Support for the distal extension denture base

Support: resistance to vertical components of masticatory force in a direction toward the basal seat

All partial dentures have two things in common:

1- They must be supported by oral structures.
2- They must be retained against reasonable dislodging forces.

Designing Support

a- *Tooth support*: When abutment teeth available at both ends of the denture base (bounded saddle). It most commonly obtained by occlusal rests.

b- *Mucosal support*: (mucoperiosteum covering residual alveolar bone). It allows varying degree of displacement.

The amount of displacement (tissue ward movement) will depend on:

1- The amount of pressure applied.
2- The nature of the mucosa (thickness).
3- Area covered by the denture(the wider the area the less the displacement).
4- Fit of the denture base.
5- Type of impression(anatomical, functional, or selective pressure).

c- *Tooth-mucosa support:* (Bilateral free end saddle).

Posterior tissue support and anterior tooth support. In the class III PD three components are necessary, support provided by rests, the connectors (stabilizing components) and the retainers. An anatomical impression is the only needed to record the anatomic form of the teeth and residual ridge in tooth born RPD.

- The distal extensions PD does not have the advantage of total tooth supported because one or more bases are extensions covering the residual ridge distal to the last abutment, but in this situation, the support comes from both the teeth and the underlying ridge tissues rather than from teeth alone.
- This is a composite support, and the prostheses must be fabricated so that the resilient support provided by the edentulous ridge is coordinated with the more stable support offered by the abutment teeth.
- The distal extension removable partial denture must depend on the residual ridge for some support, stability, and retention. Indirect retention, to prevent the denture from lifting away from the residual ridge, should also be incorporated in the design.

In addition provision must be made for three other factors:

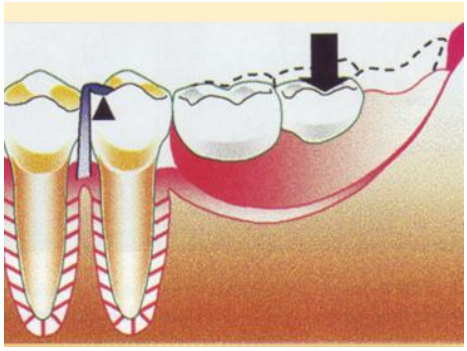
1- Best support must be obtained from the resilient tissues that cover the edentulous ridges. This is accomplished by the impression technique more than by the PD design. The area covered by the pd base is a factor in such support.

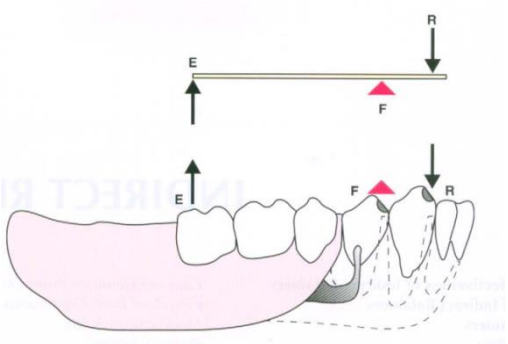
2- The method of direct retention must take into account the inevitable tissueward movement of distal extension base(s) under the stress of mastication and occlusion. Direct retainers must be designed so that the occlusal loading will result in the direct transmission of this load to the long axis of the abutment teeth.

3- The PD, with one or more distal extension denture bases, must be designed so that movement of the unsupported and unretained end away from the tissues will be prevented by indirect retainer.

The main problems which might occur in tooth-tissue support are:

1- Mucosa is resilient and displaceable and can lead to unstable prostheses.
2- Difficult to record mucosa at resting and at displaced condition simultaneously.
3- In distal ERPD under function compresses the mucosa and act as class I lever thus it cause damaging to the abutment teeth, the solution is to record tissue in the functional form so the denture not exert additional stress to the abutment teeth.



