

## Attachments in overdenture

**Attachments:** are small mechanical devices, they are incorporated to provide retention and support, one part is connected to a root, tooth or implant (male part) and other part to a prosthesis (female part)



## Function of Attachment

- 1- Securing the prosthesis against forces that tend to lift it.
- 2- Providing periodontal support for the prosthesis.
- 3- Transferring the forces of the muscles of mastication from the prosthesis to the periodontium in as nearly axial direction as possible
- 4- Distributing shearing forces.
- 5- Stabilizing and/or splinting the abutment teeth



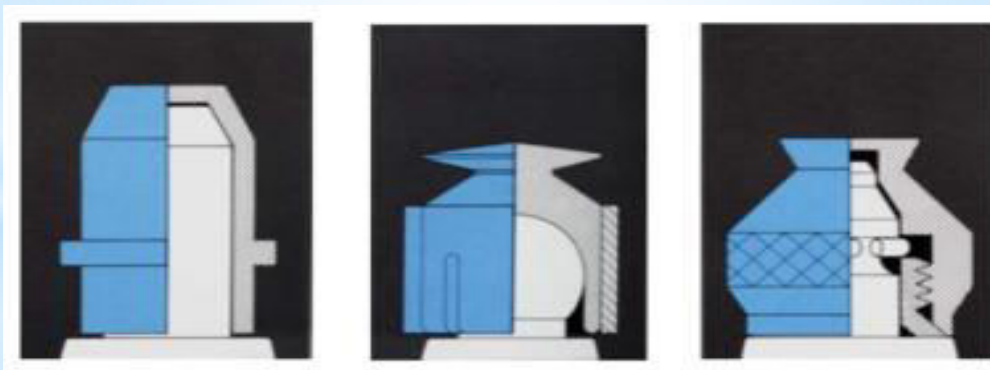
## Factors Affecting Attachment Selection

1. Available inter-arch space.
2. Crown root ratio and alignment of the roots.
3. Type of copying.
4. Vertical space available.
5. Number of teeth present.
6. Amount of bone support.
7. Location of abutments.
8. Location of the strongest abutments.
9. Whether the overdenture is a tooth-supported or tooth tissue-supported.
10. The type of the opposing dentition whether it is complete denture, overdenture, fixed appliance or natural dentition.
11. The maintenance problems and the cost.
12. Clinical experience and personal preference.

## Retentive Mechanism

It is achieved by either:

- 1- Active retention provided by springs that fit into recesses.
- 2- Friction between the components.
- 3- Magnetic anchorage





## Classification of Attachments

### A- Non rigid attachment:

it permits **rotational movements** of the denture around the anchor in one or more planes, or **vertical body movements**. The greater the number of the non-rigid attachments used in the same denture, the more limited will be movement of each.

**Advantage:** Reduced effect of tipping force on the abutment teeth.

#### **Disadvantage:**

-Greater stress on the tissues supporting the denture (Ridge resorption)

### B- Rigid attachments:

A retentive attachment is considered to be rigid if it is **grasps the abutment tooth bodily** and **permits no movement between anchor and prosthesis except for rotation around the long axis of the element in case of a single tooth**. Even with rigid attachment there is a minimal amount of movement, which can increase when the attachment wear.

#### **Advantages:**

- 1- Reduction of the load on the edentulous ridge during function and parafunction.
- 2- Minimum tipping of the abutment teeth when subjected to lateral forces.

#### **Disadvantages:**

The applied forces and movements of the denture are transmitted almost entirely to the abutment teeth

## Non rigid attachments may be indicated under the following conditions:

1- When the geometric distribution of the remaining teeth is unfavorable for the stability of the denture. This can give rise to undesirable tipping and rocking movements especially if the soft tissue support is more resilient and/or less expanded than normal.

2- When only a short dowel (post) can be used to anchor the coping. If a rigid attachment were used over a short dowel, uncontrolled movement of the denture might loosen the dowel from the root

## Types of attachments

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graph TD; A[Types of attachments] --> B[1. Stud attachments: (2 types)]; A --> C[2. Bar attachments: (2 types)]; A --> D[3. Magnet Attachments]; B --> E[Intra radicular attachments. (E.g. Zest anchor attachment).]; B --> F[Extra radicular attachments. (E.g. Ceka Revax attachment).]; C --> G[Bar units.]; C --> H[Bar joints.];
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1. **Stud attachments: (2 types)**
    - Intra radicular attachments. (E.g. Zest anchor attachment).
    - Extra radicular attachments. (E.g. Ceka Revax attachment).
  2. **Bar attachments: (2 types)**
    - Bar units.
    - Bar joints.
  3. **Magnet Attachments**

## Stud attachment

- ❖ Male stud –soldered to the base which is a coping covering the prepared tooth stump
- ❖ Female housing –this is embedded in the acrylic of the OD or it is soldered to substructure in the OD
- ❖ Male and female attachments may be either resilient or non resilient

There are many systems of stud attachments:

**1. Zest anchor (intraradicular attachment)**

- Post prep is made within the root and the female sleeve is cemented into place .
- Male portion consists of a nylon post and a ball head attachment to the overdenture as a chair side .
- Ideal for interim overdenture.



**Advantage**

1. Overcomes any space problem since the attachment is within the root structure.
2. Leverage to the abutment tooth is reduced
3. Attachment procedure is simple
4. Parallelism is not necessary if more than one tooth is used due to the flexibility of the nylon
5. No casting is required

**Disadvantage**

1. Caries susceptibility as no coping placed
2. Nylon stud can bend preventing seating (To correct this frequent recall visits are necessary )
3. When eating foods without the OD can cause food to stagnate in the female part.

## 2. Ceka Attachment (extra radicular attachment)

- Male part fixed to the tooth and has a rounded shape wider at the top and split vertically into 4 sections. They are flexible and can be compressed .
- Female housing fits over this .
- The attachment can also be constructed with a different type of retention male that has a space between the parts to allow both rotational and vertical movement



Patrx – metal ring

Matrix – attachment pin  
(split metal post)

## 3. Dalbo attachment

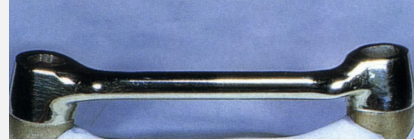
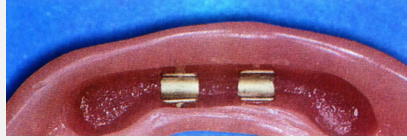
- Rigid, resilient or the stress breaker type
- Male part is soldered to the tooth and the housing to the base
- The rigid type has a cylindrical male unit with a rounded head
- The resilient is the smallest and the most commonly used.
- Rotational and vertical movement possible because of relief spacers between the units.
- Retention in this is by the flexible arms of the female unit fitting over the undercut head of the male unit



## Bar attachment

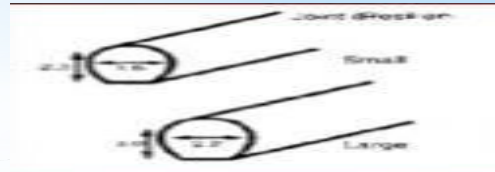
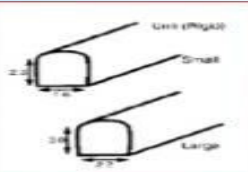
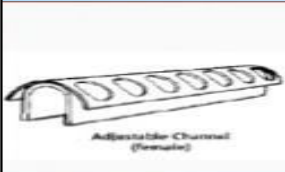
- The purposes of using bars are: – stabilization and/ Splinting of abutment teeth – Retention and support of the prosthetic appliance.

- There are 2 types:



**1. Bar units :** which are the rigid type, no movement between bar and overlying sleeve, transmits occlusal stress totally to abutments.

**2. Bar joints:** which allow some movement of the rotational type. Utilizes the residual ridge for support .



## There are many systems of bar attachment such as:

### 1- Hader Bar

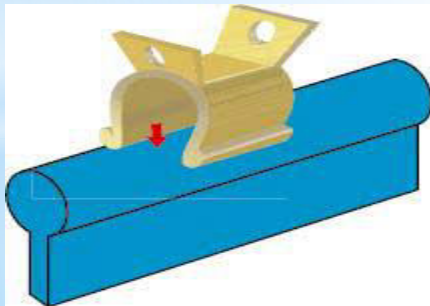
This bar can serve either as a bar joint or a bar unit or as stud .It consist of preformed plastic bars and clips .The bar is attached to the coping wax-up and is casted with the coping. The plastic clips can be imbedded in the denture base to gain retention.





## 2-Ackerman bar and C.M. clip

It consists of a round bar soldered to the post copings and the clip fits over the bar, It in addition has retention wings for engagement of the clip into the resin in the overdenture, spacer is supplied, so that the clip does not rest directly on the bar providing both rotational and vertical movement.

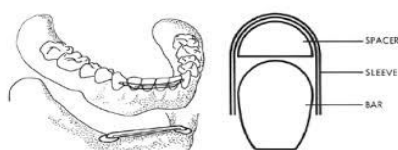


## 3- Dolder bar

➤ **Bar unit:** preformed bar with parallel sides and rounded top soldered to the coping , Sleeve is present in the denture bases , Retention is due to friction ,If the post of the copings cannot be made parallel to seat the soldered bar then a **schubiger unit** is used . **Because of the parallel walls and close adaptation rotation is not possible**



➤ **Bar joint:** Egg shaped bar with a spacer. This allows some movement – Difficult to adapt to tissue contour and bulky.



## C-Magnet Attachments

Magnet system of cobalt - samarium magnet built into the denture base and a magnetisable dowel -coping or keeper plate of palladium cobalt-nickel alloy into the abutment teeth



## O-Ring attachment

They are doughnut shaped, synthetic polymer objects that possess ability to bend with resistance and then return back to their original shape. The O-ring attaches to a post with a groove or undercut area.

### Advantage

- ❖ Ease in changing the attachment.
- ❖ Wide range of movement.
- ❖ Low cost.
- ❖ Elimination of time & cost of a superstructure of prosthesis.



## Oral Hygiene Instructions

- ❖ Motivating and instructing the patient in the care of the overdenture is of the extreme importance for its long term success .
- ❖ Learned during the preliminary treatment phase, the oral hygiene procedures practiced by the patient following placement of the overdenture should be an uninterrupted continuation of the home care measures.

## Overdenture care

1. Ordinary toothbrush or a special denture brush.
2. Tooth pastes with low abrasiveness and non-alkaline soaps.
3. Denture cleansers (mostly peroxide based) are a useful adjunct.
4. Candidacies can be treated by immersing the denture in a 0.2%chlorhexidine solution for 10-15 minutes every day



## Care of abutment

### A-Mechanical aid

1. All abutment teeth with or without root coping must be cleaned on all sides.
2. All exposed root surfaces and gingival area should be brush again with an inter proximal brush.
3. Dental floss is used only to clean under interdental bars and beneath root coping that are solder together.

### B-Chemical aid

#### 1. Fluoride in gel

Fluoride in a 0.025% solution can also be used as a daily rinse.

#### 2. Chlorhexidine:

0.1-0.2% solution as a daily rinse  
gel to be applied inside the denture base or the female attachment.

## Prosthodontics follow up care:

### to correct

- ❖ Occlusion (remounting records).
- ❖ Base (relining).
- ❖ Pressure spots.
- ❖ Bar (loose screws).
- ❖ Bar clips (broken, loose).
- ❖ Female retainers and clips remounted with acrylic resin.
- ❖ Signs of wear

## **Reasons for a Classification System**

Classifying edentulous patients according to present criteria can be an aid in numerous aspects of treatment:

1. Establishing a basis for diagnostic and treatment procedures
2. Justifying treatment procedures and fees to patients
3. Screening patients treated in dental faculties for assignment to undergraduate or graduate students
4. Providing data for review of treatment outcome
5. Simplifying communication in discussions of treatment with patients and colleagues.

## **The classes are differentiated from each other according to the following features:**

1. The skill level required to treat that class of patient: Does the patient require novice or expert treatment?
2. The necessity for modification of basic clinical or laboratory procedures: Will more complicated procedures or more time be required for treatment?
3. Overall management and complexity of treatment: Will expert intervention and referral be required?



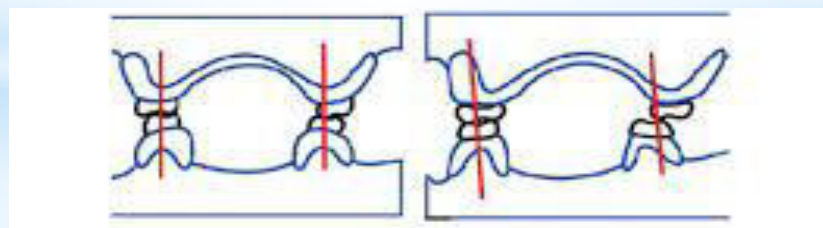
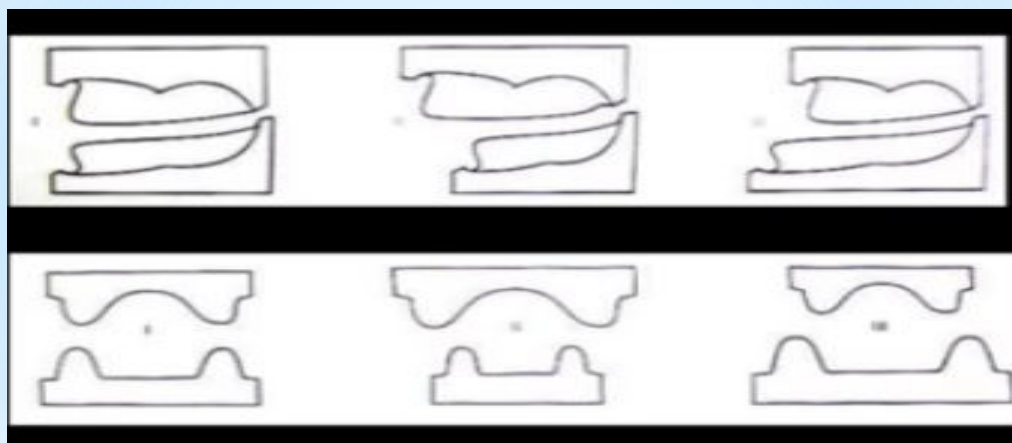
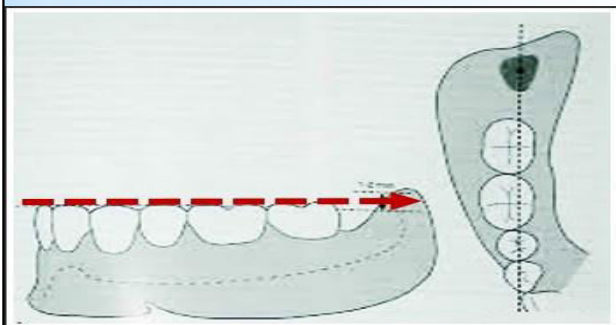
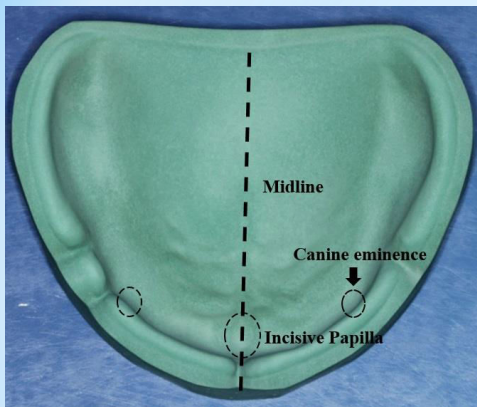
### **Guidelines for Use of the Complete Edentulism Classification System**

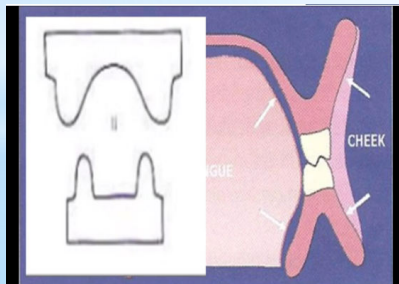
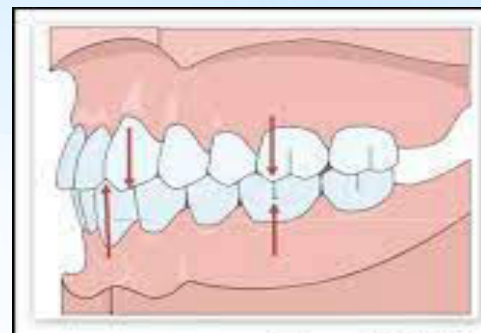
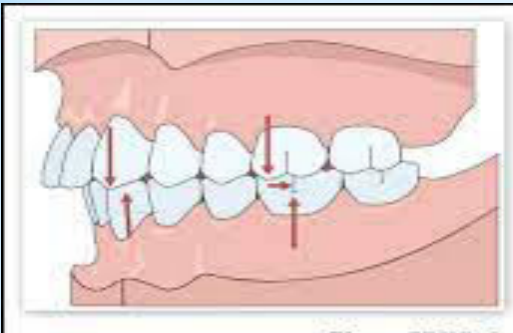
- ❖ In those instances when a patient's diagnostic criteria are mixed between two or more classes, any single criterion of a more complex class places the patient into the more complex class. The analysis of diagnostic factors is facilitated with the use of a worksheet.
- ❖ Use of this system is indicated for pre-treatment evaluation and classification of patients. Re-evaluation of classification status should be considered following preprosthetic surgery. Retrospective analysis on a post treatment basis may alter a patient's classification.
- ❖ The classification system for complete edentulism is based on the most objective criteria available to facilitate uniform utilization of the system. With such standardization, communication will be improved among dental professionals.
- ❖ This classification system will help to identify those patients most likely to require treatment by a specialist or by a practitioner with additional training and experience in advanced techniques.
- ❖ This system should also be valuable to research protocols as different treatment procedures are evaluated.

### **Arrangement of artificial teeth in abnormal jaw relations: Maxillary protrusion and wider upper arch (class II jaw relation).**

#### **Arrangement of anterior teeth in maxillary protrusion.**

As the upper arch in these situations is further forward in the anterior region, the first problem is that of an excessive amount of overjet ( horizontal overlap ) which results in an abnormal upper and lower canine tooth relationship. No attempt should be made to reduce this horizontal overlap by moving the upper anterior teeth palatally or the lower anterior teeth labially.





## Management

The management of such situation can be attempted in any of the following ways, depending upon the severity of the maxillary protrusion.

1. If the protrusion is not too extreme, the simplest way is to select the lower anterior teeth of a narrower mesiodistal width and try to achieve the normal canine relationship.
2. If esthetics permit, a little crowding of the lower anterior teeth by overlapping may solve the problem well.
3. Another solution which is effective at times is leave slight spaces between the upper anterior teeth to attain normal canine relations. However, such a procedure is esthetically limited.
4. In situations where the discrepancy is not too great, grinding of the distal surface of lower canine is sufficient to restore the normal canine relationship.
5. In situations where the discrepancy is excessive and cannot be managed by the manipulation and modification of the lower anterior teeth, the lower anterior teeth must be left as they are, and the lower first premolars must be eliminated from the dental arch.

### **Arrangement of posterior teeth when the upper jaw is wider as in class II jaw relation:**

In this situation, the lower crest of the ridge in the posterior region is lingual to the upper residual ridge. This relationship is not very common, but when present, it may give rise to considerable difficulty in the placement of upper and lower teeth in their correct occlusal relationship. In such instances, the upper arch is wider than the lower, and if the upper teeth are placed on the crest of the ridge, they will make inadequate occlusal contact with the correctly placed lower teeth. At the same time, if an attempt is made to occlude the lower teeth with the correctly placed upper teeth, the lower teeth will place too far buccally leading to an instability of the lower denture. This is much more detrimental as the lower denture-bearing area is already very small.

### **Management:**

The following methods of correction may be employed:

1. If the discrepancy is very slight, the upper teeth are moved slightly in a palatal direction to provide a working occlusal contact with the lower teeth. However, such a procedure has a very limited application as the upper posterior teeth cannot be moved inside (palatally) to any great extent without affecting phonetics and cheek support.
2. If the upper arch is much wider than the lower one, any of the following methods can be used successfully:
  - (a) The lower posterior teeth are correctly placed on the crest of the ridge. The upper teeth are then set so that they occlude well with the lower teeth. Then the buccal contours are built on the upper teeth in wax which is later replaced by tooth-colored acrylic resin to fulfill esthetic requirements and to provide support for the cheek.

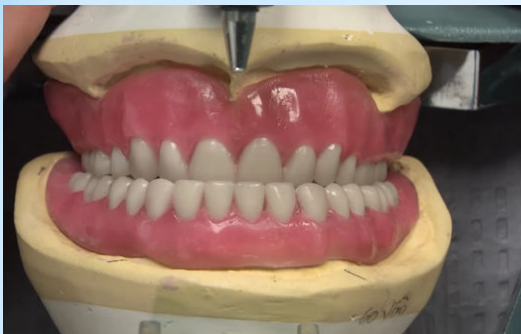
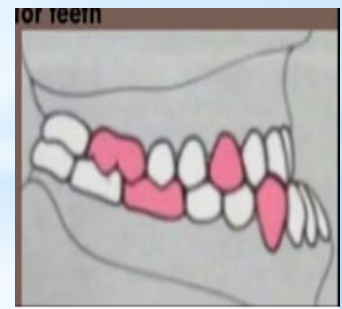
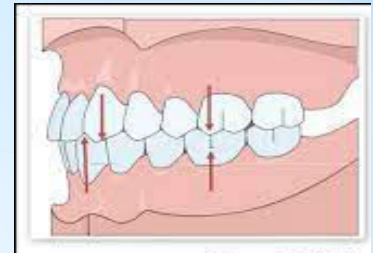
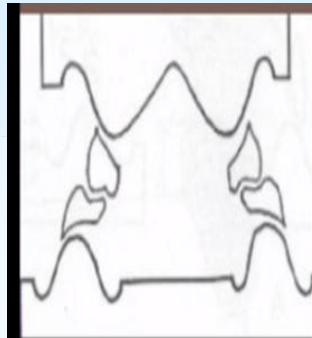
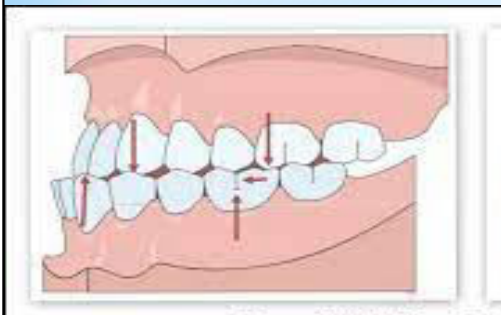
**(b)** Another method can be used alternatively for the same problem. The upper posterior teeth are arranged first to meet the requirements of esthetics. The lower teeth are kept on the crest of the ridge. This will result in an unfavorable occlusal relationship of the upper and lower posterior teeth. In order to establish a functional occlusal contact between the upper and lower posterior teeth, wax is added on the palatal aspect of the upper posterior teeth. This wax is later replaced by tooth colored acrylic resin. This gives a functionally effective occlusal contact as well as an esthetically acceptable buccal surface contour of the upper posterior teeth. Nonanatomical posterior teeth are best for these procedures as they allow more freedom in their buccolingual placement.

### **Arrangement of artificial teeth in abnormal jaw relations: Mandibular protrusion and wider lower arch (class III jaw relation):**

#### **Arrangement of anterior teeth in mandibular protrusion.**

This condition is characterized by the lower anterior ridge being forward in relation to the maxillary ridge. This may vary from edge-to-edge relation (where both upper and lower ridges are at the same level) to a marked prognathism (in which the lower ridge is forward in relation to the upper ridge).





## Management:

These situations can be managed by any of the following methods, depending upon the severity of the mandibular protrusion.

1. If the ridges are in an edge-to-edge relation, the incisal edges of the upper and lower incisors and cuspids will also meet in edge-to-edge relationship. The upper and lower teeth are placed as near as possible to the labial plates of bone in their respective ridges. No attempt should be made to introduce normal horizontal overlap if the ridge relation does not permit it.
2. With an extreme protrusion of the mandible, a negative or reverse horizontal labial overlap must be used. The lower anterior teeth are placed labial to the upper anterior teeth. The magnitude of the reverse horizontal overlap depends upon the amount of protrusion of the lower residual ridge.

3. If the difference in ridge size is too great, one of the following methods may be used to solve the problem.
  - (a) Use a slightly larger lower-tooth mold than that suggested for normal use with the upper teeth. This will compensate for the greater lower-arch width. This is the simplest method.
  - (b) Use a slight overlapping in the upper anterior teeth, if esthetically acceptable. This will automatically narrow the lower-arch space and may eliminate spacing.
  - (c) Use an extra lower incisor to avoid the spaces. However, this is hardly an acceptable measure. It is better, esthetically, to leave some spaces between the lower anterior teeth than for the dentures to appear to have too many teeth.The relationship of the upper and lower canines in this situation does not present much of a problem. The lower anterior teeth are set in a forward relation to the upper anterior teeth. The distal surface of the lower canine coincides with the tip of the upper canine. If it finishes mesial to the canine tip, the discrepancy can be rectified by using small spaces between the lower anterior teeth so that the canine teeth will have their normal relationship.

### **Arrangement of posterior teeth when the lower arch is wider:**

#### **MANAGEMENT:**

An arrangement for the posterior cross-bite relationship will depend on the severity of its deviation from normal. One of three procedures may be used:

1. If the difference in size is slight and the upper ridge is well formed, the upper posterior teeth can be set slightly buccal to the crest of the upper ridge in such a position that correctly placed lower posterior teeth can make effective occlusal contacts with their antagonists. This should not be done to an extent that it introduces potential midline fracture in the upper denture.
2. Nonanatomical teeth may be used. These teeth allow more freedom in their buccolingual placement and still provide an adequate occlusal contact between the upper and lower teeth. The teeth can still be kept on the crests of the respective ridges without losing the desired occlusal contacts.

3. If the lower arch is too wide and cannot be managed otherwise, an interchange can be accomplished by using upper teeth on the lower denture and lower teeth on the upper denture. The interchange is made across the arch as well. The right upper teeth are placed on the left lower ridge, and left lower teeth are placed on the right upper ridge. Similarly, the left upper posterior teeth are set on the right lower ridge, and right lower posterior teeth are placed on the left upper ridge. Start by placing the lower teeth on the upper ridge. As the upper arch is already smaller in these patients, it is imperative that the first premolar tooth be eliminated from the arch to develop correct intercusp relationships. The second premolar, first molar, and second molar (lower teeth) are set on the upper ridge. The buccal cusps of these teeth correspond to the guideline of the lower occlusal rim.

Sometimes a cross-bite setting (i.e., a reverse horizontal buccal overlap) is suggested without interchanging the teeth between the two arches. The success of such an arrangement of teeth is doubtful, as anatomically they are not meant to intercuspate with each other in this relationship. However, it might be attempted if nonanatomical posterior teeth are used.

**Table 1. Checklist for Classification of Complete Edentulism**

|                                                                | Class I | Class II | Class III | Class IV |
|----------------------------------------------------------------|---------|----------|-----------|----------|
| <b>Bone Height-Mandibular</b>                                  |         |          |           |          |
| 21 mm or greater                                               |         |          |           |          |
| 16-20 mm                                                       |         |          |           |          |
| 11-15 mm                                                       |         |          |           |          |
| 10 mm or less                                                  |         |          |           |          |
| <b>Residual Ridge Morphology-Maxilla</b>                       |         |          |           |          |
| Type A - resists vertical & horizontal, hamular notch, no tori |         |          |           |          |
| Type B - no buccal vest., poor hamular notch, no tori          |         |          |           |          |
| Type C - no ant vest, min support, mobile ant. ridge           |         |          |           |          |
| Type D - no ant/post vest, tori, redundant tissue              |         |          |           |          |
| <b>Muscle Attachments-Mandibular</b>                           |         |          |           |          |
| Type A - adequate attached mucosa                              |         |          |           |          |
| Type B - no b attach mucosa (22-27), +mentalis m               |         |          |           |          |
| Type C - no ant b&l vest (22-27), +genio & mentalis m          |         |          |           |          |
| Type D - att mucosa only in post                               |         |          |           |          |
| Type E - no att mucosa, cheek/lip moves tongue                 |         |          |           |          |
| <b>Maxillomandibular Relationships</b>                         |         |          |           |          |
| Class I                                                        |         |          |           |          |
| Class II                                                       |         |          |           |          |
| Class III                                                      |         |          |           |          |
| <b>Conditions requiring Preprosthetic Surgery</b>              |         |          |           |          |
| Minor soft tissue procedures                                   |         |          |           |          |
| Minor hard tissue procedures                                   |         |          |           |          |
| Implants - simple                                              |         |          |           |          |
| Implants with bone graft - complex                             |         |          |           |          |
| Correction of dentofacial deformities                          |         |          |           |          |
| Hard tissue augmentation                                       |         |          |           |          |
| Major soft tissue revisions                                    |         |          |           |          |
| <b>Limited Interarch Space</b>                                 |         |          |           |          |
| 18-20 mm                                                       |         |          |           |          |
| Surgical correction needed                                     |         |          |           |          |
| <b>Tongue Anatomy</b>                                          |         |          |           |          |
| Large (occludes interdental space)                             |         |          |           |          |
| Hyperactive - with retracted position                          |         |          |           |          |
| <b>Modifiers</b>                                               |         |          |           |          |
| Oral manifestations of systemic disease                        |         |          |           |          |
| mild                                                           |         |          |           |          |
| moderate                                                       |         |          |           |          |
| severe                                                         |         |          |           |          |
| Psychosocial                                                   |         |          |           |          |
| moderate                                                       |         |          |           |          |
| major                                                          |         |          |           |          |
| TMD symptoms                                                   |         |          |           |          |
| Hx of paresthesia or dysesthesia                               |         |          |           |          |
| Maxillofacial defects                                          |         |          |           |          |
| Ataxia                                                         |         |          |           |          |
| Refractory Patient                                             |         |          |           |          |



## Classification system for completely edentulous patients

The American College of Prosthodontists (ACP), has developed a classification system for complete edentulism based on **diagnostic findings**. These guidelines may help practitioners determine **appropriate treatments** for their patients. Four categories are defined, ranging from Class I to Class IV; with Class I representing an uncomplicated clinical situation and a Class IV patient representing the most complex and higher-risk situation.

**Each class is differentiated by specific diagnostic criteria.**

This system is designed for use by dental professionals who are involved in the diagnosis of patients requiring treatment for complete edentulism.

**Potential benefits of the system include:**

1. Better patient care.
2. Improved professional communication.
3. More appropriate insurance reimbursement.
4. A better screening tool to assist dental school admission clinics.
5. Standardized criteria for outcomes assessment.



Completely edentulous patients exhibit a broad range of physical variations and health concerns. Classifying all edentulous patients as a single diagnostic group is insensitive to the multiple levels of physical variation and the differing treatment procedures required to restore function and comfort.

A graduated classification of complete edentulism has been developed that describes varying levels of loss of denture supporting structures.

**Complete edentulism** defines as follows: the physical state of the jaw(s) following removal of all erupted teeth and the condition of the supporting structures available for reconstructive or replacement therapies.

### Development of the classification system:

A review of the prosthodontic literature was used to identify the many variables associated with complete edentulism. These variable were differentiated into four subclasses:

1. Physical findings.
2. Prosthetic history.
3. Pharmaceutical history.
4. Systemic disease evaluation.

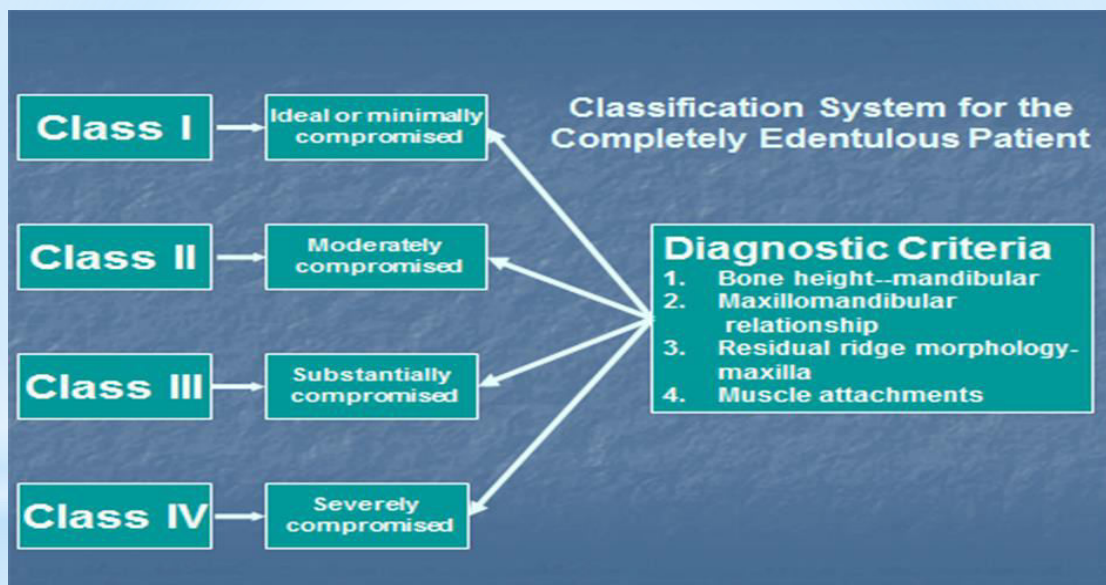
A classification system was developed based on the most objective variables. The classification system will be subject to monitoring and revision as new diagnostic and treatment information becomes available in the literature.

## Diagnostic Criteria

The diagnostic criteria are **organized by their objective nature and not in their rank of significance**. Because of variations in adaptive responses, certain criteria are more significant than others. However, objective criteria will allow for the most accurate application of the classification system and measurement of its efficacy.

**The diagnostic criteria used in the classification system are:**

1. Bone height-**mandible**.
2. Residual ridge morphology-**maxilla**.
3. Muscle attachments-**mandible**
4. Maxillomandibular relationship.



## 1. Bone height-mandible only:

The identification and measurement of residual bone height is the most easily **quantified objective criterion** for the mandibular edentulous ridge. In addition, it represents a **measurement of the chronic debilitation** associated with complete edentulism in the mandible. Despite the lack of a known etiology, it has been established that the loss of denture supporting structures does occur.

Atwood's description in 1971 of **alveolar bone** loss is still applicable today: "Chronic progressive, irreversible and disabling process probably of multifactorial origin. At the present time, the importance of various cofactors is unknown."

### **The continued decrease in bone volume affects:**

1. Denture-bearing area.
2. Tissues remaining for reconstruction.
3. Facial muscle support/attachment.
4. Total facial height.
5. Ridge morphology.

The results of a radiographic survey of residual bone height measurement are affected by the variation in the radiographic techniques and magnification of panoramic machines of different manufacturers.

To minimize variability in radiographic techniques, **the measurement should be made on the radiograph at that portion of the mandible of the least vertical height**. The values assigned to each of the four types listed below are averages that historically have been used in relation to preprosthetic surgical procedures

**A measurement is made and the patient is classified as follows:**

**Classification according to bone height-mandible only:**

**Type I (most favourable):** Residual bone height of 21mm or greater measured at the least vertical height of the mandible.



**Type II:** Residual bone height of 16 to 20 mm measured at the least vertical height of the mandible.



**Type III:** Residual alveolar bone height of 11 to 15mm measured at the least vertical height of the mandible.



**Type IV:** Residual vertical bone height of 10 mm or less measured at the least vertical height of the mandible.





## 2. Residual ridge morphology-maxilla only:

- ❖ Residual ridge morphology is the most objective criterion for the maxilla, because measurement of the maxillary residual bone height by radiography is not reliable."
- ❖ The classification system continues on a logical progression, describing the effects of residual ridge morphology and the influence of musculature on a maxillary denture.

### Classification according to residual ridge morphology-maxilla only:

#### Type A (most favorable):

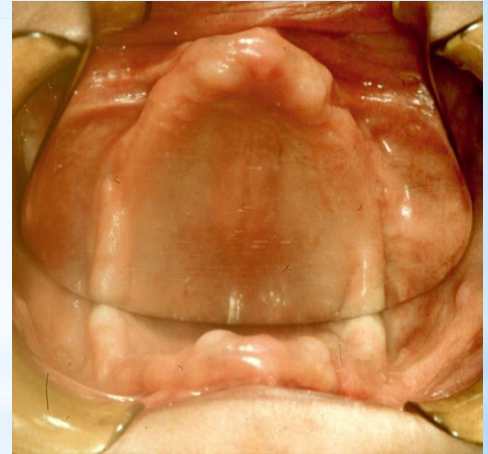
1. Anterior labial and posterior buccal vestibular depth that resists vertical and horizontal movement of the denture base.
2. Palatal morphology resists vertical and horizontal movement of the denture base.
3. Sufficient tuberosity definition to resist vertical and horizontal movement of the denture base.
4. Hamular notch is well defined to establish the posterior extension of the denture base.
5. Absence of tori or exostoses.





### **Type B:**

1. Loss of posterior buccal vestibule.
2. Palatal vault morphology resists vertical and horizontal movement of the denture base.
3. Tuberosity and hamular notch are poorly defined, compromising delineation of the posterior extension of the denture base.
4. Maxillary palatal tori and/or lateral exostoses are rounded and do not affect the posterior extension of the denture base.



### **Type C:**

1. Loss of anterior labial vestibule.
2. Palatal vault morphology offers minimal resistance to vertical and horizontal movement of the denture base.
3. Maxillary palatal tori and/or lateral exostoses with bony undercuts that do not affect the posterior extension of the denture base.
4. Hyperplastic, mobile anterior ridge offers minimum support and stability of the denture base.
5. Reduction of the post malar space by the coronoid process during mandibular opening and/or excursive movements.



### **Type D:**

1. Loss of anterior labial and posterior buccal vestibules.
2. Palatal vault morphology does not resist vertical or horizontal movement of the denture base.
3. Maxillary palatal tori and/or lateral exostoses"(rounded or undercut) that interfere with the posterior border of the denture.
4. Hyperplastic, redundant anterior ridge.
5. Prominent anterior nasal spine.



### **3. Muscle Attachments: Mandible only**

The effects of muscle attachment and location are most important to the function of a mandibular denture. These characteristics are difficult to quantify. The classification system follows a logical progression to describe the effects of muscular influence on a mandibular denture. The clinician examines the patient and selects the category that is most descriptive of the mandibular muscle attachments.

## Classification according to muscle attachments: Mandible only

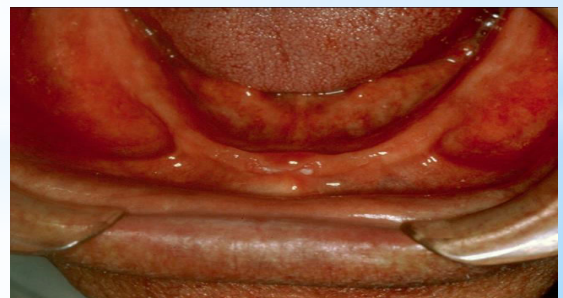
### Type A (most favorable):

1. Attached mucosal base without undue muscular impingement during normal function in all regions.



### Type B:

1. Attached mucosal base in all regions except labial from canine to canine.
2. Mentalis muscle attachment near crest of alveolar vestibule ridge.



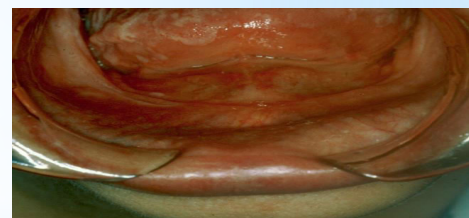
### Type C:

1. Attached mucosal base in all regions except anterior buccal and lingual vestibules-canine to canine.
2. Genioglossus and mentalis muscle attachments near crest of alveolar ridge.



### Type D:

1. Attached mucosal base only in the posterior lingual region.
2. Mucosal base in all other regions is detached.



### Type E:

- No attached mucosa in any region.





## 4. Maxillomandibular Relationship

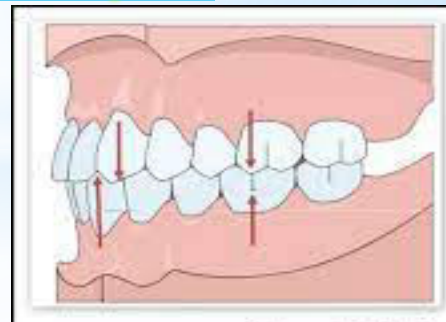
The classification of the maxillomandibular relationship characterizes the position of the artificial teeth in relation to the residual ridge and/or to opposing dentition.

Examine the patient and assign a class as follows:

### Classification according to maxillomandibular relationship

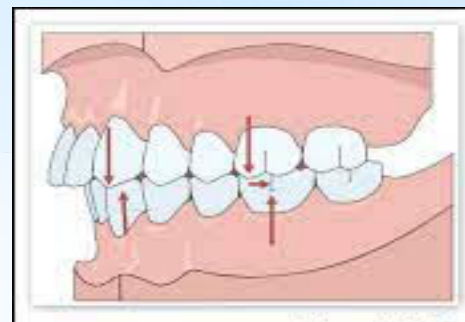
#### **Class I (most favorable):**

Maxillomandibular relation allows tooth position that has normal articulation with the teeth supported by the residual ridge.



#### **Class II:**

Maxillomandibular relation requires tooth position outside the normal ridge relation to attain esthetics, phonetics, and articulation (e.g., anterior or posterior tooth position is not supported by the residual ridge; anterior vertical and/or horizontal overlap exceeds the principles of fully balanced articulation).



#### **Class III:**

Maxillomandibular relation requires tooth position outside the normal ridge relation to attain esthetics, phonetics, and articulation (i.e. cross bite-anterior or posterior tooth position is not supported by the residual ridge).



## Integration of Diagnostic Findings

The previous four sub classifications are important determinants in the overall diagnostic classification of complete edentulism. In addition, variables that can be expected to contribute to increased treatment difficulty are distributed across all classifications according to their significance.

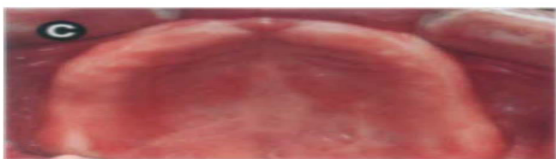
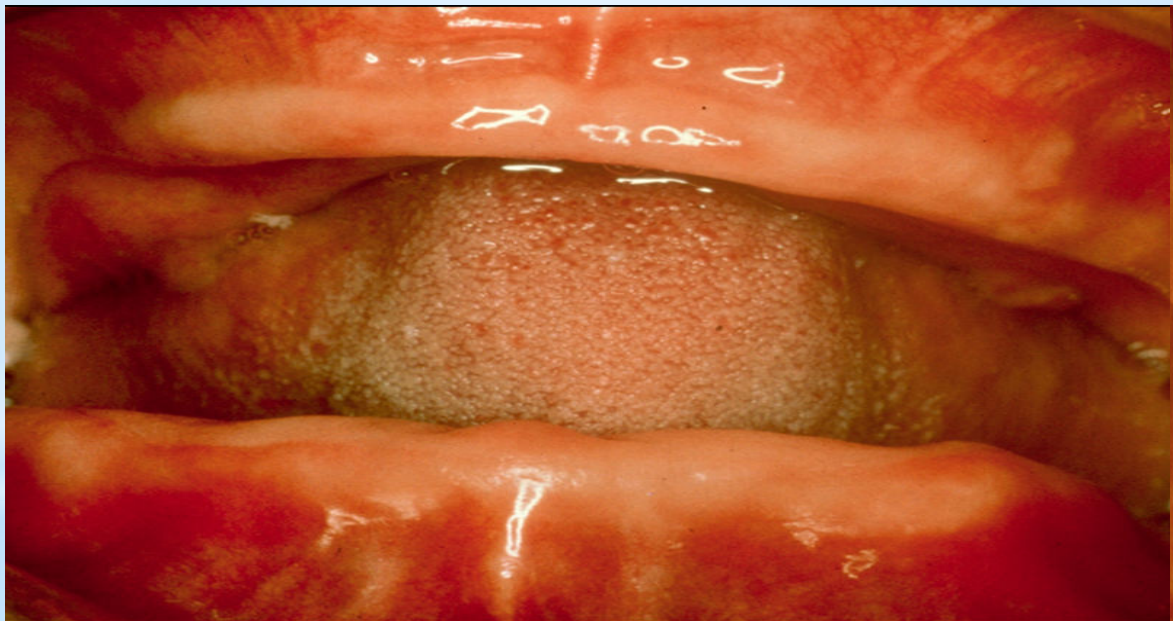
## Diagnostic Classification of Complete Edentulism

### **Class I**

This classification level characterizes the stage of edentulism that is most appear to be successfully treated with complete dentures using conventional prosthodontics techniques. All four of the diagnostic criteria are favorable.

- ❖ Residual bone height of 21 mm or greater measured at the least vertical height of the mandible on a panoramic radiograph.
- ❖ Residual ridge morphology resists horizontal and vertical movement of the denture base; Type A maxilla.
- ❖ Location of muscle attachments that are conducive to denture base stability and retention; Type A or B mandible.
- ❖ Class I maxillomandibular relationship





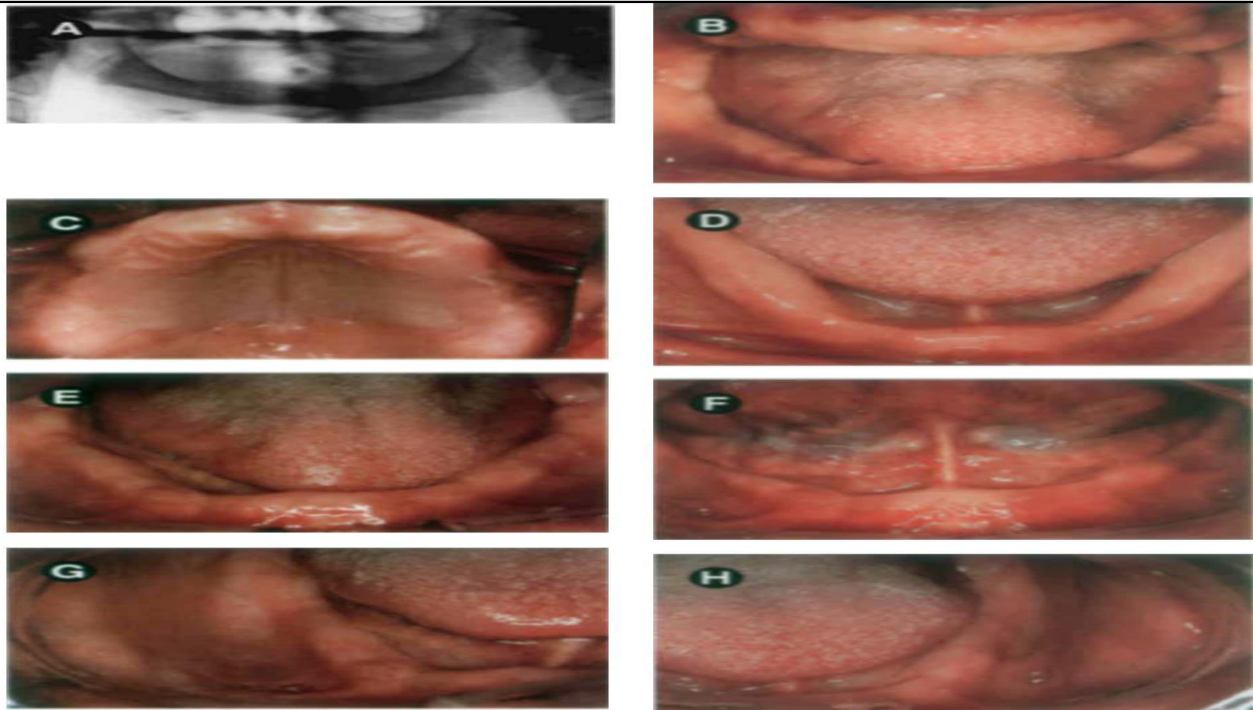
**Figure 14. Class I patient.** (A) Panoramic radiograph. (B) Facial view at the approximate occlusal vertical dimension. (C) Occlusal view; maxillary arch. (D) Occlusal view; mandibular arch. (E) Facial view; tongue in resting position. (F) Facial view; tongue elevated. (G) Lateral view of mandible; patient right. (H) Lateral view of mandible; patient left.

## **Class II**

This classification level distinguishes itself by the continued physical degradation of the denture supporting anatomy, and, in addition, is characterized by the early onset of systemic disease interactions, patient management, and/or lifestyle considerations.

- ❖ Residual bone height of 16 to 20 mm measured at the least vertical height of the mandible on a panoramic radiograph.
- ❖ Residual ridge morphology that resists horizontal and vertical movement of the denture base; Type A or B maxilla.
- ❖ Location of muscle attachments with limited influence on denture base stability and retention; Type A or B mandible.
- ❖ Class I maxillomandibular relationship.
- ❖ Minor modifiers, psychosocial considerations, mild systemic disease with oral manifestation.





**Figure 15. Class II patient.** (A) Panoramic radiograph. (B) Facial view at the approximate occlusal vertical dimension. (C) Occlusal view: maxillary arch. (D) Occlusal view: mandibular arch. (E) Facial view: tongue in resting position. (F) Facial view: tongue elevated. (G) Lateral view of mandible: patient right. (H) Lateral view of mandible: patient left.

### **Class III**

This classification level is characterized by the need for surgical revision of supporting structures to allow for adequate prosthodontic function. Additional factors now play a significant role in treatment outcomes.

- ❖ Residual alveolar bone height of 11 to 15 mm measured at the least vertical height of the mandible on a panoramic radiograph.
- ❖ Residual ridge morphology has minimum influence to resist horizontal or vertical movement of the denture base; Type C maxilla.
- ❖ Location of muscle attachments with moderate influence on denture base stability and retention; Type C mandible.
- ❖ Class I, II, or III maxillomandibular relationship.
- ❖ Conditions requiring preprosthetic surgery:
  - 1) minor soft tissue procedures;
  - 2) minor hard tissue procedures including alveolotomy.
  - 3) simple implant placement, no augmentation
  - 4) multiple extractions leading to complete edentulism for immediate denture placement.



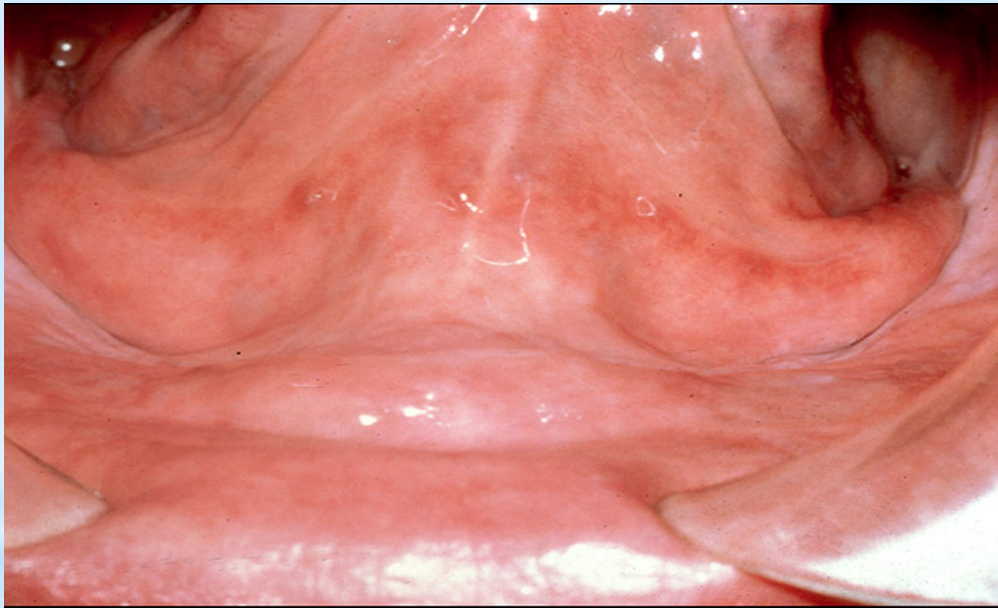
- ❖ Limited interarch space (18-20 mm).
- ❖ Moderate psychosocial consideration and or moderate oral manifestations of systemic diseases or conditions such as xerostomia
- ❖ TMD symptoms present.
- ❖ Large tongue (occludes interdental space) with or without hyperactivity.
- ❖ Hyperactive gag reflex.



#### **Class IV**

This classification level depicts the most debilitated edentulous condition. Surgical reconstruction is almost always indicated but cannot always be accomplished because of the patient's health, preferences, dental history, and financial considerations. When surgical revision is not an option, prosthodontics techniques of a specialized nature must be used to achieve an adequate treatment outcome.

- ❖ Residual vertical bone height of 10 mm or less measured at the least vertical height of the mandible on a panoramic radiograph.
- ❖ Residual ridge offers no resistance to horizontal or vertical movement; Type D maxilla.
- ❖ Muscle attachment location that can be expected to have significant influence on denture base stability and retention; Type D or E mandible.
- ❖ Class I, II, or III maxillomandibular relationships.



- ❖ Major conditions requiring preprosthetic surgery:
  - 1) complex implant placement, augmentation
  - 2) surgical correction of dentofacial deformities;
  - 3) hard tissue augmentation required;
  - 4) major soft tissue revision required, ie, vestibular extensions with or without soft tissue grafting.
- ❖ History of paresthesia or dysesthesia.
- ❖ Insufficient interarch space with surgical correction required.
- ❖ Acquired or congenital maxillofacial defects.
- ❖ Severe oral manifestation of systemic disease or conditions such as sequelae from oncological treatment.
- ❖ Maxillo-mandibular ataxia (incoordination).
- ❖ Hyperactivity of tongue that can be associated with a retracted tongue position and/or its associated morphology



- ❖ Hyperactive gag reflex managed with medication.
- ❖ Refractory patient (a patient who presents with chronic complaints following appropriate therapy).  
These patients may continue to have difficulty achieving their treatment expectations despite the thoroughness or frequency of the treatments provided.
- ❖ Psychosocial conditions warranting professional intervention

## Complete Denture Duplication

**The copy denture :** is a second denture intended to be a copy of the first denture.

**Synonyms :** it's also called duplicate dentures, Template dentures, Replica dentures.

### Aims

1. The transfer of contours from old to new dentures for maintenance of neuromuscular control.
2. Any modifications done to the basic shape of the old denture should therefore be only those necessary to correct the loss of fit i.e., (patient's complaint) and those considered essential by the operator, e.g., slight increase in the OVD and the replacement of the worn denture teeth.

## Indications of Copy denture.

1. When it is desirable, especially for the older patients, to provide replacement dentures (with improved fit) similar in most aspects to those to which patients are already accustomed. It is not easy for a geriatric patient to get used to a new denture with altered polished surface contours readily.
2. If we desire to renew old deteriorated and stained denture base material, the duplicate denture will have the appearance of being completely new.
3. If it is desired by a patient to have a spare denture in case of accidentally fracture or loss of the original denture. The patients often are concerned about being without dentures during required repair or relining process.
4. If we need to experiment interchanging the occlusal relationship of the dentures – for clinical or research reasons. This could be carried out on the spare denture, without changing the original one.

## When to Duplicate a Denture?

- ❖ We are not going to duplicate a denture unless its examination reveals satisfactory findings as regards to esthetic, physiologic, and psychologic needs of a patient.
- ❖ The denture(s) should be evaluated for any previous fractures, craze lines, missing or replaced teeth, esthetics, phonetics, accuracy of fit, and vertical and centric relations.
- ❖ On the basis of this examination, the patient is then advised whether the existing denture should be duplicated or remade.

## Temporary Duplicate Dentures

❖ Production of temporary duplicate dentures is sometimes carried out with the aim that these can be progressively modified if the patient's capacity to adapt is in doubt (e.g., gradual increase in occlusal vertical dimension) or if the cause of the patient's complaints is not clear (e.g., patient may be a denture collector).

❖ These could be fabricated with low cost and with less clinical and laboratory time. Once a satisfactory appliance has been achieved, it can then be copied to produce a definitive denture.

## Techniques for Denture Duplication

A number of methods or techniques have been reported for producing a duplicate or copy denture. All these techniques are similar except in the use of mould container and materials. Some of these methods are:

- ❖ Modified denture flask method
- ❖ Duplicating flask method
- ❖ Pour resin flask method
- ❖ Cup flask method
- ❖ Soap container method
- ❖ Agar container method

Basically, a mould of the old denture is produced in an elastic material, such as alginate or silicon putty supported in a rigid container.

The wax or auto-polymerizing resin template is fabricated from this mould. Any necessary modifications to the old denture are performed on this template denture and tried – in the patient's mouth before finishing the prosthesis.

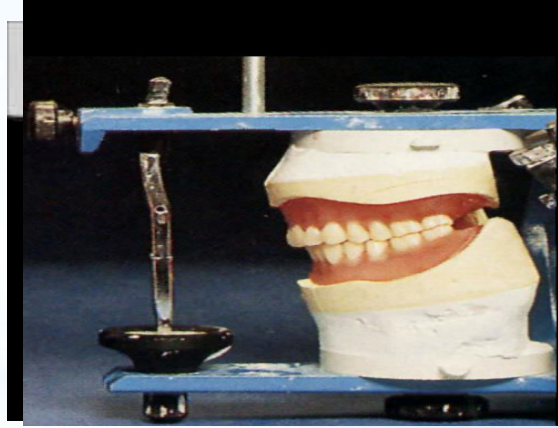
In some of the techniques, auto-polymerizing resin teeth are also fabricated instead of using available ready-made mould, especially for the temporary duplicate dentures.

**The first and most important stage of fabrication of duplicate dentures is to decide which features of the existing dentures are acceptable and which need modifications.**



## 1<sup>st</sup> visit

This visit includes duplication of the old denture in auto-polymerizing acrylic resin, recording the centric jaw relation, and selection of the shade, size, and form of the denture teeth, if the previous selection (old denture) is not accepted by the dentist and the patient.



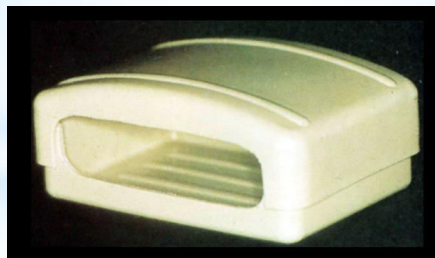
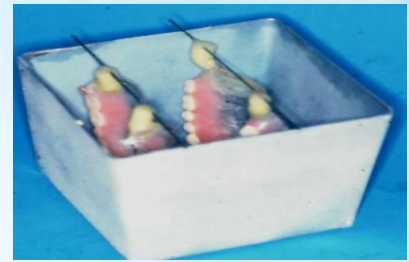
Facebow/Earbow record is taken,....to minimize the occlusal error.



Intra-oral CR Record is also obtained.

## Laboratory procedures for denture duplication

Impressions of the dentures are recorded in alginate using a suitable rigid container, such as a duplicating flask, a modified denture flask or a soap container.



Types of container to be used

The denture is submerged in alginate.



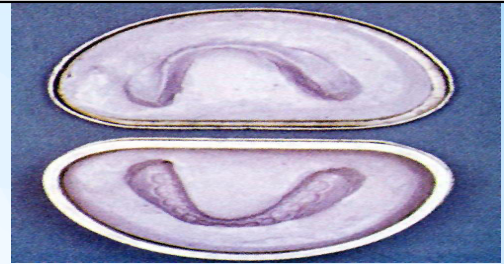
When the alginate is set, any flash of the material on the base is trimmed with a sharp knife.



The flask is then filled with a new mix of alginate avoiding any air entrapment, and the lid is closed.



Alginate halves are separated and the denture is removed. It is returned to the patient.



Sprue holes are then cut into the posterior border of the alginate mold.



The impression is reassembled and held together with adhesive tape. Auto-polymerizing resin is then run into one of the sprue holes until it rises from the other.



Lastly, the duplicate monochrome denture is removed from the flask and mounted on a suitable articulator.

Then the pink colored teeth are replaced by the selected mold of the teeth.



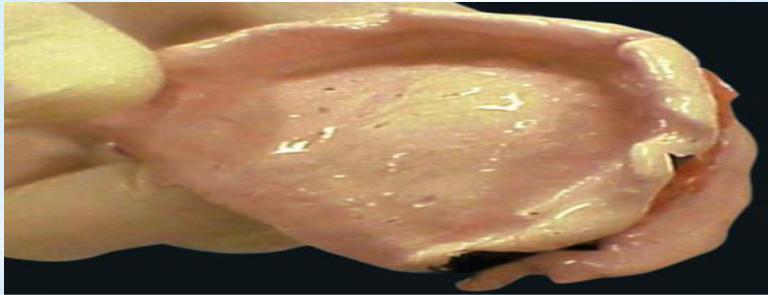
Original and Auto-polymerizing resin  
Upper & Lower Template  
dentures





## 2<sup>nd</sup> visit

This visit includes try in of the dentures – verification of the jaw relations and tooth positions for esthetics and phonetics.



Lower denture reline impression

### Laboratory Procedure

The dentures are now processed, finished and polished with routine laboratory procedures.

