

Complete denture impressions

Dental Impression: a negative imprint of an oral structure used to produce a positive replica of the structure to be used as a permanent record or in the production of a dental restoration or prosthesis.

Complete denture impression: it's a negative registration of the entire denture bearing, stabilizing and seal area of either the maxilla or the mandible.

Objectives of impression making:

Complete denture impression procedures must provide five objectives:

1. Retention
2. Stability
3. Support for denture
4. Aesthetic
5. Preservation of the residual alveolar ridge and soft tissue

Retention: Is the resistance of the denture to remove from the mouth by resisting displacement forces at right angle to the occlusal plane.

Stability: Is the quality of prosthesis to be firm, steady or constant to resist displacement by functional horizontal or rotational movement.

*Retention is the constant relation of the denture base to underlying soft tissues, while stability is the relation of the denture base to underlying bone. These relations may be constantly changing.

*Retention must hold the denture in its position when it is set at rest.

*Stability must resist displacement by rocking when a force is applied to teeth over a limited area.

Support: Is the quality of prosthesis to resist displacement from the denture supporting foundation; therefore, the greater the amount of area covered the greater the support.

*The best support for denture is the compact bone covered with fibrous connective tissue.

* Retention = Denture base + Soft tissue.

* Stability = Denture base + Bone.

* Support = Denture base + Bone + Soft tissue.

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Aesthetics: Border thickness should be varied with the need of each patient in accordance with extend of residual ridge loss. The vestibular fornix should be filled, but not overfilled, to restore facial contour.

Preservation of the residual alveolar ridge and soft tissue: preservation of the remaining residual ridge is physiologically accepted that with the loss of the stimulation of the natural teeth, the alveolar ridge will atrophy or resorb. Prosthodontist should keep in mind the effect of impression material and technique on the denture base and the effect of the denture base on the continued health of both the soft and hard tissues of the jaws.

Primary impression

Primary impression: it is a negative likeness made for the purpose of diagnosis, treatment planning, or the fabrication of a tray. It is the first impression made for the patient and from which the study cast was produced. This impression is obtained by a stock tray.

* For the upper stock tray, the posterior border of the tray should cover the maxillary tuberosity and hamular notch, anteriorly should include the antero- alveolar ridge.

* For the lower stock tray posteriorly should cover the whole area of retromolar pad area and anteriorly include the alveolar ridge.

Materials used for making primary impression:

1. Impression compound.
2. Alginate impression material.
3. Rubber base impression material (heavy body).

Primary cast (study model or diagnostic cast): a cast formed from a preliminary impression for use in diagnosis or the fabrication of an impression tray.

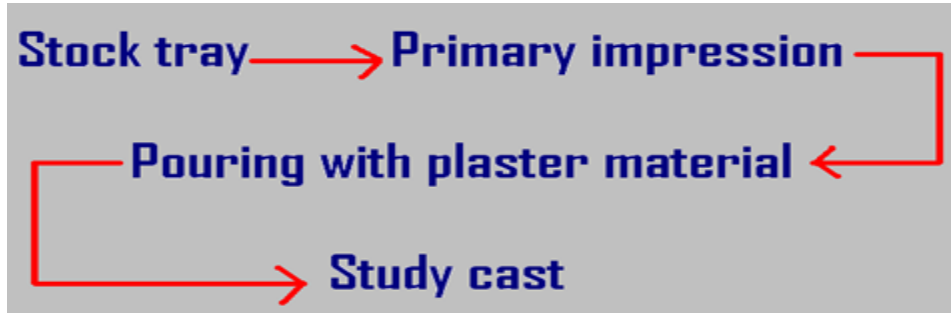
Production of study cast (primary cast):

The primary impression is poured or casted in plaster (after beading and boxing) to get the primary cast or study model which is the positive reproduction of the oral tissues.

The plaster mixed with water by the saturation method in the rubber bowel. When the plaster became hard, the cast is separated from the impression by the use of hot water (55-60 °C). When using very hot water,

the impression compound will be sticky and it will be difficult to remove from the cast. The special tray will be constructed on the primary or study cast which is used to make final impression.

After construction of special tray, it is tried in the patient mouth and checked for proper extension and adaptation on the alveolar ridge, as good impression cannot be obtained unless this step is made. So a correct special tray is a primary fact in obtaining a good working impression.



Production of study cast (primary cast)

Final or secondary impression

Final impression in general: The impression that represents the completion of the registration of the surface or object.

Final or secondary impression (for edentulous patient that use for complete denture construction): It is a negative likeness or registration of the entire denture bearing, stabilizing area and border seal area of the mandible and maxilla for the purpose of fabricating a prosthesis.

The final impression is made with special tray and it is used for making master cast which must be poured with stone material.

Master cast (definitive or final cast): A replica of the tooth surfaces, residual ridge areas and or other parts of the dental arch and or facial structures used to fabricate a dental restoration or prosthesis.

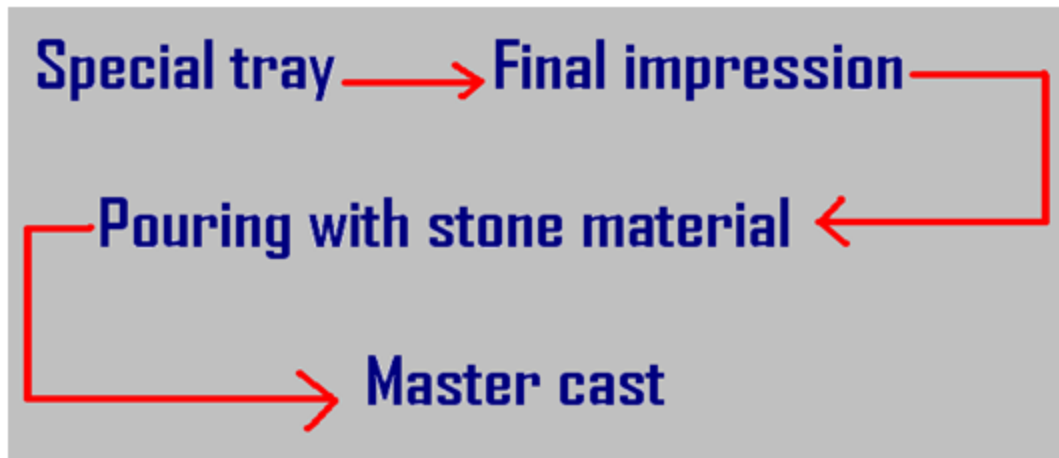
Materials used for final impression:

1. Zinc oxide eugenol impression material (ZOE).
2. Alginate impression material.
3. Impression plaster.
4. Elastomers impression material:
 - a- Polysulphide (rubber base).
 - b- Poly ether.
 - c- Silicon (light body).

5. Waxes.

The techniques used for making final impression:

1. Mucostatic impression technique (non- pressure technique).
2. Muco-compression or Functional impression technique (pressure or closed mouth technique).
3. Selective pressure impression technique.



Production of definitive or final cast (master cast)

Boxing an impression and making the casts

Boxing: Is the enclosure of an impression to produce the desired size and form of the base of the cast and to preserve desired details.

Boxing impression can be used for primary and final impression for complete denture. This procedure cannot usually be used on impression made from hydrocolloid materials (e.g. alginate) because the boxing wax will not adhere to the impression material and the impression material (alginate) will be distorted.

Advantages of boxing:

1. To facilitate pouring the impression with plaster or stone.
2. Produce the desired size and form of the base of the cast.
3. Provide adequate thickness of cast.
4. Preserve desired details and borders of the impression.
5. In the lower impression, boxing makes the reproduction of the lingual borders and tongue space easier.

Materials used for boxing impression:

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1. Beading wax: A strip of wax is attached all the way around the outside of the impression approximately (2-3 mm) below the border and sealed to it with wax knife.

2. Boxing wax: A sheet of wax is used to made the vertical walls of the box and it is attached around the outside of the beading wax strip so that it does not alter the borders of the impression, the width of the boxing wax is about 10-15 mm above the impression.

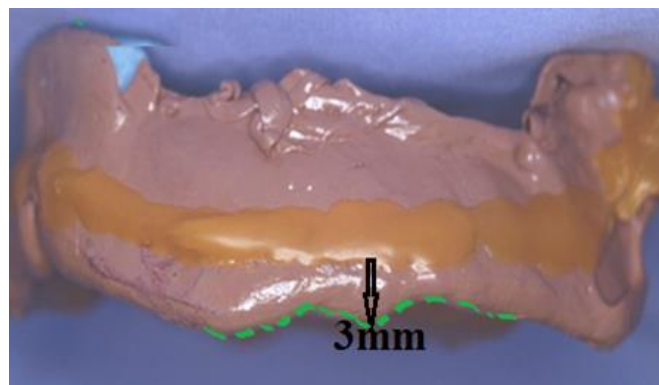
3. Base plate wax: A sheet of wax can be used to fill the tongue space in the lower impression that is sealed to lingual border of the impression and should be located just below the lingual border of the impression.

Dental stone is mixed according to manufacturer's direction and sufficient stone is poured into the final impression so that the base of the cast will be from 10-15mm in thickness .The cast is called master cast.

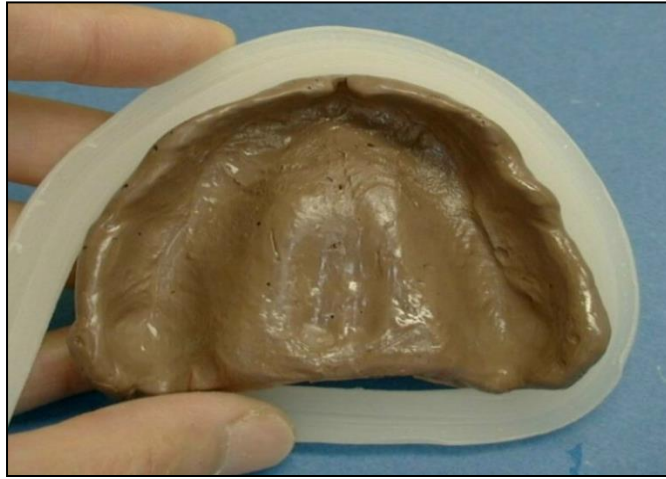
Common faults in impression making:

1. Poor selection of the tray.
2. In sufficient material loaded in the tray.
3. Excessive material loaded in the tray.
4. Failure to press the tray completely to position (insufficient seating pressure)
5. Excessive seating pressure.
6. Incorrect position of the tray before final seating it (Un centralization).
7. Obstruction of the proper flow of the material by lips, cheek or tongue.

Boxing upper final impression and making the master cast



Apply a layer of sticky wax around the impression 3 mm below the periphery as shown.



Soften the beading wax and apply it to the sticky wax to form the land area.

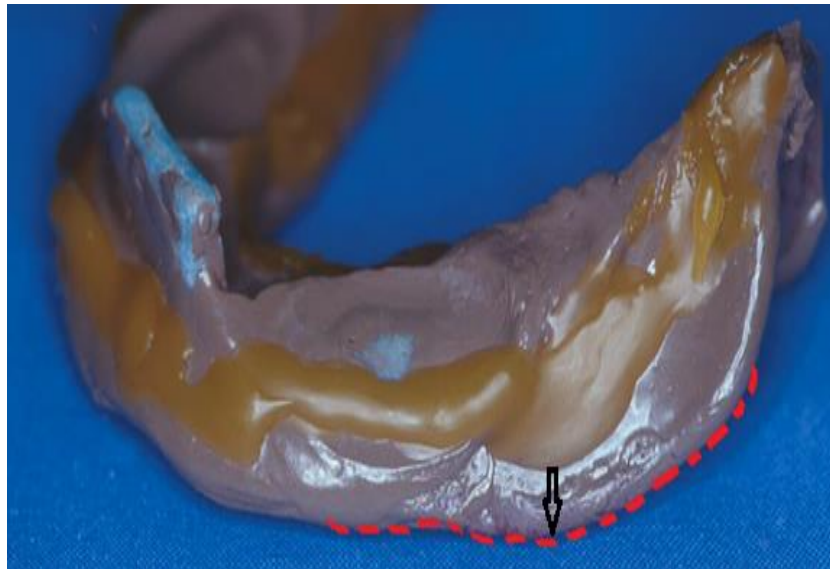


Wrap a sheet of red boxing wax around the beading wax to form a container. All joints must be sealed with hot wax to prevent stone from leaking through.

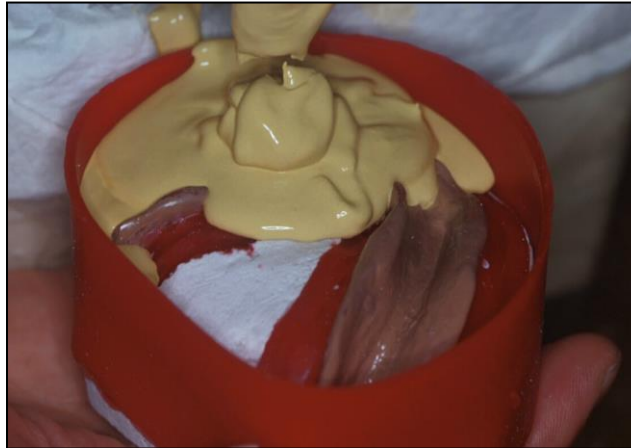
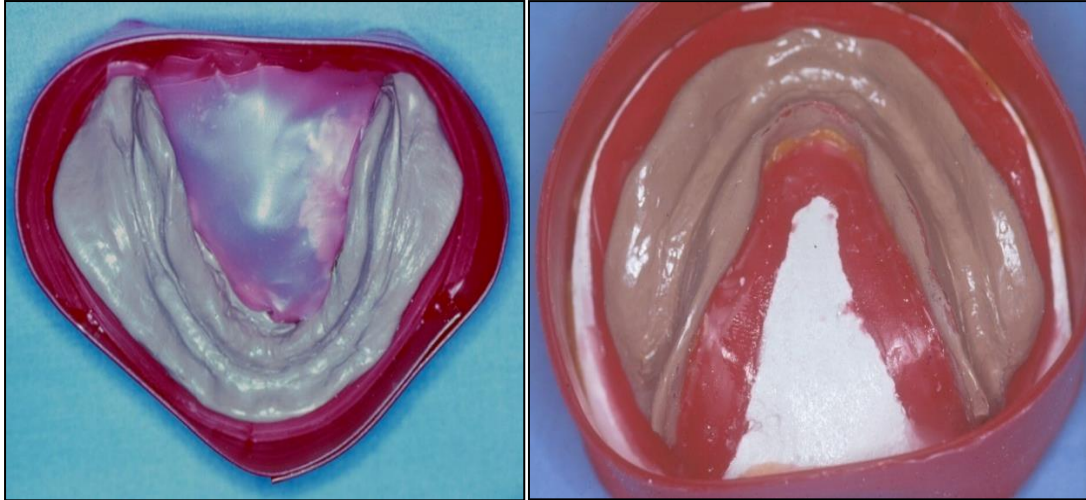


Note: The palatal shelf should be oriented parallel to the bench top and approximately 15-20 mm below the superior periphery of the boxing wax. Prepare a dense mix of yellow stone using your vacuum mixer and gently vibrate the stone into the boxed impression. Be careful to avoid entrapment of air bubbles.

Boxing lower impression and making the master cast



Apply a layer of rubber base adhesive or hot sticky wax to the impression as shown. This layer should be about 3 mm above the height of the border of the impression.



Apply a strip of red beading wax to the sticky wax layer to form the land of the cast. Close the lingual tongue area of the impression with a sheet of wax or with pumice and plaster.

Record Base and Occlusion Rims

Record base: an interim denture base (temporary form) used to support the record rim material for recording maxilla-mandibular records.



Requirements of record base:

1. The record base must have rigidity.
2. The record base must have accuracy and stability.
3. The borders should be developed in the same manner as borders of finished denture.
4. All surfaces that contact lips, cheek and tongue should be smooth, round and polished.
5. The crest, labial and /or buccal slopes should be thin to provide space for teeth arrangement.

The accuracy of maxillo-mandibular relation record is affected by:

- * Rigidity of record base.
- * Stability of record base.
- * The movability of the record bases.
- * The smoothness of the polished surfaces contributes to the comfort of the patient.
- * The more comfortable and compatible the record bases are to the tissues, the more normal are the jaw movements.

Types and materials used in construction of record bases:

- * **Temporary record bases:** They are discarded and replaced by denture base material, once their role in establishing jaw relation, teeth arrangement and try in is complete.

Types of temporary record bases:

1. Shellac base plate.
2. Reinforced shellac base plate.
3. Cold cure acrylic resin.
4. Visible light cure acrylic resin.
5. Vacuum formed vinyl and polystyrene.
6. Base plate wax (rarely used because it lacks rigidity and dimensional stability).

***Permanent record bases:** they are not discarded and become part of the actual base of the finished complete denture.

Types of permanent record bases:

1. Heat cure acrylic resin.
2. Gold.
3. Chromium-cobalt alloy.
4. Chromium-nickel alloy.

Occlusion Rims (record or bite rim)

Occlusion rim: the occlusal surfaces fabricated on record bases for the purpose of making maxillomandibular relationship records and/or arranging teeth - called also occlusion rim.

Requirements of occlusal rim:

1. The position should be in the anticipated position of the artificial teeth.
2. It must be securely attached to the base.
3. The occlusal surface must be smooth and flat.
4. It should be contoured to support the lip and cheeks accurately.
5. All the surfaces should be smooth.

