JAW RELATIONS

By: Dr. Pratik Acharya

CONTENTS

- Introduction
- Classification of jaw relations
- Horizontal jaw relation
- Centric relation

  - Definitions
  - characteristics
  - significance
  - physiology of centric relation
  - recording centric relation
  - verification of the record

- Factors affecting the record
- Problems associated with centric records
- Interocclusal record materials
- Eccentric relations and their records
- Summary and conclusion
- References

INTRODUCTION

Components of masticatory system

↓

Functional unit

Edentulous subject→→→dental component lost

Mastication speech function with dentures

↓

specific vertical and horizontal relations of the mandible to the maxilla.

Unless these relations are properly ascertained, recorded and transferred to the articulator, the prosthesis may fail.

The human mandible can be related to the maxilla in several positions in the horizontal plane

↓

centric relation

relates the dentulous/edentulous mandible to maxilla

↓

teeth,muscles &TMJ function in harmony

It is a position of occluso-articular harmony

CLASSIFICATION OF JAW RELATIONS

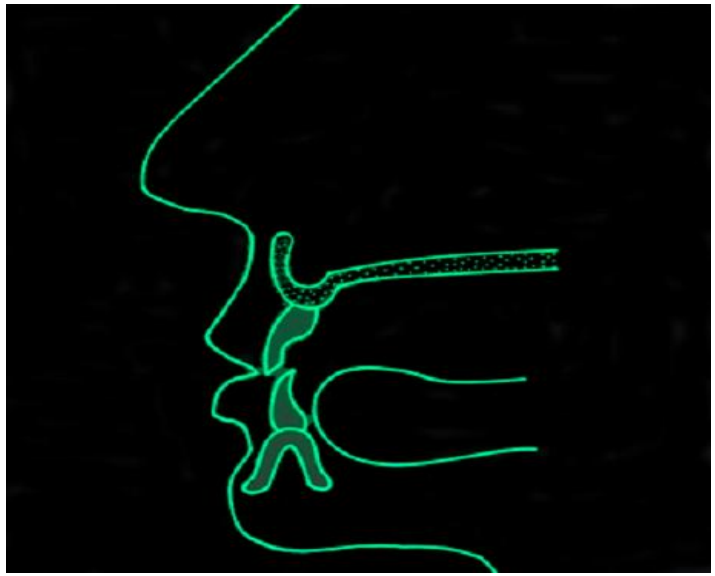
3 types→

- orientation
- vertical
- horizontal

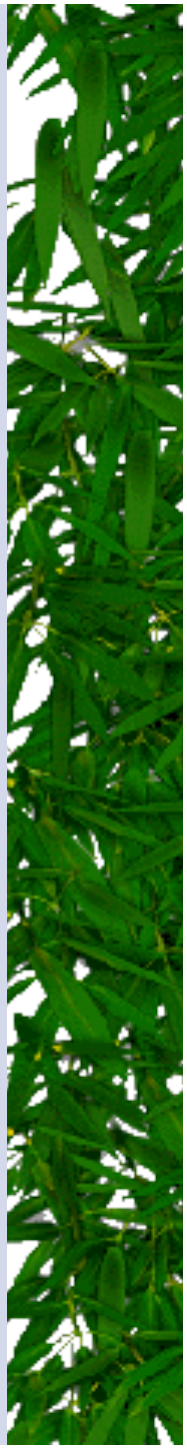
HORIZONTAL JAW RELATIONS

Jaw relation may be defined as any relation of the mandible to the maxilla

Horizontal jaw relation is the relationship of the mandible to the maxilla in a horizontal plane or in an antero posterior direction



Term	Abbreviation	Definition
Centric relation	CR	1. The maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective discs, with the complex in the anterior-superior position against the slopes of the articular eminences. This position is independent of tooth contact. It is restricted to a purely rotary movement about the transverse horizontal axis. 2. The most retruded physiologic relation of the mandible to the maxillae to and from which the individual can make lateral movements. It is a condition that can exist at various degrees of jaw separation. It occurs around the terminal hinge axis. 3. 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 movements can be made, at any given degree of jaw separation. 4. The most posterior relation of the lower to the upper jaw from which lateral movements can be made at a given vertical dimension. 5. A maxilla to mandible relationship in which the condyles and discs are thought to be in the midmost, uppermost postion. The position has been difficult to define anatomically but is determined clinically by assessing when the jaw can hinge on a fixed terminal axis (up to 25 cm). It is a clinically determined relationship of the mandible to the maxilla when the condyle disc assemblies are positioned in their most superior position in the mandibular fossae and against the distal slope of the articular eminence. 6. The relation of the mandible to the maxillae when the condyles are in the uppermost and rearmost postion in the glenoid fossae. This position may not be able to be recorded in the presence of dysfunction of the masticatory system. 7. A clinically determined position of the mandible placing both condyles into their anterior uppermost position. This can be determined in patients without pain or derangment in the TMJ.



CENTRIC RELATION

"The maxillomandibular relationship in which the condyles articulate with the thinnest avascular position of their respective discs with the complex in the anterior-superior position against the slopes of the articular eminences. This position is independent of tooth contact. This position is clinically discernible when the mandible is directed superior and anteriorly.It is restricted to a purely rotary movement about the transverse horizontal axis"

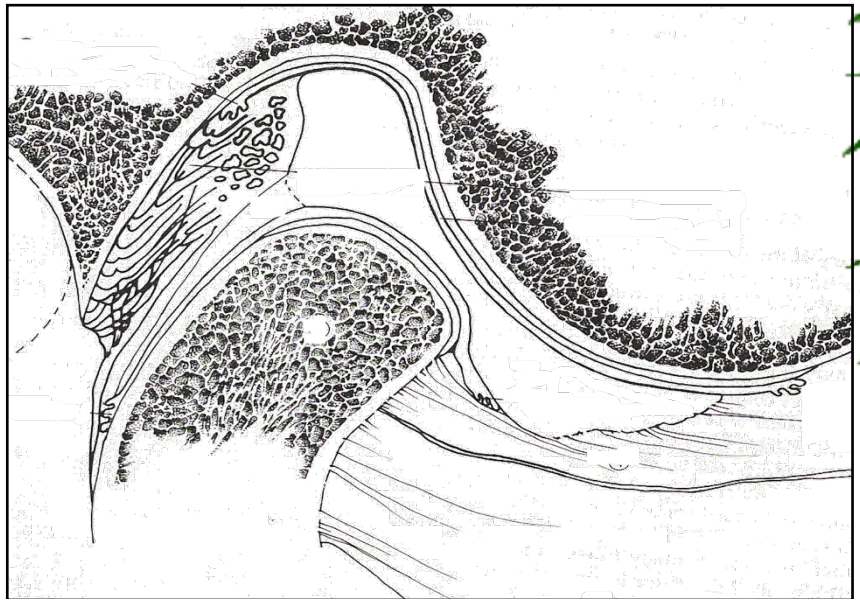
GPT 1999

GPT 4 defines it as-

The jaw relation when the condyles are in the most posterior, unstrained position in the glenoid fossa at any given degree of jaw separation from which the lateral movements can be made

BOUCHER defines it as-

The most posterior relation of the lower to the upper jaw from which lateral movements can be made at a given vertical dimension.



- It is the relation of the mandible to the maxillae when the condyles are in their uppermost and rearmost position in the glenoid fossae.This position may not be recorded in dysfunction of the masticatory system.

- It is the maxilla to the mandible relation in which the condyles and disks are thought to be in the midmost,uppermost position.

CENTRIC OCCLUSION (Boucher)

Centric occlusion is the occlusion of the opposing teeth when the mandible is in centric relation

According to Peter Dawson(1974) :

Centric occlusion refers to the relationship of the mandible to the maxilla when the teeth are in maximum occlusal contact, irrespective of the position or alignment of the condyle-disk assemblies. This is also referred as acquired position of the mandible or maximum interocclusal position

ECCENTRIC RELATION

Any relationship of the mandible to the maxilla other than centric relation.

The eccentric relations that are recorded and used in complete dentures are

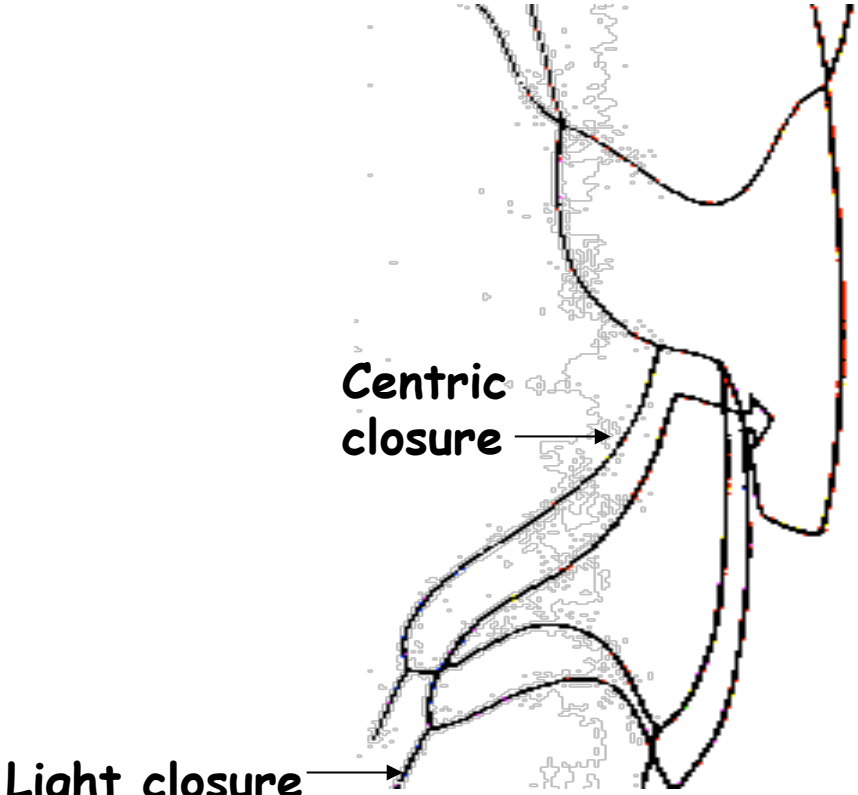
- Protrusive
- Right lateral
- Left lateral

LONG CENTRIC

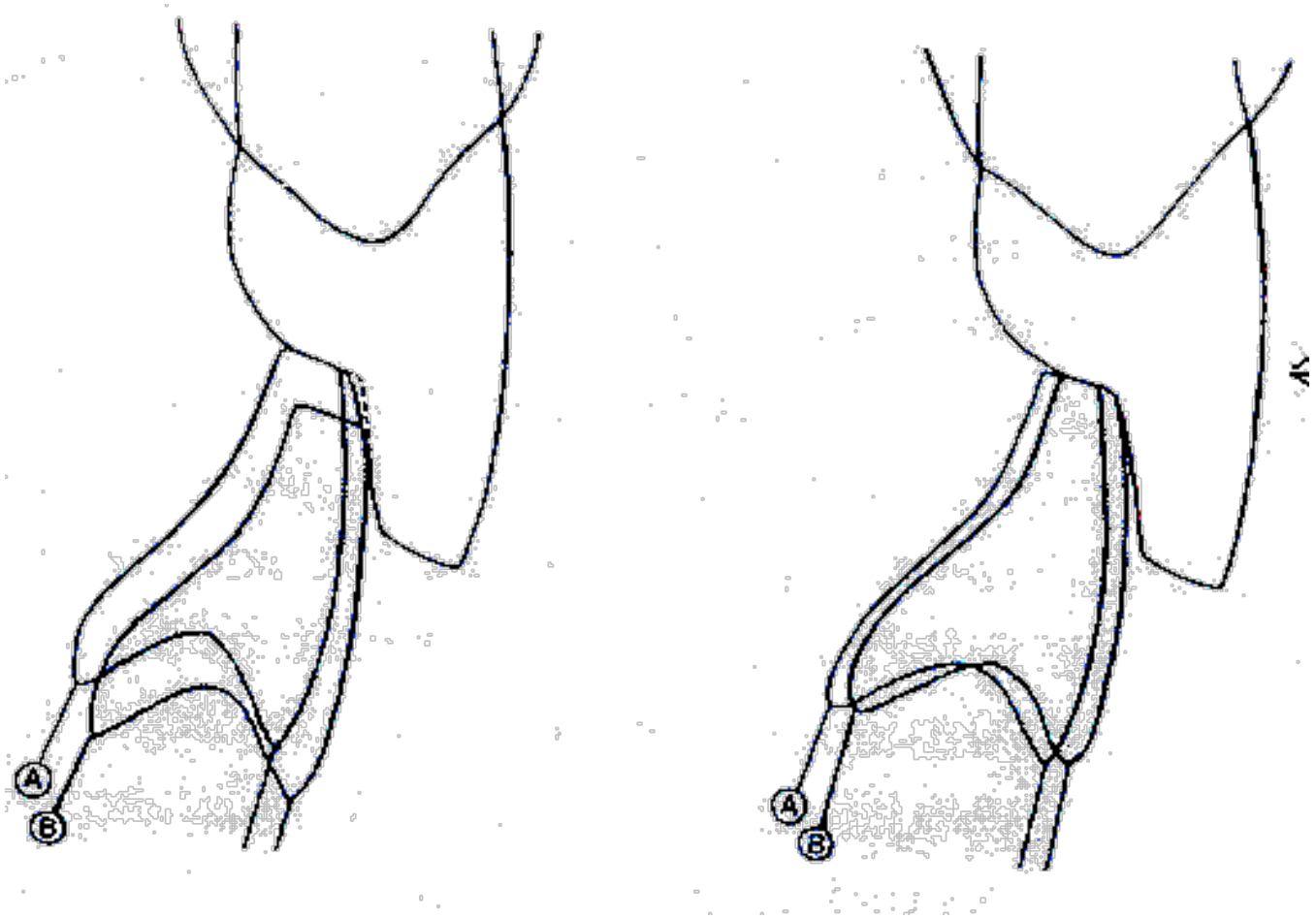
- According to Peter Dawson "it is the freedom to close the mandible either into centric relation or slightly anterior to it without varying the vertical dimension at the anterior teeth."

Centric relation

contact



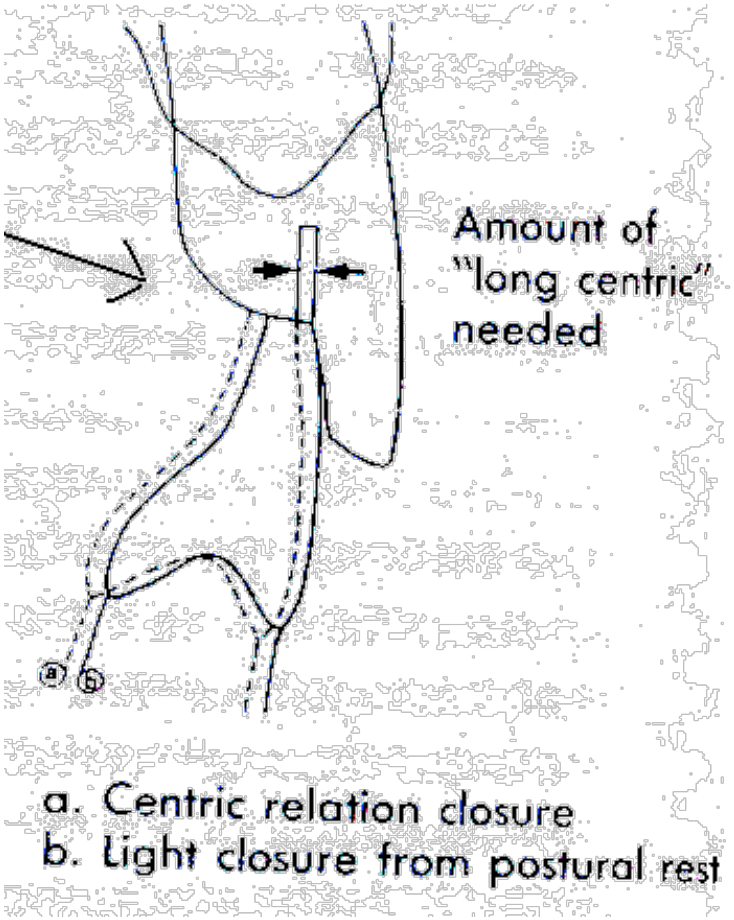
Contact against the lingual incline when jaw closes lightly from postural position



Lingual inclines reduced thus preventing wedging action

a. **Centric closure**

b. **Light closure**



Determination of the amount of long centric needed

CHARACTERSTICS OF CENTRIC RELATION

- antero-posterior position of the condyles against the slope of articular eminences
- condyles exhibit pure rotation without any translation and the mandible moves in hinge motion to 2.0-2.5 cm at the incisor region in the sagittal plane
- learnable, repeatable and a recordable position
- definite learned position from which mandible can move to any eccentric

  position and return back involuntarily;a center from which all movements can be made.

- Determined by lateral ligaments of TMJ; does not depend on presence of teeth so does not alter when natural teeth are extracted or when a new occlusal surface replaces an unsatisfactory one (Basker/ Davenport)

- centric relation is the most posterior relation of the mandible to the maxilla, but an antero-superior relation of the condyle to the glenoid fossae.

SIGNIFICANCE OF CENTRIC RELATION

Why only centric relation?
Repeatable,recordable,learnable position

- Recorded with a greater degree of consistency/predictability
- Does not vary with posture
- Not influenced by abnormal occlusion and does not alter once new occlusal surface has been provided
- Closer to the intercuspal position

Dentulous patient → Proprioceptive impulses → Periodontal ligament

edentulous patient → Proprioceptive impulses → TMJ

Centric relation acts as a proprioceptive impulse to guide the mandible

Receptor organs of touch and pressure in the oral mucosa also capable to some extent, in compensating for loss of periodontal receptors

(Brill 1957)

- **Swenson**

muscles, bones, ligaments, teeth

grow into

↓

"muscle center"

- Dentist should guide the patient in recording the centric relation

- posterior border position and the posterior limit of the envelope of motion

- Accurately recorded centric relation transferred to articulator

↓

proper adjustments of condylar guidances for eccentric movement control

- reference position for occlusal rehabilitation in dentates

- reference position to relate several occlusal positions of upper/lower teeth

PHYSIOLOGY OF CENTRIC RELATION

BEGINNING OF CENTRIC RELATION

Centric relation is established quite early in life (Moyers 1956)

Sillman(1940)

development of "occlusal sense"

↓

Neuromuscular reflex establishing centric relation

- **After the teeth have erupted, the muscles learn one position of occlusion providing maximum of occlusal contact/minimum of stress on roots**