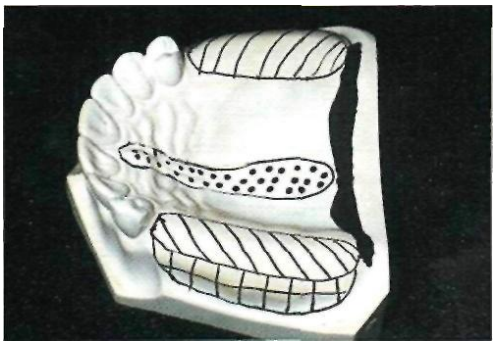


Factors influencing the support of a distal extension denture base

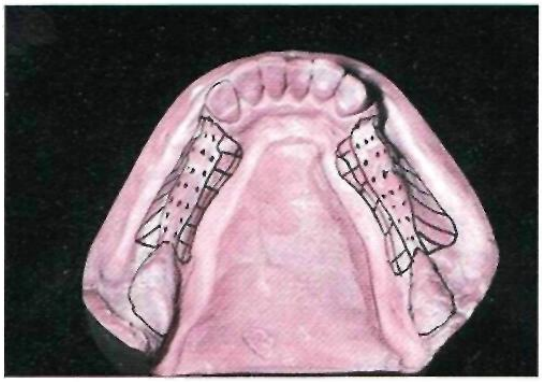
1- Quality of the residual ridge.
2- Extent of residual ridge coverage by the denture base.
3- Type and accuracy of impression registration.
4- Accuracy of denture base.
5- Design of the partial frame work.
6- total occlusal load applied,

1-Quality of the residual ridge for good support.

- The ideal residual ridge to support a denture base would consist of cortical bone that covers relatively dense cancellouse bone with abroad rounded crest and high vertical slopes, and covered by firm, dense fibrous connective tissue.
- Buccal shelf area (bounded by the external oblique line and crest of alveolar ridge) in the lower ridge as primary stress bearing area, because it is covered by relatively firm, dense, fibrous connective tissue supported by cortical bone, while the crest is mostly cancellous not good for support. While in maxillary ridge the crest is primary stress bearing area. *should be hard palate according to the book Prosthodontics treatment of edentulous patient p. 213. it says, "The crest of the edentulous ridge is an important area of support. However, the bone is subject to resorption, which limits its potential for support, unlike the palate, which is resistant to resorption. Because of this, the ridge crest should be looked on as a secondary supporting area, rather than a primary supporting area"*
- Slopes of the ridge can resist horizontal forces.



Crest of maxillary residual ridge *(diagonal lines/* is primary supporting region for maxillary distal extension denture base. Buccal and palatal slopes may furnish limited vertical support to denture base. It seems logical that their primary role is to counteract horizontal rotational tendencies of denture base. *Dotted portion* outlines incisive papilla and median palatal raphe. Relief must be provided for these regions, especially if tissues covering palatal raphe are less displaceable than those covering crest of residual ridge.



Dotted portion outlines cresi of residual ridge, which should be recorded in its anatomic form in impression procedures. Similarly, retromolar pads should not be displaced by impression. Buccal shelf regions *(diagonal lines'* serve as primary support and therefore additional pressures may be placed on these regions for vertical support of denture base. Lingual slopes of residual ridge *tcross-hatched)* may furnish some vertical support to restoration; however, these regions principally resist horizontal rotational tendencies of denture base and should be recorded by impression in undisplaced form.

2- Extent of residual ridge coverage by the denture base.

The broader the residual ridge coverage the greater the distribution of the load, which results in less load per unit area. A denture base should cover as much of the residual ridge as possible and be extended the maximum amount within the physiological tolerance of the limiting border structures or tissue lead to better distribution of load and better withstanding of vertical and horizontal forces.

The longer the edentulous area covered by the denture base, the greater the potential lever action on the abutment teeth.

- Flat ridge will provide good support, poor stability.
- Sharp spiny ridge will provide poor support, poor to fair stability.
- Displaceable tissue on ridge will provide poor support and poor stability.

The DERPD derives its support from the residual ridge with its fibrous connective tissue covering. The length and contour of residual ridge significantly influence the amount of available support and stability.

Comparison of two removable partial dentures for same patient. A, A distal extension base that is adequately extended, as it covers both the buccal shelf and retromolar pad. B, Underextension of this base results in less support to the prosthesis from the residual ridge, which can cause increased instability of the prosthesis.

3-Type and accuracy of impression registration.

