

Impression materials and techniques for RPD

Making the master impression for fabrication of a removable partial denture (RPD) prosthesis is accomplished once the remaining teeth in the partially edentulous arch have been modified. The modifications, including intracoronal and extracoronal restorations and/or enameloplasty to enhance extracoronal contours, should follow the treatment plan derived after careful analysis, design, and prescription for the prosthesis.

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.

1. Primary impression

An impression made for the purpose of diagnosis or for the construction of a custom tray.

2. Secondary or definitive impression

An imprint that record the entire functional denture bearing area to ensure maximum support, retention and stability for the denture during use.

Primary purpose to record accurately the tissues of the denture bearing areas, in addition to recording functional width and depth of the sulci.

Impression material

1. Rigid materials:

- Plaster of paris
- Metallic oxide paste (zinc oxide eugenol impression material).

2. Thermoplastics materials:

- Modeling plastic.
- Impression wax & resin.

3. Elastic materials:

- **Hydrocolloid :**
 - Reversible hydrocolloid (Agar-Agar)
 - Irreversible hydrocolloid(alginate)
- **Elastomers:**
 - Mercaptan rubber base impression material (polysulfide)
 - Silicon impression material:
 - a. Condensation reaction silicon
 - b. Addition reaction silicon
 - Polyether impression.

Rigid materials :

Although rigid material may be capable of recording tooth and tissue detail accurately, they cannot be removed from the mouth accurately and without fracture and reassembly.

1. Plaster of paris:

Now elastic materials have completely replaced the impression plaster.

Modified impression plasters are used by many dentists to record maxillomandibular relationships. Also used for recording impression of edentulous area without under cut.

2. Metallic oxide paste:

Which usually some form of zinc oxide eugenol combination those are not used as primary impression materials & should never be used for impression that include the remaining natural teeth also they are not be used in stock impression tray. Metallic oxide pastes are manufactured with a wide variation of consistencies most of them are dispensed from two tubes; this enables the dentist to dispense and mix the correct proportion from each tube on a mixing slab.

Metallic oxide paste can be used as :

- ✓ Secondary impression material for CD & for distal extension base edentulous ridge areas of RPD.
- ✓ It can be used with custom acrylic impression tray (special tray) which has being properly designed & attached to the partial denture framework.
- ✓ Also it can be used as impression for relining distal extension denture bases.



Thermoplastic materials :

It cannot record minute details accurately because they undergo permanent distortion during withdrawal from tooth & tissue undercuts.

1- Modeling plastic (modeling compound):

The most commonly used modeling plastic is the red material in cake form record impression for edentulous area in function form and the green stick form for use in the border molding impression materials. It is generally used only as means of building up the underside of the denture before recording the tissue with some secondary impression material. A common error in the use of modeling plastic is that it is often subjected to higher temperatures than intended by the manufacturer. It then becomes too soft and loses some of its favorable working characteristics & the material becomes brittle and unpredictable. Also, there is the ever-present danger of burning the patient when the temperature used in softening the modeling plastic is too high.



2- Impression wax and resin:

It is used in recording the edentulous area in function form also it may be used to correct the borders of impression made of more rigid material.

Elastic impression materials:

They are the only one that can be withdrawn from tooth & tissue undercuts without permanent distortion & are therefore most generally used for making impression for RPD, immediate denture, crown & bridge, & fixed partial denture when tooth & soft tissue undercut & surface details must be recorded with accuracy.

1- Hydrocolloids:

- Reversible hydrocolloid(agar-agar)

- a. Which are fluid at high temperature and gel on reduction in temperature.
- b. The preparation of agar hydrocolloid for clinical use requires careful control and moderately expensive apparatus. It needs special types of tray (contain tube of water to cooled the impression materials).
- c. Agar hydrocolloid impressions are dimensionally unstable on standing; thus models should be made as soon as possible after the impression is taken.
- d. Complaints sometimes arise from patients as a result of thermal shock to the teeth, producing pain and discomfort. This situation can arise from the heat the impression material when introduced into the mouth or the comparatively low temperatures attained during cooling of the impression to obtain a set gel.
- e. It's used as impression material for fixed restoration and for cast duplication.
- f. They demonstrate acceptable accuracy when properly used.
- g. The border control of impression made with this material is difficult.

