fixed anterior inclined plane. Fixed mechanotherapy may be started**

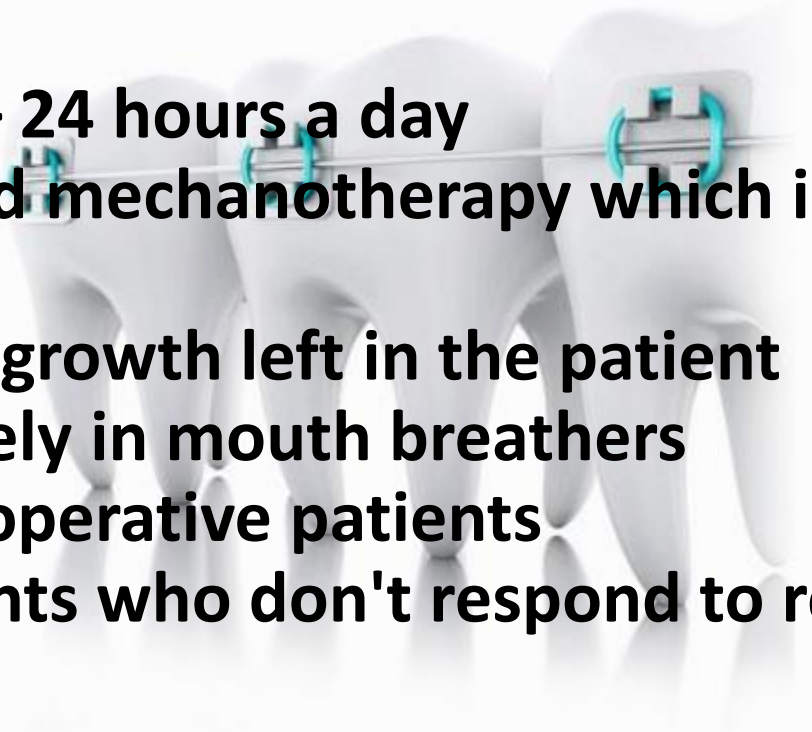






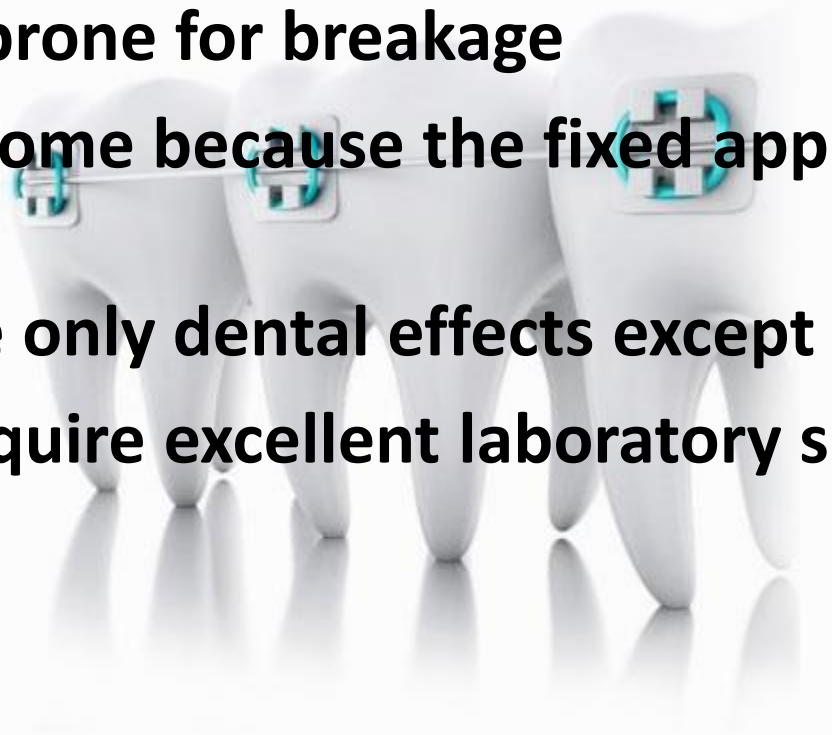
# *Fixed functional devices*

# FIXED FUNCTIONAL APPLIANCE



- **ADVANTAGES:**
  **Fixed to the mouth – 24 hours a day**
  **Used along with fixed mechanotherapy which is an added advantage**
  **Can use the residual growth left in the patient**
  **Can be used effectively in mouth breathers**
  **Can be used in uncooperative patients**
  **Can be used in patients who don't respond to removable functional appliances**