↓

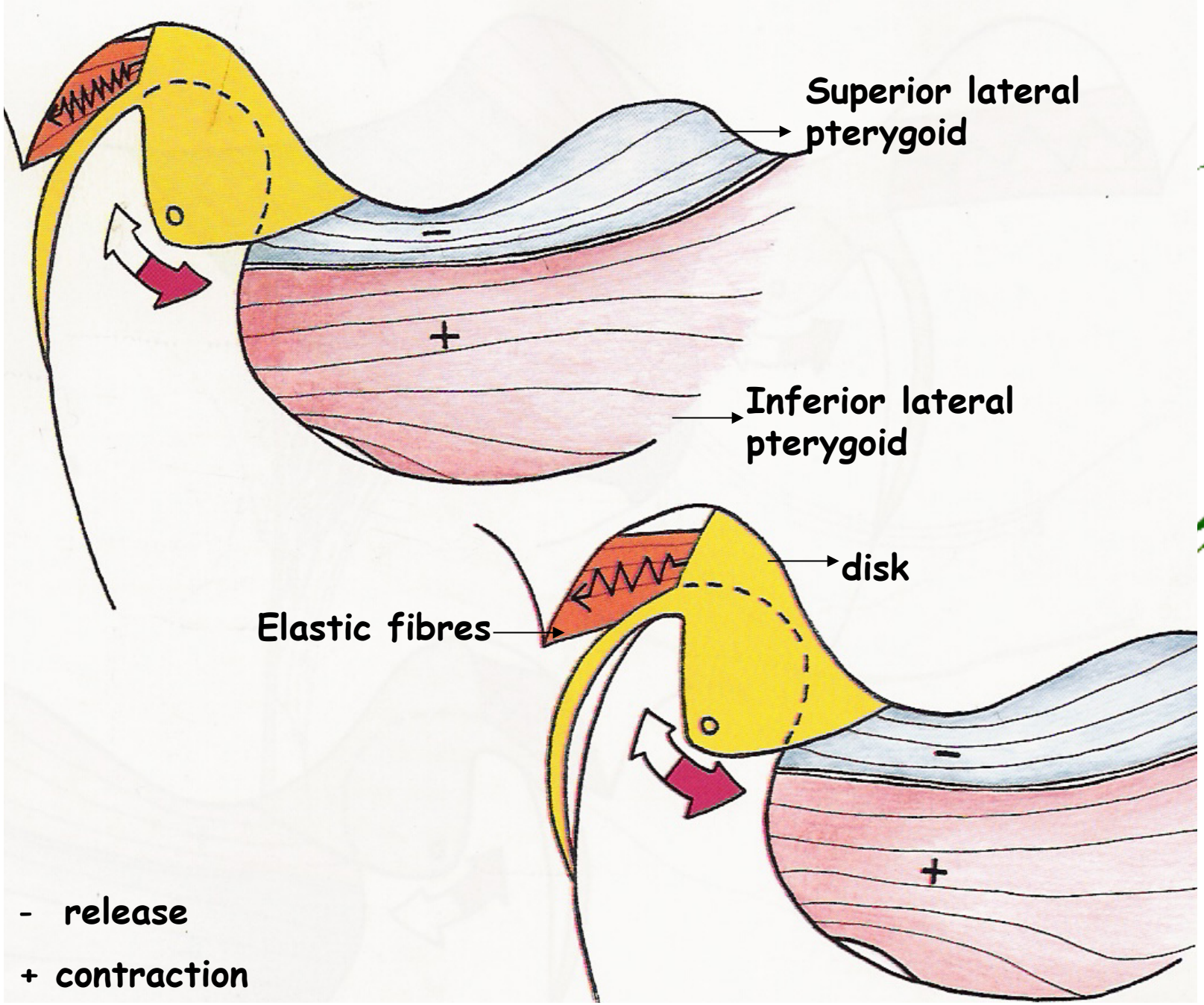
beginning of centric relation

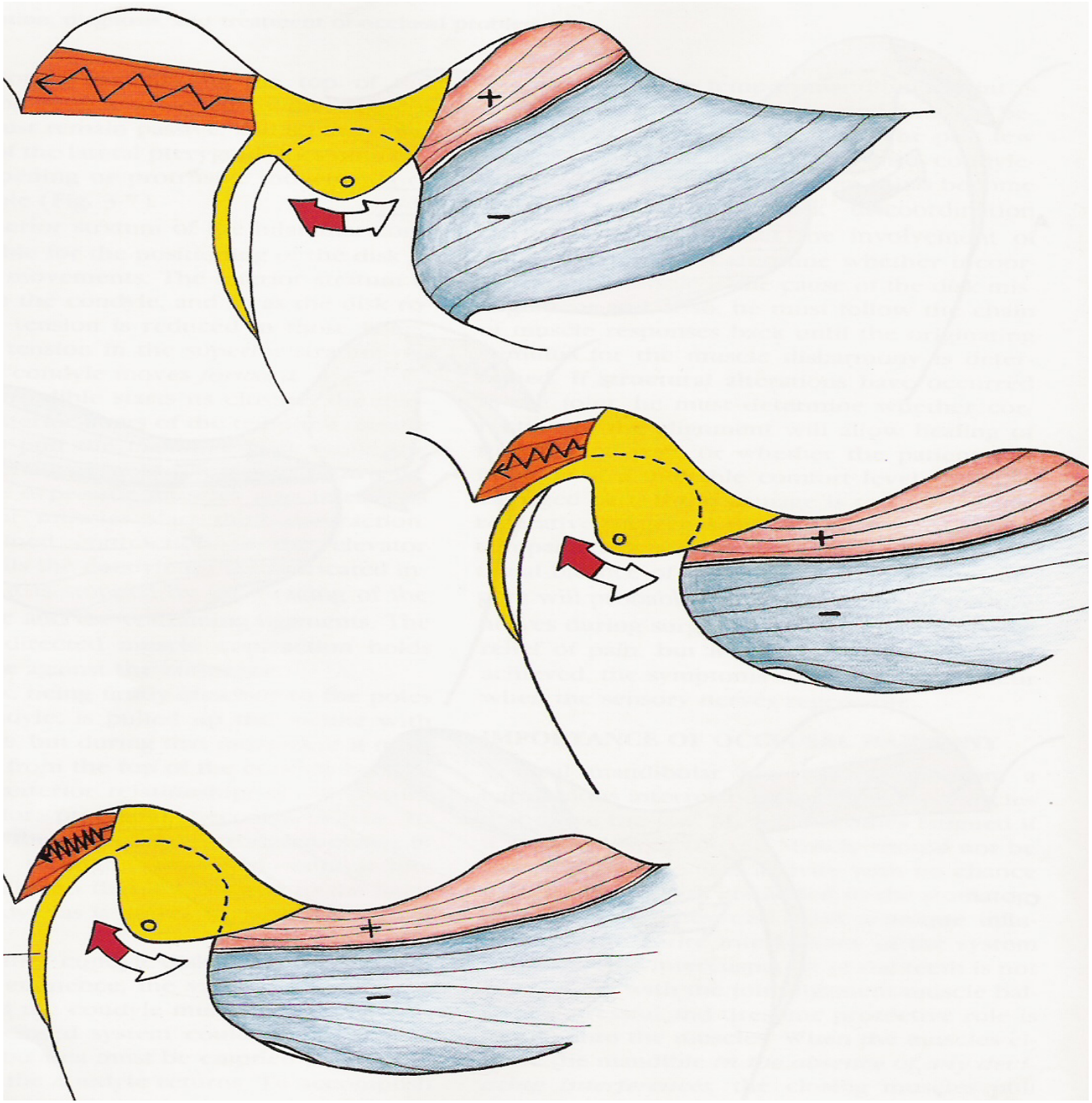
↓

centric relation and centric occlusion identical

"Centric relation is the first established neuromuscular reflex concerning mandibular position when the teeth are in occlusion."

MUSCLES AND TMJ MOVEMENT





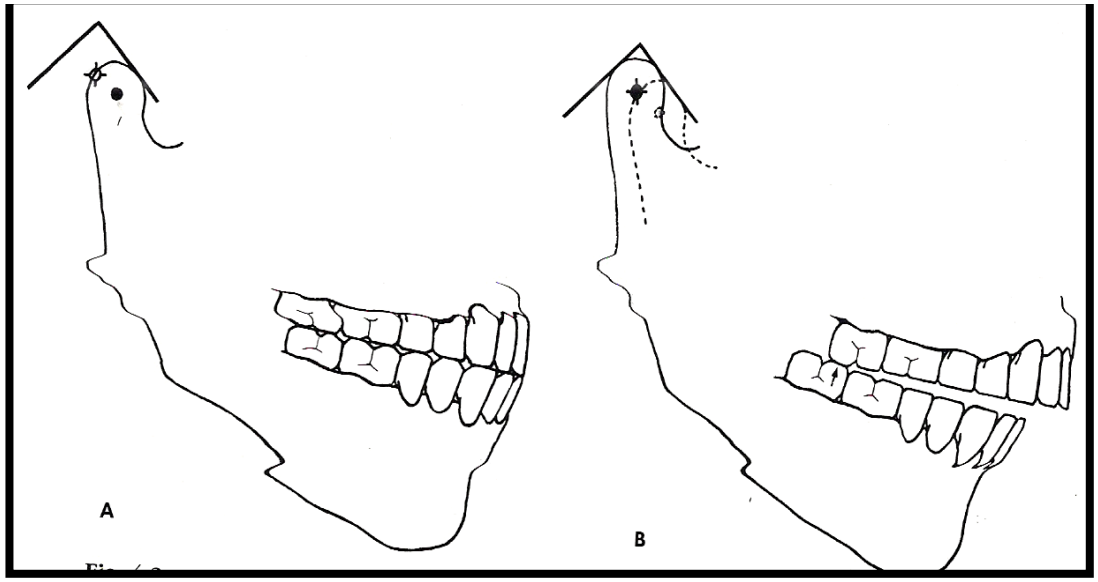
Start of closing stroke of the mandible

APEX OF FORCE POSITION OF THE CONDYLES

position a healthy condyle assumes if its disk is properly aligned and there is no muscle bracing to prevent it from going to the most superior position against the eminentia

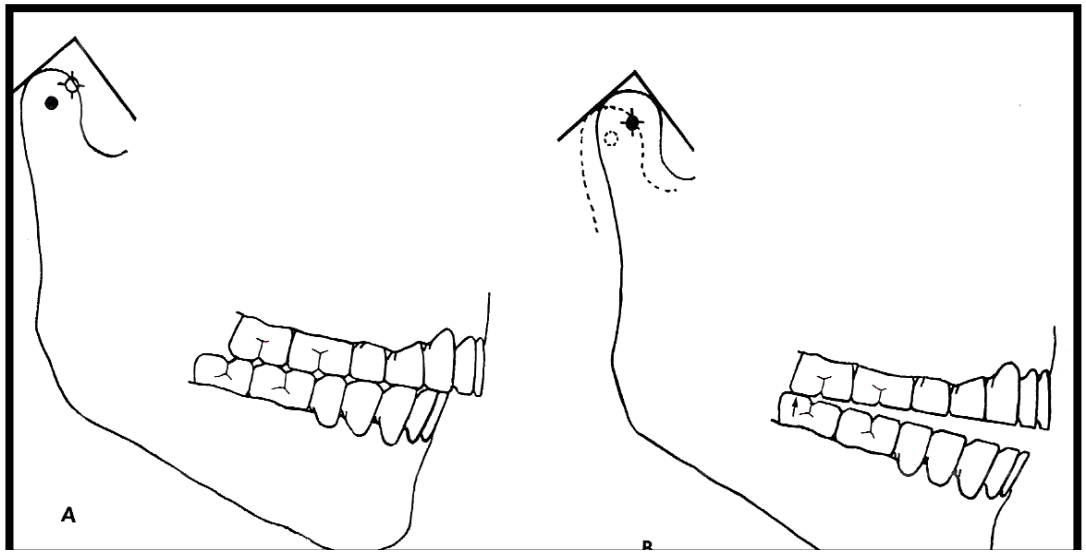
if disc is properly related to condyle the position at the apex of force relates to the most superior position against the eminence

(Dawson)



Occlusion harmonized to a protruded condyle

Occlusion harmonized to distalized condyle



- From a physiologic standpoint,

Occlusion harmonized to a downwardly directed condyle

↓

Protective hypercontraction of lateral pterygoid muscle

↓

Medial pterygoid/masseter also contracted

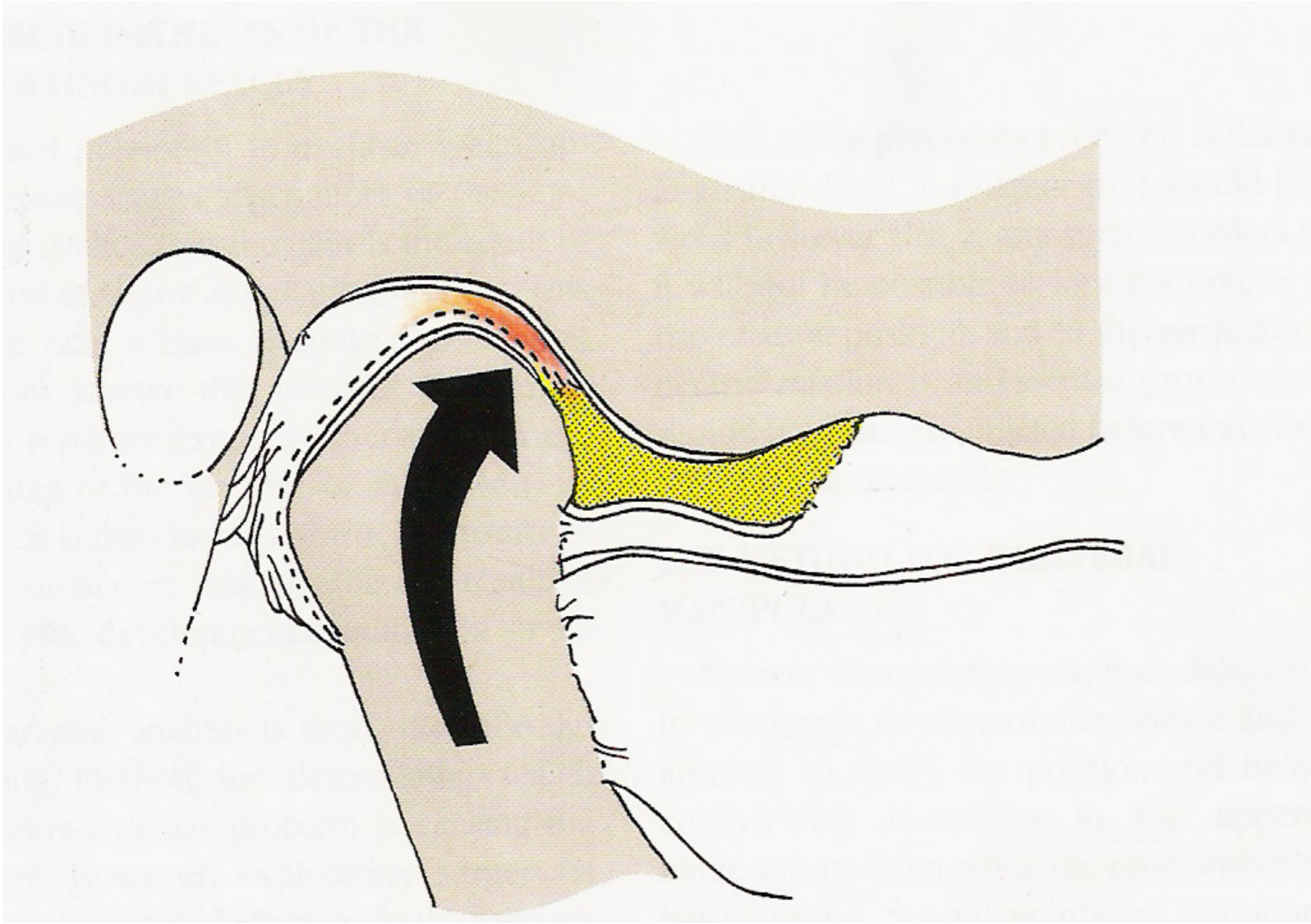
↓

Excessive forces on the interfering teeth

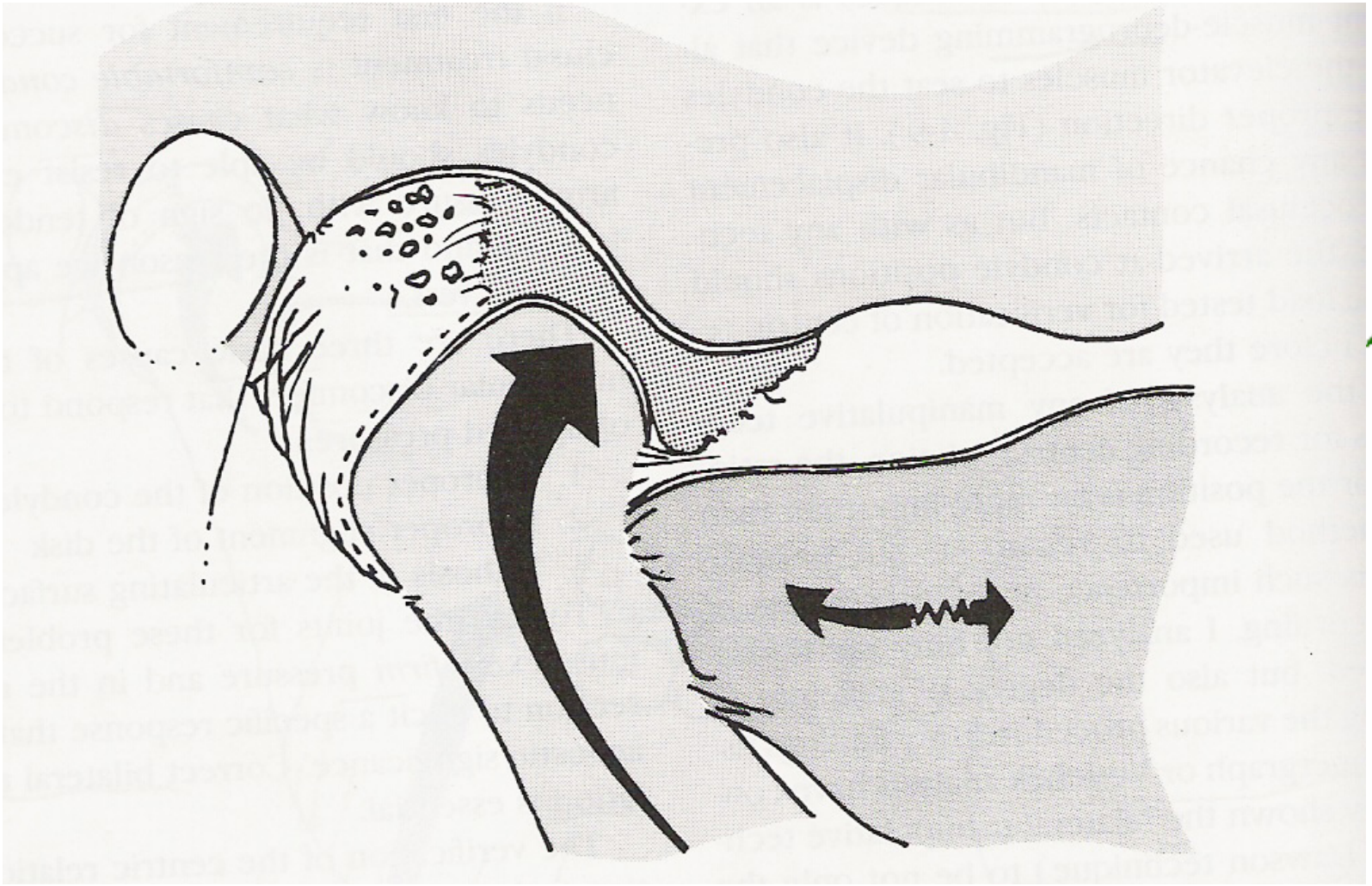
Condyle in an unstrained position—

- Condyle-disc assembly correctly aligned with each other
- Stopping of the condyles by a bony stop

Misalignment of the disc



Improper position of the condyles



PROPRIOCEPTIVE ENGRAMS

Tooth interferences to jaw closure

↓ periodontal receptors stimulated

Muscles change jaw position

↓

Interfering tooth protected

Because of constant repetition of proprioceptive triggers to muscles, they become patterned to the devious closure. Such memorized patterns of muscle activity are called as *engrams*

The primary aim of recording centric relation in edentulous patient is to do away with the eccentric reflexes (engrams) that might have been used

- Muscle exercises
- Patient relaxation
- Premedication (Mephensin)

Obliteration of the superimposed eccentric reflex allows the more basic reflex of centric relation to act in a free and an uninhibited manner

RECORDING CENTRIC RELATION

- Retruding the patient's mandible
- Recording the centric relation
- Verifying the record

RETRUDING THE MANDIBLE

AIM?

Condyles in most anterosuperior position

&

Pure hinge movements possible

- **reproducible , reliable, repeatable , recordable reference position**

Methods to retrude the mandible:

- **Boucher**
  - "Let your jaw relax, pull it back, and close slowly and easily on your back teeth."
  - "Get the feeling of pushing your upper jaw out and closing on your back teeth together".
  - Protrude or retrude the mandible repeatedly while holding finger lightly against the chin. This is an excellent method to get abnormal tissue repositioned from the back of the condyle (Swenson).
  - Turn the tongue backwards on the posterior border of the upper denture.

- Tapping the rims or back teeth repeatedly
- Palpate the temporal and masseter muscles

- **Brill(1957)**

Mandible in most actively retruded position.
If passive:

-condyles/ligaments loaded

-receptor organs in soft tissues of mandible may initiate avoiding actions on part of musculature leading to errors in recording

- **Dawson(1989)**

Chin point guidance techniques never successful in retruding the mandible as they push the mandible down and back

first given by GUICHET (1970)

Points to be noted

- Deprogamming of muscles a must
- Delicacy and gentleness,timed guidance (Dawson)
- Mandible should not be forced into centric relation
- Pressure applied after the neuromuscular release

???Why so many methods?