- Irreversible Hydrocolloid (alginate)

- a. Used for making diagnostic cast, orthodontic cast and master cast for RPD.
- b. These material have a low strength provide less surface details than other material.
- c. Dimensionally unstable, it can be used in the presence of moister, it is hydrophilic.
- d. Have a good taste &odor and nontoxic.

2- Elastomers:

A. Mercaptan rubber base impression material (Polysulfide or *Thiokol*):

1. It can be used for RPD impression especially for altered cast impression.
2. The accuracy of Mercaptan rubber base impression material exceeds that of properly made irreversibly hydrocolloid impression; beside that *Thiokol* is hydrophobic so the mouth should be dried thoroughly before making an impression. It has long setting time (**12 minutes**).
3. Other advantages over hydrocolloid impression material in that the surface of an artificial stone poured against them is of a smoother &harder than one poured against a hydrocolloid material. But delay pouring is avoided to minimize curing shrinkage, and shrinkage from loss of by-product (**water**).

B. Silicone Impression materials:

These materials were developed to overcome some of the disadvantages of polysulfide. It's in two types according to polymerization reaction form.

1- Condensation reaction silicone:

Have a moderate (5 to 7 min.) working time that can be altered by adjusting the amount of the accelerator. They have a pleasant odor, moderately high tear strength, and excellent recovery from deformation. Dimensional stability is comparatively less because of the high polymerizing shrinkage, and shrinkage from loss of by-product (ethyl alcohol). It is hydrophobic, which can make cast formation a problem, ideally, these materials should be poured within 1 hour.

2- Addition reaction silicone:

Are the most accurate of the elastic impression materials. They have less polymerization shrinkage, low distortion, fast recovery from deformation, and moderately high tear strength. These materials have a **working time of 3 to 5 min.**, which can be easily modified with the use of retardants and temperature controls. They are available in both **hydrophilic** and **hydrophobic** forms, have no smell or taste, and also come in putty form. Most of the addition reaction silicones are available in automixing devices, can be **poured up to 1 week** after impression making with acceptable clinical results, and are stable in most sterilizing solutions. Sulfur in latex gloves and in ferric and aluminum sulfate retraction solution may **inhibit** polymerization. It has low flexibility (hard) care should be taken while removing the stone cast from the impression to avoid any breakage.

C. Polyether impression materials

These materials have demonstrated good accuracy in clinical evaluations and are provides good surface detail and makes them useful as a border molding material. It should be noted, however, that these materials are **not compatible** with the addition reaction silicone impression materials and **should not** be used to border mold custom trays when the silicone impression materials are to be used as the final impression material. The polyethers are also hydrophilic, which produces good wettability for easy cast forming. The polyethers have low to moderate tear strength and much shorter working and setting times, which can limit the usefulness of the material, beside that the material was very stiff and it is expensive.

The principal differences between reversible and irreversible hydrocolloid

1. Reversible hydrocolloid converts from the gel form to a solution form by heat raise. It can be converted to gel form by a reduction in temperature. This physical change is reversible.
2. Irreversible hydrocolloid becomes a gel via a chemical reaction as a result of mixing alginate powder with water. This physical change is irreversible.

Important precautions to be observed in the handling of hydrocolloid:

1. Impression should not be exposed to air because some dehydration will inevitably occur & result in shrinkage (syneresis).
2. Impression should not be immersed in water because some imbibition will inevitably result with an accompanying expansion (imbibition).
3. Impression should be protected from dehydration by placing it in a humid atmosphere or wrapping it in a damp paper towel until a cast can be, poured. To avoid volume change, this should be done within 15 minutes after removal from the mouth.
4. Exudates from hydrocolloid have a retarding effect on the chemical reaction of gypsum products and results in a chalky cast surface. This can be prevented by pouring the cast immediately or by first impression in a solution of accelerator, slurry of water that produce from cast trimming.

