

Impression Procedures for Partially Edentulous Arches

by:
Dr Piyush Mankar



Contents

- **Introduction**
- **Definitions**
- **Review of impression materials**
- **Tooth supported removable partial denture**
- **Support for the tooth and tissue supported removable partial dentures**
- **Impression techniques**
 - **Anatomic form impression**
 - **Functional impression techniques**
- **Review of literature**
- **Summary and conclusion**
- **References**



Introduction

- Partial dentures are generally considered to contribute to trauma to the surrounding tissues. This is due to the fact that too often little consideration is given to stress tolerance of supporting anatomic structures, when partial dentures are planned or designed.
- Hence, it is essential to understand the nature of the supporting tissues which are teeth, resilient mucosa and underlying bone.

Definitions (GPT-8)

Impression : A negative likeness or copy in reverse of the surface of an object; an imprint of the teeth and adjacent structures for use in dentistry

Partial denture impression : a negative likeness of a part or all of a partially edentulous arch

Support : the foundation area on which a dental prosthesis rests. With respect to dental prostheses, the resistance to displacement away from the basal tissue or underlying structures

Partial denture: a removable dental prosthesis or a fixed dental prosthesis that restores one or more but not all of the natural teeth and/or associated parts and may be supported in part or whole by natural teeth, dental implant supported crowns, dental implant abutment(s), or other fixed dental prostheses and/or the oral mucosa.

Distal extension Partial Denture or Extension base partial removable dental prosthesis :A removable dental prosthesis that is supported and retained by natural teeth only at one end of the denture base segment and in which a portion of the functional load is carried by the residual ridge

Altered cast partial denture impression: a negative likeness of a portion or portions of the edentulous denture bearing area(s) made independent of and after the initial impression of the natural teeth. This technique employs an impression tray(s) attached to the removable dental prosthesis framework or its likeness.

Altered cast : a final cast that is revised in part before processing a denture base—called also corrected cast, modified cast.

Review of Impression Materials

- Choice of the impression material critical.
- Basic qualities :
 - Should register the mean shape of the tissues with respect to the technique used
 - Dimensionally stable
 - Accurate
 - Compatible with gypsum materials

Elastic impression materials

Hydrocolloid

- Agar
- Alginate

Rubbers

- Polysulfide.
- Poly
- silicones.
- Polyether.

Non-elastic or Rigid impression materials

- Impression compound
- ZOE

By the manner in which they harden or set

Chemical / irreversible

Temp / reversible

- Plaster of Paris
- ZOE
- Alginate
- Elastomers

Thermoplastic

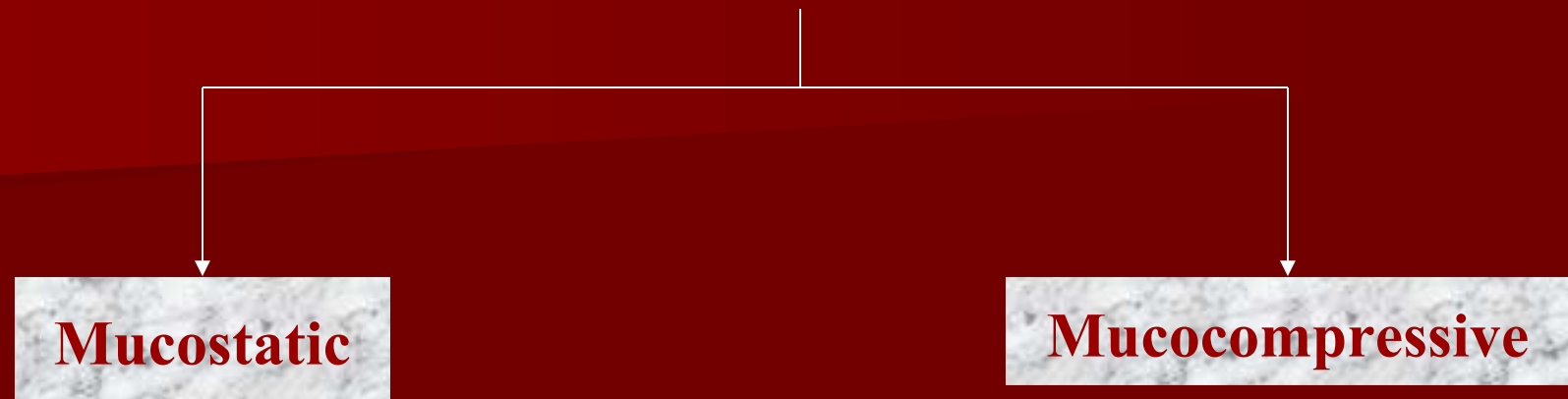
- Impression compound

- Waxes

Non-thermoplastic

Agar

5. According to the viscosity or tissue displacement:



- Impression plaster
- Agar
- Alginate

- Impression Compound
- Putty elastomers

- Waxes
- Rubber base
- Zinc oxide eugenol
- Hydrocolloids

Waxes

- The impression waxes are solid at room temperature but have the ability to flow at mouth temperature.
- Most commonly used are:
 - Iowa wax *
 - Korreкта wax no. 4** (more fluid than Iowa wax)

* Developed by Dr. Smith, University of Iowa

** Developed by Dr. O.C. Applegate and Dr. S.G. Applegate at University of Detroit and Michigan

- Used for making correctable impressions
- It should always be carried by a temporary base as it records the supporting contour of the underlying structures
- Technique sensitive and time consuming

Alginate

Component	Function	Wt%
Potassium alginate	Soluble alginate	15
Calcium sulfate	Reactor	16
Zinc oxide	Filler particles	4
Potassium Titanium fluoride	Accelerator	3
Diatomaceous earth	Filler Particles	60
Sodium phosphate	Retarder	2

Advantages:

1. Easy to mix and manipulate.
2. Minimum requirement of equipment.
3. Accuracy (if properly handled)
4. Low cost
5. Comfortable to the patient
6. Hygienic (as fresh material is used for each impression)

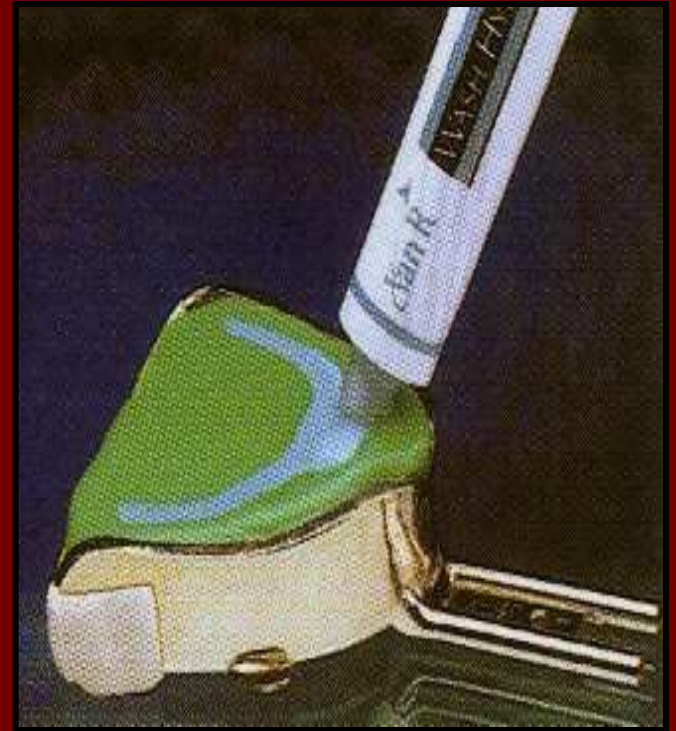
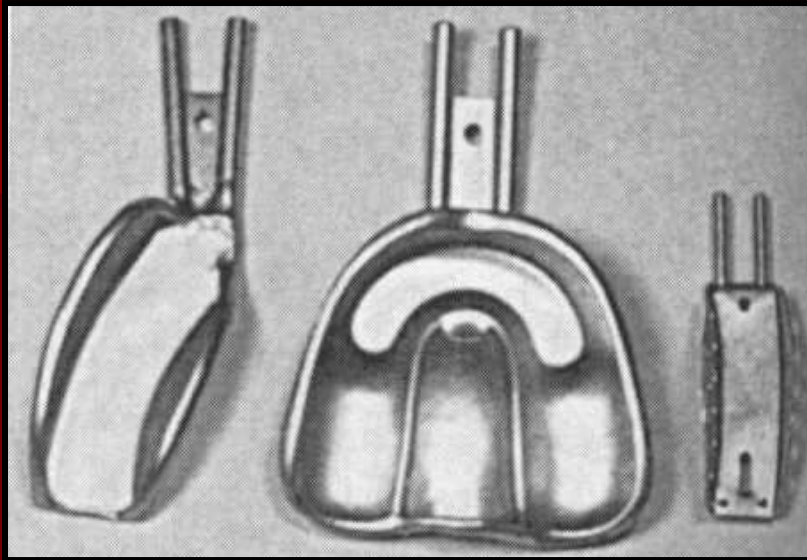
Disadvantages:

1. Distortion occurs easily
2. Poor dimensional stability
3. Poor tear strength

Agar

Composition

<i>Component</i>	<i>Function</i>	<i>Composition (%)</i>
Agar	Brush Heap structure	13 – 17
Borate	Strength	0.2 – 0.5
Pot. Sulfate	Gypsum hardener	1.0 – 2.0
Wax, ZO, Silica, DM, etc.	Filler	0.5 – 1.0
Thixotropic materials	Thickener	0.3 – 0.5
Water	Reaction medium	Balance 84%
Alkylbenzoates	Perservative	0.1



ZINC OXIDE EUGENOL PASTE:

Composition:

- Base
 - Zinc oxide 87 %
 - Mineral oil 13 %
- Catalyst
 - Eugenol 12 %
 - Poly rosin 50 %
 - Filler (Silica) 20 %
 - Lanolin 3 %
 - Resinous balsam 10 %
 - CaCl₂ 5 %

Rubber Base Impression Materials

Based on the type of polymerization reaction

- Condensation silicones
- Addition silicones

CONDENSATION SILICONE:

- Available in light, medium and putty consistency

COMPOSITION:

Base	Accelerators
Polydimethyl siloxane (hydroxy-terminated)	Orthoethyl silicate – cross linking agent
Colloidal silica or microsized metal oxide (filler) 35-75%	Stannous octoate - catalyst

Addition silicones:

Base:

Poly methyl hydrogen siloxane

Other siloxane prepolymers

Fillers

Accelerator:

Divinyl poly siloxane

Other siloxane pre polymers

Platinum salt: Catalyst (chloroplatinic acid)

Palladium (Hydrogen absorber)

Retarders

Fillers

Tooth supported removable partial denture

- Direct transfer of occlusal forces to abutment teeth
- Length of edentulous span and type of tissue support not critical
- The impressions need to record the anatomic form of teeth and the surrounding structures to achieve a relationship of the denture base to the tissue as accurately as possible.
- To make the desired accurate records, an individual custom tray is indicated rather than an ill-fitting stock tray.