Difficulties in retruding the mandible

1. Biologic
   - lack of coordination of opposing muscles
   - habitual eccentric jaw relation
   - Pain in the structures involved in mandibular movements

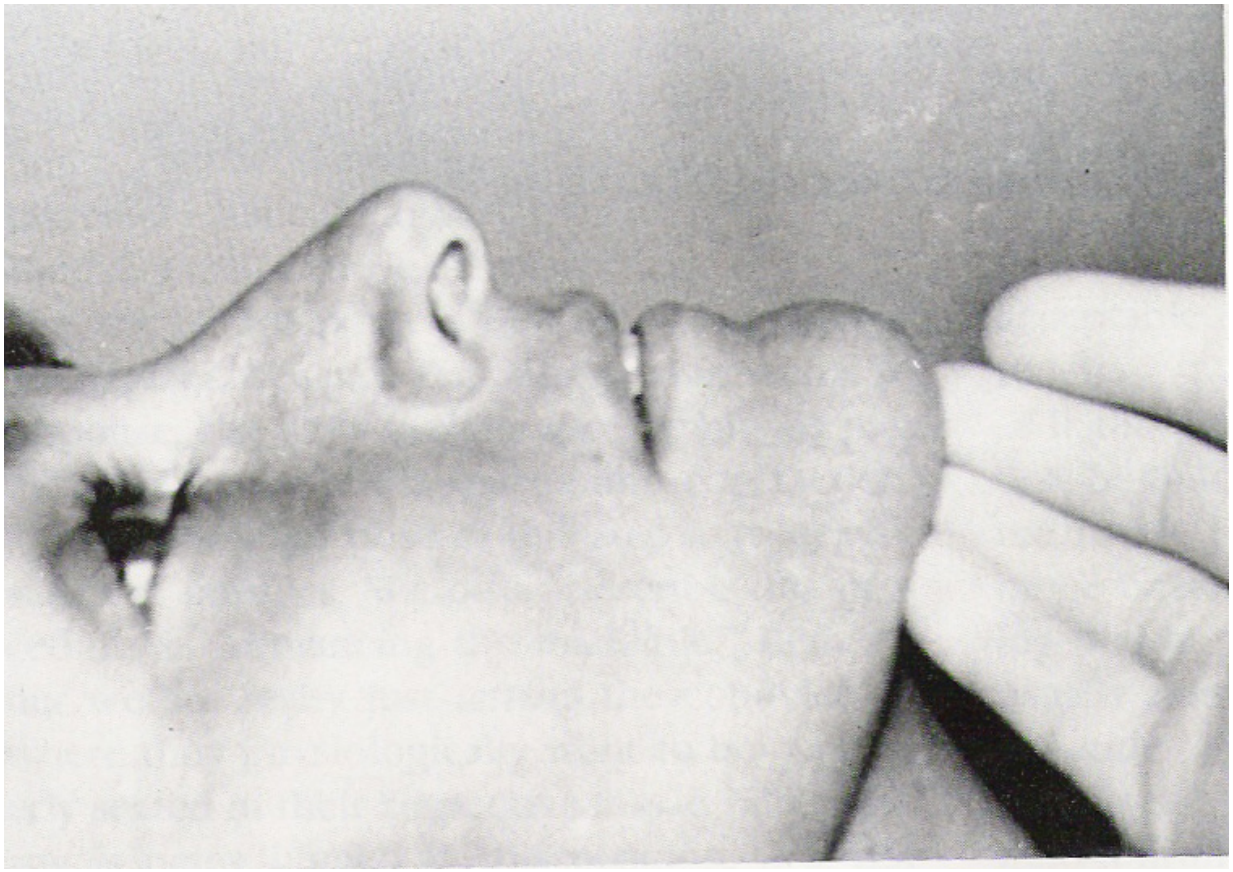
   "reflex interference" by Thielemann
2. Psychologic (difficulties involving both the dentist and the patient)

   Inability of the patient to follow the instructions of the dentist
3. Mechanical

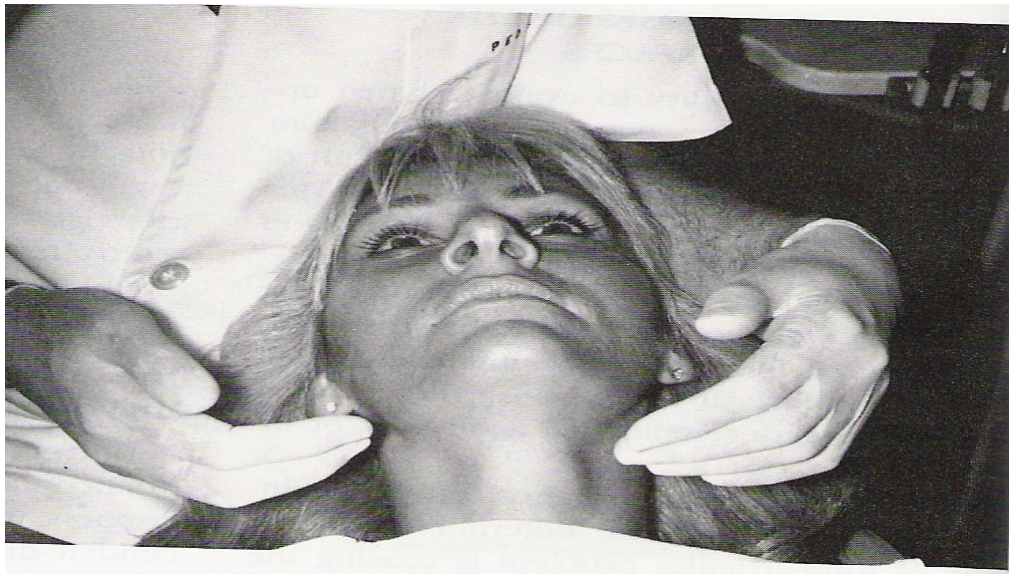
   poorly fitted base plates

In dentulous patients,methods:

Dawson's bilateral manipulative technique:



Recline the patient all the way back; point the chin up



Working from a back position stabilize the head

Place 4 fingers on Lower border of the mandible

Bring thumbs to form a letter C

Manipulate jaw without applying pressure

RECORDING THE CENTRIC RELATION

Different methods adopted by workers from time to time:

simple wax check bite records

and

Cephalometrics

(Pyott/Schaeffer 1952)

and

flashing light method

(Ghalichebaf M *et al*,J Prosthet Dent 1986)

CLASSIFICATION OF METHODS

Kingery(1952)

- Graphic
- Direct
- Functional

Swenson's grouping of methods

- Static
- Functional

Myers (1982)

- Direct checkbite interocclusal recordings
- Graphic recordings
- Functional records
- Cephalometrics

Functional methods:

- Needles house method
- Patterson method

Graphic methods:

- Intra oral method
- Extra oral method

Physiological methods:

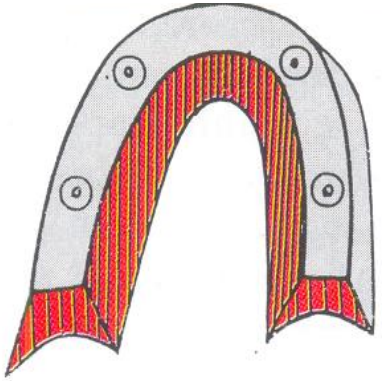
- Tactile or interocclusal check record method
- Pressure less method
- Pressure method

FUNCTIONAL METHOD OR CHEW IN METHOD

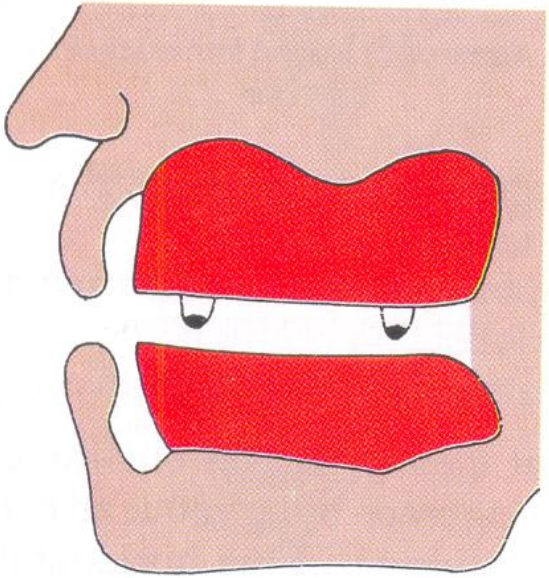
These methods utilize the functional movements of the jaws to record the centric relation

Patient is asked to do movements in protrusion,retrusion and right lateral and left lateral

NEEDLES HOUSE METHOD (1923)

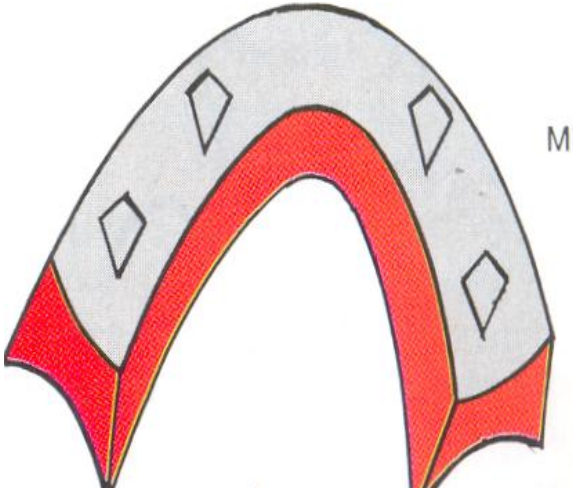


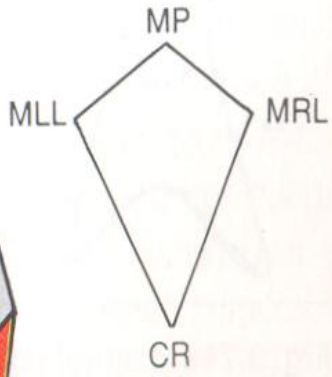
Maxillary occlusal rim made of impression compound with metal styli



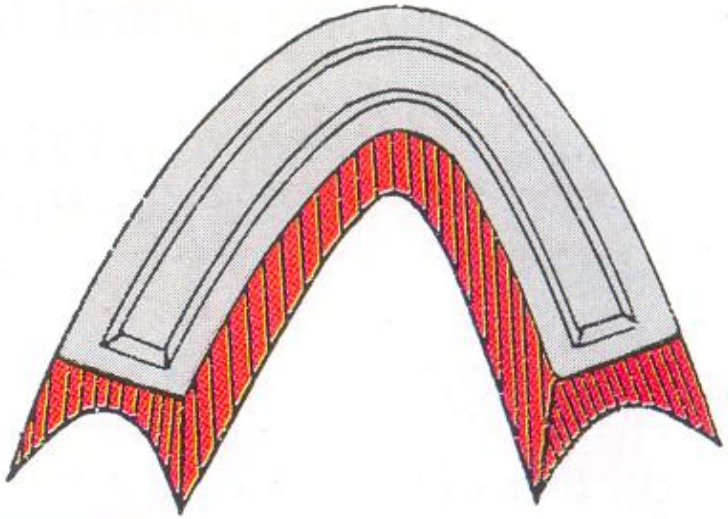
Recording the mandibular movements

The posterior most point of this diamond pattern indicates the centric jaw relation.

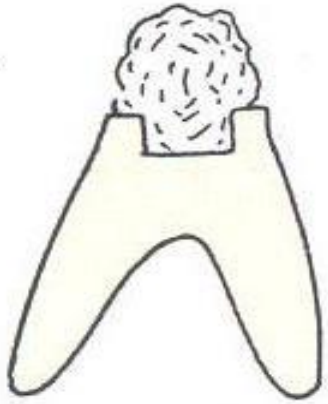




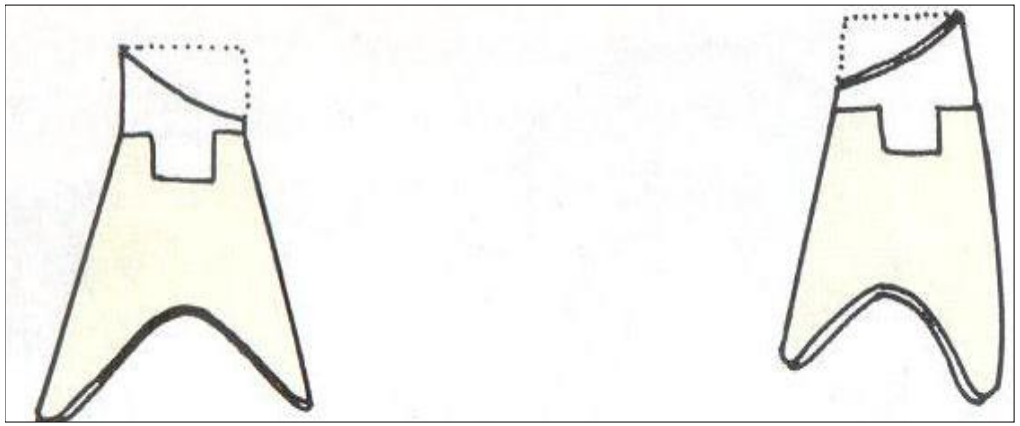
PATTERSON'S METHOD (1923)

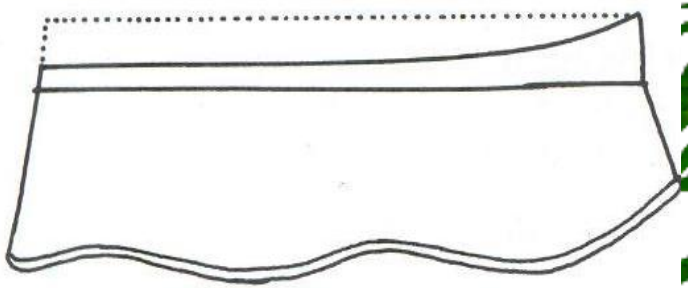


Trench made in lower rim



Carborundum/plaster mix





Compensating curve drawn

PHYSIOLOGICAL METHODS

- They are called so as they are based on the proprioceptive impulses of the patient and visual acuity and sense of touch of the dentist
- Kinesthetic sense helps to direct mandibular movements
- No pressure is exerted on the interocclusal record

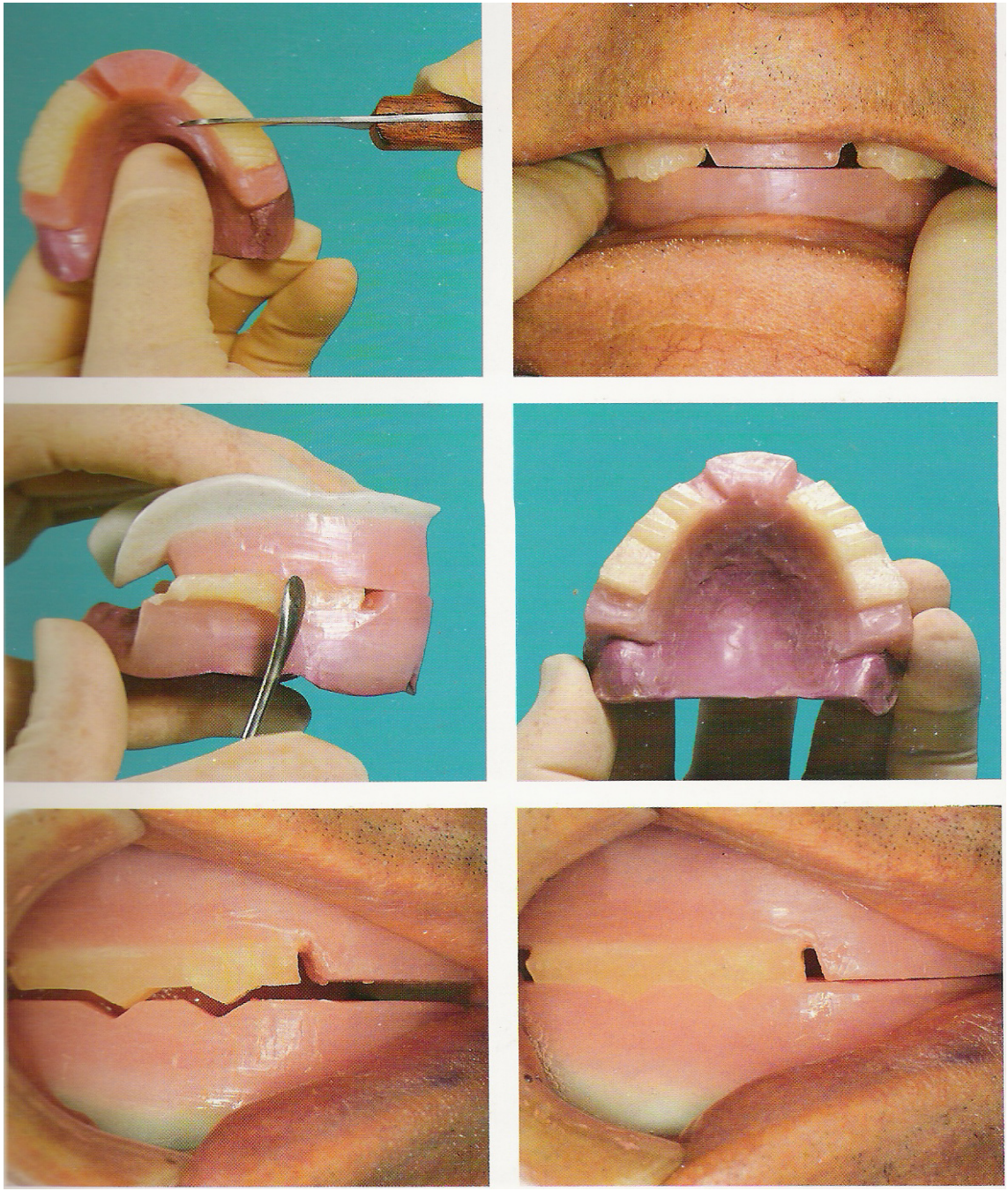
1.INTEROCCLUSAL CHECK RECORD METHOD

Procedure includes 2 steps:

1. Tentative records using occlusion rims attached to stable record bases

2. Interocclusal check records made at the try in appointment after teeth arrangement is done

STATIC OR PRESSURELESS METHOD



PRESSURE METHOD

- The entire lower occlusal rim is softened in water bath and inserted carefully into patient's mouth

- Patient is guided in centric relation till predetermined vertical dimension is achieved. Rims are cooled and articulated

GRAPHIC METHODS

Two types:

1. **Arrow point/Gothic arch tracing (Intraoral/ extaoral)**
2. **Pantograph**

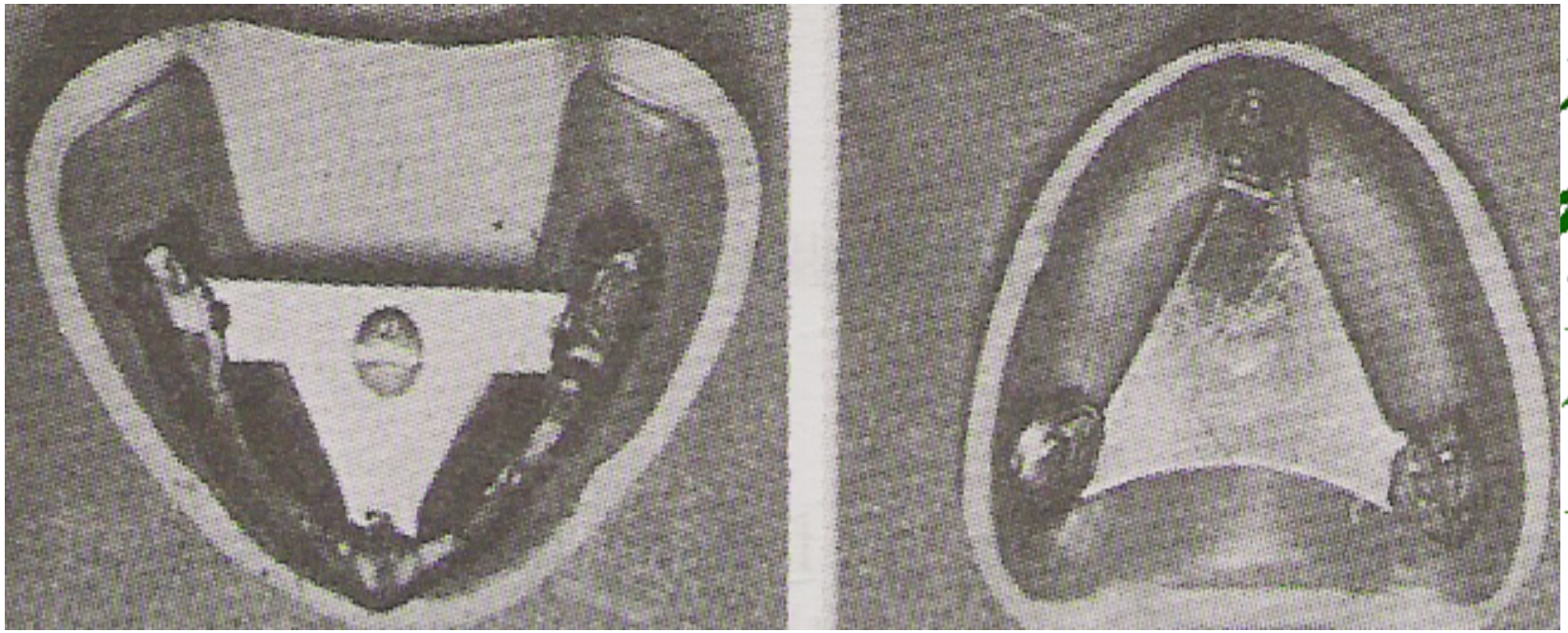
- ✓ **Earliest graphic records based on study of mandibular movements of Balkwill(1866)**
- ✓ **First known needle point tracing was by Hesse(1897) ,improved and popularized by Gysi(1910)**

ARROW POINT TRACINGS

- Records centric relation in a single plane
- Central bearing device is used
- It is"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 opposing dental arch.The plate provides the surface on which bearing point rests or moves and on which the tracing of mandibular movements is recorded.It may be used to distribute the occlusal forces evenly during jaw relation and/or correction of disharmonious occlusal contacts"(GPT)

Central bearing device consists of:

- Central bearing point
- Central bearing plate

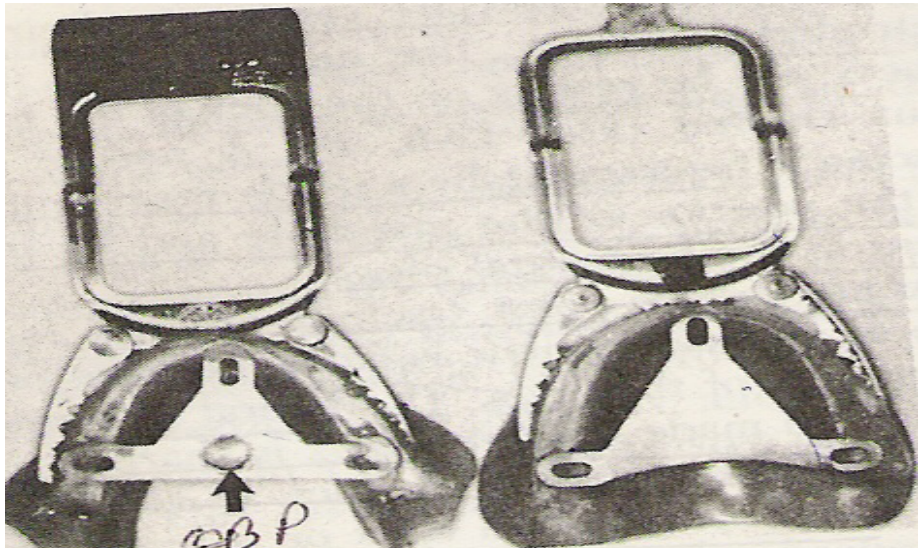


Extraoral tracers without central bearing point devices are not considered very satisfactory (Boucher)

Tracers fastened to baseplates centered laterally and anteroposteriorly

↓

Pressure equalized on the rims



Arrow/Gothic arch tracings are of 2 types:

- Extraoral
- Intraoral

EXTRAORAL ARROW POINT TRACING:

- Larger than intraoral because they are made farther from centers of rotation
- Apex is more discernible
- It is visible while tracing is being done
- Patient can be guided properly

INTRAORAL ARROW POINT TRACING:

- Located intra orally
- Simple compared to extra oral

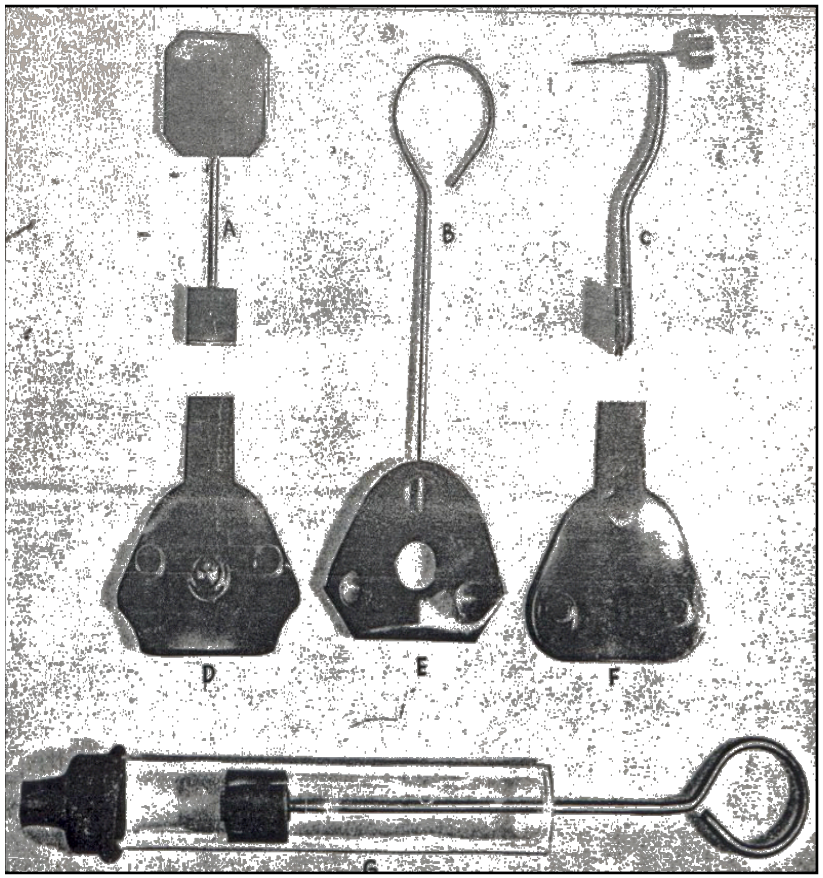
Disadvantage:

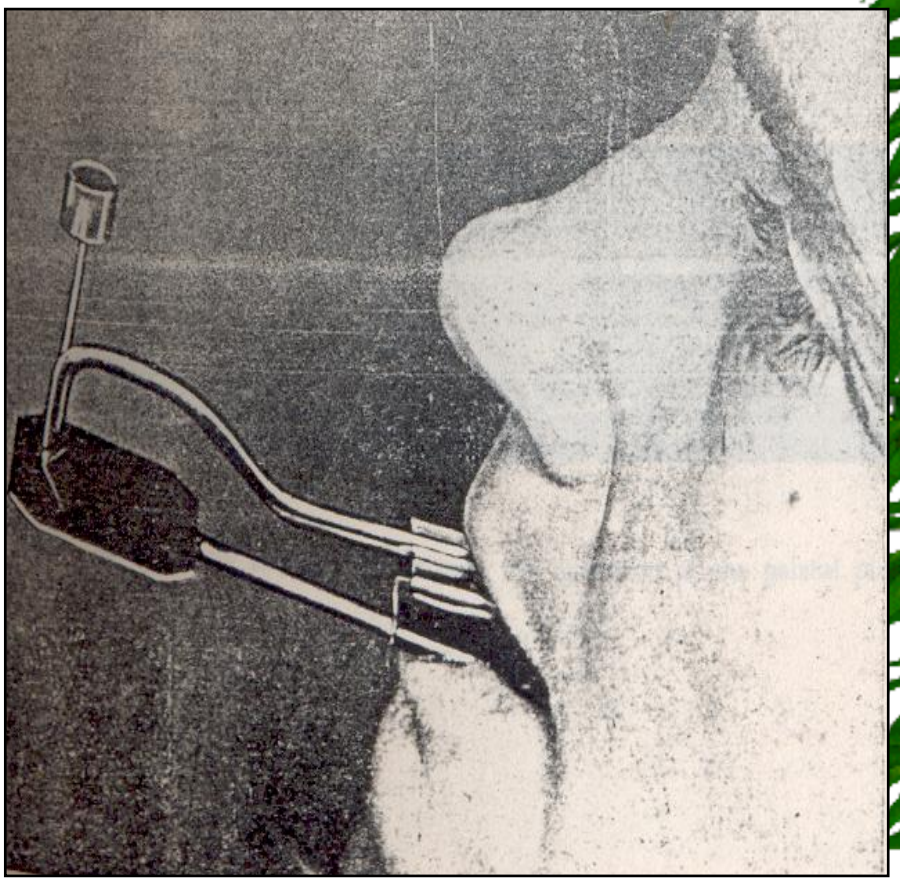
- It cannot be observed during the tracing
- Small tracing;difficult to see apex

Types of Extra Oral Tracers:

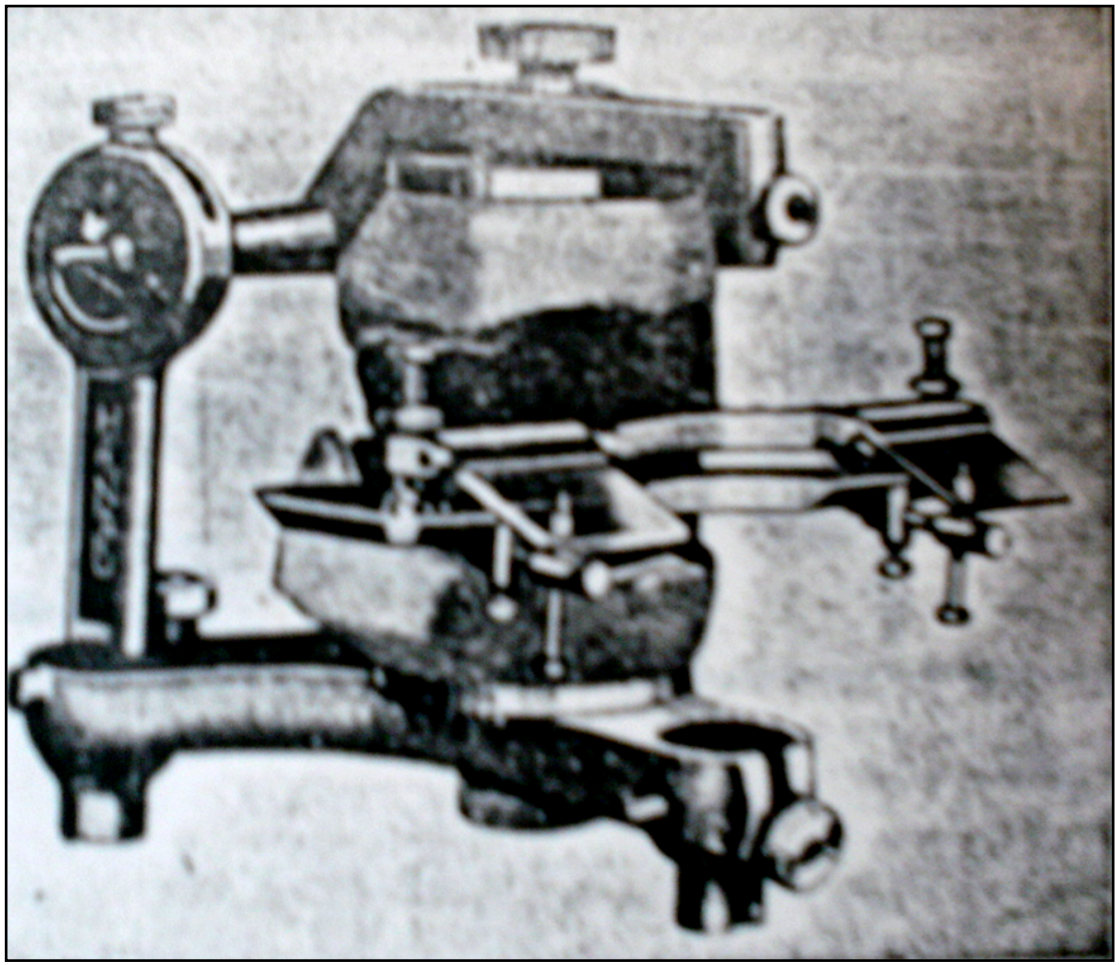
- Hight tracers(with or without central bearing point)

Stransbery tracers

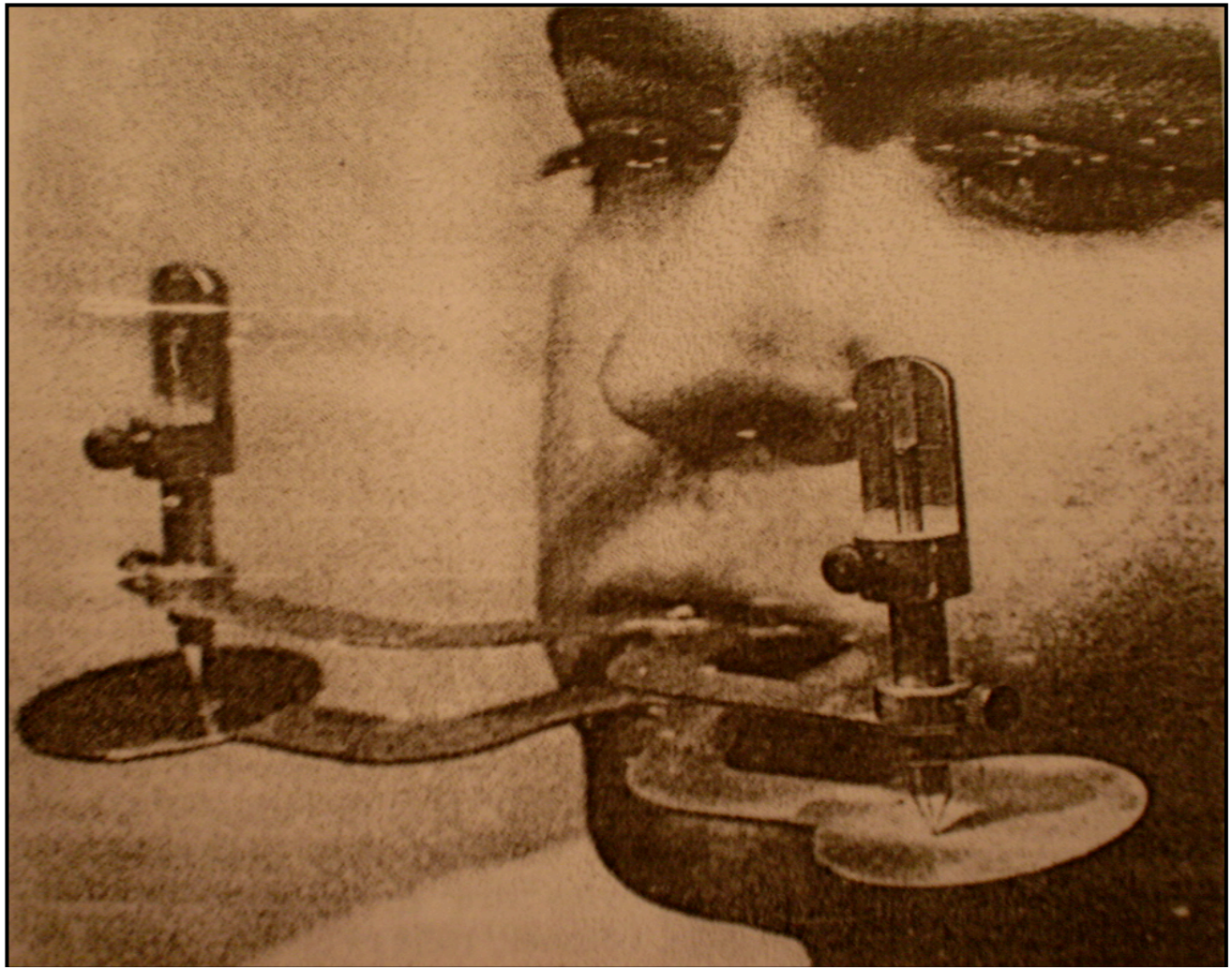




- Sears trivet (is a central bearing point tracer with two registration pins)