Materials used in construction of occlusal rims:**1. Wax:**

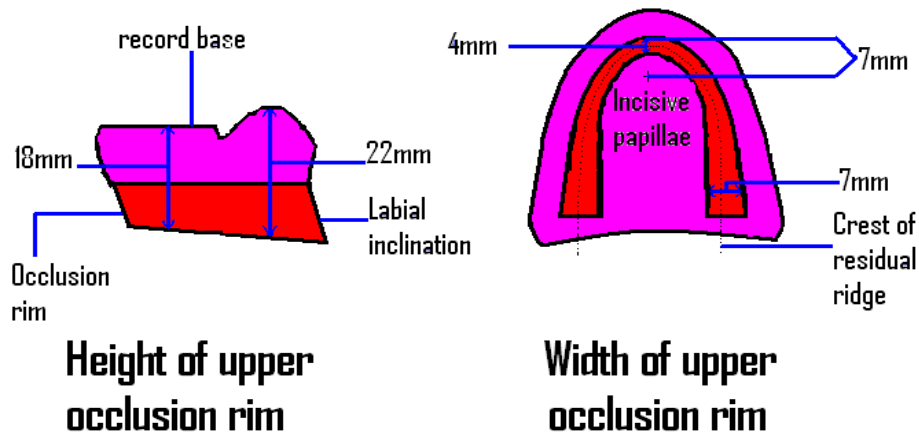
- a. Bite blocks wax (readymade occlusion rim).
- b. Paraffin wax or base plate wax sheets (hand made occlusion rim).

2. Modeling compound.

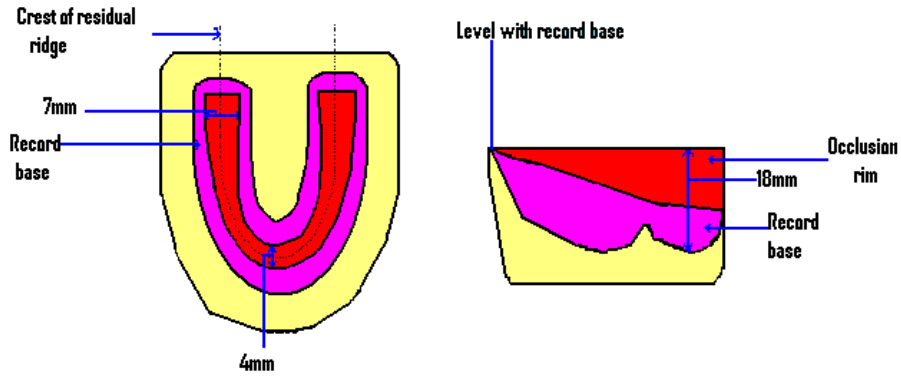
Wax is used more frequently, since it is easier to manage in the registrations and in the arrangement of teeth.

Measurements of maxillary occlusion rim:

1. The maxillary rim should have a slight labial inclination and the maxillary labial surface should be 7 mm anterior to the line bisecting the incisive papillae.
2. The final wax rims should be 4 mm wide anterior and gradually, become wider posterior to measure 7 mm.
3. They should be directly over the crest of the residual ridges.
4. The occlusal height of maxillary rim should be 22 mm from the labial flange lateral to the labial frenum and 18 mm from the buccal flange to the tuberosity area.

**Measurement of mandibular occlusion rims:**

1. It should occupy the space over the crest of the residual ridge.
2. The occlusal height should be 18 mm from the labial flange lateral to the labial frenum and should be level with the acrylic base posteriorly.
3. The labio-lingual thickness should approximately 4 mm anteriorly and also increase posteriorly to be 7 mm in molars area.



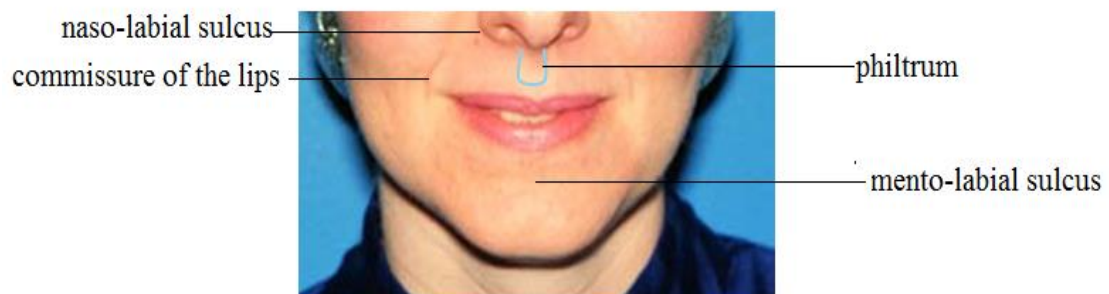
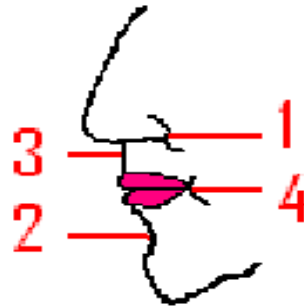
Width of lower occlusion rim

Height of lower occlusion rim

All above points regards in the laboratory work, while in patient mouth we have other guides used in occlusion rims construction.

The best anatomic guides to aid in determining the proper contouring of anterior section of upper and lower occlusion rims:

1. The naso-labial sulcus.
2. The mento-labial sulcus.
3. The philtrum.
4. The commissure of the lips.

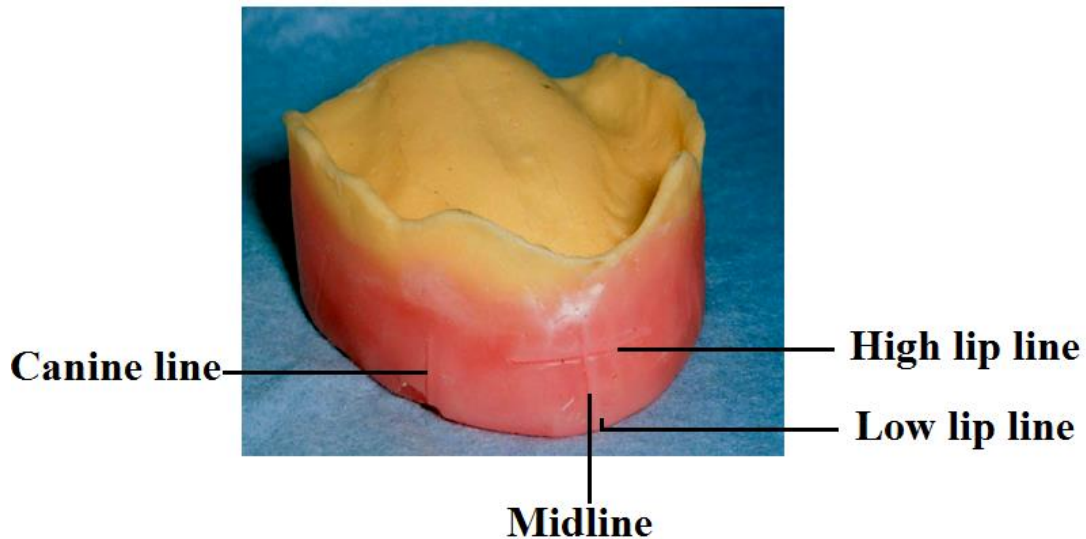


Uses of occlusion rims:**1. In determination of jaw relation which include:**

- a. Determination of the vertical dimension.
- b. Determination of the centric and eccentric jaw relation.

2. In selection of teeth:

- a. The position of midline can be determine
- b. Canine line (cuspid line) is drawn on occlusal rim at the corner of mouth on each side when occlusion rims seated in mouth and in occlusion.
- c. Width of 6 anterior teeth is equal to distance between the 2 canine lines.
- d. The width of posterior teeth is equal to distance between the canine line and end of wax rim posterioly.
- e. The high length of anterior teeth is determined by drawing high lip line (gum line, or smiling line) .When patient smiling; the whole of anterior incisor should be seen.
- f. The low lip line (speaking line, or relaxed lip line) is a line drawn on wax rim when lip is relax, in this case 2 mm of anterior teeth should be seen.

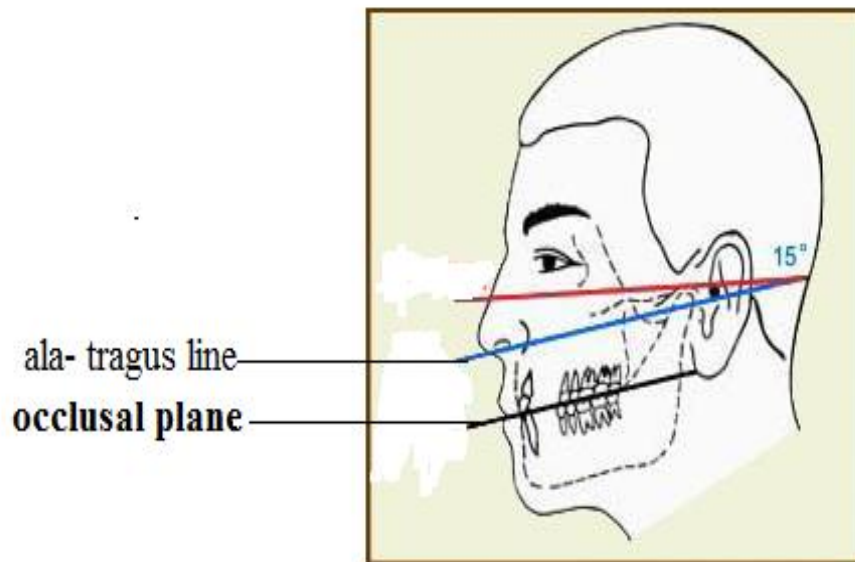
**3. Setting up of teeth.****4. Orientation of occlusal plane.****5. Determination of shape of arch.****6. Support of the facial musculature.**

Occlusal plane

The average plane established by the incisal and occlusal surfaces of the teeth. Generally, it is not a plane but represents the planar mean of the curvature of these surfaces.

It's an imaginary surface which is related anatomically to the cranium and theoretically attached the incisal edges of the incisors and the tips of the occluding surfaces of posterior teeth.

The height of the occlusal plane (the vertical length of maxillary occlusion rim anteriorly) should be 1-2 mm below the relaxed upper lip and this will be different from patient to other and affected by the age of the patient and type of the lip. Generally there are 1-2 mm showing from the incisors in the average dentulous patient but each case should be considered separately in relation to the height of the lip, age of the patient and sex of the patient, e.g. for the patient that have long lip the height of the occlusal plane should be with the border of the upper lip, while for the patient with short lip there is more than 2 mm showing from upper lip. So each case should be considered separately for best appearance.

**Fox bite (Fox plane guide)**

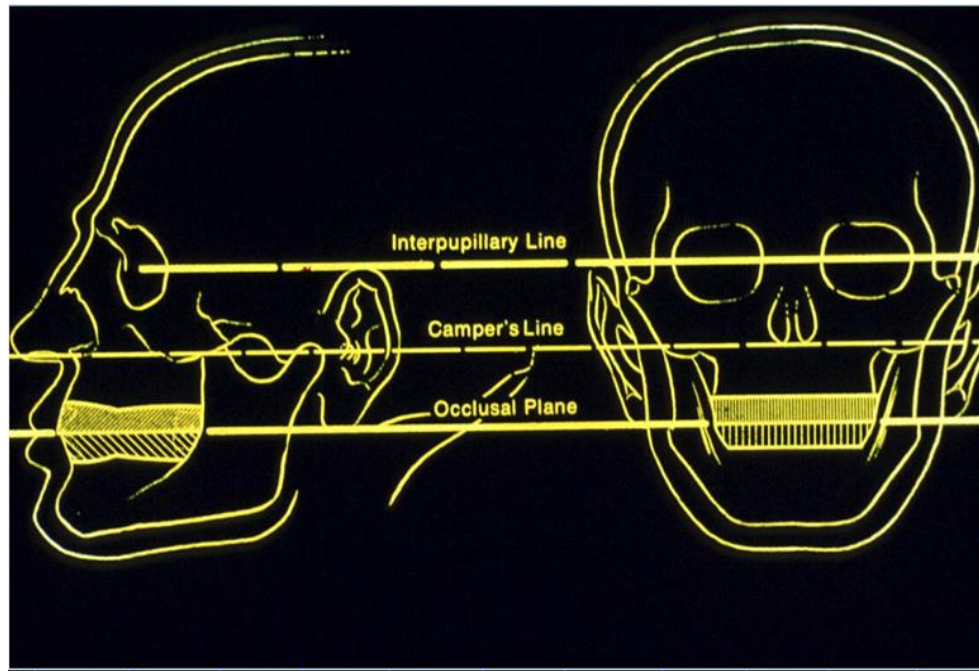
An appliance used to check the parallism of the wax occlusal rim anteriorly and posteriorly.

Lecture 6

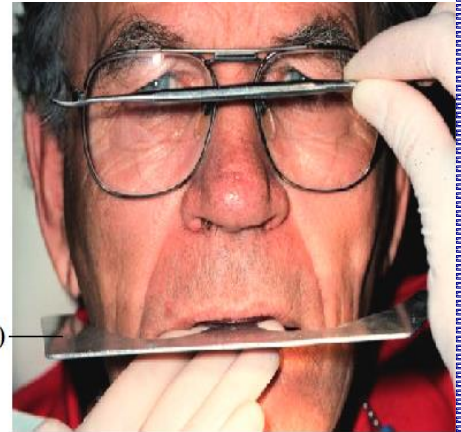
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*The **anterior part** of the wax rim should be parallel to the **interpupillary line** (this is an imaginary line running between the centers of the two pupils of the eyes when the patient is looking straight forward).

***Posteriorly** the occlusal plane starting from the canine region backward should be parallel to the (**Camper's line**), this is a line running from the ala of the nose to the superior border of the tragus of the ear (Ala-tragus line).



Fox bite



Fox bite (Fox plane guide)
anteriorly parallel with
inter-papillary line



Posteriorly the occlusal plane starting from the canine region backward should be parallel to the **Camper's line**.

MAXILLARY WAX RIM

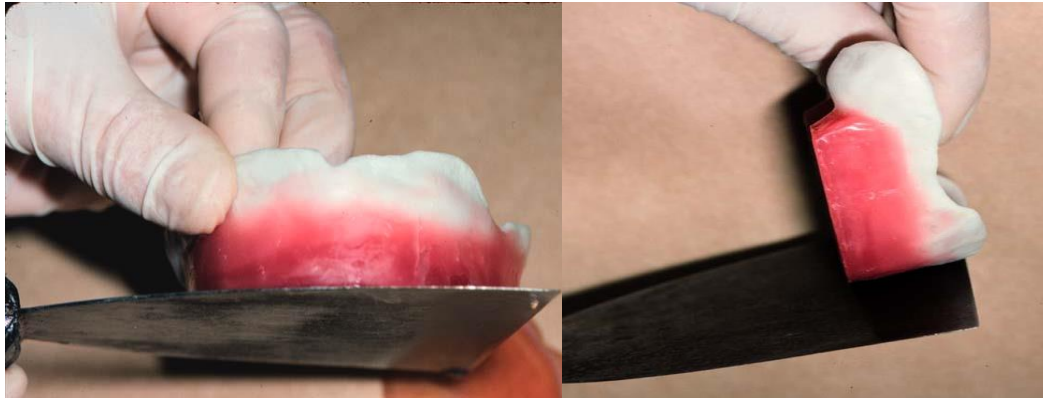
Main Menu

Technique


- Place maxillary record base on the cast.
- Heat a sheet of baseplate wax in the Bunsen burner until the wax is very pliable.
- Roll the wax into long tube.
- Starting at the tuberosity, press the roll of wax against the crest of the ridge.
- Seal the wax to the record base with a hot wax spatula. If necessary, fill in voids with additional wax.

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Paraffin wax or base plate wax sheets (handmade occlusion rim)



MAXILLARY WAX RIM [Main Menu](#)



- All surfaces of the wax rim must be smooth and free of voids
- The posterior section of the rim should be tapered to avoid contact with the retromolar pad
- The curvature of the anterior portion must simulate the curvature of the edentulous arch

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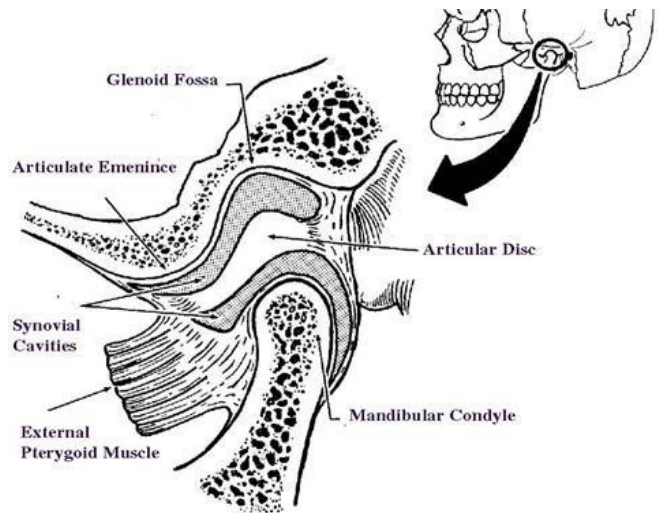
Bite blocks wax (readymade occlusion rim)

ANATOMY AND PHYSIOLOGY OF TEMPOROMANDIBULAR JOINT

Temporomandibular joint (TMJ): Is the articulation of the condyloid process of the mandible and the inter-articular disk with the mandibular (glenoid fossa) of the temporal bone.

The TMJ consists of the following parts:

1. The mandibular or glenoid fossa.
2. The condyle or head of the mandible.
3. The articular disc or "Meniscus" which is found between the condyle and the glenoid fossa. It divides the synovial joint or TMJ into upper (superior) and lower (inferior) compartments.
4. Synovial cavity.



