



Retention Stability and Support in Complete Denture

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Retention:

Is the quality of a denture that resists movement away from the tissue.

Factors affect in the retention of CD

- 1) Physical factors.
- 2) Anatomical factors.
- 3) Mechanical factors.
- 4) Muscular factors.
- 5) Surgical factor.

I- Anatomical factors:

The various anatomical factors that affect retention are:

Size of the denture bearing area, quality of the denture bearing area

It mainly affects lower denture

1- Ridge form:

- 1) High and flat crest and well formed in recent extraction. The problem only is no space for setting of teeth
- 2) Flat one difficult and no retention and stability so in taking the impression try to extend it beyond mylohyoid area to gain more stability and retention.
- 3) Ridge with undercut more common in upper (bilateral maxillary tuberosity) so we do surgery in one side and block out the other and we have to change the path of insertion.
- 4) Knife ridge difficult and cause lacerations and pain so we do relief.
- 5) Flabby ridge fibrous tissue and movable, not good seal so we either modified in the impression technique or do surgical correction.

2- Vault Form:

- 1) U shaped >>> good in retention and stability.
- 2) V shaped >>> have retention but no stability and any pressure on it could break the seal.
- 3) flat shaped no enough depth, so no retention and stability.

3- Arch Form:

Squared, ovoid, tapered and the best one is the squared. This is because of:

1-there is 4 points of contact with denture.

2-Resistant the lateral forces.

4- Arch relationship

Most of edentulous patient have class III >>> because of the pattern of bone resorption of the ridges. So the limited in movement only opening and closing. (No protrusive movement)

Some have class II and it isn't favorable because it has small surface area, and difficult to get the upper and lower in contact.

5- Interarch distance: Small interarch space more retention

6- Tongue: If too big >> it could interfere with denture. So dislodging of the lower and upper.

7- Mucosa: We need it Firm, compressible and even thickness. Not to be thick and flabby.

II- Physical factors:

1- Adhesion:

It's a physical attraction between unlike molecule like the contact of saliva to both oral tissue and denture base

The amount of retention provided by adhesion is depend on

1- Close adaptation of the denture base

2- type of saliva (viscosity and wet ability) Thin serous saliva provides better adhesion than thick ropy saliva, it builds up pressure & pushes the denture out of position

3- Area cover by the denture. The size of maxillary denture bearing area is about (24 cm²) & that of mandible is about (14 cm²)

Mandibular foundation has decreased surface area and hence decreased adhesion. V shaped palate induces sliding or deflection, hence retention by adhesion is less.

2- Cohesion: Its physical attraction between Like molecules.

Factor affecting cohesion:

1. Area covered by the denture (cohesion is directly related to the area covered by denture if all the factor are equal)

2. Thickness of the salivary film (saliva film should be thin, watery serous saliva can form a thinner film and is more cohesive than thick mucous saliva)

3. Adaptation to denture base to mucosa (close adaptation of denture to the mucosa is needed so that only a thin of saliva is present.

4. Interfacial surface tension: A property of liquids in which the exposed surface tends to contract to the smallest possibly.

To obtain maximum interfacial surface tension

1. Saliva should be thin and even

2. Perfect adaptation should be present between the tissues and denture

3. The denture base should cover a large area.

4. There denture should have good adhesive and cohesive force to aid to the enhancement of interfacial surface tension

3- Capillary attraction

It defined as "the quality that causes elevation or depression of the surface of the liquid that is in contact with the solid".

Factors that aid to improve capillary attraction;

- 1) Close adaptation of denture base to soft tissue. Greater the distance less the capillary force
- 2) Greater the size of the denture bearing area greater the Capillary attraction retention

4- Atmospheric pressure and peripheral seal

When a dislodging force is applied on the denture having good border seal, a negative pressure develops in the space created between the denture base and the mucous membrane. When the negative pressure develops inside, the atmospheric pressure from outside pushes the denture towards the basal seat helping in retention of the denture

Factor affecting atmospheric pressure

a) Closeness of adaptation to keep air out of tissue contact depends mainly on the

- 1) impression technique. 2) An impression material that places slight generalized pressure on soft tissue is preferred.
- 3) Proper border molding

b) Peripheral seal

Is defined as the area of contact between the mucus membrane & peripheral polished surface of denture base

To have good peripheral seal

c) Posterior palatal seal area

It is defined as "The soft tissue at or along the junction of the hard and soft palates on which pressure within the Physiological limits of the tissues can be applied by the denture to aid in the retention of the denture.

