

# **SURVEYING OF REMOVABLE PARITAL DENTURES**

**FEB, 11, 2015**

## ***Dental Surveyor:***

It is a mechanical device used to determine the relative parallelism of the teeth surfaces and the undercuts areas in relation to the common path of insertion and removal of the denture.

- ✘ The surveyor was first introduced to the dental profession in 1918 by Dr A.J.Fortunati. Followed by Ney surveyor in 1923, Jelenko and *Williams*.
- ✘ This instrument, which is essentially a parallelometer, is one of the cornerstones of effective RPD design and construction. The surveyor allows a vertical arm to be brought into contact with the teeth and ridges of the dental cast, thus identifying parallel surfaces and points of maximum contour.
- ✘ Ideally the clinician, rather than the dental technician, surveys the study cast in preparation for designing an RPD.
- ✘ Both acrylic and Metallic Removable Partial Dentures. Before designing the primary casts should be surveyed.

➤ **The most widely used surveyors are:**

- **Ney**
- **Jelenko**
- **Williams**

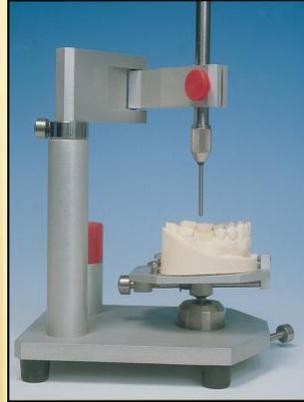


## COMPONENTS OF DENTAL SURVEYOR

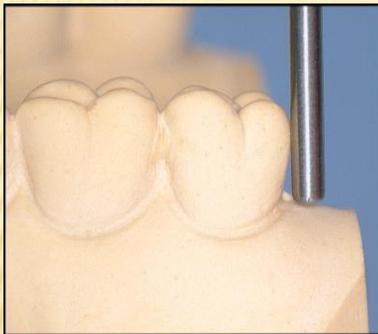
1. Base
  2. Vertical arm
  3. Analysing rod
  4. Horizontal arm
  5. Mandrel
  6. Adjustable table
- Accessories

### Analyzing rod

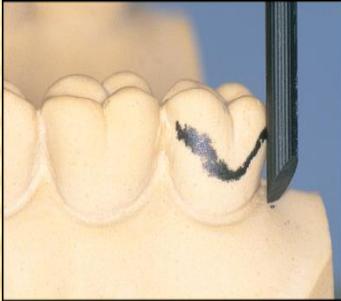
- Carbon or graphite marker
- Wax trimmer
- Undercut gauges
  - ✓ 0.25 mm or 0.01 inch
  - ✓ 0.50 mm or 0.02 inch
  - ✓ 0.75 mm or 0.03 inch



- 1. Analyzing rod** ✘ This metal rod is placed against the teeth and ridges during the initial analysis of the cast to identify undercut areas and to determine the parallelism of surfaces without marking the cast.

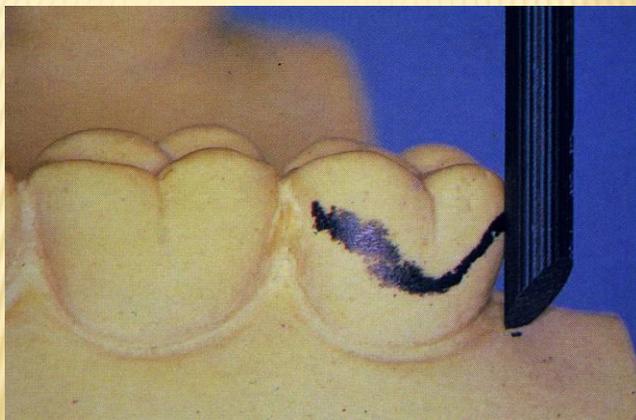


**2. Graphite marker** ✕ The graphite marker is moved around the tooth and along the alveolar ridge to identify and mark the position of maximum convexity (survey line) separating non-undercut from undercut areas.

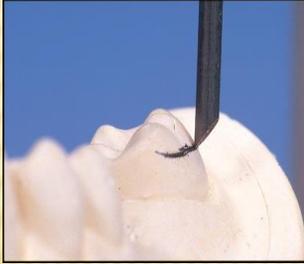


✕ When surveying a tooth, the tip of the marker should be level with the gingival margin allowing the side of the marker to produce the survey line as shown in the illustration.

***Survey line:*** Lines drawn around the most bulbous part of the tooth in relation to the common path of insertion and displacement.