## 3<sup>rd</sup> visit

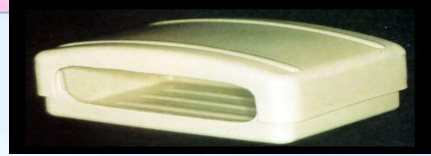
This visit includes all the necessary clinical procedures performed at the insertion appointment of a complete denture including the PIP adjustment and occlusal adjustments.

A clinical remount procedure should also be carried out to perfect the occlusion of the duplicated dentures.



## Denture Duplication Technique 'The Soap Container'

The Soap container



Denture borders are modified with green stick compound.



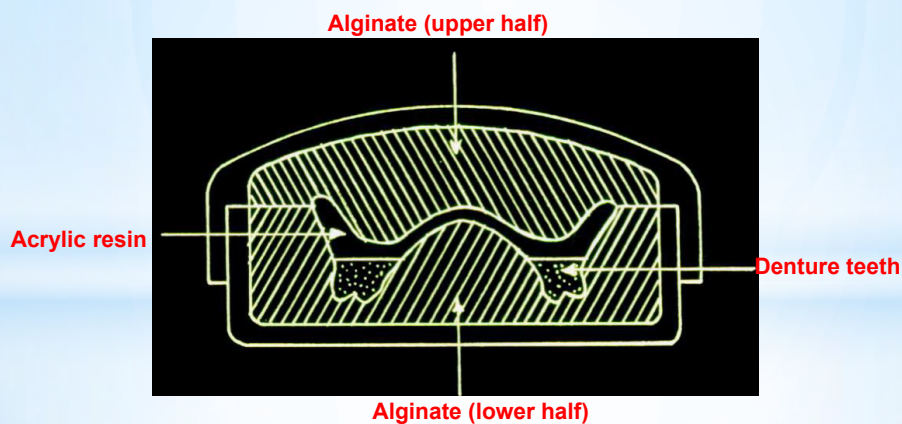
It is then submerged in alginate in the soap container.



Denture invested in the lower part of the container.

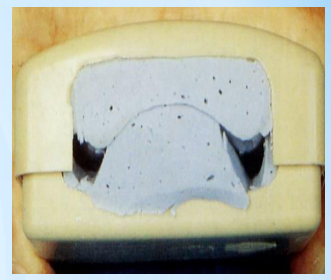


Second pour of alginate to complete the investment procedure – the soap container should be pressed from the sides to avoid its distortion.

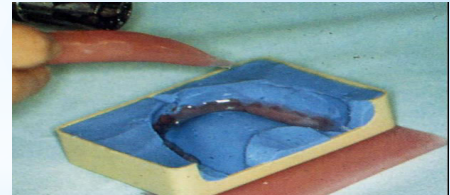


Line drawing showing the mould components

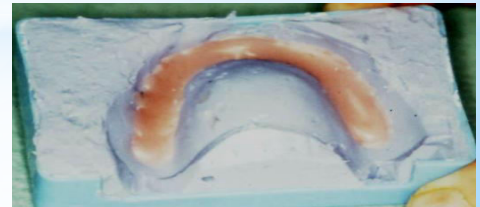
Two halves are then opened and the sprue holes (diameter of a pencil) are cut with a sharp knife. The halves are then re-assembled and can be held together with elastic bands.



Replication of teeth in Wax.



Wax horse shoe representing the teeth



Two halves together – self cure resin is being poured down one of the holes with light vibrations, while air escapes from the other. Place the container with the sprue holes upright in a pressure pot that contain water at 110°F and process the resin under 15-30 psi pressure for 30 minutes.



The Waxed or Auto-polymerized duplicate dentures are then recovered from the molds.



Upper and lower Templates with waxed teeth and self-cured acrylic resin bases.

The Waxed or Auto-polymerized duplicate dentures are then recovered from the molds. Upper and lower Templates with waxed teeth and self-cured acrylic resin bases. Centric relation record is obtained after adjusting the waxed teeth for the OVD.



The wax teeth on one of the dentures are replaced with the identical mould of the resin teeth. The opposing denture guides then set up in identical position to the original denture.



### Denture Duplication Technique 'The Silicon Putty'

An 80 years old patient wearing 25 years old dentures. Note a marked reduction in the OVD. However, the patient is satisfied with the appearance of her old dentures and wants to have similar features in the new dentures as well – Hence the template or duplicate dentures are indicated.





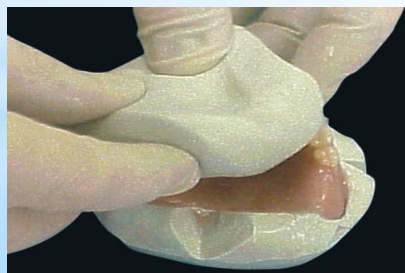
The intra oral occlusion of her old dentures suggests anterior cross bite – indicative of alveolar ridge resorption.



However, extra-orally the dentures can be occluded in normal centric occlusal contacts.



Silicone putty molds are produced and shellac record bases are adapted on the impression of the fitting surface. The molds are then closed and filled with molten pink wax to produce the replica of teeth.







The old denture.



The duplicate wax-denture.

Manipulation of the wax replica dentures is then carried out to correct any errors in the old dentures, e.g., OVD.

Upper reline impression is obtained after adjusting the occlusal plane level and the OVD of the wax replicas.

The duplicate dentures are then mounted on a suitable articulator to replace the wax teeth with the selected mould of the teeth.



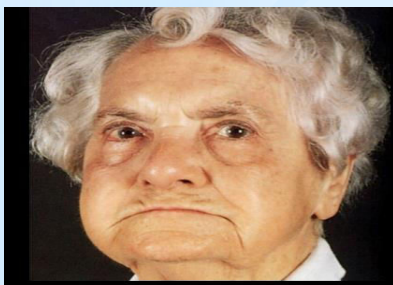
The tooth arrangement is guided by the old dentures.

The relation of the ridges allow the new tooth arrangement to follow the original pattern.

The tooth arrangement is guided by the old dentures. The relation of the ridges allow the new tooth arrangement to follow the original pattern.

Intra-oral Wax try-in is essential to verify esthetic and phonetic virtues of the modified duplicate dentures.

The new dentures can be recognized as the improved version of the old denture.



Old Dentures

vs.

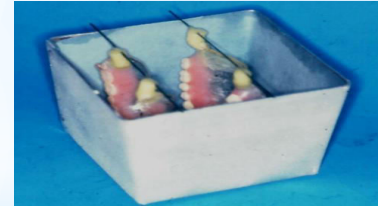
New 'duplicate' Dentures

## Denture Duplication Technique 'the Agar-Agar'

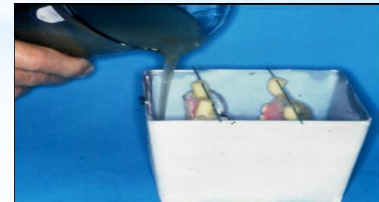
Dentures are suspended with a metal rod through the sticky wax sprues



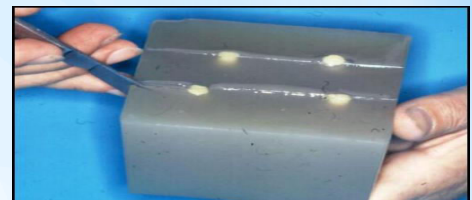
Both Dentures are suspended in the agar container.



Molten Agar is being poured in the container.



Once Agar is set, the mold is sectioned through the sprue holes to retrieve the dentures.



The mold space after removal of the denture.



Auto-polymerized acrylic resin is then poured in the mold space to produce template dentures for modifications.





## Denture Duplication Technique Modifications / Further applications

1. Addition of a labial flange to the open-face denture



- 2- Production of Temporary dentures: Teeth are fabricated with dentin colored self-cured acrylic resin before adding tissue colored pink denture base resin.



## Problem Areas in Fabrication & Solutions

- 1. Rigidity of the Box:** The container used for fabricating the alginate mold must be rigid to avoid distortion of the alginate and subsequently the self-cured acrylic resin template. Precautions must be taken so as the rubber bands used to hold two halves of the mold must not distort the soap container.
- 2. Distortion of the Alginate ridge:** Immediately after pouring the wax to from template teeth, the mold should be reassembled to check that the alginate impression of the ridge does not indent the soft wax. Wax is removed if necessary to avoid any possible distortion of the alginate ridge and production of a base plate without an intact all-acrylic resin impression surface.
- 3. Impression & Jaw relation records:** These steps should be performed with utmost care. Silicone impression material is recommended for obtaining the reline impressions as the template dentures have to be re-inserted in the mouth for recording the OVD and Centric Relation.
- 4. Tooth position and Tissue contours:** Since the spatial positioning of the teeth and the resin contours of the polished surfaces are important for neuromuscular control, the selection and placement of the stock (ready made) teeth on the templates must be undertaken with great care.



## 4-The flabby ridge

### The flabby ridge

This condition is most frequently seen in the upper anterior region. The bone becomes grossly resorbed, often up to the level of the anterior nasal spine, and is replaced by fibrous tissue. As a result of this mobile fibrous tissue, the stability of a complete denture will be poor and both function and appearance can be heavily compromised.

### Aetiology

It has long been believed that the condition, sometimes called the '**combination syndrome**', is caused by the presence of lower natural teeth. This is probably not surprising when the many factors that influence bone metabolism are considered. Nevertheless it is probably wise to keep such patients under regular review to ensure that a dramatic level of damage is not occurring.

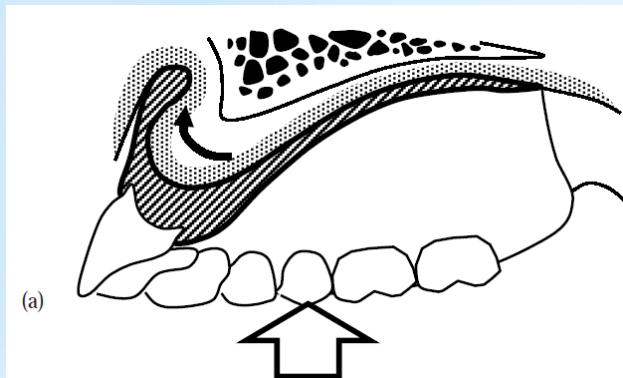
### Management (Approaches to treatment )

The management of this condition is somewhat controversial, opinion falling into two camps.

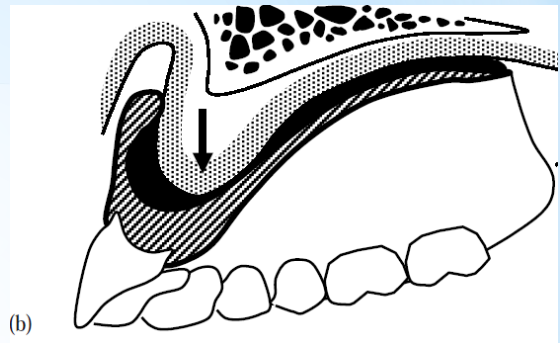
❖ In one, **surgical removal of the fibrous tissue** is favoured in every case where the health of the patient allows. This approach produces a firm ridge which is reduced in size. Advocates of the opposing view suggest that surgical removal should rarely, if ever, be carried out because the fibrous tissue may have a cushion effect which reduces trauma to the underlying bone. If the tissue is removed, it must be replaced by denture base material with consequent increase in the bulk and weight of the prosthesis.

❖ **Second: Non-surgical treatment:** A key aspect in the non-surgical management of the flabby ridge is the choice of impression technique employed.

To employ **a mucodisplacive impression technique** which **compresses the flabby** tissue in order to try and obtain **maximum support from it** or, To use a **mucostatic impression technique** with the aim of **achieving maximum retention**.



(a) Under occlusal pressure, the upper denture is seated and the flabby anterior ridge



(b) When the teeth are apart, the flabby tissue recoils and displaces the denture downwards.

## 5- Denture breakages

**Midline fracture** of the complete upper denture accounts for **29%** of all repair work in dental laboratories, whilst **teeth debonded** from complete dentures account for **33%**. These two common problems will be considered.

### Types of fracture:

- 1- Fatigue of the acrylic resin (fatigue fracture).
- 2- Impact fracture.

### 1- Fatigue of the acrylic resin

Fatigue fracture results from **repeated flexing of the denture by forces too small to fracture it directly**. Failure of the denture base is due to the progressive growth of a crack originating from a point on the surface where an abrupt change in the surface profile causes a localised concentration of stress many times that applied to the bulk of the denture. The crack often starts palatally to the upper central incisors, grows slowly at first but undergoes an enormously increased rate of growth just before the denture fractures. A failure of this type most commonly occurs in dentures that are about 3 years old. Midline fracture due to fatigue of the acrylic resin is the commonest type of denture breakage.

### 2- Impact fracture

Denture breakage might occur, for example, if the patient **accidentally drops** the denture while cleaning it. It might also result from an **accident** in which the patient receives a blow to the mouth.

Whenever possible, the cause, or causes, of the fracture must be identified before the denture is repaired or replaced. Unless this is done and the cause attended to, the denture is likely to fracture again within a short period of time.

### Causes of fracture:

#### A. Denture factors

1. Stress concentrators.
2. Absence of a labial flange.
3. Incomplete polymerization of the acrylic resin.
4. Previous repair.
5. Shape of the teeth on the denture.
6. Poor fit.
7. Lack of adequate relief.

#### B. Patient factors:

1. Anatomical factors: a prominent labial frenum will require a deep notch in the flange resulting in stress concentration in that area.
2. High occlusal loads: These may occur in patients with powerful muscles of mastication, or whose natural lower teeth are still present, or who are bruxists.

## 6- Debonding of teeth

**The usual reasons for a weak bond between tooth and denture base are:**

1. The presence of tin-foil substitute on the ridge-lap surface of the tooth
2. The presence of residual wax on the same surface.
3. The use of cross-linked teeth which are incompatible with the particular denture base polymer.

**Of the various recommendations that have been made for minimising the risk of debonding the following have received fairly widespread support :**

1. Choose artificial teeth and a denture base polymer which are compatible by checking the information sheets provided with the products or by seeking information from the manufacturers. Conventional denture teeth tend to achieve a higher bond strength than cross-linked teeth.
2. Ensure all traces of wax and tin-foil substitute are removed. The complete removal of wax is not consistently achieved with boiling water alone and so for optimum bond strength the use of a wax solvent is recommended .
3. Drill small channels into the palatal surface of the teeth to increase the area available for the polymerising denture base resin. However, it needs to be remembered that such recesses in the ridge-lap surface of the teeth can make complete wax removal more difficult. Therefore particular care needs to be taken when removing the wax, otherwise the adjustments can result in a weaker, rather than a stronger bond.
4. Apply a solvent such as dichloromethane to the ridge-lap surface of the teeth. The solvent creates microscopic pores and channels which promote diffusion of the polymerisable materials.
5. Use a heat-curing denture base polymer. This material polymerises more slowly than a cold-curing material and ensures better penetration into the tooth substance.



## 7- Gagging reflex (retching)

Is a protective reflex which guards the airway and posterior oropharynx. It may occur during prosthetic procedures such as impression taking, or when dentures are worn or, in extreme cases, when a mouth mirror is placed on the lips or tip of the tongue.

### Aetiology

There are a number of causes that may be conveniently grouped together as follows:

(1) **Somatic:** The term 'somatic' covers those situations where the reflex is triggered by tactile stimulation of the soft palate, posterior third of the tongue.

(2) **Iatrogenic:** Iatrogenic causes, which are related to the dentures, are numerous. Some patients begin to retch after new dentures are inserted, but in most cases this reflex soon disappears as they adapt to the dentures. However, the reflex may persist if there are faults with the dentures such as an **excessive occlusal vertical dimension**, or if the dentures are **stimulating the sensitive areas of the soft palate and tongue directly**.

This stimulation may be caused by **palatal over-extension**, a **posterior border which is too thick** or **poorly adapted**, the **teeth encroaching on tongue space** or indeed by any factor producing **denture instability**. An upper denture whose posterior border is under-extended posteriorly can provoke gagging because as the edge of the denture terminates on relatively incompressible mucosa a **satisfactory post-dam cannot be produced**. This result in poor retention, which increases denture instability, stimulates the tongue and palate, and causes apprehension in the patient. When this diagnosis is established, it requires a very careful explanation by the dentist to convince the patient that to cure the problem it will be necessary to cover more, rather than less of the palate.

(3) **Psychogenic:** Psychogenic causes may arise from **sight, sound or thought**. They include the sight of impression material being mixed or the sound of another patient retching. The patient may be extremely apprehensive because of an unhappy first experience of dental procedures or as a result of disturbing stories from friends. In rare instances, retching may be a manifestation of a psychological disturbance which is not primarily related to the patient's dental treatment.

(4) **Systemic:** Less frequently, the causative factor may be **systemic disease**, particularly conditions affecting other regions of the gastrointestinal tract; for example, the link between retching and alcoholism may be related to the persistent gastritis found in such patients. Persistent catarrh will prevent nose breathing and may contribute to the problem of retching.

## **Patient management:**

### **❖ Assessment of the severity of the problem**

A carefully taken history will reveal the severity of the problem and provide clues as to the cause. For example, a situation where a patient has been able to tolerate the clinical stages of denture construction, but then has difficulty in wearing the finished dentures, points to an iatrogenic cause which should be treated relatively simply by correcting the error in denture design.

### **❖ Impressions**

Most of individuals find impression taking unpleasant. However, retching during impression taking can usually be prevented by the following:

**(1) Reassurance and relaxation:** It is very important that the dentist has a confident and relaxed chairside manner. It is essential that the anxious patient is reassured and encouraged to relax both physically and mentally. The dental nurse can also play a major role in creating an appropriate state of mind in the patient.

**(2) Position of the patient:** The dental chair should be adjusted so that the patient is sitting comfortably in the upright position.

**(3) Breathing through the nose:** Instructing the patient to breathe through the nose while the tray is being tried in the mouth or the impression is being taken is one of the most helpful methods of preventing retching. During nasal breathing the soft palate remains stationary in its low position and the tongue in its 'guarding' position, protecting the nasopharynx from the threat of the foreign body in the mouth. If the patient breathes through the mouth, this protection is lost and movement of the soft palate results in intermittent contact with the setting impression material, increasing stimulation.

**(4) Impression technique:** Impression trays should be well fitting. As close-fitting special trays are less bulky than spaced trays, they are better tolerated and should be used whenever possible.

When trying trays in the mouth, firm, positive movements should be used. Most patients tolerate the lower impression better than the upper one, so if the lower impression is taken first, the success of the procedure is likely to reassure the patient. The impression material should be mixed or prepared out of sight of the patient and the amount placed in the tray kept to the minimum necessary to record the relevant structures. A saliva ejector should be used if copious amounts of saliva collect in the floor of the mouth.

**(5) Distraction:** It is during the insertion of the impression and while the material is setting that it is particularly important to distract the patient's attention from what is going on. This may be achieved by the dentist talking about something that is known to be of particular interest to the patient, or by reinforcing the requirement that the patient continues to breathe slowly and steadily through the nose. It has even been suggested that the patient be asked to raise one leg and to concentrate on not lowering it until the impression has set!

### **The severe gagging reflex**

❖ **The first challenge** when trying to treat a patient who has this problem is to obtain an accurate impression so that a well-fitting denture base can be constructed.

❖ **The second challenge** is to provide a prosthesis that can be worn by the patient for a reasonable length of time.

**The following approaches to the management of this difficult problem have been found useful:**

**(1) Conscious sedation**

**(2) Acupuncture:** The gag reflex has been shown to be capable of being controlled by acupuncture. Although there is evidence to show that the technique is of assistance when undertaking the various clinical stages of denture construction there is, as yet, no evidence that it can be used by the patient to allow the denture to be worn.

**(3) Hypnosis:** Hypnosis has been used in the treatment of severe cases its success is dependent upon the patient being well motivated and being able to practise self-hypnosis, thus enabling a denture to be worn outside the dental surgery

**(4) The training denture:** The training denture approach may be of value when treating any patient with a long history of difficulties which suggest frank denture intolerance, including retching.

## 8- The burning mouth syndrome

The burning mouth syndrome (BMS) can be very troublesome to the patient, presents problems of diagnosis and often involves prolonged treatment. The symptoms occur in **5–7% of the adult population**. Of those who seek treatment, there is a predominance of **women**, with a mean age of approximately **60 years**. The most common sites of the complaint are the **tongue and the upper denture-bearing tissues**. Rather less common are the **lips and lower denture-bearing tissues**. The oral mucosa appears normal.

Many of the BMS patients have consulted a number of health care professionals before seeking help from the dentist or dental specialist. They know of no other people with the complaint and therefore feel quite isolated. If several professionals have stated that the mouth looks normal the patient may start to feel as if 'it is all in the mind'. The level of anxiety is consequently raised and cancerophobia may well develop.

### Classification

Three types of BMS have been described. **The classification is useful as it points the way towards appropriate treatment and a probable prognosis.**

**Type 1:** There are no symptoms on waking. A burning sensation then commences and becomes worse as the day progresses. This pattern occurs every day. Approximately **33%** of patients fall into this category and are likely to include those with **haematinic deficiencies** and **defects in denture design**.

**Type 2:** Burning is present on waking and persists throughout the day. This pattern occurs everyday. About **55%** of patients are placed in this category, a high proportion of who have **chronic anxiety** and are the most difficult to treat successfully.

**Type 3:** Patients have symptom-free days. Burning occurs in less usual sites such as the floor of the mouth, the throat and the buccal mucosa. This category is made up of the remaining **12%** of patients. A study of this group has shown that the main causative factors are **allergy** and **emotional instability**. The investigation of these patients is likely to include patch testing.



## **Aetiology**

BMS has been attributed to a multitude of causes and these broadly fall into three groups:

- A.** Local irritants
- B.** Systemic factors
- C.** Psychogenic factors.

### **A. Local irritation**

#### **1. Denture faults**

Errors in denture design which cause a denture to move excessively over the mucosa, which increase the functional stress on the mucosa or which interfere with the freedom of movement of the surrounding muscles may initiate a complaint of burning rather than frank soreness.

Denture design errors have been discovered in 50% of BMS patients.

**2. Residual monomer:** High levels of residual monomer in the denture base have been reported and the tissue damage produced is considered to be the result **of chemical irritation rather than a true allergy**.

It is possible that high levels of **residual monomer**, which have ranged from three to ten times the normal value, are due to errors inadvertently introduced into the **short curing cycles** which are popular with manufacturers and dental laboratories. If the requisite curing temperature of 100°C is not achieved in the relevant part of the short curing cycle, there is a marked increase in residual monomer content. Some authorities may not consider this condition to be an example of BMS where, classically, the mucosa looks normal. However, a patient who reacts to a high level of residual monomer complains of a burning sensation and so we feel justified in including it.

### 3. Micro-organisms

The role of micro-organisms in burning mouth syndrome is controversial and studies have not shown a link between the presence of *Candida albicans* and the complaint.

### 4. Smoking and mouthwashes

Smoking and the regular use of some mouthwashes are irritants that have been implicated in BMS.

## B. Systemic causes

### 1. Nutritional deficiencies

Contributions from nutritional deficiencies such as iron, vitamin B complex and folic acid should be highlighted. An example of BMS caused by a deficiency is **Iron deficiencies have been found in 8%** and **folic acid deficiencies in 6%** of BMS patients. **Low blood levels of vitamin B1 and B6 were found in 40%** of patients.

### 2. Endocrine disorders

What is apparent is the relative unimportance of the climacteric as a causative factor, a modern viewpoint which is at variance with past clinical opinion. On rare occasions, the symptoms are found to be linked with an **undiagnosed diabetes mellitus**. Treatment of the medical condition invariably results in complete resolution of BMS.

**Xerostomia**, frequently associated with BMS. One that should be highlighted here is drug-induced xerostomia. Recent investigations have produced evidence of a link between BMS and **reduced parotid gland function** and of **anti-depressant medication** reducing the salivary flow. It should be recognized that the presence of a dry mouth is capable of accentuating the symptoms initiated by any of the causes of local irritation. This is an example of the **multifactorial nature of BMS**.

### 3. Hypersensitivity

True hypersensitivity to constituents of denture base polymer is rare and usually results in local symptoms such as burning or itching. In one instance where there were systemic symptoms of nausea, dizziness and general malaise the patient was found to have reacted to **dyes used to color** the polymer. Dentures made of clear polymer proved successful

### 4. Parkinson's disease

It has been reported that the prevalence of BMS was **24% in people** suffering from Parkinson's disease

### C. Psychogenic causes

The more common disorders associated with BMS are **anxiety, depression, cancerophobia** and **hypochondriasis**. The associated **parafunctional** activities such as bruxism and abnormal and excessive tongue movements are capable of inducing mucosal irritation.

## Management

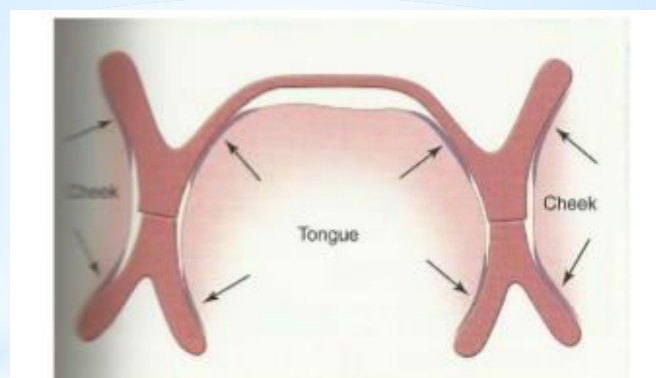
Faced with a multitude of causative factors, it will be recognized that the process of diagnosis and treatment is usually a time-consuming affair.

- ❖ Initial assessment (history/examination/special tests).
- ❖ Provisional diagnosis.
- ❖ Initial treatment (e.g. elimination of local irritants and investigating and treating haematinic deficiencies).
- ❖ Assessment of initial treatment.
- ❖ Definitive diagnosis.
- ❖ Definitive treatment (local/systemic correction/psychological therapy).
- ❖ Follow-up.

With regard to outcome, analysis of various studies suggests that **about two-thirds** of BMS patients are either **cured or improved** to such an extent that the burning sensation is no longer an overwhelming problem. There remain a group of patients for whom the current state of knowledge can offer relatively little benefit. Some in this small group remain totally resistant to treatment. However, it should be remembered that even in these refractory cases BMS is not necessarily a life sentence as spontaneous remissions can eventually occur for no apparent reason.

## 9- Disturbance of speech

The presence of complete dentures can modify speech by **affecting articulation** and by **altering the degree of oral resonance**. A number of sounds are articulated by contact of the tongue to the palate and to the teeth. A change in speech that may be quite marked when the dentures are first inserted will usually disappear completely within a few days. However, if the changes in the contact surfaces require a modification of tongue behavior that is beyond the adaptive capability of an individual patient, a speech defect will persist. It should also be remembered that the tongue of a patient who is wearing complete dentures has a dual function – to take part in speech articulation and to control the dentures. If the dentures are loose, the demands of this latter function may be so great that there is a general deterioration in the quality of speech. As mentioned





**The following relationships are particularly important to the production of clear speech:**

**(1) Tip of the tongue to the palate.**

Contact between the tip of the tongue and the palate is required in the production of /s/, /z/, /t/, /d/ and /n/. Consequently, a change in the shape or thickness of the denture contact surface resulting from the fitting of new dentures will require a modification of tongue behaviour in order to produce sounds which are the same as before. In the vast majority of cases, the necessary modification occurs without any difficulty in a relatively short period of time.

The sound most commonly affected in this way is /s/, a sound which is generally produced with the tongue tip behind the upper anterior teeth. A narrow channel remains in the centre of the palate through which air hisses. If the palate is too thick at this point, or if the incisors are positioned too far palatally, the /s/ may become a /th/. If the denture is shaped so that it is difficult for the tongue to adapt itself closely to the palate, a channel narrow enough to produce the /s/ sound will not be produced and a whistle or /sh/ sound may result. This is most likely to be the consequence of excessive palatal thickening laterally in the canine region

**(2) Lower lip to incisal edges of upper anterior teeth.**

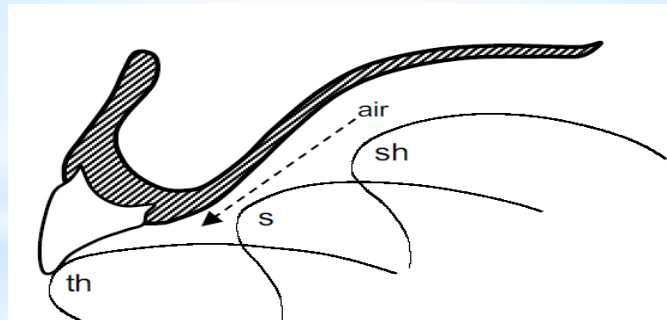
The lower lip makes contact with the incisal edges of the upper anterior teeth when the sounds /f/ and /v/ are produced. If the position of these teeth on a replacement denture is dramatically different to that on the old denture there is likely to be a disturbance in speech.

**(3) Lateral margin of the tongue to posterior teeth.**

Contact between the lateral margins of the tongue and the posterior teeth is necessary to produce the English consonants /th/, /t/, /d/, /n/, /s/, /z/, /sh/, /zh/ (as in measure), /ch/, /j/ and /r/ (as in red). Air is directed forwards over the dorsum of the tongue and may be modified by movement of the tongue against the teeth or anterior slope of the palate to produce the final sound. If the contact can only be achieved with difficulty, movement of the tip of the tongue may be restricted with consequent impairment of speech. This difficulty arises if the posterior contact surfaces are too far from the resting position of the tongue as a result of the occlusal plane being too high, the occlusal vertical dimension too great or the posterior teeth placed too far buccally. In extreme cases, it may not be possible for the tongue to produce a complete lateral seal and so a lateral sigmatism develops.

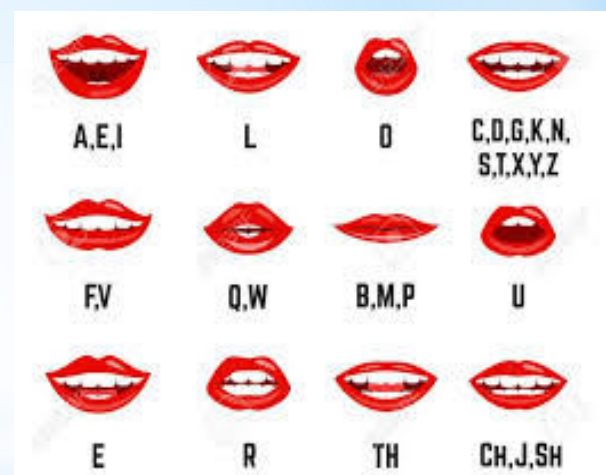
#### (4) The relationship of mandible to maxilla.

The mandible moves closest to the maxilla during speech when the sounds **/s/, /z/, /ch/ and /j/** are made. Normally, at this time, there will be a small space between the occlusal surfaces of the teeth. However, if the occlusal vertical dimension of the dentures is too great, the teeth may actually come into contact so that the patient complains that the teeth clatter.



The position of the tongue for producing the sounds /th/, /s/ and /sh/.

| Type of Obstruction  | Consonant Sound                |
|----------------------|--------------------------------|
| Lips                 | /p/ /b/                        |
| Lips/teeth           | /f/ /v/                        |
| Tongue between teeth | /th/ /ch/                      |
| Tongue behind teeth  | /t/ /d/; /n/; /s/ /z/; /l/     |
| Roof of mouth        | /sh/, /zh/; /ch/ /j/; /y/; /r/ |
| Back of mouth        | /k/ /g/; /ng/; /wh/ /w/        |
| Throat               | /h/                            |



## Complications in complete denture wearers

In this lecture, we stress the importance of planning a programme of recall appointments after fitting complete dentures, to ensure that the tissues are not being damaged and that the dentures are functioning efficiently and comfortably. A recall visit also gives the patient an opportunity to seek advice over any concerns.

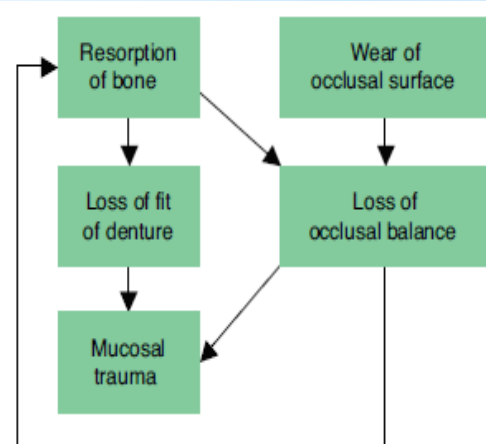
To reduce the risk of mucosal damage and bone resorption in complete denture wearers, a check should be made every year. It is important that the patient is not under the mistaken belief that once the artificial substitute for the natural teeth has been provided there will be no further problems, and no need for further maintenance.

Epidemiological studies of edentulous population have shown that most patients with complete dentures have pathologic tissue changes that require treatment.

## Changes occurred require long term recall appointments

**Long term recall appointments done because the following changes occurred.**

- ❖ Mucosal changes
- ❖ Bone resorption
- ❖ Occlusal changes
- ❖ Adaptation of patient.



**Figure 15.2** Cycle of tissue damage resulting from lack of denture maintenance.

## **Mucosal changes**

The need to carry out periodic checks with respect to oral cancer was stressed. In 2007, in the UK, there were 5325 new cases and 1841 deaths, with an increased prevalence in deprived communities. It should be emphasised that the typical edentulous patient falls into a risk group, as a retrospective study of patients with oral cancer showed that 59% were edentulous, tended to be older than 60 years, were tobacco and alcohol users, had a lower socioeconomic status and had a somewhat negative attitude to recall appointments.

## **Bone resorption**

The long-term changes in shape of the residual ridges and the consequent effect on dentures have been studied extensively. A continuing reduction in height of the alveolar ridges over a period of 25 years has been observed. There appears to be a marked reduction in the first year of denture wearing and in the next few years a continuing loss averaging 1 mm each year. Over periods of time, the loss in height of the anterior lower ridge is four times that of the upper. As the lower denture covers a much smaller area, the functional stress transmitted to the underlying tissues is greater than that to the upper tissues; thus, it is likely that the greater loss of mandibular bone is due to the physiological limit of this tissue being exceeded. The resorption of bone brings in its wake a loss of both occlusal vertical dimension and rest vertical dimension. The former dimension is reduced to a greater extent and thus the freeway space is increased.



## **Occlusal changes**

The progressive loss of fit of dentures, resulting from resorption of bone, also leads to deterioration in occlusal balance. In the case of dentures with acrylic teeth this occlusal deterioration can be aggravated by occlusal wear. The combination of loss of fit and occlusal imbalance encourages mucosal inflammation and further bone resorption, thus establishing a vicious cycle. It is clearly important, if oral health and function are to be maintained, that this cycle is broken by regular denture review and effective maintenance.

## **Adaptation of the patient**

The progressive long-term deterioration of dentures that has been described is not invariably associated with a complaint. This is because adaptive changes can occur and a tolerance can develop which allows patients to continue wearing the dentures. Thus, a considerable amount of tissue damage can go unnoticed. Whereas successful adaptation to new dentures is a prerequisite for success, a patient who tolerates slowly developing faults beyond a certain point will store up troubles for the future. In addition to the likelihood of tissue damage, reduction in rest vertical dimension and the adoption of abnormal mandibular postures create problems for both the clinician and the patient when replacement dentures are eventually required.

The first long-term recall appointment should be made no more than a year after the dentures were first fitted. Thereafter, an appointment every 2 or 3 years to check on tissue health and quality of the dentures is a realistic arrangement, on the mutual understanding that the patient will attend sooner if problems develop in the meantime. The clinician should make the point that the dentures have a limited life and should stress to the patient the potential dangers of wearing dentures that have become inadequate.

Treatment required at long-term recall appointments will be one, or a combination, of the following:

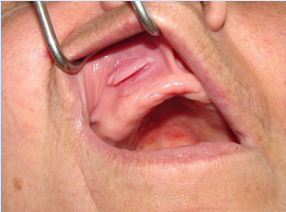
1. Adjustment of the impression surface
2. Correction of denture base extension
3. Occlusal adjustment with or without a check record
4. Reline or rebase of the dentures
5. Construction of replacement dentures.

\* Prevalence of CD Complications:

Following prosthetic complications have been recorded as a result of research done by Hakan B. et al 2012 for complete denture wearers

1. Loss of retention (62.5%)
2. Existence of any denture irritation or ulceration (51.6%)
3. Existence of any debonded/fractured artificial teeth (26.6%)
4. Existence of any fracture in the denture base (31.3%)
5. Existence of denture stomatitis (9.4%)
6. Existence of epulis fissuratum
7. Existence of inflammatory papillary hyperplasia

Denture stomatitis



Epulis fissuratum

Inflammatory papillary hyperplasia



## Some Clinical Problems and Solutions associated with complete denture

1. Pain and instability
2. Lack of saliva
3. Hard and soft materials for modifying the impression surface of dentures
4. The flabby ridge
5. Midline fracture
6. Debonding of teeth
7. Gagging reflex
8. The burning mouth syndrome
9. Disturbance of speech.

## 1. Pain and instability:

The most common problems associated with complete dentures are pain and instability of the dentures. They are summarised in the table below. The most likely main complaints have been indicated in each case. However, it should be remembered that there is considerable overlap between the two columns, as any cause of instability may additionally give rise to a complaint of pain. It should also be stressed that there may be more than one cause of a complaint.

**Persistent pain:** This problem is more often seen in the lower jaw where the area available for distribution of the occlusal load is relatively small. As noted in the table below, there are many possible causes of this complaint, which may be attributed to the denture design and to the patient.

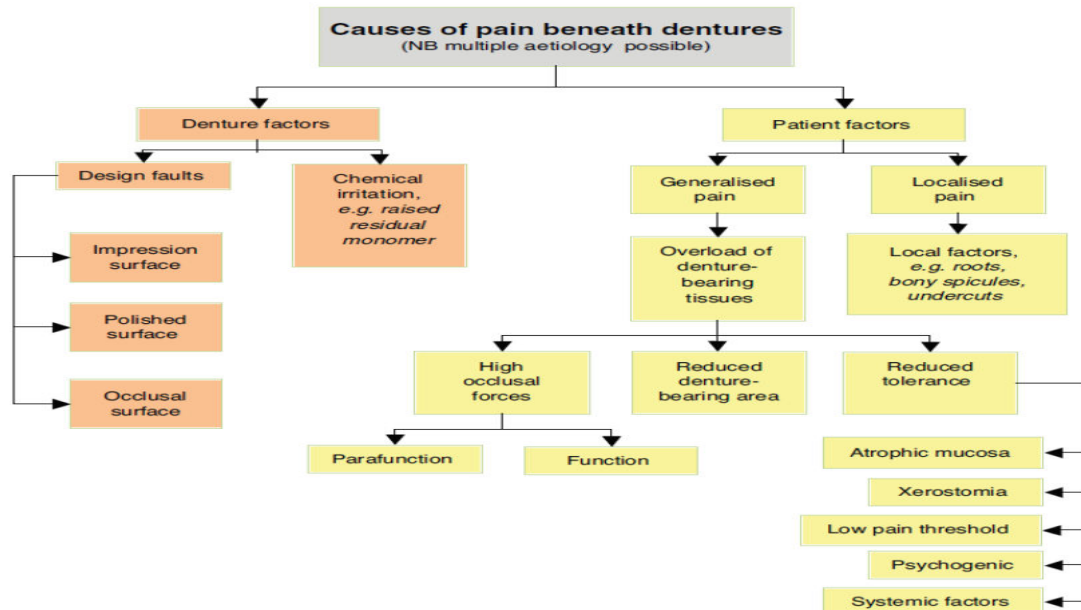


Figure 16.1 A diagnostic flow chart of the various possible causes of pain beneath dentures.



Discomfort can arise from overloading of the mucosa as a result of clenching or grinding the teeth. These occlusal habits are caused by increased activity of the masticatory muscles produced during stressful situations.

In treating parafunction, the patient must be made aware of the problem and should be told that teeth should be out of contact for most of the time. It is important to reassure the patient, describe the link between stress, parafunction and pain under dentures and point out that there is no change in the oral mucosa. The importance of conscious relaxation should be emphasised and the patient should be strongly encouraged to leave both dentures, or at least the lower denture, out at night.

## 2. Lack of saliva :

### **Functions of saliva**

Saliva possesses the following functions in the edentulous patient:

- Denture retention – saliva is an essential component in the physical retention of complete dentures.
- Lubrication – the glycoproteins in saliva facilitate movement of the soft tissues during speech, mastication and the swallowing of food.
- Cleansing – saliva physically washes food and other debris from the soft tissues and from the polished surfaces of prostheses
- Taste – flavours are perceived only when substances are in solution in saliva or other fluids. It prepares food for swallowing and facilitates the sense of taste
- Digestion – digestion begins during mastication when salivary amylase starts to breakdown glucose.
- Antimicrobial – there are antimicrobial components, such as antibodies, in

**Problems of reduced salivary flow** A reduction, or absence of saliva (xerostomia), is likely to cause problems with all the functions listed above so that a general, and significant, reduction in the quality of life results. Reduced retention of dentures is a particular problem for edentulous patients. There may also be an increased susceptibility to denture trauma resulting in complaints of pain and in some case the burning mouth syndrome

### **Aetiology of reduced salivary flow :**

**Medical History:** A full history is taken including a 'I'm taking an anti-depressant and question on current medication a diuretic' 'For how long have you been 'One year' DRY MOUTH is a possible taking these tablets?' contributory factor to the oral complaint

**Social History:** The history has revealed a number of possible causes of the persistent pain. The diagnosis can be established only after a careful examination of the patient, the mouth and the various sets of dentures in order to confirm or deny the various possibilities. The point should be made that unless a full history is obtained some of the possible causes might never be revealed. The provision of new dentures would do little to eliminate the problem if the persistent pain was due to a dry mouth and to parafunction.

However, the condition is relatively common in middle-aged and older people, the main candidates for complete dentures, with between 12% and 16% complaining of a dry mouth

**The commonest causes of dry mouth (Niedermeier et al. 2000; Field et al. 2001) are:**

1. Adverse effects of drug therapy, e.g. tricyclic antidepressants, beta-blockers
2. Depression and chronic anxiety
3. Dehydration
4. Mouth breathing
5. Auto-immune disease like Sjögren's syndrome
6. Head and neck radiotherapy
7. Poorly controlled diabetes
8. Smoking.

A complaint of dry mouth can occur in the absence of the clinical signs of dryness ('symptomatic xerostomia'). Under such circumstances the physical retention of the dentures would not be expected to be diminished.

### **Management of dry mouth :**

In clinical xerostomia there are intra-oral signs of dryness such as a dry, atrophic mucosa and lack of saliva pooling in the floor of the mouth. The dentist can check the dryness of the buccal mucosa simply and quickly during the examination of the patient by carrying out the 'mirror test'. For this the dentist lightly presses the face of the mirror against the buccal mucosa and then tries to remove it. If the mirror comes away easily the mucosa is still covered by a substantial film of saliva; if the mucosa adheres to the mirror then it is dry.

Close collaboration with the patient's general medical practitioner or with a specialist in oral medicine is often necessary. It might be possible, for example, to change an existing xerostomic drug to one less liable to reduce salivary flow. As there is a definite relationship between fluid intake and secretory performance it is essential that the patient is kept well hydrated. Chewing and energetic exercise improve salivary flow, possibly because of improved blood circulation to the glands. In cases where flow rate cannot be improved limited relief may sometimes be obtained by the use of artificial saliva.

## Measures for managing xerostomia :

**Measures for managing xerostomia : may be local or systemic**

### **A- Local measures:**

1. Artificial saliva: In cases where the salivary flow rate cannot be improved limited relief may sometimes be obtained by the use of artificial saliva.
2. Denture and oral hygiene: It is very important for a denture patient with a dry mouth to maintain an excellent level of denture hygiene. The likelihood of the proliferation of *Candida albicans* and other microorganisms is increased in xerostomia and therefore unless denture hygiene is maintained at a high level the denture is likely to be rapidly colonised by the micro-organism, resulting in denture stomatitis. Motivation and instruction of the patient, followed by monitoring the quality of denture hygiene are essential.
3. Denture retention. In cases where an intractable dry mouth gives rise to a persistent problem of loose dentures a denture adhesive will usually provide some improvement in denture function.

### **B- Systemic measures:**

1. Treatment of an underlying disease. It might be possible, for example, to change an existing xerostomic drug to one less liable to reduce salivary flow. Also if the patient is diabetic, an improved glycaemic control will alleviate the xerostomia.
2. Increasing fluid intake. As there is a relationship between fluid intake and secretory performance, it is essential that the patient is kept well hydrated.
3. Sialogogues. Pilocarpine can stimulate salivary flow where some functional salivary tissue remains, particularly in drug-related xerostomia, but it commonly has unpleasant side effects such as increased sweating. The dry mouth may also be occasionally alleviated by sialogogues such as sugar-free chewing gum, glycerine or sorbic acid and lemon mouthwash



### **C- Cleaning dentures**

Cleaning dentures it should be done for: Deposits form on dentures such as:

1. Microbial plaque.
2. Calculus.
3. Food debris.

These deposits may be responsible for a variety of problems including:

1. Denture stomatitis.
2. Angular stomatitis .
3. Unpleasant tastes .
4. Odours .
5. Unsightly appearance.
6. Accelerated deterioration of some denture materials such as short-term soft lining materials.

The effective cleaning of dentures is therefore of considerable importance to the patient's general well-being and oral health.

❖ IPH-Inflammatory Papillary Hyperplasia, Candidiasis and Wearing ill-fitting dentures 24h/7 days, are contributing factors. Resolve before making new dentures because, if left as it, new dentures will be loose after placement, as inflammation resolves. Treatment by:

- Leave dentures out at night.
- Reline with tissue conditioner.
- Nystatin mouth rinse

In cases where an intractable dry mouth gives rise to a persistent problem of loose dentures a denture adhesive will usually provide some improvement in denture function.

### 3- Hard and soft materials for modifying the impression surface of dentures

Materials which can be used to modify the impression surface to overcome some of these problems; these materials can either be applied by the dentist at the chairside or by the dental technician in the laboratory.

The materials may be classified as follows:

1. Hard materials
2. Short-term soft lining materials
3. Long-term soft lining materials.

#### 1. Hard materials :

Recent years have seen the development of a group of useful materials, frequently described as chair side reline materials, which can be used to modify the impression surface of an existing denture.

##### **Composition**

Commonly these materials consist of a powder containing polyethylmethacrylate together with a liquid monomer, butylmethacrylate. The important point to make is that monomeric methylmethacrylate, a tissue irritant, is avoided. Many of the products include a primer to enhance the adhesion of the material to the existing denture polymer. The available materials vary in working time, setting time and viscosity. These materials can be useful for relining dentures. As they can be used at the chairside a 'one-stop' reline technique can be employed.

**Clinical applications:** This has great benefits in the following situations:

1. A laboratory reline would require the patient to be without any denture for an inconvenient length of time.(patient have one set of denture and socially unacceptable to be without denture and in case of immediate denture patient ).
2. A reline is required, but it is not necessary for it to last for much longer than a year. (the immediate denture patient is likely to fall into this category, as after a year the chairside reline will usually need replacing by a permanent rebase or by a replacement denture.
3. Where a direct technique is indicated. (A chairside reline).

**Clinical performance:** Clinical trials have shown that the best of this group of materials are convenient to use and provide immediate improvement of fit and comfort. Over a period of time there is a loss of material, especially at the borders of the denture; this loss is more apparent in the lower denture. However, the loss does not appear to cause marked deterioration of fit or comfort. The better materials should be regarded as having a working life of about one year. The surface can be cleaned in the normal manner and there is relatively little discolouration.

## 2. Short-term soft lining materials :

### Composition

Most materials are supplied in a powder/liquid form. An alternative presentation is in a ready-to-use sheet form which can be found in one product available to the dental profession and in several 'over the counter' products available directly to the general public.

It is essential that traumatised tissue is examined by the dentist and that rational, rather than empirical, treatment is prescribed.

The composition of the powder/liquid types is as follows:

1. **Powder.** Polyethylmethacrylate, or copolymers of polyethyl/methylmethacrylate.
2. **Liquid.** A mixture of:
  - (a) an aromatic ester, such as dibutyl phthalate which acts as plasticiser
  - (b) ethyl alcohol.

### **Clinical applications**

Short-term soft lining materials are placed in existing dentures for the following reasons:

1. Tissue conditioning. For tissue conditioning, the material is applied for a period of a few days to the impression surface of a denture when the mucosa is traumatised and inflamed. The tissue conditioner acts as a cushion absorbing the occlusal loads, improving their distribution to the supporting tissues and encouraging healing of the inflamed mucosa.
2. Temporary soft relines. A short-term soft lining material can be used to improve the fit of a denture, typically an immediate restoration.
3. Diagnosis. A short-term soft lining material can be used as a diagnostic aid where the dentist wishes to check the reaction of the patient and the tissues to an improvement in fit of a denture.
4. Functional impression. A short-term soft lining material can be used as a functional impression material applied to the impression surface of a denture for the purpose of securing an impression under functional stresses.
5. Recording the neutral zone. The ability of these materials to be moulded by the oral musculature over an extended period of several minutes allows them to be used to record the neutral zone

### **3. Long-term soft lining materials :**

Long-term soft lining materials distribute stress more evenly under dentures than do the hard denture base materials. They also absorb impacts that can arise from masticatory function. They can therefore be said to have a shock-absorbing or cushioning effect. As a consequence it has been shown that the addition of a long-term soft lining to a complete lower denture improves the ability to bite and chew and provides general improvement in comfort when compared with hard relines. The lining has also been shown to improve masticatory performance



### **Indications for use :**

- 1. Persistent pain under a denture.**
- 2. Thin atrophic mucosa.**
- 3. Parafunction.** It is useful to consider the first three indications together, as a complaint of persistent pain may be due to the poor quality of the denture-bearing mucosa or to the patient's inability to regulate gripping or grinding habits. It is important to make two points; first, the problem is almost always found in the lower jaw and, second, it is essential to ensure that all existing denture faults have been eliminated before deciding to proceed with a long-term soft lining.
- 4. Replacing an existing denture which has a soft lining.** Once a patient has successfully worn a lower denture with a soft lining and has got used to its 'feel' it is often wise to repeat the prescription. If this is not done and the new denture is made with a hard base the patient may have problems in adapting to it and reject the prosthesis as a result.

- 5. Sharp bony ridges or spicules.** The pattern of resorption of the mandible may result in sharp ridges or spicules of bone on which the denture-bearing mucosa. The problem might be overcome, at least in the short term, by surgically smoothing the bone. However, there are often occasions where poor health or a strong preference by the patient to avoid surgery are contraindications to this approach. There is also the danger that surgical interference with the mandible will speed up resorption of the bone. An alternative, conservative approach is to provide a soft lining, which often provides an acceptable level of comfort under these circumstances.
- 6. Superficially placed mental nerve.** Another consequence of advanced resorption of the mandible is that the mental foramen and mental nerve may become superficially placed within the denture-bearing area so that the nerve is traumatised during function. This typically gives rise to a complaint of a severe, sharp, stabbing pain from the area of the mental foramen which is brought on by biting. A soft lining restricted to the problem area may provide relief. However, it is not uncommon to find that a superficial mental nerve requires greater pressure relief than can be provided by a soft lining. If this is the case it may be necessary to cut the denture away in the area of the nerve to eliminate pressure on the nerve altogether.

### **Types of long-term soft lining**

Soft linings are made either of silicone rubber or soft acrylic. The silicone materials may be cold-curing or heat-curing. The soft acrylics are heat-curing; cold-curing soft acrylics have a very limited life span and are best thought of as temporary soft linings.

# GERIATRIC DENTISTRY RELATED TO PROSTHETIC



## Definitions

**Geriatric Dentistry:** is the branch of dentistry that emphasizes dental care for the elderly population and focuses upon patients with chronic physiological, physical and/or Psychological changes or morbid conditions/ diseases. Oral health reflects overall wellbeing for the elderly population.

**Dental geriatrics:** 1. the branch of dental care involving problems peculiar to advanced age and aging; 2. Dentistry for the aged patient.

**Growth:** - is increase in size.

**Development:** - is progress towards maturity.

**Maturation:** - The stabilization of the adult stage brought about by the growth and development.

**Aging:** Refers to irreversible and inevitable changes occurs with time. It is also defined as the sum of all morphologic & functional alterations that occur in an organism and lead to functional impairment which decline the ability to survive stress.

# Definitions

- ❖ **Gerontology**: - Is the study of aging in all its aspects biologic, physiologic, sociologic & psychologic.
- ❖ **Gerodontology**: the study of the dentition and dental problems in aged or aging persons.
- ❖ **Gerodontics**: the treatment of dental problems of aging persons; also spelled gerodontics.
- ❖ **Geriatrics**: The branch of medicine that deals with the diagnosis and treatment of diseases and problems specific to the aged.

## What causing Aging ?

The consensus today is that aging is the end result of **multiple biological processes** which include:

1. **Genetic level**:- Where information for the initiation & maintenance of cellular functions are encoded.
2. **Cellular level**:- Where integrity of somatic cells is maintained
3. **Organ & Organ system level**:- Where physiologic functions are performed
4. **Coordination level**:- Physiologic functions are controlled & assembled into complex function.



## Factors influencing Aging:

### A) Genetic:

- 1) Mutation:- Several mutations reduces life span.
- 2) Species specific life span:- Each species is characterized by its own pattern of aging & maximum life span.
- 3) Hybrid vigor:- The effect of genetic constitution on longevity is perhaps best exemplified where hybrid vigor is demonstrated.
- 4) Sex:- In humans\animals, female lives longer.
- 5) Parental age:- Like father like son.
- 6) Premature aging syndrome :- Single gene changes results in premature senescence in humans e.g. progeria, cockayne's syndrome, werner's syndrome (rapid premature aging).

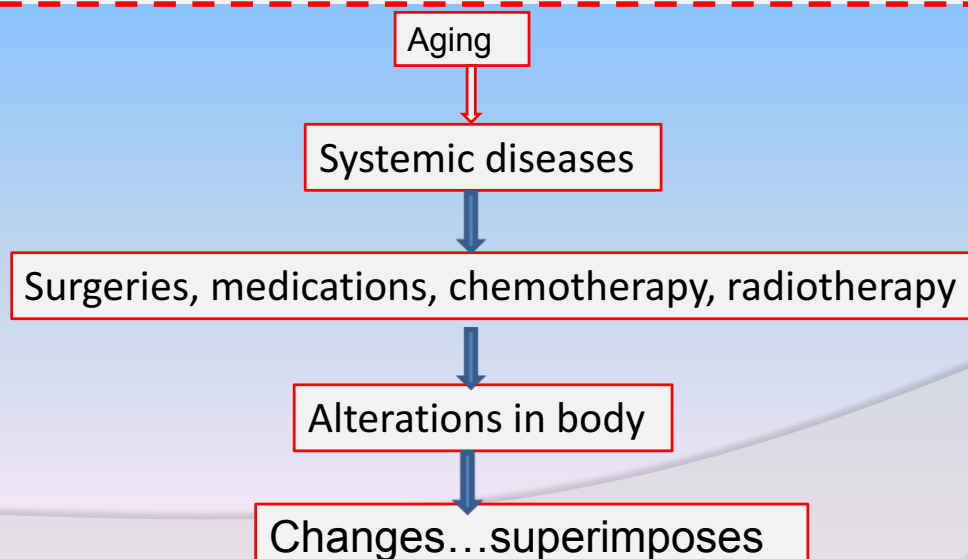
## Factors influencing Aging:

### B) Environmental

- 1) Physical and chemical:- Pollution, radiations, working, atmosphere etc .
- 2) Biological factors:- Nutrition, general health etc .
- 3) Pathogens and Parasites:- They influence the rate of human development → low income group \ tropical countries.
- 4) Socioeconomic conditions:- Bad housing, stresses etc.

## Aging vs others

- ❖ It has always been difficult for researchers to differentiate whether the changes in tissues/organ system are due to physiologic aging or pathologic.
- ❖ There is no precise method for determining the rate or degree of aging because



## Goal of Geriatric dentistry

- 1) To maintain oral health of individuals.
- 2) To maintain ideal health and function of masticatory system by establishing adequate preventive measures.
- 3) In diseased patients maintaining oral and general health.

## Objectives of Geriatric dentistry

- 1) To recognize and relieve difficulties of elderly people.
- 2) Restoration and preservation of function for maintaining normal life in elderly patients.

## Psychological disorders

Psychological disorders of elderly patients generally seen by prosthodontist include anxiety, depression, conversion hysteria and body image disturbance.

- ❖ Anxiety: It is a response to the perception of danger, actual or anticipated. Its purpose is to alert individuals to danger, so as to prepare them to cope with it. A major source of anxiety is alteration of body integrity and the way the body functions. Extensive changes in oral cavity (loss of teeth and replacement with denture) represent such a threat and therefore can trigger anxiety.

❖ **Depression:** It is a response to loss, actual or threatened, real or fantasized. Sadness and hopelessness are the common feelings when significant loss is experienced, such as loss of loved one or loss of a body part. The impact is particularly serious when it is involved emotionally on the invested parts of the body such as face (teeth). For some patients, the teeth have become so invested with meaning that their loss is experienced as catastrophic.

❖ **Conversion Hysteria:** This means, people convert the anxiety from emotional conflicts into somatic symptoms such as pain, muscle weakness, or sensory disturbance, or they reproduce a symptom which they had at some time in the past.

❖ **Body image disturbance:** The mouth is the most emotionally charged area of the body and therefore, frequently involved in body image disturbance. Any alteration to the patient's mouth is a body change to which they must adapt; until they do anxiety will be present.

## Factors that influence the patient's response

**1. Parental influences:-** The parental attitude toward body values is assumed by the children and this is obviously true regarding the value and appearance of the mouth. Patients who, as children, observe their parents undergoing dental treatment may become traumatically, conditioned by such observations.

**2. Sibling's influence:-** The behavior of siblings also has a strong influence on the dental attitude developed by patients.

**3. Peer group:-** A person is influenced to some extent by his peer group.

**4. Symbolic significance:-** The more common symbolic significance of tooth loss is aging, loss of femininity, loss of virility, loss of attractiveness and vitality and body degeneration.

**5. Current life circumstances:-** Where one's life is already seriously disrupted, additional trauma as such as tooth loss may impair the ability to cope and increase the probability of a maladaptive response.



## Personality traits for success in dentistry

Seven basic personality traits will be considered in the light of their influence on success in dentistry. Maximum benefits will be obtained only by those who make an honest attempt to search for personal shortcomings, because of general failing to underestimate grossly personal weakness.

- 1) BE AGREEABLE .**
- 2) BE A GOOD LISTENER.**
- 3) AVOID ARGUMENTS.**
- 4) DON'T BE EGOTISTIC.**
- 5) CRITICIZE TACTFULLY.**
- 6) REMEMBER NAME AND FACES.**
- 7) BE INTERESTED IN OTHERS.**

**1) BE AGREEABLE** A group of postgraduate students was asked by Cranes to select the dentist they considered best of those they had visited and write down the reasons for their choice. First on the list, when their answers had been tabulated was. "He was cheerful, friendly, and congenial." Courtesy, politeness, and accommodation cost not one cent, yet they may be sold. Some of the most successful dentists keep a card index system under which is listed personal information about each patient and his family. By the dentist's being conversant with affairs that are of personal interest, each patient is made to feel that he occupies a position of special importance in the practice. The dentist who can make patients "feel at home" in his office will never be worried about future dental practice.

**2) BE A GOOD LISTENER** “A bore is the fellow who keeps talking about himself when I want to talk about myself.” Cultivate the habit of listening, not merely remaining silent while another speaks, but giving others their undivided attention. Too many people are so concerned about what they are going to say as soon as an opening presents itself that they do not really listen. listening is an art. Some individuals, without uttering a word, can be more flattering than most people. If patients are encouraged to “think out loud” it gives the dentist an opportunity to size up each individual, to learn something of his likes, dislikes, prejudices, and to plan a presentation accordingly. If the dentist wants to enjoy maximum success he must, of course, be a good conversationalist and an enthusiastic educator, but, first of all, he should be a good listener.

**3) AVOID ARGUMENTS:-** It must be remembered that force never won a permanent victory on the battlefield, and verbal force, which is just another way of describing arguing; there are times when one must fight for principles. One can convince few men and certainly no woman by arguing. Crane’ says, “Guide me deftly to the decision you want me to make--don’t crowd, don’t shove, just feed me ideas as fast as I can absorb them. If you can influence me to persuade myself, I will sign.”

**4) DON’T BE EGOTISTIC:-** Individuals simply cannot wait for others to discover their good qualities; they extol their own virtues at every opportunity and, in so doing, arouse a feeling of antagonism among those with whom they come in contact. It is important to wait for the others appreciate the effective dental service that you provide.

**5) CRITICIZE TACTFULLY:-** In general, it can be said that criticism is futile because it aims a death blow at one's self-respect by undermining the feeling of personal worth. Criticism places people on the defense; it makes them appear foolish and silly. It usually opens up deep wounds that never heal, but fester down through the years. Yet it is possible to criticize and accomplish the proper results without offending. It merely requires a little tact. Hence an excellent policy to follow: compliment first, and then tactfully offer constructive criticism.