Step by step procedure for making an impression:

1. Select a suitable, sterilize a rim-lock or perforated impression tray that's large enough to provide 4-5mm thickness of the impression material.
2. Build-up the palatal part maxillary impression tray with wax or modeling plastic to ensure even distribution of impression material to prevent material from slumping away from palatal surface also if gelation occurs next to the tissues the deeper portion is still fluid, a distorted impression of the palate may result, which cannot be detected in the finished impression. This can result in major connector of finished casting not being in contact with under lying tissue. The maxillary tray has to be extended posteriorly to include the tuberosities & vibrating line region of the palate. Such an extension also aid in correctly orienting the tray in the patient mouth when the impression is made.

3. The lingual flange of the mandibular tray may need to be lengthen with wax in the retromylohyoid area also wax may need to be added inside the distolingual flange to prevent the tissue of the floor of mouth from rising inside the tray.
4. Place the patient in an upright position, with the involved; arch nearly parallel to the floor.
5. When irreversible hydrocolloid is used, place the measured amount of water (at 700 F) in a clean, dry rubber mixing bowl (600 ml capacity). Add the correct measure of powder. Spatulate rapidly against the side of the bowl with a short, stiff spatula. This should be accomplished in less than 1 min. The patient should rinse his or her mouth with cool water to eliminate excess saliva while the impression material is being mixed & the tray is being loaded.
6. In placing the material in the tray, avoid entrapping air. Have the first layer of material lock through the perforations of the tray or rim-lock to prevent any possible dislodgment after gelation.
7. After loading the tray, remove the gauze with the topical anesthetic and quickly place (rub) some of the impression material on any critical areas using your finger (areas such as rest preparations and abutment teeth). If a maxillary impression is being made, place the material in the highest aspect of the palate and over the rugae.
8. Use a mouth mirror or index finger to retract the cheek on the side away from you as the tray is rotated into the mouth from the near side.
9. Seat the tray first on the side away from you, next on the anterior area, while reflecting the lip, and then on the near side, with the mouth mirror or finger for cheek retraction. Finally, make sure that the lip is draping naturally over the tray.
10. Be careful not to seat the tray too deeply, leaving room for a thickness of material over the occlusal and incisal surfaces.
11. Hold the tray immobile for 3 minutes with light finger pressure over the left and right premolar areas. To avoid internal stresses in the finished impression, do not allow the tray to move during gelation. Any movement of the tray during gelation will produce an inaccurate impression. Do not allow the patient or the assistant to hold the tray in position, some movement of the tray will be inevitable during the transfer and the impression will probably be inaccurate. Do not remove the impression from the mouth until the impression material has completely set.

12. After releasing the surface tension, remove the impression quickly in line with the long axis of the teeth to avoid tearing or other distortion.
13. Rinse the impression free of saliva with slurry water, or dust it with plaster, and rinse gently then examine it critically & finally cover it immediately with a damp paper towel.
14. A cast should be poured immediately into a disinfected hydrocolloid impression to avoid dimensional changes and syneresis. A delay should not exceed a 15 min.



The palatal part max. impression tray, The lengthen lingual flange of the mand. tray.

Step by step procedure for making a stone cast from a hydrocolloid impression

1. Have the measured dental stone at hand, along with the designated quantity of room temperature water, as recommended by the manufacturer. A clean 600-mL rubber mixing bowl, a stiff spatula, and a vibrator complete the preparations.
2. First, pour the measure of water into the mixing bowl and then add the measure of stone. Spatulate thoroughly for 1 min., remembering that a weak and porous stone cast may result from insufficient spatulation. Mechanical spatulation under vacuum is preferred. After any spatulation other than in a vacuum, place the mixing bowl on the vibrator and knead the material to permit the escape of any trapped air.

