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SECOND EDITION

Textbook of
Prosthodontics

Complete Dentures
Removable Partial Dentures
Fixed Partial Dentures
Maxillofacial Prosthetics
Implant Dentistry
TMJ Disorders
Dental Materials



Deepak Nallaswamy Veeraiyan

JAYPEE

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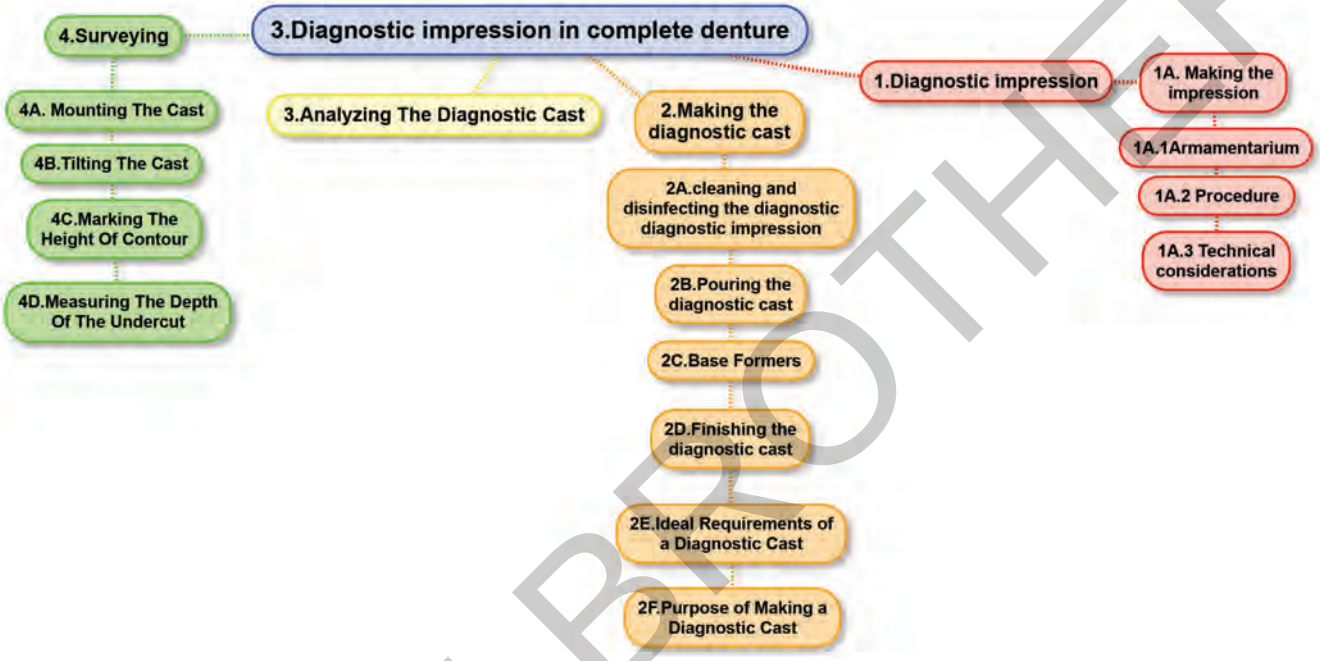
Chapter 3
Diagnostic Impressions in Complete Dentures





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Diagnostic Impressions in Complete Dentures

Some patients may have abnormal landmarks, which are unfavorable for placing a denture. These unfavorable tissues should be corrected before making the primary impression. Procedures that involve the correction of these soft and hard tissue abnormalities are collectively known as preprosthetic surgical procedures.

As a first step in preprosthetic surgery, a diagnostic cast is prepared and surveyed to determine the amount of surgery required. In this chapter we shall discuss in detail about making the diagnostic impression,[1] pouring the diagnostic cast and surveying the diagnostic cast.



Fig. 3.1: Modifying a metal stock tray.

1. Diagnostic Impression

Diagnostic impressions are made as a part of treatment planning. It should be understood that this impression cannot be used to fabricate the denture. A diagnostic impression is defined as "the negative replica of the oral tissues used to prepare a diagnostic cast".[2]

As mentioned above, the diagnostic cast is used for study purposes like measuring the undercuts, locating the path of insertion, etc. and not for any fabrication purposes.