**6) REMEMBER NAME AND FACES:-** We can give people nourishment for their self-esteem by making it a point to remember their name. Anyone, who wishes, can improve his memory simply by listening attentively and concentrating on the name at the time of the introduction. Safer method is to place names of patients and their children on a card. together with any other information deemed worthwhile.

**7) BE INTERESTED IN OTHERS:-** Dentists in general become more interested in things than in people. The habit of being interested in others find that, without making any conscious, effort, without realizing exactly why, they hold in their hands the key, the open sesame to the hearts and minds of people.

# Systemic Diseases and its dental relation

**Cardiovascular diseases (CVD) and periodontitis:-** has interrelationship because of common bacteria associated with its pathogenesis. Periodontal inflammation leads to bacteremia caused by common oral pathogens like Porphyromonas Gingivalis. This microorganism has been isolated from CVD like coronary and carotid atheromas. Therefore, CVD and Periodontitis are interrelated and commonly seen in geriatric patients.

**Infective endocarditis:-** other common disease found in elderly patients has association with periodontitis. The bacteria like viridians streptococci normally found in oral cavity, whereas the bacteria found in dental plaque like Actinobacillus actinomycetemcomitans, Eikenella Corrodens, Fusobacterium Nucleatum and Bacteroides Forsythus have been isolated from the blood sample of Infective endocarditis patients.

**Respiratory infections:-** are usually caused by oropharyngeal and periodontal microorganism and bacteria. The main cause of respiratory infections and bacterial pneumonia in adults is aspiration of oropharyngeal bacteria. This micro flora habitats in inadequate oral hygiene resulting in formation of dental plaque further serving as a reservoir for respiratory pathogens.

The other common disease **Rheumatoid arthritis (RA):-** is seen in elderly patients. This RA has similar characteristic of periodontitis as there is destruction of hard and soft tissues as a result of inflammatory response. However, the interrelationship as well as association between RA and periodontitis has not been proved.

**Diabetes Mellitus (DM):-** the other most common disease seen adult and elderly individuals in 21st century. It has been proved and found that the patients suffering from Type 1 and Type 2 DM have distinguished dental manifestations such as loss of periodontal attachment, gingival and periodontal abscess and early loss of teeth.

## Effect of Aging on Oral Tissues (Gerontology of the Oral Cavity)

- Losses of tooth support structures (periodontium)
- increased loss of epithelium attachment
- and alveolar bone in the elderly
- temporomandibular joint,
- orofacial/mastication muscles, oropharyngeal mucosa, and oral
- sensory/motor nerve systems.
- salivary gland function, taste, tactile sensation and Swallowing

Often there is no clear demarcation between normal **physiological aging and pathological diseases**. However, there may be some specific changes in individual tissues during aging, e.g.,

- ❖ Losses of tooth translucency and surface details
- ❖ Abrasion, attrition, and erosion of teeth usually increase with advancing age. The dental pulp becomes smaller.

## Geriatric Dentistry differs from traditional general "practice in the following aspects

- ❖ It is concerned with aging patients, 86% of whom have at least one chronic disorder. (Nursing home residents may have as many as 25 concurrent disorders).
- ❖ Cognitive Dysfunction such as dementia affects compliance and oral health.
- ❖ Use of Polypharmacy causes xerostomia. (over 1000 medications cause dry mouth)
- ❖ Many elderlies have physical disabilities such as vision, hearing and taste disorders.
- ❖ Requires exceptional skill in history taking.
- ❖ Challenges the dentist's ability to design treatment plan and differentiate normal aging from pathologic aging.



## Pathological Oral Conditions In The Elderly

- ◉ Conditions affecting the periodontium & tooth structure.
- ◉ Ulcerative lesions.
- ◉ Denture related condition
- ◉ Xerostomia (dry mouth)
- ◉ Tongue Conditions
- ◉ White lesions
- ◉ Malignant lesions
- ◉ Vesiculo-bullous lesions
- ◉ Pigmented lesions

## Salivary glands and saliva

There are 3 major paired & several minor salivary glands present in oral cavity.

- ◉ Major glands are:-parotid, sublingual, submandibular
- ◉ Minor glands are:-labial, buccal, palatal

Primary function-exocrine production of saliva.

### Major roles of saliva in maintenance of oral health

- ❖ Preparation & translocation of food bolus.
- ❖ Lubrication of oral mucosa.
- ❖ Preservation of microbial balance.
- ❖ Mechanical cleansing.
- ❖ Antibacterial & antifungal activities.
- ❖ Maintenance of oral ph.
- ❖ Remineralization of dentition.
- ❖ Mediation of taste activity.

### Salivary function during aging

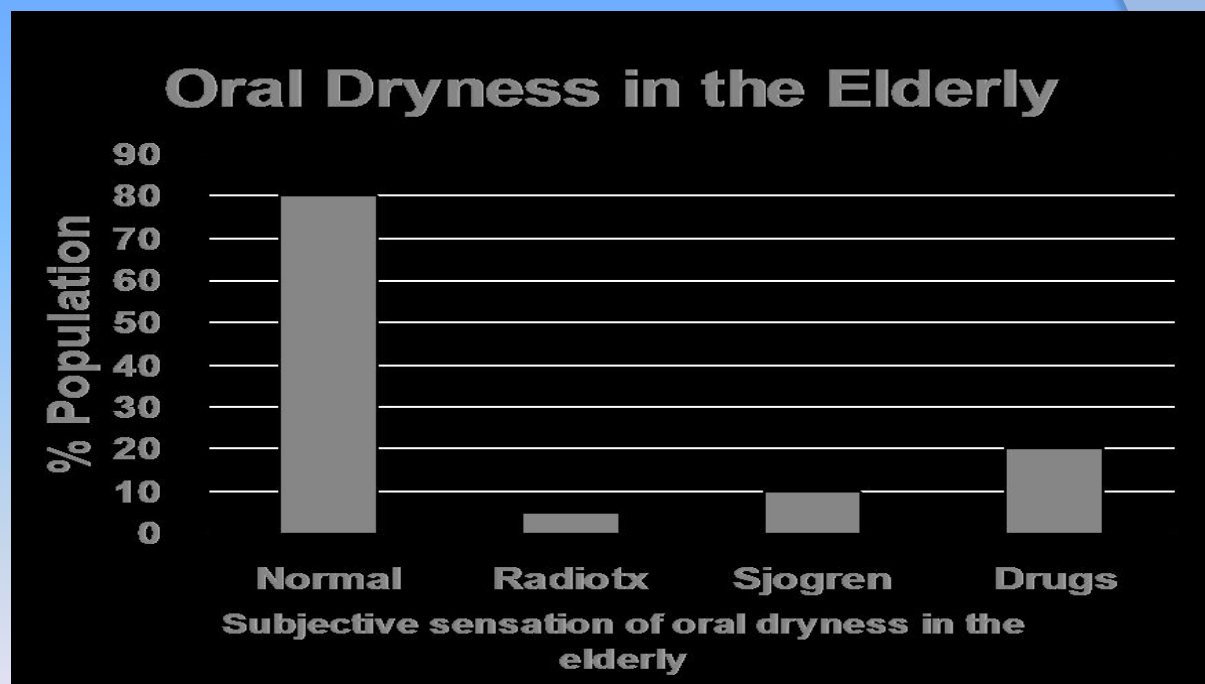
There occurs a fairly linear loss of acinar cells, replaced by fatty or connective tissue.

- Submandibular gland – 40% loss of acinar cells
- Parotid gland - 30% loss of acinar cells
- Minor labial glands - 45% loss of acinar cells.

### Morphometric studies show

- Proportion of gland parenchyma occupied by acinar cells is reduced by %30 - %25
- Atrophy of acinar cells.
- Proliferation of ductal elements.
- Some degenerative changes.

Earlier, it was thought that salivary secretion is also reduced with age but recent functional studies showed, despite the appearance of age related morph metric changes in salivary glands - Functional output & composition of saliva doesn't appear to be consistently altered in older but otherwise healthy persons. The decrease in salivary production is more related to salivary gland dysfunction & related oral morbidities associated with systemic diseases & medications.



## Oral mucosal barrier

The oral mucosa performs essential protective function that profoundly affect the general health & wellbeing of host.

- ❖ It provides first line of defense.
  - ❖ Specialized mucosal sensory detectors serve to warn us of many potentially harmful situations such as spoiled food stuffs, temperature extremes, sharp objects, etc.
  - ❖ Any changes in O.M. barrier could expose the aging host to myriads of pathogens & chemicals that enter the oral cavity.
  - ❖ Both histologic layers of oral mucosa, epithelium, & connective tissue have important defensive functions.
  - ❖ Stratified squamous epithelium containing attached & disjunct cells forms physical barrier which restricts entry of microorganisms & toxic substances.
  - ❖ Mucosal epithelial cells synthesize keratin & laminin. Preserve structural integrity & restore wound healing.
- keratin (masticatory mucosa) Protect against abrasive insults e.g. stiff foods.  
But literature doesn't give clear picture of histologic status of O.M. with normal aging.  
Reports say thinning of epithelium while others contradict.

## Effects of aging on periodontium

### A) Gingival epithelium

- ❖ Thinning & decreased keratinization of the gingival epithelium
- ❖ Flattening of rete pegs, altered density.
- ❖ Migration of functional epithelium from its position in healthy individual (on enamel) to more apical position on the root surface with accompanying gingival recession

### B) Periodontal ligament (pdl)

A fibrous connective tissue that is noticeably cellular & vascular. Its functions are:

- ❖ Attachment & Support
- ❖ Nutrition
- ❖ Proprioception
- ❖ Synthesis

## Periodontal Disease

### **Etiology**

- ❖ Gram positive and negative bacteria
- ❖ Exacerbated in the elderly by diminished motor dexterity (Arthritis, Stroke) and poor hygiene
- ❖ Wide spectrum range of gingivitis, inflammation of sulcular epithelium, recession to periodontal pocketing

### **Treatment:**

- Antimicrobial therapy (chlorhexidine 0.12% mouth wash, tetracycline impregnated sulcular fibers, metronidazole 500mg qid or clindamycin 300 mg qid for 10 days).
- Surgical elimination of pockets.

### **C) Cementum.**

- ❖ Cementum continuous be laid through out life but rate of formation diminishes with age
- ❖ A thickening of cementum is observed on teeth that are not in function (hypercementosis).
- ❖ increase in cemental width (5-10 times) as cementum deposition is continues after tooth eruption.
- ❖ increase in width is greater apically & linguall

### **D) Alveolar bone (in relation to periodontium)]**

- ❖ A more irregular PDL surface of bone and less irregular insertion of collagen fibers.
- ❖ Healing of bone in extraction socket appears to be unaffected by aging.

### **E) Bacterial plaque**

Dentogingival plaque accumulation increase because increase in hard tissue surface area as a result of gingival recession and the surface characteristic of the exposed root surface for plaque formation compared to enamel

## Aging and teeth

### A. Enamel changes

#### **Chemically**

Levels of N2 & flourine' therefore, organic matrix.

Enamel near the surface become darker & decay resistant

There is reduced permeability & enamel becomes brittle.

**Attrition:** It may be defined as physiological wear of occlusal or incisal surfaces and proximal contacts as a result of mastication, physiologic tooth movement, functional or para functional movements of mandible.

### **Clinical features**

a) Small polished facets on cusp tips\ridges\slight flattening of incisal edges

b) Because of slight mobility of teeth in their sockets & a manifestation of resiliency of pdl, facets also occur at proximal surface.

c) Decreased cusp height

d) Flattening of occlusal plane.

e) Shortening of length of dental arch

(All these changes occur more **severely in men than women** due to greater masticatory force)

### **Abfraction**

Recently, it has been proposed that the predominant causative factor of some of the cervical, wedge-shaped defects is a strong (heavy) eccentric occlusal force resulting in microfracture or abfraction, such microfracture occur as the cervical area of the tooth flexes under such loads.

• **This defect is termed as Idiopathic erosion or abfraction.**





## **B. Dentin changes**

### **• Vitality of dentin**

Since odontoblasts & its processes are integral part of dentin, therefore, there is no doubt that dentin is vital tissue.

- It is laid throughout life though as age progress dentinogenesis slows.

## **Aging and functional changes in dentin**

### **reparative\secondary dentin**

If attrition, abrasion, erosion, cavity cutting procedures causes odontoblast processes to cut or exposed, either they die or if they live they form dentin called as reparative dentin

This reparative dentin seals of the zone of injury occurs as a healing process initiated by the pulp resulting in resolution of the inflammation process and removal of dead cells.

The reparative dentine has fewer & more twisted tubules.

## **C. Pulp cell changes:**

Decrease in number, size,& cytoplasmic organelle.

### **Fibroblast changes (Fibrosis)**

a) In aging pulp accumulations of both diffuse fibrillar components as well as bundles of collagen fibers usually appear.

b) Fiber bundle arranged( **longitudinally ---radicular pulp**) or (**diffusely---coronal pulp**).

c) Increased in fibers is generalized through out the pulp organ

d) Collagen increases in medial & adventitial layers of blood vessels

e) Increased in collagen fiber is more apparent than actual because of decreased in size of pulp which makes the fibres to occupy less space

f) Vascular changes in the aging pulp is same as occur in any other organ like **plaque calcifications**

## **Pulp stones /denticles**

- They are defined as nodular, calcified masses appearing in either or both the coronal or root portion of pulp organ.

- They are seen in otherwise normal tooth in other respects

- They are seen in functional as well as embedded unerupted teeth

#### D. Tooth Loss

- ❖ Not a normal part of aging.
- ❖ A consequence of oral disease:
  - ❖ Caries
  - ❖ Periodontal disease
- ❖ Often associated with systemic diseases

Decline in Edentulous Adults, improved and still improving dental health care has led to significant declines in the number of edentulous adults with increased retention of teeth into old age, we are seeing more incidences of caries and other dental diseases in those teeth.

#### E. Oral Mucosa with aging

- ❖ Epithelium thinner, more fragile, less keratinized
- ❖ Loss of collagen and elastin from fibers also weaken mucosa
- ❖ Increase in pathological change - loss of tongue papillae and taste buds
- ❖ minor salivary glands diminish
- ❖ Lesions more common and slower to heal.
- ❖ Inflammations, irritation and infections

#### F. Tongue

- ❖ • It seems to increase in size in edentulous mouth which may be because of result of transferences of some of the masticatory & phonetic function of the tongue. Enlarged tongue have negative effect on retention of denture.
- ❖ • There is depapillation which usually begin at apex & lateral border.
- ❖ • fissuring is also common.
- ❖ • There is also reduction in the taste buds



### **G. Taste**

Reasons for decline in sense of taste are unclear.

- ❖ Possible decline in number of taste buds
- ❖ Possible decline in density of taste buds
- ❖ Possible decline in sensitivity of taste buds
- ❖ Possible decline in neural processing or retrieval

**All of the above also possible.**

### **Medications Known to Interfere with Taste**

Medications, including the most commonly prescribed, interfere with taste or olfactory senses:

- ❖ Antibiotics: Ampicillin Azithromycin (Zithromax)
- ❖ Ciprofloxacin (Cipro) Clarithromycin (Biaxin)
- ❖ Griseofulvin (Grisactin) Metronidazole (Flagyl)
- ❖ Ofloxacin (Floxin) Tetracycline
- ❖ Anticonvulsants: Carbamazepine (Tegretol)
- ❖ Phenytoin (Dilantin)

### **H. Oral motor performance:**

**Speech      Mastication      Swallowing**

Tissues involved are :-upper lip, lower lip , jaws, tongue, floor of oral cavity, soft palate etc.

#### **1. Speech**

Speech production is most resistant to aging but that does not mean there are no age-related changes in speech.

- You can very well perceive differences when person of old age speaks but these are largely related to laryngeal rather than oral events.

other speech changes may occur due to:

- Edentulous patient (partial or complete)
- ill-fitting prosthesis.

#### **2. Swallowing**

- ☐ Reduced chewing effectiveness
- ☐ Decreased tongue strength
- ☐ Less muscle and an increase in fatty and connective tissue in the tongue
- ☐ Atrophy of the alveolar bone with lost dentition
- ☐ Increased swallowing time with age
- ☐ Swallowing disorders may be prevalent

### **Swallowing/oral movement in old age**

- People chew slowly as they get older. Although the duration of the total chewing cycle does not seem to change, it does seem that vertical displacement of mandible is shortened.
  - Movements of the mandible are governed by a generator in the brainstem & influenced by the proprioception in the muscles, joints, & mucosa.
- Age may impair the central processing of nerve impulses, impede the activity of striated muscles & retard the ability to make decisions
- ❖ Poor motor coordination & weak muscles.
  - ❖ decrease no of functional motor units, fast muscle fibers & decrease in cross sectional area of masseter & medial pterygoid muscles.
  - ❖ Muscle tone decrease by 20-25% which probably explains the shorter chewing stroke & prolonged chewing time if it is there.
  - ❖ Some individuals who assumes the characteristic stoop of old age experience pain on swallowing because of osteophytes & spurs growing on the upper spine adjacent to the pharynx.
  - ❖ Abnormal mandibular movements consequent to teeth loss, use of complete denture, deflective occlusal contacts.

### **I. Atrophy of masticatory muscles and masticatory ability**

**Masticatory ability:** it is an individual's own assessment of his/her masticatory function.

#### **Masticatory efficiency:**

it is the capacity to grind the food during mastication:

- ❖ Essential that masticatory function (in complete denture wearers) be maintained throughout life.
- ❖ Masticatory function depends on the skeletal muscular force and the ability to co-ordinate oral functional movements during mastication
- ❖ Maximal bite forces decrease in older patients
- ❖ Greater atrophy occurs in complete denture wearers especially women.
- ❖ Little evidence that new dentures reduce this atrophy

Wearing dentures does compromise masticatory performance greatly as compared to a natural set of teeth

# Impression

Successful primary impression is governed by proper stock tray selection, proper material selection and manipulation (usually irreversible hydrocolloid material is used) and well trained dentist to handle and make the impression in a proper technique.

❖ Stock tray metal or plastic must extended to cover the intended denture bearing area able to record the vestibule extension, it must cover the retromolar area in the lower arch and extended posteriorly to include tuberosity and hamular notch in the upper arch. Enough space between the tray and the oral tissue to have enough and uniform thickness of the impression material; this does not mean to use oversized tray because it distort the tissue and recording procedure. Wax sheet may be used to complete minor under extension. The impression must be free of voids fully extended according to the planned prosthesis design.

❖ In some cases when the remaining teeth are very loose, there is a risk of teeth extraction during impression making, **so try to fix these tooth either by:**

1. applying a lubricant medium to the teeth .
2. In case of adjacent teeth to each other's applying molding soft wax into sub-contact point spaces and around the necks of teeth so that the impression material is prevented from locking into the undercuts .
3. In case of solitary tooth placing a loose fitting copper band over the tooth before taking impression.
4. Placing holes in the tray and using an amalgam condenser to release the tray over the loose tooth.



## The primary impression:

May be useful as a final impression in case of immediate single tooth replacement with or without short span partially edentulous arch.

- ✓ Primary cast is delivered by pouring the primary impression with any of the gypsum products.
- ✓ This cast helps as a study cast to plan the sequences of the treatment as well as used to construct special tray.
- ✓ Surveying, undercuts block out and relief must be done on the cast.

## The Final impression:

Different tray design and impression techniques were described to deliver final impression, these techniques may range from simple to more complicated depend on tray design and material used.

### **Selection of a suitable technique depending on:**

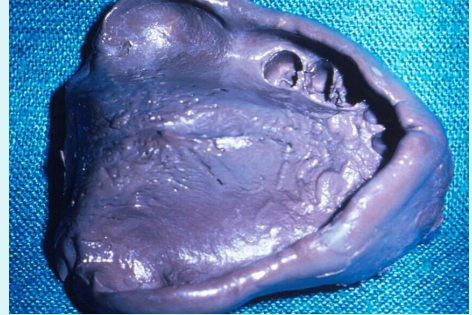
- a. Case difficulty.
- b. Number and location of teeth included in the immediate denture treatment.
- c. Teeth and tissue undercut.
- d. Type of the planned surgical operation, impression material.
- e. Dentist skill and experience.

The imperative technique is that record the tissues and denture bearing area in a maximum accuracy that minimize the insertion, post-extraction denture adjustment and maintenance phases as possible.

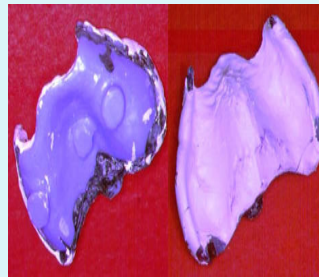
Special tray is constructed on the primary cast, cold cure resin is a suitable material.

## Final impression may be taken by:

### 1. Single full arch custom tray



### 2. Sectional impression tray OR Split impression tray technique



## 1. Single full arch custom tray

- This technique can be used for conventional immediate denture and the only tray used for interim immediate denture.
- Also, it is used when the patient have anterior teeth only or anterior and posterior remaining teeth.

Technically;

- ❖ first of all, on the primary cast outline the tray extension to be shorter than the vestibular depth by 2 mm and include the posterior limit.
- ❖ The remaining teeth must be covered with single layer of sheet wax; then second layer is used to cover all the area needed to be recorded by the impression and covered with the denture; this technique usually used in conventional immediate denture while in interim immediate denture all the teeth and denture foundation area are blocked using two layers of wax. Tissue undercut must be blocked properly to facilitate tray removal.

- ❖ A stops effect is provided by making 4-5 regular holes through the wax, symmetrically distributed anteriorly and posteriorly.
- ❖ Finally adapt the cold cured acrylic resin dough layer to fabricate the special tray; ensure proper extension and stops holes are filled with acrylic. The handle can be placed on the anterior area as usual or you may place it in the mid of the palate to prevent over lengthening of the tray in the anterior area might interfere with impression making.
- ❖ Allow the resin to set; then remove the tray and reduce excess material, finish and smooth the borders and surfaces. Proper perforations must be done symmetrically -as possible- or using adhesive depending on used impression material.

- ❖ This technique can be used when the anterior teeth are remaining only or when anterior and posterior teeth are present.
- ❖ Now check the tray in the patient's mouth and do border molding by using tracing compound; in the same manner as in conventional complete denture and continue to do final impression.
- ❖ You may use irreversible hydrocolloid or polyvinyl silicone or polysulfide rubber base or polyether as a final impression material. More expert dentist may use 2 impression material in one tray for maximum accuracy.

## 2. Sectional impression tray OR split impression tray technique

- Use two trays or sectional custom tray.
- This technique is used in conventional immediate denture only; and cannot be used in interim immediate denture.
- It involves construction of two trays on the same cast one for the posterior region made as in complete denture and the 2nd is constructed for the anterior region backless tray indices or references must be made in the tray.

### Procedure:

- ❖ Outline the tray extension in the same manner as in 1st technique.
- ❖ Block all tissue undercuts and interdental spaces.
- ❖ Use proper separating medium then adapt the cold cured resin mix to the posterior edentulous area and extend it to cover the lingual surface of the anterior teeth beyond the incisal edge then put the handle.
- ❖ **For the anterior region; you may use:**
  - construct a custom tray to cover this area only. Alternatively, the impression material may be carried to the mouth in a second sectional tray that is indexed to the primary tray. In either case, the anterior section impression will capture the facial anatomy of the teeth, the vestibular anatomy, and indices on the primary impression/tray. Upon removal of the anterior and posterior sections separately, the two sections are reassembled outside the mouth (using the indices) and prepared for casting.

- you may adapt and cut a plastic stock tray to fit the anterior section.
- expert dentist prefer not to use a tray but they use a heavy mix of elastomeric impression material in the mouth.
- ❖ The anterior section of the impression must record the labial aspect of the teeth as well as the vestibular area.
- ❖ To make the impression, the posterior sectional tray (must be tried for proper extension, border molding is made with tracing compound) as in conventional complete denture, then final impression for edentulous area is made by using zinc oxide eugenol impression material or polyvinylsilicon or polysulfide or polyether, you can use non-elastomeric impression material here.
- ❖ The most important thing in sectional impression tray is the accuracy and proper seating of the trays and reassembling both. Care must be taken not to distorted this assembly during tray removal from the mouth or during pouring therefore it's advisable to bead and box the impression before pouring.

- ❖ Modification of the above technique can be made as to make a full tray covering the denture bearing area with a hole opposite to the teeth area, again we do border molding and impression then a proper stock tray over the custom one can be used to capture the teeth area with alginate material.
  - ❖ Finally when you remove the impression from patient's mouth it will record the whole denture bearing area made by two different materials.
  - ❖ This technique is used mainly when the posterior area is edentulous and only anterior teeth are remain and need to be replaced with immediate denture.
- Note: the projections on the external tray surface serve as indices.**
- ❖ It is also possible to use special tray instead of stock tray but it is essential to put the indices or references to ensure reassembling.
  - ❖ The final impression must be poured with stone to get the master cast; this cast is used to prepare the record base and the occlusion rim.



## Beading and boxing:

All the impression must be beaded before pouring. Wax may not stick to the alginate impression material, therefore care must be taken to insure proper beading. Once you fix beading wax, boxing wax sheets can be easily stick to the impression. In the sectional impression, be careful to seat the sections properly on the indices. Pour the impression and remove the tray as in the conventional manner.

## Record base and occlusion rim:

Bite rim usually constructed to record jaw relations

- ❖ If the patient have enough number of remaining anterior and posterior teeth no need for record base or bite rim as in most of interim immediate denture.
- ❖ while if there isn't enough number of remaining teeth as in all of conventional immediate denture and some of the interim immediate denture cases; bite rim must be constructed.

- ❖ Before constructing the record base, all teeth and tissue undercuts must be blocked by wax, then cold cure acrylic dough is applied on the edentulous area of the cast. When the material set, record base must be finished and polished; final evaluation must show a stable properly extended record base.
- ❖ Wax occlusion rim is added to the corresponded edentulous area on the base. Leveling of the wax must depend on some anatomical landmarks as the retromolar area and you may use the remaining teeth but not always.
- ❖ Record base extension and wax rim height must be evaluated clinically. Lip lines; high and low must be determined and marked on the cast, in this way any correction or modifications can be done or marked on the cast to be considered in the teeth setting.

## **Jaw relations record:**

- ❖ Include vertical and horizontal relations, these usually made as in the conventional denture construction.
- ❖ If we have vertical stops between two opposing posterior teeth, these relation are maintained unless further corrections are needed to improve esthetic or function.
- ❖ Evaluation of the existed vertical dimension of occlusion must be accomplished and dentist must decide if this going to be restored or modified.
- ❖ Uneven tooth loss, teeth wear, loosening of the remaining teeth drifting and extrusion all may indicate correction of vertical relation.
- ❖ The occlusion rim and sometimes remaining teeth must be adjusted for correct occlusal vertical dimension.

- ❖ In the immediate complete denture; leave first premolars bilaterally to maintain vertical and horizontal relations and facilitate recording of the jaw relations.
- ❖ In this visit dentist must record the midline, canine lines, ala-tragus line, smiling and high lip line, anterior occlusal plane In relation to the remaining teeth.
- ❖ Face bow transfer and centric Jaw relation must be recorded.
- ❖ Once you record vertical and horizontal relations you are ready to mount the cast on a suitable articulator.
- ❖ Selection of artificial teeth, acrylic teeth are the recommended type.
- ❖ Consider all parameters in teeth selection, in the anterior and posterior segment. Shade, Size, form, an occlusal form of posterior teeth must be selected to fit each case specifically.
- ❖ Arrangement of posterior teeth done in the same way as in the conventional complete denture, maintain proper occlusal plane.

## Try-in

- ❖ In this way you set the posterior or anterior missing teeth to try it in the patient's mouth check and verify occlusal plan and jaw relations in the try-in step.
- ❖ Try in step is not possible in every immediate denture case but even so mounting of the master casts must be confirmed in patient's visit.
- ❖ In most of conventional immediate denture cases posterior teeth are missed so you can set the posterior teeth as in conventional complete denture construction following the rules of teeth arrangement in the centric occlusion.
- ❖ The trial denture now must be tried in the patient's mouth and verify the vertical and centric relations.
- ❖ If errors can be detected in the centric relation, lower cast must be remounted after a new record and teeth must be reset.

❖ Confirm all the landmarks recorded in the diagnostic step to set the patient's desire as:

☐ The midline whether it is the same or verified but it is very important to inform the patient if you decide any change prepare yourself to explain the reasons for the patient.

☐ The anterior plane of occlusion; teeth may be extruded-or over erupted so correct plane of occlusion must be recorded on the casts. Use some of the anatomical landmarks interpupillary line and parallelism with the ala-tragus line.

☐ High lip line must be determined and marked on the cast. Discussion must be made with the patient about the amount of display of the teeth and gingiva.

☐ Localized alveoloplasty or some changes in the teeth alignment may be suggested to improve appearance. Make sure that the patient sees and approves this.

☐ Diastema , rotated teeth, overjet and overbite and other natural variations must be discussed with the patient because some patient may ask for a perfect looking even if they never had, others may like their natural variations( in this way nobody can notice the denture). Dentist may share his experience, knowledge and opinion for best results especially when the patient ask for changes or variations interfere with function and esthetic principles. The patient must be actively involved in the decisions of esthetics.

☐ Always reevaluate final result after every changes.

- ❖ All the required change must be recorded on the cast as well as on the case sheet.
- ❖ In this visit further information about the following must be given, Surgical procedures, tissue changes as edematous and discoloration few days after insertion, local sense of lip puffiness even when the edema dissolved due to the flange extension.
- ❖ Answer all the questions asked by the patient directly and very clear.
- ❖ At the end of the try in visit you have to check all what is related to the present teeth and mark all what you have to change- teeth and tissues.

## Cast trimming:

- ❖ The remaining teeth now must be trimmed to be replaced with artificial teeth.
- ❖ Trimming of the cast must be done carefully to estimate as possible the shape of the residual ridge after teeth extraction.
- ❖ Final cast ridge must be similar to the contour of the foundation area after teeth extraction.
- ❖ More than one method may be use to trim and set the teeth in immediate denture cases,

### It depends on:

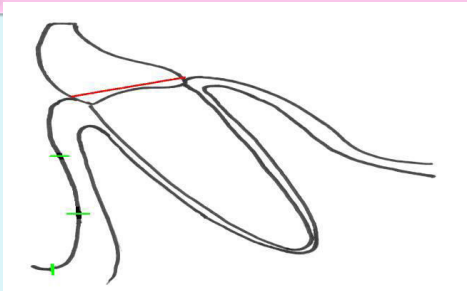
1. If you decide to duplicate same teeth alignment or not.
2. Esthetic and functional requirement.
3. Amount of changes expected during surgery.



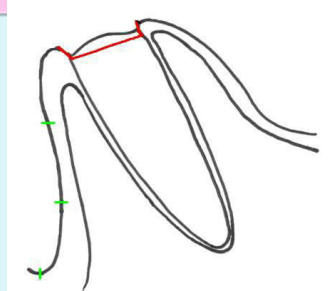
Usually teeth are trimmed by using a saw or disc bur sharp knife or wax knife may help.

Scribe guidelines on the cast recording the position, angulations and incisal level of the natural teeth (In this step it must follow the rule of third to guide cast trimming).

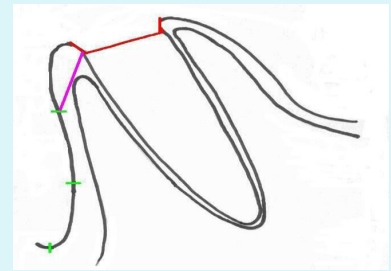
### Steps of Cast trimming are:



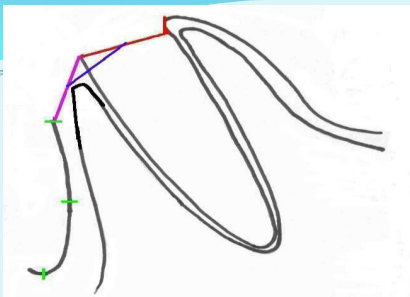
Step 1  
Remove tooth at gingival level



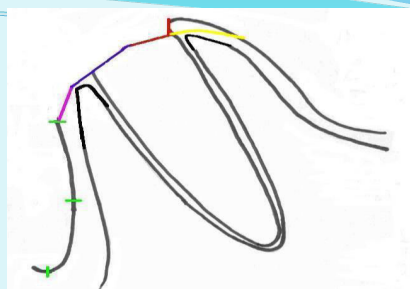
Step 2  
Rounded the cervical area of the removed tooth



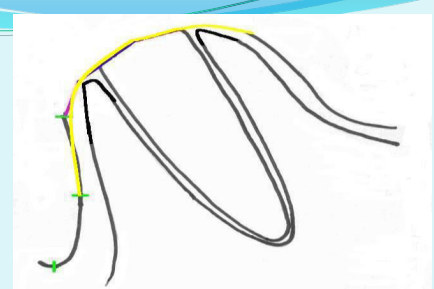
Step 3  
Labial edge recess to incisal third mark



Step 4  
Mid-point recess to mid-width labial cut



Step 5  
Round over lingual aspect of socket



Step 6  
Round off labial to middle third, sand & smooth

- ❖ Note that the amount of grinding is very minimal on the palatal side, this is because the remodeling after extraction is usually minimal in this side.
- ❖ Final ridge form must be round and continuous from the buccal and lingual surfaces.
- ❖ Cast trimming may be done at same time of teeth arrangement.
- ❖ Do not change or trim the essential landmarks as incisive papilla or any frenum.

## Surgical splints:

- ❖ After complete cast trimming, surgical splint must be constructed
- ❖ It is a thin transparent form of tissue surface of the immediate denture, it is used to guide the surgical shaping of the alveolar process.
- ❖ It is essential when there is a need to do some alveolar corrections after teeth extraction or ridge recontouring or correction of the inter septal bone or in multiple teeth extraction.
  - ☐ Make alginate impression on the cast after trimming.
  - ☐ Pour the impression (cast duplication).
  - ☐ Make the clear template processed either by heat or light ,vacuum form and sprinkle-on method can be Used also.
- ❖ **Advantage: Splints also help to remove any expected pressure area at the sight of extraction thus minimize insertion time and adjustment at the insertion time.**

## Setting of anterior teeth:

Arrangement of anterior teeth can be made in different ways, we have to decide:

- 1. If the teeth are need to be changed in location or alignment to improve the aesthetic.**
- 2. The teeth are well aligned, aesthetically and functionally acceptable; then we can reproduce same alignment in the denture.**

### ❖ First way:

Produce a labial index of the natural teeth before they are cut off the cast. The index can be produced quite simply by molding silicone putty against the labial surface of the teeth and ridge on the cast, wait till the material set, trim the cast, then the artificial teeth can be set into the index while its held against the cast preserving same teeth location.

in this technique same teeth morphology and location is duplicated, thus consultation with the patient about own teeth alignment and morphology must be made at the time of diagnosis.

### ❖ Second way:

Remove one tooth from the cast and immediately wax an artificial tooth into position so that the adjacent teeth serve as a guide to the positioning of the artificial replacement. Repeat this procedure alternatively, this is called the alternative or every other method; you can use every tooth as an index to arrange same tooth but in the other side OR trim all the teeth on one side and use the other side as a reference.

## Waxing and flasking :

- ❖ Generally immediate denture is thinner than the conventional CD especially in the anterior, but be careful at time of insertion and in the presence of undercut the acrylic must be thick enough to be adjusted.
- ❖ In this step you have to custom any selected personalization criteria must be carved.

## Processing and finishing

- ❖ It is same as in the conventional complete denture.
- ❖ Do not remove posterior undercut and try to modify the path of insertion.
- ❖ Keep both the denture and the splint template in the disinfectant to delivery.

## Insertion:

### At the day of surgery and insertion:

- ❖ Examine the patient intraorally to check for any changes.
- ❖ Extraction of the marked teeth; preserve the labial plate and be conservative, no bone trimming is done without guiding; use suture if necessary.
- ❖ Use the surgical template to guide any alveolar corrections. Seat the template: blanch areas seen through the template indicates pressure, then need correction.
- ❖ Insert the denture; remove all the detected over extended especially heels areas and correct any pressure areas. Check the frenum relief.
- ❖ Check for firm bilateral occlusion with no gross occlusal interference quickly correct.
- ❖ In some cases the denture is not retentive and loose this is mostly occurs in the improper diagnosis and preparations or unexpected surgical problems.
- ❖ Usually we use the tissue conditioner to retain the denture BUT do not allow the material to extend in the socket areas otherwise normal socket healing will be compromised.
- ❖ At the day of insertion try to reduce the numbers on insertion and removing of the denture to avoid trauma and edema.

### Post-operative care and instructions:

#### First 24 hour:

- ❖ Avoid removing the immediate denture.
- ❖ Put gentle biting pressure on your denture during the first four hours.
- ❖ Avoid hard food and eat soft healthy food, avoid drinking hot fluids.
- ❖ Using ice pack in the first 24h (20 min on followed by 20 min off) may control inflammation and swelling.
- ❖ Patient should be reminded that the pain from extraction will not reduce by removal the denture.
- ❖ Analgesic, antibiotic, must be prescribed to patient depending on the case.
- ❖ There may be some oozing of blood. The denture acts as a bandage to protect the extraction sites and helps to control bleeding and swelling.



### 1st Adjustment must be seen after 24 hours:

- ❖ The denture should be kept out of patient mouth only for short time, therefore quickly checking the tissue sore spots, over extension and any gross occlusal discrepancy.
- ❖ On removal the denture may be painful; inform the patient and adjust sore area which appears as deep red areas mostly undercuts as canine eminence, tuberosity, and retro mylohyoid ridge.
- ❖ Adjust occlusion.
- ❖ Assess retention and use tissue conditioner if needed.

### 1st week after extraction and denture insertion:

- ❖ Instruct your patient to wear the denture day and night for first 7 days after extraction or until swelling reduction.
- ❖ Remove the denture 4 or 5 times a day after the first day, and rinse the mouth with warm salt water. Do this for the first week.
- ❖ The denture must be cleaned and rinsed after meal as early as possible and when removal and insertion of the denture is with little or tolerable pain.

### Further follow up care:

- ❖ 2nd week is the next call, this is depend 0 the case. Then the patient should be seen one month later, 4-6 months intervals.
- ❖ A denture adhesive will be necessary to help hold the denture in place.
- ❖ Relining may be necessary to achieve esthetic and occlusion corrections.
- ❖ Frequent or periodic recall mainly for changing temporary liner, this is depend on the rate and amount of bone resorption and ability of patient to keep the liner clean

## IMMEDIATE DENTURE

### Introduction:

There are different treatment options for a patient facing loss of his or her remaining natural teeth, immediate denture is one of these options that fulfill an important role in today's treatment modalities by providing the patients with esthetics, function, and psychological support after extractions and during the healing phase.

### Definition:

An immediate denture is "any complete or partial removable dental prosthesis fabricated for placement immediately following the removal of natural teeth".

It may be either single immediate dentures or upper and lower immediate dentures in the same patient. The latter should be made together to ensure optimal esthetics and occlusal relationships.







## Indications:

1. **Educated patient** with daily social activity (doctors, lawyers and teachers).
2. **Hopeless remaining teeth** (caries, periodontal diseases or malocclusion)
3. patient with **stable health condition**.
4. Patient **don't mind some additional visits or cost**.

The best patient for immediate dentures is the philosophical type. Their motivation for denture is the maintenance of health and appearance, and they accept replacement of natural teeth that can't be saved as normal procedure.



## Contraindications:

1. Patients who are in **poor general health** (systemic diseases).
2. Patients who are identified as **uncooperative, indifferent** and **unappreciative**.
3. Patient at risk from **bacteremia**.
4. Patient with **recurrent history of post extraction hemorrhage**.
5. The presence of **acute periapical or periodontal diseases** and **extensive bone loss**.
6. Patient **don't mind being edentulous** for a period of time till complete healing.

## Advantages:

1. **Maintenance of a patient's appearance** because there is no edentulous period.
2. **Circumoral support**, muscle tone, vertical dimension of occlusion, jaw relationship, and face height can be maintained. The tongue will not spread out as a result of tooth loss.
3. **Less postoperative pain** is likely to be encountered because the extraction sites are protected. Some authors have discussed whether immediate dentures reduce residual ridge resorption.
4. **It is easier to duplicate** (if desired) the natural tooth shape and position, plus arch form and width.

## Advantages:

5. The patient is likely to **adapt more easily to dentures** at the same time that recovery from surgery is progressing. **Speech and mastication are rarely compromised, and nutrition** can be maintained.
6. Overall, **the patient's psychological and social well-being** is preserved. The most compelling reasons for the immediate denture prescription are that a **patient does not have to go without teeth** and that there is no interruption of a normal **lifestyle of smiling, talking, eating, and socializing**.

## Disadvantages:

Immediate dentures are a more challenging modality than complete dentures because the presence of teeth makes impressions and maxillomandibular positions more difficult to record.

**Specific disadvantages include the following:**

1. The anterior ridge undercut (often severe) that is caused by the presence of the remaining teeth may interfere with the impression procedures and therefore preclude also accurately capturing a posteriorly located undercut, which is important for retention.

2. **The presence of different numbers of remaining teeth in various locations** (anteriorly, posteriorly, or both) frequently leads to recording incorrectly the centric relation position or planning improperly the appropriate vertical dimension of occlusion. An occlusal adjustment, or even selective pre-treatment extractions, may be needed to make accurate records at the proper vertical dimension of occlusion.
3. **The inability to accomplish a denture tooth try-in** in advance on extractions precludes knowing what the denture will actually look like on the day of insertion
4. Because this is a more difficult and demanding procedure, **more chair time, additional appointments, and therefore increased costs** are unavoidable.
5. **Functional activities such as speech and mastication** are likely to be impaired however this is a temporary inconvenience.

## Types of immediate dentures:

According to the case and type of treatment plan, immediate denture may be planned to be:

### 1. **Conventional (or classic) immediate denture (CID):**

After this immediate denture is placed and after healing is completed, the denture is refitted or relined to serve as the long-term prosthesis.

### 2. **Interim (or transitional or non-traditional) immediate denture (IID):**

After this immediate denture is made and after healing is completed, a second, new complete denture is fabricated as the long-term prosthesis. The interim prosthesis is designed to enhance esthetics, stabilization and/or function for a limited period of time, after which it is replaced by a definitive prosthesis. It is a temporary treatment, must be followed by the definite treatment.

## **Comparison between CID & IID:**

| <b>CID Definitive</b>                                                                                                                              | <b>IID Transitional</b>                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Intended as the final or long term prosthesis                                                                                                      | Intended for short term use only                                                                                                      |
| After healing, it is relined with acrylic resin                                                                                                    | After healing, a second denture is made                                                                                               |
| Indicated when two extraction visits are feasible                                                                                                  | Indicated when only one surgical visit is preferable to maximize insurance benefits                                                   |
| The esthetics of the denture cannot be changed                                                                                                     | The second denture procedure allows an alteration of esthetics, and all other factors, if indicated                                   |
| At the end of treatment, the patient has one denture                                                                                               | At the end of treatment, the patient has a spare denture to use in case of extenuating circumstances                                  |
| If all posterior teeth are initially removed, vertical dimension of occlusion is not preserved.                                                    | Since posterior teeth need not be removed, vertical dimension of occlusion may be preserved                                           |
| Contraindicated for patient who need complicated treatment plans involving both arches, such as periodontal therapy, fixed ,partial dentures , etc | Often indicated when the patient will become edentulous in one arch and partially edentulous in the opposing arch for the first time. |

**Immediate denture can be classified according to type of restoration into:**

- 1. Immediate complete denture.**
- 2. Immediate partial denture.**
- 3. Immediate over denture.**

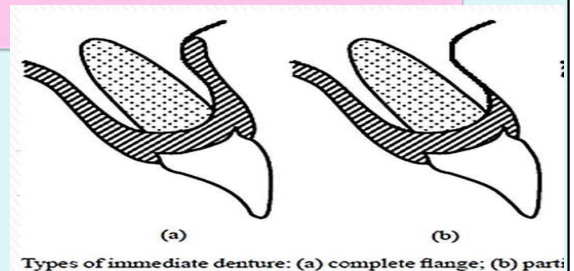
However immediate denture are probably better described by the more appropriate term of transitional dentures. This term is more appropriate because the day that the last teeth are removed and the dentures placed is the beginning or transition from natural teeth to denture teeth.

The transitional denture has three or four phases." The first phase is preparatory extractions of all posterior teeth in the arch to receive the denture. All molars and bicuspid are removed and the bone and overlying gums are allowed to heal. Sometimes Upper and lower first bicuspid are left to keep the bite dimension from changing as well as provide a broader smile during healing. The healing period varies but is usually **six to eight weeks**. Some patients will have transitional removable partial dentures made to replace the back teeth. , These partial dentures are used only during the healing of the posterior areas phase. They can be placed the same day the back teeth are removed and will require some adjustments for fit and function during healing. Use of transitional removable partial dentures is not always possible so each case must be determined on an individual basis.

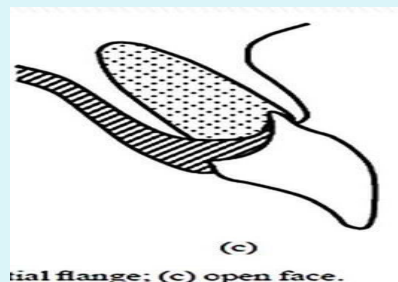
### According to flange design:

#### 1. flanged type immediate denture .

- A. complete flange.
- B. partial flange.



#### 2. Open-faced flangeless type (open face or close fit) immediate denture .





## Comparisons of flanged and open faced denture:

1. **Appearance of flanged denture does not altered** after fitting where the appearance of **open – face denture (although good initially) can deteriorate rapidly as resorption** create a gap between the necks of the teeth and

2. The flange **positioning** of teeth, where, in **positioned** in the sockets of the

So on case **good alignment** in flanged denture



### 3. **in upper denture:**

A flange on an upper denture create a more effective borders seal, therefore, better **retention** than is achieved with an open face denture.

### 4. **in lower denture:**

Open face denture is not usually constructed because of poor stability of lower denture during function, so flange denture is commonly used. So flange denture is better from the point of **stability**.

5. The presence of **labial flange** produces a **stronger denture**, labial flange will make the denture stiffer so the **midline fatigue fracture** caused by repeated flexing across the midline is reduced. so from the point of strength the flange denture is better.

6. As the bone resorbed following extraction the denture become loose and a reline is required, so the presence of labial flange make it **easier to add either a short-term soft lining materials or a cold curing relining materials as a chair side procedure**, as the color of some reline materials is not always ideal they may be **visible when used with open face denture**.

7. **The flange denture cover the clot completely** and protect them more effectively, the flange denture exerts **pressure on both lingual and labial gingiva** reducing post extraction hemorrhage.

8. **The consequence wearing of ill-fitting denture can lead to:**

- a. If it is open face, will produce a scalloped ridge in the region of the socketed teeth
- b. In flange denture, distribution the functional loads more favorably to the underlying ridge, thus minimizing bone resorption.

9. When patient have got used to an open face immediate denture there **is difficulty to accept a denture with labial flange in future and patient will complain from the fullness of the lip**.

If flange denture had worn from the beginning this problem does not occur.

10. **When the ridge morphology produce deeply undercut area it may not be possible to fit a full labial flange unless there is surgical reduction**, In this case the using of partially flange denture or open face denture is preferable when surgical procedure is contraindication.

## **Explanation to the Patient Concerning Immediate Dentures:**

1. They do not fit as well as complete dentures. They may need temporary linings with tissue conditioners and may require the use of denture adhesives.
2. They will cause discomfort. The pain of the extractions, in addition to the sore spots caused by the immediate denture, will make the first week or two after insertion difficult.
3. The esthetics may be unpredictable. Without an anterior try-in, the appearance of the immediate denture may be different from what you expected.

4. Many other denture factors are unpredictable such as the gagging tendency, increased salivation, different chewing sounds, and facial contour.

5. Immediate dentures must be worn for the first 24 hours without being removed by the patient. If they are removed, they may not be able to be reinserted for 3 to 4 days. The dentist will remove them at the 24-hour visit.

6. Because supporting tissue changes are unpredictable, immediate dentures may loosen up during the first 1-2 years, or 4-6 months depending on the no. of teeth and their location.

## Construction Steps of Immediate Denture

- Diagnosis (Appendix 1)
- Pre extraction records.
- Impression (Appendix 2)
- Beading and boxing (Appendix 3)
- Record base and Occlusal rim (Appendix 4)
- Jaw relations records (Appendix 5)
- Selection and arrangement of artificial teeth (Complete the set up of posterior teeth).
- Try in (Appendix 6)
- Cast trimming (Appendix 7)
- Surgical splints (Appendix 8)
- Setting of anterior teeth (Appendix 9)
- Waxing and flasking (Appendix 10)
- Processing and finishing (Appendix 11)
- Insertion (Appendix 12)
- Post insertion care and instructions (Appendix 13) .

## Diagnostic steps:

- 1. Good oral hygiene** is essential before starting any prosthodontic treatment.
- 2. Patient's systemic condition**, it is very important to check the general health of the patient because multiple extraction may not be tolerated by all the patients, that's why patients with uncontrolled systemic diseases should not be included in this type of treatment. Patients under medical control and do not interfere with the steps of denture construction including several teeth extraction with or without some surgical corrections can be included, medical consultation is advisable.
- 3. Full dental history** must be recorded in the case sheet.

- 4. Periodontal condition of the remaining teeth must be assess,** this must include teeth mobility, measurement of the pockets; because this might affect surgical step of the treatment course. Severe case of periodontal disease may suggest some surgical correction after extraction to have well contoured residual ridge covered with firmly attached mucosal tissue. Periodontal condition may give a primitive assessment about the bone remodeling subsequent to the surgical phase.
- 5. Full teeth charting,** teeth my help in retention as a partial denture or overdenture abutments must be determined, any soft or hard tissue correction as frenal release or bone reduction must be included after good evaluation.

- 6. Radiographic examination :**Which is essential for immediate denture patients. Periapical radiograph may be useful for localized area; OPG view give general view for both jaws in single image.
- 7. Teeth mold and shade must be recorded:** proper communication with the patient about his teeth shade and form is essential, furthermore teeth alignment and any individual variations as diastema, spacing, rotation of the teeth if the patient like to preserve same appearance or improvement could be suggested by dentist for better appearance. **BUT it is very important to remove any premature contacts because** these may interfere with correct jaw relation record, essential changes to improve occlusal plane, midline, overjet and overbite and any other corrections that help in esthetic and functional requirements.



- 8. Occlusal plane adjustment** :is necessary because the factors that necessitate tooth extraction are often associated with occlusal discrepancies. These also interfere with centric relation record as well as with the proper determination of occlusal vertical relation. Proper location of low and high lip lines must be determined to determine the required changes in teeth position or angulations.
- 9. Presence of any infection or inflammation** in the soft and hard tissues. Periapical abscess, granuloma and cysts may make the estimated tissue changes at the time of extraction and healing and remodeling process unpredictable, this may increase of the risk of unfitted immediate denture.
- 10. Previous prosthesis, (if present) must be checked** as an additive reference for the jaw relations or teeth selection. It also may help the dentist to explain some of treatment or correct some errors.

11. In many cases of immediate denture construction, **a diagnostic casts are essential**. These casts could serve a lot in the treatment plan and communication with the patient. the casts also can be used as a pre-extraction record.
12. All immediate denture patients must have **good oral prophylaxis, proper scaling and good oral hygiene**, this will reduce postoperative edema and infection. Other treatments as restoration crown and bridges or even RPD all must be one coincidence with immediate denture planning.

In the diagnosis step; with all the collected information you have to decide type of surgical procedure, **immediate denture can be constructed with one of the surgical procedure:**

- 1. Extraction of teeth only.**
- 2. Extraction of teeth with alveoloplasty.**

In some case simple corrections may be needed at the sight of extracted teeth to improve the shape of the alveolar process in order to facilitate and improve denture objectives. In these cases surgical splint construction is important. This splint usually constructed on the master cast after teeth trimming. Cases with excessive bone correction may be end up with rapid bone resorption and unfitted denture, therefore bone removal must be conservative. Consultation with the surgeon is essential in some cases.

Department of:  
HERE

***The alternative line of treatment plane for such patient could be either:***

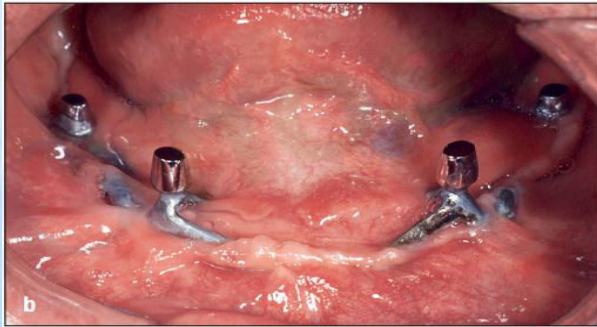
- ❖ It can be best treated with dental implant if possible
- ❖ Use of resilient denture liner in the mandibular denture.

Mandibular single denture have very poor prognosis.



## Dental implant materials

**Dental implant** : a prosthetic device made of alloplastic material(s) implanted into the oral tissues beneath the mucosal and/or periosteal layer and on or within the bone to provide **retention** and **support** for a fixed or removable dental prosthesis;  
a substance that is placed into and/or on the jaw bone to support a fixed or removable dental prosthesis



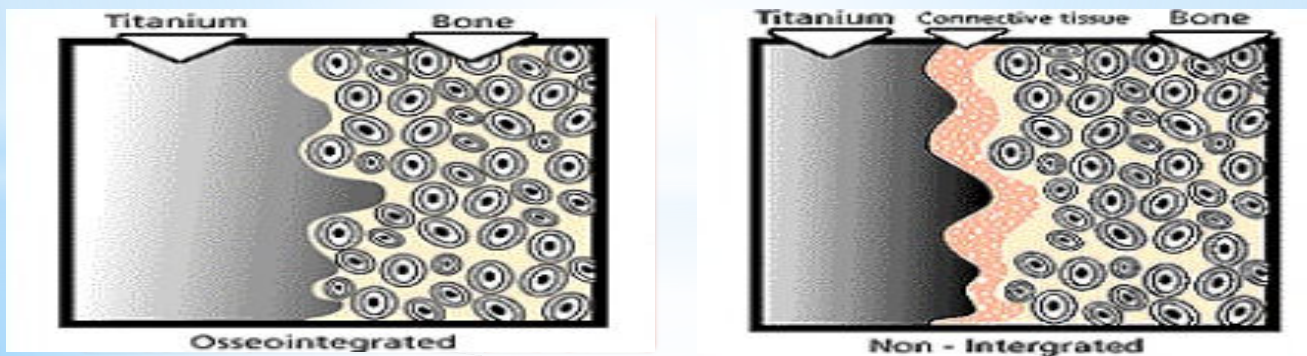
The **composition** and **nature of the surface** on an implant are important characteristics because of their effect on the **biologic development of an interfacial relationship between the bone and the implant**.

**To be successful, an implant must meet four conditions:**

- 1) Be **biocompatible** so there is no undesirable reaction between the tissues and the implant (i.e. corrosion, dissolution and/or resorption).
- 2) Have an interface that **stabilizes postoperatively** in as short a time as possible.
- 3) Be capable of **carrying and transferring** the **occlusal stresses** that are placed upon it.
- 4) **Remain stable** for a long period of time.

A knowledge of the **composition** of implant materials, their **surfaces**, and their **forms** are important factors when **developing** and **understanding of the biocompatibility** of implants and how they develop a **symbiotic relationship with living tissues**.

**Osseointegration:** 1. The apparent **direct attachment** or **connection** of osseous tissue to an inert, alloplastic material **without intervening fibrous connective tissue** or 2. the process and resultant apparent direct connection of an exogenous material's surface and the host bone tissues, without intervening fibrous connective tissue present **or** 3. the interface between alloplastic materials and bone.



**Biomaterial:** any substance other than a drug that can be used for any period of time as part of a system that treats, augments, or replaces any tissue, organ, or function of the body.

**Biomaterial:** A synthetic material used to make devices to replace part of a living system or to function in intimate contact with living tissue.

A variety of devices and materials are used in the treatment of disease or injury. Common place examples include suture needles, plates, teeth fillings, etc.

**Bio-compatibility:** Acceptance of an artificial implant by the surrounding tissues and by the body as a whole.



## Selection of Biomedical Materials

The process of material selection should ideally be for a logical sequence involving:

- 1) Analysis of the problem.
- 2) Consideration of requirement.
- 3) Consideration of available material and their properties leading to:
- 4) Choice of material.

The most common classes of materials used as biomedical materials are **polymers**, **metals**, and **ceramics**. These three classes are used singly and in combination to form most of the implantation devices available today.

Implant material should have suitable mechanical strength, biocompatibility, and structural biostability in physiologic environments.

The development of biomaterials sciences has resulted in classification schemes for implantable materials according to chemical composition and biologic response.

## Classification of implant materials

1. According to **biocompatibility** of the material in the bone (**Strunt's classification**).
2. According to **type of material**. metallic or non-metallic (**Combe's classification**).

### 1. Strunt's classification



- Distant osteogenesis
- Contact osteogenesis
- True bond osteogenesis
- Bond osteogenesis

### 2. Combe's classification



- Metallic material.
- Non-metallic material.

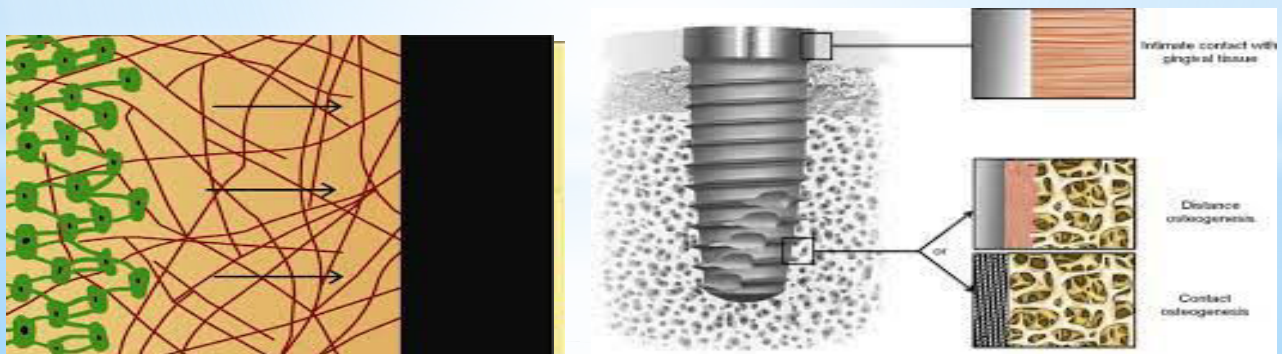
## 1. Strunt's classification according to biocompatibility:

Depending on their reaction with surrounding bone and on the ability of implant material to stimulate bone formation (behaviour of the material in bone)

### a. Distant osteogenesis: (biotolerated material):

In this type, there will be a gap between implant & bone which is filled with connective tissue. There will be a connective tissue capsule (fibrous scar). Possible osteoid or chondroid contact can be seen. The type of the materials include,

**Stainless steel, Co-Cr-alloy, gold alloy, poly methyl methacrylate.**

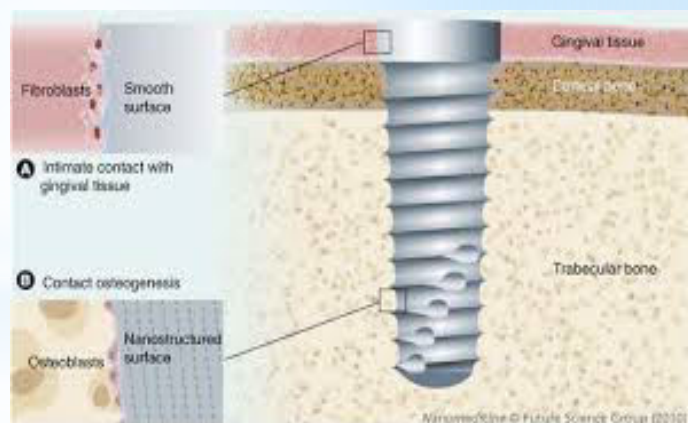
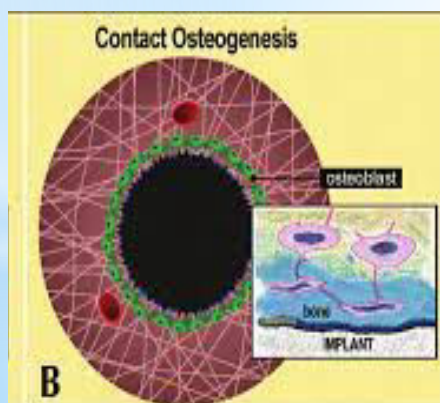


### b. Contact osteogenesis: (Bio inert material)

In this type, there is contact between implant & bone like: **Titanium, Tantalum, Aluminium oxide & ceramic (non-reactive type).**

Ceramics are 2 type:

- **Reactive**: induce bone formation
- **Non reactive**: does not induce bone formation



### **c. True bond osteogenesis: (Bioactive material)**

In this type, there is a chemical bond between the implant and bone, materials like ceramics bioglass , calcium phosphate apatite.

