DESIGNING FOR REMOVANLE PARTIAL DENTURES

Dr. Rupal J. Shah

Professor ad Head,

Department of Prosthodontia,

Govt. Dental College and Hospital

Ahmedabad.

❖ INTRODUCTION:

- After the diagnostic cast has been surveyed for determination of the path of insertion and removal and the available undercut areas for the placement of the suitable clasp, the most essential step designing of the removable partial denture is accomplished.
- Designing of the cast removable denture is solely a duty of the dentist only and is not the job for the dental technician.
- The design for the denture must follow the basic principles for the removable partial denture construction.

❖ PRINCIPLES OF DESIGN:

- The dentist must have thorough knowledge of both mechanical and biologic factors involved in partial denture design.
- The treatment plan must be based on a complete examination and diagnosis of the individual patient.
- The dentist must correlate all the factors that affect the design of the denture and determine a proper plan of treatment.
- A removable denture should restore the form, function and esthetics when in anterior region without damaging the remaining structures.
- A removable denture is a part of treatment not the cure sot the oral tissues must be kept in optimum oral health.
- The design should be such that modifications in to it can be easily made to compensate for the changes that occurs in oral tissues.

❖ PHYLYSOPHY OF DESIGN:

- There are too many philosophies or concepts regarding to the design of the removable partial denture. But the main
- However there are three main concepts to distribute the forces acting on a partial denture between the soft tissue and the teeth. They are:

  (1) Stress equalization between the teeth and saddle areas.

  (2) Physiologic basing of the denture base

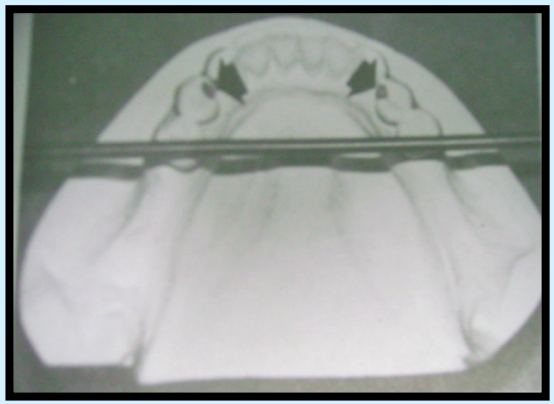
  (3) Broad stress distribution

❖ESSENTIALS OF PARTIAL DENTUREDESIGN:

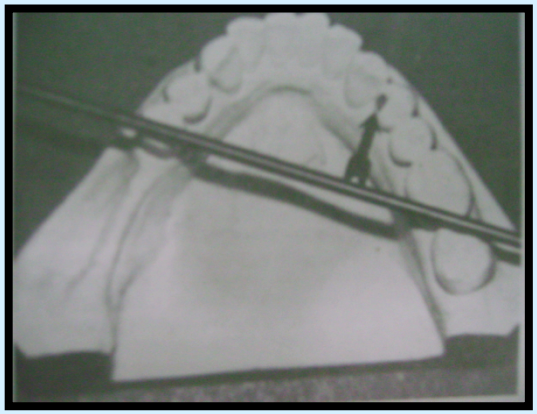
1) **Direct retainer** in the form of a suitable clasp determined according to the available undercut on the abutment teeth by surveying.

2) **Indirect retainer** in the form of an occlusal or incisal rest located as far anteriorly as possible to the fulcrum line.

✓ Indirect retention is needed for all class I and II cases. The fulcrum line is marked as a line passing through the most distal surfaces of the abutment teeth. A line perpendicular to the fulcrum line determines the ideal location for the indirect retainer.



Class I



Class II

3) **Rests** for the proper support for the prosthesis which may be occlusal or incisal rest.

4) **Major connectors**

5) **Minor connectors**

6) **Denture base area**

❖ DESIGN PROCEDURE:

COLOR CODING:

➢ A color coding system for the various parts of the partial denture have been established for better communication between the dentists and the technicians. That is as under:

✓ **Brown** color used for metallic portion of the partial denture

✓ **Blue** color used for the denture base area

✓ **Red** color indicates areas that will be relieved or needs to be modified.

✓ Rest seats are drawn in **dark red** color.

✓ The **black pencil** mark used to dictate the *survey lines, tripod marks and soft tissue undercuts*

❖ STEP BY STEP PROCEDURE:

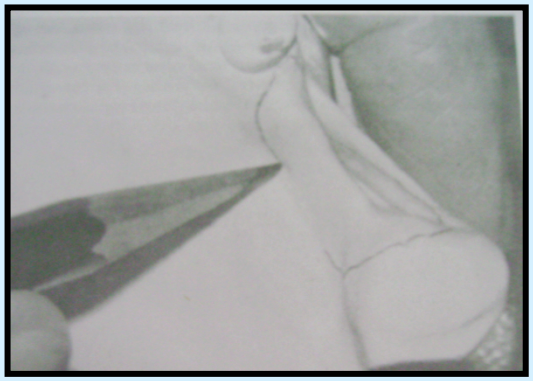
- Before starting the designing one must determine first weather the denture will be tooth supported, mucosa supported or the combination of both.
- The following dictates step by step procedure for designing of the removable partial denture:

(1)First stage:Examine the mounted diagnostic casts:

- ✓ Indicate the proposed rest seat areas on the cast
- ✓ Indicate areas of the cusps to be relieved to get clearance for rests
- ✓ Examine lingual occlusion for accommodation of the rests.

(2) Second stage: Outlining the denture base area (saddle area):

- The next step is to outline the saddle area. As a general rule maximum coverage of the edentulous ridge is desired.
- In such a way maximum bone is involved to resist the vertical and horizontal loads which fall on the saddle during mastication.



- The antero-posterior extension of the saddle is determined by the abutment tooth in case of tooth supported and by the abutment tooth and maxillary tuberosity and retromolar pad area in case of tissue supported prosthesis.

(3) Third stage: Planning support for the saddles:

- Supporting a saddle is meant by that the vertical load acted on the prosthesis is adequately resisted during function.
- In lower only edentulous ridge is available for support, but in upper the edentulous ridge and the palate is available, therefore upper is more suitable than lower for gaining support.
- Tooth support is effectively gained by means of occlusal rest, incisal rest, onlays or embrasure hooks which are prepared on the occlusal surfaces of the teeth.
- Wide distribution of the load is effective by placing occlusal rests on a large number of standing teeth.
- In case of tooth supported dentures support is always possible to bounded saddle but with mucosa supported dentures part of the load must be borne by mucosa.

(4) Fourth stage: Planning bracing for the saddles:

- Bracing means providing resistance to lateral movements.
- The lateral component of force is most destructive to the ridge and the supporting structures.
- Two approaches of reducing the lateral load are considered

(1)By reducing the magnitude of lateral component of the force by reducing the size of the occlusal table and by selecting the teeth with sharp efficient cusps.

(2)The second method by reducing the lateral component of force is by distributing the force widely which is best achieved by maximum tissue coverage and proper clasping of the available teeth.

(5) Fifth stage: Planning the resistance for the saddle to antero-posterior movements:

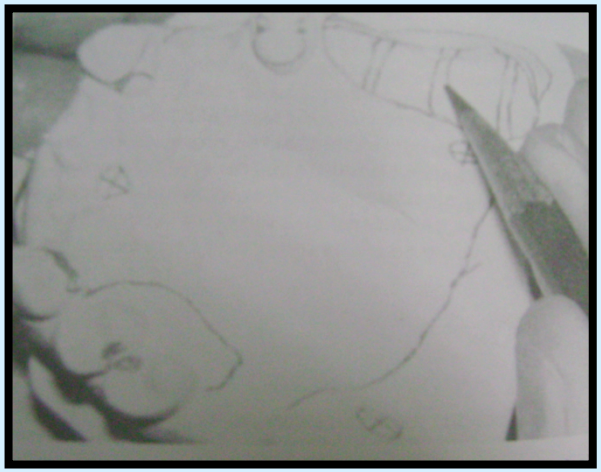
- These movements may be prevented by resistance at the end of the saddle towards which the movement takes place.
- In the upper this movement is prevented by anterior part of the mouth and in lower by most posterior anatomical structures.
- However best resistance is provided by the healthy remaining teeth.
- In some cases, extra resistance may be needed and is provided by careful clasping of the available teeth.

(6) Sixth stage: Planning the retention

- The philosophies of adhesion, cohesion, peripheral seal are partly effective in cases of partial denture because of the partial coverage of the edentulous ridges.
- So in cases of partial denture, extra retention is provided by means of direct and indirect retainers.
- The usual method for gaining direct retention is by means of suitable clasps.
- However broad distribution of the saddle area may act as a supplement to retention by applying adhesion and cohesion factors.

(7) Seventh stage: Joining the saddle and retainer units

- When the saddle are adequately supported, braced, stabilized, and retained, they are finally joined by rigid connector to form the partial denture.



- It may be of metal or acrylic resin. But in case of metal, plate in place of bar should be preferred for better distribution of load.
- The connector must be rigid enough to provide support and strength to the prosthesis
- A design for the partial denture is now complete, onto which wax pattern is carefully prepared which is then invested and casted in suitable metal.

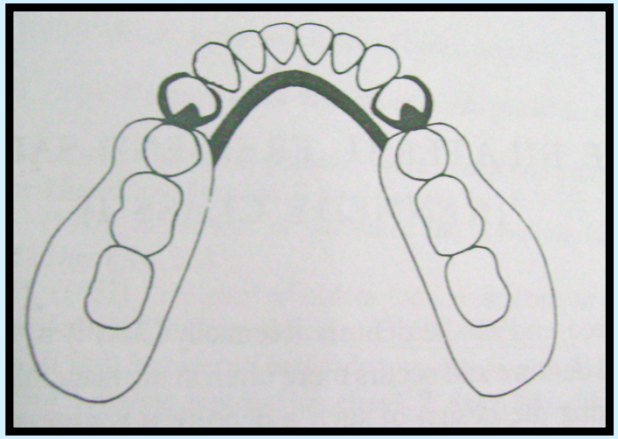
DESIGN FOR KENEDY CLASS I DENTURE

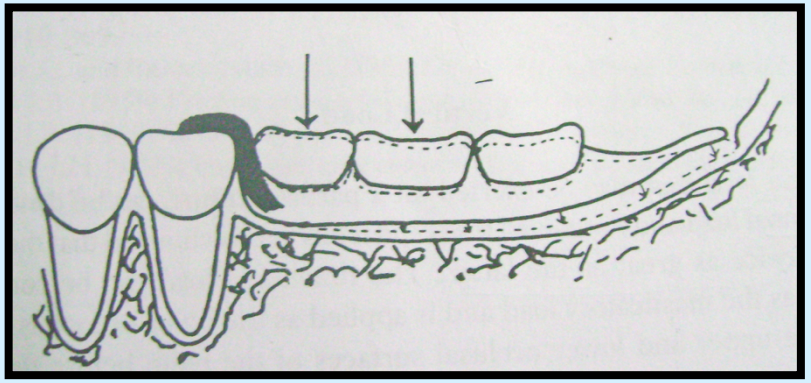
- The ***bilateral free-end saddle (Kennedy class I)*** is the most common design of partial denture and occurs more often in the mandible than in maxilla.
- Before considering the design, the force components which are divided into vertical, lateral and anteroposterior component has to be evaluated.