1.A. Making the Impression

Diagnostic impressions are prepared using elastic impression[3] materials like agar or alginate. Rigid impression materials are contraindicated for making diagnostic impressions.[4] This is because the rigid materials get locked in undercuts and tend to break easily. Alginate is chosen because it is elastic (records the undercuts) and economical.

1.A.1. Armamentarium

- Diagnostic instruments (mouth mirror, probe).
- Perforated stock trays.
- Rubber bowl and spatula.
- Alginate impression material.
- Measuring scoops.

1.A.2 Procedure

- It is done only after complete healing is ensured.
- The patient's oral cavity is examined for ulcers and undercuts. Care should be taken not to pressurize the freshly healed areas while making the impression.
- Stock tray selection[5]
  - Perforated edentulous stock trays are used for alginate impressions.
  - The stock tray should have atleast 2–3 mm clearance. It should not be too large or small.
  - The borders of the tray should be about 2 mm short of the vestibule.
- Modifying the tray to suit the patient[6] (Fig. 3.1)
  - The tray can be bent or contoured to suit the patient's ridge using an orthodontic plier.
  - There should be an even space of 2 mm between the tray and the tissue surfaces.
  - If the sulcus is too deep, the borders of the tray should be built using utility wax.
- Required quantity of water is taken in a clean rubber bowl. Alginate powder is dispensed (sifted) into it.
- The alginate can be mixed manually using "figure of 8" motion or mechanically using an alginate spatulator (Fig. 3.2).

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- After mixing, the material is loaded quickly on the tray and inserted into the patient's mouth.
- The operator should lift and manipulate the patient's lips and cheeks while making the impression. The lips should be moved upward, outward and downward.[7] This helps to record the freni and sulci (Figs. 3.3A and B).
- The tray should be supported till the impression material is set.
- After the material is set the impression should be removed very quickly and gently in a snap. The impression should be removed very quickly and gently in a snap.
- Excessive impression material should not be loaded, because it can produce gagging.
- For patients with hypersalivation, anti-sialogogues like methantheline bromide, etc. can be used to reduce salivation.[8]
- If there is a single large undercut, the impression should be removed along the direction of the undercut. This helps to prevent distortion of the impression.

1.A.3. Technical Considerations

- If the patient has periodontally compromised teeth that have to be extracted, care should be taken not to traumatize the remaining teeth while removing the impression. In such cases, the impression should be withdrawn along the long axis of the remaining teeth.
- The impression is inspected for extent and voids. If there are gross deficiencies, the impression should be repeated.

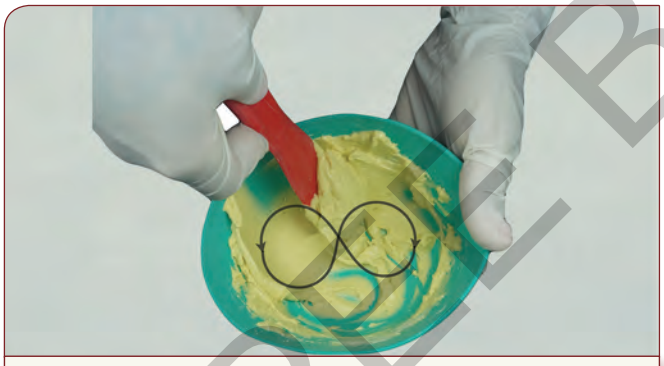


Fig. 3.2: Mixing alginate.

2. Making the Diagnostic Cast

2.A. Cleaning and Disinfecting the Diagnostic Impression

Disinfection of impressions is important to prevent infectious diseases like hepatitis B, acquired immune deficiency syndromes and herpes simplex.[8] This is done to prevent transmission of infection to the dental lab technicians through models and casts.