The residual ridge may be said to have two forms:

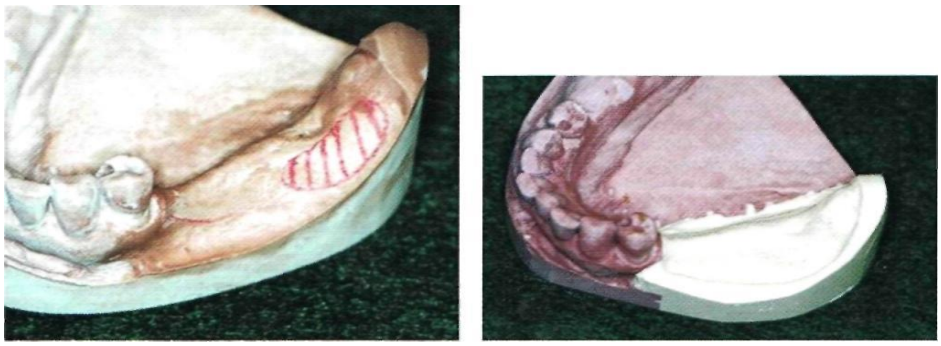
1- The anatomic form: The anatomic form is the surface contour of the ridge when it is not supporting an occlusal load. The anatomic form and the relationship of the remaining teeth in the dental arches, as well as the surrounding soft tissue, must be recorded accurately so that the denture will not exert pressure on those structures.

2- The functional form of the residual ridge is the surface contour of the ridge when it is supporting a functional load. The support form of the soft tissues underlying the DE base of the PD should be recorded so that firm areas are used as primary stress- bearing areas and readily displaceable tissues are not over loaded, only in this way can maximum support of the PD base be obtained.

*McLean and others recognized the need to record the tissue that supports a distal extension removable partial denture base in its functional form, or supporting state, and then relate them to the remainder of the arch by means of a secondary impression. This was called a functional impression because it recorded the ridge relation under simulated function.

Many of the requirements and advantages that are associated with the distributed stress denture apply equally well to the functionally or physiologically based denture. Some of these requirements are:

(1) Positive occlusal rests; (2) An all-rigid, nonflexible framework; (3) Indirect retainers to acid stability; and (4) Well-adapted, broad coverage bases.



Comparison of anatomic and functional ridge forms. A, Original mandibular cast showing left residual ridge area recorded in its anatomic form. Buccal shelf region is outlined. B, Same cast after left residual ridge area has been repoured to its functional form as recorded by secondary impression.

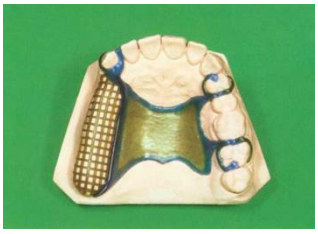
4- accuracy of denture base.

- Distal extension base is enhanced by intimacy of contact of the tissue surface of the base and the tissue that covers the residual ridge. The tissue surface of the denture base must optimally represent a true negative of the basal seat regions of the master cast.
- In addition, the denture base must be related to the removable partial denture framework in the same manner as the basal seat tissue was related to the abutment teeth when the impression was made. Every precaution must be taken to ensure this relationship when the altered cast technique of making a master cast is used.

5- design of the the partial frame work.

- Some rotation movement of a distal extension base at the distal abutment is inevitable under functional loading.
- The greatest movement takes place at the most posterior extent of the denture base, the retromolar pad region of the mandibular residual ridge and the tuberosity region of the maxillary residual ridge therefore are subjected to the greatest movement of the denture base
- Use of more anterior or mesial rest is suggested as it allow vertical ridge loading, permit greater ridge area for support, transfer stress to anterior abutment.

- Incorporation of indirect retainer.
- Incorporation of RPI system in free end suddle which make stress release.



A typical framework for restoring a unilaterally shortened maxillary arch. A maximally extended denture base combined with a wide palatal strap helps resist rotation

Occlusal rest is placed on mesioocclusal surface of left mandibular first premolar, which will move point of rotation anterior to conventionally placed disto-occlusal rest if contact of proximal minor connector on distal guiding plane is designed to release under function. Occlusal rest is connected to lingual bar by minor connector, which contacts small mesiolingual prepared guiding plane.