Support for the distal extension partial denture

“A distal extension base does not have the advantage of total tooth support and depends on the residual ridge for some support, stability and retention.”

Factors influencing the support of distal extension base

- Contour and quality of residual ridge
- Extent of residual ridge coverage by denture base
- Type and accuracy of impression registration
- Accuracy and fit of denture base
- Design of the removable partial denture
- Total occlusal load applied

Contour and quality of residual ridge

- Ideal ridge – cortical bone covering dense cancellous bone with broad rounded crest and high vertical slopes and covered by firm, dense, fibrous connective tissue.
- Positional relationship of the bone to direction of forces that will be placed on it
- Mandible – Buccal shelf area

Accuracy and fit of the denture base

- Intimacy of contact between the denture base and residual tissue

Extent of coverage by denture base

- The broader the residual ridge coverage, the greater the distribution of the load
- Maximum coverage for maximum support

Type and accuracy of impression registration

- Anatomic form
- Functional form

Staffel has classified the advocates of various techniques for treating distal extension partial dentures as follows:

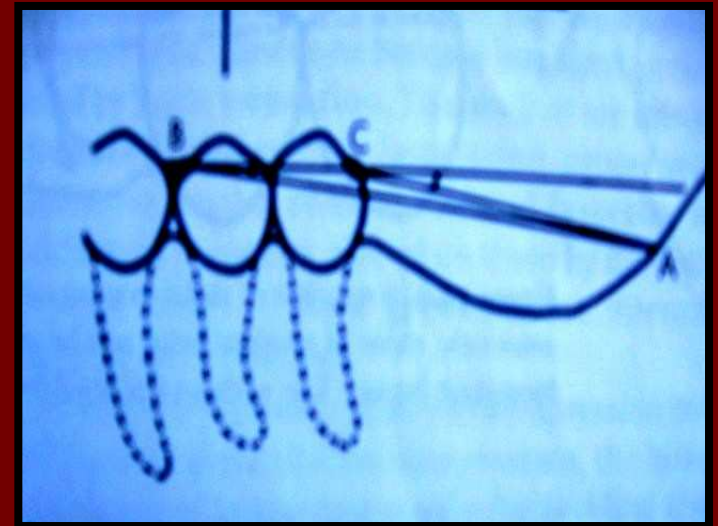
1. Who believe ridge and tooth supports can be best equalized by use of stress breakers
2. Who insist on bringing out equalization of support by pressure impression or relining the denture under functional stresses
3. Who uphold the idea of extensive stress distribution for stress reduction at any one point



Functional Impression

Design of the framework

- Rotational movement of the distal extension base
- Maximum at the distal end of the saddle
- Steffel and Kratochvil suggested more anterior location of the rotational axis so that the residual ridge receives more vertically directed forces



Total occlusal load applied

- The support from the residual ridge should be optimized and shared appropriately with the remaining natural teeth
- Number, width and occlusal efficiency of artificial teeth are a major influence
- According to Kaires " *Reduction in size of occlusal table reduces the vertical and horizontal forces that act on the removable partial dentures and consequently the stresses on abutment teeth and supporting tissues* "

George W. Hindels in his presentation "Stress analysis in Distal Extension Partial dentures"* stated that :

1. Masticatory stresses exerted on the base of distal extension partial dentures are transmitted to the supporting structures through contacting parts of the appliance
2. If the parts are incorrectly designed they will alter the direction and force of these stresses which may not be within the limits of tolerance of the mucosa
3. Movement of the extension base must be recognized and should be limited to vertical direction only. Provision should be made for this movement in the clasp and rest designs
4. The stresses other than the vertical must be reciprocated

**J PROSTHET. DENT. March 1957;7(2):197-205*

Types of Impression Techniques

```
graph TD; A[Types of Impression Techniques] --> B[Anatomic form]; A --> C[Functional form];
```

Anatomic form

- One stage
- Does not represent a functional relation between various supporting structures

Functional form

- Provides maximum support for the partial denture base
- Allows for the maintenance of occlusal contact between both natural and artificial dentition with minimal movement of the denture base

Anatomic Form Impression

- It represents all the hard and soft tissues at rest.
- When the denture is positioned in the mouth, the rests will fit on to the abutments and the denture base will contact the mucosa during the rest position

- When masticatory load is applied to extension saddle, the rest will act as definite stop, which will prevent the part of the saddle near the abutment tooth from transmitting the load to underlying anatomic structures.
- The distal end of saddle, however able to move freely will transmit the full masticatory load. The result will be traumatic load to the base underlying the distal end of saddle and to the abutment tooth which in turn will result in bone loss and loosening of abutment tooth.

Theory Of Rest Impression*

- The law of hydrostatic tell us that water is incompressible i.e. one cannot take a given amount of water and reduce its volume by pressure.
- Mucoperiosteum is semisolid with 80% water and according to law of hydrostatics mucosa is incompressible by any force that muscles of mastication are able to deliver.
- While mucoperiosteum cannot be compressed, it may however be displaced in absence of confining walls.
- Tissue is elastic and will not remain passive in a displaced position. It will try to recover its unrestrained rest form.

Theory Of Rest Impression*

“In theory, rest impression is plausible but in practice they may not suffice for retention and function. They are ideal during periods of rest, which embrace the greater part of day and night. But under hazards of resistive bolus the dentures made from such impression may be dislodged.”

* M.M. DEVAN. “Basic principles of impression making.” J PROSTHET DENT. 1952;2: 26-35

Functional Impression Technique.

"Recording the mucosa in a compressed or a displaced state by one impression and then relating it to the abutment teeth by means of secondary impression."

- The proponents of functional impression put great emphasis on the tissue compression to get a registration of "Functional ridge form" in order to place load properly on ridge and there by minimize cantilever action on abutment teeth.

- The functional method selected is greatly determined by the support potential of the residual ridge.
- Two requirements must be satisfied:
 - That it records and relates the supporting soft tissue under some loading
 - It distributes load over a maximum area

FUNCTIONAL IMPRESSION METHODS

```
graph TD; A[FUNCTIONAL IMPRESSION METHODS] --> B[PHYSIOLOGIC IMPRESSION TECHNIQUE]; A --> C[SELECTIVE TISSUE PLACEMENT IMPRESSION METHOD]
```

PHYSIOLOGIC IMPRESSION TECHNIQUE

Records the ridge portion of the cast in its functional form by placing an occlusal load on impression tray during impression procedure.

- Mc.Leans
- Hindel's method
- Functional reline method
- Fluid wax method

SELECTIVE TISSUE PLACEMENT IMPRESSION METHOD

Are intended to equalize the support between abutments and the soft tissue and to direct the force to the portions of the ridge that are most capable of withstanding such force

Robert B. Lytle carried out a study to determine "Soft tissue displacement beneath a removable partial and complete dentures"*

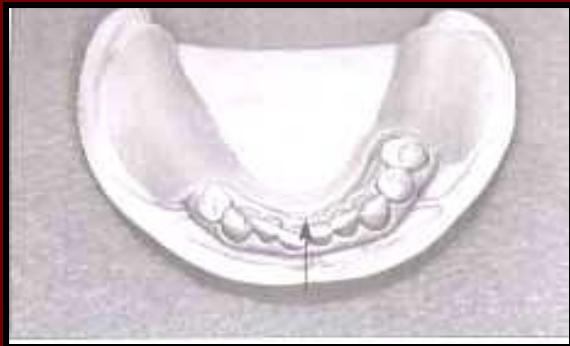
They concluded that :