The differences between TMJ and other Joints in the body are:

1. **TMJ has an articular disc which completely divides the joint spaces into upper and lower joint compartments.**
2. **TMJ is Ginglymoarthrodial Joint.**
 - a. **Hinge action (Rotation)**
 - b. **Slide Action (translation)**
3. **Relationship of teeth affects the relationship of the articulating components.**
4. **The mandible is the only bone in the body hinged on both ends that is not capable of independent movement at one ends.**

The ligaments that affect the movement of the mandible consist of:

1. Temporomandibular and capsular ligaments.
2. Sphenomandibular ligament.
3. Stylomandibular ligament.

The mandibular bone has specific relationships to the bones of the cranium. The mandible is connected to the cranium at the two TMJ by the temporomandibular and capsular ligaments. The sphenomandibular and Stylomandibular ligaments also connect the bones in such a way as to limit some motions of the mandible.

The function of the ligaments is to stabilize the joints by limiting the movements, ligaments do not stretched but it could be elongated and the elongation of the ligament could compromise normal joint function.

The muscles that control the movement of the mandible may be considered in 3 groups:

1. Closing muscles.
2. Gliding muscles.
3. Opening muscle.

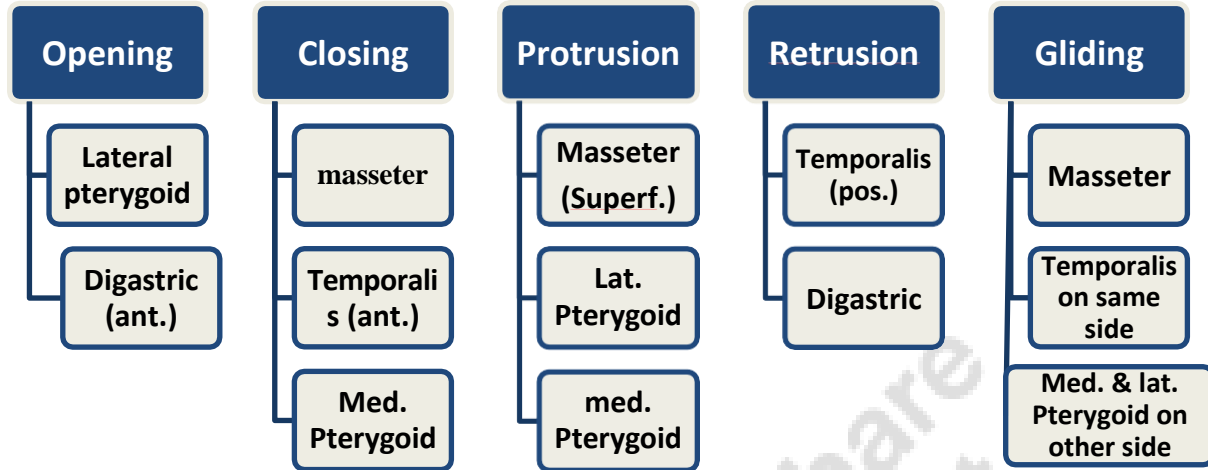
The masseter, temporalis and medial pterygoid muscles supply the power for pulling the mandible against the maxillae (elevating and closing mandible).

The lateral pterygoid muscles connect the mandible to the lateral pterygoid plate in such a way as to act as the steering mechanism for the mandible and act to protrude the jaw or to move it laterally.

While the muscles that depress the mandible (open) consist of four groups, suprahyoid muscle, platysma muscles, infrahyoid muscles, and lateral pterygoid muscles.

Good prosthodontic treatment bears a direct relation to the structures of the temporomandibular articulation, since occlusion is one of the most important parts of treatment of the patients with complete dentures. The TMJs affect the dentures and likewise the dentures affect health and function of the joints.

Muscular functions

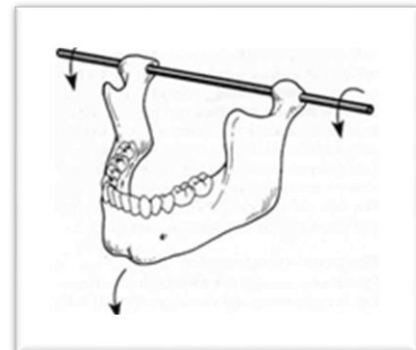


Mandibular Axes & Mandibular Movements:

Mandibular axis: There are three axes around which the mandibular movements take place in horizontal, sagittal and frontal planes. These axes include the followings:

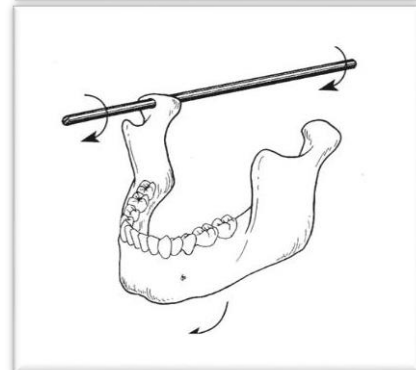
1. **Hinge axis:** or transverse horizontal axis:

An imaginary line around which the mandible may rotate within the sagittal plane. (During the opening and closing movement).



2. **Sagittal axis of the mandible :**

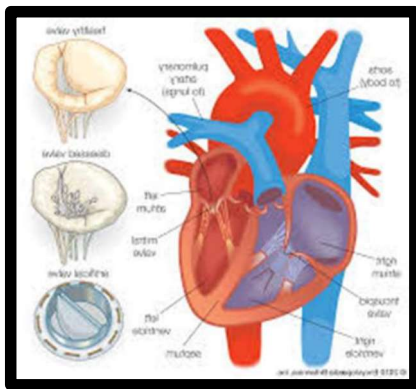
An imaginary anteroposterior line around which the mandible may rotate when view in the frontal plane.



Prosthetics: The art and science of supplying artificial replacements for missing parts of the human body.

Prosthodontics (Prosthetics dentistry): Is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation and maintenance of the oral function, comfort, appearance.

Prosthesis: An artificial replacement of an absent part of the human body.



Dental prosthesis: An artificial replacement of one or more teeth (up to the entire dentition in either arch) and associated dento / alveolar structures.

Fixed dental prosthesis: Any dental prosthesis that is luted, screwed or mechanically attached or otherwise securely retained to natural teeth, tooth roots, and/or dental implant abutments that furnish the primary support for the dental prosthesis. This may include replacement of one to sixteen teeth in each dental arch.

Fix dental prosthesis

Removable dental prosthesis: Any dental prosthesis that replaces some or all teeth in a partially dentate arch (Partial removable dental prosthesis) or edentate arch (complete removable dental prosthesis). It can be removed from the mouth and replaced at will.

**Removable partial denture**

Complete denture: A removable dental prosthesis that replaces the entire dentition and associated structures of the maxillae or mandible, called a complete removable dental prosthesis.



- **Objectives of Complete denture:**

1. Restoration of the function of mastication.
2. Restoration of the disturbed facial dimension and contours. (esthetics)
3. Preservation of the remaining tissues in health.
4. Satisfaction, pleasing and comfort of the patient.
5. Correction of speech due to the loss of natural teeth.

- **General consideration in CD construction:**

- 1. From the operator.**

- a. Certain degree of diagnostic skills.
- b. Sound knowledge of biological and mechanical principles.
- c. Certain degree of artistic ability.
- d. Careful manipulation of dental materials and devices.

- 2. From the patient:**

- a. Co-operation with the dentist.
- b. Some understanding of the limitation of prosthetic restoration.
- c. Patience during the construction, learning and adjustment of the new prosthesis.

- 3. From the technician.**

There should be co-operation between clinical and technical procedures.

Complete denture is composed of the following:**1. Basal or impression surface.**

The part of a denture that rests on the foundation tissue and to which teeth are attached.

2. Denture occlusal surface.

The portion of the surface of a denture that makes contact with its antagonist.

3. Denture polished surface

The portion of the denture surface that extend in an occlusal direction from the border of the denture and include the palatal surface. It is usually polished and includes the buccal and lingual surfaces of the teeth.

4. Denture border.

The margin of the denture base at the junction of the polished surface and the impression surface.

5. Denture flange.

The part of the denture base that extends from the cervical ends of the teeth to the denture border.

ANATOMICAL LANDMARKS IN THE MANDIBLE

They can be broadly grouped into:

Limiting Structures

- Labial frenum.
- Labial vestibule.
- Buccal frenum.
- Buccal vestibule.
- Lingual frenum.
- Alveololingual sulcus.
- Retromolar pads.
- Mylohyoid ridge.
- External oblique line.

Supporting Structures

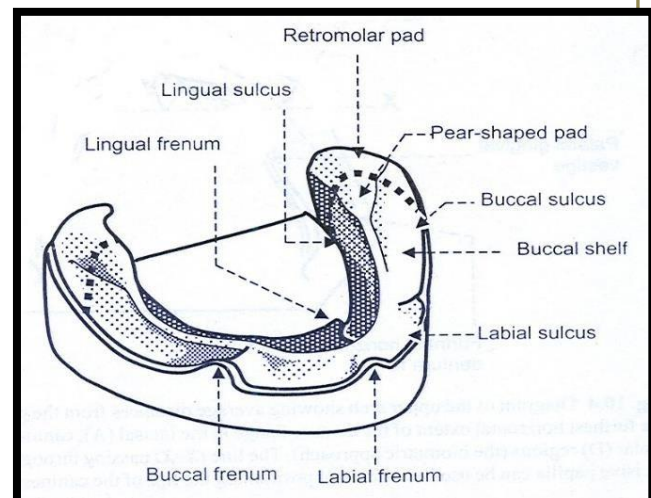
- Buccal shelf area
- Residual alveolar ridge

Relief Areas

- Crest of the residual alveolar ridge.
- Mental foramen.
- Genial tubercles
- Torus mandibularis.

Labial Frenum

It is a fibrous band similar to that found in the maxilla. Unlike the maxillary labial frenum, it is active. The mandibular labial frenum receives attachment from the orbicularis oris muscle. Hence, it is quite sensitive and active. On opening wide, the sulcus gets narrowed.



Labial frenum

**Labial Vestibule**

This is the space between the residual alveolar ridge and the lips. The length and thickness of the labial flange of the denture occupying this space is important in influencing lip support and retention.

Buccal Frenum

The fibers of the buccinator are attached to the frenum. It should be relieved to prevent displacement of the denture during function.

Buccal Vestibule

It extends posteriorly from the buccal frenum till the retromolar region. It is bound by the residual alveolar ridge on one side and buccinator on the other side.

**Lingual Frenum**

It is a fold of mucous membrane that can be observed when the tongue is elevated, extending along the floor of the mouth to the under surface of the tongue. It will produce the lingual notch in the denture. This frenum is activated when the tongue

is moved therefore it must be molded well in the impression to prevent displacement of the denture or ulceration of the tissue.



The height and width of the frenum varies considerably. Relief should be provided in the anterior portion of the lingual flange. This anterior portion of the lingual flange is called *sub-lingual crescent area*

Alveololingual Sulcus

It extends from the lingual frenum to the retromylohyoid curtain. It is considered in three regions namely:

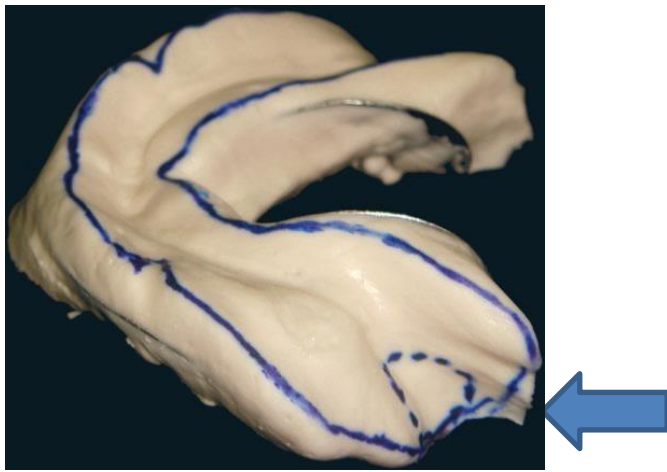
Anterior region It extends from the lingual frenum to the premylohyoid fossa, where the mylohyoid curves below the sulcus. The flange will be shorter anteriorly and it should touch the mucosa of the floor of the mouth when tip of the tongue touches the upper incisors.

Middle region It extends from the pre-mylohyoid fossa to the distal end of the mylohyoid ridge. This region is shallower than other parts of the sulcus. This is due to the prominence of the mylohyoid ridge and action of the mylohyoid muscle.

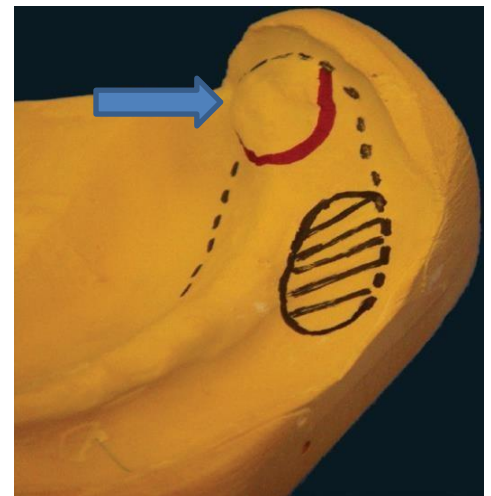
Posterior region The retro-mylohyoid fossa is present here. The denture flange in this region should turn laterally towards the ramus of the mandible to fill up the fossa and complete the typical S-form of the lingual flange of the lower denture.

Retromolar Pad (Pear-Shaped Pad):

The retromolar pad, is soft elevation of mucosa that lies distal to the third molar. It contains loose connective tissue with an aggregation of mucous glands and is bounded posteriorly by the temporalis tendon, laterally by the buccinators and medially by the pterygomandibular raphe and the superior constrictor muscle. The retromolar pad is quite important for the support and the peripheral seal.



(a)

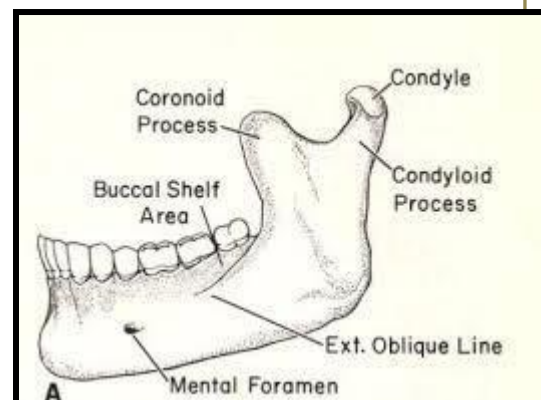


(b)

The arrows shows the retromolar pad area on (a) impression and (b) cast.

External oblique ridge:

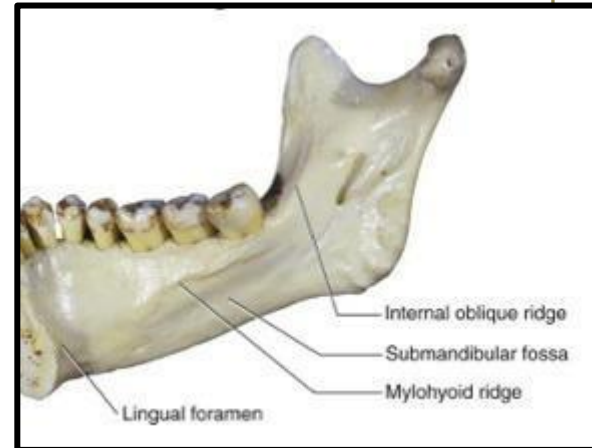
It is a ridge of dense bone extended from just above the mental foramen superiorly and distally to be continuous with the anterior border of the ramus. In some patient this ridge becomes a guide for the termination of the buccal flange of the denture.



Mylohyoid ridge:

It is an irregular bony crest on the lingual surface of the mandible. This ridge is near the inferior border of the mandible in the incisor region but becomes

higher posteriorly until it terminates near the 3rd molar area; it is the area where the mylohyoid muscle arises to the floor of the mouth. The border of the lingual flange may extend below the mylohyoid line if it slopes toward the tongue.

**Relief area:****1. Mental Foramen:**

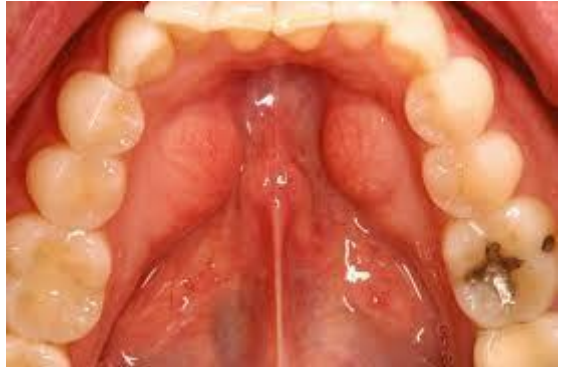
It is located on the external surface of the mandible between the 1st and 2nd premolar area. In case of severe resorption of residual ridge, the denture should be relieved over the foramen to prevent pressure being applied on the mental nerves and blood vessels.

2. Genial tubercle:

These are a pair of bony tubercles found anteriorly on the lingual side of the body of the mandible. Due to resorption, it may become increasingly prominent making denture usage difficult.

3. Torus Mandibularis:

It is an abnormal bony prominence found bilaterally on the lingual side, near the premolar region. It is covered by a thin mucosa. It has to be relieved or surgically removed as decided by its size and extent.



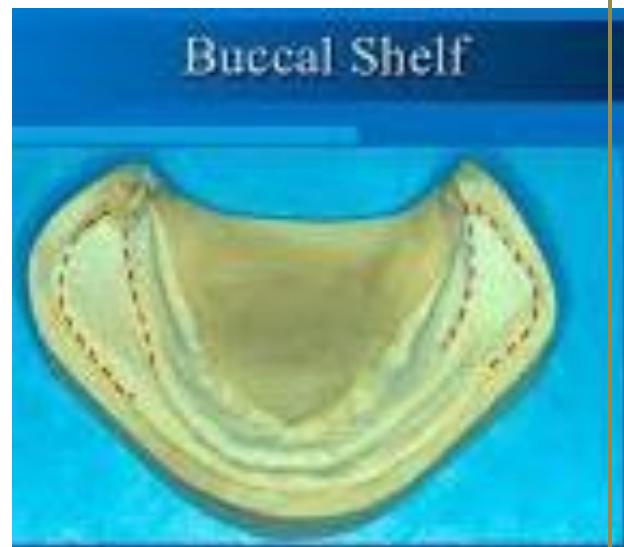
Supporting Structures:

The mandibular denture poses a great technical challenge. The support for a mandibular denture comes from the body of the mandible. The available denture-bearing area for an edentulous mandible is 14 cm² but for maxilla it is 24 cm².