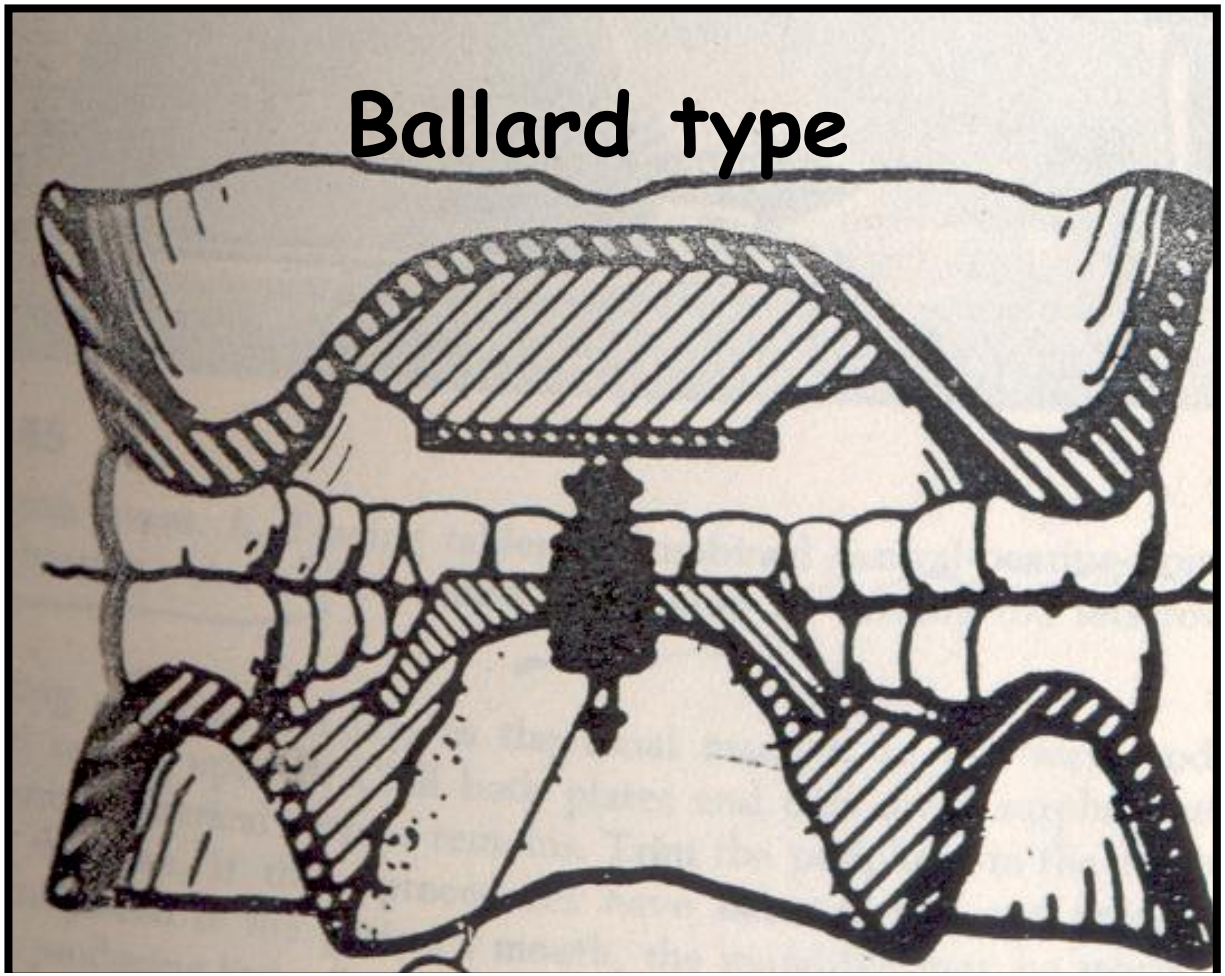


- Phillips tracer (it registers CR and condyle paths simultaneously

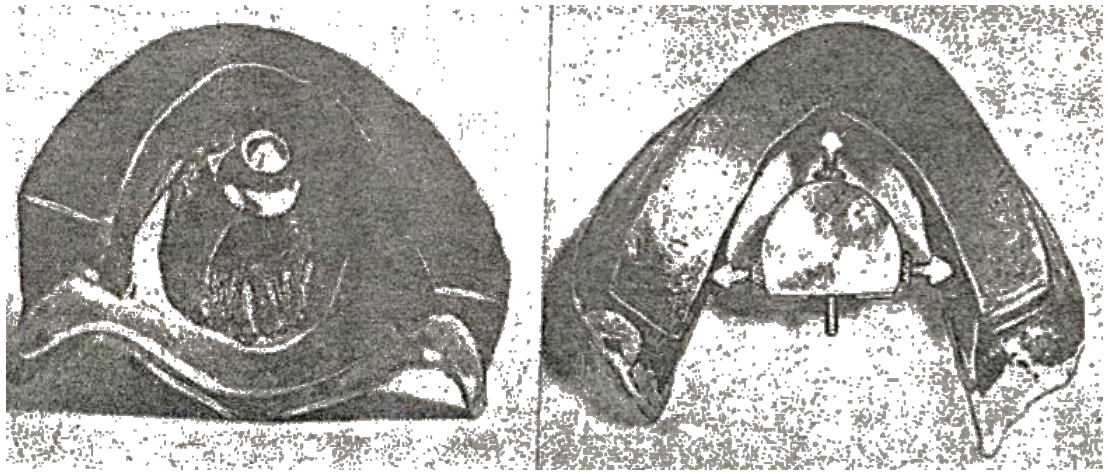


Types of INTRAORAL ARROW Tracers

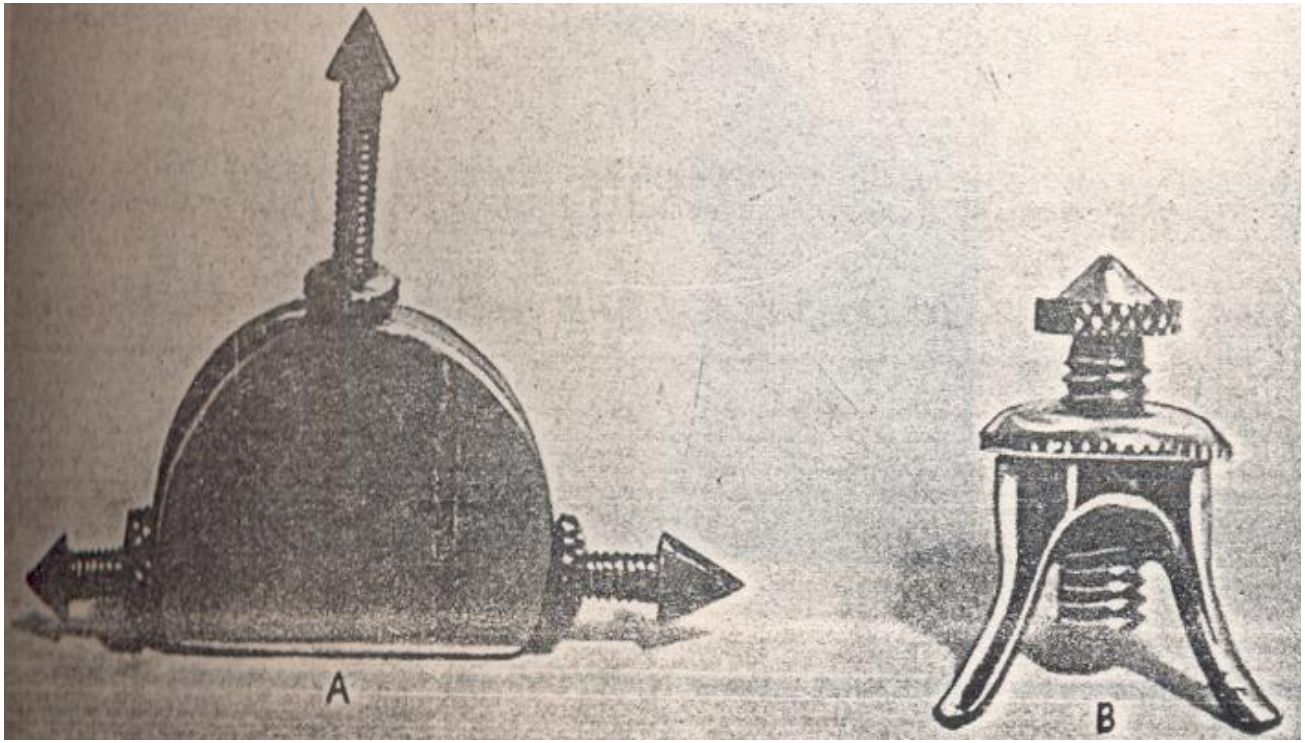
- Seidel
- Ballard
- Masserman



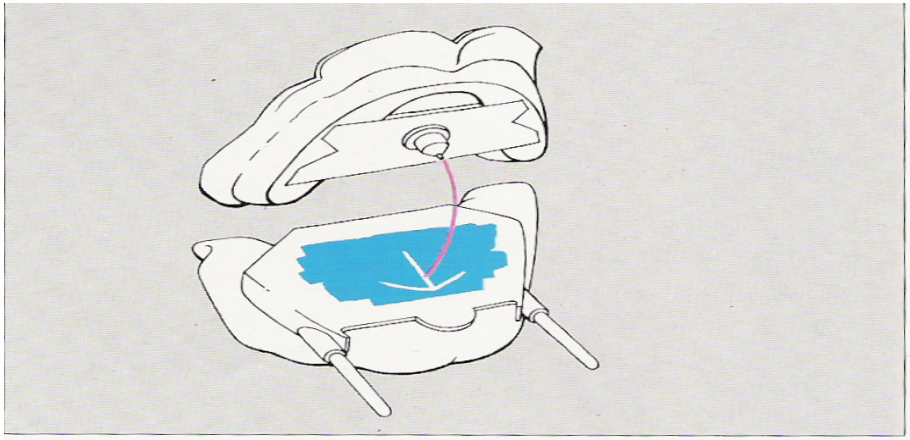
Masserman type

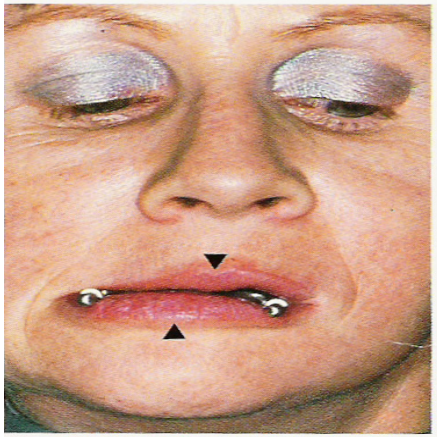


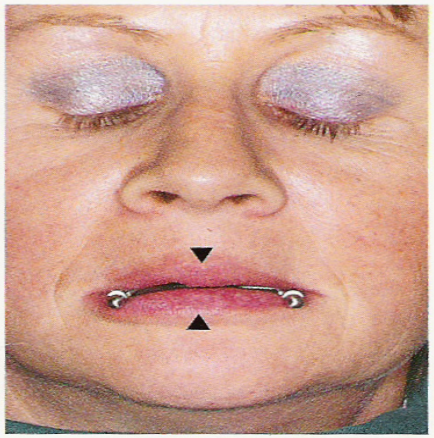
Tracing table/central bearing point and stylus

