Prosthodontics

3rd class

Lec.1 **Dr. osama Alheeti**

INTRODUCTION TO REMOVABLE PARTIAL DENTURES

Partial Dentures

A removable partial denture or a fixed partial denture that restores a partially edentulous arch

1.Removable partial denture (RPD): Is a prosthesis that replaces some teeth in a partially dentate arch, and can be removed from the mouth and replaced at will; it is either acrylic type or metallic type (cobalt/chrome)or flexible type.



2.Fixed partial denture (FPD): A partial denture that is luted securely retained to natural teeth, tooth roots, and /or dental implant that furnish the primary support and retention for the prosthesis.

Removable prosthodontics:

The branch of prosthodontics concerned with the replacement of teeth and contiguous structures for edentulous or partially edentulous patients by artificial substitutes that are readily removable from the mouth by the patient.

Why do we have to make a removable partial denture?

Objectives for RPD construction:

1. Restore esthetic (especially for anterior teeth).

2. Restore function (phonetic and mastication) for proper speech, proper occlusion and proper food mastication.

3. To prevent apposing teeth extrusion or migration and tilting of adjacent teeth.

4. To fill empty space or spaces.

5. Prevent disease atrophy by a form of stimulation to the underlying tissue and ridge.

6. For proper muscular balance.

7. To restore the psychological status of the patient.

Indications of removable partial dentures:

1. Distal extension situations (free end situation).

2. Long span tooth-bounded edentulous area.

3. Need for cross-arch (bilateral) stabilization.

4. Excessive loss of the residual ridge.

5. Unusually sound abutment teeth.

6. If the prognosis of remaining teeth is questionable or reduced periodontal support of remaining teeth (these teeth cannot support fixed prostheses).

7. After recent extraction (need immediate replacement of extracted teeth).

8. Patient younger than 18 years old.

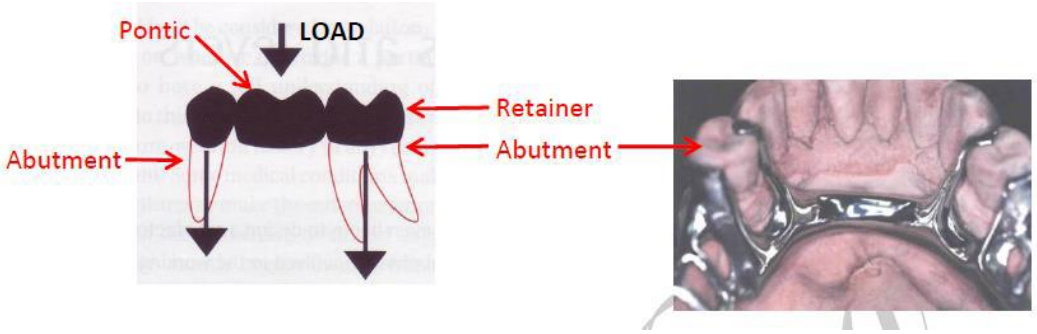
9. Economic consideration.

Components of a typical removable partial denture:

1. Major connectors.
2. Minor connectors.
3. Rests.
4. Direct retainers.
5. Stabilizing or reciprocal components (as parts of a clasp assembly.
6. Indirect retainers (if the prosthesis has distal extension bases).
7. One or more dentures bases each support one to several replacement teeth

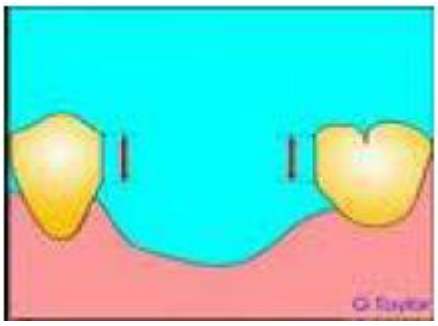
Definitions

Abutment: A tooth, a portion of a tooth, or that portion of a dental implant that serves to support and/or retain a prosthesis.

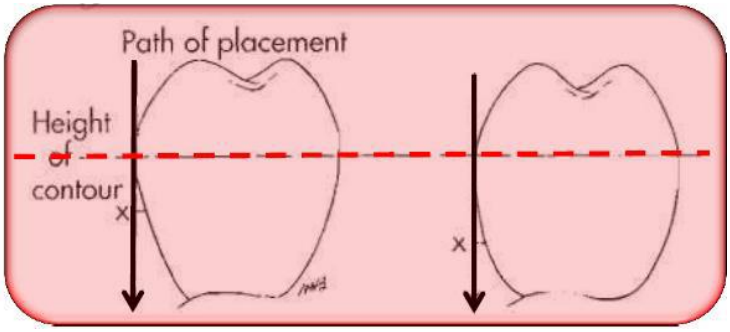


Height of contour: A line encircling a tooth and designating its greatest circumference at a selected axial position determined by a dental surveyor.
Undercut: The portion of the surface of an object that is below the height of contour in relationship to the path of placement.

Guiding planes are two or more vertically parallel surfaces of abutment teeth shaped to direct prosthesis during placement and removal.



Path of insertion (path of placement) is the specific direction in which prosthesis is placed on the abutment teeth.



Bounded edentulous area: It is an edentulous area that is bounded and supported by natural teeth at both ends.
Free-end edentulous area: It is an edentulous area that is bounded and supported by natural teeth at one end.

Tooth supported: For partially edentulous patients the prosthetic options available include natural tooth-supported fixed partial dentures, removable partial dentures, and implant-supported fixed partial dentures.

Tooth and tissue supported: For removable partial dentures that do not natural tooth support at each end of arch (the extension base removable partial denture), it is necessary that the residual ridge be used to assist in the functional stability of the prosthesis.

FINISHED

PROSTHODONTICS

Lec.2 Dr. osama Alheeti

Classification of Partially Edentulous Arches

A classification that is based on diagnostic criteria has been proposed recently for partial edentulism. Several classifications of partially edentulous arches have been proposed and are in use. This variety has led to some confusion and disagreement concerning which classification best describes all possible configurations and should be adopted. The most familiar classifications are those originally proposed by **Kennedy, Cummer, and Bailyn. Beckett, Godfrey, Swenson, Friedman, Wilson, Skinner, Applegate, Avant, Miller,** and others have also proposed classifications.

Need for classification:

1. To formulate a good treatment plan.

2. To anticipate the difficulties common to occur for that particular design.

3. To communicated with a professional about a case.

4. To design the denture according to the occlusal load usually expected for a particular group.

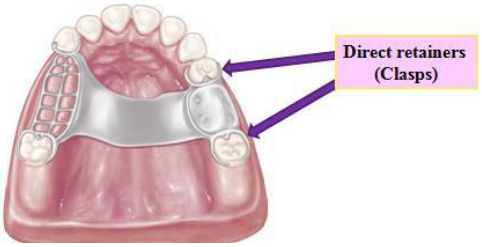
Removable partial dentures may be classified according to the type of support into:

1. Tooth supported prosthesis: is a prosthesis or part of the prosthesis that depends entirely on the natural teeth (abutments) for support.

For partially edentulous patients the prosthetic options available include:

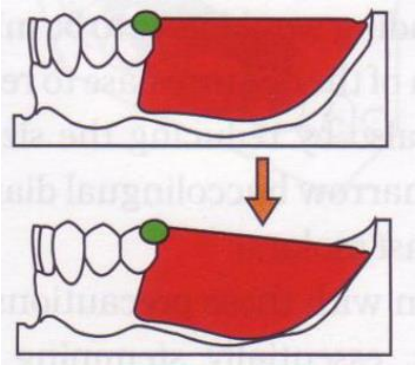
- Natural tooth - supported fixed partial dentures.
- Natural tooth – supported removable partial dentures.
- Implant - supported fixed partial dentures.

Retention is derived from direct retainers on the abutment teeth, tooth supported RPDs do not move appreciably in function.



2. Tooth - tissue supported prosthesis: is a prosthesis or part of the prosthesis that depends on the natural teeth (abutment) as well as the residual ridge and tissue for support. Also called true partial denture, it includes a free end extension.

The tooth – tissue supported RPD supported at one end by natural teeth, which essentially do not move, and at the other end by the denture bearing tissues (mucosa overlying bone) which moves because of the resiliency of the mucosa.



3. Tissue supported prosthesis: is one which is supported entirely by mucosa and underlying bone.

Tissue supported RPDs are primarily supported by tissues (mucosa overlying bone) of the denture foundation area. Tissue supported RPDs usually have plastic major connectors and are, therefore, usually interim RPDs. Tissue supported RPDs will move in function because of the resiliency of the mucosa.

Retention for tissue supported RPDs is customarily provided by wrought wire retentive clasp arms on selected natural teeth.

Removable partial dentures may be classified according to the type of material used into:

1. Acrylic (Temporary RPDs): is the RPD made of acrylic and artificial teeth, retentive wires (clasp) may be used for retention.

2. Cr/Co (Chrome/Cobalt)-metal RPDs (Definitive RPDs): is the RPD made of metal or alloys and artificial teeth, acrylic may be used as a denture base.

Removable partial dentures may be classified according to the type of treatment:

1. Definitive RPDs:

Definitive RPDs are constructed after extensive diagnosis, treatment planning, and through preparation of the teeth and tissue for the prosthesis. The length of service of definitive RPDs is intended to be many years.

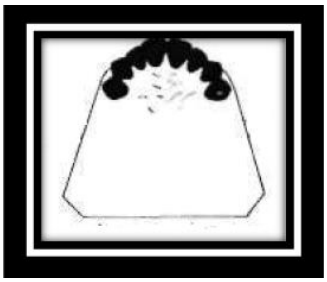
2. Interim RPDs:

Interim RPDs are usually constructed as part of the preparation of the mouth for definitive RPD, FPD or implant treatment. The length of service of interim RPDs is generally planned to be a year or less, they are frequently referred to as *temporary RPDs* .

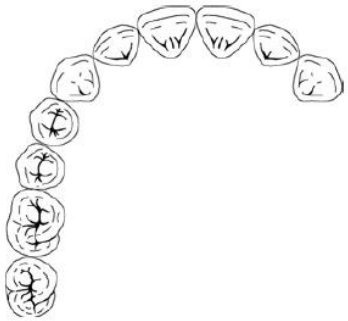
Classification based on arch configuration:

The most widely accepted system of classification of RPDs and partially edentulous arches was proposed by Dr. Edward **Kennedy** in 1923.

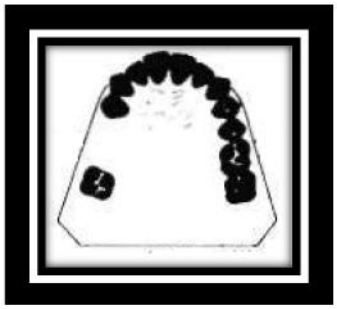
Class I: Bilateral edentulous areas located posterior to the natural teeth.



Class II: Unilateral edentulous area located posterior to the remaining natural teeth.

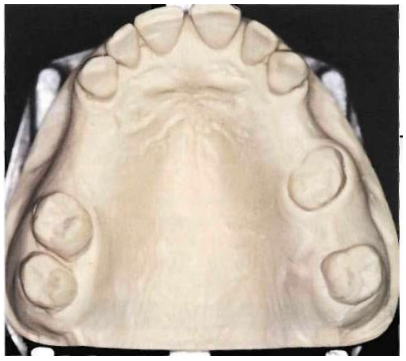


Class III: Unilateral edentulous area with natural teeth remaining both anterior and posterior to it.



Class IV: Single, but bilateral (crossing the midline), edentulous area located anterior to the remaining natural teeth.

Edentulous areas other than those determining the basic classes were designated as modification spaces and written as a number 1, 2, 3… depending on the number of the extra edentulous spans. Example:



Class III, modification 2

Rules for Applying the Kennedy Classification

Rule 1: Classification should follow rather than precede extraction.

Rule 2: If the 3rd molar is missing and not to be replaced, it is not considered in the classification.

Rule 3: If the 3rd molar is present and to be used as an abutment, it is considered in the classification.

Rule 4: If the second molar is missing and not be replaced, it is not considered in the classification.

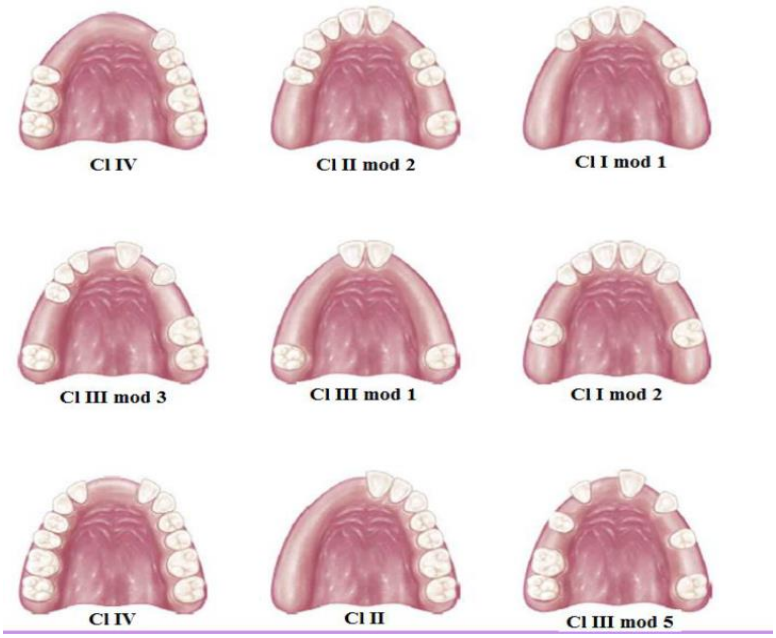
Rule 5: The most posterior edentulous area determines the classification.

Rule 6: Edentulous areas other than those determining classification are called modification spaces.

Rule 7: The extent of the modification is not considered, only the number.

Rule 8: There is no modification space in Class IV.

Examples of different partially edentulous arches cases



PROSTHODONTICS

Lec.3 Dr.Osama alheeti

Surveying

The ideal requirements for successful removable partial denture are:

1. Be easily inserted and removed by the patient.

2. Resist dislodging forces.

3. It should be aesthetically pleasing.

4. Avoid the creation of undesirable food traps.

5. Minimize plaque retention.

Surveying

It's the determination of the relative parallism of two or more surfaces of the teeth or other parts of the cast of the dental arch.

Survey

It's the procedure of the locating and delineating the contour and position of the abutment teeth and associated structures before designing a removable partial denture.

Objective of surveying

In order to plane those modifications to fabricate a removable partial denture thus can be easily inserted in the mouth and retained in place during function.

Purposes of the Surveyor

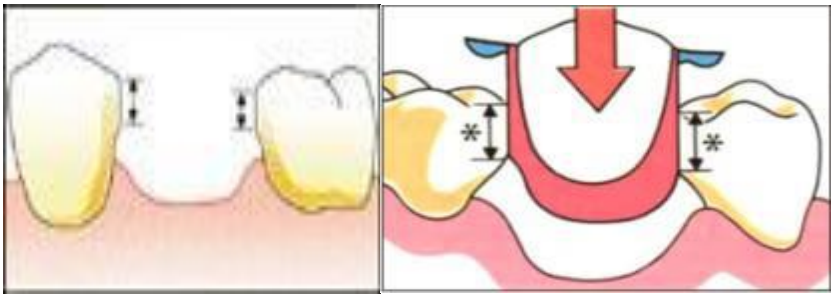
- Surveying the diagnostic cast.
- Recontouring abutment teeth on the diagnostic cast.
- Contouring wax patterns.
- Measuring a specific depth of undercut.
- Surveying ceramic veneer crowns.
- Placing intracoronal retainers.
- Placing internal rests.
- Surveying and blocking out the master cast.

Guiding planes*:* two or more vertically parallel surfaces on abutment teeth and/or fixed dental prostheses oriented so as to contribute to the direction of the path of placement and removal of a removable partial denture, maxillofacial prosthesis, and overdenture. They are:

A. Flat surfaces parallel to the path of insertion.

B. Represent the initial contact of the RPD.

C. Help to stabilize, control and limit the movement of the RPD.



Advantages of single path of placement (insertion):

A. Allows insertion and removal of prosthesis without interference.

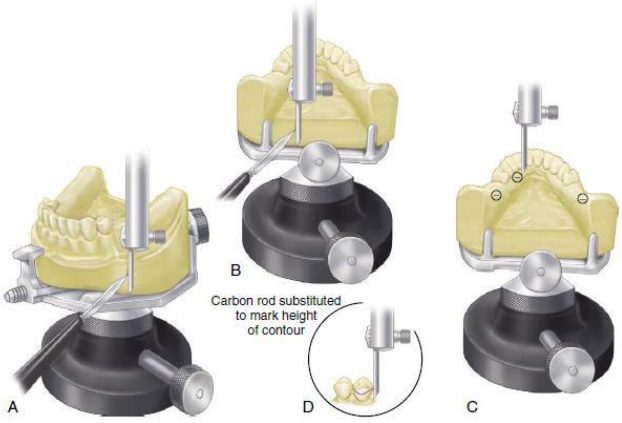
B. Help to direct the force along the long axis of the tooth.

C. Provide frictional retention.

D. Minimize torque on the abutment teeth.
E. Cross arch stabilization.
F. Equalize retention.

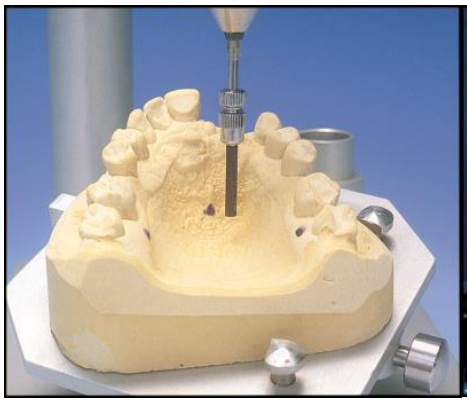
<u>Path of displacement</u>: This is the direction in which the denture tends to be displaced in function. The path is variable but is assumed for the purpose of design to be at right angles to the occlusal plane.

Undercuts could be:
A. Desirable undercut: this is useful in to retain RPD against dislodging forces.
B. Undesirable undercut: other than that used to retain the RPD; in most of the case undesirable undercut interfere with placement and removal of the prosthesis or produces damaging effects on the teeth and underlying structures. Such type of undercut can be eliminated by:
- Block out with wax.
- Preparation and alteration of the tooth surfaces (within a limit).
- Crown restoration, in which the tooth surface can be reshaped to serve RPD functions and requirements.

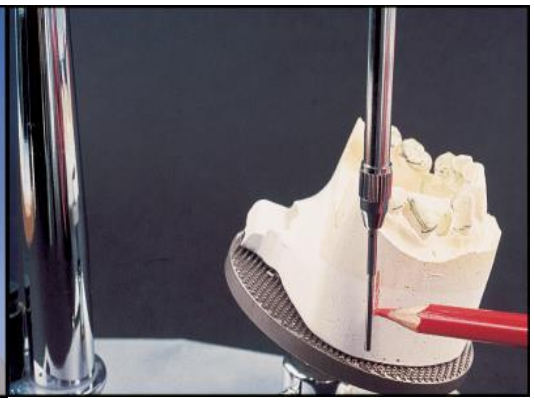


A-B, The path of placement is determined, and the base of the cast is scored to record its relation to the surveyor for future repositioning. **C,** An alternate method of recording the relation of the cast to the surveyor is known as *tripoding*. A carbon marker is placed in the vertical arm of the surveyor, and the arm is adjusted to the height by which the cast can be contacted in three divergent locations. The vertical arm is locked in position, and the cast is

brought into contact with the tip of the carbon marker. Three resultant marks are encircled with colored lead pencil for ease of identification. Reorientation of the cast to the surveyor is accomplished by tilting the cast until the plane created by three marks is at a right angle to the vertical arm of the surveyor. **D,** Height of contour is then delineated by a carbon marker.



Three dots (tripoding)



Parallel lines

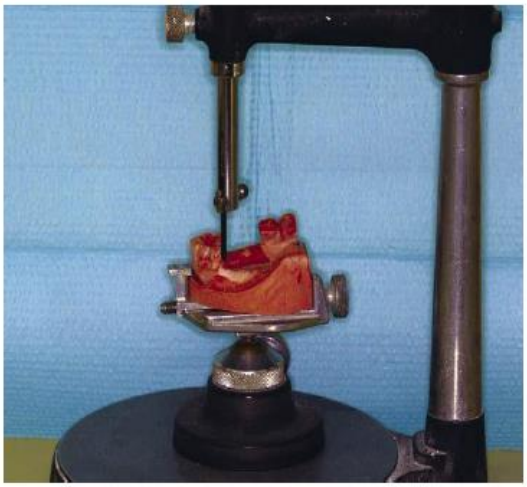
<u>Dental surveyor</u>

It's as an instrument used to determine the relative parallelism of two or more surfaces of the teeth or other parts of the cast of a dental arch.

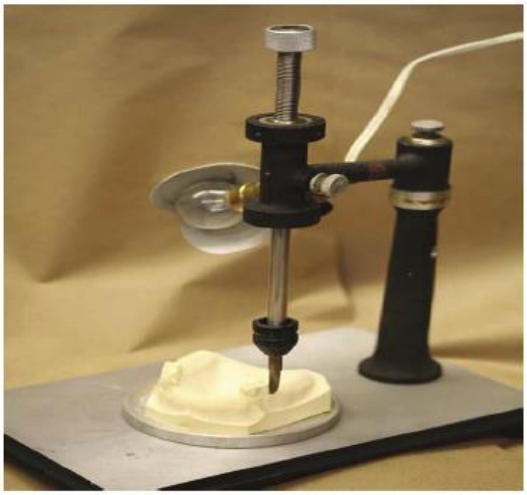
Types of dental surveyors

The most widely used surveyors are:

1. ***Ney surveyor*** with non-swiveling horizontal arm. **The Ney surveyor is widely used because of its simplicity and durability.**
2. ***Jelenko surveyor*** with swiveling horizontal arm and has spring mounted paralleling tool.



Ney surveyor



Jelenko surveyor

Parts of dental surveyor (Ney type surveyor):

A. Platform on which the base is moved.

B. Vertical arm or upright column that supports the superstructures.

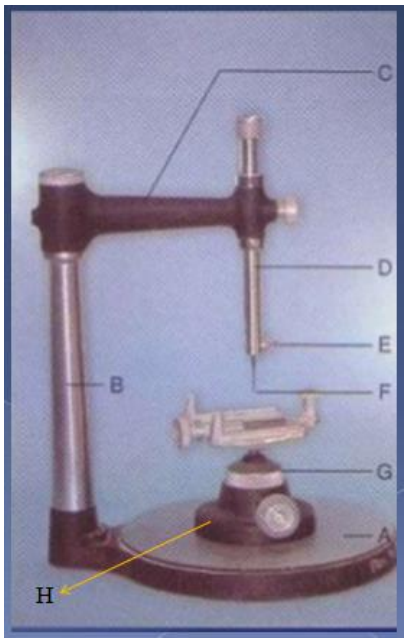
C. Horizontal arm from which surveying tools suspends.

D. Survey arm.

E. Mandrel for holding special tools.

F. Tools which are used for surveying **(in sequence)** include: analyzing rod, carbon marker, undercut gauges, wax trimmer.

G. Table to which the cast is attached.**H. Base** on which the table swivels.

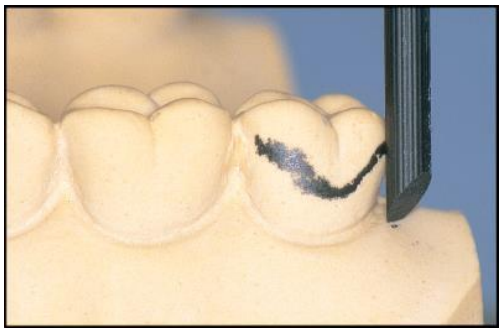


Analyzing rod

A thin straight metal rod used to analyse contours and undercuts. This is the principal tool used in surveying. This metal rod is placed against the teeth and ridges during the initial analysis of the cast to identify undercut areas and to determine the parallelism of surfaces without marking the cast.

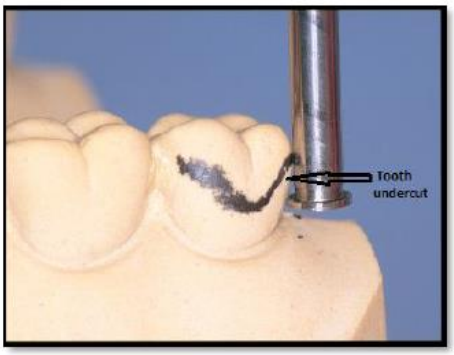
Carbon marker

It's used for the actual marking of the survey lines on the cast. A metal shield is used to protect it from breakage.



Undercut gauge

Gauges are provided to measure the extent of horizontal undercut and are available in the following sizes: 0.25 mm, 0.50 mm and 0.75 mm. By adjusting the vertical position of the gauge until the shank and head contact the cast simultaneously, the point at which a specific extent of horizontal undercut occurs can be identified and marked.

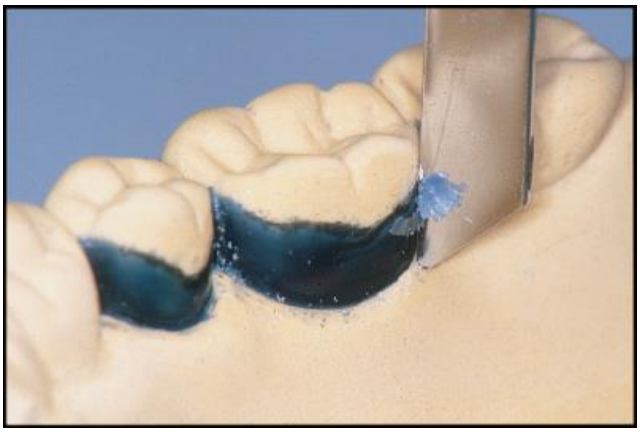


Ney undercut gauge

Trimming knife

Before talking about trimming knife we have to mention about (**Blocking out the Master Cast procedure).** After the path of placement and the location of undercut areas have been established on the master cast, any undercut areas that will be crossed by rigid parts of the denture (which is every part of the denture framework but the retentive clasp terminals) must be eliminated by blockout by wax.

Trimming knife: This instrument is used to eliminate unwanted undercuts on the master cast. Wax is added to these unwanted undercut areas and then the excess is removed with the trimmer so that the modified surfaces are parallel to the chosen path of insertion.



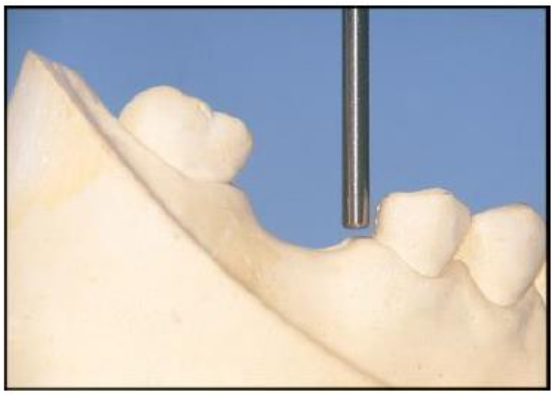
<u>Surveying procedure:</u>

This may be divided into the following distinct phases:

- Preliminary visual assessment of the study cast.
- Initial survey.
- Analysis.

 Final survey.

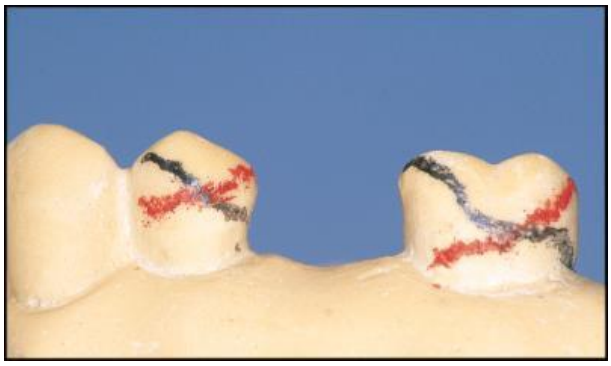
Preliminary visual assessment of the study cast: This stage has been described as ‘eyeballing’ the cast and is a use- ful preliminary to the surveying procedure proper. The cast is held in the hand and inspected from above.



Initial survey: The cast is positioned with the occlusal plane horizontal. The teeth and ridges are then surveyed to identify undercut areas that might be utilised to provide retention in relation to the most likely path of displacement.

Analysis: An RPD can be designed on a cast which has been surveyed with the occlusal plane horizontal (ie so that the path of insertion equals the path of displacement). However, there are occasions when tilting of the cast is indicated so that the paths of insertion and displacement differ.

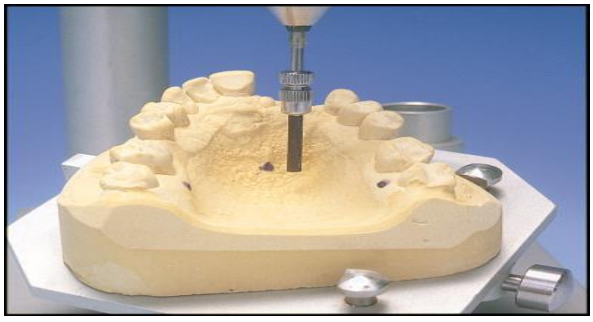
Final survey: If it is decided that the cast should be tilted, the analysing rod is exchanged for a marker different in colour from that used in the first survey, and the final survey is carried out. It will then usually be found that the teeth to be clasped have two separate survey lines which cross each other. In order to obtain optimum retention it is necessary to understand how to position the clasps correctly in relation to the two survey lines.



Recording the orientation of a cast.

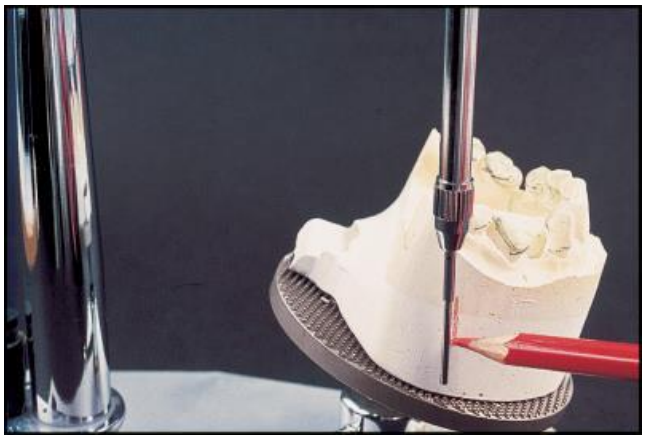
If the cast has been tilted for the final survey, the degree of tilt must be recorded so that the position of the cast can be reproduced in the laboratory. There are two methods of recording the degree of tilt.

1. Using the tripod method, the vertical arm of the surveyor is locked at a height that allows the tip of the marker to contact the palatal surface of the ridge in the molar and incisal regions. Three points are marked with the graphite marker, one on each side posteriorly and one anteriorly. The points will then be ringed with a pencil so that they are clearly visible.



2. Alternatively, the analysing rod is placed against one side of the base of the cast and a line drawn on the cast parallel to the rod. This is repeated on the other side and at the back of the cast so that there are three widely spaced

lines parallel to the path of insertion.



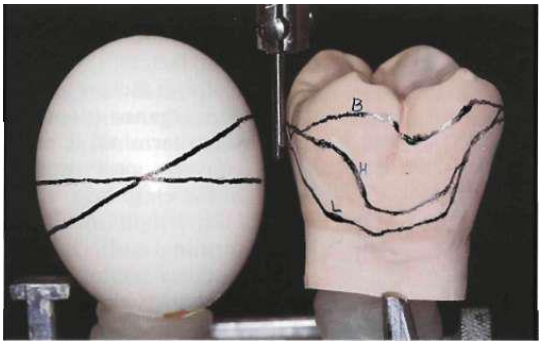
PROSTHODONTICS

Principles of surveying

- Surveying a tooth consist of locating accurately the height of its maximum contour in relation to the plane in which the cast is positioned.
- Modifying the proximal tooth surfaces so that the prosthesis goes smooth in place without interferences.

- The fact that the majority of the natural teeth crowns are bulbous in shape (have a suprabulge region), where this suprabulge region could occur anywhere between the occlusal surface and the gingival margin.

- When a tooth is tilted or rotated in relation to the analyzing rod, another survey line will be traced, as a result, the extent of non-undercut area and the undercut area are consequently changed. That means the survey line can vary according to the angle formed by contact of the vertical analyzing rod with the tooth surface.



- Alteration of undercut area can be done by anterior or posterior tilting of dental cast. So that the effect of tilting a cast on the surveyor will be:

1. Redistribution of undercuts to the desired areas.
2. Allow a more favorable path of insertion.
3. Allow the use of a desired type of clasp for better function and esthetics.
4. Allow the use of a design to minimize food impaction, food entrapment and plaque accumulation.

Path of placement (Insertion)

The specific direction in which a prosthesis is placed on the residual alveolar ridge, abutment teeth, dental implant abutment(s).

Factors that determine and affect the path of placement (insertion) and removal of the RPD

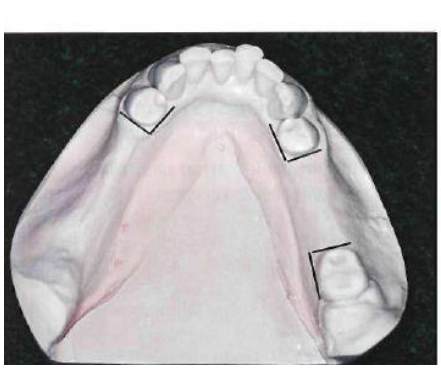
1. Guiding Planes

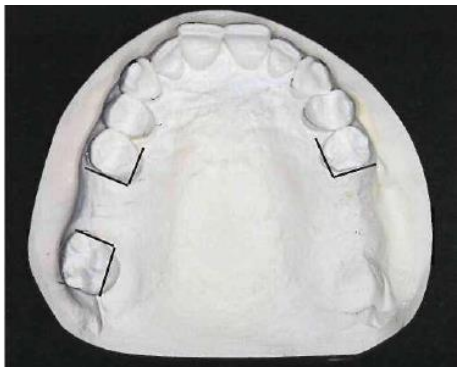
Guiding planes are parallel surfaces of abutment teeth that direct the insertion and removal of a partial denture. *The path of insertion should be parallel to guiding planes*. Proximal tooth surfaces that bear a parallel relationship to one another must either be *found* or be *created* to act as guiding planes.

To do so this, proximal plates (part of the RPD contact guiding planes) should, whenever possible, be the ***initial portions of the partial denture to contact the abutments***.

Function of guiding plane:

- The denture can be easily placed and removed by the patient without strain on the teeth contacted .
- Can provide bracing or stabilization when placed in the axial tooth surfaces.
- Ensure clasp assembly function including retention and stabilization.
- The friction forces of contact of prosthesis with the guiding planes wall will contribute significantly to the retention of the RPD.





2. Retentive Areas

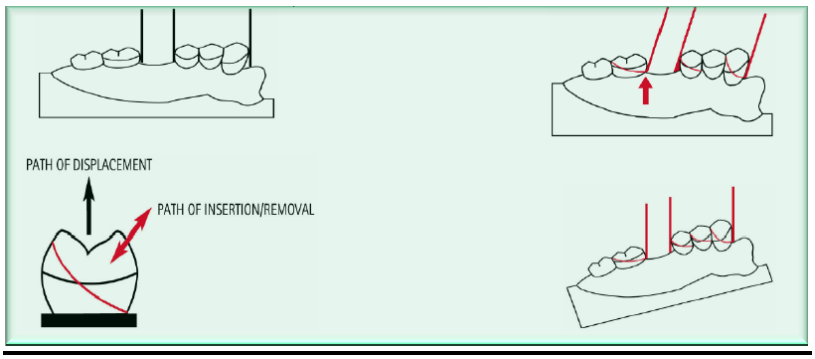
Retentive areas must exist for a given path of placement and must be contacted by retentive clasp arms that are forced to flex over a convex surface during placement and removal.

Fairly even retention may be obtained by one of two means:

➢ Change the path of placement to increase or decrease the angle of cervical (Gingival) convergence of opposing retentive surfaces of abutment teeth.

➢ Alter the flexibility of the clasp arm by changing its design, its size and length, or the material of which it is made.

For a clasp to be retentive; ***its path of escapement*** must be ***other than parallel to the path of removal of the denture itself***; otherwise, it would not be forced to flex and thereby generate the resistance known as retention. Clasp retention therefore depends on the existence of a definite path of placement and removal.



3. Interference

The prosthesis must be designed so that it may be placed and removed without encountering tooth or soft tissue interference (areas of interference like the proximal tooth undercut, maxillary or mandibular lingually or labialy or buccally incline teeth, bony exesistosis and tissue undercuts).

A path of placement may be selected that encounters interference only if the interference can be eliminated:

- During mouth preparations.
- On the master cast by a reasonable amount of blockout.

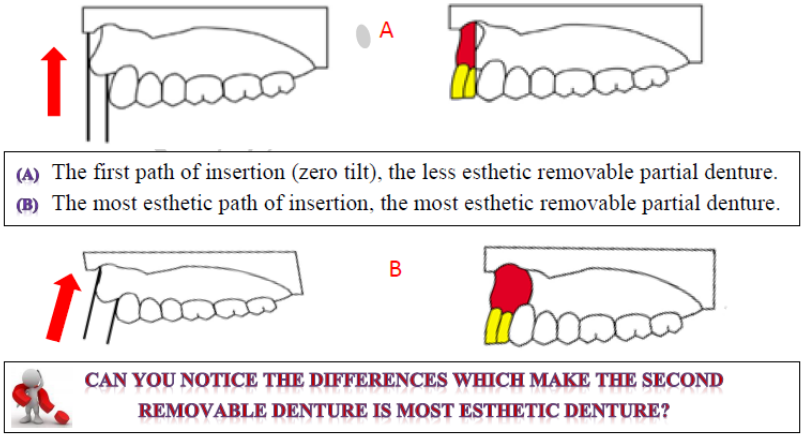
Interference may be eliminated during mouth preparations by:

- Surgery.
- Extraction of the tooth or teeth.
- Modification of interfering tooth surfaces.
- Or alteration of tooth contours with restorations

4. Esthetics

A path of insertion should be selected to provide the most esthetic placement of artificial teeth and the least amount of visible metal on the abutment teeth. Retentive areas must be selected to optimize retention purposes with esthetic requirements.

• Metal component must be concealed. Less metal will be displayed (most esthetic location of clasps) if the retentive clasp is placed at a more *distogingival area* of tooth surface made possible either by changing the path of placement selected or by the contour of the restorations.



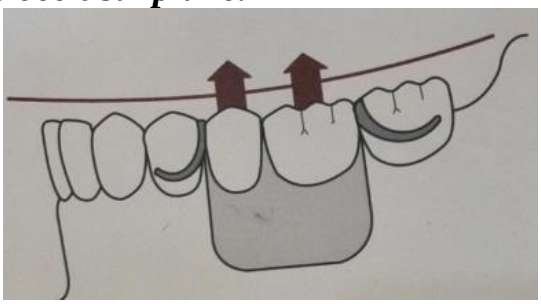
Rules of surveying

1. The undercut areas cannot be created or produced by tilting the cast.

2. All casts are originally surveyed with the occlusal plane is parallel to the base of surveyor; this is what we called ***zero tilt***, in which the retentive undercut must be present on the abutment teeth.

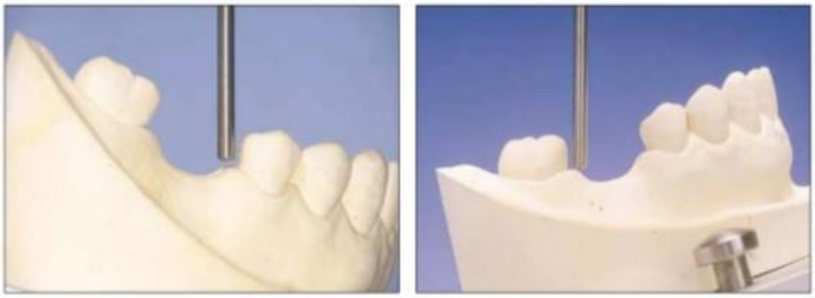
Most patients will tend to seat the partial denture under the force of occlusion.