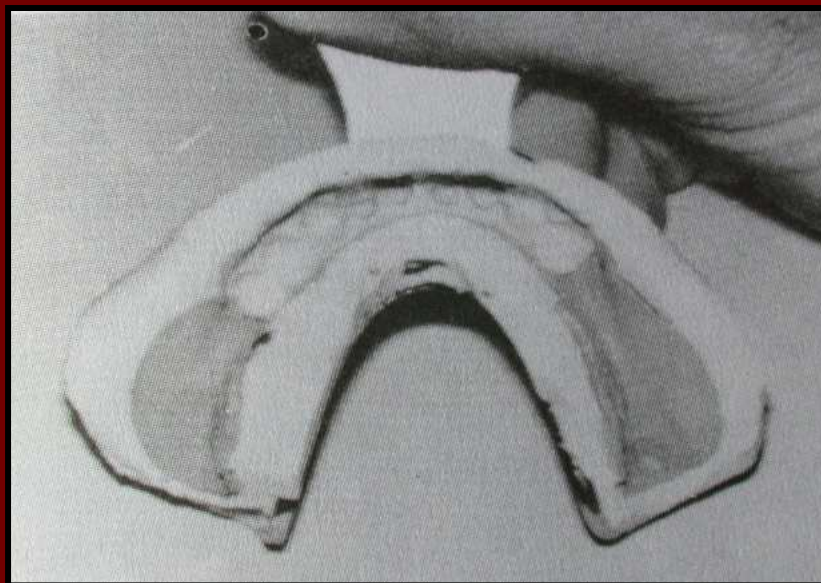
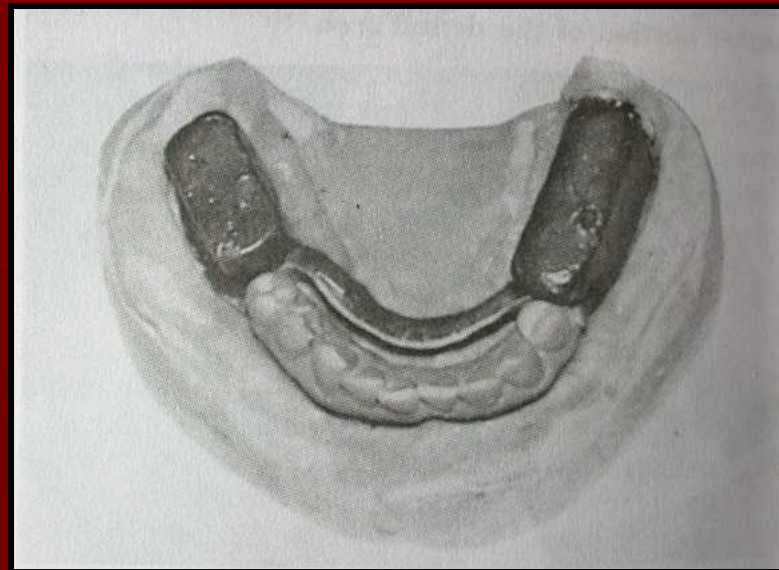
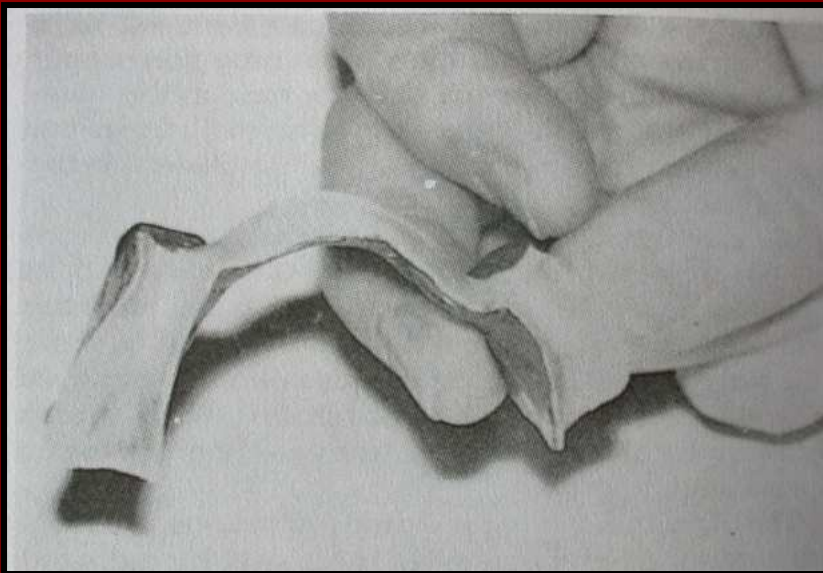
1. Removable partial dentures should be designed with strategically placed rests on the remaining natural teeth
2. Dentures that cause minimal displacement of the soft tissues are more ideal than those causing excessive displacement
3. denture bases should be extended to cover the maximum area of the denture foundation compatible with the movement of border tissues.

**J PROSTHET. DENT. Jan 1962:12(1);34-43*

McLean's Physiologic Impression

- McLean among many others was the first to recognize the need for functional impression.
- the need for recording the supporting tissues of residual ridge in the functional form and then relating to remainder of the arch by means of a second impression was well realized.
- The technique :
 - Fabricate a custom tray
 - Functional impression is made of the distal extension ridge was made under biting pressure over constructed occlusal rims





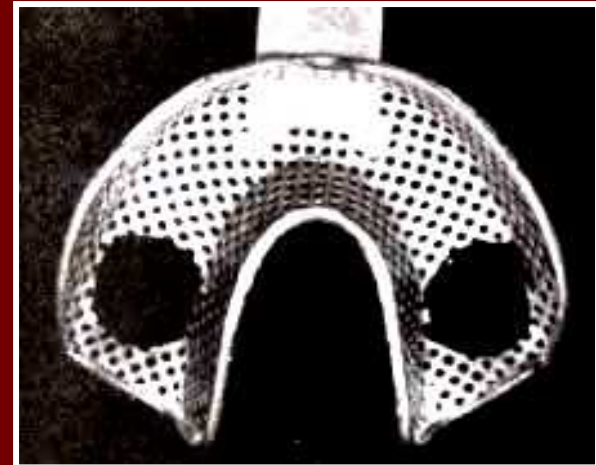
- Then a hydrocolloid 'over impression' is made keeping the special tray in the functional position

Disadvantage:

- The finger pressure had to be applied on the hydrocolloid impression tray during the 'overimpression'. This finger pressure could only be approximated to the occlusal load applied earlier.

McLean-Hindels Impression Technique

- Hindel and others developed/modified impression tray for second impression procedures.
- These trays had large holes in posterior segment so that the operator could apply finger pressure to functional impression as the hydrocolloid impression was being made.



The chief modifications were:

- Impression of the edentulous ridge was made in the anatomic form made with zinc oxide eugenol and not under finger pressure.
- However, when the over impression was being made with the hydrocolloid, finger pressure was applied through the modified tray to the anatomic impression.
- The pressure had to be maintained till the alginate sets.
- The finished impression was a reproduction of the anatomic surface of ridge and the surfaces of teeth but the two were related to each other as if the masticating forces were taking place on the denture base.

Disadvantages:-

- If action of relative clasps is sufficient to maintain a denture base in its intended position, the tissue of the ridge will be in its functional form. This may result in compromised blood flow with adverse soft tissue reaction and resorption of underlying base.
- If the action of retentive clasp is not sufficient to maintain that functional relationship of denture base to soft tissue, the denture base will be occlusally positioned when soft tissue are at rest. This causes premature contact of artificial teeth which may be objectionable to many patients.

Functional Reline Method

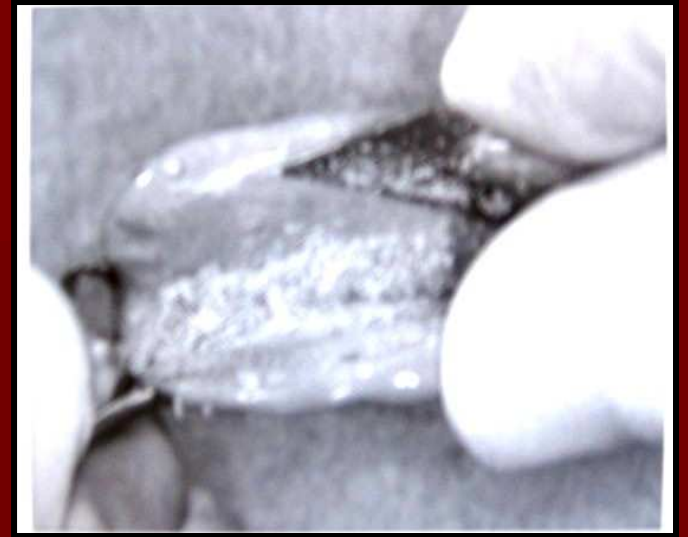
- It consists of adding of a new surface to the tissue side of the denture base.
- It may be accomplished before insertion of denture base or even later when due to the bone resorption denture base no longer fits adequately.

Procedure :

1. Partial denture frame work is constructed on cast made from single impression. (anatomic form)
2. To allow room for impression material between the denture base and the ridge, a uniform space is provided by adopting a metal spacer over ridge of cast before processing the denture base.



3. After processing the denture base, metal spacer is removed and uniform space is achieved.
4. Low fusing modeling plastic is applied onto the tissue surface of denture base, tampered and placed in patient's mouth. Sequence is repeated until accurate impression is obtained.
5. To provide space for impression material of 1mm of modeling plastic is removed and impression is made with free flowing zinc oxide euqenol paste or light bodied polysulfide rubber base.



Advantages:

The amount of soft tissue displacement can be controlled by the amount of relief given to the modeling plastic before the final impression is being made. Greater the relief lesser will be the tissue displacement.

Disadvantages:

- Failures to maintain correct relationship between framework and abutment teeth, during impression procedure
- Failure to achieve correct occlusal contact following reline.
- The patient must keep the mouth partially open because
 - The border tissues, cheek and tongue are thus best controlled
 - The relationship between partial denture framework and teeth must be observed

Fluid wax Functional Impression.

- Fluid wax may be used to make reline impression for an existing partial denture or to correct the edentulous ridge portion of master cast.
- Objective:-
 - To obtain maximum extension of peripheral borders while not interfering with function of movable border tissues.
 - To record stress bearing areas of the ridge in their functional form.
 - To record non pressure bearing areas in their anatomic form.

Procedure:-

- A container of wax is placed in water bath maintained at 51°C-54°C.
- The wax is painted onto impression surface with brush. Tray borders should not more than 2mm because the fluid wax does not have sufficient strength beyond that distance.



- The tray is then seated in the mouth and the patient must hold is mouth half open for about 5 min.
- The tray is then removed and examined. When tissue contact is present, wax will be glossy and where tissue contact is not present it will be dull
- Add more wax and the tray must remain in the mouth for 5 min after each addition.
- The peripheral extensions are developed by functional movements.
- When complete tissue contact and anatomy of limiting border structure has been established, the impression is left in the mouth for 12 min. this is to ensure that wax had flowed completely.