3. After removing the impression from the damp towel, gently shake out surplus moisture and hold the impression over the vibrator, impression side up, with only the handle of the tray contacting the vibrator. The impression material must not be placed in contact with the vibrator because of possible distortion of the impression.
4. With a small spatula, add the first cast material to the distal area away from you. Allow this first material to be vibrated around the arch from tooth to tooth toward the anterior part of the impression. Continue to add small increments of material at this same distal area, with each portion of added stone pushing the mass ahead of it. This avoids the entrapment of air. The weight of the material causes any excess water to be pushed around the arch and to be expelled ultimately at the opposite end of the impression. Discard this fluid material. When the impressions of all teeth have been filled, continue to add artificial stone in larger portions until the impression is completely filled.
5. The filled impression should be placed on a supporting Jig & the base of the cast can be completed with the same mix of stone. The base of the cast should be 16 to 18 mm (2/3 to 3/4 inch) at its thinnest portion and should be extended beyond the borders of the impression so that buccal, labial, and lingual borders will be recorded correctly in the finished cast.
6. As soon as the cast material has developed sufficient body, trim the excess from the sides of the cast. Wrap the impression and cast in a wet paper towel, or place it in a humidifier, until the initial set of the stone has taken place. The impression is thus prevented from losing water by evaporation, which might deprive the cast material of sufficient water for crystallization. Chalky cast surfaces around the teeth are often the result of the hydrocolloid's acting as a sponge and robbing the cast material of its necessary water for crystallization.
7. After the cast & impression have been in the humid atmosphere for 30 min., separate the impression from the cast. Thirty minutes is sufficient for initial setting. Any stone that interferes with separation from the tray must be trimmed away with a knife.
8. Clean the impression tray immediately while the used impression material is still elastic.
9. Trimming of the cast should be deferred until final setting has occurred.

Possible causes of an inaccurate or a weak cast of a dental arch

1. Distortion of the hydrocolloid impression:
 - (a) by use of an impression tray that is not rigid.
 - (b) by partial dislodgment from the tray.
 - (c) by shrinkage caused by dehydration.
 - (d) by expansion caused by imbibition (this will be toward the teeth and will result in an undersized rather than oversized cast).
 - (e) by attempting to pour the cast with stone that has already begun to set.
2. A ratio of water to powder that is too high. Although this may not cause volumetric changes in the size of the cast, it will result in a weak cast.
3. Improper mixing. This also results in a weak cast or one with a chalky surface.
4. Trapping of air, either in the mix or in pouring, because of insufficient vibration.
5. Soft or chalky cast surface that results from the retarding action of the hydrocolloid or the absorption of necessary water for crystallization by the dehydrating hydrocolloid.
6. Premature separation of the cast from the impression.
7. Failure to separate the cast from the impression for an extended period.

Technique for making individual acrylic resin impression trays

1. Outline the extent of the tray on the cast with a pencil. The tray must include all teeth and tissues that will be involved in the removable partial denture. Adequate space must be provided for frenal attachments. Mark the area of the posterior palatal seal on the max. cast & cut a 1mm × 1mm groove following the line designating the posterior extent of the tray.
2. Adapt one layer of baseplate wax over the tissue surfaces and two layers over the teeth of the cast to serve as a spacer for impression material. The wax spacer should be trimmed 2 to 3 mm short of the outline drawn on the diagnostic cast. Wax covering the posterior palatal seal area should be removed so that intimate contact of the tray and tissue in this region may serve as an aid in correctly orienting the tray when the impression is made.