6. total occlusal load applied,

- Patients with distal extension removable partial dentures generally orient the food bolus over natural teeth rather than prosthetic teeth, because of:
  1-) The more stable nature of the natural dentition.
  2-)The proprioceptive feedback they provide for chewing, and
  3-) the possible nociceptive feedback from the supporting mucosa.
- This has an effect on the direction and magnitude of the occlusal load to the removable partial denture, and thus on the load transferred to the abutments.
- The support from the residual ridge should be optimized and shared appropriately with the remaining natural dentition.
- The ***number*** of artificial teeth, the ***width*** of their occlusal surfaces, and their ***occlusal efficiency*** influence the ***total occlusal load*** applied to the removable partial denture.
- The ***reduction of the size of the occlusal table reduces the vertical and horizontal forces*** that act on the removable partial dentures and lessens the stress on the abutment teeth and supporting tissue.

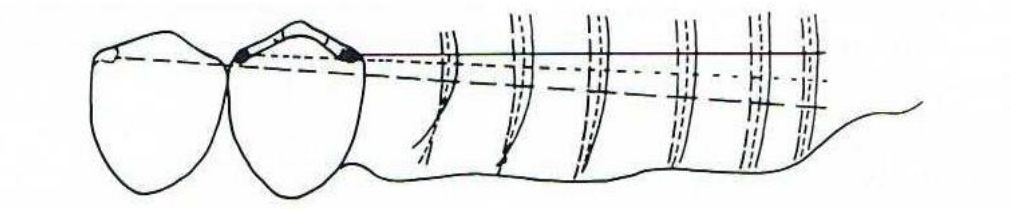


Figure 16-6 If rotation of distal extension base occurs around nearest rest; as rest is moved anteriorly, more of residual ridge will be used to resist rotation. Compare vertical arcs of long-dash broken line with arcs of solid line. (See also Figure 10-4.)

ANATOMIC FORM IMPRESSION

* The anatomic form impression is a one-stage impression method using an elastic impression material that will produce a cast that does not represent a functional relationship between the various supporting structures of the partially edentulous mouth. It will only represent the hard and soft tissue at rest.

* With the removable partial denture in position in the dental arch, the occlusal rest(s) will fit the rest seat(s) of the abutment teeth, whereas the denture base(s) will fit the surface of the mucosa at rest.

* When a masticatory load is applied to the extension base(s) with a food bolus, the rest(s) will act as a definite stop, which will limit the part of the base near the abutment tooth from transmitting the load to the underlying anatomic structures.

* The distal end of the base(s) that is able to move more freely, however, will transmit more of the masticatory load to the underlying extension base tissue and will transmit more torque to the abutment teeth through the rigid removable partial denture framework.

* A removable partial denture fabricated from a one-stage impression, which only records the anatomic form of basal seat tissue, places more of the masticatory load on the abutment teeth and that part of the bone that underlies the distal end of the extension base.

METHODS FOR OBTAINING FUNCTIONAL SUPPORT FOR THE DISTAL EXTENSION BASE

The objective of any functional impression technique is to provide maximum support for the removable partial denture bases.

- This allows for the maintenance of occlusal contact between both natural and artificial dentition.
- Minimum movement of the base, which would create leverage on the abutment teeth.
- Some tissueward movement of the distal extension base is unpreventable and dependent on the six factors listed previously, it can be minimized by providing the best possible support for the denture base.
- No single impression material can record both the anatomic form of the teeth and tissue in the dental arch and, at the same time. The functional form of the residual ridge. Therefore some secondary or corrected impression method must be used.
- Methods for obtaining functional support for either should satisfy the two requirements for providing adequate support to the distal extension removable partial denture base. These are (**1**) that it records and relates the supporting soft tissue under some loading and (**2**) that it distributes the load over as large an area as possible.