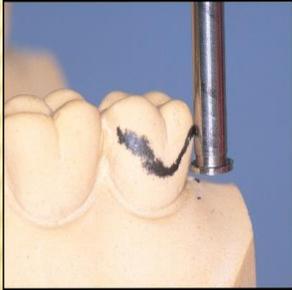
## Graphite marker



- ✘ A false survey line will be produced if the tip of the marker is incorrectly positioned. In this example there is no undercut area on the tooth although an incorrect surveying technique has indicated one. If this false line is used in designing an RPD, errors will arise in the positioning of components, especially clasps.



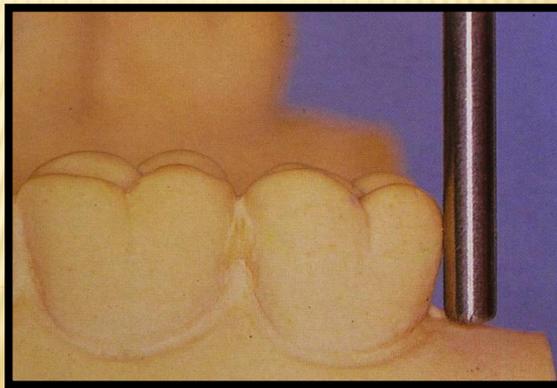
### **3.Undercut gauge**

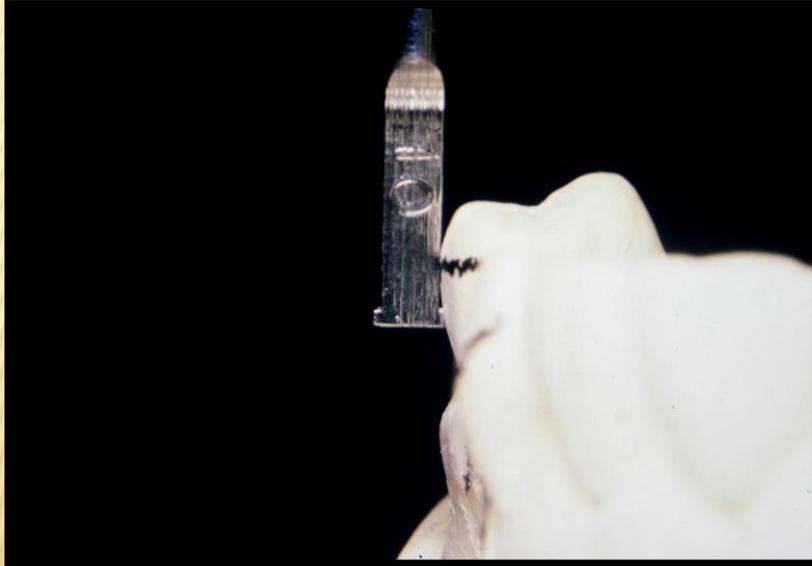


- ✘ Gauges are provided to measure the extent of horizontal undercut and are available in the following sizes: 0.25 mm, 0.50 mm and 0.75 mm. By adjusting the vertical position of the gauge until the shank and head contact the cast simultaneously, the point at which a specific extent of horizontal undercut occurs can be identified and marked. This procedure allows correct positioning of retentive clasp arms on the tooth surface .
- ✘ Other, more sophisticated, types of undercut gauge are available such as dial gauges and electronic gauges. These attachments fulfil the same function as the simpler type of gauge.

***Undercuts:*** That part of a tooth, which lies between the survey line and the gingival.

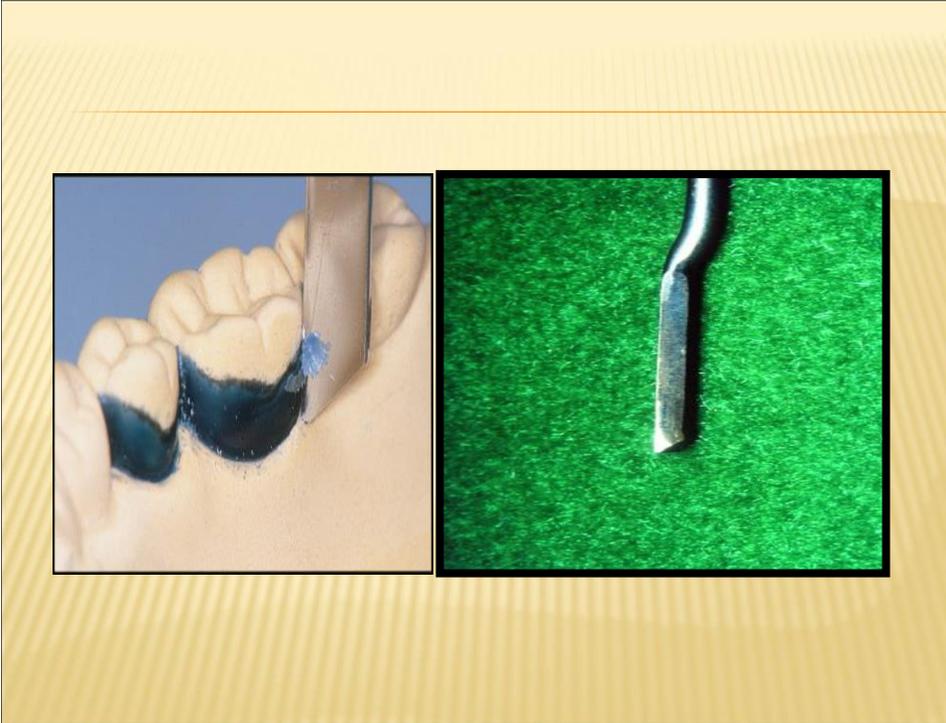
1. Hard tissue undercut "teeth".
2. Soft tissue undercut.
3. True and false undercuts.





