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Research Article

SURVEYING: THE FORGOTTEN KEY STEP TO SUCCESS

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A B S T R A C T

A denture will not succeed unless it is designed & constructed in harmony with all the physiologic & mechanical problems present in patient's mouth. To overcome these problems a procedure called surveying is employed. Through this article we would like to review about the surveyor, survey technique and recent advances.

INTRODUCTION

Coming to partial denture, a typical arch for which a partial denture is to be planned, consists of asymmetrical teeth, separated by edentulous areas, & residual ridges of varied lengths. The long axis of the standing teeth usually lack parallelism with each other, while the surface of the crowns of the teeth is irregularly convex in shape. The surveying procedure is an integral part of planning process which helps the dentist to determine which teeth are more desirable as abutment for placing the rest seats for maximum support and distribute stresses without excessive clasping & tooth coverage. A dental surveyor is vitally important to the planning, execution, & verification of appropriate mouth modifications for a removable partial denture.[1,2,3] Acc to GPT-9[4]SURVEY is defined as – "To examine as to condition, value, or situation; to appraise, to determine the form and position of a given entity by means of taking linear and angular measurements, To inspect or scrutinize, The procedure of locating and delineating the contour and position of the abutment teeth and associated structures before designing a removable partial denture" and the procedure is called as surveying, which is defined as "An analysis and comparison of the prominence of intraoral contours associated with the fabrication of prosthesis." The instrument used for surveying is surveyor, it is defined acc to GPT-9 as "A paralleling instrument used in the construction of a dental prosthesis to locate and delineate the contours and relative positions of abutment teeth and associated structures." Though surveying has a key role in success of a prosthesis, it has been omitted by all the dentists so through this article we would like to review about the surveyor, survey technique and recent advances.

HISTORY:[5,6,7]

Until 1950s most RPD were designed and constructed by time honored method of "eye balling" (FIG1).A prosthesis made on the basis of educated guesses.This was accomplished by holding a cast at arm's length while viewing it with one eye closed. Practitioner needs to hold a sharp pencil with the other hand perpendicular to the occlusal plane,pass the pencil lead over the axial surfaces of the teeth to develop a survey line at the greatest diameter of each tooth

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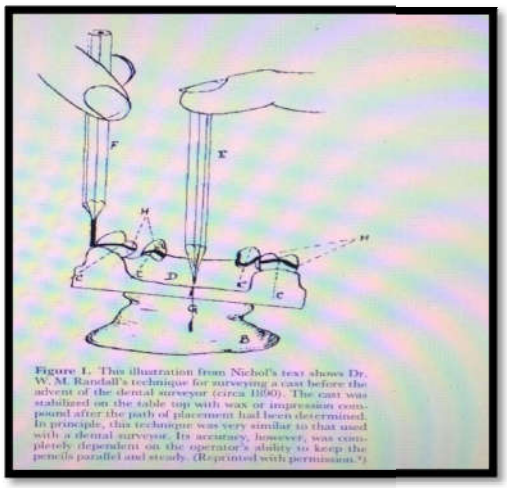

FIG 1 Paralleling technique – eye balling

The turning point in the partial denture construction from guess work based on clinical experience to scientifically based procedure was the appearance of dental surveyors in 1918.The Robinson surveyor is the first surveyor by Dr. A. J. Fortunati (FIG: 2).