3. Adapt an additional layer of baseplate wax over the teeth if the impression is to be made in irreversible hydrocolloid. This step is not necessary if the choice of impression material is a rubber-base or silicone type of material.
4. Expose portions of the incisal edges of the central incisors to serve as anterior stops when placing the tray in the mouth. Bevel the wax so that the completed tray will have a guiding incline that will help position the tray on the anterior stop.
5. Paint the exposed surfaces of the cast that may be contacted by the light-polymerized resin tray material with a model release agent (MRA) to facilitate separation from the cast.
6. Mix the correct proportions of autopolymerizing acrylic resin (8ml of monomer to 24ml of polymer) in a mixing paper cup. When the acrylic resin no longer string and can be handled without adhering to the fingers, form it into a wafer, the size and the thickness of a cake of modeling plastic or use special stone templates to form the wafer. A wooden roller and forming block are also available dental supply houses in kit form.
7. Carefully transfer the resin wafer to position on the cast & adapt the acrylic with the fingers, covering the wax spacer & palatal seal area & maintaining a uniform thickness. Remove the gross excess with a sharp knife while the acrylic resin is still soft.
8. Form a handle with the excess acrylic resin. The handle should be about 11mm (1/2 inch) wide, about 6mm (1/4 inch) thick, & about 5cm (2 inches) long.
9. Attach a handle into the tray over the region of the central incisors & shape it to extend 12mm (1/2 inch) downward & 2.5cm (1 inch) outward. It is usually necessary to place additional monomer on the handle & tray to provide a satisfactory union.
10. When the polymerizing cycle is completed, remove the tray from the cast. The wax spacer can be removed from the tray with a suitable instrument. Perfect the borders of the tray with rotary instruments and slightly polish the external surface of the tray.
11. Place perforations (No. 8 bur size) in the acrylic resin tray at 4.5mm (3/16 inch) intervals, with the exception of the alveolar groove areas, if an irreversible hydrocolloid impression material is to be used.
12. The finished tray must be sanitized and tried in the mouth so that any necessary corrections to the tray can be accomplished before the impression is made.

Impression concepts for complete and removable partial denture

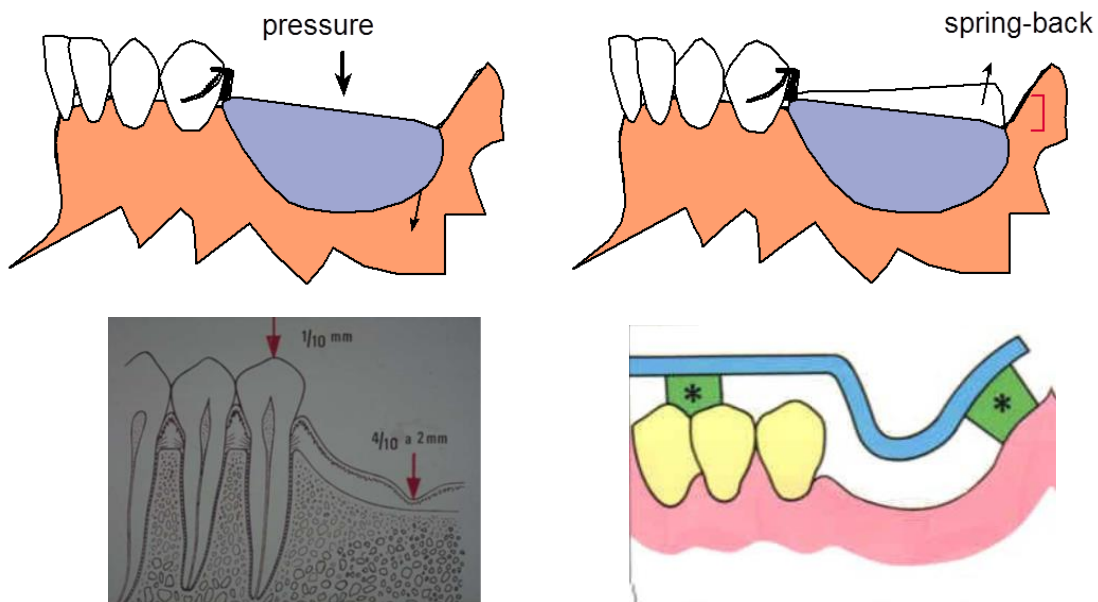
1. Mucostatic impression.
2. Mucodisplacive impression.
3. Selective pressure impression.

Mucostatic impression

The mucosa overlying the alveolar ridges and hard palate is not of uniform thickness. The mucostatic technique places minimal pressure to the tissues, and therefore records their resting shape. plaster, zinc oxide eugenol, low viscosity alginates are the Materials used in this concept. They are more fluid, so they displace the tissues less. These are known as mucostatic impression materials. These essentially record an impression of the undisplaced mucosa. This results in better retention of the denture because of closer adaptation to the mucosa at rest. But there will be instability of the denture during function as the tissues distort.