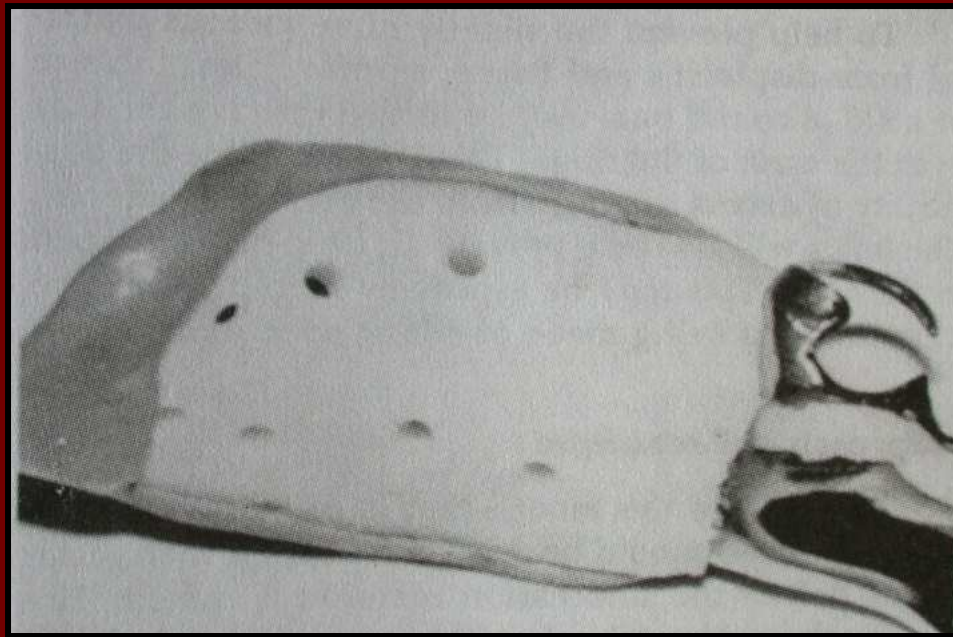
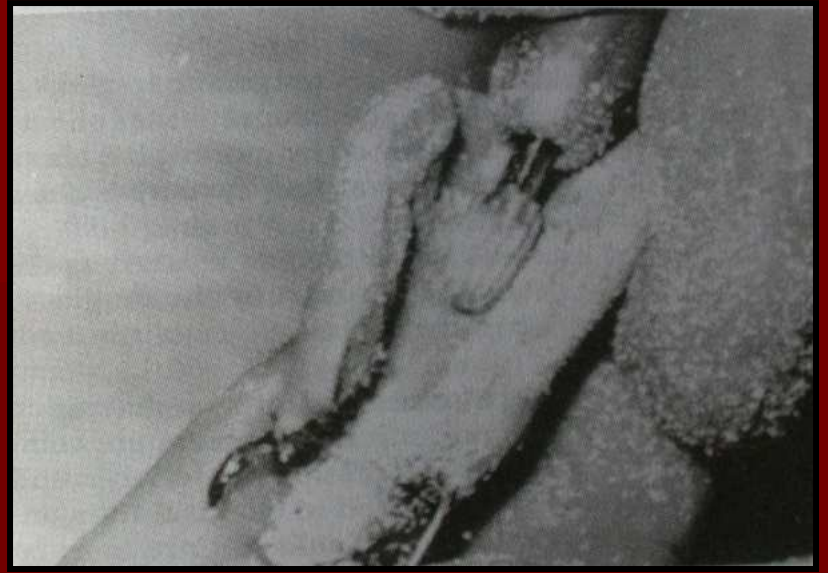
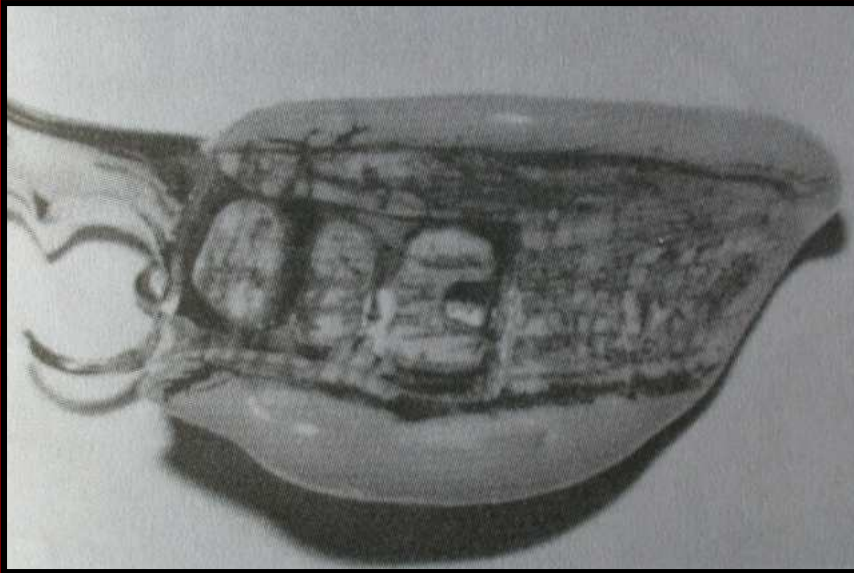


Selective Tissue Placement Impression Method.

This attempts to direct more force to those portions of the ridge that are able to absorb stress and to protect areas of ridge least able to absorb stress.

- To accomplish this, tissue surface of the tray is selectively relieved.
- The amount of relief is dependent on the block out and relief procedure performed during laboratory phases of framework construction.
- Buccal shelf is primary stress bearing area and the crest of the ridge is non stress bearing area

- The border molding is done for the edentulous areas. Excess is removed and the tissue contact area is scraped lightly.
- As impression is made, material over crest of the ridge is not closely confined and will exert minimal tissue ward force. This will result in slightly greater tissue displacement.
- This results in denture base that is closely adapted to and in firm contact with the tissue covering the buccal shelf area. Where as the crestal portion is lightly adapted to soft tissue resulting in minimal force application.
- A more viscous material will result in greater displacement of soft tissue and less viscous impression material will result in decreased tissue displacement. However over displacement should be avoided as it may lead to inflammation of the soft tissues underneath.

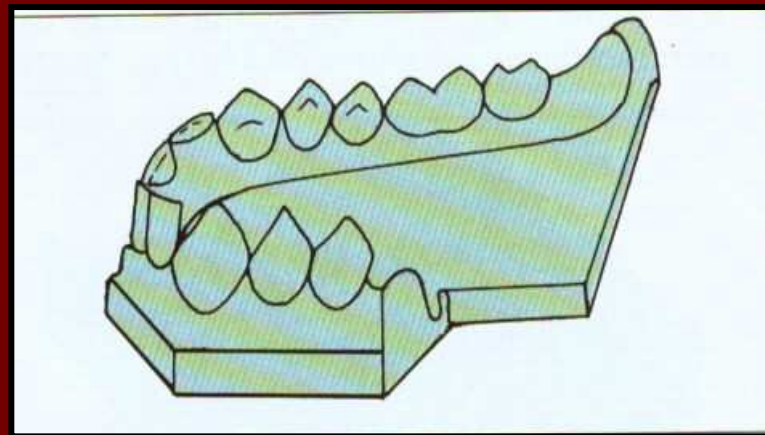
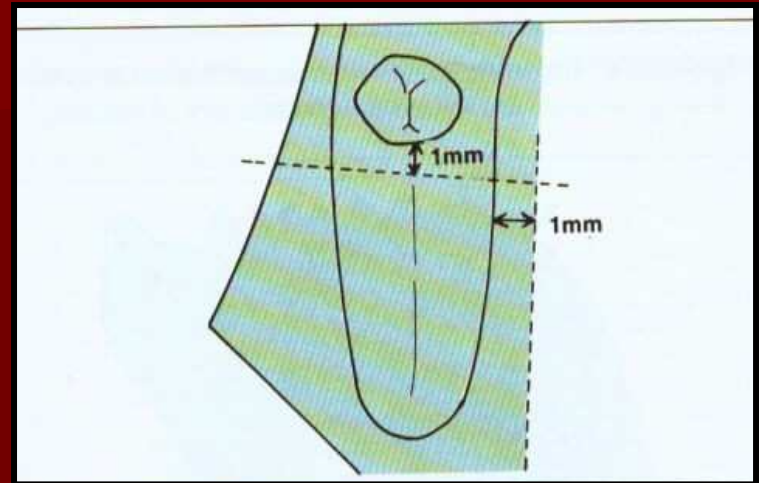
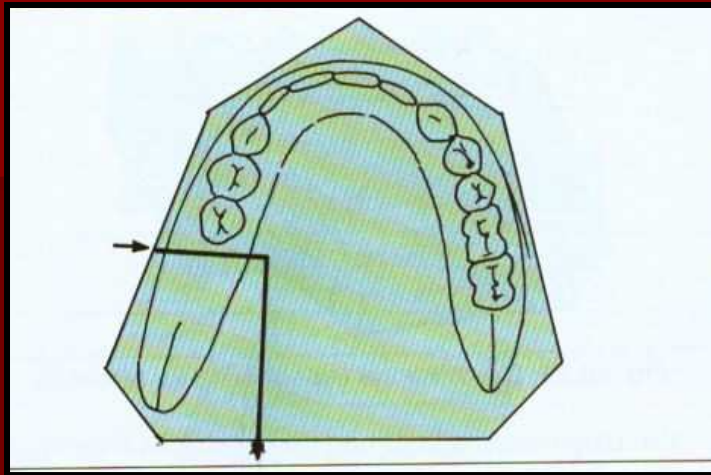


Preparing the original cast and pouring the corrected cast

(Altered Cast Technique)







R. R. Diwan and F. Fahmi compared the conventional altered cast technique to the single pour altered cast technique and concluded that

- a. The single pour technique reduces the complicated lab procedures
- b. The technique registers edentulous ridge in functional form and the teeth in their anatomic form

- Richard Bauman and James DeBoer in their modification of the altered cast technique suggested the use of interocclusal record to determine the centric relation and use it to mount the cast on the articulator
- Thomas A. Lynde et al advocated the use of detachable custom acrylic trays to make the functional impression

John B. Holmes conducted a study to determine the “Influence of impression procedures and occlusal loading on partial denture movement”*

He concluded that:

1. The movement of partial dentures from occlusal loading is related to the impression technique and material used.
2. The altered cast technique provided the least amount of movement from occlusal loading at the time of insertion .
3. Partial dentures made with Korecta wax 4 (altered cast) resulted in least amount of movement.