- Dental stone should be sprinkled on the impression to identify the saliva present on the impression. The remnants of patients saliva should be removed using a Camel-hair brush dipped in water. Impression should not be washed under direct water because it may get distorted.
- The impression should be disinfected before pouring the cast. Immersing the impression in a disinfectant like iodophor for 10 minutes is sufficient for complete disinfection.

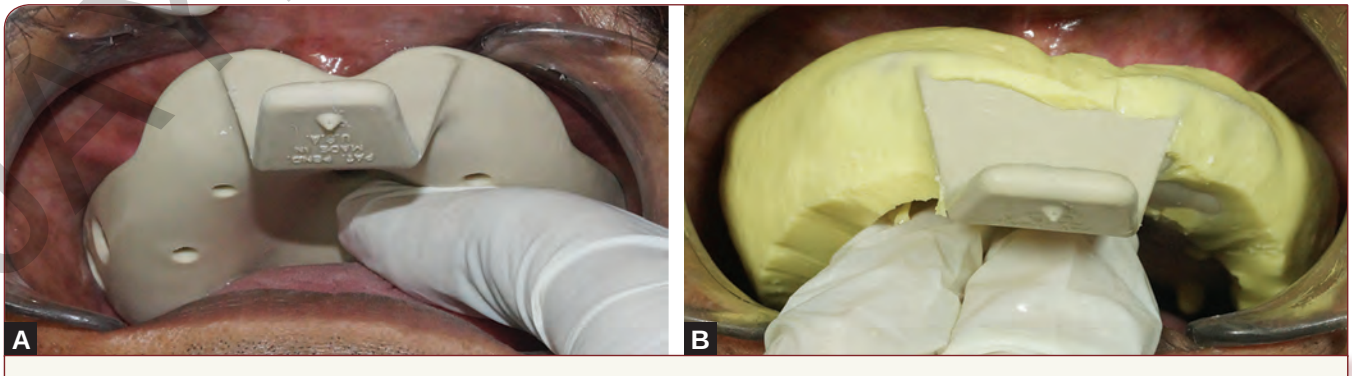
Before disinfection the impression should be rinsed to remove any debri or blood contaminants.

The impression can be disinfected by the use of one of the following disinfectants:[9,10]

- 1% NaOCl
- 2% glutaraldehyde
- Dilute hypochlorite or iodophor.

The methods include:

- Steam spray
- Heat sterilization



Figs. 3.3A and B: Making a primary impression using alginate.

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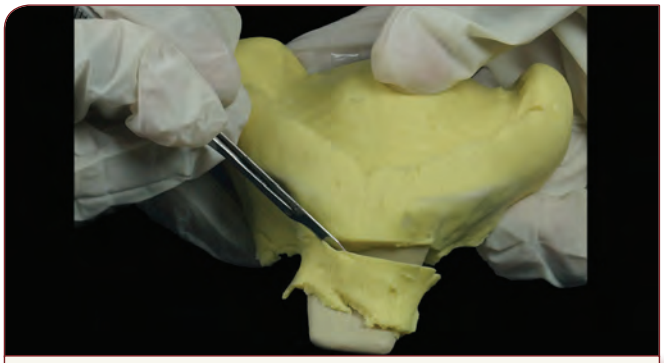

Fig. 3.4: Trimming the excess impression material.

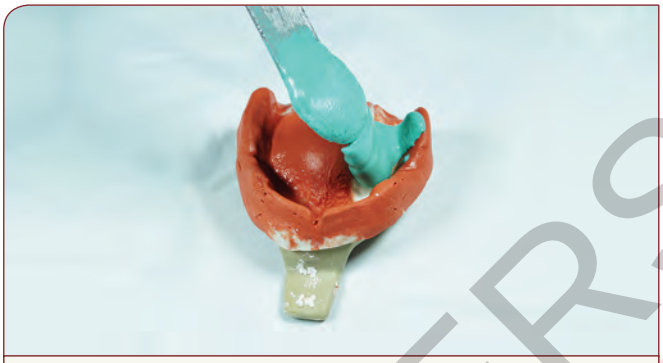

Fig. 3.5: Pouring the first pour from the distal end of the impression.