- 4. Trimming knife** × This instrument is used to eliminate unwanted undercuts on the master cast. Wax is added to these unwanted undercut areas and then the excess is removed with the trimmer so that the modified surfaces are parallel to the chosen path of insertion.





## *Surveying:-*

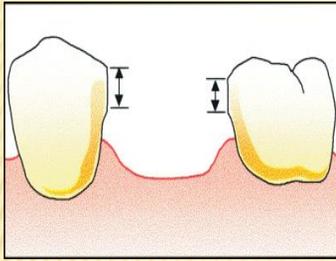
**The procedure of analyzing and delineating the contours of the abutment teeth (Hard tissues) and associated structures (soft tissues) before designing a RPD.**

## ***TYPE OF SURVEYING:***

1. **Initial surveying on the primary or diagnostic cast.**
2. **Final surveying on the master cast.**

## ***SURVEYING PROCEDURE***

- × Before discussing the functions of a surveyor in more detail it is necessary to explain the following terms:
  - **Guide surfaces.**
  - **Path of insertion.**
  - **Path of displacement.**



- × **Two or more parallel axial surfaces on abutment teeth which can be used to limit the path of insertion and improve the stability of a removable prosthesis. Guide surfaces may occur naturally on teeth but more commonly need to be prepared.**

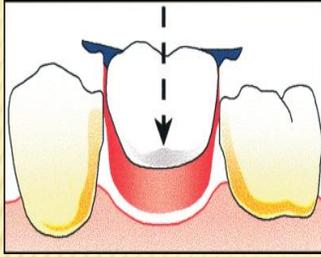
## **GUIDE SURFACES OR GUIDE PLANES**

## **COMMON PATH OF INSERTION**

**All possible paths along where a RPD can be inserted and removed from the mouth.**

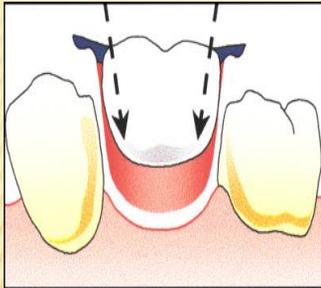
**OR**

**The path followed by the denture from its first contact with the teeth until it is fully seated. This path coincides with the path of withdrawal and may or may not coincide with the path of displacement. There may be a single path or multiple paths of insertion.**



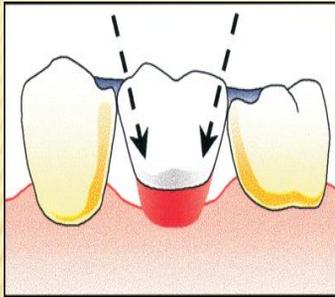
- ✘ A single path of insertion may be created if sufficient guide surfaces are contacted by the denture; it is most likely to exist when bounded edentulous areas are present.

## SINGLE PATH



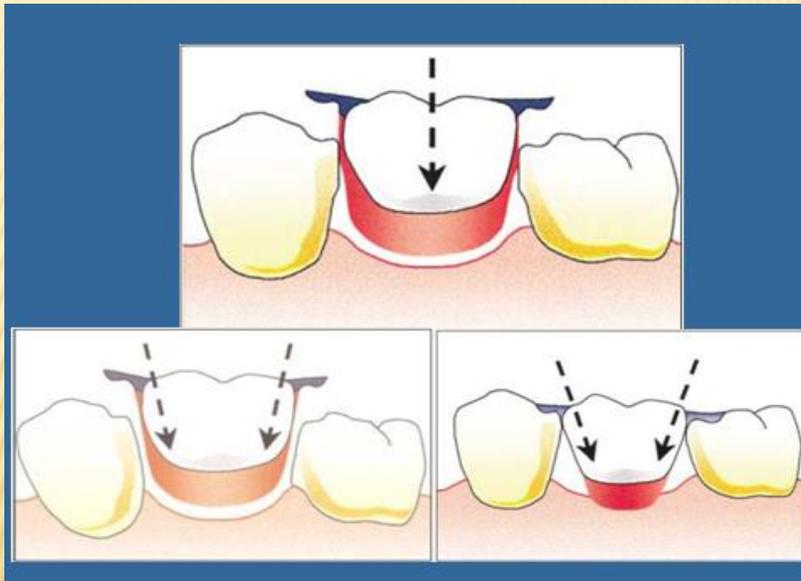
- ✘ Multiple paths of insertion will exist where guide surfaces are not utilized, for example where the abutment teeth are divergent.