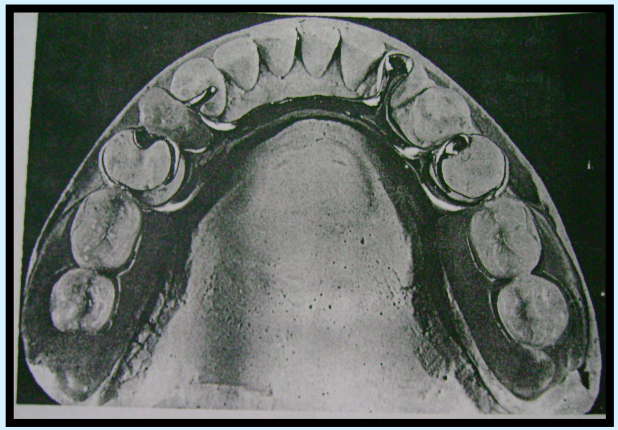
(1)Vertical loading:

- Vertical load is divided into parafunctional and functional load.
- Functional load is exerted during mastication.
- The distribution of the vertical load is dependent upon the condition of the abutment teeth and the displacibility of the residual tissues.
- The major part of the force falls on to the saddles. So an accurate mucostatic impression of the edentulous area is important.
- If the tissues are more displaced by the vertical forces it induces more bone resortption and so the distal extension dentures frequently requires rebasing.

- As the vertical load is applied to the saddle, both the abutment teeth and the soft tissue covering the saddle area are displaced, with alveolar tissues being displaced to greater extent than the abutment teeth.
- This will bring rotation of the partial denture about the abutment teeth if the conventional design with distal rest seat is used.



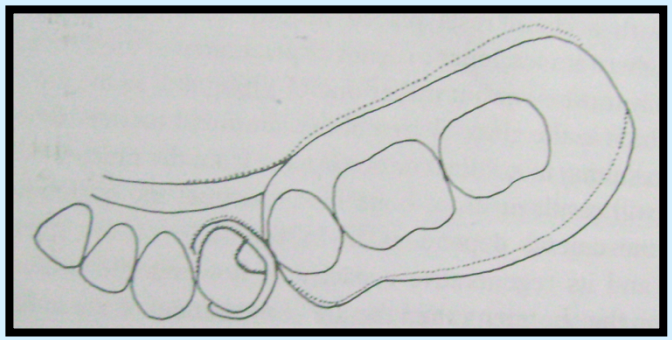


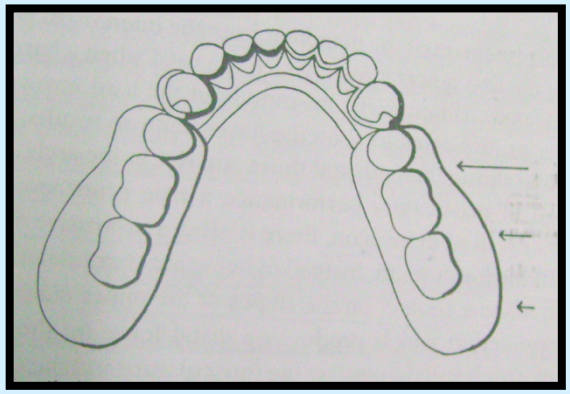


- This is best prevented by mesial rest partial denture.

(2) Lateral loading:

- Lateral forces come in to act during the later stages of masticatory cycle when the natural teeth from their lateral position come into intercuspal position.
- The denture moves bodily as a result of lateral forces.





- The lateral forces are best resisted by providing more rigid connector, holding the abutment tooth by deep occlusal rest and clasp arm and by providing lignguoplate as additional indirect retainer.
- Lateral forces are also acted on the denture by adjacent facial and lingual musculature during swallowing and they act throughout the day and can be prevented by using narrow posterior teeth

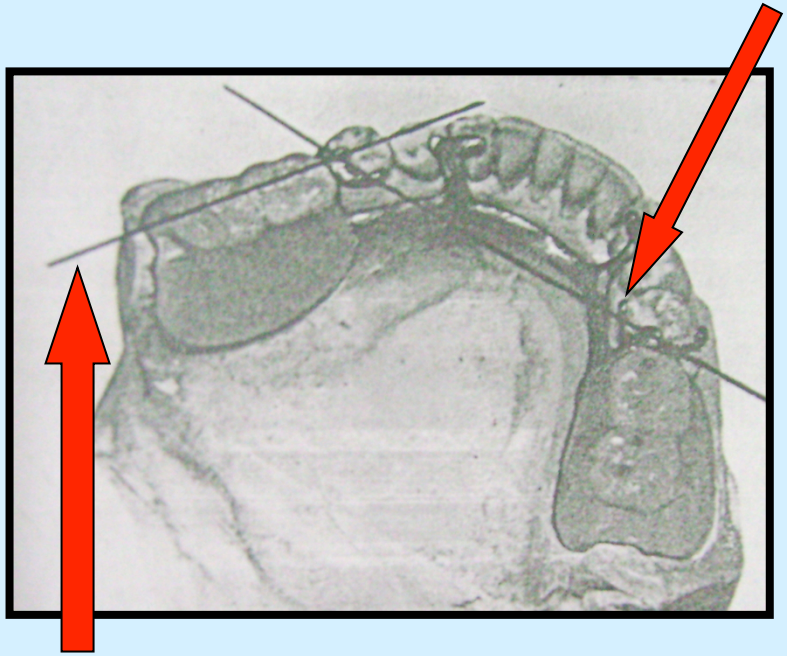
(3) Antero-posterior loading:

- Posterior displacement of the denture occur during the first power strokes of the mastication. Which is best resisted by the giving indirect retainer to the teeth anterior to the abutment teeth. This posterior force is partly resisted by the ascending ramus part of the mandible.
- However in grinding no protrusive movement is found, so an anterior element of force is not generally acted on the denture.

In the design and construction of removable partial denture, it is of **utmost importance to preserve which is remaining, rather than blindly replacing that which is missing.** This is generally more difficult in free-end saddles due to the nature of the supporting tissues.

❖Movements of class I appliance:

- ✓ The distal extension base class I denture has the tendency to make two vertical movements toward and away from the saddle around the fulcrum line joining the direct retainers on the most posterior abutment teeth.



- ✓ The third movement of the saddle is around the fulcrum line that parallels the ridge crest and passes through the rest on the adjacent abutment teeth.

TREATMENT OPTIONS FOR FREE-END SADDLE:

- There are some suggested methods for restoring the free-end saddle with optimum success. They are as under:

(A) BY REDUCING THE LOAD: Achieved by:

- Using canines and premplars instead of molars
- Using narrow teeth

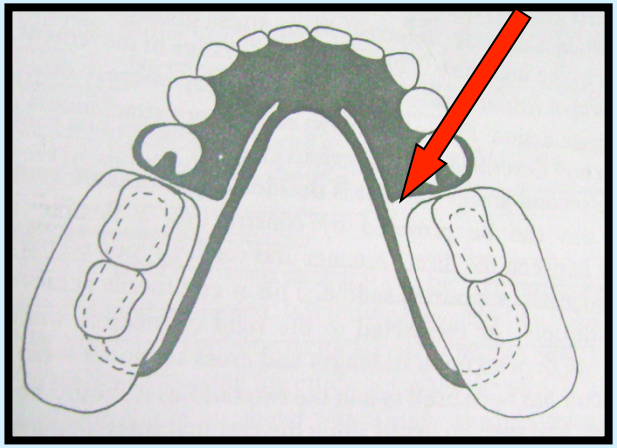
- By these, width of the occlusal table is reduced and so as the vertical forces of mastication.

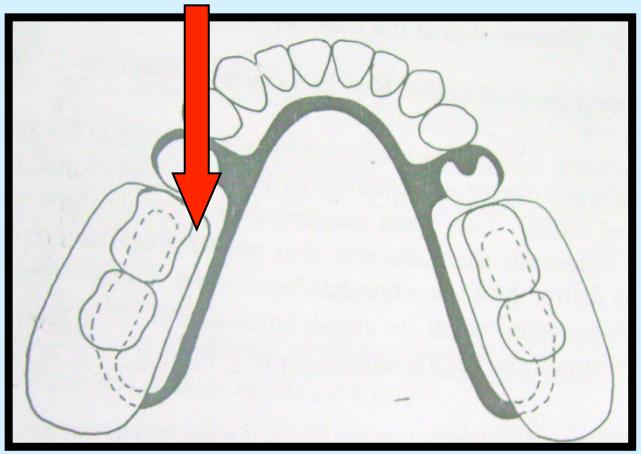
(B) By DISTRIBUTING THE LOAD BETWEEN TEETH AND RESIDUAL RIDGES:

1) By varying the connector between clasp and saddle:

- ✓ Combination of rigid connection and gingivally approaching arm
- ✓ Combination of rigid connection and occlusally approaching arm

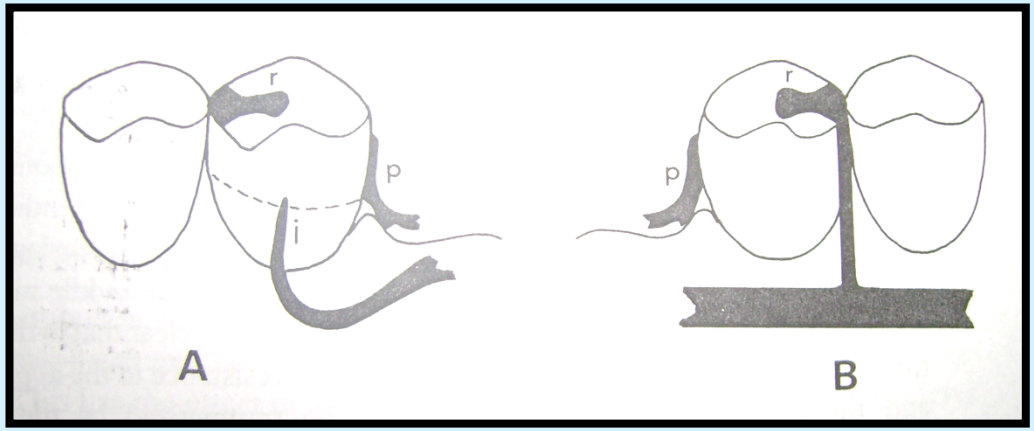
✓By using stress breakers: by split lingual bar or non-rigid connection.