**J PROSTHET. DENT. May 1965:15(3);474-481*

Review of literature

Technique for semi-precision and precision partial dentures*



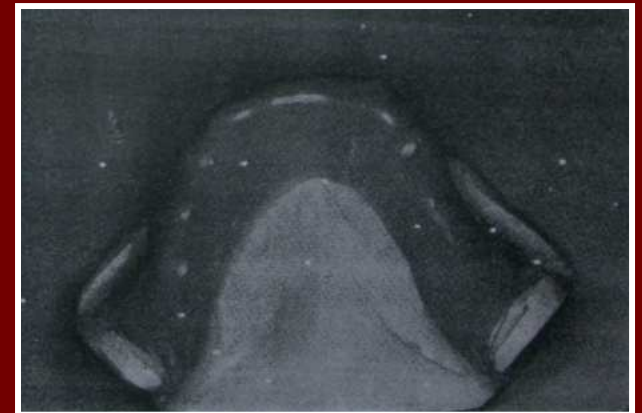
Preliminary hydrocolloid impression



Cast poured with impression



Base plate wax adapted over the teeth



A second layer of base plate adapted over the complete cast

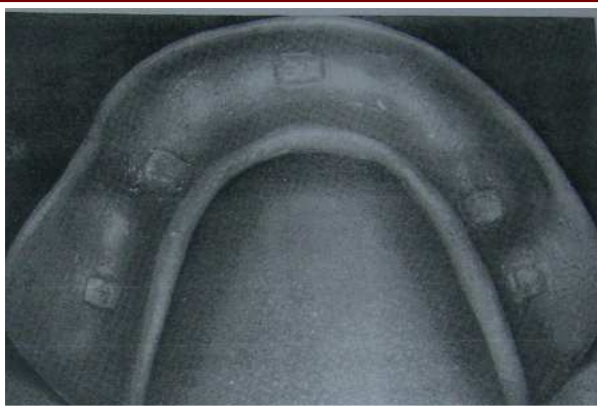
*Louis Blatterfien et al. *J Prosthet. Dent*, 1980;43 (1);9-14



Windows cut to provide stops for
impression tray



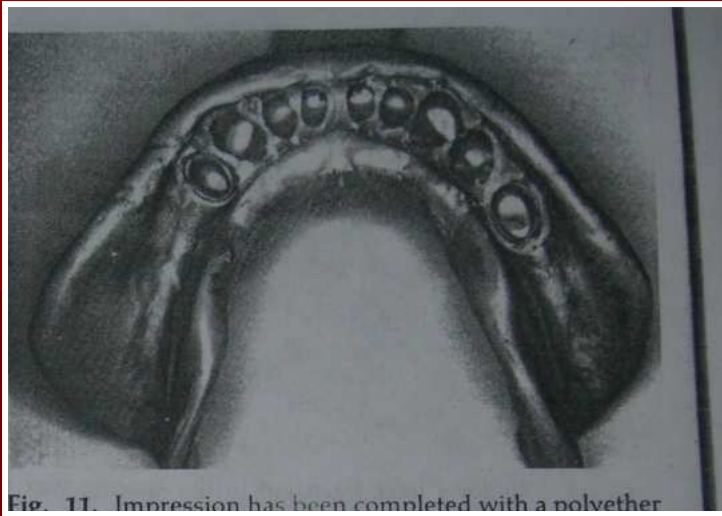
Acrylic tray



Inner surface of tray with the stops



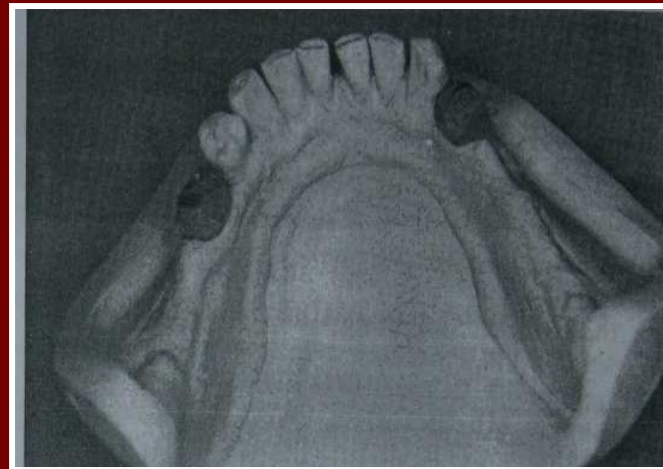
Border molding done



Impression made in polyether gel



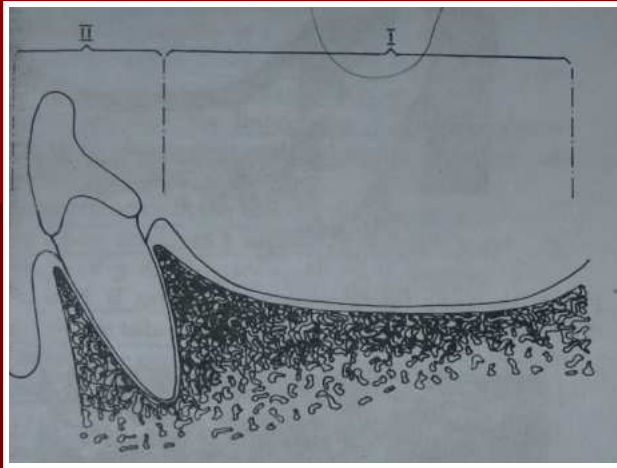
Cast prior to pouring



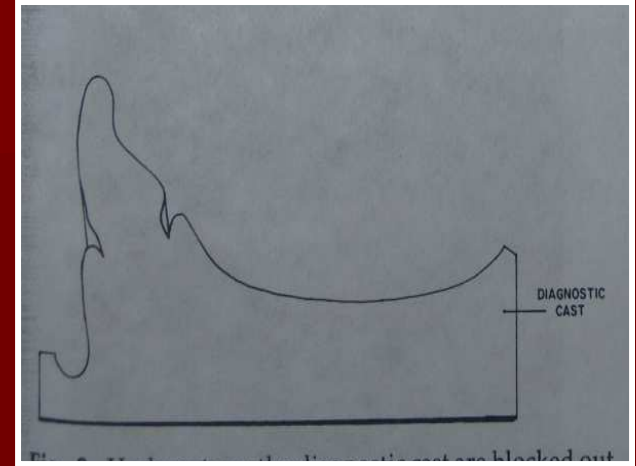
Final cast with abutments related to the ridge in the loaded form

Two stage impression technique for distal extension removable partial denture

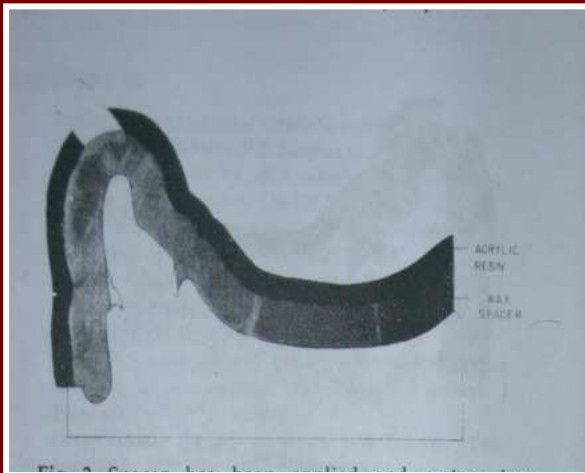
Roberto von Krammer. *J Prosthet. Dent*, Aug 1988;60(1);199-201



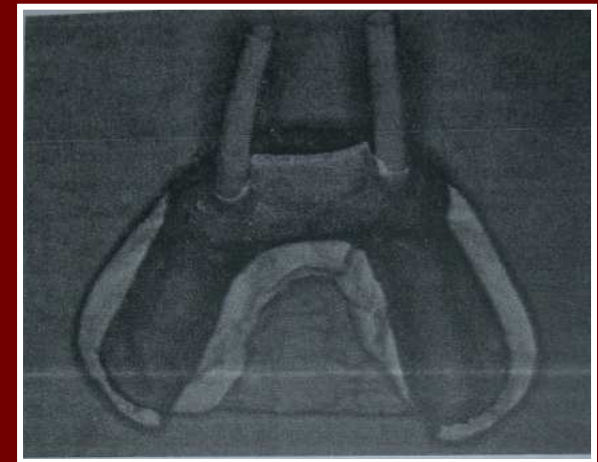
Impression area divided into zones



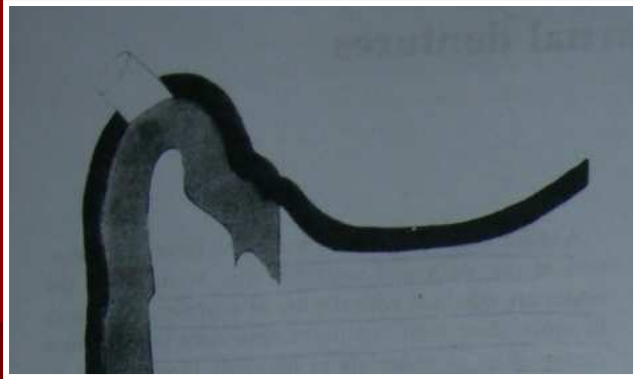
Undercuts are blocked out



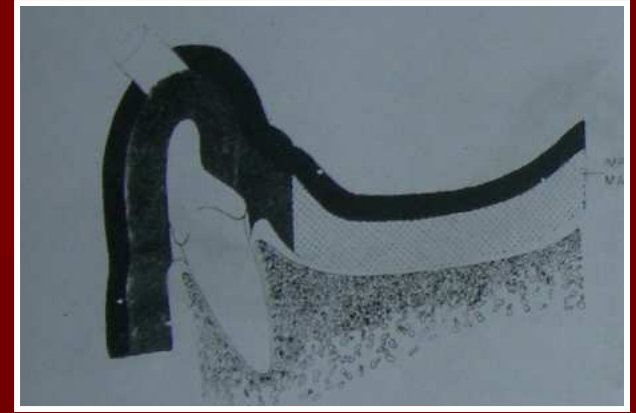
Spacer adapted and custom tray fabricated