# DISADVANTAGES



- Most appliance are prone for breakage
- Breakage is cumbersome because the fixed appliance also undergoes breakage
- Most appliance have only dental effects except Herbst
- Certain appliance require excellent laboratory support for fabrication

# CLASSIFICATION

- ***RIGID***
  **Prototype Herbst**
- ***FLEXIBLE***
  **prototype Jasper Jumper**
- ***SEMIRIGID/HYBRID***
  **Prototype Forsus FRD**

# INDICATIONS

**Indications for using the FFAs are:**

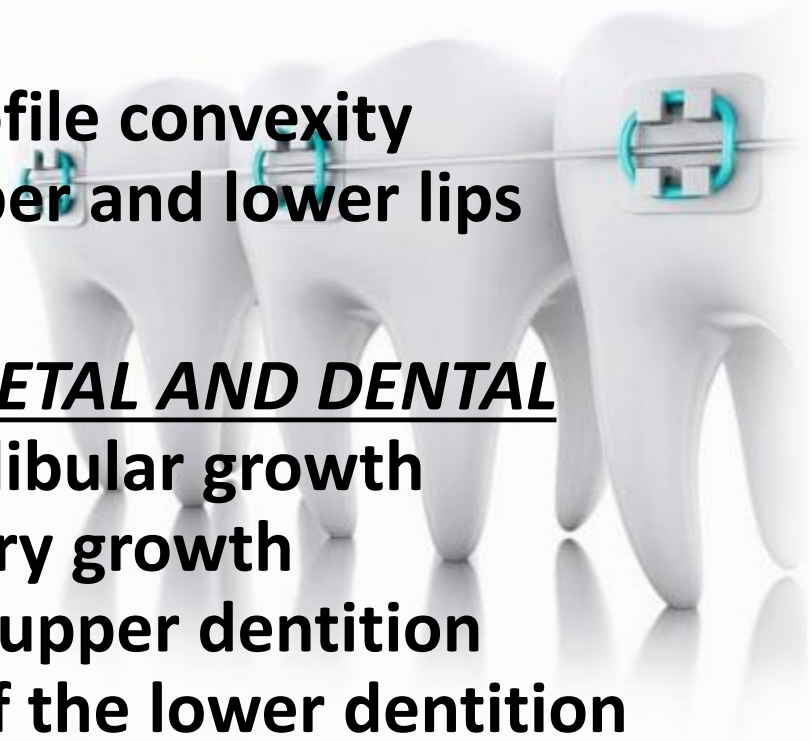
1. Mild to moderate skeletal/dental class II cases;
2. Skeletal class II due to retrognathic mandible; and not normal mandible and prognathic maxilla
3. The patient should have convex profile

# HERBST APPLIANCE

**RIGID FFA**

- **Herbst is a prototype rigid FFA**
- **Given by Emil Herbst , later propagated by Pancherz**
- **The appliance has evolved into different types over years from the initial banded variety**
- **Bonded Herbst**
- **Fliplock Herbst are some of the types**