Buccal Shelf Area:

It is the area between the buccal frenum and anterior border of the masseter. Its boundaries are:

- Medially the crest of the ridge
- Distally the retro-molar pad
- Laterally the external oblique ridge.



Residual Alveolar Ridge:

The bony process that remains after loss of teeth is known as residual alveolar ridge bone. The size and shape of the ridge varies from one patient to another. The bone of crest of lower residual ridge being made of spongy bone therefore may not be favorable as a primary stress bearing area for the lower denture. It won't provide stability or support to the denture.



Crest of mandibular residual ridge

Complete denture impression

Impression Trays

In complete denture prosthesis we make two impressions for each patient: a primary impression and final or secondary impression. To make an impression we should have impression tray.

Impression tray: it is a device used to carry, confine and control the impression material from the patient's mouth while making an impression. During impression making, the tray facilitates insertion and removal of impression material from the patient's mouth.

Parts of the impression tray:

Impression tray consists of two main parts:

1. Body: it is consisting of:

- * Floor
- * Flanges

2. Handle:

The handle is an extension from the union of the floor and labial flange in the middle region (midline), it's (L) in shape so that it will not interfere with lip during impression procedure.

* There are upper tray to make impression of maxillary arch and lower tray to make impression of mandibular arch.

* The difference between them is that in the upper tray, there is the palatal portion we called (vault) and in the lower tray there is the lingual flanges.



Types of trays

There are 2 main types:

- 1. Stock trays:** These are used for primary impression procedure.
- 2. Special trays or individual trays:** These are used for final impression procedure.

1. Stock trays: Impression trays serve to carry the impression material to the mouth and support it in the correct position while it is hardening. This type of the trays can be used for several patients and used for making primary impression.

They are made of different materials such as aluminum, stainless steel, tin, brass or Plastic, in variety of shapes, size were made to fit different mouths.

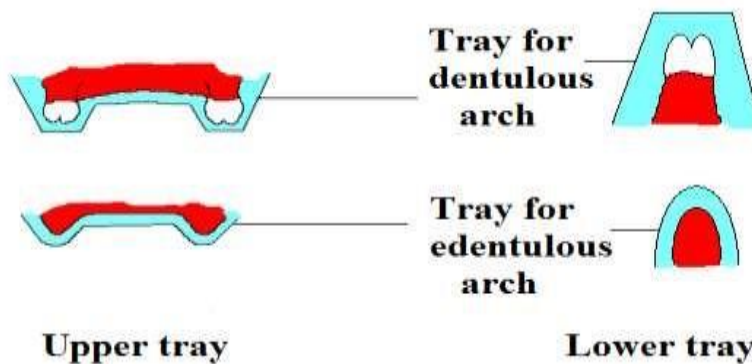
Types of stock trays

A. Stock tray for dentulous patient

B. Stock tray for edentulous patient

*We can distinguish between them by: stock trays for dentulous patient have long flanges, wide and flat floor, while the other have short flanges, oval and narrow floor.

*Tray with combination flat and oval floor is suitable for partial denture work.



Stock trays can be classified according to impression material in to two types:

1. Perforated stock tray.

a. Perforated stock tray without rim lock.


b. Perforated stock tray with rim lock (rim lock stock tray).

These types used with alginate impression material.

2. Non - perforated stock tray.

- a. Non - perforated stock tray without rim lock used with impression compound.
- b. Non - perforated stock tray with rim lock used with alginate impression material.

Factors effect in selection of stock tray

1. The type of impression material used in the primary impression procedure. Example; with impression compound we used non-perforated tray because it will be stick on the tray. And if we use alginate impression material we should use perforated stock tray.
2. Size of the arch.
3. Form of the arch. (Round, square and taper). 
4. The stock tray must cover all the anatomical landmarks needed in complete denture and this is a most important point.
5. Stock tray should give a sufficient space to impression material in all direction (the stock tray should leave sufficient room or space for impression material 4-5mm).

2. Special tray (Individual or custom tray): An individualized impression tray made from a cast recovered from primary impression. It is used in making a final impression.

Special tray is constructed on the primary cast. As edentulous ridge show variations of shape and size (some have flattened ridges and other have bulky ridge), for this reason stock tray can fit the ridge only in an arbitrary manner, so special tray is constructed.

Advantages of special trays

1. Economy in impression material (used less impression material required in special tray).
2. More accurate impression.
3. Special tray provides even thickness of impression material. This minimizes tissue displacement and dimensional changes of impression material and produce impression with correct extension.
4. The work with special tray is easier and quicker than modifying stock tray to provide accurate impression.

5. Special tray is more accurately adapted to the oral vestibules, this helps in better retention of denture.
6. Special tray is less bulky than stock tray which is more comfortable for the patient.

Materials used for construction of special tray

The special tray can be constructed by the use of different materials; this is depending on the type or technique of impression taking. It can be constructed from:

1. Cold cure acrylic resin or self-cure acrylic resin or auto-polymerizing acrylic resin (more common).
2. Visible light cured acrylic resin (VLC).
3. Shellac base plate.
4. Impression compound (some time).
5. Heat cure acrylic resin (rarely).

Types of special tray

We have two types of special tray:

1. Spaced special tray (with or without stoppers).
2. Closed fitted special tray.

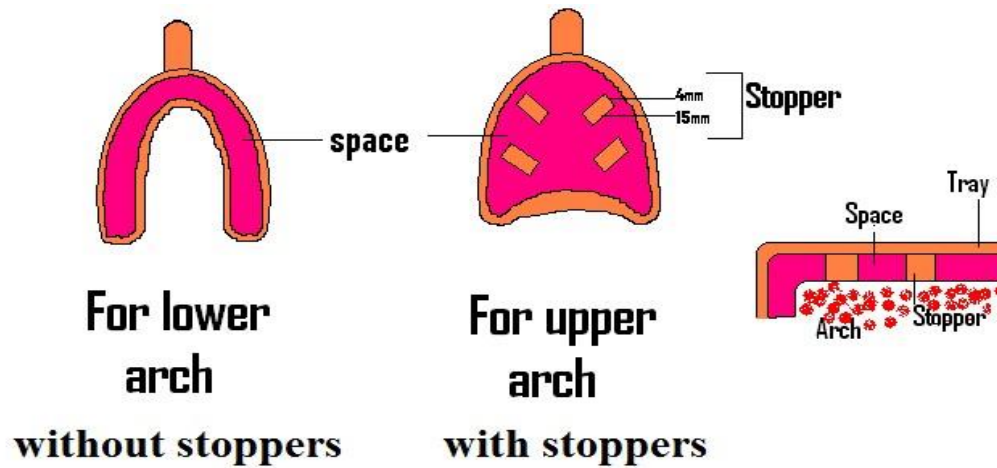
Techniques or methods for construction of special trays

1. Finger adapted dough method.
2. Sprinkle-on acrylic method.

Finger adapted dough method

*In **special tray with stoppers** we should have 4 stoppers, 2 at anterior area (canine area) and 2 at posterior area (first molar area) in both sides. A baseplate wax sheet 1mm in thickness is adapted on the cast (after heating the wax) and a window open on the wax sheet in area of stoppers by removing the wax to make the stoppers and then put a uniform layer of selfcure acrylic resin upon it. When we remove the wax, there is a space with 4 stoppers which will stop the special tray in the mouth of the patient and stop the pressure on the material during make the impression.

*While **for spaced one without stopper**, a baseplate wax 1mm in thickness is adapted on the cast (after heating the wax) then put the acrylic resin on it, when the wax is removed there is space without stoppers.



* In **close fit special tray** we used only separating medium on study cast and a self-curing acrylic resin tray material is mixed and uniformly adapted over the cast, so that the tray will be about 2-3 mm in thickness.

Acrylic resin handle is attached in the anterior region of the tray to facilitate removal of the final impression.

Sprinkle- on acrylic technique

This technique used for construction of individualized impression tray.

1. Eliminate undercuts on the cast with a thin coat of wax.
2. Paint cast with separating medium (cold mold seal).
3. Place acrylic resin powder (polymer) in a container with a perforated top (like a salt shaker). Place the (liquid) monomer in a dappen dish.
4. Shake the polymer on the border area. With a glass medicine dropper, add monomer to the saturation point. Continue to build this over the entire denture – bearing area to thickness that will yield a rigid tray (a minimum of 2.5 mm).
5. Just before the final polymerization, remove the tray, reseal on the cast and allow complete polymerization.
6. Reduce the borders to coincide with the outline on the cast (2 mm under extended).
7. Roughen the ridge area on the top of the tray anteriorly at the midline, then make a handle from acrylic resin and attach to the tray at this area.

Criteria for Special tray construction:

1. The impression tray must not impinge upon movable structures.
2. The borders must be under extended (2 mm).
3. The posterior limits of the impression tray should be slightly over-extended to ensure inclusion of the posterior detail for development of the post-dam area in upper tray.
4. The tray should be rigid and of sufficient thickness that it will not fracture during its use.
5. The tray must have a handle for manipulation and the handle must not interfere with functional movement of the oral structures.
6. The tray must be smooth on its exposed surfaces, and should have no sharp edges which would injure the patient.

Finger adapted dough method

[Main Menu](#)

Mix approximately $\frac{1}{4}$ cup of tray resin for each tray.
Apply a thin layer of vaseline to your fingers.

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Wait for the material to get to a doughy consistency before you apply it to the template. Press material with a glass slab to obtain the proper thickness.

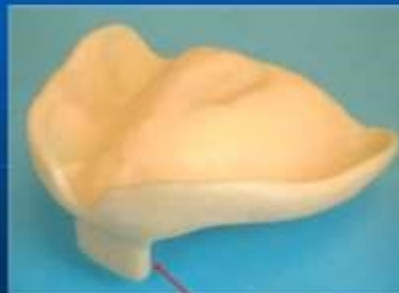


- Adapt the resin material to the cast as shown
- Trim excess with knife
- Place additional resin to create handles
- Allow resin to polymerize



Maxillary tray check list

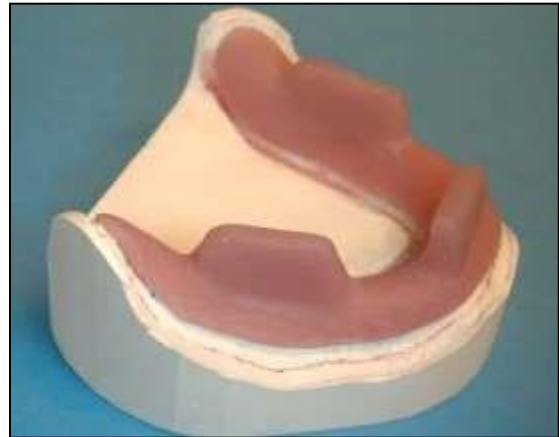
Tray periphery should be 2-3 mm thick. The edges should be rounded. The rest of the tray should be about 1-2 mm in thickness.



Tray handle - 10mm high

Sprinkle- on acrylic technique

Sprinkle-on technique of resin addition.



ANATOMICAL LANDMARKS

A good knowledge about the intra-oral landmarks for the maxillary and mandibular arch will help the clinician to carefully manage a patient and it will act as positive guides to the limit of the impression and denture extensions.

The intra-oral anatomical landmarks divided into:

1. Maxillary arch anatomical landmarks: which is divided into:

- a. Supporting structures
- b. Limiting structures
- c. Relief areas

a. Supporting structures:

1. Residual alveolar ridge
2. Maxillary tuberosity
3. Incisive papilla
4. Rugae area
5. Median palatal raghae
6. Canine eminence
7. Zygomatic process
8. Hamular notch
9. Torus palatinus

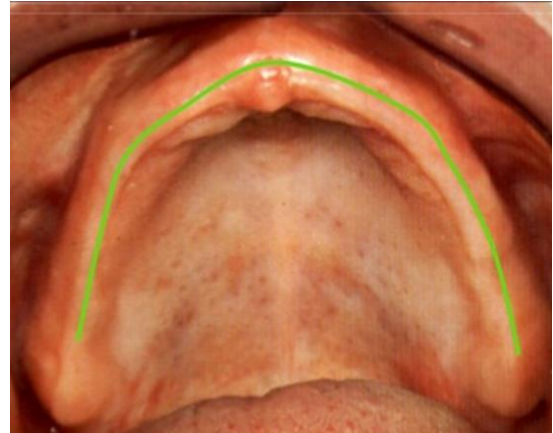
Support is the resistance to the displacement towards the basal tissue or underlying structures and it can be Primary stress bearing areas or supporting area represented by the horizontal portion of the hard palate lateral to the midline and Slopes of residual alveolar ridge and a Secondary stress bearing area or supporting areas represented by Rugae area and Maxillary Tuberosity.

1. Residual alveolar ridge:

The bony process that remain after teeth have been lost is known as **Residual alveolar ridge** which is covered by mucous membrane.

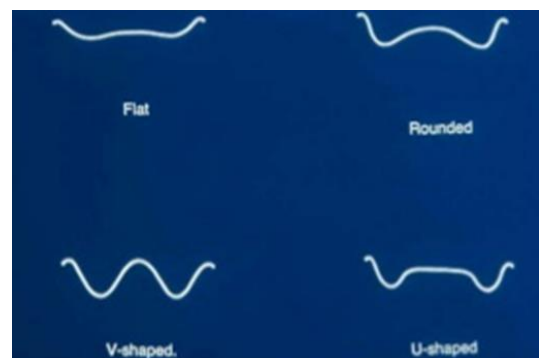
The Residual alveolar ridge considered to be as a primary stress bearing area.

And it will produce the ridge fossa or groove in the impression or denture.



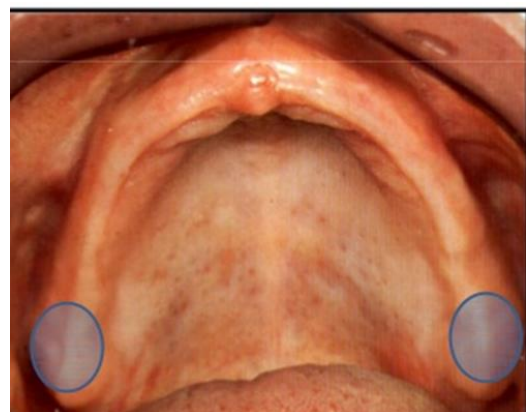
Types of Residual alveolar ridge:

- a. Flat
- b. Rounded
- c. V Shape
- d. U Shape



2. Maxillary tuberosity

It is the area of the alveolar ridge that extends distally from the second molar to the hamular notch in some cases it may be very large in size and not allow for proper placement of the denture so may need surgical interferences.



Maxillary tuberosity may be oversized, resorbed or undercut areas; in case of oversized and undercut type surgical corrections may be needed.

3. Incisive papilla

It is a pad of connective tissues lies between the two central incisors on the palatal side overlying the incisive foramen of the nasopalatine duct where the nasopalatine nerves and vessels arise. In an edentulous mouth



it may lie close to the crest of the residual ridge. Relief over the Incisive papilla should be provided in the Denture to avoid pressure on the nerve and blood supply.

4. Rugae area

These are raised areas of dense connective tissue in the anterior One-third of the palate. It aid in the formation of vocal sound also regarded as a secondary stress bearing area.

5. Median palatal raghae

It overlies the medial palatal suture; extend from the incisive papilla to the distal end of the hard palate. The mucosa over this areas is usually tightly attached and thin, the underlying bonny union being very dense and often raised, the palatal tori are located here if present.



6. Canine eminence

It is a round elevation in the corner of the mouth, it represent the location of the root of the canine which is helpful to be use as a guide for the arrangement of maxillary anterior teeth.

7. Zygomatic process

It is located opposite to the 1st molar region, hard area found in the mouth that has been edentulous for long time. Relief over this area may be required to prevent soreness of the underlying tissues.



8. Hamular notch

It is a narrow cleft of loose connective tissue situated between the maxillary tuberosity and the pterygoid hamulus (approximately 2mm antero-posteriorly). It is used as boundary of the posterior border of maxillary denture.

9. Torus palatinus

It is a hard bony enlargement occurs in the midline of the roof of the mouth (hard palate). It is found in 20% of some patient, surgical correction may be needed if the tori very large.