Selective Tissue Placement Impression Method

- Soft tissue that covers basal seat areas may be placed, displaced, or recorded in their resting or anatomical form. Placed and displaced tissue differs in the degree of alteration from their resting form and in their physiological reaction to the amount of displacement. For example, the palatal tissue in the vicinity of the vibrating line can be slightly displaced to develop a posterior palatal seal for the maxillary complete denture and will remain in a healthy state for extended periods. On the other hand, this tissue develops an immediate inflammatory response when it has been overly displaced in developing the posterior palatal seal.
- Oral tissues that have been overly displaced or distorted attempt to regain their anatomic form. When they are not permitted to do this by the denture bases, the tissues become inflamed and their physiological functions become impaired, accompanied by bone resorption. Tissues that are minimally displaced (placed) by impression procedures for definitive border control respond favorably to the additional pressures placed on them by the resultant denture bases if these pressures are intermittent rather than continuous.
- ***The selective tissue placement impression method*** *is based on these* ***clinical observations****:*
    1. the histological nature of tissue that covers the residual alveolar bone.
    2. the nature of the residual ridge bone.
    3. and its positional relationship to die direction of stresses that will be placed on it.

It is further believed that by use of specially designed individual trays for impressions, denture bases can be developed that will use those portions of the residual ridge that can withstand additional stress and at the same time relieve the tissue of the residual ridge that cannot withstand functional loading and remain healthy.

The framework try-in

*****Since the goal is to maximize soft tissue support and also use teeth to their supportive advantage, the framework fitted to the teeth while registering soft tissue support is a means to coordinate both. This means that ***before the trays are attached, the framework must be fitted in the mouth.***

***** If the master cast is an exact likeness of the mouth, then every metal casting which has been fitted to the master cast accurately can be seated to its resting position in the mouth. ***** However, when long delays occur between the time of impression making and the framework try-in minor tooth movements may occurred and the teeth may resist the free placement of the framework, in accurate master casts, and defective

casting, also produce impediments to the seating produce, laboratory errors in the framework.

***** No artificial teeth, trays or denture base should be added to the metal until the casting is adjusted and physiologically relieved.

Prior to patient's appointment, the framework should be removed from the master cast and evaluated for:-

1- Nodules inside the clasps.
2- Nodules inside the guide planes.
3- Nodules inside the minor connectors.
4- Sharp edges which may lacerate the oral mucosa.
5- Roughness of metal from blockout procedure.
6- Proper polish to tissue surfaces.

* Nodules should be removed with stone burs, these areas then be smoothed with rubber disks and cones, after that check the master cast for signs of abrasion from injudicious seating of the framework.

* During the initial seating or insertion in patient mouth, don't use excessive force to seat the framework immediately. Gradual seating and searching for interferences, it should expect minor positional changes of the abutments have occurred.

Materials which can be used to detect interferences to seating are:-

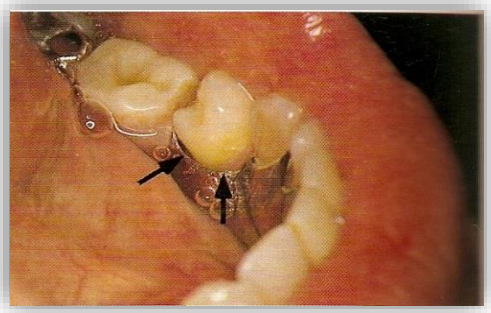
1. Pressure indicating paste.(pip)
2. Disclosing wax or kerr's impression wax.
   - Remove internal interferences until the framework is fully seated into the rest preparations.
   - After the metal framework is fully seated into the rest preparations, are placed in the mouth and checked for occlusal equilibrium by using ***articulating paper***. When both maxillary and mandibular restorations are being constructed they should first be inserted and equilibrated independently. Then both framework are placed in the mouth and checked to insure occlusal harmony with each other.

The metal framework requirements

1- The framework must confirm to the original design.
2- The framework must fit the master cast; if the fit is unsatisfactory on the cast it will also be unsatisfactory in the mouth.
3- All components which are designed to be clear of the gingival margin area should be checked to insure that the clearance is adequate.
4- In the mouth, these aspects should be checked again, remembering that the likelihood of some instability in free end saddle cases may be due to spacing beneath the mesh retention.