The shape of posterior palatal area depends on the shape of palate. According to house classification:

- 1) Class I flat - Wide palatal vault in the hard palate so the shape of posterior palatal seal is butter- flay 3-4 mm in width and Width 1.5 depth
- 2) Class II intermediate
- 3) Class III deep-high vault so the shape of PPS is bead 1mm in depth
Width 1.5 depth.

Function of the posterior palatal

- 1) Aids in retention by maintaining constant contact with the soft palate during functional movements like speech mastication and deglutition.

- 2) Reduce the tendency for gag reflex as it prevents the formation of the gap between the denture base and soft palate during functional movements.
- 3) Prevent food accumulation between the posterior border of the denture and the soft palate
- 4) Compensates for polymerization shrinkage

5- Gravity

Gravity acts as retentive forces for the mandibular denture and displacement for the maxillary denture when patient is in upright posture

6-Viscosity

Is the resistance to flow of fluid resulting from intermolecular forces acting within the fluid. Fluid having a high viscosity resist flow more effectively than those of lower viscosity. The additional saliva will cause loss of retention of the denture because of the resultant increase in distance between the denture & mucosa

7-Wettability

For adhesion to be accomplished between a solid & fluid, wetting of solid by fluid must take place.

The degree to which this occur depend on relative surface tension. The wetting characteristics may be described in terms of contact angle (high contact angle indicate poor wetting).

III- MECHANICAL FACTORS:

The varicose mechanical factors which aid in retention are:

- 1) Undercuts
- 2) Magnetic force
- 3) Denture adhesion
- 4) Suction chambers and suction discs

1- Engagement of undercut:

Unilateral undercuts aids in retention while bilateral undercuts will interfere with denture insertion and require surgical correction.

If bony undercuts exist, retention may be enhanced by designing a denture that utilizes these undercut areas. In order to achieve this without traumatizing the mucosa" on insertion and removal of the denture, special care is required in planning the path of insertion

2- Magnets.

Intramucosal magnetic aid in increase retention of highly resorbed ridge.

Magnetic attachments can significantly improve the retention of mandibular complete over denture.

The location of magnetic attachments greatly influences the retentive force of the over denture

Indication:

Some metal alloys possess magnetic properties which can be utilized in the retention of over dentures or partial dentures.

3- Denture adhesive:

Indications:

1-Denture adhesives are indicated when well-made complete dentures do not satisfy a patient's perceived retention and stability expectations.

2-Patients who suffer from xerostomia.

3- Neurological diseases like stroke and Orofacial dyskinesia

4-Patients who have undergone extensive surgery for removal of Oral Neoplasia

Contraindication

1-Adenture adhesive should not be used for patient with ill- fitting dentures

2- It should not be used with patient with worn out denture.

3- t- It should not be used as a substitute to reline or tissue conditioner.

4-it should not be used for patient with physical inability to clean dentures.

5-It should not be used in patient with temporary or immediate dentures where infections could result.

6- It should not be used in patient allergic to adhesive

Mode of action of adhesives:

Mechanism of action: it enhances retention through the optimizing interfacial forces by:

1. Increasing the adhesive and cohesive properties and viscosity of the interposed medium

2. Eliminating the voids between denture base and its basal seat

3. Increases viscosity of saliva

4. Hydrated material swells up in the presence of saliva /water

5. Hydrated material formed by adhesives stick readily to the tissue surface and the mucosal surface of the denture

Forms of denture adhesive

A- Powder form

Start its action immediately with maximum effectiveness & decrease with time.

B- Cream form

Starts its action immediately with accepted effectiveness which increases to maximum within Time

Side effect of denture adhesive:

- High or Elevated Zinc Blood Levels.
- Symptoms of Nerve Damage.
- Numbness or Tingling in the Arms and Legs Paresthesia.
- Anemia
- Bone Marrow Failure

4- Vacuum device

-It's like a suction chamber Alternative name is rubber disk or palatal window in the past suction chamber in the maxillary dentures were used to aid in retention by create an area of negative pressure which increase retention.

They are avoided now due to their potency for creating palatal hyperplasia

IV MUSCULAR FACTOR:

The oral and facial musculature supply supplementary retentive forces, provided

- 1) The teeth are positioned in the "neutral zone" between the cheeks and tongue and
- 2) Polished surfaces of the dentures are properly shaped.