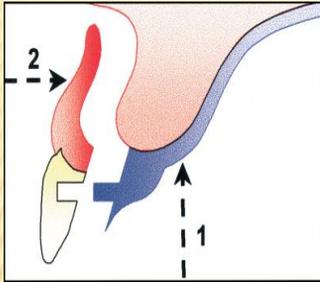
## MULTIPLE PATHS



- ✘ Multiple paths will also exist where point contacts between the saddle of the denture and the abutment teeth are employed in the 'open' design of saddle.

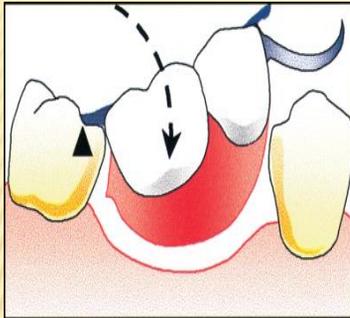
## MULTIPLE PATHS





- ✘ Two distinct paths of insertion will be employed for a sectional, or two-part denture illustrated here by a diagram in the sagittal plane of a Kennedy Class IV denture.

## TWO DISTINCT PATHS

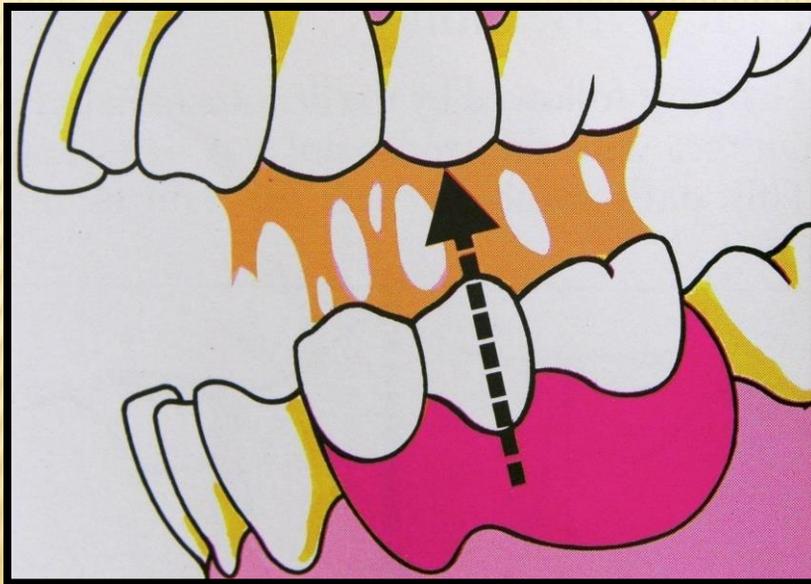


- ✘ A rotational path of insertion can be used.

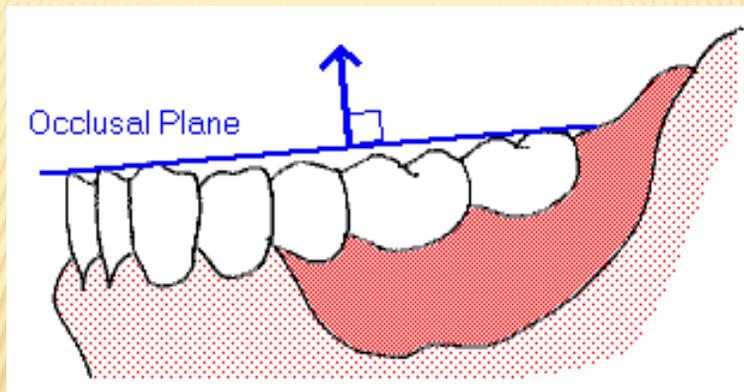
## A ROTATIONAL PATH OF INSERTION

## ***COMMON PATH OF DISPLACEMENT:***

**The path along where a RPD is most likely to be displaced during function. The path is a t right angle (90°) to the occlusal plane.**



- ✘ Displacing forces are directed at nearly 90 angle to the occlusal plane.
- ✘ Displacing forces are generated as a direct effect of consumed sticky foodstuff.
- ✘ Magnitude of displacing forces vary according to the type of the consumed sticky foodstuff.
- ✘ Displacing forces will dislodge the denture if their magnitude becomes greater than the retention force obtained by the various components of the RPD retentive elements.



