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FUNCTIONAL WAXING OF A CROWN FOR ABUTMENT OF A REMOVABLE PARTIAL DENTURE

Anthony D. Steas [1], Paul D. Garefis [1], Kenneth D. Rudd [2]

[1] *Department of Prosthodontics, University of Thessaloniki, Greece*
[2] *Department of Prosthodontics, University of Texas Health Science Center at San Antonio, USA*

Summary. *This article describes making a surveyed crown with the aid of a home-made instrument that can be used to measure the amount and position of the retentive undercut in relation to the reciprocal portion of a crown, either in wax or metal. The instrument, attached to surveying spindle (rod), can be used to actually carve the reciprocal portion of the waxed crown to make it parallel to the path of insertion and can determine how long this surface must be.*

Key words: *functional waxing, crown, abutment, removable partial denture*

Introduction

Poor design of both the artificial abutment crown and removable partial denture clasps on the crown, may contribute to increased mobility of the abutment tooth and possible bone loss around it, as well as, irritation of the soft tissue (1).

Insertion or removal of the removable partial denture (R.P.D.) may increase lateral forces acting on the abutment teeth due to the action of the clasps as they are forced open as the retentive arm passes over the greatest diameter of the tooth, (survey line) (2).

One purpose of the reciprocal arm (3,4) is to stabilize the tooth while the retentive clasp arm springs over the greatest diameter of the tooth and seats in the retentive undercut of the tooth where it will be passive. The reciprocal arm also functions as the clasp is removed from the tooth.

During seating and removal of the removable partial denture, the reciprocal arm must touch the reciprocal surface before (or at least simultaneously with) the retentive arm touches the tooth to opposite side and must remain in the contact with the tooth as the partial denture is seated and until removed from the mouth (5, 6) (Fig. 1).

In this maner , the reciprocal arm will be in contact with the tooth the entire time the retentive arm is springing over the greatest diameter of the tooth and will prevent the tooth from being torqued to the lingual every time the RPD is seated or removed from the mouth (Fig 1)

The achievement of this synchronization requires considerable skill and knowledge on the part of both the dentist and the dental technician who makes the abutment crown and clasp (6).

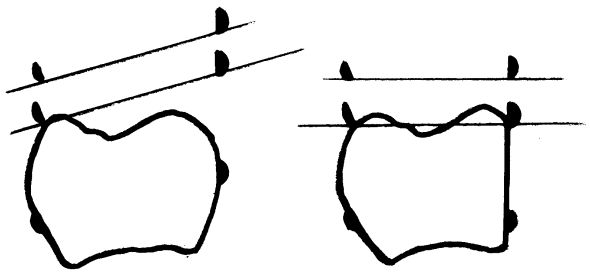


Fig 1. Cross section of a tooth and clasp arms. (a) retentive arm, (b) reciprocal arm. During seating of partial denture, reciprocal arm (b) must touch tooth before, or simultaneously, with retentive arm (a), in order to function correctly.

The heigh of the reciprocal surface must be at least as long as the distance defined by the first contact of the retentive arm of the clasp with the crown and the point at which the arm assumes its final seated position, when the remavable partial denture is firmly in place (Fig 2).
Of course to function properly, the guideplane (reciprocal surface) must be parrallel to the path of insertion.

The vertical length, of the reciprocal surface, necessary to support against lateral movement, is dependet upon the contour (profile) of the facial surface of the tooth, wich dictates the position of the survey line in relation to the path of insertion and the amound of the undercut used (Fig 2).

As Muller Divan wrote (7) , the surface of a tooth is

divided into three parts in a vertical direction; the supra-bulge zone, the infra-bulge zone and the neutral zone or survey line.

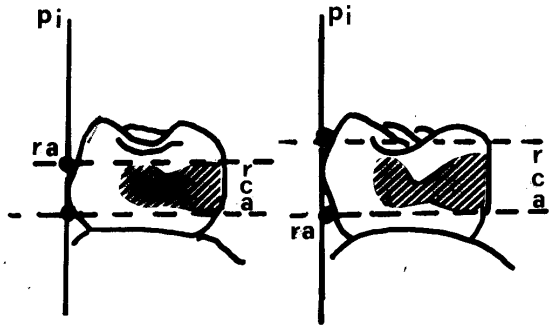


Fig 2. When contour of labial surface (left side of each drawing) has a good form angle) it is possible to reduce vertical length (height) of reciprocal surface and still maintain the effective operation of reciprocal arm. p.i = Path of insertion, re = retentive arm, and rca = reciprocal area.