### **d. Bond osteogenesis: (Bio inert & structure osteotropic material)**

In this type there is physical & chemical bonding of implant to bone, materials: Titanium with rough surface (to increase the surface area) & very thin thickness of coating layer.

## **2. Combe's classification:-**

### **1- Non-metallic material:**

- A. Bio inert (non-reactive)**
- B. Bio active**

### **2- Metallic material.**



## 1- Non-metallic material:

**A. Bio inert (non-reactive):** mean minimal interaction between implant material & the tissue like: **Polymers**, **Vitreous carbon**, **nonreactive types of Ceramic** e.g. (Aluminium oxide and Zirconium oxide).

**1- Polymers:** There are a large number of polymeric materials that have been used as implants or part of implant systems. The polymeric systems include acrylics, **polyamides**, **polyesters**, **polyethylene**, **polysiloxanes**, **polyurethane**, **polytetra-fluoro-ethylene (PTFE)**, **poly ether ether ketone (PEEK)** and a number of reprocessed biological materials.

All polymers are **radiolucent**, they are used as **coating or membrane** but nowadays they used the PEEK as **solid implant after modification of their mechanical properties by addition of different types of fillers**.



**2- Vitreous carbon:- Stable & well tolerated material**, classified as ceramic because of **inertness & biocompatibility**. It has undesirable physical properties, Widely used in cardio vascular disease.

### Disadvantages of carbon:

1. It has not performed well in clinical practice & high percentage of clinical failure & withdrawal of this device.
2. Radiolucent in x-ray.
3. Color of the material is black.
4. Brittle & lack of ductility.

The pyrolytic carbons appear to have better potential due to their enhanced **physical properties** & may be **further reinforced with carbon fiber** producing a material which is well tolerated when implanted.



Zirconium XT  
Vitrac Screw



Carbon fiber reinforced  
high performance PEEK



### 3- Non reactive ceramics:

- One type of non-reactive ceramics that has shown evidence of success in clinical studies is made from **Aluminum oxide ( $Al_2O_3$ )**, either as a **poly crystalline** or as **single crystal**
- Although this ceramics is well tolerated by bone.
- It is **not** bioactive, because it does **not** promote the formation of bone
- It does possess high strength, stiffness and hardness
- These implants are designed with either **screw** or **blade** shape
- It appears to work optimally when they are used as abutment for prosthesis in partially edentulous patient.



### Zirconia-based ceramics

- It is well tolerated in the tissue
- Possess mechanical stability during the experimental method of one year
- Attractive color
- Ease of preparation of abutment
- Radiographic opacity
- Surface structure is important to create enough unique fracture toughness
- Because of their good combination of mechanical property and excellent biocompatibility, Zirconium's ceramics are recognized as one of the best biocompatibility for joint prosthesis.
- Proper quality control during manufacturing & polishing when used as endosseous dental implant.





**B. Bio active (Hydroxy apatite, Bioglass):-** those material used to enhanced the bond strength of implant to bone & accelerate the rate at which attachments occurs mainly used as coating applied to develop bounded interface with bone to promote bone formation.

The bioactive materials promotes bonding to bone by:

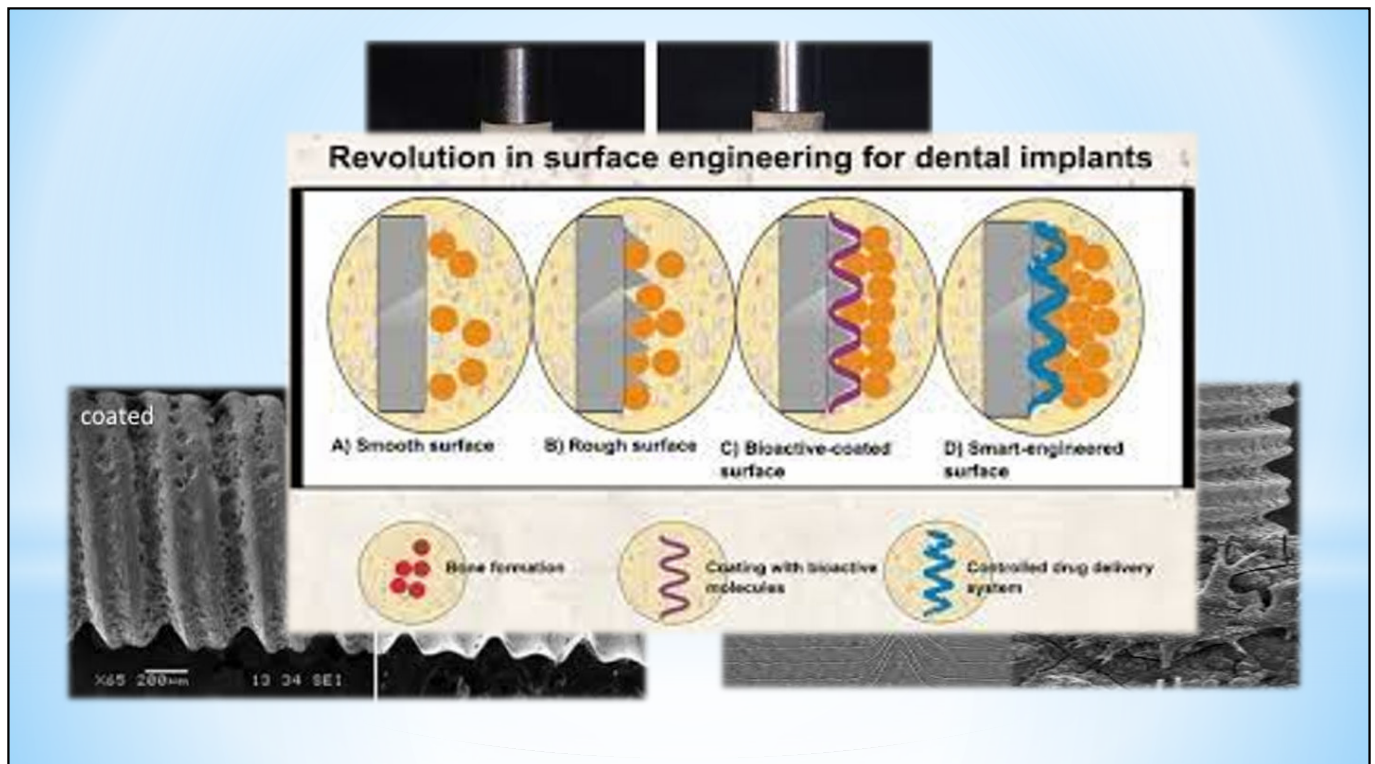
- 1- Providing bonding sites for collagen fibers.
- 2- Providing an environment which favors osteoblast over fibroblast.
- 3- Releasing ions which promote hydroxyapatite formation.

❖ have a bone-implant interface characterized by direct chemical bonding of the implant with surrounding bone.

❖ Free calcium and phosphate compounds at the surface.

❖ Are materials which have designed into them a controlled surface reactivity.

❖ Surface reactivity effect on ionic changes and this effect osteoblast formation rather than osteoclast formation, but this depend on the field. Used as coating not as implant because of brittleness and dissolution of the material.

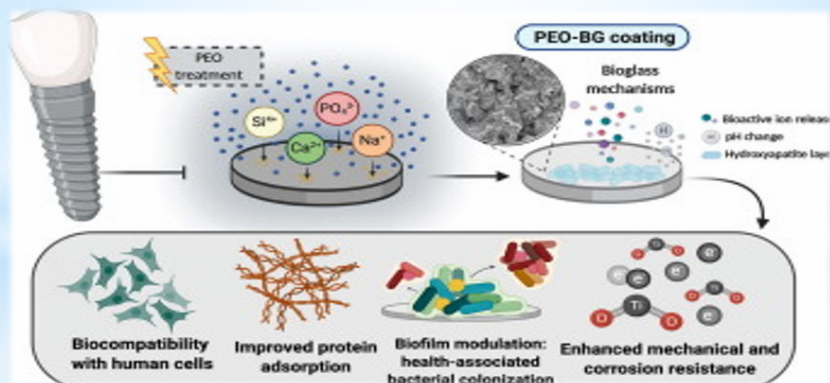


**1- Hydroxy apatite:** HA ceramics has been shown to be biocompatible. non-toxic & capable of forming a biochemical bond with bone due to its chemical similarity to bone mineral. The use of HA as coating for titanium substructures addressed to mechanical deficiencies of the material while realizing the benefits of its bioactivity.



## 2- Bioglass:-

- ❖ dense ceramic material made from  $\text{CaO}$ ,  $\text{Na}_2\text{O}$ ,  $\text{PO}_5$ ,  $\text{Si}_2\text{O}$ , this material bonds chemically to bone. The bond has been shown to be strong that when tested failure fracture occurs with bone or bioglass material leaving interface intact.
- ❖ Thus the brittle nature of bioglass become the limiting factor in its use as stress bearing dental implant.



### 3- Metallic materials:

The conventional metals and alloys used for medical devices belong to three main metallic systems: **stainless steel**, **cobalt chromium alloys** and **titanium alloys**.

These systems exhibit an excellent combination of **high strength**, **relative workability** and **good resistance to corrosion**. The improvements made mainly consist in variations in the chemical composition, heat treatments and processing technologies in order to improve aspects such as fatigue behaviour, wear, corrosion, ion release and stress transmission to the surrounding tissues.

- Metal like Stainless steel & Co-Cr alloy because of their acceptable physical properties and relatively good corrosion resistance.
- They are tolerated by bone to a certain extent but cannot integrate with it.
- So currently titanium or titanium alloy implants are widely used for their superior properties of biocompatibility.
- Other metals that is used as implants materials are gold, tantalum.



## Titanium

- They have proven their worth as a material of choice for the prosthetic superstructure since the late 80's. titanium has certain specific properties which makes it absolutely ideal for these applications.
- It is a silvery-gray metal of groups IV b of the periodic table. It is light weight metal with density of 4.51 g/cm<sup>3</sup>, it has low elastic modulus of 110 GPa and a relatively high melting point of 1668°C.
- Pure titanium is ductile, elastic modulus is 1/2 of steel & 5 times greater than compact bone.
- Titanium is a reactive metal. This mean that in air, water or any other electrolyte an **oxide is spontaneously** formed on the surface of the metal. This oxide is one of the **most resistant minerals known, building a dense film which protects the metal from chemical attack, including that of aggressive body fluids.**

- Titanium is (inert) in tissue. The oxide film in contact with the tissue as practically insoluble; no ions are released that could go on to reach with organic molecules.
- Titanium possesses **good mechanical** properties. Its tensile strength is very close to that of the stainless steel used for load-bearing surgical implant.
- The **poisoning effect of titanium is low** because the metal is passivated by the immediate formation of the surface oxide during manufacturing. The thickness of the oxide increases during sterilization in water vapor. It is this oxide layer that the biomolecules meets when the implant is placed into bone. Beside its excellent physical properties. Ti has a high corrosion resistance.



## Commercially pure titanium CPT

CPT is available in four grades, the purest is known as grade 1

American specification require that such material should contain maximum of 0.18% by weight of oxygen and 0.2% by weight of iron. The strength of CPT increase with increase concentration of oxygen & iron.

**Grad 1:-** titanium is the softest. The most ductile, made as barrier for GBR procedure.

**Grade 2:-** Used for Implant and abutment parts.

**Grade 4:-** is the hardest type & least ductile.

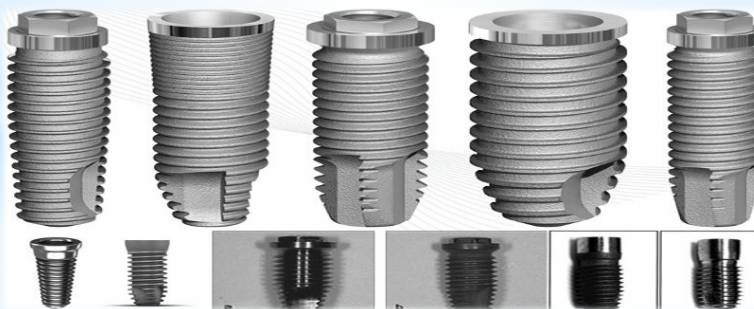
Ti 6 Al 4V:- require particular tensile strength of these alloy.

♦ (Ti-6Al-4V) alloy was found to cause adverse tissue reaction in the interface in contrast to CPT, the metal has been found to cause the most natural tissue reaction of those metals tested.

## Types of surface modification:

### 1- Machined surfaces:-

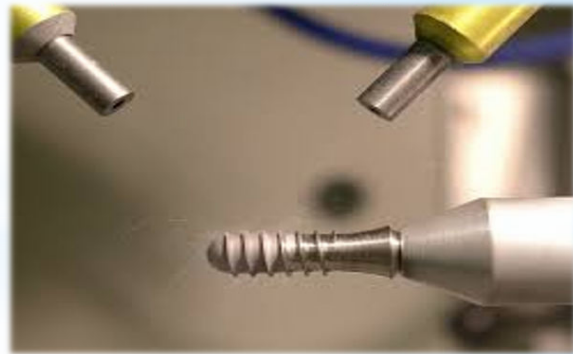
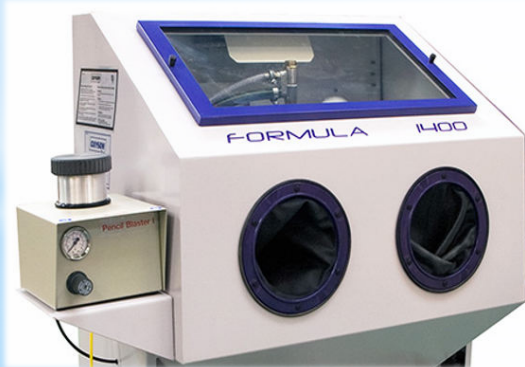
The microscopic surfaces of machined implants are related to machining operation used for forming the threaded shapes & include fine machining lines, pits & grooves. Such features invariably occur during machining of metal such as Ti & Ti alloys. These line surface features may be significant for **promoting osteoblast adherence, bone formation & attachment to the implant surface & therefore promoting osseointegration.**





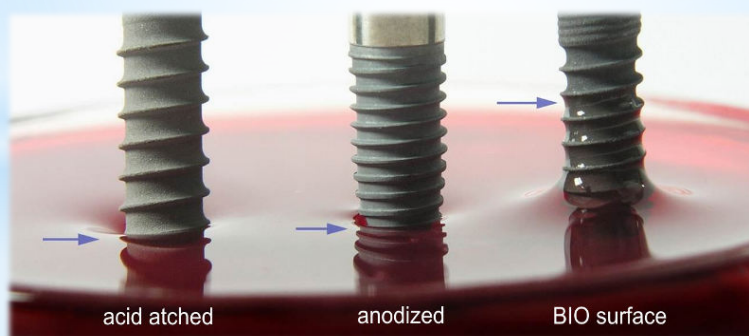
## 2- Shot-blasted features:-

using of sand blasting medium for producing rough surface. Typically, A1205, Sic, glass or TiO<sub>2</sub>, shot (particles) is used to erode a substrate to form very irregular surface with pits & depressions that vary in size & shape depending on the blasting condition.



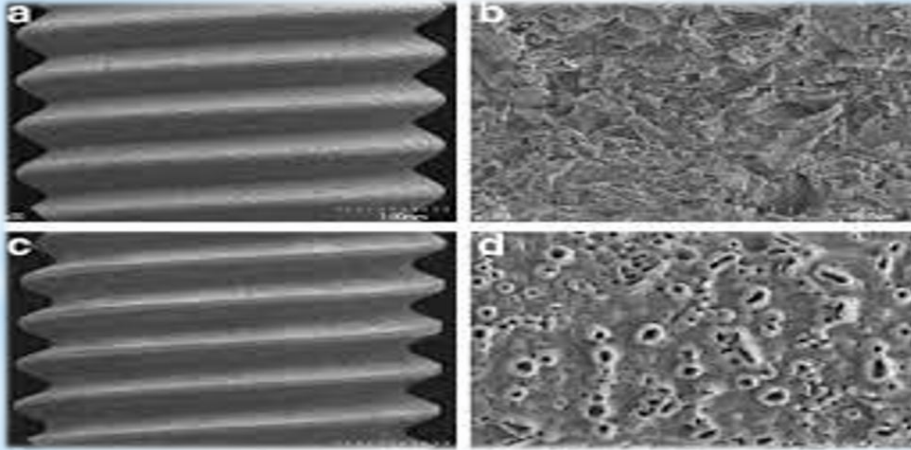
## 3- Chemically etched surface

Chemical etching has been used to develop textured bone-interfacing implant surfaces for enhanced implant fixation. As a result of the controlled surface chemical attack that results from exposure to acid solutions small pits form more or less regular arrays over the implant surface. The result of such treatment is significant increase in implant surface area (**2 time or more**) that result in more effective mechanical interlock of bone & improved implant fixation.



#### 4- Porous Sintered Surfaces

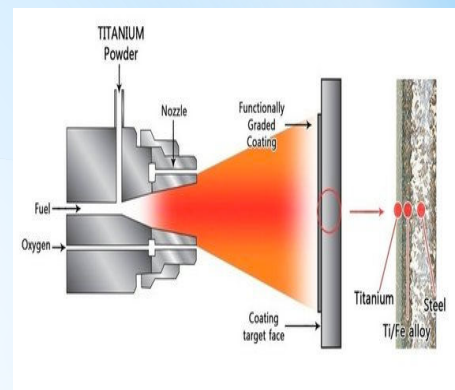
This is another approach for achieving fixation by bone in growth & micro mechanical interlock through sintering Ti-6Al-4V alloy powders to a mechanical Ti alloy substrate.



#### 5- Plasma-sprayed surfaces

is a process by which a material is deposition on to a substrate to form an irregular surface suitable for promoting secure implant fixation by bone growth onto surface irregularities. It is used widely because of the higher temperature reached & higher powder particle velocities. It exhibits higher densities & higher bond strengths.

Plasma is a neutral electrical flame containing equal amount of positive & negative charges. The ions & electrons are produced by passing a gas or mixture of gases through a high current arc.



## Surface design:

The design of implant surface can be:

- 1) Porous
- 2) Roughened (minimize shear movement)
- 3) Granulated
- 4) Textured (screw shaped surface is ideal for dental implant).
- 5) Smooth (weak bonding because sliding of implant)

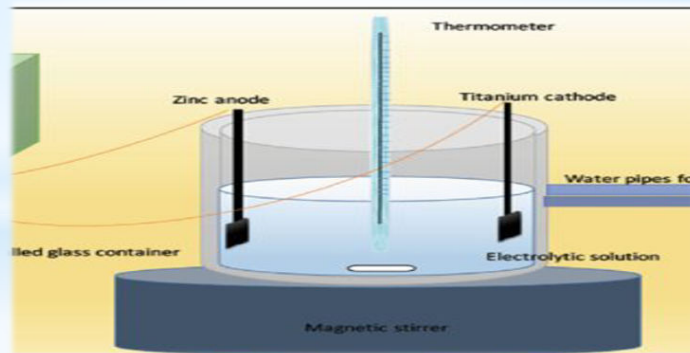
## Ceramic coating:-

The types of ceramic coatings available include both the **bioactive** type such as **calcium phosphates** & the **inert ceramics** such as **aluminum oxide** & **zirconium oxide**. Methods of applying ceramic material as coating for dental implant are:-

- 1) Plasma spraying.
- 2) Vacuum deposition techniques:-
- 3) Sol Gel & Dip coating method
- 4) Electrolytic processing (Electrochemical).

Electrochemical coating has an advantages:-

- 1) Thin coating layer.
- 2) Fine crystalline structure.
- 3) High solubility.
- 4) 100% coverage of porous implant structure.



**Advantage of HA coating:-**

- 1- Aids in direct bonding of bone to the implant surface.
- 2- Quick closure of the surgical site as a new bone grows from the implant surface to meet bone growing from the socket.

The final properties of a ceramic coating are influenced by the method of processing.

\*The most popular ceramic coating from a commercial stand point is plasma -sprayed HA.

Enhancement of bone –to-implant contact



### Enhancement of bone –to-implant contact

Many methods used for this purposes:

**1- hydroxyapatite (plasma sprayed)** onto a roughened & prepared titanium implant ( HA coating range from 50-70nm,also pressurized hydrothermal post plasma – spray increase the crystalline HA content from 77 to 96% this improve bone adhesion .

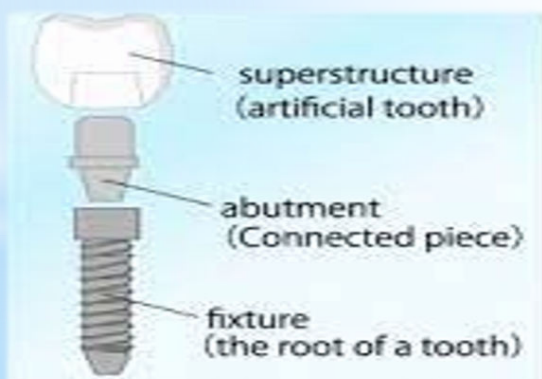
**2-titanium plasma – sprayed surface implant.** The process is characterized by high – velocity molten drops of metal being sprayed onto the implant body to a thickness of 10-40nm this will get greater area for bone attachments & more term results in fully & partially edentulous patient.

**3- Implant surface-Pitch,** the number of threads per unit length, is an important factor in implant osseointegration. Increased pitch and increased depth between individual threads allows for improved contact area between bone and implant.

Moderately rough surfaces with  $1.5\mu\text{m}$  also, improved contact area between bone and implant surface.

### Super structure:

It could be defined as a metal framework that fits the implant abutments and provides retention for the prosthesis. Recently, it is defined as the superior part of multiple layer prosthesis that includes the replaced teeth and associated structures





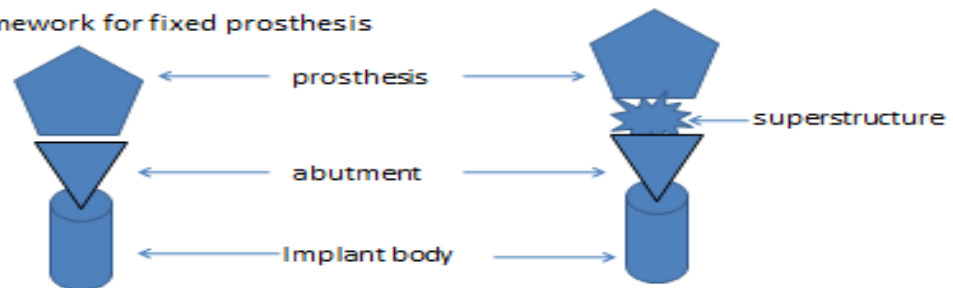
## Prosthetic Attachment

### Abutment

portion of the implant that supports or retains a prosthesis or implant superstructure

### Superstructure

metal framework that attaches to the implant abutment and provides either retention for removable prosthesis or framework for fixed prosthesis

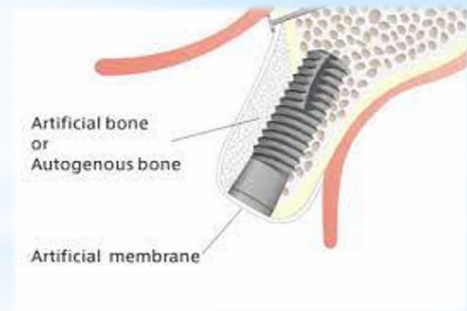
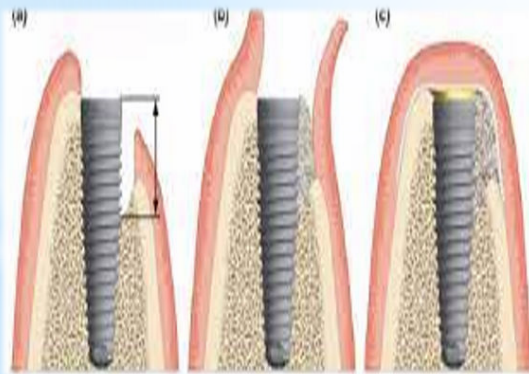


Implant Protheses Restoration

Cement-Retained Multiple Unit castable with extension and stabilizing abutment.

## GBR (Guided Bone Regeneration)

**GBR (Guided Bone Regeneration):** Bone augmentation procedures are frequently used in oral & maxillofacial reconstructive surgery when in sufficient bone volume for implant placement.



Several methods including **bone grafting & membrane techniques** has been described.

### **Materials used as GBR:**

1. Millopore filter.
2. Poly lactic acid (PLA) it's used in iliac bone crest reconstruction.
- 3- Poly Galactine defect.
4. Collagene membrane.
5. Biobrane.
6. Dura matter.
7. Human periosteium.
8. E-PTFE (expanded poly tetra fluoro ethylene) most biocompatible material used in dental implant.

# The principle of (GBR) has been successfully applied to the regeneration of bone in conjunction with the placement of endosseous dental implants where **insufficient bone support exists before or after placement of implants.**

# e-PTFE membranes could regenerate bone in surgically created jaw defect, use a special membrane & under it special bone (pure tri-calcium phosphate)  $\text{Ca}_3\text{PO}_4$ , which is **bioresorbable material, it will induce bone formation & then it will resolve like scaffold, when we put the membrane the bone will be guided in one direction for 1 month.**

### **Indications**

1. Dehiscence defects.
2. Residual osseous defect.
3. Fenestration defect.
4. Extraction defect

### **Non-resorbable membrane for oral surgery**

TEFGEN-FD :

- \* Totally inserted biomaterial
- \* optimal use in oral surgery
- \* Easy handling

#### **Application in:-**

1. Protect extraction site.
2. Cover periodontal defect.
3. Provide space for bone augmentation.
4. Augment implant site.
5. Cover peri implant defect.

#### **Advantages:**

- 1- Non porous the pores are 0.2 micron.
  - 2- No primary closure necessary.
  - 3- Membrane can remain expose to oral cavity.
  - 4- Healing without infection.
  - 5- Handled easy.
- Uncomplicated removal, no need for 2nd surgery described.

## Mechanism of bone grafting Osteogenesis Osteoconduction Osteoinduction

**Osteogenesis:** is the development of bone; formation of bone, an osteogenic graft is derived from or composed of tissue involved in the growth or repair of bone. Osteogenic cells differentiate and the different phases of bone regeneration, encourage bone formation in soft tissue, or active quicker bone growth.

**Osteoinduction:** the capability of chemicals or procedures to induce bone formation through the differentiation and recruitment of osteoblasts; phenotypic conversion of mesenchymal cells into osteoblasts.

**Osteoinduction:** is the act or process of stimulating osteogenesis. It can be used to enhance bone regeneration, and bone may even grow or extend into an area where it is not normally found.

**Osteoconduction:** the process whereby bone grows on a surface or on a scaffolding that is conducive to bone deposition; this is a passive process;

**Osteoconduction:** Provides a physical matrix or scaffolding suitable for deposition of new bone and conducive to bone growth. It allows bone apposition from existing bone, but they do not produce bone formation when placed in soft tissue.

**Osteoconductive graft:** a graft material that serves as a scaffold for new bone growth; this is a passive process.

**Type of graft material:**

Type of graft material 1. Autogenous bone 2. Allografts 3. Alloplasts

**1. Autogenous Bone:** originating or derived from sources within the same individual; self-produced; self-generated; autologous

**autogenous graft:** a graft taken from the patient's own body.

Autogenous Bone an organic autologous material utilizes osteogenesis, osteoinduction, osteoconduction the best grafting material from intraoral, extraoral

**Disadv.** Need for second operative site possibility of not being to obtain a sufficient amount of bone

**2. Allografts:** allograft a graft of tissue between genetically dissimilar members of the same species.

alloplast: 1. an inert foreign body used for implantation within tissue;

2. a material originating from a nonliving source that surgically replaces missing tissue or augments that which remains

**3. alloplastic graft:** a graft consisting of an inert material

alloplastic material: any non-biologic material suitable for implantation as an alloplast



# Implant prostheses

**Osseointegration:** is a direct bone anchorage of an implant body, which can provide a foundation to support prosthesis.

Dr Per-Ingvar Branemark, Sweden Professor developed the concept of osseointegration and coined the term. In his study, microcirculation, Prof. Branemark surgically inserted the titanium chamber into the tibia of a rabbit. The initial concept of Osseointegration stemmed from vital microscopic studies. Then studies that followed involved titanium implants placed into jaws of dogs.

**Oral Implantology (Implant Dentistry):** It is the science and discipline concerned with the diagnosis, design, insertion, restoration and/or management of alloplastic or autogenous oral structures to restore the loss of contour, comfort, function, esthetics, speech and/ or health of the partially or completely edentulous patient

**Implant Prosthodontics:** It is the branch of implant dentistry concerning the restorative phase following implant placement and the overall treatment plan component before the placement of dental implants.

**or** It is the phase of prosthodontics concerning the replacement of missing teeth and/or associated structures by restorations that are attached to Dental Implants .

**Implant:** Any object or material, such as an alloplastic substance or other tissue, which is partially or completely inserted or grafted into the body for therapeutic, diagnostic, prosthetic or experimental purposes .

**Implant Prosthesis:** Any prosthesis (fixed, removable or maxillofacial) that utilizes dental implants in part or whole for retention, support and stability.

**Implant System:** Dental implant components that are designed to mate together. An implant system can represent a specific concept, inventor, or patent. It consists of the necessary parts and instruments to complete the implant body placement and abutment components.

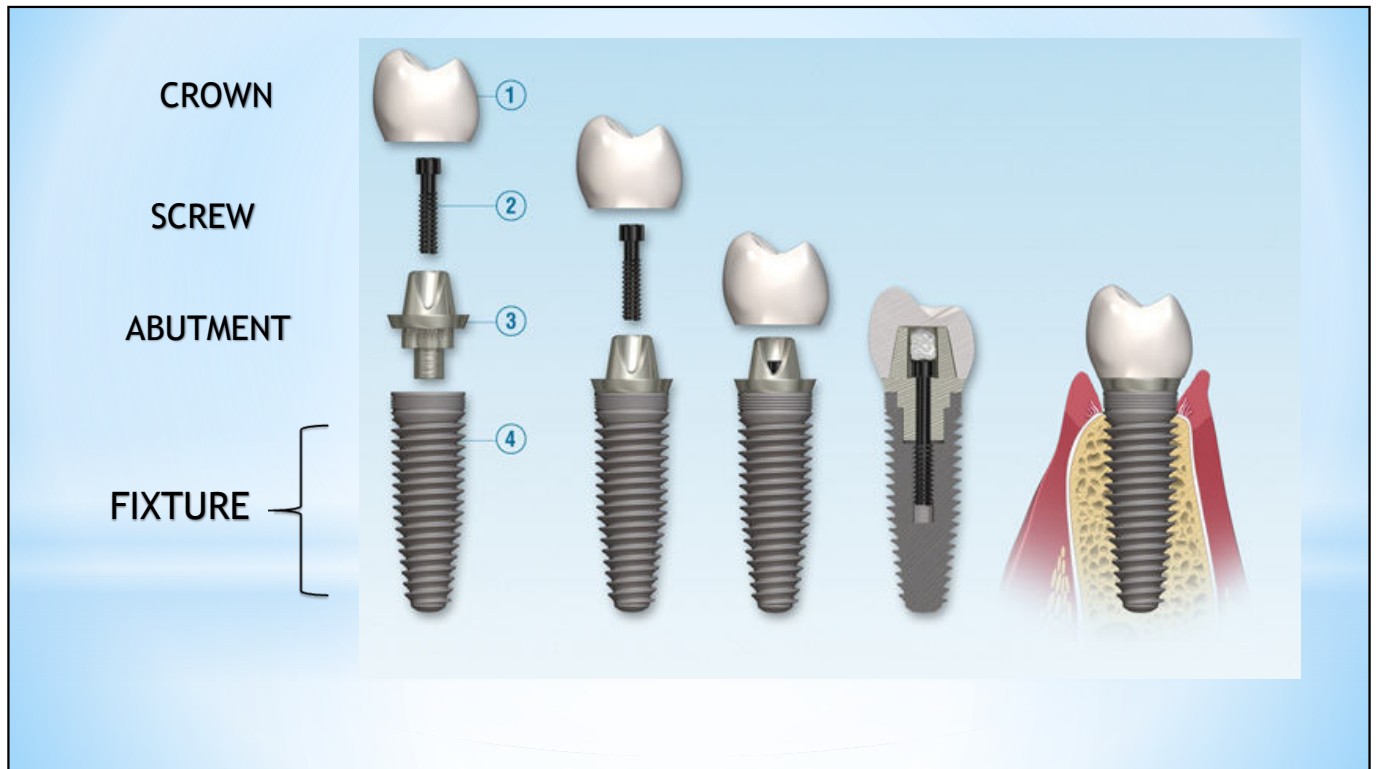
**Osseointegration:** The apparent direct attachment or connection of osseous tissue to an inert, alloplastic material without intervening connective tissue.

**Direct bone anchorage to an implant body, which can provide a foundation to support prosthesis** (Branemark, 1983).

**A direct structural and functional connection between ordered living bone and the surface of a load carrying implant** (Albrektsson *et al.*, 1981).

**Endosseous Implant/Endosteal Implant:** A device placed into the alveolar and/basal bone of the mandible or maxilla and transacting only on cortical plate.

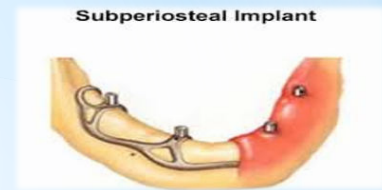
**or :** A device inserted into the jawbone (endosseous) to support a dental prosthesis. It is the 'tooth root' analogue and is often referred to as fixture (Richard Palmer).



Implant classification

**Dental implant can be classified depending on placement within tissue**

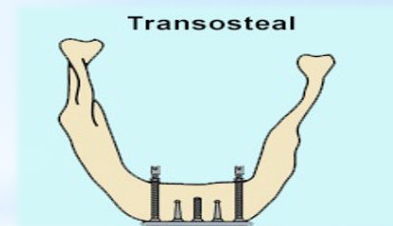
❖ **Subperiosteal:** A CoCr casting custom made for an edentulous bony ridge and placed subperiosteally with integral trans-mucosal posts for denture retention.



❖ **Transmandibular (transosseous)** dental implants “staple bone plates”:

❖ - The staple bone plate is used to rehabilitate the atrophic edentulous mandible.

❖ - It is a transosteal threaded posts which penetrate the full thickness of the mandible and pass into the oral cavity in the parasymphysial area

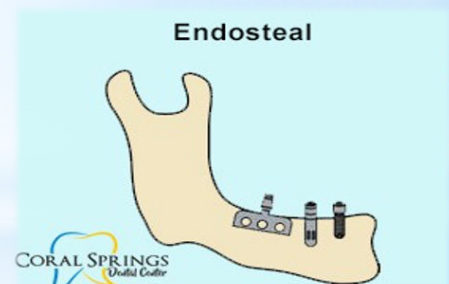


❖ **Submucosal implants:** A small “presstud- like” device within the soft tissue helping to retain a denture, usually maxillary

❖ **Transdental fixation:** A metal implant placed through a tooth and extended through the root canal into the periapical bone to stabilize the mobile tooth sometimes referred to as **endodontic implants**. This was first used by Cuswell and Senia in 1983



❖ **Endosseous—blade (plate),** ramus frame, transosteal or staple, root form, or cylindrical: These implants are anchored in bone and penetrate the oral mucosa to provide prosthetic anchorage.



## 1- Classification of endosseous implants according to their design

- a- Cylinders endosseous implants.
- b- Screws or spiral post endosseous implants.
- c- Blade form endosseous implants.
- d- Root form endosseous implants



## 2- Classification of endosseous implants according to their materials:

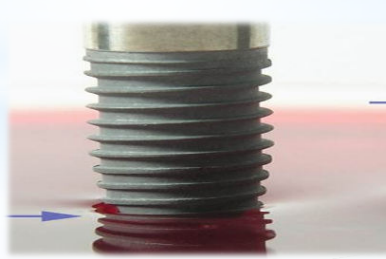
- a- Pure titanium:** the titanium oxide surface was responsible for the formation of the direct bone- implant interface.
- b- Titanium alloy:** the titanium alloys exist in three forms: alpha, beta and alpha beta phases and they all originate when pure titanium is heated and mixed with aluminium and vanadium.





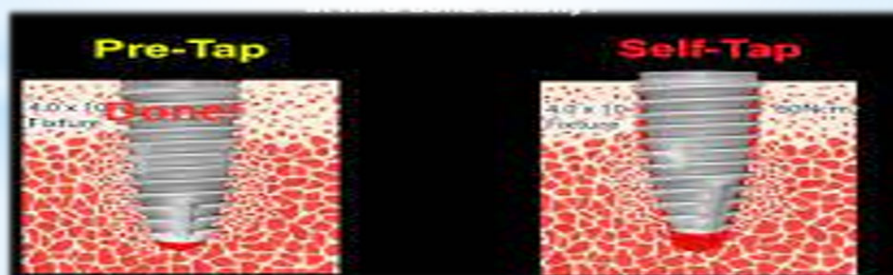
### 3- Classification of endosseous implants according to **surface characteristics**:

- a- Sand blasted surface.**
- b- Titanium Plasma Sprayed surface (TPS),** it has satisfactory results regarding the osseointegration and the clinical prognosis.
- c- Titanium oxide surface coating** the implants to make the inert metal a bioactive one.
- d- Hydroxyapatite coating**



### 4- Classification of endosseous implants according to **the insertion technique**:

- a- Press fit technique:** in this type of unthreaded implants, the implant site is drilled slightly smaller than the actual implant size, where the implant is pressed into the recipient site with slight friction.
- b- Self tapping technique:** in this type of threaded implants, the implant threads are used to tap its site during insertion.
- c- Pre-tapping technique:** in case of very dense bone, the implant sites are better to be **previously tapped** using the **bone tap instrument** before insertion of the threaded implant



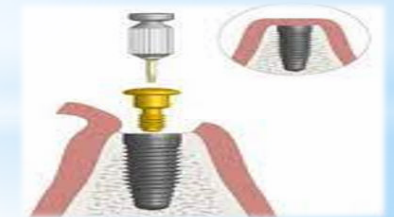
## 5- Classification of endosseous implants according to surgical stages:

**a- Single stage design** (none submerged – transgingival): the body of the implant is inserted into the bone with its abutment portion penetrating through the mucoperiosteum during the healing period.

Surgical placement of a dental implant, which is left, exposed to the oral cavity following insertion. This is the protocol used in **non-submerged implant** systems



**b- Two stage design:** in this design the implant body is completely embedded in bone for complete osseointegration. The implant body is then exposed and the healing abutment is placed for soft tissue healing before the impression is made for prosthesis fabrication



## 6. Classification of endosseous implants according to the time of installation:

**a- Immediate implants:** they are placed into a prepared extraction socket **following tooth extraction**.

**b- Immediate delayed implants:** they are placed within **6-12 weeks** after the tooth loss.

**c- Delayed implants:** they are placed within **6-12 months** after tooth extraction, when complete healing and bone remodeling occur

## 7. Classification of endosseous implants according to time of prosthetic loading:

**a- Immediately loaded implants:** an acrylic resin prosthesis which is designed to be out of occlusion is placed **immediately after implant placement**, specially in anterior region for esthetic purposes.

**b- Delayed loading implant:** delayed loading is done in maxillary implants after **4-6 months** and in mandibular implants after **3-4 months** to allow for better osseointegration due to the difference of the investing bone composition

## Factors affecting healing :

### 1- Surgical technique

All surgical procedures are traumatic. The level of trauma is a critical factor that determines whether **healing will progress toward fibrous** or **osseous integration**. Surgical preparation on hard tissue causes a necrotic zone of bone (interface) due to cutting of blood vessels, frictional heat, and vibrational trauma.

Excessive trauma leads to fibrous encapsulation of the implant.

Surgical trauma must be minimized during all aspects of implant surgery to optimize success rates. The temperature for **impaired bone regeneration** has shown to be as low as **44 C° to 47 C° for one minute**.

### 2- Premature loading

Time should be allowed for healing of necrotic bone, formed due to surgery.

**Movement of the implant during this healing phase will result in fibrous encapsulation.** For this reason it is recommended by many operators to keep the recently placed **implants unloaded** for a period of **two to eight months** depending on the **clinical situation**, **implant coating**, **location of the implant**, and whether the implant is **placed into bone grafts**.

### 3- Surgical fit

Even with the best technical precautions, bone contacts only portions of the implant and a perfect microscopic contact is not possible. A longer healing period will be required before loading implants than surgical fit less than optimal

### 4- Bone quality and quantity

The mandible has a denser cortex and a coarser thicker cancelli than the maxilla. When we go posterior, jaws tend to have a thinner, more porous cortex, and a finer cancelli. Bone regeneration is more likely to progress at a faster rate if the surrounding is denser. it is very frequent to find that bone amount is not enough for implant placement. **The following measures can be done to overcome this problem:**

- ❖ The use of shot implants.
- ❖ Changing the implant angulations.
- ❖ Ridge augmentation.
- ❖ Trans positioning of the neurovascular bundle in the mandible.
- ❖ Subantral augmentation (sinus lift) in the maxilla.
- ❖ Bone synthesis (ossified tissue can be created in predetermined shapes and dimensions).

#### **5- Physical condition of the patient:**

Nutritional status, aging, diabetes mellitus, blood diseases, corticosteroids therapy and radiation treatment are among many factors which can affect healing.

#### **Team approach**

❖ Some authors believe that the same operator should place and restore the implants. The rationale is that it is more efficient from a patient's point of view. It also allows the practitioner more freedom in changing the predetermined position of the implants at the time of surgery. Because the same individual is responsible for the prosthetic treatment, these changes can be incorporated into the treatment plan more readily.

❖ Others believe that **a team approach** is more appropriate to follow. A surgeon should place the implants, and a prosthetic dentist should complete the restoration. Because it allows for the utilization of expertise of the two individuals, there is a built-in second opinion in the approach. Additionally, there is shared responsibility and shared liability. Regardless of the philosophy followed, it is well to delineate the responsibilities at each stage of implant therapy, and it should be clear that dental implant is a **prosthetic technique with a surgical step**.

#### **The prosthodontic should:**

- 1- Perform the initial clinical evaluation.
- 2- Perform the initial radiographic evaluation.
- 3- Obtain the diagnostic casts.
- 4- Obtain the diagnostic wax- up.
- 5- Determine the location and number of implants and fabricate a surgical template.
- 6- Select the proper abutment following the implant exposure.
- 7- Design and fabricate the prosthesis.
- 8- Provide oral hygiene care and instructions.
- 9- Ensure recall of the patient to evaluate maintenance and provide care as required.



### The oral surgeon responsibilities include:

- 1- Confirmation of the radiographic evaluation.
- 2- Confirmation of the physical evaluation.
- 3- Determination of the location and number of implants within limits set by the prosthetic dentist.
- 4- Placement of the implants (first stage surgery).
- 5- Uncovering of the implants (second stage surgery).
- 6- Confirmation of osseointegration of the implants.

### Components of Branemark's implant system

#### I. Implant Fixture/Implant Body

The portion of a dental implant that provides support for the abutment(s) through adaptation upon (eposteal), within (endosteal) or through (transosteal) the bone. The body is that portion of the implant designed to be surgically placed into the bone. It may extend slightly above the crest of the ridge.

#### II. Healing/Cover Screw

The component of an endosteal dental implant system used to seal, usually on an interim basis, the dental implant body during the healing phase after surgical placement. The purpose of the healing screw is to maintain patency of the internal threaded section for subsequent attachment of the abutment during the second stage surgery.



### III. Healing Abutment/ Interim Endosteal Dental Implant Abutment

Any dental implant abutment used for a limited time to assist in healing or modification of the adjacent tissues . After a prescribed healing period that allows a supporting interface to develop, second stage surgery is performed to uncover or expose the implant and attach the **transepithelial portion or abutment**. This transepithelial portion is termed a **second stage permucosal extension**, because it extends the implant above the soft tissue and results in the development of a permucosal seal around the implant.

### IV. Implant Abutment

The portion of a dental implant that serves to support and/or retain any prosthesis .

**Three main categories** of implant abutments are described according to the **method by which the prosthesis or superstructure is retained to the abutment**:

- (i)** an abutment for screw uses a screw to retain the prosthesis or superstructure;
- (ii)** an abutment for cement uses dental cement to retain the prosthesis or superstructure;
- (iii)** an abutment for attachment uses an attachment device to retain the removable prosthesis.

Many manufacturers **classify abutments**: as **fixed** whenever **cement retains the prosthesis** and **removable** when they are **screw retained**. Each **of the three types of abutments is further classified into**:

- straight and
- angled abutments, **describing the axial relationship between the implant body and abutment**.

### V. Hygiene Screw

It is placed over the abutment between prosthetic appointments to prevent debris and calculus from entering the internally threaded portion of the implant.

## **VI. Transfer Coping/Impression Coping**

Any device that registers the position of the dental implant body or dental implant abutment relative to adjacent structures.

## **VII. Implant Analog**

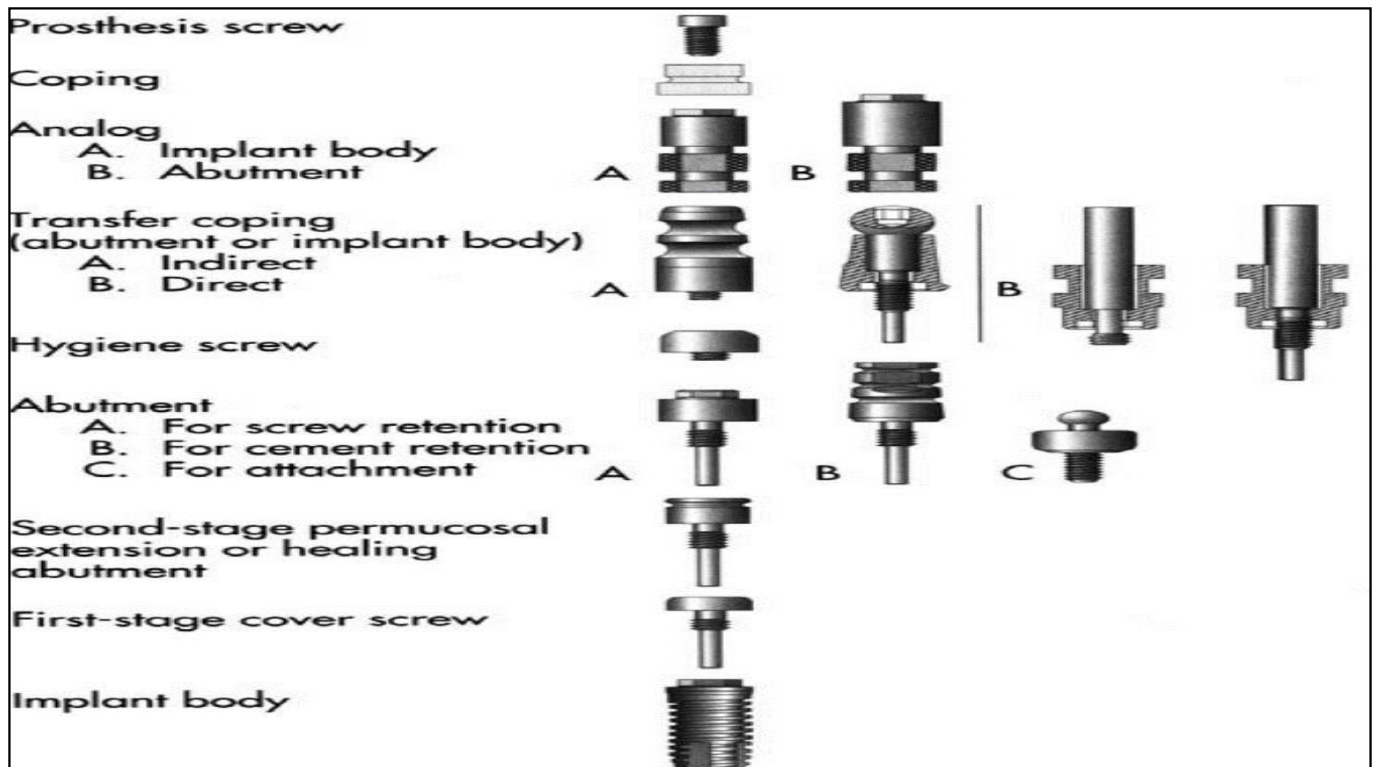
An analog is something that is analogous or similar to something else. Implant analog is used in the fabrication of the master cast to replicate the retentive portion of the implant body or abutment. After the master impression is secured the corresponding analog (implant body, abutment for screw or other portion) is attached to the transfer coping and the assembly is poured in stone to fabricate the master cast.

## **VIII. Coping/Gold Cylinder**

It is a thin covering usually designed to fit the implant abutment and serve as the connection between the abutment and the prosthesis or superstructure. A prefabricated coping usually is a plastic pattern cast into the metal superstructure or prosthesis.

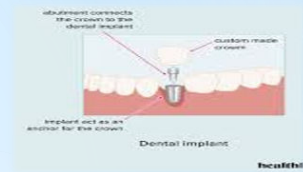
## **IX. Coping Screw**

The screw retained prosthesis or superstructure is secured to the implant body or abutment with a coping screw.



## Prosthetic option in implant dentistry

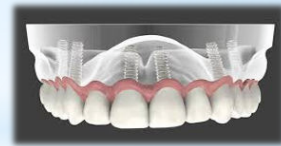
A. Implant supported single tooth



B. Implant supported fixed bridge or partial denture



C. Fully Bone Anchored Prosthesis, Implant supported full arch prosthesis screw retained



D. Implant supported over denture



## Fully Bone Anchored Prosthesis

The fully bone anchored prosthesis is connected to supporting fixtures through the transmucosal components, the abutments either in the maxilla/mandible. To provide proper support for a fully bone anchored prosthesis a minimum of four to six fixtures are necessary. Ideally a fifteen millimeter length/longer should be placed when there is adequate bone. If bone density and quality is poor, the number of fixtures should be increased.

### Design:

Fully bone anchored prosthesis does not obturate the space between the prosthesis and residual tissues.

### Advantages:

- Satisfies functional demands.
- Greater psychological acceptance.

### Disadvantages:

- Airflow pattern produced during speech is unimpeded, which may present problems for the patient if their occupation requires good speaking ability.



### Overdenture (implant supported overdenture)

Implant supported overdenture is a treatment of choice in case of soft/hard tissue defects, Esthetics can be improved by increasing or decreasing the amount of denture base material.

This change in design can enhance lip and facial support. Overdenture is attached to supporting fixtures using various connectors or attachments, which usually do not alter esthetic results. Minimum of two fixtures are needed for support.



## BASIC SEQUENCE OF PROCEDURES IN IMPLANTS TREATMENT :

### **a. Chief Complaint:**

The practitioner must determine which is the most important for the patients, aesthetic, mastication or phonation. This requires careful listening and sufficient time

### **b. Physical Evaluation:**

The medical history normally taken in the modern dental office often is enough for implant patient. It must be kept in mind that there are few contraindications to the use of dental implants. Proper evaluation should be made whether the patient can tolerate the planned procedures or not consultation with the surgeon at this point may be necessary to arrive at proper evaluation in- patients with complicated medical history.

The physical ability or limitations of the patient also play a part in the design of the prosthesis, the selection of the final restoration.

### **c. Psychological Evaluation**

One must realize that. For many patients, the perception of what constitutes implant therapy has been formed from information provided by friends, publications, and other mass media. This is not necessarily all negative, because it results in the patient seeking implant therapy. Many times, however, the patient cannot properly evaluate the information, and limitations

of therapy are not clearly understood therefore, it is necessary to educate the patient concerning the necessity of specific procedures for the case.

### **d. Dental Evaluation**

In addition to the usual dental evaluation,

- ❖ The prosthodontist must incorporate into this evaluation the possible effects of the conditions present in the oral cavity on implants placed in this environment.
- ❖ A history of bruxism, mal-aligned dentition and extruded teeth, which preclude the development of harmonious occlusion and a hygienic restoration should alert the operator to problems in this area. The patient's commitment to a life long- term maintenance program must be evaluated.



#### **e. Bone**

The age of the patient and the amount and type of bone available to support the implants must be determined through the following:

- 1. radiographs evaluation:** The types of radiographs used depend on the number of implants to be placed, the location in the jaws, and the availability of the equipment.
2. Another method, which can be used in determining the amount of bone available, is **palpation**. This method is particularly useful in the mandible. It is often possible to encircle the mandible completely with forefinger and thumb and obtain an indication of the size and shape of the arch at a particular point.

#### **f. Soft tissue**

The soft tissue through which implants exist in the oral cavity is a critical area in terms of long- term success. This is the area that the patient must maintain to ensure **gingival health** and therefore must be capable of withstanding the hygiene manipulation (brushing and flossing). **Fixed keratinized tissue** is the preferred tissue in this area. This is the only type of tissue that has ability to form a tight collar around the implant necks. If soft tissue grafting is anticipated, it is probably best done before implant placement.

#### **h. Ridge relationships**

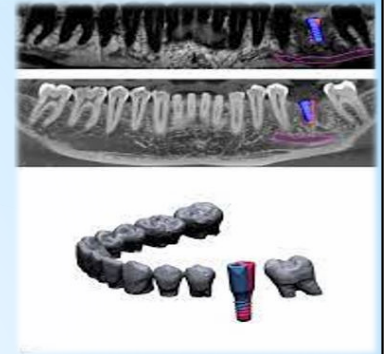
The relationship of the maxilla to the mandible plays an important role in determining the type of prosthesis that can be done and is a deciding factor in the type of occlusion that can often be determined by visual examination, the best observation of this relationship is achieved from mounted diagnostic casts.

#### **i. Radiographic evaluation**

radiological evaluation for determination of sufficient bone quantity and quality to support the implants must be done. The choice of radiological technique appropriate for a given patient depends on a number of factors, including the type of restoration and implants to be used, the position of the remaining dentition, the extent to which bone quality or quantity is in question, the availability of the machine needed, and the cost.

**The following radiological techniques are available:**

- 1- Periapical radiographs.
- 2- Panoramic radiographs.
- 3- Lateral cephalometric radiographs
- 4- Conventional tomograms (CT).
- 5- Computed tomography.
- 6- Magnetic resonance imaging(MRI)

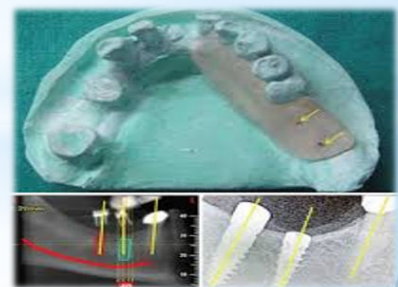


**A maker** of known size should be placed directly on the mucosa during the exposure, when a periapical or panoramic radiographs was selected as the preferable technique. The aim of placing such marker (**metal ball of known diameter**) is the determination of actual ridge height because ordinary radiographs do not have one-to-one correspondence with regard to size. For example, if the actual diameter of the maker is 5 mm. However, on the panoramic film they measure 6 mm., **a 20% magnification occurred**. Therefore, if the bone measure above the interior dental canal is measured 22 mm on the film only 18.3 mm is actually available.

**A.Radiographic Stent:**

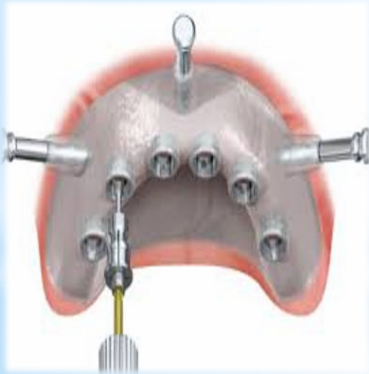
A **diagnostic template** incorporating **stainless steel balls** is used for treatment planning of the implant position. The **actual diameter** and **position** of the **stainless steel balls** in the template relative to the diameter and the position measured on the radiograph help determine distortion of **size and position as seen on the radiographs**.

In the maxilla the vertical bone between the floor of maxillary sinus-alveolar crest and nasal floor-alveolar crest is evaluated. In mandible distance from inferior dental canal or mental foramen is evaluated.



**Surgical Template** As mentioned in radiographic splint, surgical template can be fabricated by duplicating the existing denture or a newly fabricated prosthesis.

Once the position of the implants is determined by palpation clinical, radiographic and diagnostic cast examination, the surgical stent is fabricated.



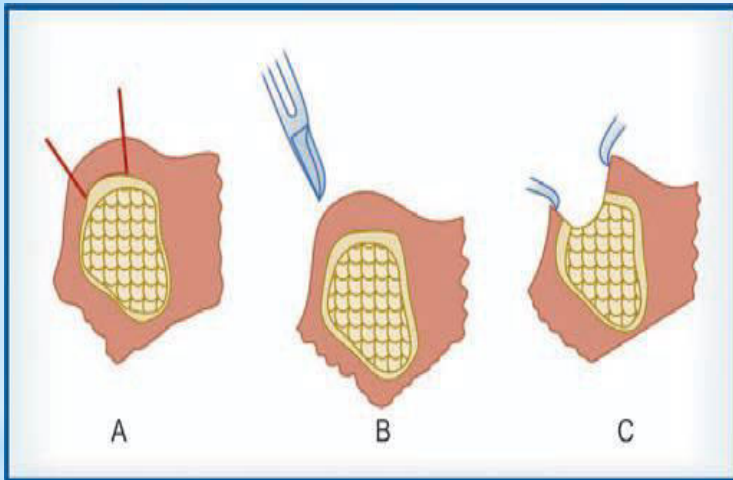
**There are two main functions for the stent:**

- 1 - guide the operator to the selected places for implant placement
- 2- to direct the operator drill to a proper direction through which he should drill in bone

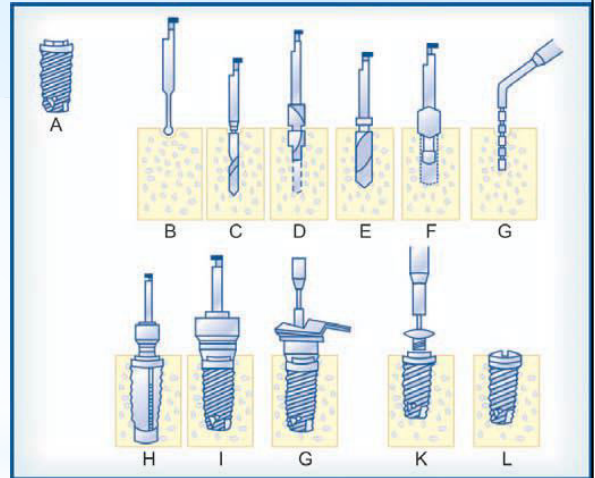
The surgical stent can be fabricated using a clear heat cured or autopolymerized acrylic resin and of approximately 4mm in thickness..

**First Stage Surgery** The following case demonstrates the placement of Branemark implant

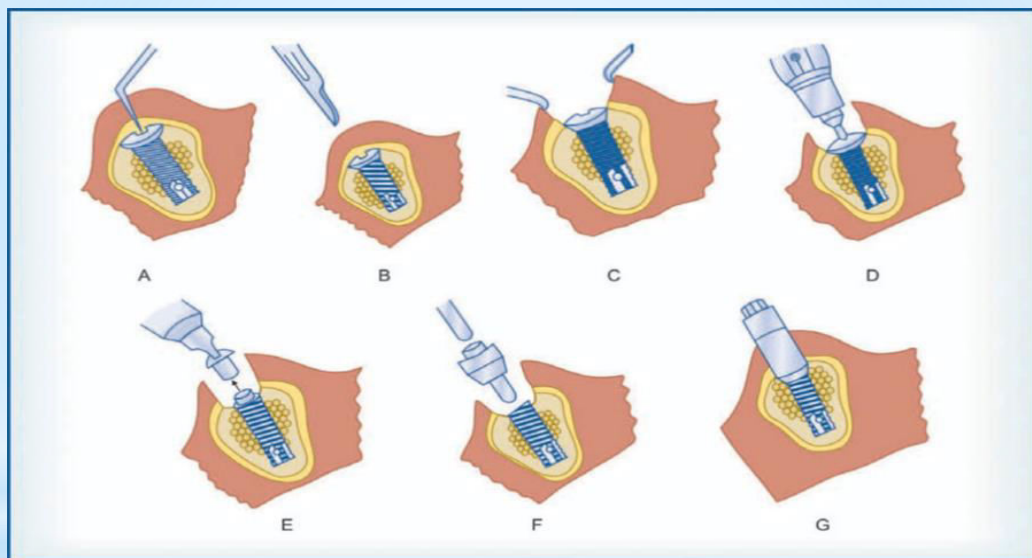
**Second Stage Surgery** The uncovering of the implant is carried out after a healing phase of at least 4 months. The gingival former is screwed onto the implant and the flap sutured around



The bone is exposed by an incision and reflection of mucosal membrane and periosteum (full thickness flap)



Procedure for implant placement



Second stage surgery



## D. Impression

After complete healing of gum about 2 weeks, next step is impression making.

Occlusion rims are used to establish maxilla mandibular relations followed by trial of the waxed up then denture and final denture insertion.