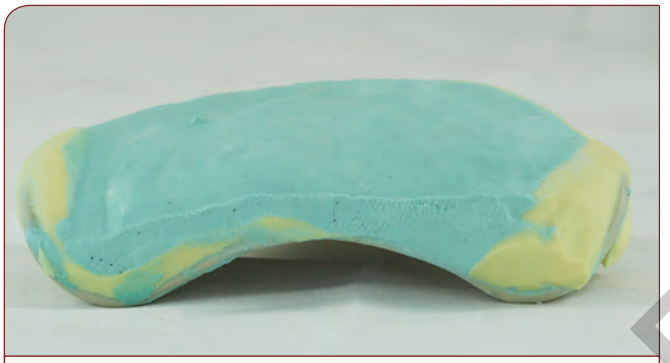

Fig. 3.6: First pour of the impression.



Fig. 3.7: Second pour of the impression.

- Spraying and immersion in disinfectant
  - The impression can be sprayed with the disinfectant and wrapped in a disinfectant soaked paper towel for 10 minutes
  - After disinfection the impression should be rinsed and then dried by shaking the excess water.
- After disinfecting the impression, it should be placed in slurry water to avoid shrinkage. Slurry water improves the wettability of plaster over the impression surface
- Excess impression material should be trimmed gently with a BP blade. Failure to trim the alginate will lead to distortion when the tray is placed on the table and the impression rests on the excess material (Fig. 3.4).

2.B. Pouring the Diagnostic Cast

- The cast should be poured within 15 minutes after impression making.[11]
- A base former can be used to make a proper base.
- Usually a diagnostic cast is poured using dental plaster. Dental plaster is preferred because it is economical and reproduction of finer details is not an important requisite.
- The impression is placed and stabilized over a piece of cotton so that the ridge appears parallel to the table.
- Required quantity of water and powder are dispensed in a rubber bowl and mixed in a circular motion.
- Once the plaster reaches a sufficient consistency, it should be placed on a vibrator to remove air bubbles.
- Impressions are usually poured in three pours.[11] In the first pour it should be of a more liquid consistency. The plaster mix should be placed on the distal end of the impression and allowed to flow all over. This prevents the entrapment of air bubbles (Fig. 3.5). The impression should be placed in a vibrator to avoid the occurrence of air bubbles. The first pour should extend up to half the height of the ridge (Fig. 3.6).
- The second pour should be a little thicker in consistency. Surface irregularities should not be removed because they act as retentive agents while pouring the last pour. After pouring the second pour it should be placed in slurry water to keep the plaster moist. The second pour should fill the entire ridge (Fig. 3.7).
- The last pour or the base pour is done using a base former. Plaster is mixed and poured onto the base former. A small quantity is applied over the second

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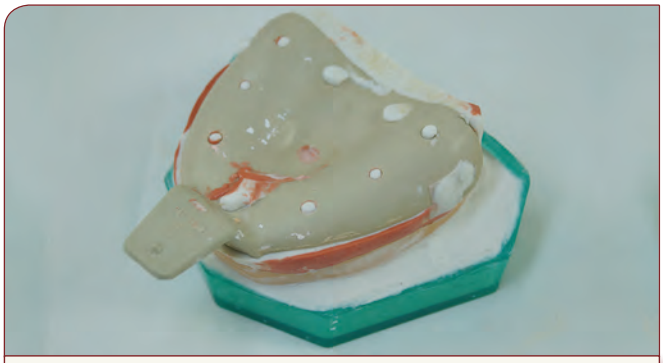

Fig. 3.8: The third or base pour.

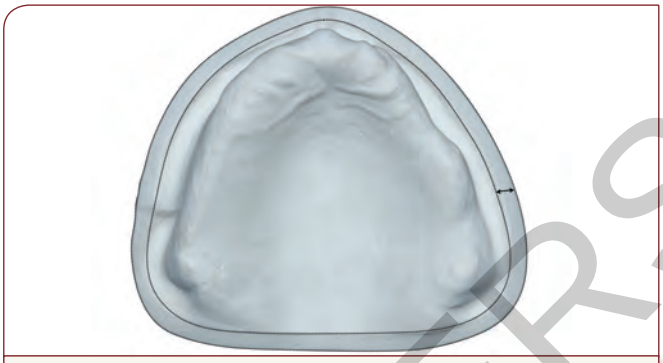

Fig. 3.9: Diagnostic cast showing the land area.