Mucodisplacive impression

The mucodisplacive technique applies pressure to the mucosa during the impression-taking procedure so that the shape of the tissues under load is recorded. Compound, high viscosity alginates, high viscosity elastomers are the materials used in this impression, called mucocodisplacive impression materials. These record an impression of the mucosa under load. This results in a wider distribution of load during function, making it more stable, on the other hand the retention of the dentures may be compromised as the oral soft tissues are resilient and tend to return to their position when forces are relieved. Dentures made by this technique tend to get displaced due to the tissue rebound at rest.



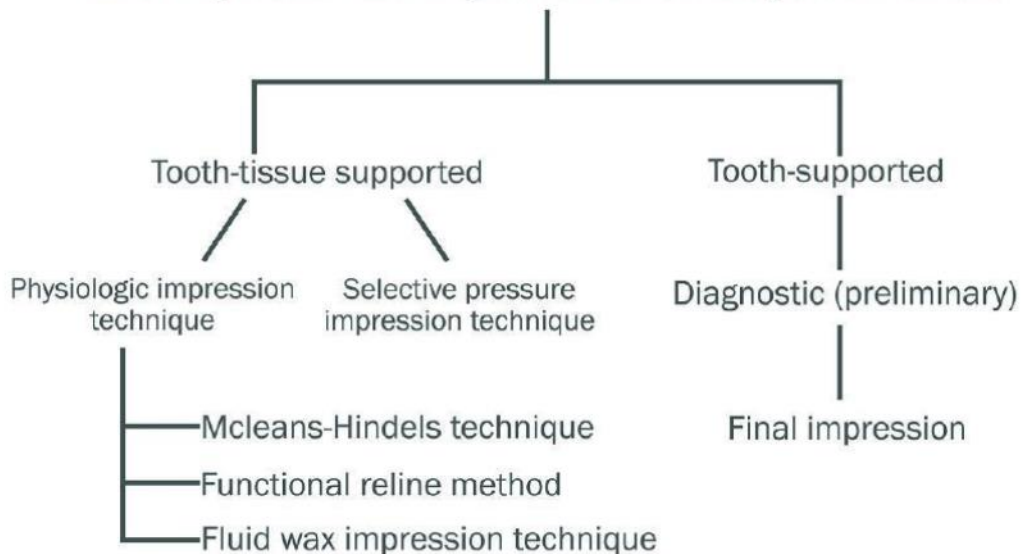
Selective pressure impression

With the selective pressure impression, an attempt is made to place light to moderate pressure on specific areas of the arches and minimal to no pressure on other areas. This technique seeks to create a denture base that selects loads the oral tissue during function of the prosthesis thus optimizes the stability and retention of the prosthesis. This is achieved through the design of the special tray in which the non-stress-bearing areas are relieved and the stress-bearing areas are allowed to come in contact with the tray .



Impression technique for removable partial denture

Final impression techniques for removable partial denture



***Anatomical impression technique:** pressure free impression record teeth and soft tissue in their anatomic form.

It is used for tooth supported removable partial denture. It does not contribute to support.

***Physiological or functional impression technique:** this type of technique records the teeth in their anatomic form and soft tissue and ridge in their functional form.

It is used in tooth –tissue supported dentures; it contributes to support.

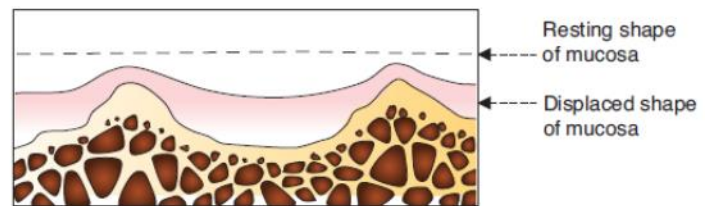
Aims of technique:

Three factors must be considered in the acceptance of an impression technique for distal extension removable partial dentures:

- 1— The material should record the tissue covering the primary stress bearing areas in their function form.
- 2— Tissues within the basal set area other than the primary stress bearing areas must be recorded in their anatomic form.
- 3— Maximum coverage by the impression must be obtained to distribute the load over as large an area as can be tolerated by the border tissues. This is an application of principle of the snowshoe.