If the path of insertion is other than vertical to the occlusal plane such seating may deform the clasps. Also dislodging forces are always directed perpendicular to the occlusal plane.



3. The retentive tip of the clasp must engage the undercut area, which are present when the cast is surveyed in certain position.
4. Wherever possible, the undesirable undercut and area of interference are removed during mouth preparation by recontouring teeth or making necessary restoration.

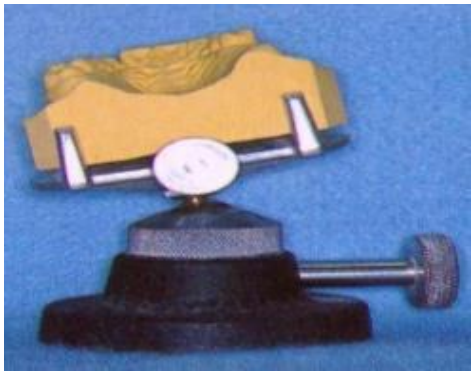
5. Anteroposterior tilt: anterior tilt will increase the mesial undercut, while the posterior tilt will increase the distal undercut. Such as in free end extension partial denture tilting the cast anteriorly will decrease or eliminate the distal undercut where the path of insertion will be changed, thus getting rid of undesirable undercut located distally, therefore the tilting of the cast is to minimize or equalize the undesirable undercut.



Anterior tilt ('heels up')

Posterior tilt ('heels down').

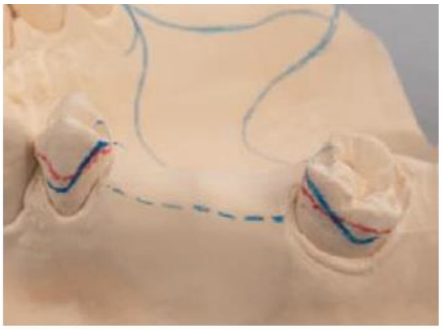
6. ***Lateral tilt:*** dealing with retentive undercut situated buccally or lingually on posterior teeth.



Blocking out the master cast:

After the master cast has been surveyed and establishment of the path of placement and the location of undercut areas on the master cast, any undercut areas that will be crossed by rigid parts of the denture (which is every part of the denture framework except the retentive clasp terminals) must be eliminated by blockout.

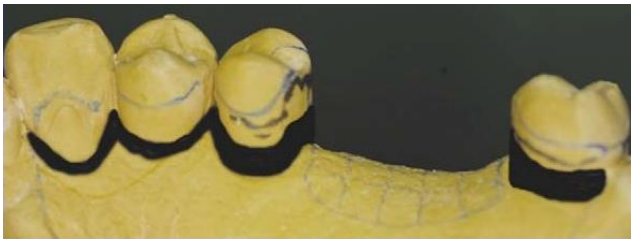
Blockout:- It is the elimination of the undercut areas that will be crossed by rigid parts of the denture except the retentive clasp terminals; this step was done on the master cast before duplication.




Deep areas in the palatal rugae and interdental spaces should also be blocked out. This facilitates subsequent removal from the duplicate mould.


Types of blockout of master cast:

1- Parallel blockout: Parallel blockout is necessary for areas that are cervical to guiding plane surfaces and over all undercut areas that will be crossed by major or minor connectors. Hard inlay wax may be used satisfactorily as a blockout material. It is easily applied and is easily trimmed with the surveyor knife. All guiding plane areas must be parallel to path of placement, and all other areas that will be contacted by rigid parts of denture framework must be made free of undercut by parallel blockout.



Sites of parallel blockout

1. Proximal tooth surfaces to be used as guiding planes.
2. Beneath all minor connectors.
3.Tissue undercuts to be crossed by rigid connectors.
4.Tissue undercuts to be crossed by origin of bar clasps.
5.Deep interproximal spaces to be covered by minor connectors or linguoplates.
6. Beneath bar clasp arms to gingival crevice.

2- Shaped blockout (Ledges for clasp arms):- For locating clasp patterns may or may not be used. However, this should not be confused with the actual blocking out of undercut areas that would offer interference to the placement of the denture framework.

Site :On buccal and lingual surfaces, to locate the wax patterns for clasp arms.

3. Arbitrary blockout: Such areas are the labial surfaces and labial undercuts not involved in the denture design and the sublingual and distolingual areas beyond the limits of the denture design. These are blocked out arbitrarily with hard baseplate wax, but because they have no relation to the path of placement, they do not require the use of the surveyor.

Arbitrary block out is done to:

1. Facilitate the removal of the cast from the impression during duplication.

2. Prevent distortion of duplicating mold when the master cast is removed.

Sites of arbitrary blockout

1. All gingival crevices.

2. Gross tissue undercuts situated below areas involved in design of denture framework.

3. Tissue undercuts distal to cast framework.

4. Labial and buccal tooth and tissue undercuts not involved in denture design.

Relieving the master cast:

It is the procedure of placing wax in certain areas on the master cast before duplication, to create a raised area on the refractory cast.

Purpose of relief

1.To prevent tissue impingement resulting from rotation of the denture framework.
2.To prevent abrasion of the cast.
3.To create space for the acrylic resin (beneath the retentive ladder).

Sites

1.Beneath lingual bar connectors or the bar portion of the linguoplates concerning the relative slope of the alveolar ridge.
2.Areas in which major connectors will contact thin tissue, such as hard areas so frequently found on lingual or mandibular ridges and elevated palatal raphes and tori.
3.Beneath the ladder minor connectors for attachment of resin bases.

Duplication is the procedure of accurately reproducing a refractory cast.
Refractory cast: It is a cast made of material that will withstand high temperature without disintegration when used in partial denture casting procedure; it has an expansion to compensate for metal shrinkage. The refractory cast has been made of investment material. The investment material is used for making the refractory cast; the type of investment depends on the type of alloy used.
a- Gypsum bounded investment is used for low heat alloys as type IV gold alloy.
b- Phosphate bounded investment is used for high heat alloys as vitallium, palladium and Co-Cr alloy.

Objectives of duplication

1.To preserve the original master cast.
2.On the duplicated cast the metal framework may be fitted without fracture or abrading the original master cast.

PROSTHODONTICS

PREPARING MASTER CASTS FOR DUPLICATION

3rd class

Lec.4 *Dr. osama Alheeti*

During RPD metal fabrication it is necessary to have two identical casts. the first (original) stone cast is used for acrylic partial denture fabrication and for producing the second cast (Refractory cast) from the impression material like silicon or agar materials that are used for modeling and making of metal partial denture frameworks.

Preparation of master model for duplication includes isolation of areas where saddles are placed. This procedure is carried out with special wax for isolation . In edentulous area of upper jaw the thickness of wax is 0,5 – 0,8 mm .In mandible master model when loss of the distal teeth bilaterally presents the thickness of isolation wax in edentulous areas can be up to 2 mm .

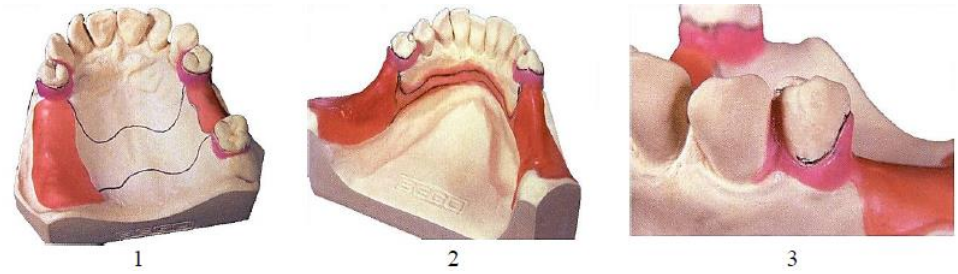


Fig. 1. Wax isolation of alveolar ridge (the position of the saddles) in upper jaw (1) and lower jaw(2) and notch forming for transfer of clasps position on the refractory model (3)

Blocking out the master cast:

After the master cast has been surveyed and establishment of the path of placement and the location of undercut areas on the master cast, any undercut areas that will be crossed by rigid parts of the denture (which is every part of the denture framework except the retentive clasp terminals) must be eliminated by blockout.

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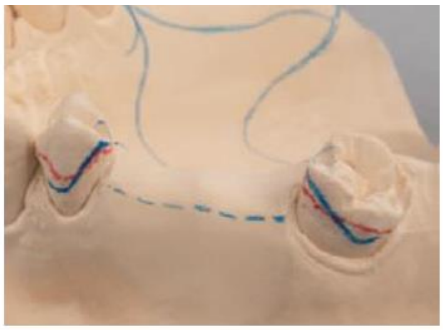


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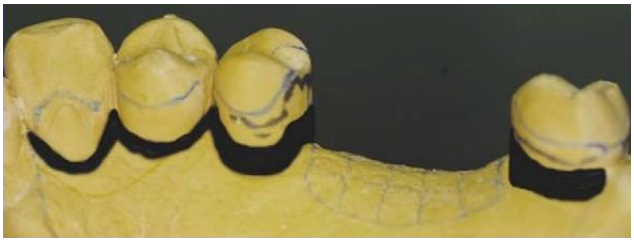

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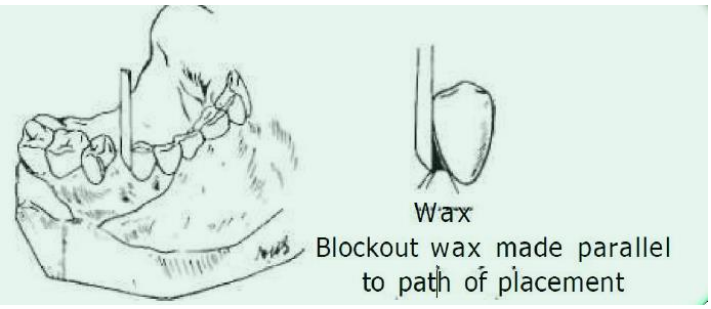

2- Shaped blockout (Ledges for clasp arms):- For locating clasp patterns may or may not be used. However, this should not be confused with the actual blocking out of undercut areas that would offer interference to the placement of the denture framework.

Site :On buccal and lingual surfaces, to locate the wax patterns for clasp arms.

Wax ledge for reciprocal clasp arm as cervical as possible also ledge for location of retentive clasp arm, ledge is applied below the survey line around the abutment teeth. Wax ledges on buccal surfaces of premolar and molar abutments have been duplicated in refractory the cast for exact placement of clasp molar pattern and the premolar wrought wire clasp.

3. Arbitrary blockout: Such areas are the labial surfaces and labial undercuts not involved in the denture design and the sublingual and distolingual areas beyond the limits of the denture design. These are blocked out arbitrarily with hard baseplate wax, but because they have no relation to the path of placement, they do not require the use of the surveyor.

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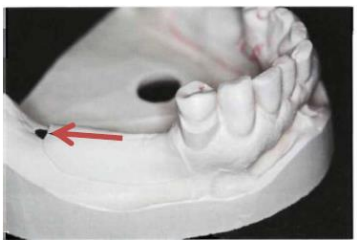
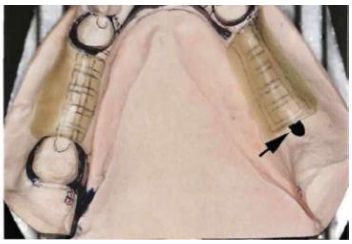
Sites

1.Beneath lingual bar connectors or the bar portion of the linguoplates concerning the relative slope of the alveolar ridge.

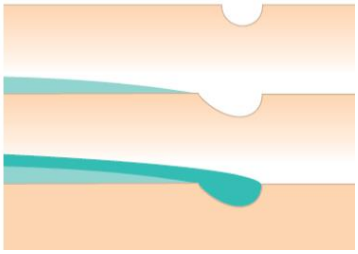
2.Areas in which major connectors will contact thin tissue, such as hard areas so frequently found on lingual or mandibular ridges and elevated palatal raphes and tori.

3.Beneath the ladder minor connectors for attachment of resin bases.

Tissue stops:- Tissue stops are represented as (2 mm x 2 mm) square cut in the relief wax over the ridge in distal extension areas. Tissue stops are integral parts of minor connectors designed for retention of acrylic resin bases. They provide stability to the framework during the stages of transfer and processing.

Preparing the finishing margins (Beading):- The finishing margins of the transversal connector marked on the model are ground to a maximum depth of 0.5 mm with a 1 mm round bur. This increases the suction of the denture. The prepared finishing margins are trimmed towards the plate to avoid any sharp edges or pressure points. Used only on maxillary design.

<u>Duplication</u> is the procedure of accurately reproducing a refractory cast.

Refractory cast: It is a cast made of material that will withstand high temperature without disintegration when used in partial denture casting procedure; it has an expansion to compensate for metal shrinkage. The refractory cast has been made of investment material.

The investment material is used for making the refractory cast; the type of investment depends on the type of alloy used.

a- Gypsum bounded investment is used for low heat alloys as type IV gold alloy.

b- Phosphate bounded investment is used for high heat alloys as vitallium, palladium and Co-Cr alloy.

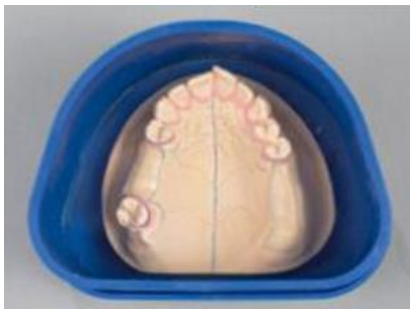
Objectives of duplication

1.To preserve the original master cast.

2.On the duplicated cast the metal framework may be fitted without fracture or abrading the original master cast.

Duplication procedure:-

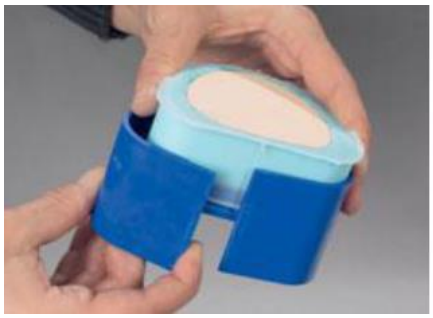
1- Mount master cast to the middle of the flask base with sticky wax. Ensure that there is a uniform gap (approx. 1 cm) between the model and the edge of the sleeve so that the silicone mold has adequate stability. Seat body of flask.



2- Prepare silicone or agar we two types of duplication materials
a- For the duplicating silicone (irreversible material) is mixed bubble free in a vacuum mixer according to the manufacturer‘s instructions for use.
b- or using agar (reversible hydrocolloid that are capable of being reused up to four times, they may be prepared and stored in an automatic duplicating machine. The clean colloid can be used by cutting it into small pieces, reheated in this double boiler to a fluid consistency, then tempered to a working temperature, it will be cooled enough to flow easily without melting the blocked out wax (63°C).

3- Filling the flask with silicone or agar

4- After hardening remove the master cast from the agar mold. Ensure that no wax sections are left in the duplicate mold.




5- Spray the duplicate mold with silicone wetting agent to avoid bubbles forming in the investment model. The Cr-Co investment is mixed bubble free in a vacuum mixer according to manufacturer‘s instructions.


6- Poured the investment slowly into the duplicate mold with the aid of a vibrator. It is important to use the correct oscillation mode for the material at the optimum level of vibration to ensure that the model is poured without bubbles. The model can be carefully removed after the investment has set.


THE END OF THE LECTURE

Prosthodontics

3rd class **Lec.5** **Dr.osama Alheeti**

Component Parts of a Removable Partial Denture

The removable partial denture consists of seven main components and these are essential for the success of the treatment for the partially edentulous patient.

1. Major connectors
2. Minor connectors
3. Rests
4. Direct retainers
5. Reciprocal components
6. Indirect retainers
7. denture bases (each supporting one to several replacement teeth)

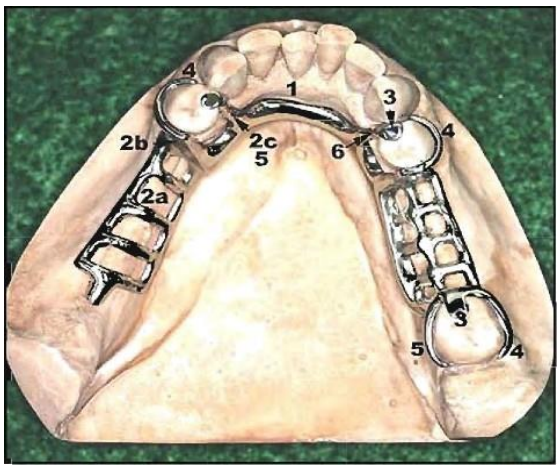


Figure 1: 1, lingual bar major connector; 2a, minor connector by which the resin denture base will be attached; 2b, minor connector, proximal plate, which is part of clasp assembly; 2c, minor connector used to connect rests to major connectors; 3, occlusal rests; 4, direct retainer arm, which is part of the total clasp assembly; 5, stabilizing or reciprocal components of clasp assembly

Major connectors

A major connector is the component of the partial denture that connects the parts of the prosthesis located on one side of the arch with those on the opposite side .

Maxillary major connector

To ***function effectively*** and ***minimize potentially damaging effects, all major connectors must:***

1. Be rigid.

A flexible major connector may cause severe damage to the hard and soft tissues of the oral cavity. Flexibility allows forces to be concentrated on individual teeth and segments of the residual ridges. This may lead to tooth mobility or tooth loss. The concentration of forces upon small segments of the residual ridges may cause resorption of the hard and soft tissues. This may result in decreased ridge height and decreased support for the associated denture bases.

2. Protect the associated soft tissues.

The Major connector must not permit impingement upon the free gingival margins of the remaining teeth.

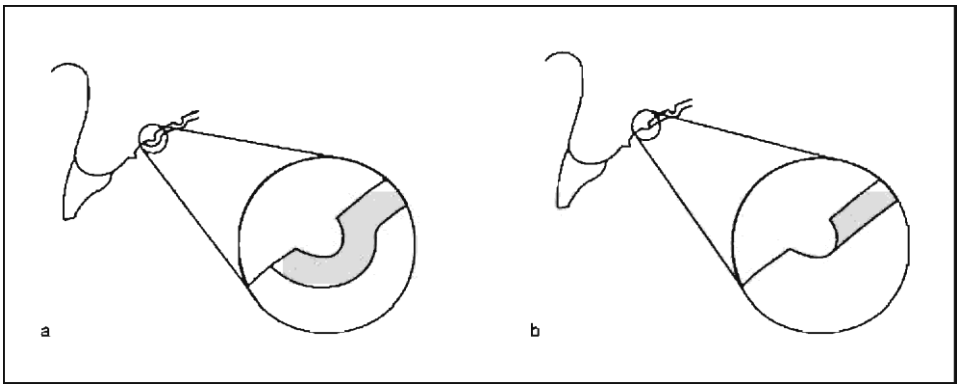
3. Provide a means for obtaining indirect retention where indicated.

Removable partial denture that is not supported at each end of an edentulous space tends to rotate about a fulcrum line. The most common method for controlling this movement is through the use of one or more indirect retainers. For practical purposes, indirect retainers will always take the form of rests.

4. Provide a means for placement of one or more denture bases.

Generally, the type of major connector will be dictated by the number and location of edentulous areas.

5. Promote patient comfort.



(a) the anterior border of a maxillary major connector should not end on the anterior slope of a prominent iuga. (b) The anterior border of the major connector should be terminatedon the posterior slope.

The edges of a major connector should be contoured to blend with the oral tissues. This is particularly true for major connectors that cross the anterior palate.

The major connector is a component part of the removable partial denture, as mentioned earlier. The ***chief functions of a major connector*** are to

1) unify the major parts of the prosthesis.

2) distribute the occlusal force throughout the arch

3) cross-arch stabilization to minimize the torque to the teeth.

Major connectors should be *designed* with the following guidelines in mind:

1. Major connectors should be free of movable tissue.
2. Impingement of gingival tissue should be avoided.

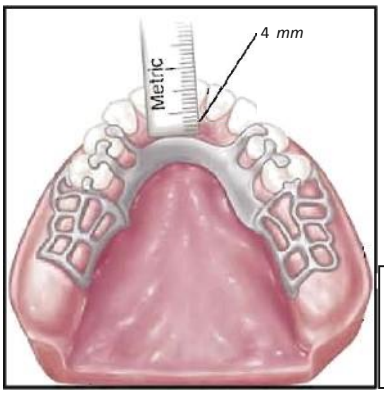


Figure: borders of the major connector should be positioned at least 4 mm from the free gingival margins

3. The borders of the major connector should run parallel to the gingival margins of the remaining teeth .

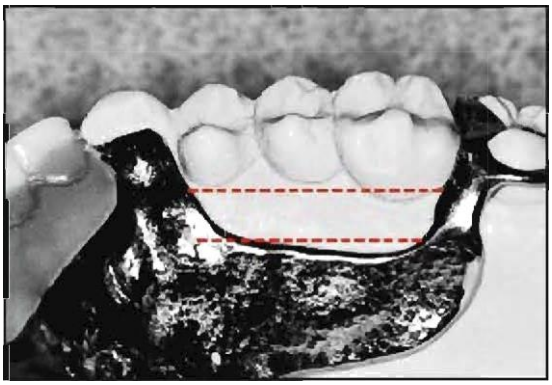
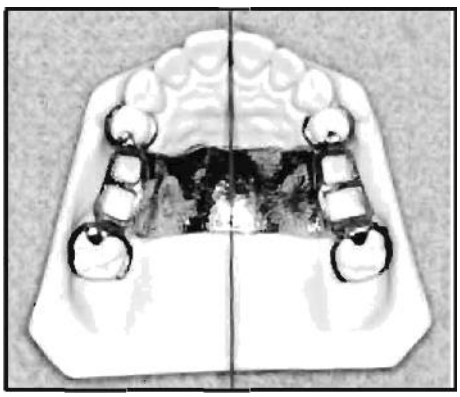


Figure: The border s of the major connector should run parallel to the gingival margins of the remaining teeth

4. The major connector should be as a symmetrical as possible.

Figure: The borders of a maxillary major connector should always cross the palatal midline at 90 degrees.



5. Bony and soft tissue prominences should be avoided during placement and removal .

Figure: Coverage of tori should be avoided if possible. The tissues covering tori are extremely thin and susceptible to irritation

6. The major connector should show smooth, rounded . Sharp angles and comers may cause patient discomfort and produce areas of stress concentration within a removable partial denture framework..

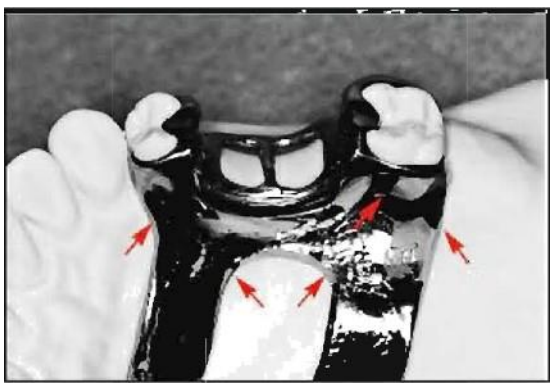


Figure : All major connectors should exhibit smooth rounded contours (arrows).

7. Relief should be provided beneath a major connector to prevent its settling into areas of possible interference, such as an elevated median palatal suture.

8. Major connectors should be located and/or relieved to prevent impingement of tissue that occws because the distal extension denture rotates in function in the mandible.

Maxillary Major Connectors

The four types of maxilla major connectors include the following:

1. Single palatal strap and Single palatal bar.

2. Combination anterior and posterior palatal strap (Anterior-posterior palatal bars).

3. Palatal plate-type connector.

4. U-shaped palatal connector/ Horse-shoe.

1- Single palatal strap and Single palatal bar.

Indications

1- Posterior bilateral edentulous spaces of short span in a tooth-supported restoration.

2- It may also be used in tooth-supported unilateral edentulous situations with provision for cross-arch attachment by extracoronal retainers.

Contraindications

1- Tooth-tissue supported removable partial denture.

2- Presence of palatal tori.

3- Extremely long edentulous span. Anteroposterior major connector would be better.

ADVANTAGES

1- Very simple design.

2- Very few metal-tissue edges.

DISADVANTAGES

It covers a considerable portion of the palate.

Characteristics and Location

(1) Anatomic replica form.

(2) Anterior border follows the valleys between rugae as nearly as possible at right angles to median suture line.

(3) Posterior border is well anterior to the vibrating line, at right angle to median suture line.

(4) Strap should be 8 mm wide or approximately as wide as the combined width of a maxillary premolar and first molar.

(5) In sagittal section, midportion of major connector demonstrates slight elevation to provide rigidity. Such thickness of major connector does not appreciably alter palatal contours.

 To differentiate between a palatal bar and a palatal strap, a palatal connector component of less than 8 mm in width is called palatal bar.

2- ANTERIO-POSTERIOR PALATAL STRAP

It is a rigid palatal major connector. The anterior and posterior palatal strap combination may be used in almost any maxillary partial denture design. The strength of this major connector design lies in the fact that the anterior and posterior components are joined together by longitudinal connectors on either side, forming a square or rectangular frame.

Indications

(1) In Class I and II arches in which excellent abutment and residual ridge support exists, and direct retention can be made adequate without the need for indirect retention from palate (palatal plate).

(2) Long edentulous spans in Class II mod. 1 arches.

(3) In Class IV arches in which anterior teeth must be replaced with a removable partial denture.

(4) Inoperable palatal tori that do not extend posteriorly to the junction of the hard and soft palates.

Contraindications

1- When can use simple major connector.

2- When there is large inoperable palatal torus that extends posteriorly to the soft palate, so broad U- shaped major connector may be considered.

ADVANTAGES

The double-strap type of major connector provides the maximum rigidity without bulk. It covers minimum of palatal tissues than full palatal coverage.

DISADVANTAGES

1- Very complex design.

2- A lot of metal-tissue edges.

3- The posterior palatal bar or strap frequently does not fit the palate closely.

4- The anterior border is frequently located in the rugae.

Characteristics and Location

(1) Parallelogram shaped and open in center portion.

(2) Relatively broad (8 to 10 mm) anterior and posterior palatal straps.

(3) Lateral palatal straps (7 to 9 mm) narrow and parallel to curve of arch; minimum of 6 mm from gingival crevices of remaining teeth.

(4) Anterior palatal strap: anterior border not placed farther anteriorly than anterior rests and never closer than 6 mm to lingual gingival crevices; follows the valleys of the rugae at right angles to the median palatal suture. Posterior border, if in rugae area, follows valleys of rugae at right angles to the median palatal raphe.

(5) Posterior palatal connector: posterior border located at junction of hard and soft palates and at right angles to median palatal raphe and extended to hamular notch area(s) on distal extension side(s).

(6) Anatomic replica surface.

3- PALATAL PLATE MAJOR CONNECTOR

The words palatal plate are used to term any thin, broad, contoured palatal coverage used as a maxillary major connector and covering one half or more of the hard palate.

Indications of complete palatal coverage

(1) In Class II arch with large posterior modification space and some missing anterior teeth.

(2) When relining is expected or cost is a factor.

(3) In the absence of a torus.

(4) In most situations in which only some or all anterior teeth remain.

(5) When the last remaining abutment tooth on either side of a Class I arch is the canine or first premolar tooth, especially when the residual ridges have undergone excessive vertical resorption.

This may be accomplished in one of two ways.

A- One method is to use a complete cast plate that extends to the junction of the hard and soft palates.

B- The other method is to use a cast major connector anteriorly with retentive means posteriorly, for the attachment of an acrylic-resin denture base that extends posteriorly to the posterior palatal seal area.

Contraindications

When less than complete palatal coverage is necessary and there are sufficient remaining natural teeth to use a palatal plate or strap major connector.

ADVANTAGES

1- Maximum support, retention, bracing, and direct-indirect retention from the palate.

2- Fairly simple design.

3- Few metal teeth edges.

4- Easy to add new prosthetic teeth to framework.

5- Can be easily converted to an interim complete denture.

DISADVANTAGES

1- Covers more teeth and tissues surface than any major connector.

2- There are several design difficulties: **A**- The hamular notch, vibrating line area must be included on a master cast.

B- Difficult to adjust the metal-tissue contact.

C- Difficult to reline the metal portion of palatal contact.

Characteristics and Location

(1) Anatomic replica form for full palatal metal casting supported anteriorly by positive rest seats.

(2) Palatal linguoplate supported anteriorly and designed for the attachment of acrylic resin extension posteriorly.

(3) Contacts all of the teeth remaining in the arch.

(4) Posterior border: terminates at the junction of the hard and soft palates; extended to hamular notch area(s) on distal extension side(s); at a right angle to median suture line.

4- U-SHAPED MAJOR CONNECTOR/ Horse-shoe

The U-shaped palatal major connector is the least favorable design of all palatal major connectors.

Indications

1- A class IV partially edentulous arch.

2- A class III or class III mod.1 partially edentulous arch with anterior edentulous spaces.

3- A partially edentulous arch with a palatal torus extends to the posterior limit of the hard palate.

4- When several anterior teeth are to be replaced.

Contraindications

1- Where support, retention, bracing, and direct-indirect retention from the palate is necessary.

ADVANTAGES

1- Minimal coverage of the palate.

2- Fairly simple design.

3- Fewer metal-tooth or -tissue edges than anteroposterior design.

DISADVANTAGES

1- It is not rigid as other maxillary major connectors; rigidity may be increased by having the metal in the vertical and horizontal planes. Its lack of rigidity (compared with other designs) can allow lateral flexure under occlusal forces, which may induce torque or direct lateral force to abutment teeth.

2- It covers the rugae, which are highly enervated, this make the patient uncomfortable.

3- Impinging the gingival tissue, this leads to gingival irritation and periodontal damage.

4- For gaining good support for U-shaped major connector, the occlusal rests should be increase.

Characteristics and Location

Where it must be used, indirect retainers must support any portion of the connector extending anteriorly from the principal occlusal rests. Anterior border areas of this type of connector must be kept at least 6 mm away from adjacent teeth. If for any reason the anterior border must contact the remaining teeth, the connector must again be supported by rests placed in properly prepared rest seats.

BEADING OF THE MAXILLARY CAST

It is the scribing of a shallow groove (not in excess of 0.5 mm in width or depth) on the maxillary master cast outlining the palatal major connector exclusive of rugae areas.

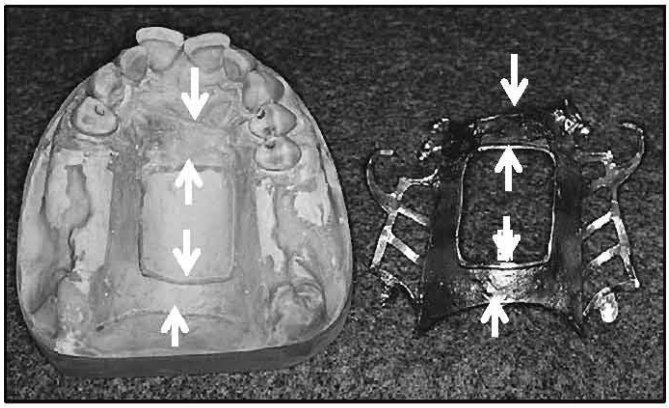
The purposes of beading are as follows:

1- To transfer the major connector design to the investment cast.

2- To provide a visible finishing line for the casting.

3- To ensure intimate tissue contact of the major connector with selected palatal tissue.

4- Preventing food from easily dislodging the prosthesis.



Prosthodontics

Major Connectors(2)

3rd class *Dr. osama Alheeti*

The **major connector** is the component of the partial denture that connects the parts of the prosthesis located on one side of the arch with those on the opposite side.

Unlike maxillary major connectors, the mandibular major connectors often need relief between the rigid metal surfaces and the underlying soft tissues. The Distal extension removable partial denture tends to rotate during function so a moderate amount of relief may be needed. Relief prevents the margins of the major connector from lacerating the sensitive lingual mucosa as a result of this movement.

Bead lines are not used in combination with mandibular major connectors. Contact with the mucosa of the mandibular arch may cause irritation, ulceration, and patient discomfort.

Location of Major Connectors.

1. Major connectors should be free of movable tissue.
2. Impingement of gingival tissue should be avoided.
3. Bony and soft tissue prominences should be avoided during placement and removal.
5. Major connectors should be located and/or relieved to prevent impingement of tissue that occurs because the distal extension denture rotates in function.
6. Margins of major connectors adjacent to gingival tissue should be located far enough from the tissue to avoid any possible impingement, the superior border of a lingual bar connector be located a minimum of 4 mm below the gingival margin.

Types of Mandibular major connectors

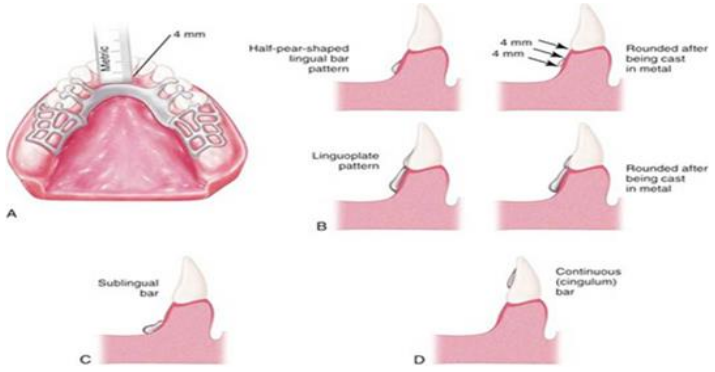
The following is a list of the different types of mandibular major connectors:

1. **Lingual bar**
2. **Lingual plate (Linguoplate)**
3. **Double lingual bar (Lingual bar with cingulum bar)**
4. **Labial bar**

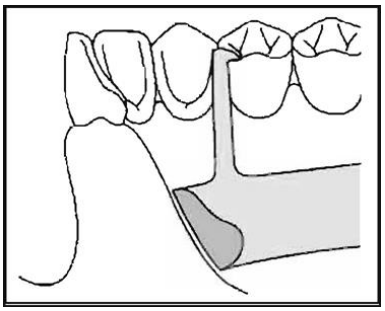
Of these, the lingual bar and lingual plate are used very frequently. The other mandibular major connectors are seldom indicated, or are advocated by few practitioners.

1- Lingual Bar

The lingual bar is perhaps the most frequently used mandibular major connector . Because of its simplicity in design and construction, a lingual bar should be used unless one of the other connectors offers a definite advantage.



A lingual bar is indicated for all tooth-supported removable partial dentures unless there is insufficient space between the marginal gingivae and the floor of the mouth.



The superior border should be tapered toward the gingival tissue and the greatest bulk should be at the inferior border which should be slightly rounded, resulting in a contour that has a half-pear shape.

The inferior border of a lingual mandibular major connector must be located free from the floor of the mouth.

ADVANTAGES

(1) Covers minimum surface area of teeth and tissue therefore potential for caries, periodontal problems caused by plaque being held in contact with teeth and tissue is minimal.

(2) It is relatively small, inconspicuously located and minimally interfere with functions, so patient prefers lingual bar over linguplate.

Disadvantages:

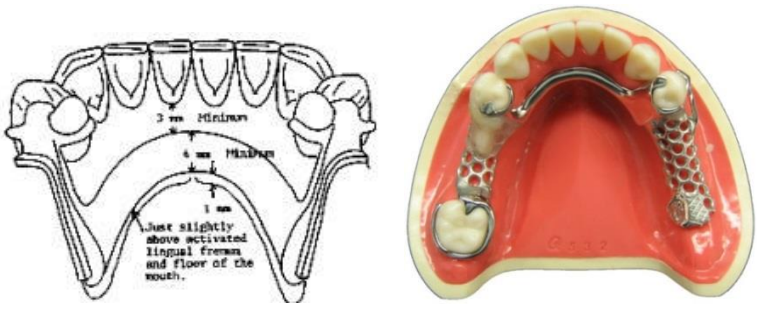
1. Not as rigid as the lingual plate, sublingual bar or lingual bar with continuous bar indirect retainer.
2. Difficult to add additional prosthetic teeth to framework.
3. Framework goes from thick (at the minor connectors) to thin (at the bar) to thick again which is metallurgically and structurally complicated.

Indications

1- The lingual bar should be used for mandibular removable partial dentures where sufficient space exists between the slightly elevated alveolar lingual sulcus and the lingual gingival tissue (at least 8 mm).
2- Diastemas or open cervical embrasures of anterior teeth.
3- Overlapped anterior teeth.

Contraindications

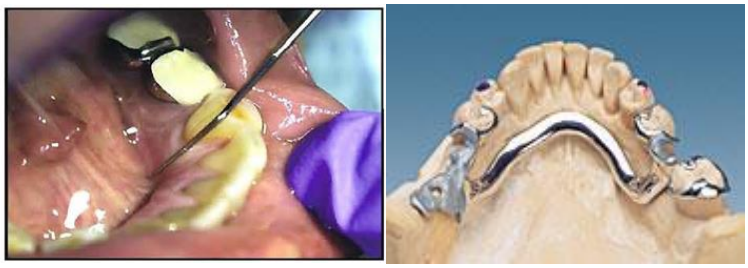
1- When the lingual frenum is high or the space available for a lingual bar is limited (less than 8 mm).
2- Lingually inclined teeth.
3- An undercut lingual alveolar ridge which would result in an excessive space between the bar and the mucosa.
4- When the future replacement of one or more incisor teeth.



There are two clinically methods to determine the relative height of the floor of the mouth to locate the inferior border of a lingual mandibular major connector.

(1) Ask the patient to touch the vermilion border of upper lip with the tip of his tongue, and measure the height of the floor of the mouth in relation to the lingual gingival margins of adjacent teeth with a periodontal probe. Recording of these measurements permits their transfer to both diagnostic and master casts.

(2) Use a special tray having its lingual borders 3 mm short of the elevated floor of the mouth and then to use an impression material that will permit the impression to be accurately molded as the patient licks the lips. The inferior border of the planned major connector can then be located at the height of the lingual sulcus of the cast resulting from such impression.

A 

2- LINGUOPLATE

The inferior border of a lingual plate should be positioned as low in the floor of the mouth as possible, but should not interfere with the functional movements of the tongue and soft tissues.

The superior border of a lingual plate must be contoured to intimately contact the lingual surfaces of the teeth above the cingula.

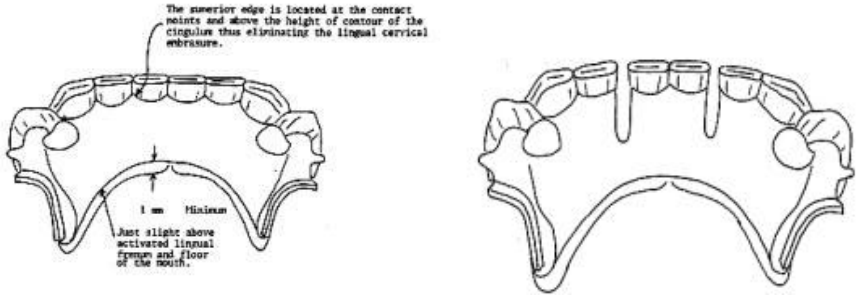
In addition. the lingual plate must completely close the interproximal spaces to the level of the contact points. Sealing these spaces from the lingual aspect prevents food from being packed into these areas. As a result of this contoming, the lingual plate should display a scalloped appearance

Indications

1.Less than 8 mm between the marginal gingiva and the activated lingual frenum and of the mouth.
2. Only a few remaining anterior teeth which must be contacted to provide a reference for fitting the framework and indirect retention.
3. Undercut or parallel lingual alveolar ridge when the superior edge of a lingual bar can not be located in close contact with the mucosa and still be at least 3 mm inferior to the marginal gingiva.
4. Distal extension RPDs with parallel or sloped lingual alveolar ridges where a lingual bar would rotate into the ridge when the base area rotates tissueward.
5. Mandibular tori or exostosis which must be covered by the RPD because they can not be surgically removed or avoided in the RPD design. Relief is provided between the torus or exostosis and the framework.

Contraindications:
1. A lingual bar may be used.
2. Overlapped anterior teeth where the undercuts in the area of the superior edge of the plate can not be removed.

3. Lingually inclined teeth.
4. Diastemas, unless the lingual plate can have slots in it to avoid the display of metal.
5. Open cervical embrasures where the plate would be visible . A lingual bar with continuous bar indirect retainer or a labial bar should be considered.