### Classification of impression techniques according to the level of impression into:-

a. **Implant level impression techniques:** (open and closed impression techniques)

b. **Abutment level impression techniques:**

Two basic techniques are used to make a master impression, and each use a different transfer coping. Based on the transfer technique performed in the mouth or on a master cast (implant level):

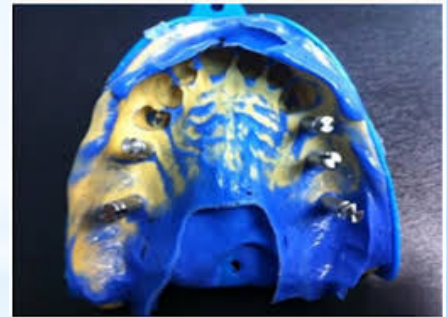
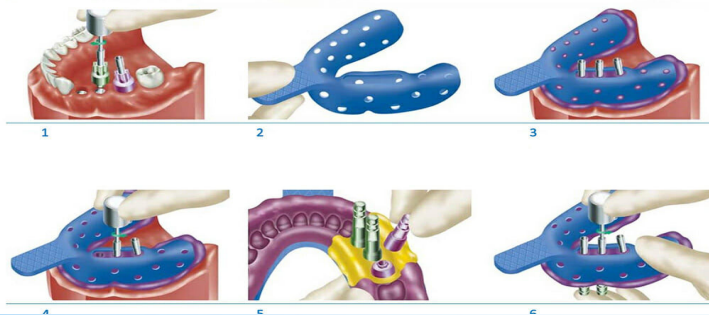
1. **An indirect transfer coping (closed tray impression techniques):** utilizes an impression material requiring **elastic properties**. The indirect transfer coping is screwed into the abutment or implant body and **remains in place when the set impression is removed from the mouth**. The indirect transfer coping is **parallel sided** or **slightly tapered** to allow ease in **removal of the impression** and often has **flat sides** or **smooth undercuts** to facilitate **reorientation into the impression**.





**2. A direct transfer coping (open tray techniques):** usually consists of a hollow transfer component, often square and a long screw to secure it to the abutment or implant body. After the impression material is set the direct transfer coping screw is unthreaded to allow removal of the impression from the mouth. The direct transfer coping takes advantage of impression materials having **rigid properties** or eliminates the error of permanent deformation because it **remains within the impression on its removal**.

Open Tray (Direct) Procedure



**E . Base plate/modeling** wax are used to fabricate the occlusion rim in the usual fashion. Wax

## Implant success and survival :

success criteria as follows:

1. The individual implant should be clinically immobile.
2. There should be no radiographic radiolucency.
3. There should be an absence of persistent pain, infections, neuropathies, and paresthesia.
4. There should be 85% implant survival at the end of a 5-year period of observation and 80% at the end of a 10-year observation period.
5. There should be less than 0.2 mm of bone loss annually following the implant's first year of loading.

Roos et al. (1997) proposed an update to these criteria to reflect that, as implant design evolved, early bone loss could be further minimized. The new criteria suggested a figure of

1. Less than 1.8 mm bone loss for the first 5 years.
2. Less than 1.0 mm bone loss in the first year
3. Less than 0.2 mm bone loss annually after the first year
6. Functional survival of 90% after 5 years and 85% after 10 years

### **Indications of implant denture**

1. Edentulous patient with history of difficulty in wearing removable dentures.
2. When there is severe change in complete denture bearing tissues.
3. Poor oral muscular coordination.
4. Para-functional habits that compromise prosthesis stability.
5. Unrealistic patient expectations for complete dentures.
6. Hyperactive gag reflex.
7. Low tissue tolerance of supporting mucosa.

### **Contraindications of implant denture**

1. High dose irradiated patients.
2. Patient with psychiatric problems such as psychosis, dysthymia.
3. Hematological systemic disorders.
4. Pathology of hard and soft tissues.
5. Patient with drug, alcohol or tobacco chewing abuse.

### **Characteristics of osseointegration Implant :**

- ❖ The most important characteristic of this osseointegrated implant is that the direct bone anchorage can support a free standing fixed prosthesis.
- ❖ Occlusal forces generated by patients with fully bone anchored prosthesis are said to approximate the forces recorded in patients with natural dentitions.
- ❖ The patient with fully bone-anchored prosthesis has masticatory functions similar to natural dentition.
- ❖ This kind of implant can be retrieved in case of failure and another fixture placed at a later time.

## Basic Guiding Factors of osseointegration :

### A: Implant related factors

1. Biocompatibility of implant material .
2. Design , Shape, length, diameter.
3. Surface characteristics and chemistry
4. Posthetic interface

### B. Other factors

1. Mechanical loading.
2. Surgical technique.
3. Patient variables: such as bone quality and quantity

## 1. Biocompatibility of Implant Material

Materials used for fabrication of dental implants can be categorized in two different ways. From a fundamental chemical point of view, dental implants fall into one of the following three primary groups: **(a) Metal (b) Ceramics (c) Polymers**.

In addition biomaterials can be classified based on the type of biologic response they elicit when implanted and the long-term interaction that develops with the host tissue.

Three major types of **biodynamic activity** are: **(a) Biotolerant (b) Bioinert (c) Bioactive**. The different levels of biocompatibility emphasize the fact that no material is completely accepted by the biologic environment. To optimize biologic performance, artificial structures should be selected to minimize the negative biologic response while ensuring adequate function.

Metals for implants have been selected based on a number of factors: **their biomechanical properties, previous experience with processing, treating, machining, finishing and suitability** for common sterilization procedures. Titanium (Ti) and its alloys (mainly Ti-6Al- 4V) have become the metals of choice for endosseous parts of currently available implants. Implants made of commercially pure titanium CpTi

## 2. Implant Design:

Implant design refers to the 3-dimensional structure of the implant, with all the elements and characteristics that compose it. Endosseous dental implants exist in a wide variety of designs with the main objective in every instance being the long-term success of **osseointegrated interface** and **uncomplicated function** of the prosthetic replacement. It has great influence on **initial stability** and **subsequent function**.

### The main design parameters are:

- ❖ **Implant Length**
- ❖ **Implant Diameter**
- ❖ **Implant Shape**
- ❖ **Surface Characteristics**
- ❖ **Prosthetic Interface:**

#### ❖ **Implant Length**

Implants are generally available in lengths from about **6 mm** to as much as **20 mm**. The most common lengths employed are between **8 and 15 mm**, which correspond quite closely to normal root length.

#### ❖ **Implant Diameter**

A minimum diameter of **3.25 mm** is required to ensure adequate implant strength. Implant diameter is more important than implant length in the distribution of load to the surrounding bone.

shorter and smaller diameter implants had lower survival rates than their longer or wider counterparts

The larger the taper, the greater the component of compressive load delivered to the interface

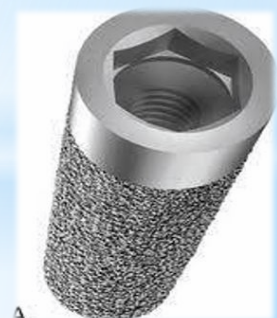
### ❖ Implant Shape

**Hollow cylinders**, **solid cylinders**, **hollow screws** or **solid screws** are commonly employed shapes, which are designed to maximize the potential area for osseointegration and provide good initial stability. Screw shaped implants also offer good load distribution characteristics in function. **A minimum diameter of 3.25 mm** is required to ensure **adequate implant strength**. Implant diameter is more important than implant length in the **distribution of load** to the **surrounding bone**.



### Dental implants are also categorized into:

- **Threaded screw implants:** are threaded into a bone site and have obvious **macroscopic retentive elements** for **initial bone fixation**. The fixture with threaded surface has :-
  - a) Larger surface area and the threads also help to balance the force distribution into the surrounding bone tissue.
  - b) The threads created in the bone site play an important role in **initial implant fixation**.
- **non-threaded, cylindrical or press fit:** The press fit implants depend on **microscopic retention** and or **bonding to the bone**, and usually are pushed or tapped into a prepared bone site. **Precision fit** of the fixture called **primary stability** is an essential element for osseointegration, the failure of which leads to soft tissue proliferation between the fixture and bone rather than direct bone interface





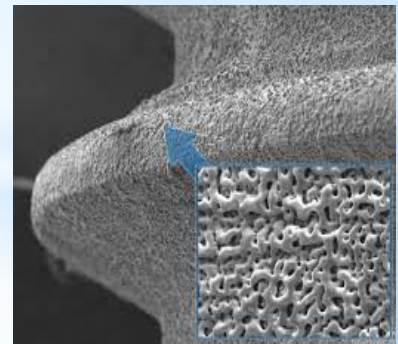
### ❖ Surface Characteristics:

The quality of the implant surface influences **wound healing** at the implantation site and subsequently effect **osseointegration**.

- **Smooth surface:** Wennerberg and Coworkers suggested that smooth be used to describe abutments,

- **Rough surface:**

- ✓ **minimally rough** (0.5 to 1  $\mu\text{m}$ ),
- ✓ **intermediately rough** (1 to 2  $\mu\text{m}$ )
- ✓ **and rough** (2 to 3  $\mu\text{m}$ ) be used for implant surfaces.



- ✓ **Plasma spraying :** Plasma spray coating is one of the most common methods for surface modification

- ✓ **blasting with particles:** In this approach, the implant surface is bombarded with particles of aluminium oxide ( $\text{Al}_2\text{O}_3$ ) or titanium oxide ( $\text{TiO}_2$ ) and by abrasion; a rough surface is produced with irregular pits and depressions. Roughness depends on particle size, time of blasting, pressure and distance from the source of particles to the implant surface.

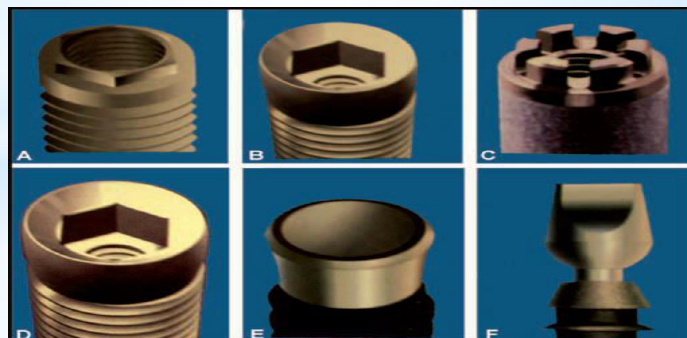
- ✓ **Chemical etching:** is another process by which surface roughness can be increased. The metallic implant is immersed into an acidic solution, which erodes its surface, creating pits of specific dimensions and shape.

**Concentration** of the acidic solution, **time** and **temperature** are factors determining the **result of chemical attack** and **microstructure of the surface**.

- ✓ **Porous:** Porous sintered surfaces are produced when spherical powders of metallic or ceramic material become a coherent mass with the metallic core of the implant body. **Lack of sharp edges is what distinguishes these from rough surfaces.** Porous surfaces are characterized: by **pore size**, **pore shape**, **pore volume** and **pore depth**, which is **affected by the size of spherical particles, temperature and pressure conditions of the sintering chamber.**

❖ **Prosthetic Interface:** It is the level at which the superstructure or the abutment connects to the implant body. It can be either

- (A) Standard external hex
- (B) Internal hex
- (C) External spline
- (D) Non-hexed conical connection
- (E) Non-hexed morse taper repeated as easily as tightening a screw with a torque wrench, and will not work if the abutment hits the bone crest before the taper interlocks.



**A) standard external hex :** The most common external connection is the hexagonal (“hex”) type. The 0.7 mm high, 2.7 mm wide, straight external hex on a 4.1 mm diameter platform is considered the industry’s standard. Due to its strength and stability limitations, however, variations in the hex and platform have evolved. The standard external hex allows 4.0° to 6.7° of rotational wobble with 3°-5° of tipping depending on the type of hex. Full seating of abutment over fixture can only be verified by taking additional radiographs. **Without intimate contact between the walls of the mating hexes, cyclic loading transmits forces directly to the fixation screw, which may cause it to repeatedly loosen.**



**B) An internal hex:** in the implant is designed to prevent rotation of the abutments. Compared to an external hex, an internal hex allows a better **protection against rotation of abutments** and **against gap formation at the implant abutment interface**.



**C) External spline:** by Calcitek acknowledges that its 0.4 mm spline connection allows 3° tipping thereby **transferring forces to the abutment screw under lateral loading**. However the **butt joint shoulder of the spline connection can also trap soft tissue during abutment seating**. Furthermore the **1.0 mm height of the spline connection can interfere with occlusal clearance** and **hinder establishment of anatomical contours on angled abutments**.

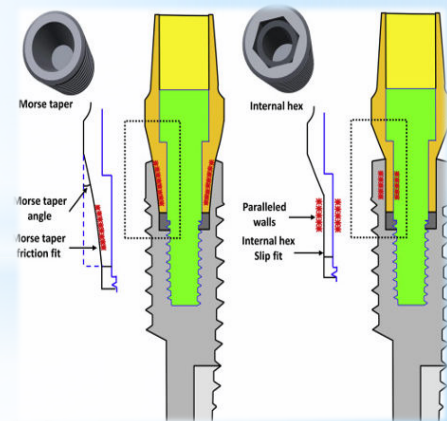


**D) Non-hexed conical connection:** is an ITI implant design which has a conical opening to an internally threaded shaft. Tightening an abutment with a matching conical surface **provides lateral stability**. It provides **no interdigitation to resist rotation**, which is of some significance in single tooth restorations. In order to assure contact with the mating conical surface, the abutment cannot be designed to seat on the top surface or 'shoulder' of the implant. This limitation prevents the use of abutments wider than the diameter of the conical opening and leaves the shoulder exposed to support the restoration. Without flush fitting abutments, there is no opportunity to prepare the margins to follow the natural contour of the tissue.



### E) Non-hexed morse taper connection.

1. A 1°-2° tapered abutment post frictionally fits into the non-threaded shaft of the implant, which has a matching taper.
2. The body of implant is designed with a series of fins for a press fit insertion procedure.
3. The connection also dictates how abutments are attached and stabilized and the type of emergence profile they can provide. However there are several potential esthetic and hygienic limitations with this connection.



### 3. Bone Factor :

The stability of the implant at the time of placement is very important and is dependent upon bone quantity, quality as well as implants design. Bone, which is predominantly cortical, may offer good initial stability at implant placement but is more easily damaged by overheating during the drilling process, especially with sites more than 10 mm in depth.

Success is highly dependent upon a surgical technique, which avoids heating the bone. Bone should **not be heated beyond 43°C**, since alkaline phosphate begins to breakdown. Gentle surgical technique with the speed of drilling equipment not to exceed **2000 rpm** and **copious amount of sterile irrigation** with internally irrigated drills should be used.

**Factors that compromise bone quality are infection, irradiation and heavy smoking.** Their effects results in **diminution of the vascular supply** to the bone which **compromises healing response**, a feature that has been well described in the healing of fractures.

#### 4.Loading Conditions :

Following installation of an implant it is important that it is not loaded during the early healing phase. Movement of the implant within the bone at this stage results in **fibrous tissue encapsulation rather than osseointegration**.

This has been compared to the healing of a fracture where stabilization prevents non-union.

The Branemark system emphasizes on maintaining the fixtures unloaded for six months in the maxilla and three to four months in the mandible, mainly because of differences in bone quality.

**No loading while healing is the basic guide to osseointegration.**

The surgical procedures are divided into two stages.

**1) The first stage:** is the installation of the fixtures into bone, allowing a **3 to 6 month healing period**. The mucosa supported interim denture should not be worn for **1 to 2 weeks**, which also helps to prevent breakdown of the soft tissue wound. Bone healing begins within first week after insertion of the fixture and reaches a peak at the **third or fourth weeks**. The initial healing tissues gradually become bony tissue after **six to eight weeks**. If fixtures are displaced or loaded during this interim healing period, fibrous tissue formation will occur.

**2) The second stage:** is the connection of abutments to fixture. the two stage surgical procedures are very important for successful osseointegration. Following the recommended healing period (**3-6 months**) abutments are connected to the implant to allow construction of prosthesis.



## Occlusion in implant-supported prostheses :

There are a few innate differences between natural teeth and implants, which need to be considered when restoring implants. Natural teeth are associated with **high occlusal awareness (proprioception)** of about **20  $\mu$ m** besides the proprioception, the presence of **periodontal ligament** as a **shock absorber** in a natural tooth brings about an apical intrusion.

Occlusal no proprioception in implants. The lack of proprioception and the absence of periodontal shock absorption are often associated with increased impact force with an implant-supported prosthesis than with a tooth-supported prosthesis

**In case of occlusal trauma**, mobility can develop in a tooth as well as in an implant. However, upon removal of the trauma, mobility can be reduced or controlled with a natural tooth, while no such response can be noted in an implant.

In general the **diameter of natural teeth** is larger than the diameter of implants.

Also, the **cross-section** of implants is rounded and the diameter is selected primarily according to bone available, not according to the load that it is anticipated to be subjected to.

The issue of such differences between natural teeth and implants lead to the establishment of **implant-protected occlusion** (IPO It is also called medially positioned lingualized occlusion, and it stems from the change in relation of the edentulous maxillary ridge to the mandibular ridge due to resorption of edentulous ridges in a medial direction. As a result, a few unique concepts are associated with implant-supported prosthesis and these constitute the guidelines for IPO

## Occlusal form and scheme:

-Where a **single implant is to be restored**, or a **small implant bridge** provided, the occlusal scheme should be confirmative. **Group function** is to be preferred to **canine guidance**,

-Where a **full arch construction** is utilized then '**balanced articulation**' should be provided in order to minimize local loading and maximize stability of the prosthesis.

There is some evidence that a degree of horizontal freedom of movement is helpful, shallow cusp angles may be associated with reduced horizontal loading of an implant during mastication.

### **Key implant position :**

The key implant positions are determined with no limitations. In other words, the radiograph is used for diagnosis to determine the prosthesis and pathology but not the available bone and implant position. Rather, the dentist “pretends” the patient has all the available bone necessary to place the implant in the key sites, the patient has no financial limitations to do the ideal treatment, time is not an issue related to treatment, and the skill necessary to place (or augment and place) an implant in the key sites is present by the dentist or the referring team.

## MAXILLOFACIAL PROSTHESIS



**Maxillofacial Prosthetics:-** The branch of prosthodontics concerned with the restoration and/or replacement of the stomatognathic and craniofacial structures with prostheses that may or may not be removed on a regular or elective basis.

**Maxillofacial Prosthesis:-** is an artificial device or any prosthesis used to replace part or all of any stomatognathic and/or craniofacial structure.

**Maxillofacial defects:** may be caused by congenital malformation, trauma or surgical resection of tumor.

## Indications of maxillofacial prosthesis:

1. When plastic surgery is contraindicated.
2. When recurrence of malignancy is expected.
3. When radiotherapy is being instituted, radium appliance and radium protector shield can be used.
4. Temporary maxillofacial prosthesis can be used when plastic surgery requires various steps.

## Objectives of maxillofacial prosthesis

1. Improve or restore the esthetics or cosmetic appearance of the patient which is of prime importance for everybody.
2. Improve or restore the functions that include:
  - A. Speech functions in patient with palatal lost part of the jaw.
  - B. Nutritional function in patient with lost part of the jaw.
  - C. Avoid escape of food to nasal cavity in children with cleft and overcome feeding problem.
3. Protect the tissues:
  - A. To protect the adjacent tissue as in radium protective, also to protect wound, stop bleeding and carry medication after surgery.
  - B. Protect the teeth as in mouth guard contact sport.
4. Therapeutic or healing effects by placement of radium applicator.
5. Physiologic therapy: to raise the moral of the patient + Help in healing fracture segments in cases of fracture face.

## Maxillofacial team member

1. Plastic surgeon
2. Radiotherapist.
3. Dental specialists.
4. Prosthodontic.
5. Oral surgeon.
6. Orthodontist.
7. Dental technician.
8. ENT specialist.
9. The psychiatrist.
10. Social workers.
11. Neurologist
12. Physiatrist.

## Maxillofacial Classification

Patients can be categorized (**classify**) by maxillofacial defects that are:

❖ Acquired defects: Include those that are the result of trauma, or of disease and its treatment. These may include a soft and/or hard palate defect resulting from removal of a squamous cell carcinoma.

❖ Congenital defects: are typically craniofacial defects that are present from birth. The most common of these include cleft defects of the palate that may include the premaxillary alveolus.

❖ Developmental defects: are those defects that occur because of some genetic predisposition that is expressed during growth and development.





**Another helpful way to classify maxillofacial patients is by the location of prosthesis**

- A.** Extraoral (cranial or facial replacement).
- B.** Intraoral (involving the oral cavity).
- C.** Intraoral and Extraoral: Lost part of maxilla or mandible with facial extension



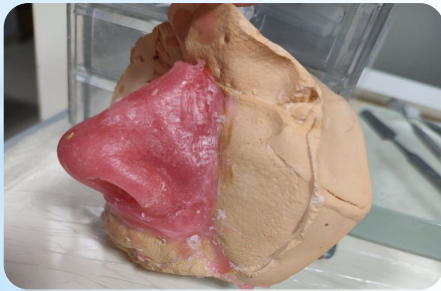
### **A. Extra Oral Appliances**

- 1. Nasal prosthesis**
- 2. Auricular prosthesis**
- 3. Orbital Prosthesis**
- 4. Radiation Carrier**
- 5. Cranial prosthesis.**
- 6. Carrier Stent**

### **1. Nasal prosthesis:**

A removable prosthesis attached to the skin which artificially restores part or all of the nose. Fabrication of a nasal prosthesis requires creation of original mold.

Additional prostheses usually can be made from the same mold, and assuming no further tissue changes occur, the same mold can be utilized for extended periods of time.



### **2- Auricular prosthesis:**

An artificial ear produced from a previously made mold. Unfortunately, the presence of hair and the absence of anatomic irregularities often result in unfavorable adhesive retention of auricular prosthesis. Endosseous implants may permit positive retention of auricular prosthesis.



### 3- Orbital Prosthesis:

- Loss of eye is emotional and physical problem to the patient.
- An orbital prosthesis is created to restore a more normal anatomical structure and cosmetic defect created by these conditions in a person. This type of restoration need retention means by implant especially when the defect is large



### 4- Cranial prosthesis:

A biocompatible, permanently implanted replacement of a portion of the skull bones.

### 5- Radiation Carrier:

A device used to **administer radiation to confined areas** by means of capsules, beads, or needles of radiation emitting materials such as radium or cesium. **Its function is to hold the radiation source securely in the same location during the entire period of treatment.**

Radiation oncologists occasionally request these devices to achieve a close approximation and controlled application of radiation to a tumor deemed amiable to eradication.

Synonymous: Radiation Applicator, Radium Carrier, Radiotherapy Prosthesis.



#### **6- Carrier Stent:**

It is used to carry skin or mucous membrane graft in vestibule, palate or mouth floor in approximation to periosteum during initial healing and prevent formation of hematoma between the graft and the underlying bone and periosteum.



## B. Intra Oral Appliances

1. Obturator.
2. Feeding prosthesis
3. Mandibular prosthesis.
4. Speech prosthesis.
5. Palatal lift prosthesis.

### 1. OBTURATOR

A maxillofacial prosthesis used to **close, cover or maintain the integrity of the oral and nasal compartments** resulting from a congenital, acquired or developmental disease process, i.e., cancer, cleft palate, osteoradionecrosis of the palate. The prosthesis facilitates speech and deglutition by replacing those tissues lost due to the disease process and can, as a result, reduce nasal regurgitation and hypernasal speech, improve articulation, deglutition and mastication.

**An obturator prosthesis is classified as:**

- A. surgical.
- B. interim.
- C. definitive.

and reflects the intervention time period used in the maxillofacial rehabilitation of the patient.



## FUNCTIONS OF OBTURATOR

The obturator fulfills the following functions:

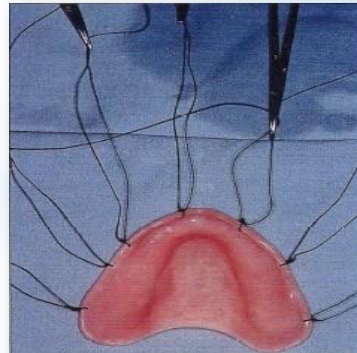
1. Feeding purpose.
2. Maintains the wound/defective area clean and hold dressings or packs post surgically in maxillary resections.
3. Enhances the healing of traumatic or post-surgical defects.
4. Helps to reshape/reconstruct the palatal contour and/ or soft palate.
5. Improves speech.



### A. Surgical obturator

A temporary maxillofacial prosthesis inserted during or immediately following surgical or traumatic loss of a portion or all of one or both maxillary bones and contiguous alveolar structures (i.e. gingival tissue, teeth).

- The Surgical obturator is secured either by palatal screw, suture or circumzygomatic wires.
- Old denture can be used as a surgical obturator but it might create some problems because the denture mostly not fit as before surgery therefore relining may help to improve patient's acceptance and tolerance.
- it is mostly used **for 10 days** more or less depends on treatment plane.



### Advantages of surgical obturator

1. Provides a matrix on which the surgical packing can be placed.
2. Reduces oral contamination of the wound and the incidence of local infection.
3. Enables the patient to speak more effectively by reproducing normal palatal contour and by covering the defect.
4. Permits deglutition, thus the nasogastric tube may be removed at an earlier date.
5. Lessens the psychological impact of surgery by making the post-operative course easier to tolerate.
6. Reduces the period of hospitalization.

## B. Interim Obturator

The temporary obturator is constructed from post-surgical impression cast which has a false palate and false ridge and generally no teeth. Every step of prosthesis construction must maximize prosthesis adaptation to enhance retention and stability to ensure optimum function, esthetic, occlusion, and correct jaw relations.

- ❖ The closed bulb extending into the defect area is hollow.
- ❖ The patient is usually seen **every 2weeks** because of the rapid soft tissue changes that occur within the defect during organization and healing of the wound.
- ❖ Correction of tissue – prosthesis relation can be made by relining.
- ❖ The temporary obturator will need to function comfortably for **as long as 6 months**.
- ❖ The timing depending on the size of the defect, the progress of the healing, presence or absence of teeth.





## Reasons for doing constructing new definitive obturator:

1. The periodic addition of interim lining material increases the bulk and weight of the obturator and this temporary material may become rough and unhygienic.
2. If the anterior teeth are included in the resection, the addition of anterior denture teeth to the obturator can be of great psychological benefit to the patient.
3. If retention and stability are inadequate, occlusal contact on the defect side may result in improvement of these aspects.

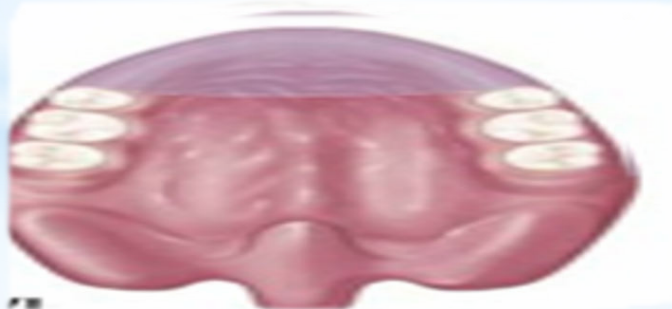
## C. Definitive obturator

A maxillofacial prosthesis that replace part or all of the maxilla and associated teeth lost due to surgery or trauma. **It is made when it is deemed that further tissue changes or recurrence of tumor are unlikely** and more permanent prosthetic rehabilitation can be achieved, it is intended **for long term use**.



## **Aramany's classification for partially edentulous maxillectomy dental arches:**

- Class I—midline resection.**
- Class II— unilateral resection.**
- Class III—central resection.**
- Class IV—bilateral anteroposterior resection.**
- Class V—posterior resection.**
- Class VI— anterior resection.**



## **2. Feeding Prosthesis, feeding aids**

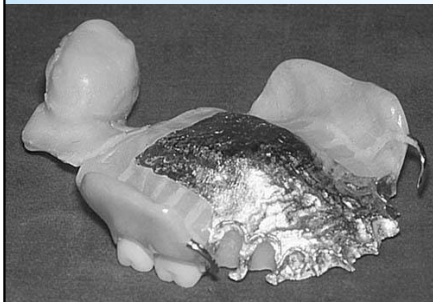
- ❖ Maintain right and left maxillary segments of an infant cleft palate patient in their proper orientation until surgery is performed to repair the cleft.
- ❖ It closes the oral nasal cavity defect, thus enhancing sucking and swallowing,





### 3. Speech Aid Prostheses

The defining characteristics of speech aid prostheses are that they are functionally shaped to the palatopharyngeal musculature to restore or compensate for areas of the soft palate that are deficient because of surgery or congenital anomaly. Such a prosthesis consists of a palatal component, which contacts the teeth to provide stability and anchorage for retention; a palatal extension, which crosses the residual soft palate; and a pharyngeal component, which fills the palatopharyngeal port during muscular function, serving to restore the speech valve of the palatopharyngeal region.



### 4. Palatal lift prosthesis

The defining characteristic of a palatal lift is that it positions a flaccid soft palate posteriorly and superiorly to narrow the palatopharyngeal opening for the purpose of improving oral air pressure and therefore speech. Patients who exhibit a structurally normal soft palate and pharyngeal port can demonstrate hypernasal speech caused by paralysis of the regional musculature. This condition is referred to as palatopharyngeal incompetence because the failure lies in function, not in anatomic deficiency.

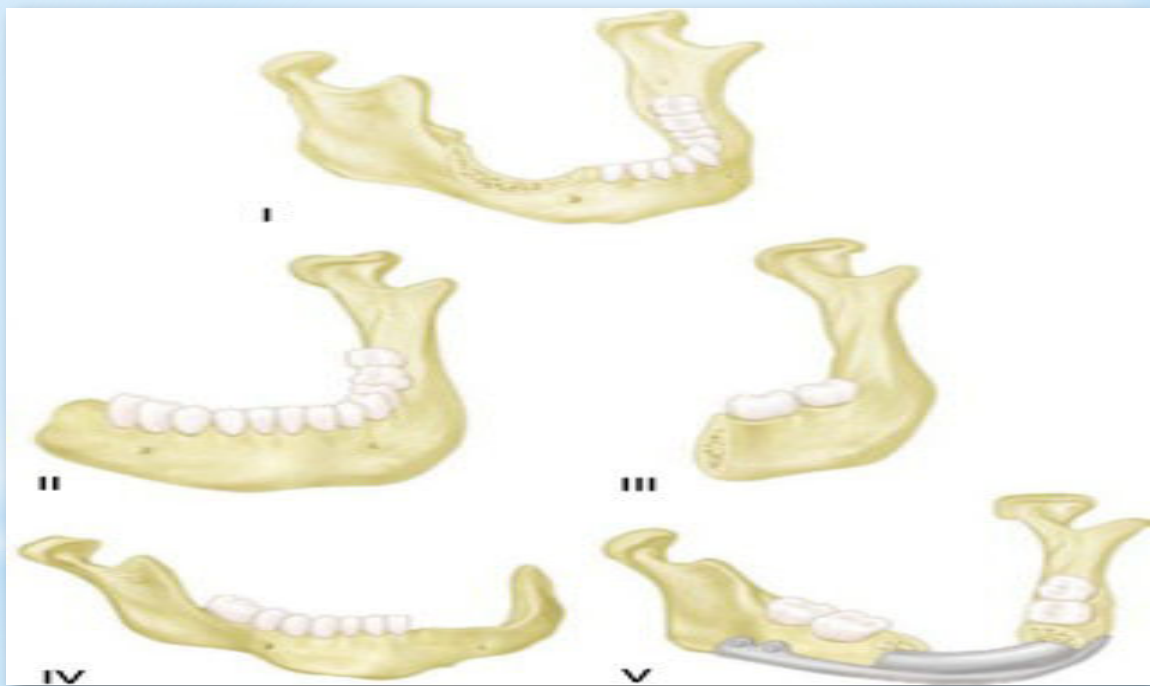


## **Mandibular resection prosthesis:**

Resection prostheses are those prostheses provided to patients who have acquired mandibular defects that result in loss of teeth and significant portions of the mandible. Mandibular resection results in defects that may preserve mandibular continuity or may result in discontinuity defects. These are further subclassified by Cantor and Curtis and provide a meaningful foundation for a discussion of removable prosthesis design considerations.

## **Cantor and Curtis classification of mandibular resection:**

- 1. Type I Resection:** In a type I resection of the mandible, the inferior border is intact and normal movements can be expected to occur.
- 2. Type II Resection:** In the type II resection, the mandible is often resected in the region of the second premolar and first molar.
- 3. Type III Resection:** A type III resection produces a defect to the midline or farther toward the intact side, leaving half or less of the mandible remaining.
- 4. Type IV Resection:** A type IV resection would use the same design concepts as type II or III resections with the corresponding edentulous areas.
- 5. Type V Resection:** In the type V resected mandible, when the anterior or posterior denture-bearing area of the mandible has been surgically reconstructed, the removable partial denture design is similar to the type I resection design.



## Retentive Aids in Maxillofacial Prosthodontics

The **Dentist** in general and **Prosthodontist** in particular has a major role in maxillofacial prosthetics because of his knowledge of anatomy, physiology and pathology as well as his skill and experience in using materials that are compatible with the patients remaining tissues. However, the Prosthodontist is limited by inadequate materials available for facial restorations, movable tissue beds, difficulty in retaining large prosthesis, and the patient's capability to accept the final result.

### Retention Methods:

1. Anatomic Retention

2. Adhesives

3. Mechanical Retention

- Intra oral
- Extra oral

- Eyeglass
- Magnets
- Cast clasps
- Acrylic buttons and retentive clips
- Implants



## 1. Anatomic Retention

• **Intraoral retention:** includes the use of both hard and soft tissues-teeth and mucosal and bony tissues. Anatomic undercut areas are a welcome feature in the postsurgical case. They may be found in the palatal area, cheek, retromolar, labial, septal, posterior nasal pharyngeal or anterior nasal spine areas. Additional aids to anatomic retention include proper occlusion, proper post dam, and surface adhesion.



## 1. Anatomic Retention

• **Extraoral retention:** necessitates the use of both hard and soft tissues of the head and neck area. Examples would be any bony wall of a defect with which part of the prosthetic device will come in contact or a cartilaginous remnant of the ear. Soft tissues prove to be more troublesome because of their flexibility, mobility, lack of bony nasal support, lower resistance to displacement when a force is applied, deficiencies as a base for firmly securing the surgical adhesive during cementation.



## 2. Adhesives

The selection of a suitable adhesive involves consideration of the prosthetic materials used in the construction of the prosthesis. Several factors should be considered when selecting an adhesive system for a facial prosthesis:

1. The strength of the adhesive bond to skin and to the facial prosthetic material.
2. Biocompatibility of the adhesive.
3. Design and material of prosthesis.
4. Composition of the adhesive.
5. Type & Quality of patient's skin.
6. Convenience of handling and removing the adhesive.

Various types of skin tissue adhesives for facial prostheses are acrylic resin, latex, silicone, pressure sensitive tapes, spirit gum, water based adhesives.

### Advantage

1. Ease of application and manipulation
2. Readily available
3. No need to undergo any surgical procedures
4. Less expensive as compared to implants

### Disadvantage

1. It may tear at the margins
2. Routine removal may damage external pigmentation
3. Patients with poor dexterity or coordination may have difficulty in applying
4. Some patients may develop allergic or irritative responses to adhesives



### 3. Mechanical Retention

Current mechanical means for retention of facial prostheses include: -

- **Eyeglass:** A possible means of retaining a nasal prosthesis by utilizing newly designed eyeglass frames for the patients who has had the bridge of the nose surgically removed. The eyeglass frame should be opaque in color rather than translucent to prevent retention marks from becoming visible.



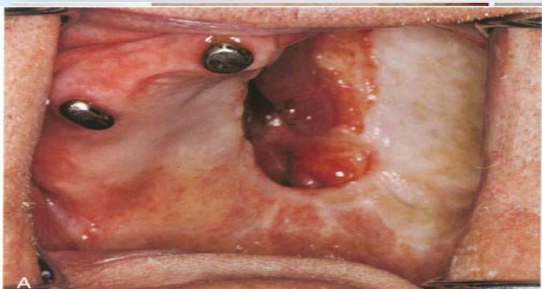
#### • Magnets:

Magnets used widely in the retention of maxillofacial prosthesis and in different ways. The traditional over denture by implanting pole in the jaw or soft tissue and the other pole fixed inside the prosthesis.

Magnets used in the joining of large prosthesis like in the treatment of patient with total maxillectomy and limited mouth opening, the prosthesis composed of two parts and the magnets connect these parts after insertion these parts separately. The magnets also used to connect the prosthesis with intra and extra oral parts.

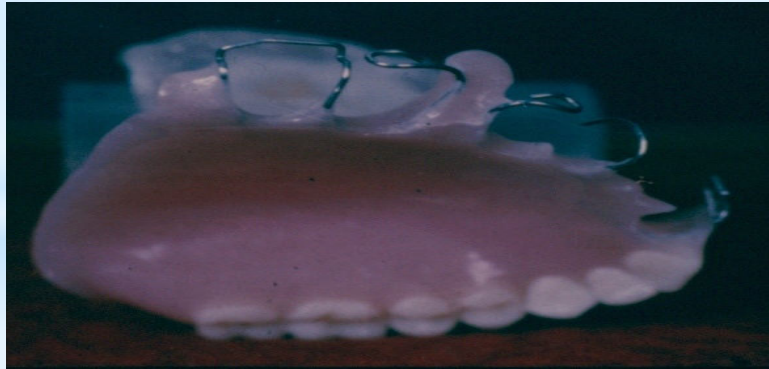
Magnets used for retention of extra oral prosthesis like auricle.

The repulsion effect of magnets used in retention of the upper and lower dentures by fixing magnets at the posterior area of the dentures made from the same pole.



- **Cast clasps:**

The most common method for retaining an intraoral prosthesis uses a cast metal clasp which enters an undercut. The properly designed and fabricated clasp will provide stability, splinting, bilateral bracing, and reciprocation, as well as retention.



- **Acrylic buttons and retentive clips:**

Acrylic buttons – retained facial prostheses usually have an acrylic substructure that fits into the defect and one or more mushroom – shaped acrylic projections (buttons) attached to the substructure. The final prosthesis is fabricated so that it will snap over the mushroom buttons for retention. Retentive clips are metallic or plastic clips that snap over the bar used as a superstructure connected to the implants. Retentive clips have more retentive ability in terms of breakaway retentive force than magnets.



## • Implants:

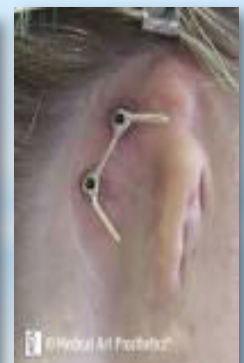
The successful clinical development of intraoral and extraoral implants to retain dentures and other prosthetic replacements.

The retention of prosthesis to implants by using **ball and socket** or by **using the magnets**.

❖ Intraoral prosthesis retained by using **osseointegrated implants** as ordinary **over denture supported by implants**.

❖ Extraoral prosthesis retained by using **osseointegrated implants** which implanted in the **facial bones** to support the facial prostheses.

For example, an auricular prosthesis fabrication in which osseointegrated implants were placed in the temporal bone and used a screw retained magnetic alloy casting to retain an acrylic resin magnet keeper, to which silicone ear prosthesis was attached.





## Steps of maxillofacial prostheses construction

### 1. Primary impression stage

A gauze may be placed in the defect-undercut- area and the preliminary impression was made in stock tray using irreversible hydrocolloid as tissue were still in the healing phase. Be careful in certain cases alginate may be tear in the defect area during removal.

Silicone impression material can be used. In some cases 2 compatible impression materials can be used in modified technique. The impression must extend as possible in the defected areas.

The primary cast obtained was used to fabricate a custom tray for the definitive impression. Any undercuts may interfere with tray construction must be blocked. Relief areas must be determined also.

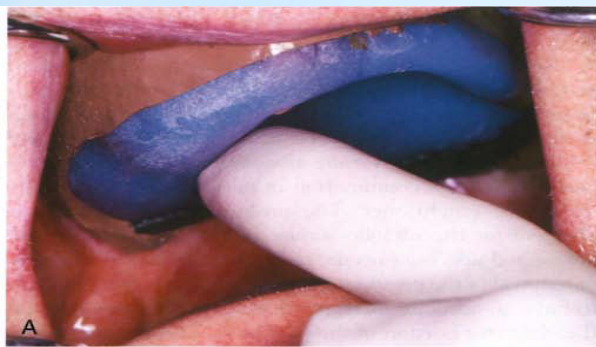


## **2. Final impression stage**

The definitive impression is made a properly extended and well-adjusted special tray was made; sectional trays or double trays technique can be used. Proper border molding and proper extension of the flanges must be established.

### **Digital Impressions**

Laser surface scanning was applied to acquire three-dimensional imaging data of the patient's facial defect. Transferred to a CAD/CAM interactive program (in computer system for image processing produced a model for fabrication of the facial prosthesis.





### **3. Jaw Relation stage**

- ❖ Minimal block out should be made because excessive block out result in unstable record base....
- ❖ Improve esthetic by an attempt to compensate for the loss of facial support on the defect side.
- ❖ Occlusal plane and wax level is difficult in most cases due to the tissue scar and block out procedure.
- ❖ Transfer the jaw relation to the
  - ✓ Semi adjustable articulator.
  - ✓ Monoplane occlusion used for those patients.



### **4. Try in stage**

In this stage should verify:

- ❖ Centric jaw relation
- ❖ Vertical dimension.
- ❖ Esthetic.

### **5. Delivery stage**

- ❖ Use of pressure indicating paste to check for pressure areas.
- ❖ Remounting of prosthesis for occlusal adjustment.
- ❖ Give instruction to the patient to maintain good oral hygiene.



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# Management of Children with Systemic Diseases

### **Management of Children with Systemic Diseases**

Systemic disease in children cover a wide range of conditions, which include diseases involving **one or more organs or systems of the body**, thereby affecting the general health of the child.

A number of systemic conditions **affect the oral tissues** and require modifications during routine dental treatment.

The systemic disease may have a profound effect on the health of the oral tissue and vice versa.

For examples:

- **Oral manifestation** of systemic disease( glossitis seen in anemia)
- **Systemic condition** might increase the risk of oral disease (dental erosion seen in a child with anorexia nervosa).
- **Medication** used for the treatment of the systemic disease might increase the risk of oral disease (gingival hyperplasia on administration of Dilantin).
- **Oral disease may pose a greater risk** for the child to develop systemic disease (bacteremia from odontogenic infection in bacterial endocarditis).

# ENDOCRINOPATHIES

## Hyperthyroidism

Patients with Hyperthyroidism are of a great concern to the dental surgeon. In children with **untreated or poorly** treated thyrotoxicosis, dental treatment, infections or trauma can precipitate an acute emergency called **thyroid crisis** or thyroid storm.

### Causes of thyrotoxicosis

Ectopic thyroid tissues

Graves' disease (Appears to be due to an autoimmune disorder in which a substance is produced that abnormally stimulates the thyroid gland)

Multinodular goiter

Thyroid adenoma Pituitary gland disease

Note: Thyroid hormones are important for **metabolic functions** that are involved with utilization.

Thyrotoxicosis means increased amount of thyroid hormones, thyroxine and triiodothyronine in blood.



### *Management in the dental clinic*

- Consultation with child's physician.
- Avoid elective dental treatment until thyrotoxicosis is under control.
- Acute infections must be dealt with antibiotic therapy to prevent thyroid crisis.
- Avoid use of adrenaline and other vasoconstrictors.
- Thyroid storm may be precipitated due to trauma, surgery, stress, or infections. Early recognition and management is important. It includes ice applied on skin, intravenous administration of hydrocortisone, glucose, etc. and cardiopulmonary resuscitation, if required.
- Patients under good medical control can be managed as normal.

# Hypothyroidism

It does not manifested as sever, life-threatening condition and in children it is called **cretinism**.

## Oral manifestations

Delayed eruption of teeth Malocclusion  
Enlarged tongue

## Oral manifestations in children

Premature loss of primary teeth and early eruption of permanent teeth.  
Early development of the jaw bones.  
Increased periodontal disease.

## Hyperparathyroidism

A lower level of calcium level stimulates release of parathyroid hormone which:

Increase bone resorption.

Retains calcium by reabsorption in the kidneys. Favorsn absorption of calcium in the intestine.

The net effect is increased serum calcium level which inhibits further parathyroid hormone secretion.

### *Oral manifestations*

- Drifting and loosening of teeth
- Malocclusion
- Pathological fracture of jaw bones
- Radioluscencies representing bone cysts (osteitis fibrosa cystica), loss of lamina dura
- A generalized ground glass or moth eaten appearance of bone may be seen

# Management in the dental clinic

- ❑ Consultation with child's physician.

- ❑ Determine serum calcium, phosphate and alkaline phosphatase level.

- ❑ Avoid routine dental treatment in patients with severe renal failure. Emergency dental treatment must be provided with proper medical advice.

- ❑ Dental treatment of malocclusion, missing teeth... etc. should be done after the treatment of the cause of hyperparathyroidism.

## Hypoparathyroidism

Commonly seen following surgical procedures involving thyroid gland and inadvertent excision of parathyroid gland (damage to the gland during surgery). Severe cases of hypoparathyroidism may lead to tetany.

### Oral manifestations

Hypoplasia of  
teeth Blunting of  
molar roots

A sharp tap over the facial nerve in front of the ear causes twitching of facial muscles around the mouth (Chvostek sign).

### Management in the dental clinic

- Consultation with child's physician.
- Avoid elective treatment in case of severe hypocalcemia with serious cardiac problems.



# Diabetes Mellitus

It is a disease complex of disordered metabolism characterized by hyperglycemia, altered protein and lipid metabolism as a result of absolute or relative deficiency of insulin.

Clinically it can be classified as:

1. Insulin dependent mellitus
2. Non-Insulin dependent mellitus

### **Symptoms of Diabetes Mellitus:**

#### **Excessive thirst**

- patients may drink huge volumes of fluid
- cause more urine will be produced and making the person thirstier as a result.

#### **Fatigue and tiredness**

- Because of imbalance of sugar level in blood.

#### **Others general symptoms**

- urinating a lot
- losing weight
- having blurred vision

# Management in the dental clinic

To minimize the risk of an operative emergency, clinicians need to consider some issues before initiating dental treatment:

**1. Medical history:** Take history and assess glycemic control at initial appointment, that's

by:

- ✓ Glucose levels
- ✓ Frequency of hypoglycemic episodes
- ✓ Medication, dosage and times.
- ✓ Consultation

## **Other symptoms include:**

Recurrent bed wetting, Repeated skin infections,  
Marked irritability, Headache, Drowsiness,  
Malaise, Dry mouth

## **Oral manifestation:**

1)Gingivitis, increased severity of periodontitis,  
bone loss.

2)Xerostomia

3)Delayed wound healing

4)Pulpitis in non-carious tooth

5)Burning sensation in tongue

6)Acetone smell in breath

7)Oral ulcers

8)Oral candidiasis

9)Increase the susceptibility to dental caries

Miscellaneous conditions such as: Neuropathies:  
may affect cranial nerves (facial).

Drug side-effects: lichenoid reaction may be  
associated with sulphonylureas (chlopropamide)

Ulcers

2. Scheduling of visits:  
Morning appointment  
Do not coincide with peak activity.
3. **Diet:**  
Ensure that the patient has eaten normally and taken medications as usual
4. **Blood glucose monitoring:** Measured before beginning. (<70 mg/dL)
5. **Prophylactic antibiotics:** To get rid of the establishment of infection.
6. **During treatment:** The most common complication of DM occur is: Hypoglycemic episode.  
Hyperglycemia
7. **After treatment:** Dietary intake  
Medications: salicylates increase insulin secretion and sensitivity → avoid aspirin

### MANAGEMENT OF SYNCOPE:

Treat the underlying cause

Immediate symptomatic therapy includes:

Recognition of unconsciousness

“Shake & shout”

Check for protective reflexes

### Management

Position victim-supination

Assess & open airway-head tilt, chin lift

Airway patency, breathing, circulation-look, listen & feel

Artificial ventilation & cardiac massage-cardiopulmonary resuscitation



# ***Pedodontics***

## **Cystic fibrosis**

It is an autosomal-recessive disorder occurring in 1 of every 2000 births. It is the most common lethal genetic disorder affecting whites. The genetically altered protein affects exocrine gland function. The defective exocrine gland function leads to microobstruction of the pancreas, which results in cystic degeneration of the pancreas and, ultimately, a digestive enzyme deficiency producing malabsorption of nutrients.

The defective gene products cause abnormal water and electrolyte transport across epithelial cells, which results in a chronic disease of the respiratory and gastrointestinal system, elevated levels of electrolytes in sweat, and impaired reproductive function. In the lungs, retention of mucus occurs, which causes obstructive lung disease and increased frequency of infections.

Children with cystic fibrosis have a high incidence of tooth discoloration when systemic tetracyclines are taken during tooth formation. With the advent of alternative antibiotics, the incidence of tooth discoloration is decreasing.

The incidence of dental caries in children with cystic fibrosis is low secondary to long-term antibiotic therapy, buffering capacity of excess calcium in the saliva, and pancreatic enzyme replacement therapy.

There is a high incidence of mouth breathing and open-bite malocclusion associated with chronic nasal and sinus obstruction.

Patients with cystic fibrosis may prefer to be treated in a more upright position to allow them to clear secretions more easily.

The use of sedative agents that interfere with pulmonary function should be avoided, and the patient's physician should be contacted before nitrous oxide–oxygen sedation is used in a patient exhibiting evidence of severe emphysema.

### *Dental management of cystic fibrosis*

- Those children suffer from delayed dental development, more commonly have enamel opacities and are more prone to calculus
- They need to have higher caloric intake and may have frequent refined carbohydrate snacks –
- May also have cirrhosis of liver -> clotting defects -> haemorrhaging following surgical procedures
- May be prescribed tetracycline to prevent chest infections -> intrinsic dental staining
- General anaesthesia should be avoided

## **Renal disease**

In renal disorders there is increased susceptibility to:

Infection and immunosuppression, bleeding tendency, decreased ability to excrete drugs, existence of A-V shunt, cross infection.

### *Dental management of renal disorders:*

- Prevent dental diseases- OHI and education
- Strict cross-infection control
- Consult patient's physician before performing dental treatment
- Monitor BP pre-op and post-op
- Treat all infections aggressively and consider prophylaxis
- Use additional hemostatic measures
- Be careful with prescribing drugs
- Never subject those patients to out-patient general anaesthesia
- Remember veins are precious
- Poor bone density -> frequent denture adjustments
- Try to perform dental treatment just after dialysis if possible

### *Oral Manifestations of Renal Disease and Dialysis:*

Enlarged (asymptomatic) salivary glands i.e. Parotitis

Decreased salivary flow, Xerostomia

Dry mouth

Odor of urea on breathe, ammonia like taste and smell

Metallic taste

Increased calculus formation

Low caries rate

Enamel hypoplasia

Extrinsic (secondary to liquid ferrous sulfate therapy), dark brown stains on crowns

Intrinsic (secondary to tetracycline staining)

Note: Chronic renal failure is the irreversible deterioration in renal function which results from a diminished mass of the excretory, metabolic and endocrine functions of the kidney which leads to the development of the clinical syndrome of uremia, so:

### **UNDER CONSERVATIVE CARE**

- Consultation with patient's physician
- Check lab values, blood urea nitrogen
- Avoid dental treatment if the disease is unstable.

- Monitor blood pressure closely
- Pay meticulous attention to good surgical technique
- Avoid nephrotoxic drugs
- Adjust doses of drugs metabolized by the kidney
- If medical parameters permit:
  - Try to eliminate all foci of infection
  - Keep only the easily maintainable teeth
  - Insist on keeping a good oral hygiene
- If patient is in advance stages, dental care may best be provided after physician's consultation and in a hospital like setting
- Because of the potential bleeding problems:
  1. Pretreatment screening for bleeding time and platelet count PTT, PT, platelet count.
  2. A hematocrit level and hemoglobin count should be obtained to assess the status of anemia.
    - If an orofacial infection exists, aggressive management is necessary using culture and sensitive tests and appropriate antibiotics. Consider corticosteroid supplementation as indicated.

#### NEPHROTOXIC DRUGS:

Tetracyclines, Streptomycin, Vancomycin, Gentamycin, Acyclovir, Acetaminophen  
Phenacetine, NSAIDs, Aspirin, Antihistamines, Phenobarbitones

So you should give:

Cloxacillin, erythromycin, minocycline, codeine, diazepam, lidocaine.

#### **PATIENT RECEIVING DIALYSIS**

Those patients at high incidence of serum hepatitis, high incidence of anemia, significant incidence of secondary hyperparathyroidism, uremic stomatitis may exist, may undergo heparinization during hemodialysis, and may have arteriovenous shunt or fistula. So keep in mind:

- The work will be the same as conservative care conditions
- Beware of concerns of arteriovenous shunt
- Consult with the physician about risk for infective endocarditis
- Avoid blood pressure cuff and IV medications in arm with shunt
- Avoid dental care on day of treatment; best to treat on day after
- Consider antimicrobial prophylaxis
- Consider corticosteroid supplementation as indicated
- Assess status of liver function and presence of opportunistic infection in those patients because of increased risk for carrier state of hepatitis B and C viruses and human immunodeficiency virus.

*Dental management*

- 1 Screen for HBsAg and HBsAb
- 2 Antibiotic prophylaxis to prevent endarteritis of arteriovenous fistula
- 3-Prevent hypoxia
- 4 Provide treatment on the day after hemodialysis
- 5 Be careful to protect the fistula or shunt when patient on dental chair
- 6-Refer the patient to physician if uremic stomatitis is noted to develop

**Renal transplant patient**

Infection in such patients is life –threatening. Before transplantation only maintained teeth should be determined by dental team approach, however, teeth with furcation involvement, periodontal abscesses, or extensive surgical requirements should be extracted.

*Dental management*

- 1- Emergency treatment only for 1st 6 months
- 2- HBs Ag screening
- 3-Prophylactic antibiotics according to AHA recommendations
- 4- Erythromycin is contraindicated in patients on cyclosporins
- 5- Immunosuppressed patients requires supplemental corticosteroids.

# OCCUSION

1

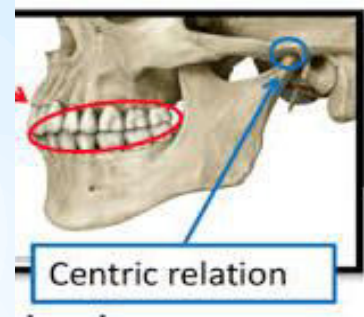
**Occlusion:** The static relationship between the incising and masticating surfaces of the maxillary or mandibular teeth or tooth analogues.



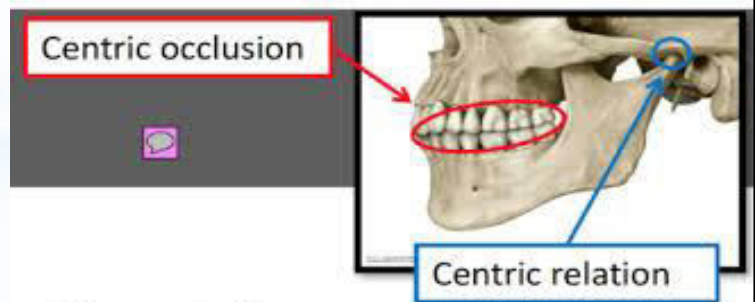
**Articulation:** It is defined as the contact relationship of maxillary and mandibular teeth as they move against each other (dynamic relationship).



**Centric relation (CR):** a maxilla-mandibular relationship, independent of tooth contact, in which the condyles articulate in the anterior-superior position against the posterior slopes of the articular eminences. It is a clinically useful, repeatable reference position. (bone to bone)



**Centric occlusion (CO):** the occlusion of opposing teeth when the mandible is in centric relation; this may or may not coincide with the maximal intercuspal position. (tooth to tooth)



**Maximal intercuspal position:** the complete intercuspation of the opposing teeth, independent of condylar position.

**Occlusal balance :** a condition in which there are simultaneous contacts of opposing teeth or tooth analogues on both sides of the opposing dental arches during eccentric movements within the functional range

**Occlusal harmony :** a condition in maximal intercuspal position and eccentric jaw relation in which there are no interceptive or deflective contacts of occluding surfaces

**Occlusal interference**

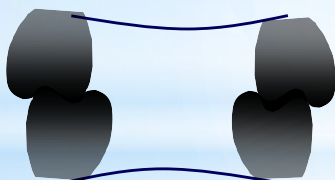
1. Any tooth contact that inhibits the remaining occluding surfaces from achieving stable and harmonious contacts;
2. Any undesirable occlusal contact.

**Mandibular movement can be:**

opening closing, protrusive, and lateral

in lateral it may be

- ❖ Working side is the side that the mandible moves toward it in lateral excursion.
- ❖ Nonworking side is the side that the mandible moves away from during lateral excursion.



**Balancing  
Side**

**Working  
Side**

### **Natural teeth**

- 1.Fixed in bone
- 2.Supported by periodontal ligament
- 3.Tooth move into socket during mastication because of elasticity of ligament
- 4.When teeth , move one side during mastication the other side is not affected
5. When teeth move in socket, they produce stretching effect and exert tensile force
- 6.Tensile force produce stimulation to under lying bone
- 7.Physiologic stimulation maintain good health of the bone
- 8.To maintain the stimulus optimal occlusion of natural teeth is important

### **Artificial teeth**

- 1.Rest on residual ridge
- 2.not fixed to soft tissue
- 3.Denture move toward tissue because of resiliency of mucosa
- 4.When teeth meet on one side ,the other side loses balance upsetting retention and stability
- 5.Compression of soft tissue causes displacement of the supporting tissue
- 6.Compression causes pressure on mucosa of affecting vascular supply of bone
- 7.Instability of denture causes loss of bone because of leverage
- 8.To maintain the supporting tissue in good health ,planed occlusion is necessary

### ***Requirements of ideal complete denture occlusion:***

1. Stability of denture in both centric and eccentric relation.
2. Balanced occlusal contact bilaterally.
3. Cusp height reduced to control horizontal force.
4. Cutting, penetrating and shearing efficiency of occlusal surface.
5. Incisal clearance during posterior function like chewing.
6. Unlocking (removing interference) of cusps mesiodistally.

## Objectives of occlusion in complete denture

1. Preservation of the remaining tissues
2. Enhancement of denture stability, retention and support
3. Proper masticatory efficiency
4. Enhancement of phonetics and esthetics

## *Requirements of complete denture occlusion:*

1. Stability of occlusion in centric relation.
2. Balanced bilaterally for all eccentric contacts ( all eccentric mandibular movements).
3. Unlocking the cusp mesiodistally to allow for gradual but inevitable settling of the bases due to tissue deformation and bone resorption.
4. Control of horizontal forces by buccoligual cusp height reduction according to the residual ridge resistance and interr ridge space.
5. Functional lever balance by favorable tooth to ridge crest position
6. Cutting and shearing efficiency of the occlusal surface (sharp cusps or ridges)
7. Anterior clearance of teeth during mastication.
8. contact between the upper and lower teeth to reduce pressure during function (lingualized occlusio)

## TYPES OF COMPLETE DENTURE OCCLUSION

- o Balance occlusion
- o Lingualized occlusion
- o Monoplane occlusion

**Balance occlusion:** in complete dentures can be defined as stable simultaneous contact of the opposing upper and lower teeth in centric relation position and a continuous smooth bilateral gliding from this position to any eccentric position within the normal range of mandibular function.

### Advantages of Balance occlusion

1. Distribution of load
2. Stability
3. Reduced trauma
4. Functional movement
5. Efficiency
6. Comfort



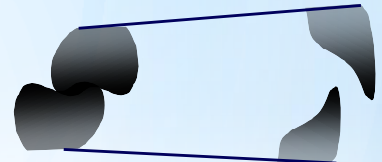
## 1- Balance in centric Occlusion

achieving → Stable and physiologic occlusion.



## 2- Balance in eccentric Occlusion

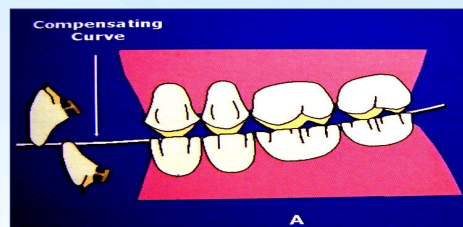
**Protrusive:** A movement of the mandible towards the anterior, pushing it forwards



It should be at least **three-point contact** between the teeth on each arch one anterior and 2 posteriors.

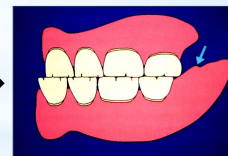


If with anatomic teeth arrangements → follow compensating curves.

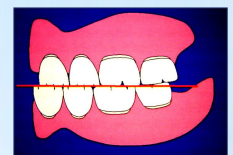


If with non-anatomic teeth, should use, as example:

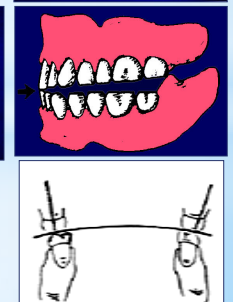
Using balancing ramp →



Tilting the second molar →



Reverse curve of Wilson →



**In lateral excursion: (working side)**

**Anterior teeth :** the maxillary & mandibular anterior teeth contact on the working side.

**Posterior teeth:** the buccal & lingual cusps of the maxillary & mandibular posterior teeth are in contact. If lingualized occlusion, the maxillary lingual cusp will be in contact with the mandibular lingual cusp..



