Sri Aurobindo College of Dentistry

Indore, Madhya Pradesh

INDIA

MODULE PLAN

TOPIC :JAW RELATION

SUBJECT:PROSTHODONTICS

TARGET GROUP: UNDERGRADUATE DENTISTRY

MODE: POWERPOINT – WEBINAR

PLATFORM: INSTITUTIONAL LMS

PRESENTER: DR.SUMEET JAIN

Introduction

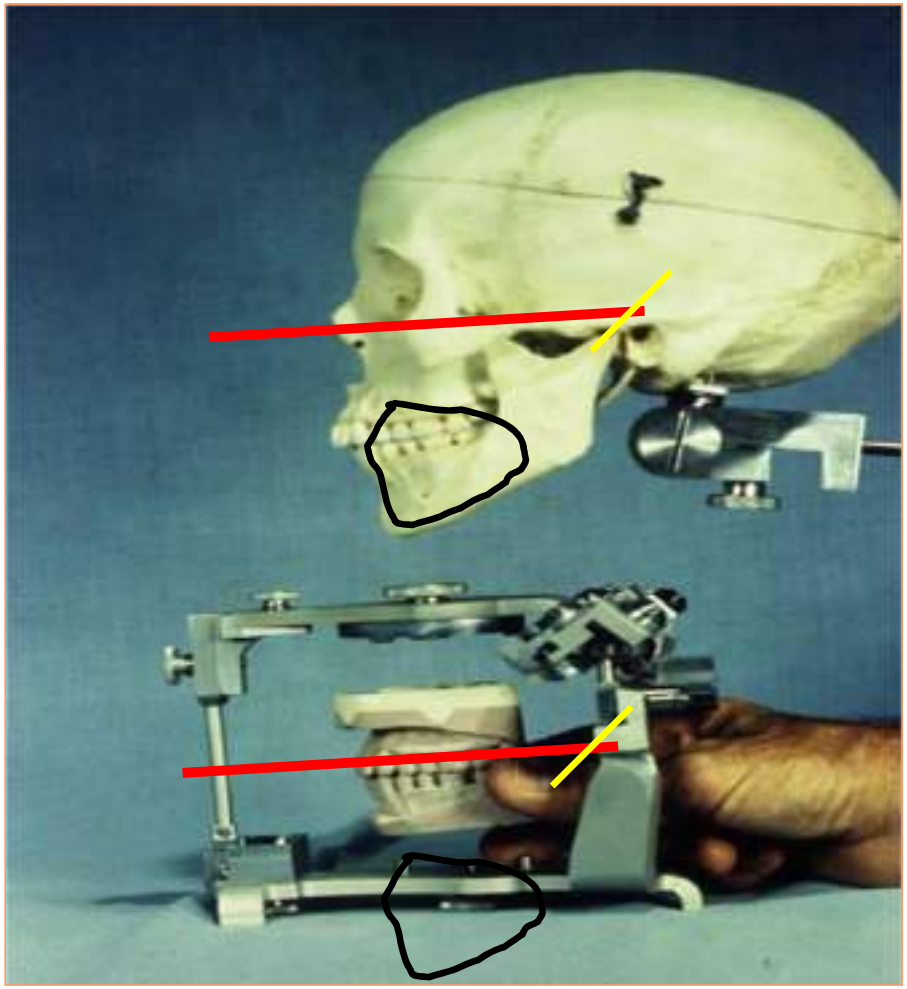
- The maxillary arch has a definite 3-dimensional relationship to all condylar motions of the mandible.

- Jaw relations can be classified as
    1. Orientation jaw relation
    2. Vertical jaw relation
    3. Horizontal jaw relation

Orientation jaw relation

- Orientation jaw relations establishes the references in the cranium.
- When the mandible is kept in the most posterior position, it can rotate in the sagittal plane around an imaginary transverse axis passing through or near the condyles.
- This axis can be located by means of an instrument called **FACEBOW**

- Facebow transfer is the first step in recording the relationship of the maxillary arch to the condylar paths on the articulator.



- **Maxillomandibular relationship:** any spatial relationship of the maxillae to the mandible; any one of the infinite relationships of the mandible to the maxillae *[Gpt-99].*

- **Transverse horizontal axis:** an imaginary line around which the mandible may rotate within the sagittal plane *[Gpt-9].*

- **Retruded contact position:** that guided occlusal relationship occurring at the most retruded position of the condyles in the joint cavities. A position that may be more retruded than the centric relation position *[Gpt-9].*

- **Face-bow:** a caliper-like instrument used to record the spatial relationship of the maxillary arch to some anatomic reference point or points and then transfer this relationship to an articulator; it orients the dental cast in the same relationship to the opening axis of the articulator. Customarily, the anatomic references are the mandibular condyles transverse horizontal axis and one other selected anterior point; called also *hingebow* *[Gpt-9].*

HISTORY OF FACEBOWS

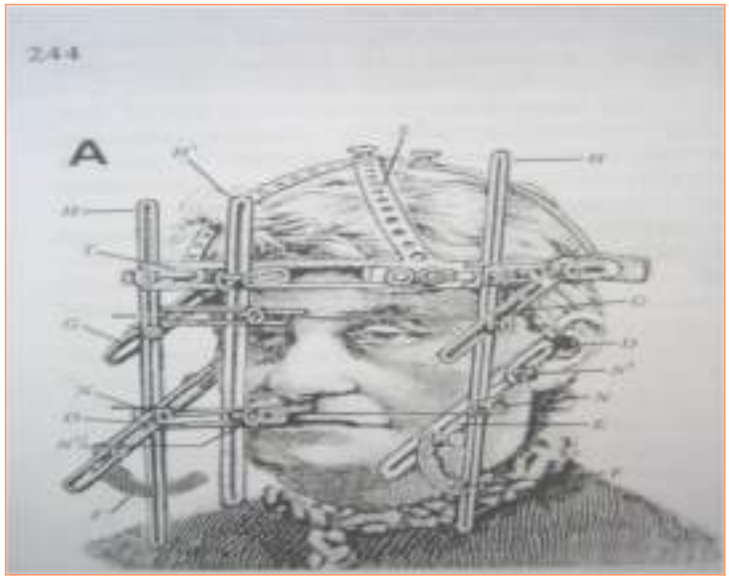
- In 1860 according to Bonwill, the distance from the centre of each condyle to the median incisal point of the lower teeth is 10 cm.
- He used this standard for mounting his casts in the articulator.

- In *1866* **Balkwill** designed an apparatus called **“bite-frame”.**

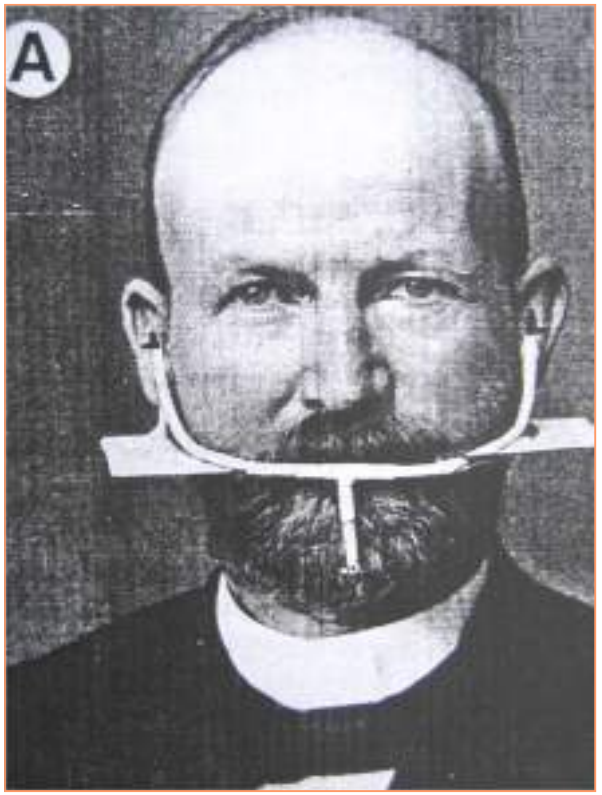
- In *1880* **Hayes** used tong like device which he called it **“articulating caliper”.**

- In 1894 **George k Bagby** devised an apparatus called **“bagby jaw gage”.**

- Walker invented **FACIAL CLINOMETER** to determine mandibular movements in *1896*.



- A little later, at about the turn of century **ALFERED GYSI** developed an instrument similar to face bow primarily to record the path of the condyle.



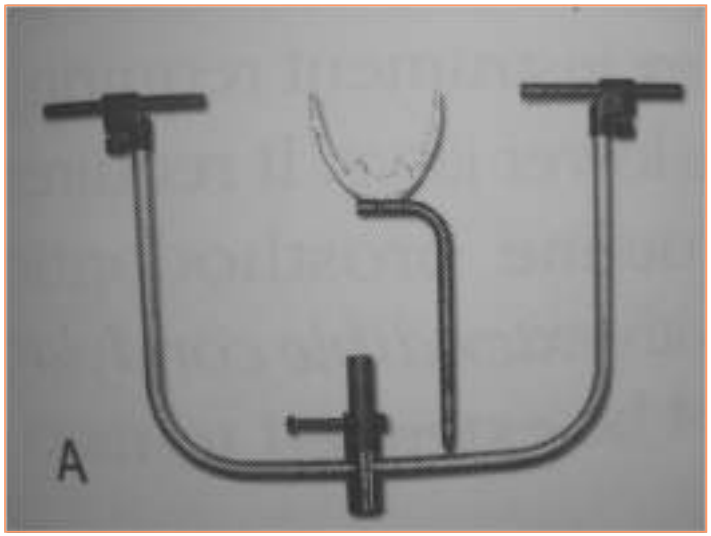
- **SNOW** introduced his face bow in *1899* and majority of the face bow used today are modifications of Snow's face bow.

CLASSIFICATION OF FACE BOW

- **Arbitrary** Face bow (Records arbitrary hinge axis)
  - Fascia Type
  - Earpiece Type
  - Twirl bow
  - Spring bow
  - Slidematic
- **Kinematic** face bow (Records true hinge axis)

ARBITRARY FACEBOW

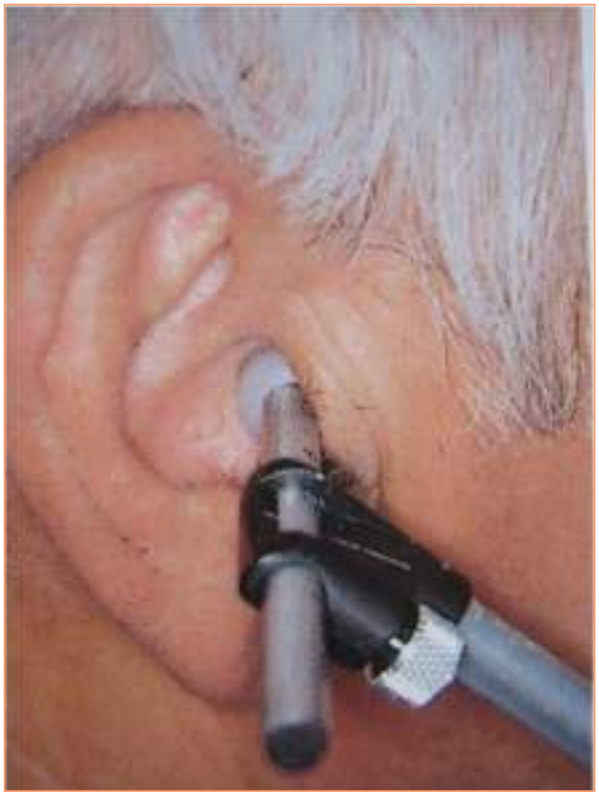
- a device used to arbitrarily relate the maxillary cast to the condylar elements of an articulator. The position of the transverse horizontal axis is estimated on the face before using this device *[Gpt-9].*