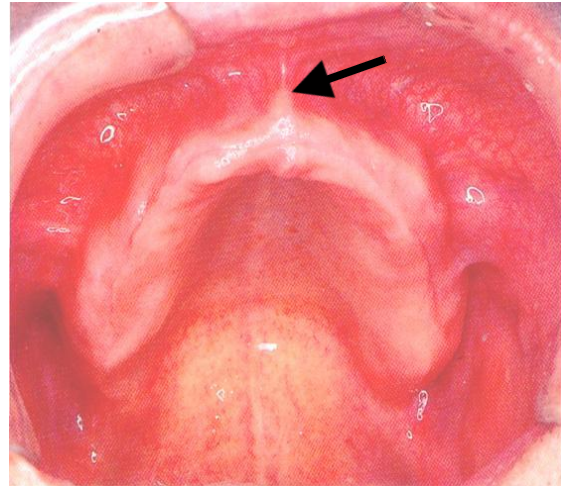
b. Limiting structures:

1. Labial frenum
2. Buccal frenum
3. Labial vestibule
4. Buccal vestibule

5. Foveae palatinae
6. Vibrating line

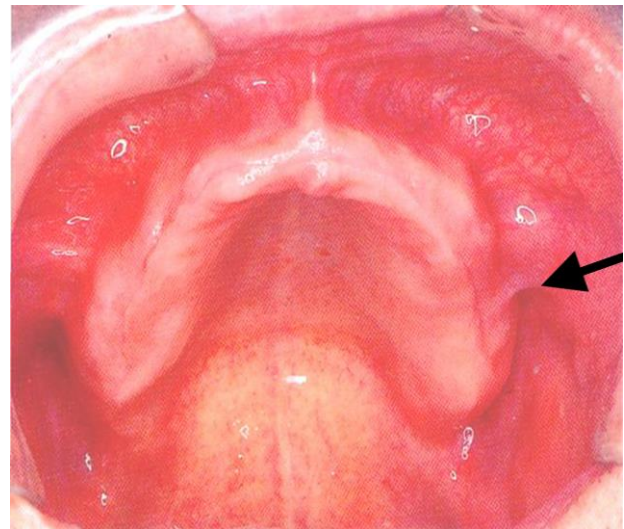
1. Labial Frenum

It is a fold of mucous membrane extends from the mucosal lining of upper lip to the labial surface of the residual ridge. The Frenum may be single or multiple, narrow or broad. It contains no muscle fibers and insert in a vertical direction which creates a maxillary labial notch in the maxillary impression or denture.



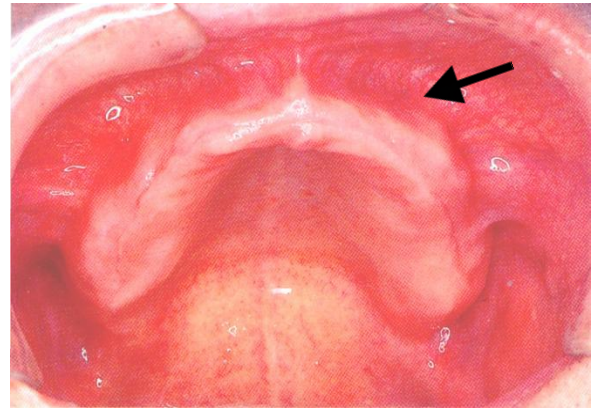
2. Buccal Frenum

A fold or folds of mucous membrane varies in size and shapes. It extends from the buccal mucous membrane reflection area toward the slope or crest of the residual alveolar ridge. It contains no muscle fibers and its direction antero-posteriorly. It produce the maxillary buccal notch in the maxillary impression or denture which must be broad enough because of the movement of the Frenum which is affected by some of the facial muscles as the orbicularis muscle pull it forward while buccinator muscle pull it backward.



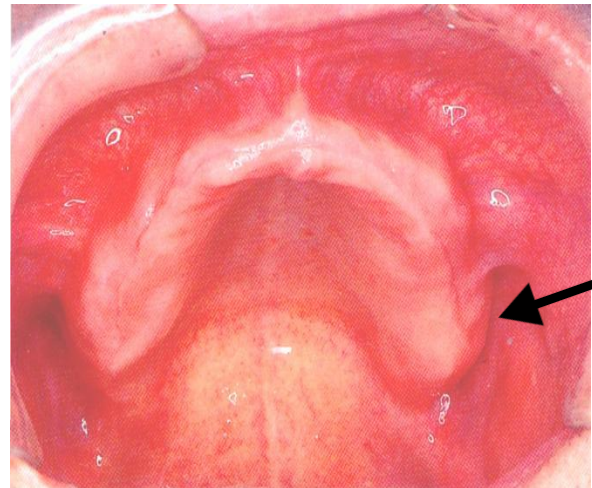
3. Labial vestibule

It extends on both sides of the labial frenum to the buccal frenum, bounded by the upper lip and residual alveolar ridge. The reflection of the mucous membrane superiorly determines the height of the vestibule. It contains no muscle fibers. In the denture the area that fills this space is known as labial flange.



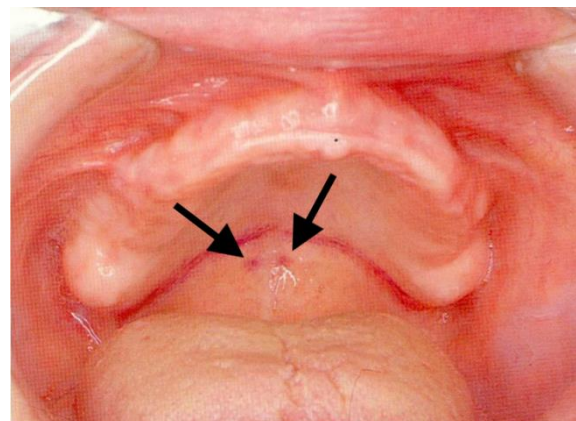
4. Buccal vestibule

Is the space distal to the buccal frenum. It is bounded laterally by the cheek and medially by the residual alveolar ridge. The area of the denture which will fill this space is known as buccal flange. The stability and retention of a denture are greater enhanced if the vestibule space properly filled with the flange distally.



5. Fovea palatinae

These are two indentations on each side of the midline formed by a coalescence of several mucous gland ducts. They act as a guide in the location of the vibrating line of the posterior border of the denture.

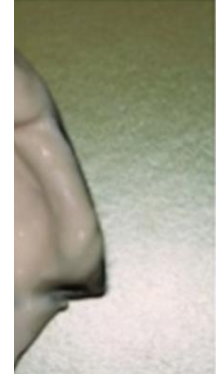
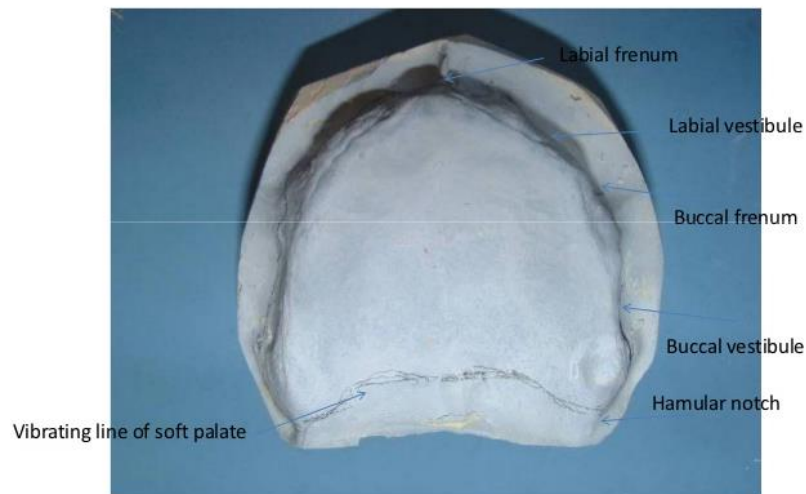


6. Vibrating line

An Imaginary line drawn across the palate extended from one hamular notch to the other. It is not well defined as a line; therefore it is better to describe it as an area rather than a line. The direction of the line varies according to the shape of the palate in the denture. The posterior border of the denture known as posterior palatal seal area.

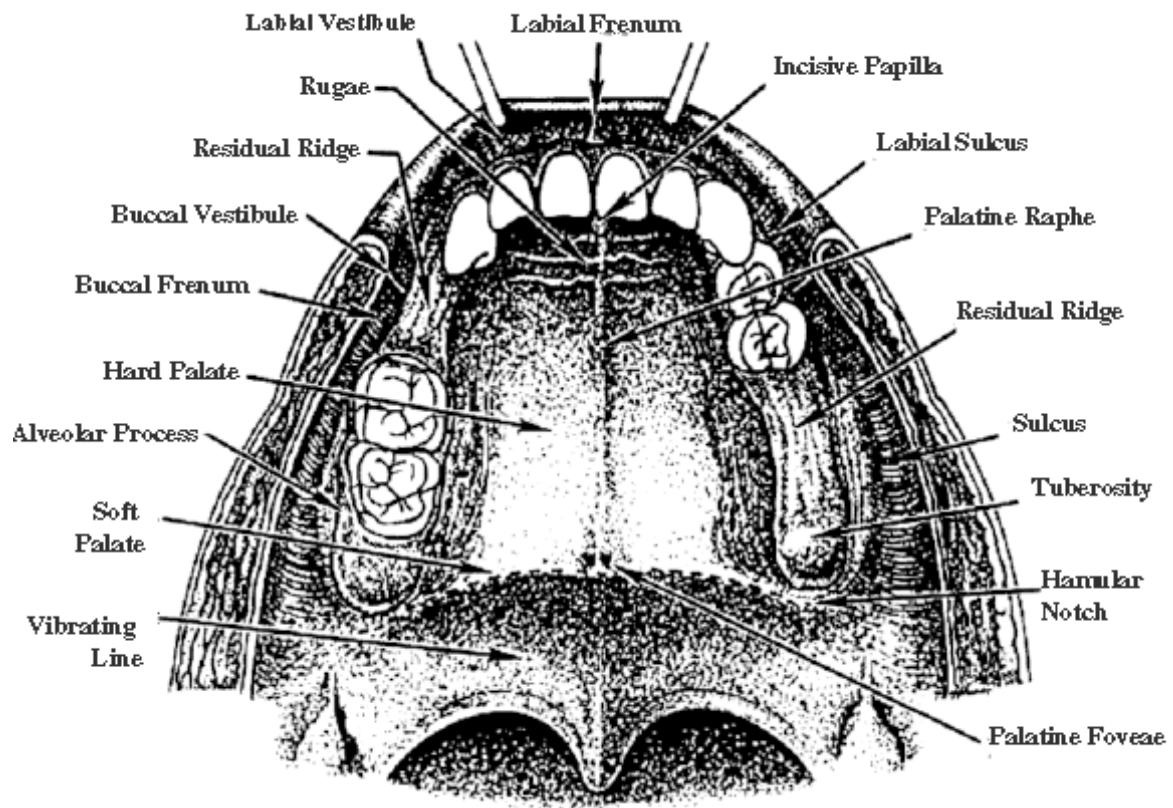


Limiting structures of maxillary denture



C. Relief Areas:

1. Incisive papilla
2. Mid-palatine raphe
3. Crest of the residual alveolar ridge
4. Cuspid eminence
5. Zygomatic Process



Anatomical Landmarks of the maxillary arch

Maxillo-mandibular Relation

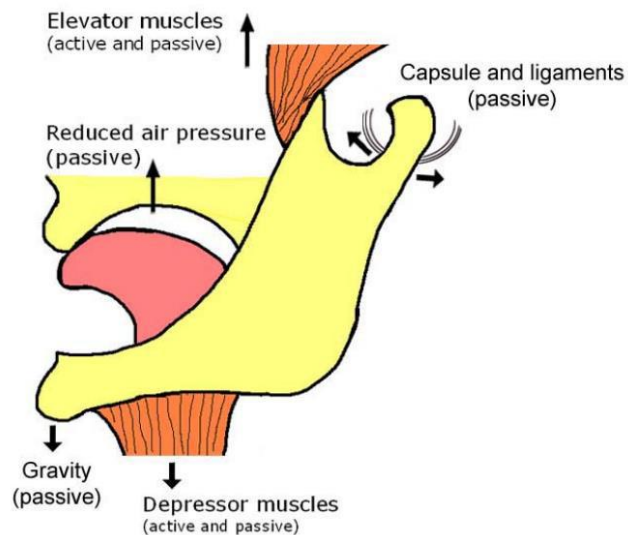
Vertical relation: It is the amount of separation between the maxilla and the mandible in a frontal plane.

Vertical dimension: It is the distance between two selected points, one on a fixed and one on a movable member.

In general, the vertical measurement of face could be recorded between any two arbitrary selected points which are usually located one above the mouth (*at the tip of nose*) and the other below the mouth (*at the tip of chin in the midline region*).

Physiological rest position: It is the postural position of the mandible when an individual is resting comfortably in an upright position and the associated muscles are in a state of minimal contractual activity.

Physiological rest position



Rest vertical dimension: It is the distance between two selected points (one at the tip of nose and the other at the tip of chin (in the midline region) measured when the mandible is in the physiologic rest position.

Occlusal vertical dimension: It is the distance measured between two points when the occluding members (teeth or occlusal rims) are in contact.

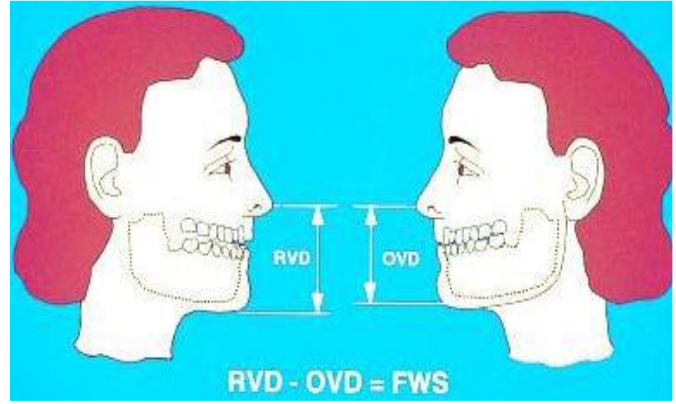
Inter-occlusal distance (inter-occlusal space): It is the distance between the occluding surfaces of the maxillary and mandibular teeth when the mandible is in a specified position.

Lecture 8

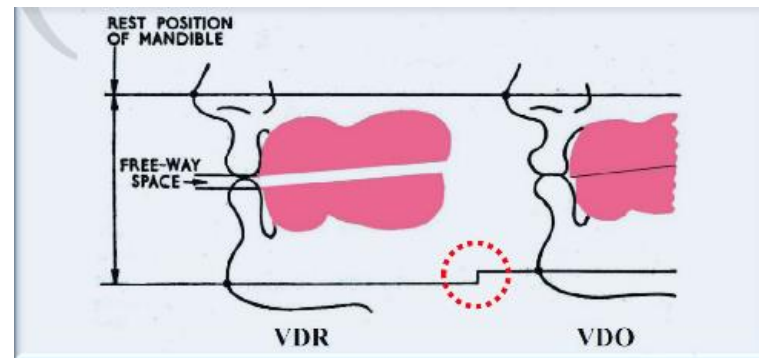
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Inter-occlusal rest space (free-way space): It is the distance between the occluding surface of maxillary and mandibular teeth when the mandible is in its physiological rest position. It is the difference between the vertical dimension of rest and the vertical dimension of occlusion.

$RVD - OVD = \text{Freeway space normally}$
 $\approx (2-4 \text{ mm})$



Rest Vertical Dimension (RVD), Occlusal Vertical Dimension (OVD), Freeway Space (FWS).



Types of Jaw Relations:

A- Vertical relation:

1. Vertical relation of rest position
2. Vertical relation of occlusion

B- Horizontal relation

1. Centric jaw relation.
2. Eccentric jaw relation.
 - A- Lateral jaw relation.
 - B- Protrusive relation

Importance of vertical dimension:

A. Functional roles: includes:

- 1 Mastication.
- 2 Deglutition.
- 3 Phonetics.
- 4 Respiration.

Lecture 8

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- B. **Physiological role:** by maintenance health of tissue (mucosa, bone, muscles, and temporo-mandibular joint); also called . **Comfortable role.**
- C. **Esthetic role.**
- D. **Psychological role.**

Consequences of Increased vertical dimension:

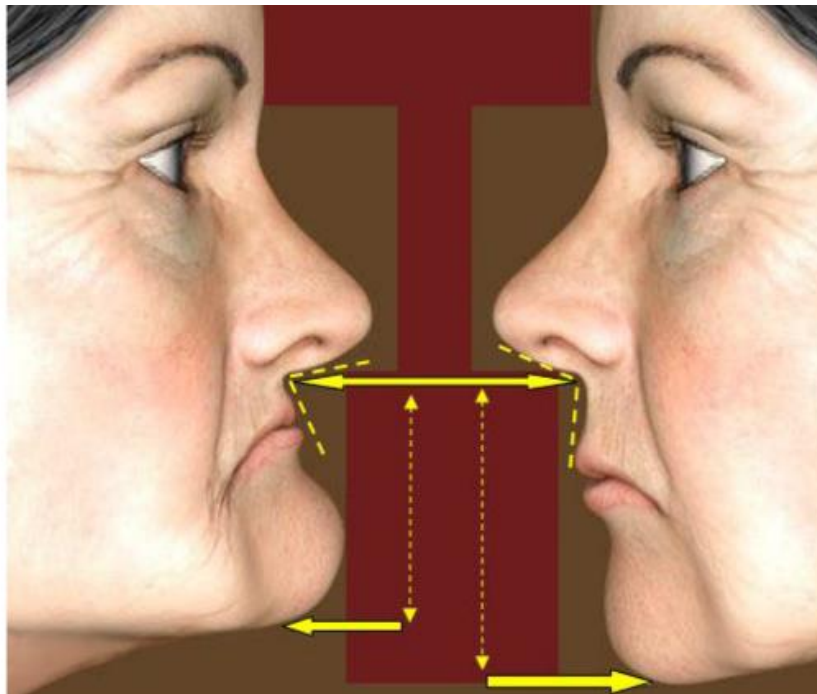
- 1 Increased trauma to the denture bearing area (acceleration of residual ridge resorption).
- 2 Inharmonious facial proportion (increased lower facial height).
- 3 Difficulty in swallowing and speech
- 4 Pain and clicking in the temporo-mandibular joint and muscular fatigue.
- 5 Stretching of the facial muscles and skin.
- 6 Increase space of the oral cavity
- 7 Loss of biting power.
- 8 Increase naso-labial angle
- 9 Sensation of bulky denture.
- 10 Premature contact of upper and lower teeth.
- 11 Instability of dentures due to their excessive height
- 12 Clicking of teeth in speech and mastication.
- 13 Separated upper and lower lip with poor esthetic and difficulty in bilabial sound (/p/b/m/).
- 14 Seem unable to open the mouth widely
- 15 Excessive display of artificial teeth and gum.