**In lateral excursion: balancing side**

**Anterior teeth:** the maxillary & mandibular anterior teeth may contact on the balancing side.

**Posterior teeth:** the lingual cusps of the maxillary teeth will be in contact with the buccal cusps of the mandibular teeth. With monoplane balanced occlusion, usually only the second molars are in contact or the balancing ramp.

## Factors affecting the balanced occlusion (Laws of Articulation Hanau quint)

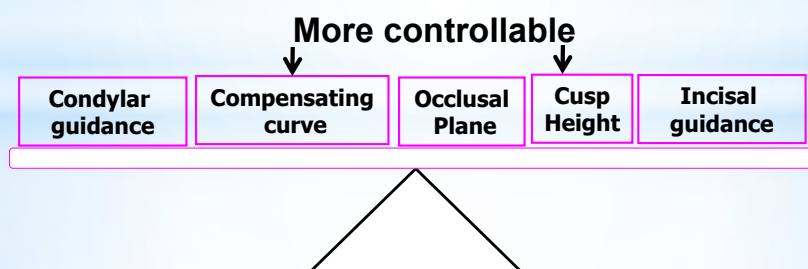
1. Condylar guidance
2. Incisal guidance
3. The occlusal plane
4. The compensatory curves
5. Cusp angulation

Interrelation between these factors may be described by **Theilman's formula**

Balanced occlusion =  $\frac{\text{condylar inclination} \times \text{Incisal guidances}}{\text{Occlusal plane} \times \text{compansatory curve} \times \text{cusps angulation}}$

**All five factors of balance interact with each other, and changes in any one effect changes in the others. for the final analysis, the dentist can only control four of five factors.**

- \* **The condylar guidance:** can be completely fixed and is not be change.
- \* **The incisal guidance and inclination of the plane of occlusion:** can be altered within a small range according to esthetic and physiologic (phonetic) factors.
- \* **Cusps, on the teeth and tooth inclination of cusplless teeth and compensating curve:** are the real working tools of balanced occlusion.



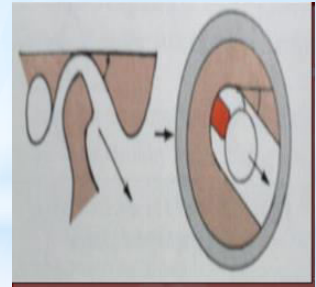
## 1. Condylar guidance:

The angle formed by an imaginary horizontal line at the superior head of the condyle and the path that the condyle will pass through during function. It varies from individual to individual because of anatomical differences. About  $33^\circ$

### Definitions

**1.condylar guidance:** mandibular guidance generated by the condyle and articular disc traversing the contour of the articular eminence

**2.condylar guidance :** the mechanical form located in the posterior region of an articulator that controls movement of its mobile member



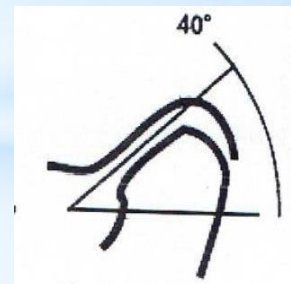
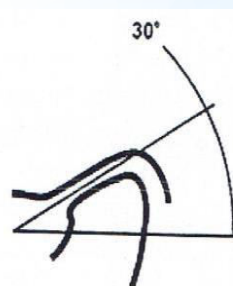
**The inclination of the condylar paths varies in different individuals and from side to side in the same person. It depends upon:**

- 1.The shape of the glenoid fossa.
- 2.The variation of the thickness of the articular disc in its different parts.
- 3.The relation of the condyle to the disc during movement.
- 4.The extent of the mandibular protrusion

The first factor of occlusion is the condylar guidance, this factor recorded from the patient .so it is fixed factor cannot be modified by the dentist.

The condylar guidance is the only factor given by the patient.

**Can't be changed**

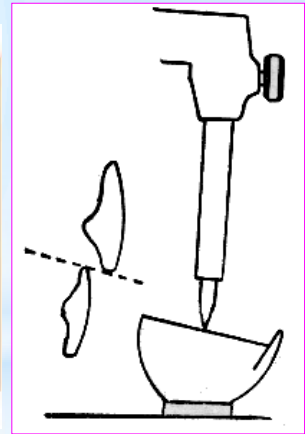
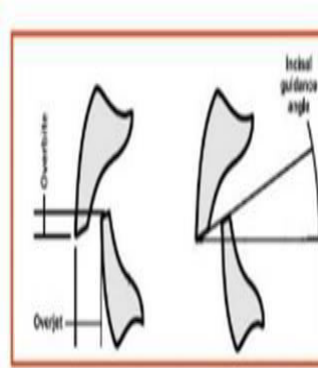


## **2-The incisal guidance**

**1 Anatomically:** . Incisal guidance: - the influence of the contacting surfaces of the mandibular and maxillary anterior teeth on mandibular movements.

It is usually expressed in degrees of angulation from the horizontal by a line drawn in the sagittal plane between the incisal edges of the upper and lower incisor teeth when closed in centric occlusion.

**B) On an articulator:** :- Incisal guidance:- the influences of the contacting surfaces of the guide pin and guide table on articulator movements.

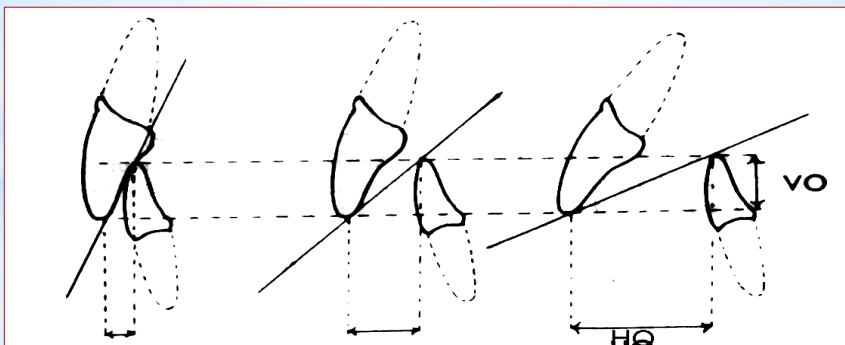


### ***Incisal guidance depends on the:***

#### **1.Desired over jet.**

#### **2.Over bite.**

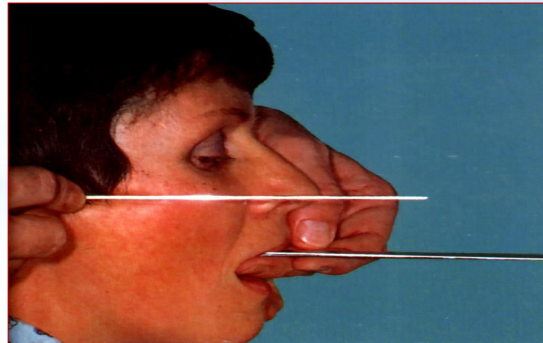
- This angle varies directly with the vertical overbite and inversely with the horizontal over jet.
- This angle is set to  $10^\circ$  in CD and not exceeding  $20^\circ$
- This angle determined by esthetic, phonetic, ridge relation, inter-alveolar distance, this means it is under the control of the dentist,



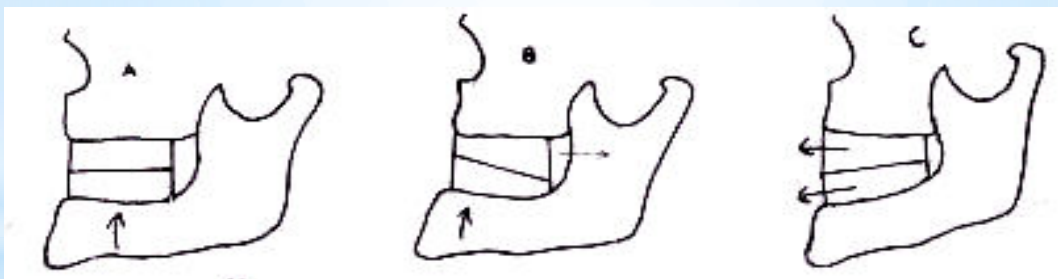


### 3.plane of occlusion (Plane of Orientations) :

1. It is imaginary surface related anatomically to the cranium and theoretically touches the incisal edge of incisors and the tip of occluding surface of posterior teeth
2. Maxillary occlusal plane should parallel to interpapillary line ,posteriorly usually parallel to the ala-tragus line
3. In the mandible established anteriorly by the cusp height of lower canine near the commissure of the mouth(corner) and posteriorly by the retromolar pad.



- ❖ The nearer the occlusal plane to the basal bone of the jaws, the less the leverage action and the better stability.
- ❖ The occlusal plane should be parallel to both supporting ridges. In this way the biting forces are vertical on the ridges and there is no tendency for horizontal displacement of the dentures



## 4. The compensating curve:

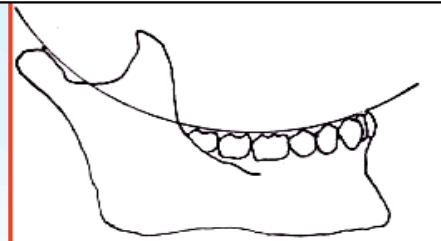
**The compensating curve:** the arc introduced in the construction of complete removable dental prostheses to compensate for the opening influences produced by the condylar and incisal guidance's during lateral and protrusive mandibular eccentric movements

- The compensating curve incorporated in a properly oriented plane of occlusion
- Compensating curve in artificial dentition is anteroposterior curve

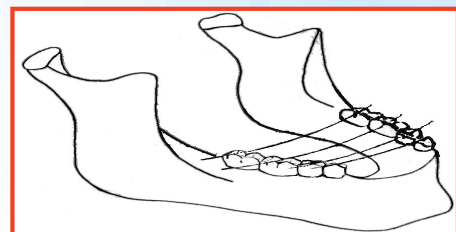
***The compensating curve of the artificial occlusion corresponds to a combination of these curves in natural teeth. It is considered one of the more important factors in establishing balanced occlusion***

### **Compensating curves**

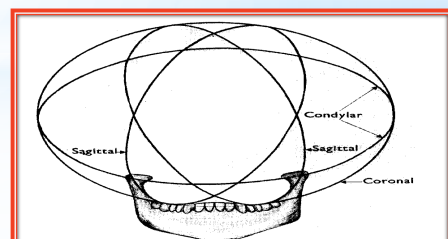
#### **Spee's curve**



#### **Curve of Wilson**

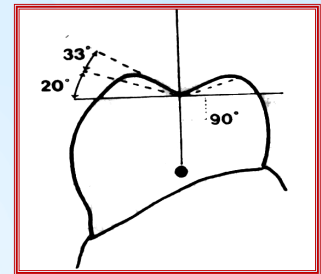


#### **Monson's curve**



## **5- Cuspal angulations, Cusp Height** **(cuspal inclines of tooth and** **inclination of cusplless teeth)**

It is measured by the angle formed by the mesiobuccal cuspal incline to the horizontal plan when the long axis of the tooth is vertical to the plane

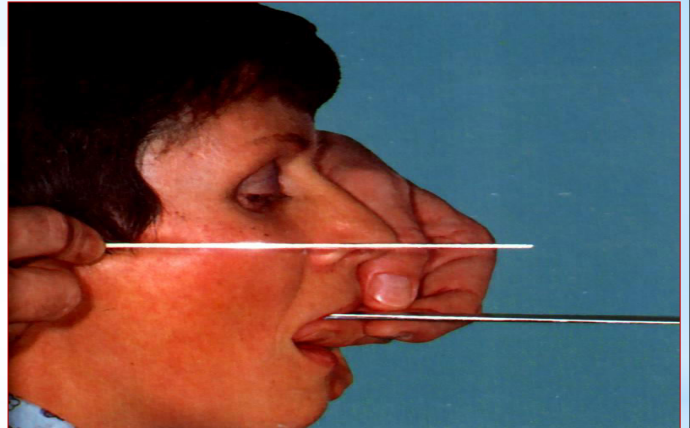


It depends on several factors : residual ridge, neuromuscular control, esthetics,etc . however, it's better to reduce the cuspal inclination to help reduce horizontal forces of occlusion.

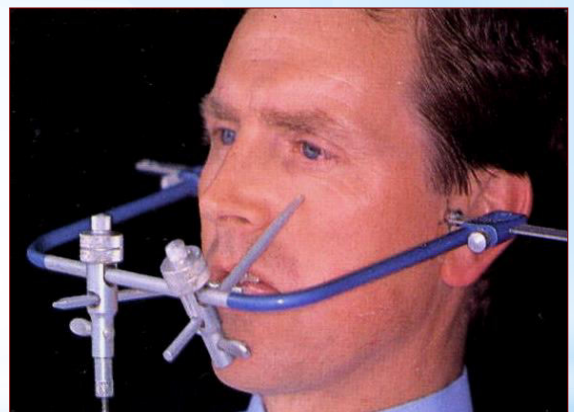
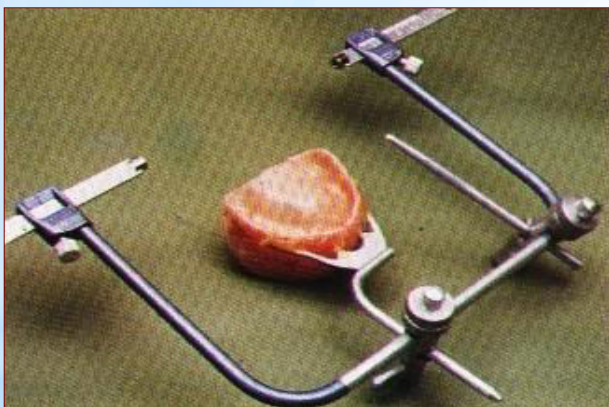
### **Interaction of the five factor**

Of the four that he can control two of them (the incisal guidance and the plane of occlusion) can be altered only a slight amount because of esthetic and physiologic factors. The important working factors for the dentist to manipulate are the compensating curve and the inclinations or cusp on the occlusal surfaces of the teeth.

*For the balanced occlusion, it is important to use adjustable articulator*

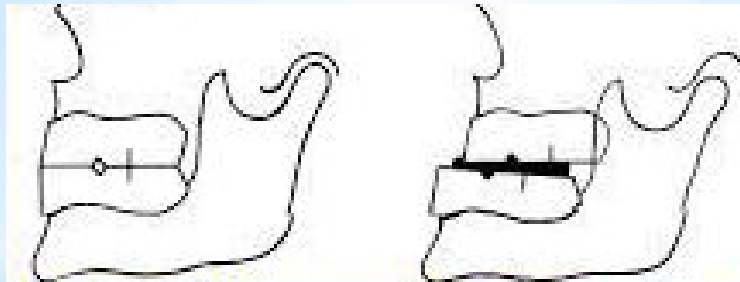












**Hanau's formula**  $L = \frac{H}{8} + 12$

*L* = lateral Condylar guidance

*H* = horizontal inclination



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### How to record the condylar guidance?

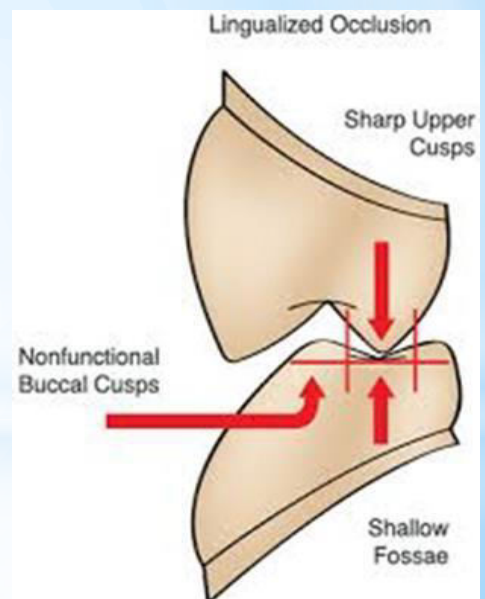
After recording of jaw relation (orientation relation, vertical ,centric jaw relation)then a protrusive record should be made, in order to set the condylar guidance on articulator according to the following steps:-

- 1.place V shape notch.
2. allow the patient protrude a minimum of 5-6mm ,but less than 12mm
- 3.place elastomeric registration material between occlusal rim while the patient close in protrude position.
- 4.after complete setting of material .record base and registration are removed, place on articulator.
- 5.on the articulator the condylar element release from hinge position, instrument protrude ,they record approximated. The condyle element are rotated until there is maximum interdigitating of the registration and opposing occlusal rim.

### ***Lingualized occlusion:***

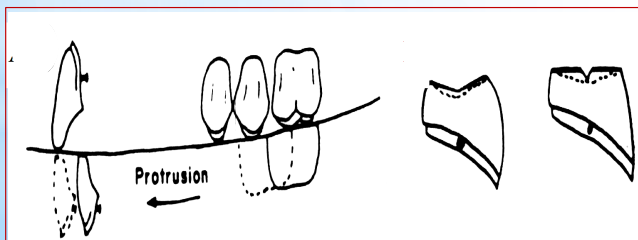
It involves use of large upper palatal cusp against wide shallow lower central fossa.

- The buccal cusps of upper and lower teeth do not contact each other.
- The maxillary palatal cusp tip should contact opposite mandibular central fossa.
- The cusp incline of mandibular teeth relatively flat result in less lateral force and displacement during function



## *Indication:*

1. High esthetic needed.
2. Weak muscle of mastication.
3. Displaceable supporting tissue.
4. Severe alveolar bone resorption.
5. Discrepancy in jaws size. Narrow upper arch and wide lower arch
6. Implant supported over denture.
7. Previous successful denture with lingualized occlusion.



## *Advantages:*

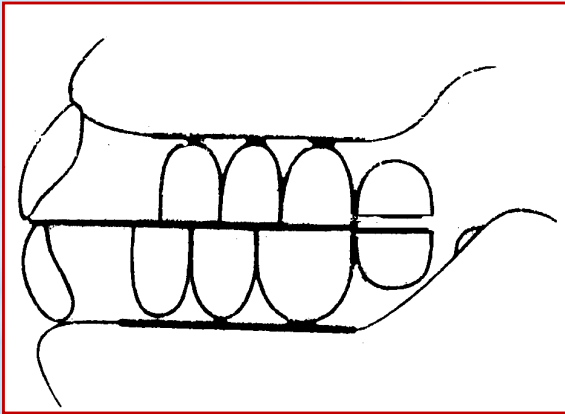
1. Simpler technique. Less precise CR records
2. Esthetics.
3. Better penetration of the food bolus.
4. easier to adjust occlusion
5. it may be used in clll, classIII and cross bite.
6. Centralization of vertical forces.
7. Minimizing tipping force.
8. Potentially of bilateral balance

## *Disadvantages:*

1. Difficulty in obtaining repeatable centric record (incoordination, jaw malrelation)
2. Severe ridge resorption (lateral forces displace the denture) may more easily be handled with a monoplane scheme.



## ***Monoplane occlusion (neutrocentric) :***



## ***Monoplane occlusion (neutrocentric) :***

- ❖ Flat occlusal plane set with non anatomic teeth.
- ❖ The antero-posterior occlusal plan parallel to the denture foundation area.
- ❖ There is no vertical overlap of anterior teeth.
- ❖ Tooth Contact should occur only when mandible in centric relation. .
- ❖ Opposing artificial teeth should not contact when jaws in eccentric relation.
- ❖ In protrusion there is disclosure of posterior teeth as a result of arrangement in single plane.the patient is instructed not to incise the bolus
- ❖ There is no curve of spee or curve of Wilson (compensating curves).



## *Indications*

1. Jaw size discrepancies CLII, CL III ,malocclusion and cross bite
2. Uncoordinated jaw movement.
3. Mostly for geriatric patients.
4. minimal ridge (resorbed ridge ) it reduces horizontal forces—implant may help.

## *Advantages:*

1. Simple technique and less time consuming.
2. Less precise jaw relation records.
3. Lateral forces are reduced by eliminating Cuspal inclines.
4. Simpler and easier occlusal adjustments.
5. Occlusion is not locked.

## *Disdvantages:*

1. Least esthetic.
2. Poor bolus penetration.
3. Cannot be balanced in eccentric excursions

**Types of Occlusal Scheme:**  
**Types of posterior teeth:**

## 1. Anatomic teeth.

Simulate the natural teeth form with inclination approximately 33 degree

### Advantages:

1. Esthetic.
2. Better food penetration.
3. Vertical stress decrease.
4. Harmony with TMJ and muscle of mastication.
5. Balance occlusion in eccentric position



### Disadvantages: -

1. Precise technique requires.
2. More time.
3. Difficult teeth position in CL II & CL III
4. Greater lateral force



## 2. Semi anatomic teeth

Cusp incline less steep than anatomical teeth called modified anatomical teeth (less than 33°)

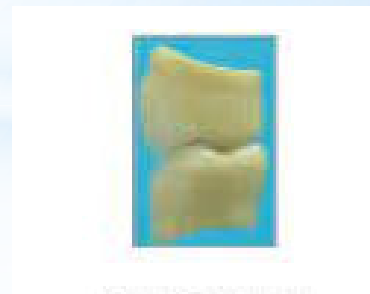
### Advantages:

1. Esthetic.
2. Good chewing efficacy.
3. Less lateral force.
4. Balance occlusion.



### Disadvantages

1. least esthetic.
2. poor bolus penetration.
3. cannot be balanced in eccentric excursions



### 3. Non anatomical teeth:- Flat and without cusp height.

#### Advantages

1. Used for patient with poor neuromuscular coordination.
2. Used for patient with malrelation jaws.
3. Used for patient with cross bite or class III.
4. More comfortable.
5. Less time required in set up.
6. slightly more esthetic than neutrocentric occlusion.

#### Disadvantages: -

- Use of compensatory curve may cause the same damaging effects as cuspal inclines.
- Occlusal adjustment are more difficult to accomplish



### Factors influencing the selection of selection of occlusal scheme

1. Characteristics of occlusal scheme:
  - ❖ Tooth form and arrangement
  - ❖ Balanced or not
2. Characteristics of the patient:
  - ❖ Height and width of the residual ridge
  - ❖ Aesthetic demands of the patient
  - ❖ Skeletal relations
  - ❖ Neuromuscular control
  - ❖ Tendency for parafunctional activity

## ❖ **Abutment Preparation**

1. Simple Tooth Modification and Reduction
2. Tooth Reduction and Cast Coping
3. Endodontic Therapy and Amalgam Plug
4. Endodontic Therapy and Cast Coping
5. Endodontic Therapy with cast coping utilizing some form of attachment
6. Endodontic treated tooth with prefabricated retentive element

### **1-Simple Tooth Modification and Reduction**

The teeth are **reshaped to eliminate undercuts** and to **reduce the vertical height**.

#### **Indication:**

1. Good oral hygiene with low caries index
2. Vital pulp.
3. Partially anandontic patient.
4. Sever abrasion of teeth.
5. **Sufficient interocclusal distance.**

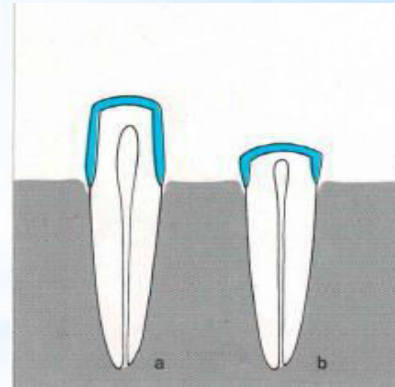


## 2- Tooth Reduction and Cast Coping

Cast copings are made after reducing the teeth to prevent sensitivity or as caries control. Endodontic is not done on these teeth.

### Indication:

1. Adequate bony support
2. Good periodontal prognosis
3. Adequate interocclusal distance.

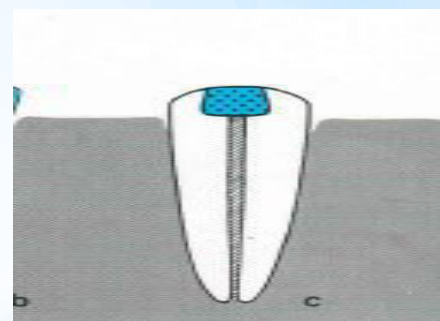


## 3-Endodontic Therapy and Amalgam Plug

The abutment endodontically treated then **reduced (1-2) mm at gingival level** to receive an amalgam restoration.

### Indication:

1. low caries index.
2. There is normal coronal height to the teeth .
3. Normal interocclusal distance with little or no loss of vertical dimension,





#### 4-Endodontic Therapy and Cast Coping

Shallow dome shape with the margin **slightly supra-gingival**. The retention is gained from a **short post** that is placed within the root canal.

##### Indication:

1. When there is a history of carious involvement.
2. Recurrent decay on the exposed dentin.

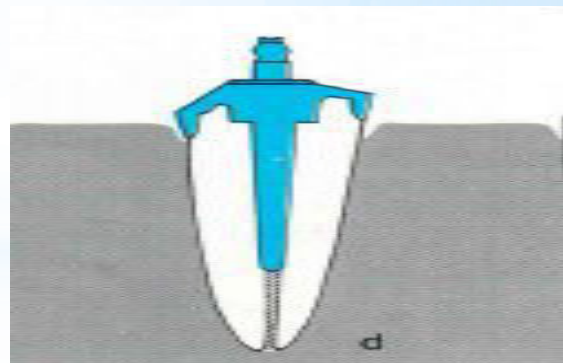


#### 5- Endodontic Therapy with cast coping utilizing some form of attachment

Overdenture retained by attachments offer the patient the idea of a fixed removable bridge instead of a denture. The abutments are prepared as in short-coping but with **long intraradicular post to prevent root-coping dislodgment**. Two attachments are enough to retain a denture, third attachment add unnecessary complexity and weakens the denture.

##### Indication:

- 1.Low caries index.
- 2.Proper home care.
- 3.Good periodontal health.
- 4.Adequate bony support.
- 5.Available interridge distance.

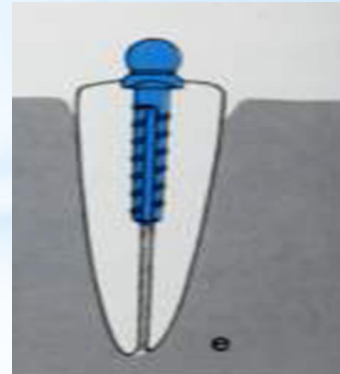


## 6-Endodontic treated tooth with prefabricated retentive element

It is a simple and inexpensive way to temporary fixation of overdenture.  
(**Spherical retentive element attached to a threaded post**).

Ex. (**Dalbo-Rotex system**).

**The disadvantage** of this type is that the **omission of a protective coping increases** the risk of carious destruction and root fracture.



## ❖ Impressions of the Abutment Teeth

1. One –stage technique with supporting element
2. One -stage technique with existing retentive element

### 1- One –stage technique with supporting element

For designs that rest on abutment teeth **without root copings**, the full-arch impression is made **as soon as the abutments are prepared**. When **root copings without retentive elements**, the impression is **made after final cementation of the copings**.

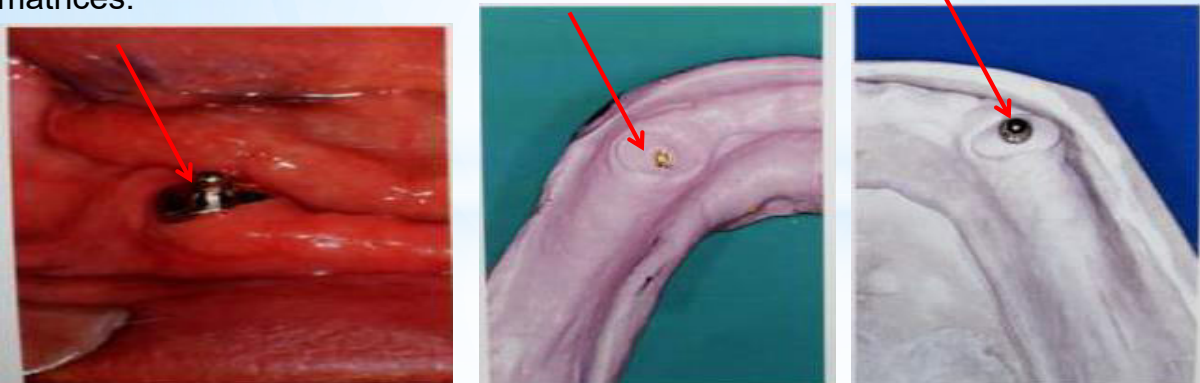


The full arch impression is made in a custom tray similar to one for conventional complete denture. It covers the entire ridge except for any undercut areas near the abutment teeth that could not be utilize for the future denture base any way. The impression is made using Zinc oxide-eugenol paste or elastomer in the same manner as in the edentulous arch.

### 2-One -stage technique with existing retentive element

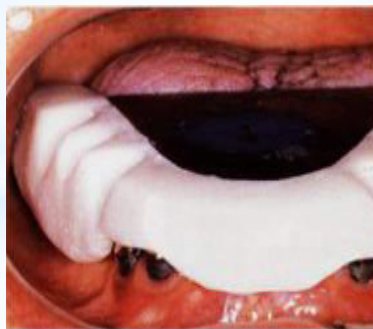
A single step full arch impression in Zinc oxide-eugenol paste or elastomer the materials used for overdenture that will rest on Pre-existing retentive elements

**Transfer matrices are set in place on the involved retentive elements and picked up in the impression.** this is make it possible to incorporate retentive elements analogs in the working cast, used custom tray similar to these used for complete denture, the tray must touch neither the root coping nor the transfer matrices.



## ❖ Record base

The only difference in the construction of the record bases for tooth –supported overdenture and conventional dentures is the **incorporation of the metal bearing in the record base**. The shape of the record base must correspond to that of the future overdenture, i.e., **it should not cover the facial marginal gingiva in the abutment region**.



## Denture Base designing

### Criteria for Designing the Base

- Not unnecessarily promote plaque accumulation.
- Not mechanically traumatize the marginal gingival.
- Not impede the performance of good oral hygiene.
- Not interfere with normal function of the tongue, lips and cheeks.
- Not interfere with esthetics or speech
- Permit modifications and additions with moderate technical efforts.



### **Designs that leave the periodontium uncovered**

The base does not cover the gingiva and the artificial teeth are prepared to fit directly upon the roots or the dowel copings

- 1- Bases that are circumdentally open**
- 2- Bases that is facially and proximally open.**

Temperatures in the gingival sulcus are significantly higher under closed bases that cover the gingival margin than with open designs. Gingival reaction was always most severe where the denture base covered the gingival margin and least severe in uncovered gingival margins.

### **Basic rules of overdenture base design**

1. Cover as little of the marginal gingiva as possible
2. Border the proximal spaces with metal.
3. The greater the number of abutment teeth and the better their prognosis, the more open the construction may be.

### **Advantages of a base designed that it does not cover the gingiva**

1. precludes direct mechanical trauma.
2. Reduce plaque retention around the abutments.
3. it possible to clean the proximal surfaces of the root coping with interproximal brushes with the prosthesis in place.
4. prevents a suction effect combined with inadequate coping shape and poor oral hygiene, would lead to hyperplasic proliferation (suction hyperplasia).
5. Prevents undesirable vacuum retention in maxillary overdentures with retentive attachment.

### **Disadvantages**

1. increased risk of fracture of the base
2. Unfavourable spatial relationships that do not permit extensive proximal openings
3. Esthetic considerations
4. Speech problems such as sigmatism
5. increased food impaction in the open proximal spaces
6. Poor prognosis for the abutment teeth, making probable an early conversion to a complete denture



## 1- Circumdentally opened design

### Indications

1. abundant space over the abutments
2. a good prognosis

### Advantages

1. Possible to clean the abutments without removing the denture.
2. The base cannot traumatize the gingiva around the abutments.
3. minimal extension of the base

### Disadvantages

1. very complex
2. The risk of fracture is greater
3. The possibilities are limited for modifying and adding to the denture when abutment teeth are lost.

## 2-Facially and proximally open design

Have enough rigidity only if they incorporate custom cast reinforcing frameworks.

### Indications

- 1- Poor prognosis
- 2- speech problems
- 3- extensive tissue loss in the anterior region
- 4- unfavorable spatial relations

### Advantages

- 1- less involved technical construction,
- 2- the reduced risk of fracture.
- 3- the ease of modification when an abutment is seldom causes any problem with phonation or food retention.

### Disadvantage

1. difficulty in cleaning
2. The greater extension of the denture base (psychological disadvantage).



## 2-Implant supported overdenture

An implant retained overdenture is an alternative form of treatment to the fixed-implant prosthesis. The denture may attach on a cast bar fixed to abutments, or it may attach to individual abutments. Patient can remove the overdenture for cleaning. Due to an increased awareness of the variety of clinical situations, bone density, biomechanics, and patient's desires, and an ever growing number of patients benefit from additional retention and support through the help of implant supported overdentures.



### Indication of Implant supported overdenture.

1. The patient's general health allows only a short surgical procedure.
2. Atrophic ridge, therefore objective improvement cannot be expected by fabrication of new conventional dentures.
3. Patient has worn removable dentures previously.
4. Edentulous patients who are no longer able to wear complete dentures.
5. The patient is basically satisfied with complete dentures but wants the security of increased retention.
6. Economics: the patient is either unwilling or unable to bear the expense of a fixed reconstruct.

### **Contraindication of Implant supported overdenture.**

- 1) Systemic conditions.
- 2) Inadequate bone substance for placement of at least two implants.
- 3) Unrealistic patient expectation.
- 4) Mental disorders.
- 5) Pregnancy
- 6) radiation to the implant site
- 7) Improper patient motivation

### **Advantages of implant supported overdenture:**

1. Prevent bone loss.
2. Maintain facial esthetics.
3. Reduce or eliminate prosthesis movement.
4. Create reproducible centric relation occlusion.
5. Eliminate soft tissue abrasions.
6. Improve prosthesis retention.
7. Improve chewing efficiency.
8. Improve speech compared with dentures.

### **Disadvantages of implant supported overdenture:**

1. Eliminate bone grafting for implants with poor prognosis for fixed restorations.
2. Some patients want implants primarily because they do not want to be able to remove the prosthesis. This would not satisfy the psychological needs of these patients to feel that the prosthesis is part of their body.
3. Lack of sufficient inter-arch space makes an overdenture system more difficult to fabricate than a porcelain fused to metal fixed prosthesis and more prone to component fatigue and failure.

### **Type of implant overdenture**

**1-implant-retained and tissue-born overdenture.**

**2-implant –retained and implant –born overdenture.**

### 1-Implant-retained and tissue-born overdenture

It depends primarily on residual alveolar ridge for support. The implants will provide support in the area of the arch in which they are placed when loading is directed over them, this type **need less number of implant** (depending on the quality and quantity of the bone for maxilla and mandible)

2-4 implants -----for mandible

3-4 implants-----for maxilla

### 2-Implant –retained and implant –born overdenture

It does not depend on tissue support but depended on implant to bear the total occlusal loading. This type requires the use of **sufficient number of implants** to accommodate the load placed on the prosthesis.

The minimum number of implant required:

4 implants ----- for mandible

6-8 implants-----for maxilla



## Consideration that determine the type of implant supported over denture

- 1-The quality and quantity of the bone in the arch.
- 2-The opposing occlusion.
- 3-The amount of inter-arch distance.
- 4-Economic considerations.
- 5- Patients desire.

## Requirments of implants used:

- ❖ Distance between bar-connected implants must be no less than 8 to 10mm, so that the lengths of the bar segments between implants are sufficient for proper placement of the retention clips.
- ❖ Arrangement of the implants should be as symmetrical as possible.
- ❖ Points of emergence of all implants should lie at the same height.
- ❖ In mandible, two implants may be sufficient.
- ❖ In maxilla, more than two implants recommended.



**The removable implant supported denture may present certain advantages over fixed implant prosthesis such as:**

- 1) Decreased costs associated with fewer implants.
- 2) Easier access for oral hygiene procedures.
- 3) Improved facial support via denture flanges.
- 4) Improved esthetics and phonetics, particularly in the maxillary arch.



## Overdenture

**The overdenture:** is any removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth, and/or dental implants .

**The overdenture:** a dental prosthesis that covers and is partially supported by natural teeth, natural tooth roots, and/or dental implants.

The overdenture is also called **overlay denture**, **overlay prosthesis** or **super imposed prosthesis**.



Fig 1: Pre-operative Intraoral View.



Fig 2: Metal Copings Cemented Over Prepared Teeth



Fig 3: Impression Surface Of The Denture



Fig 4: Overdenture Over Restored Abutments.

## ***The important goals of overdenture:***

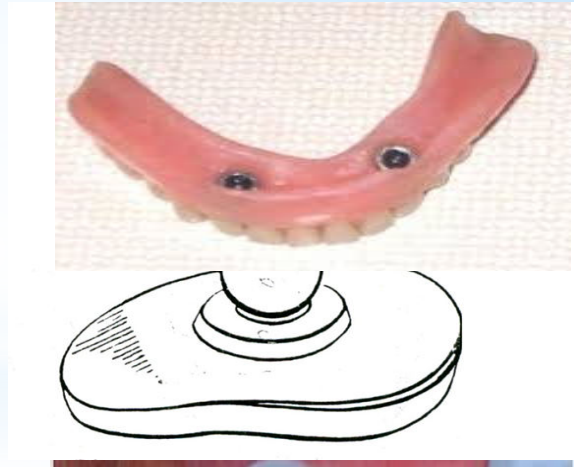
1-Maintains teeth as part of the residual ridge

- ❖ Withstands more occlusal load
- ❖ More support .
- ❖ Retention improve

2-Decrease in the rate of bone resorption. Alveolar bone exists as a support for teeth.

3- Retaining the proprioception.

4- An increase in the patient's manipulative skills in handling the denture.



## ***Indications of Overdenture.***



## ***Indications of Overdenture.***

- 1- Few remaining teeth unsuitable for fixed or removable partial dentures.
- 2- Remaining teeth present with unhealthy periodontal condition.
- 3- Patients with class II or class III Angle's classification - Esthetics & masticatory function improved.
- 4- Patients presenting abnormal jaw size large maxillary or mandibular bone defects.
- 5- The construction of over-denture is an alternative line of treatment to single dentures opposing few natural teeth.
- 6- Patients presenting congenitally missing teeth and congenital defects as cleft palate, microdontia, amelogenesis or dentinogenesis imperfecta or partial anodontia.

## ***Contraindications of Overdenture:***

- 1- Poor oral hygiene.
- 2- Inter-arch space inadequate to accept the denture and the abutments.
- 3- Mentally and \or physically handicapped.
- 4- Cost and time considerations.
- 5-When other treatment modalities promise superior results.
- 6-Lack of patient acceptance.



## ***Advantages of overdenture prosthesis***

- 1- Preserving the remaining residual ridge by decreasing the rate of bone resorption.
- 2- Preservation the abutments as part of residual ridge to gain support.
3. Preserving the response of proprioceptive exist in the periodontal membrane of the abutment tooth.
- 4- The modified teeth provide a definite vertical stop for the denture base .
- 5-Horizontal and torque forces are minimized.

- 6- Stability and support are increased
- 7- Provide retention through the attachments.
- 8- A Simple Approach to the Problem Patient.
- 9- Fewer post insertion problems
- 10- Convertibility& effective management.
- 11- Periodontal Maintenance (**by distributing the applied forces over the remaining teeth**) physiological stimulation.
- 12- Patient acceptance and Psychological Benefits.

## ***Disadvantages of overdenture prosthesis***

1. The susceptibility of the overlaid teeth to caries is high.
2. Periodontal disease of the retained teeth.
3. Bony undercuts of the alveolar ridge are often found adjacent to retained teeth over contoured (bulky denture) or under contoured flanges especially in canine eminence.
4. Encroachment interocclusal distance beyond the denture space.
- 5- Overdenture construction is time consuming and expensive.

## **Overdenture Classification**

Overdentures can be classified into:

**1-tooth supported**



**2-implant supported**



### 1-Tooth supported

A complete or partial removable denture supported by tooth or retained roots that is intended to provide improve support, stability and tactile and proprioceptive sensation and to reduce ridge resorption. The tooth -supported over denture is also called **overlay denture**, **telescopes denture** and **biological denture** are among the many terms used to define the tooth-supported complete denture.



### 2-Implant supported

The denture appears like traditional prosthesis. However, that part of the denture overlying implants is modified to retain various attachments that receive implant extensions projecting above the gum.



**Before**



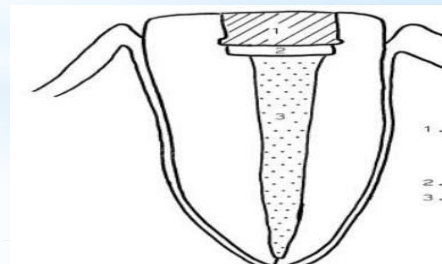
**After**

## 1-Tooth supported Overdenture

Classification of tooth supported overdenture **Based on the method of abutment preparation:**

### 1. Non coping abutment

- ❖ The tooth is reduced to a coronal height of 2 to 3 mm.
- ❖ The crown is contoured to a convex or dome shape.
- ❖ The tooth is endodontically treated and filled with amalgam or composite restoration.



### 2. Abutment with coping preparation

Cast metal copings cover for the exposed tooth surface, with a dome shaped surface and a chamfer finish line at the gingival margin.





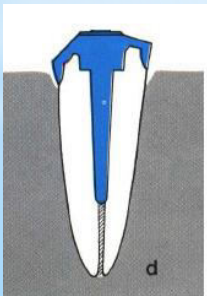
## There are two types of copings:

A. Short copings

B. Long copings

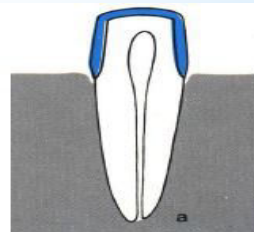
### A- Short cast copings

- ❖ 2 to 3 mm long abutment.
- ❖ cast coping has a post is fitted to endodontically treated canal.



### B-Long cast copings

- ❖ 5 to 8 mm long abutment
- ❖ Endodontic treatment is not a must (abutment is prepared conservatively to prevent pulp involvement to receive the cast)
- ❖ Greater level of osseous support





### 3- Abutments with attachment

- ❖ Attachment is small precision device
- ❖ Most attachment are secured to the abutment by cast coping.
- ❖ Objective to improve retention of denture base.
- ❖ Consisting of 2 parts: Male and Female.



### 4. Submerged Vital Roots

1. this method is innovative attempt to overcome some problems associated with the more conventional overdenture abutments included caries, gingivitis, periodontitis and the need for endodontic therapy .
2. This method included vital roots are transected and reduced to 2mm below the crestal bone .
3. covered by mucoperiosteal flap.
4. The disadvantage of these method **dehiscences over the retained roots** and **pulp pathosis**.



### 5-Abutments with telescopic crown

- ❖ Abutment teeth are either vital or endodontically treated & contoured to tapered configuration.
- ❖ Tapered metal copings constructed & cemented over abutments
- ❖ Denture constructed with metal crowns having veneered facings.



### Indicated:

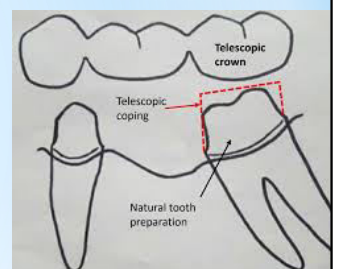
- 1) unparallel abutment
- 2) uneven spaces between abutments
- 3) useful for obturators

### Advantage

increased retention and stability

### Disadvantages

bulky crowns.



## Classification of overdenture based on the type of the overdenture

### 1. Immediate overdenture

The remaining teeth are reduced to accept the overdenture (on the cast), the overdenture are constructed prior to the preparation of abutment teeth and is inserted after the preparation.

### 2- Transitional or intermediate overdenture

Used for patient in transition or preparation phase until permanent overdenture constructed or patient with old partial denture and add new artificial teeth using self-cure acrylic resin.

### 3-Definitive overdenture

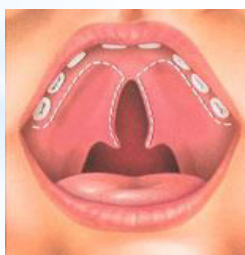
Conventional complete over denture constructed over one or more abutment teeth. Could be made entirely of acrylic resin or in conjunction with metal bases.

## Uses of overdenture concept in other areas

The overdenture approach has applications besides the obvious replacement of complete denture therapy or extensive restorative dentistry.

### Congenital and acquired defects

Patients presenting with such anomalies as cleft palate microdontia, amelogenesis imperfecta etc...the overdenture application can afford a very workable and relatively simple solution to patients with selected problems. The important benefit is that the technique is totally reversible.



## Uses of overdenture concept in other areas

### Partial overdenture

The use of an overlaid tooth that might otherwise be extracted to give posterior support to distal extension base or to provide anterior support for a large anterior supply on a partial denture renders obvious support advantage.



## Sequence of Treatment of Patient Who Need an Overdenture

### A-Assessment of the patient

1. History (**general and oral**).
2. Clinical examination (**visual and digital examination, radiographic examination and study model of the arch**).

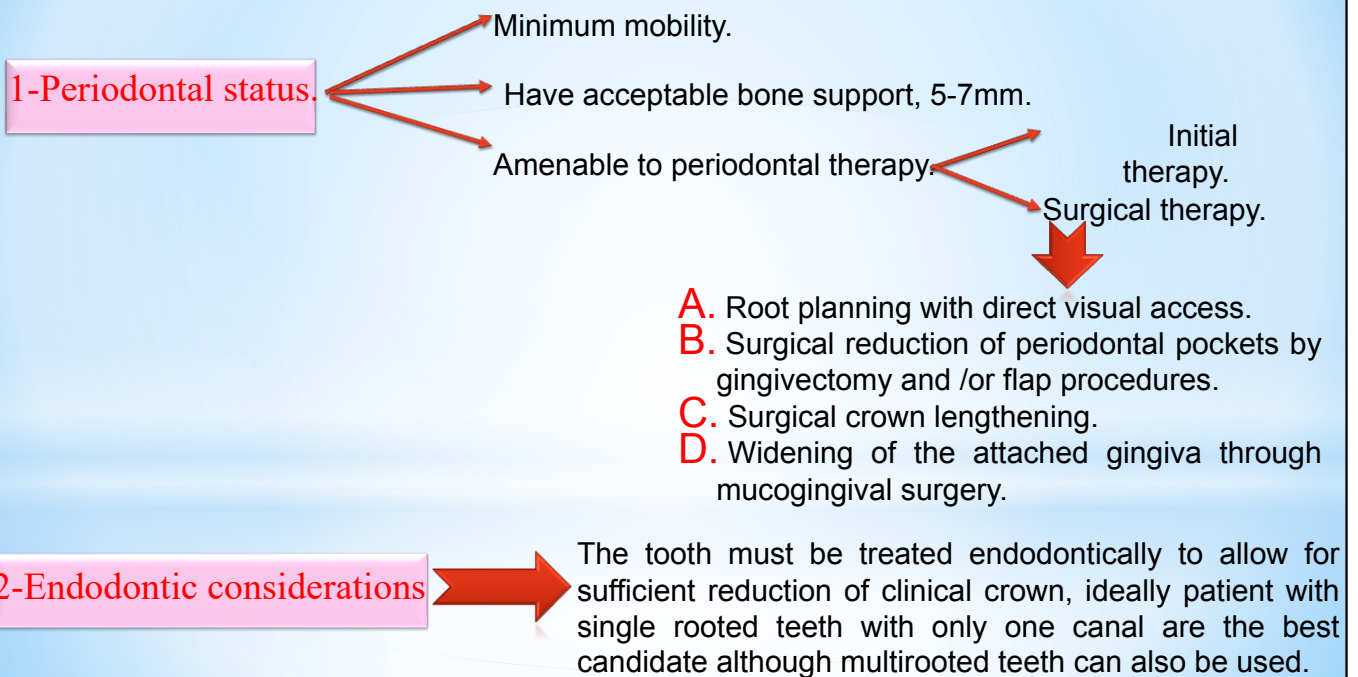
### B-Treatment plan

#### ❖ Evaluation the abutments

- 1-Periodontal status.
- 2-Endodontic considerations
- 3-The number and position of abutment teeth in the arch



## B-Treatment plan



## 3-the number and position of the abutment teeth in the arch

- ❖ Ideal is 2 teeth per quadrant ( canine or first premolar and second molar in each quadrant) The stress is distributed over a rectangular area .
- ❖ Tripod is the next most favourable form.
- ❖ Two teeth in each arch.
- ❖ In maxillary arch incisors are used, One tooth in each arch the less favourable form.
- ❖ most commonly used teeth in the mandible for abutment is Canine for, reasons :
  - Position (angle of mouth).
  - Large surface area (root).
  - Time period of retention of the tooth.
  - less susceptibility to periodontal breakdown.
  - The Canine response
  - fewer anatomical and positional difficulties



## ❖ **Abutment Preparation**

1. Simple Tooth Modification and Reduction
2. Tooth Reduction and Cast Coping
3. Endodontic Therapy and Amalgam Plug
4. Endodontic Therapy and Cast Coping
5. Endodontic Therapy with cast coping utilizing some form of attachment
6. Endodontic treated tooth with prefabricated retentive element

## Posterior Palatal Seal

Complete dentures may suffer from a lack of proper border extension, but most important of all is the posterior palatal extension on maxillary complete dentures. The posterior border terminates on a surface that is movable in varying degrees and not at a turn of tissue as are the other denture borders. Locating and designing of posterior palatal seal after thorough understanding of the anatomic and physiological boundaries of this dynamic region greatly enhances border seal and increases maxillary complete denture retention.

Hundreds of dentures have failed due to the improper establishment of the distal limit and to an improper posterior palatal seal. Its location and preparation on the master cast are often done by the dentist or dental technician without reference to anatomical landmarks of the mouth. Various methods of achieving posterior palatal seal and reproducing it in the maxillary denture have been described in the literature.

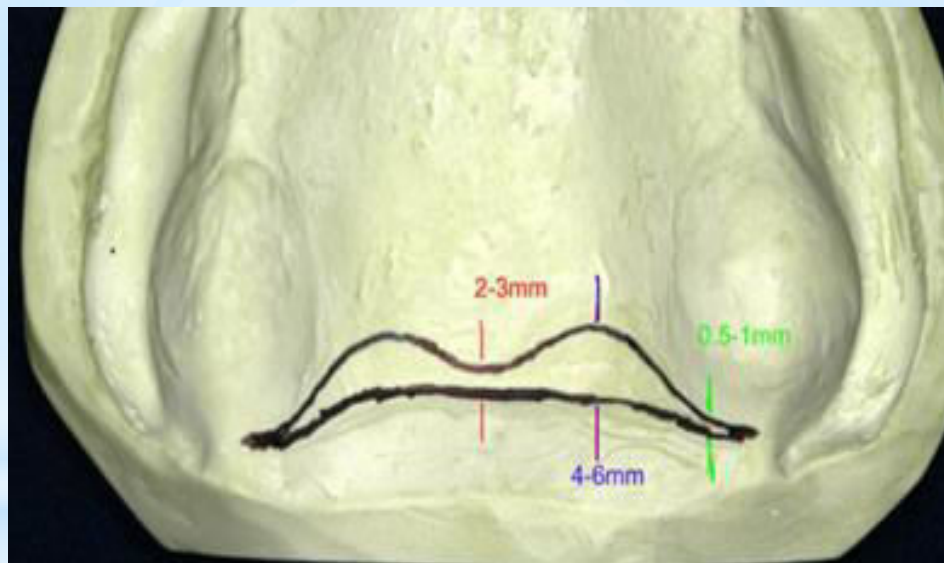
Retention of a denture is achieved from adhesion, cohesion & interfacial surface tension that resist the dislodging forces that act perpendicular to the denture base.

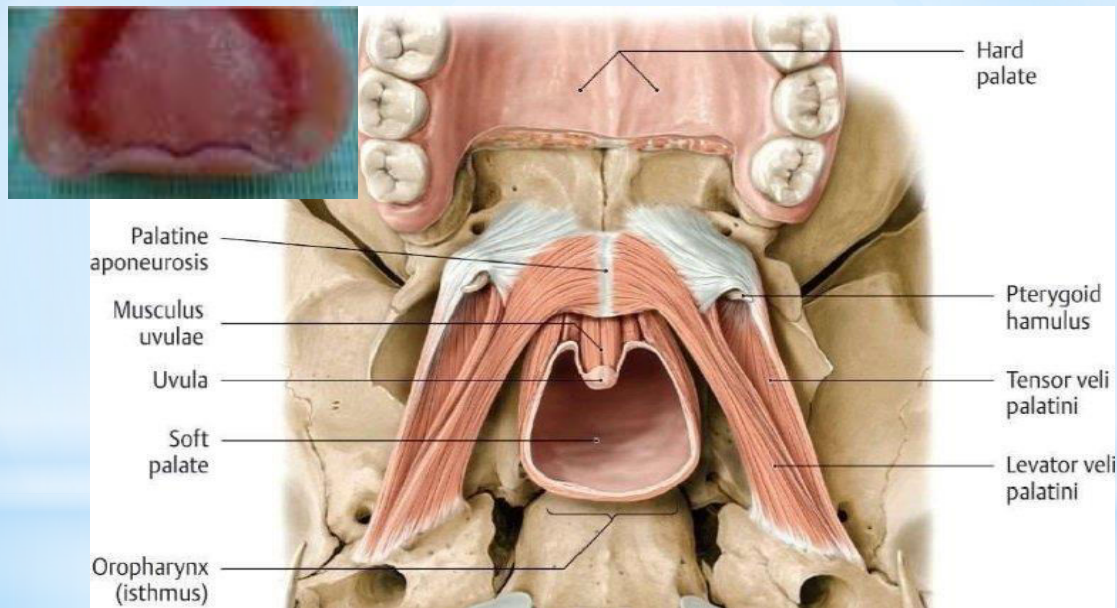
A well-fitting and retentive complete denture requires a well-adapted tissue surface, a peripheral border compatible with the muscles and tissues which make up the mucobuccal and mucolabial spaces so that a peripheral seal is created by the soft tissue draping over them. It is usually obtained by labial and buccal seal. In the posterior region, it is mainly by the posterior palatal seal. At the posterior extension of the maxillary denture, where the tissues are less compliant, special attention is required to make the seal effective.

**The peripheral seal of maxillary denture:** is an area of contact between the mucosa and peripheral polished surface of the denture base, the seal prevent passage of air between denture and tissue.

**Posterior palatal seal area:** it is the soft tissue area limited posteriorly by the distal demarcation of the movable and nonmovable tissues (limited movement) of the soft palate and anteriorly by the junction of the hard and soft palates on which pressure, within physiologic limits, can be placed; this seal can be applied by a removable complete denture to aid in its retention.

The adequate PPS resist the horizontal and lateral forces acting on maxillary denture base as the denture border terminate on soft resilient tissue and there by maintain a proper denture seal.





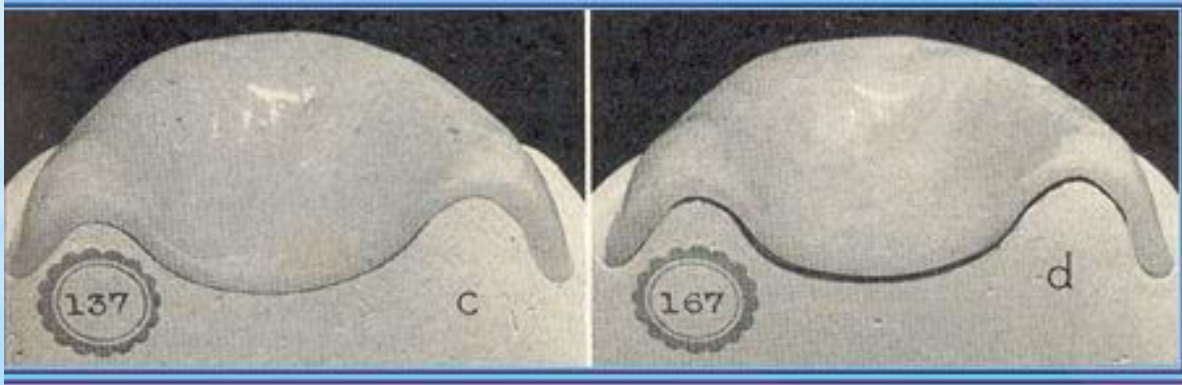
## Functions of the Posterior Palatal Seal

**The primary function is that of completing the peripheral seal and enhancing the retention of complete denture.** The other purposes served by the PPS are as follows:

1. Maintains contact of denture with soft tissue during functional movements of stomatognathic system, by which decreases gag reflex.
2. Decreases food accumulation with adequate tissue compressibility.
3. Decrease patient discomfort of tongue with posterior part of denture.
4. Compensation of volumetric shrinkage that occurs during the polymerization of PMMA
5. Increases retention and stability by creating partial vacuum.
6. Increased strength of maxillary denture base.
7. Adds confidence and comfort to the patient by enhancing retention.



**The posterior palatal seal:** is placed in the maxillary complete denture because the acrylic will distort slightly and pull away from the posterior palatal area of the maxillary cast. The acrylic will shrink toward the areas of greatest bulk, which are the areas over the ridge where the teeth are placed. In addition to the movement of soft palate during function may air to pass under the denture base. The posterior palatal seal provides a vacuum seal between the denture and the soft palate that holds the maxillary complete denture securely in place.



### Anatomical Considerations for Posterior Palatal Seal

❖ The PPS is divided in two anatomic separate boundaries

1. Post palatal seal: is extend from one tuberosity to the other.

2. Pterygomaxillary seal: extend through pterygomaxillary notch continuing for 3-4 mm anterolaterally approximation the mucogingival junction. It also occupies the entire width of pterygomaxillary notch.

The notch is covered by pterygomaxillary fold (extend from posterior aspect of tuberosity to retromolar pad). This fold influences the posterior border seal if mouth is wide open during final impression procedure.

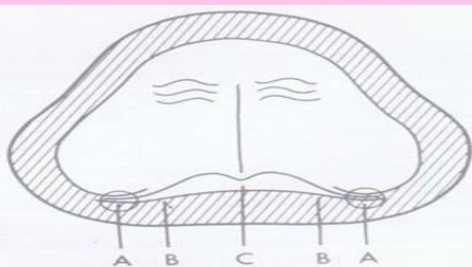
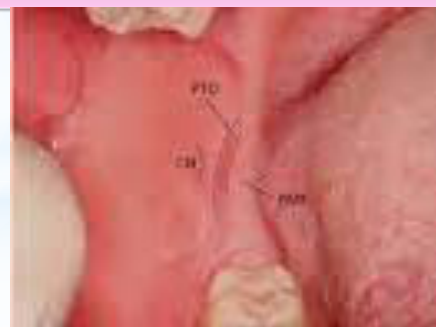


Figure 8-1 (A) Pterygomaxillary seal extends through the pterygomaxillary notch. (B) Postpalatal seal extends medially from one tuberosity to the other. (C) Posterior palatal seal area lies between the anterior and posterior vibrating lines.



❖ **Medial palatal raphe** which overlies medial palatal suture contain little or no submucosa and will tolerate little or no compression. The seal area narrows down in the midpalatine area due to the scarcity of connective tissue and the prominence of posterior nasal spine. Frequently formed at the junction of the aponeurosis and the posterior nasal spine is a narrow bundle similar to a ligament. The posterior palatal seal is not placed over this narrow area. If the torus palatini extend to the bony limit of the palate leaving little or no room to place the PPS then its removability is indicated

- ❖ **Fovea palatina** are two glandular opening within the tissue posterior of hard palate lying on the either side of midline.
- ❖ Fovea palatina should be used only as a guideline for the placement of posterior palatal seal (**It passes about 2mm in front of the fovea palatine**).

❖ **Physiological consideration:**

- ❖ **Saliva:** Presence of thick ropy saliva can create hydrostatic pressure in the area anterior to the posterior palatal seal, resulting in a downward dislodging forces.

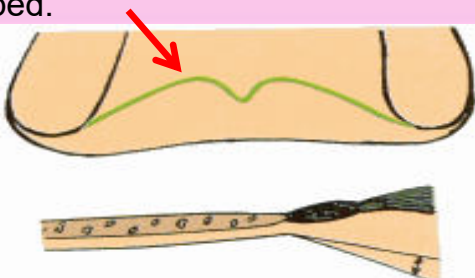
❖ **Vibrating line:** An imaginary line across the posterior part of the soft palate marking the division between the movable and immovable tissues; this line can be identified when the movable tissues are functioning.