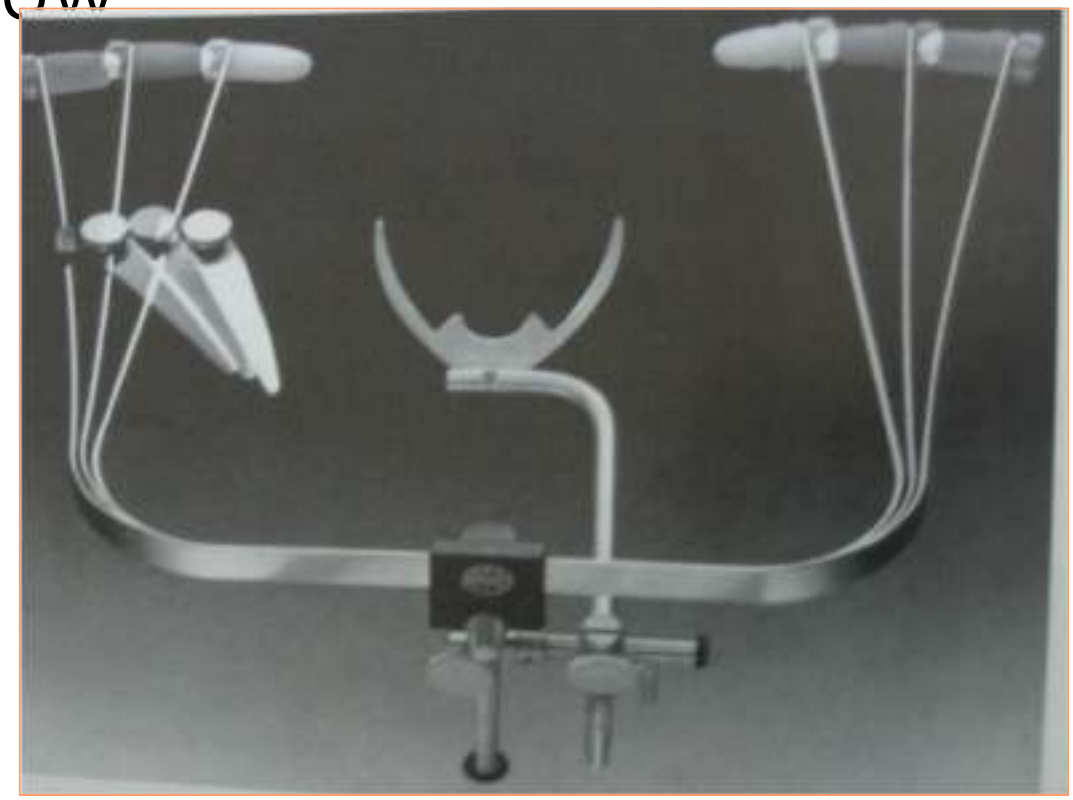
TYPES OF ARBITRARY FACEBOWS

Fascia Type

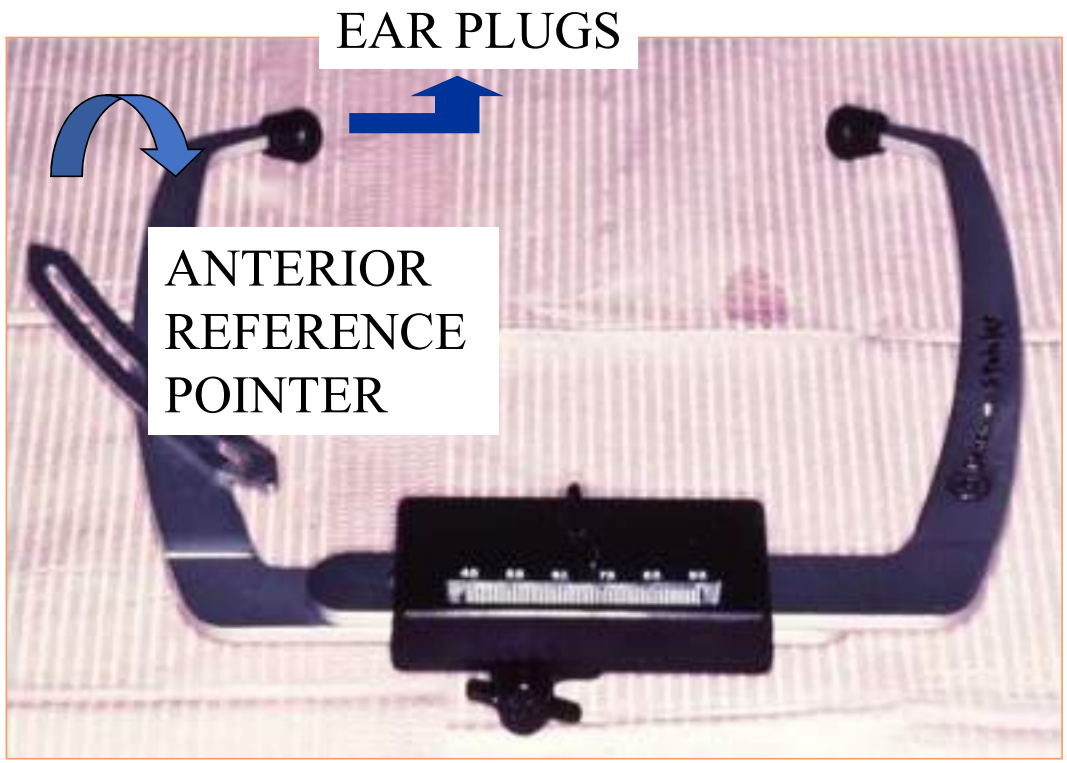
Earpiece Type



Spring bow



Slidematic

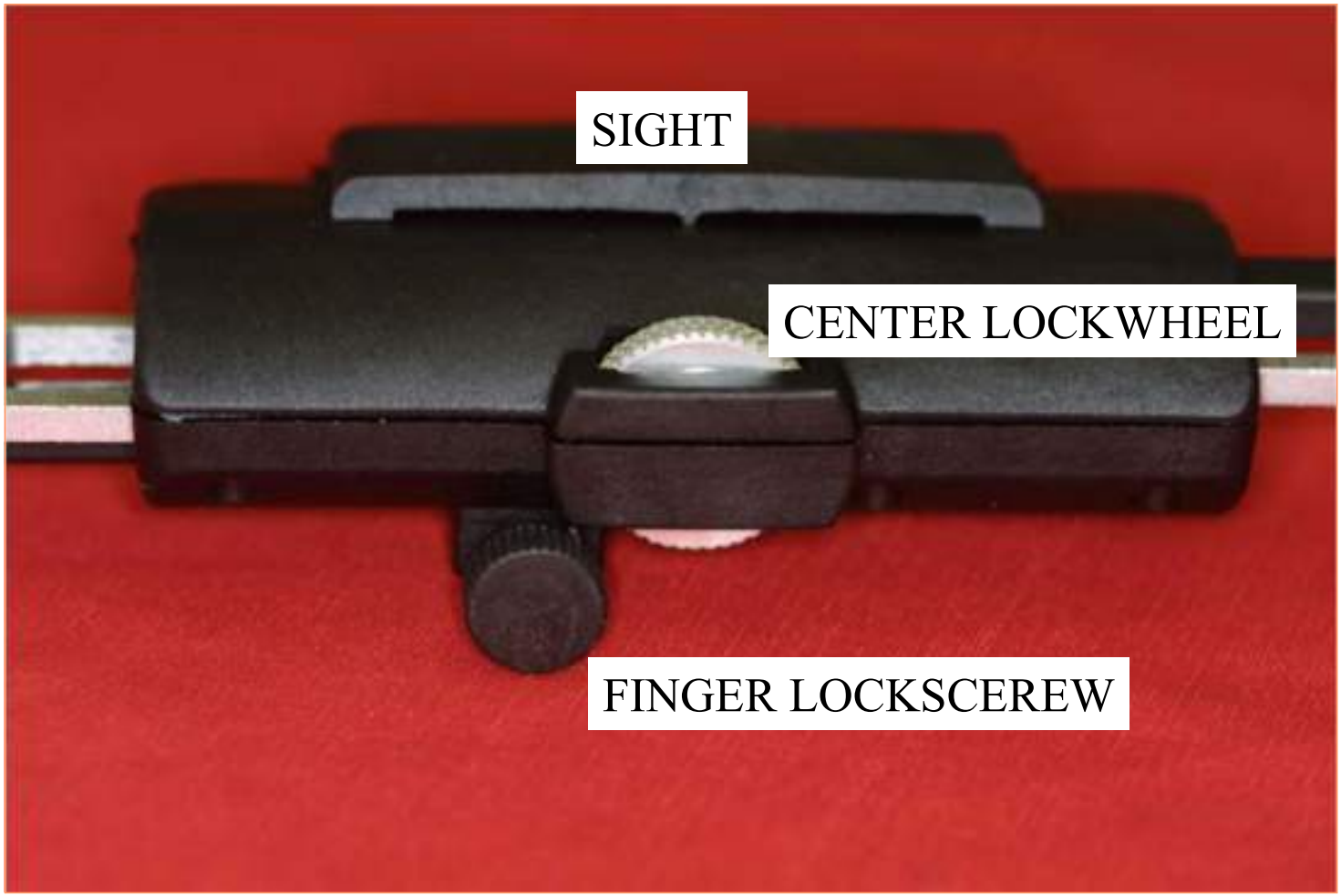


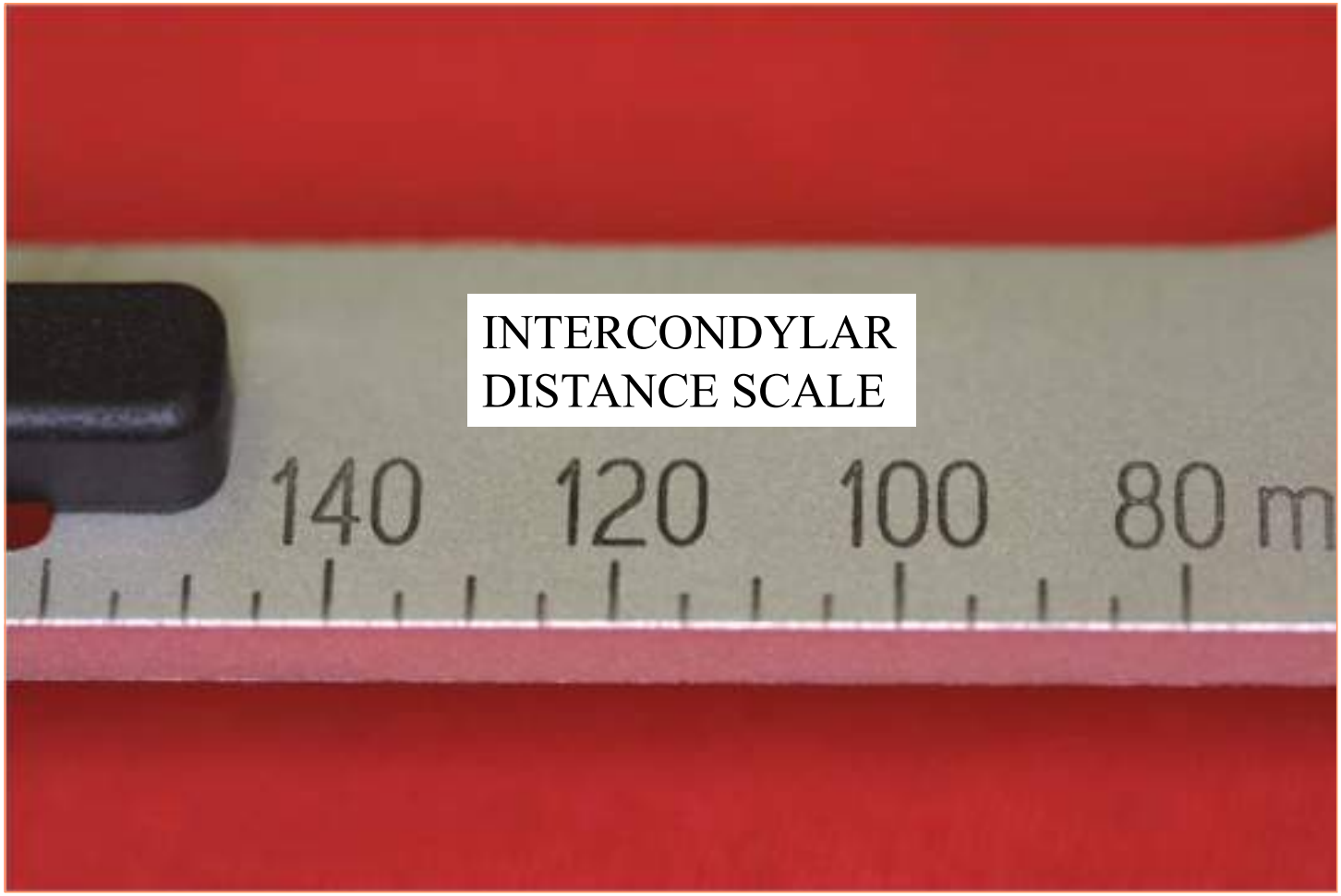
KINEMATIC FACE BOW

- a face-bow with adjustable caliper ends used to locate the transverse horizontal axis of the mandible *[Gpt-99].*