5- The occlusion is examined to ensure that there are no premature contacts caused by support units. This should be done by visual examination, from comments by the patient and with the use of articulating paper or disclosing wax. Any premature contact should normally remove at this stage, and if slight, can be adjusted at the delivery stage.

The design as drawn and then executed in the metal framework



In general fitting the framework involves the following steps:

1. Use of a disclosing media to identify interferences to completely seating the removable partial denture framework
2. Use of disclosing media to identify the appropriate contact(s) of the component parts of the framework during the seating of the framework and when the framework is completely seated in its designated terminal position
3. Adjusting the seated framework to the opposing occlusion

* If there are opposing frameworks, the maxillary framework is removed from the mouth and the mandibular framework is adjusted to the natural maxillary dentition. Then the maxillary framework is replaced and it is adjusted to the mandibular dentition with its framework in place. It is important to remember that the metal frameworks must allow all of the natural dentition to maintain the same designed contact relationship with the opposing arch as when the frameworks are out of the mouth. After the framework has been fitted and the custom trays have been attached, the selective tissue placement impression and cast formation can be accomplished.

The framework must be evaluated to assure complete seating, full contact with the remaining dentition for stabilization, support, and retention as planned, and to allow full natural tooth contact. A, Several types of disclosing media may be used, such as stencil correction fluid, rouge and chloroform, and disclosing fluids, pastes, and waxes. Here, a spray disclosing medium has been applied and the framework is placed with mild pressure. Incomplete seating is seen when the framework binds. It is imperative that the framework not be forced to place at this initial seating. B, Upon removal it is seen that a portion of the proximal plate is preventing complete seating. C, The framework is carefully adjusted since over-adjustment can result in a poorly adapted framework.

D 

 E

Cont'd D, The framework is seen to completely seat following adequate adjustment. This may require disclosing and careful adjustment repeated times; however, if improvement is not seen with each framework modification there should be a concern regarding frame accuracy. E, Following complete seating and verification of appropriate tooth contacts by component parts (i.e., rests, proximal plates, stabilizing components) the occlusion must be checked and the framework adjusted until natural tooth contacts that exist without the framework seated are achieved with the framework in place. All adjusted regions can be carefully polished with rotary rubber points.

The Altered Cast Technique

- The altered cast method of impression making is most commonly used for the mandibular distal extension partially edentulous arch (Kennedy Class I and II arch forms).
- Altered cast impression methods are seldom used in the maxillary arch because of the nature of the masticatory mucosa and the amount of firm palatal tissue present to provide soft tissue support.
- The altered cast technique allows for the different compressibility of different parts of the mucosa, and ensures that an even pressure is applied everywhere when force is applied.
- An impression of the saddle area is taken while it is under light pressure. The stiff bits of mucosa (e.g. over the ridge) will be hardly deformed at all, but the fatty soft bits (e.g. the pear shaped pad) will be squeezed flatter and flatter until they offer the same resistance as the stiff bits.
- Cast partial denture made using the altered cast impression technique helps create an environment in which the teeth and the edentulous tissues support the base as compatibly as possible. ***The result is a potentially more stable RPD that improves the support for the occlusal relationship of the opposing dentition and the RPD restoration.***

- However, this technique has the potential ***benefits*** of ***reducing the number of postoperative visits***, ***preserving the residual ridges***, ***improving stress distribution, decreasing food impaction and decreasing the torquing of abutment teeth.*** All of which ***lead to increased patient satisfaction***.

Purpose of altered cast technique:

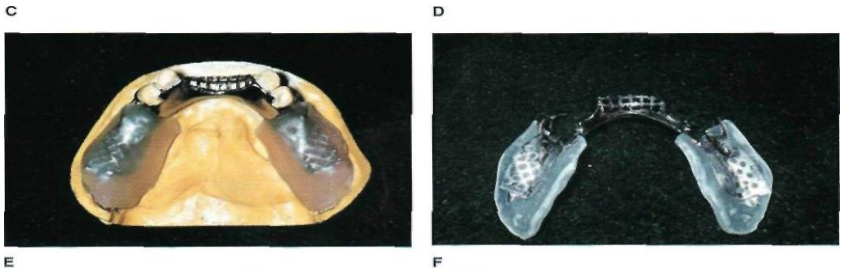
1. ***Impression is used to modify master cast***
2. ***More accurate relationship between abutments & ridge***
3. ***Equalize stress between ridge and abutments***
4. ***Correct peripheral adaptation***