The nearer the retentive tip of the retentive arm is to the cervical line (gingiva), the greater in heigh, the reciprocal surface of the tooth must be.

The more parallel the retentive surface (usually labial) is to the path of insertion, and the greater the distance between the retentive tip of the retentive arm and the survey line, the greater in height the reciprocal surface of the tooth must be. Conversely, the greater the deviation of the retentive surface of the tooth from the path on insertion and the closer the retentive tip to the survey line, the shorter in height the reciprocal abutment surface need be (Fig. 2).

As a general rule , depending on the position of the undercut on the facial surface of the tooth, the greater amount of the lingual surface of the tooth that is parallel to the path of insertion, the easier it is to establish this relationship (and the less modification of the abutment tooth is required).

We face this problem using canines or insisives as abutment, because of the inclination and contour of their lingual surface.

The following guidelines will aid in making functional surveyed crowns and clasps (5, 6):

1. The botton of the reciprocal arm should be at the same horizontal level perpendicular to the path of insertion as the tip of the retentive arm when the RPD is completely seated.

2. The greatest diameter of the abutment crown should be in the gingival 1/3 of the retentive surface. However, the closer the retentive tip is to the gingiva, the closer the reciprocation must be to the gingiva.

3. The terminal portion of the retentive tip of the clasp should be as close to the survey line as possible and still be in the measured amount of undercut fot the planned clasp.

4. The height (lenght) of a guideplane on the reciprocal surface of an abutment tooth must be at least as long as the surface defined by the first contact of the retentive arm of the clasp with the crown of that tooth and the point at which it is completely seated in the undercut, when the RPD is firmly in place (Fig. 5).

5. When a tooth can not be recontoured sufficiently without going through the enamel, the tooth should be prepared and a surveyed crown made.

6. When the crown is too short for the placement of the reciprocal or retentive clasp arm, concideration should be given to reducing the gingival tissue to expose more of the crown on either the facial and /or lingual surface as needed.

The purpose of this paper is to present a simple instrument and method by which, based on an accurate wax crown model, the correct relation between the retentive arm of the clasp and the reciprocal arm of the clasp can be achieved in order to avoid lateral forces exerted by the retentive arm of the clasp during the seating and removal of the partial denture.

The instrument

1. The instrument can be made easily and is composed of two strips 35 mm long, 5 mm wide and 2 mm high (Fig. 3 and 4), made from a sheet of poly (methylmethacrylate), and also two pieces 7 mm long and 5 mm wide bonded to the end of each long strip.

2. Drill a hole, the size of a staight handpiece mandrel screw, in each offset end. The hole for the screw must be at right angles to the surface drilled and screw must fit snugly in hole.

3. Join the two offset ends together with a straight handpiece mandrel.

4. Drill a hole in each free end, large enough to snugly fit an undercut gauge and a wax knife (Fig. 4). Hole must be at right angles to surface drilled and all holes must be parallel to each other.

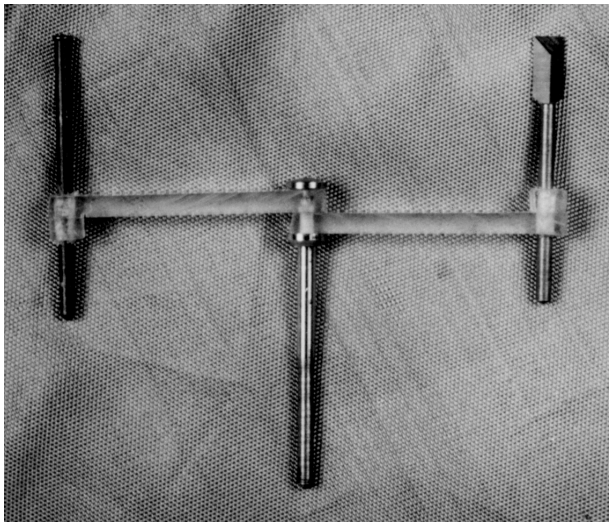


Fig 3. The instument: Two arms of poly (methyl-methacrylate). Wax knife. Straight handpiece mandrel. Undercut gauge.