BASIC PARTS OF A FACEBOW

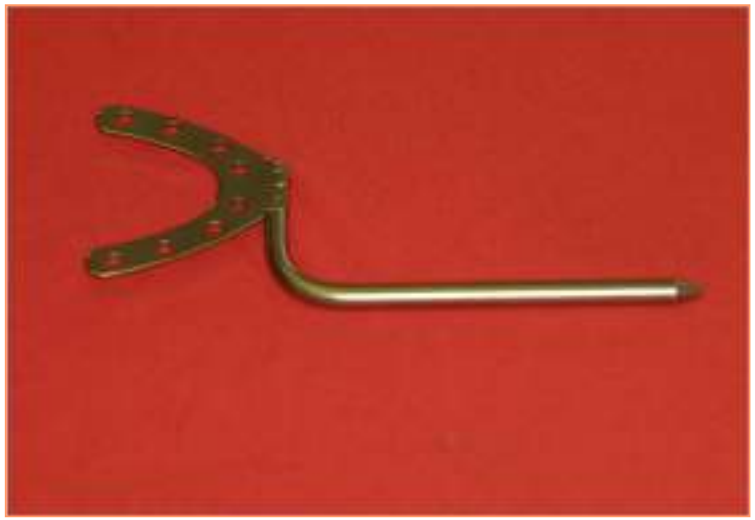
- **U shaped frame work.**
- **Condylar rods.**
- **Bite fork.**
- **Locking device**
- **Orbital pointer with clamp (optional). Additional features & parts vary according to types & brands.**

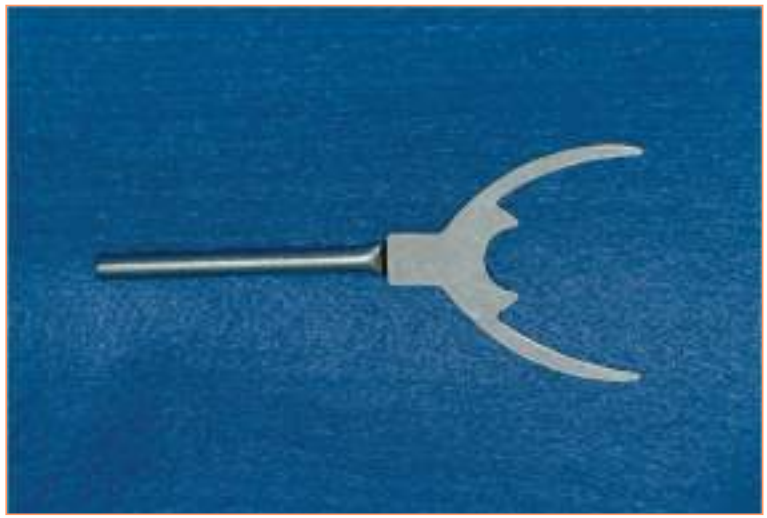

SIGHT
CENTER LOCKWHEEL
FINGER LOCKSCEREW


INTERCONDYLAR
DISTANCE SCALE
140
120
100
80 m

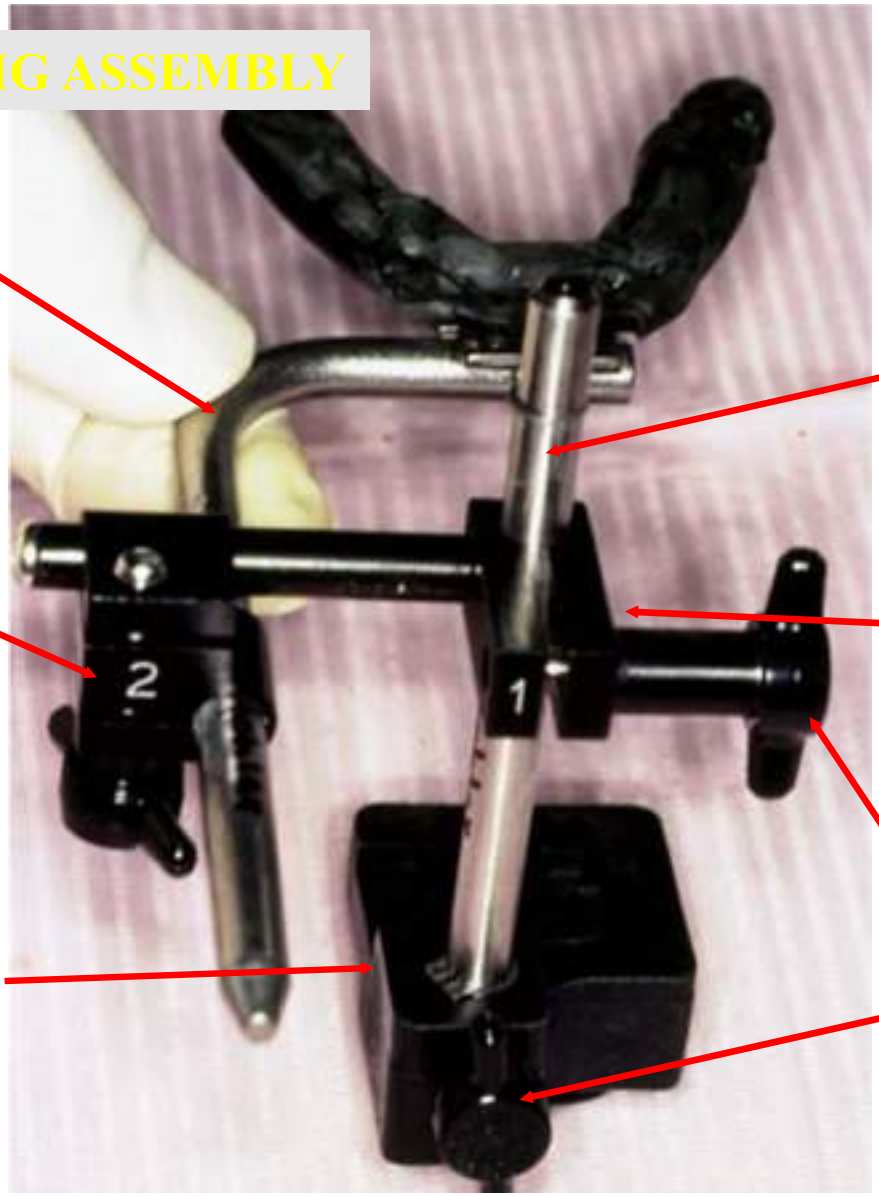

ANTERIOR
REFERENCE
POINTER

Bite forke





TRANSFER JIG ASSEMBLY



- It is constructed in 3 bars, 1 anterior, 2 lateral

- U-SHAPED FRAME

- It forms the main frame of the face bow. All other components are attached to this frame. It extends from the region of TMJ on one side to the another side without contacting the face.

- CONDYLAR RODS
- Two small metallic rods on either side of the free end of the U shaped frame that contact the skin over the TMJ.
- They are used to locate the hinge axis and then transfer it to the articulator.
- Some face bows have ear piece that fit into the external auditory meatus instead of condylar rods.

- BITE FORK
- “U” shaped plate, which is attached to the occlusal rims, used while recording the orientation relation. It is attached to the frame with the help of a rod called the stem.

- LOCKING DEVICE -This part of the face bow helps to fix the bite fork to the U-shaped frame firmly after recording the orientation relation.

- THIRD REFERENCE POINT -It is used to orient the face bow assembly to a anatomical reference point on the face along with the two condylar reference points.

- It varies in the different face bows, example orbital pointer-orbitale, Nose piece – Nasion etc.

INDICATIONS OF FACEBOW

- Balanced occlusion is desired.
- Cusp form teeth are used.
- Interocclusal check records are used.
- Full mouth rehabilitation
- Diagnostic & treatment planning.

☑Complete upper denture opposes a natural dentition

☑Patient exhibits obvious signs of non vertical chewing movements

☑Occlusal vertical dimension to be altered.

☑Remounting

- Is facebow transfer essential in all cd cases?

- It is not required when
  - Monoplane teeth are used
  - No alterations to occlusal surface of teeth are done
  - Articulators that do not accept facebow transfer

ADVANTAGES OF FACEBOW

- Reduce errors in occlusion.
- More accurate programming of articulator.
- Supports the cast while mounting on the articulator.
- Assist in correctly locating the incisal plane

ERRORS IN RECORDING HINGE AXIS

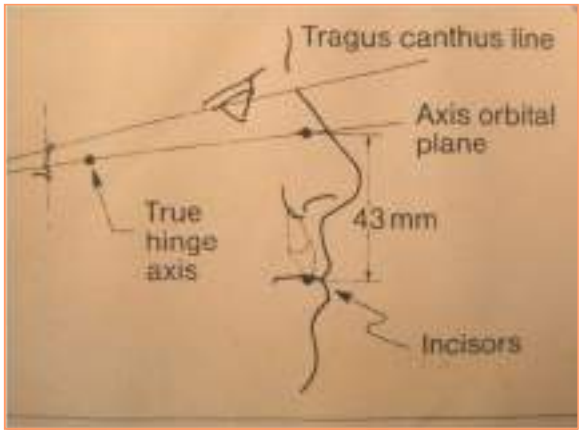
- Movement of the skin over the condyle during registration.
- Tipping of Base will invalidate the eventual recording.
- The angle of opening movement is small about 10-12 degrees and thus the arc of movement of the stylus is small.

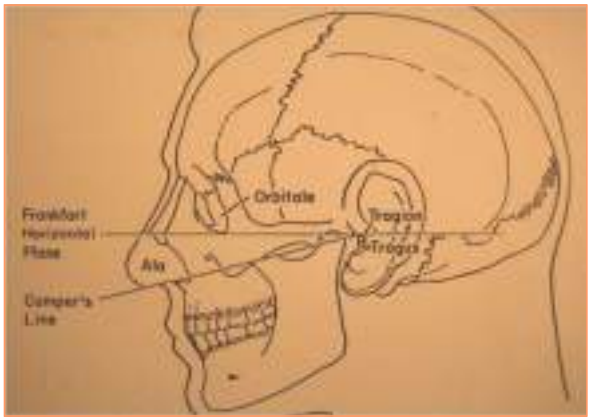
SOME COMMONLY USED ANTERIOR REFERENCE POINT

- Orbitale - located by orbital pointer
- Orbital minus 7mm – refer to Frankfort plane
- Nasion minus 23mm
- Incisal edge plus articulator midpoint to articulator axis- horizontal distance
- Ala of the nose
- 43 mm superior from lower border of upper lip (Denar reference plane locator).

COMMONLY USED PLANES OF ORIENTATION DURING FACEBOW TRANSFERS

- Axis – orbitale plane.
- Frankfort plane.
- Camper's plane.
- Axis – Nasion plane.