Secondary impression CLASSIFIED INTO:-

1. Conventional techniques
2. Physiological or Functional techniques
3. Reline and rebases techniques
4. Selective pressure techniques



Conventional technique (Anatomical or Mucostatic impression techniques):-the surface contour of the ridge is recorded at its resting form (no occlusal load) (soft or less viscous alginate impression material)

Disadvantages: In free end saddle dentures, distal end will show tissue ward movement under occlusal load recommended for tooth supported partial dentures Kennedy class III and IV these are bounded saddles.

Physiological or Functional dual impression technique or Applegate

Here, one anatomical impression is made of the entire ridge and one physiological or functional impression is made only on the edentulous portion. The functional impression is made by applying occlusal load on the impression tray while making the impression. Thus the tissues are displaced during impression making.

The common techniques employed to record a physiological dual impression are:

- **McLean's technique** (made before the framework construction)
- **Hindle's modification of McLean's technique** (made before the framework construction)
- **Functional relining method** (made after finishing of RPD).
- **Fluid wax** (made after the framework construction)

McLean's Physiologic Impression

Two impressions are made in this procedure. A functional impression of the edentulous ridge is made. The second impression is made **over** the functional impression and it records the structures in their anatomic form. The second impression is also known as the *pickup* impression because it covers, and picks up the functional impression (first impression) along with itself.

Procedure

- A custom-made impression tray is fabricated over the edentulous areas of the preliminary cast. A spacer is not adapted because we intend to record only the supporting tissues with this tray.
- Occlusal rims are made on the custom tray.
- The tray loaded with the impression material is inserted into the patient's mouth and the patient is asked to close on the occlusal rims built over the tray.
- After making the impression, the custom tray should not be removed from the mouth
- An alginate **over-impression** (this impression is made over the existing impression) is made using a large stock tray.
- When over impression is removed, the functional master impression comes along with it.
- A cast is poured into the impression. This cast will reproduce the teeth in the anatomical form and the tissues in the functional form.

Disadvantage

Finger pressure used to settle the functional impression while making the over impression is not equal to the biting force used while making the functional impression. Secondly, there will be a small quantity of alginate between the occlusal rim of the custom tray and the over-impression stock tray. This alginate may act like a buffer and prevent the transfer of the entire load (finger pressure) applied on the stock tray to the special tray.



Modification by Hindle

It is similar to McLean's technique.

Hindle modified McLean's technique to overcome the disadvantages mentioned before.

Method

- A special tray with an occlusal rim is fabricated using the primary cast. The special tray should have stoppers to avoid excessive pressure on the tissues. The stoppers should be placed on the tray extending over the stress-bearing areas.
- The special tray is used to record the supporting tissues under *Function*.
- A special stock tray with large holes is used to make the over impression. While making the over-impression, the clinician should place his finger into the holes of the stock tray and apply steady constant pressure on the occlusal rim built on the special tray. Pressure should be held till the alginate sets completely.

Disadvantages:

Since the tissues are constantly compressed there will be excessive bone resorption.



Functional Relining Method

Advantages:

- It improves the fit of the denture after bone resorption.
- The tissue surface of the metal framework can be relined after insertion.