ADVANTAGES
1- More rigid than lingual bar.
2- Easy to add additional prosthetic teeth to framework.
DISADVANTAGES
1- Covers more teeth and tissue surface than lingual bar.
2- May be more noticeable to the patient than lingual bar.
3- May cause flaring of incisors if it contacts their cingula as the base area rotates tissue-ward.

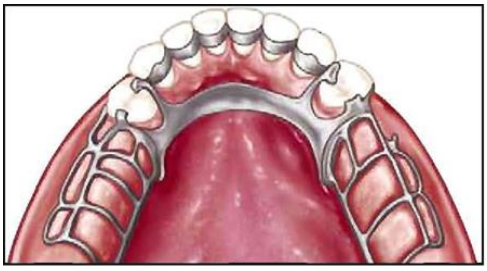
The linguoplate does not in itself serve as an indirect retainer. When indirect retention is required, definite rests must be provided for this purpose. Both the linguoplate and the cingulum bar ideally should have a terminal rest at each end, regardless of the need for

indirect retention. However, when indirect retainers are necessary, these rests may also serve as terminal rests for the linguoplate.

The linguoplate can then be constructed so that the metal will not show through the spaced anterior teeth. This is a modification of the linguoplate and is named "interrupted linguoplate" or "step backs". To accomplish this, the superior border of a lingual plate should cover the cingulum of the individual tooth. The border should extend toward the contact area of the tooth and then turn apically, following the line angle to the level of the gingiva. The rigidity of the major connector is not greatly altered. However, such a design may be as much of a food trap as the continuous bar type of major connector

3. Double lingual bar (Lingual bar with cingulum bar or Kennedy bar).

The connector consists of a lingual bar plus a secondary bar resting above the cingula of the anterior teeth. The upper and lower components of a double lingual bar are not joined by a continuous sheet of metal. As a result, the lingual surfaces of the teeth and the interproximal soft tissues are largely exposed .



The lower component of this major connector should display the same structural characteristics as does a lingual bar. The upper bar should be half oval in cross section. This bar should be 2 to 3 mm in height and I mm thick. The upper bar should not run straight across the lingual surfaces of the teeth but should present a scalloped appearance. The two bars should be joined by rigid minor connectors at each end. Rests should be placed at each end of the upper bar and should be located no farther posterior than the mesial fossae of the first premolars. Placement of these rests is intended to prevent the bar from moving inferiorly and causing orthodontic movement of the remaining anterior teeth.

The secondary bar supposedly acts as an indirect retainer and performs a role in the horizontal stabilization of periodontally involved teeth. The performance of these functions is questionable. Additionally, this major connector can create a food trap between the two bars. The use of this type of connector is not encouraged.

Indications :

1. when a linguoplate is indicated but the axial alignment of anterior teeth is such that excessive blackout of interproximal undercuts would be required.

2. When wide diastema exist between mandibular anterior teeth and a linguoplate would objectionably display metal in a frontal view.

The disadvantage of this type of major connector is the tendency of the upper bar to trap debris especially with crowding of the mandibular anterior teeth. This can be minimized by accurate impressions and good adaptation of the upper bar to the anterior teeth. Also, the double lingual bar may irritate the tongue and annoy the patient due to the multiple borders and the thickness of the upper bar. Thus, a modified lingual plate major connector may be preferred.

4. Labial Bar

As its name suggests, a labial bar runs across the mucosa on the facial surface of the mandibular arch . Like other mandibular major connectors, a labial bar displays a half-pear shape when viewed in cross section. But, because of its placement on the external curvature of the mandible, a labial bar is longer than a corresponding lingual bar, double lingual bar or lingual plate. To ensure rigidity, the height and thickness of a labial bar must be greater than those described for a lingual bar.

In only few situations when the extreme lingual inclination of the remaining lower premolar and incisor teeth prevent the use of a lingual bar major connector. With the use of conservative mouth preparations in the form of recontouring and block out, a lingual major connector can almost always be used. Lingually inclined teeth sometimes may have to be reshaped by means of crowns. Although the use of a labial major connector may be necessary in rare instances, this should be avoided by resorting to necessary mouth preparations rather than by accepting a condition that is otherwise correctable.

The same applies to the use of a labial bar when a mandibular torus interferes with placement of a lingual bar. Unless surgly is definitely contraindicated, interfering mandibular tori should be removed so that the use of a labial bar connector may be avoided.

Indications :

1. When lingual inclinations of remaining mandibular premolar and incisor teeth cannot be co1Tected, preventing placement of a conventional lingual bar connector.
2. When severe lingual tori cannot be removed and prevent the use of a lingual bar or lingual plate major connector.
3. When severe and abrupt lingual tissue undercuts make it impractical to use a lingual bar or a lingual plate major connector.

Characteristics and Location:

1. Half-pear shaped with bulkiest portion inferiorly located on the labial and buccal aspects of the mandible.
2. Superior border tapered to soft tissue.
3. Superior border located at least 4 mm inferior to labial and buccal gingival margins and farther if possible.
4. Inferior border located in the labial-buccal vestibule at the junction of attached (immobile) and unattached (mobile) mucosa.

A labial bar can be used in association with the linguoplate as a modification for the linguoplate. This concept is incorporated in the Swing-Lock design, which consists of a labial or buccal bar that is connected to the linguoplate major connector by a hinge at one end and a latch at the other end.

Support is provided by multiple rests on the remaining natural teeth. Stabilization and reciprocation are provided by a linguoplate that contacts the remaining teeth and are supplemented by the labial bar with its retentive struts. Retention is provided by a bar type of retentive clasp with arms projecting from the labial or buccal bar and contacting the infra-bulge areas on the labial surfaces of the teeth.

Use of the Swing-Lock concept would seem primarily indicated when the following conditions are present:

1) Missing key abutments
2) Unfavorable tooth contours
3) Unfavorable soft tissue contours
4) Teeth with questionable prognoses.

Contraindications to the use of this hinged labial bar concept are poor oral hygiene or lack of motivation for plaque control by the patient, the presence of a shallow buccal or labial vestibule, & a high frenal attachment.

FINISHED

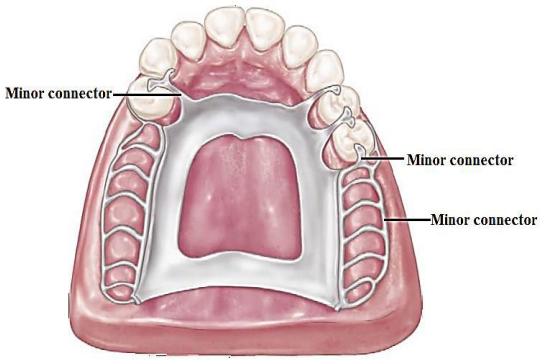
PROSTHODONTICS

3rd class

Lec.7 Dr. osama Alheeti

MINOR CONNECTORS

Minor connectors: the connecting link between the ***major connector*** or ***base*** of a removable partial denture ***and*** the ***other units*** of the prosthesis, such as the clasp , indirect retainers or rests.



FUNCTIONS OF MINOR CONNECTORS

In addition to joining denture parts, the minor connector serves other purposes.

1- To transfer functional stress to the abutment teeth. This is a (prosthesis-to-abutment function) of the minor connector.

2- To transfer the effect of the retainers, rests, and stabilizing components throughout the prosthesis. This is an (abutment-to-prosthesis function) of the minor connector.

3- Provide unification and rigidity.

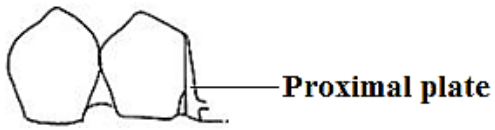
4- It might help in retention and stability of the prosthesis.

5- Through its connection to the guiding plane; it helps as a bracing element.

6- Share in the path of insertion and removal maintenance.

There are four types of minor connectors based on ***location*** and ***function***:
1. Proximal minor connectors.
2. Embrasure minor connectors.
3. Surface minor connectors.
4. Denture base retention mechanism.

1. Proximal minor connectors
Proximal minor connectors contact an abutment tooth adjacent to an edentulous space. Proximal minor connectors are usually term ***proximal plates*** but are sometimes call ***guiding plates***.

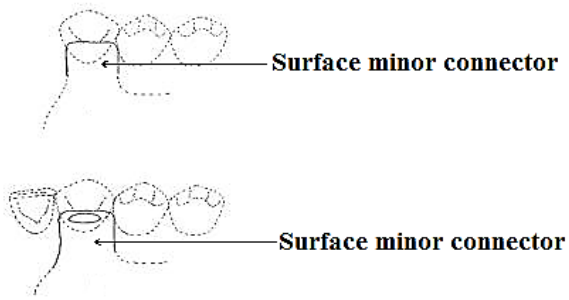


The functions of proximal plates are to:
(1) Connect rests and clasp arms to the major connector.
(2) Contact proximal guiding planes on the teeth thus helping to determine the path of placement of the RPD.
(3) Prevent food impaction between the proximal surface of the tooth and the RPD.
(4) Provide a definite finish line for the junction of the denture base and major and minor connectors.
(5) Provide frictional retention by contact with guiding planes on the teeth.
(6) Help reciprocate the force of the direct retainer.
(8) Distribute forces (bracing).

2. Embrasure minor connectors
Embrasure minor connectors are located between two teeth. Their functions are to:
a. Connect rests and clasp arms to the major connectors.
b. Contact interproximal guiding planes thus helping to determine the path of placement of the RPD.
c. Provide frictional retention by contact with the guiding planes on the teeth.
d. Help reciprocate the force of the direct retainer.
e. Unite the dental arch by substituting for lost proximal tooth contacts.
f. Distribute forces (bracing).

3- SURFACE MINOR CONNECTORS

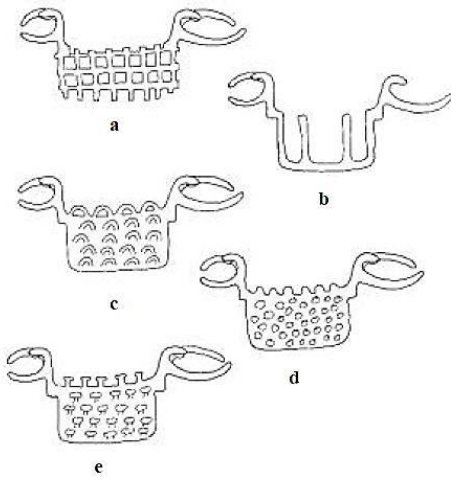
Surface minor connectors are located on the lingual surface of incisors and canines. They connect lingual rests to the major connector. Their junction with the major connector is a rounded right angle and they taper toward the occlusal (incisal). The lateral borders extend into the proximal embrasures to hide these edges from the tongue.



4. Denture base retention mechanism

The denture base retention minor connector is the means by which the plastic denture base is mechanically attached to the framework. There are several types of denture base retention minor connectors:

a. Retentive mesh.
b. Retentive lattice.
c. Retentive loops.
d. Retentive bead.
e. Retentive posts.



Forms and location of minor connector

1. All types of minor connector must have sufficient bulk to be rigid; otherwise the transfer of functional stresses to the supporting teeth and tissue will not be effective.

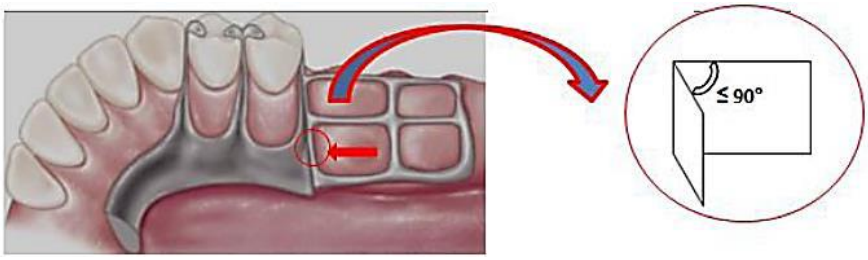
2. Minor connectors placed into embrasures between two adjacent teeth should not be located on a convex surface. Instead it should be located in an embrasure where it will be least noticeable to the tongue.

3. Minor connector that contacts the guiding plane surface of the abutment teeth adjacent to an edentulous space. Here the minor connector must be broad buccolingually to use the guiding plane to the fullest advantage, and thin mesiodistally to place a prosthetic tooth in a natural position.

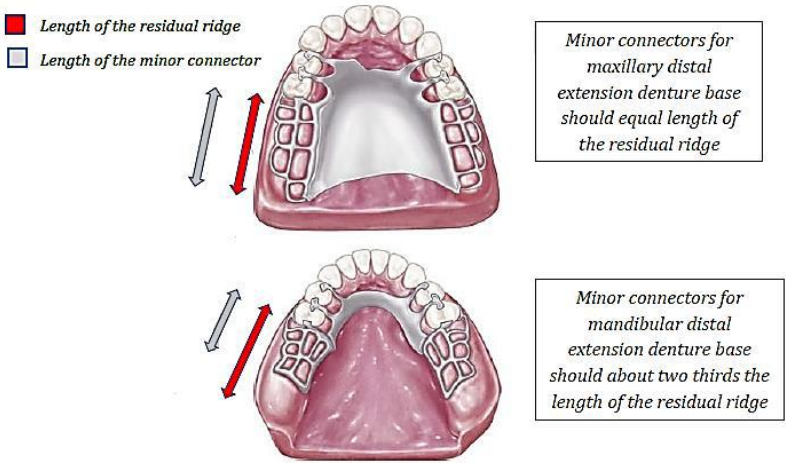
4. When an artificial tooth will be placed against a proximal minor connector, the minor connector's greatest bulk should be toward the lingual aspect of the abutment tooth. This way sufficient bulk is ensured with the least interference to placement of the artificial tooth.

5. It should passing vertically from the major connector and covers as little of the gingival tissue as possible.
6. The minor connector cross the free gingival area must be relieved in order not to impinge the tissue.
7. The deepest part of the interdental embrasure should have been blocked out to avoid interference during placement and removal, and to avoid any ***wedging effect*** on the contacted teeth.

8. Minor connector that covers the edentulous area to join denture base to major connector should be completely embedded within the denture base.
9. The junctions of these mandibular minor connectors with the major connectors should be strong butt-type joints; angles formed at the junctions of the connectors should not be greater than 90°, thus ensuring the most advantageous and strongest mechanical connection between the acrylic resin denture base and the major connector.



10. Minor connector for ***mandibular distal extension base*** should extend posteriorly about two thirds the length of the edentulous ridge. Such design will not only add strength to the denture base but also may minimize distortion of cured base from its inherent strains caused by processing.
11. Minor connectors for ***maxillary distal extension denture*** *base* should extend entire length of the residual ridge and should be of a ladder-like or mesh-like.



12. Minor connector for vertical projection of bar type clasp approaches the tooth from an apical direction rather than from an occlusal direction, the

approach arm should display a smooth, even taper from its origin to its terminus.

13. Minor connector for vertical projection of bar type clasp must not cross a soft tissue undercut (need parallel block out).

FINISHED LECTURE

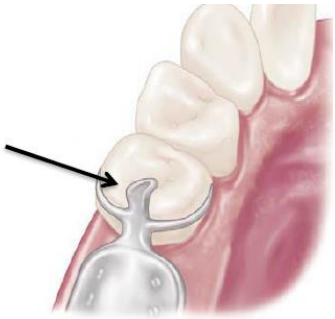
PROSTHODONTICS

3rd class Dr. osama Alheeti

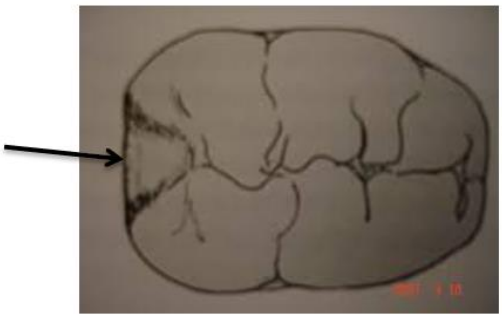
Rest and Rest seat

Rest: - Is any rigid part of an RPD framework which contacts a properly prepared surface of a tooth.

A rest that is part of a retentive clasp assembly is referred to as a ***primary rest.*** The main purpose of a primary rest is to prevent vertical movement of a prosthesis toward the tissues and also helps transmit forces to the supporting teeth. A rest that is responsible for additional support or indirect retention is called an ***auxiliary rest*** or ***secondary rest.***



Rest seat: The prepared surface of an abutment to receive the rest.



Functions of the Rests:

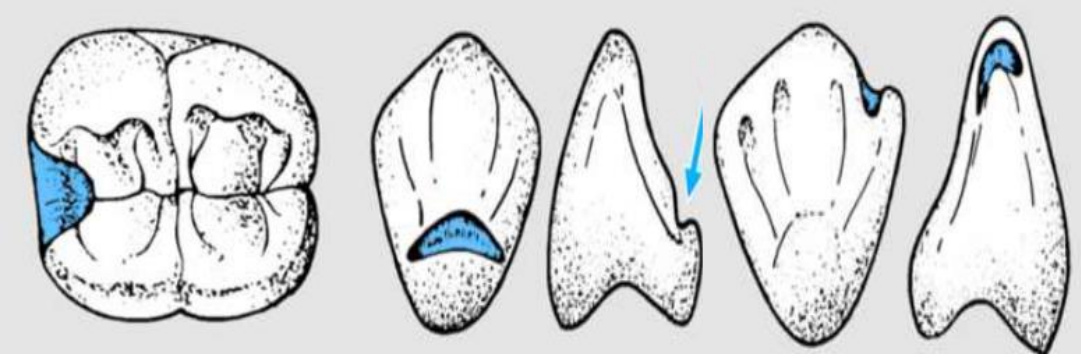
1.Provide vertical support for the partial denture.
2.Maintains components in their planned positions.
3.Maintains established occlusal relationships by preventing settling of the denture.
4.Prevents impingement of soft tissue.
5.Directs and distributes occlusal loads to abutment teeth.

Types of rest:

1.**Occlusal rest: -** A rest placed on the occlusal surface of a bicuspid or molar.

2. **Lingual (Cingulum) rest**: - A rest placed on the cingulum of an anterior tooth (usually the canine). Rests may also be placed on the lingual of posterior teeth by creating a ledge of the tooth surface (prescribed for surveyed crowns).

3.**Incisal rest: -** A rest placed on an anterior tooth at the incisal edge.



Requirements of Rests:

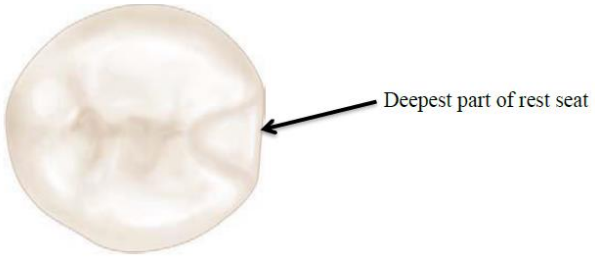
1. Should have sufficient thickness to avoid fracture.
2. Should be able to direct forces along the long axis of tooth.
3. Extend properly close to the center of the tooth as possible.
4. Placed in rest seats properly.
5. Must not raise the vertical dimension of occlusion.
6. In bounded partial denture: placed in the near zone of the occlusal surface to edentulous area.
7. In free end partial dentures: placed in the far zone of the occlusal surface to decrease torque action on abutment tooth.

8. The use of amalgam restoration to support an occlusal rest is not recommended due to amalgam's tendency to creep and flow under pressure.

Form or preparation of the rest and rest seat

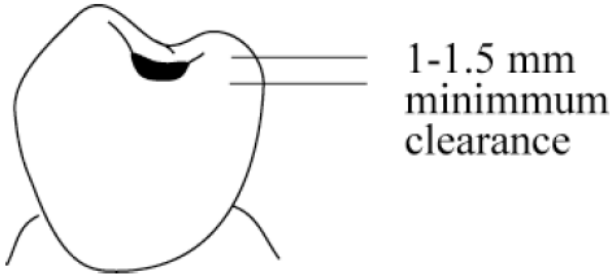
1- Occlusal rest

1- The outline form of an occlusal rest seat should be a rounded triangular shape with the apex toward the center of the occlusal surface.



2- The base of the triangular shape is at the marginal ridge and should be approximately one third the bucco-lingual width of the tooth.

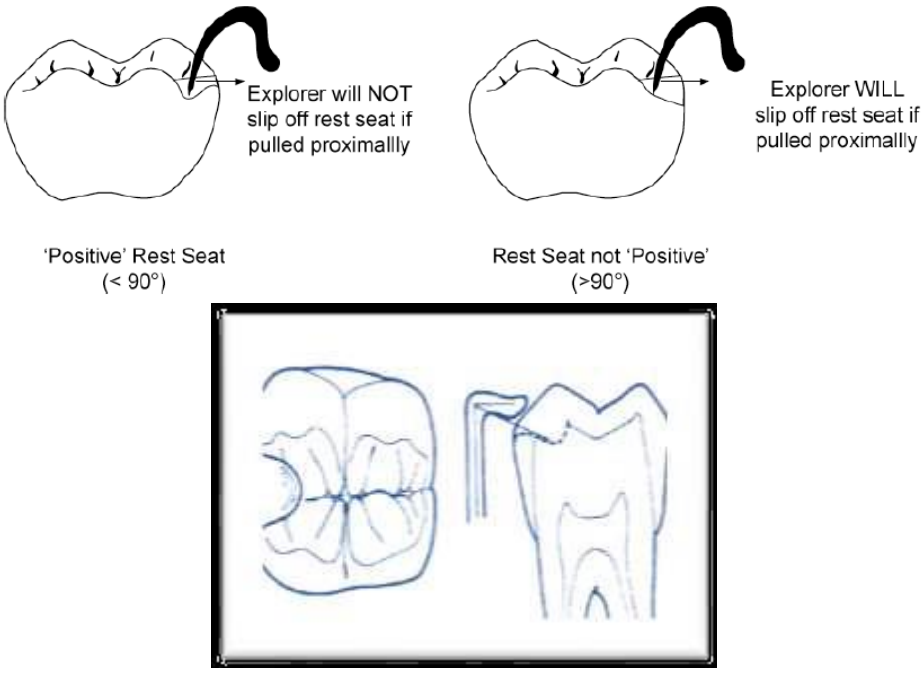
3- The marginal ridge must be lowered and rounded to permit a sufficient bulk of metal to prevent fracture of the rest from the minor connector (1 to 1.5 mm).



4- The floor of the occlusal rest seat should be apical to the marginal ridge and the occlusal surface and should be concave, or spoon shaped.

5- The floor of the rest seat should be inclined towards the centre of the tooth, so that the angle formed by the rest and the minor connector should be less than 90°. This helps to direct the occlusal forces along the long axis of the tooth.

A clinician can test to see if a rest seat is ‘positive’ (i.e. <90°) by trying to slide an explorer tip off the rest seat. An angle of more than 90° fails to transmit the occlusal forces along the long axis of the tooth and permits movement of the clasp assembly away from the abutment and orthodontic movement of the tooth.



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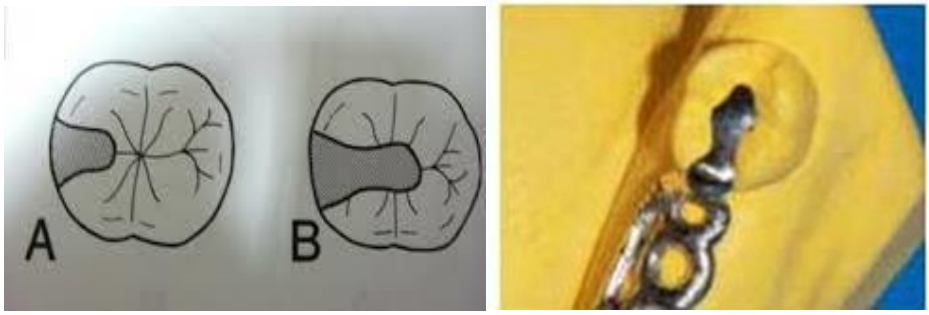
2. Extended O.R.: This rest should extend more than one-half the mesiodistal width of the tooth, should be approximately one-third the buccolingual width of the tooth, usually used mesially tipped molars.
This rest should extend more than one-half the mesio-distal width of the tooth, should be approximately one-third the bucco-lingual width of the tooth.



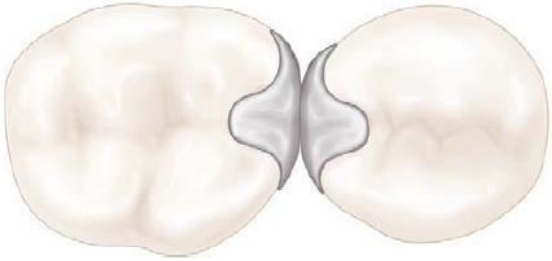
3- Interproximal Occlusal Rest Seats

The design of a direct retainer assembly may require the use of interproximal occlusal rests.
These rest seats are prepared as individual occlusal rest seats. The lingual interproximal area requires only minor preparation. Creation of a vertical groove must be avoided to prevent a torqueing effect on the abutments by the minor connector. This is especially true for RPDs with distal extension bases.

The advantages of such occlusal rests are:

1) Prevent interproximal wedging by the framework.

2) The joined rests shunt food from contact points



Internal Occlusal Rests:

They are used for a partial denture that is totally tooth supported for both occlusal support and horizontal stabilization . They must be used in association with a crown on the abutment tooth. *An* internal occlusal rest should not be confused with an internal attachment.

The main advantages of the internal rest are:

1) **The clasp arm buccally is not visible. Retention is provided by a lingual clasp arm.**
2) **Permits the location of the rest seat in a more favorable position in relation to the tipping axis (horizontal) of the abutment.**

Occlusal Rests on Amalgam Restorations

It is always better to place an occlusal rest on sound enamel or cast restoration. Sometimes a conservative amalgam restoration may be used to support removable partial denture, but advantages and disadvantages of such treatment should be carefully considered.

As for a large ama1gam restoration, it is easier to place an occlusal rest on a large amalgam restoration because an amalgam restoration costs less than a crown. However, the disadvantages are greater than the benefits so this is not advisable.

The flow characteristics and poor tensile characteristics of amalgam increase the possibility of restoration failure. Amalgam alloys tend to deform when a sustained load is applied and this may result in fracture of the material and failure of the restoration.

Occlusal Rest on Crowns

All-ceramic restorations should not be used to support removable partial dentures, via rests, because of the undesirable physical characteristics of ceramics. Ceramic materials are relatively strong in compression, but Weak

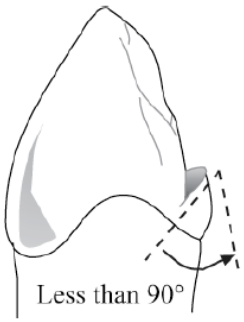
in tension and any wedging or elongation of a ceramic surface often lead to fracture.

Metal -ceramic restorations can be used but it is recommended that rest seats be constructed entirely in metal. The metal borders should extend at least 1 mm beyond the borders of the rest (in all directions).

4- Lingual Rests on Canines and Incisor Teeth

If an anterior tooth is sound and the lingual slope is gradual rather than perpendicular, a lingual rest sometimes may be placed in an enamel seat at the cingulum or just incisally to the cingulum. This type of lingual rest is usually confined to maxillary canines that have a gradual lingual incline and a prominent cingulum.

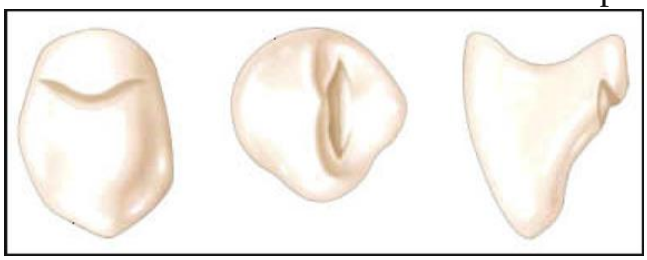
A slightly rounded V is prepared on the lingual surface at the junction of the gingival and the middle one third of the tooth. The apex of the V is directed incisally. The proximal view demonstrates the correct angulation of the floor of the rest seat (< 90°).



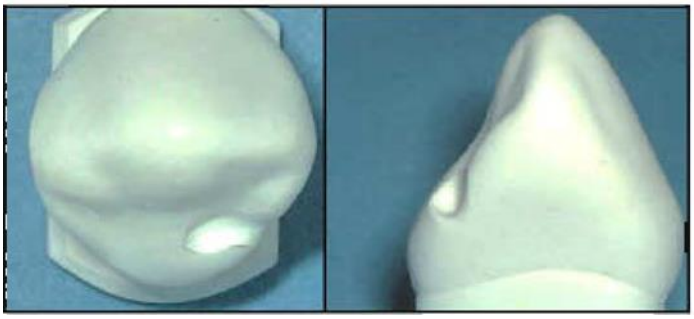
The most satisfactory lingual rest from the standpoint of support is one that is placed on a prepared rest seat in a cast restoration.

The preparation of an anterior tooth to receive a lingual rest is accomplished in two ways:

First method: A slightly rounded V-shape prepared on the lingual surface at the junction of the gingival and the middle one third of the tooth The apex of the V is directed incisally. The mesio-distal length of the preparation should be a minimum of 2.5 to 3 mm, labia-lingual width about 2 mm, and incisal-apical depth a minimum of 1.5 mm. This preparation of the tooth starts with an inverted cone shapedbur .



Second method: A ball type of rest may be used in a prepared seat .Round rest seats are occasionally prepared on the mesial side of the canine when the use of a typical cingulum rest is contraindicated (i.e. large restoration, lack of clearance with the opposing teeth, poorly developed cingulum). The seats of these rests are prepared in the same manner as that of the occlusal rest seats.

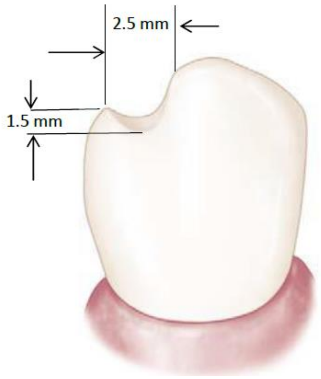


5- Incisal Rests and Rest Seats

Incisal rests are placed at the incisal angles of anterior teeth and on prepared rest seats.

Although this is the least desirable placement of a rest seat for reasons previously mentioned. Therefore incisal rests generally are placed on enamel. Incisal rests are used predominantly as auxiliary rests or as indirect retainers. It is more applicable to the mandibular canine.

An incisal rest seat is prepared in the form of a rounded notch at the incisal angle of a canine or on the incisal edge of an incisor, with the deepest portion of the preparation apical to the incisal edge



A. Implants as a Rest

Implants can serve as a rest, since they resist tissue-ward movement and are useful for retentive needs as well. Their use allows a low profile connection (i.e., close to the ridge), and less torque to the implant.

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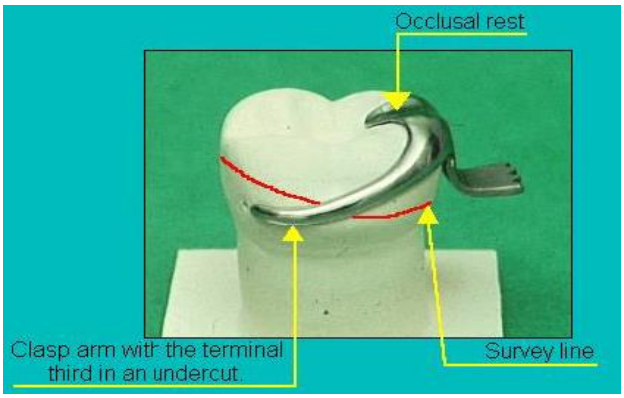
DIRECT RETAINERS

which are clasp assemblies or attachments applied to an abutment tooth to retain an RPD in position. A **CLASP ASSEMBLY** is the part of an RPD that acts as a direct retainer for the prosthesis by partially contacting an abutment tooth. The **CLASP** is the component of the clasp assembly that engages a portion of the tooth surface and either enters an undercut for retention or remains entirely above the height of contour to act as a reciprocating element.



Requirements of a Direct Retainer:

1. Retention

Retention is provided by the retentive arm which prevents the partial denture from displacement away from the tissues toward the occlusal.

2. Support

Resistance to gingival displacement (occlusal rests). Support in a clasp is generally provided by the rest.

3. Stability

Resistance to lateral movement (reciprocal arms, minor connectors). When the direct retainer comes into contact with the tooth, the framework must be

stabilized against horizontal movement for the required clasp deformation to occur.

4. Reciprocation

Resistance to orthodontic movement of teeth using reciprocal arms or elements placed against guiding planes (PP).

5. Fixation

Prevents the prosthesis from moving away from the tooth. Fixation of a clasp assembly is provided by having the components of the clasp assembly encircle at least 180 degrees of the abutment tooth's circumference. Fixation of a clasp assembly is frequently calling **ENCIRCLEMENT.**

6. Passivity

Direct retainers should not exert forces on the abutment teeth when the RPD is seated. They should be PASSIVE when the RPD is seated. Forces should occur only when the denture is being seated or removed.

They are of two types:-
1. Clasps designed without movement accommodation.
2. Clasps designed to accommodate distal extension functional movement

Clasps designed without movement accommodation: (Supra bulge clasps) or occlusally approach clasp since the clasp approaches the retentive undercut from the occlusal direction.

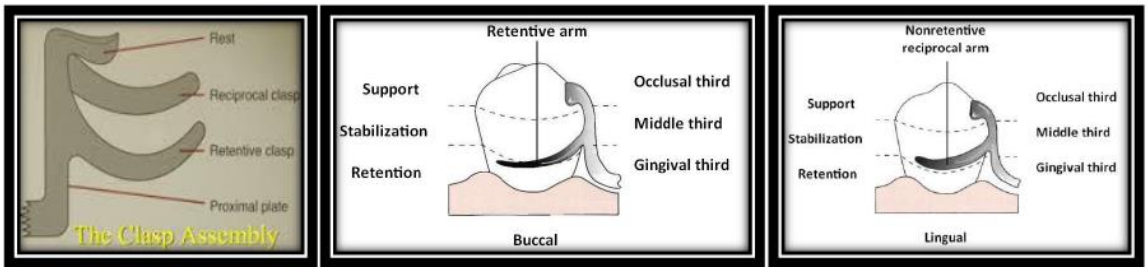
Clasps for tooth-borne partial dentures (Class III, IV) have one function – to prevent dislodgment of the prosthesis without damage to the abutment teeth. These clasps can also be used in modification spaces for tooth and tissue supported removable partial dentures (Class I, II).

1.Circumferential (Circle or Akers) clasp:

- It is the most logical clasp to use with a tooth-supported partial denture.
- The circumferential clasp will be considered first as an all-cast clasp and it is the simplest one.

The basic form of the circumferential clasp is a buccal and lingual arm originating from a common body (principle occlusal rest and minor connector).

The circumferential clasp has only one retentive clasp arm, opposed by a nonretentive reciprocal arm on the opposite side.



Indications:

1.It is a most logical clasp to use with all tooth-supported partial dentures because of its retentive and stabilizing ability.

2.On free end extension when minimal undercut is utilized.

Contraindication:

1.When the retentive undercut may be approached better with a bar clasp arm.

2.When esthetics will be enhanced by using bar clasp arm.

Advantages:

1.Excellent bracing qualities.

2.Easy to design and construct.

3.Less potential for food accumulation below the clasp compared to bar clasps.

Disadvantages:

1.More tooth surface is covered than with a bar clasp arm because of its occlusal origin.

2.In the mandibular arch, more metal may be displayed than with the bar clasp arm.

3.Its half-round form prevents adjustment to increase or decrease retention. True adjustment is impossible with most cast clasps.

2. Ring clasp

a. Encircles nearly the entire abutment tooth.

b. Usually used with mesially and lingually tilted mandibular molars (with a M-L undercut) or mesially and buccally tilted maxillary molars (with a M-B undercut).

c. Should always be used with a supporting strut on the non-retentive side with an auxiliary occlusal rest on the opposite side.

Advantages:

a. Excellent bracing (with supporting strut).

b. Allows use of an available undercut adjacent to edentulous area.

Disadvantages:

a. Covers a large area of tooth surface, therefore requiring meticulous hygiene.

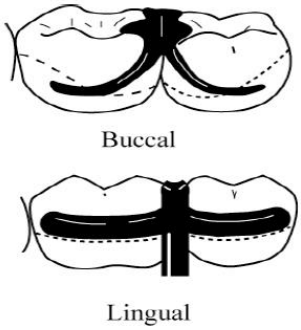
b. Very difficult to adjust due to the extreme rigidity of the reciprocal arms.

Contraindications: excessive tissue undercuts prevent the use of a supporting strut.

3. Embrasure (double Akers) clasp:

The embrasure clasp always should be used with double occlusal rests, even when definite proximal shoulders can be established. This is done to avoid interproximal wedging by the prosthesis, which could cause separation of the abutment teeth and result in food impaction and clasp displacement.

In addition to providing support, occlusal rests also serve to shunt food away from contact areas.



Advantages:

a. Allows placement of direct retainer where none could otherwise be placed (especially contralateral to the edentulous span on a Class II case).

Disadvantages:

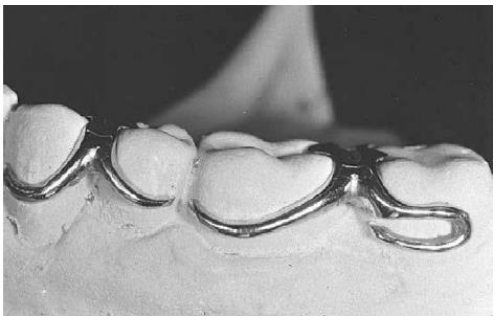
a. Extensive interproximal reduction is usually required.

b. Covers large area of tooth surface - hygiene considerations.

Other less commonly used modifications of the cast circumferential clasp are:

a.Reverse-action clasp (Hairpin):

Ring clasp or bar clasp originating on the opposite side of the tooth can be used with the same result getting from reverse- action clasp.



Advantage:

Clasp arm is designed to permit engaging a proximal undercut (undercut adjacent to edentulous space) from an occlusal approach.

Disadvantages:

1.Esthetically objectionable when using an anterior abutment.

2.The clasp covers a considerable tooth surface and may trap debris.

3.Almost impossible to adjust.

4. Difficult to fabricate.

5.Insufficient flexibility on short crowns due to insufficient clasp arm length.

Indications:

1. When a proximal undercut must be used on a posterior abutment and when tissue undercuts, tilted teeth or high tissue attachments prevent the use of a bar clasp arm.

2.When lingual undercuts may prevent the placement of a supporting strut (of ring clasp) without tongue interference.

b. Back action clasp:

o The back-action clasp is a modification of the ring clasp.

o It is used on premolar abutment anterior to edentulous space

c. Multiple clasps:

The multiple clasps are simply two opposing circumferential clasps joined at the terminal end of the two reciprocal arms.

Indications:

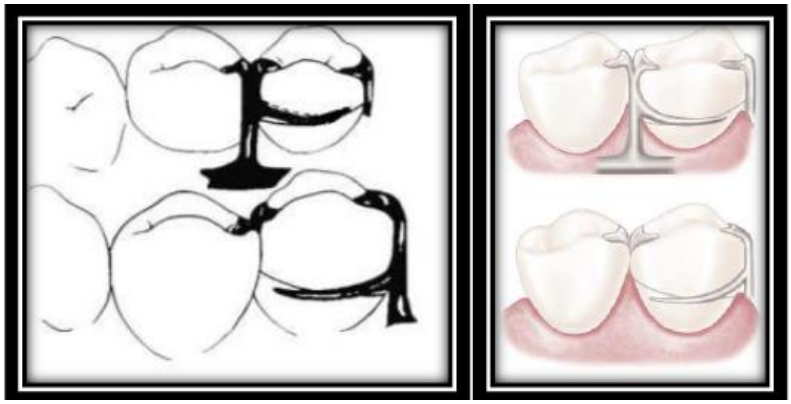
- It is used when additional retention and stabilization are needed, usually on tooth-supported partial dentures.
- It may be used for multiple clasping in instances in which the partial denture replaces an entire half of the dental arch.
- It may be used rather than an embrasure clasp when the only available retentive areas are adjacent to each other.