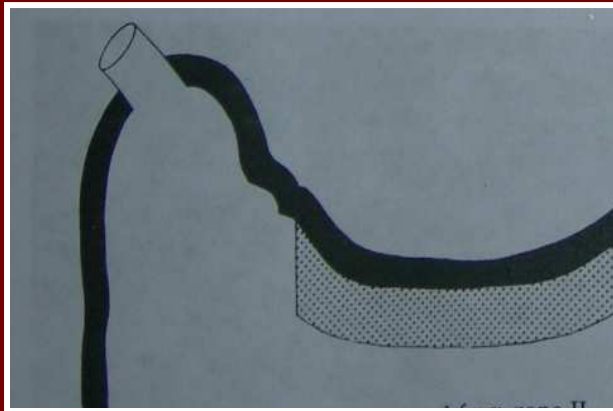
Tubes for injection of the impression material



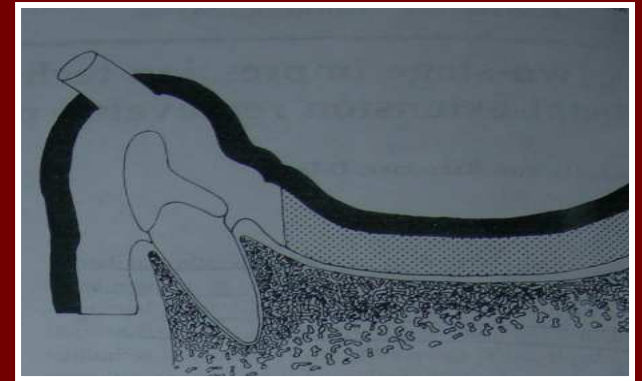
Spacer removed from zone I



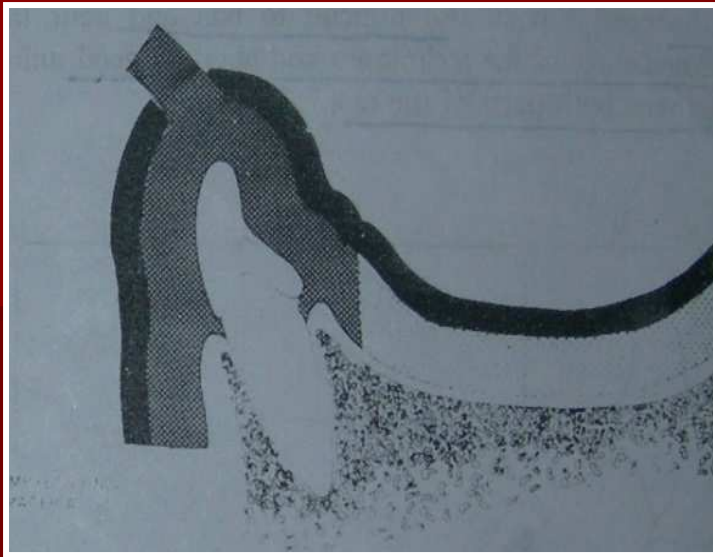
Impression made of zone I



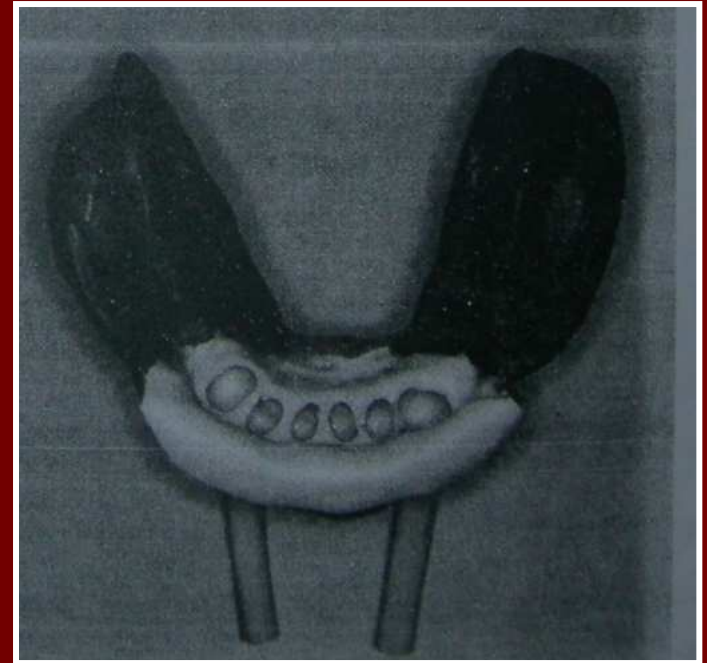
Spacer removed from zone II



Tray with impression of zone I is replaced and located correctly



Impression material injected
for zone II



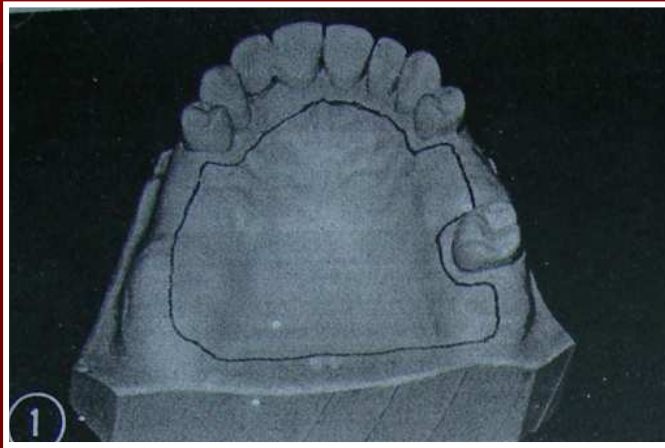
Completed impression

Zone I : ZOE

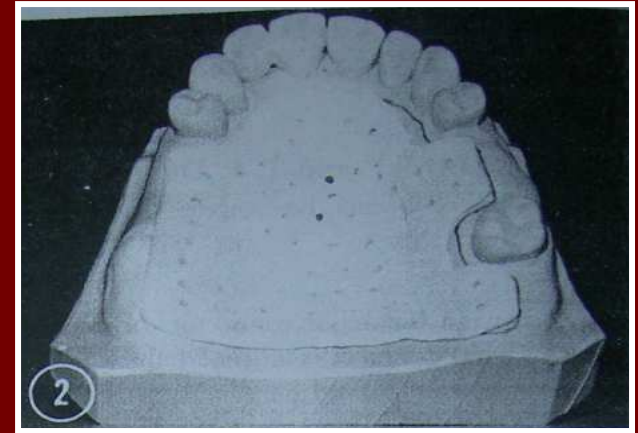
Zone II : Irreversible hydrocolloid

Impression technique for maxillary removable partial dentures

Clyde D. Leach and T. E. Donovan. *J Prosthet Dent*, Aug 1983;50(2);283-285



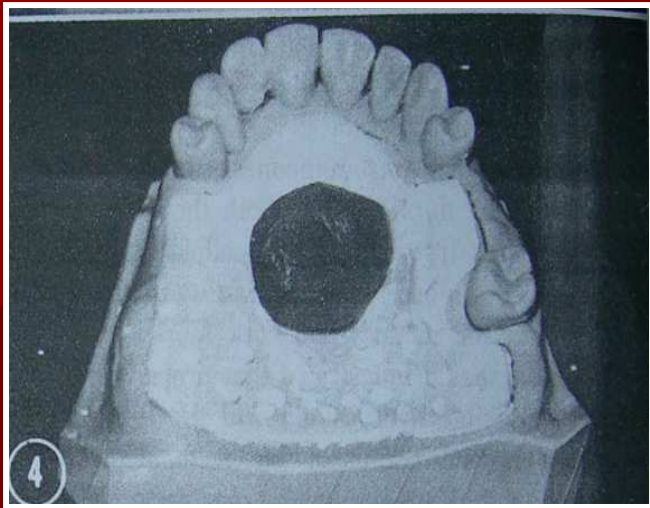
Outline for resin tray



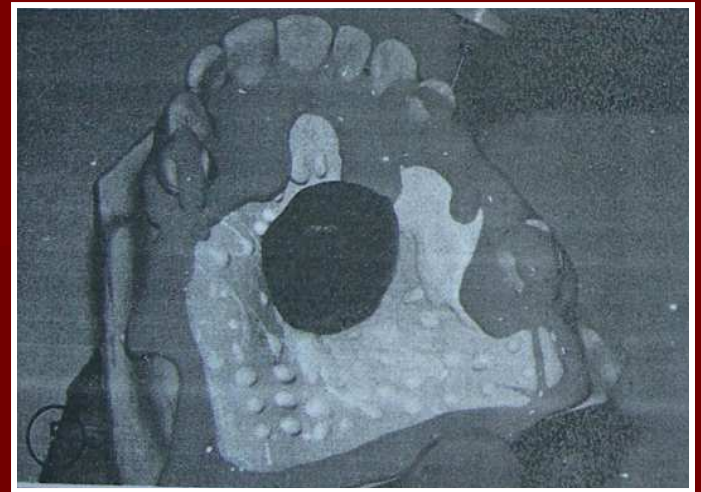
Tray completed and perforated



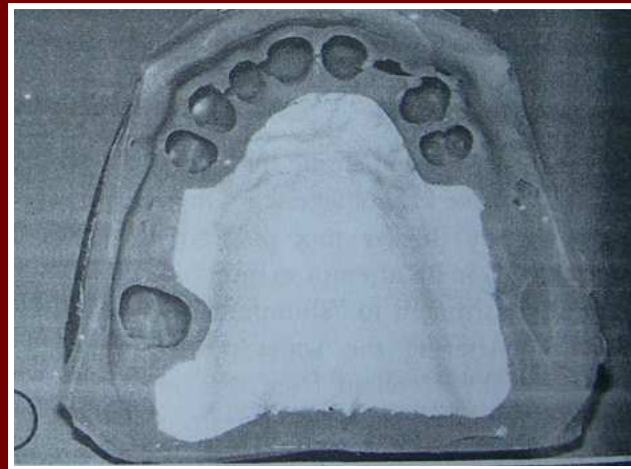
Impression of the palatal tissues



Wax stop for over impression



Impression material injected around the special tray



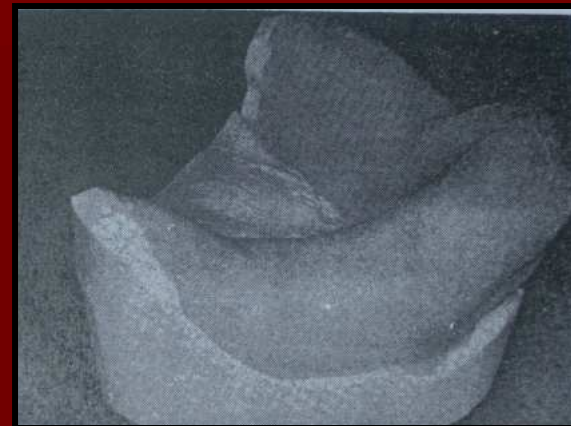