Increased vertical dimension



Consequences of Decreased vertical dimension:

1. Comparatively lesser trauma to the denture bearing area.
2. Inharmonious facial proportion (decreased lower facial height).
3. Difficulty in swallowing and speech.
4. Pain and clicking in the temporo-mandibular joint and muscular fatigue.
5. Loss of muscle tone and presence of wrinkles and folds that is not due to age.
6. Decreased space of the oral cavity, and pushing the tongue backward.
7. Loss of biting power.
8. Naso-labial angle is less than 90° .
9. Angular cheilitis due to folding of the corner of the mouth.
10. Cheek biting.
11. Thinning of the vermilion borders of the lip
12. Prominence of lower jaw and chin
13. Obstruction of the opening of the Eustachian tube due to elevation of the soft palate due to elevation of the tongue and mandible.



The differences between increased and decreased vertical dimension

Methods of recording rest vertical dimension:**1. Facial measurements**

Instruct the patient to stand or sit comfortably upright with eyes looking straight ahead at some object which is on the same level. Insert the maxillary record base with the attached contoured occlusion rim. With an indelible marker, place a point of reference on the end of the patient's nose and another on the point of the chin. The patient is asked to perform functional movements like wetting his lips and swallowing, and to relax his shoulders (this is done to relax the supra- and infra-hyoid muscles). When the mandible drops to the rest position, the distance between the points of reference is measured. Repeat this procedure until the measurements are consistent. Such measurements are helpful but cannot be considered as absolute.

2. Tactile sense

Instruct the patient to stand or sit erect and open the jaws wide until strain is felt in the muscles. When this opening becomes uncomfortable, ask them to close slowly until the jaws reach a comfortable, relaxed position. Measure the distance between the points of reference.

3. Phonetics

Ask the patient to repeat pronounce the letter (**m**) a certain numbers of times, like repeat the name *Emma* until they are aware of the contacting of the lips as the first syllabus *em* is pronounced. When patient have rehearsed this procedure, ask that they stop all jaw movement when the lips touch. At this time measure between the two points of reference.

4. Facial expression

The experienced dentist may notice the relaxed facial expression when the patient's jaws are at rest.

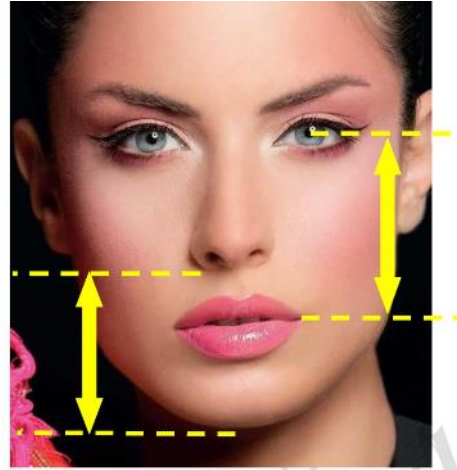
The following facial features indicate that the jaw is in its physiological rest position:

The upper and lower lips should be even antero-posteriorly and in slight contact in a single plane. The skin around the eyes and over the chin should be relaxed; it should not be stretched, shiny, or excessively wrinkled. The nostrils are relaxed and breathing should be unobstructed. These evidences of rest position of the maxilla-mandibular musculature are the indications for recording a measurement of the vertical dimension of rest.

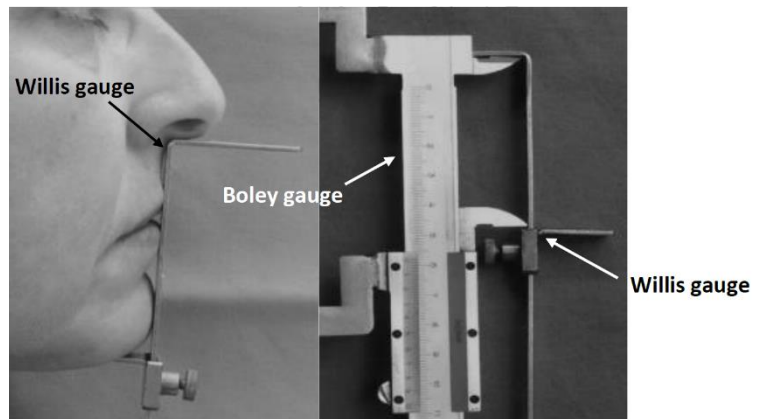
5. Anatomical landmarks (Willis method)

The Willis guide is designed to measure the distance from the pupils of the eyes to the corner of the mouth and the distance from the anterior nasal spine to the lower border of the mandible. When these measurements are equal, the jaws are considered at rest. Its accuracy is questionable in patients with facial asymmetry.

Anatomical landmarks



Willis method and Boley gauge used to measure the distance recorded by Willis gauge.



6. Electro-myographic method (EMG)

By using a special device that measures the tone of masticatory muscles, when the tone is at its least, this means these muscles are in rest position and the jaws are at rest position.

Methods of recording occlusal vertical dimension:**1. Pre-extraction records:**

These records are made before the patient extracts all teeth and loses his occlusal vertical dimension; these records are:

A. Profile photographs

They are made and enlarged to life size. Measurements of anatomic landmarks on the photograph are compared with measurements using the same anatomic landmarks on the face. These measurements can be compared when the records are made and again when the artificial teeth are tried in. The photographs should be made with the teeth in maximum occlusion, as this position can be maintained accurately for photographic procedures.

Profile photograph

**B. Profile silhouettes**

An accurate reproduction of the profile silhouettes can be cut out in cardboard or contoured in wire. The silhouettes can be repositioned to the face after the vertical dimension has been established at the initial recording and/or when the artificial teeth are tried in.

Profile silhouette: Cardboard (A); Wire (B).



C. Profile radiographs

They have been much used in researches of vertical dimension of occlusion rather than routine clinical use in prosthodontic treatment for edentulous patients. The two types of radiographs advocated are the cephalometric profile radiograph and radiograph of the condyles in the fossae. The inaccuracies that exist in either the technique or the method of comparing measurements make this method unreliable.



Cephalometric radiograph

D. Articulated casts

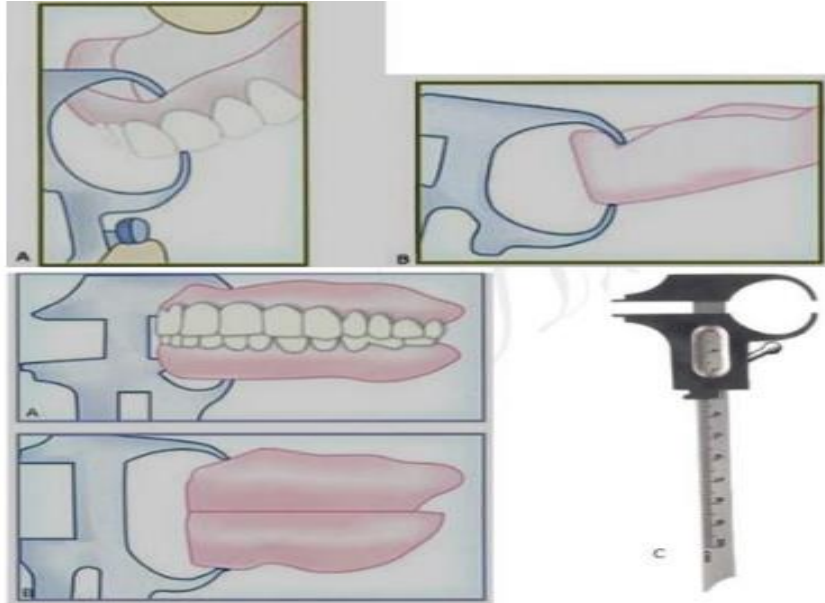
When the patient is dentulous, an accurate casts of the maxillary and mandibular arches have been made, the maxillary cast is related in its correct anatomic position on the articulator with a face-bow transfer. An occlusal record with the jaws in centric relation is used to mount the mandibular cast. After the teeth have been removed and edentulous casts have been mounted on the articulator, the interarch measurements are compared. Generally, the edentulous ridges will be parallel to one another at the correct vertical dimension of occlusion. This method is valuable with patients whose ridges are not sacrificed during the removal of the teeth or resorbed during a long waiting period for denture construction

E. Facial measurements

Before extraction, the patient is instructed to close the jaws into maximum occlusion, then two tattoo points have been marked, one on the upper half of the face and the other on the lower half. The distance is measured, after extraction these measurements are compared with measurements made between these points when the artificial teeth are tried in.

F. Measurements from former dentures

Dentures that the patient has been wearing can be measured, and measurements can be correlated with observations of the patient's face to determine the amount of change required. These measurements are made between the ridge crests in the maxillary and mandibular dentures with a *Boley gauge*.



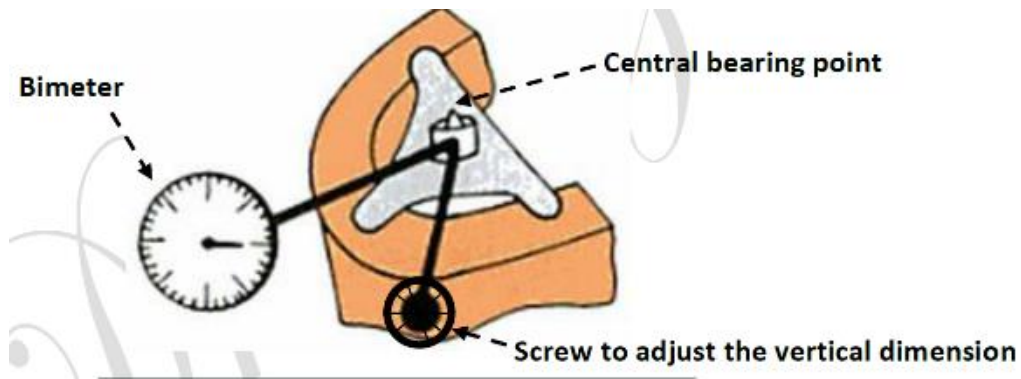
2. Without Pre-extraction records:

A. Direct methods to find occlusal vertical dimension

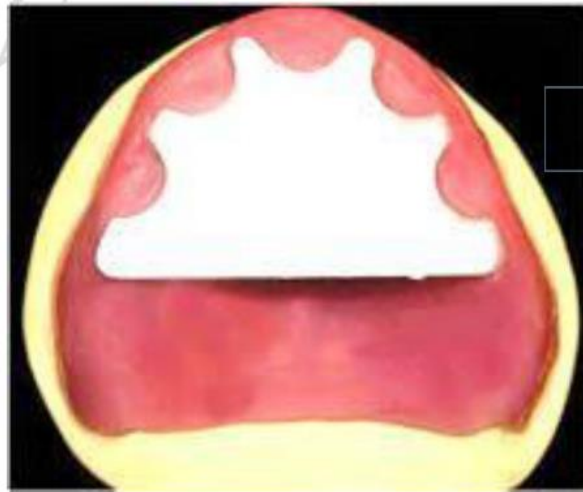
1. Boos power point method:

By: Boos R.H. A metal plate (*central bearing plate*) is attached to the maxillary record base. A bimeter (*an oral meter that measures pressure*) is attached to the mandibular record base. This bimeter has a dial, which shows the amount of pressure acting on it.

The record bases are inserted into the patient's mouth and the patient is asked to bite on the record bases at different degrees of jaw separation. The biting forces are transferred from the central bearing point to the bimeter. The highest value is called the power point which represents the occlusal vertical dimension.



Boos power point method



Central bearing plate

2. Tactile sense or neuromuscular perception:

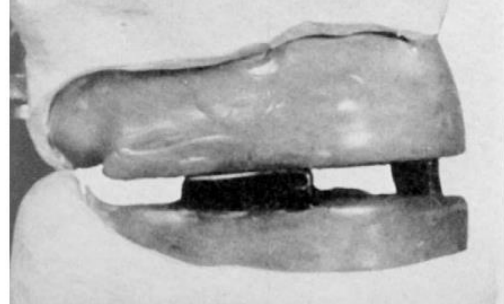
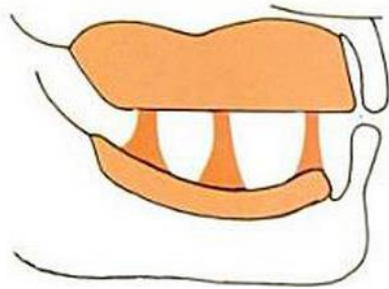
A central bearing screw/central bearing plate apparatus is used and attached to accurately adapt record bases permits the patient to experience through neuromuscular perception the different vertical relations. The central bearing screw is adjusted downward and upward until the height of contact feels right to the patient and this represents the occlusal vertical dimension.

3. Swallowing threshold:

The theory behind this method is that at the beginning of swallowing cycle, the teeth of the upper and lower jaws almost come together with a very light contact. This factor can be used as a guide to determine the occlusal vertical dimension.

The technique involves fabrication of cones of soft wax on the mandibular record base. The maxillary and mandibular record bases are inserted in the

patient mouth. Salivation is stimulated and the patient is asked to swallow. The repeated action of swallowing the saliva will gradually reduce the height of the wax cones to allow the mandible to reach the level of occlusal vertical dimension.



Swallowing method

4. Phonetics:

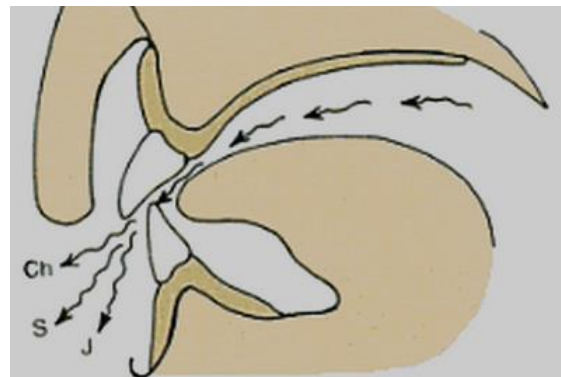
By: Silverman M. Meyer Silverman's closest speaking space: It is the minimal amount of inter-occlusal space between the upper and lower teeth when sounds like *ch*, *s*, and *j* are pronounced. There is *1-2 mm* clearance between teeth when observed from the profile and frontal view.

Phonetic tests of the vertical dimension include listening to speech sound production and observing the relationships of teeth during speech. The production of *ch*, *s*, and *j* sounds brings the anterior teeth closest together without contact.

If the distance is too large, it means that too small a vertical dimension of occlusion may have been established.

If the anterior teeth touch when these sounds are made, the vertical dimension is probably too great.

Silverman's closest speaking space



Horizontal Jaw Relation

Horizontal Jaw Relation

It is the relationship of the mandible to the maxilla in a horizontal plane. It can also be described as the relationship of the mandible to the maxilla in antero-posterior and side to side direction.

The horizontal relations include:

- 1- Centric jaw relation.
- 2- Eccentric jaw relations.
 - A. Protrusive or forward relation.
 - B. Left or right lateral relation.

Centric jaw relation:

It is the maxilla-mandibular relationship in which both condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the shapes of the articular eminencies. This position is independent of tooth contact.

This position is clinically discernible when the mandible is directed superior and anteriorly, and from which the individual can make lateral movements at a given vertical dimension. It is restricted to a purely rotary movement about the transverse horizontal axis.

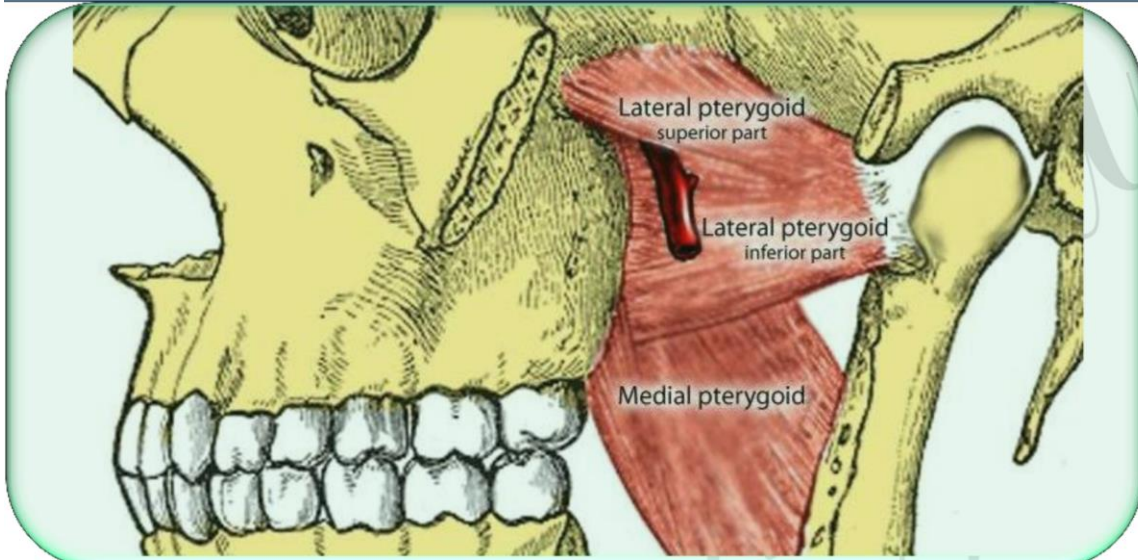
It is a clinically determined relationship of the mandible to the maxilla when the condyle disk assemblies are positioned in their most superior position in the mandibular glenoid fossae and against the distal slope of the articular eminence (*it is bone-to-bone relationship*).

Centric occlusion:

It is the occlusion of opposing teeth when the mandible is in centric relation.

Maximal intercuspal position:

The most complete interdigitation of the teeth independent of condylar position. Hence maximal intercuspal position is a maxilla-mandibular relationship determined by *tooth-to-tooth relationship*.



Importance of centric relation

- 1- It is a reference position.
- 2- It is learnable, repeatable and recordable position.
- 3- It is the start point for developing occlusion.
- 4- Functional movement like chewing and swallowing are performed in this position.
- 5- It is a reliable jaw relation, because it is bone to bone relation.