Disadvantage:

- Its disadvantage is that two embrasure approaches are necessary rather than a single common embrasure for both clasps.

d. **3. Half-and-half Clasp**:

- It is consists of a circumferential retentive arm arising from one direction and a reciprocal arm arising from another.
- The second arm must arise from a second minor connector, and this arm is used with or without an auxiliary occlusal rest.
- Its design was originally intended to provide dual retention, a principle that should be applied only to unilateral partial denture design
- Reciprocation arising from a second minor connector usually can be accomplished with a short bar or with an auxiliary occlusal rest, thereby avoiding so much tooth coverage.
- There is little justification for the use of the half-and-half clasp in bilateral extension base partial dentures.



2.Clasps designed to accommodate distal extension functional movement(Tooth and Tissue Borne RPD's)

Tooth and tissue borne situations (Class I & II) require special attention in direct retainer selection, due to stresses created by rotational movements of the prostheses. Stress releasing clasp assemblies include:

1. The bar clasp with mesial rest (e.g. RPI clasp).
2. The RPA clasp.

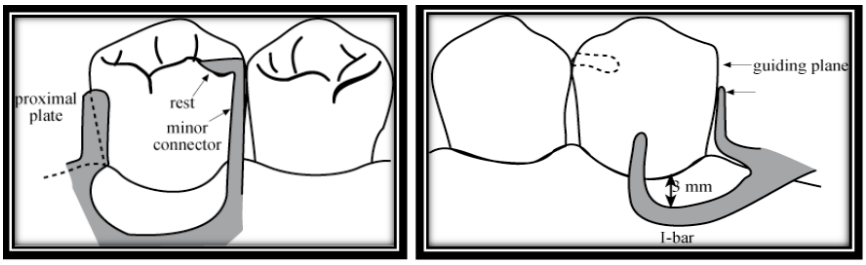
3. The combination clasp.

Mesial rest concept clasps assemblies (RPI, RPA, and Bar clasp): These are proposed to accomplish movement accommodation by changing the fulcrum location to prevent harmful tipping or torquing of the abutment tooth and prevent more denture base movement. This is concept includes RPI and RPA clasps.

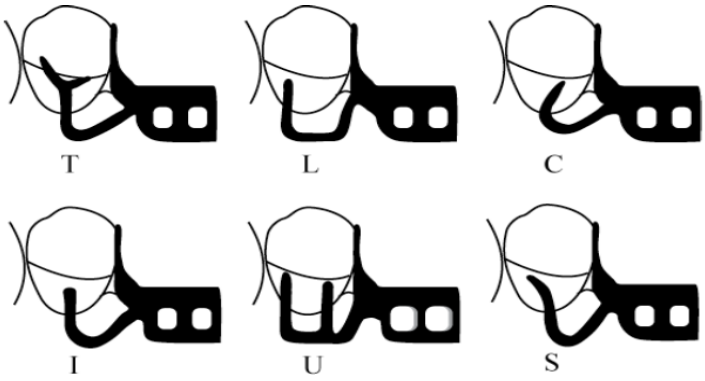
1.RPI clasp:

RPI clasps are referring to the: R = Rest always mesial, P = Proximal plate, and I = I-bar. These are component parts of the clasp assembly.

a) The bar clasp is a cast clasp that approaches the retentive undercut from gingival direction (as opposed to a circumferential clasp that approaches the undercut from the occlusal direction).



b) Retentive clasps are identified by shape of retentive terminal, i.e. T, Y, L, I, U, and S. The bar clasp arm has been classified by the shape of the retentive terminal. Thus it has been identified as T, Y, L, I, U and S. I shape bar is preferred than other shapes because this shape being biologically and mechanically sound



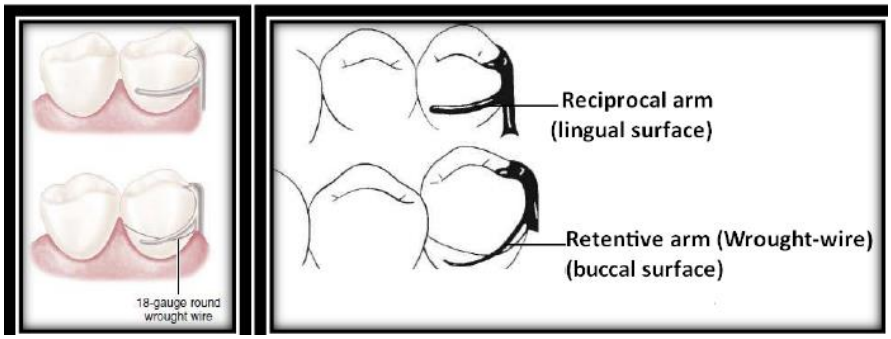
c) T-and **Y**-shaped terminal ends are the most misused clasps.

d) L-shaped clasp is same as **I** clasp with a longer horizontal component.
e) The **S**-shaped terminal end is used to avoid a mesial soft tissue undercut.

Contraindications:
a) Deep cervical undercuts.
b) Severe soft tissue or bony undercuts.

2.Bar Clasp
This clasp assembly is similar to the RPI design except a wrought wire circumferential clasp (Akers) is used instead of the **I**-bar. This clasp arises from the proximal plate and terminates in the mesio-buccal undercut. It is used when there is insufficient vestibule depth or when a severe tissue undercut exists.

3. Combination Clasp
The combination clasp is similar to the cast circumferential clasp with the exception that the retentive arm is fabricated from a round wrought wire (platinum-gold-palladium alloy or chrome-cobalt alloy).



Advantages:
- The flexibility.
- The adjustability
- The esthetic appearance of the wrought-wire retentive arm over other retentive circumferential clasp arms).
- Minimum of tooth surface covered because of its line contact with the tooth, rather than having the surface contact of a cast clasp arm.
- A less likely occurrence of fatigue failures.

Disadvantages:
- It involves extra steps in fabrication, particularly when high-fusing chromium alloys are used.

- It may be distorted by careless handling on the part of the patient.
- Because it is bent by hand, it may be less accurately adapted to the tooth and therefore provide less stabilization in the suprabulge portion.
- It may distort with function and not engage the tooth.

Indications:

- When maximum flexibility is desirable, such as on an abutment tooth adjacent to a distal extension base where only a mesial undercut exists on the abutment or a weak abutment or where a large tissue undercut, contraindicates a bar- type direct retainer.
- It may be used for its adjustability when precise retentive requirements are unpredictable and later adjustment to increase or decrease retention may be necessary.
- When esthetic required overcast clasps, because wrought -wire is round, light is reflected in such a manner that the display of metal is less noticeable than with the broader surfaces of a cast clasp.

Circumferential clasp	Bar clasp
It approaches the undercut from the occlusal aspect of the abutment.	It approaches the undercut from the gingival aspectof the abutment.
It rises above the height of contour of the abutment	It arises below the height of contour of the abutment.
It has a rigid minor connector.	It has a flexible minor connector. The minor connector for the bar clasp is called approach arm.
It is easier to remove. This is because only the retentive terminal should flex to be relieved from the undercut.	It is easier to seat but difficult to remove because the minor connector should flex along with the retentive arm to be relieved from the undercut.
It has pull-type retention. That is the retentive tip should pull occlusally to engage the undercut.	It has push-type retention. That is the retentive tip should push occlusally to engage the undercut.
Due to continuous tooth contact, it has a good bracing effect.	Due to limited 3-point tooth contact, it has a less bracing effect.
It is less aesthetic, due to more metal exposure	More aesthetic as it is present below the height of contour.
It has reduced food debris accumulation as it adapts more closely to the tooth	Increased food debris accumulation, because space exists between the minor connector and the abutment surface and the length of the clasp assembly is more.
Easy to repair due to its simple design.	Difficult to repair as the design is more complex.
It increases the width of the occlusal table because the retentive arm arises near the occlusal surface of the tooth. It increases the occlusal load on the abutment.	No such problem as it is placed in a lower position abutment.
Due to increased tooth coverage, it may cause decalcification.	No decalcification due to limited 3-point contact.
It can be used in tilted abutments and cases with soft tissue undercuts.	It cannot be used in cases with tilted abutment and soft tissue undercuts.

Clasp selection:

Successful clasp selection depends upon many factors. The practitioner should select a direct retainer that will control tipping and torquing forces on the abutment teeth, provide adequate retention against normal dislodging forces, and be compatible with the tooth and tissue contours, and satisfy the patients esthetic and functional requirements. The most important factor is the location of the retentive areas and placement of the survey line. The clasp selection will depend upon where the retentive undercut is located and

how much undercut is available. If the existing undercut area is undesirable, then the contour of the abutment tooth must be changed. The alteration in the height of contour is accomplished through the use of fixed restorations or enamel recontouring. These procedures will allow the clinician to ideally place the survey line in a more desirable and functional position.

Accurate diagnostic casts are a requirement if an accurate diagnosis is to be made regarding clasp selection. The amount of soft tissue undercut can be determined, if present, to evaluate the possibility of using a bar clasp. The height of the contour must be accurately marked to evaluate the survey line and amount of retentive undercut available. This accumulation of information will guide the practitioner in an intelligent and informed selection of the proper clasp design.

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Denture Base in RPD

Denture base: The part of a denture that rests on the foundation tissues and to which teeth are attached.

The primary function of denture base:

1. Masticatory function as the denture base transfers the occlusal stresses to the underlying supporting oral structures.

2. Esthetic or cosmetic function: this is related to reproduction of natural looking contours.

3. Stimulation of the underlying tissue by massaging action during vertical movement of the denture base under functional stresses, as this will maintain the form and health of underlying tissue.

Types of denture base according to support:

1. Tooth supported partial denture base.

2. Tooth tissue borne partial denture base.

1- Tooth-supported Partial Denture Base

In a tooth-supported prosthesis, the denture base is primarily a span between two abutments supporting artificial teeth. Thus occlusal forces are transferred directly to the abutments through rests. Also, the denture base and the supplied teeth serve to prevent horizontal migration of all of the abutment teeth in the partially edentulous arch and vertical migration of teeth in the opposing arch. When anterior teeth are replaced, esthetics may be of primary importance. Future relining or rebasing may not be necessary to reestablish support.

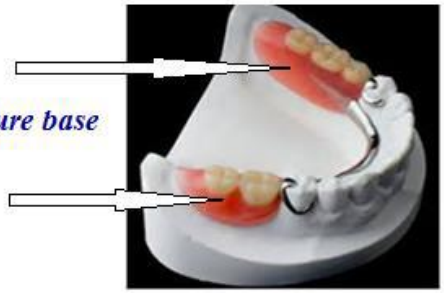
Tooth supported partial denture base

2.Tooth tissue borne partial denture base.

In a distal extension partial denture, the denture bases must contribute to the support of the denture and improving prosthesis stability.

Maximum support from the residual ridge may be obtained by using broad, accurate denture bases, which spread the occlusal load equitably over the entire area available for such support (snowshoe principle). Therefore support should be the primary consideration in selecting, designing, and fabricating a distal extension partial denture base.

Tooth tissue borne partial denture base



The edentulous area close to the terminal abutments is supported primarily by the occlusal rest on the abutment teeth however; farther from the

abutment the support from the underlying ridges tissue becomes increasingly important.

Maximum support from the residual ridge may be obtained by:

1. Using broad denture base.

2. Using accurate denture base.

Management of distal extension cases:

1- Using mesial rest on the last abutments.

2- Using indirect retainers.

3- Using special type of direct retainers, the first choice is R.P.I system, second choice is I bar, and the third choice is combination clasp.

4- Relining the finished free end extension partial denture before insertion inside patient mouth.

5- Using special kind of impression technique called altered cast technique.

6- Using implant to support the denture base.

Types of the denture base according to materials:

1. Resin type (acrylic denture base).
2. Metal type denture base.

1. Resin type (acrylic denture base):

Its most widely used type of denture base because of easy of fabrication and easy of attachment to metal framework. The resin denture base attached to metal framework by mechanical mean (throughout the hole present in meshes or ladder area) in addition, the resin denture base having the advantage of future relining or rebasing

ADVANTAGES

1- Can be easily relined.

2- Easy to fabricate, adjust, finish, polish, and repair.

3- Resin is more esthetic than metal.

DISADVANTAGES

1- More porous than metal and therefore more difficult to clean.

2- Requires more bulk for rigidity than metal.

3- Easily abraded.

4- Easily fractured.

5- Plastic is a poor thermal conductor.

6- Has the potential to be dimensionally unstable.

2. Metal type denture base:

It's made of either:

a. Gold and platinum but these materials are so expensive.

b. Stainless steel or chrome cobalt that are more being in use now day.

c. Recently, the titanium being used as a denture base and in oral implant because of its excellent properties

The metal type denture base has the ability to stimulate the underlying tissues that will maintain the integrity of the bone by preventing osseous tissue resorption, but it principle disadvantage its difficulty to reline in future, therefore the metal type denture base will be indicated in:

a. Short span (tooth borne removable partial denture).

b.When there is no enough space for artificial teeth (inadequate intermaxillary space) because of over eruption of opposing teeth.

Advantages of metal denture base:

1.Accuracy and permanency of form

2. Comparative tissue response

3.Thermal conductivity

4.Weight and bulk

Disadvantages of metal denture base:

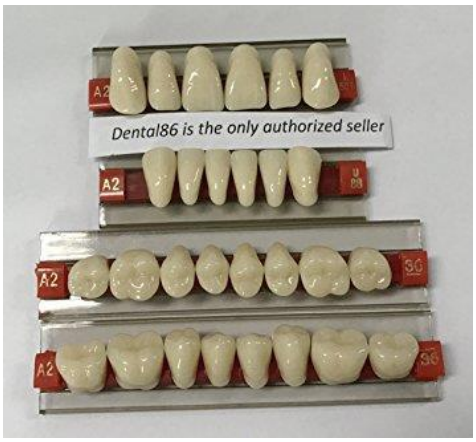
1. Difficult to reline and rebase.

2. Expensive.

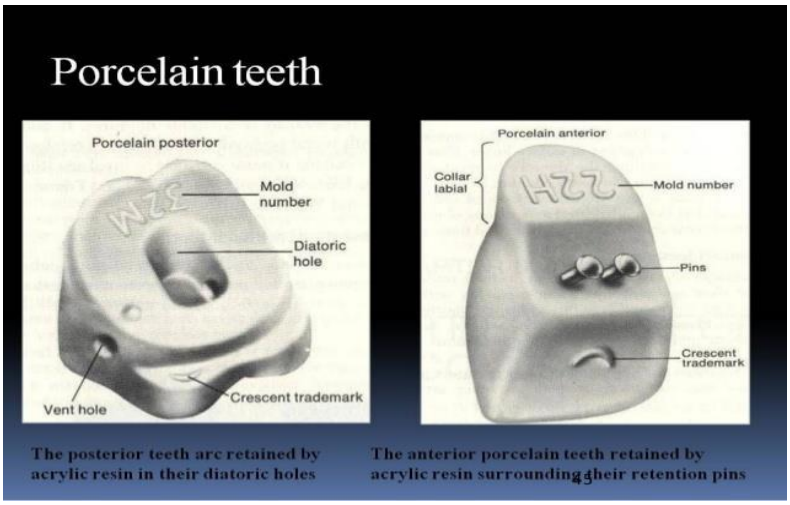
3. The error that occur in posterior palatal seal area (post dam) can't be corrected with metal denture base, while if same error occurred in resin denture base repostdaming is the choice for this problem.

Types of artificial teeth:

1. Acrylic teeth: Artificial teeth that have been made of acrylic resin, it has the ability to be attached chemically to denture base.



2. Porcelain teeth: Is made of feildspathic porcelain material, its attached to denture base by mechanical mean, either by pin that will be processed in denture base and a hole is presenting the base of the tooth allowing its attachment by cementation.



3. Metal teeth: Some cases the anterior or posterior teeth may be processed as part of the denture base by casting procedure this is indicated in cases of limited intermaxillary spaces.

Modified poly-ether-ether-ketone (PEEK):

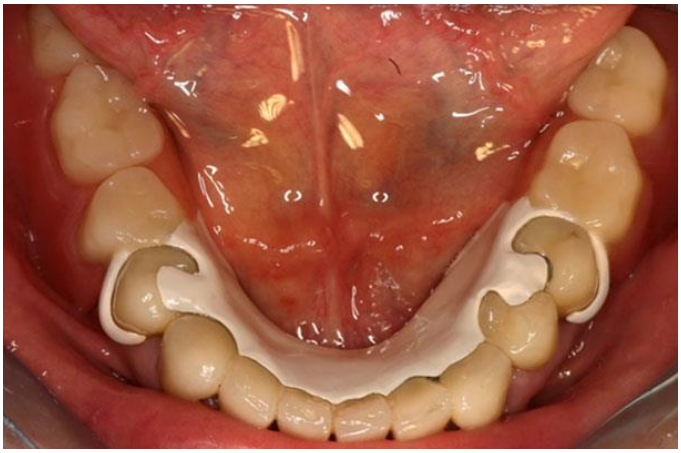
A new material in prosthodontics. Comparing to the metals used in dentistry.

1. An alternative material for the fabrication of distal extension removable dental prosthesis (RDP) frameworks.

2. This material can be used for patients allergic to metals, or who dislike the metallic taste, the weight, and the unpleasant metal display of the denture framework and retentive clasps.

3. A biocompatible, nonallergic, rigid material, with flexibility comparable to bone, high polishing and low absorption properties, lowplaque affinity, and good wear resistance.

4. Can be constructed either via CAD/CAM manufacturing or via the conventional lost wax technique.



Prosthodontics

3rd class ***Dr. Osama Alheeti***

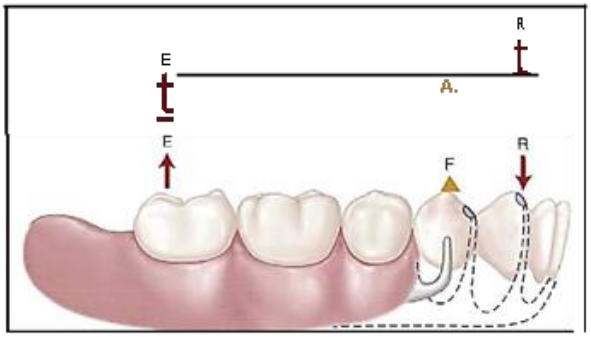
Indirect Retainers

Partial denture movement can exist in three planes; horizontal, frontal, and sagittal. Tooth-supported partial dentures use teeth to control movement away from the tissues. Tooth-tissue-supported partial dentures have at least one end of the prosthesis free to move away from the tissue.

A fulcrum line is a theoretical line around which a removable dental prosthesis tends to rotate when subjected to forces towards or away from the residual ridge.

This movement away from the residual ridge around the fulcrum line can be prevented by the action of an indirect retainer. Therefore, the main function of the indirect retainer is to prevent movement of a distal extension base away from the tissues.

An indirect retainer consists of one or more rests and the supporting minor connectors and should be placed as far from the distal extension base as possible in a prepared rest seat on a tooth capable of supporting its function.



Action of the indirect retainer where E: Effort (e.g. sticky food), F: fulcrum line, & R: Resistance (indirect retention).

The most effective location of an indirect retainer is in the area of an incisor tooth, but this tooth may not be strong enough may have steep inclines that cannot support a rest. Thus, the nearest canine or the mesio-occlusal surface of the first premolar may be the best location for the indirect retention and on both sides of the arch closer to the fulcrum line are used to compensate for the compromise in distance.

In the absence of indirect retainers for distal end extension dentures subjected to posterior dislodging forces, two undesirable events may take place:

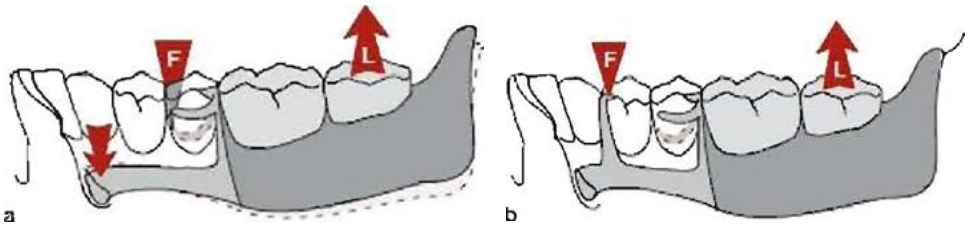
(1) the denture base moves away from the supporting tissues.

(2) the anterior segment of the major connector impinges upon the underlying soft tissues .This results m transmission of destructive forces to the hard and soft tissues of the dental arch.

<u>When an indirect retention is included in distal extension dentures:</u>

(1) forces acting to dislodge the distal extension bases are neutralized.

(2) the rotational axis shifts from the abutment teeth to the indirect retainers and as long as the clasp assemblies resist the vertical dislodging forces, the prosthesis remains in place.



Movement of a distal extension denture in the absence (a) and presence (b) of an indirect retainer.

The following are the main factors influencing the effectiveness of an indirect retainer:

1. The principal occlusal rests on the primary abutment teeth must be held in their seats by the retentive arms of the direct retainers. If rests are held in their seats, rotation about an axis should occur, which subsequently would activate the indirect retainers. If total displacement of the rests occurs, no rotation about the fulcrum would occur, and the indirect retainers would not be activated.

2. Distance from the fulcrum line. The following three areas must be considered:

a. Length of the distal extension base.

b. Location of the fulcrum line.

c. How far beyond the fulcrum line the indirect retainer is placed.

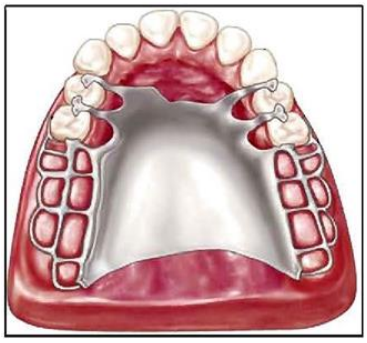
3. Rigidity of the connectors supporting the indirect retainer. All connectors must be rigid if the indirect retainer is to function as intended.

4. Effectiveness of the supporting tooth surface. Tooth inclines and weak teeth should never be used to support indirect retainers.

Forms of Indirect Retainers:

1. Auxiliary Occlusal Rest

The most commonly used indirect retainer is an auxiliary occlusal rest located on an occlusal surface and as far away from the distal extension base as possible. As mentioned earlier, this is the best form of indirect retention.



In a Class I arch this location is usually on the mesial marginal ridge of the first premolar on each side of the arch. The ideal position for the indirect retainer perpendicular to the fulcrum line would be in the area of the central incisors, which are too weak and have steep lingual surfaces. Bilateral rests

on the first premolars are quite effective, even though they are located closer to the axis of rotation . **This is advantageous because**

1) not only are they effective without jeopardizing the weaker single-rooted teeth.

2) interference with the tongue is far less when the minor connector can be placed in the embrasure between canine and premolar rather than anterior to the canine teeth.

Indirect retainers for Class II partial dentures are usually placed on the marginal ridge of the first premolar tooth on the opposite side of the arch from the distal extension base .

Class II design showing a favorable location for the indirect retainer on the mesio- occlusal of the first premolar. This location is at 90 degrees to the fulcrum line.

2. Lingual rest

A cingulum rest also can be used as an effective indirect retainer. A cingulum rest on the adjacent canine tooth may be used when the mesial marginal ridge of the first premolar is too close to the fulcrum line or when the teeth are overlapped. Modifications of the lingual rest can be applied for anterior teeth when the conventional c:ingulum rest is inapplicable.

3. Incisal rest

An incisal rest also may provide indirect retention where other rests are contraindicated. This is particularly true for maxillary and mandibular incisors, as well as mandibular canines. Because of the unfavorable lingual anatomy of these teeth, incisal rests may be the only acceptable option. Unfortunately, incisal rests are esthetically objectionable and exhibit long approach arms that may transfer harmful tipping forces to abutments. A

better solution would be to use one of the modifications for a lingual rest on these teeth.

4. Canine Extensions from Occlusal Rests

A finger extension from a premolar rest is placed on the prepared lingual slope of the adjacent canine tooth when the first premolar must serve as a primary abutment

5. Cingulum Bars (Continuous Bars) and Linguoplates:

In Class I & II partial dentures, a cingulum bar or linguoplate may act as an indirect retainer. Technically, cingulum bars (continuous bars) and linguoplates are not indirect retainers because they rest on unprepared lingual inclines of anterior teeth.

6. Modification Areas

The occlusal rest on a secondary abutment in a Class II partial denture may serve as an indirect retainer. A secondary abutment is an abutment adjacent to a bounded edentulous span other than the free end extension.

7.Rugae Support

The rugae area of the maxillary arch can be used as a means of indirect retention because the rugae area is firm and usually well situated to provide indirect retention for a Class I removable partial denture. Although this is true, rugae coverage is undesirable and should be avoided if possible.

The use of rugae support for indirect retention is usually part of a U shaped maxillary major connector (palatal horseshoe design). Posterior retention is

inadequate due to absence of posterior palatal seal and the requirements for indirect retention are greater than avoiding rugae coverage.

In a maxillary arch, where only anterior teeth remain, full palatal coverage is usually necessary. In fact, with any Class I maxillary removable partial denture that extends distally from the first premolar teeth, except when a maxillary torus prevents its use, palatal coverage may be used to advantage.

Prosthodontics

3rd class *Dr. osama Alheeti*

Stress Breaker and internal attachments

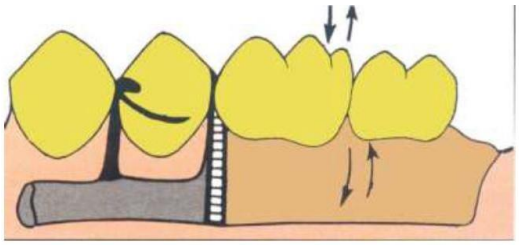
A stress breaker is defined as, *"A device which relieves the abutment teeth of all or part of the occlusal forces.*
OR
STRESS BREAKER:-It is a device that permits some hinge or rotational movement between the denture base or its supporting framework and the direct retainers (whether they are intra coronal or extracoronal retainer)

Dentures with a stress breaker are also called as a ***broken stress partial dentures*** or ***articulated prostheses***. We know that the soft tissues are more compressible than the abutment teeth. In a tooth-tissue supported partial denture, when an occlusal load is applied, the denture tends to rock due to the difference in the compressibility of the abutment teeth and the soft tissues. As the tissues are more compressible, the amount of stress acting on the abutments is increased. This can produce harmful effects on the abutment teeth.
In order to protect the abutment from such conditions, stress breakers are added to the denture.

Types of stress breaker

1-Type 1 : RPD having a movable joint between the direct retainer and the denture base include hinge , sleeve , and cylinder, ball and socket device.

These types have a movable joint between the direct retainer and the denture base and permit vertical movement and hinge action of the distal extension denture base.



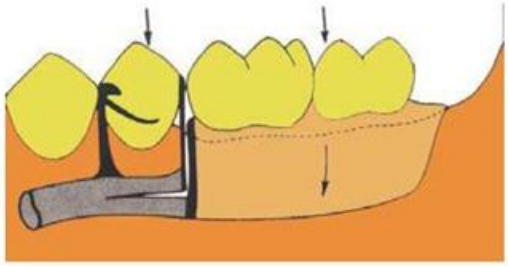
(The denture base shows independent movement with type I stress breakers)

2.Type 2

It has a flexible connection between the direct retainer and the denture base. It can be a wrought wire connector, divided or split major connector or a movable joint between two major connectors.

The major connector is split by an incomplete cut parallel to the occlusal surface of the teeth into two units namely the upper unit (more near to the tooth) and the lower unit. The denture base is connected to the lower unit and the rests and direct retainers are connected to the upper unit.

1-Divided major connector (split bar): by using this type of stress breakers, the vertical forces applied on distal extension base must pass anteriorly along the lower bar and then back along more rigid upper bar to reach abutment tooth therefore the tipping forces that would otherwise be transmitted directly to abutment teeth are dissipated by flexibility of lower bar and distance traveled.

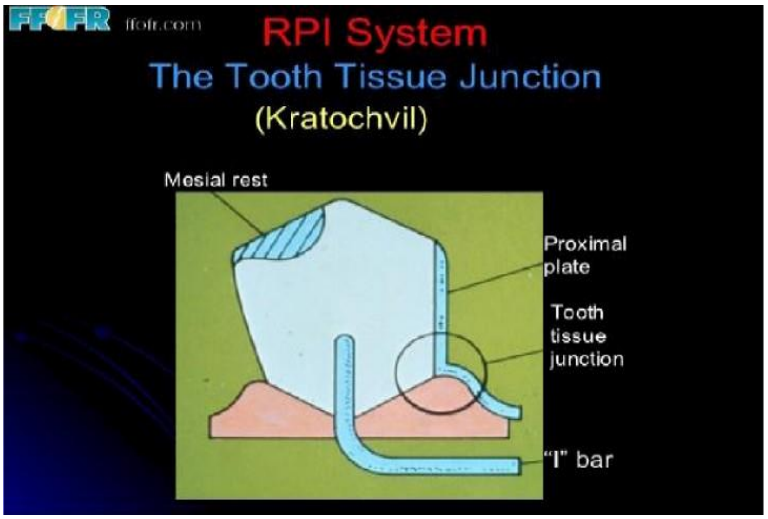


2-wrought wire soldered to major connector

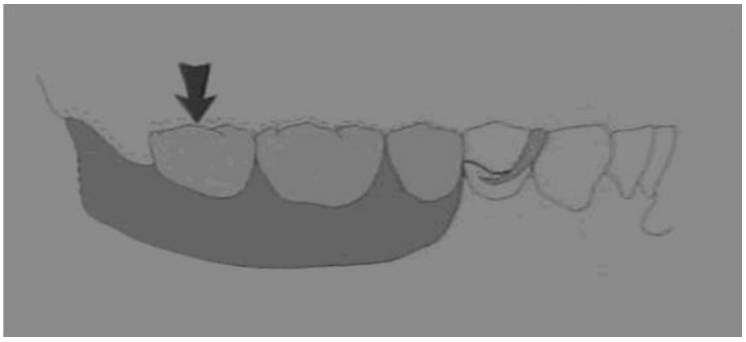
3- 3-clasps having stress breaking effect:

a-RPI system

R=rest mesially located ,P=proximal plate on abutment distally, I=I bar



b-Reverse Aker clasp



c-RPA system

R=rest mesially located P=proximal plate, A= Aker clasp

Advantages:

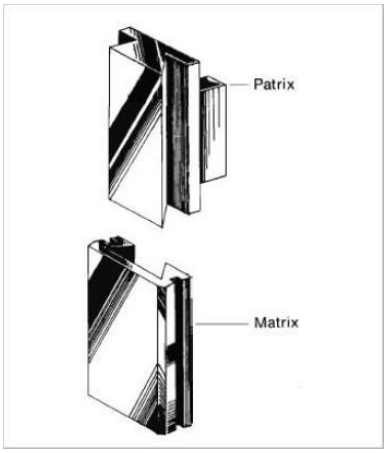
1. The alveolar support of the abutment teeth is preserved as the stress acting on the abutment teeth are reduced.
2. The stress on the residual ridge and the abutment teeth are balanced.
3. Weak abutment teeth are well splinted even during the movement of the denture base.
4. Abutment teeth are not damaged even if relining is not done appropriately (after the denture wears out).
5. Minimal requirement of direct retention.
6. Movement of the denture base produces a massaging effect on the soft tissues.
7. This avoids the frequent need for relining and rebasing.

Disadvantages

1. Design is complicated and expensive.
2. The assembly is very weak and tends to fracture easily. Distorts to rough handling.
3. It is difficult to repair.
4. It can be used only to counter the vertical forces on the denture. Inability to counteract lateral stress acting on the ridge leads to ridge resorption.
5. Reduced stability against horizontal forces.
6. Both vertical and horizontal forces are concentrated on the ridge leading to resorption.
7. Inappropriate relining leads to excessive ridge resorption.
8. Reduced indirect retention.

Internal and precision attachment of RPD

The precision attachment denture has long been considered advantageous in dentistry as it combines fixed and removable prosthodontics in such a way as to create the most esthetic partial denture possible.



Classification

• Based on their method of fabrication and the tolerance of fit between the components.

I. Precision attachment (prefabricated types) prefabricated machined components with precisely manufactured metal to metal .

II. Semi precision attachment (laboratory made or custom made types) components usually originate as prefabricated (made of plastic, nylon or wax) or Hand waxed.

According to their relationship to the abutment teeth.

1) Intracoronal / internal attachment

   If the attachment resides within the body / normal contours of the abutment teeth.

2) Extracoronal / external attachment

   If the attachment resides outside the normal clinical contours of the abutment crown / teeth.

Advantages of precision attachments

1.Improved esthetics and elevated psychological acceptance

2. Compared to conventional clasp retained partial denture they give better retention and stability, less liable to fracture than clasp, less bulky.

3. Lateral forces in the abutment during the insertion and removal are eliminated and more axial force during functions are achieved.

Disadvantages

1. Complexity of design, complex principles and procedures for fabrication and clinical treatment.
2. Expensive – increased overall cost of the treatment. .
3. Requires high technical expertise for successful fabrication experience and knowledge on the part of dentist and laboratory technician are essential.
4. Increased demand on oral hygiene performance

Intracoronal precision attachment – prefabricated type: It comes as two component matrix and patrix. Matrix (female) is waxed into the crown or bonded into a preparation in the tooth. Patrix (male) is attached to the framework usually by soldering. Type of retention is either friction or mechanical.

Advantages

1) Improved esthetics (particularly important in anterior part of mouth)
2) Natural self cleansing contours of teeth can be maintained.

Disadvantages

1) Requires adequate faciolingual width / cervicoocclusal height to provide as large as frictional area as possible between the slot and flange.
2) Requires extensive preparation of the abutment teeth to obtain space for the keyway mechanism.

2. Semiprecision Attachment: There is a type of attachment usually referred to as a semiprecision rest attachment that utilizes an intracoronal rest seat and resilient lingual arm.

Advantages

1. Laboratory fabricated precision attachment offers far greater adaptability to a wide variety of clinical situations compared to prefabricated precision attachments.
2. Versatility for many clinical variation
3. Variation in tooth size and shapes are most easily accommodated.

Disadvantages

1. Long term wear is more
2. Lack of interchangeability of male and female attachment as there is no standardization of sizing as been in prefabricated parts.
3. Repair and replacement of custom attachments are more difficult as composed to prefabricated parts.

Extracoronal attachments

Classified by (Boitel 1978)

1.Rigid attachment
2.Resilient attachment
3.Bar attachment

Advantages

1. It does not alter the normal contour of the abutment, crown being entirely outside the tooth contour.
2. Easy insertion and greater freedom in design.
3. Do not require space within the contours of the abutment tooth hence can be used when there is insufficient buccolingual width to accommodate the intraoral attachment.

Disadvantages

1. Lack of occlusal stability
2. Improper control of force distribution between dentulous and edentulous area
3. Maintenance problems
4. Bulky, break or wear
5. Rebasing problem.

4. Magnets as Attachment: Use of magnets started gaining popularity since 1960 – when magnets based on rare earth element was developed. These magnets were of small size having high strength. In recent years, there has been an increased interest in the use of magnets, the modern alloy are powerful and retain their magnetism for a long time.

Prosthodontics

CLINICAL AND LABORATORIES STEPS FOR CONSTRUCTION OF CHROM COBALT PROSTHESIS

3rd class *Dr. Osama Alheeti*

Knowledge of the laboratory phase of partial denture construction is essential for the clinician, who must assume total responsibility for the design and the quality control of all aspects of this construction.

1. Primary impression making at 1st clinical appointment for patient seeking for removable partial denture. A diagnostic cast with a neat and specific design carefully drawn on it.(clinical work).

-Marking the height of contour

-Measuring the undercut

-Drawing the clasps ,rest and drawing the connectors.

2-mouth preparation inside the patient mouth (**clinical** work).

3-final impression and master cast production(**clinical** work).

4-After recording the master impression, the framework is fabricated for a cast partial denture.(Laboratory work).

• The framework is essential for other procedures like preparing occlusal rims, jaw relation, etc.

• Framework fabrication involves the following steps:-

1. Wax-up
2. Duplication and preparation of refractory casts
3. Waxing
4. Investing
5. Burn out
6. Casting
7. Finishing and polishing.

The first step in framework construction is the transfer of the design to the master cast by the dental technician

The tripoded master cast is placed on the surveyor and the height of contour marked according to the pre-selected path of insertion and

removal. The technician then carefully transfers the design on the diagnostic cast to the master cast.

The elimination of undesirable undercuts on the master cast with wax is referred to a s blockout. This will help insure the finished casting will go to place with minimal engagement of these undercuts. Certain areas under the RPD framework are deliberately relieved, using various thickness of wax sheets. Relief is usually associated with the denture base and mandibular major connectors.

Blockout is classified as paralleled, shaped or arbitrary. Parallel blockout used in proximal surfaces, and lingual surfaces where reciprocation by plate, shaped blockout used wherever clasp arm is used facially and lingually, arbitrary blockout used to blockout undercuts out the design to protect the mold from distortion when lifting the master cast from duplicating material.

Relief done on the saddle, beneath the lingual bar and bar clasp, on any bony projection and torous.

Fig: Relief

Fig: Shaped blockout

The elimination of undesirable undercuts on the master cast with wax is referred to a s **block out**. This will help insure the finished casting will go to place with minimal engagement of these undercuts. Certain areas under the RPD framework are deliberately relieved, using various thickness of wax sheets.

Relief is usually associated with the denture base and mandibular major connectors

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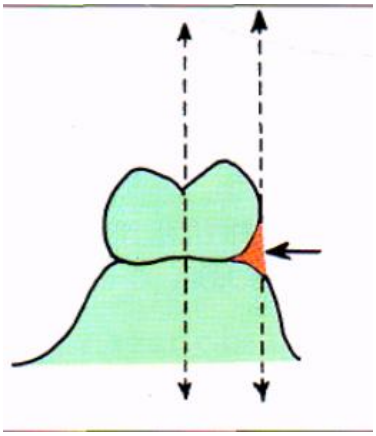
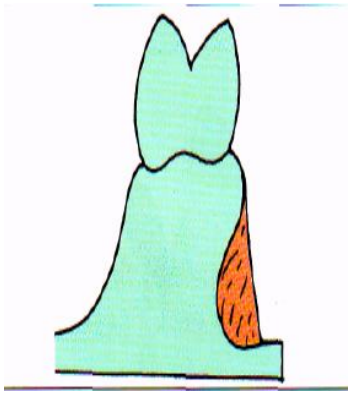
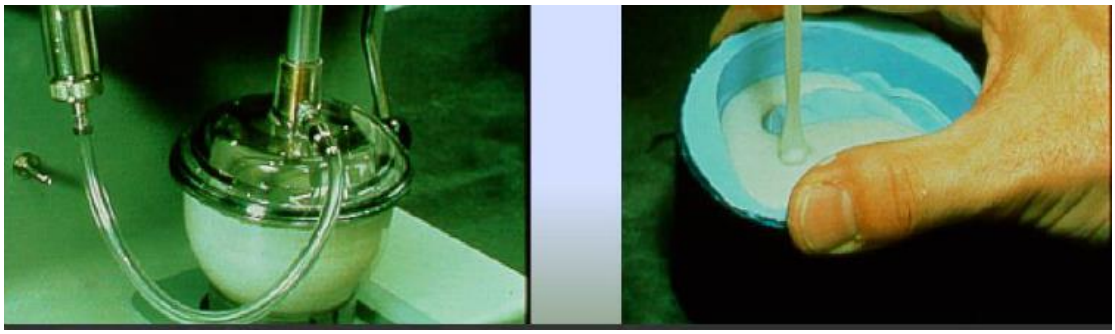


Shaped blockout :ledges on which clasp patterns are to be placed

arbitrary blockout: used to blockout undercuts out the design to protect the mold from distortion when lifting the master cast from duplicating material.