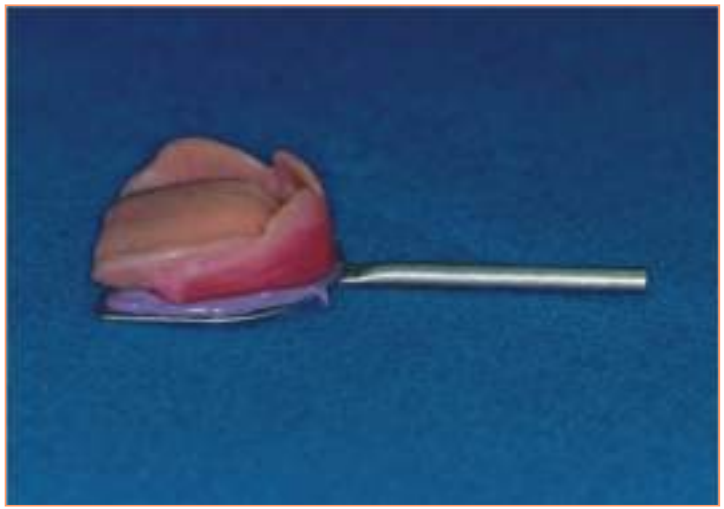




PROCEDURE FOR FACE BOW TRANSFER USING ARBITRARY FACEBOW

- Posterior reference point is measured and marked.
- Condylar rod or earpiece is positioned on posterior reference point The locking nuts are then secured.

- The Bite fork is attached to the maxillary occlusal Rim.
- Occlusal rim are inserted into patient mouth.
- The midline of bite fork should coincide with the midline of the maxillary occlusal rim.

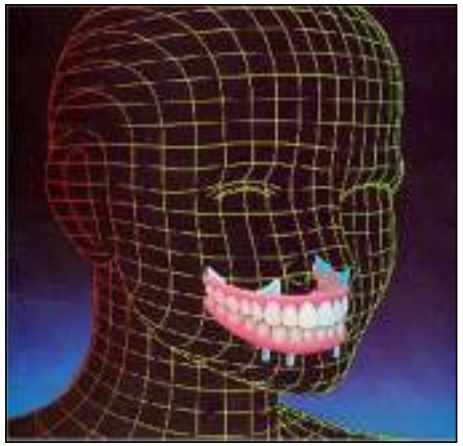


PROCEDURE FOR FACEBOW TRANSFER USING KINEMATIC FACEBOW

- Facebow is attached to the lower jaw by means of clutch.
- Graph of Grid paper is placed near temperomandibular joint region detects the stylus movement.

- Patient is asked to open and close the mandible at centric. Initial movement of the stylus may be arc shaped.
- The stylus is adjusted until the tip rotates instead of arcing.
- This point identified as the hinge axis is tattooed on the skin.

VERTICAL JAW RELATION



Contents

Introduction

- Vertical jaw relation is a bone to bone relation that establishes the vertical jaw separation.

- Vertical jaw relation can be expressed as :

1. Vertical dimension at occlusion, VDO.
2. Vertical dimension at Rest, VDR.

Anatomy & Physiology

- The vertical relation of the Maxillae to the Mandible is established by :

1. Neuromuscular control
2. Mandibular musculature
3. Occlusal stops
4. Patients posture

Neuromuscular Control

- Edentulous patients don’t have a guide to maintain mandible at a specific relation to maxillae.

- However patients neuromuscular control &tactile sense to bring mandible in a position were muscles feel unstrained helps establish desired jaw relation.

Mandibular Musculature

- *Closing Muscles*; Masseter, Medial Pterygoid, Temporalis
- *Opening muscles*; Lateral pterygoid, digastric & platysma.

Occlusal Stops

- Produced by teeth in dentulous patients.
- By occlusal rims in edentulous patients.
- Thus for complete denture fabrication establishing correct VDO is important.

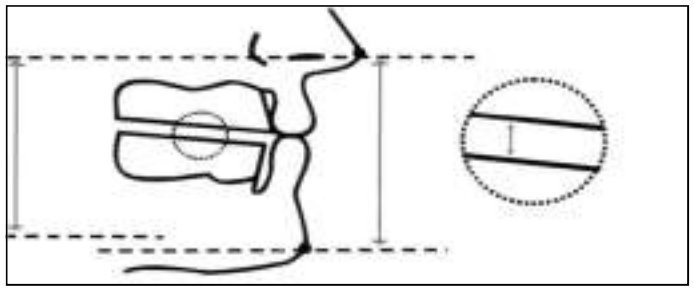
Postural Relationship

- ***Posture of Head*** ; if head is upright force of gravity is added to the force applied by the jaw opening muscles.

- If head is reclining force of gravity will not pull mandible down.

Physiologic Rest Position

- The mandibular position assumed when the head is in an upright position and the involved muscles i.e. the elevator and depressor are in equilibrium & minimal tonic contraction, also the condyles are in a neutral, unstrained position in glenoid fossa.



Significance of Rest Position

- Reproducible
- Free way space allows relaxation of masticatory apparatus
- Constant throughout the life.
- Patient can Recognize it
- Helps relate to vertical dimension at rest & vertical centric.

Physiologic Rest Position

- *Mortone and Edward ;* stated that the rest position of the mandible established by :
- Postural reflex
- Weight of mandible
- Pull of gravity
- Tension of depressor & elevator muscles.

Factors Affecting VDR

- Position Of Head.
- Patient's Attitude.
- Neuromuscular Disturbance.
- Duration Of Rest Position.
- External Stimuli.

Methods of Determining Vertical Dimension at Rest

The following factors influence the rest position:

1. **The posture of the patient**: The rest position is affected by postural changes. The patient should be sitting upright or standing with the head erect and looking straight ahead, when the rest position is determined.

2. **A relaxed patient**: When a patient is nervous, tense, irritable or tired, the rest position may be inaccurate. It should be determined when the patient is relaxed.

3. **Neuromuscular disturbance**: It will be difficult to determine the rest position in patients with such problems. The dentist should be more considerate, patient and spend more time to establish the rest position in such individuals.

4. **Duration**: As it is a position in space, the patient cannot maintain the rest position for long periods. The dentist should make the measurement without delay when the patient assumes this position.

5. **Use of several methods**: Although the rest position is measurable and repeatable, there is no single scientific method of establishing the same. A combination of various methods is used to verify the position

1. Facial measurements: The vertical dimension at rest is calculated by making facial measurements.

- Two marks are commonly placed, one on the tip of the nose and other on the chin directly below the nose marking. The markings can be made with an indelible marker or pieces of adhesive tape

- As the patient assumes rest position, the vertical distance between the two points is measured using a divider or scale. Measurements can also be made with special instruments made for the purpose like Willis gauge and Dakometer.

The following methods are used to make the patient assume the postural rest position:

(i) **Swallowing:** The patient is instructed to drop the shoulders, wipe his/her lips with tongue, swallow and close the mouth. This makes the mandible assume the rest position, which is immediately measured.

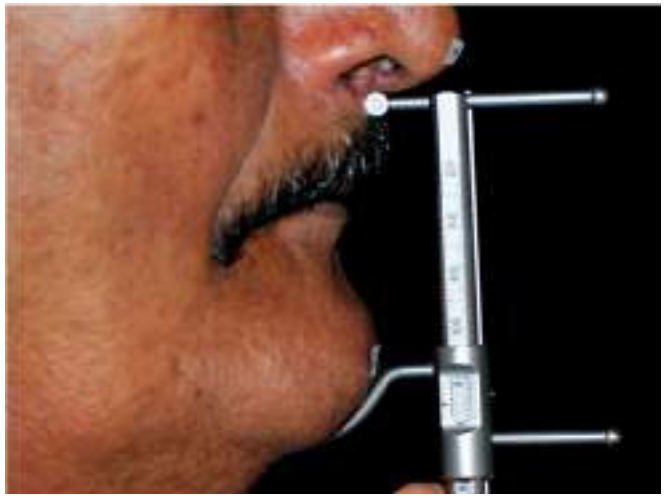
(ii) Tactile sense: The patient is instructed to open the mouth wide until strain is felt in the muscles (may be for 1–2 min). They are then asked to close the mouth slowly until they feel comfortable and relaxed. Measurement is made in this position.

(iii) Phonetics: The patient is instructed to repeatedly say words that contain the letter ‘m’. The lips meet when this is pronounced and the patient is instructed to stop all jaw movements when this happens. Measurement is made between the two points of reference.

(iv) Facial expression: The following indicates rest position: ○ Lips are even anteroposteriorly with slight contact. Skin around the eyes and chin is relaxed. Relaxation around the nostrils with unobstructed breathing

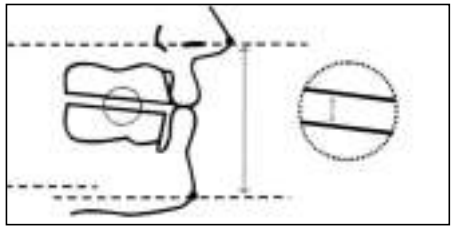
2. Measurement of anatomic landmarks

The **Willis guide** states that the distance from the pupil of the eye to the rima oris (corner of mouth) should be equal to the distance from the anterior nasal spine to the lower border of the mandible, when the mandible is in its physiologic rest position.



Inter-Occlusal Gap

- It is the gap existing between maxillary and mandibular teeth when the mandible is in physiologic rest position.
- Normally it ranges from 2-4 mm in first premolar region.

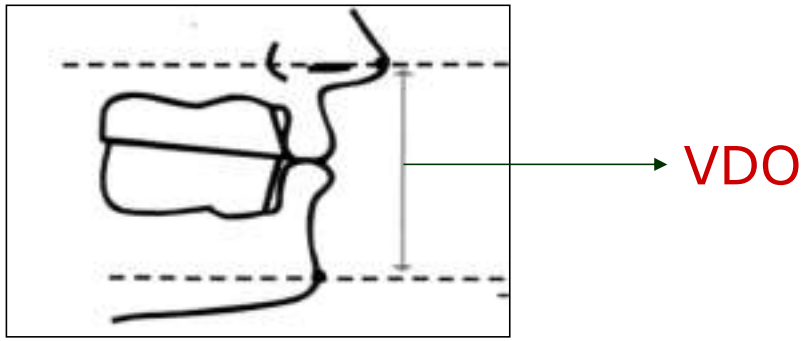


Significance of Inter-Occlusal Gap

- Normal Physiologic Function
- Rest to muscles
- Prevent Fatigue
- Prevent clicking due to premature contacts
- Prevent soreness of the tissues of basal seat.
- Prevent rapid resorption of alveolar bone.

Occlusal Vertical Dimension

- The distance measured between two points when the occluding members are in contact.(VDO)



Determining Vertical Relation

- Determination of Vertical Relation is done by two methods :

1. Mechanical methods
2. Physiologic methods

Determining Vertical Relation
Mechanical Methods

- Ridge relation
  - Distance of incisive papilla -mandibular mucosa
  - Parallelism of the ridge.
- Measurement from former denture
- Pre extraction record :Profile radiograph
  Profile photograph
- Articulated preextraction cast records
- Lead win silhouettes
- Facial measurement

Determining Vertical Relation
Physiologic Methods

- ***Physiologic rest position tests.***

1. Parting the lips after swallowing
2. Niswonger's methods

Phonetics

1. Using the m sound
2. Using ch, s and j sound
3. Silverman's closest speaking space

Determining Vertical Relation
Physiologic Methods

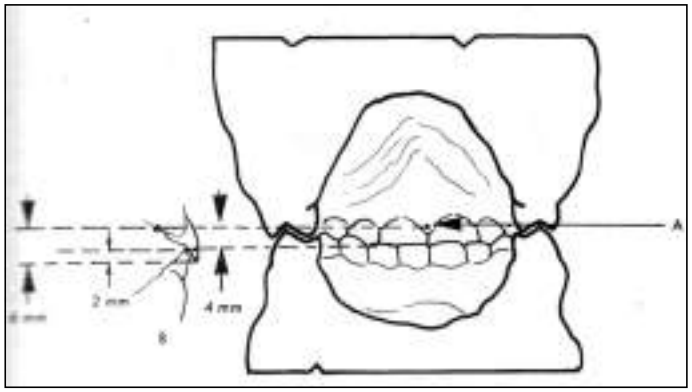
- Facial expression and esthetic as guide
- Swallowing threshold
- Tactile sense
- Lytles method
- Boos bimeter (power point)
- Electromyography

Mechanical Methods

- ***Ridge Relationship***; The positional relationship of mandibular ridge to the maxillary ridge. It can be measured by two methods.
- Distance from the incisive papilla to mandibular incisors.
- Parallelism of ridge.