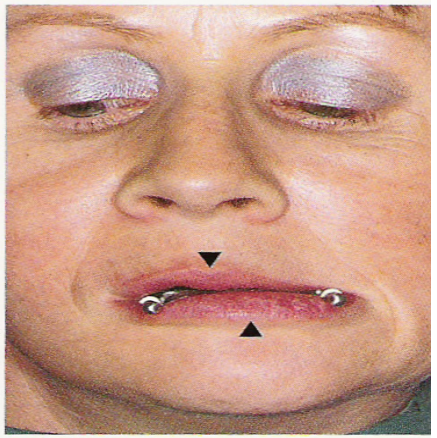


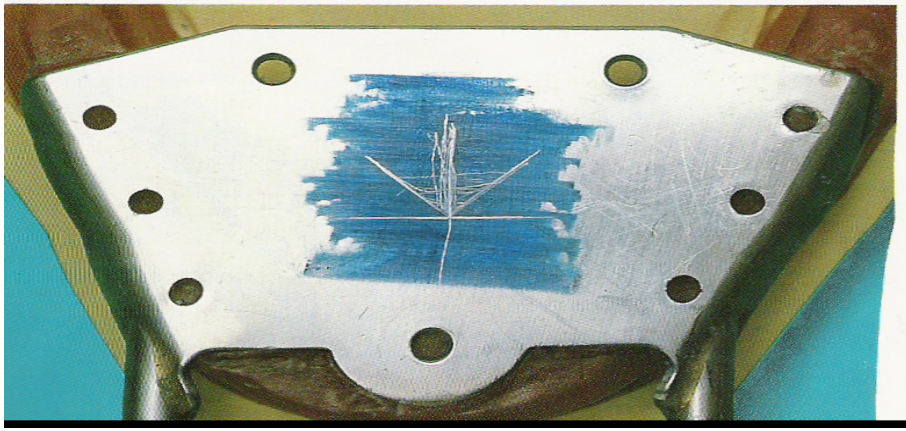
PROCEDURE FOR INTRAORAL TRACING

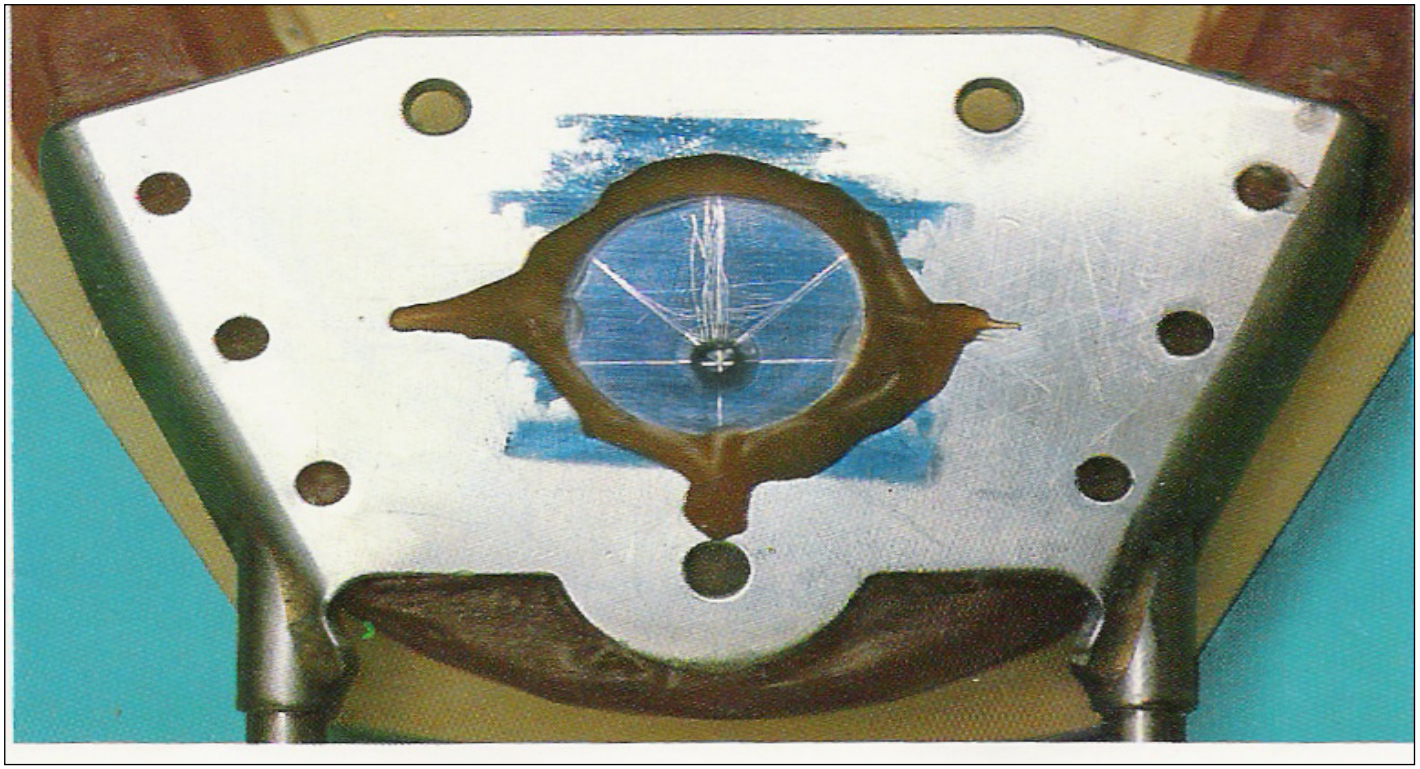


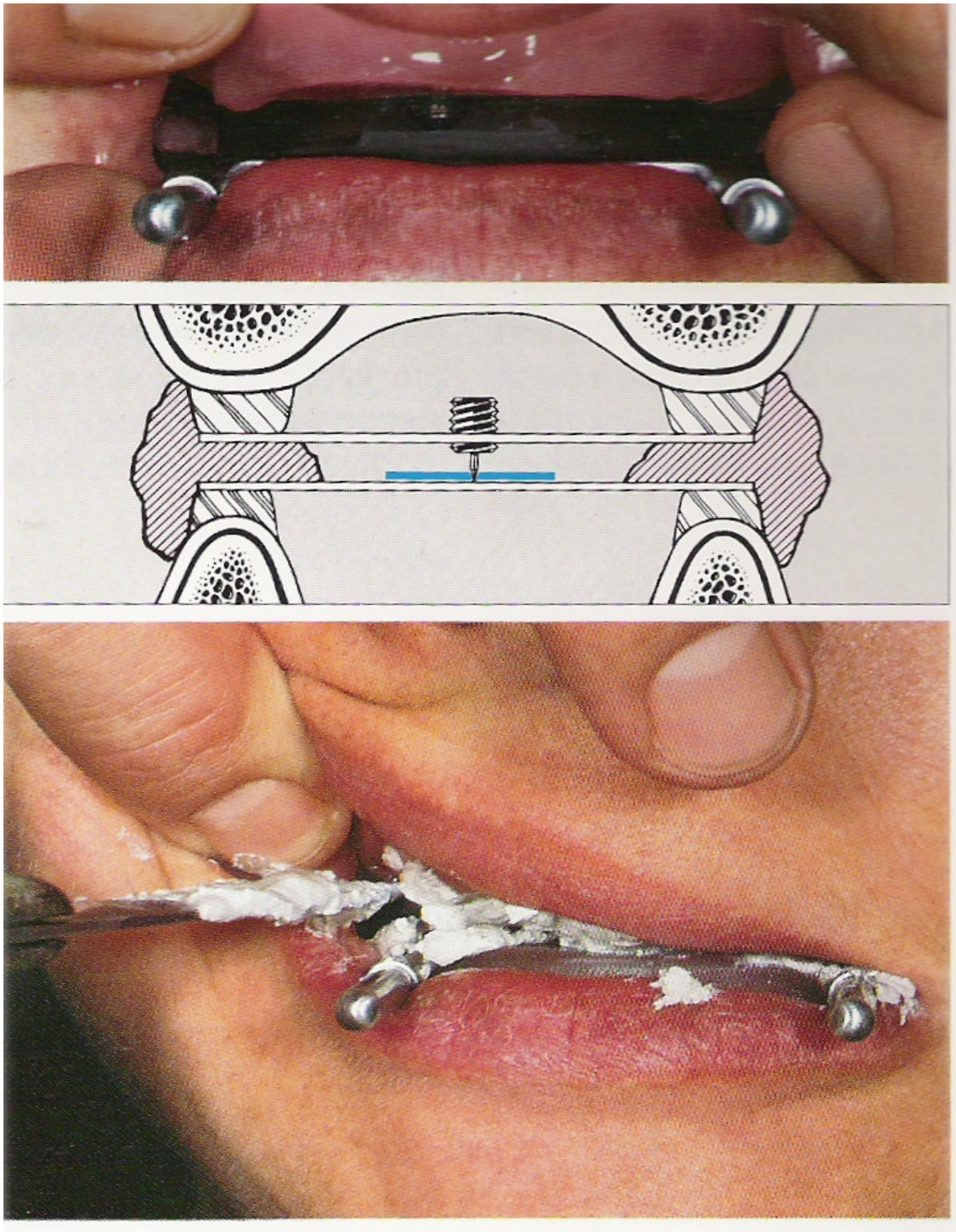


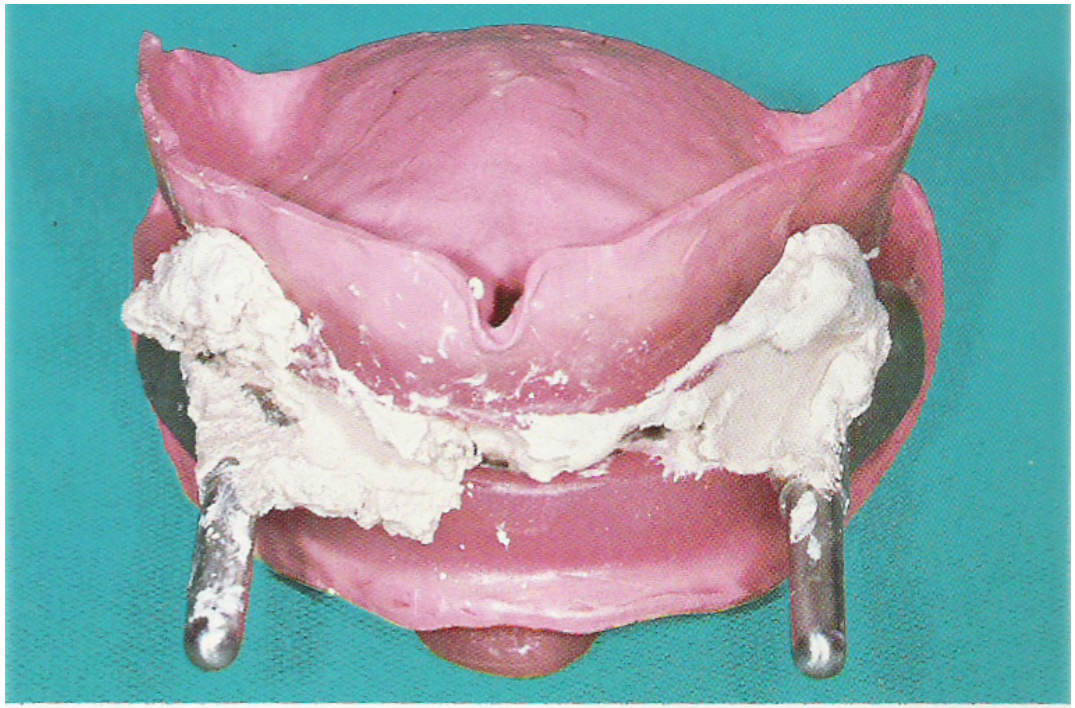


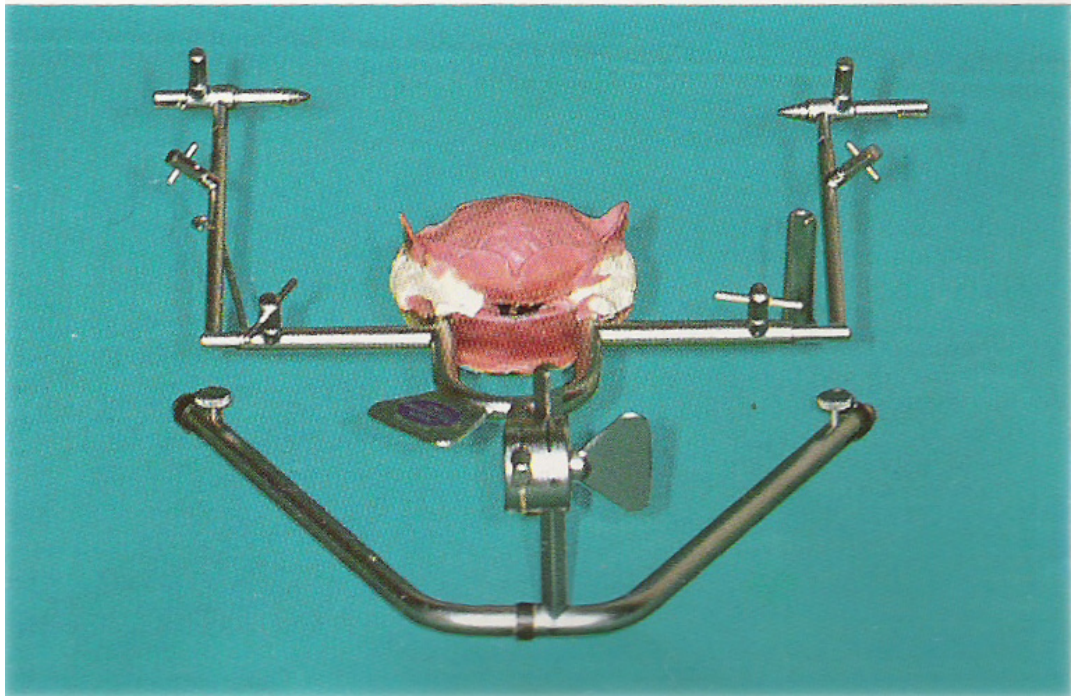




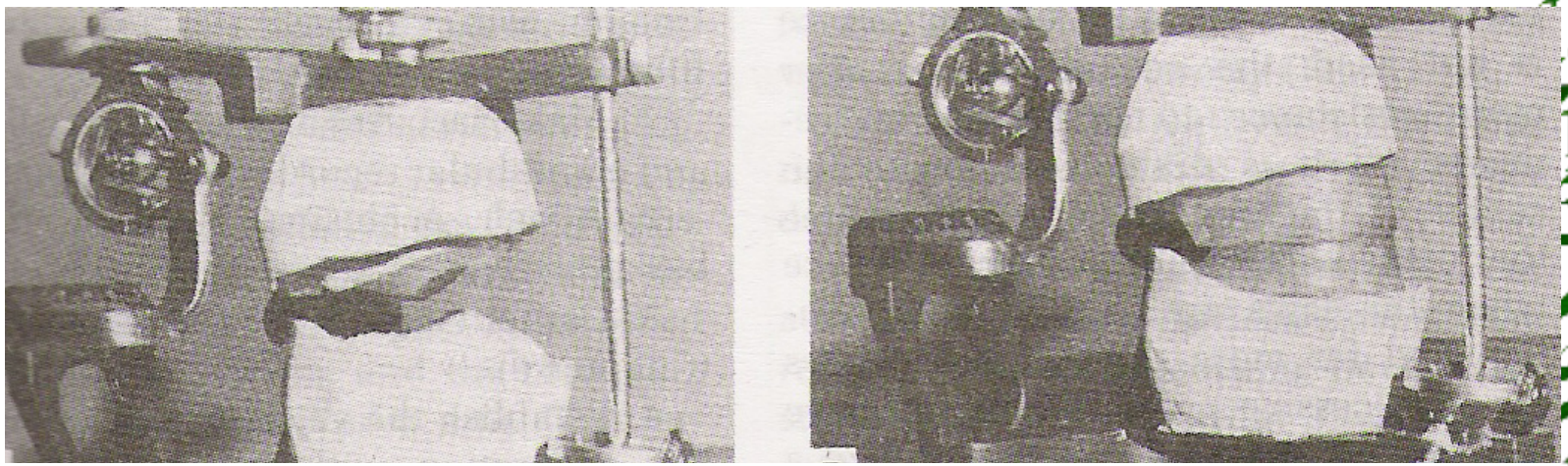




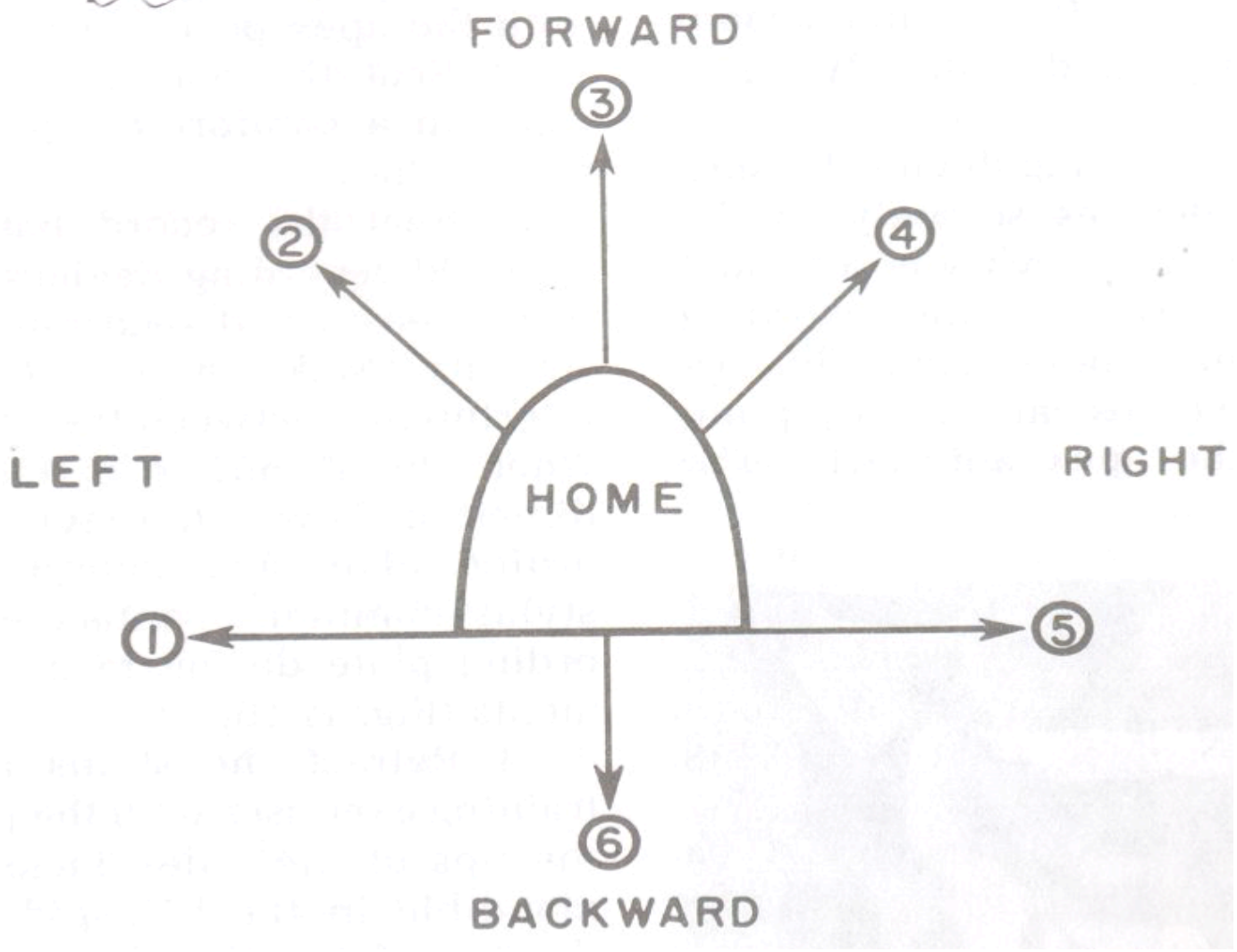


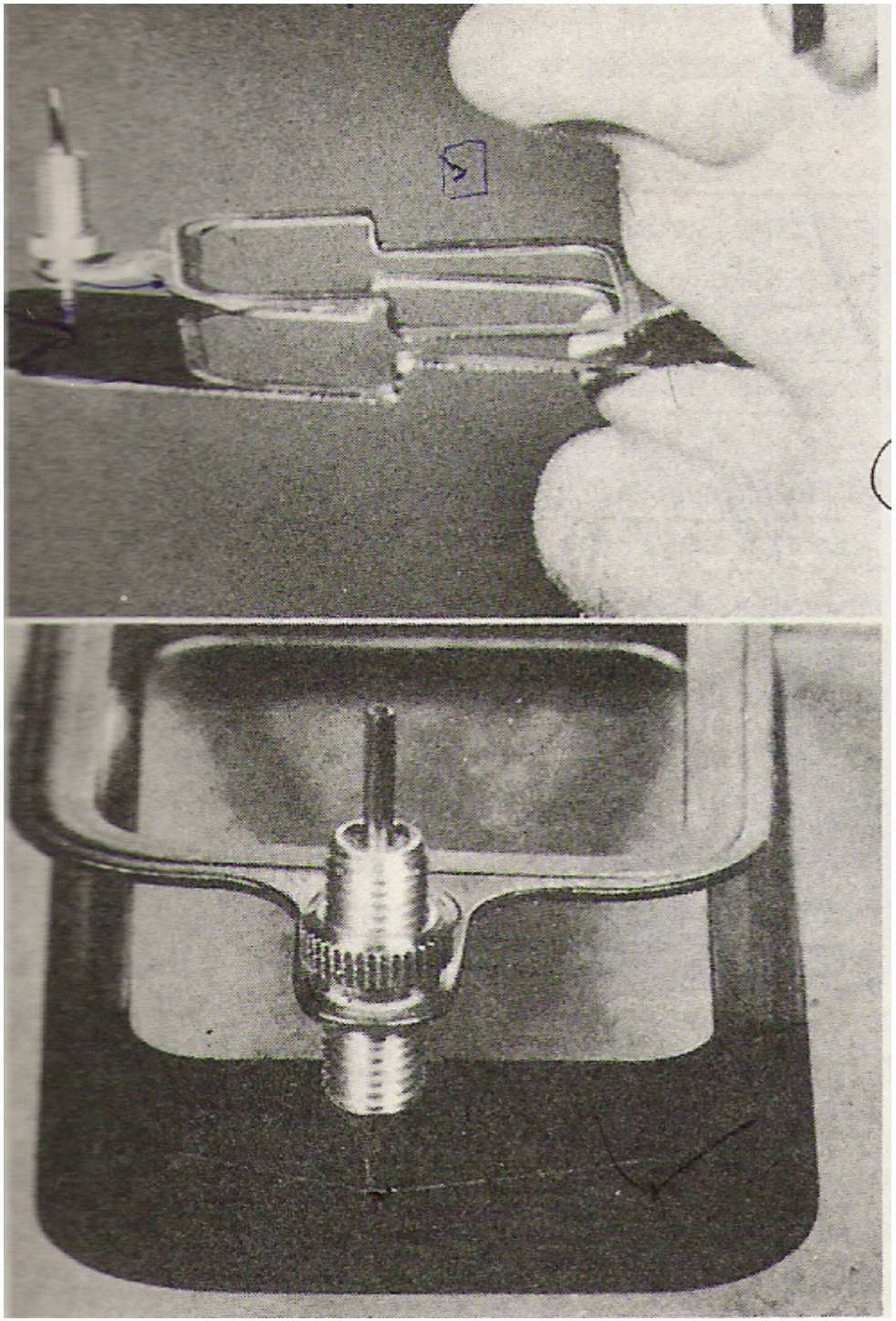


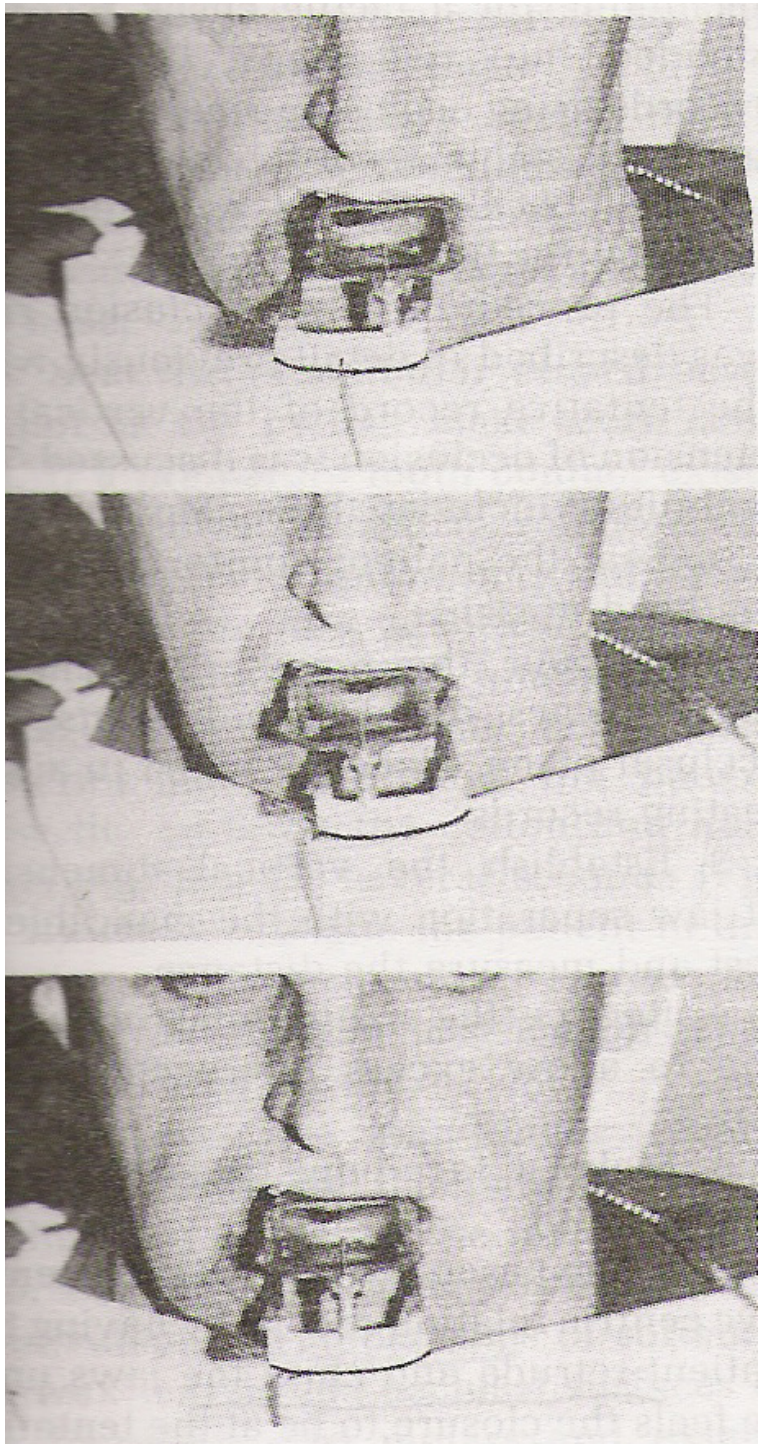
PROCEDURE FOR EXTRA ORAL TRACING

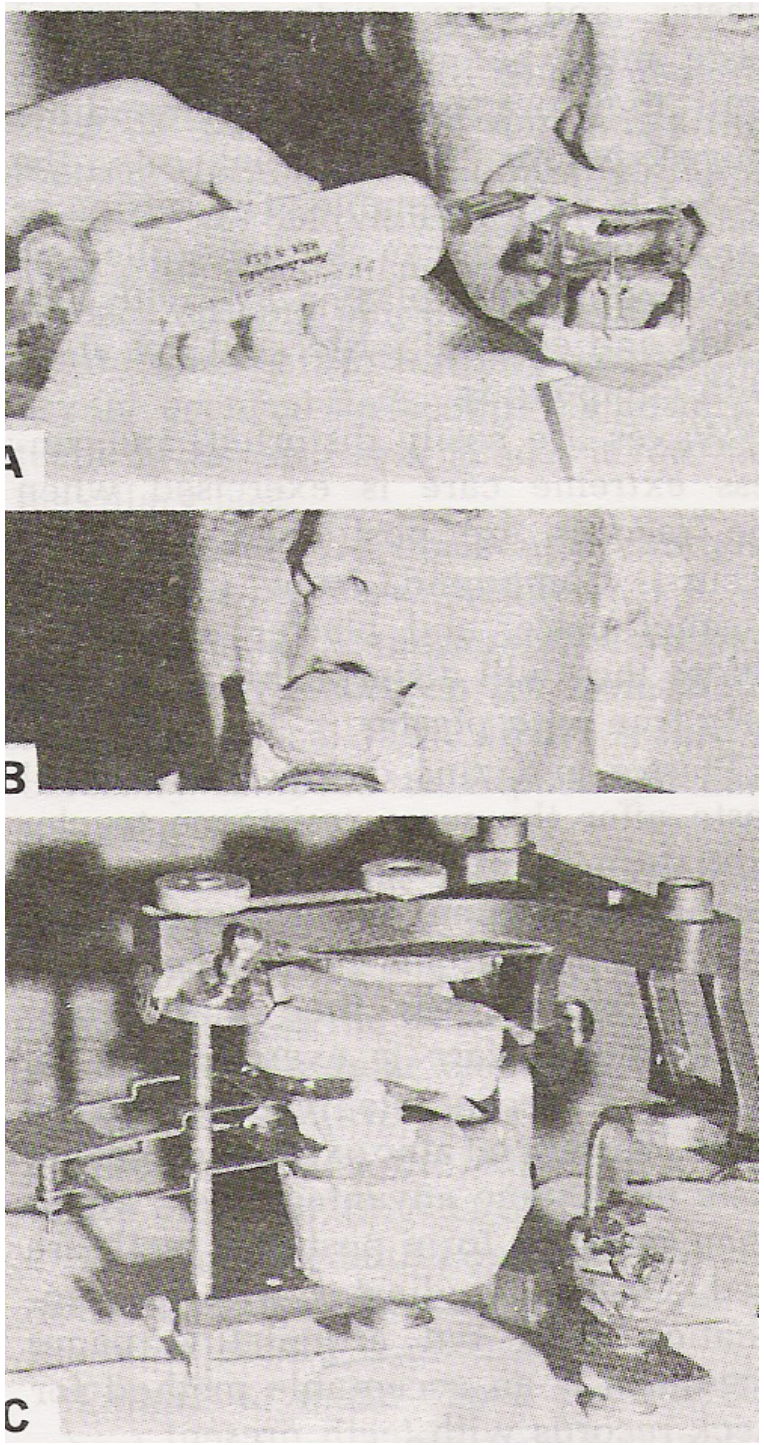


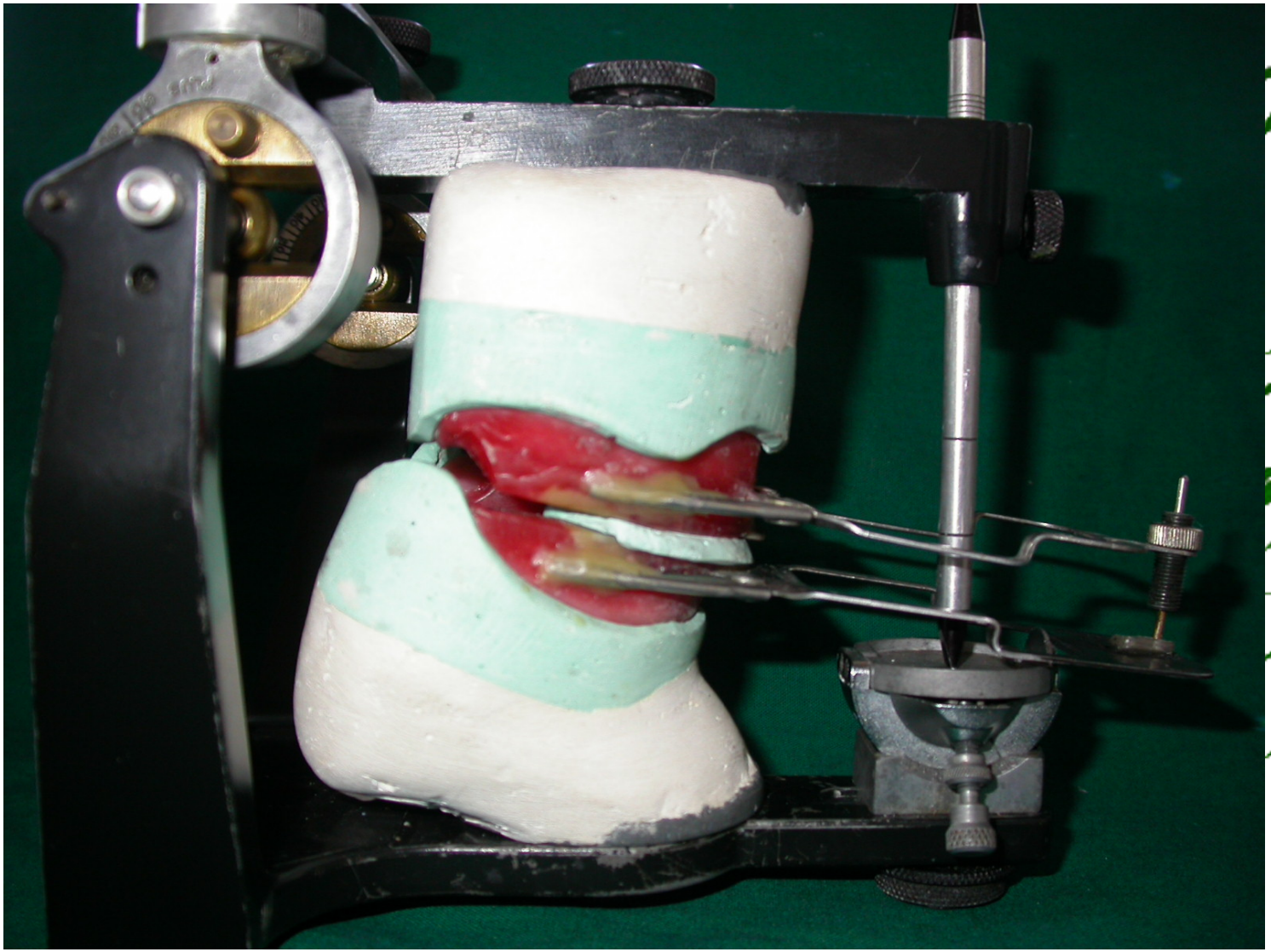
NEY MANDIBULAR EXCURSION GUIDE



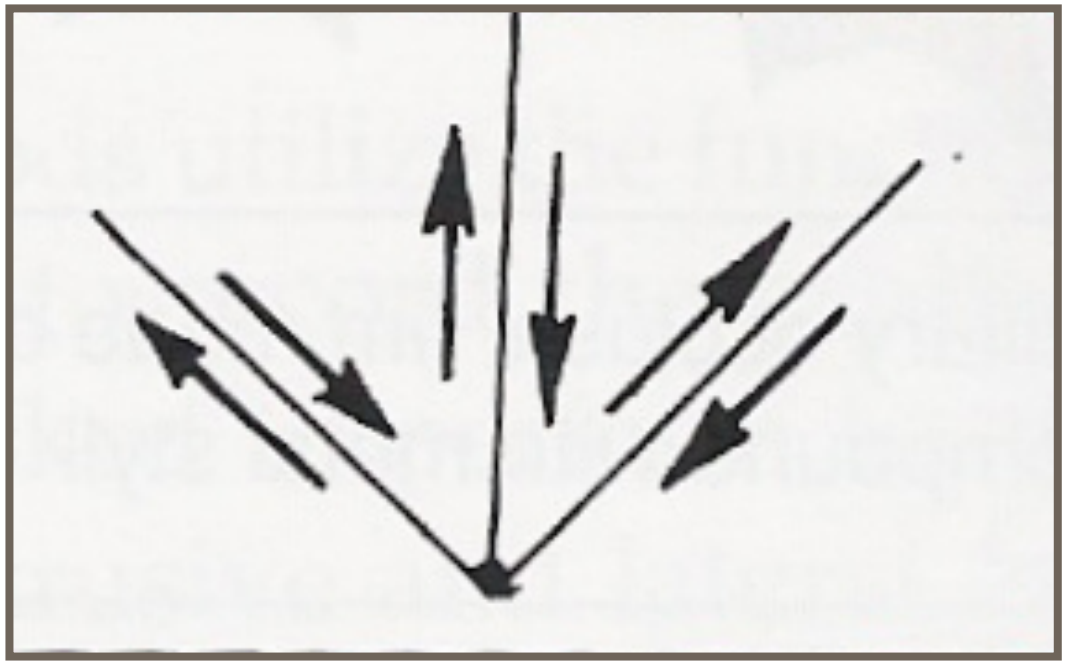





A
B
C



Correct tracing has a sharp and well defined apex



Disadvantages of the gothic arch tracings:

Kingery(1952)

- Equalization of pressures did not occur
- Class II/III patients not used
- Flabby tissues and large tongues may cause shifting of the bases

Payne(1955)

- Tracing is difficult to see, especially intraoral ones
- Too much patient cooperation is needed

Block(1953)

- Any sore spot under the bases could cause an eccentric relation

Boucher(2003)

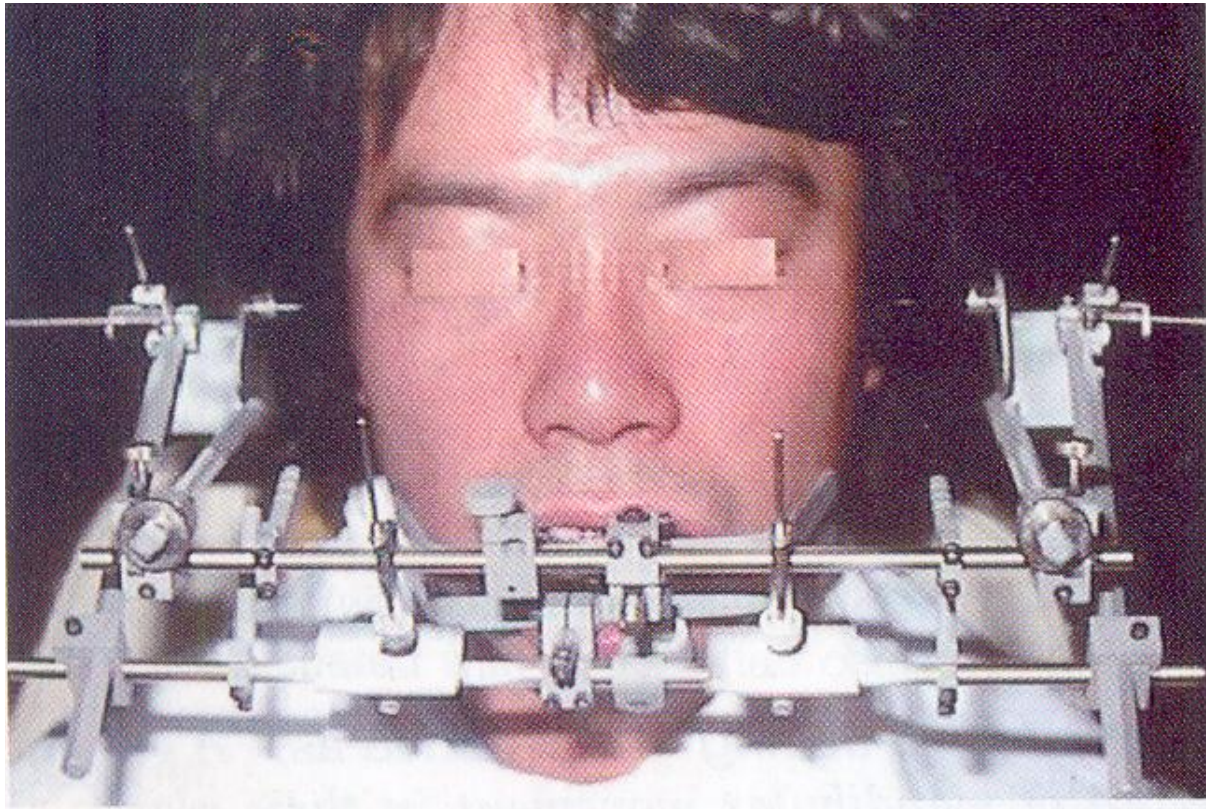
- Obtaining accurate records from the patient requires that the graphic writing apparatus be firmly fixed to the jaws. This is not difficult in dentulous patients but problematic when teeth are absent. The graphic records are inaccurate as a result and so offer no advantage over the more arbitrary interocclusal records. The extra capability of an articulator that will reproduce curved movements is thus of no use.

PANTOGRAPHIC TRACINGS

PANTOGRAPH----is an instrument used to graphically record one or more planes/ paths of mandibular movement and to provide information for the programming of the articulator-**GPT**

PANTOGRAPHIC TRACING

A graphic record of mandibular movement in three directional planes as registered by the styli on the recording tables of pantograph; Tracings of mandibular movement recorded on plates in horizontal and sagittal planes-**GPT**.



Pantographic tracer

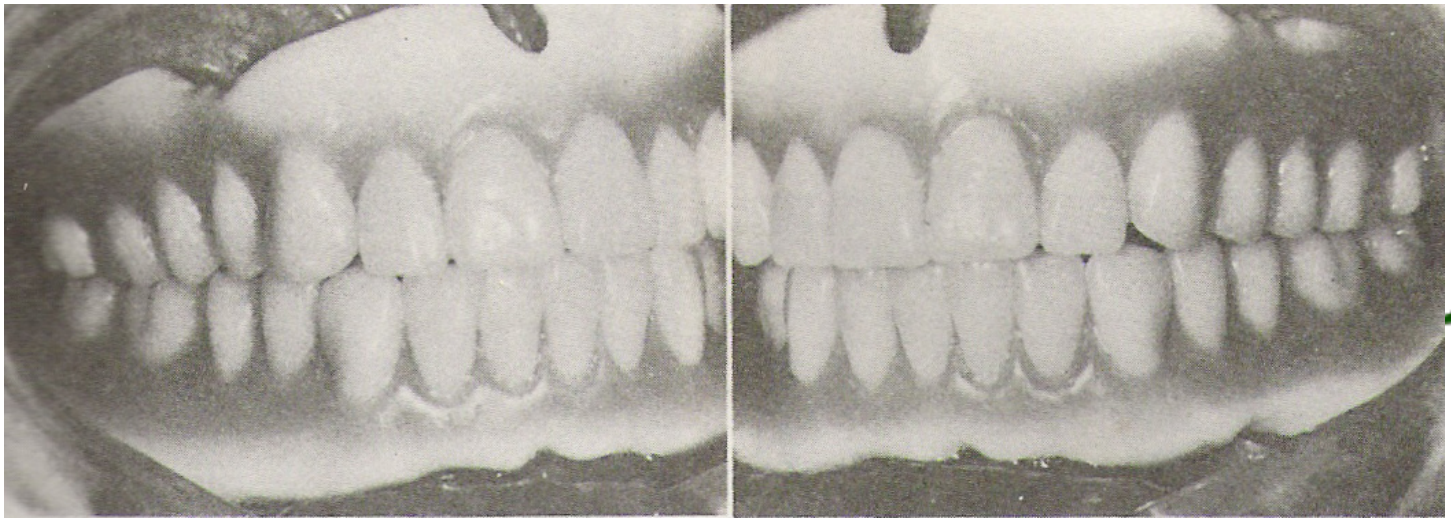
VERIFICATION OF THE RECORD

- Tested by very firm application of upward pressure on mandible with fingers while teeth kept apart with downward thumb pressure at symphysis (Dawson)

if pain/tenderness reported

record incorrect

pathosis of TMJ



Aluwax used to verify the centric record

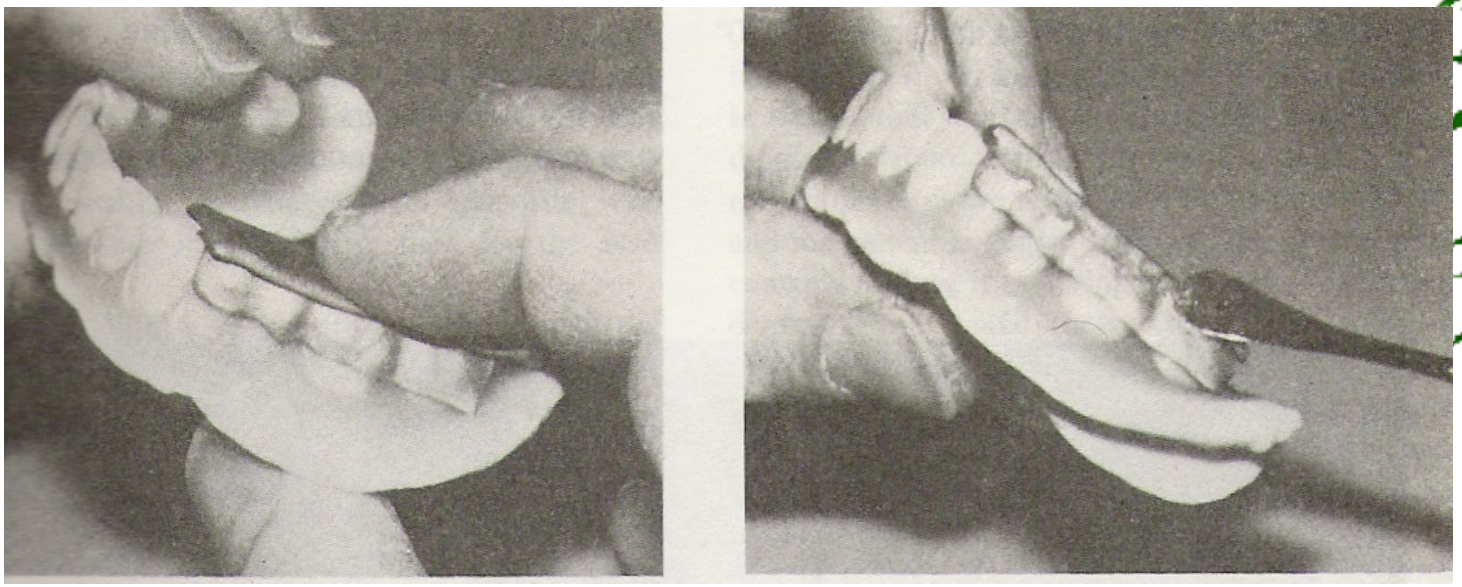


Fig. 18-8 Only the Aluwax is immersed, in 130° F (54° C) water for 30 seconds.

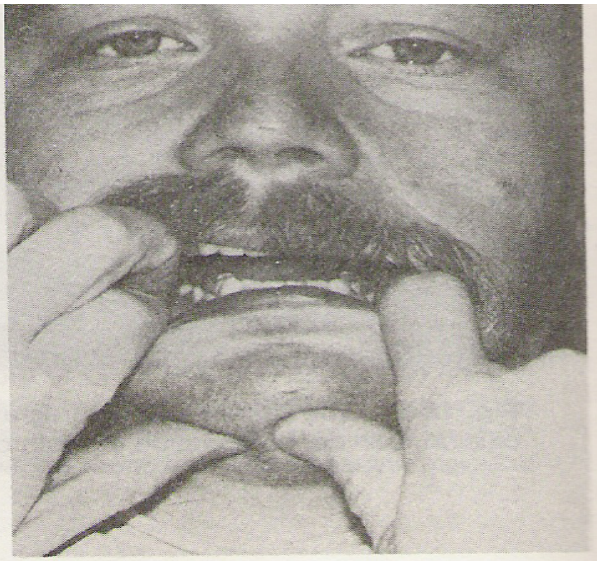


Fig. 18-9 The mandible is guided into CR w the thumb on the anteroinferior portion of the c and the index fingers seating the lower trial d ture in a downward and forward direction.

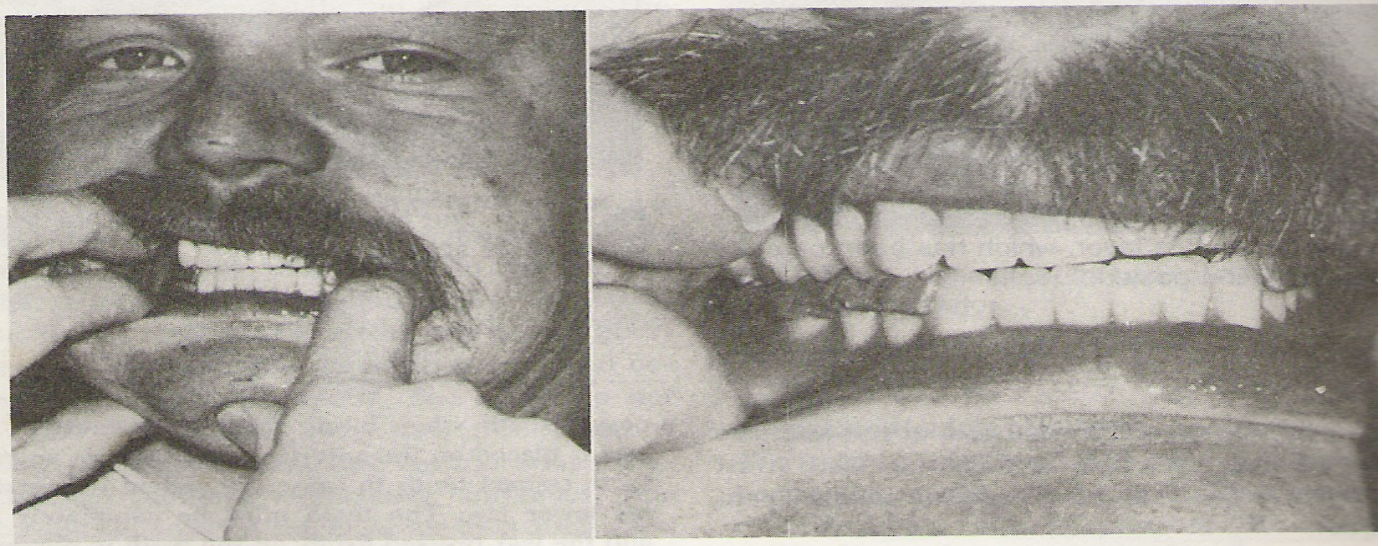
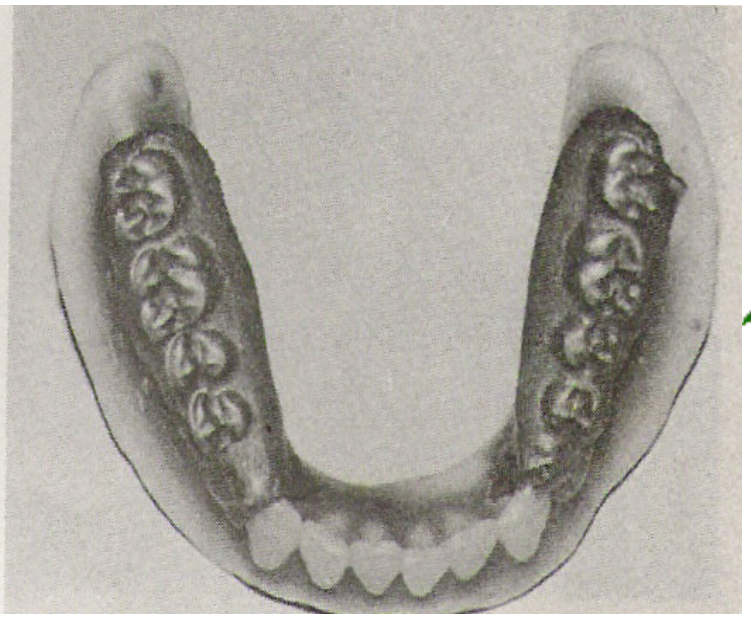


Fig. 18-10 The patient is instructed to close lightly into the softened wax. The index fingers should be slightly raised from the buccal flanges at this point.

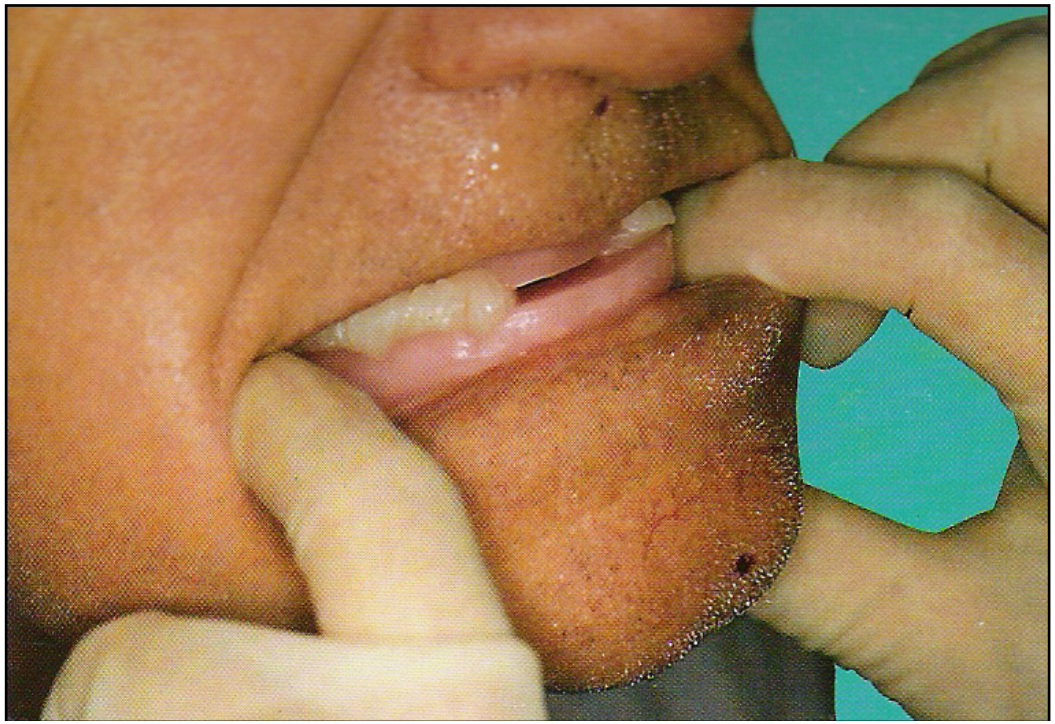


FACTORS AFFECTING THE CENTRIC RECORDS

Kapur/Yurkstas (1964)

- Resiliency of the supporting tissues
- Stability of the recording bases
- TMJ and its associated neuromuscular mechanisms
- Character and pressure applied in making the records
- Skill of the dentist
- Health and cooperation of the patient
- Maxillomandibular relations

- Condition of the residual alveolar ridges
- Size and position of the tongue
- Technique used in making the record and the associated recording devices used

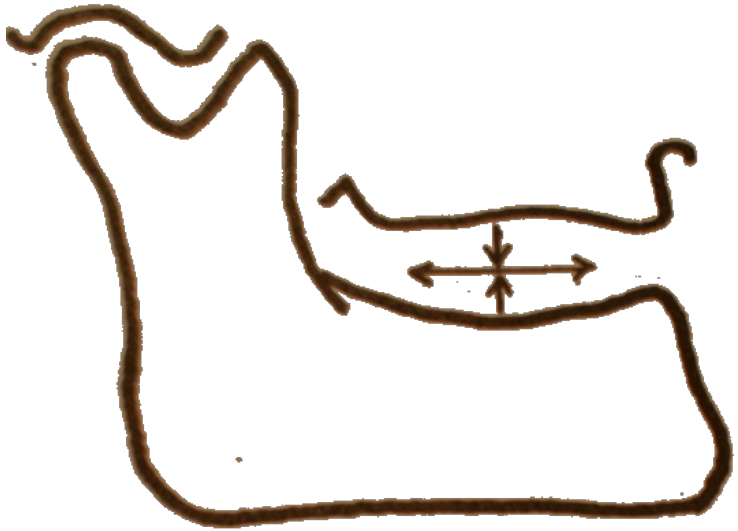


PROBLEMS ASSOCIATED WITH CENTRIC RELATION

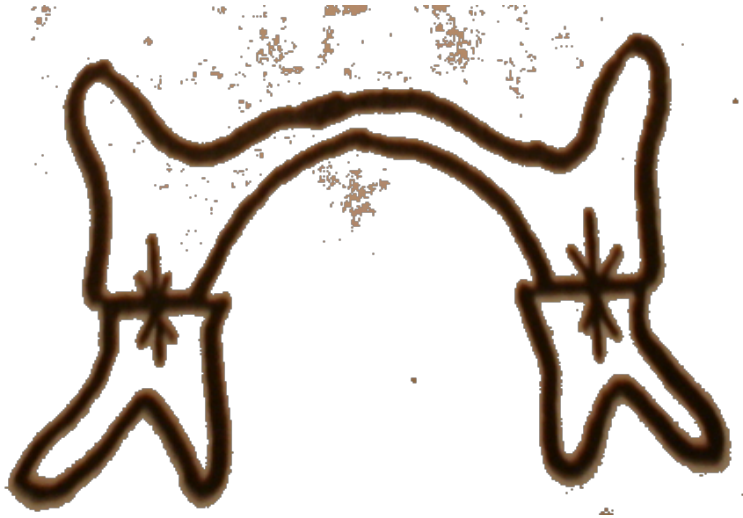
Kingery (1952)

1.Problem of requirement

- Recording the correct antero posterior or horizontal relation of the mandible to the maxilla in centric relation.
- Equalization of contact on the denture supporting areas, called as equalization of vertical contact



Correct horizontal relation of mandible to maxilla



Equilibration of vertical contact

2.Problem of errors

- Positional errors---errors in the registration of centric relation

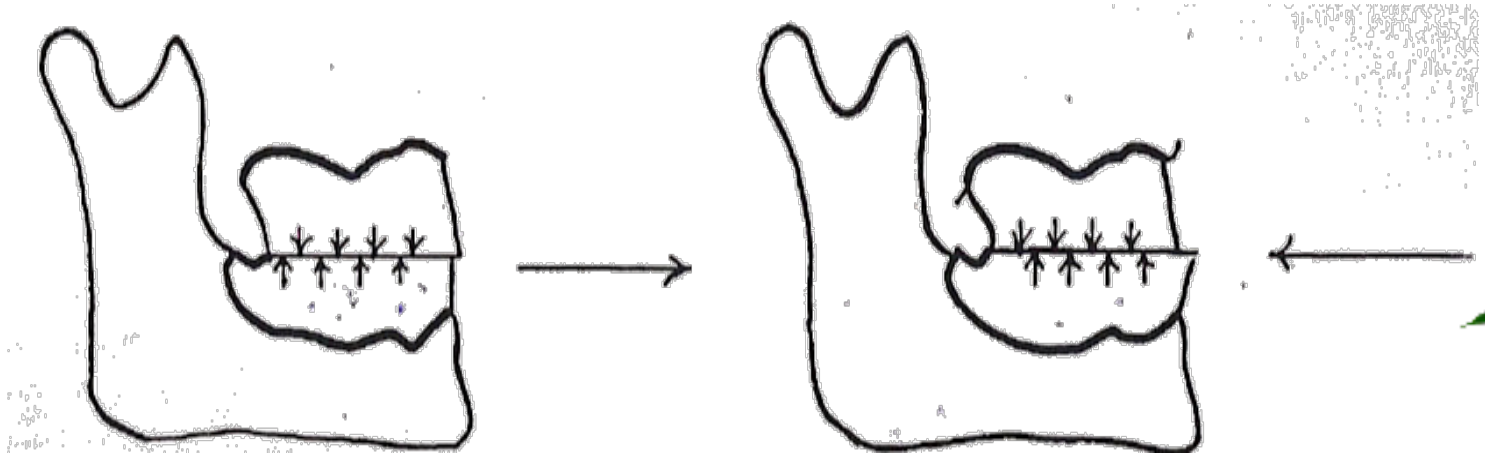
- Technical errors
  - Ill-fitting occlusal rims
  - Slight shifting of the teeth which occurs between the stage of final arrangement in wax and transfer to a permanent base material.