**1. Anterior vibrating line:** It is an imaginary line lying at the junction between the immovable tissues over the hard palate and the slightly movable tissue of the soft palate

**2. Posterior vibrating line:** It is an imaginary line at the junction of the aponeurosis of the tensor veli palatine muscle and the muscular portion of the soft palate,

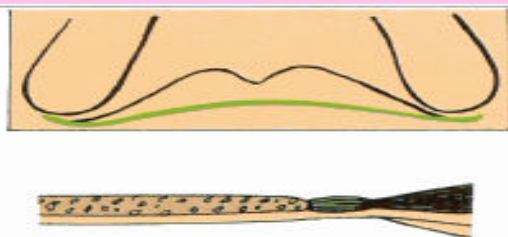
**Methods of location of anterior vibrating line (AVL):**

It is visualized while instructing the patient to say "AH" with short vigorous bursts due to projection of the posterior nasal spine. It represents demarcation between the hard palate that has no movement and movable (limited) tissue of soft palate. The anterior vibrating line is not a straight line between both hamular processes. The AVL is cupid's bow shaped.



**Methods of location of Posterior vibrating line (PVL):**

It is visualized while instructing the patient to say 'ah' in short bursts in a normal unexaggerated fashion. It represents demarcation between the part of soft palate that has limited or shallow movement during function and the remainder of the soft palate that is markedly displaced during functional movement. The posterior vibrating line marks the most distal extension of the denture base.



### Classification of soft palate:

According to House classification:

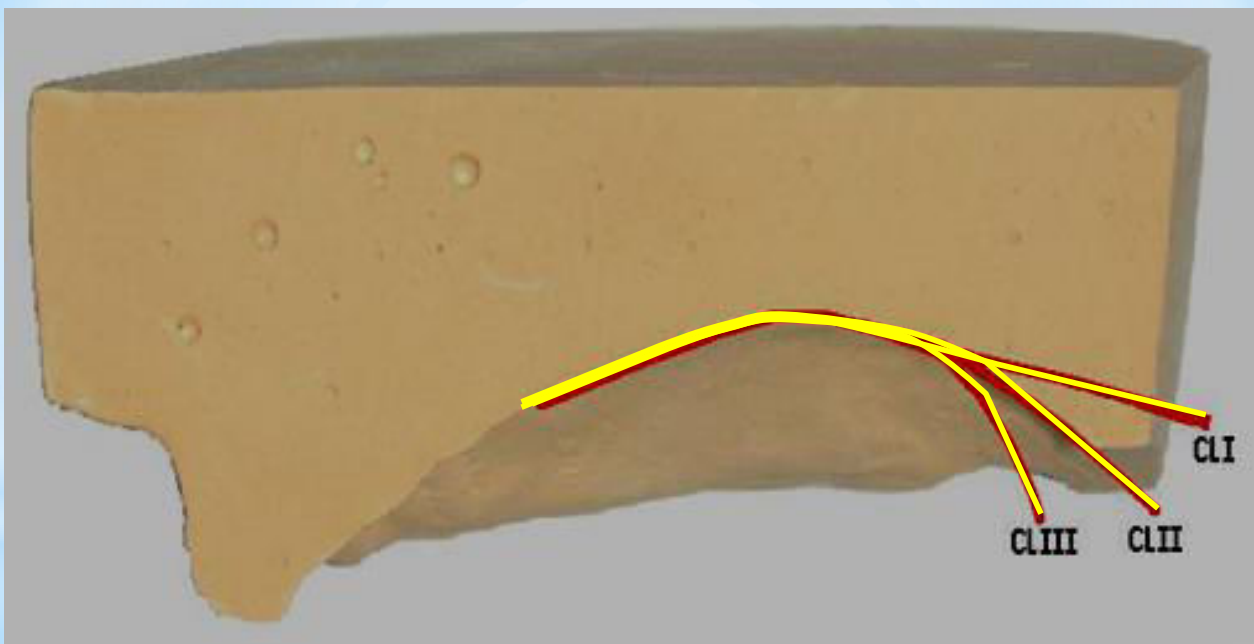
**Class I:** It indicates soft palate that is rather horizontal as it extends posteriorly with minimum muscular activity. There is considerable separation between anterior and posterior vibrating line, thus having a wide PPS area yielding more retentive denture base.

**Class II:** The soft palate gradually slopes from the hard palate. Overextension of the posterior limit of the denture can be tolerated to some extent. Palatal contour lies between class I and class III.

**Class III:** The soft palate abruptly slopes from the hard palate. Hence, the posterior limit of maxillary denture remains very critical. It is seen in conjunction with a high V shape palatal vault. There is a few mm separation of anterior and posterior vibrating line thus there is a small PPS area and less retention.

**Class I :** easiest to tolerate, broadest range, hardest to locate.

**Class II :** most common **Class III –** easiest to locate, hardest to tolerate



### **Designs of the posterior palatal Seal area**

Winland and Young surveyed the commonly employed posterior palatal seal designs and summarized them as follows:

1. A bead posterior palatal seal
2. A double bead posterior palatal seal
3. A butterfly posterior palatal seal
4. A butterfly posterior palatal seal with a bead on the posterior limit
5. A butterfly posterior palatal seal with the hamular notch area cut to half the depth of a no. 9 bur
6. A posterior palatal seal constructed in reference to House's classification of palatal forms:

**Class I:** A butterfly shaped posterior palatal seal with 3-4 mm wide.

**Class II:** A butterfly shaped posterior palatal seal is narrow with 2-3 mm of width.

**Class III:** A single beading made on the posterior vibrating line.

### **Methods or techniques of recording posterior palatal Seal area:**

1. Conventional approach.
2. Fluid wax technique.
3. Arbitrary scraping of master cast.



### **1. Conventional approach:**

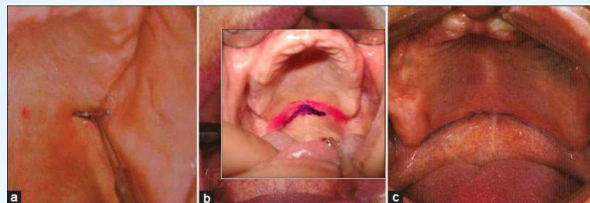
After the special tray is fabricated there are certain instructions given to the patients:-

1. To rinse with astringent mouth wash that is to remove the stringy saliva that might prevent clear transfer marking.
2. Location of pterygo-maxillary notch is done by moving the T burnisher along the posterior angle of the maxillary tuberosity until it drops into the pterygo- maxillary notch. This is necessary as there are times when small depression in the residual ridge may resemble pterygo- maxillary notch.
3. Identification of posterior vibrating line, the patient asked to say "AH" in a normal unexaggerated fashion.
4. Identification of the anterior vibration line. This is done by asking the patient to say "AH" with short vigorous bursts.

### **Procedure:**

5. A line is placed with an indelible pencil through the pterygo maxillary notch and extended 3-4 mm antero-laterally to the tuberosity area approximating the mucogingival junction, the same is done on the opposite side. This complete the out lining of pterygo maxillary seal.
6. The posterior vibrating line is marked with an indelible pencil by connection the line through the pterygomaxillary seal with line just drawn demarcation the post palatal seal.
6. The resin or shellac tray inserted into the mouth and seated firmly to place, so that upon removal from the mouth the indelible lines will be transferred to the tray.
7. Sometimes it is necessary to redefine transfer marking. The tray is return to master cast to complete the transfer of the complete posterior border.
8. The tray is trimmed until the posterior vibration line so that it decides the posterior extent of denture border.

9. Returning to the mouth the palatal fissure are palpated with the 'T' burnisher or mouth mirror to determine their compressibility in width and depth.
10. The termination of glandular tissue usually coincides with the anterior vibrating line.
11. The anterior vibrating line now marked and transferred to master cast. This will complete the transferring of the outline of posterior palatal seal area.
12. The visual outline is in the shape of cupid bow, the area between the anterior-posterior vibrating lines is usually narrowest in the mid palatal region because of the projection of the posterior nasal spine.
13. Carving of the master cast is done using a Kingsley scraper. Deepest areas are located on either sides of the midline, one-third the distance anteriorly from the PVL, depth of 1-1.5 mm is carved. The tissues covering the Mid-palatal raphe are scored to a depth of 0.5-1 mm because it contain little sub mucosa and cannot withstand same compressive force as the tissue lateral to it. As the seal approaches the anterior vibrating line there is just a slight scraping of the cast. Just posterior to the deepest portion of the seal, it is tapered again towards the PVL. Failure to taper the seal posteriorly led to tissue irritation.



**Advantages of this technique:**

1. The trail base will be more retentive .
2. This can produce more accurate maxillo mandibular records.
3. Patient will be able to experience the retentive qualities of the trail base, giving them the psychologic security of knowing that retention will not be a problem in the completed prosthesis.
4. The practioner will be able to determine the retentive qualities of the finished denture.
5. The new denture wearer will be able to realize the posterior extent of the denture which may ease the adjustment periods.

**Disadvantages:**

1. It is not a physiologic technique and therefore depends upon accurate transfer of the vibrating lines and careful scraping of the cast.
2. The potential for over compression of the tissue is great.

**2- Fluid wax technique (functional technique or physiological technique):**

All of the procedure remain the same as conventional technique that is transfer location and transfer marking of the anterior and posterior vibrating line.

**The marking are recorded in final impression.** ZOE/impression plaster (not with elastomeric impression material as they are resilient, non-adherent to wax, and distort wax when reseated into oral cavity).

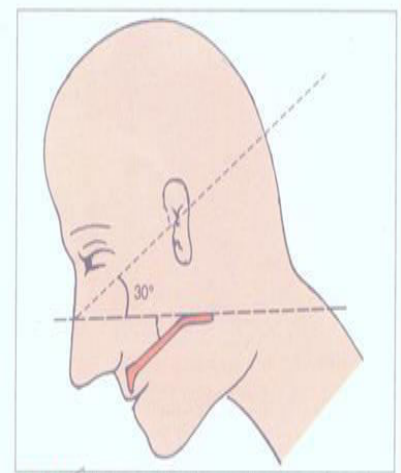
**One of the four type of wax can be used for this technique:-**

1. Iowa wax white
- 2- Adaptol green wax.
3. Korecta wax no. 4 (orange).
4. K.L physiologic paste (yellow-white).

These waxes are designed to flow at mouth temperature. The melted wax is painted into the impression surface and in the outline at seal area, usually the wax is applied in slightly excess of the estimated depth and allowed to cool to below mouth temperature to increase its consistency and make it more resistant to flow. The impression is carried to the mouth and held in place under gentle pressure for 4-6 min and allow time for the material to flow.

### Patient position during impression making of palatal seal area:

An impression should be made when the patient is seated in upright position with head flexed 30 degree forward, below FH ( Frankfort) plane to allow the soft palate to reach its functionally depressed position. The patients tongue should be placed under tension against either the handle of the impression tray or the dentist's finger which is held in the region of the upper maxillary incisors. After 4 min remove impression tray, if the tissue contact has been established it will appear glossy. Trim excess (or) if no tissue contact is established then add and redo the procedure. A Secondary impression is reinserted and held for 3-5 minutes under gentle pressure followed by 2-3 minutes of firm pressure applied to mid palatal area of the impression tray, upon removal of tray from the mouth it is carefully examined to see wax terminate in feathered edge near the anterior vibrating line.



**Fig. 7.19:** While recording the postdam, the patients head should be tilted downwards by 30°. The blue dotted line shows the Frankfort's plane. Notice that the soft palate hangs down in this position.

### Advantages:

- It is physiologic technique displacing tissues within their physiologically acceptable limits.
- Over compression of tissue is avoided.
- Posterior palatal seal is incorporated into the trail denture base for added retention.
- Mechanical scrapping of the cast is avoided.

### Disadvantages:

- More time is necessary during the impression appointment.
- Difficulty in handling the materials and added care during the boxing procedure.

### 3- Arbitrary scraping of master cast:

According to Winkler, arbitrarily mark the anterior and posterior vibrating line and scrape about 1-1.5 mm. It is the least accurate methods used to mark the posterior palatal seal. Its high potential for over post damming is due to its nature of unphysiologic technique of recording.

### ERROR IN RECORDING OF PPS

1. Under extension.
2. Over extension.
3. Under post damming.
4. Over post damming.

**1- Under extension:** This is the one of most common causes for poor posterior palatal seal. It may be produced due to one of the following reason:

1. The denture does not cover the fovea palatina, the tissue coverage is reduced and the posterior border of the denture is not in contact with the soft resilient tissue which will move along with the denture border during functional movements
2. The dentist leaves the posterior border under extended to reduce the patient anxiety to gagging.
3. Improper delineation of the anterior and posterior vibrating line.
4. Excessive trimming of the posterior border of the cast by the technician.



**2- Over extension:** Over extension of the denture can lead to:

1. Ulceration of the soft palate and painful deglutition.
  2. The most frequent complaint from the patient will be that swallowing is painful and difficult.
  3. The hamuli are covered by the denture base, the patient will experience sharp pain, especially during function.
- (Prevention): These region are trimmed with a bur and carefully polished.

**3- Under postdamming:**

1. This can occur due to improper head positioning and mouth positioning. E.g. the mouth is wide open while recording the posterior palatal seal, the mucosa over the hamular notch becomes stretched. This will produce a space between the denture base and tissue.

**Detection:** Inserting a wet denture into a patient's mouth and inspecting the posterior border with the help of mouth mirror. If air bubble are seen to escape under the posterior border it indicates under damming.

**Prevention:** The master cast can be scraped in the posterior palatal area or the fluid wax impression can be repeated with proper patient position.

#### **4- Over postdamming:**

1. This commonly occur due to excess scraping of the master cast. It occur more commonly in the hamular notch region. Pterygo maxillary seal area then upon insertion of the denture the posterior border will be displaced inferiorly.

**Prevention:** Reduction of the denture border with a carbide bur, followed by lightly pumicing the area while maintaining its convexity.

#### **Addition of posterior palatal seal to existing denture:**

Existing denture may have poor length and depth of PPS. Properly examine existing dentures. If there are other problems in the dentures (vertical dimension, centric, esthetics etc.) then new dentures are to be made. If only PPS is short then correction should be undertaken. Different authors using different materials have advised various techniques.

Moghadam and Scandrett advised the use of fluid wax technique for recording posterior palatal seal and addition of posterior palatal seal with auto polymerizing acrylic resin. A similar technique using softened greenstick modeling compound has been suggested by Carrol and Shaffer.

#### **Other suggested materials for correction of PPS include:**

1. Heat cured acrylic resin material.
2. Self cured acrylic resin.
3. Light cured resin.

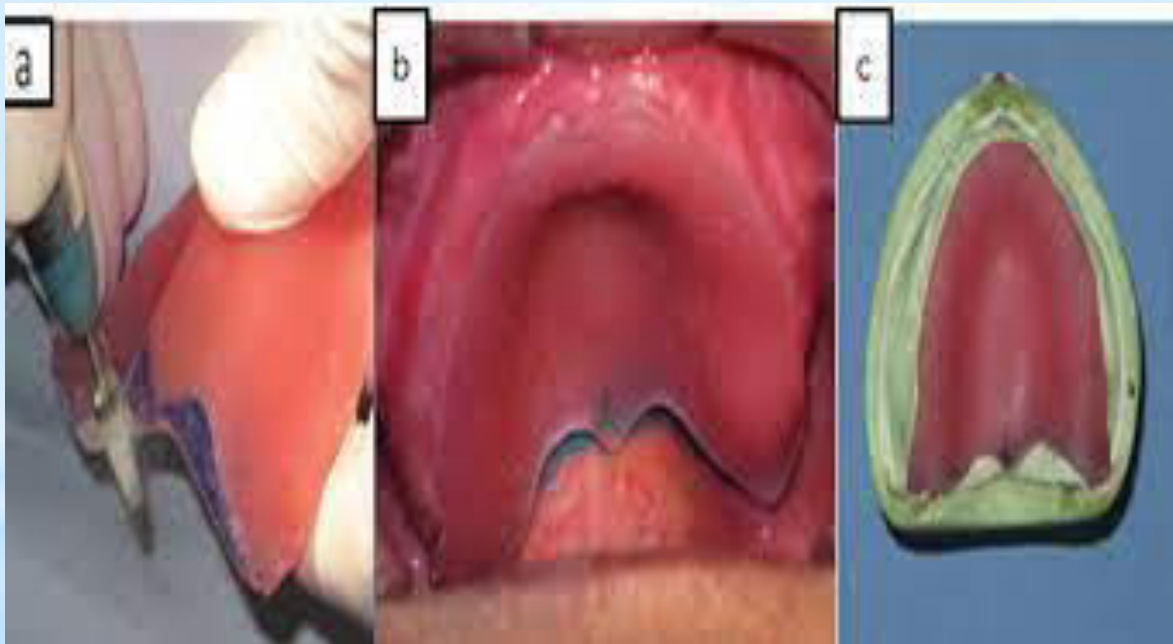
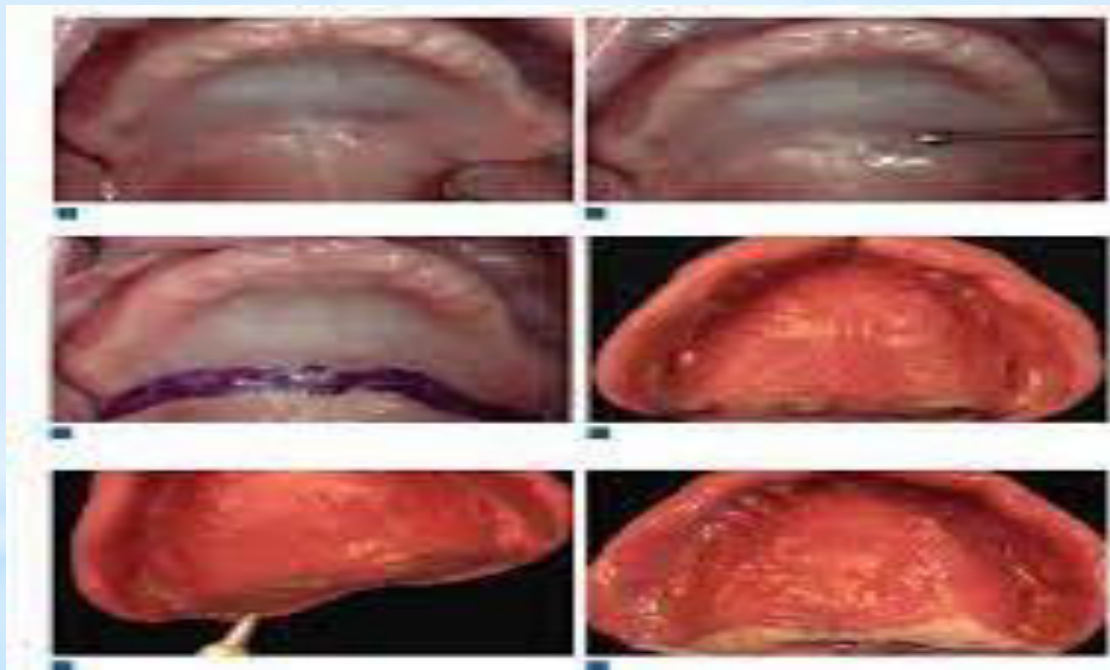
### **When to record PPS:**

There are two schools of thought as to when to record PPS:

1. Before try in - provide the patient with psychological confidence.
2. After try in to prevent possible mechanical displacement of the trial base by the tissues, which result in an inferior placement of the posterior segment of the denture base leading to occlusal error in 2nd molar region due to improper seating of bases during jaw relation.

Orally, the area of the vibrating line is recorded by making marks with an indelible transfer stick in the fovea palatina area and the hamular notch areas on both sides of the palate and then connecting them with a solid line.





## Post Insertion Denture Problems

Post-insertion treatment is that phase of the complete denture procedure that involves any necessary alteration of the dentures, tissue treatment and patient education, to provide patients with comfortable dentures that provide maximum function without irritation to the oral tissues and further educate the patient to successfully master them.

Ideally, the first post-insertion visits should be approximately 24 hours after insertion of the dentures. In this situation, the patient is instructed not to remove the dentures during this period. If the patient cannot be seen for several days after the first insertion, he should be instructed to remove the dentures if there is any severe discomfort. However, he should reinsert the dentures for at least 6-8 hours before the next appointment.

At the first post-insertion appointment, the patient is asked to relate his experience. The operator should then remove the dentures and examine the tissues, especially those areas noted by the patient. Observe for inflamed or ulcerated areas and areas painful to palpation. After correcting any problems the patient should be given an appointment at the 72-hour post insertion point (48 hours after first appointment). Successive visits should be encouraged at the discretion of the patient until all problems are corrected as determined by the dentist.

For many patients, three adjustments are sufficient to make them comfortable with their new denture.

Patients must understand that even the best dentures are only about 30% as efficient as natural teeth. It is the patient's responsibility to learn how to use them efficiently within their limits of performance.



**The usual areas liable for ulceration are :**

**In the upper jaw**

1. Hamular notch.
2. Post-dam area.
3. Labial frenum.

Ulceration in the hamular notch and post dam area causes sore throat.

**In the lower jaw**

1. Lingual pouches of the mylohyoid region because of the presence of muscle undercuts. The patient may complain from sore throat.
2. Labial frenum.
3. Sublingual region since it is a movable area.

**Classification of Post-Insertion Denture problems :**

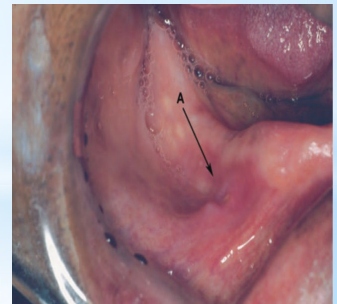
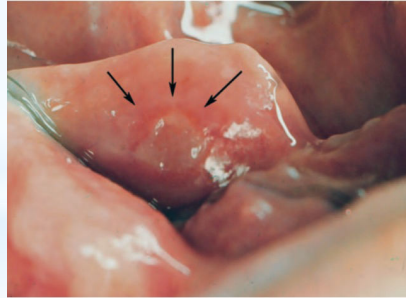
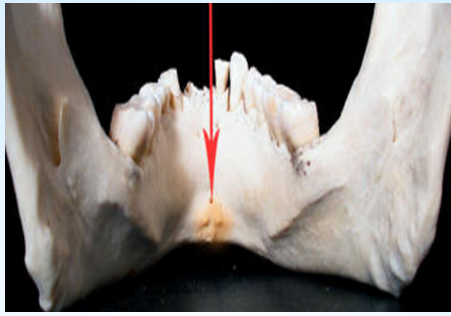
- I. Complaints about comfort of the denture
- II. Complaints about function of the denture
- III. Complaints about esthetics
- IV. Complaints about phonetics

## 1. Complaints about comfort of the denture:

1. Sore spot
2. Burning sensation
3. Redness
4. Pain in TMJ
5. Tongue and cheek biting
6. Swallowing & sore throat
7. Nausea and gagging
8. Clicking of teeth
9. Fatigue of the muscles of mastication

## 1. Sore spot

|                                                       |                                     |                                                                                                |
|-------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------|
| ❖ Sore spots in the vestibule                         | a- Overextension .                  | Adjust denture (disclosing wax).                                                               |
|                                                       | b- Unpolished or sharp edge.        | Polish denture borders.                                                                        |
| ❖ Sore spots posterior limit of the maxillary denture | a- Posterior palatal seal too deep. | Identify area with pressure indicating paste and relief high pressure area.                    |
|                                                       | b- Sharp posterior palatal seal.    | Round off sharp areas.                                                                         |
|                                                       | c- Overextension.                   | Adjust peripheral extension                                                                    |
| ❖ Single sore spots over ridge.                       | a- High occlusion in that area      | Adjust denture (disclosing wax).                                                               |
|                                                       | b- Bubbles of acrylic .             | Inspect the denture under good light to detect surface roughness then remove & polish lightly. |





|                                                       |                                                                   |                                                                                                                                                                    |
|-------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ❖ Soreness under labial flange                        | a- Excessive overbite.                                            | Reseat maxillary anterior teeth.                                                                                                                                   |
|                                                       | b- Habit-mastication in protrusive relation .                     | Train the patient to masticate in centric relation                                                                                                                 |
|                                                       | c- Overextended labial flange.                                    | Adjust peripheral extension.                                                                                                                                       |
| ❖ Soreness under lingual flange of mandibular denture | a- CO not on harmony with CR (drives mandibular denture forward). | If only slight, if can be corrected, record, remounting & selective grinding                                                                                       |
|                                                       | b- Overextended lingual flange                                    | Apply pressure indicating paste to denture periphery, adjust peripheral extension.                                                                                 |
| ❖ Generalized soreness over the alveolar ridge.       | a- Excessive vertical dimension                                   | If the occlusal plane of the upper is judged to be correct, make a new lower denture to the decreased vertical dimension, otherwise, new upper and lower dentures. |
|                                                       | b- Inaccurate denture base.                                       | Dentures can be rebased if the occlusion is adequate.                                                                                                              |



## 2. Burning sensation :

|                                                    |                                             |                               |
|----------------------------------------------------|---------------------------------------------|-------------------------------|
| a- Anterior hard palate & anterior alveolar ridge. | Pressure over the anterior palatine foramen | Relief over the foramen.      |
| b- Premolar to molar area,                         | Pressure on the posterior palatine foramen, | Relief area over the foramen. |
| c- Lower anterior ridge,.                          | Pressure on the mental foramen              | Relief over the foramen.      |

## 3. Redness :



**Allergy to denture.**

Remake the denture & use metallic denture base.

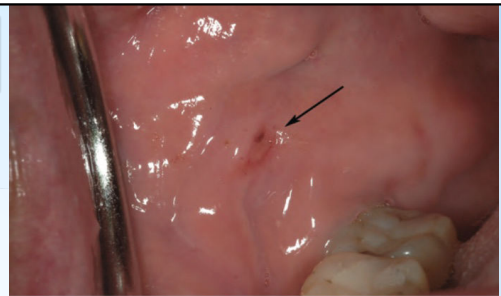
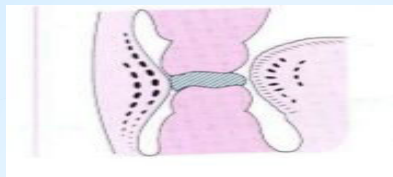
|                                                                                  |                      |                                |
|----------------------------------------------------------------------------------|----------------------|--------------------------------|
| a- Fiery redness of all tissues contacted by denture, including tongue & cheeks. | Denture base allergy |                                |
| b- Redness of the denture bearing tissues.                                       | Ill-fitting denture  | Remake or rebase the denture   |
| c- Avitaminosis.                                                                 |                      | Employ vitamin therapy regime. |



## 4. Pain in TMJ :

|                                                  |                                          |
|--------------------------------------------------|------------------------------------------|
| 1. Insufficient vertical dimension of occlusion. | Increase vertical dimension.             |
| 2. CO not in harmony with CR.                    | .Correct occlusion by selective grinding |
| 3. Arthritis                                     | Treat with analgesics.                   |

## 5. Tongue and cheek biting :



|                                                                                          |                                                                                               |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1. Posterior teeth edge to edge (insufficient horizontal overlap).                       | Re-contour buccal surface of mandibular molars & premolars to increase the horizontal overlap |
| 2. Over-closure.                                                                         | Restore the vertical dimension                                                                |
| 3. Changes in the occlusal plane leading to cheek & tongue biting.                       | New denture with proper occlusal height                                                       |
| 4. Posterior teeth too far buccal leading to cheek biting.                               | Re-contour buccal surface of the upper molars.                                                |
| 5. Posterior teeth too far lingual (reduction of tongue space) leading to tongue biting. | Re-establish adequate tongue space.                                                           |

## 6. Swallowing & sore throat :

|                                                              |                                                        |                                       |
|--------------------------------------------------------------|--------------------------------------------------------|---------------------------------------|
| A. Maxillary denture :                                       | 1- Over extension of posterior border.                 | Adjust posterior border extension.    |
|                                                              | 2- Too thick posterior border.                         | Reduce thickness                      |
| B. Mandibular denture :                                      | 1- Overextension of the posterior lingual flange area. | adjust posterior lingual flange area. |
|                                                              | 2- Too thick lingual posterior flanges.                | Reduce thickness                      |
| C. Insufficient vertical dimension of occlusion.             |                                                        | Increase vertical dimension.          |
| D. Excessive vertical dimension of occlusion                 |                                                        | Reduce vertical dimension.            |
| E. Posterior teeth set inside the ridge (tongue is crowded). |                                                        | Re-set teeth in correct position.     |

## 7. Nausea and gagging :

|                                                         |                                                                                    |                                |                                           |
|---------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------|
| 1- Immediately upon denture placement.                  | A. Maxillary denture :                                                             | 1- Over extension              | Adjust denture                            |
|                                                         |                                                                                    | 2- Too thick posterior border. | thin posterior border.                    |
|                                                         | B- Mandibular denture :                                                            | Distolingual Flange too thick. | Reduce thickness of disto-lingual flange. |
|                                                         | C- Psychogenic factors.                                                            |                                |                                           |
| 2- Delayed (2 weeks to months) after denture placement. | A. Incomplete border seal allowing saliva under the denture Improve border seal.   |                                | Correct occlusion.                        |
|                                                         | B. Faulty occlusion causing denture to loosen & allowing saliva under the denture. |                                | Correct occlusion.                        |

## 8. Clicking of teeth :

|                                        |                                   |
|----------------------------------------|-----------------------------------|
| A. Increased vertical dimension        | Increase vertical dimension.      |
| B. Cuspal interference.                | Reduce vertical dimension.        |
| C. Poor retention of the lower denture | Re-set teeth in correct position. |
| D. Using porcelain teeth               |                                   |

## 9. Fatigue of the muscles of mastication :

|                                                  |                              |
|--------------------------------------------------|------------------------------|
| 1. Excessive vertical dimension of occlusion.    | Reduce vertical dimension.   |
| 2. Insufficient vertical dimension of occlusion. | Increase vertical dimension. |

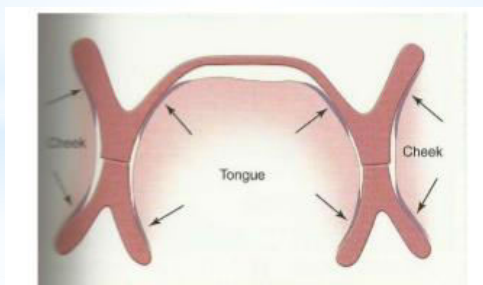
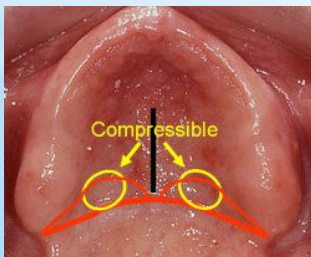
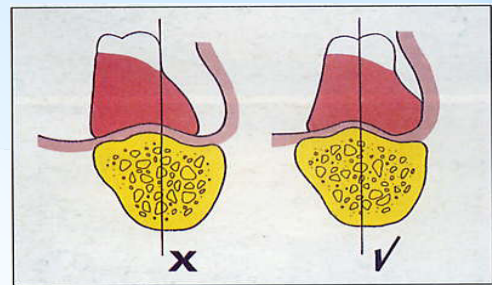
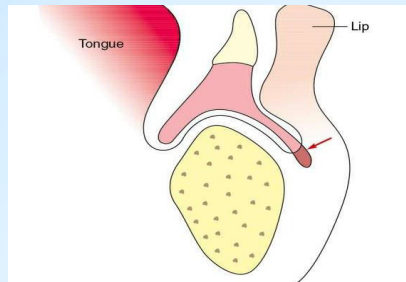
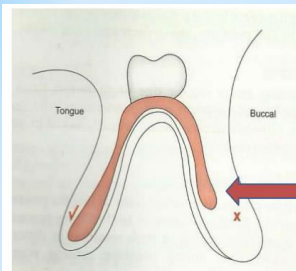


## II. Complaints about function of the denture:

1. Loose denture (poor retention)
2. Unstable denture
3. General feeling dentures are not right, but with absence of pain

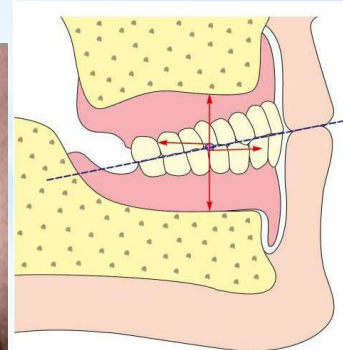
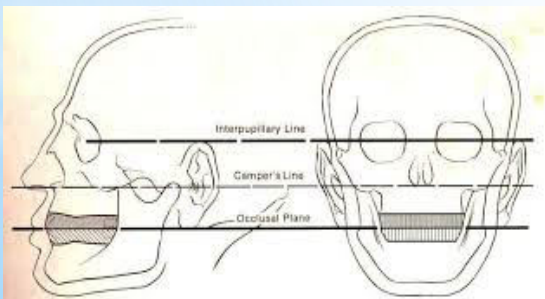
### 1- Loose denture (poor retention) :

|                                                     |                                                  |
|-----------------------------------------------------|--------------------------------------------------|
| A. Inadequate border seal.                          | Test with green stick. Add to or reline denture. |
| B. Overextension of denture flange.                 |                                                  |
| C. Excessively thick denture flange.                | Reduce and raconteur to permit normal function.  |
| D. Underextention of denture flange.                | Re-set teeth in correct position.                |
| E. Inadequate post dam (for the upper denture).     | Test with green stick. Add to or reline denture. |
| F. Perforated denture base.                         | Repair by addition.                              |
| G. Flabby tissues displaced when making impression. |                                                  |
| H. Dehydration of tissues due to lack of saliva.    |                                                  |



## 2- Unstable denture :

|                                              |                                                  |
|----------------------------------------------|--------------------------------------------------|
| A. Under-extension of denture.               | Test with green stick. Add to or reline denture. |
| B. Excessively increased vertical dimension. | Reduce or reset teeth or remake denture.         |
| C. Improper placement of occlusal plane.     | remake denture.                                  |
| D. Errors in occlusion.                      |                                                  |





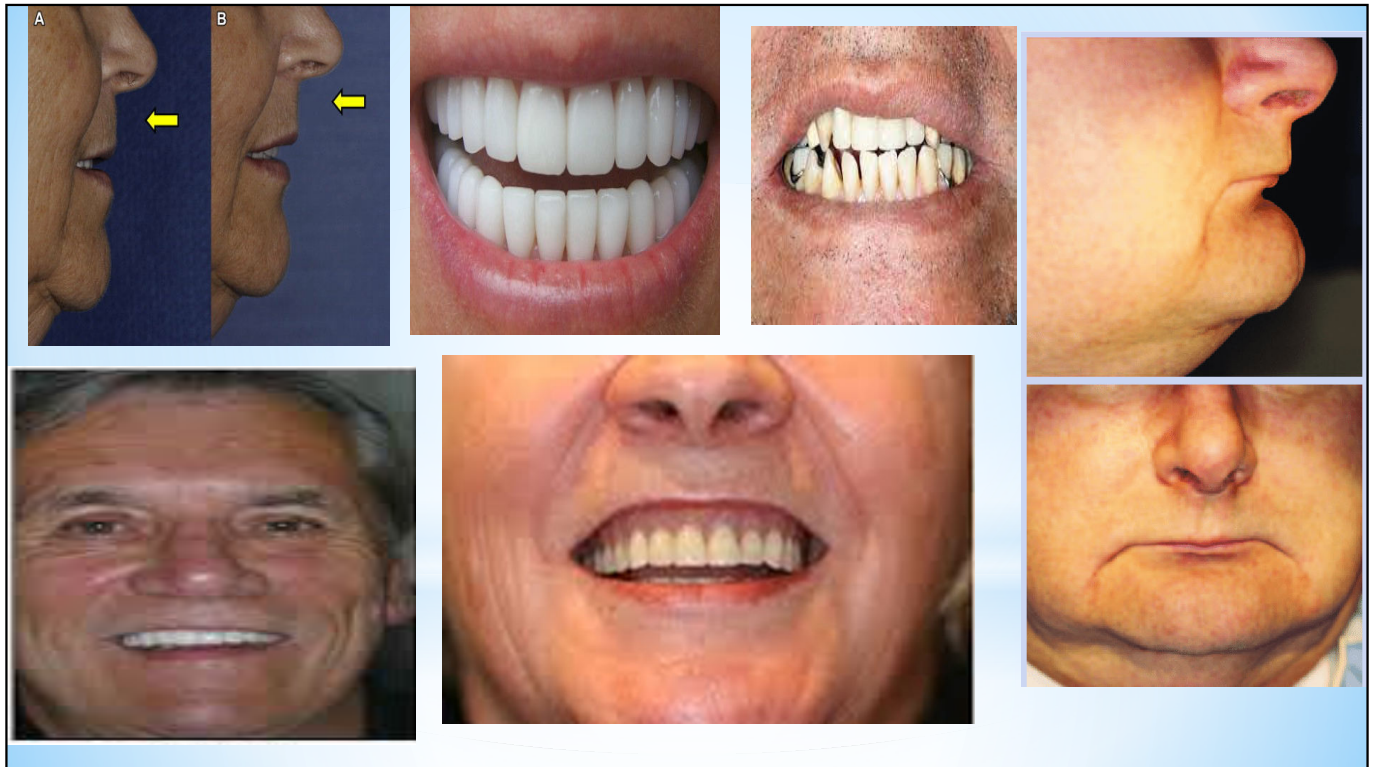
### 3- General feeling dentures are not right, but with absence of pain :



|                                                              |  |
|--------------------------------------------------------------|--|
| 1. Mal-occlusion                                             |  |
| 2. Centric occlusion is not in harmony with centric relation |  |
| 3. Incorrect vertical relation of occlusion                  |  |

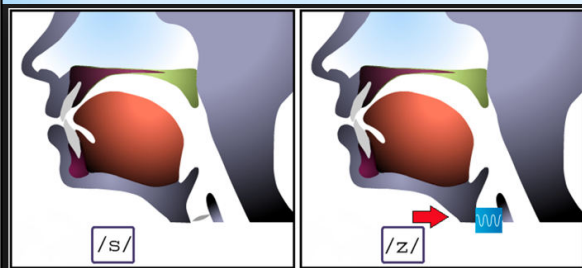
### III. Complaints about esthetics :

|                                                 |                                                                                                                                                                                                                                                                          |                                                                        |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 1. Fullness under nose.                         | Labial flange of upper too long or too thick.                                                                                                                                                                                                                            | Reduce length or thickness of labial flange.                           |
| 2. Depressed philtrum and/or nasolabial sulcus. | Labial flange too short, too thin.                                                                                                                                                                                                                                       |                                                                        |
| 3. Upper lip sunken in.                         | upper anterior teeth too far lingual.                                                                                                                                                                                                                                    |                                                                        |
| 4. Shows too much of the teeth:                 | a- Vertical dimension too great<br>b- Incisal plane too low                                                                                                                                                                                                              |                                                                        |
| 5. Artificial look :                            | a- Technique set-up, the teeth are in too regular alignment (individualize by rotating and shortening some teeth)<br>b- All teeth same shade.<br>c- Lack of grinding incisal edges and angles.<br>d- Lack of individualizing gingival contours and color of denture base | Grind incisal edges & angles to give a more individualized appearance. |

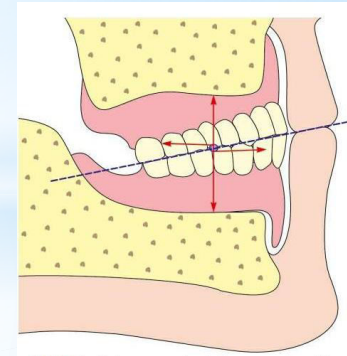
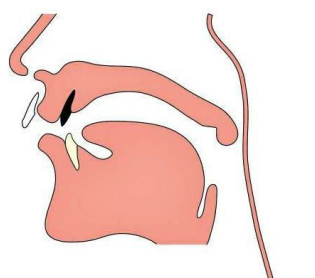
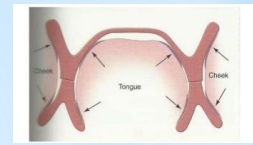
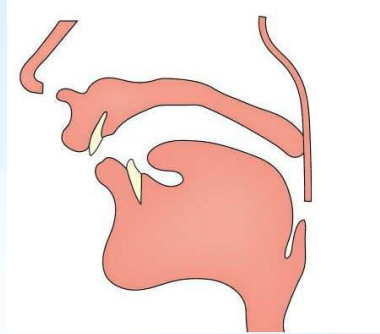


#### IV. Complaints about phonetics :

|                                     |                                                                              |
|-------------------------------------|------------------------------------------------------------------------------|
| 1. Whistles on "S" sounds.          | Too narrow an air space on the anterior part of the palate.                  |
| 2. Lisp on "S" sounds.              | Too broad and air space on the anterior part of the palate                   |
| 3. "Th" and "T" sounds indistinct.- | Inadequate inter-occlusal distant                                            |
| 4. "T" sounds like "Th".            | Upper anterior teeth too far lingual                                         |
| 5. "F" and "V" sounds indistinct.   | Improper position of upper anterior teeth either vertically or horizontally. |



- The **front of the tongue** is raised closer to the tooth ridge (gum)
- Watch that the **vocal cords vibrate** for /z/



## Oral Mucosal Lesions Induced by Removable Dentures

Lesions of the oral mucosa associated with the wearing of removable dentures may represent acute or chronic reactions to microbial denture plaque, a reaction to constituents of the denture base material or a mechanical denture injury.

### Causes of Mucosal Irritation

1. Mechanical irritation by denture
2. Accumulation of microbial plaque on denture
3. Toxic or allergic reaction to constituents of denture material



Local irritation of mucosa, increase mucosal permeability to allergens or microbial antigen.

**Types of these lesions (Oral Mucosal Lesions Induced by Removable Dentures):**

### **1. Denture stomatitis : also termed :**

- ◆ Denture sore mouth
- ◆ Denture- induced stomatitis
- ◆ Chronic atrophic candidiasis
- ◆ Candida-associated denture induced stomatitis
- ◆ Denture-associated erythematous stomatitis

Is a common condition where mild inflammation and redness of the oral mucous membrane occurs beneath a denture. In about 90% of cases, Candida species are involved. This is normally a harmless component of the oral microbiota in many people.

It is usually painless and asymptomatic. The appearance of the involved mucosa is erythematous (red) and edematous (swollen).

## **Classification of Denture stomatitis**

The Newton classification divides denture-related stomatitis into three types based on severity. Type one may represent an early stage of the condition, whilst type two is the most common and type three is uncommon.

- ❖ **Type 1 - Localized inflammation or pinpoint hyperemia**
- ❖ **Type 2 - More diffuse erythema (redness) involving part or all of the mucosa which is covered by the denture**
- ❖ **Type 3 - Inflammatory nodular/papillary hyperplasia usually on the central part of hard palate and the alveolar ridge. This type often is seen in association with type 1 or type 2.**



**This condition is multifactorial, the causes include :**

1. Ill fitted denture.
2. Disharmonious occlusion.
3. Nutritional deficiencies.
4. Poor oral hygiene.
5. Candidal infection.
6. Wearing the denture continuously.

## **2. Angular Cheilitis**

Angular cheilitis also called (angular stomatitis) is inflammation of one or both of the corners (angles) of the mouth. There are many possible causes, including:

- ◆ Nutritional deficiencies (iron, B vitamins, folate)
- ◆ Contact allergy
- ◆ Infection (Candida albicans, Staphylococcus aureus or  $\beta$ -hemolytic streptococci, often with overclosure of the mouth and associated with denture-related stomatitis.





### 3. Flabby ridge

Also called alveolar fibrosis i.e. removable and extremely resilient alveolar ridge, is due to replacement of bone by fibrous tissue, in a generalized and localized form, it is seen most commonly in the anterior part of the maxilla, particularly when there are remaining anterior teeth in the mandible, flabby ridges provide poor support for the denture, so the tissue should be removed surgically to improve the stability of the denture and to minimize alveolar ridge resorption.



### 4. Denture irritation hyperplasia

A common tissue reaction to ill-fitting denture is the occurrence of tissue hyperplasia of the mucosa in contact with denture border. They includes :

A- Epulis fissuratum



B- Papillary hyperplasia.



**A- Epulis fissuratum :** usually asymptomatic and clinically appear as numerous folds or highly vascular tissue in the labial or buccal vestibule and ulceration might occur at the mucobuccal fold commonly in the maxillary arch. Usually it occur as a result of reduction of the residual alveolar ridge especially in case of immediate denture when bone loss is rapid and the patient fail to make a new denture or relining within 6 months and due to the overextended flanges of the denture.

Its treatment include conservative or surgical treatments. **The conservative treatment include :**

- 1- Using of tissue conditioning material with shortening & smoothening the overextended denture border.
- 2- Construction of a new denture with relief of pressure areas on these lesions.
- 3- Massage of the tissue with a piece of gauze .

**B- Papillary hyperplasia :** or nodular hyperplasia appears as multiple nodules in the palate under maxillary denture. The causes are:

- 1- in patients having a relief chamber for retention.
- 2- if the patient wearing the denture continuously. 8

**The treatment include :**

- a- using tissue conditioning material.
- b- Construction of a new denture with relieve of pressure areas on these lesions.

## 5- Traumatic ulcer

Or sore spots, most commonly develop within 1-2 days after insertion of new denture. Appear either as red area (erythema) or with even break of continuity of the epithelium, the associated symptom is slight to sever pain depending on the pain threshold of the patient.

### The possible causes are :

- overextended denture.
- When the mucosa is squeezed between spinus bone and denture base (pressure area).
- Rough surface of the denture.
- Inharmonious occlusion may cause scattered traumatic ulcers.



## 6- Burning Mouth Syndrome

Burning mouth syndrome (BMS) is a chronic, painful condition characterized by burning sensations in the tongue, lips, palate (roof of the mouth), gums, inside of the cheeks and the back of the mouth or throat. Oral mucosa appear healthy , Feeling of dry mouth with persistent altered taste perception , Headache , irritability, depression. burning mouth syndrome appears to affect women seven times more often than men. Often appears for the first time in association with the placement of new denture.



### **7- Hypersensitivity**

Very rare, induced by continuous or frequent repeated exposure to an allergic substance. The patient complains from swollen tissue underneath the denture, sometimes accompanied by a metallic taste. This allergic reaction may be early (anaphylactic reaction )or delayed reaction. To diagnose this condition we do the patch test for the skin. The condition is treated by change the denture base material other than methacrylate like (Cr/ Co) base denture.

## Residual Ridge Resorption (RRR)

**Residual bone:** That component of maxillary or mandibular bone that remains after the teeth are lost.

**Residual ridge:** The portion of the residual bone and its soft tissue covering that remains after the removal of teeth

**Residual ridge crest:** The most prominent continuous surface of the residual ridge, not necessarily coincident with the center of the ridge;

**Residual ridge resorption:** Is a term used for the diminishing quantity and quality of residual ridge after teeth are extracted. It is a chronic, progressive and irreversible process with the rate being fastest in the first 6 months after extraction. The size of the residual ridge is reduced most rapidly in the first six months, but the bone resorption activity of the residual ridge continues throughout life at a slower rate, resulting in removal of a large amount of jaw structure. This unique phenomenon has been described as residual ridge reduction.

Post tooth extraction, a cascade of inflammatory reactions is immediately activated, and the extraction socket is temporarily sealed by blood clotting. Epithelial tissues begin its proliferation and migration within the first week and the disrupted tissue integrity is quickly restored. Histologic evidence of active bone formation in the bottom of the socket is seen as early as **2 weeks** after the extraction and the socket is progressively filled with newly formed bone in about 6 months. **The most striking feature of the extraction wound healing is that even after the healing of wounds, the residual ridge alveolar bone undergoes a lifelong catabolic remodeling.**

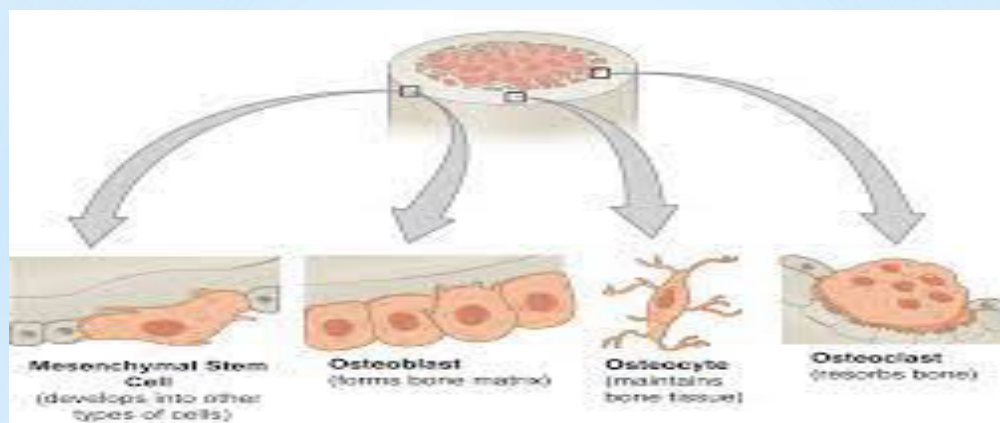
The rate of RRR is different among persons and even at different times and sites in the same person.



A basic concept of bone structure and its functional elements must be clear before bone resorption can be understood.

### The structural elements of bone are:

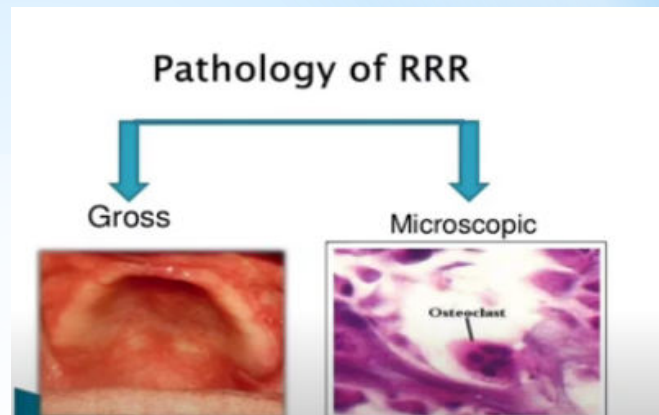
- 1. Osteocytes:** These are cells responsible for metabolic activity of bone.
- 2. Intercellular substance or bone matrix consisting of fibrils or called Calcified cementing substance:** The calcified cementing substance consists mainly of polymerized glycoprotein. Mineral salts namely calcium carbonate and phosphates are bound to these protein substances.
- 3. Osteoblasts:** Osteoblasts, by their function of forming and calcifying the intercellular substance, are the active bone forming cells. The osteoblasts surround the bone in a continuous layer. In the course of bone formation, some osteoblasts get engulfed in the intercellular substance and become osteocytes.
- 4. Osteoclasts:** Osteoclasts are the cellular components of bone that are responsible for bone resorption. Bone resorption always requires the simultaneous elimination of the organic and inorganic components of the intercellular substance.



Alveolar bone has two structural characteristics: **A hard compact outer layer** is superimposed on a **spongy some what resilient substructure**. A healthy and thoroughly healed alveolar process has a layer of wear resistant compact bone of varying thickness. Beneath the compact bone is the spongy bone. The spaces between the trabeculae communicate throughout the spongy bone. Bone is constantly undergoing changes in response to replacement and functional demands.

## Pathology of RRR

1. Gross Pathology
2. Microscopic Pathology

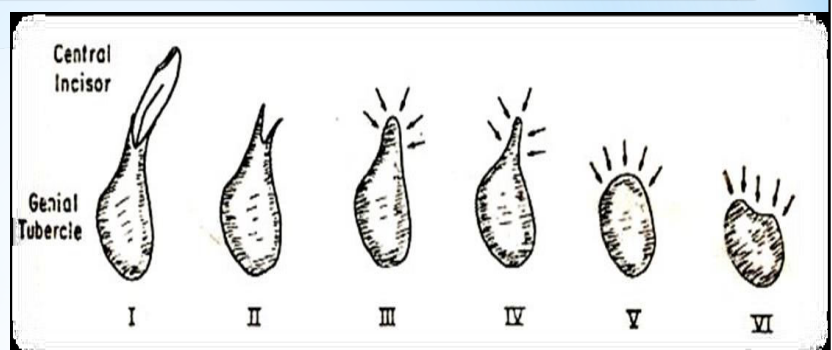


### 1. Gross Pathology:

A frequent lay expression for RRR is “My gums have shrunk”. Actually the basic change in RRR is a reduction in the size of the bony ridge under the mucoperiosteum. It is primarily a localized of bone structure. Sometimes it may leave the overlying mucoperiosteum excessive and redundant. There exists a wide variety of shapes and sizes of residual ridges.

**They are categorized into common residual ridge configuration in a system of six orders given by Atwood Order:**

- Order 1 : Pre-extraction
- Order 2 : Post extraction
- Order 3 : High, well rounded
- Order 4 : Knife-edge
- Order 5 : Low, well rounded
- Order 6 : Depressed



RRR does not stop with residual ridge, but may go well below where apices of teeth were, sometimes leaving only a thin cortical plate on the inferior border of the mandible or virtually no maxillary alveolar process of the upper jaw. In clinical examination usually one can visually judge the residual ridge form. However, sometimes a knife-edge ridge may be masked by redundant or inflamed soft tissues.

## 2. Microscopic Pathology:

Microscopic studies have revealed **osteoclastic activity** on the external surface of the crest of residual ridges. The scalloped margins of Howships lacunae sometimes contain visible osteoclasts which cause bone resorption. There exists a wide variation in the **configuration, density and porosity** of the residual ridges, sometimes even with evidence of osteoporosis.

Studies have shown the presence of **new bone** and reversal lines inside the residual ridge and minute areas **of bony repair on the periosteal side** in some specimens. The mucoperiosteum shows **varying degrees of keratinization**, acanthosis, **edema** and architectural pattern of mucosal epithelium in the same mouth and between subjects. Similarly, **varying degrees of inflammatory cells** are found in areas that appear from clinically normal to frankly inflamed in edentulous patients or who were denture or non-denture wearers. Inflammatory cells include **lymphocytes** and **plasma cells**. There exists proximity of **small blood vessels** to area of bone resorption.

## Pathogenesis of RRR:

Immediately following the extraction (order II), any sharp edges remaining are rounded off by external osteoclastic resorption, leaving a high well rounded residual ridge (order III). As resorption continues from the labial and lingual aspects, the crest of the ridge becomes increasingly narrow ultimately becoming knife-edged (order IV). As the process continues, the knife-edge becomes shorter and even eventually disappears, leaving a low well rounded or flat ridge (order V). Eventually, this too resorbs, leaving a depressed ridge (order VI). **RRR is chronic, progressive, irreversible and cumulative.**

**According to the American college of prosthodontists: Based on Bone Height (Mandible only):**

**Type I :** Residual bone height of 21 mm or greater measured at the least vertical height of the mandible.

**Type II :** Residual bone height of 16 - 20 mm measured at least vertical height of the mandible.

**Type III :** Residual alveolar bone height of 11 - 15 mm measured at the least vertical height of the mandible.

**Type IV :** Residual vertical bone height of 10 mm or less measured at the least vertical height of the mandible

**Direction of bone resorption**

❖ **Maxilla resorbs upward and inward** to become **progressively smaller** because of the direction and inclination of the roots of the teeth and the alveolar process.

❖ The opposite is true of the mandible, **which inclines outward** and becomes **progressively wider**.

❖ This **progressive change of the edentulous mandible and maxilla** makes many patients appear **prognathic**.

❖ Thus, RRR is **centripetal in maxilla** and **centrifugal in mandible**.



## Patterns of bone resorption

**In the Mandible, large proportions of bone loss occurs in the:**

- labial side of anterior residual ridge,
- equally on the buccal and lingual side in premolar region and
- lingually in the posterior or molar region.

**In the Maxilla bone loss primarily occurs on:**

- the labial or buccal aspect.

**Therefore, while teeth arrangement we should try to restore the natural position of the teeth before they were lost, Hence:**

- ❖ Teeth **in the maxillary arch** are arranged slightly **labially and buccally**.
- ❖ While **in the mandible**, teeth in the anterior region are **arranged labially, on the center of the ridge in the premolar region and slightly lingually in the molar region.**

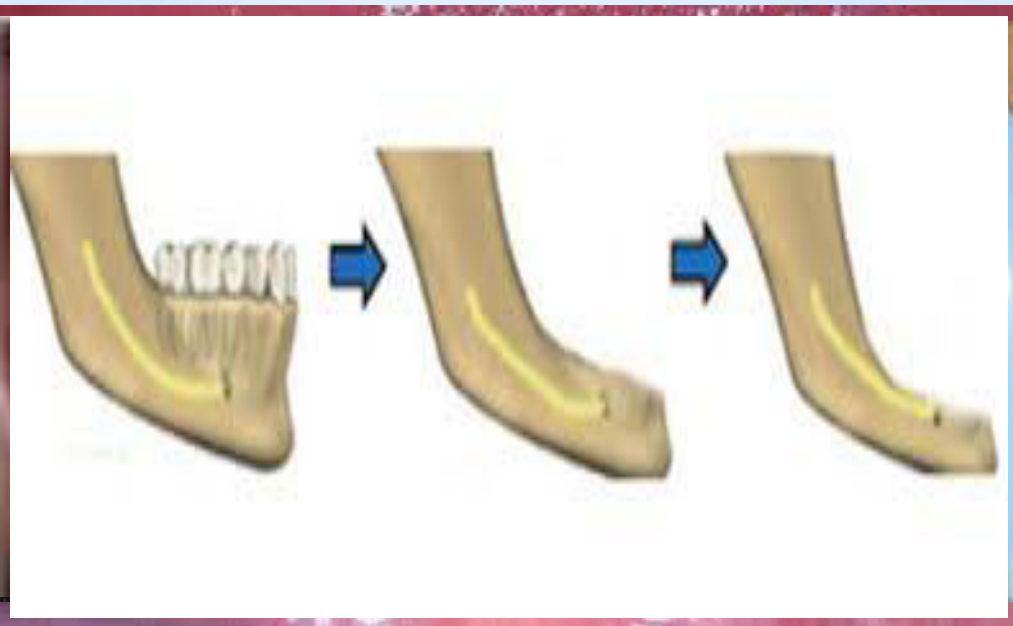
## Maxilla V/s Mandible

- ❖ It is a clinically acknowledged fact that the anterior mandible resorbs **4 times** faster than the anterior maxilla.
- ❖ Woelfel et al have cited the projected maxillary denture area to be **4.2 sq** in and **2.3 sq** in for the mandible; which is in the ratio of **1.8:1**.
- ❖ If a patient bites with a pressure of **50 lbs**, this is calculated to be **12 lbs/sq** in under the maxillary denture and **21 lbs/sq** under the mandibular denture.
- ❖ The significant difference in the two forces may be a causative factor to cause a difference in the rates of resorption.
- ❖ Cancellous bone is ideally designed to absorb and dissipate the forces it is subjected to.
- ❖ The maxillary residual ridge is often broader, flatter, and more cancellous than the mandibular ridge.
- ❖ Trabeculae in maxilla are oriented parallel to the direction of compression deformation, allowing for maximal resistance to deformation.
- ❖ The stronger these trabeculae are, the greater is the resistance



### Consequences of RRR:

1. There is apparent loss of sulcus width and depth.
2. Muscle attachments are displaced closer to the crest of the residual ridge.
3. Due to loss of VDO lower face height is reduced and mandible is rotated anteriorly.
4. Patient may develop habitual prognathic appearance.
5. Inter-alveolar ridge relationship is altered.
6. Morphological changes in residual ridge may appear such as sharp, spiny, uneven residual ridges.
7. Resorption of the mandibular canal wall and exposure of the mandibular nerve.
8. Location of the mental foramina close to the top of the mandibular residual ridge. This provides serious problems to the clinician on how to provide adequate support, stability and retention of the denture.



## Etiology of RRR

In equilibrium the two antagonistic actions (of osteoblasts and osteoclasts) are in balance. Ingrowth, although resorption is constantly taking place in the remodeling of bones as they grow, increased osteoblastic activity more than makes up for the bone destruction. Whereas in osteoporosis, osteoblasts are hypoactive, and, in the resorption related to hyperparathyroidism, increased osteoblastic activity is unable to keep up with the increased osteoclastic activity. Ridge resorption varies directly with some systemic or localized bone resorptive factors and inversely with some bone formation factors

RRR  $\propto$

bone resorption factors

bone formation factors

Systemic factors influence the balance between the normal bone formation and bone resorption. These factors create a natural resistance to unfavorable local factors. They are:

1. Estrogen.
2. Thyroxin.
3. Growth hormone.
4. Androgens.
5. Calcium.
6. Phosphorus.
7. Vitamin D.
8. Protein.
9. Fluoride.

Some local biochemical factors in relation to periodontal disease which affects the ridge resorption:

1. Endotoxins from dental plaque on unclear dentures.
2. Osteoclast activating factor (OAF).
3. Prostaglandins.
4. Human gingival bone resorption stimulating factors.
5. Heparin acts as a cofactor in bone resorption which is produced from mast cells

**RRR    $\alpha$**

bone resorption factors

bone formation factors

### **Etiology of RRR**

factors affect residual ridge resorption



RRR is a multi-factorial, biomechanical disease that results from a combination of anatomic, metabolic and mechanical determinants (functional and prosthetic).

### 1- Anatomic Factors:

- A. Amount of bone.
- B. Quality of bone.

### 2- Metabolic factors:

- A. Hormonal Factors.
- B. Dietary Factors.