2) By anterior placement of the occlusal rest :

✓ By **RPI** system



3) By mucocompression:

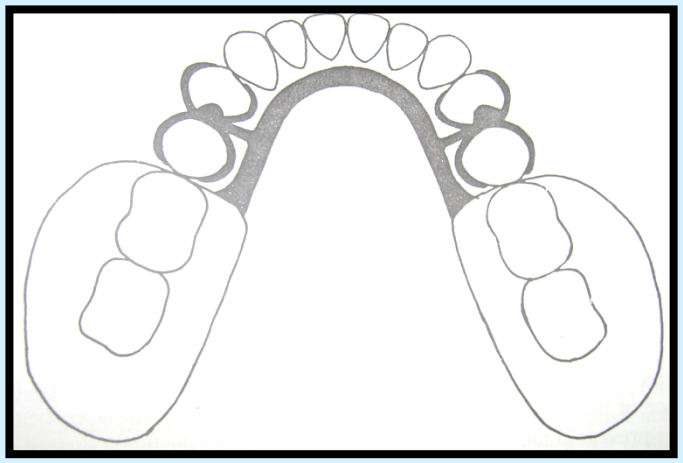
- The third method of distributing the load suitably between abutment teeth and the edentulous ridge is by compressing the mucosa covering the ridge.

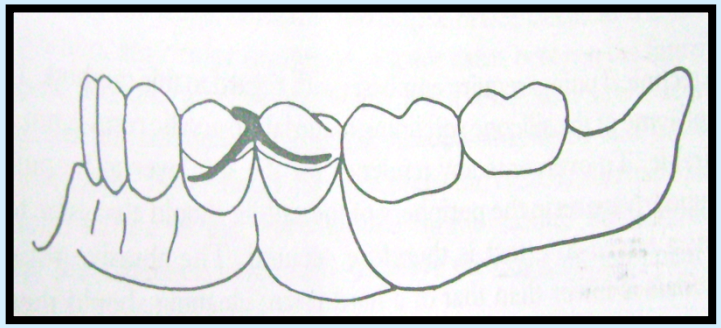
- A cast poured from mucocompressive technique produces the tissues as they are under load. So the mucosa is displaced minimally during function producing less posterior rotation of the denture base.

(C)BY WIDE DISTRIBUTION OF THE LOAD:

1) WIDE DISTRIBUTION OVER THE TETH:

- ✓ some amount of additional stress distribution can be achieved by additional or compound clasping of the abutment teeth.

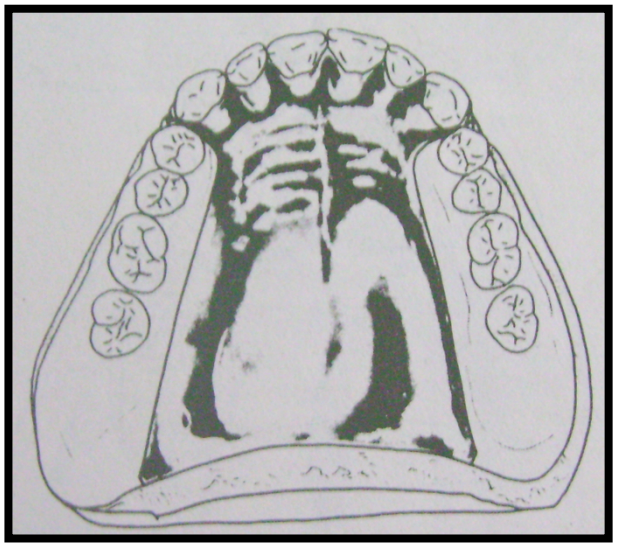


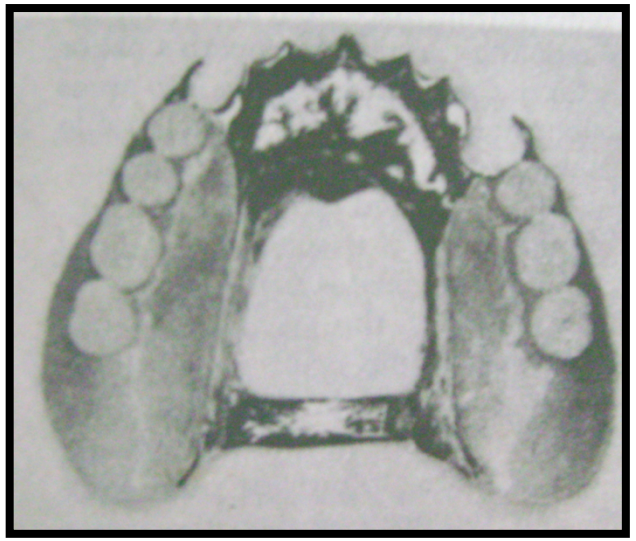


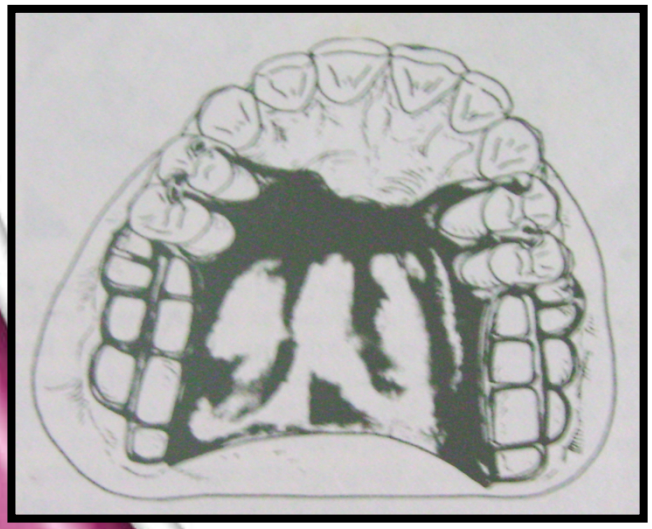
2) BY DISTRIBUT OF LOAD OVER THE RIDGE:

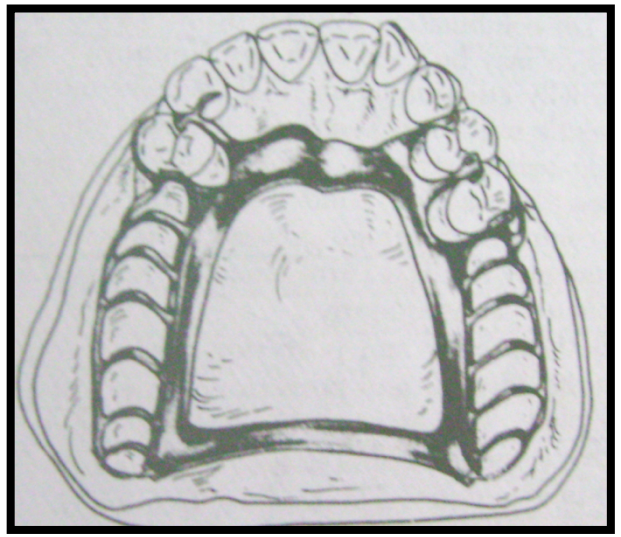
- ✓ The saddles of the denture should always cover the largest possible area, so that the pressure falling over the edentulous area is evenly distributed.
- ✓ Full coverage over the retromolar area, tuburosity area in case of upper and buccal shelf area is desirable for stress distribution.

Some designs for class I partial denture







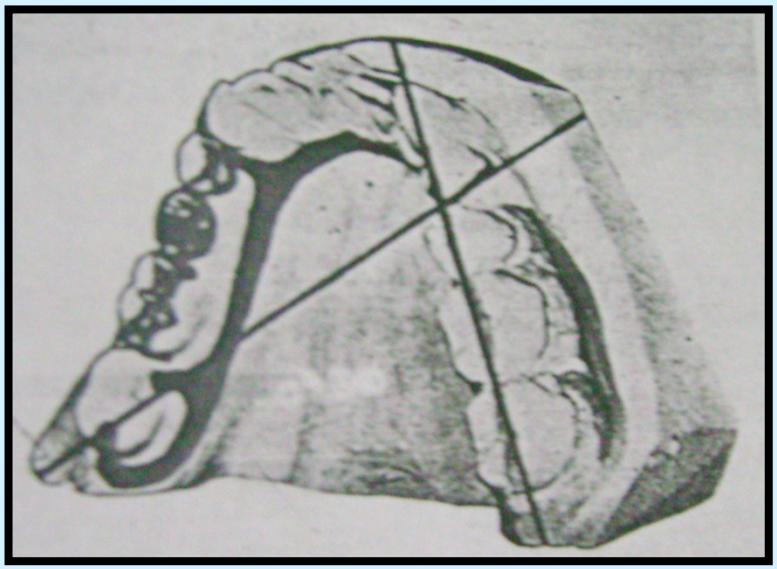


DESIGN FOR KENEDY CLASS II DENTURE (UNILATERAL FREE-END SADDLE)

- The main problem associated with unilateral distal extension denture is the same as that of class I denture. It must accept the vertical and lateral forces same as that in case of bilateral distal extension denture.
- However due to presence of the teeth on the contralateral site, retention is reduced because the factors of adhesion and cohesion are reduced and also the prosthesis is more susceptible to the detrimental lateral forces.
- in such cases additional retention is achieved by clasping more than one tooth on the contralateral side and using more rigid type of clasps.