Final Impression

Single tray dual impression for distal extension partial dentures

Joseph A. Rapuano. *J Prosthet Dent*, July 1970;24(1);41-46



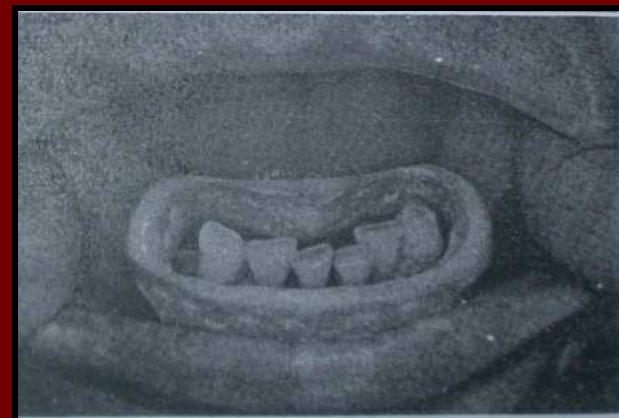
Spacer adapted over the teeth



Special tray



Opening made over teeth region



Tray in patients mouth



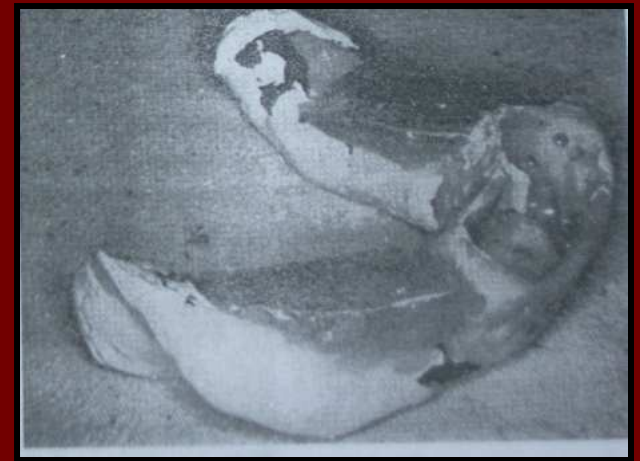
Border molding of the edentulous segment



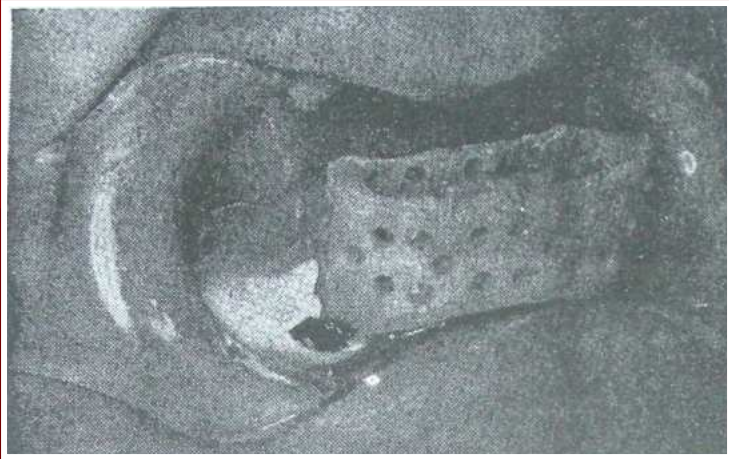
Impression being made.



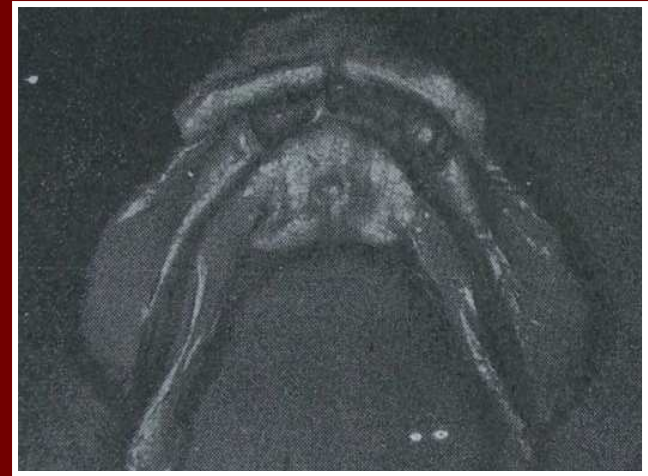
Final impression of the residual ridge



Occlusal rim being fabricated over the tray



Perforated anterior part of the tray



Final impression

Simplified Distal Extension Impression Technique

(Dr. Mahesh Verma and Dr. P. Laxman Rao)

- Advantages:

1. Convenient.
2. Less time consuming .
3. Simple.

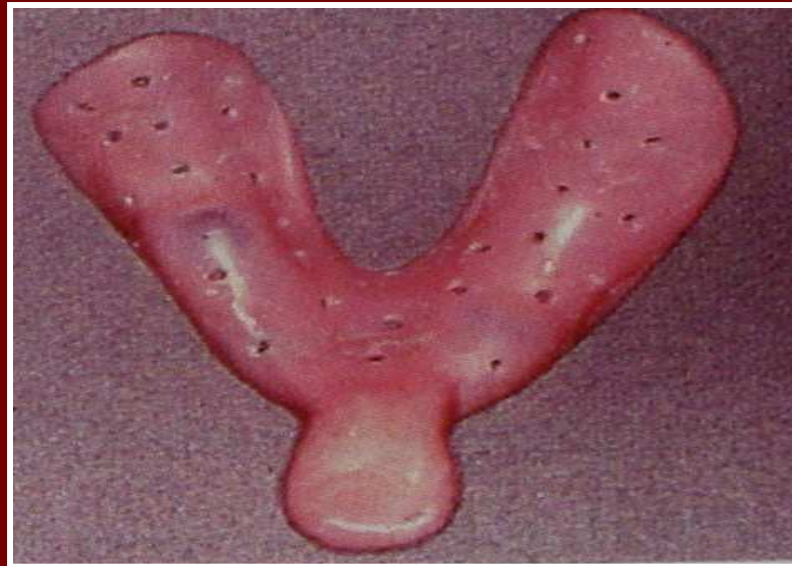
- Requirements:

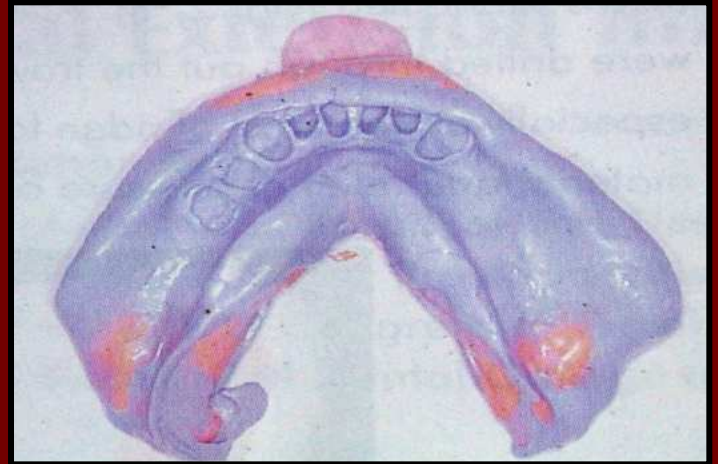
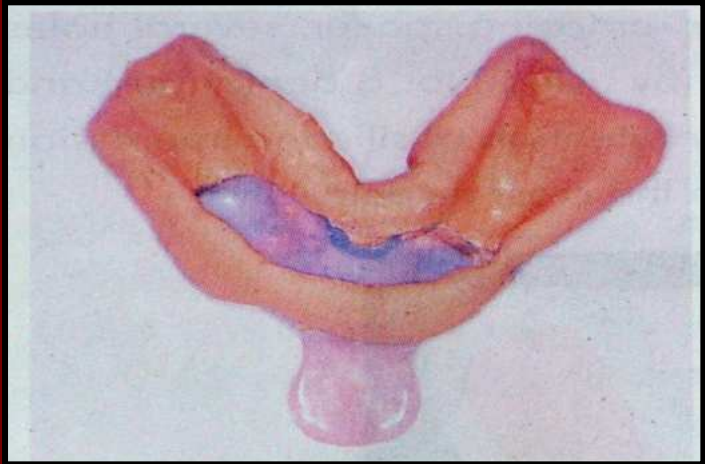
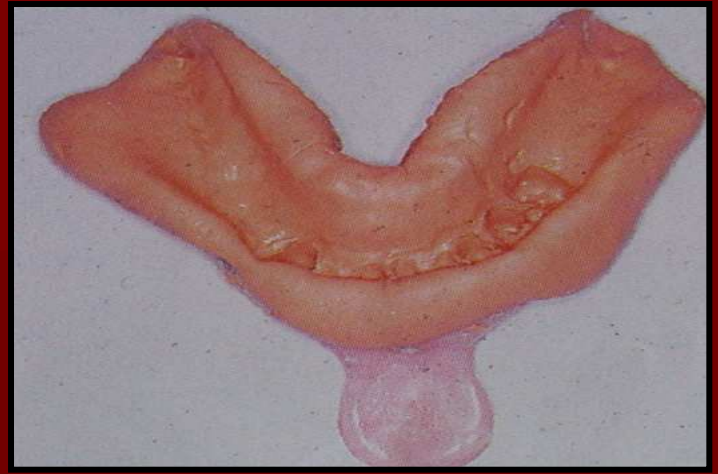
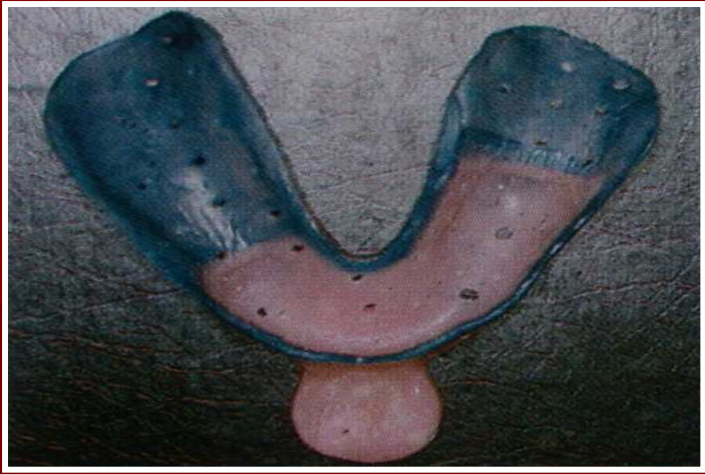
Special tray on diagnostic model.