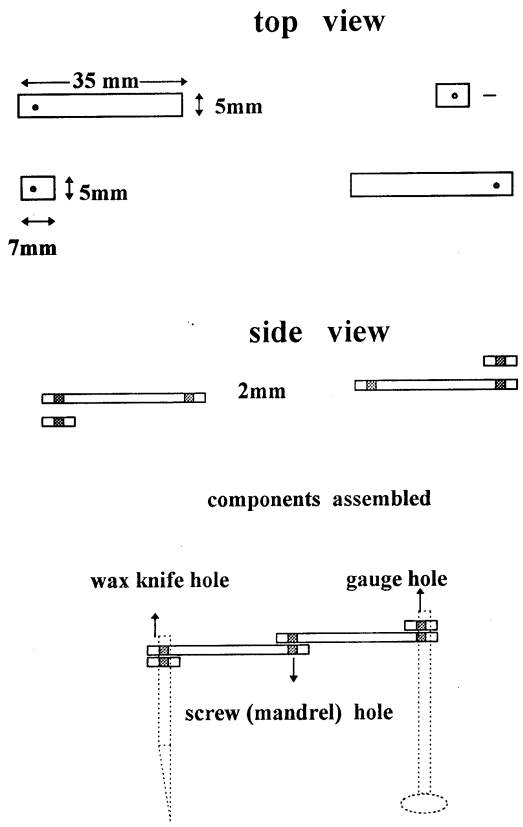


Fig 4. Dimensions of the components of the instrument. Two arms of poly (methylmethacrylate) 35 mm long, 5 mm wide, 2 mm high. Two pieces 7 mm long and 5 mm wide, 2 mm high.

Most importantly, the shanks of the undercut gauge and the wax mandrel must be parallel to each other and to the shank of the mandrel when it is locked in place (Fig. 7).

Waxing procedure

1. Complete the crown preparation(s) and precede to make cast, dies and, after accurate relation records, mount this cast in an articulator. Wax the crown on the abutment using standard procedures,

2. Wax the abutment crown(s) to full contour and in occlusion with the opposing arch. Make the facial surface with the greatest diameter in the gingival 1/3 and the desired amount of undercut at least 2 mm above the gingiva (Fig. 5).

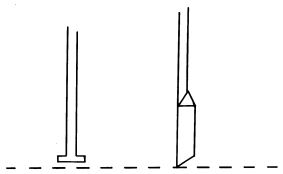


Fig 5. Tip of wax knife is positioned 1 mm lower than end of undercut gauge.

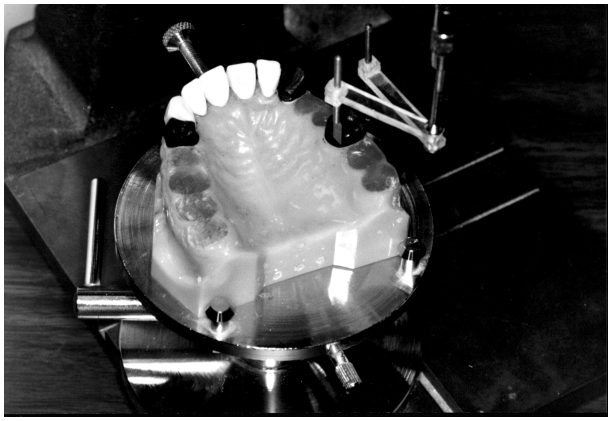


Fig 6. The entire instrument assembly fastened on the surveyor.

3. Select the undercut gauge for the amount of retentive undercut desired based on the shape, lenght, and diameter of the retentive clasp arm and the type of metal alloy to be used for the RPD framework. Clasp arms made on non-gold alloys usually should not be required to spring into an undercut of more than .020 inch (0.508 mm).

4. Asseble the cutting-measuring instrument (Fig. 7). Tighten the screw head of the mandrel to hold the two long plastic strips firmly but so they can be moved horizontally with some force.Insert the undercut gauge and wax knife into their respective holes.

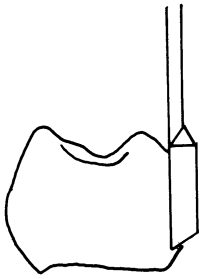


Fig 7. Wax knife touches reciprocal side of wax crown with tip positioned at cervical margin of crown as low as possible on cast and reciprocal surface is parallel with flat knife blade.