❖Movements of class Ii appliance:

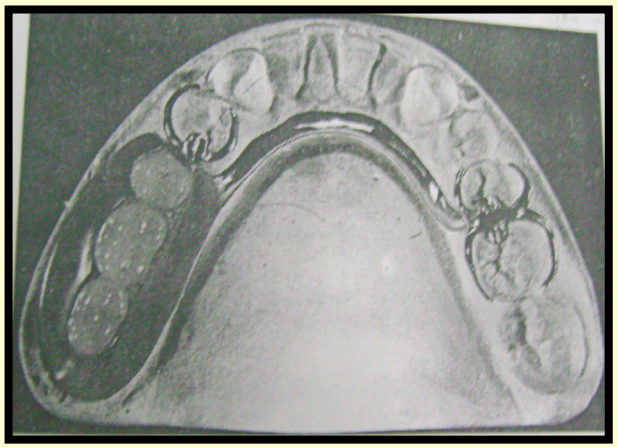
✓Movements of the class II appliance is the same as that of observed in class I appliance and in addition lateral movement of the saddle is found if unilateral design is used without contralateral bracing.



- As far as design is concerned the unilateral free end saddle dentures are divided into two groups, **depending upon the nature and length of the edentulous ridge and the condition of the abutment.**

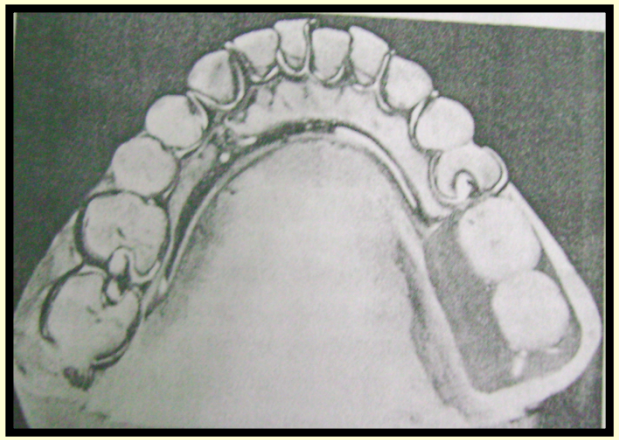
(A) The first group can be dealt with by combining relatively rigid clasping of the abutment tooth with rigid connection between the saddle and the retainer.

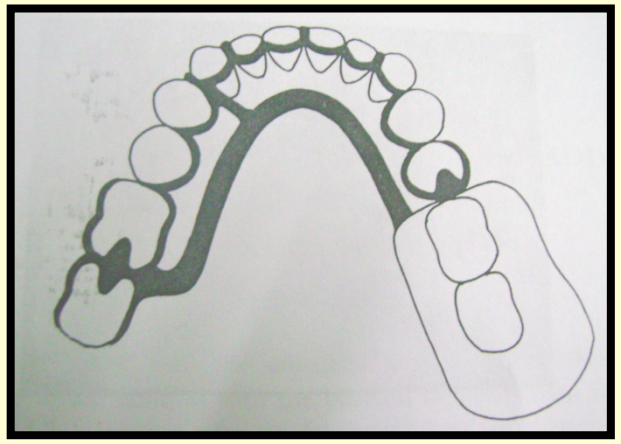
- It is indicated where the length of the saddle is short. However rigid clasping with rigid connection can be used in longer saddles provided that the abutment teeth are sound.
- When the abutment teeth are sound periodontally, the design shown as under will usually be satisfactory for Kennedy Class II dentures.



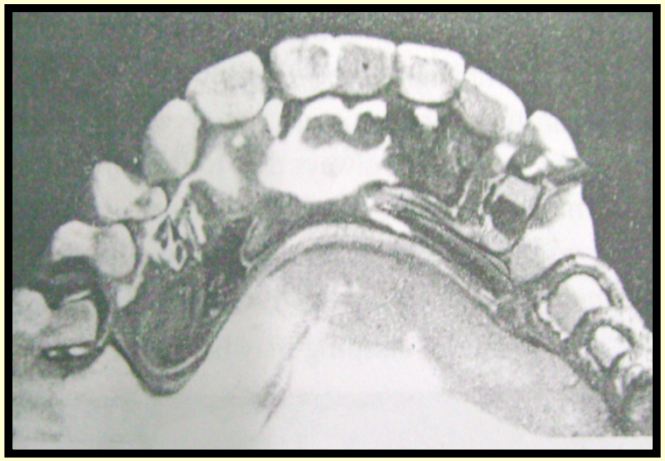
(B) The second group are less common where the condition of the abutment, length of the saddle and the displaceability of the mucosa contraindicate the rigid type of connectors.

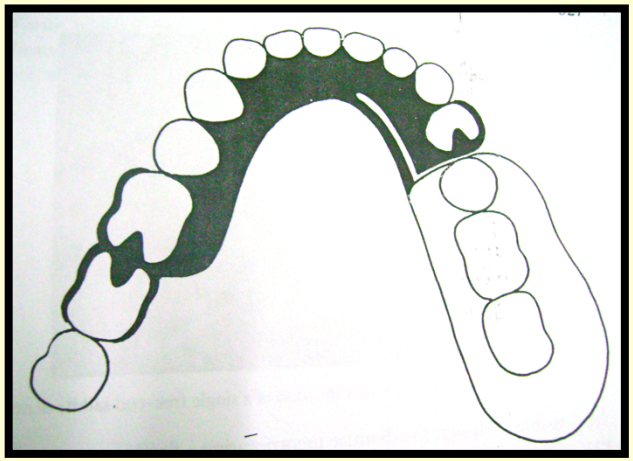
- So the treatment of choice in such cases where rigid connection is not possible the saddle and the retainer unit are connected by flexible or semi-flexible connector.
- The first design is applicable to shorter saddles by anterior placement of the occlusal rests, usually on the first premolar which is connected to the opposite side by a semi-flexible lingual bar.



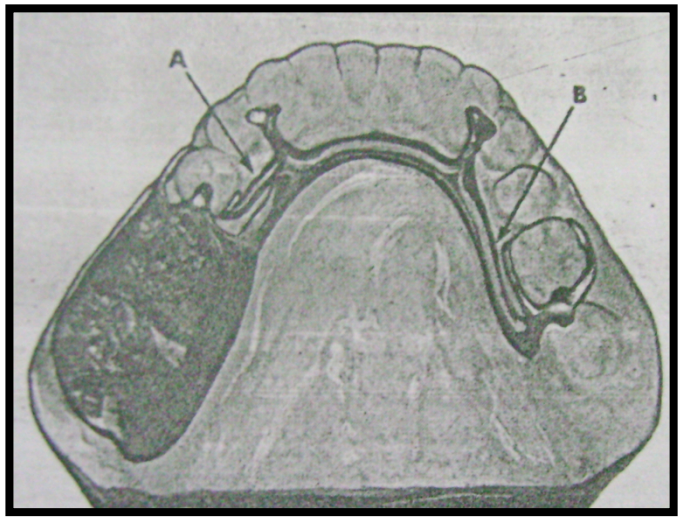


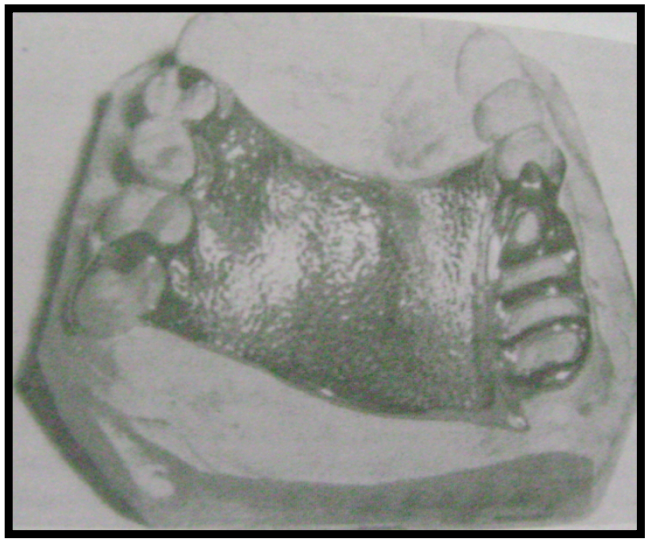
- The second design includes a split casting linguoplate. A split of appropriate length is made at the inferior border of the plate and to the lower flexible part, saddle is joined and the clasp on the same side is attached to the rigid upper part of the plate.
- However the slit has to be kept clean regularly to avoid food lodgment.

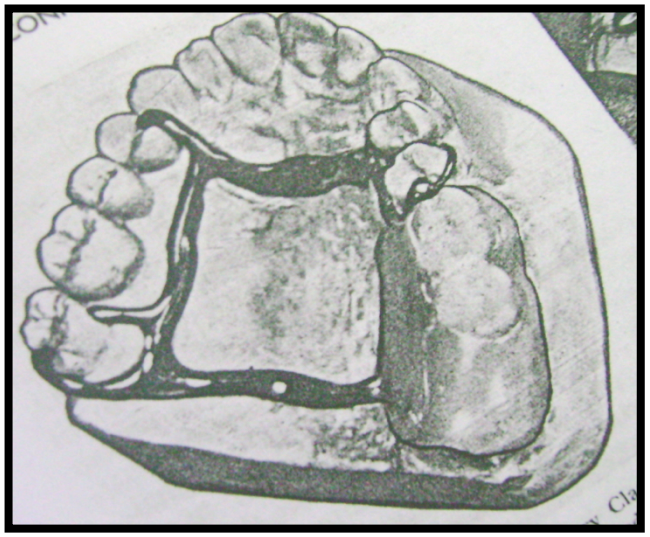




Some designs for class II partial denture







DESIGN FOR KENEDY CLASS III DENTURE (UNILATERAL BOUNDED SADDLE)

- The bounded saddle are not so common as compared to free-end saddle.
- Bounded saddles are divided into three groups according to their clinical representations:

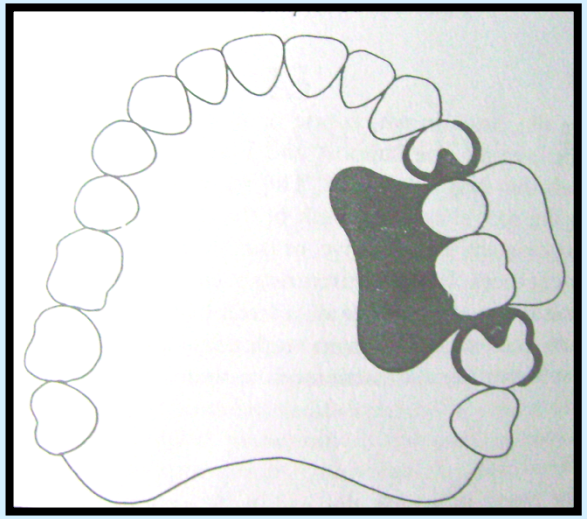
Group A:- Where saddles are short, abutment teeth are healthy and there has been minimum bone loss around the teeth.