- In this technique the ***master cast*** is made first using ***anatomical impression technique***
- This ***anatomical cast*** is then after ***checking the metal framework*** in class one and two is altered according to ***functional impression***, which is made later.
- The amount of pressure exerted by the mucocompressive impression is not under measurable control to suit each patient's individual need. It is very difficult to tell whether pain is being caused by the fitting surface or the occlusion. If the pain is localized, it is usually the fitting surface, but it could be due to rotational movement of the saddle (i.e. occlusion).

Mandibular metal framework seated on final cast

A B

Secondary impression for distal extension mandibular removable partial denture is made using individual trays attached to distal extension minor connectors of removable partial denture framework. A, Framework has been tried in and fitted to the mouth. B, The cast has had the tray outline marked to outline the tray extension.

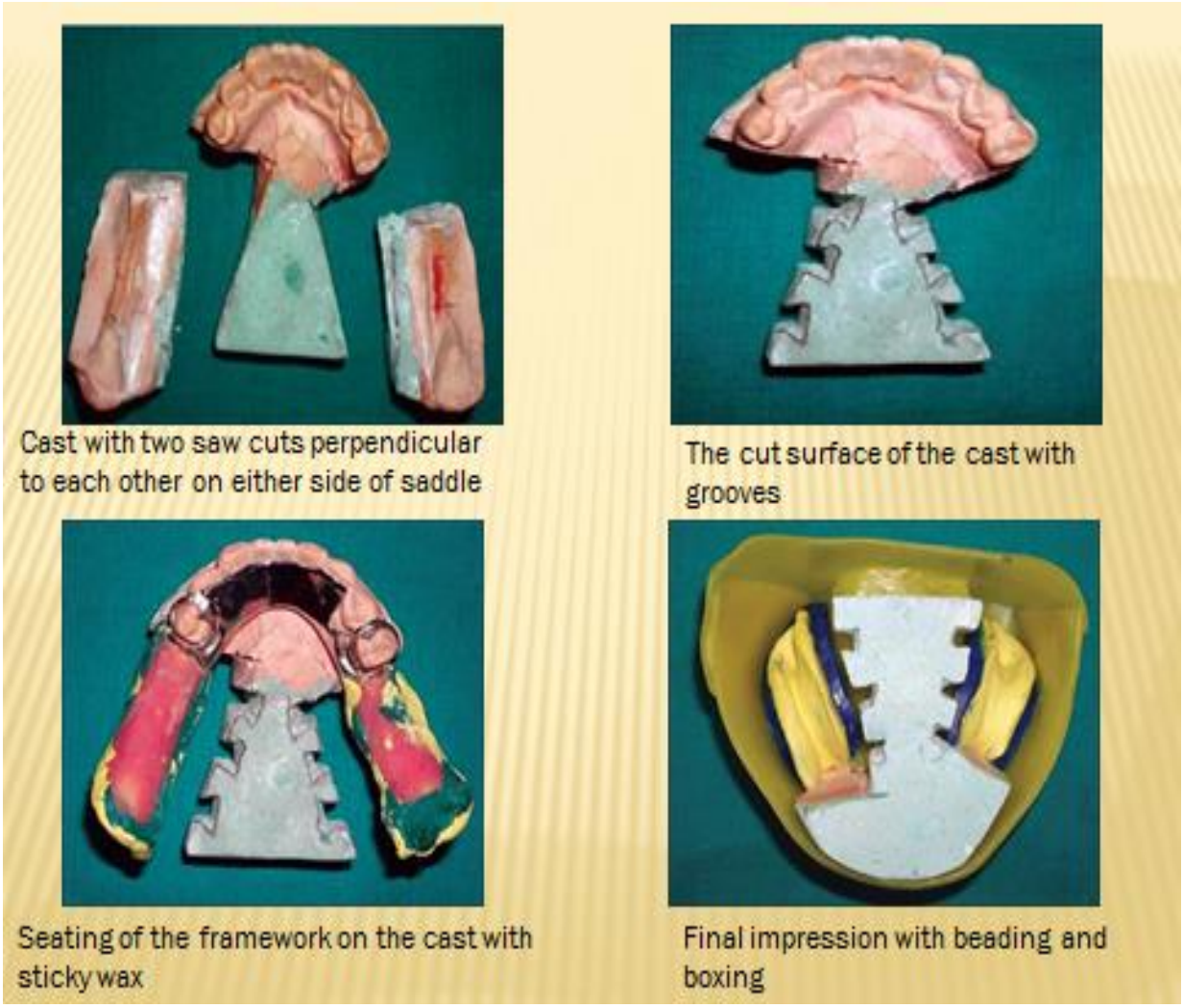


C D

E F

G

Cont'd C, A single sheet of baseplate wax relief provided with a window for the posterior tissue stop and anterior tissue index. D, The framework is warmed and pressed to position on cast. All regions of cast that will be contacted by autopolymerizing acrylic-resin or VLC resin are painted with tinfoil Substitute (Alcote) or model release agent (MRAi. E, A sheet of VLC resin material is adapted to cast and over the framework with finger pressure. Excess material over borders of cast is removed with sharp knife while material is still soft. F, The cured acrylic resin trays with framework are removed from cast, and trays are trimmed to outline of wax spacer. G, Borders of trays will be adjusted to extend 2 mm short of tissue reflections. Holes will be placed in trays corresponding to crest of residual ridge and retromolar pads to allow escape of excess impression material when impression is made.



Technique with figures:

1- Framework has been tried in the mouth and fits mouth and master cast as planned.
2- Outline of acrylic resin trays is pencilled on cast.
3- One thickness of base plate wax is adapted to the outlines to act as spacers so that room for impression material exists in finished trays.
4- Framework is warmed and pressed to position on relieved master cast.
5- All regions of cast that will be contacted by autopolymerizing acrylic resin dough are painted with separating medium.