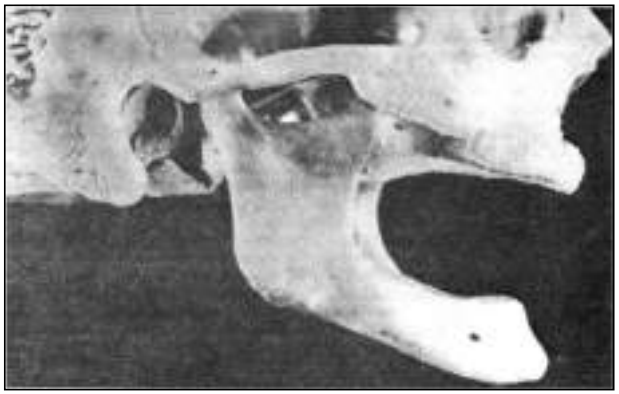
Ridge Relationship

- ***Incisive Papilla*** Distance of the papilla to the maxillary incisors edge is 6mm & vertical overlap is 2mm (overbite). Hence the distance between the incisive papilla and the lower incisor will be approximately 4mm. based on the value, the vertical dimension at occlusion can be calculated



Ridge -Parallelism

- The mandible is parallel to the maxilla only at occlusion. The factor can be used to determine the vertical dimension at occlusion.
- The mandible of the patient is adjusted to be parallel to the maxilla (this position associated with a 50 opening of the jaw in the TMJ gives a correct amount of jaw separation).

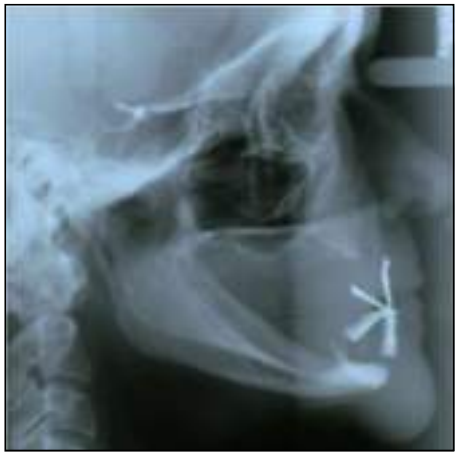


Pre-Extraction Records

- ***Pre-Extraction photographs*** ; with the teeth in occlusion are taken and compared for aesthetics and measurements of facial landmarks with the rims inserted & occluded.

Pre-Extraction Records

- Radiographs ; records of patients in occlusion or of previous denture wearers can used as a guide to establish vertical dimension at occlusion



Pre-Extraction Records

- ***Profile Silhouettes***; an accurate reproduction of profile silhouettes in cardboard with natural teeth occluded (Pre –Extraction) can be used to check the established VDO

Pre-Extraction Records

- ***Articulated Cast*** ;dentulous patients maxillary & mandibular cast records are taken in occlusion & mounted on the articulator. This is used as pre-extraction record.

Pre-Extraction Records

- ***Former dentures*** ;
vertical records from previous dentures can be taken and an idea can be taken for establishing vertical dimension at occlusion.

Facial Measurements

- Willi's Guide : it works on the symmetry of the face.
- It says the distance from the pupils of eye to rima oris and anterior nasal spine to border of mandible should be equal.
- When these measurements are equal the mandible is said to be in rest position.

Physiologic Method

- *Parting lips after swallowing ;* with trunk upright & head unsupported the patient is asked to repeatedly swallow & let the jaw relax.
- Carefully part the lips w/o moving jaw.
- Check for the Interocclusal distance (2-4mm).
- Adjust if found insufficient or excessive.

Physiologic Method

- *Niswonger's Method ;* patient is made to sit in an unstrained position.

1. Mark 2 references point one on each jaw
2. Insert both rims and guide the patient to say words ending with "M".
3. As patient closes lips ask him to stop moving jaws.
4. Repeatedly make patient do this till he unconsciously performs this.

Physiologic Method

5. Measure the distance b/n the reference points
6. This distance is taken as VDR.
7. An IOG of about 2-4mm is then established by trimming off baseplate wax from mandibular rim.
8. The achieved vertical relation is recorded as VDO.

Physiologic Method

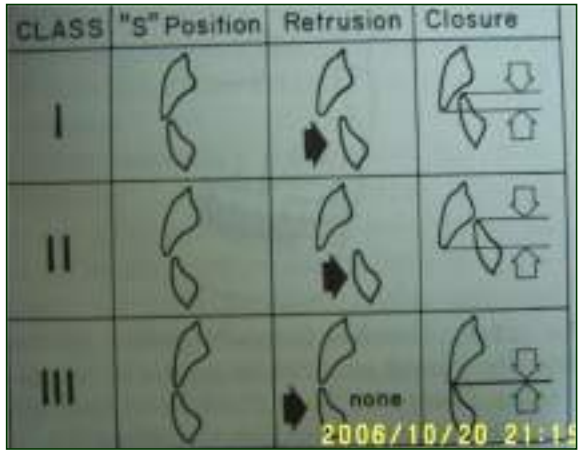
- *Aesthetic as Guide ;* if proper vertical relation is not established lips will look more vertical or stretched.
- Also wrinkles will be formed at nasiolabial fold.
- Cheeks will look too full or drenching inwards.
- Two chin appearance.

Using “M” Sound

- When the patient repeats the letter ‘M’ , on initial complete contact of upper & lower lips patient is advocated to stop raising mandible upward.
- This point is referred to as vertical dimension at rest.

Using “F” or “V” & “S” Sounds

- In this method, the Incisal guidance is established by arranging the ant teeth on the occlusal rim before recording the vertical dimension at occlusion



Using “F” or “V” & “S” Sounds

- The position of ant. teeth is determined by the position of the max patient pronounce words beginning with ‘F’ & ‘V’.

- The position of the lower ant teeth is determined by the position of the mandible when the patient pronounces words beginning with the letter ‘S’.

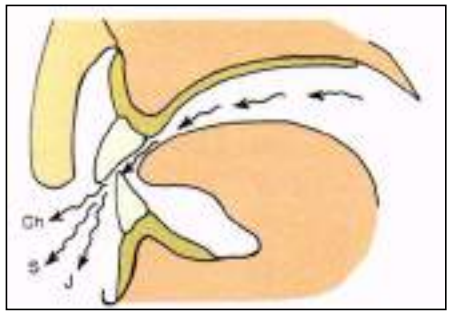
Silverman's Closest Speaking Space

- Closest relationship of the occlusal surfaces and incisal edges of the mandibular teeth to the maxillary teeth during function and rapid speech.

- This was later called *closest speaking level* by Dr Silverman.

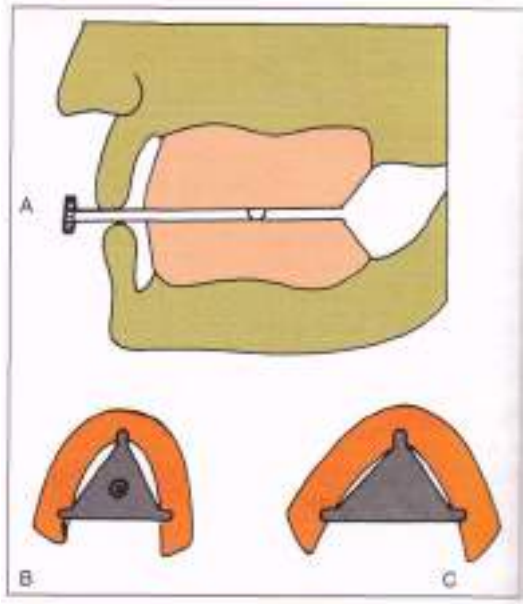
Closest Speaking Space

- The space should not be more or less than 1 to2 mm between the incisal edges of the teeth when the patient is unconsciously repeating the letter “S” (*speaking centric*).



Swallowing Threshold

- This technique is based on the fact that when a person swallows, the teeth comes together with very light contact .



Swallowing Threshold

- Cones of soft wax having excessive height are placed on the lower base salivation is stimulated (eg. Using candy) and the patient is instructed to swallow. The repeated swallowing reduces the height of the wax to the occlusal vertical dimension.

LYTLE'S METHOD

- This works on patients perception.
- Place the record bases with central bearing point attached to mandible.
- The central bearing point is opened first till the patient feels rims are contacting too wide open. This reading is recorded.
- This is followed by closing the screw so as patient feels that the rims are contacting too early & this reading is recorded.
- After this the screw is unwinded to a position halfway between the above two recorded positions.
- Then the screw is given half turn up or down to finally establish VDO as per patients perception.

BOOS BIMETER

- Maximum biting force occurs at VRO. Boos Bimeter is attached to the mandibular base and a metal plate with central bearing point to maxillary. The screw is turned to adjust vertical relation. The maximum power point is determined on the spring gauge & this vertical relation is recorded as VDO.

Electromyography

- Rest position can also be determined by recording the minimal activity of muscle of mastication.
- Electromyograph is attached to the depressor & elevator muscles of the mandible & patient is asked to move it up & down.
- This is done until a neutral reading is recorded on the EMG.
- This is taken as rest position of mandible.

Increased Vertical Height

- Discomfort and annoyance to the patient.
- Trauma to underlying mucosa
- Rapid resorption of alveolar bone
- Clicking of teeth
- Rapid wear of acrylic teeth
- Stained appearance elongated face.

Decreased Vertical Height

- Decreased chewing efficiency
- Cheek biting
- **Appearance :-** The chin appear close to nose, lip loose their fullness and vermilion border is reduced to a line, wrinkles are deepened
- **Angular cheilitis:-** A deep crease forms at the corner of the mouth constant wetness due to saliva leads to infection & soreness.
- TMJ pain, clicking sounds, headache

Evaluating Vertical Dimension

Preparing patient :

1. Contour the wax in the form of finished denture
2. Place the trial in denture in patients mouth
3. Train the patient to do various physiologic movements

Evaluating Vertical Dimension

- ***Patients Tactile Sense*** : tell the patient to swallow and then bring the teeth in maximum intercuspation.
- Ask the patient weather the teeth come in contact too soon or too far.

Evaluating Vertical Dimension

- ***Soft Wax Technique*** ; place cones of soft wax on the mandibular 1st molar.
- Encourage the patient to swallow several times.
- Swallowing several times brings teeth in centric occlusion.
- If the vertical dimension is correct the wax will be penetrated & reduced to tooth contact.

Evaluating Vertical Dimension

- ***Phonetics*** : ask the patient to say following words or numbers ;

1. Three-thirty-three
2. Fifty five
3. Emma & Mississippi

CENTRIC RELATION

Introduction

- The term centric relation was derived from the word "center" or "center oriented relation".
- Condylar centricity was proposed by ***Gysi*** and later accepted by several authors.
- ***Gerber*** who described it as a "Zenith of the fossa" relation.
- It is most posterior relation of the mandible to the maxillae at established vertical dimension.
- It is bone to bone relation and classed as horizontal relation.
- It is a reference relation which is constant for each patient provided that soft tissue structures are healthy.
- *Centric relation is a significant and important position as it is useful in relating the dentate and edentate mandible to maxillae where the teeth, muscles and the temporomandibular joint could function in harmony.*

Definition

- Centric relation is the most posterior relation of the mandible to the maxillae at the established vertical dimension.

(BOUCHER 9th edition ; WINKLER 2nd edition)

- The relation of the mandible to the maxilla when the condyles are in their **rearmost, uppermost ,midmost positions** in the glenoid fossae. Centric relation can exist over a range of jaw openings and is not violated until the condyles leave their posterior position in the glenoid fossae. The unstrained hinge position of the mandible.

(The International Academy Of Gnathology 1979 & Glossary Of Occlusal Terms)

- The most retruded relation of the mandible to the maxillae when the condyles are in the **most posterior , unstrained position** in the glenoid fossae from which lateral movement can be made , at any given degree of jaw separation.

(GPT 1st)

- It is the **most retruded** relation of the mandible to the maxilla to and from , which the individual can make lateral movements. It can be made at any given degree of jaw separation. It occurs around the terminal hinge axis.