Group B:- In which one or more abutment teeth can not provide adequate support and bracing. The saddles may be too long, excessive occlusal forces or the abutment teeth have bone loss around it.

Group C:- In which saddles are exceptionally long and one of the abutments is unable to provide any support for the denture. Example is when the terminal abutment is a third molar and anterior abutment is lateral incisor.

(A)Unilateral denture:

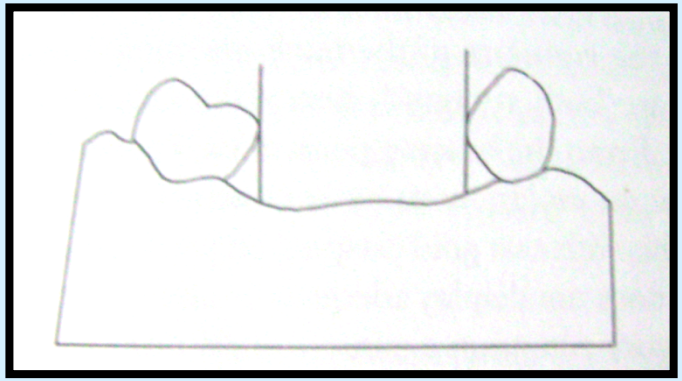
- The main feature of this design is that it covers the tissues on one side of the mouth only.
- Such and appliance however results in inadequate distribution of vertical loads so are indicated in short saddles and adequate abutment teeth are available. It also lacks the stability to lateral loads as the palatal vault is not covered.

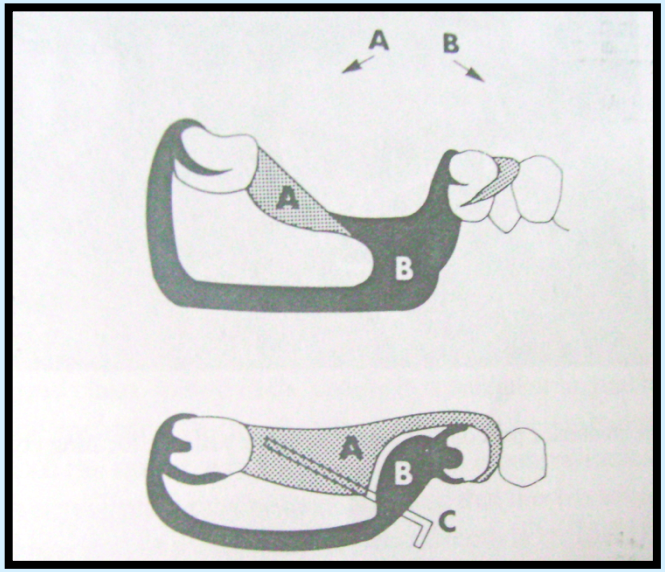


- Vertical forces applied to the denture should fall between the lines joining the rest seats. So the rest seats must be prepared wider than usual.

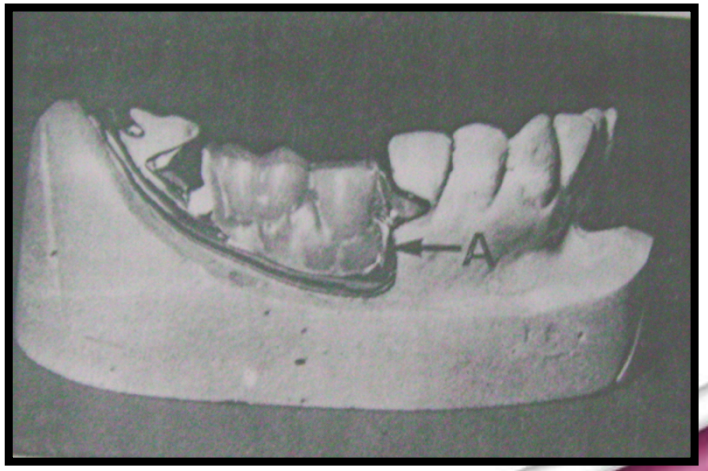
(B) The sectional denture:

- In cases with bilateral severe undercuts, the path insertion of the prosthesis can not be determined adequately, then the sectional denture design may be used.



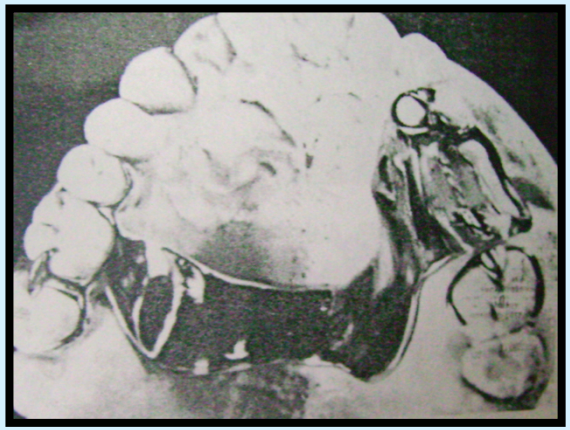


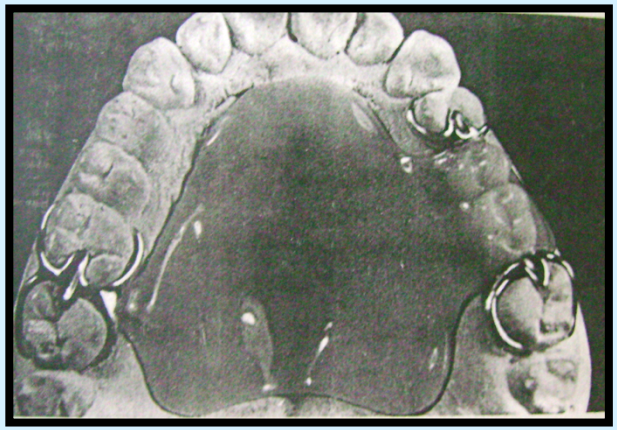
- In this case, the prosthesis is made in to two parts with different paths of insertion and then once inserted, it is secured in place with the help of locking pin.



(C) The bilateral denture:

- The bilateral denture has the advantage of increased stability and wider load distribution
- It is indicated in cases where either the crown shape, root size or periodontal condition of one or more abutments are not considered suitable for the support of a unilateral denture.
- The design for an Kennedy class III will be as under:





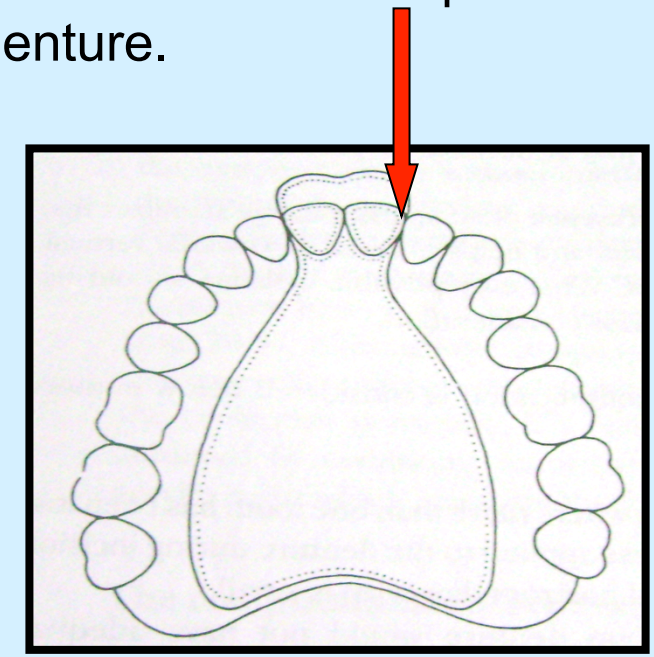
- The clasps are given on the either side of the abutment teeth and also to the opposite side of the jaw, joined to the saddle by palatal or lingual bar. A continuous clasp may be added in the design, the purpose mainly to provide resistance to lateral movements.
- If due to economical reasons the metal denture is not feasible than acrylic plate may be used.

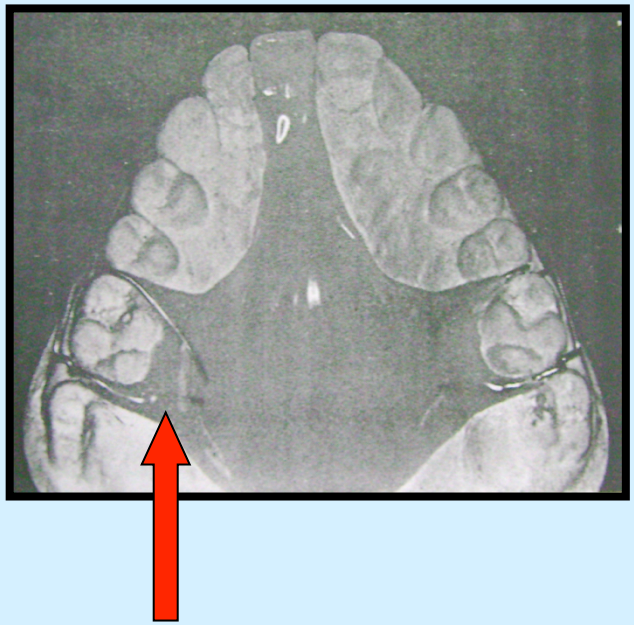
DESIGN FOR KENNEDY CLASS IV DENTURE (ANTERIOR BOUNDED SADDLE)

- A single saddle is present anterior to the abutment teeth. There are no modifications in this class but the length of the saddle varies.
- The anterior saddle is less commonly found in lower as the upper teeth are more prominent and are more prone to trauma.
- However the anterior saddle is frequently encountered in young patients so the replacement of the teeth depends upon the age of the patient.