6- Autopolymerizing acrylic resin is mixed, until dough stage, and adapted to the cast and over the framework edentulous area, excess material removed with sharp knife, while the material is still soft.
7- Cured acrylic resin trays and framework are removed from cast, and trays are trimmed to outlines of wax space.
8- Borders of trays will be adjusted to extend within 2mm of tissue reflections.
9- Selective tissue placement impression method could be utilized by using thin layer of stick modelling compound is painted on tissue sides of impression trays by first softing molding plastic with flame, tempered in water, and placed in patients mouth. This

procedure is repeated several times until basal seat tissues are not displaced, at this time border molding procedures can begin.

10-borders are perfected from buccal side by manipulating cheeks, and lingually by tongue movements. Note that lingual changes have assumed an S shape, which is formed by action of mylohyoid muscle.

11-borders of compound are shortened 1-1.5 mm whole inside of impression relieved about 1mm except buccal shelf area. Modling plastic is removed from holes in the trays.

12- Final impression is completed with elastic impression material such light body silicone rubber.

13- framework must be perfectly seated and maintained in position while the impression material is setting, after setting remove the impression from patient mouth.

Prescribe the following laboratory service

1- Edentulous regions of the cast are eliminated by sawing along the dotted line previously put on the cast.
2- Drill retention slots into the sides of the sectional master cast with crosscut fissure bur for additional retention.
3- Framework and impression are retuned to cast and are luted with sticky wax to avoid displacement during boxing and pouring procedure.
4- Utility wax is used to box impression.
5- Pour the new impression in dental stone, when the stone has set, place the cast in hot water to soften the modelling compound. Remove the framework and impression.
6- Heat the plastic impression tray until it softens, remove the tray from the framework.
7- Return the framework to the altered cast and proceed with fabrication of stabilized record bases.

The objective of the altered cast technique is to obtain soft tissue support to aid abutments in resisting functional stresses , it is important to record maximum extension (within physiological limits) so that functional loads are distributed over as large an area as possible.

An altered cast occlusal view of mandibular cast partial denture