When the technician has completed the blockout and relief, the master cast is then duplicated, usually using reversible hydrocolloid(Agar) or thin viscosities of silicone in a duplicating flask.
The reversible hydrocolloid impression is poured in refractory material, either gypsum, phosphate or silicate bonded, depending on the metal used in the casting, and allowed to set. The technician then has a duplicate of the master blocked out cast, in an investment material on which the RPD framework will be directly waxed.
Also the design must once again be transferred to the refractory cast so that the technician can accurately place the component parts of the framework



ADVANTAGES OF DUPLICATION:

1-preserve the original cast

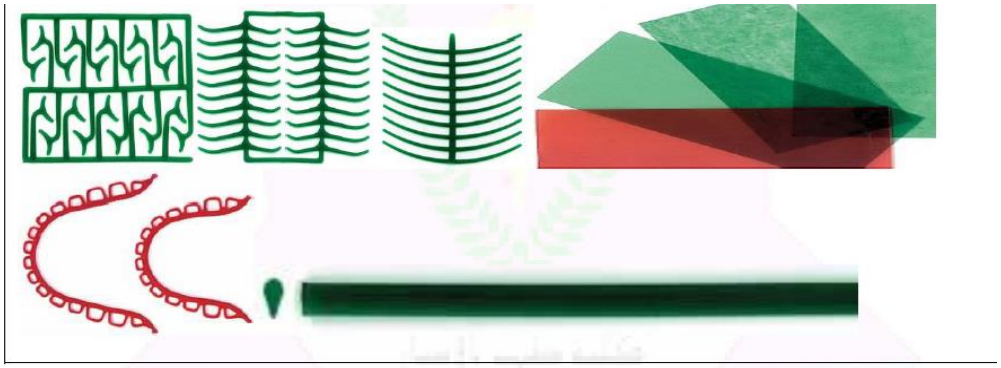
2- eliminating the danger of fracture or abrading the surface of the original master cast

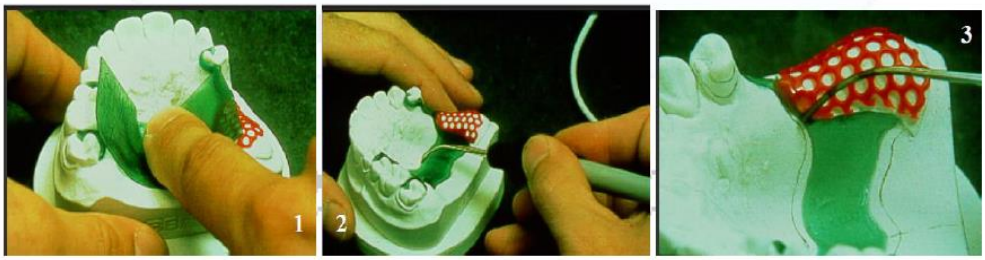
3- forming the wax or plastic pattern

4-the metal framework is cast against the surface of refractory cast

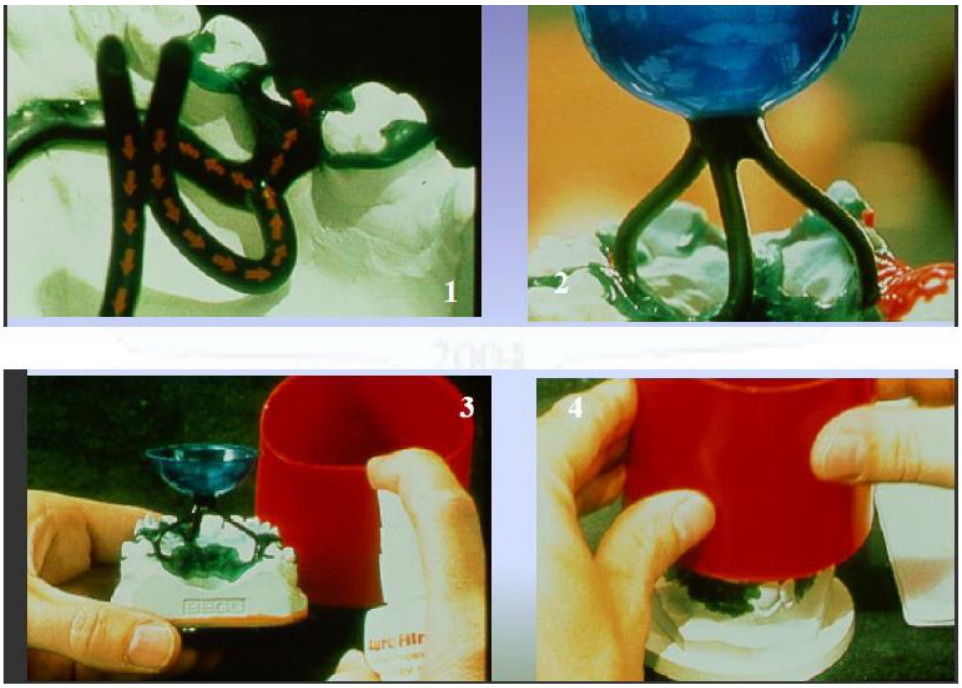
Before waxing, the refractory cast is dried and dipped into hot beeswax to insure a smooth, dense surface. Also, the design must once again be transferred to the refractory cast so that the technician can accurately place the component parts of the framework .

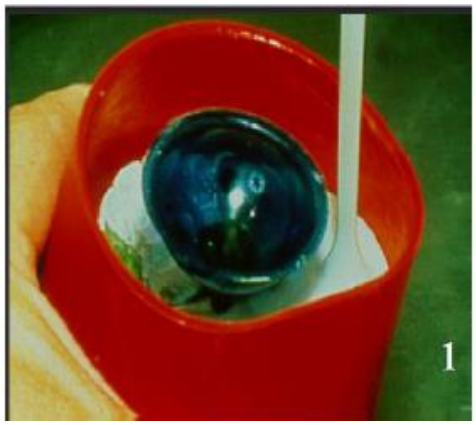
Most components of an RPD framework are manufactured, flexible, plastic patterns that are modified by the technician to fit the existing requirements. The plastic patterns are placed onto the refractory cast with adhesive so they will not lift off. Some freehand waxing must be done to connect all the components together into a rigid, smooth pattern.

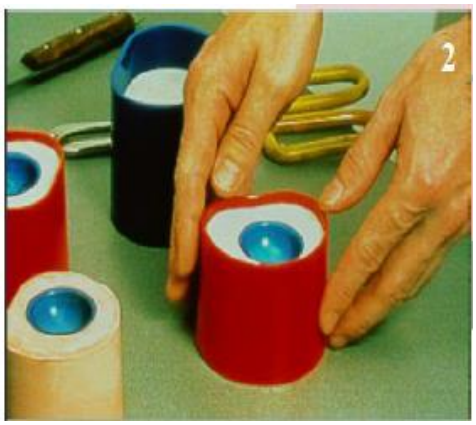




The waxed framework is sprued directly on the refractory cast and invested with refractory material in a casting ring. The wax pattern is not removed from the cast.







After the investment sets, the ring is placed in a burnout oven for a prescribed time and temperature. Casting and burnout procedures differ, depending on the type of metal being used. The Chromium-cobalt and Nicle-chromium alloys usually require a high heat burnout and usually induction casting (2500 F), as compared to torch casting. When the casting is complete, the mold is removed from the machine and allowed to cool according to the manufacturer's direction. The casting is removed from the investing material and cleaned with a sand blaster

The burn out procedure serves three purposes:

1-it derives off moisture in the mold .

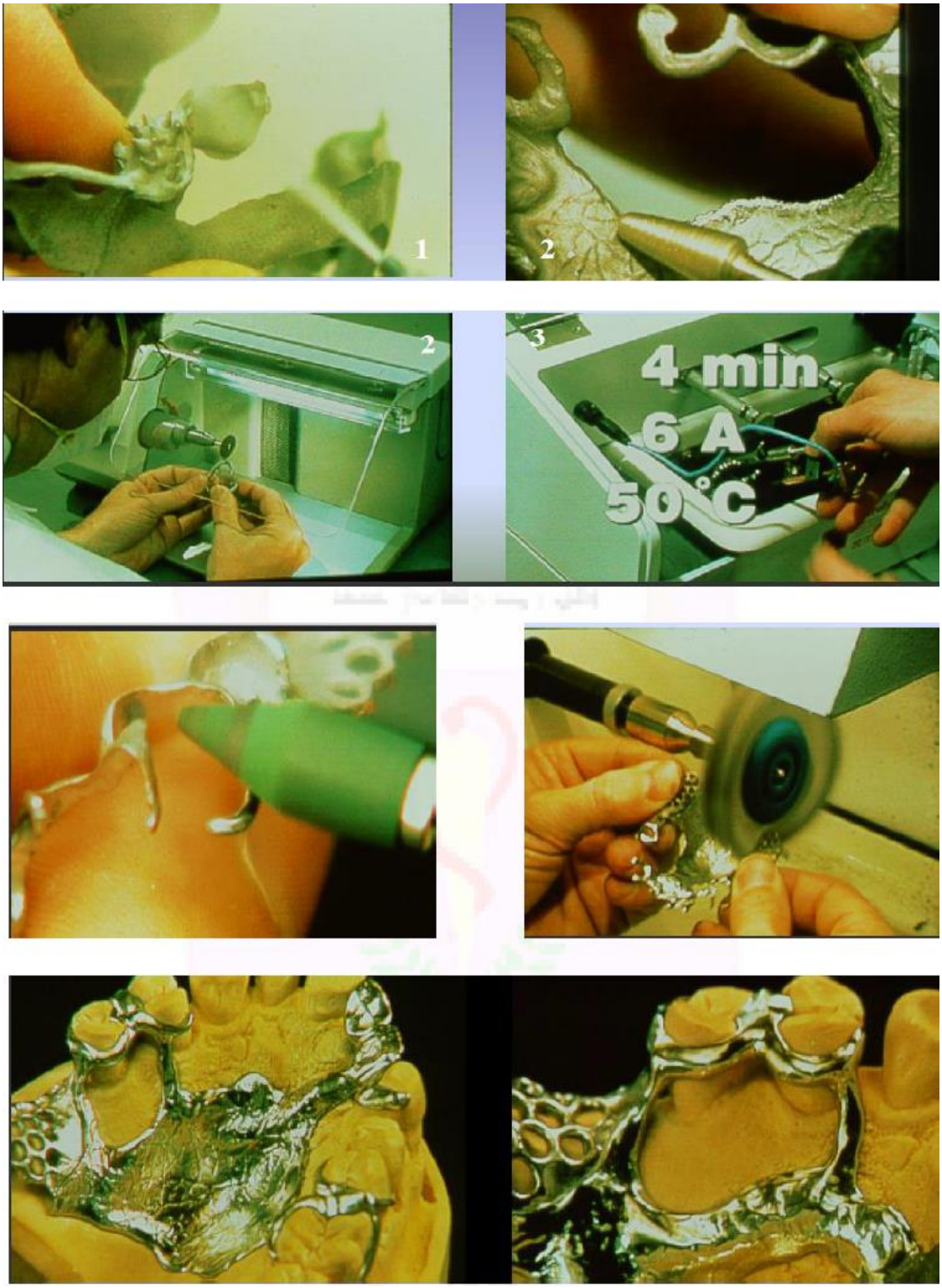
2-it vaporizes and thus eliminates the pattern , leaving a cavity in the mold

3-it expands the mold to compensate for contraction of the metal on cooling .

The metal is melted by an electric muffle and the molten alloy is forced into the mold cavity by centrifugal force this procedure is called **Casting**.

The sprue removal and finishing is done with high-speed lathe, large abrasive discs, polishing compounds and wheels.

The sprue removal and finishing is done with high-speed lathe, large abrasive discs, polishing compounds and wheels. The final finishing procedures are similar to those used for gold alloy but the Chromium-cobalt and Nicle-chromium alloys is much harder. The major difference is that the Chromium-cobalt and Nicle-chromium alloys is also electropolished, in addition to the usual mechanical lathe polishing, to produce a smooth surface. This is necessary due to the hardness of the metal and complexity of the design for hand polishing. The unfinished RPD framework should not be tried on the master cast, as it will abrade the surface of the gypsum. Many laboratory technicians used a duplicate master cast for fitting the framework, and only place the framework on the original master cast when the framework is completely finished and polished. This is an excellent practice to follow.



The framework should be returned from the laboratory on an unabraded, unbroken master cast, clean and properly fabricated and polished. There should be no rocking of the framework on the master cast and all of the rests should be seated accurately with the rest seat preparations and the clasp arms contacting the desired locations of the abutment teeth. The

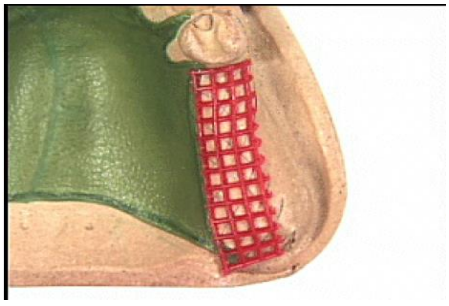
design should be exactly as you have drawn it on the diagnostic cast and on the laboratory work authorization.

Laying Sheet Wax

A piece of 0.4mm sheet casting wax is lightly warmed and laid it down over at least half the palate. (This wax is textured or stippled on one side to simulate the texture of the soft tissues of the mouth. The stippled side is always laid uppermost). The wax must not be unduly stretched, which will result in thinning leading to a possible miscast and loss of surface detail, while at the same time pressed firmly but gently to ensure it contacts all of the refractory cast.

Retention Wax

Retention profile wax in the form of mesh or loops, provides the mechanical retention which holds the acrylic resin on to the metal framework. Without suitable retention the acrylic quickly becomes detached from the casting, requiring a new framework to be made. The retention wax is placed onto the saddle areas, extending just over the crest of the ridge and abutting with the palatal sheet wax.



Prosthodontics

3th class *Dr.Osama Alheeti*

Principles of removable partial denture design

The forces occurring through the removable partial denture can be widely ***distributed***, ***directed***, and ***minimized*** by the selection, the design and the location of components of removable partial denture and by developing a harmonious occlusion.

Types of partial dentures

1. Removable partial denture, which includes the cobalt chromium and acrylic removable partial denture.
2. Fixed partial denture.
3. Implant supported partial denture, this could be fixed (implant retained partial denture) or removable (implant support partial denture).

General principle

1. Utilize what is present.
2. Minimize the framework elements.
3. Plan for future.
4. Consider caries susceptibility.
5. Avoid placing rest seats or guiding planes on direct restorations such as amalgam.
6. Never design any removable partial denture without surveying.

Factors influencing the design of removable partial denture:

1. ***Which arch, is needed to be restored:*** because each arch may have certain criteria indicates specific design, and if both arches are needed to be restored, the relationship between maxillary and mandibular arches in removable partial denture designing and construction may consider:

α. Inter-ridge space as well as space available for missing teeth restoration.
β. Orientation of occlusal plane.
χ. Occlusal relationship of remaining teeth.
δ. Arch integrity.
ε.Tooth morphology.

2. *Type of support:* cases supported entirely by teeth are differ than cases with tooth-tissue support, if one or more distal extension bases are involved, the following must be considered:

•α.Type of secondary impression material and technique.

β. Clasp design that will best minimize the forces applied to the abutment teeth during function.

χ.Need for indirect retention.

δ. Need for later relining or rebasing, which influence the type of base material used.

3. Abutment teeth: selection and modifications required (simple grinding to more complicated restorations or splinting). This may affect the clasp design and type.

In evaluating support that an abutment tooth can provide, consideration should be given to

- Tooth number and location in the arch relative to edentulous spaces.
- Periodontal health.
- Crown and root morphology.
- Crown to root ratio.
- Bone support (tooth response to stress (index area)).
- Opposing dentition .

In evaluating support available from edentulous ridge areas, consideration must be given to:

(1) the quality of the residual ridge.
(2) the extent to which the residual ridge will be covered by the denture base
(3) the type and accuracy of the impression
(4) the accuracy of the denture base.
(5) the occlusal load.

4. Type of major connector indicated.
5. Materials to be used for the framework and for the bases.
6. Type of artificial teeth to be used,
In general, removable partial dentures opposing natural teeth will require greater support and stabilization over time because of the greater functional load demands.

7. Patient past dental history and his experience with removable partial denture and the reasons for making a new one, e.g. if patient was objectionable for an anterior palatal bar because bulky, location or tissue irritation, another major connector could be used and located more posteriorly.

8. Using of other types of treatment modalities to restore missing tooth as replacing of single missed anterior teeth by fixed restoration or benefits from implant to simplify the removable partial denture design.

9. Response of oral structures to previous stress.

Different between the removable partial denture and fixed partial denture:

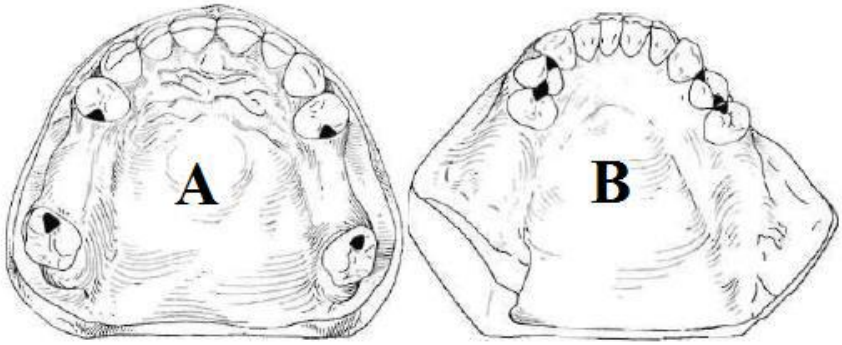
1. Fixed partial denture does not move in function, this mean not supported by clasp as in removable partial denture that the patient can easily insert and remove the removable partial denture in mouth.

2. Occlusal forces are usually directed down the long axes of the teeth in fixed partial denture so it considered to as a part of the natural tooth.

Differentiation between two main types of removable partial denture (tooth supported and tooth - tissue supported removable partial denture):

1. Differences in the manner in which each is supported.

The Class I type and the distal extension side of the Class II type derive their primary support from the tissue underlying the base and secondary support from the abutment teeth.



2. Differences in the method of impression registration and jaw record require.

An impression registration for the fabrication of a partial denture must fulfill the following two requirements:

• ***The anatomic form*** and the relationship of the remaining teeth in the dental arch and the surrounding soft tissue must be recorded accurately so that the denture will not exert pressure on those structures beyond their physiological limits.

• ***The supporting form*** of the soft tissue underlying the distal extension base of the partial denture should be recorded so that firm areas are used as primary stress-bearing areas and readily displaceable tissues are not overloaded.

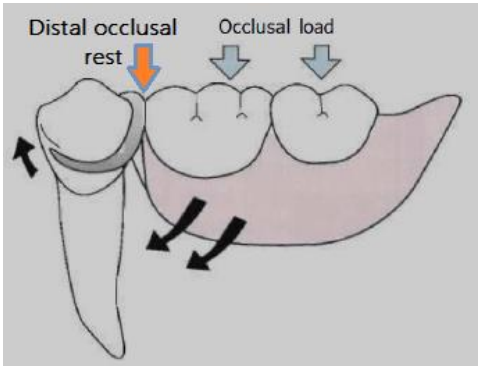
3. Differences in the need for indirect retention exist in the distal extension type of partial denture.

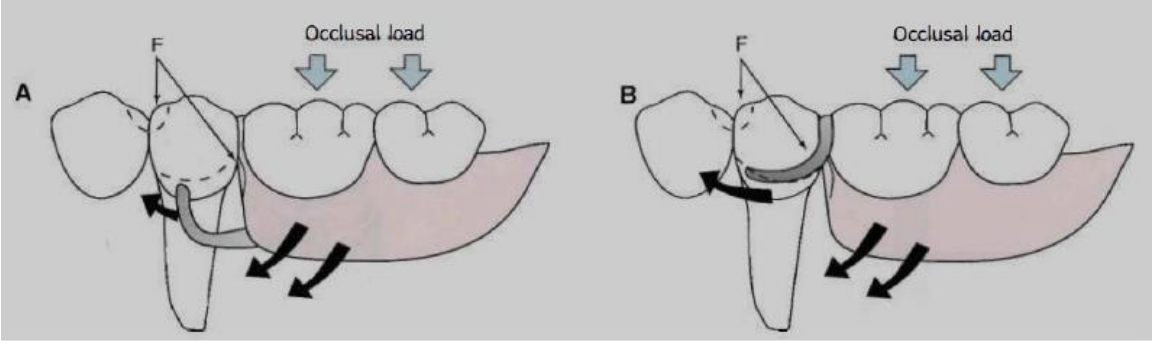
4. Differences in the type of the base material that can be relined to compensate for tissue changes.

5. Differences in Clasp Design

• ***The tooth-supported partial denture*** is retained and stabilized by a clasp at each end of each edentulous space. Cast retentive arms are generally used for this purpose. These may be either circumferential or bar clasp.

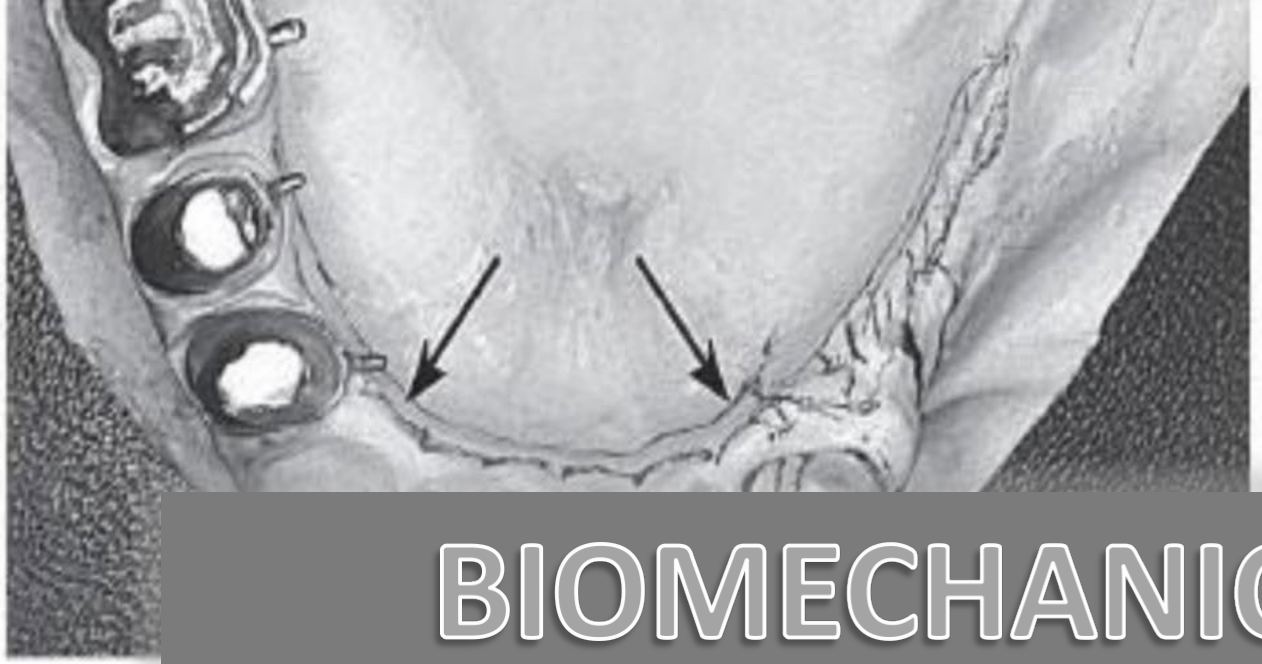
• ***In the tooth-tissue supported removable partial dentures***, because of the anticipated functional movement of the distal extension base, the direct retainer adjacent to the distal extension base must be able to flex sufficiently to dissipate stresses that otherwise would be transmitted directly to the abutment tooth as leverage, in addition to that of resisting vertical displacement. A retentive clasp arm made of wrought wire can flex more readily in all directions than can the cast half-round clasp arm.



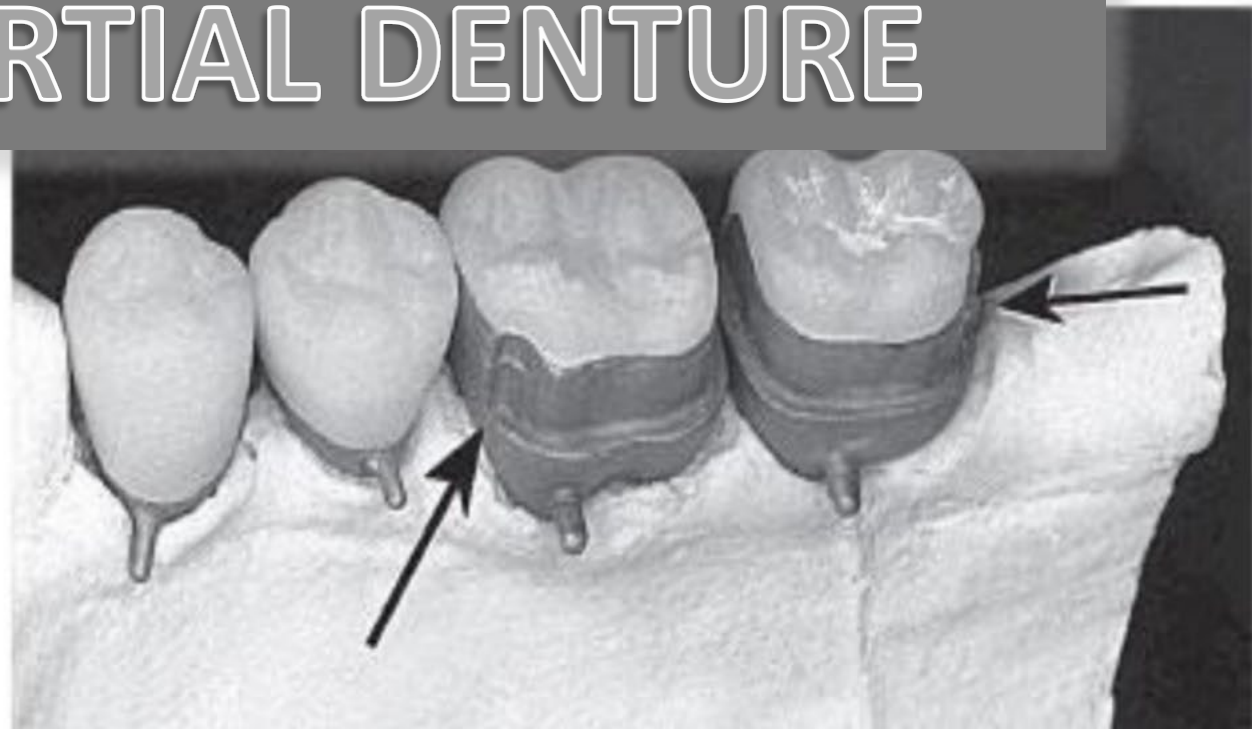


The key to selecting a successful clasp design for any given situation is to choose one that will:

- Avoid direct transmission of tipping or torqueing forces to the abutment.
- A clasp design with correctly positioned component parts on abutment tooth surfaces.
- Provide retention against dislodging forces.
- Compatible tissue contour and esthetic desires of the patient.
- Location of the undercut is the most important single factor in selection of a clasp.

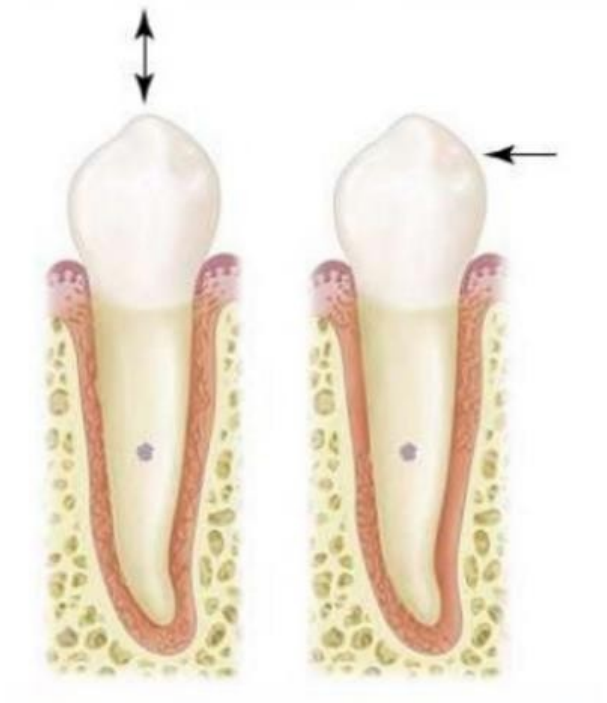


BIOMECHANICS RELATED TO REMOVABLE PARTIAL DENTURE



What is Biomechanics in Prosthodontics?

Application of mechanical principles on biological tissues while studying the biology from a functional viewpoint and then using these principles to design a stable prosthesis.



Biomechanical considerations:

The RPD and their associated structures are subjected to various forms of stress. Their ability to resist them depend on:

- **Direction**, **Duration**, **Magnitude** and **frequency** of the Stress (Force) being applied onto the denture and denture bearing areas
- **Capacity** of these areas to **resist these forces/stress**
- Changes due to resistance over time
- **The type of Resistance Generated:**
  - **1.Tooth based**
  - **2.Tooth and Tissue**

Types of Stress (Force) acting on an RPD within the oral cavity:

These stresses can be classified into:

- **Vertical**

Displacing Force

Dislodging Force

Horizontal

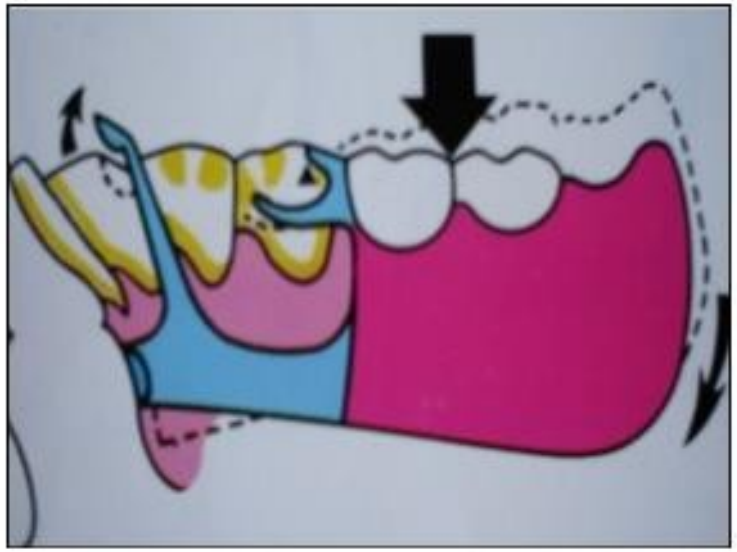
Torsion

Resistance to stress can be divided into:

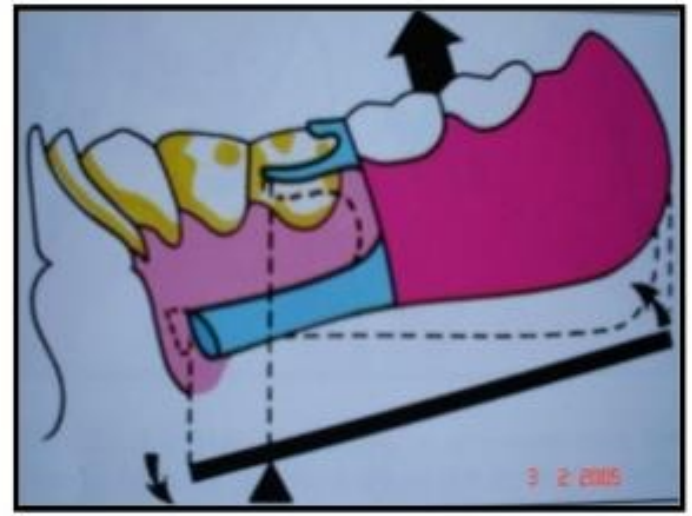
Tooth based resistance contributes mainly to resisting Horizontal Stress (*direct retainers*)

Tooth-Tissue based resistance contributes to resisting Vertical Stress and Torsion (*major connectors and indirect retainers*)

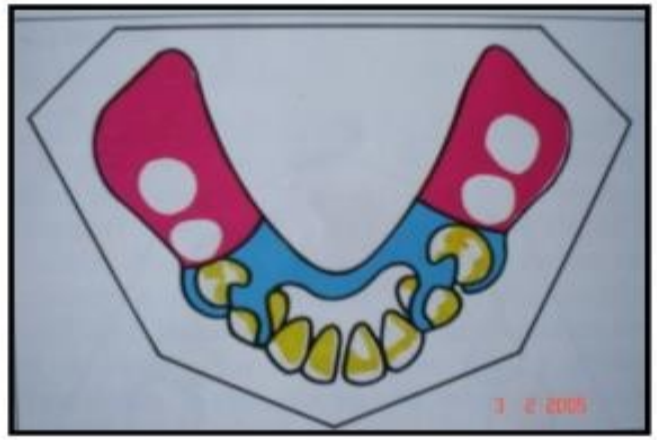
Displacing stress



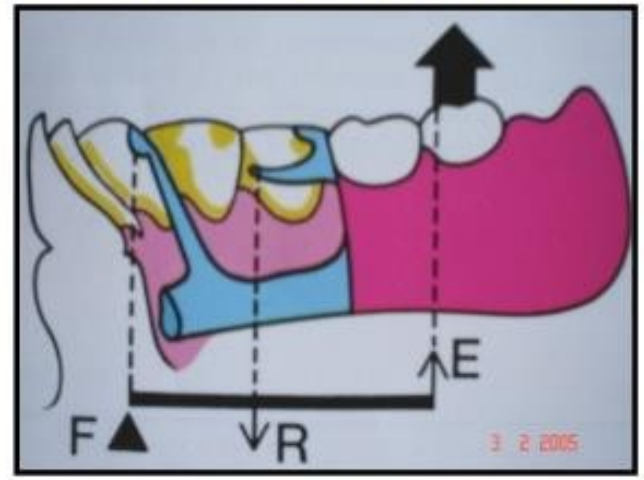
Dislodging stress



Horizontal stress



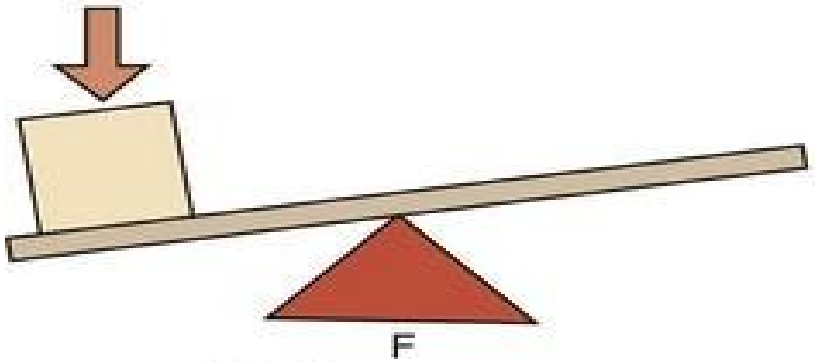
Torsional stress



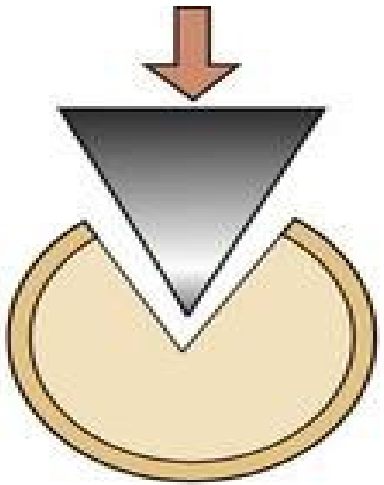
Factors contributing to the amount of Stress on the RPD:

- The **length** of edentulous span (*example:* Kennedy Classification III usually exhibit no lever action)
- Quality of **Ridge Support** (*example:* Wider ridges disperse more stress due to the Snow Shoe Principle)
- Quality of **Oral Mucosa** (*example:* Healthy mucosa are able to withstand much greater force than weak flabby mucosa)
- **Clasp Design** (flexibility, length and material used)
- **Occlusal Harmony**

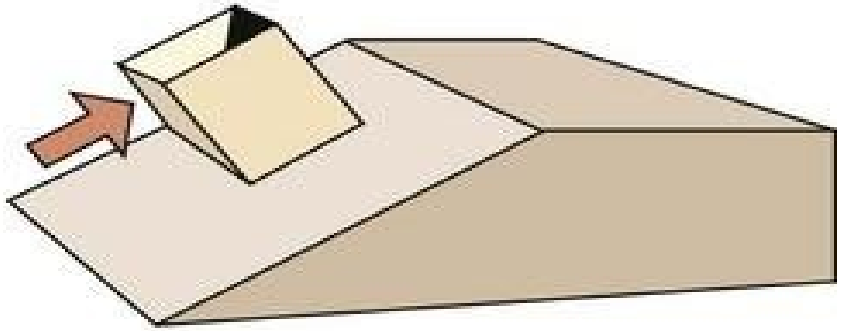
Principles of Mechanical forces (According toMcCraken):



Lever

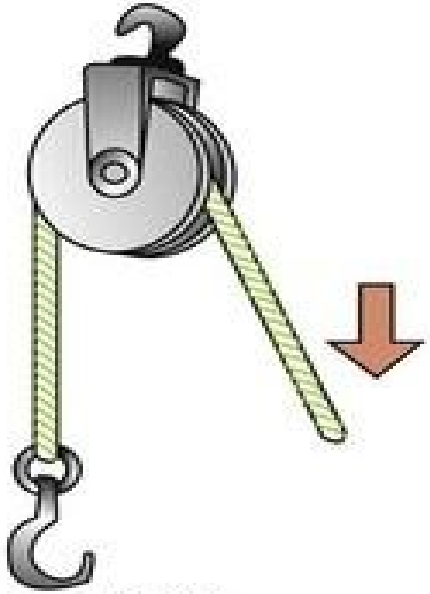


Wedge

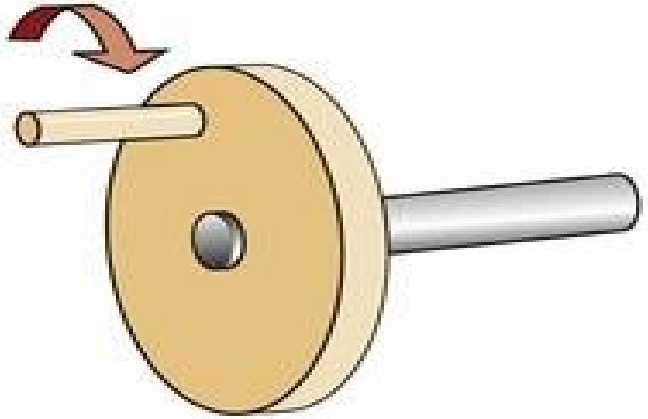


Inclined plane

Screw



Pulley



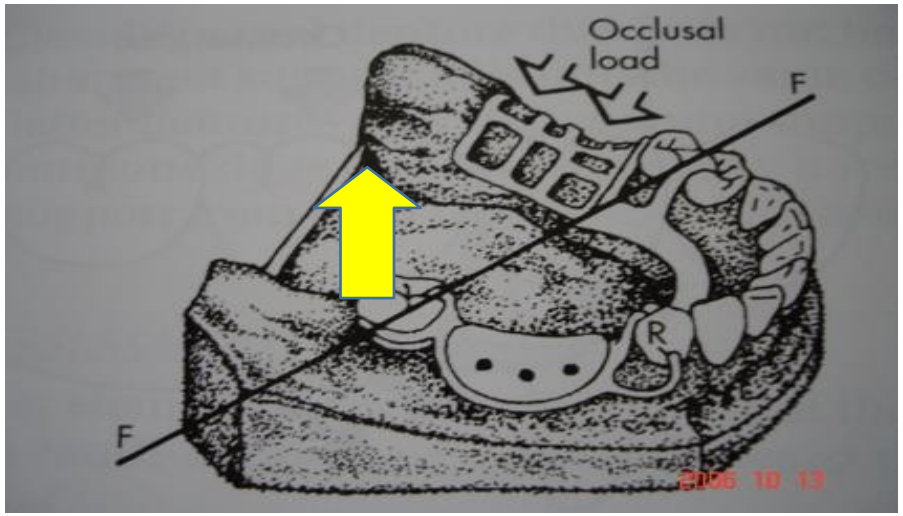
Wheel and axle

Mechanical Force Principles to be considered within the oral cavity:

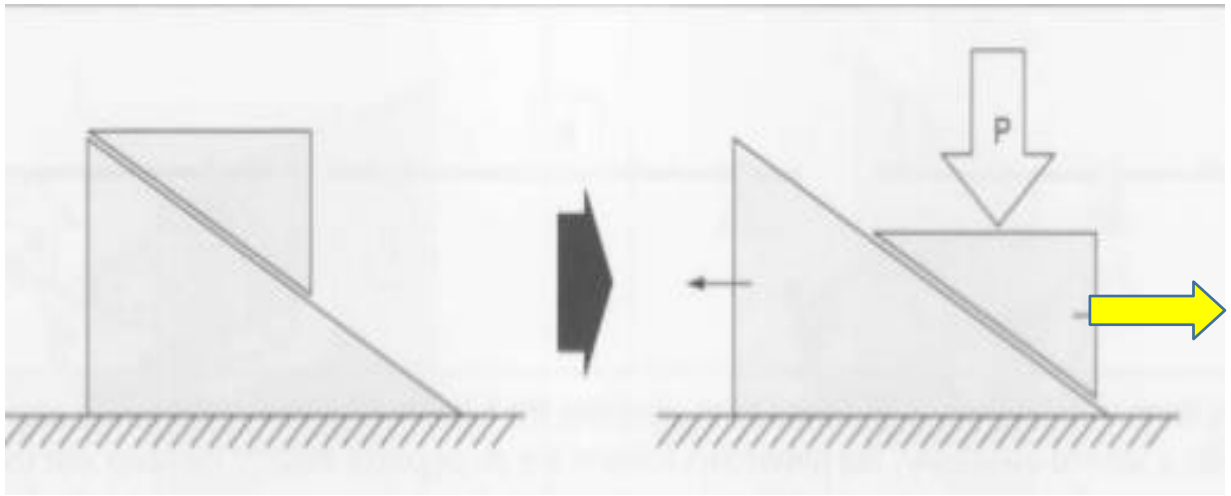
Lever Principle (Further divided into Orders I, II and III)

Inclined Plane Principle

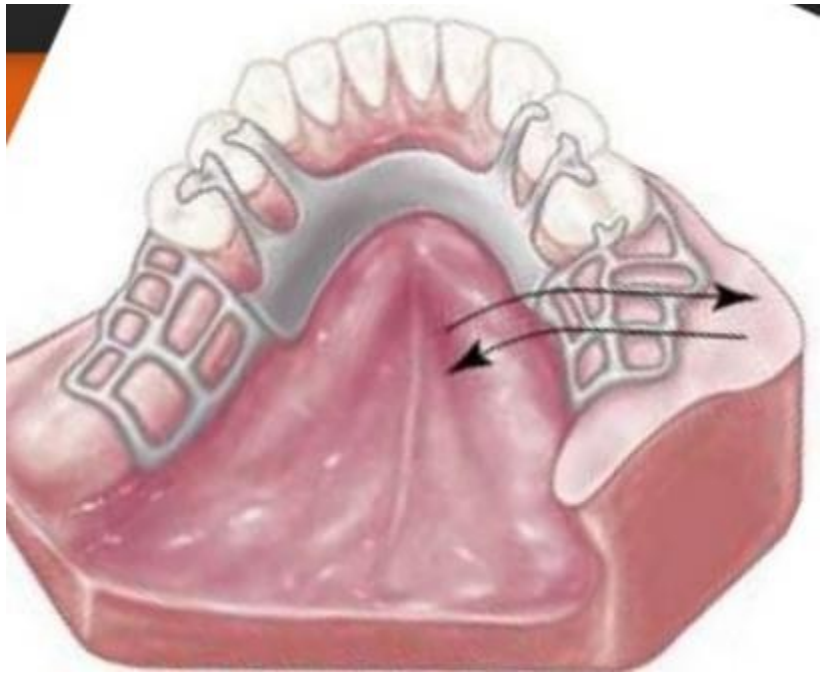
Wheel and Axle (Rotation)



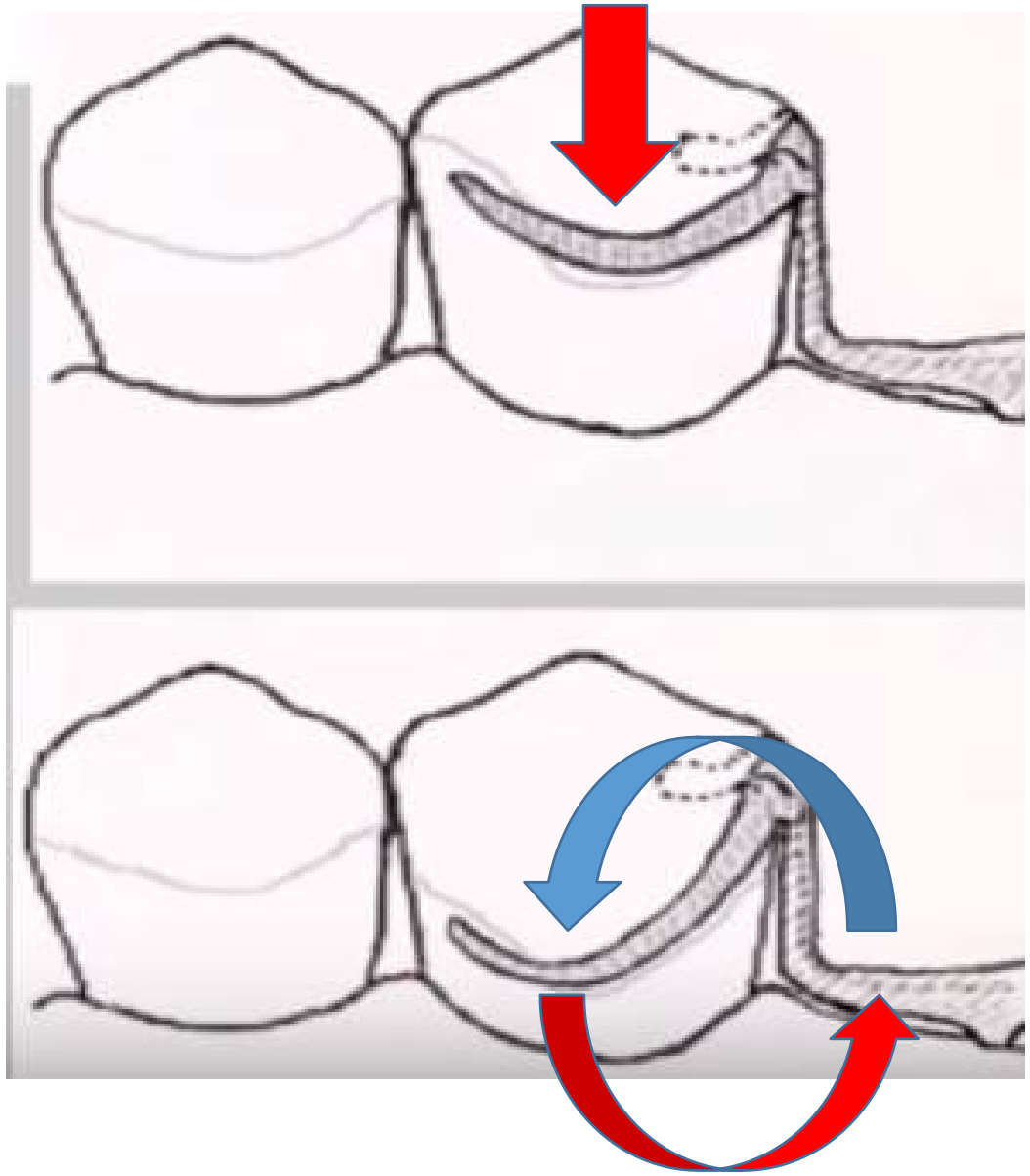
LEVER PRINCIPLE



INCLINED PLANE PRINCIPLE



WHEEL AND AXLE (along Saggital Axis)

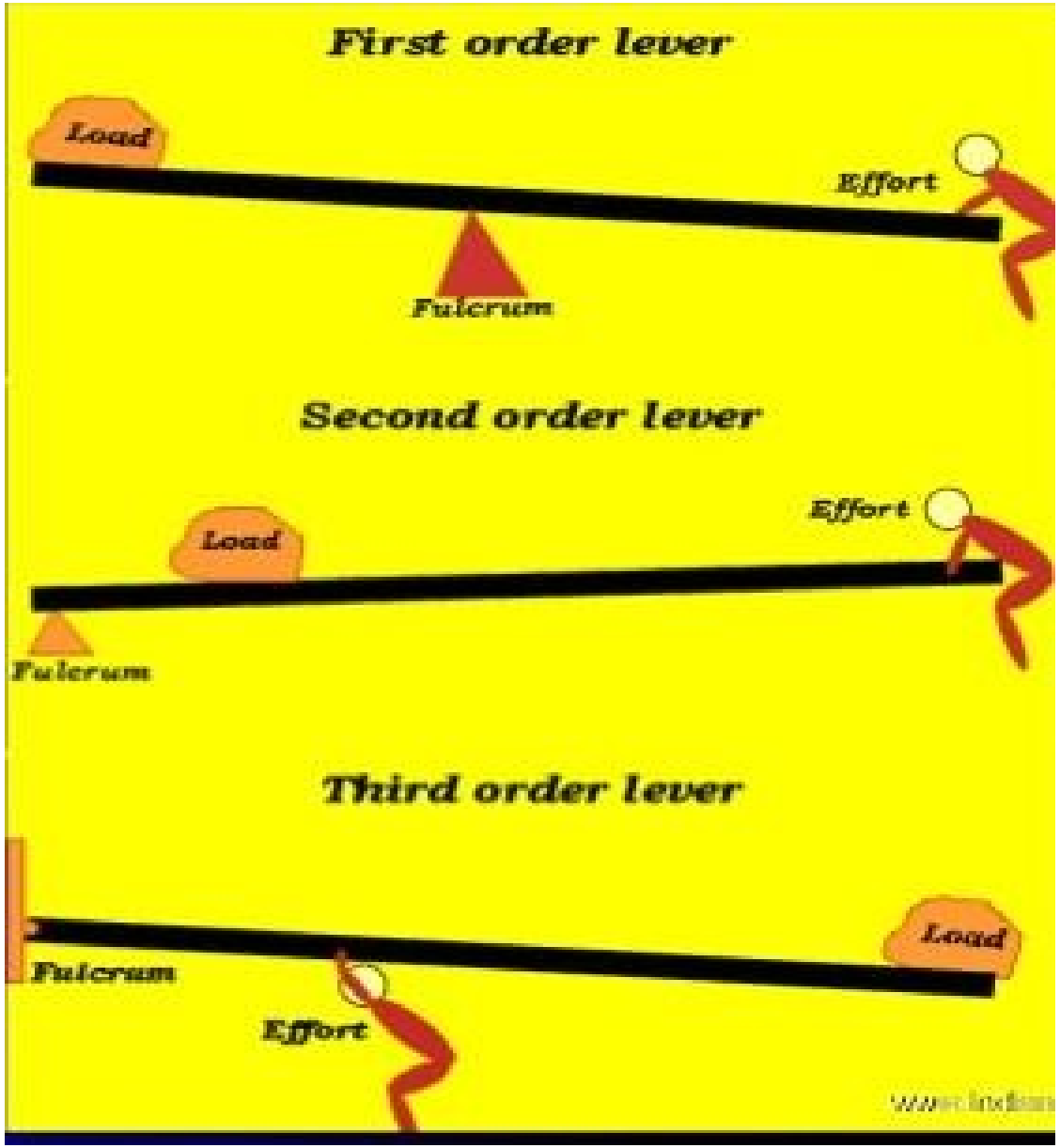


WHEEL AND AXLE PRINCIPLE (along horizontal axis)

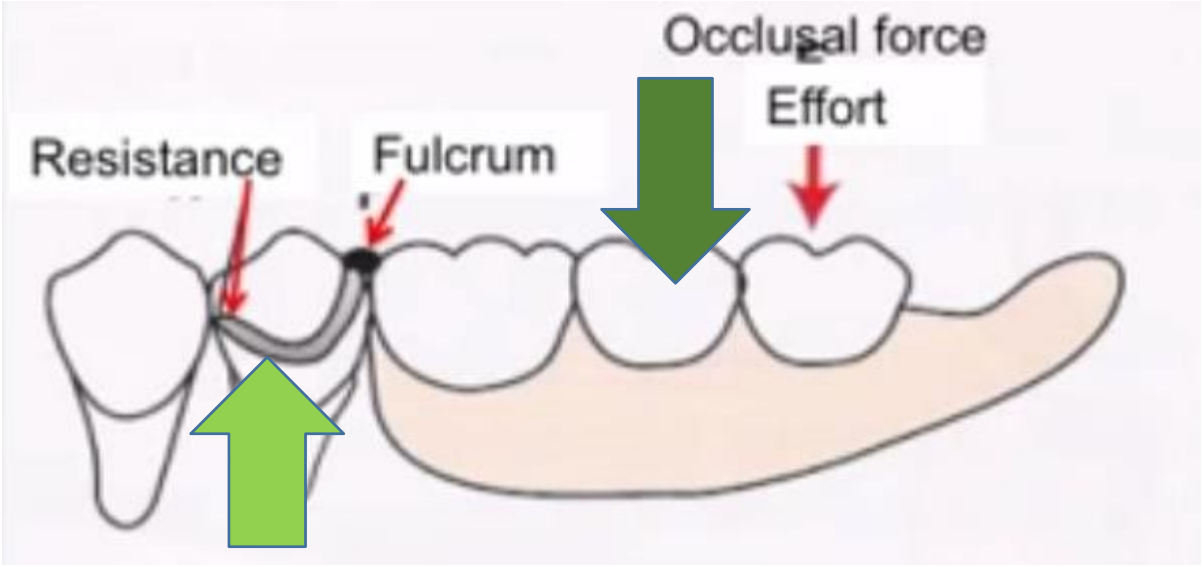
Types of lever Action:

There are 3 types of mechanical lever action based on:

1. the position of the **fulcrum**
2. The location of the **load** along the *fulcrum line.*
3. The area from which the**effort** to displace is exerted

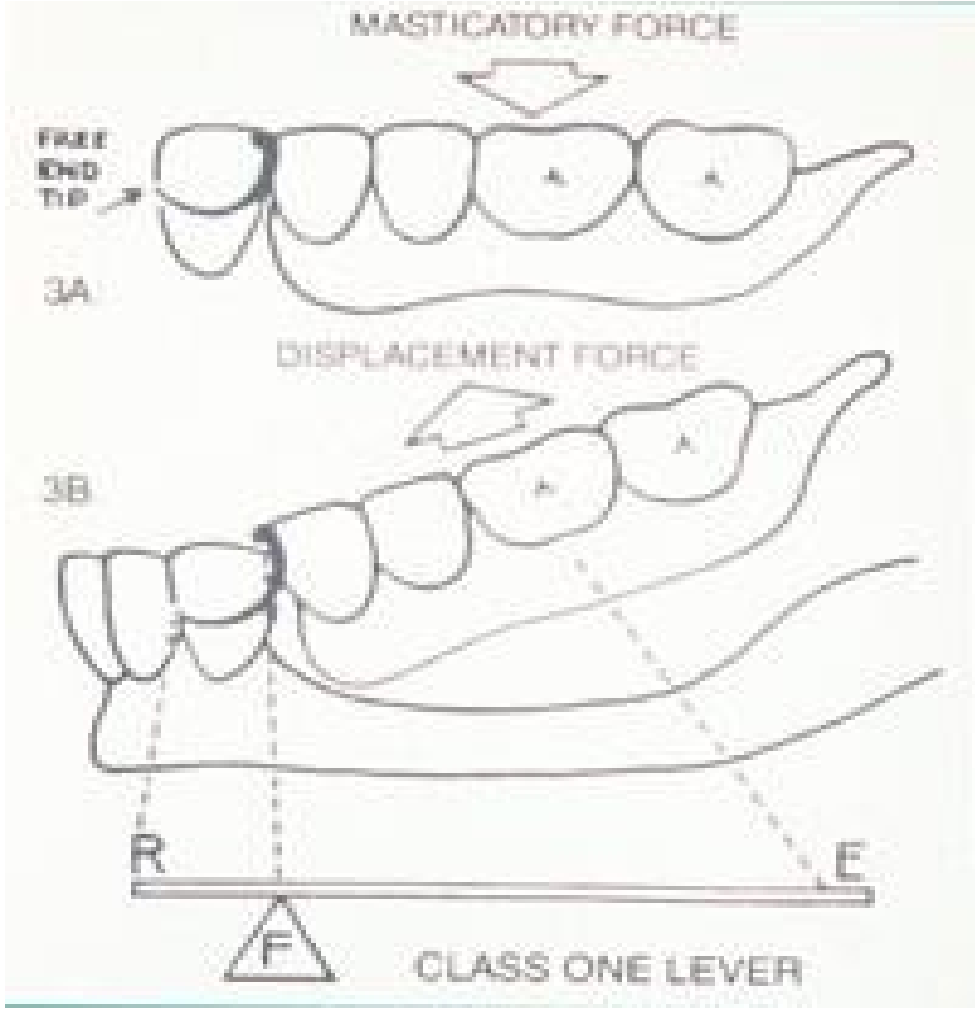


First Order Lever Action (Class I):

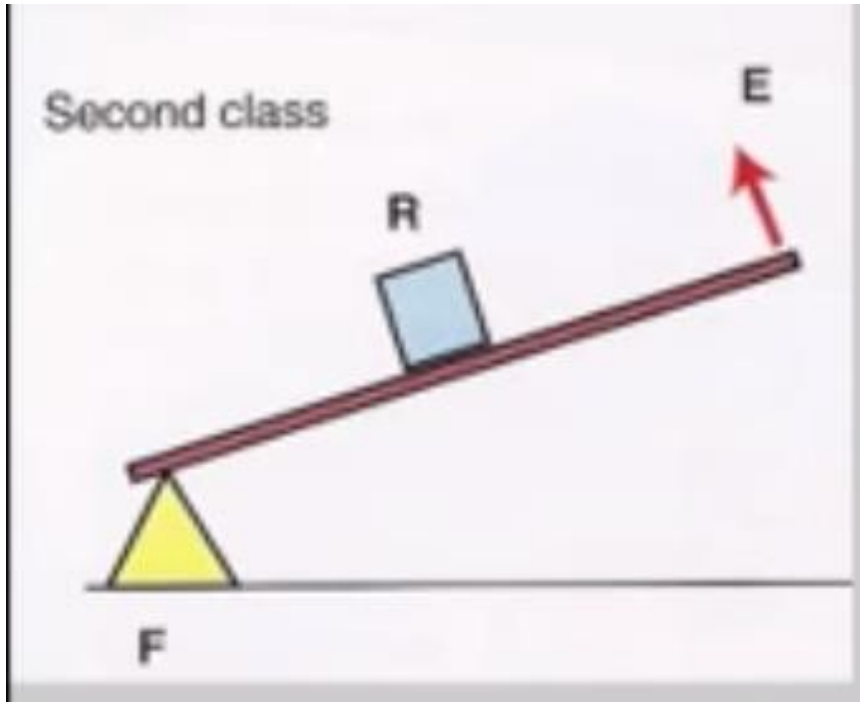


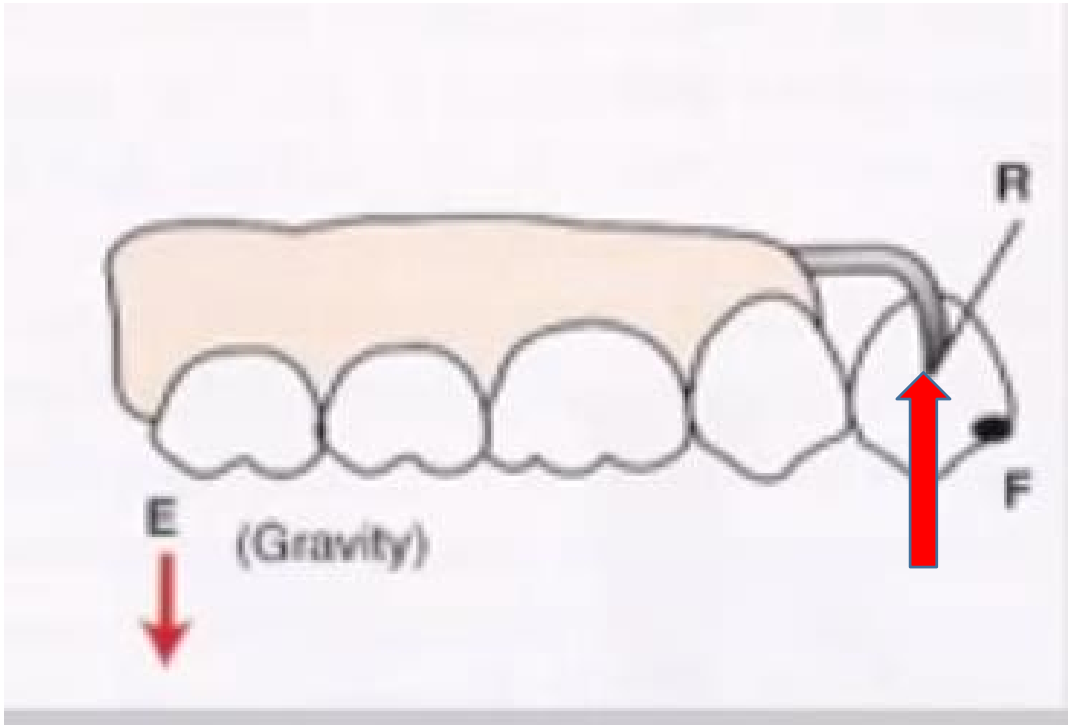
Example of 1st Order Lever Action

In cantilever type of Removable Partial Denture where There is Distal Extension. If there is bone Resorption of the residual alveolar ridge under the distal extension, it will result in an effort leading to first order lever movement along the fulcrum line.

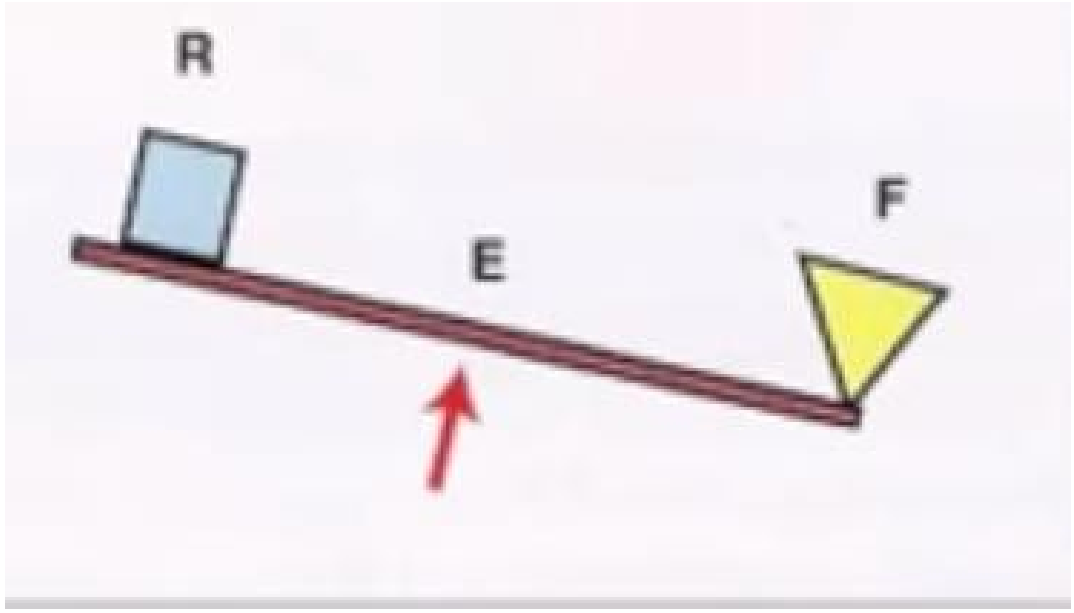


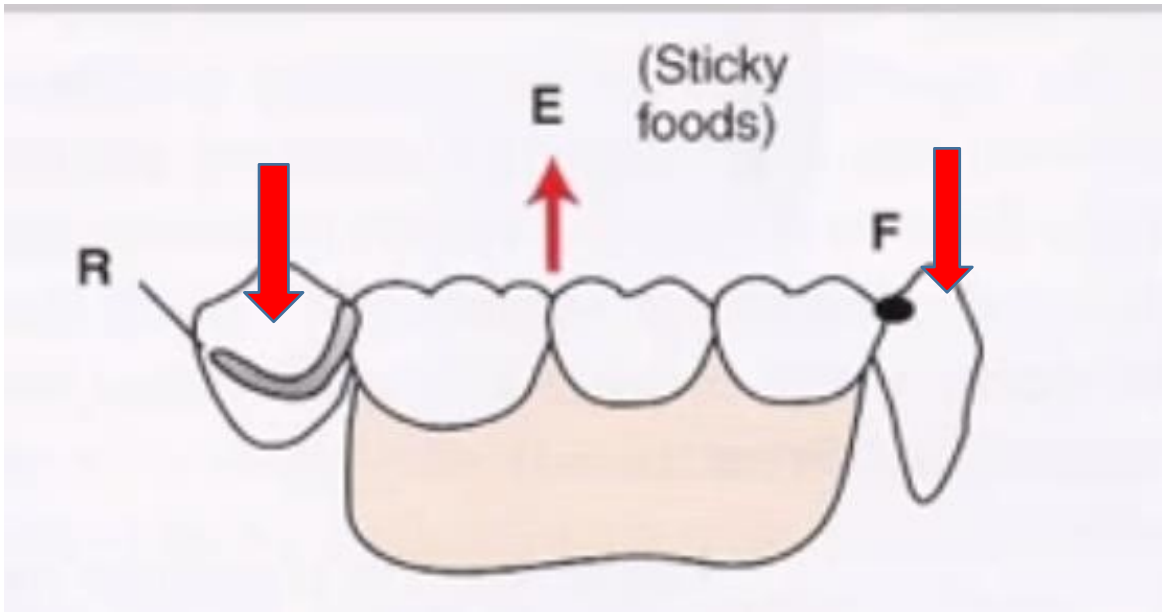
Second Order Lever Action (Class II)





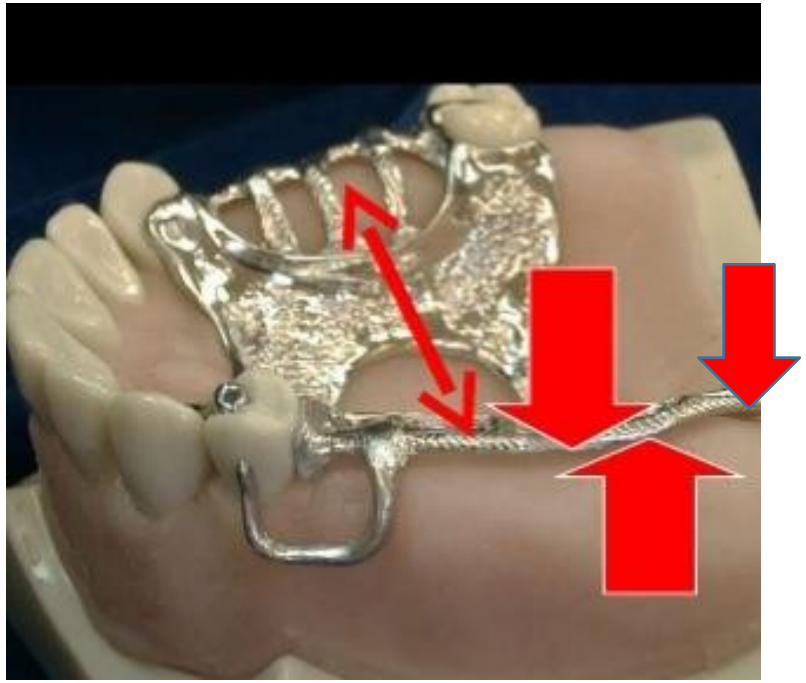
Third Order Lever Action (Class III)



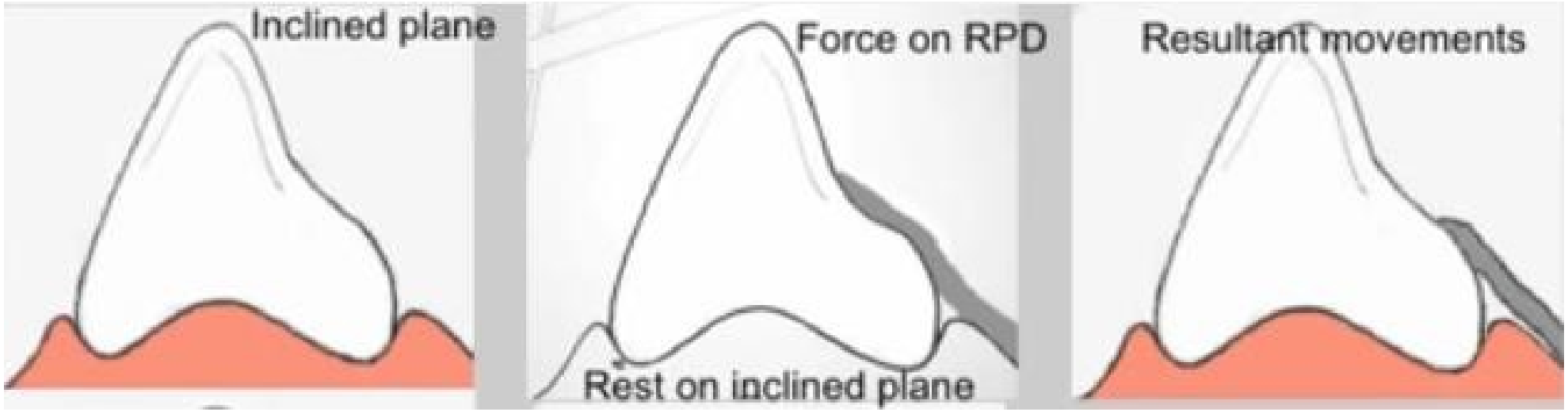


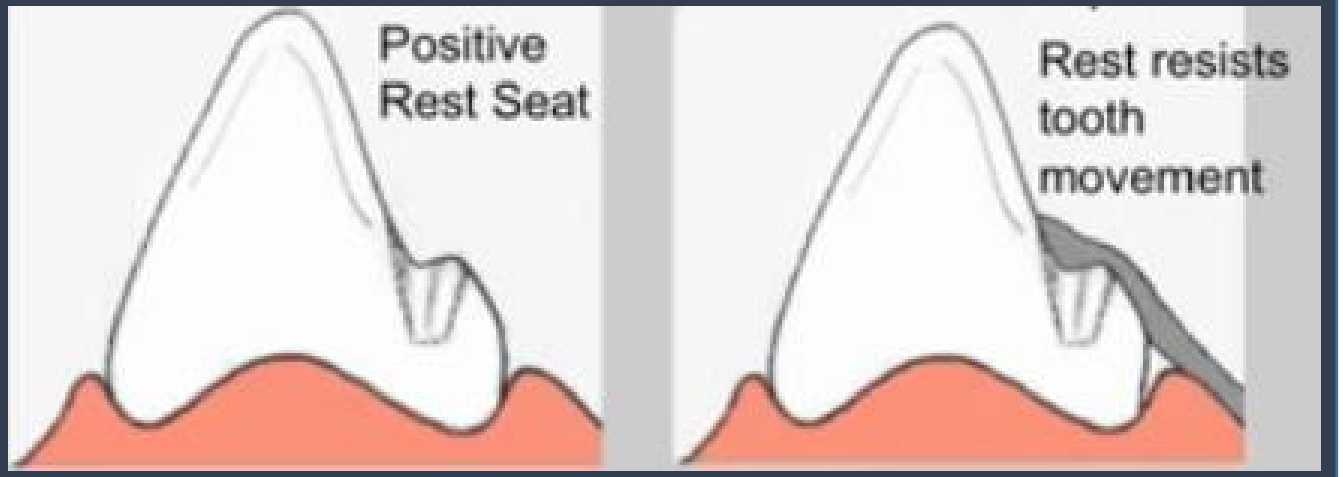
Example of third order Lever action:

Usually seen in the tooth supported RPD. Upon consuming sticky food, the food exerts pulling effort on the prosthetic teeth while the natural teeth and retainers exert counteracting forces from both sides.



Biomechanics of Inclined Planes:





Wheel and Axle Principle: (Rotation)

The Partial denture can rotate along one of 3 planes:

The saggital plane .A

The frontal plane .B

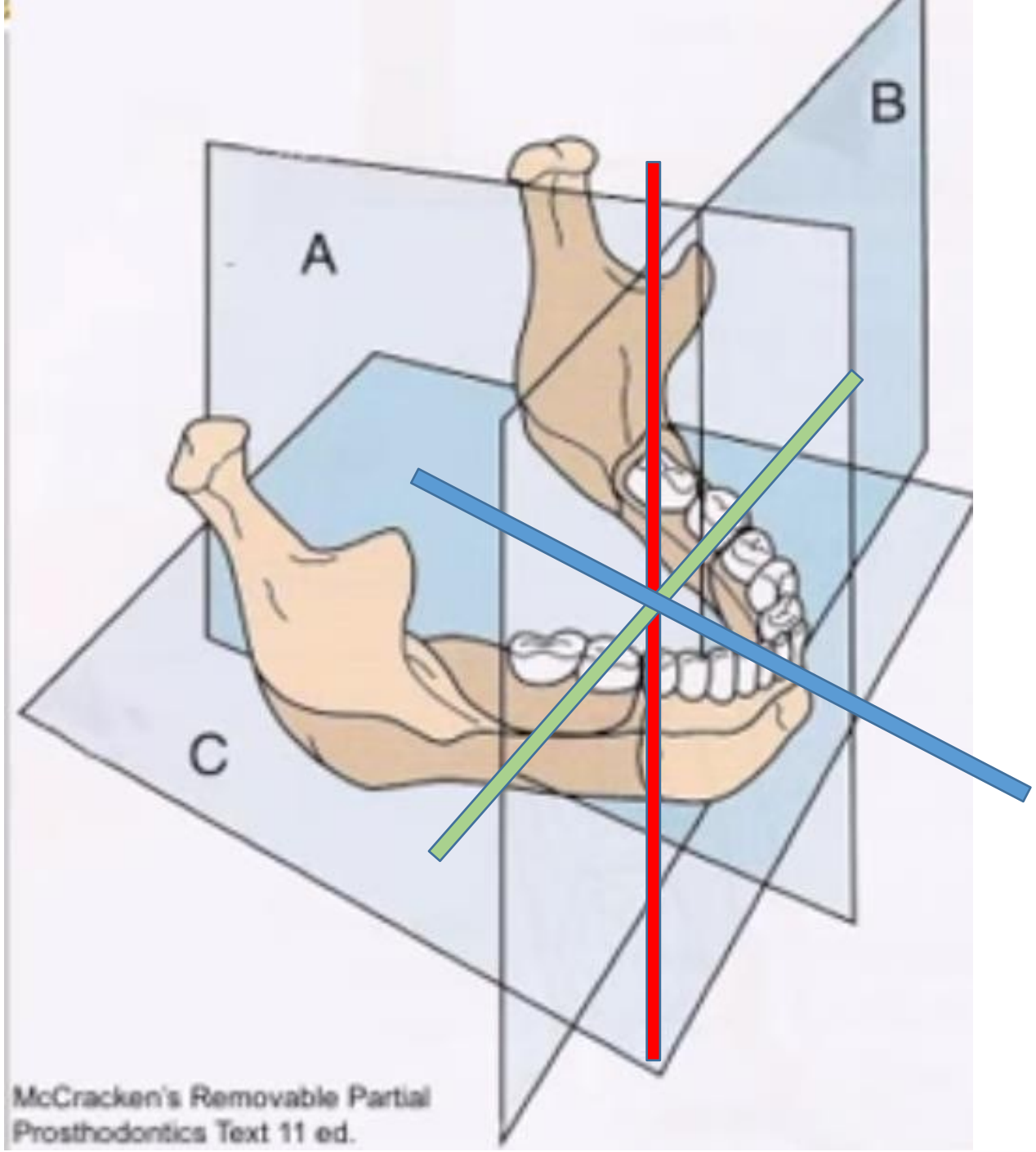
The horizontal Plane .C

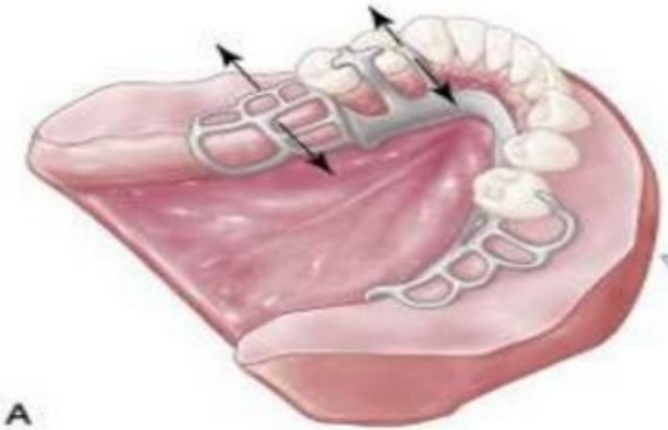
And along one of 3 axes:

Saggital axis

Vertical axis

Horizontal axis.