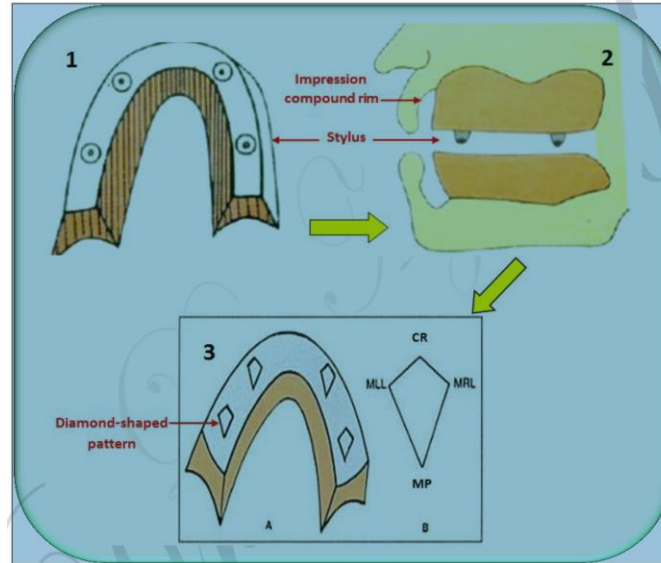
Methods of recording centric relation

- 1- Functional (chew-in) methods.
- 2- Graphic method.
- 3- Tactile or inter occlusal check record method.

1- Functional methods:

A- Needles-House technique

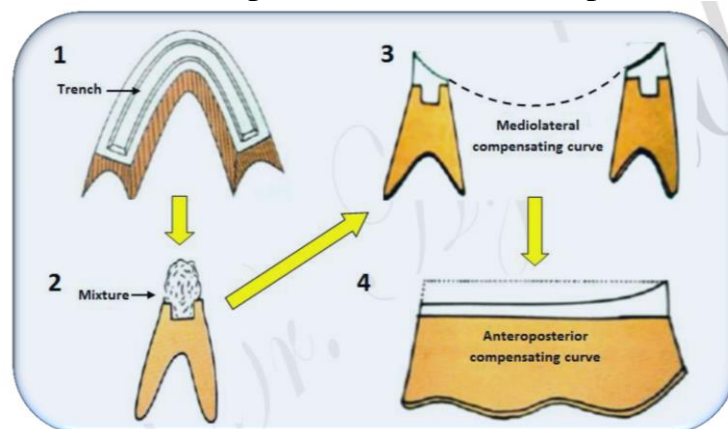
This method used impression compound occlusion rims with four metal styli placed in the maxillary rim. When the patient moves his mandible, the styli on the maxillary rim will create a marking on the mandibular rim, after all mandibular movements are made, and a diamond-shaped pattern is formed. The anterior most point of this diamond pattern indicates the centric jaw relation.

**Hints:**

- 1 *Maxillary rim made from impression compound with four metal styli inserted.*
- 2 *Recording the mandibular movements.*
- 3 *Diamond-shaped marking made on the mandibular rim. (MP maximum protrusion, MLL maximum left lateral, MRL maximum right lateral, CR centric relation).*

B- Patterson technique

This method used wax occlusion rims. A trench is made along the length of mandibular rim. A 1:1 mixture of pumice and dental plaster is loaded into the trench. When the patient moves his mandible, compensating curves on the mixture will produced, and the height of the mixture is also reduced. The patient is asked to continue these movements till a predetermined vertical dimension is obtained. Finally the patient is asked to retruded his jaw and the occlusal rims are fixed in this position with metal staples.



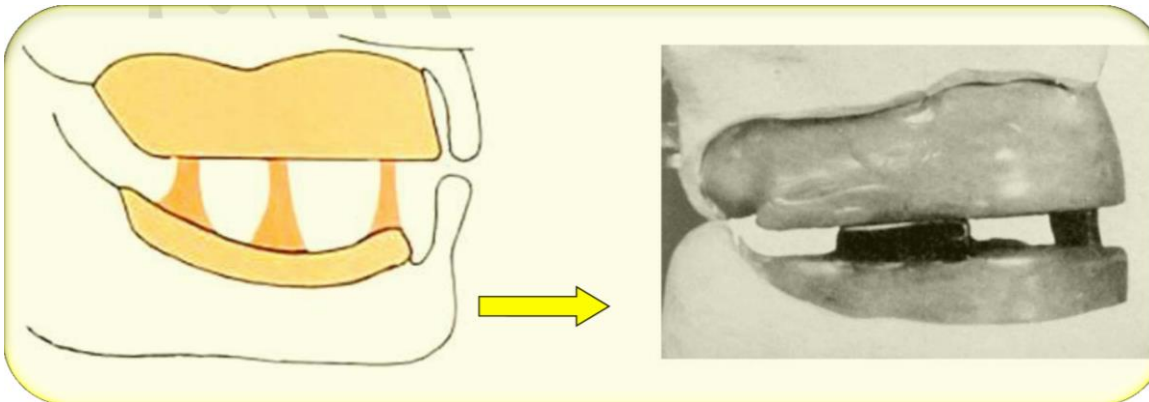
Hints:

- 1 *Trench made in the mandibular rim.*
- 2 *Mixture of pumice and dental plaster loaded on the trench.*
- 3 *Mediolateral compensating curve generated on the mixture.*
- 4 *Anteroposterior compensating curve generated on the mixture.*

The disadvantages of functional methods involve lateral and anteroposterior displacement of the recording bases in relation to the supporting bone while the record is being made.

C- Swallowing technique

In this method soft cones of wax are placed on the lower record base. The wax cones contact the upper occlusion rim when the patient swallows.

**2- Graphic methods**

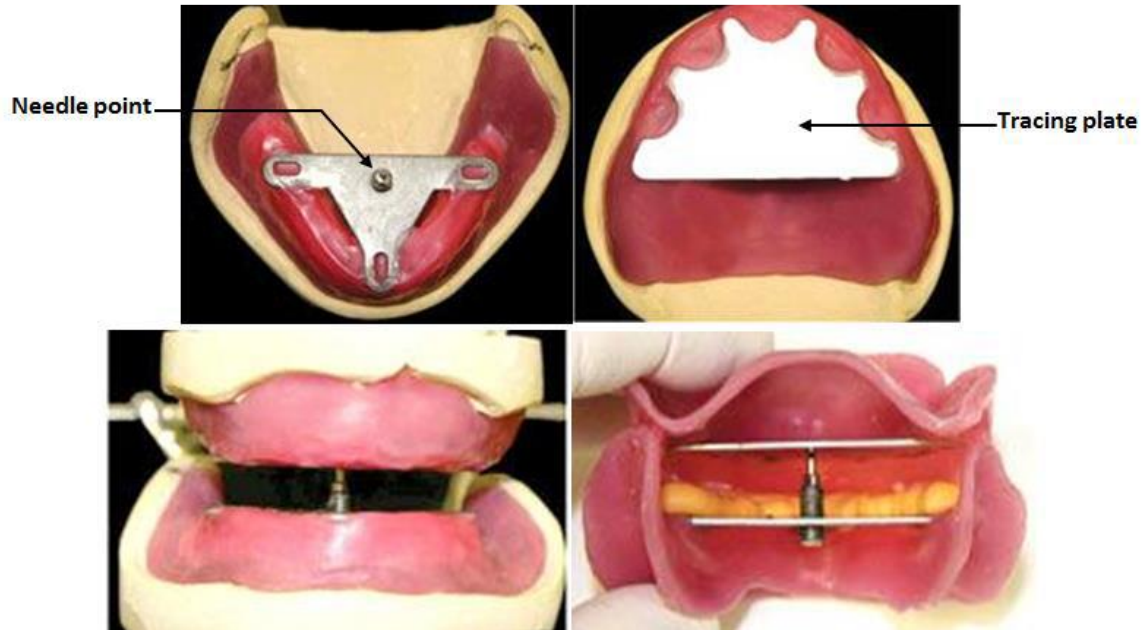
These methods are called so because they use graphs or tracing to record the centric relation.

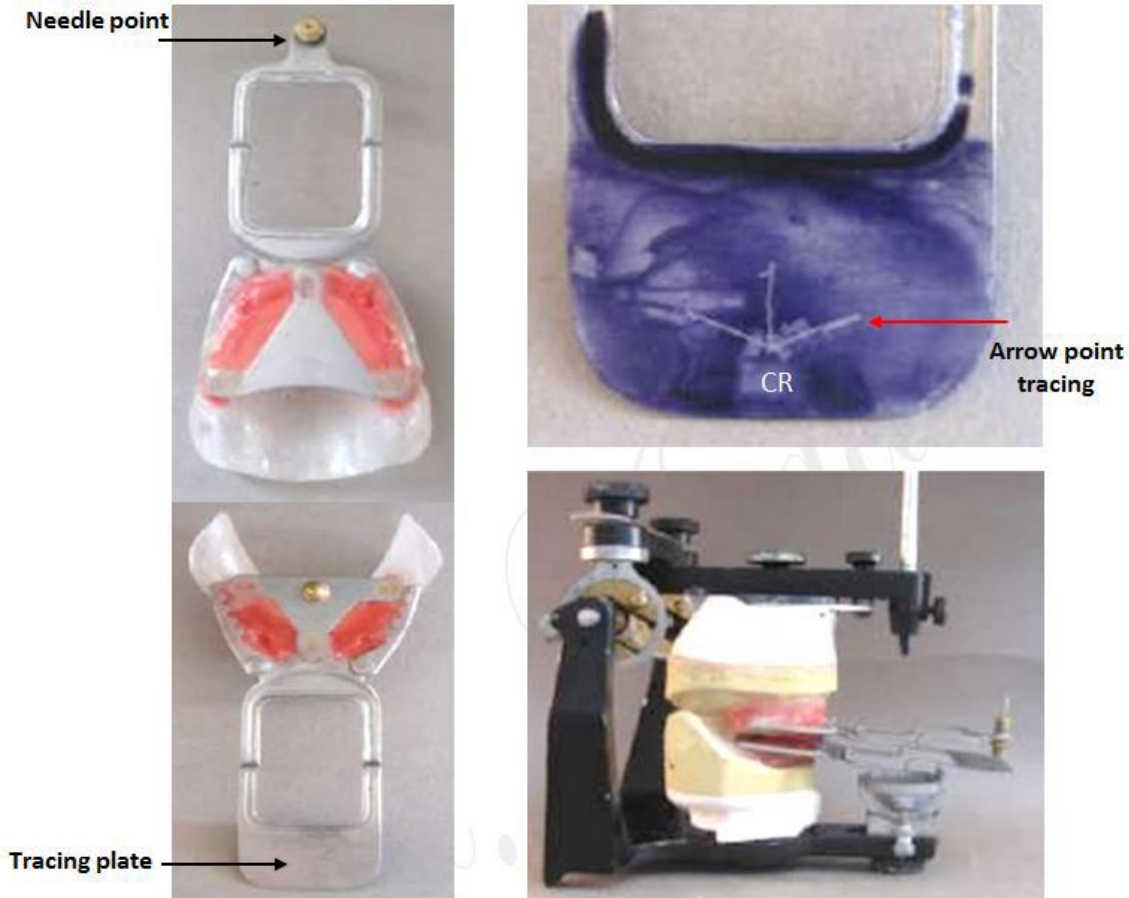
The general concept of this technique is that a pen-like pointer is attached to one occlusal rim and a recording plate is placed on the other rim, the plate coated with carbon or wax on which the needle point can make the tracing, when the mandible moves in horizontal plane, the pointer draws characteristic patterns on the recording plate.

The characteristic patterns created on the recording plate is called arrow point tracing, also known as Gothic arch tracing. The apex of the arrow point tracing gives the centric relation, with the two sides of the tracing originating at that point being the limits of the lateral movements. The apex of the arrow head should be sharp else the tracing is incorrect.

The graphic methods are either intra-oral or extra-oral depending upon the placement of the recording device. The extra-oral is preferable to the intra-

oral tracing, because the extra-oral is more accurate, more visible, and larger in comparing with the intra-oral tracing.





3- Tactile or inter occlusal check record method

In this method the centric relation is recorded by placing a record medium between the record bases when the jaws positioned at centric relation.

The patient closes into the recording medium with the lower jaw in its most retruded unstrained position and stops the closure at predetermined vertical dimension.

This method is simple, because mechanical devices are not used in the patient mouth and are not attached to the occlusion rims.

This method has advantage of causing minimal displacement of the recording bases in relation to the supporting bone.

This method is essential in making an accurate record, the visual acuity and the sense of touch of the dentist also inter in making of centric relation record, this phase is developed with experience and it is difficult to teach to another individual.

Materials that are commonly used for **inter occlusal check record** include wax, plaster, zinc oxide eugenol, silicon and polyether.

Indication of inter occlusal check record method:

- 1- Abnormally related jaws.
- 2- Displaceable, flabby tissue.
- 3- Large tongue.
- 4- Un controllable mandibular movements.
- 5- It can also be done for patients already using a complete denture.

Methods for assisting the patient retruded the mandible:

1. Instruct the patient by saying “let your jaw relax, pull it back, and close slowly and easily on your back teeth”
2. Instruct the patient to contact with his tongue a piece of wax placed on the posterior palatal seal area and slowly close.
3. The patient is asked to bring his upper jaw forward while occluding on the posterior teeth.
4. The head is tilted backward which makes protrusion more difficult
5. The patient is asked to swallow and close slowly.
6. Instruct the patient to do routine jaw exercises.

Factors that complicates centric relation record

- 1- Resiliency of the tissues supporting the denture base.
- 2- Stability and retention of the record bases.
- 3- The TMJ and its neuromuscular mechanism.
- 4- Amount of pressure applied in making the record.
- 5- Technique employed in making the record.
- 6- The ability of the dentist.

Eccentric jaw relations:

Any relationship between the jaws other than centric relation.

Lateral jaw relation: The relation of the mandible to the maxillae when the lower jaw is in a position to either side of centric relation.

Protrusive jaw relation: The relation of the mandible to the maxillae when the mandible is thrust forward.

Methods of recording eccentric jaw relations:

The main reason in making an eccentric jaw relation is to adjust the articulator to simulate the eccentric movement of the mandible to the maxilla, and establish balanced occlusion.

The methods are similar to that made for centric relation and include, the functional, graphic and inter occlusal records.

Inter occlusal eccentric records

(Protrusive, left and right lateral movement), can be made on the occlusion rim or on the posterior teeth at the try-in appointment.

For Hanau articulator the following formula is used to obtain lateral inclination: $L=H/8+12$

L= lateral condylar inclination.

H= horizontal condylar inclination as established by protrusive record.

Factors to be considered while making eccentric jaw relation

1. The condylar path of the patient cannot be altered.
2. The condyles do not travel in straight lines during eccentric mandibular jaw movements.
3. Semi-adjustable articulators in which the condyles travel on a flat path cannot be used to reproduced eccentric movements exactly.
4. Fully-adjustable articulators, where the condylar and incisal guidance are fabricated individually with acrylic, can travel in the path of the condyle using pantographic tracings.

DENTAL ARTICULATOR

Prof. Dr. Raghdaa Kareem Jassim

Definition:

It is a mechanical instrument that represents the temporo-mandibular joints and jaw members, to which maxillary and mandibular casts may be attached to simulate some or all mandibular movements.

Functions:

1. It allows most of the prosthetic work to be done in the absence of the patient (diagnosis, treatment planning, setting –up of teeth and development of balanced articulation and waxing-up of dentures).
2. Maintain jaw relation record during setting-up of teeth.
3. Denture remounting after processing for correction disharmony.

➤ Types of dental articulators:

1. Simple hinge articulators (**Class I**).
2. Mean value or Fixed condylar path articulators (**Class II**).
3. Adjustable condylar path articulators.
 - a. Semi-adjustable condylar path articulators (**Class III**).
 - b. Fully-adjustable condylar path articulators (**Class IV**).



➤ 1. Simple Hinge Articulators (plane line)

➤ Design:

➤ It consists of an upper and lower members held apart at a certain distance by a screw which acts at the back. The screw can be increased or decreased to change the distance between the two members, and permits only a hinge like movement as shown in **Fig. 1**.



Possible movements:

This type of articulators gives only opening and closing movements.

Records required:

- a. Vertical dimension of occlusion.
- b. Centric relation records.

Disadvantages:

These articulators do not represent the temporo-mandibular joint and the dynamic mandibular movements.