**PURPOSES OF DENTAL SURVEYOR:****1. SURVEYING THE DIAGNOSTIC CAST.****The objectives are as follows:**

- 1) To determine the most desirable path of placement that will eliminate or minimized interference.
- 2) To identify proximal tooth surfaces that need to be made parallel so that they act as guiding planes during placement and removal.
- 3) To locate and measure areas of the teeth that may be used for retention.
- 4) To determine whether tooth and bony areas of interference will need to be eliminated surgically, modification, block out or by selecting a different path of placement.

**PURPOSES OF DENTAL SURVEYOR:****1. SURVEYING THE DIAGNOSTIC CAST.**

- 5) To determine the most suitable path of placement that will permit locating retainers and artificial teeth to the best esthetic advantage.
- 6) To permit an accurate charting of the mouth preparations to be made
- 7) To delineate the height of contour on abutment teeth and to locate areas of undesirable tooth undercut that are to be avoided, eliminated, or blocked out.
- 8) To record the cast position in relation to the selected path of insertion for future reference ( Tripoding )

**PURPOSES OF DENTAL SURVEYOR:****2. CONTOURING WAX PATTERN.**

1. The surveyor blade is used as a wax carver during mouth preparation phase so that the proposed path of insertion maintained throughout the preparation of cast restorations for abutment teeth.
2. Guiding planes, areas of reciprocation and stabilizing components, location and depth of undercut areas, and position of the retentive clasp arm must be surveyed and carved in the surveyor to maintained the previously determined path of placement.

**PURPOSES OF DENTAL SURVEYOR:****3. SURVEYING CERAMIC VENEER CROWN**

For esthetic reasons, ceramic veneer crowns are often used under RPD. The surveyor is used to contour all areas of the wax pattern except buccal or labial surfaces so, before the final glaze is accomplished, the abutment crown should be returned to the surveyor on a full arch cast to ensure the correct contour of the veneered portion or to locate those areas that need recontouring.

**PURPOSES OF DENTAL SURVEYOR:****4. PLACEMENT OF INTERNAL ATTACHMENT**

**In the placement of intracoronal retainers the surveyor is used as follows:**

- 1) To select a path of insertion in relation to the long axes of the abutment teeth that will avoid areas of interference elsewhere in the arch.
- 2) To cut recesses in the stone teeth in the diagnostic cast for estimating the proximity of the recesses to the pulp (used in conjunction with X-ray film) and to facilitate the fabrication of metal or resin jigs to guide the preparations of the recesses in the mouth
- 3) To carve recesses in the wax patterns, to place internal attachment matrix or its tray in wax patterns, or to cut recesses in the casting with the handpiece holder.
- 4) To place the keyway portion of the attachment in the casting before investing and soldering; each keyway must be parallel to the other keyways elsewhere in the arch.

**PURPOSES OF DENTAL SURVEYOR:****5. PLACEMENT OF INTERNAL REST SEAT**

- The surveyor may be used as a drill press, with a dental handpiece attached to the vertical arm by a handpiece holder. Internal rest seats may be carved in the wax patterns and further refined with the handpiece after casting, or the entire rest seats may be cut in the cast restoration with the handpiece.

PURPOSES OF DENTAL SURVEYOR:

## 6. MACHINING CAST RESTORATIONS.

With handpiece holder attached, all the follows may be refined and improved by machining;

- a) Axial surfaces of casts and ceramics.
- b) Proximal surfaces of crowns and inlays, which will serve as guiding planes.
- c) Vertical surfaces above crown ledges

PURPOSES OF DENTAL SURVEYOR:

## 7. SURVEYING THE MASTER CAST.

- 1) To select the most suitable path of insertion by following mouth preparations that satisfy the requirements of guiding planes, retention, noninterference, and esthetics.
- 2) To permit measurement of retentive areas and to identify the location of clasp terminals guided by:
  - i) The flexibility of the clasp arm.
  - ii) The magnitude of the tooth undercuts.

## PURPOSES OF DENTAL SURVEYOR

- 3) To locate undesirable undercut areas that will be crossed by rigid parts of the restoration during placement and removal; *this must be eliminated by block-out.*
- 4) To trim block-out materials parallel to the path of insertion before duplication.