❖Treatment for children:

- As in young children, the growth is continued, the loss of one or more anterior teeth are replaced with the help of acrylic denture or spoon denture.





- However the spoon denture displaces during function and offers less retention so they can be reinforced with the help of Adam's clasps.

❖ Treatment for young:

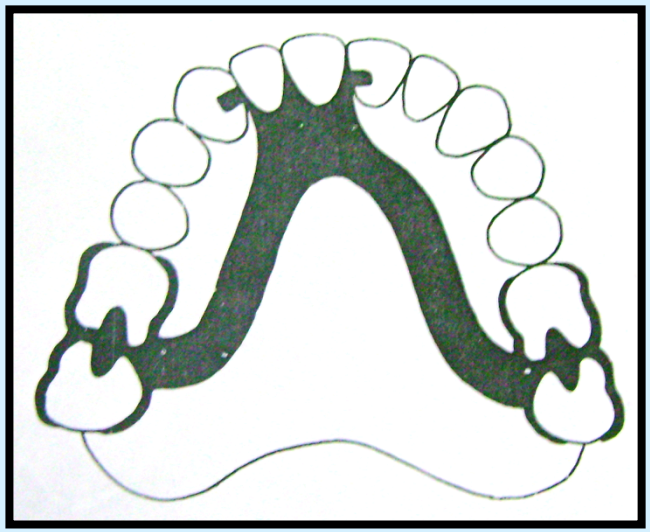
- When a stable oral condition is reached the treatment options for multiple anterior teeth loss can again be assessed.
- Although fixed partial denture is the first treatment of choice, it is contraindicated due to following reasons and the removable partial denture is the ultimate option:

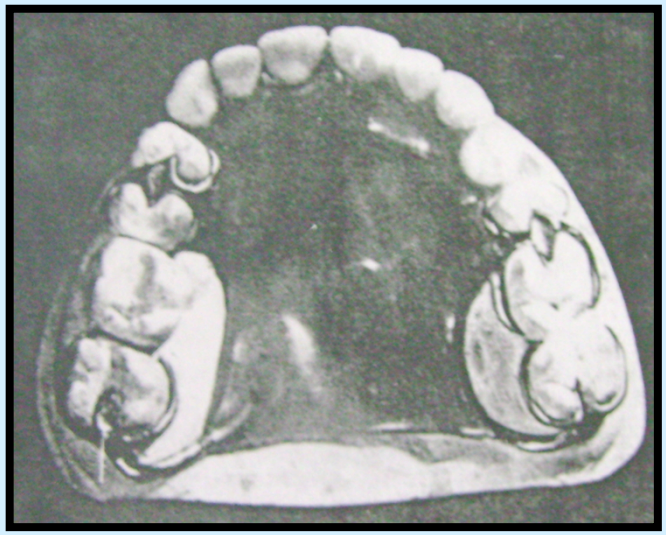
✓ Due to excessive ridge resorption

✓ Condition of the abutments are not suitable for support

✓ The length or curve of the edentulous span is too great.

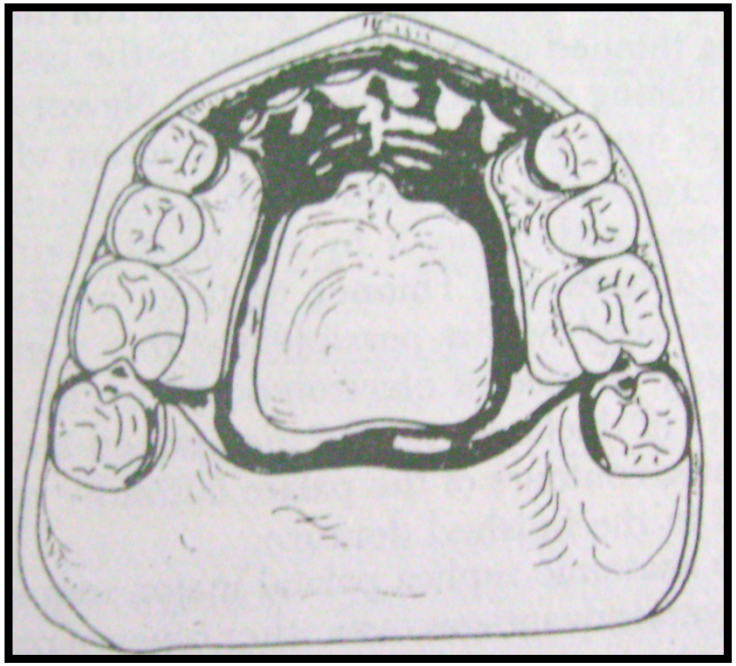
- If the saddle is short, a metal denture base design as shown is satisfactory. Indirect retention is achieved by occlusal rest posterior to the abutment teeth.





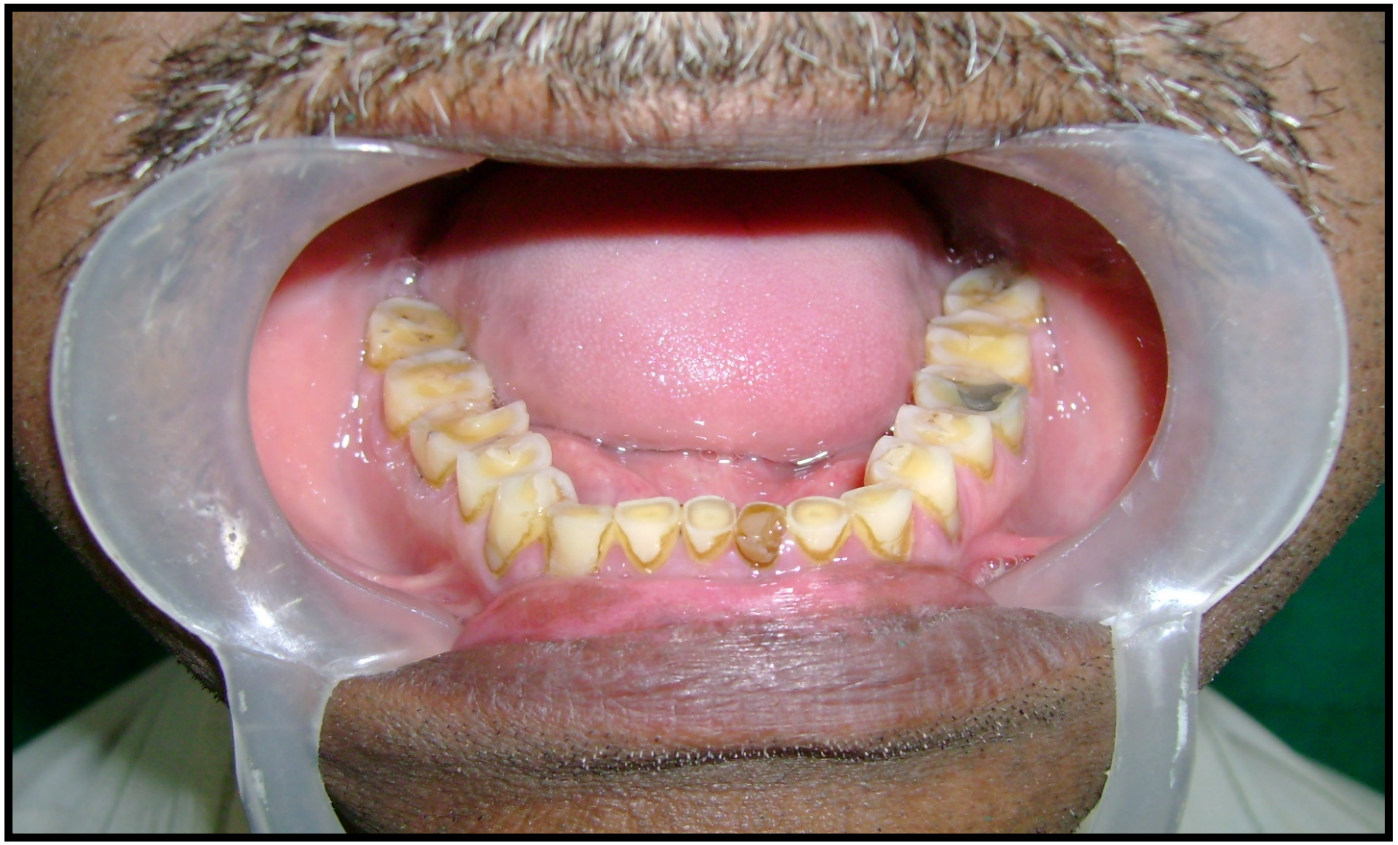
- When vertical forces are applied, a displacing rotation occurs around the fulcrum line that lies joining the most anterior abutment teeth. This displacing rotation is resisted largely by the clasping placed posteriorly to the rotatory axis.
- The more posteriorly the clasping is placed, the greater is the retention of the appliance.