3. Problem of recognizing symptoms of errors associated with centric relation

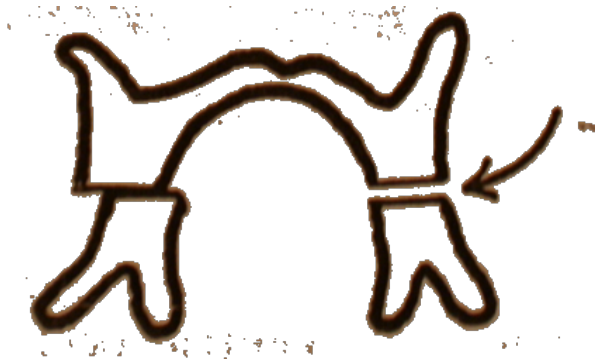
- Symptoms of unequalized vertical contact
- Symptoms of an error on horizontal relationship;when centric relation recorded does not coincide with centric occlusion established

  It is of 2 types→

- ✓ Anterior error
- ✓ Posterior error



Anterior and posterior errors



Failure in equilibration of vertical contact

3. Problem of recording the centric relation

This may be due to—

- Large number of methods
- Difficulties presented by patients
- Materials used as interocclusal records may also cause a problem

  eg. dimensional instability

INTEROCCLUSAL RECORD MATERIALS

HISTORICAL REVIEW (Myers 1982)

Direct interocclusal record (check bite)- oldest type of record used in complete denture fabrication

1756 Phillip Pfaff check bite records

1905 Christensen used impression wax

1910 Greene used compound bite record with plaster wash for accuracy

1954 Brown made repeated closures into soft wax

1955 Trapozzano preference to wax records

ECCENTRIC RELATION RECORDS

- Purpose of eccentric records

  adjust the horizontal and lateral condylar inclinations so that the articulator jaw members perform eccentric movements equivalent to,but not identical to relative movements of the mandible to maxilla

  ↓

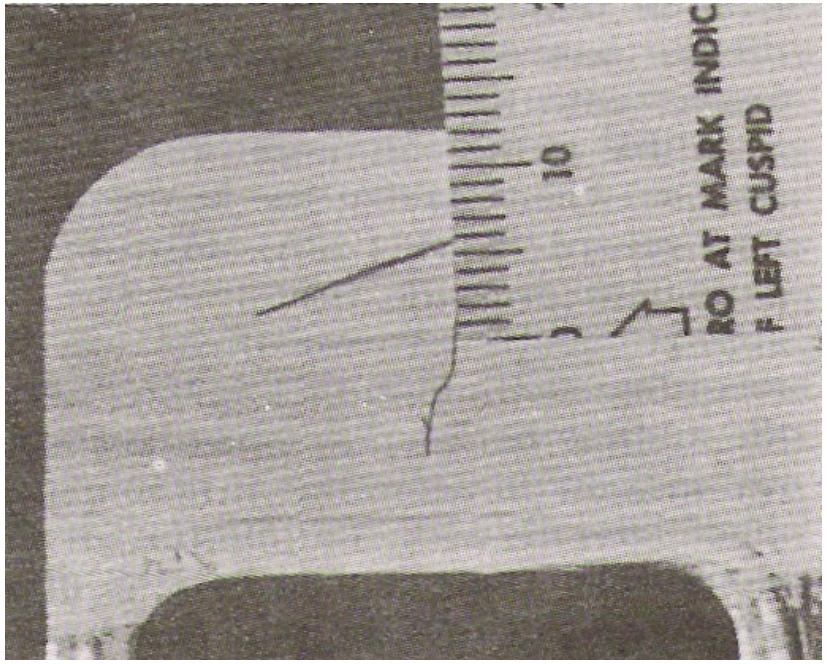
  arrange the teeth in balanced occlusion

- Eccentric positions: protrusive

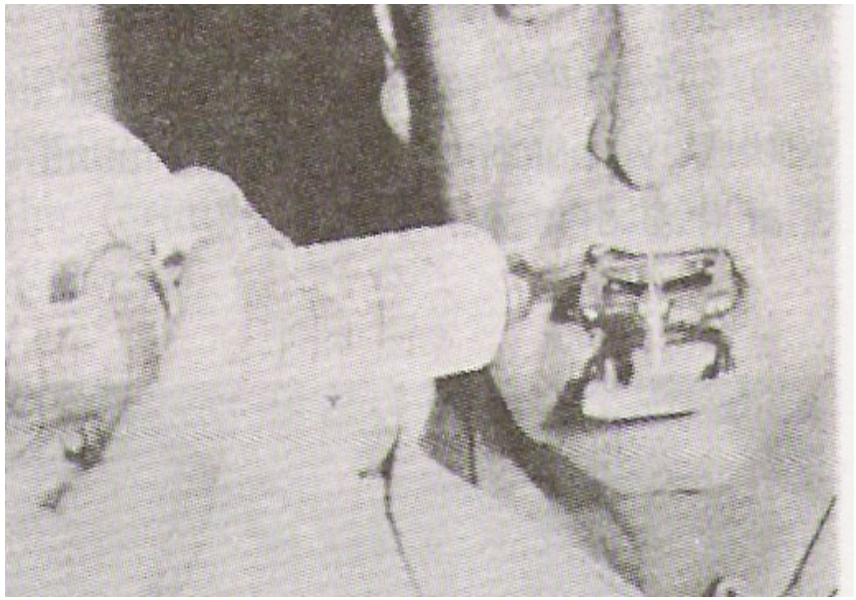
  right lateral

  left lateral

GRAPHIC METHOD



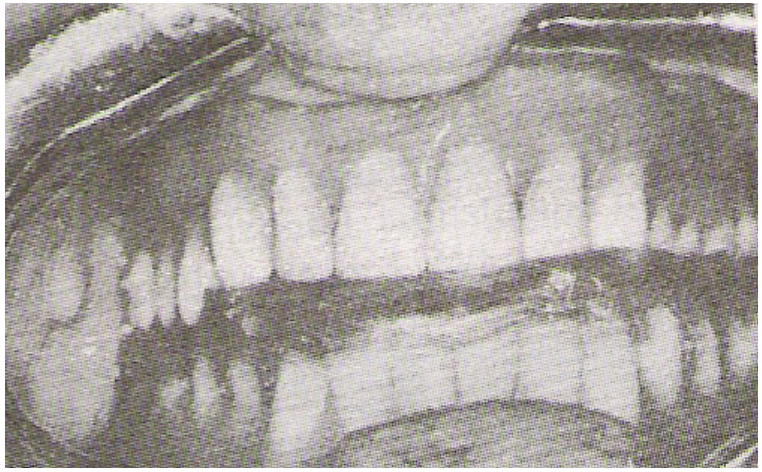
Measuring from apex of arrow point tracing to protrusive tracing



Injecting fast setting plaster

Adjusting the condylar elements by releasing the locknuts.incisal pin raised ½ inches and record bases seated on casts.locknuts secured with positive finger pressure.

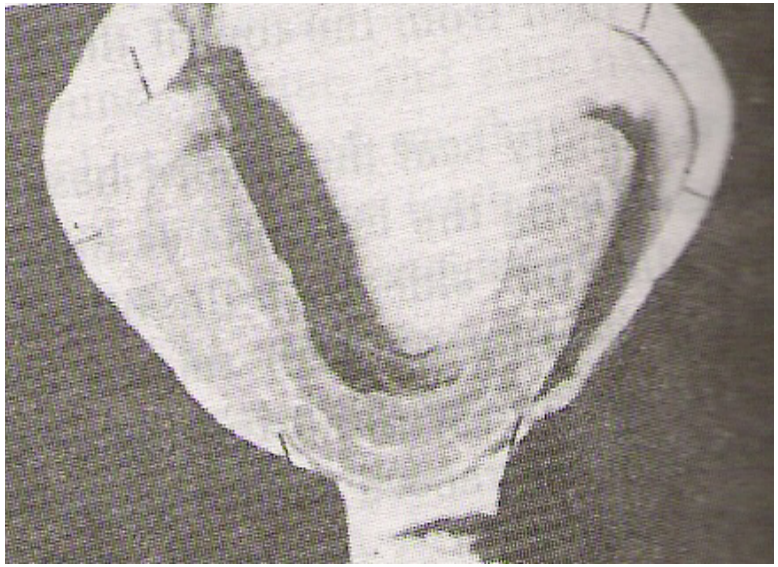
TACTILE OR DIRECT CHECK RECORD



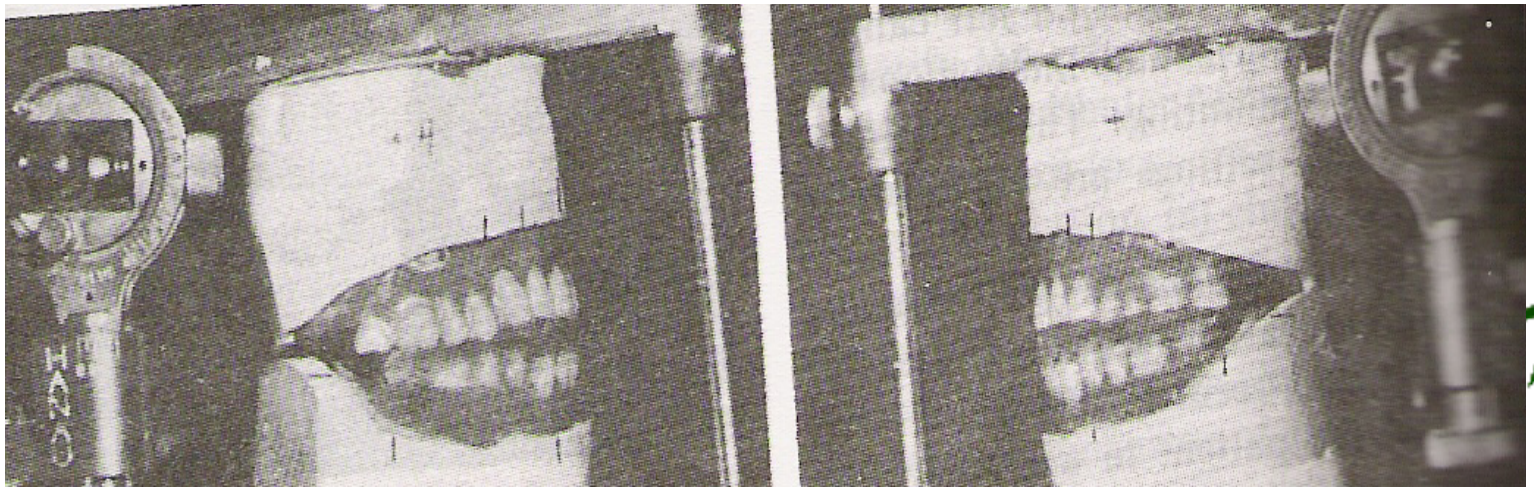
interocclusal check record

Inserted and mandible

protruded 5-6mm



Wax record with even contacts



Horizontal inclinations recorded on the right/left plaster mountings

LATERAL RELATION RECORD:

Hanau recorded a formula to arrive at an acceptable lateral inclination

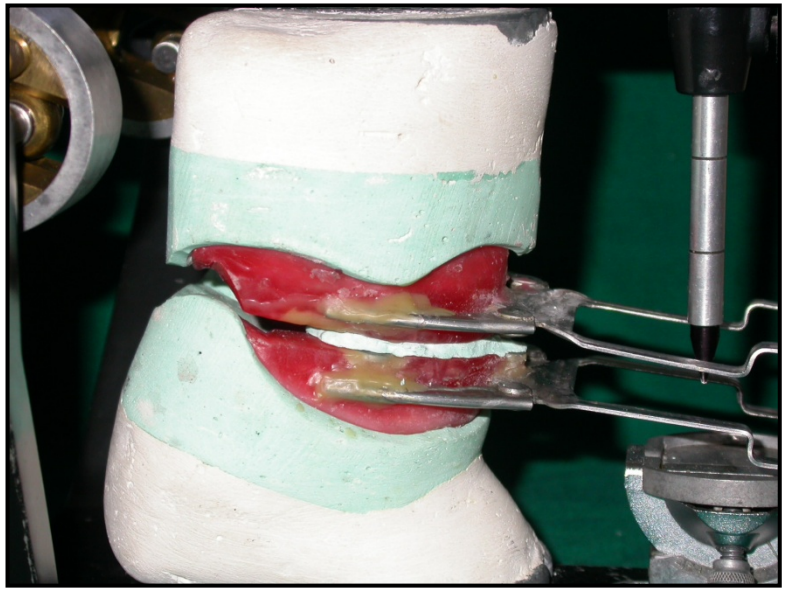
L=H/8+12 where L= lateral condylar guidance, H= horizontal condylar guidance

Boucher(2004)

variation in the accuracy of the eccentric records and absence of evidence for their usefulness in the clinical result

Arbitrary setting of articulator provides satisfactory condylar movements

33 degree sagittal 15 degree lateral



SUMMARY AND CONCLUSION

Sears-"The problem has confused a great number of readers ,which is not surprizing,as many of the writers are also confused."

Boos-"The bone,TMJ,teeth,soft tissues and musculature all produce the same relation to each other and any one of the many registration techniques may be used."

In the final analysis,the skill of the dentist and the cooperation of the patient are probably the most important factors in securing an accurate centric relation record.

The position of the mandible of any patient is determined by that patient's neuromuscular mechanisms and not by the dentist's paraphernalia.

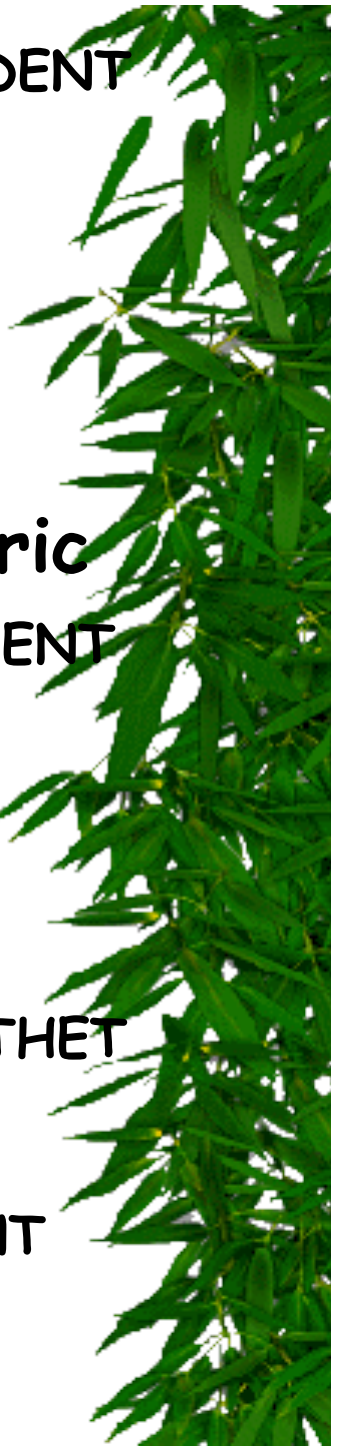
Stallard and Stuart-"I suppose we fear centric relation, as the superstitious fear a ghost, because we do not understand it."

REFERENCES

- Zarb GA,Bolender CL Prosthodontic treatment for edentulous patients 12th edition
- Zarb GA,Bolender CL,Carlsson GE Boucher's prosthodontic treatment for edentulous patients 11th edition
- Dawson PE Evaluation,diagnosis and treatment of occlusal problems 2nd edition
- Sharry JJ Complete denture prosthodontics 3rd edition
- Heartwell CM,Rahn AO Syllabus of complete dentures 4th edition.

- Winkler's Essentials of complete denture prosthodontics 2nd edition
- Swenson's complete dentures Boucher editor 5th edition
- Myers,M.L.:centric relation records-Historical review.J PROSTHET DENT 47:141,1982
- Hughes,G.A,Regli,C.P.:What is centric relation J PROSTHET DENT 11:16,1961
- Kingery,R.H.:A review of some of the problems associated with centric relation. J PROSTHET DENT 2:307,1952
- Moyers,R.E.:Some physiologic considerations of centric relations and other jaw relations. J PROSTHET DENT 6:185,1956

- Granger,E.R:Centric relation. J PROSTHET DENT 2:160,1952
- Brill,N.:. Reflexes,registrations,and prosthetic therapy.J PROSTHET DENT 7:341,1957
- Sheppard,I.M.:The bracing position,centric occlusion and centric relation J PROSTHET DENT 9:11,1959
- Boos,R.H.:Centric relation and functional areas.J PROSTHET DENT 9:191,1959
- Trapozzano,V.R.:Occlusal records J PROSTHET DENT 5:325,1955
- Villa,h.:Gothic arch tracing.J PROSTHET DENT 9:624,1959



- Bissasu,M.:Use of the tongue for recording centric relation for edentulous patients.J PROSTHET DEN 82:369,1999
- Ghalichebaf,M.:A flashing light method of recording centric relation. J PROSTHET DENT 55:221,1986
- Kapur,K.K,Yurkstas,A.A.:An evaluation of centric relation records obtained by various techniques.J PROSTHET DENT 7:770,1957
- Kingery,R.H.:The maxillomandibular relationship of centric relation. J PROSTHET DENT 9:922,1959
- McCartney,J.W.:Recording centric protrusive jaw relationship. J PROSTHET DENT 43:231,1980

- Yurkstas,A.A,Kapur,K.K.:Factors affecting centric relation records in edentulous mouths. J PROSTHET DENT 14:1054,1964
- Rader,A.F.:Centric relation is obsolete. J PROSTHET DENT 5:333,1955
- Shpuntoff,H.,Shpuntoff,W.:A study of physiologic rest position and centric position by electromyography. J PROSTHET DENT 6:621,1956
- Kantor,M.E.,*et al.*:Centric relation recording techniques. J PROSTHET DENT 28:593,1972
- Lucia,V.O.:Centric relation-theory and practice. J PROSTHET DENT 10:849,1960

- Michman,J.:,Langer,A.;Comparison of three methods of registering centric relation for edentulous patients. J PROSTHET DENT 13:248,1963
- Javid,N.S,Porter,M.R.: The importance of the Hanau formula in construction of complete dentures. J PROSTHET DENT 34:397,1975
- Watanabe,Y.:Use of personal computers for gothic arch tracings. J PROSTHET DENT 82:562,1999
- Oliver,B.,Basker,R.M.:Check records. QUINTESSENCE INTERNATIONAL 25:763,1994
- McCord,J.F,Grant,A.A.:registration:Stage II-intermaxillary relations Br Dent J 2000;188:601-606

- Wilson,P.H.R,Banerjee,A.: Recording the retruded contact position: a review of clinical techniques *Br Dent J* 196: 395-402,2004

Internet recourses


THANK YOU