For the oral and facial musculature to be most effective in providing retention for complete dentures, the following conditions must be met:

- (1) The denture bases must be properly extended to cover the maximum area possible, without interfering in the health and function of the structures that surround the denture;
- (2) The occlusal plane must be at the correct level.
- (3) The arch form of the teeth must be in the "neutral zone" between the tongue and the cheeks.

The muscles affected on retention are:

A- Buccinators

B- orbicularis oris

C- muscle of tongue

The accurate approximation of tongue, cheeks and lip to a denture controls the flow of saliva under the denture, thereby increasing the effective area of retention.

In accurate extension of denture may allow increased saliva and air to enter under the denture & cause loss of retention.

Active muscle fixation of dentures may be obtained by careful attention to the form of those surfaces which contact their environmental tissue

Denture surface:

Occlusal surface: That portion of the surface of a denture which makes contact or near contact with the corresponding surface of the opposing denture or dentition) .

Polished surface: It is that part of the denture base which is usually polished, includes the labial, buccal and lingual surfaces of the teeth, and is in contact with the lips, cheeks and tongue. Proper contour & design of the polished surfaces should be in harmony with the function of tongue & cheeks to keep the denture in its position Craddock described the gripping action of the buccinators muscle on the buccal flange of the mandibular denture

If the buccal flanges of the maxillary denture slope Up & out from the occlusal surface teeth & the buccal flanges of the mandibular denture slope down & out from the occlusal plane, the contraction of the buccinators will tend to seat both dentures on their basal seats

Impression surface: That portion of the surface of a denture that had its shape determined by the impression. It includes the borders of the denture and extends to the polished surface. The lingual surfaces of the lingual flanges should slope toward the center of the mouth so the tongue can fit against them & perfect the border seal on the lingual side of the denture.

Lingual flanges turn laterally in posterior part toward the ramus. Also helps ensure the border seal at the back end of mandibular denture."

V Surgical factors

1) Vestibuloplasty 2) Tuberooplasty 3) Ridge augmentation

STABILITY:

that quality of maintaining a constant position in the presence of **forces** that threaten it; The quality of a denture to be firm, stable or constant and to resist displacement by **functional stresses** & not to be subject to change of position when forces are applied.

The various factors that affecting the stability are:

1-Vertical height of the residual ridge

2-Quality of the impression

3-Occlusal rims

4-Arrangement of the teeth

5-Contoure of the polish surface

6- Shape of the palatal Vault

7- Retention

8- Proper relief

Width of the occlusal table >> must be less than normal teeth >> to get good stability and retention.

1) Vertical height of the residual ridge

The residual ridge should have sufficient vertical height to obtain good stability. Highly resorbed ridges offer the least stability.

2) Quality of the impression:

An impression should be as accurate as possible. The impression surface should be smooth and duplicate all the details accurately.

It should be devoid of voids and any rough surfaces. The impression should not warp on removal. The impression should be dimensionally stable and the cast should be poured as soon as possible.

3) Occlusal plane:

The occlusal plane should be oriented parallel to the ridge .if the occlusal plane is inclined then the sliding force may act on reduce its stability. The occlusal plane should divide the inter arch space equally

4) Teeth arrangement (balanced occlusion and neutral zone):

The position of the teeth and their occlusion play an important role in the stability of the denture. Balanced occlusion facilitates the even distribution of force across the denture. Absence of the balanced occlusion may produce unbalanced lever type of force of any one side of the denture leading to loss of stability.

The teeth in the denture should arrange in the neutral zone.

Neutral zone: the potential space between the lips and cheeks on one side and the tongue on the other.

Natural or artificial teeth in this neutral zone are subjected to equal and opposite force from the surrounding musculature""

5) Contour of the polished surface;

The polish surface of the denture should be harmonious with the oral structures. They should not interfere with the action of the oral musculature.

6) Shape of palatal vault

A steep palatal vault may enhance stability by providing greater surface area of contact & long inclines approaching. A right angle to the direction of force

Hard palate:

Hard palate can be classified as:

- 1 -U-shaped: ideal for both retention and stability.
- 2-V-shaped: retention is less as the peripheral seal is easily broken.
- 3-round: reduced resistance to lateral and rotator force.

Stability decreases with

- 1-Loss of vertical height of the ridge,
- 2- Increase in the movement of flabby tissue.

Support:

The resistance to the forces of mastication, occlusal forces & other forces applied in a direction towards the denture bearing area.

The resistance to vertical forces of mastication, occlusal forces & other forces applied in a direction towards the denture bearing area.