Some designs for class IV partial denture



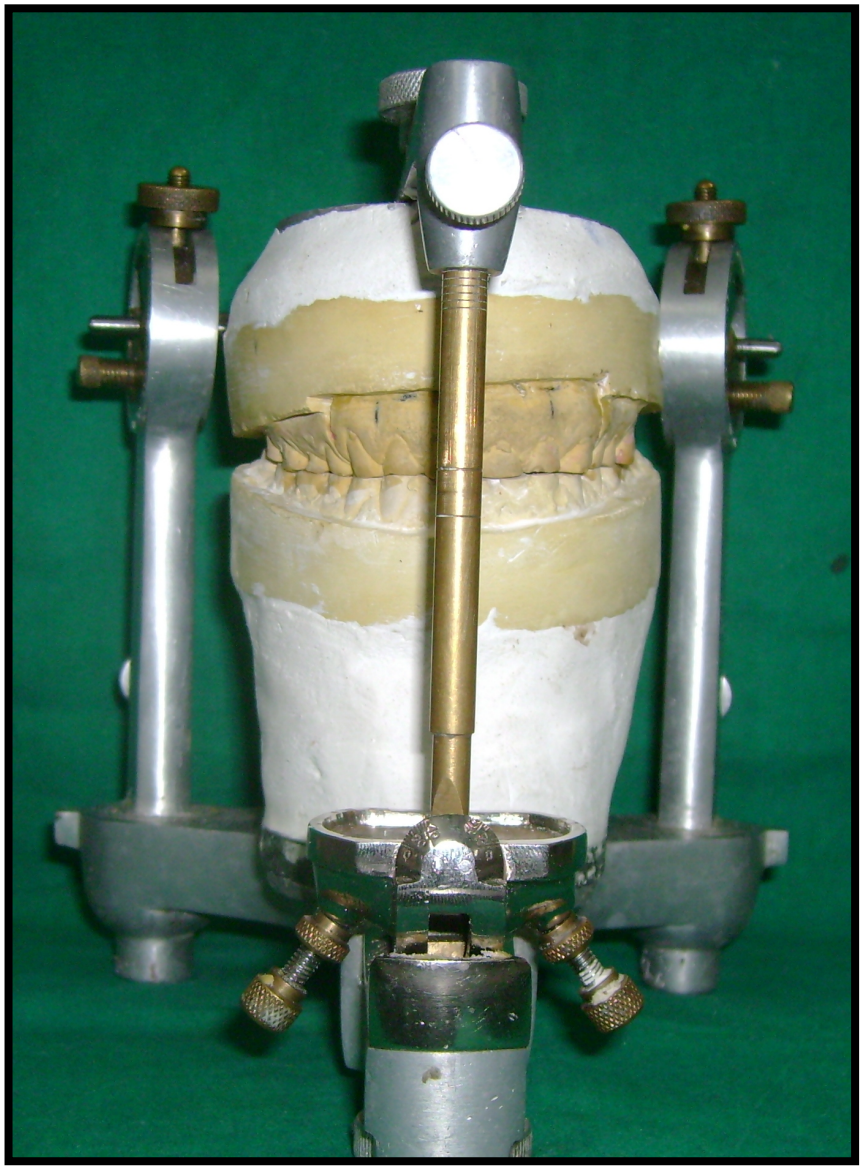
FULL MOUTH REHABILITATION BY HOBO'S TWIN TABLE TECHNIQUE

PRETREATMENT

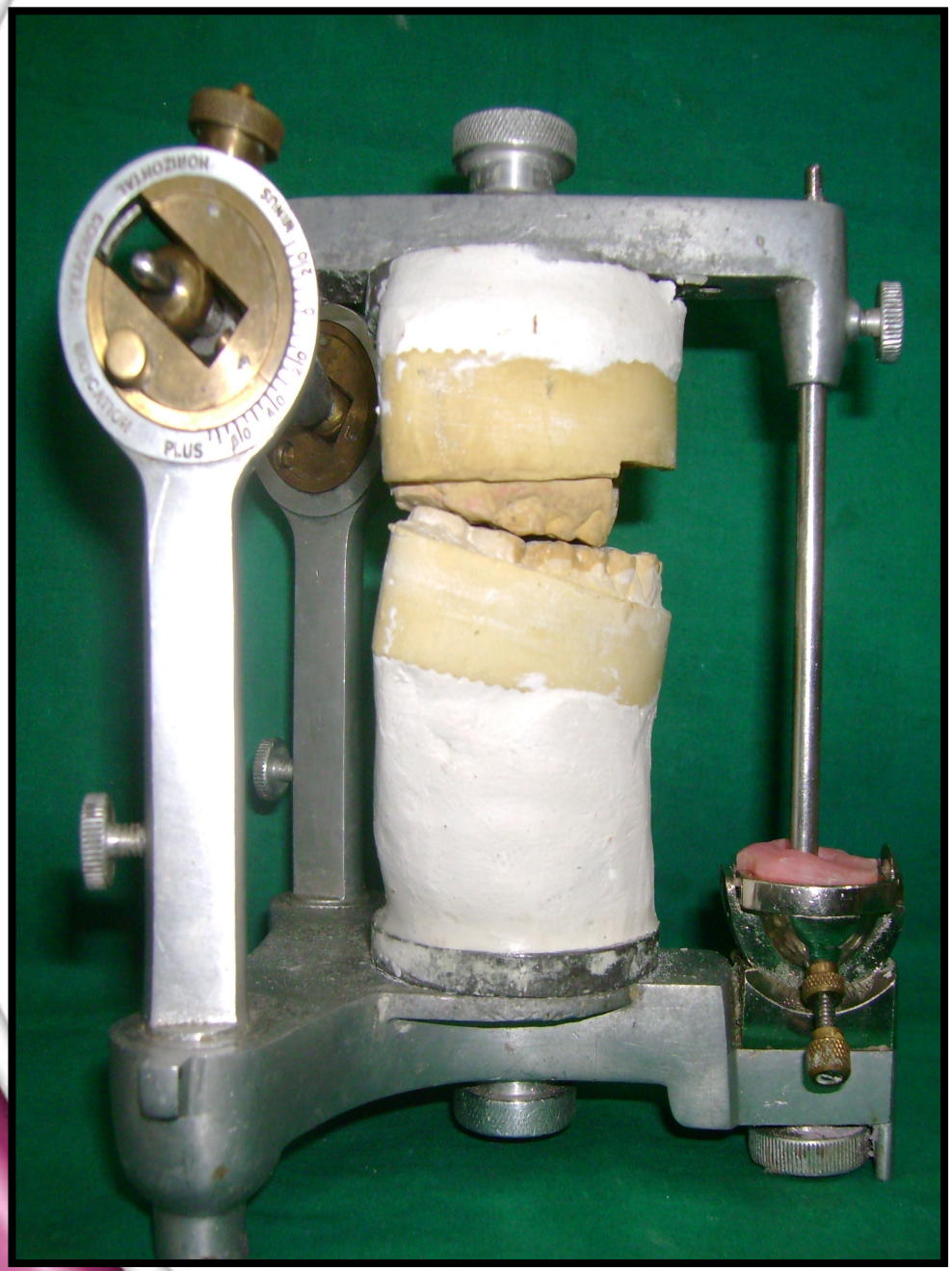


PRETREATMENT

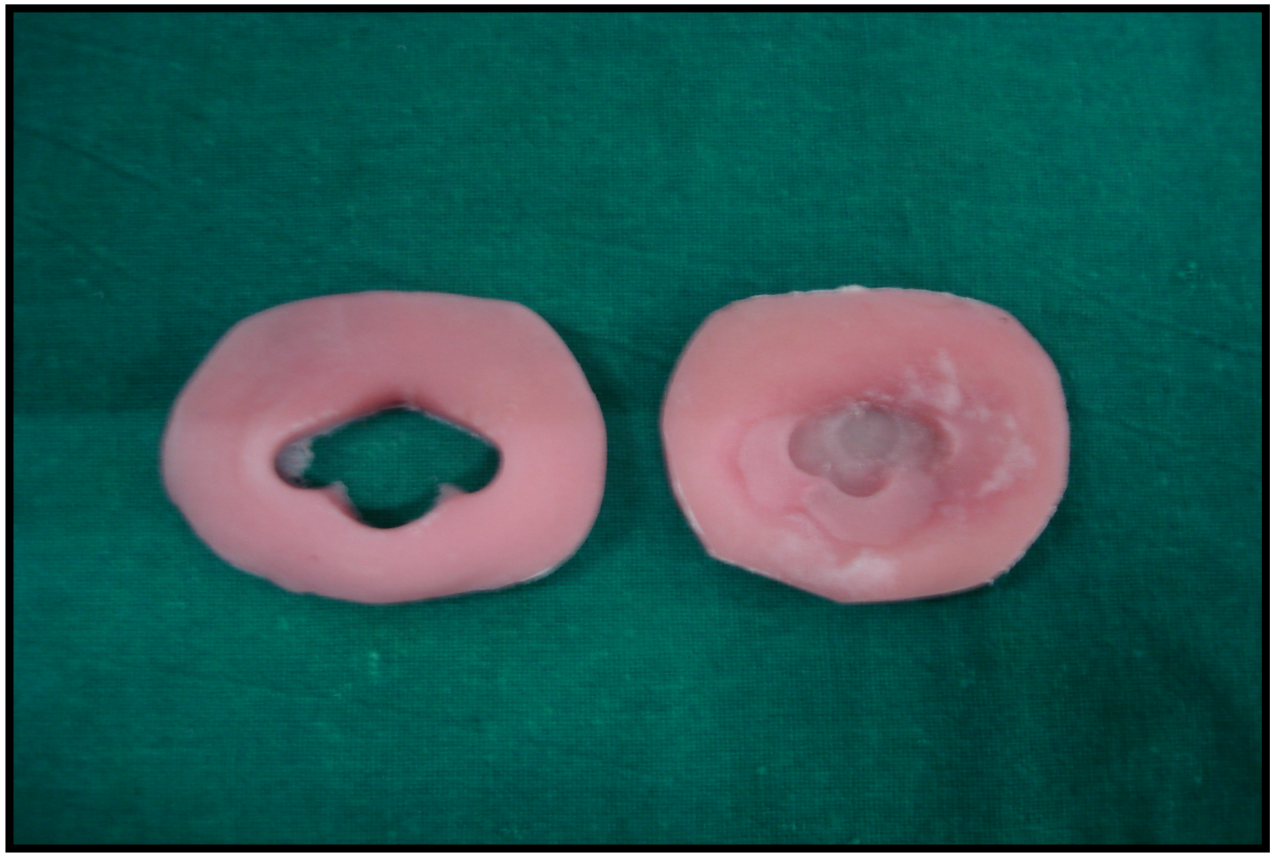
PRETREATMENT OCCLUSION



DIAGNOSTIC MOUNTING



PROTRUSIVE RECORD

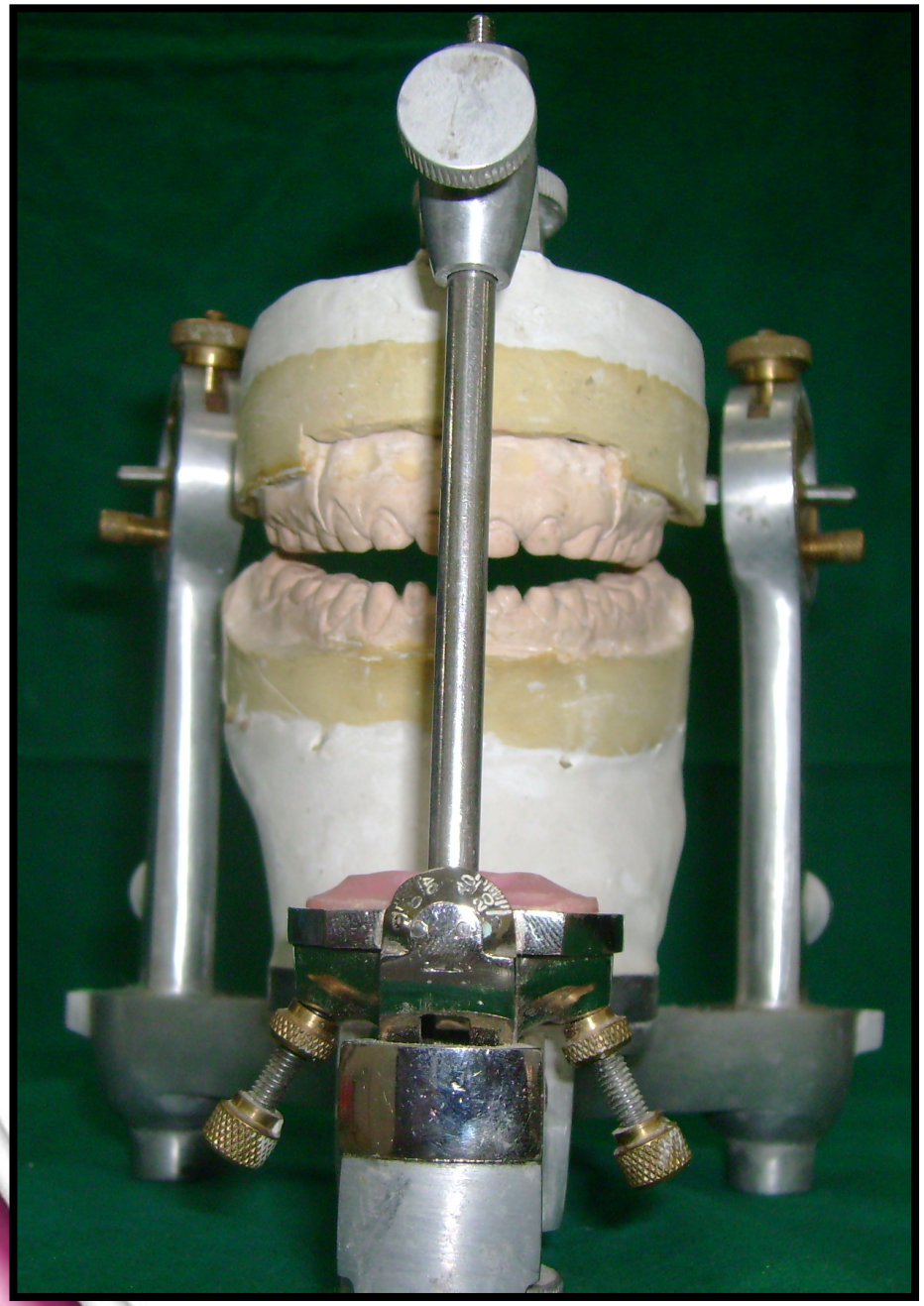


