A Technique to Facilitate Tooth Modification for Removable Partial Denture Prosthesis Guide Planes

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Abstract

The technique in this article was developed to provide a means to create prepared guide planes of proper dimension to ensure a more stable and retentive removable partial denture prosthesis (RPDP) framework when providing this service for a patient. Using commonly found clinical materials, a paralleling device can be fabricated from the modified diagnostic cast of the patient’s dental arch requiring an RPDP. Polymethyl methacrylate or composite added to an altered thermoplastic form can be positioned intraorally and used as a guide to predictably adjust tooth structure for guide planes. Since it can potentially minimize the number of impressions and diagnostic casts made during the procedure, this can help achieve the desired result more efficiently and quickly for the patient.

Keywords
Surveyor; abutment tooth; tooth modification.

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Modification of tooth structure for removable partial denture prosthesis (RPDP) treatment has been documented and established as a necessity to ensure intimate contact of the framework with abutment teeth and also to minimize tilting or rotation of the prosthesis during function. Establishing parallel guide planes on two or more teeth can present a challenge to even the most experienced practitioner, but can be even more difficult to the novice dental student. Alteration to the dentition can be problematic in creating a desired path of insertion and removal. If the resultant walls are too divergent, the retention of the framework may be compromised.

Due to the difficulty of visually determining whether the necessary modifications have been completed, most clinicians will make numerous impressions, make multiple diagnostic casts, and use a surveyor to verify if the desired result has been achieved. Especially if multiple surfaces are involved, this can be a very tedious and time-consuming procedure.

A method to simplify this procedure is presented here. Using the diagnostic cast with a modified vacuum-formed matrix, an alignment jig can be fabricated on the altered diagnostic cast using a surveyor to align the guide planes. Composite or autopolymerizing methyl methacrylate acrylic resin is then placed on the matrix to create parallel guides using the straight wax carver as a means to establish equally parallel walls. It can be a useful teaching aid and clinical guide for dental students as well as seasoned clinicians.

Technique

1. An impression of the arch is made using irreversible hydrocolloid (Jeltrate; Dentsply Caulk, Milford, DE) in a stock metal tray. Vacuum-mixed type III stone (Microstone; Whip Mix Corporation, Louisville, KY) is vibrated into the mold, and a cast is fabricated (Fig 1).

2. Create a thermoplastic vacuum matrix (clear) from 0.020” material (Buffalo Dental Mfg. Co., Syosset, NY), similar to that used for fabrication of provisional crowns.

3. Trim the excess material to ensure ease of placement on the diagnostic cast without scraping or marring the cast.

4. Carefully remove clear plastic matrix from cast.

5. Open areas of the matrix associated with planned guide plane(s) using a sharp scalpel (#25 blade). A window opening is sufficient from line angle to line angle as well as exposure of a portion of the occlusal surface.

6. The cast is placed on the survey table.

7. Determine the best occlusal plane relative to the floor/table top so that they are close to parallel.

8. Make slight modifications to the tilt based on your assessment of the teeth in the arch until you can achieve the desired position of the cast on the surveyor (Ney surveyor; Dentsply Prosthetics, York, PA).

9. Place the matrix back on the cast. You should see areas of the tooth surface adjacent to the edentulous ridge exposed. Align these teeth with the analyzing rod first to
Figure 1 Cast of mandibular arch surveyed and tripoded.

Figure 2 Carving rod being used to prepare guide plane on stone cast tooth #21.

Figure 3 New survey line placed on distal #29 following modification of stone cast.

Figure 4 Fabrication of paralleling guide using clear orthodontic resin.

Figure 5 Parallel guides completed on clear matrix.

Figure 6 High-speed handpiece in position to modify tooth for parallel guide plane using matrix.

Figure 7 Fabrication of paralleling guide plane using composite resin.

Figure 8 Matrix in place intraorally adjacent to #11.
check the position. Once this is established, exchange the analyzing rod for the wax carving instrument.

10. Position the teeth of the cast next to the carver and gently scrape the exposed surface of the proximal surface of the stone tooth abutment until the desired dimension of the guide plane is established (Fig 2). Use of the surveyor is especially helpful when evaluating multiple surfaces on opposite sides of the arch. After the teeth in question have been modified on the diagnostic cast, check for the desired result in terms of dimension, parallelism, and divergence.

11. Using the marking pencil in the surveyor, mark the new guide planes (Fig 3). Make sure tripod marks have been made on the cast to ensure proper orientation on the guide table. Use your preferred method to roughen or modify that portion of the matrix that covers the edentulous ridge to enhance retention for the next step.