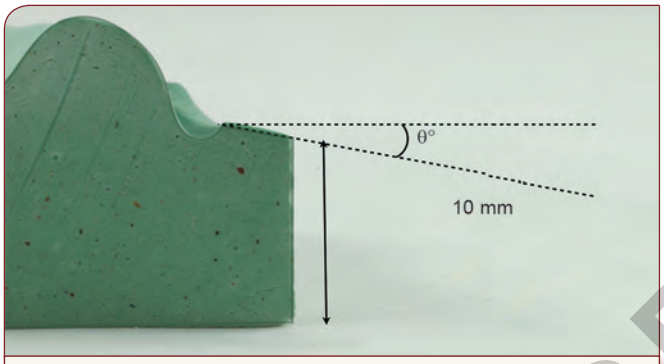

Fig. 3.10: Cross-section of the diagnostic cast showing the augulation of the land plane and the minimum required height of the cast θ = 45° for the anterior region and θ = 60° for the posterior region.

pour. The impression with the second pour is inverted over the base former. The third pour is contoured on the peripheral areas to remove any demarcation between the second and third pours (Fig. 3.8).

- The base should have a minimum thickness of 10 mm at its thinnest portion[12]
  - 10 mm at the center of hard palate in the Maxilla
  - 10 mm at the depth of lingual sulcus in the mandible.
- Excess plaster should be trimmed away.
- In case of mandibular impressions, the excess plaster in the tongue space area should be removed and contoured using a plaster knife. Care should be taken to avoid over trimming the plaster.

2.C. Making a Base Using Base Formers

Base formers produce perfectly smooth, symmetrical bases for study models.[12]

- They provide proper base sizes and eliminate the need for trimming.
- They are quick and easy to use.

Base formers can be made of:

- Plastic
- Silicone rubber or as disposable base formers
- They are available in small, medium and large sizes
- Sectional base formers are available for sectional impressions
- In the absence of a base former, a mix of plaster is spread over a glass plate or tile and the impression is inverted over it. Later, this base should be trimmed as per standards.

2.D. Finishing the Diagnostic Cast

- The diagnostic cast should be separated from the impression only an hour after its initial set.
- Since alginate is elastic, it is easy to remove the impression away from the cast. Care should be taken while removing the impression material from the undercut areas.
- Small nodules and projections on the impression surface should be removed.
- The cast should not be washed under direct water because the superficial surface of the plaster will dissolve and get washed away.
- If a base former is not used during the third pour, then the base of the cast should be trimmed using a model trimmer.
- Before using the model trimmer, the cast should be soaked in slurry water for 5 minutes.
- A base should have the following characteristics[13]
  - The sides of the cast are trimmed so that they are parallel to the buccal surfaces of the teeth. Posterior surface of the cast must be perpendicular to the floor. Edentulous casts will not have distinct surfaces
  - Land area/periphery should be 3 mm wide all around the cast. This is done to preserve the depth and width of the sulcus (Figs. 3.9 and 3.10).
- When the cast is trimmed in a model trimmer the trimmed plaster forms a paste, which is called **sludge**.

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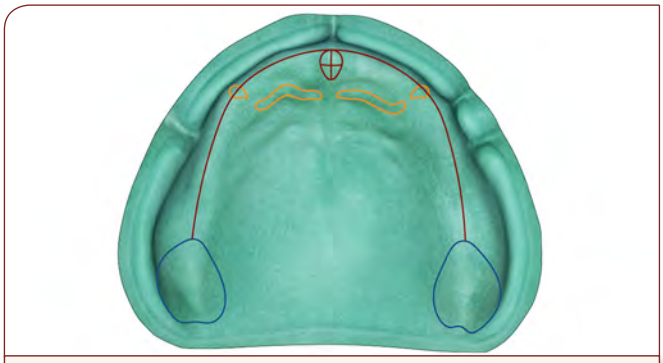

Fig. 3.11: Model analysis for upper cast.