Disadvantages

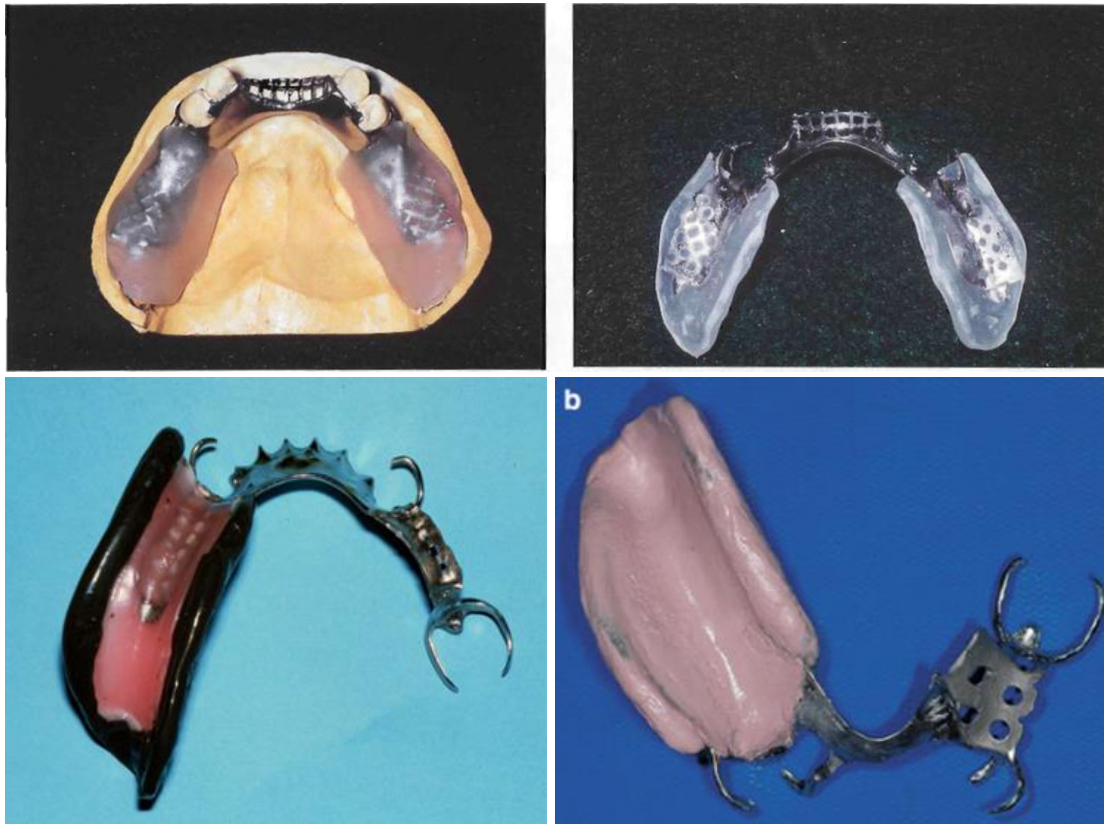
- It is difficult to maintain the relationship of the framework to the abutment teeth while making the impression.
- Occlusion is usually affected due to the addition of a new layer to the tissue surface of the denture base.

Fluid Wax Functional Impression

In this technique, a framework is fabricated using the anatomical impression as described in functional relining. The framework is modified into a special tray. A fluid wax functional impression is made using the special tray. The difference between this method and functional relining is that in functional relining the framework is directly used to record the functional impression, whereas in fluid wax technique, the framework is converted into a special tray to record the functional impression.

Selective pressure technique

Techniques to achieve selective pressure impression Kennedy Class I & II by Altered cast technique. In this technique one anatomical impression and one selective pressure functional impression is made. A master cast is prepared from the anatomical impression and is later altered according to the selective pressure functional impression. This technique differs from the previous techniques in that the second functional master impression is a selective pressure functional impression.



The control of gagging during making impression:**1- The dentist should:**

- a) Not mention the subject of gagging
- b) Ask whether the patient has had impressions made previously.

2- Before the impression is made:

- a) Ask the patient to use astringent mouth rinse and cold-water rinses.
- b) Prescribing a combination of atropine and a mild sedative medication.
- c) Seat the patient in an upright position with the occlusal plane parallel with the floor.
- d) Ask the patient to take a deep breath and hold the breath while the dentist quickly checks the size and fit of the tray.
- e) Correct the maxillary tray with modeling plastic and leaving sufficient unrelieved modeling plastic at the posterior border.

3- The impression material must:

- a) Have the consistency of thick whipped cream
- b) Fast-setting alginate. Set up to a rubbery consistency in few minutes.

4- During the impression procedure:

- a) Not overfill the tray with impression material.
- b) Seat the posterior part of the tray first and then rotate the tray into position.
- c) Force excess alginate in an anterior direction.
- d) Ask the patient to:
 - Keep the eyes opened and focused on some small object.
 - Breathe through the nose.
 - The "leg lift" procedure is used before and during the making of the impression.
 - Giving all instructions to the patient in a firm, controlled manner.