(GPT 3rd)

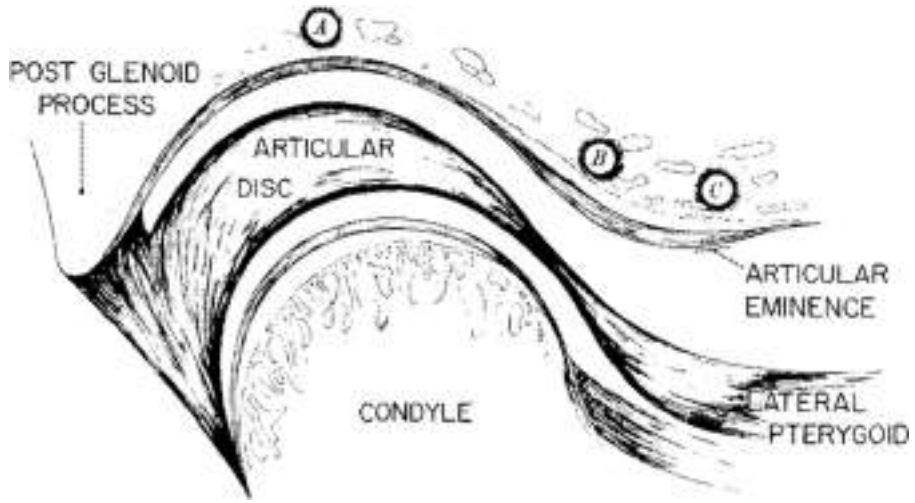
- It is the **most retruded** relation of the mandible to the maxilla when the condyles are in the **most posterior unstrained position** in the glenoid fossa from which lateral movements can be made at any given degree of jaw separation.

(GPT 4 edition, JOHN. J. SHARRY 3rd edition)

- **It is the maxillo-mandibular relationship in which the condyle articulates with the thinnest avascular portion of the respective disc with the complex in anterior-superior position against the shape of the articular eminence. It is independent of tooth contact. This position is clinically discernible when the mandible is directed superiorly and anteriorly. It is restricted to a purely rotatory movement about the transverse horizontal axis.**

(GPT 5/7/8)

- GPT 9(2017) : A maxillomandibular relationship, independent of tooth contact, in which the condyles articulate in the anterior-superior position against the posterior slopes of the articular eminence ; in this position, the mandible is restricted to a purely rotatory movement ;from this unstrained, physiological, maxillomandibular relationship, the patient can make vertical, lateral, or protrusive movements; it is clinically useful , repeatable reference position.



- **Centric occlusion** :- It is the occlusion of opposing teeth when the mandible is in centric relation. This may or may not coincide with the maximal intercuspal position.
- It is relationship of upper and lower teeth to each other. (BOUCHER 9th edition)
- **Maximum intercuspation :-** It is the complete intercuspation of the opposing teeth independent of condylar position, sometimes referred to as the best fit of the teeth regardless of the condylar position—called also maximal intercuspation.

SALIENT FEATURES

- It is learnable, repeatable, recordable position which remains constant throughout life.
- It is a definite learned position from which the mandible can move to any eccentric position and return back involuntarily.
- Act as a centre from which all movements can be made.
- If mandible has to move from one eccentric position to another it should go to the centric relation before advancing to target eccentric position.
- Functional movements are performed in this position because it is unstrained positioned.
- Muscles that act on tmj are arranged in such a way that it is easy to move mandible to centric position from where all movements can be made.
- It is helpful in adjusting condylar guidance in an articulator to produce balanced occlusion.
- Definite entity, so it is used as a reference point in establishing CO
- Pure rotation takes place.
- Independent of position of teeth.

SIGNIFICANCE OF CR

1. It provides reference for evaluation and reconstruction of occlusion.
2. It is a horizontal reference position that can be examined from edentulous mandible of the patient.
3. CR must be accurately recorded and transferred to the articulator to permit proper adjustments of the condylar guidance for the control of eccentric movements of the instrument.
4. It is reproducible arch to arch relationship and is an optimum recordable position of jaws.

5. When CR and CO of the artificial teeth do not coincide, the periodontal structures are endangered.

6. It is a reproducible position which can be repeatedly arrived and serves as a reliable guide to develop centric occlusion in artificial dentures .

7. An accurate CR record properly orients the lower cast to the opening axis of the articulator and the mandible.

8. It serves as a reference position for the institution of occlusal rehabilitation in dentate condition.

9. When CR and CO of the artificial teeth do not coincide , the stability denture base is in jeopardy and patient bear unnecessary pain or discomfort.

CLINICAL METHODS OF MANIPUALTION FOR CENTRIC RELATION

- One handed technique almost never achieve true terminal hinge position of the mandible.
- It is extremely difficult to record terminal hinge position when the patient is upright. Manipulation of the mandible is much simpler and far more consistent if the patient is in supine position.
- The mandible can not be forced into terminal hinge axis position. The terminal hinge axis must be located in an open position without pressure on the mandible and then it must be firmly held on that axis while the mandible is closed to the first point of contact.
- If the pressure on the mandible toward the condyle causes tenderness or pain in either condyle area, the condyle on the painful side is being held forward by muscle and is not in terminal hinge position.
- Proper manipulation is neede to get the condyles farther back and up. When the condyle – disk assembly is braced against bone and ligament, pressure toward the condyle will not cause pain or any tenderness.
- Once the correct method of manipulation is learned, patients will not fight the operator. No appliances are needed if the mandible is manipulated properly .

Retruding the Mandible

There are 2 methods to retrude the mandible

PASSIVE METHODS

- Mandible is retruded by patient itself .
- Relax, pull jaw back and close on back teeth.
- Get the feeling of pushing the upper jaw out and close on back teeth.
- Touch the posterior part of upper denture with tongue and close till rims contact.
- Swallow and close.
- Tap occlusal rims together repeatedly and rapidly.
- Tilt head back while performing exercises.
- Protrude and retrude the mandible repeatedly holding his/her fingers lightly against chin.

ACTIVE METHODS

Patient is guided to retrude with physical assistance from dentist.

1. CHIN POINT GUIDANCE (Guichet 1970)
Dentist places his thumb and forefingers on patients chin to exert a mild but firm posterior force while patient closes on rims.

2. THREE FINGER METHOD (Peter Thomas)-

Thumb, forefinger, middle finger – position the condyle in antero superior position.

3.BIMANUAL PALPATION (Dawson)-

Step 1-

- Recline the patient all the way back.
- Point the chin up as it makes it easier to position the fingers on the mandible and prevents the tendency of patients to protrude the jaw.
- Supine position is more relaxed

Step 2-

- Stabilize the head.

Step 3-

- After the head is stabilized, lift [illegible] slightly stretch the neck.

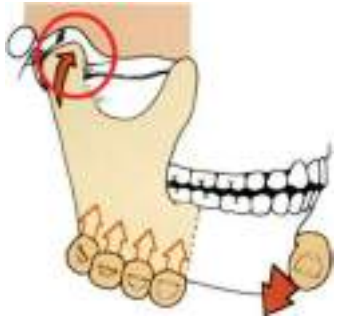
Step 4-

- Gently position the four fingers of each hand on the lower border of the mandible.
- The little finger should be slightly behind the angle of mandible.
- Position the pads of your fingers so they align with the bone.
- Keep all your fingers tightly together.

Step 5-

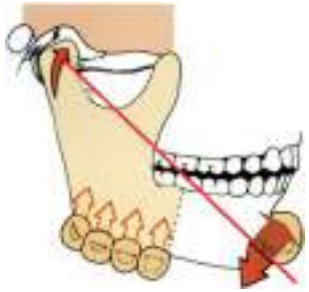
- Bring the thumbs together to form C with each hand.
- The thumbs should fit in the notch above the symphysis.
- No pressure should be applied at this time. All movements should be made gently.

- Ensure that the fingers are properly positioned- most common mistake in taking centric relation is positioning the fingers too forward.
- Draw an imaginary line in the centre of inferior border of mandible (dotted line). This separates the front half from the back half.
  DO NOT LET FINGERS MOVE FORWARD OFF THAT LINE
  Keep the fingers tight together and confined to the back half, where the elevator muscles are located.

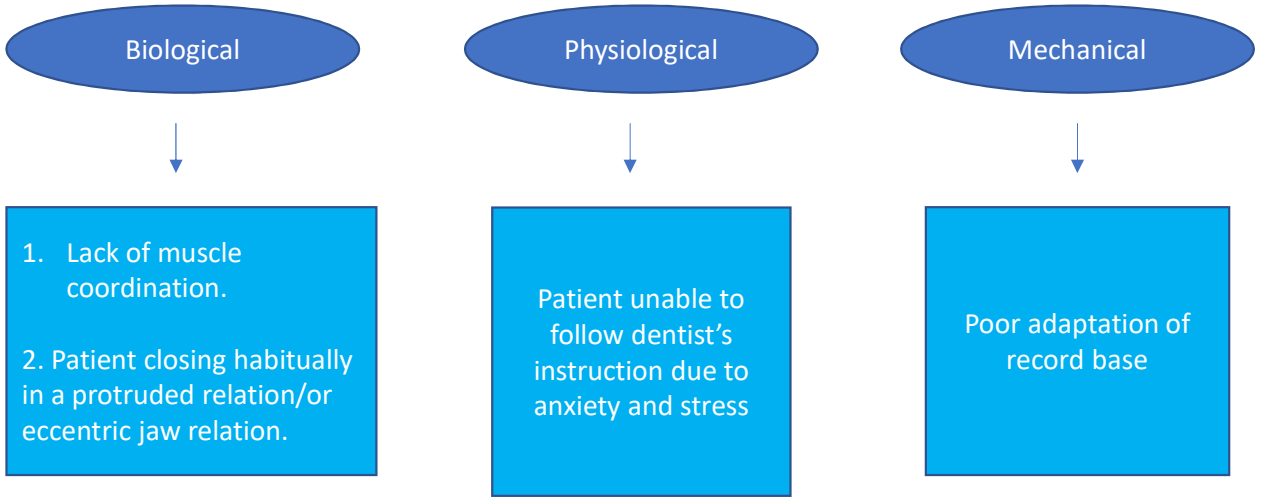


Step 6-

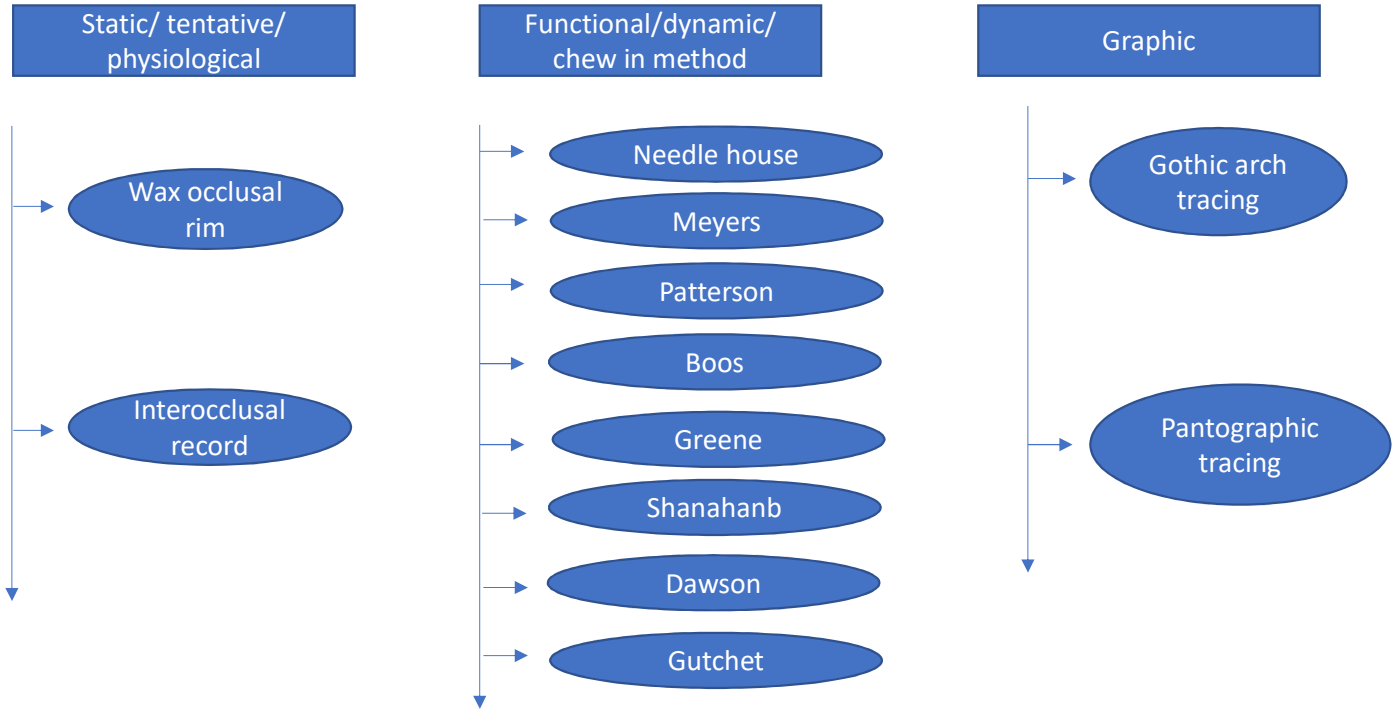
- With a very gentle touch, manipulate the jaw so it slowly hinges open and closed.
- As it hinges, mandible will slip up into centric relation automatically if no pressure is applied.
- Any pressure applied before the the condyles are completely seated will be restricted by the lateral pterygoid muscle.
- The contracted muscles will be stretched by the pressure and will respond with greater muscle contraction.
- Once these muscle have been stimulated to contraction, it is extremely difficult to seat the condyles into centric relation.