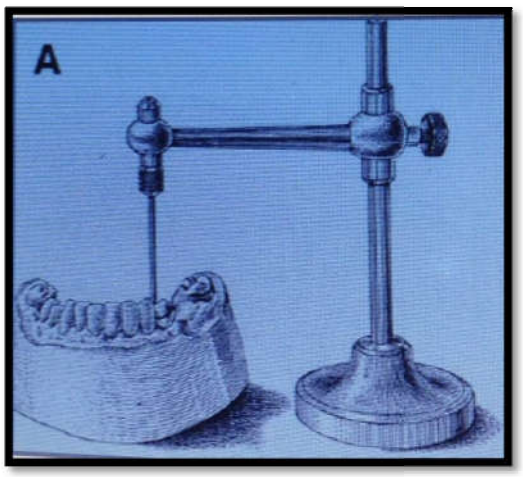

FIG 2 Robinson surveyor

In 1950, Mc Call and Hugel reported that 11 dental surveyors had been featured in scientific exhibits at the American Dental Association's 1948 Annual Meeting. These were:
1)Ney—1923,2)Brown-Maier—1925, 3)Wills—1929,4)Lentz—circa 1935, 5)Lineer—1937,6) Ney—1937,7)Franzwa—1937, 8)Ringle-Hiatt-Smith—1944,9)McKay—1944, 10) Hagman—1944, 11) Roach—1944
PARTS OF SURVEYOR (FIG 3, 4, 5):[1,2,3]
1.Horizontal platform, 2.Vertical arm, 3. Horizontal arm, 4. Surveying arm, 5.Surveying table6. Additional tools- Analyser rod (FIG 4b), Undercut gauges (FIG 5a,b,c), Wax knife, Carbon marker (FIG 4a)

Things To Be Known Before Surveying:[1,2,3]

- Tilt?
- Path of placement?
- Height of contour ?
- Survey lines?
- Block outs?
- Color coding?
-

WHAT IS THE TILT???

Cast tilting--- changing the position of the cast which thus changes the long axis of each tooth on the cast relative to horizontal plane, The position of survey line, The location and extent of any undercut area of the tooth[2,3]

Uses of Tilting

- Used to increase desirable undercuts
- To decrease undesirable undercuts
- To distribute available undercuts to produce more uniform retention throughout the available abutment teeth
- Used to develop a path of insertion that will permit the most effective use of anterior space for replacement

If A Cast Doesnot Have Usable Undercuts, Tilting Itself Will Not Produce Them

Basic Cast Tilts: The basic position or tilt of the cast on the surveyor should be the horizontal tilt, or, as some call it a ZERO tilt.In horizontal tilt, occlusal surfaces are at or near parallelism to the horizontal plane. This is the standard reference from which further tilts originate.

Basic Tilts

1. The anterior tilt – the anterior teeth are tilted downward
2. The posterior tilt- the posterior portion of the cast is tilted downward
3. The right lateral tilt – the right portion of the cast is tilted downward
4. The left lateral tilt – the left portion of the cast is tilted downward

• The viewpoint in describing the basic portion of tilt is always from posterior aspect of the cast.

The principle effects of tilting on undercuts are

- Anterior tilt ------ increase mesial undercuts on abutment teeth &residual ridges -decrease distal undercuts
- Posterior tilt------ increase distal undercuts-decrease mesial undercuts
- Right lateral tilt----increase buccal under cuts on right side -increase lingual/ palatal undercuts on left side-decrease buccal undercuts on the left side
- Left lateral tilt------increase buccal under cuts on left side -increase lingual/ palatal undercuts on right side-decrease buccal undercuts on the right side

- The tilt of the cast on the surveyor is contemplated to determine at what angle the partial denture will seat over the remaining teeth and any other obstructions that may present. This angle that the prosthesis takes as it goes to place is referred to as the PATH OF INSERTION.
- Factors determining the path of placement:
- Guiding planes
- Retentive areas
- Interference
- Esthetics

Guiding Planes:[2,3]Proximal tooth surfaces that bear a parallel relationship to one another must either be found or be created to act as guiding planes during placement & removal of the prosthesis. Guiding planes are also necessary to ensure predictable clasp retention. Helps the patient to place & remove the denture easily without strain on the teeth contacted or on the denture itself and without damage to the underlying soft tissues.