## SURVEYING PROCEDURE

This may be divided into the following phases:

- A. Preliminary visual assessment of the study cast.**
- B. Initial survey.**
- C. Analysis.**
- D. Final survey.**

## **A. PRELIMINARY VISUAL ASSESSMENT OF THE STUDY CAST.**

This stage has been described as 'eyeballing'. The cast is held in the hand and inspected from above. The general form and arrangement of the teeth and ridge can be observed, any obvious problems noted and an idea obtained as to whether or not a tilted survey should be employed.

## **B. INITIAL SURVEY**



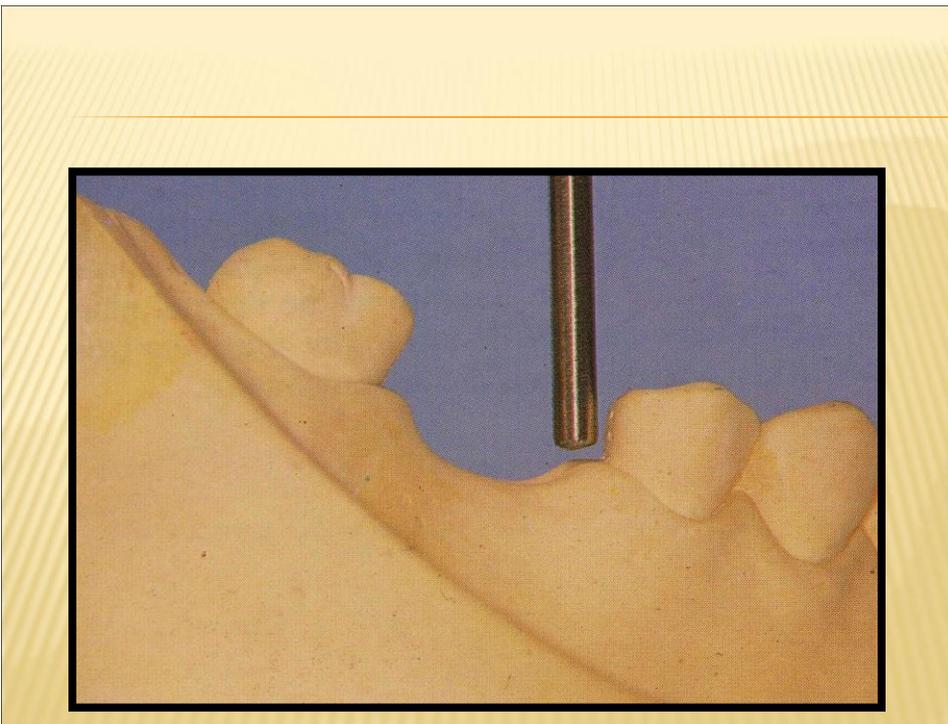
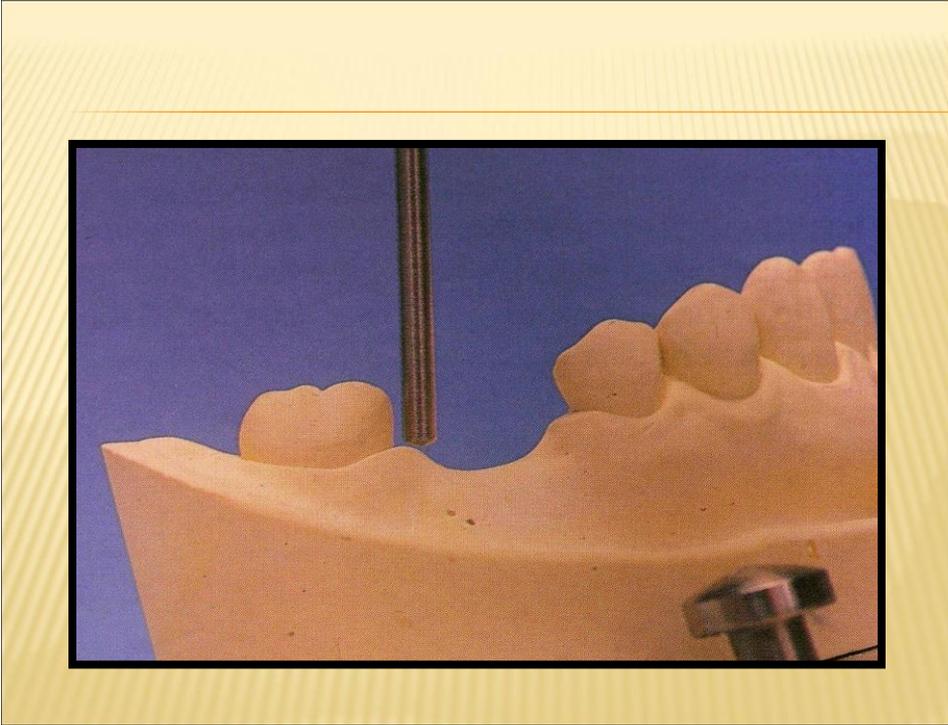
- ✘ The cast is positioned with the Occlusal plane horizontal or parallel to the bench and then the teeth (hard tissue) and the ridge (soft tissue) are surveyed to identify undercut areas which might be utilized to provide retention in relation to the most likely common path of displacement. Thereafter, the amount of undercuts can be measured by undercut gauges, whether they are sufficient for retention or not.