What leads to difficulty in retruding mandible?



Methods to record CR in edentulous patients



Static method

1.WAX OCCLUSAL RIMS-

- Most commonly used method.

Wax occlusal rims contoured and VDO is established ensuring even contacts of rims.

↓

Patient is trained to retrude the mandible and asked to close

↓

Rims are sealed in this position, removed from mouth and articulated.

How to seal ?

a. Heat : Using a hot wax knife.
It can melt and flow the wax at the junction of rims.

b. Pinning : It can be sealed using pins.
Slight warm metal staples can be used to join side of rims.

Not recommended because – 1.chances of burning and injury to lips and cheeks.
2. no equalization of pressure.

c. Nick and Notch method : Most recommended method.

Wax occlusal rims contoured at VDO

↓

V shaped notches are placed in molar region in maxillary rim to prevent antero- posterior movement.

↓

Nick is cut anterior to notch in premolar area
to prevent lateral movements.

↓

Trough in the mandibula rims (posteriorly).

↓

Patient is asked to close in centric by retruding the mandible.

↓

Recording material loaded in trough and then patient is instructed to retrude and close.

Contact of maxillary and mandibular rims should be observed

↓

Once material sets, rims get sealed and are removed.

Materials used-
1. soft wax
2. ZOE
3. Quick setting plaster
4. Elastomeric bite material

2. INTEROCCLUSAL CHECK RECORD:

- These records are used to verify the CR at the time of try in or denture insertion.
- Also called physiological method as patient's proprioception and tactile sense is important.

Alu wax is used to make ICR.

↓

It is softened and loaded on occlusal surface of mandibular teeth.

↓

Patient is asked to retrude the mandible and close on wax till tooth contact.

↓

Wax hardens

↓

Assembly is transferred on articulator and centric is verified.

Maxillary denture removed from record and placed on mounted maxillary cast.

Mandibular denture removed along with record and placed on cast.

↓

Horizontal condylar lock released.

↓

If CR is same as check record, then both condylar elements of the articulator will contact centric stop i.e. articulated cast need not move to fit into check records.

(condylar element- condyle in articulation)
(centric stop- centric position of condyle in glenoid fossa)

INDICATION-

1.Abnormally related jaw.

2.Displaceble, flabby tissue.

3. Large tongue.

4. Uncontrolled mandibular movement.

FACTORS AFFECTING SUCCESS OF INTEROCCLUSAL RECORD

1.Uniform consistency of recording material.

2.Accurate vertical JR

3.Stabilty and fit of record base

Functional method

- This method utilizes the functional movement of jaw to record CR.
- Patient is asked to perform border movements such as protrusive and lateral excursive movements in order to identify the most retruded position of mandible.

ADVANTAGE- VD And CR can be determined.

DISADVANTAGE/ CRITICISM OF FUNCTIONAL RECORDING MEDIUM - inaccuracy can result from-

1. displaceable basal seat tissue.
2. Resistance of recording medium.
3. Lack of equalized pressure.

- Patient must have a good neuromuscular control.

1. NEEDLE HOUSE METHOD-

Occlusal rims are fabricated from impression compound.

Four metal balls or styli are embedded in canine and molar area of maxillary rims.

Occlusal rims inserted.

Patients performs functional and excursive movement of mandible with the styli contacting lower rim.

Patient is stopped at appropriate Vertical dimension.

Styl makes a 3D diamond shaped tracing that are transferred to suitable articulator.

2. PATTERSON METHOD:

Wax occlusal rims are fabricated

Trench or trough made on mandibular rims.

It is filled with mixture of carborundum paste and plaster.

Occlusal rims inserted and functional movemets performed.

It will produce compensating curves in the plaster lower rims.

As vertical height reaches appropriate level, patient is asked
retrude his jaw and occlusal rims are joined with metal staple

3. MEYERS METHOD:

Used soft wax to generate functional pathway and record CR.

4. GREENE(1910):

Used pumice and plaster mixture in one of rims.

Instructed patients to grind rims together.

Teeth were set to generated pattern.

5. BOOS(1940):

Used Gnathodynamo-meter to determine vertical and horizontal position at which maximum biting force could be produced.

He stated that optimum occlusal position and position of maximum biting force would coincide.

6. SHANAHANB(1955):

Placed cones of soft wax on mandibular rims.

Asked patient to swallow several times.

During swallowing, tongue forced mandible into its CR.

Cones of soft wax was removed and physiologic CR was recorded.

7. BILATERAL MANIPUALTION

8. CHIN POINT GUIDANCE

Graphic method

- These methods are called so because they use graphs or tracings to record the centric jaw relation.
- Graphic methods are of 2 types-

Gothic arch tracing

Pantographic tracing

- Gothic arch tracing records mandibular movements in one plane (horizontal) pantographs record in all three planes.

1.GOTHIC ARCH TRACING

- This concept was proposed by HESSE (1897) and popularized by GYSI (1910).
- Also called as “Arrow head tracing” or “Needle point tracing”.

- Factors to be considered while carrying out tracing procedures-

Following factors may affect the accuracy of graphic tracing :

1. Stability of denture base.
2. Resistance offered by the occlusal rims against occlusal forces.
3. Difficulty in placing the central – bearing device in protruded and retruded jaws.
4. Presence of flabby tissue and its effect on the denture base.
5. Height of the residual alveolar ridge influencing the stability of the record base.
6. Interference from the tongue.
7. Efficiency of the recording devices during physiological mandibular movements.
8. Obtaining a pointed apex in the tracing pattern.
9. Lack of coordinated movement. This can cause double tracing.
10. The graphic tracing should harmonize with the centric relation, centric occlusion, bone-to-bone relation and tooth-to-tooth contact.

Concept

- The concept of attaching a stylus (a writing device with a pointed end) to one occlusal rim and a plate to the other rim.
- The stylus traces or marks the path in the plate as the mandible performs excursive movements from centric position.
- The tracing is typically in the shape of a gothic arch or arrow head if the patient is trained to move the mandible from centric to protrusive, right and left lateral positions.
- The characteristic pattern created on the recording plate is called a central arrow-point tracing.
- Central arrow point tracing- the pattern obtained on the horizontal plate used with a central bearing device- GPT

ADVANTAGES:

1. Documented to be the most accurate method of recording CR.
2. Allows equalization of pressure on the supporting tissues.
3. Easily verifiable.
4. Can also be used to record eccentric relation.

DISADVANTAGES:

1. May be difficult to locate the centre of the arches which is very important for central bearing function and accuracy of tracing.
2. More time consuming.
3. Training patient in making mandibular movements is strenuous.

INDICATION:

1. Broad edentulous sides.
2. Adequate interarch space.
3. In patients with habitual centric, the use of graphic methods eliminates all occlusal contacts on the rims, thus breaking the neuromuscular reflex and allows the patient to record his true centric.

CONTRAINDICATION:

1. Severely resorbed ridges and excessively flabby ridges as they lead to instability of denture base.
2. Decreased interarch space.
3. TMJ arthropathy.
4. Abnormal jaw relation

COMPONENTS-

a. Central bearing device – A device that provides a central point of bearing or support between the maxillary and mandibular dental arches.

- It consists of a contacting point attached to one dental arch and a plate attached to the opposing dental arch.
- The plate provides the surface on which the bearing point rests or moves and on which the tracing of the mandibular movement is recorded.
- It may be used to distribute the occlusal forces evenly during jaw relation and / or for the correction of disharmonious occlusal contacts .

b. Central bearing point: It is defined as, "*The contact point of the central bearing device*"—GPT.

- It is a triangular plate of metal with extensions provided to attach itself to the occlusal rim. In the center of the triangle a metal pointeris present.
- The pointer can be adjusted in height.
- It is *usually attached to the mandibular occlusal rim* but can also be attached to the maxillary rim
- Since it is placed across the tongue space of the mandibular occlusal rim; it cannot be used in patients who cannot retract the tongue sufficiently and those who have macroglossia

c. Central bearing plate*:* It is also a triangular piece of metal with extensions at the three corners provided to attach the plate to the occlusal rim.

- *It is usually attached to the maxillary occlusal rim .*
- A mixture of denatured spirit and precipitated chalk is coated on this plate. The spirit dries to leave a fine layer of precipitated chalk.
- The tracing is marked on this layer of precipitated chalk.

Figs. 9.85A and B: (A) Applying heated crayon. (B) Central bearing plate coated with an even layer of crayon wax attached to the occlusal rim

Based on the location of tracers it can be classified as-

Intraoral

Extraoral

Intraoral arrow-point tracers:

- The central bearing device is located intraorally and is more simple compared to the extraoral arrow point tracers.
- The tracer is placed within the mouth.
- The disadvantage of this method is that the tracer is not visible during the procedure and the size of the tracing is very small making it difficult to determine the apex of the tracing.

Intraoral tracing devices:

- Shield tracer
- Ballard tracer
- Messer man tracer
- Essig and Patterson method

PROCEDURE:

The record bases attached to the central-bearing point and the central-bearing plate (coated with chalk) are inserted into the patient's mouth.

The central bearing point is adjusted such that it contacts the central-bearing plate at a predetermined vertical dimension

When the patient closes his mouth, the central bearing point contacts the metal plate.

The patient is asked to make anteroposterior and lateral movements.

While making these movements, the central-bearing point will draw the tracing pattern on the central-bearing plate.

After completing the movements, the tracing is removed and examined.

The tracing should resemble an arrow point with a sharp apex.

If the apex is blunt, the record is discarded and the procedure is freshly repeated.

Extraoral arrow point tracers:

- The concept is similar to an intraoral tracer.
- These tracers have the same central bearing device attached to the occlusal rims.
- Additionally, they have attachments that project outside the mouth.
- An extraoral tracing pointer and the recording plates are attached to these projections.
- Since the recording pointer and the plates are situated extraorally, the tracing can be examined as it is made.
- The size of the tracing pattern is also larger.
- Hence, the apex can be identified easily.

PROCEDURE:

The maxillary cast is mounted on the articulator with a facebow transfer.

The mandibular cast is oriented to the maxillary cast at the established vertical dimension with a static CR record.

The condylar elements of the articulator are secured against the centric stops.

The central bearing and tracing devices are mounted on the respective rims.

The patient is seated with head upright, in a comfortable position on the dental chair.

The record bases with the attached devices are inserted in the patient's mouth. They are checked for stability, contact during mandibular movement and interference.