THREE DIMENSIONAL INCISAL RECORDS

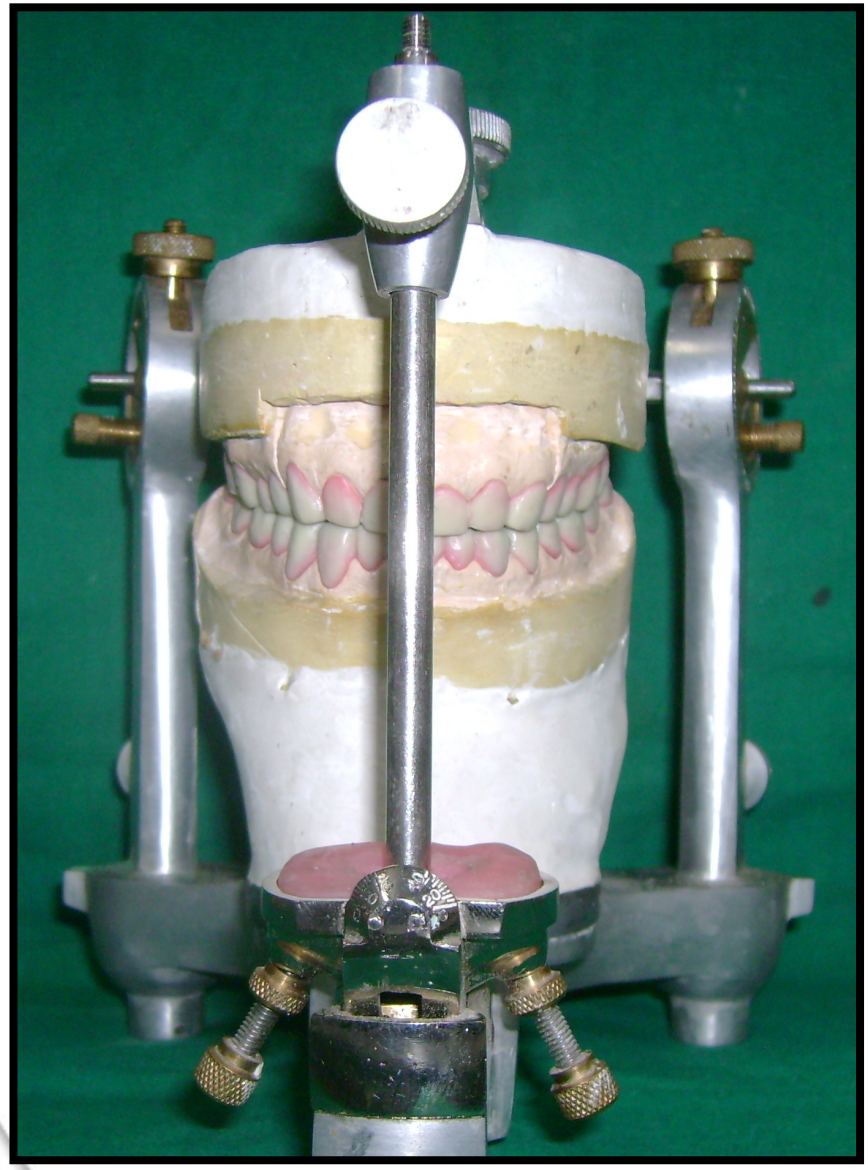
TOOTH PREPARATION

FINAL IMPRESSION IN RUBER BASE MATERIAL

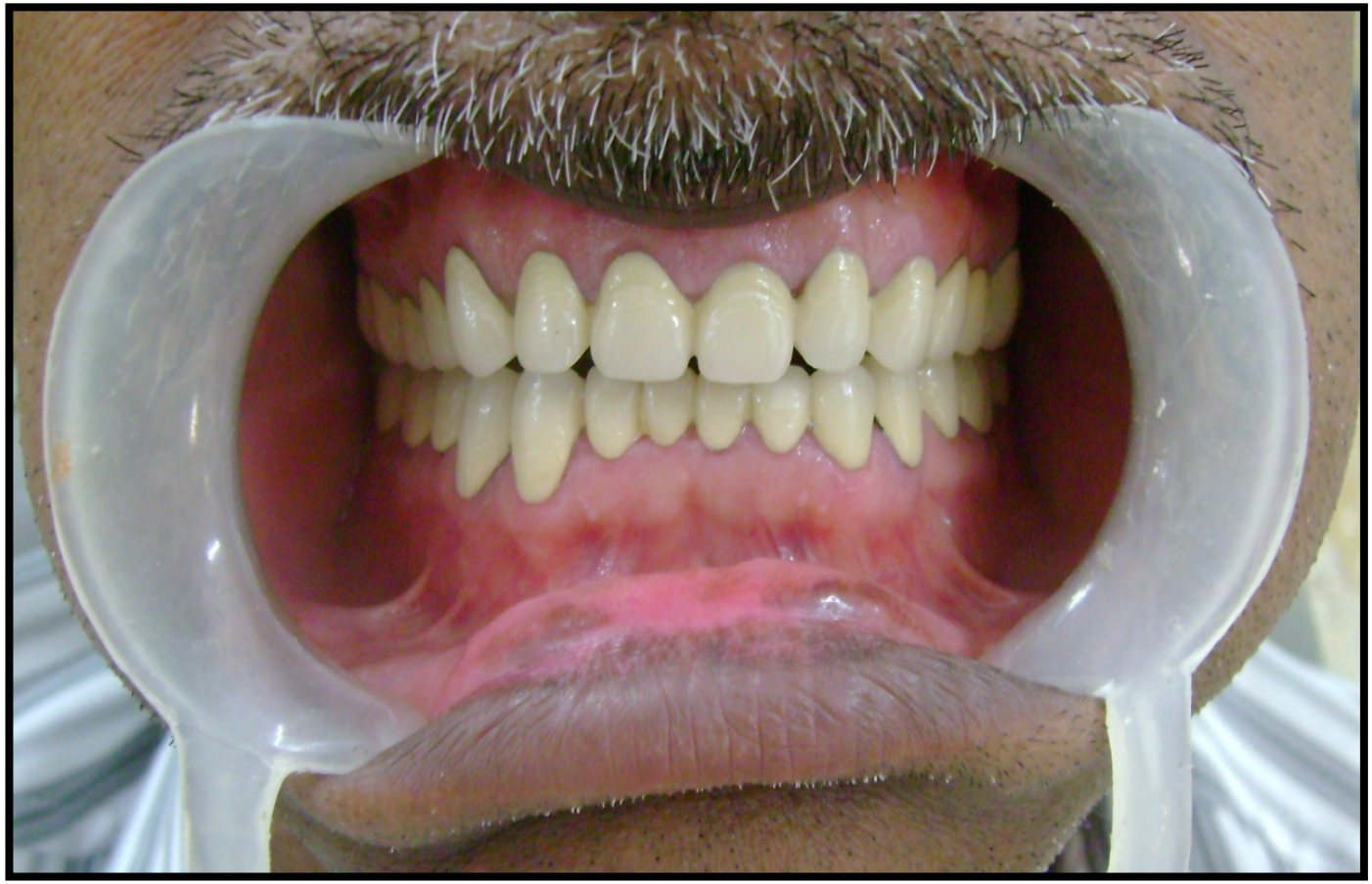
TEMPORARY CROWNS CEMENTED



FINAL MOUNTING



WAX PATTERN TRIAL



FINAL PROSTHEIS CEMENTED

PRE-TREATMENT

POST-TREATMENT

PRE-TREATMENT

POST-TREATMENT


THANKYOU