## C. ANALYSIS

A partial denture can be designed on a cast which has been surveyed with the Occlusal plane horizontal (i.e. so that the path of insertion is = the path of displacement). However, there are occasions when tilting of the cast is indicated so that the paths of insertion and displacement differ. Once the tilt has been indicated, the carbon marker should be changed for an analyzing rod, trying different positioned without marking the teeth.

### REASONS FOR CHOOSING ANOTHER TILT FOR THE CAST DURING SURVEYING

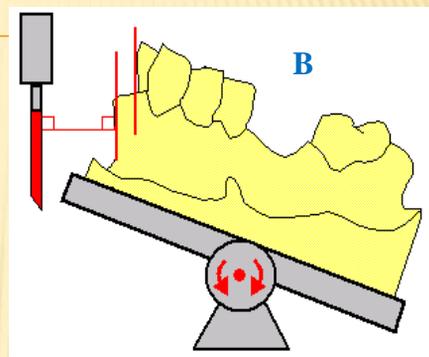
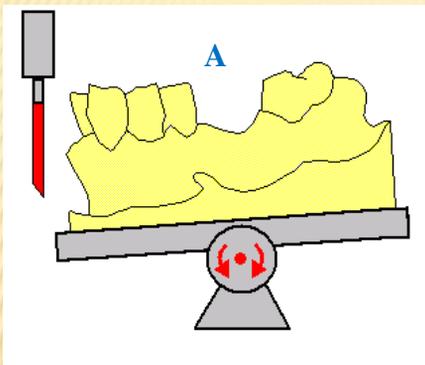
- 1) To achieve better appearance. (**Appearance**).
- 2) To obtain retention from guide surfaces. (**Retention**)
- 3) To avoid anatomical interferences and obstructions such as bulbous ridges or inclined teeth. (**Interference**).
- 4) To preserve tooth structure





- ✘ When a maxillary cast, containing an anterior edentulous area, is surveyed with the occlusal plane horizontal it will often be found that there are undercuts on the mesial aspects of the abutment teeth. If the RPD is constructed with this vertical path of insertion there will be an unsightly gap between the denture saddle and the abutment teeth gingival to the contact point.

## APPEARANCE.



IN THIS CASE ESTHETICS WERE OF IMPORTANCE IN RELATION TO AN ANTERIOR SADDLE TO FILL THE SPACE ANTERIOR TO THE CANINE TEETH.



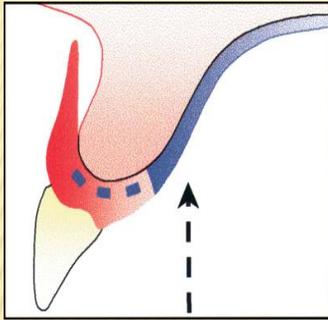
- ✘ This unsightly gap can be avoided by giving the cast a posterior (heels down) tilt so that the analysing rod is parallel with the mesiolabial surface of the abutment tooth.

**APPEARANCE.**



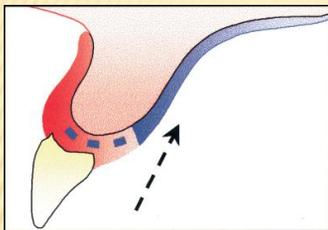
- ✘ With this posterior path of insertion the saddle can be made to contact the abutment tooth over the whole of the mesiolabial surface and a much better appearance results.

**APPEARANCE.**



- ✘ While examining the cast with the occlusal plane horizontal, sometimes the undercuts on the teeth and the ridge becomes apparent and this could obstruct the insertion and removal of the rigid part of the denture. By tilting the cast, a path of insertion may be found which avoids this interference. For example, if a bony undercut is present labially, insertion of a flanged denture along a path at right angles to the occlusal plane will only be possible if the flange stands away from the mucosa or is finished short of the undercut area. This can result in poor retention as well as a poor appearance.