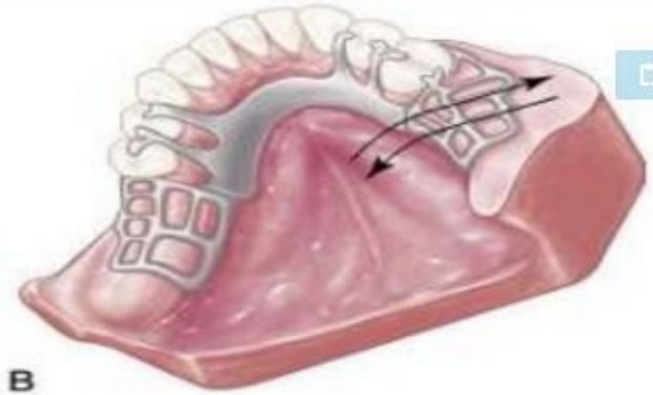




Sagittal

A

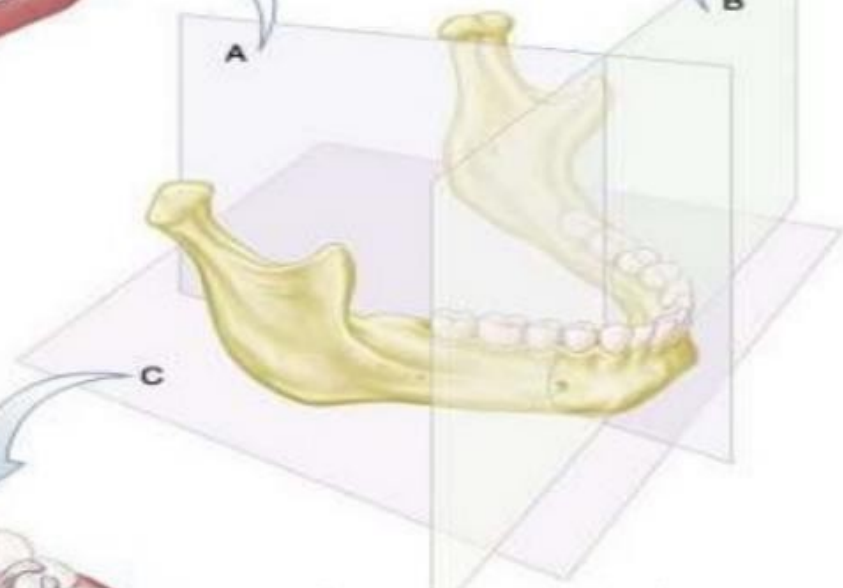
Rotation around a fulcrum line passing through the most posterior abutments when the denture base moves vertically toward or away from the supporting residual ridges



Frontal

B

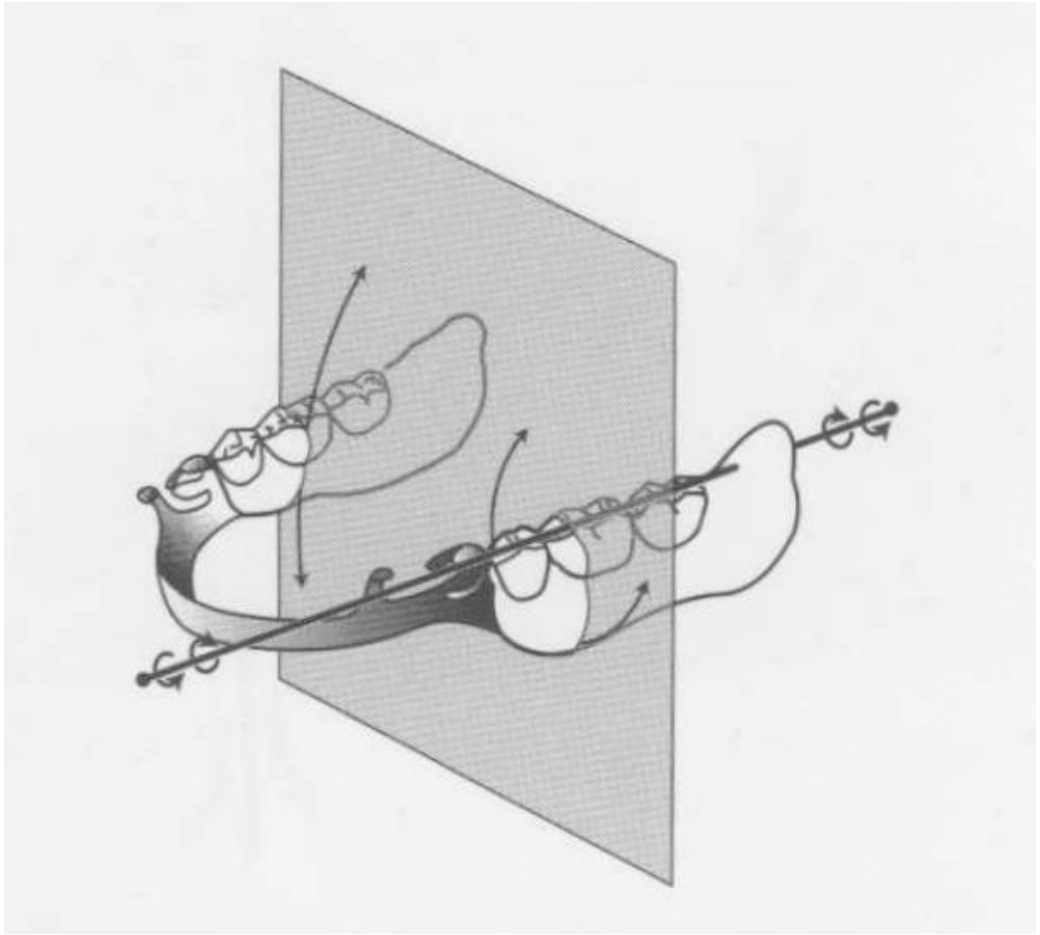
Rotation around a longitudinal axis formed by the crest of the residual ridge



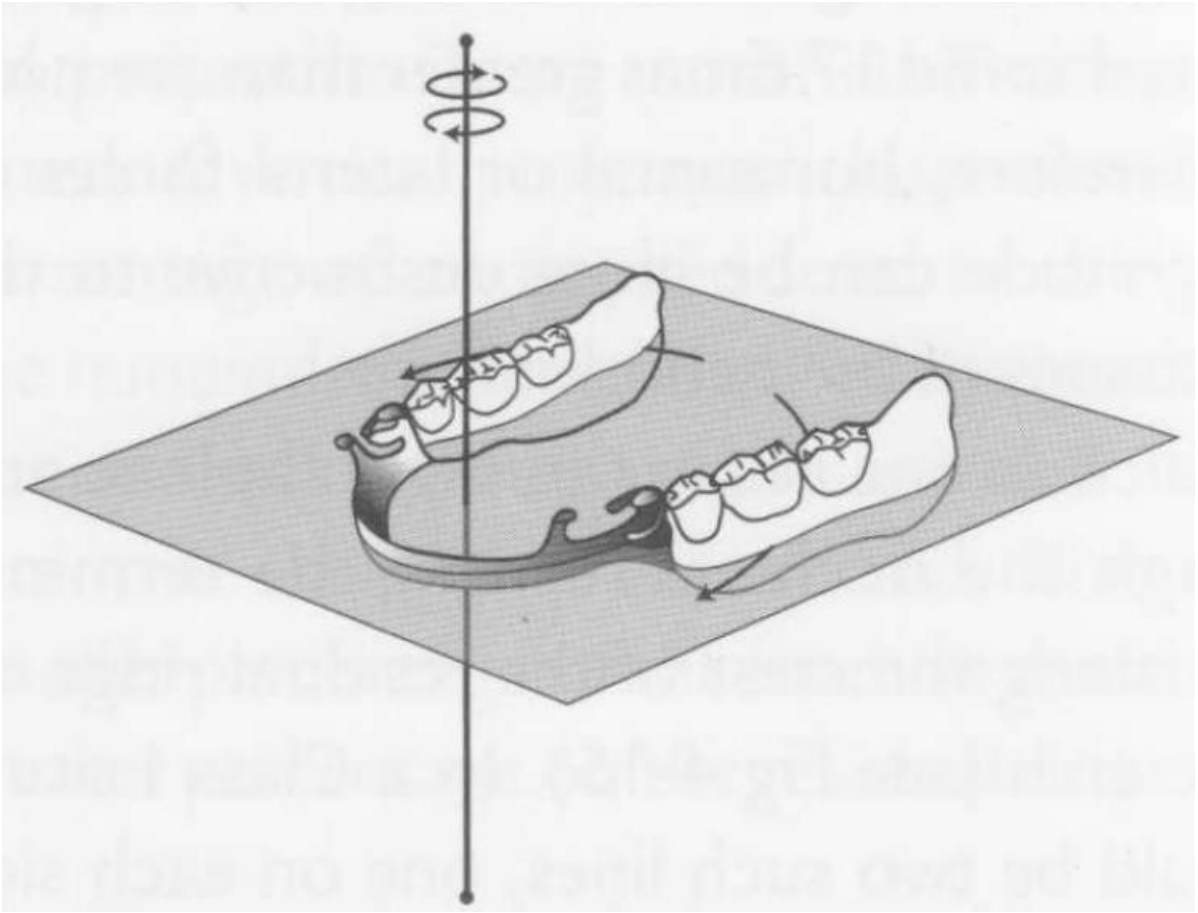
Horizontal

C

Rotation around a vertical axis located near the center of the arch

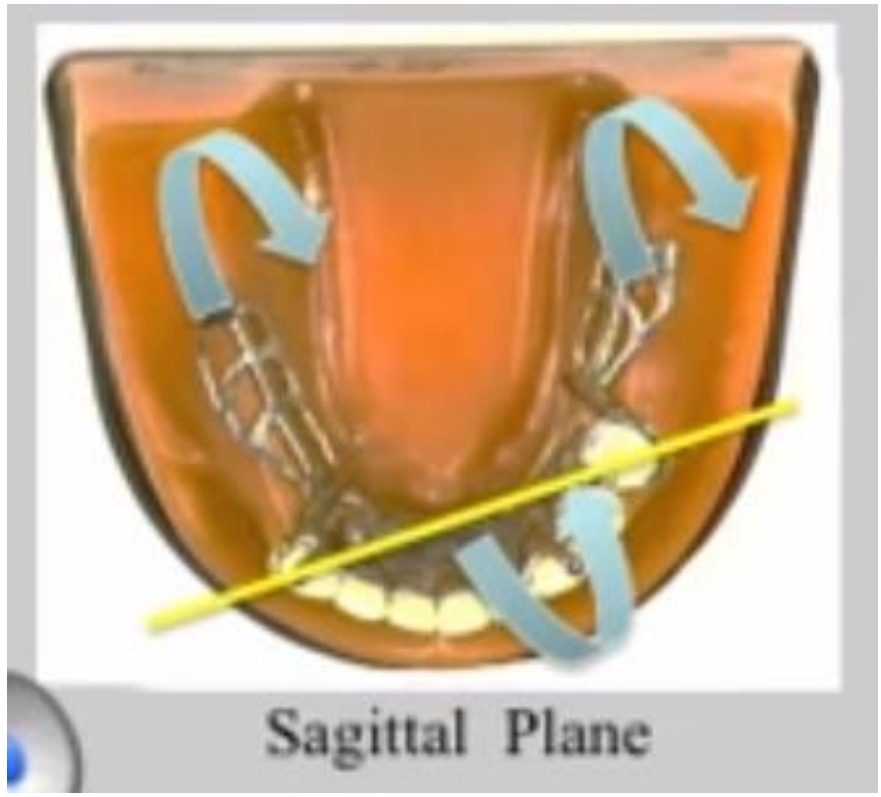


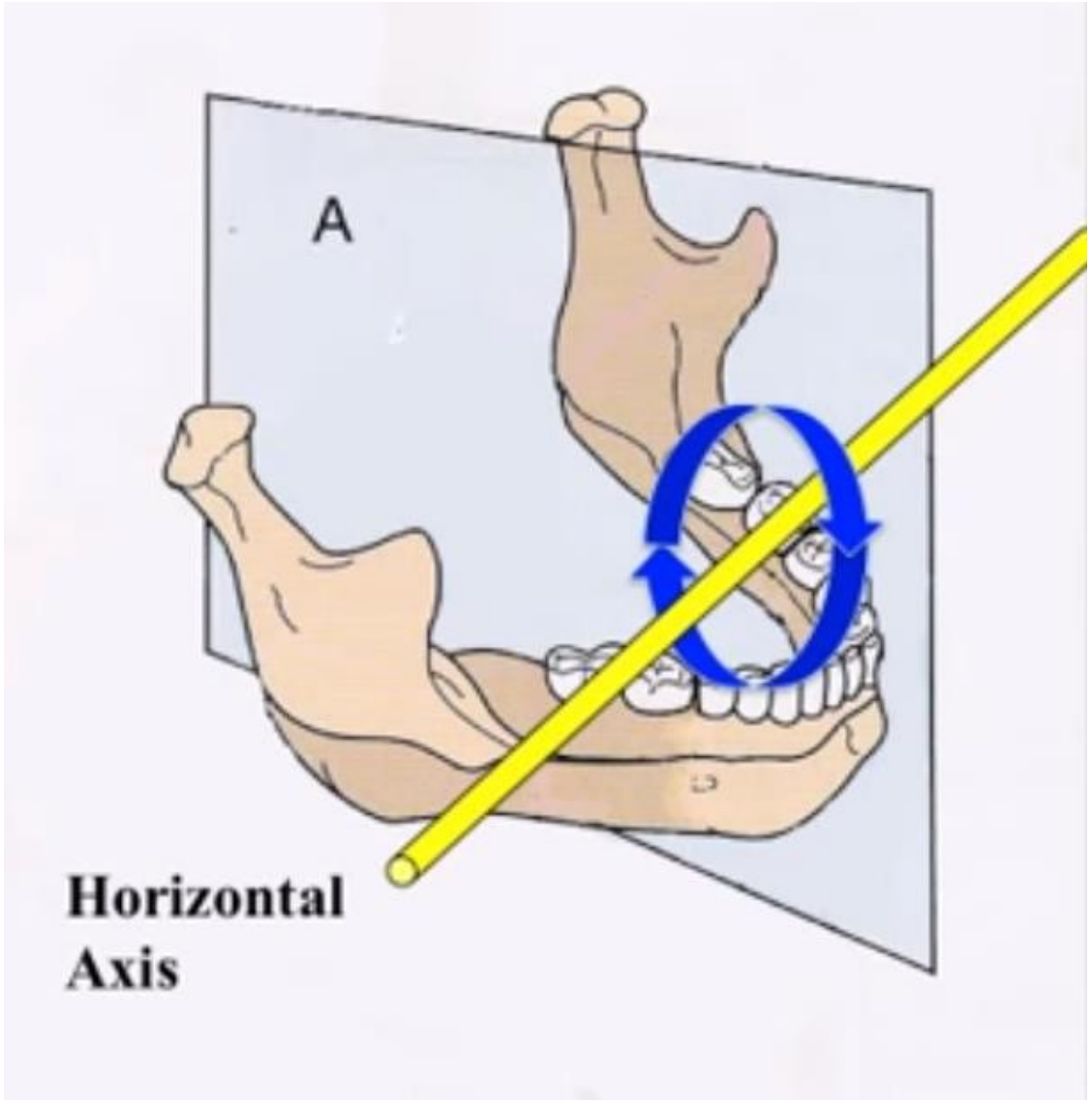
Rotation of Frontal Plane along Saggital Axis



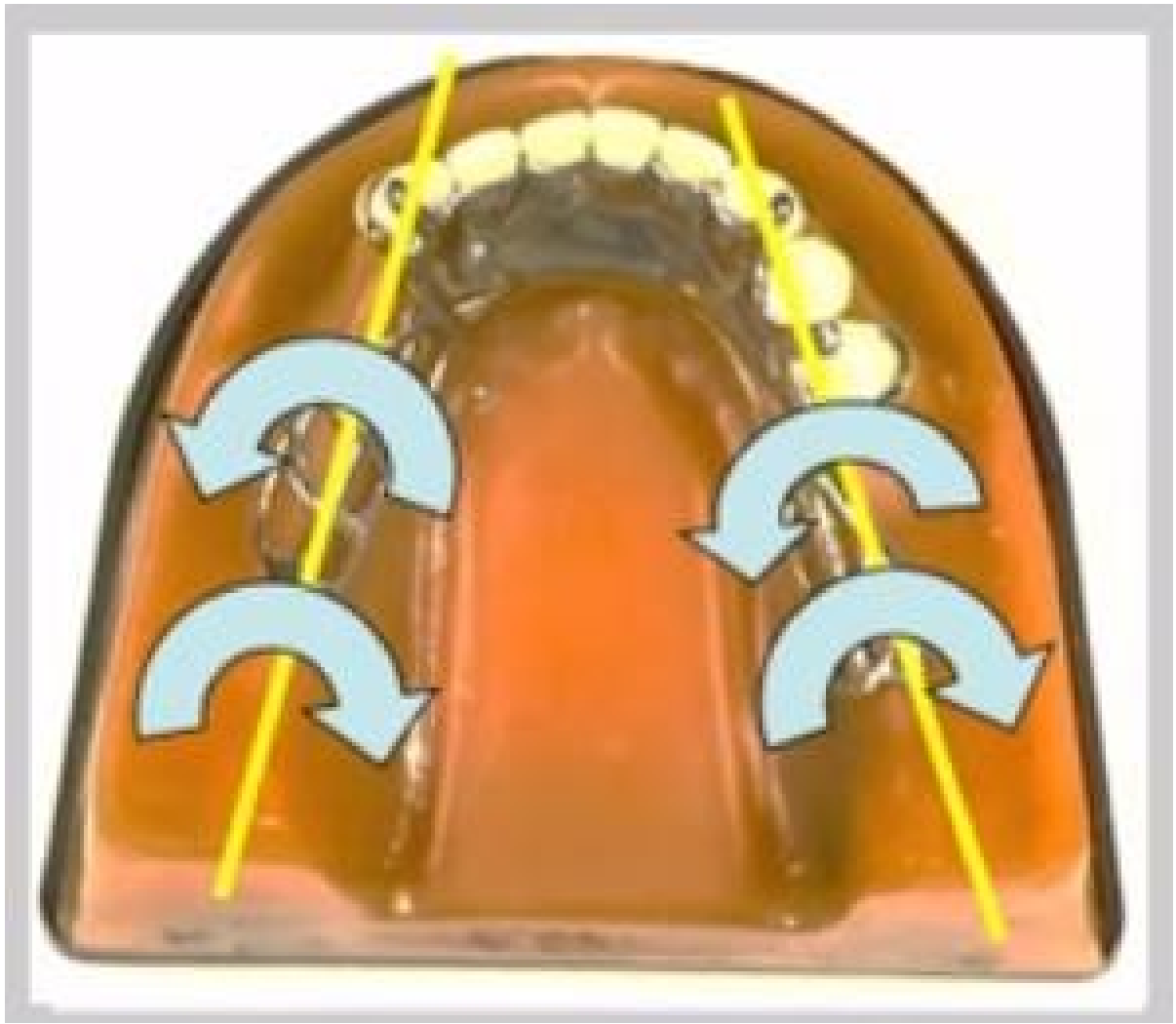
Rotation of Horizontal Plane along Vertical Axis

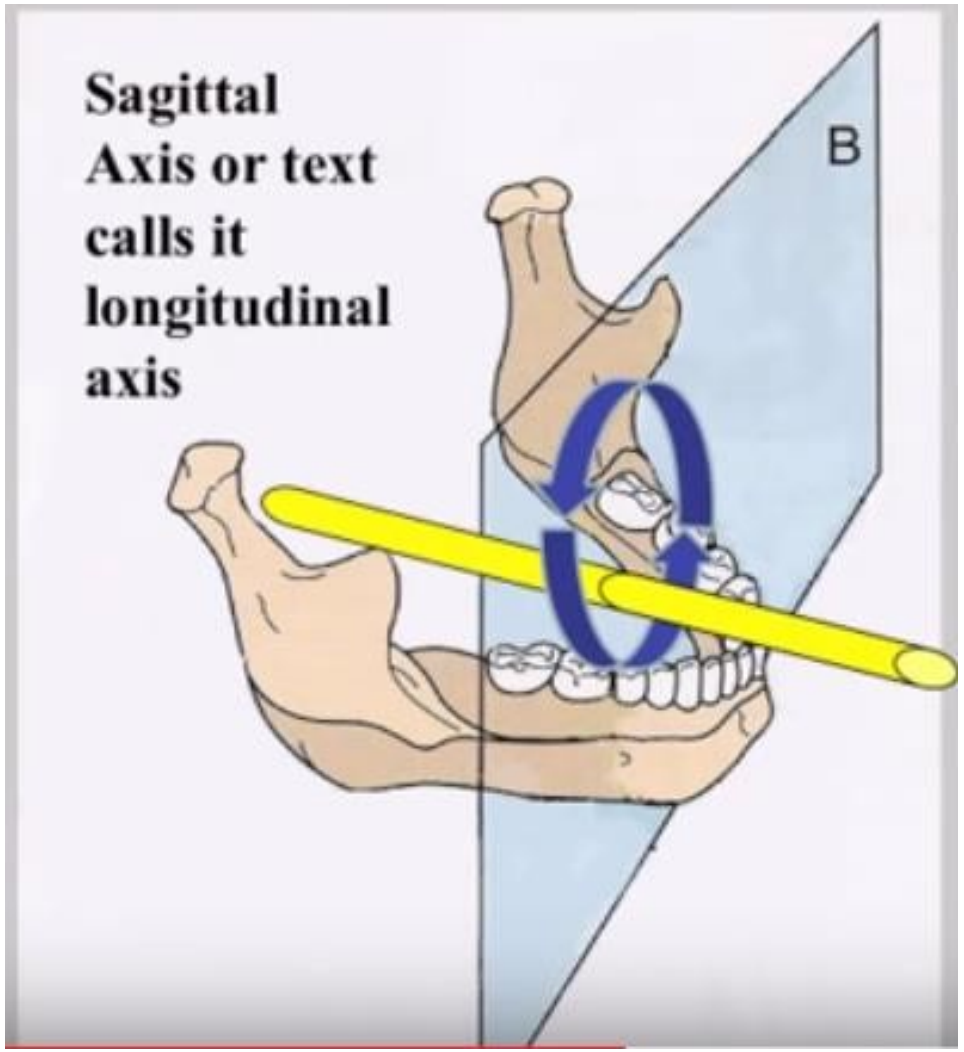
Saggital Plane and Horizontal Axis Rotation





Frontal Plane Rotation Along the saggital Axis





Snow Shoe Principle

The basis of the principle is to distribute stress/forces onto as large an area as possible in order to counteract the stresses applied to a partial denture.

Snow Shoe Principle

In order to overcome the forces acting against the RPD, the prosthesis must take full advantage of all the primary and secondary stress bearing areas.

Ex. Buccal shelf area are the primary stress bearing areas in the mandible because of their position on the occlusal plane. Not extending the denture to the shelf area will result in displacing forces and horizontal forces during mastication.

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- Basic Principles of removable partial denture, *Abbasi Begum, online journal, slideshare.net, 06-06-2016*
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Prosthodontics

3rd class **Dr.Osama Alheeti**

Jaw Relation in Removable Partial Denture and arrangement of teeth

Record bases:

The ideal jaw relation record base is one that is processed (acrylic resin bases) or cast (cast metal bases) to the form of the master cast, becoming the permanent base of the completed prosthesis.

Bases for jaw relation records must have maximum contact with the supporting tissue. Those areas are most often undercut and require blockout of ***the distolingual and retromylohyoid areas of the mandibular cast***, ***the distobuccal and labial aspects of the maxillary cast, and, frequently, small multiple undercuts in the palatal rugae***.

For permanent denture base: When undercut are present, the master cast will be destroyed during removal of the base, then existing undercuts must be blocked out inside the denture base before dental stone is poured into it to make a cast for articulator mounting.

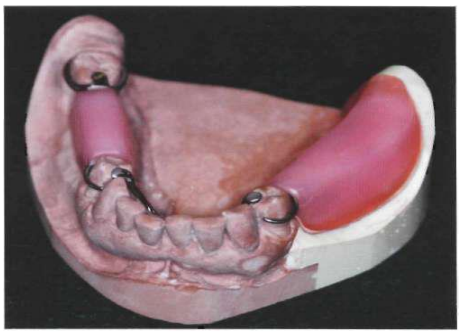
For temporary denture base: These undercut areas and any others are blocked out with a minimum of clay or wax, to obliterate as little of the surface of the cast as possible. A close-fitting base may then be made that will have the necessary accuracy and stability and yet may be lifted from and returned to the master cast without abrading it.

Types of record bases according to materials constructed from it:

1. Visible light- cured bases (VLC).
2. Autopolymerizing acrylic resin bases.
3. Cast metal bases.
4. Compression molded or processed acrylic resin bases.

Occlusion rims:

Occlusion rims are added to allow recording of jaw relation records. Placement of wax record is dictated by the opposing tooth position and the supporting ridge character. When possible, the occlusion rim should allow recording of the jaw position within the primary bearing area of the ridge.



Occlusion rims for static jaw relation records:

The materials of occlusion rims that are used to establish static occlusal relationships include:

1. Hard baseplate wax: most commonly used to establish static occlusal relationship.

2. Wax occlusion rim: registration made on wax occlusion rims using a wax registration material .

3. Modeling plastic (compound): has several advantages and may be used rather than wax for occlusion rims.

Occlusion rims for static jaw relation records should be so shaped that they represent the lost teeth and their supporting structures.

An occlusion rim that is too broad and is extended beyond where prosthetic teeth will be located will lead to:

1. Alter the shape of the palatal vault.

2. Alter arch form of the mandibular arch.

3. Crowd the patient's tongue.

4. Have an unwelcome effect on the patient.

5. Offer more resistance to jaw relation recording media than will a correctly shaped occlusion rim.

Occlusion rims for recording functional or dynamic jaw relationship record:

It used for this purpose:

1. Because they can be carved by the opposing dentition.

2. Because most of them are hard enough to support occlusion over a period of hours or days.

The construction of this type of occlusion rim consider as chair side procedure rather than a laboratory procedure because it corrected at clinic.

Purpose of Recording the Jaw Relations in removable partial denture;

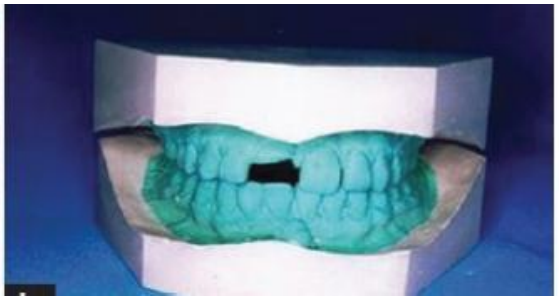
1. To establish and maintain a harmonious relationship

2. To ensure that all the effects of occlusal loading be distributed

3. To best control the undesirable effects of rotational or torquing forces on the prosthesis.

4.To prevent any deflective contacts of the teeth during centric or eccentric closures

Methods of recording jaw relation in removable partial denture:.
1-Direct apposition of casts: This should not influence the path of closure of mandible

The first method is used when sufficient opposing teeth remain in contact to make the existing jaw relationship obvious, or when only a few teeth are to be replaced on short denture bases and no evidence of occlusal abnormalities is found. With this method, opposing casts may be occluded by hand. The occluded casts should be held in apposition with

rigid supports attached with sticky wax to the bases of the casts until they are securely mounted in the articulator.

2-Interocclusal records with posterior teeth remaining:-

A second method, which is a modification of the first, is used when sufficient natural teeth remain to support the removable partial denture (Kennedy Class III or IV) but the relation of opposing natural teeth does not permit the occluding of casts by hand. In such situations, jaw relations must be established as for fixed restorations with some type of interocclusal record like using metallic oxide paste,interocclusal wax record

The least accurate of these methods is the interocclusal wax record . The bulk, consistency, and accuracy of the wax will influence the successful chilling. Excess wax that contacts the mucosal surfaces may distort soft tissue, thereby preventing accurate seating of the wax record onto the stone casts. Distortion of wax during or after removal from the mouth may also interfere with accurate seating.

3-Occlusal relations using occlusion rims on record base:

1-one or more distal extension areas are present

2- a tooth supported edentulous space is large

3-when opposing teeth do not meet.

A third method is used when one or more distal extension areas are present, when a tooth-supported edentulous space is large, or when opposing teeth do not meet

In any of these situations, jaw relation records are made entirely on occlusion rims. The occlusion rims must be supported by accurate jaw relation record bases. Here, the choice of method for recording jaw relations is much the same as that for complete dentures, so jaw relation will be done as following:

Jaw relation for R.P.D. (third method):
1-orientation jaw relation(by using (face bow).

2-vertical jaw relation: it is measured between two arbitrary point marked on the face one above the mouth and one below the mouth.

1- At rest

also called physiological rest position is determined when the patient is in an upright position and is completely at rest. The mandibular position is produced by a muscular balance between the muscles of mastication ,the postcervical muscle group,and the suprahyoid muscle group.

At this position maxillary and mandibular teeth should not be touching. The space between the maxillary and mandibular teeth is referred to as (*the interocclusal rest space).*

2- At occlusion:

is determined by measuring the vertical dimension while the patient, s teeth are in maximal intercuspal position.

The physiological rest dimension will always be greater than the occlusal vertical dimension.

FREE way space=rest _OVD=(2-4)mm

3-horizontal jaw relation: it is determined after a correct vertical dimension of occlusion is established. There are two horizontal relationship that are of importance in developing occlusion .

a-centric jaw relation

b-eccentric jaw relation(protrusive and right –left movement).

Altering the existing vertical dimension of occlusion

Normally the VDO(vertical dimension of occlusion) for a partially edentulous patient is provided by the opposing natural teeth contact if they have normal shape, size and position and it should not be changed

unless:

Symptoms of diminished OVD exist such as :

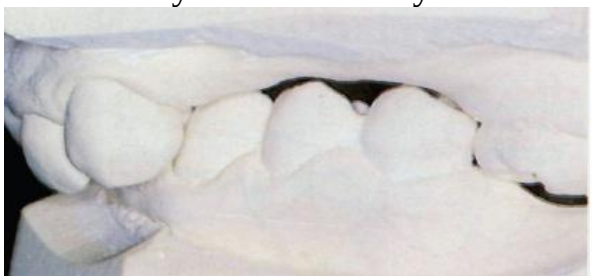
1-tired aching muscles,

2-unexplained pain in the head and neck region,

3- shortened nose-chin distance (appearance of premature aging).

4-Excessive Free way Space or ‘over-closure’ of the jaws.

5-Confirmation of decrease in VD can be seen with severe tooth wear, intrusion and greater than 4 mm free way. Temporary removable device in form of acrylic resin overlay



This device must be worn for 24 hrs. If the patient can tolerate this fo 3- 4 months then definitive correction should be instituted.

Mounting casts on the articulator:

Mounting the maxillary and mandibular casts on adjustable articulator in same relationship as they are on the patient by using a face-bow transfer .

Arrangement of artificial teeth

Principles that should be taken during arrangement of artificial teeth:

1. In general, the same rules which apply to complete dentures also apply to partial dentures in regard to the arrangement of posterior artificial teeth, however, since the occlusal surfaces of most natural teeth have been altered by wear, artificial teeth should be altered with suitable stones and acrylic burs so that they will properly intercuspate with the natural teeth. So it was preferring to use resin teeth since they are more easily modified and reshaped.

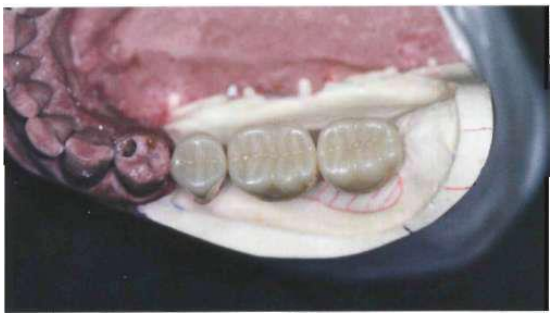
2. The teeth are usually arranged for intercuspation with the opposing teeth in a normal cuspal relationship.

3. Artificial posterior tooth forms should be selected to restore the space and fulfill the esthetic demands of the missing dentition.

4. The artificial teeth must contact all opposing natural teeth to prevent their extrusion.

5. There is broad agreement that selection posterior teeth with narrow (reduced buccolingual) occlusal surfaces form are desirable.

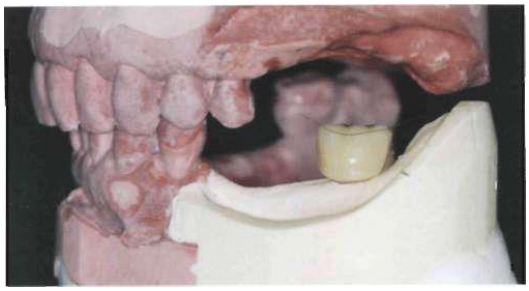
they are placed relative to the primary support (buccal shelf) to distribute the functional load to the most anatomically favorable location in a manner that reduces leverage effects.



6. Sometimes a second and /or third molar will be extracted in an arch opposing a removable partial denture to help decrease the length of the occlusal table and thus reduce stress on a free – end extension abutment.

7. Artificial posterior teeth should not be arranged farther distally than the

beginning of a sharp upward incline of the mandibular residual ridge or over the retromolar pad.



To do so would have the effect of shunting the denture anteriorly.
Mandibular posterior teeth should not be arranged distal to the upward incline (ascending ramus) of residual ridge. The molar tooth has been placed just anterior to a mark on the cast land area designating the beginning incline.

8. Sometime it may be necessary to select teeth other than those lost by the patient. For example, an artificial second premolar and first molar may be indicated for a space occupied by two molars (first and second molars). Fewer or smaller teeth are often necessary in a tooth – bounded edentulous space because the abutments may have drifted toward one another.

9. Esthetic is often a factor in the selection of teeth for partial dentures. The artificial teeth must be at least as long occlusogingivally as the abutment teeth .

10. Anterior teeth on removable partial dentures are concerned primarily with esthetics and the function of incising.

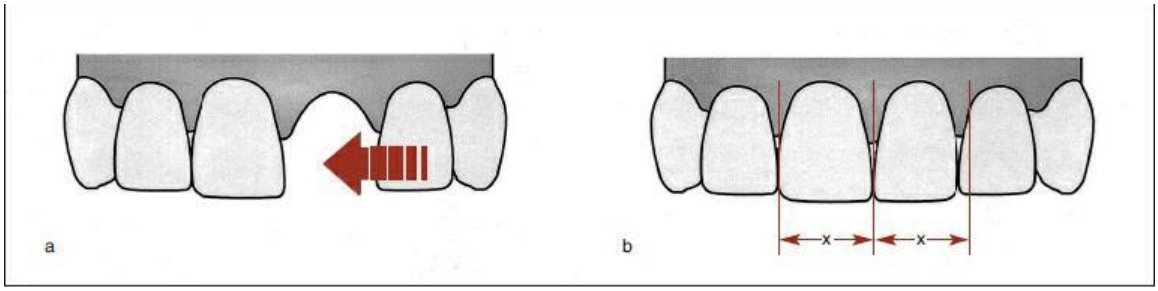
11. Anterior artificial teeth should be matched as closely as possible to the adjacent natural teeth or fixed restorations. The matching process should be accomplished using natural light and should be completed as quickly as possible to prevent eye fatigue.

12. The selection of teeth for partial dentures replacing anterior teeth is essentially the same as anterior tooth selection for complete dentures.

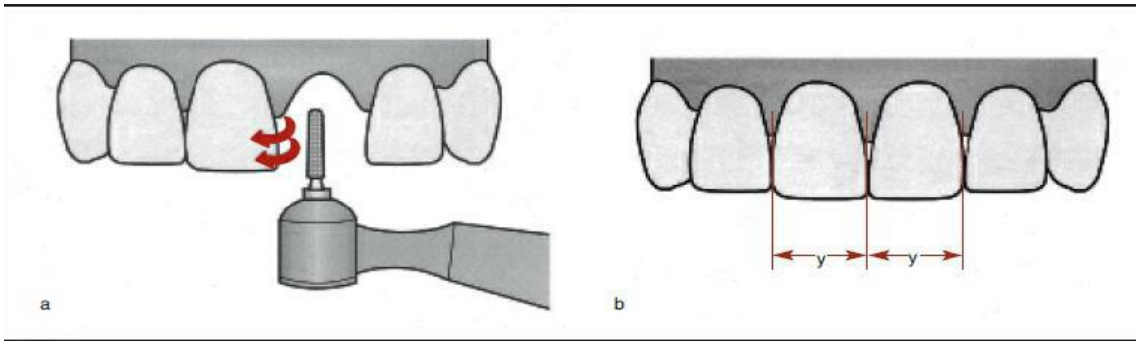
13. As a general rule, the most difficult part of arranging anterior denture teeth is directly related to a loss of restorative space. Unless anterior teeth are replaced immediately following their extraction, the natural teeth adjacent to the space will either drift or tilt into the space.

During the mouth preparation appointment, an attempt should have been made to regain the original width of the space by ***reshaping*** the proximal surfaces of the adjacent teeth. If the entire width cannot be recovered, consideration should be given to ***overlapping*** the artificial teeth so that a

normal-sized tooth may be used to harmonize with the patient's face and remaining teeth.



(a) When an anterior tooth is lost, adjacent teeth often drift or tip into the space. (b) This produces a noticeable decrease in restorative space and forces the selection of a replacement that is too narrow.



(*a)* When space has been lost, reshaping of adjacent teeth is indicated. *(b)*This permits the practitioner to achieve an improved esthetic result.

14. If the maxillary central incisors are missing, it is essential that these teeth be set first.

Record Bases, Occlusion Rims, Mounting and Arrangement of Teeth

Record bases:

Bases for jaw relation records should be made either of materials possessing accuracy or those that can be relined to provide such accuracy. The ideal jaw relation record base is one that is processed (acrylic resin bases) or cast (cast metal bases) to the form of the master cast, becoming the permanent base of the completed prosthesis.

Bases for jaw relation records must have maximum contact with the supporting tissue. The accuracy of the base will proportionate to the contact provided to the total area of intimate tissue. Those areas are most often undercut and require blockout of ***the distolingual and retromylohyoid areas of the mandibular cast***, ***the distobuccal and labial aspects of the maxillary cast, and, frequently, small multiple undercuts in the palatal rugae***.

For permanent denture base: When undercut are present, the master cast will be destroyed during removal of the base, then existing undercuts must be blocked out inside the denture base before dental stone is poured into it to make a cast for articulator mounting. A second cast, which includes the undercuts, must be poured against the entire base to support it when processing the overlying acrylic resin that supports the teeth and establishes facial contours.

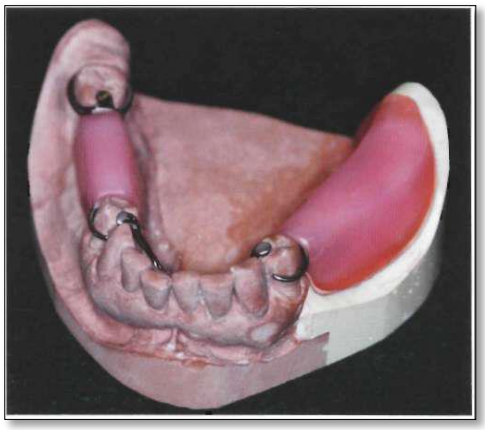
For temporary denture base: These undercut areas and any others are blocked out with a minimum of clay or wax, to obliterate as little of the surface of the cast as possible. A close-fitting base may then be made that will have the necessary accuracy and stability and yet may be lifted from and returned to the master cast without abrading it. Then the cast and the blockout or reliefs are coated with a separating medium before making the record base.

Types of record bases according to materials constructed from it:

1. Visible light- cured bases (VLC).
2. Autopolymerizing acrylic resin bases (using sprinkled acrylic resin technique).
3. Cast metal bases.
4. Compression molded or processed acrylic resin bases.

Occlusion rims:

Occlusion rims are added to allow recording of jaw relation records. Placement of wax record is dictated by the opposing tooth position and the supporting ridge character. When possible, the occlusion rim should allow recording of the jaw position within the primary bearing area of the ridge.



Occlusion rims may be made of several materials according to method used for recording jaw relation.

Occlusion rims for static jaw relation records:

The materials of occlusion rims that are used to establish static occlusal relationships include:

1. **Hard baseplate wax:** most commonly used to establish static occlusal relationship.
2. **Wax occlusion rim:** registration made on wax occlusion rims using a wax registration material must be handled carefully and mounted immediately on the articulator. As with wax rims, an adjustable frame also may be used to support the final record.
3. **Modeling plastic (compound):** has several advantages and may be used rather than wax for occlusion rims.

Occlusion rims for static jaw relation records should be so shaped that they represent the lost teeth and their supporting structures. An occlusion rim that is too broad and is extended beyond where prosthetic teeth will be located will lead to:

1. Alter the shape of the palatal vault.
2. Alter arch form of the mandibular arch.
3. Crowd the patient's tongue.

4. Have an unwelcome effect on the patient.
5. Offer more resistance to jaw relation recording media than will a correctly shaped occlusion rim.

Occlusion rims for recording functional or dynamic jaw relationship record:

Occlusion rims must be made of a hard wax like inlay waxes. It used for this purpose:

1. Because they can be carved by the opposing dentition.
2. Because most of them are hard enough to support occlusion over a period of hours or days.

The construction of this type of occlusion rim consider as chair side procedure rather than a laboratory procedure because it corrected at clinic.

Mounting casts on the articulator:

Mounting the maxillary and mandibular casts on adjustable articulator in same relationship as they are on the patient by using a face-bow transfer and an accurate centric occlusal relationship record on accurate record bases at establish correct vertical dimension of occlusion.

Arrangement of artificial teeth to the opposing cast:

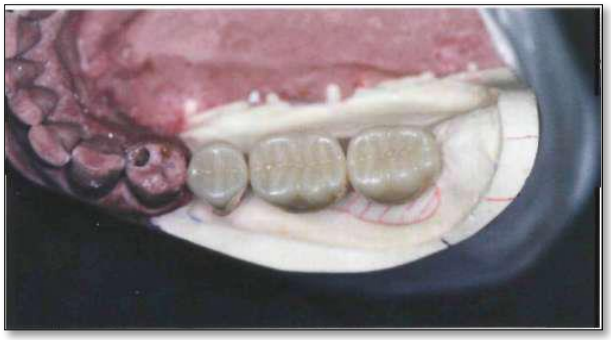
Before arrangement of teeth, the denture base on which the jaw relation record has been made must first be removed and discarded (by heating the acrylic resin over a properly adjusted burner and using a pliers to remove the softened material away from the metal framework) unless metal bases are part of denture framework, or heat- polymerized acrylic resin bases were used.

Principles that should be taken during arrangement of artificial teeth:

1. In general, the same rules which apply to complete dentures also apply to partial dentures in regard to the arrangement of posterior artificial teeth, however, since the occlusal surfaces of most natural teeth have been altered by wear, artificial teeth should be altered with suitable stones and acrylic burs so that they will properly intercuspate with the natural teeth. So it was preferring to use resin teeth since they are more easily modified and reshaped.
2. The teeth are usually arranged for intercuspation with the opposing teeth in a normal cuspal relationship. Whenever possible, the mesiobuccal cusp of the maxillary first molar should be located in relation to the buccal groove of the

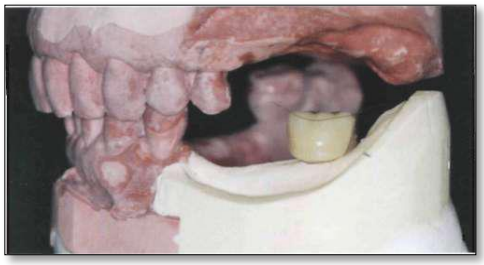
mandibular first molar and all other teeth arranged accordingly. However, this classic relationship is not essential to good function and, of course, cannot be achieved in many instances.