Initial denture support is achieved by using impression procedure that provide optimal extension & functional loading of the supporting tissue

Nature of the Supporting tissue

The soft tissues should be

1- In the edentulous person, the mucosa covering the hard palate and the crest of the residual ridge, including the residual attached gingiva, is classified as masticatory mucosa. It is characterized by a well-defined keratinized layer on its outermost surface that is subject to changes in thickness depending on whether dentures are worn and on the clinical acceptability of the dentures

2- The submucosa is firmly attached to the periosteum of the underlying supporting bone and will usually withstand successfully the pressures of the dentures.

(The thickness and consistency of the submucosa are largely responsible for the support that the mucous membrane affords a denture because in most instances, the submucosa makes up the bulk of the mucous membrane. When the submucosal layer is thin, the soft tissues will be non-resilient, and the mucous membrane will be easily traumatized. When the submucosal layer is loosely attached to the periosteum or it is inflamed or edematous, the tissue is easily displaceable, and the stability and support of the dentures are adversely affected).

3- Covered by keratinized mucosa.

Hard tissue should be

Relatively resistance to remodeling & resorptive changes.

Consideration must be given to the maintenance of alveolar ridge height in the conventional complete denture patient.

Minimizing the pressure in those regions most susceptible & directing the forces toward those regions relatively resistance to resorption can maintain healthy residual ridge.

There are two types of osseous tissue that form bones.

Cortical bone: It is harder, stronger and stiffer than cancellous bone

Cancellous bone: is less dense, softer, weaker, and less stiff. It typically occurs at the ends of long bones,

Mandibular anatomical consideration:

1-Buccal shelf area

The surface of the mandible from the residual alveolar ridge or alveolar ridge to the external oblique line in the region of the lower buccal vestibule. It is covered with cortical bone.

Buccal shelf area is the primary support area for the mandibular denture because

- 1) it's usually covered by mucosa with an intervening sub mucous layer containing glandular connective tissue & buccinators muscle fibers
- 2) It is parallel to occlusal plan.
- 3) It lined by cortical bone.

MANDIBULAR RESIDUAL RIDGE

It is covered by a keratinized layer and is attached by its submucosa to the periosteum of the mandible. The extent of this attachment varies considerably. In some people, the submucosa is loosely attached to the bone over the entire crest of the residual ridge, and the soft tissue is quite movable. In others, the submucosa is firmly attached to the bone on both the crest and the slopes of the lower residual ridge.

The ridges crests are reserved as secondary support areas.

- 1) The lack of the muscle attachment
- 2) Presence of cancellous bone

MAXILLARY ANATOMICAL CONSIDERATION

1) Horizontal portion of the hard palate is considered as primary stress bearing area

It has keratinized masticator mucosa overlies a distinct Sub mucosa layer everywhere

2) In the region of the medial palatal suture, the submucosa is extremely thin, with the result that the mucosal layer is practically in contact with the underlying

bone. For this reason, the soft tissue covering the medial palatal suture is non-resilient and may need to be relieved to avoid trauma from the denture base.

3) In the area of the rugae, the palate is set at an angle to the residual ridge and is rather thinly covered by soft tissue. This area contributes to the stress-bearing role, though in a secondary capacity. The submucosa covering the incisive papilla and the nasopalatine canal contains the nasopalatine vessels and nerves

4) CREST OF MAXILLARY RIDGE

The crest of the edentulous ridge is an important area of support. However, the bone is subject to resorption, which limits its potential for support, unlike the palate, which is resistant to resorption. Because of this, the ridge crest should be looked on as a secondary supporting area, rather than a primary supporting area. The inclined facial surface of the maxillary ridge provides little support,

Although the peripheral tissues should be contacted to provide a border seal

The configuration of the bone that provides the support for the maxillary denture varies considerably with each patient.

Factors that influence the form and size of the supporting bone include

- (1) Its original size and consistency;
- (2) The person's general health;
- (3) Forces developed by the surrounding musculature;
- (4) The severity and location of periodontal disease (a frequent cause of tooth loss).
- (5) Forces accruing from the wearing of dental prostheses.
- (6) Surgery at the time of removal of the teeth.
- (7) The relative length of time different parts of the jaws has been edentulous. In addition, a number of anatomical features influence the shape of the hard palate and residual ridge.

Methods used for improving the retention stability and support, these are described in the following.

- Dental implants improve the support, retention and stability of a full or partial denture reducing the slip and movement while speaking or eating
- **Mini-implants have become a common treatment option for improving retention of lower dentures**