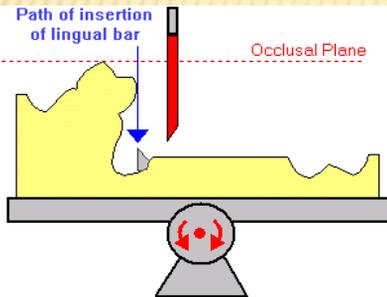
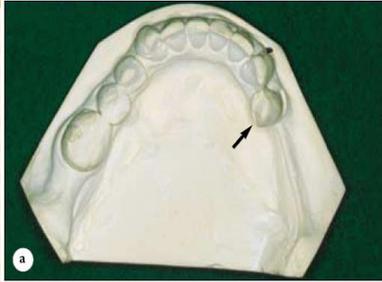
## INTERFERENCE.



- ✘ if the cast is given a posterior tilt so that the rod, and thus the path of insertion, is parallel to the labial surface of the ridge it is possible to insert a flange that fits the ridge accurately.

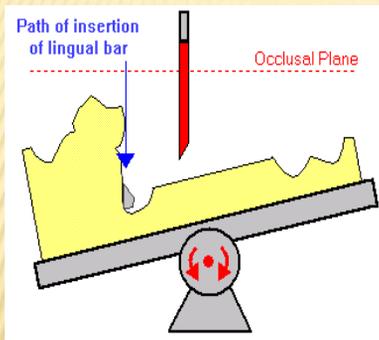
## INTERFERENCE.

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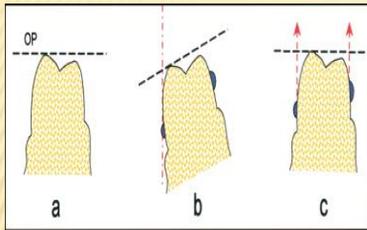


- ✘ Lingually tilted premolars can make it impossible to place a sublingual, or lingual, bar connector sufficiently close to the lingual mucosa.

## INTERFERENCE.



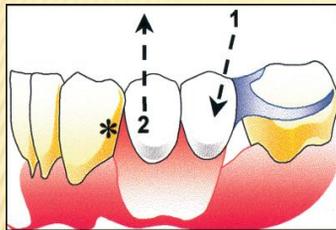
- ✘ Tilting the cast laterally, will enable better placement of the major connector.
- ✘ consideration should be given to the possibility of eliminating the interference by tooth preparation, for example by crowning to reduce the lingual inclination.



✘ To obtain retention, undercuts must be present on teeth relative to the horizontal survey. It is a misconception to believe that changing the tilt of the cast will produce retentive undercuts if none exist when the cast is horizontal.

- a. No undercuts on the tooth when the occlusal plane (OP) is horizontal.
- b. An apparent undercut created by tilting the cast laterally.
- c. Clasp arms placed in this false undercut do not provide any resistance to movement along the path of displacement.

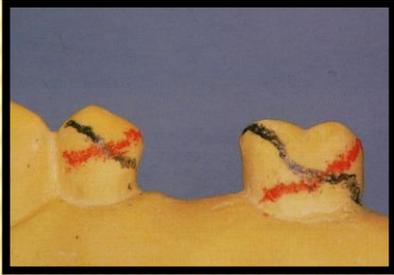
## RETENTION.



- ✘ The principle of tilting the cast to enhance retention is that by so altering the path of insertion (1) a rigid part of the denture can enter an area of the tooth surface or an area of the ridge which is undercut relative to the path of displacement (2).
- ✘ In this example, providing retention by engaging the distal undercut (\*) of the canine may well look more pleasing than a clasp arm on the same tooth.

## RETENTION.

## D. FINAL SURVEYING:



- ✘ If it is decided that the cast should be tilted, the analyzing rod is exchanged for a marker different in color from that used in the initial surveying and the final surveying is carried out. It will then usually be found that the teeth to be clasped have two separate survey lines which cross each other. In order to obtain maximum retention, it is necessary to know where to position the clasps correctly in relation to the two survey lines.

## Summary Of The Clinical Objectives Of Surveying

*Surveying is undertaken to obtain information that will allow decisions to be made concerning the following:*

**(1) The optimum path of insertion of the denture.**

*The choice of a path of insertion will be influenced by:*

- a. •The need to use guiding surfaces to achieve a pleasing appearance.
- b. • The need to avoid interference by the teeth or ridges with correct positioning of denture components.
- c. • The need to use guide surfaces for retention.

**(2) The design, material and position of clasps.**

*Decisions on these aspects of clasps can be obtained from:*

- a. Measurement of the horizontal extent of undercut on abutment teeth and
- b. The identification of sites on the teeth to provide reciprocation & stabilization either from guiding surfaces or from cross-arch stabilization

## REFERENCES

- McCracken's Removable Partial Prosthodontics. 12<sup>th</sup> Edition.
- J. C. Davenport, R. M. Basker, J. R. Heath, J. P. Ralph, and P-O. Glantz (2000): *A Clinical Guide to Removable Partial Denture Design* (ISBN 0-904588-637).