The stylus is retracted and patient is trained to make various excursive movements passively and actively (if needed).

↓

Patient is instructed to move the jaw forwards, right and left from centric position.

↓

The Ney Excursion Guide has been used as an aid in training the patient.

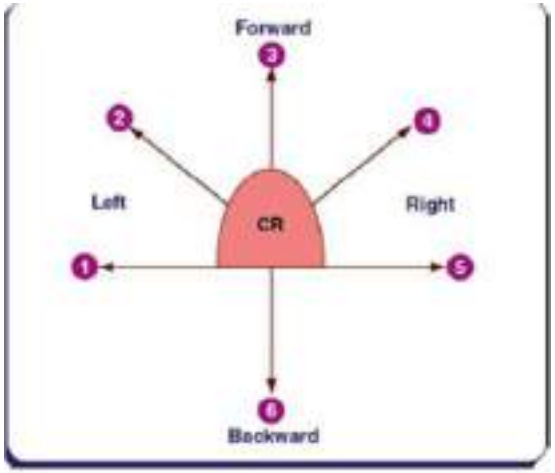


FIGURE 6.71 Ney Excursion Guide. The patient is trained to make the mandibular movements in the numerical order.

When the patient is well trained in making the movements, the recording plate is coated with a thin coating of lacquer, precipitated chalk or dark coloured wax.

↓

The coating material should not provide any resistance to movement and produce a clearly visible tracing.

↓

The stylus is made to contact the recording plate and the patient is instructed to make the specific movements.

↓

When an acceptable tracing is made with a single sharp apex, a centric record is obtained.

↓

The rims and tracing are prepared to receive the centric record .

↓

The patient is instructed to retrude the mandible such that the stylus contacts the apex of the tracing.

↓

Quick setting plaster is injected between the rims and allowed to harden thus, the centric record is obtained.

↓

The rims are remounted on the articulator with the new record.

FIGURE 6.66 Extraoral tracer components – stylus (tracing device) and central bearing plate attached to the maxillary arch.

FIGURE 6.67 Extraoral tracer components – recording plate (tracing device) and central bearing point (central bearing device) is attached to the mandibular arch.

FIGURE 6.69 Extraoral tracers attached to articulated occlusal rims. The stylus must be in contact with the recording plate and the tracers must be mounted parallel to each other.

FIGURE 6.70 Occlusal rims with the extraoral tracer inserted in the patient's mouth.

FIGURE 6.72 Characteristic arrow head tracing obtained in the recording plate coated with recording medium. For obtaining a centric record, patient is asked to close on the apex of the tracing.

FIGURE 6.73 Patient is instructed to close in centric (contact of the stylus with the apex of the tracing is verified) and quick setting plaster is injected to make a centric record.

A B

FIGURE 6.75 Centric record (A) and protrusive record (B).

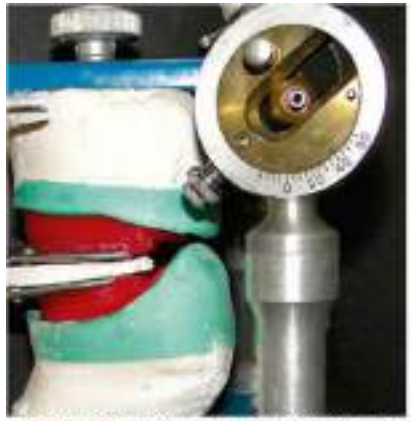
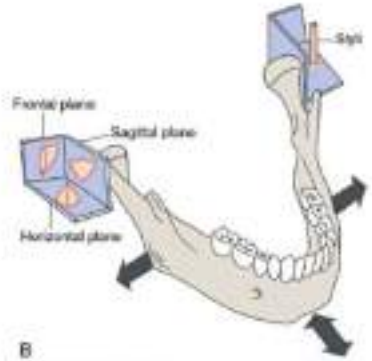


FIGURE 6.76 The occlusal rims are seated over the casts and with the centric record in place, and the mandibular cast is remounted with the new record.

2. PANTOGRAPHIC TRACING:

- It is defined as, ″ A graphic record of mandibular movement in three planes as registered by the styli on the recording tables of a pantograph; tracings of mandibular movement recorded on plates in the horizontal and sagittal planes" — GPT.
- It is a three-dimensional graphic tracer.
- It is the most accurate method available to record centric jaw relation.
- Even eccentric jaw relation can be recorded using these instruments.
- These equipments are very sophisticated and are generally not used in the fabrication of complete dentures.
- This is because complete dentures have a *realeff factor* that aids to compensate for the minor fabrication errors.
- These tracers are generally used for full-mouth rehabilitation of dentulous patients.
- The instrument used to do a pantographic tracing is called a pantographic tracer.

- A pantographic tracer is defined as, " An instrument used to graphically record one or more planes paths of the mandibular movement and to provide information for the programming of the articulator"— GPT.



- It resembles a complicated face-bow. The surface over which the tracing is done is called a *flag.* A stylus (tracing pointer) is present for each *flag* .
- The styli draw tracing patterns on the flags .
- A pantographic tracer has six flags:

• Two flags located perpendicular to one another near the condyles. Totally there are four flags adjacent to the right and left condylar guidances. They locate the actual (true) hinge axis.

• Two flags are placed in the anterior region. They record the anteroposterior movements.

Differences Between Intraoral And Extraoral Tracing

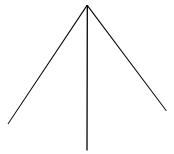
S.No	Intraoral Tracing	Extraoral Tracing
1.	It cannot be observed during tracing.	It can be observed during tracing.
2.	They are small.	They are large .
3.	It is difficult to find true apex.	The apex is more discernible
4.	The tracer must be seated in a hole at the point of the apex to assure accuracy when injecting plaster between the occlusal rims .	The stylus can be observed in the apex of tracing during the process of injecting plaster between the occlusion rims and no hole is required.
5.	If the patients moves the mandible before the occlusion rims are secured the record shift on their basal seat. This destroy accuracy of record.	The patient can be directed and guided more intelligently during the mandibular movements.

- Gerber classified gothic arch tracing into six types :-

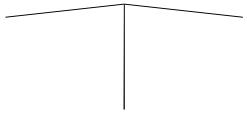
1. Classical pointed form
2. Classical flat form
3. Weak tracing
4. Asymmetrical form
5. Miniature form
6. Tracing with vertical line beyond point

- The gothic arch tracing with intra oral tracing devices in edentulous condition are classified as follows :-

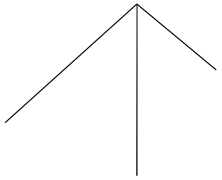
1. Typical :- A well defined apex with symmetrical left and right lateral component . The gothic arch angle is about 120 degree.



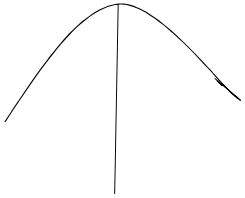
2.Flat form :- it is similar to typical form but has more obtuse left and right lateral tracing .The gothic arch angle is more than 120 degree.



3. Asymmetrical form :- the left and right lateral tracing meet in an arrow point , however their inclination to the protrusive path is not symmetrical. One of the lateral tracing is shorter.

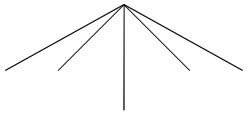


4. Apex absent / Round form :- instead of sharp arrow point , tracing is round. It shows weak retrusive movement.

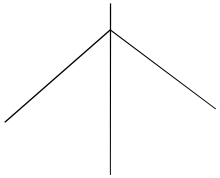


5. Miniature arrow point :- similar to typical arrow point, but extension of tracing is very limited.

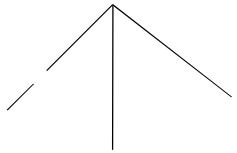
6. Double arrow point :- it is a record of habitual and retruded centric relation .



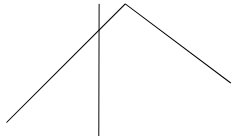
7. Dorsally extended arrow point :- the protrusive path extends beyond the apex of the gothic arch .



8. Interrupted gothic arch :- break or loss of continuity of lateral incisal path of gothic arch. It is due to posterior interference at the heels of occlusal rims during lateral movements.



9. Atypical form :- protrusive component does not meet at apex but on one of the lateral path.



Factors Influencing Centric Relation Records

- The resiliency of the supporting tissue.
- The stability of recording bases.
- The temporomandibular joint ant its associated neuromuscular mechanism.
- The skill of the dentist.
- The health and cooperation of the patient.
- The maxillomandibular relationship.
- The character of the pressure applied in making the recording
- The technique used in making the recording and the associated recording devices used.

- The posture of patient.
- The character or size of the residual alveolar arch.
- The amount and character of the saliva.
- The size and position of the tongue.

(Kapur and Yurkstas ,JPD 1964)

COMPLICATIONS IN RECORDING CR

1. The structure of TMJs are such that one joint can be displaced downward by uneven pressure when records are made and the condyles remain in their most retruded position.

- This situation cannot occur on the articulator and thus a deflective occlusal contact may be the source of instability , soreness and resorption despite the correctness of the other relations.

2. Soft tissues of are of varying density. HANAU referred tissue resiliency as "***REALEFF" .***

Realeff effect by Hanau: If there is uneven resiliency in the soft tissues , it is present in both the mucosa and the TMJs.

- The undue pressure in securing the relation must be avoided ,excessive displacement of soft tissues occur.

3. Even though a balanced and equalized registration has been made it is lost due to:

I. Cast mounting procedures

II. Processing of dentures

(Boucher 9th edition)

ERRORS IN RECORDING CR

- Errors are classified into 2 types :

1. Positional errors
2. Technical errors

- Positional errors may be caused by:-

i. Failure of the operator in registration of the correct horizontal relationship.

ii. Failure of the operator to record equalized vertical contact.

iii. Application of excessive closure pressure by the patient at the time of recording.

iv. Changes in the supporting area.

Technical errors may be caused by :-

i. Ill fitting occlusion rims.

ii. Indiscriminate opening and closing of the occluding device or articulator. an articulator in reality is a jig which maintains a record of position.

iii. The slight shifting of teeth which occurs between the stage of final arrangement in wax and the transfer to a permanent base material.

iv. A movement by the tooth or several teeth either horizontally, or vertically, introduces an error.

Symptoms of unequalised vertical contact are:

i. Loss of retention

ii. Irritation on the crest of lower ridge in the area of premature contact.

iii. One tooth or several teeth on one side seem long to the patient or seem to strike first.

iv. Premature contact may be anteriorly or posteriorly.

- The horizontal relations errors may occur either

1. Anterior error

2. Posterior error to centric relation.

- Anterior error :- When the centric occlusion is established in the arrangement of teeth is anterior to centric relation of the patient causes ***anterior error***. They are as follows :-

i. Looseness of the mandibular denture.

ii. Denture consciousness.

iii. Irritation under the anterior lingual flange.

- Posterior error :- When the centric occlusion is established in the arrangement of teeth is posterior to centric relation of the patient causes ***posterior error***. They are as follows :-

i. Looseness of the maxillary denture.

ii. Irritation under the anterior labial flange of the mandibular denture.

(R.H.KINGERY ,JPD 1952)

CR/MIP

- In NATURAL teeth – Both CR and MIP are present but may NOT coincide.

  No damage to proprioreceptors present in PDL establishes a memory pattern which guides mandible away from contacts in CR into MIP.

- In EDENTULOUS patients – CR and MIP coincide.

  As no PDL, no proprioception, no memory loss

  This causes- movement of denture base
  - displacement of supporting tissues
  - directs mandible away from its path.

  CR does not Coincide CO in DENTATE
  CR coincide CO in EDENTULOUS

Conclusion

Centric relation is most significant ,classical ,reference repeatable ,recordable and treatment position . It is bone to bone relationship and is a potential position of occluso – articular harmony.

If CR and CO of the artificial teeth do not coincide the stability of denture base is in jeopardy and patient have to bear unnecessary pain and discomfort.

It can be recorded by various techniques introduced by different authors by guiding the mandible into the anterio-superior position .