# TREATMENT CHANGES

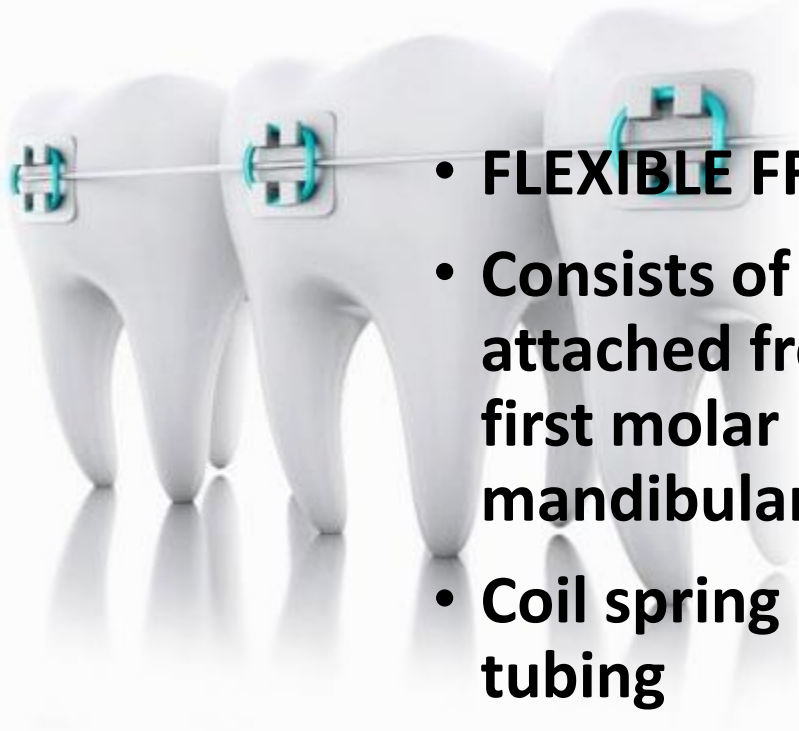


- ***SOFT TISSUE***
  **Reduction in the profile convexity**
  **Retrusion of the upper and lower lips**

- ***HARD TISSUE – SKELETAL AND DENTAL***
  **Stimulation of mandibular growth**
  **Inhibition of maxillary growth**
  **Distal movement of upper dentition**
  **Mesial movement of the lower dentition**

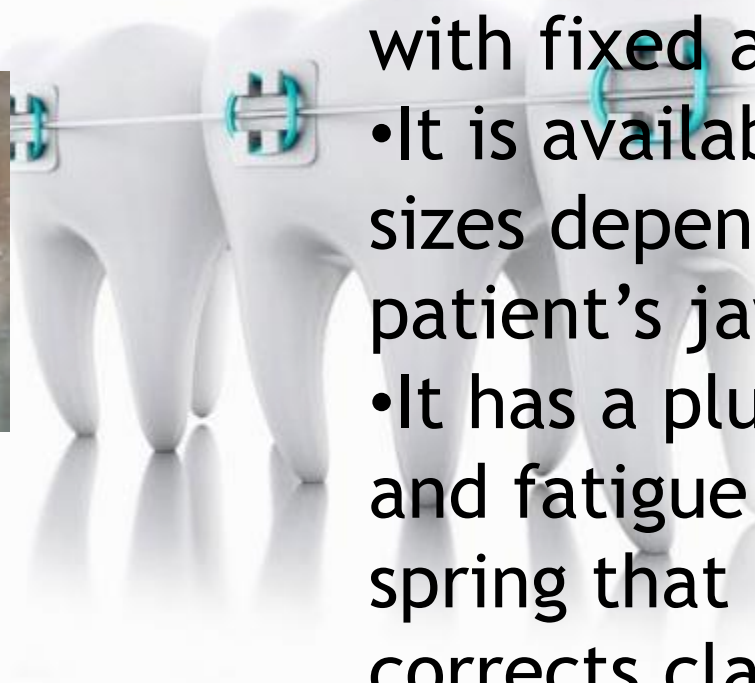
# FLEXIBLE FFA

**JASPER JUMPER**



- **FLEXIBLE FFA**
- **Consists of heavy coil spring attached from distal of maxillary first molar buccal tube to distal of mandibular canine.**
- **Coil spring encased in rubber tubing**
- **It is engaged to the archwire distal to canine by means of outrigger.**

# *HYBRID APPLIANCE eg. Forsus FRD*



- Forsus is used along with fixed appliances
- It is available in many sizes depending on the patient's jaw size.
- It has a plunger rod and fatigue resistance spring that effectively corrects class II malocclusion

# THANK YOU