5. Adjust the undercut gauge so its head is about 1 mm shorter than the tip of the wax carver (Fig. 8).

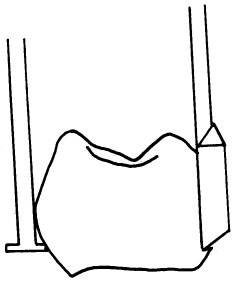


Fig 8. Close arms of the instrument until undercut gauge touches retentive (facial) surface and wax knife touches a reciprocal (lingual) surface.

6. Fasten the shank of the mandrel of the cutting-measuring instrument to the surveying instrument holder of the vertical arm (surveying tool-rod) (Fig. 9).

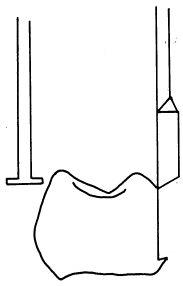


Fig 9. Shape retentive surface by adding or reducing wax crown to desired shape so undercut gauge should not touch the waxed tooth. Examine wax pattern with knife resting against the top of reciprocal surface.

7. Place the sharp straight edge of the wax knife against the reciprocal surface of the waxed crown. Adjust the surveying tool of the surveyor so that the tip of the wax knife is near the gingiva around the crown on the cast or near the margin of the preparation on the die and trim the lingual surface of the waxed crown so it is parallel with the sharp straight edge of the wax trimmer. The guideplane may be developed with or without a ledge near the gingival margin as shown in Figure 10. The principle is the same regardless of the design chosen.

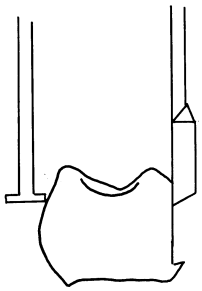
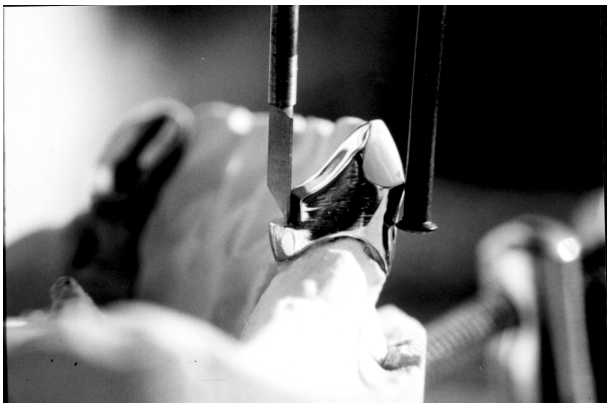


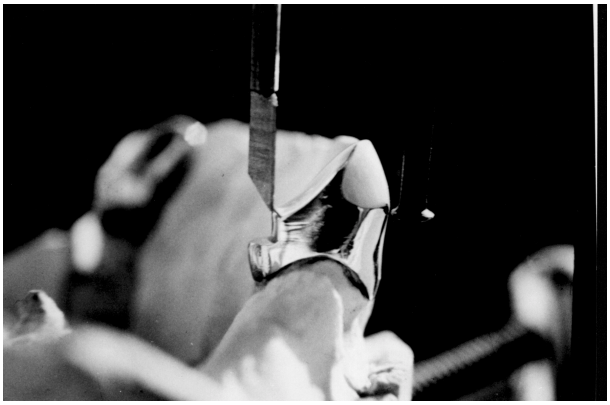
Fig 10.Lower vertical arm of the surveyor to see point on facial retentive surface where retentive arm first touches tooth.

8. To examine the results of the carving in relation to the undercut on the facial surface of the crown, stop the carving periodically and measure the progress made with the cutting-measuring instrument.

9. Hold the straight edge of the wax carver against the reciprocal surface of the waxed crown and swing the undercut gauge into contact with the retentive surface where the tip of the retentive clasp arm is intended to rest (Fig. 11). The wax carver should be in full contact vertically with the reciprocal surface and the head of the undercut gauge should touch the crown as shown in Figure 8. The bulge on the retentive surface must be carved to rather exact proportions to establish the height of the retentive tip above the gingival and the measured amount of retentive undercut in relatio to the guide-plane, therefore, both the retentive surface and the reciprocal surface must be contoured simultaneously.



(a)



(b)

Fig 11.Verification of the above mentioned procedures in the final crown: (a) When the wax knife is at its final position against the reciprocal surface, the undercut gauge comes into contact with the crown. (b) Without altering the distance between the wax knife and the undercut gauge, check if the wax knife touches the crown before or at least simultaneously with the undercut gauge.