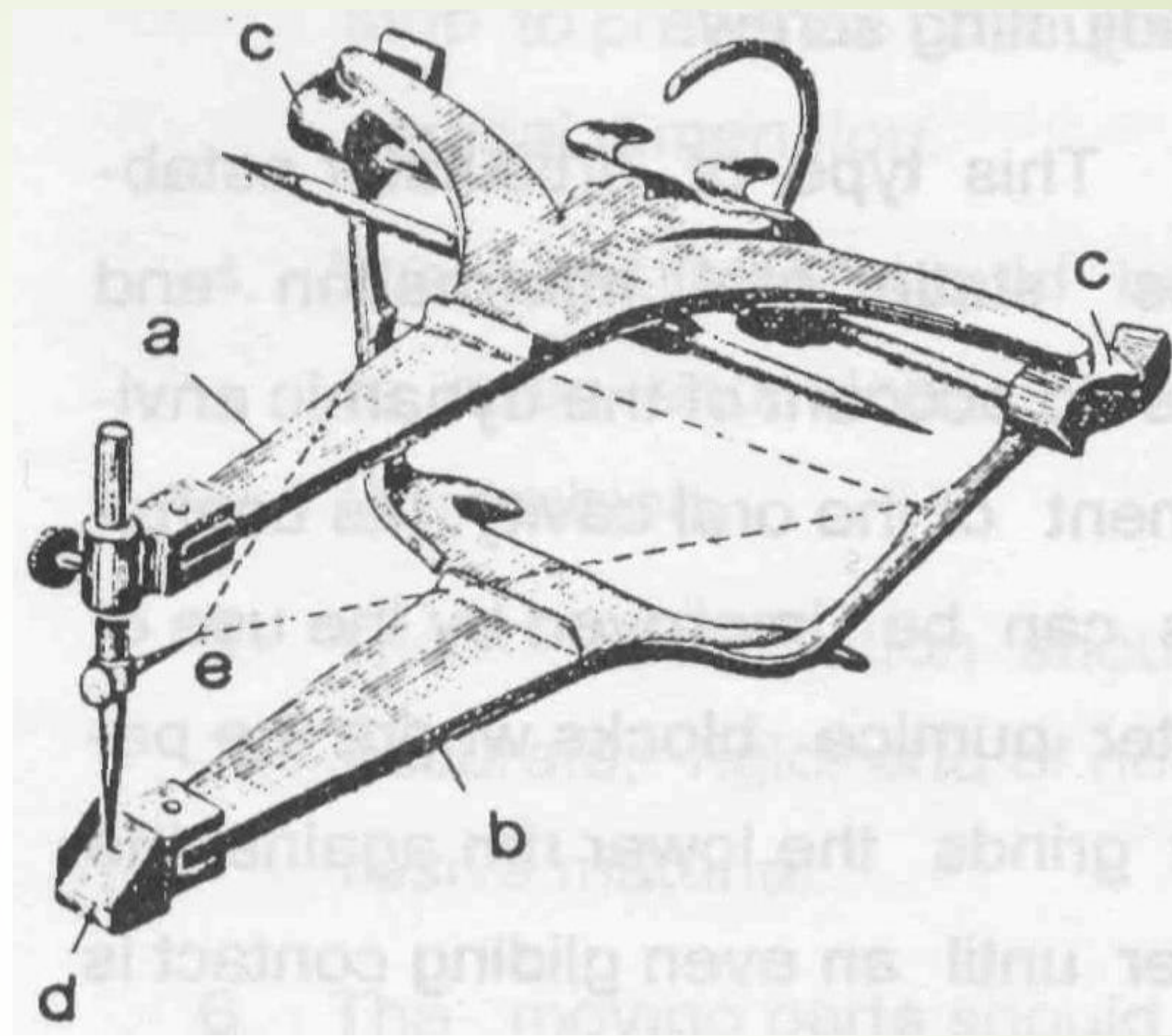
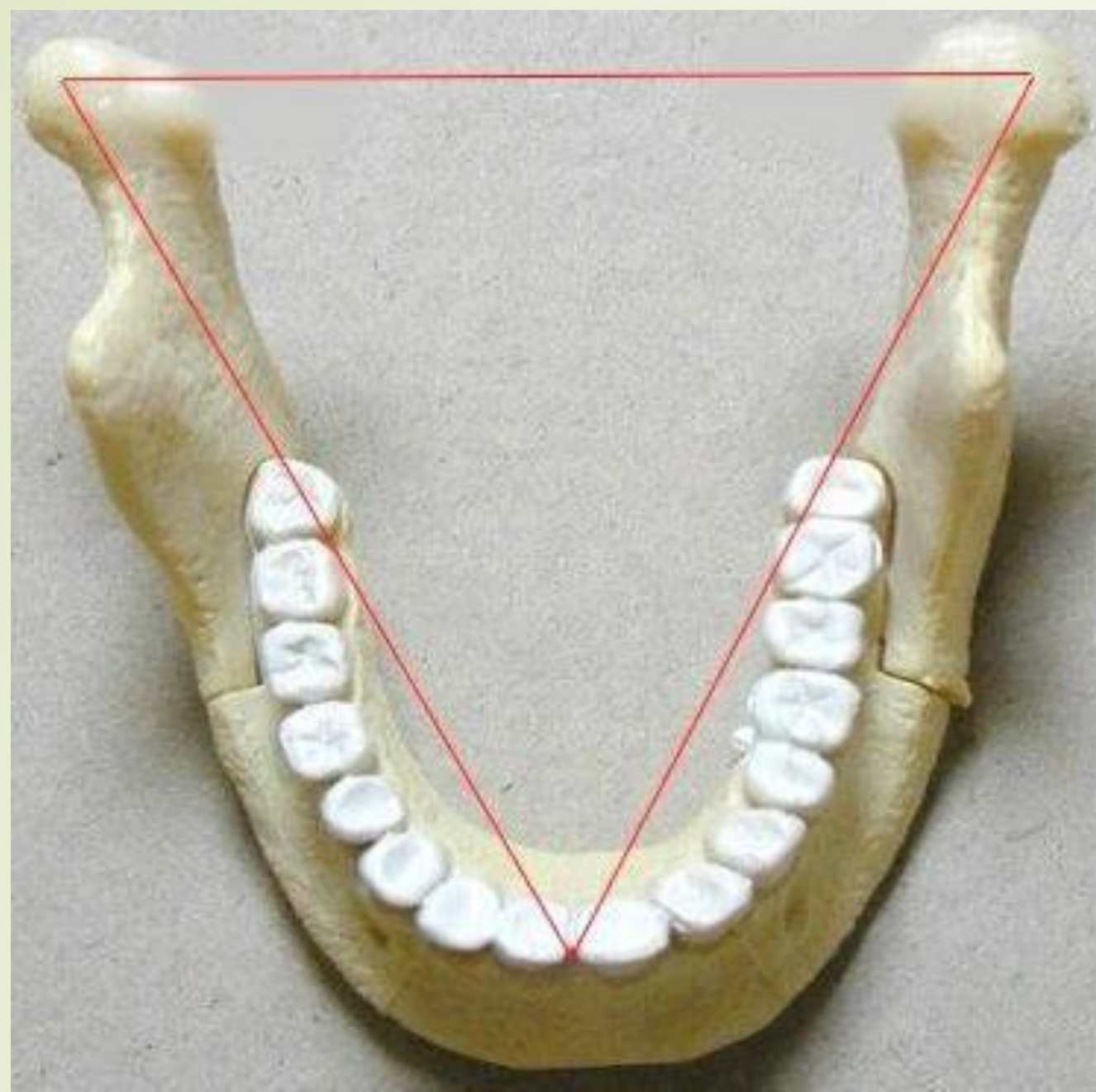


Fig. 2: Left; Bonwill triangle. Right; Fixed condylar path articulator. Mounting of maxillary cast according to Bonwill triangle (dotted line)

Possible movements:

1. Opening and closing.
2. Protrusive movement at a fixed condylar path angle.

Records required:

- a. Vertical dimension of occlusion.
- b. Centric relation record.
- c. Face-bow record: In some designs of these articulators, the upper cast can be mounted by a face bow transfer.

When the articulator does not accept face-bow record, the mounting is made according to Bonwill triangle.

Bonwill found in mandibles that the inter-condyle distance as well as the distance from each condyle to the contact point of the lower central incisors was 4 inches equilateral triangle **(Fig. 2)**. An anterior pointer is attached to the incisal pin of the articulator to locate the tip of the occlusion rim labially and thus to orient cast in relation on the Bonwill triangle.

On the fixed and most condylar path articulators the upper members are movable (the condyle) and the lower members are non-movable, as seen in **(Fig. 3)**.



Fig. 3: The mean value articulators

3. Adjustable Condylar Path Articulators:

This type of articulators differs from the fixed condylar path articulators in that it has adjustable condylar and incisal guidance. They can be adjusted so that the movements of its jaw members closely resemble all movements of the mandible for each individual patient.



A- Semi-adjustable condylar path articulators:

Page
Design:

10

In these articulators (e.g. Hanau's articulator **Fig. 4, 5**) the horizontal condylar path is adjusted by a protrusive record obtained from the patient.

The lateral condylar path inclination is adjusted according to the Hanau's formula:

$$L = H / 8 + 12.$$

Where; L= The lateral condylar path. H= The horizontal condylar path.

Some semi-adjustable articulators are Non-Arcon as in **Figure 4**, while others are Arcon (**Fig. 5**). The term Arcon is commonly used to indicate an instrument that has its condyles on the lower member and the condylar guides on the upper member.



Possible movements:

- a. Opening and closing.
- b. Protrusive movement according to the horizontal condylar path angle determined from the patient.
- c. Lateral movement to the angle estimated from the Hanau's formula.
- d. Some types have Bennett movement (immediate side shift).

**Fig. 5: Arcon
semi-adjustable
articulators**



Whip Mix, 8500



Hanau, H2 Arcon

Records required:

a. A Maxillary face bow record to mount the upper cast.

Some of the semi-adjustable articulators have orbital plane guides. The orbital plane guide allows the casts to be mounted in relation to the orbital plane axis of the patient and orients the casts on the articulator in the same relationship to the dental arches as in the patient.

b. Centric occluding relation record (vertical dimension and centric relation) to mount the lower cast.

Disadvantages:

Multiple records are required with the possibility of errors. Therefore, the semi- adjustable articulators are usually enough for complete denture construction.

FACE-BOW

The face-bow is a caliper- like device that is used to record the relationship of the maxilla to the temporo-mandibular joints or the opening axis of the jaws and to orient the casts in this same relationship to the opening axis of the articulators.

The face-bow consist of :

1. U- shaped frame or assembly.
2. The condyle rods.
3. The fork.



Types of face-bow:

There are two basic types of face-bow; the kinematic, and the maxillary.



1. The kinematic (mandibular, hinge axis locator) face-bow:

It is used to locate the kinematic (true or terminal) transverse hinge axis.

The transverse hinge axis is an imaginary line, in which the mandible rotates during opening and closing for about 20 mm.

2. The maxillary face-bow:

It is used to record the position of the upper jaw in relation to the hinge axis and transferring the relation to the articulator **(Fig.7, 8)**.

The maxillary face-bow is oriented to the kinematic or arbitrary hinge axis.

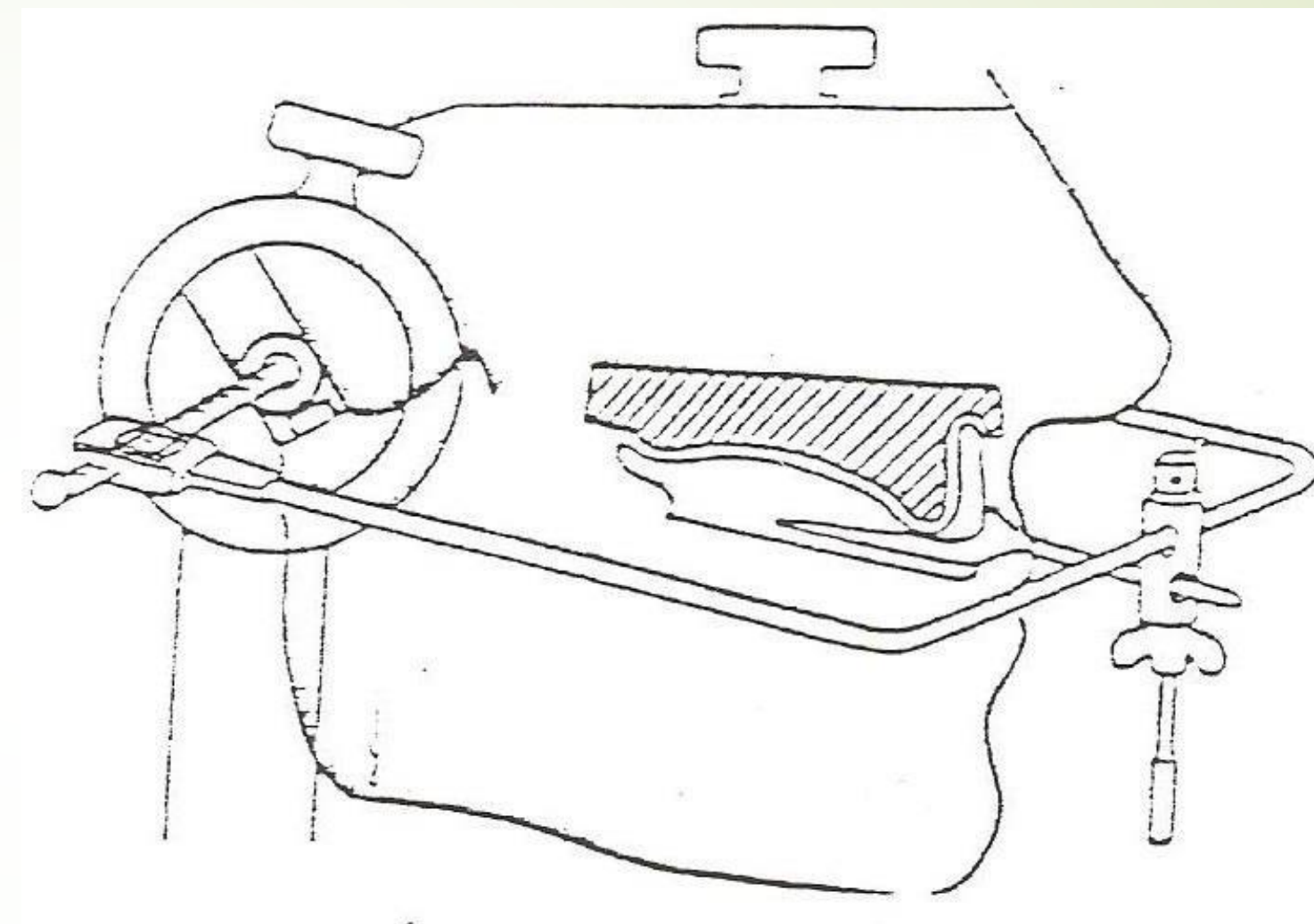
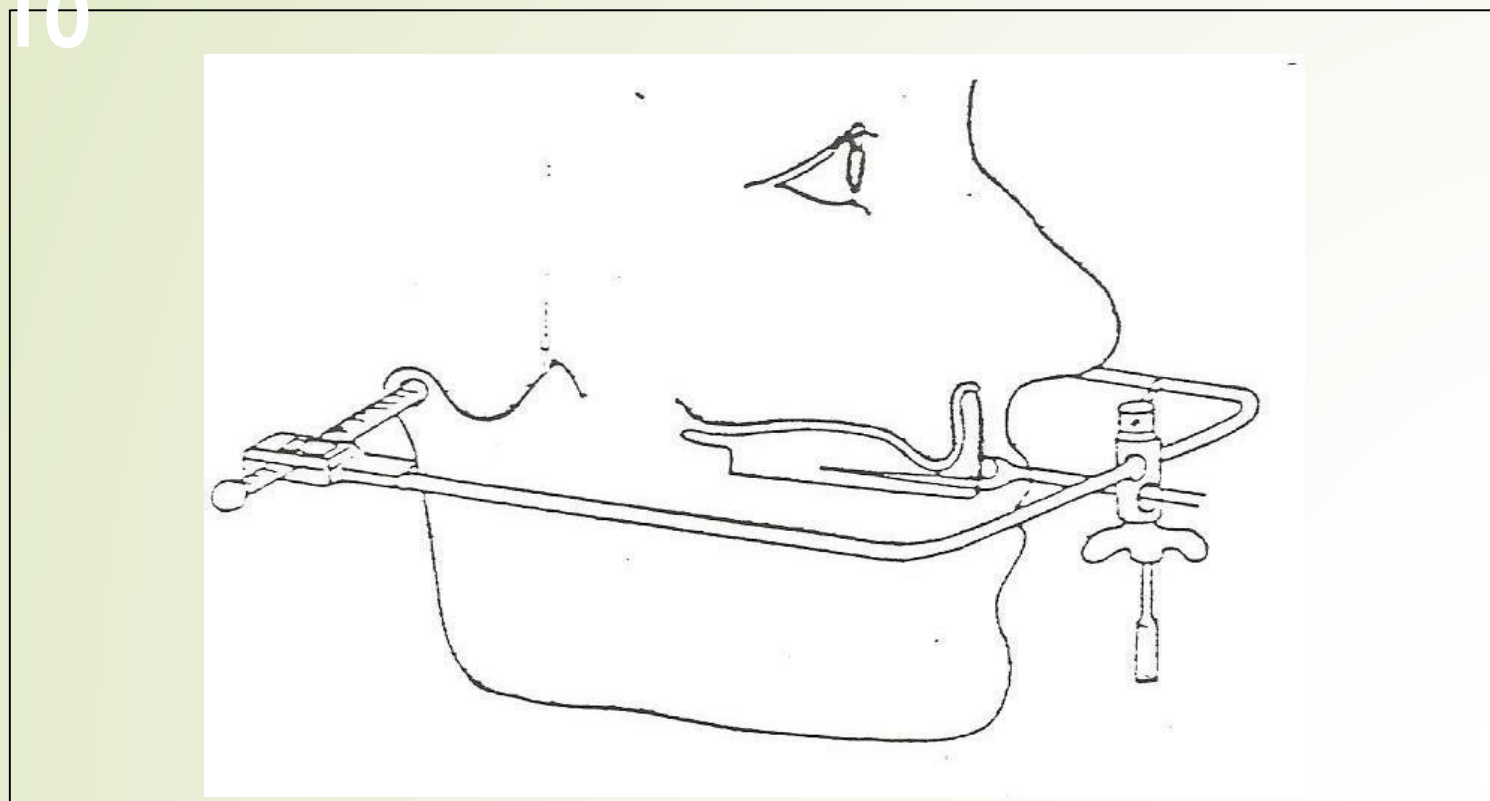


Fig. 7: The maxillary face-bow on the patient

Important of the face-bow:

1. An arbitrary mounting of the maxillary cast without a face-bow transfer can introduce errors in the occlusion of the finished denture.
2. A face-bow transfer allows minor changes in the occlusal vertical dimension on the articulator without having to make new maxillo-mandibular records.
3. It is helpful in supporting maxillary cast while it is being mounted on the articulator.



Thank you