Retentive Areas:[2,3]Retentive areas must exist for a given path of placement and must be contacted by retentive clasp arms that are forced to flex over a convex surface during placement & removal. For a clasp to be retentive, its path of escapement must be other than parallel to the path of removal of the denture. Although desirable, retention at each principal abutment may not be balanced in relation to the tooth on the opposite side of the arch, however, positive cross arch reciprocation to retentive elements must be present. Retention should be sufficient only to resist reasonable dislodging forces. Even retention can be obtained by: To change the path of placement to increase or decrease the angle of convergence of opposing retentive surfaces of abutment teeth. To alter the flexibility of the clasp arm by changing its design, its size and length, or the material of which it is made.

Interference:[2,3]The prosthesis must be designed so that it may be placed and removed without encountering tooth or soft tissue interference. A path of placement may be selected that encounters interference only if the interference can be eliminated during mouth preparations or on the master cast by a reasonable amount of block out. Interference that cannot be eliminated for one reason or other will take precedence over the factors of retention and guiding planes

Esthetics:[2,3] By one path of placement the most esthetic location of artificial teeth is made possible, and less clasp metal and base material may be displayed. The location of retentive areas may influence the path of placement selected, and therefore retentive areas always should be selected with the most esthetic location of clasps in mind. Esthetics dictates the the choice of path selected when anterior teeth must be replaced with the partial denture. In such instances a more vertical path of placement is often necessary so that neither the artificial tooth nor the adjacent natural teeth will have to be modified excessively. This necessitates the preparation of abutment teeth to eliminate interferences and to provide guiding planes and retention in harmony with that path of placement dictated by esthetic factors.

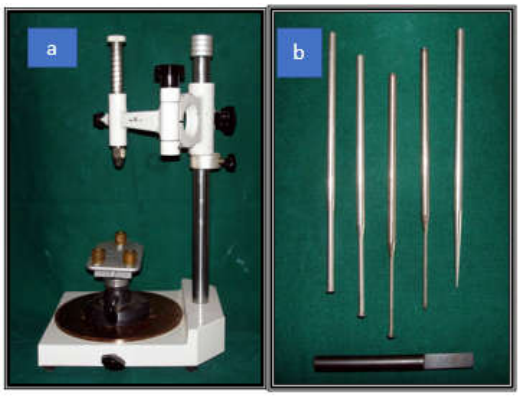

FIG 3: 3a. Surveyor, 3b. Tools of a surveyor

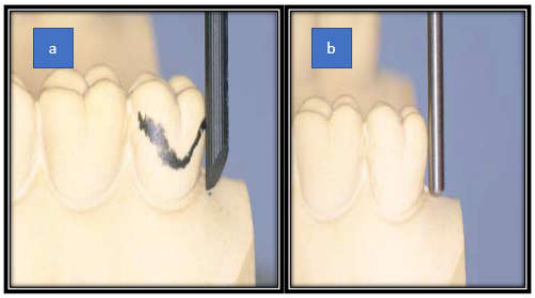

FIG 4: 4a. Carbon marker, 4b. Analyzing rod

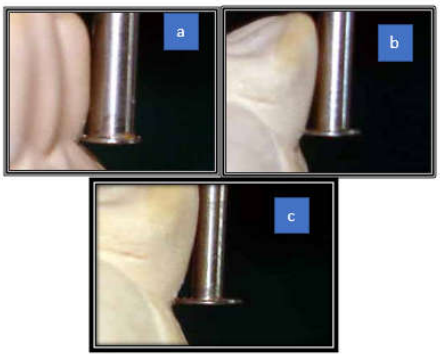

FIG 5: 5a. Undercut gauge 0.01 inch 5b. Undercut gauge 0.02 inch, 5c. Undercut gauge 0.03 inch

Step By Step Procedure (FIG 6):[1,8,9]