3. Artificial posterior tooth forms should be selected to restore the space and fulfill the esthetic demands of the missing dentition. Manufactured tooth forms usually required modification to satisfactorily articulate with an opposing dentition. The original occlusal form, therefore, is of little importance in forming the posterior occlusion for the removable partial denture.
4. The artificial teeth must contact all opposing natural teeth to prevent their extrusion.
5. There is broad agreement that selection posterior teeth with narrow (reduced buccolingual) occlusal surfaces form are desirable.



The posterior teeth in this distal extension have been selected with a narrower buccal-lingual width than the original teeth, and they are placed relative to the primary support (buccal shelf) to distribute the functional load to the most anatomically favorable location in a manner that reduces leverage effects.

6. Sometimes a second and /or third molar will be extracted in an arch opposing a removable partial denture to help decrease the length of the occlusal table and thus reduce stress on a free – end extension abutment.
7. Artificial posterior teeth should not be arranged farther distally than the beginning of a sharp upward incline of the mandibular residual ridge or over the retromolar pad. To do so would have the effect of shunting the denture anteriorly.



Mandibular posterior teeth should not be arranged distal to the upward incline (ascending ramus) of residual ridge. The molar tooth has been placed just anterior to a mark on the cast land area designating the beginning incline.

8. Sometime it may be necessary to select teeth other than those lost by the patient. For example, an artificial second premolar and first molar may be indicated for a space occupied by two molars (first and second molars). Fewer or smaller teeth are often necessary in a tooth – bounded edentulous space because the abutments may have drifted toward one another.

9. Esthetic is often a factor in the selection of teeth for partial dentures. The artificial teeth must be at least as long occlusogingivally as the abutment teeth to prevent unwanted display of denture base material. This is particularly important on maxillary partial dentures.

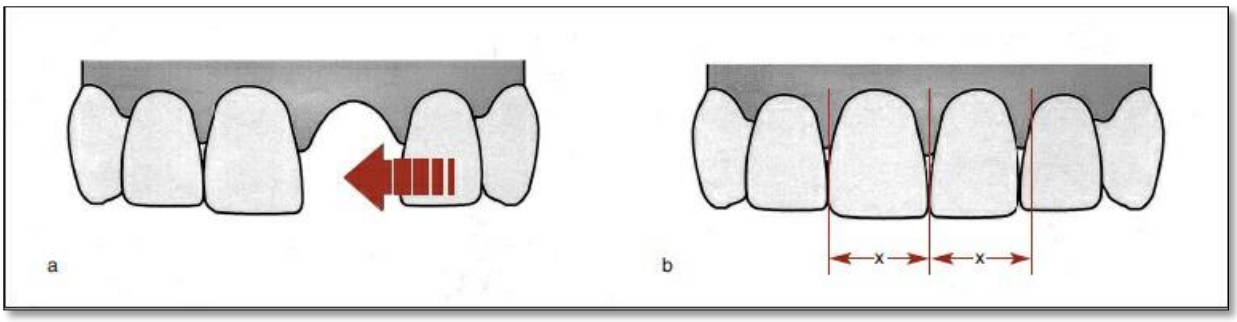
10. Anterior teeth on removable partial dentures are concerned primarily with esthetics and the function of incising. These are best arranged when the patient is present because an added appointment for try-in would be necessary any way.

11. Anterior artificial teeth should be matched as closely as possible to the adjacent natural teeth or fixed restorations. The matching process should be accomplished using natural light and should be completed as quickly as possible to prevent eye fatigue.

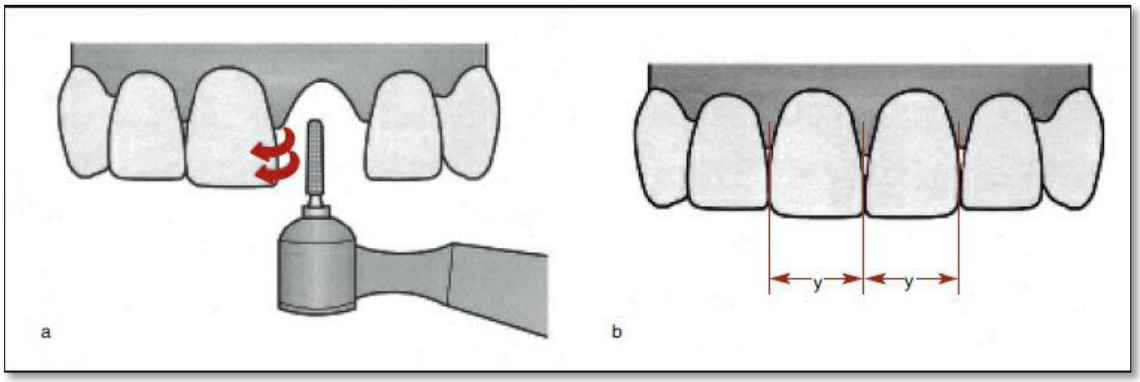
12. The selection of teeth for partial dentures replacing anterior teeth is essentially the same as anterior tooth selection for complete dentures. The shade and mold are selected to match the remaining teeth and /or compliment the patient feature. Arrangement of anterior teeth for partial dentures follows the same principles as for arrangement anterior teeth for complete dentures.

13. As a general rule, the most difficult part of arranging anterior denture teeth is directly related to a loss of restorative space. Unless anterior teeth are replaced immediately following their extraction, the natural teeth adjacent to the space will either drift or tilt into the space. The drifting or tilting produces a noticeable decrease in the restorative space and forces the selection of one or more prosthetic teeth that are narrower than their natural counterparts.

During the mouth preparation appointment, an attempt should have been made to regain the original width of the space by ***reshaping*** the proximal surfaces of the adjacent teeth. If the entire width cannot be recovered, consideration should be given to ***overlapping*** the artificial teeth so that a normal-sized tooth may be used to harmonize with the patient's face and remaining teeth.



(a) When an anterior tooth is lost, adjacent teeth often drift or tip into the space. (b) This produces a noticeable decrease in restorative space and forces the selection of a replacement that is too narrow.



***(a)* When space has been lost, reshaping of adjacent teeth is indicated. *(b)*This permits the practitioner to achieve an improved esthetic result.**

14. If the maxillary central incisors are missing, it is essential that these teeth be set first. This allows the practitioner to reestablish the maxillary midline in the center of the face.

Laboratory procedure of arrangement teeth:

Example: arrangement of artificial teeth for chrome cobalt removable partial denture in case of class II (missing first and second molars):

- The teeth are selected for the mandibular partial denture to fill the existing space.
- The partial denture framework is placed on cast and stabilized by wax while the teeth are being set.
- Drop the incisal pin 1mm. This will open the articulator 1mm at the incisal table.

- The first molar is set into position. The gingival side of the tooth may need to be reduced but should be “hollow-ground” to preserve the facial surface.
- Adapt by grinding the mesial surfaces of the first molar so that they fit around the distal of the minor connector; a piece of articulating paper is inserted between the tooth and minor connector and the tooth is wiggled slightly. The marks on the tooth are then reduced. This procedure is repeated untilled the tooth is adapted to the minor connector.
- The buccal cusp tips of the mandibular first molar are set in the central groove of the opposing tooth. Check to make sure the lingual cusps are in tight contact.
- After the tooth has been properly positioned, the incisal pin should be returned to its original position and the occlusal surface of the artificial tooth altered with suitable stones and acrylic burs until the incisal pin touches the incisal table (the occlusal surface is altered by reducing the area marked by the articulating paper).
- Then second molar is set in similar fashion. The second molar is checked for occlusion. Note that the occlusal alteration is done tooth by tooth.
- Spaces between the mandibular posterior artificial teeth may result during their anteroposterior placement. These spaces are usually dictated by the maxillary natural teeth and are not to be considered undesirable unless they interfere unreasonably with esthetics. Then a compromise position must be selected.

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University of Anbar

Dental Faculty

Prosthodontics Unit

Asst. Prof. Dr. Salah Kh. Al-Rawi (BDS, MSc, PhD)

3th Grad / Lec.18th

2019-2020

Repairs and Additions to Removable Partial Dentures

The need for repairing or adding to a removable partial denture will occasionally arise. However, the frequency of this occurrence should be held to a minimum by careful diagnosis, intelligent treatment planning, adequate mouth preparations, and the carrying out of an effective removable partial denture design with proper fabrication of all component parts.

Broken Clasp Arms:

Reasons for breakage of clasp arms:

1- Breakage may result from repeated flexure into and out of too severe an undercut. If the periodontal support is greater than the fatigue limit of the clasp arm, failure of the metal occurs first. Otherwise the abutment tooth is loosened and eventually is lost because of the persistent strain that is placed on it. Locating clasp arms only where an acceptable minimum of retention exists, as determined by an accurate survey of the master cast, can prevent this type of breakage.

2- Breakage may occur as a result of structural failure of the clasp arm itself. A cast clasp arm that is not properly formed or is subject to careless finishing and polishing eventually will break at its weakest point. This can be prevented by providing the appropriate taper to flexible retentive clasp arms and uniform bulk to all rigid non retentive clasp arms.

Wrought-wire clasp arms may eventually fail because of repeated flexure at the region where it exits from the resin base (Figure 22-1), or at a point at which a nick or constriction occurred as a result of careless use of contouring pliers. They also may break at the point of origin from the casting as a result of excessive manipulation during initial adaptation to the tooth or subsequent readaptation. Clasp breakage can best be prevented by cautioning the patient against removing the removable partial denture by sliding the clasp arm away from the tooth with the fingernails. A wrought-wire clasp arm can normally be adjusted several times over a period of years without failure. It is only when the number of adjustments is excessive that breakage is likely to occur. Wrought-wire clasp arms also may break at the point of origin because of recrystallization of the metal. This can be prevented by proper selection of wrought wire, avoidance of burnout temperatures exceeding 1300°F, and avoidance of excessive casting temperatures when a cast-to method is used. When wrought wire is attached to the framework by soldering,

the soldering technique must avoid recrystallization of the wire. For this reason, it is best that soldering be done electrically to prevent the wrought wire from overheating.

3- Breakage may occur because of careless handling by the patient.

Fractured Occlusal Rests:

Breakage of an occlusal rest almost always occurs where it crosses the marginal ridge. Improperly prepared occlusal rest seats are the usual cause of such weakness: an occlusal rest that crosses a marginal ridge that was not lowered sufficiently during mouth preparations may be made too thin or may be thinned by adjustment in the mouth to prevent occlusal interference. Failure of an occlusal rest rarely results from a structural defect in the metal and rarely if ever is caused by accidental distortion. Soldering may repair broken occlusal rests.

In preparation for the repair, it may be necessary to alter the rest seat of the broken rest or to relieve occlusal interferences. With the removable partial denture in its terminal position, an impression is made in irreversible hydrocolloid and then is removed, with the removable partial denture remaining in the impression. The dental stone is poured into the impression and is allowed to set. The removable partial denture is removed from the cast, and platinum foil is adapted to the rest seat and the marginal ridge and overlaps the guiding plane. The removable partial denture is returned to the cast and, with a fluoride flux, gold solder is electrically fused to the platinum foil and the minor connector in sufficient bulk to form an occlusal rest.

Distortion or breakage of other components—Major and Minor connectors:

Distortion usually occurs from abuse by the patient . Major and Minor Connectors should be designed and fabricated with sufficient bulk to ensure their rigidity and permanence of form under normal circumstances. Major and minor connectors occasionally become weakened by adjustment to prevent or eliminate tissue impingement. Such adjustment at the time of initial placement may result from inadequate survey of the master cast or from faulty design or fabrication of the casting. Such a restoration should be remade instead of further weakening the restoration by attempting to compensate for its inadequacies by relieving the metal. Similarly, tissue impingement that arises from inadequately relieved components results from faulty planning, and the casting should be remade with enough relief to prevent impingement. repeated adjustment to a major or minor connector results in loss of rigidity to the point that the connector can no longer function effectively. In such situations, a new restoration must be made, or that part must be replaced by casting a new section and then reassembling the denture by soldering. This occasionally requires disassembly of denture bases and artificial teeth. The cost and probable success must then be weighed against the cost of a new restoration. Generally the new restoration is advisable.

Loss of a Tooth or Teeth not involved in Support or Retention of the Restoration:

Additions to a removable partial denture are usually simply made when the bases are made of resin. The addition of teeth to metal bases is more complex and necessitates casting a new component and attaching it by soldering or creating retentive elements for the attachment of resin extension. In most instances when a distal extension denture base is extended, the need should be considered for subsequent relining of the entire base. After the denture base has been extended, a relining procedure for both the new and the old base should be carried out to provide optimum tissue support for the restoration.

Asymptomatic fractured lateral incisor. A, Clinical presentation of the fractured tooth B, Pick-up impression of the prosthesis. C, Cast formed from the pick-up impression, showing a fully seated prosthesis. D, Preparation of the prosthesis included a mechanical means for retention. E, The finished repair

Loss of an Abutment Tooth Necessitating its Replacement and Making a New Direct Retainer:

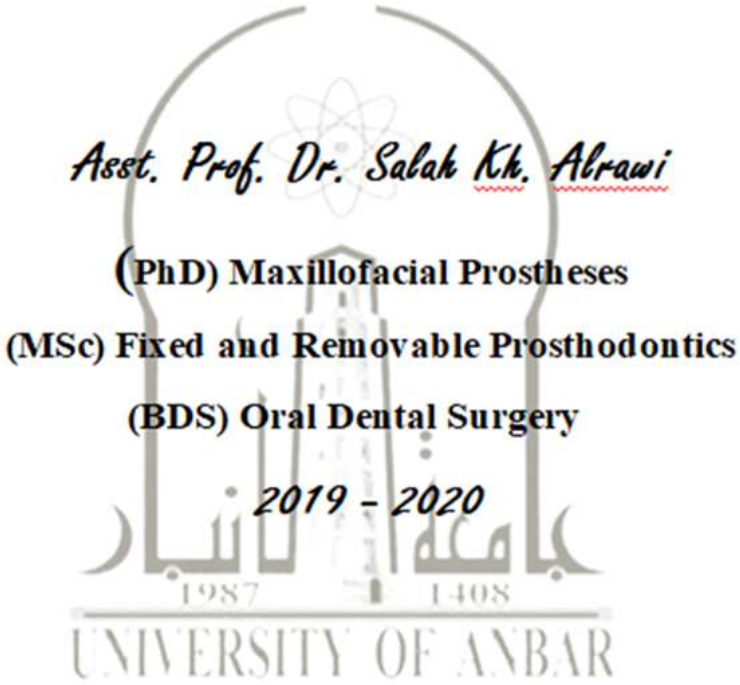
If an abutment tooth is lost the next adjacent tooth is usually selected as a retaining abutment, and it generally will require modification or a restoration. Any new restoration should be made to conform to the original path of placement, with proximal guiding plane, rest seat, and suitable retentive area. Otherwise, modifications to the existing tooth should be done the same as during any other mouth preparations, with proximal re-contouring, preparation of an adequate occlusal rest seat, and any reduction in tooth contours necessary to accommodate retentive and stabilizing components. A new clasp assembly may be cast for this tooth and the denture reassembled with the new replacement tooth added.

Other Types of Repairs

Other types of repairs may include the replacement of a broken or lost prosthetic tooth, the repair of a broken resin base, or the reattachment of a loosened resin base to the metal framework. Breakage is sometimes the result of poor design, faulty fabrication, or use of the wrong material for a given situation. Other times, it results from an accident that will not necessarily repeat itself. If the latter occurs, repair or replacement usually suffices. On the other hand, if fracture has occurred because of structural defects, or if it occurs a second time after the denture has been repaired once before, then some change in the design by modification of the original denture or with a new denture may be necessary.

Repair by Soldering

Approximately 80% of all soldering in dentistry can be done electrically. Electric soldering permits soldering close to a resin base without removing that base because of rapid localization of heat at the electrode. The resin base needs only to be protected with a wet casting ring liner during soldering.



Clinical Phases of Removable Partial Denture Construction

Ist Phase: Education of patient

Is the process of informing a patient about a health matter to secure informed consent, patient cooperation, and a high level of patient compliance.

1. The dentist and the patient share responsibility for the ultimate success of a removable partial denture.
2. Motivation and instruction to the patient for proper oral hygienase measure, the patient should understand that removable partial denture cause periodontal problem, caries and bad oral hygiene that is why partial denture is not supply to a patient unless the oral hygiene is satisfactory.
3. Patient education should begin at the initial contact with the patient and continue throughout treatment. This educational procedure is especially important when the treatment plan and prognosis is discussed with the patient.
4. A patient will not usually retain all the information presented in the oral educational instructions for this reason; patients should be given written suggestions to reinforce the oral presentations.

2nd Phase: Diagnosis, Treatment Planning, Design, Treatment Sequencing, and Mouth Preparation

Treatment planning and design begin with thorough medical and dental histories. The complete oral examination must include:

A. Clinical and radiographic interpretations of: -
   1. Caries.
   2. The condition of existing restorations.
   3. Periodontal conditions.
   4. Responses of teeth (especially abutment teeth) and residual ridges to previous stress.
   5. The vitality of remaining teeth.

B. Evaluation of the occlusal plane.

C. Evaluation of arch form.

D. Evaluation of occlusal relations of the remaining teeth by clinical visual evaluation and diagnostic mounting of diagnostic casts.

After a complete diagnostic examination has been accomplished and removable partial denture has been selected as treatment of choice, a treatment plan is sequenced and a partial denture design is developed based on the support available. For distal extension situations in which no posterior abutments remain and in which extension bases must derive their principle support from the underlying residual ridge require an entirely different partial denture design than does one in which total abutment support is available.

Sufficient differences exist between the tooth-supported and the tooth and tissue- supported removable restorations to justify a distinction between them. Principles of design and techniques employed in construction may be completely dissimilar. The points of difference are as follows: -

1. Manner in which the prosthesis is supported.
2. Impression methods required for each.
3. Types of direct retainers' best suited for each.
4. Denture base material best suited for each.
5. Need for indirect retention.

The dental cast surveyor is an absolute necessity in which patients are being treated with removable partial dentures. The surveyor is instrumental in diagnosing and guiding the appropriate tooth preparation and verifying that the mouth preparation has been performed correctly.

After treatment planning, a predetermined sequence of mouth preparations can be performed. Mouth preparations, in the appropriate sequence, should be oriented toward the goal of providing: -

1. Adequate support, stability and retention for partial denture.
2. A harmonious occlusion for the partial denture.

Through the aid of diagnostic casts on which the tentative design of the partial denture has been outlined and the mouth preparations have been indicated in colored pencil, occlusal adjustments, abutment restorations and abutment modifications can be accomplished. Then the final form of the denture framework should be drawn accurately on the master cast after surveying so that the technician can clearly see and understand the exact design of the partial denture framework that is to be fabricated.

3rd Phase: Support for Distal Extension Denture Bases

It does not apply to tooth-supported removable partial dentures because support comes entirely from the abutment teeth through the use of rests.

For the distal extension partial denture (FEE), however, a base made to fit the anatomic ridge form does not provide adequate support under occlusal loading;

therefore, special impression technique is needed to satisfy the requirements for support of any distal extension partial denture base.

Certain soft tissue in the primary supporting area should be recorded or related under some loading so that the base may be made to fit the form of the ridge when under function. This provides support and ensures the maintenance of that support for the longest possible time. This requirement makes the distal extension partial denture unique in that the support from the tissue underlying the distal extension base must be made as equal to and compatible with the tooth support as possible.

4th Phase: Establishment and Verification of Occlusal Relations an Tooth Arrangements

Whether the partial denture is tooth supported or has one or more distal extension bases, the recording and verification of occlusal relationships and tooth arrangement are important steps in the construction of a partial denture. For the tooth-supported partial denture, ridge form is of less significance than it is for the tooth- and tissue-supported prosthesis, because the ridge is not called on to support the prosthesis. For the distal extension base, however, jaw relation records should be made only after obtaining the best possible support for the denture base. This necessitates the making of a base or bases that will provide the same support as the finished denture. Therefore, the final jaw relations should not be recorded until after the denture framework has been returned to the dentist, the fit of the framework to the abutment teeth and opposing occlusion has been verified and corrected, and a corrected impression has been made. Then either a new resin base or a corrected base must be used to record jaw relations.

5th Phase: Initial Placement Procedures.

This phase begins when the patient is given removable partial denture. It seems that minute changes in the planned occlusal relationships occur during processing of dentures. Not only must occlusal harmony be ensured before the patient is given the dentures, but also the processed bases must be reasonably perfected to fit the basal seats.

The patient must be understanding the suggestions and recommendation given by the dentist for care of the dentures and oral structures and understands about expectations in the adjustment phases and use of the restorations.

6th phase: Periodic Recall

Periodic reevaluation of the patient is critical for early recognition of changes in the oral structures to allow steps to be taken to maintain oral health. These examinations must monitor: -

1. The condition of the oral tissue.
2. The response to the tooth restorations.
3. The prosthesis (removable partial denture).
4. The patient's acceptance.
5. The patient's commitment to maintain oral hygiene.

Although a 6- month recall period is adequate for most patients, a more frequent evaluation may be required for some.

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2019-2020

Computer-Aided Design/Computer-Aided Manufacture (CAD/CAM) Techniques For Removable Denture Fabrication

INTRODUCTION

With continuous developments over several years, present-day technological advancements allow the use of different systems with computer-aided design/computer-aided manufacture (CAD/CAM) technology for the fabrication of removable dentures, including milling and rapid prototyping (RP). CAD/CAM technology refers to digital design and manufacture. CAD software recognizes thegeometry of an object while CAM software is used for the manufacture. The CAD/CAM manufacturing process can either include additive (RP) or subtractive manufacturing (computer numerical control [CNC] machining; milling). RP has been used for industrial purposes and was developed from CAD/CAM technology. It is used to create automatically physical models from computerized three-dimensional (3D) data. RP, also known as solid freeform fabrication or layered manufacturing, has been used for creating 3D complex models in the field of medicine since the 1990s and has recently become popular for the fabrication of removable dental prostheses. CAD/CAM and RP have been used for several years for the fabrication of inlays, onlays, crowns, fixed partial dentures, implant abutments/prostheses, and maxillofacial prostheses.[6] Currently, not only fixed restorations but also removable dentures are manufactured using CAD/CAM and RP. However, few studies have reported on the use and effectiveness of RP for removable denture fabrication. Subtractive manufacturing technique is based on milling the product from a block by a CNC machine. The CAM software automatically transfers the CAD model into tool path for the CNC machine. This involves computation that points the CNC milling, including sequencing, milling tools, and tool motion direction and magnitude. Due to the anatomical variances of dental restoration, the milling machines combine burs with different sizes. The accuracy of milling is shown to be within 10 µm. The first removable prosthesis based on 3D laser lithography was manufactured in 1994. Subsequently, the removable prosthesis duplication technique was improved using CAD/CAM with a computerized numerical control (CNC) system and ball-end mills in 1997. Then, fabricated individual physical flasks using a 3D printer. Impressions of the edentulous maxilla and mandible or existing dentures are subjected to laser scanning during CAD. Also, cone beam computed tomography is used for the modification of previous dentures. CNC, laser lithography, and RP are used for the CAM process. AvaDent and Dentca are the two available commercial manufacturers of removable complete dentures with CAD/CAM, using a gadget for transferring the maxillomandibular relation (MMR) to a digital articulator and finalizing the dentures completely with CAD/CAM. In the process used by AvaDent, denture bases are milled

using a subtractive technique from prepolymerized denture resin. The Dentca technique uses an additive process, wherein a trial denture can be prepared, if the dentist requires, using RP (stereolithography [SLA]) before the conventional fabrication of a definitive prosthesis. An electronic search was conducted in the PubMed/MEDLINE (National Library of Medicine, Washington, DC), ScienceDirect, Google Scholar, and Web of Science databases for identifying English articles using the following key word combinations:

- "CAD/CAM and complete dentures"
- "CAD/CAM and removable partial dentures (RPDs)"
- "CAD/CAM and removable dentures"
- "CAD/CAM and removable prosthesis"
- "RP and complete dentures"
- "RP and RPDs"
- "RP and removable dentures"
- "RP and removable prosthesis"
- "Digitally designed and removable dentures"
- "Digitally designed and complete dentures"
- "Digital complete dentures"
- "Digital removable dentures"
- "Rapid manufacturing and removable dentures"
- "Milled," "machined," "computerized," and "removable dentures."

Techniques And Materials Used For Dental Computer-Aided Manufacture

CAM includes subtractive and additive manufacturing techniques [Figure 1]. Early CAM systems are based on subtractive method that was relied on cutting the restoration from a prefabricated block using burs, drills, or diamond disks. Subtractive manufacturing includes CNC machining used for the manufacture of crowns, posts, inlays, and onlays. The subtractive production methods include spark erosion and milling. The spark erosion can be defined as a metal substractive process using continuing sparks to erode material from a metal block according to the CAD under required conditions. Milling techniques are diamond grinding and carbide milling which are now found together in chair-side and in Lab CAD/CAM devices together and as the latest transferred technology from manufacture industry to dental use is laser milling, which was announced in first quarter of 2015. Milling techniques are mostly dependent on the device properties such as the dimensional approach and possibilities of working axis: 3 spatial direction X, Y, and Z which refers to 3 axis milling devices while 3 spatial

direction X, Y, Z and tension bridge refers to 4 axis milling device, and finally 3 spatial direction X, Y, Z, tension bridge with milling spindle is classified as 5 axis milling device. Additive 3D printing techniques include SLA, digital light projection (DLP), jet (PolyJet/ProJet) printing, and direct laser metal sintering (DLMS)/selective laser sintering (SLS). The SLA technique uses ultraviolet (UV) laser for layer-by-layer polymerization of materials. The technique is used for the manufacture of dental models from UV-sensitive liquid resins. DLP uses UV laser and visible light for polymerization and is used for the manufacture of dental models, wax patterns, removable partial frameworks, and provisional restorations from visible light-sensitive resins, wax, and composite materials. After the material is printed, it is cured using a light-emitting diode light source or lamp. Also, polymethyl methacrylate (PMMA) is used in the DLP technique. Jet (PolyJet/ProJet) printing uses a series of ink-jet print heads and tiny pieces of material jetted onto support material and create each layer of the part. Then, each jetted layer is hardened using a UV lamp, light source, or heating. This technique is used for the manufacture of dental models, surgical drill guides, aligners, wax patterns, and removable frameworks from dental resin and waxes. DLMS/SLS is a powder-based technique wherein high-power laser beam hits the powder, resulting in melt and fusion of the powder particles. This technique is used for the manufacture of dental models, copings, and surgical guides from cobalt-chrome, palladium chrome, and nylon.

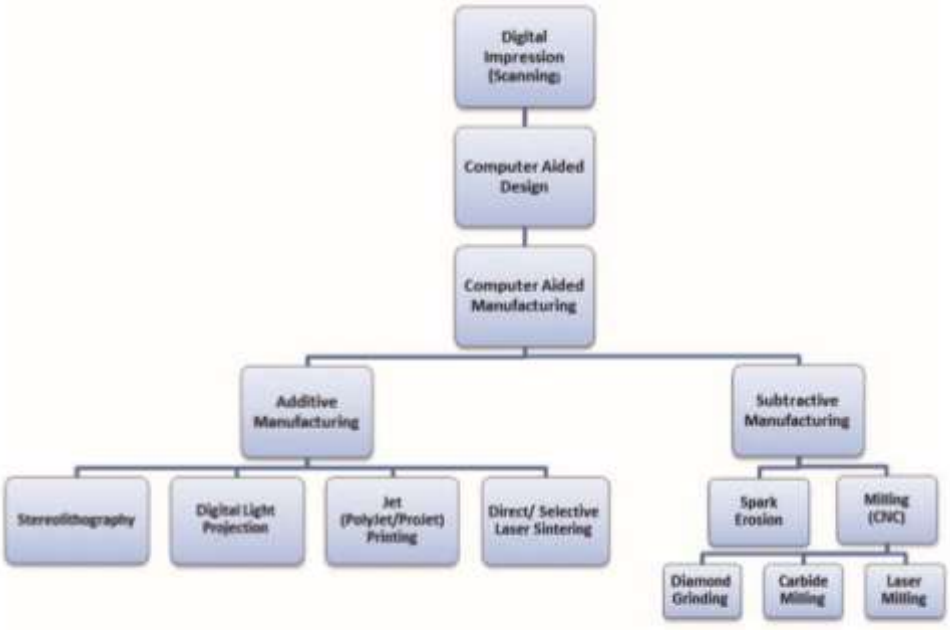

Figure 1: Overview of computer-aided design/computer-aided manufacture systems for dental use

Manufacturing Process Of Removable Prosthesis With Computer-Aided Design/ Computer-Aided Manufacture And Rapid Prototyping

- **Manufacturing Steps For Framework Of Partial Prosthesis**

Designing of the RPD framework generally consists of four parts as base, plate, clasp, major, and minor connector of the framework. Every part of the RPD framework must be done proper design and thick value in the designing process. Because of the variety of RPD parts and their irregular forms, 3D designing of RPD framework is taking much time and complicated. For this reason, researchers investigated proper CAD/CAM method and software for 3D designing of RPD framework for many years. Basically, steps for manufacturing of framework of partial prosthesis with CAD/CAM and RP are: First, dental casts are prepared using conventional impression method or digital impression. Casts are scanned using digital scanner for conventional technique. Path of insertion of the RPD is defined digitally, and then shape of the components of the framework is designed 3D by dentists or laboratory technicians. Finally, digitally designed metal RPD frameworks are produced with RP.

- **Manufacturing Steps For Complete Dentures**

First, models can be prepared using conventional impression or intraoral digital impression. When digital impression is considered, practitioner will need for high speed, high density, small size, and multifunctional device which has driven the development of 3D imaging. The precision of digital impression has been studied by several researchers and found out that use of digital models is a relatively new technique that has an accuracy of up to 10 µm, and the models have been found to be as reliable as traditional stone casts. Therefore, casts are scanned using digital scanner for conventional technique. After taking impression, the next step is making MMR transfer during complete prosthesis fabrication using CAD/CAM. There are three options for MMR transfer during complete prosthesis fabrication using CAD/CAM: The MMR can be transferred using conventional impression and transfer techniques, the AvaDent system kit, or the Dentca system kit. Two clinical appointments are required for the manufacture of removable complete dentures using the Avadent and Dentca systems. In the first appointment, impressions are recorded using special trays provided in the AvaDent or Dentca system. Then, the jaw relation is recorded using an anatomical measuring device. The occlusal vertical dimension (OVD) is determined using conventional methods. Subsequently, the centric relation is recorded, and teeth are selected. The last step of the first appointment is the delivery of the final impression to the manufacturer (AvaDent or Dentca).

At the laboratory, the denture borders are first defined and marked using the system's computer software. Then, the teeth are virtually set, and the prosthesis base is milled from traditional denture resin material. A trial denture can be prepared as per the dentist's request. In the second clinical appointment, the dentures are delivered and any occlusal adjustments made. These steps are similar to those for conventional prosthesis delivery. Only the AvaDent technique of denture base manufacture is not conventional.

Advantages Of Digital Fabrication Of Dentures

- Decreased number of appointments.
- Shrinkage of acrylic base caused by milling of prepolymerized acrylic resin with an increase in the strength and fit of dentures.
- Decreased duration of prosthesis manipulation.
- Decrease in the risk of microorganism colonization on the denture surfaces and consequent infection.
- Advances in standardization for clinical research on removable prostheses.
- Easy reproduction of the denture and manufacture of a trial denture using stored digital data.
- Superior quality control by clinicians and technicians.

Limitations And Disadvantages Of Digital Fabrication Of Dentures

- Manufacturing challenge caused by impression-taking and OVD-recording procedures, MMR transfer, and maintenance of lip support, which are all similar to the procedures used in the conventional process.
- Inability to define the mandibular occlusal plane.
- Expensive materials and increased laboratory cost compared with those for conventional methods.
- Lack of trial denture manufacture by the Avadent system,[which precludes the evaluation of dentures by patients and dentists before final denture fabrication.

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2019 - 2020

PROSTHODONTICS

3rd class **Dr.Osama Alheeti**

Flexible Denture

Flexible dentures or Soft dentures are an excellent alternative to traditional hard-fitted dentures, when traditional dentures cause discomfort to the patient that cannot be solved through relining. Soft dentures are not the same as a soft reline for traditional dentures. Soft relines use a soft putty-like substance to separate gums from the hard acrylic in dentures. Flexible dentures use a special flexible resin that prevents them from chafing the gums, allows the wearer to chew properly. Some of the commercially available products are: Valplast, Duraflex, Flexite, Proflex, Lucitone Impak whereas valplast and lucitone are monomer free.

Advantages:

1.Translucency of the material picks up underlying tissue tones, making it almost impossible to detect in the mouth.

2.No clasping is visible on tooth surfaces (when used in manufacturing of clear clasps), improving aesthetics.

3.It is comfortable for the patient (thin and lightweight), so it does not fracture even if it is thrown intentionally from some height whereas patient with full acrylic partial or complete dentures often visit the dentist with broken or fractured prosthesis as these are brittle.

4.The material is exceptionally strong and flexible which allows it to engage the undercut beneath the bony exostosis that is not possible in rigid partial dentures.

5.Complete biocompatibility is achieved because the material is free of

monomer and metal, these being the principle causes of allergic reactions in conventional denture materials.

6. Flexible dentures may be used as an alternate treatment plan in rehabilitating the anomalies such as ectodermal dysplasia.

Effect on the oral mucosa: Flexible dentures exhibit viscoelastic behavior that lead to improvement in masticatory function and patients comfort compared with hard dentures .They show little effects on the mucosa of denture bearing area and little changes on the mucosa. Denture bearing area of flexible denture is healthier with less tissue changes compared with traditional acrylic denture. Flexible removable partial dentures can adapt to the shape and movement of mouth and for this reason, these are far more comfortable to wear.

Disadvantages:

1.not used for long-term restorations and is intended only for provisional or temporary applications. Metal frame partial dentures remain the" standard" for long-term restorations.

2.Flexible dentures tend to absorb the water content and will discolor often. The acrylic teeth are mechanically bonded to thermoplastic nylon. Hence the teeth can come out of the prosthesis.

3.When comparing it with cast partial dentures the flexible dentures do not give the patients sense about hot or cold eatables as these are bad conductors.

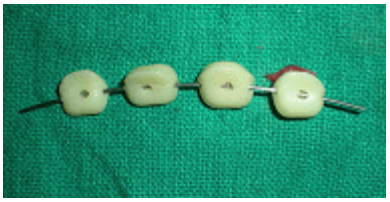
4.When grinding this prosthesis, proper ventilation, masks, and vacuum systems should be used and the procedure is sensitive technique.

5.Extreme caution is necessary when processing to avoid skin contact with the heated sleeve, cartridge, furnace, heating bay, hot cartridge, injection insert, piston head adapter, hot flasks and heat lamps.

Flexible denture base material:

It is polyamide nylon thermoplastic material that does not sacrifice function and preserves aesthetics. It is available in the form of granules in cartridges of varying sizes. It was first introduced by the name of valplast and flexiplast to dentistry in 1956.

Injection-molding technique is used for fabrication of flexible denture base prosthesis. Acrylic resin teeth do not bond chemically with flexible denture base resin. They are mechanically retained by making T shape holes undercuts (as shown below) into which denture base resin flows to retain teeth mechanically.



Flexible partial denture:

The removable partial denture can be fabricated from metal alloy, acrylic resin and thermoplastic resins. The removable cast partial denture is a definitive prosthesis which has been in use in dental profession since decades for rehabilitation of partially edentulous patients. It consists of a metal base (made up of base metal alloys, commonly with cobalt-chromium alloy), with acrylic teeth attached to it. Metal retentive clasp holds the cast partial denture in place. The metallic appearances of the clasp may be restrictive for treating the patients who are very much concerned about the aesthetics. When maxillary posterior teeth are missing and only anterior teeth are present, placement of metallic clasps on canines may not be acceptable to the patients.

The second type of removable partial denture is all acrylic resin prosthesis, which is also known as temporary, interim removable partial denture or a “FLIPPER”. It acts as a space maintainer and is usually used to restore the function during the treatment until the definitive prosthesis is fabricated.

The flexible partial denture aesthetically has several advantages over the other two types of partial dentures. There is no metal/wire clasps used in

FRPDs. Instead of metal clasps. The clasps of flexible removable partial denture are extensions of denture base into undercut areas and they are also made up of flexible thermoplastic material with

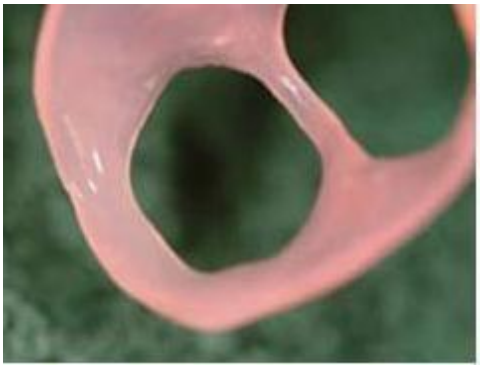
excellent esthetics, which can be adjusted by dipping the clasp area in boiling water and then bending with the plier in or out to increase or decrease the retention.





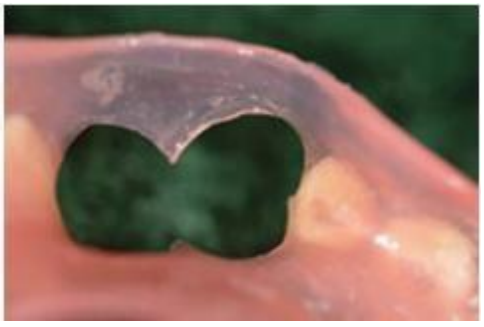
Different clasp designs are used:

Main clasp



Circumferential clasp

Combination clasp (of main clasp clasp)



Continuous circumferential clasp and circumferential

Partial dentures with resin clasp and metal framework

It is also an option for cosmetic improvement of teeth that appear elongated due to recession of gums and also for patients who are allergic to acrylic.

The insertion technique for RPD:

Immediately prior to inserting the RPD in patient's mouth, immerse it in very hot tap water. Leave it in the water for about 1 minute, remove it and allow cooling to the point where it will be tolerated by the patient. Gently insert it in the mouth. The hot water permits a smooth initial insertion and good adaptation with the natural tissues in the mouth. If the patient senses any discomfort because of tightness of a clasp, the clasp may be loosened slightly by immersing that area of the partial in hot water and bending the clasp outward. If a clasp requires tightening, bend clasp inward.

The adjustment for FRPD:

If any reduction is needed due to persistent irritation, the RPD must be handled differently than acrylic. It is recommended to use green mounted stones. Use a delicate touch with the hand piece rotating between 20,000 and 25,000 rpm in rapid repetitive motion. Then it is smoothened and

polished with rubber wheel. The resin will melt if there is prolonged contact with a bur or wheel, so continuously move the instrument over the surface.

Using green mounted stone to trim adjustment kit

Special instructions for flexible denture wearer:

The patient should be instructed to practice good oral hygiene and clean prosthesis regularly after every meal, in order to maintain appearance and cleanliness of the prosthesis because it is prone to staining by various ingredients of food, tea and coffee if it is not polished properly and cleaned by the patient regularly. The prosthesis should be removed during the brushing of the natural teeth, to avoid the scratching of the prosthesis.

To help your flexible partial denture to look and feel like new, please follow these simple instructions:

1- Always rinse your flexible partial under running hot tap water for approximately 20 to 30 seconds before wearing it. The small flexible clasps will get hard and could break if this is not done.
2- Do not wear your partial to bed. Remove at night and keep it in water when not being worn to keep it hydrated.
3- Rinse your appliance after eating to remove food particles.
4- Always remove your flexible partial denture to brush your teeth. Toothpaste is great for your teeth but not for your partial. Brushing your partial with toothpaste may remove the polish and roughen the surface over time. Use a gentle soap and your toothbrush to clean your new partial.
5- Bring your partial to your dentist for ultrasonically dental cleaning. Loose particles can be removed with the use of a sonic denture cleaner. Ultrasonic cleansing devices don't replace brushing but they do help to make your overall cleaning efforts more effective.