12. Add monomer to the surface of the matrix, then with the straight carver in position next to the modified tooth, place polymethyl methacrylate (PMMA) onto the matrix and build up a flat surface parallel to the adjacent modified tooth (Fig 4). Composite may be substituted for the PMMA, but use the appropriate bonding agent compatible with the material. About 3 to 4 mm away (closer if you prefer) from the tooth should allow sufficient operating room to use your preferred rotary instrument (diamond, straight carbide) to establish the guide plane (Figs 5 and 6).

13. Make any adjustments necessary to achieve a finished product on the matrix, such as removing flash, reinforcing weak areas, and polishing rough surfaces (Fig 7). Disinfect and place intraorally to achieve the desired mouth preparations for the RPDP previously planned for the arch (Fig 8).

Discussion

Guide planes in removable partial prosthodontics are vertically parallel surfaces on abutment teeth and/or dental implant abutments oriented so as to contribute to the direction of the path of placement and removal of an RDP. Other authors of textbooks and periodicals convey a similar description. The frictional control gained from this procedure of creating parallel surfaces is an adjunctive aspect of retention for an RPDP in addition to direct retention, the neuromuscular control of the patient, and the forces of adhesion and cohesion.

Numerous articles have been published regarding different techniques to enable the practitioner to establish guide planes or achieve parallelism with prepared teeth. Intraoral paralleling instruments have been mentioned in published reports, ranging from simple to complex. Several authors have offered a variety of indirect techniques to gain the desired proximal surface configuration.

The use of a dental surveyor to evaluate a dental cast is the first step in diagnosing and planning an arch to receive an RPDP. This device permits the practitioner to evaluate the occlusal plane, determine height of contour on abutment teeth, discern potential problems with soft tissue contour, and analyze what areas require modification to ensure the best path of insertion and removal. The potential for error in the fabrication of the prosthesis is minimized by using a paralleling device to ensure that the path of insertion is perpendicular to the occlusal plane and that “artificial” undercuts are not created by excessive tilting of the dental cast.

When researching the literature to find other methods previously reported, two articles were found that use a modified clear matrix in their technique. Waghorn and Kuzmanovic used a thicker (0.60 mm) thermoplastic material that was modified with a milling machine to achieve parallel surfaces. Their material was altered to expose the tooth structure to be contoured, but this method may present difficulty for the inexperienced clinician since there is no adjacent structure to use as a guide, only the flattened surface of the matrix itself. Ma and Brudvik wrote that a tooth preparation guide was fabricated from the diagnostic cast using a thermoplastic material with parallel plastic rods placed in close proximity to the guide plane areas. This method provided added adjacent guides, but since they were rods, it did not provide depth or dimension to aid the clinician in creating a guide plane of proper form and shape.

The authors of this technique are developing a pilot study that would evaluate the ability of the novice clinician to complete the creation of multiple guide planes in a more efficient manner. We hope to use 25 fourth-year dental students for this evaluation of the technique. They would be charged with the task of modifying guide planes on a dentiform for an RPDP having a Kennedy Class II Modification I indication. Parameters taught during their second year of predoctoral study would be followed to modify teeth #21, #28, and #31 to create appropriate parallel guide planes. Methodology, they are taught (technique 1), involves modifying abutment teeth of a “practice cast” to desired contours. This is then used as a means to guide them as they modify the teeth for the partial framework. Multiple impressions and casts may be needed to achieve an acceptable alignment as evaluated on a surveyor. The technique suggested by this manuscript would then be employed on a new set of identical teeth for comparison. Preparatory and clinical times for each technique will be recorded as well as measurements in two dimensions of the resultant guide planes on the working cast generated. A statistical analysis of the resultant data would be performed to give additional information on the results. Once the protocol is approved, we will seek acceptance and authorization from the Human Studies Committee at this institution (Georgia Regents University). Results from this study would subsequently be submitted for publication as a second part to this article.

Summary

The technique mentioned in this article was developed to provide a means to create adequately prepared guide planes of proper dimension to ensure a more stable and retentive framework when providing removable prosthetic treatment. Using materials routinely found in dental offices, a paralleling device can be fabricated from the modified diagnostic cast of the patient’s dental arch requiring an RPDP. PMMA or composite added to a thermoplastic form can be positioned intraorally and used as a guide to properly modify tooth structure for guide planes. Since it can potentially minimize the number of
impressions and diagnostic casts made during the procedure, this can help achieve the desired product more efficiently and with less stress to the patient.

References