Fig. 3.12: Model analysis for lower cast.

Sludge should be removed when it is wet. Removing dry sludge is difficult and often results in damage to the cast.
- Excess plaster present in the lingual aspect of the mandibular casts should be removed using a bevelled chisel.
- The base should be properly smoothened using sandpaper.[14]
- The cast is ready for use.

2.E. Ideal Requirements of a Diagnostic Cast[15]

- They should be free of voids or projections.
- The surface should be smooth, dense and free of sludge.
- It should cover all the areas, which provide denture support, e.g. it should extend 3–4 mm beyond the retromolar pad.
- The walls of the cast should be vertical or tapering outward but never inward.
- The tongue space in a mandibular cast should be smooth. The lingual peripheral seal (the lingual sulcus, lingual frenum and sublingual fold space) should also be intact.
- The cast should not show any traces of moisture.
- The occlusal table should be parallel to the floor.

2.F. Purpose of Making a Diagnostic Cast[16]

A diagnostic cast can be used for the following purposes:
- To measure the depth and extent of the undercuts
- To determine the path of insertion of the denture
- To identify and plan the treatment for interferences like tori
- To perform mock surgeries for maxillofacial prosthesis
- To determine the amount of preprosthetic surgery required
- To evaluate the size and contour of the arch
- To get an idea about retention and stability offered by the tissues
- To determine the need for additional retentive features like over denture abutments, implant abutments, etc.

3. Analyzing the Diagnostic Cast

The Bio-functional Prosthetic System (BPS®)[16,17] follows robust protocol to analyze the diagnostic casts which has been included here.

***Step 1*:** Analyzing the maxillary diagnostic cast (Fig. 3.11)
- The incisive papilla and the tuberosities should be marked with a pencil.
- The incisive papilla should be divided into four quadrant by a crosshair mark.
- A straight line should be marked connecting the two hamular notches.
- The pencil should be angled by 45° to shade the crest of the ridge.[18]
- The second rugae line (most complete rugae) should be marked and extended laterally to the canine eminence.

***Step 2*:** Analyzing the mandibular diagnostic cast (Fig. 3.12)
- The retromolar pad should be marked and divided into three segments.
- Next, the crest of the ridge should be shaded as described for the anteroposteriorly maxillary cast.
- Marking the myostatic outline: (John P Frush).
  - The outline of the mentalis muscle attachment should be marked and shaded
  - The mylohyoid ridge and the external oblique ridges should be marked with the pencil held at 30–45° against the prominence of the ridges[19]
  - Next, the frenal attachments (Labial, Buccal and lingual frenae) should be marked as an "inverted-V"
  - The markings should all be connected as a continuous line, thereby providing the "myostatic outline".
  - Frush believed that establishing this outline provided excellent stability for the denture.

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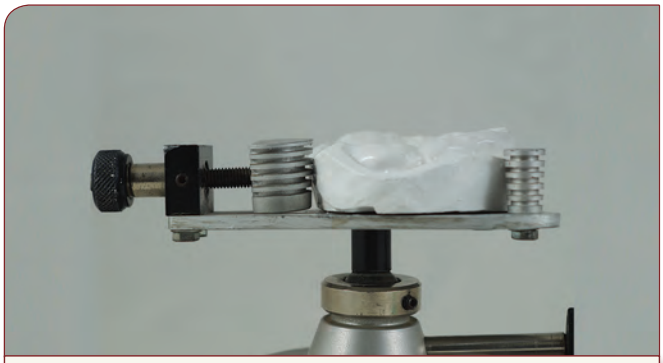

Fig. 3.13: Mounting the cast.



Fig. 3.15: Marking the height of contour using a carbon marker.