Tray adhesive.

Putty silicone impression material.

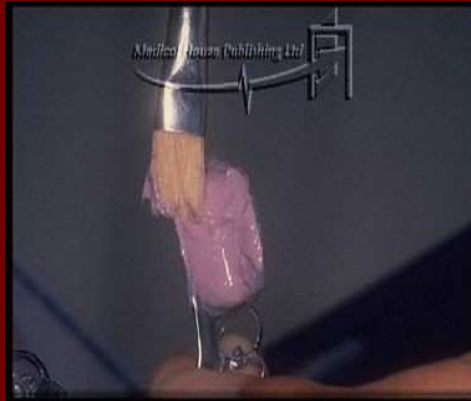
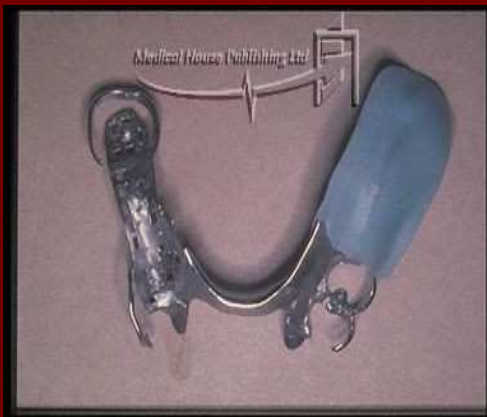
Medium body silicone impression material





Recent trends in impression making

- Use of combination technique using specially fabricated impression trays and two irreversible hydrocolloid materials i.e. low density injectable hydrocolloid (syringe- accu gel) and very high density tray hydrocolloid (tray accu-gel)
- The use of rubber base impression materials for fabrication of tray as well as for impression making



Summary and Conclusion

Impression procedures

Anatomic form

Functional form

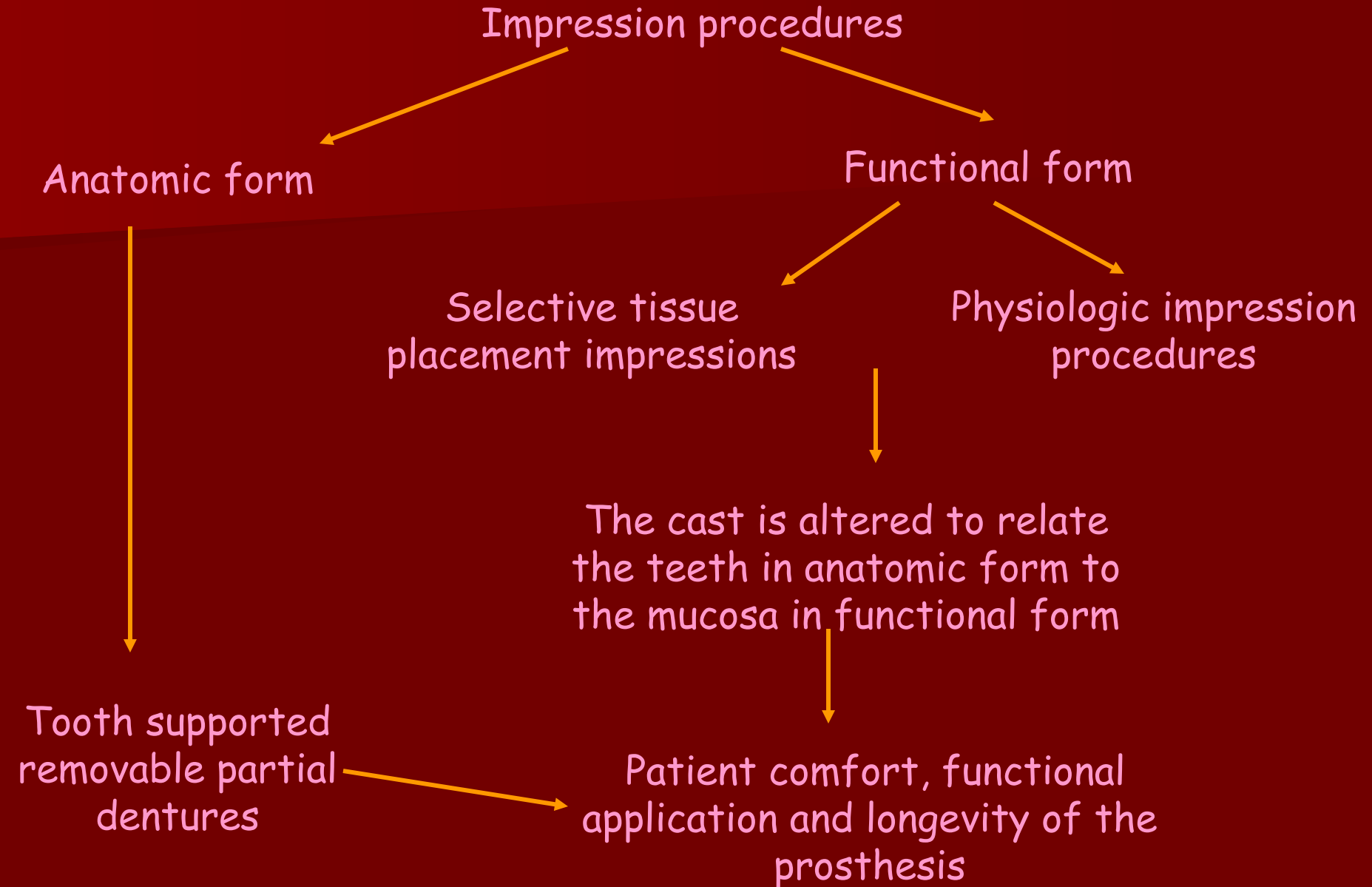
Selective tissue placement impressions

Physiologic impression procedures

The cast is altered to relate the teeth in anatomic form to the mucosa in functional form

Tooth supported removable partial dentures

Patient comfort, functional application and longevity of the prosthesis



"Unless a partial denture is made with adequate abutment support, optimal base support and with harmonious and functional occlusion, it should be clear to all concerned that such a denture should be considered only a temporary treatment"

References

- APPLGATE OC. An evaluation of the support for removable partial denture. J PROSTHET DENT 1960; 10:112-23.
- APPLGATE OC. The fundamentals of removable partial denture prosthesis. IIInd ed.
- Clyde D. Leach, T. E. Donovan. Impression technique for maxillary removable partial dentures. J PROSTHET DENT 1983;50(2):283-286
- HINDEL GW. Load distribution in extension saddle denture. J PROSTHET DENT 1952; 22:92-100.
- HINDEL GW. Stress analysis in distal extension partial. J PROSTHET DENT 1957; 7:197-205.
- HOLMES JB. Influence of impression procedures and occlusal loading on partial denture movement. J PROSTHET DENT, 1965; 15:474-81.

- Joseph A. Rapuano. Single tray dual impression technique for distal extension partial dentures. J PROSTHET DENT 1970;24(1): 41-46
- LEUPOLD RJ, KRATCHOVIL FJ. *An altered cast procedure to improve tissue support for removable partial denture.* J PROSTHET DENT; 1965 15:672-8.
- LEUPOLD RJ, FLINTON RJ. Comparison of vertical movement occurring during loading of distal extension partial denture bases made by three impression techniques. J PROSTHET DENT 1992; 68:290-293.
- Louis Blatterfien. A loading impression technique for semi-precision and precision removable partial dentures. J PROSTHET DENT 1980;43(1):9-14

- Lytle Robert B. Soft tissue displacement beneath removable partial and complete dentures. J PROSTHET DENT 1962;12(1):34-43
- M.M. DEVAN. Basic principles of impression making. J PROSTHET DENT. 1952; 2: 26-35.
- McCRACKEN'S REMOVABLE PARTIAL PROSTHODONTICS, EIGHTH EDITION
- McCRACKEN'S REMOVABLE PARTIAL PROSTHODONTICS, ELEVENTH EDITION.
- R.R. DIWAN, F, FAHMI. Comparison of two functional impression techniques for distal extension removable partial dentures. J PROSTHET DENT 1988;60:470-473.

- Richard Bauman. A modification of the altered cast technique. J PROSTHET DENT 1982;47(2):212-213
- Roberto von Krammer. A two stage impression technique for distal-extension removable partial dentures. J PROSTHET DENT 1988;60(2): 199-201
- STEWART'S: CLINICAL REMOVABLE PARTIAL PROSTHODONTICS, THIRD EDITION.

A scenic view of a river flowing through a valley. The river is wide and shallow, with many rocks visible in the water. The surrounding hills are covered in green vegetation, and the sky is clear. The overall atmosphere is peaceful and natural.

**T
h
a
n
k**

**y
o
u**