10. When you approach to finish hold both wax-knife and undercut-gauge in contact with corresponding surfaces and fix the two long arms of the cutting-measuring instrument with a drop of wax, so the angle between them remains constant.

11. Whithout changing the angle or the tilt of the surveyor table, slide horizontally the instrument, away from the crown, and lift the vertical arm of the surveyor until the cutting-measuring instrument is above the waxed crown.

12. Slide again horizontally the vertical arm of the surveyor until the waxed crown is positioned as it was in step 11 before the cutting-measuring instrument was moved. Then lower the vertical arm of the surveyor until the tip of the straight edge of the wax knife touches the limit of the reciprocal surface (Fig. 12). When the relationship is correct, the head of the undercut gauge should almost (but not quite) touch the bulge on the

retentive surface of the waaxed crown. When the head of the undercut gauge touches the retentive surface of the waxed crown before the straight edge of the wax trimmer touches the flat reciprocal surface of the waxing crown, some of the wax should be removed from the relevant facial surface of the crown to recontour it.

13. When the surprabulge of the retentive surface is adjusted and recontoured, lower the cutting-measuring instrument, still fastened to the vertical arm of the surveyor, until the head of the undercut gauge and straight edge of the wax trimmer both touch the waxed crown. The straight edge of the wax trimmer should touch the reciprocal surface of the crown by at least 1/2 mm when the head of the undercut gauge is in contact with the retentive surface just above the survey line (Fig. 13).

14. When the retentive and reciprocal surfaces are nearly perfected, use the cutting-measuring instrument as in step 9 to measure the contours, make any minor changes necessary in the wax, then continue to shape and blend the remaining contours of the aburment crown, sprue, invest, and cast it in the metal of choice.

15. Recover the casting, finish, and polish it. Fit it to the die and place it in the working cast.

16. Use the appropriate portions of steps 6 through 13 to examine, correct, and adjust the completed abutment crown.

Discussion

The difference in height, of the tips if the wax trimmer and the head of the undercut gauge, represent the difference between the retention and reciprocal arms of the clasp, and permit the exact assessment of the points at which the arms of the clasp will make contact with the tooth surface upon seating the RPD. The reciprocal clasp arm (represented by the wax trimmer) touches the reciprocal surface of the crown before the retentive clasp arm (represented by the undercut gauge). Conversely, during removal, the reciprocal arm will remain in contact longer than the retentive arm of the clasp. In this way, permanent reciprocal action is ensured during the entire time pressures being exerted by the retentive arm during seating and removal of the partial denture.

Ordinary surveying instruments (styli) in a surveyor can give information about the position and depth of the undercut and whether the guideplane is parallel to the path of insertion but they can not measure the exact point at which the retentive clasp arm starts to open or tell exactly how long the guiding plane (reciprocal surface) must be to have its full supporting potential for the abutment tooth. The home made cutting measuring instrument described in this article can measure these points and surfaces precisely.

The wax trimmer in contact with the reciprocal portion of the waxed crown indicates that the tooth will be supported by the reciprocal clasp arm while the retentive clasp arm springs over the bulge and into the undercut.

It must be remembered that the guide of the waxed crown(s) must be parallel to the path of insertion and must be in line with other abutment teeth involved in the RPD whether or not they have been prepared for a surveyed crown (Fig. 6)

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FUNKCIONALNO MODELOVANJE KRUNE ZA NOSAČ PARCIJALNE PROTEZE

Anthony D. Steas [1], Paul D. Garefis [1], Kenneth D. Rudd [2]

[1] Klinika za protetiku, Univezitet u Solunu, Grčka
[2] Klinika za protetiku, Univezitet teksaškog zdravstvenog centra u San Antoniu, SAD

Kratak sadržaj: *Ovaj članak opisuje metod izrade paralelometarske krune uz pomoć kućno izradjenog instrumenta koji može biti korišćen za merenje iznosa i položaja retencione podminiranosti u odnosu na recipročni deo krune, bilo*

u vosku ili metalu. Instrument, pričvršćen na osovinu paralelometra, može biti korišćen da stvarno rezbari recipročni deo voštane krune da bi ga učinio paralelnim sa putom unošenja i može odrediti koliko duga ova površina mora biti.

Ključne reči: *funkcionalno modelovanje, kruna, nosač, pokretna parcijalna proteza*

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