4. Surveying

Surveying is the best way to prevent the occurrence of various problems associated with complete dentures:

- Reasons to survey a diagnostic cast.[20]
  - Determination of path of insertion
  - Determine favorable and unfavorable undercuts
  - To determine need for surgery and to perform mock surgeries.
- Most of the above-mentioned procedures like determining the depth of the undercuts, path of insertion and evaluating the surgical correction required are all done by a procedure called surveying.[21] Surveying is done using an instrument called Surveyor. Surveyors are discussed in detail in the removable partial denture section (Ref Chapter 18).
- Surveying procedure includes mounting the cast, tilting the cast to avoid undercut, marking the height of contour and finally measuring the depth of the undercuts.

4.A. Mounting the Cast[22] (Fig. 3.13)

- The cast is mounted by placing and locking it on the surveying table.

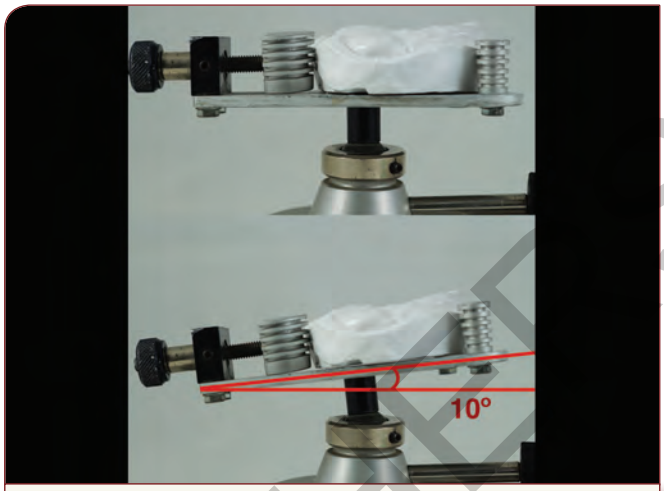

Fig. 3.14: Cast can be tilted to a maximum of 10° to compensate for a unilateral undercut.

- It should be placed in the center with its tissue surface in a horizontal plane.
- Once the symmetry (placement at the center) is checked, the cast position is marked so that it can be remounted anytime.

4.B. Tilting the Cast[23] (Fig. 3.14)

It is done to change the path of insertion of a complete denture.

- When an undercut is present on one side of the ridge, tilting the denture to that side during insertion solves the problem.
- The cast should not be tilted more than 10° or else it will require excessive mouth opening at the time of insertion.

4.C. Marking the Height of Contour[24] (Fig. 3.15)

This is done to demarcate the undercuts on a cast.

- A carbon marker is placed on the surveying arm of the surveyor.
- The marker is made to run around the ridge.
- Wherever the marker touches the side of the ridge, is the highest point or the height of contour of the ridge The area below the height of contour is called undercut.

4.D. Measuring the Depth of the Undercut[25] (Fig. 3.16)

- The depth of an undercut is measured using an undercut gauge.
- The gauge is positioned on the surveying arm and the distance between the deepest point of the undercut and the height of contour is measured.

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Fig. 3.16: Measuring the depth of the undercut using an undercut gauge.



Fig. 3.17: Surveying knife used to prepare mock preparations.

Sometimes a surveying knife is mounted on the surveying arm, and the height of contour of the ridge should be reduced up to the depth of the undercut. This is something like a mock surgery preparation. The scraped cast gives an idea about the amount of surgical reduction required (Fig. 3.17).

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Deepak Nallaswamy Veeraiyan BDS MDS–Prosthodontics (Saveetha Dental College) MS–Prosthodontics (University of Toronto) MDP (Harvard University) currently serves as the Director of Academics at Saveetha University, Chennai, Tamil Nadu, India; Professor and Program Head, Department of Prosthodontics and Program Director, Department of Implantology at Saveetha Dental College, Chennai. As a passionate academician, he received 'The best teacher' awards at Saveetha Dental College and the University of Toronto, Canada. Furthermore, he has invented the MILA (Multiple Interactive Learning Algorithm) and CABLE (Critical Appraisal based Learning). He has 3 pending patents in dental implant, and articulator designs. He was instrumental in establishing the clinic system at Saveetha Dental College that resulted in over 10 fold increase in patient care done by the students. This fetched him the 'Best Pioneer in Dental Education' at the world Dental Congress, London in 2017.

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