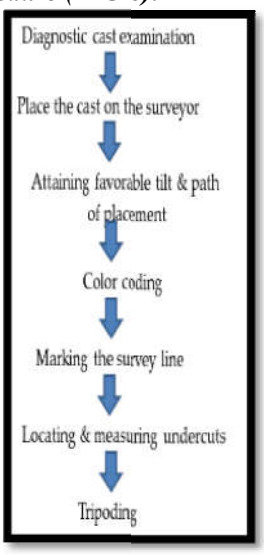

FIG 3

- Examine the occluded diagnostic casts.
- Indicate the proposed rest areas by short vertical lines on the cast below the tooth with black pencil.
- Examine the lingual aspect of the occluded casts for adequate space for cingulum rests, indirect retainers. Use black pencil for marking.
- Indicate with pencil, using the following symbols, the type of tooth replacement. Tube tooth.→ T, Facing→ F, Metal pontic→ M, Resin forced acrylic pontic→ RAP.
- Place these symbols on the soft tissue portion of the cast, adjacent to the edentulous area.
- If the shape and contour of these teeth necessitate recontouring indicate the location and extent of proposed alteration with red crayon pencil.
- Determine the most favorable tilt of the cast that will permit convent and proper placement of clasps, minor connectors anterior teeth, and denture base areas.
- Determine the path of placement.
- RECORDING THE RELATION OF CAST TO SURVEYOR:[8] This helps in returning the cast to the surveyor for future reference. The need for returning is any wax patterns, trimming, block out on master cast or locating clasp arms in undercut areas. Place the carbon marker in the vertical arm of the surveyor and scribe the survey line on teeth that will be contacted the partial denture.
- With red pencil draw in the extent of rest areas to be prepared in the mouth
- Outline the exact positioning of the denture base area. Blue pencil indicates acrylic base; Brown pencil indicates metal denture base
- With brown pencil outline the frame work design to harmonize and join the major connector, rest seats, indirect retainers and minor connectors.
- Replace the carbon marker with appropriate undercut gauge
- With the brown pencil draw the clasp arm to the actual shape, size, and location desired.
- Indicate the position and extent of undesirable tissue undercuts that may interfere with the insertion of restoration. This completes the design

Recent Advances

Parallel light beams are produced by light bulbs with small,dense filaments and condenser lenses contained in a box. The light beams are made parallel with vertical rod of conventional surveyor by fixing the box firmly to an iron bar. The cast is placed on the movable table and surveyed in a dark room using parallel light beams.The survey line is the border of light bright and dark zones-the line where the light beams are tangent to the cast and create a shadow.By tilting the table to establish various paths of insertion,undercuts and survey lines may be inspected without drawing on the cast.After securing the most favorable path of insertion for design of removable partial denture,the table of surveyor is fixed in position and survey lines are marked with lead marker.[10]

1. MICRO SURVEYOR COMPASS[11]: is Small hand held surveyor, developed in Japan. It establishes the path of insertion by tilting its vertical arm rather thanits cast holder. CHARACTERISTICS: Ultra- compact, Support determines the direction of insertion, Easy observation of "difficult to see "locations, highly accurate surveying

Electronic survey[11, 12]: using CAD-CAM. The dental cast can be scanned with the help of an accurate and sophisticated scanner such as multi slice helical CT scan and the digital model used for the purpose of diagnosis, treatment planning and storage for future use. The dimensional accuracy of the digital models when compared to the study models was statistically significant; and measurement can be made to a precision of 0.17mm.Therefore, digital/electronic surveying is a reliable method which can be accomplished by locating the height of contour, guide planes and undercut depth measurements as the digital model can be viewed from various angles and positions. Compared with hand-made set-up models, the computed diagnostic cast has advantages such as high speed processing and quantitative evaluation on the amount of 3D movement of the individual tooth relative to the craniofacial plane.

MAMOUN J S[13] proposed a microscope based on observation of diagnostic cast to determine appropriate path of placement (POP) for an RPD which guided in surveying the diagnostic cast and intra oral verification that contouring has shaped teeth surfaces such that they are compatible with intended POP.

CONCLUSION

The fabrication of an RPD as a viable treatment modality for oral rehabilitation must be based on mastering the use of the dental surveyor, starting with the understanding of the aspects involved in the dynamics of insertion and withdrawal of the prosthesis. Compromising the ideal in the location and design of components, however, may jeopardize the potential success of the prosthesis.

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