### 3- Mechanical Factors:

- A. Functional Factors.
- B. Prosthetic Factors.

#### 4. Nutrients, Glucose and Lipids

- |                        |                       |
|------------------------|-----------------------|
| 1. Protein             | 1. Vitamin A.         |
| 2. Vitamins.           | 2. Vitamin B complex. |
| 3. Carbohydrates (Star | 3. Vitamin C.         |
| 4. Fats and Organic Su | 4. Vitamin D.         |
| 5. Inorganic Elements. |                       |

## 1- Anatomic Factors: :

These factors includes amount of bone and quality of bone.

**A- Amount of bone:** When we clinically examine a completely edentulous foundation, we tend to gauge the residual ridge on the basis of it being high/low, broad/narrow, rounded/spiny, covered by thick/thin mucoperiosteum.

The rate of vertical bone loss in broad, high ridge may actually be slower than that of a narrow ridge because there is more bone to be resorbed per unit of time and because the rate of resorption also depends on the density of the bone.

**B- Quality of bone:** On theoretic grounds, the denser the bone, the slower the rate of resorption because there is more bone to be resorbed per unit of time.

## 2- Metabolic factors

it includes both nutritional disturbances and hormonal causative factors.

### **Metabolic factors: A- Hormonal Factors:**

#### **1. Pituitary Glands (Hypophysis)**

The hypophysis is the master gland of the **endocrine system**. The control of the hypophysis over the endocrine system is complex and problems of dysfunction require the analysis of an endocrinologist. Such findings are of importance to the dentist because they involve the general health of the patient, which is reflected in the oral cavity.

#### **2. Thyroid Glands**

They are responsible for the regulation of the **rate of metabolism**. Hyperthyroidism increases the metabolic rate leading to negative nitrogen balance. Such a balance is equivalent to protein deficiency, which can be a direct cause of osteoporosis. Thyroxin also has a direct influence on the kidneys, causing an increased excretion of calcium and phosphorus. This depletion of calcium and phosphorus results in decreased bone apposition and increased osteoclastic activity.

#### **3. Parathyroid Glands**

Parathormone maintains blood calcium by mobilizing it from the bones through osteoclastic activity.

#### **4. Islets of Langerhans**

The failure of these glands to produce sufficient insulin for proper utilization of glucose causes diabetes mellitus. The syndrome of poor healing, low tissue tolerance and rapid resorption of bone is associated with the diabetic patient. In the absence of insulin, a relative nitrogen starvation occurs from increased gluconeogenesis with the amino acids being diverted from protein synthesis. A diabetic controlled by either insulin or diet is not affected by this mechanism. Since perfect control is rarely possible, a word of caution and explanation to diabetic patients is necessary so that they can appreciate their prosthetic difficulties.



### **5. Suprarenal Glands**

The adrenal cortex produces steroid hormones called corticoids. Cortisone and related steroids are antianabolic. It may induce the formation of glucose from carbohydrates and may increase the calcium loss by direct effect on calcium excretion. The prolonged use and administration of such steroids are considered very dangerous to bone tissue. However, one of the beneficial effects of corticoids is to control the defense mechanism of inflammation.

### **6. Gonads**

In general, the sex hormone (androgens and estrogens) promotes a protein anabolic action on all tissues including bone. A moderate amount of osteoporosis accompanies senescence because of the increased catabolic action reflected by atrophic and degenerative changes throughout the body. The ageing person produces decreased amount of androgens and estrogens, which results in faulty protein metabolism for tissue repair. The bone matrix suffers and normal bone loss cannot be compensated.

### **Metabolic factors: B-Dietary Factors**

Food is classified as proteins, carbohydrates, fats, vitamins and inorganic elements.

#### **1. Protein**

Protein is necessary to build and maintain tissue and to supply energy. The synthesis of osteoid tissue in protein starved people is compromised and calcification is decreased since the protein matrix is embarrassed.

Protein may not be available because of inadequate intake, improper assimilation or excessive loss as in nephrosis or because it is utilized as calorie requirements because of hyperthyroidism/ uncontrolled diabetes.

Inadequate incorporation of protein in diet (3 ounces/ day) will cause slow growth of bone. Bone apposition cannot keep up with normal osteoclastic activity and a negative bone factor exists.

## 2. Vitamins

The action of vitamins in many respects is said to be same as that of hormones. The relationship of vitamins and hormones can be explained on the basis that the endocrine glands produce intrinsic hormones and the vitamins are extrinsic hormones.

**1- Vitamin A:** A deficiency of vitamin A may result in poor development and calcification of bone. Prolonged deficiency of vitamin A causes renal damage by hornification of tubules, which then lose the capacity to reabsorb phosphorus. The imbalance of the calcium: phosphorus ratio leads to osteoporosis.

**2- Vitamin B complex:** The total effect of vitamin B complex is of a regulatory nature. Hypovitaminosis B results in loss of appetite, dietary insufficiency, increase in nervous irritability resulting in lowered resistance to stress and emotional tension. The total well-being of the individual is impaired.

**3- Vitamin C:** Lack of vitamin causes decalcification of the bone and has been held responsible for diffuse alveolar atrophy. The apposition of new bone slows down dramatically because osteoblastic activity is impaired. The collagen content of bones is also reduced in vitamin deficiency. The periosteum thickness and the cells appear immature and resemble fibroblasts. This condition may make the periosteum easily prone to injury by the denture base. Osteophytes appear as a result of avitaminosis C. The rapid loss of bone and the increased inflammation of the mucoperiosteum cause the development of these bony outgrowths.

**4- Vitamin D:** It is necessary for the calcium phosphorus balance to remain within tolerable limits. Vitamin D would be unnecessary if the exact required ratio of calcium and phosphorus were available in the diet. When bone loses its ability to calcify the matrix, administration of vitamin D will cause calcification and denser bone. Moderate overdosage causes excessively mineralized bone, but gross overdosage causes bone resorption. Many drugs act as vitamin antagonists. These drugs act largely on vitamin C and B complex and their excessive use may cause a marked vitamin deficiency.

Some of the common vitamin inhibitors are **nicotine, alcohol, barbiturates, morphine, some of the sulfa drugs and some of the antibiotics such as streptomycin and penicillin.**

### 3.Carbohydrates (Starch and Sugars)

They provide the chief source of energy. They are related only indirectly to bone resorption through association with diabetes and by substitution for more favorable foods.

### 4.Fats and Organic Substances

They are those, which yield heat and energy and only secondarily build/repair tissue.

### 5.Inorganic Elements

Calcium salts (calcium carbonate and calcium phosphate) form the rigid supporting structure of bones. Phosphorus in the form of calcium and magnesium phosphate, gives hardness to bone. Abnormalities of the calcium phosphorus elements of the blood stream may be associated with alveolar resorption or rarefaction.

The body requires **0.7 gm of calcium/day**, which can be obtained from **1 quart of milk**. Other sources of calcium are dairy products, spinach, oranges, celery, chard, carrots and lettuce. The phosphorus need is **about 1.5 to 3 gm daily** dependent upon the form. Dry beans, milk, cheese, leafy vegetables, celery and carrots may fulfill these requirements.

## **Edentulous patients should follow a prescribed dietary regimen**

This diet should be low in carbohydrates and high in protein intake. The diet should include at least a quart of milk or substitute dairy products, vegetables, fruits and a multiple vitamin supplement.

The normal equilibrium may be upset and pathologic bone loss may occur if either bone resorption is increased or bone formation is decreased, or if both occur.

- ❖ Since bone metabolism is dependent on cell metabolism, anything that influences cell metabolism of osteoblasts and osteoclasts is important.
- ❖ The thyroid hormone affects the rate of metabolism of cells in general and hence the activity of both, the osteoblasts and osteoclasts.
- ❖ Parathyroid hormone influences the excretion of phosphorous in the kidney and also directly influences osteoclasts.
- ❖ The degree of absorption of Ca, P and proteins determines the amount of building blocks available for the growth and maintenance of bone.
- ❖ Vit C aids in bone matrix formation.
- ❖ Vit D acts through its influence on the rate of absorption of calcium in the intestines and on the citric acid content of bone.
- ❖ Various members of Vit B complex are necessary for bone cell metabolism.
- ❖ In general terms, anabolism exceeds catabolism during growth and convalescence, levels off during most of adult life and is exceeded by catabolism during disease and old age. Bone has its own specific metabolism and undergoes equivalent changes. At no time during life is bone static, but rather it is constantly rebuilding, resorbing and remodeling subject to functional and metabolic stresses.

## Osteoporosis and residual ridge modeling:

The clinical and patho-physiologic views of osteoporosis has been refined recently to the concept of Type I and II osteoporosis.

**Type I osteoporosis** is defined as the specific consequence of menopausal estrogen deprivation, and characteristically presents the bone mass loss, notably in the trabecular bone.

**Type II osteoporosis** reflects a composite of age related changes in intestinal, renal and hormonal function. Both cortical and trabecular bone are affected in Type II osteoporosis.

### 3.Mechanical Factors:

**3.Mechanical: A-Functional Factors:** include the frequency, intensity, duration and direction of forces applied to bone which are translated into cellular activity, resulting in either bone formation or bone resorption, depending upon on the patients' individual resistance to these forces. Wolff's law postulates that all changes in the function of bone are attended by definite alterations in its internal structure. Forces within physiologic limits of bone are beneficial in their massaging effect. On the other hand, increased or sustained pressure, through its disturbance to the circulatory system, produces bone resorption. The amount and frequency of stress and its distribution and direction are important factors in treatment planning. Although the total amount of the necessary masticatory stress cannot be diminished, increasing tissue coverage and decreasing the length and width of the occlusal table may lessen the load/unit area.

The frequency of stress application modifies the reaction of alveolar bone to external forces. Constant pressure on bone causes resorption, while intermittent forces favor bone formation. Since recurrent forces over short intervals of time have essentially the same resorbing effect as constant pressure, a rest period between meals is beneficial. For this reason, the patient should be warned that gum chewing has a destructive effect on the bone.

Bruxism is an expression of nervous tension, which manifests itself as gnashing, grinding or clenching of the teeth while the patient is asleep or awake. Since most denture patients do grind their teeth in sleep, the dentures should not be worn during this period. Thus the supporting structures are afforded the rest period essential to the maintenance of the alveolar bone. While grinding of the teeth when the patient is awake may be a habit of tension, it may also be caused due to lack of interocclusal distance.



The principal concern should be in the pattern and position of the posterior teeth. There are two mandibular movements associated with mastication: a closing/cutting movement and a lateral or grinding movement. A sharp cusp will penetrate a bolus of food with less force than a flat occlusal form. However, a law of physics explains that forces applied to an inclined plane produce a resultant force or vector perpendicular or right angles to the plane. Applying this principle to occlusal form, the resultant force of the steep incline of high cusps would produce a lateral force, which might cause alveolar resorption. Stress distribution favorable to healthy alveolar bone maintenance is dependent principally upon bilateral balanced occlusion. Balanced occlusion is that arrangement of the teeth, which will permit the necessary mandibular movements without tending to dislodge the denture or traumatize the supporting structure

**3.Mechanical: B.Prosthetic Factors:** The prosthetic factors are extremely difficult to evaluate because of tremendous number of variables, including anatomic, metabolic and functional factors. The traditional design of dentures includes many features whose goal is to reduce the amount of force to the ridge and to thereby reduce RRR.

**These prosthetic factors include:**

- ❖ broad-area coverage (to reduce the force per unit area);
- ❖ decreased number of dental units,
- ❖ decreased bucco-lingual width of teeth, and improved tooth form (to decrease the amount of force required to penetrate a bolus of food);
- ❖ avoidance of inclined planes (to minimize dislodgement of dentures and shear forces);
- ❖ centralization of occlusal contacts (to increase stability of dentures and to maximize compressive forces);
- ❖ provision of adequate tongue room (to increase stability of denture in speech and mastication);
- ❖ adequate inter-occlusal distance during rest jaw relation (to decrease the frequency and duration of tooth contacts).

### Treatment and Prevention of RRR:

The best way to manage the problem of residual ridge resorption is by using every means to prevent it.

- a. **Prevention of loss of natural teeth**
- b. **Proper design of dentures and maintenance.**
- c. **Nutrition.**
- d. **Preprosthetic surgery.**
- e. **Immediate dentures: Some authors claim that extraction.**
- f. **Overdentures.**
- g. **Osseointegration and implant**

### Treatment and Prevention of RRR:

The best way to manage the problem of residual ridge resorption is by using every means to prevent it.

- a. **Prevention of loss of natural teeth:** Clinicians must try to retain residual roots whenever feasible.
- b. **Proper design of dentures and maintenance.**
  - ❖ Optimal tissue health prior to making impression.
  - ❖ Impression procedures
    - Minimal pressure impression technique.
    - Selective pressure impression technique: places stress on those areas that best resist functional forces
    - Adequate relief of non stress bearing areas eg. Crest of mandibular ridge.

- ❖ Broad area of coverage helps in reducing the force /unit area (**Snow Shoe Effect**) increased denture bearing area can greatly reduce the load per unit area on the underlying mucosa and improve denture comfort, always assuming that the OVD is not excessive.
- ❖ Avoidance of inclined planes to minimize dislodgment of dentures and shear forces.
- ❖ Centralization of occlusal contacts to increase stability and maximize compressive forces.
- ❖ Provision of adequate tongue room to improve stability of denture in speech and mastication.
- ❖ Adequate interocclusal distance during jaw rest to decrease the frequency and duration of tooth contact. Correcting the occlusal vertical dimension: Clinical studies have shown increased (excessive) OVD to be a common fault in many dentures. Guidelines suggest 2-5 mm of freeway space, but this may need to be increased in order patients or for those patients with atrophic mucosa overlying the residual ridges.
- ❖ Occlusal table should be narrow
- ❖ The concept and arrangement of teeth in neutral zone helps the teeth to occupy a space determined by the functional balance of the oro- facial and tongue musculature Eliminating disruptive occlusal contacts, which lead to denture instability. In general, occlusal tables tend to be too large. This leads to problems of support and stability, which put too much pressure on the atrophic mucosa during function

- Overdentures help minimize ridge resorption and contribute to enhance retention stability, support of prosthesis along with preservation of proprioception.
- The introduction of dental implants has revolutionized clinical practice. Use of implants for providing implant supported or implant assisted prosthesis also helps avert continuing residual ridge resorption.

### **Reducing the forces required to drive the denture teeth through the bolus of food:**

This may be achieved by either increasing the denture bearing area or reducing the size and altering the morphology of the occlusal table.

#### **1- Increasing the denture bearing area:**

The smaller the size of the fitting surface of the denture, the greater are the loads applied to the underlying mucosa. In such cases, the denture bearing area may be increased using green stick impression compound before relining or by using a chair-side relining material prior to the denture being relined conventionally.

#### **2- Reducing the size and altering the morphology of the occlusal table.**

#### **c. Nutrition**

- ❖ It has been seen that one of the cofactor in RRR is low calcium and vitamin D metabolism.
- ❖ Diet counseling for prosthodontic patients is necessary to correct imbalances in nutrient intake.
- ❖ Denture patients with excessive RRR report lower calcium intake and poorer calcium phosphorus ratio, along with less vitamin D.

#### **d. Preprosthetic surgery:**

- ❖ Excessive RRR leads to loss of sulcus width and depth with displacement of muscle attachment more to the crest of residual ridge.
- ❖ Osseous reconstruction surgeries, removal of high frenal attachments, augmentation procedures, vestibuloplasties etc may be required to correct these conditions.

**e. Immediate dentures:** Some authors claim that extraction followed by immediate dentures reduces the ridge resorption.

**f. Overdentures** Tooth supported over dentures help in improved stress distribution there by maintaining the integrity of residual ridge. A study was conducted with overdentures supported by canines and it was seen that, the bone loss was 0.6mm where as 5mm in conventional complete dentures

#### **g. Osseointegration and implant**

Precautions during extraction to reduce RRR When a tooth is removed the labial plate should be preserved.

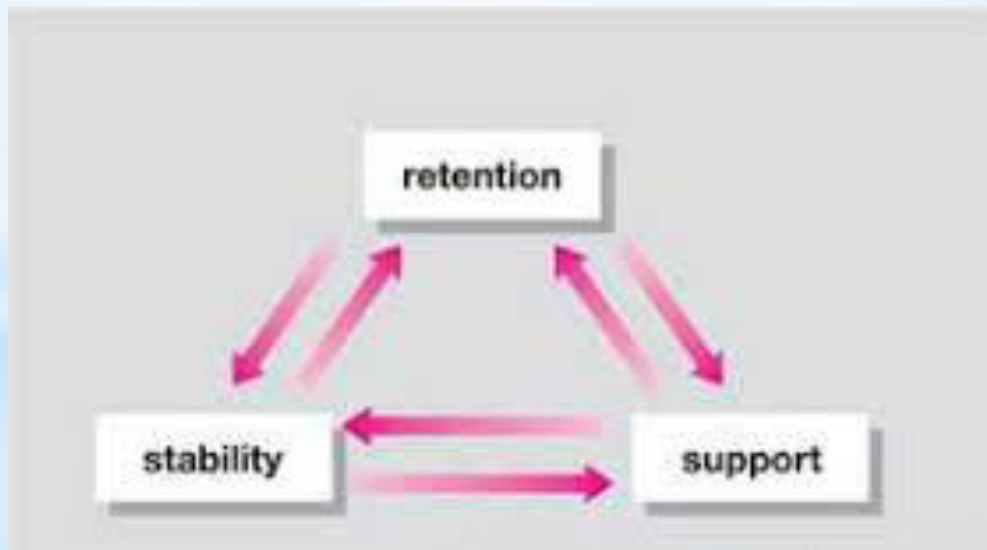
- ❖ The labial periosteal covering should remain intact as its inner layer is responsible for remodeling of bone.
- ❖ If a bone has to be removed it must be the palatal plate.

## IMPORTANT NOTES :

1. Reduction of residual ridges (RRR) needs to be recognized for what it is: a major unsolved oral disease which causes physical, psychologic, and economic problems for millions of people all over the world.
2. RRR is a chronic, progressive, irreversible, and disabling disease. At the present time, the relative importance of various cofactors is not known.
3. Much is known about the pathology and the pathophysiology of this oral disease, but we need to know much more about its pathogenesis, epidemiology, and etiology.
4. The ultimate goal of research of RRR is to find better methods of prevention or control of the disease. Because prevention is the key.



# Retention, Support and Stability of Complete Denture



**Retention:** is the quality of a denture that resists movement away from the tissue.



## Factors affect the Retention of Complete Denture

- I. Anatomical factors.
- II. Physical factors.
- III. Mechanical factors.
- IV. Muscular factors.
- V. Surgical factors.

## **I. Anatomical factors.**

- 1- Ridge form.**
- 2- Volt Form.**
- 3- Arch Form.**
- 4- Arch relationship .**
- 5- Interach distance.**
- 6- Tongue.**
- 7- Mucosa.**

### **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 myloheid 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.



The ideal form is a high ridge with flat crest and parallel or nearly parallel sides (square ridge). This type of ridge gives the maximum amount of support, retention and stability. The V-shaped ridge and flat ridge has poor retention.

## 2- Vault Form

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



### 3- Arch Form

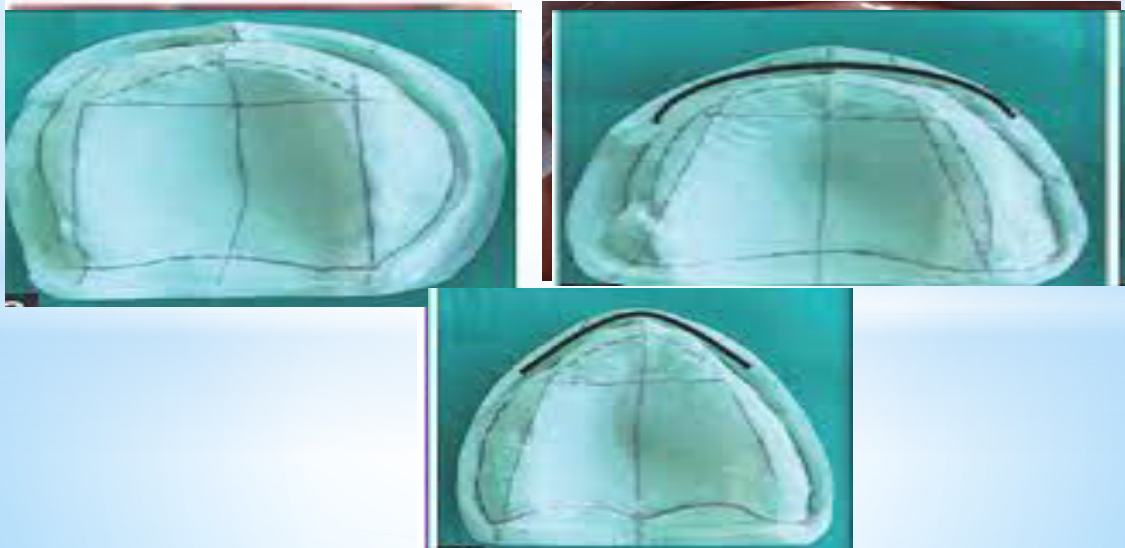
Squared, ovoid, tapered and the best one is the squared.

This is because of:

1-there is 4 points of contact with denture.

2-Resistant the lateral forces.

while tapered arch is the least favorable



### 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

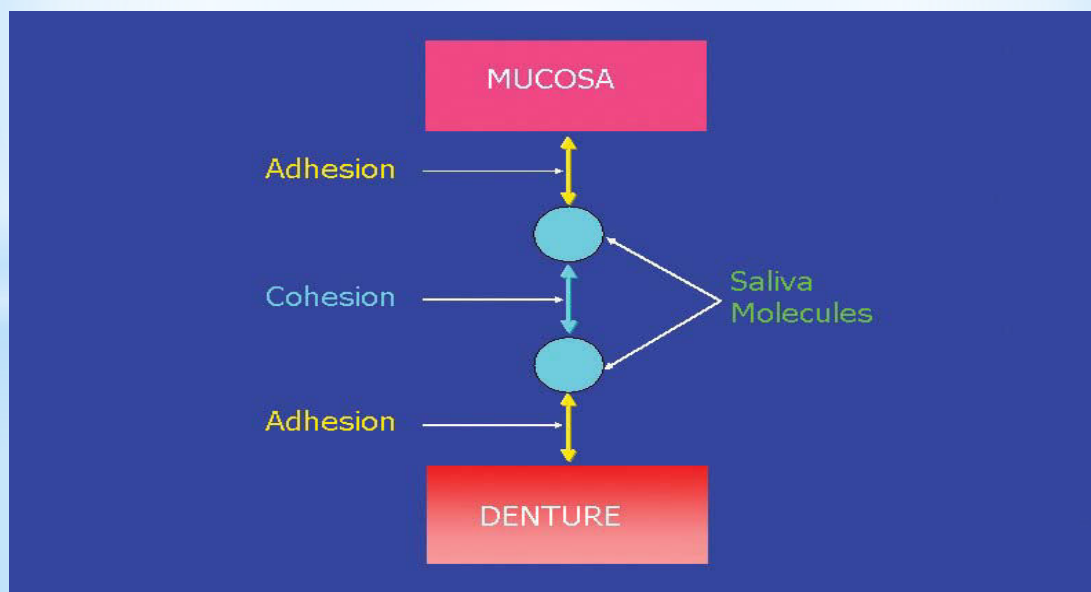
If too big >> it could interfere with denture. So dislodging of the lower and upper.

### 7-Mucosa

We need it Firm, compressible and even thickness. Not to be thick and flabby.

## II. Physical factors

- 1- Adhesion .
- 2- Cohesion.
- 3- Capillary attraction .
- 4- Atmospheric pressure and peripheral seal.
- 5- Gravity .
- 6- Viscosity .
- 7- Wettability .





**1- Adhesion** :is defined as the physical attraction of unlike molecules to each another **It acts when saliva wets and sticks to the basal surface of the denture and to the mucous membrane of the basal seat.**

**The amount of retention provide by adhesion depend on :**

1. **Adaptation of denture base to the residual ridge:** close adaptation (fitness) of denture base to the underlying residual ridge thin serous saliva provide better retention since thin film of saliva will be formed .
2. **Type of saliva (viscosity and wettability):**Thin serous saliva provide better adhesion than thick ropy saliva. it builds up pressure & pushes the denture out of position
3. **Area covered by denture base:** The amount of retention supplied by adhesion is directly proportional to the area covered by the denture. The size of maxillary denture bearing area is about (24 cm<sup>2</sup> ) & that of mandible is about (14 cm<sup>2</sup> )

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:-**is defined as the physical attraction of like molecules for each other. The cohesive forces act within film of saliva.

**The amount of retention provide by cohesion depend on :**

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.

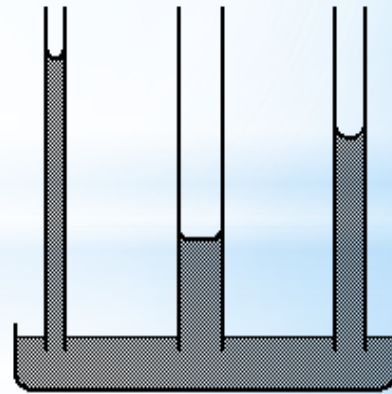
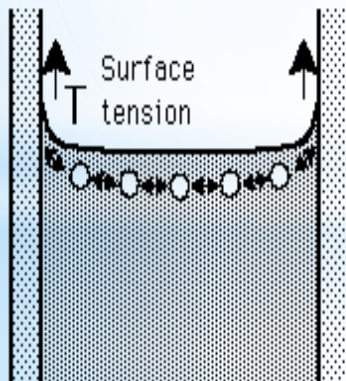
**To obtain maximum (retention from) interfacial surface tension:**

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



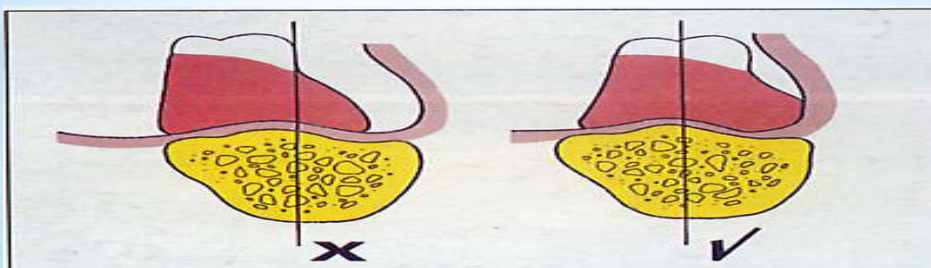
**4-Atmospheric pressure & peripheral seal:-**When a dislodging force is applied on the denture having good border seal, a negative pressure develops in the space created between the denture base and the mucous membrane. When the negative pressure develops inside, the atmospheric pressure from outside 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**

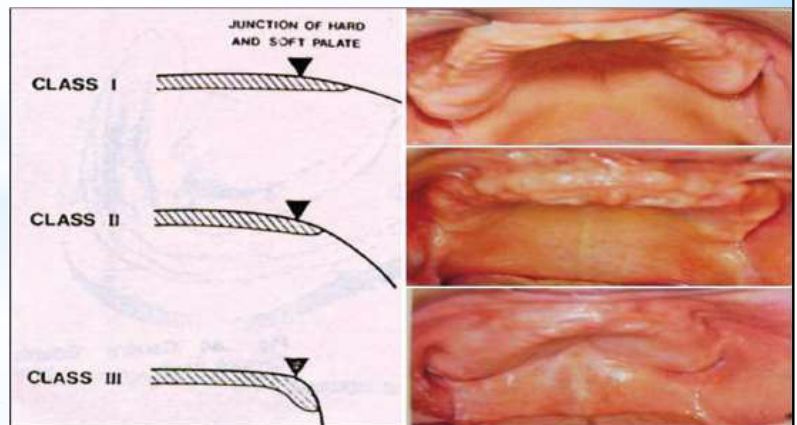
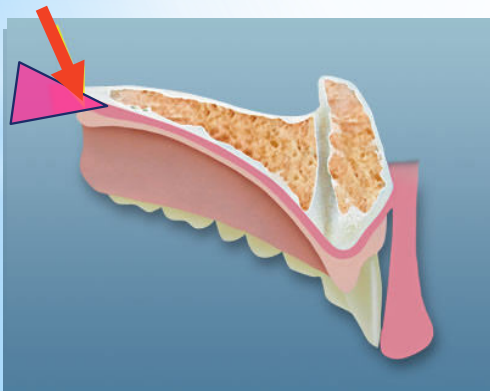


**c) Posterior palatal seal area:-** It is defined as "The soft tissue at or along the junction of the hard and soft palates on which pressure within the Physiological limits of the tissues can be applied by the denture to aid in the retention of the denture.

**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(it is the most favorable it allows more tissue coverage for producing the palatal seal).
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**

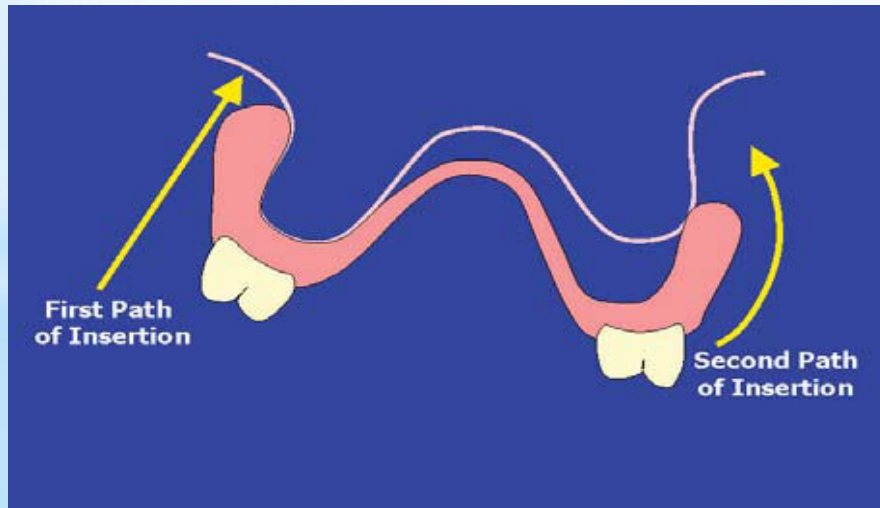
**The varicose mechanical factors which aid in retention are:**

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



**1- Engagement under cut:-** unilateral undercuts aid 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 area. In order to achieve this without traumatizing the mucosa on insertion and removal of 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 adhesives:-** They should be coated on the tissue surface before wearing 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



**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

## **Indications of Denture adhesives :**

- 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

## **Contraindications of Denture adhesives :**

- 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

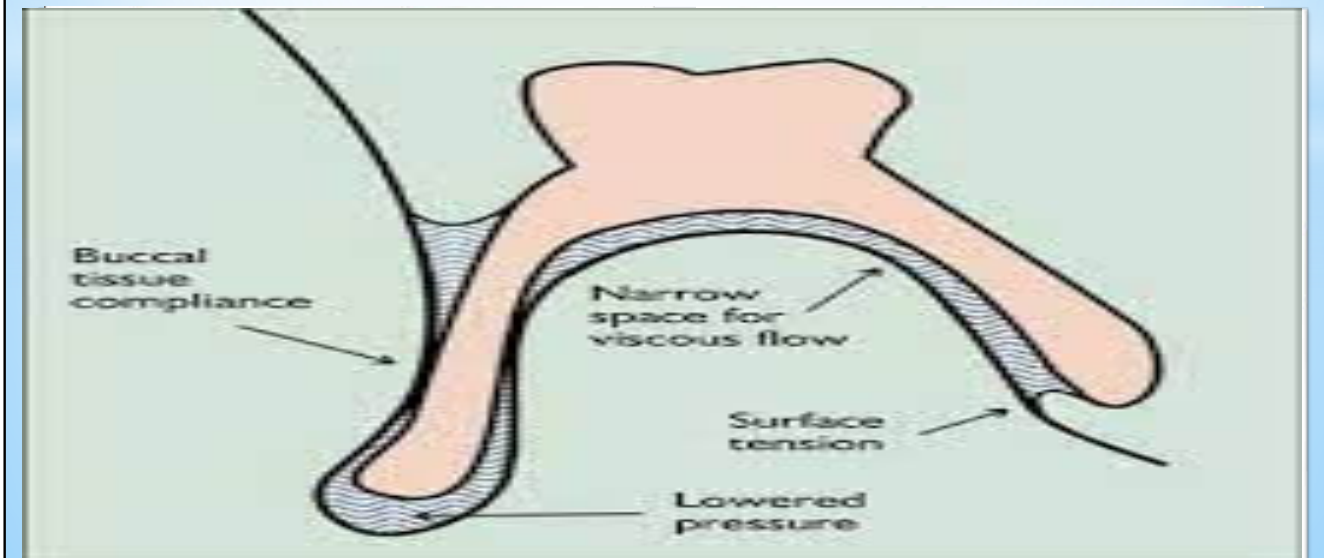
**4- Suction chambers & Suction devices:** -It's like a suction chamber. Alternative name is rubber disk or palatal window. In the past suction chamber in the maxillary dentures were used to aid in retention by create an area of negative pressure which increase retention . They are avoided now due to their potency for creating palatal hyperplasia



#### IV- Muscular factors

The oral and facial musculature supply supplementary retentive forces, provided

- 1) The teeth are positioned in the "neutral zone" between the cheeks and tongue.
- 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**

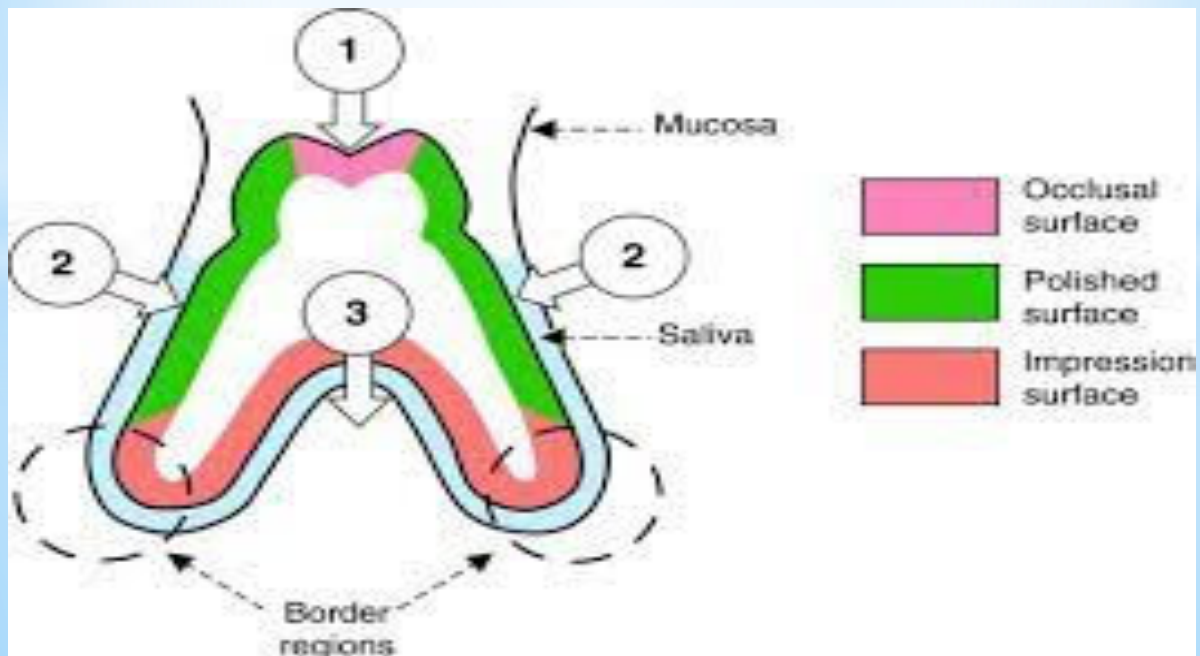
The accurate approximation of tongue, cheeks and lip to a denture controls the flow of saliva under the denture, thereby increasing the effective area of retention.

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 surfaces:

1. Occlusal surface.
2. Polished surface.
3. Impression surface.



**1. Occlusal surface:** that portion of denture which makes contact or near contact with the corresponding surface of the opposing denture or dentition.

**2. Polished surface:** is that of denture base which is usually polished and includes the labial, buccal and lingual surfaces which in contact with the lips, cheeks and tongue. Proper contour and design of polished surface should be in harmony with the function of lips, cheeks and tongue to keep the denture in its position.

Craddock described the gripping action of the buccinator 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 buccinator will tend to seat both dentures on their basal seats.

❖ 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."

**3. Impression surface:** That portion of denture that has its shape determined by the impression. It includes the borders of the denture and extends to the polished surface.

## V- Surgical factors:

1. vestibuloplasty.
2. Tuberoplasty.
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**.



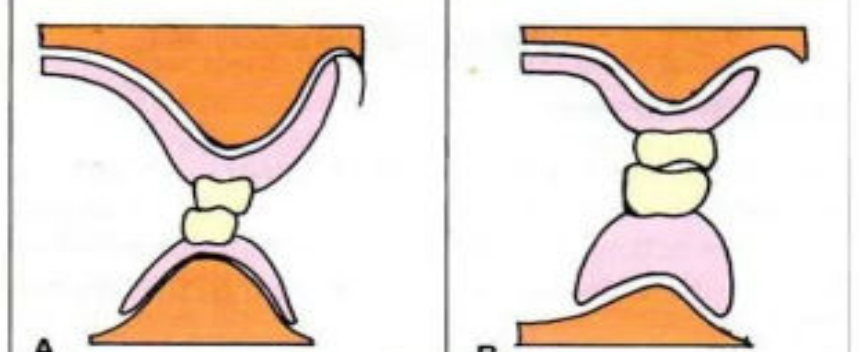
**The various factors that affecting the stability are:**

- 1- Vertical height of the residual ridge
- 2- Quality of the impression
- 3- Occlusal plane orientation (Occlusal rims).
- 4- Arrangement of the teeth
- 5- Contoure of the polish surface
- 6- Shape of the palatal Vault
- 7- Retention
- 8- Proper relief



## Factors affect stability of complete denture:

**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.



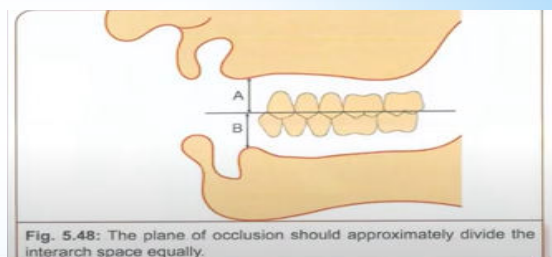
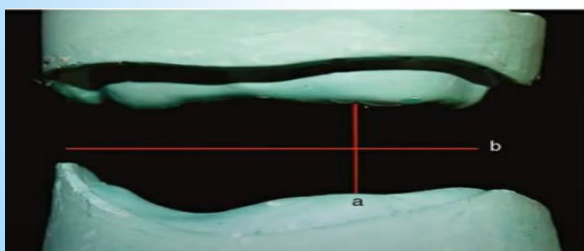
**2-Quality of soft tissue covering the ridge:-** The ridge should provide a firm soft tissue base with adequate sub-mucosa to offer good stability.



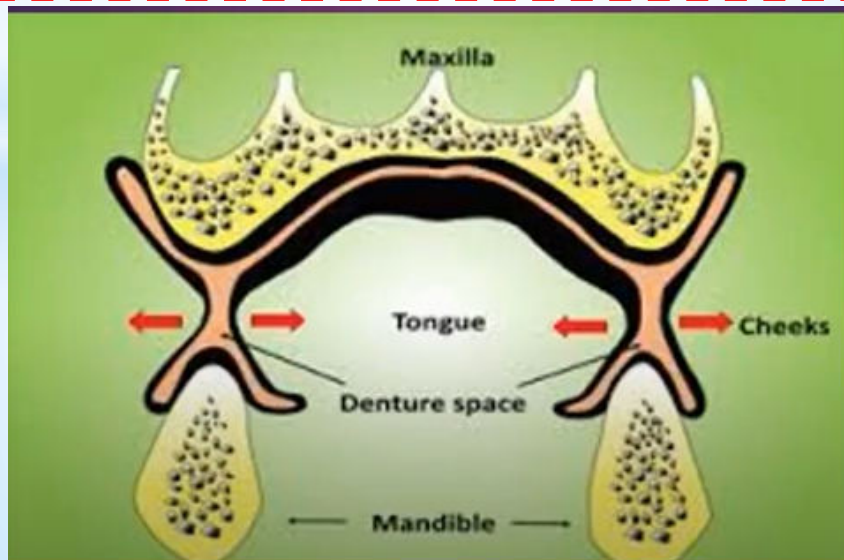
**3-Quality of the impression :-** An impression should be accurate as possible .The impression surface should be smooth and duplicate all the details accurately. It should be devoid of voids and any rough surfaces. The impression should not warp on removal . It should be dimensional stable and cast should be poured as soon as possible.



**4-Occlusal plane orientation:-** it should be oriented parallel to the ridge. If the occlusal plane is inclined ,then the sliding forces may act on the denture, reduce its stability. The occlusal plane should divide the inter arch space equally. Width of the occlusal table >>must be less than normal teeth >> to get god stability and retention.



**5-Arrangement of teeth (balance 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""



**6-Contour of the polished surfaces:-** The polished surfaces of the denture should be harmonious with the oral structures. They should not interfere with the action of the oral musculature.

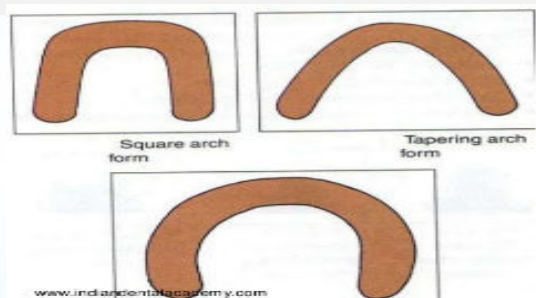
**7- Shape of palatal vault:** A steep palatal vault may enhance stability by providing greater surfaces area of contact and long inclines approaching at right angle to the direction of force

**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 shaped**: Reduced resistance to lateral force.

**Stability decreases with :**

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



## Support

**Support:** is defined as the resistance to vertical forces of mastication, occlusal forces and other forces applied in a direction towards to denture bearing area

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

Support is derived from bone, to which all forces are ultimately transmitted via the mucosa.

The best support for denture is the compact bone covered with fibrous connective tissue. This depends on the anatomical, histological factors of the ridge and the way of pressure direction on the ridge during impression making procedure, therefore the maximum coverage provides the greater the support, which distributes applied forces over as wide an area as possible.

## 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

### 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.

#### 2- 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 nonresilient 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.

### Stress Bearing Areas(Supporting Area):-

Areas of the oral structures that resist forces, strains or pressures brought on them during function. They are portions of the mouth capable of providing support for a denture, they show minimal ridge resorption even under constant load.

#### Stress bearing areas of Maxilla:

##### A-Primary stress bearing areas:

1-Hard palate    2-Posterior lateral slopes of residual ridge

##### B-Secondary stress bearing areas

1-Rugae area    2-Maxillary tuberosity.

#### Stress bearing areas of Mandible:

##### Primary stress bearing area

buccal shelf area.

##### Secondary stress bearing area

labial and lingual slopes of lower residual ridge



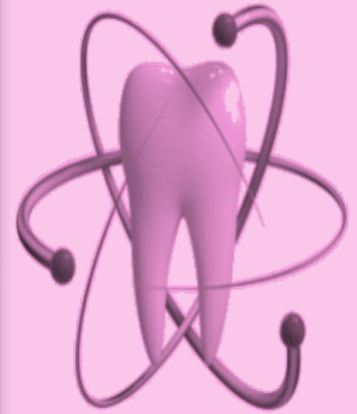
**Factors that influence the form and size of the supporting bone include**

- (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

# Single Dentures



**The construction of a single denture may be presented in a variety of dental combinations. It could be:**

**1- Single complete denture opposing Natural teeth. which either:**

- a) **Upper complete** opposing by **complete mandibular** dentition
- b) **Upper complete** opposing by **mandibular partial** denture
- c) **Lower complete** opposing by **upper partial** denture
- d) **Lower complete** opposing by **complete maxillary** dentition

**2- Single complete denture opposing previously constructed complete denture**

*The single complete maxillary denture opposing all or some of the mandibular natural teeth is a very common clinical situation*

## Problems of single denture:

1. Greater magnitude of forces Changes in the underlying bone. In the long term, Denture will be compromised
2. Occlusal form of the remaining natural teeth: This occlusal form dictates occlusal form of the denture teeth which might be unsuitable for the denture.
3. Occlusal scheme causing more horizontal forces.



### These factors causes occurrence of:

- A. Single denture syndrome.
- B. damage of mucosa.
- C. ridge resorption.
- D. loose or tilting denture.

## How to Overcome These Problems?

The primary consideration for a continued success of a single complete denture is by preservation of remains tissue through the followings

1) Proper diagnosis and full use of every factor, which favors success for this denture. Diagnosis and treatment planning includes:

- a) Complete case history is taken extraoral and intraoral examination is done.
- b) Studying upper and lower casts
- c) The upper cast is mounted on the articulator using a face bow.
- d) The lower cast is mounted on the articulator using a provisional centric interocclusal record at an acceptable vertical dimension.

e) Applying the principles of complete denture construction **which includes:**

- Maximum base extension within functional anatomical limits (distributed forces over the largest possible area of supporting structures and the force per unit area kept at minimum.)
- Lip support
- Minimal vertical overlap (Overbite)
- Suitable occlusion and free articulation
- Avoid broad inclined planes.

## **Steps for Single Denture construction**

### **1) Proper Diagnosis and mounting the diagnostic casts for evaluation of:**

- a. Ridge relationship
- b. Interdental space
- c. Occlusal plane
- d. Spaces
- e. Tooth position (Cusp inclination & Rotations)
- f. Tooth wear: With single complete dentures, the natural dentition opposing the edentulated arch often exhibits an uneven occlusal plane. Tilted teeth

### **2) Occlusal Adjustment and Tooth Modification.**

### **3) Final Impression (An ideal impression should provide):**

- a) Maximum extension without muscle impingement.
- b) Intimate contact with the tissue area covered.
- c) Proper form of the borders including the posterior border of the maxillary denture.
- d) Proper relief of hard and sensitive areas.

### **4) Jaw relation.**

**5) Face bow transfer** → Recording Intermaxillary Relations for Single Upper Denture. The incisal level of the upper front teeth and the occlusal plane can be determined later by reference to the lower natural teeth.

### **6) Artificial teeth adjustment and Try-in of waxed denture.**

### **7) Delivery.**

### **Upper complete opposing by complete mandibular dentition**



### **Maxillary complete edentulous opposing by complete mandibular dentition. with this case:**

- ❖ A gross occlusal discrepancy are very common and require occlusal modification, adjustment or orthodontic.
- ❖ Morphology of natural teeth which determine the selection of artificial teeth .Ex size& shape.
- ❖ If mandibular teeth had attrition, a 0° cusplless teeth are preferred.
- ❖ If mandibular teeth are not attrite, anatomic teeth are preferred.



## **OCCLUSAL MODIFICATION:**

occlusal modification of remaining natural teeth is usually required prior to construction of single complete denture .it is a pre prosthetic procedure where occlusal discrepancy present in natural teeth are corrected.

Several techniques could be used to determine occlusal modifications that are necessary prior to denture construction:

### **Swenson's Technique**

- Upper and lower casts are mounted on the articulator. The upper denture is constructed. If the lower natural teeth interfere with the placement of the denture teeth, they are adjusted on the cast and the area is marked with a pencil. The natural teeth are then modified using the marked diagnostic cast as a guide. This technique is simple but time consuming



### **Bruce Technique**

The Modifications are made on the stone cast. A clear acrylic resin template is fabricated over the modified stone cast. The inner surface of the template is coated with pressure indicating paste and placed over the patient's natural teeth, the unfavorable areas are shown → remove them.



## Yurkstas Technique

Use of a commercially available U shaped metal occlusal template that is slightly convex on the lower surface. This template is often an aid in detecting minor deviations in the occlusal scheme



## Upper complete opposing by mandibular partial denture



**These denture are very significant due their complications, teeth selection is very important in fabrication of denture. so selection of teeth based on the following:-**

1. If opposing partial denture has porcelain teeth, porcelain teeth are preferred.
2. If opposing natural teeth have gold or metal crown, then acrylic teeth preferred.
3. Acrylic teeth are preferred in denture opposing normal natural teeth or partial denture with artificial acrylic teeth.
4. If mandibular teeth are attrited so .cusplless teeth are preferred.
5. If mandibular teeth are not attrited so anatomic teeth are preferred.

### **Complications**

❖ **Combination syndrome**

❖ **Wear of natural teeth**

❖ **Denture fracture**

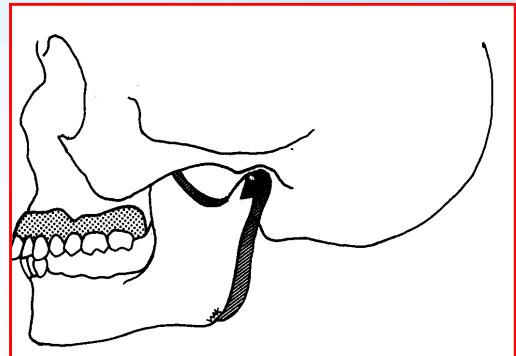
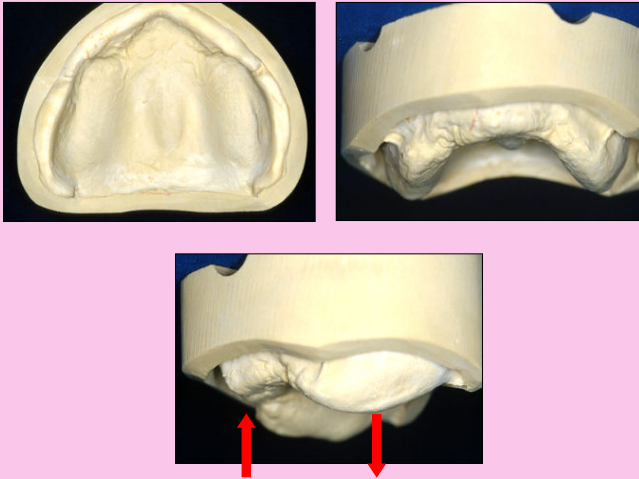
## Complications

1. Combination syndrome
2. Wear of natural teeth
3. Denture fracture

### A. Combination syndrome :



## **Combination Syndrome**

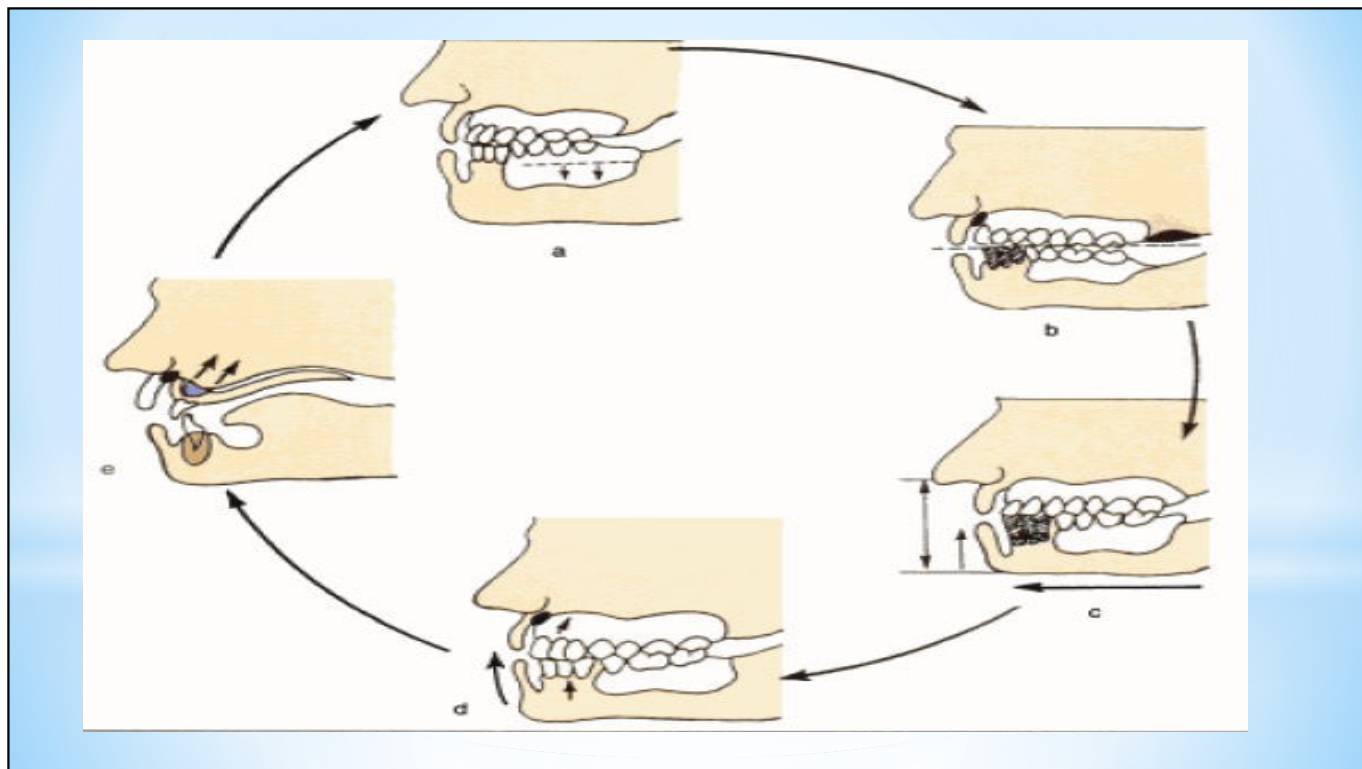
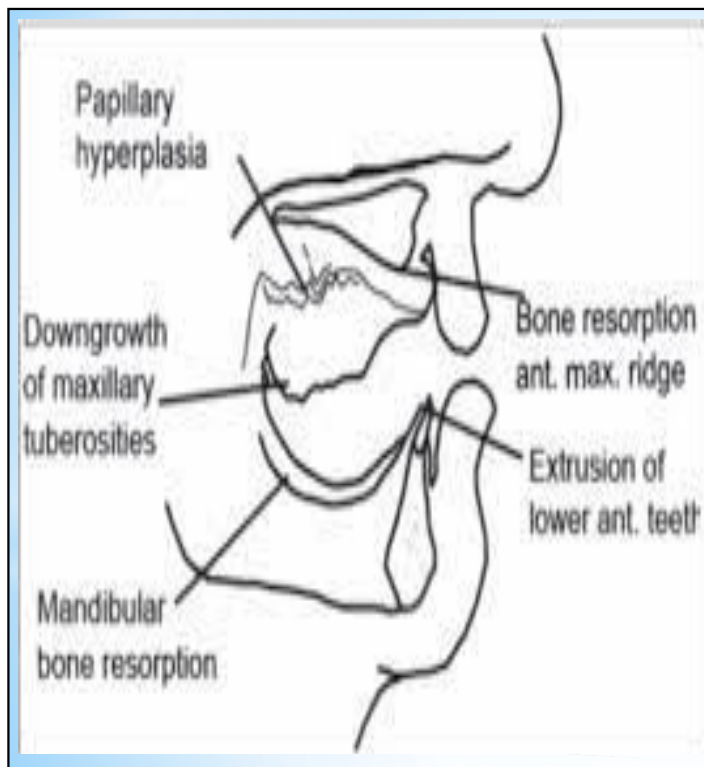


**When mandibular anterior teeth remain, patient will attempt to function in protrusive relationship to sense feeling of mastication.**

### **a. Combination Syndrome and Associated Changes (Kelly's Syndrome)**

A Combination Syndrome by Kelly (1972): destructive problems, which may be encountered as a result of long term use of a mandibular distal extension partial denture against a complete maxillary denture.





### Sequence 1:-

- ❖ the patient will tend to concentrate the occlusal load on the remaining natural teeth (mandibular anterior) for proprioception. Hence there is more force acting on the anterior portion of the maxillary denture.
- ❖ this leads to increased resorption of anterior part of maxilla which gets replaced by flabby tissue. the occlusal plane gets tilted anteriorly upwards and posteriorly downwards due to lack of anterior support.
- ❖ The labial flange will displace and irritate the labial vestibule leading to the formation of epulis fissuratum.

- ❖ Posteriorly there will be fibrous overgrowth of the tissue in the maxillary tuberosity.
  - ❖ The shift of the occlusal plane posteriorly downward produced resorption in the mandibular distal extension denture bearing area.
  - ❖ Due to the tilt of occlusal plane shift anteriorly during occlusion, the vertical dimension decreased. the retention and stability of the denture is also decreased
  - ❖ The tilt of occlusal plane disoccludes lower anterior causing them to supraerupt this reduces the periodontal support of the anterior teeth.
  - ❖ The shift of the occlusal plane posteriorly downward produces resorption in the mandibular distal extension denture bearing area.
  - ❖ Due to the tilt of occlusal plane disoccludes the mandible shift anteriorly during occlusion.
- The supraerupted anteriors increase the amount of force acting on the anterior part of the complete denture and the vicious cycle continues

## ❖ **Sequence 2:-**

- ❖ There is gradual resorption of the distal extension residual ridge in the mandible .
- ❖ This leads to tilting of the occlusal plane posteriorly downwards and anteriorly upwards
- ❖ Rest of vicious cycle continues

## **The combination syndrome consists of:**

1. Loss of bone from the maxillary anterior edentulous ridge
2. Down growth of the maxillary tuberosities
3. Papillary hyperplasia of the tissues of the hard palate.
4. Extrusion of the lower anterior teeth
5. Loss of bone beneath the removable partial denture bases.

### **Combination syndrome usually has six associated changes:**

1. Loss of vertical dimension of occlusion.
2. Occlusal plane discrepancy
3. Anterior spatial resorption of the mandible.
4. Development of epulis fissuratum
5. Poor adaptation of the prosthesis.
6. Periodontal changes.

### **The Combination Syndrome Is a Result of Three Main Factors**

1. the great magnitude of forces involved.
2. the unsuitability of the denture foundation to resist them
3. the particularly unfavorable occlusal relationship

**Setting of teeth and occlusal concept (Balanced occlusion or monoplane occlusion).**

**Selecting the occlusal concept depends on the occlusal anatomy of the opposing teeth :-**

1. Opposing teeth anatomic then balanced occlusion is used.
2. Opposing teeth are attrited then monoplane occlusion is used

## **B. Fracture of the Denture:**

Fracture of denture it is a common case with single complete .this is because the denture will receive excessive load from the natural teeth the precipitating factors which produce denture fracture.

1. Excessive anterior occlusal load.
2. Deep labial frenal notches.
3. High occlusal load due to excessive action of the masseter.

### **Precaution checking for the occlusion:**

- a) Maintain adequate thickness of denture base
- b) Never deepen the labial notch
- c) For cases with high fracture potential, use a cast metal denture base.

## **C. Wear of Teeth:**

When porcelain teeth are used, sever abrasion of opposing natural teeth will occur, hence, a proper selection of teeth material is very important, care should be taken to avoid any occlusal discrepancy.

Selecting the occlusal concept depends on the occlusal anatomy of the opposing natural teeth

- Opposing teeth anatomic then balanced occlusion is used.
- Opposing teeth are attrited then monoplane occlusion is used.



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3. Acrylic teeth are preferred in denture opposing normal natural teeth or partial denture with artificial acrylic teeth.
4. If mandibular teeth are attrited so .cusplless teeth are preferred.
5. If mandibular teeth are not attrited so anatomic teeth are preferred.

### **Types of Teeth:**

1. **PORCELAIN TEETH:** (problem) they cause rapid wear of opposing natural teeth, but the occlusal vertical dimension is maintained.
2. **ACRYLIC TEETH:**(problem) No wear of the opposing natural teeth, they are the teeth of choice. The major disadvantage is their wearing, which results in loss of vertical dimension.
3. **ACRYLIC WITH GOLD OCCLUSAL SURFACE:** In patients with the financial resources, gold occlusal can be used to minimize wear of the occlusal surfaces. Although gold occlusal are considered the best material to oppose natural teeth, but they are expensive and need time in their fabrication
4. **ACRYLIC WITH AMALGAM STOPS:** In patients with limited financial resources, amalgam stops can be inserted into the cusp tips of the acrylic resin denture teeth reduce the occlusal wear, and the technique is simple less time consuming and less expensive than with the gold occlusal.

## Mandibular single denture:

The prognosis of a mandibular single denture against natural teeth is less favorable than when the full upper denture is opposed by natural lower teeth

It would be difficult to classify this case as clinically successful. This is due to:

1. Excessive resorption of lower ridge due to greater stresses per unit area delivered to the mandibular ridge by the natural teeth.
2. Amount of firmly attached mucosa to denture.
3. Denture bearing area in mandible less than maxilla.

***The alternative line of treatment plane for such patient could be either:***

- ❖ It can be best treated with dental implant if possible
- ❖ Use of resilient denture liner in the mandibular denture.

Mandibular single denture have very poor prognosis.

