Esthetic Rehabilitation of a Partially Edentulous Gastroesophageal Reflux Disease Patient with Combined Fixed and Removable Treatment Using Surveyed Crowns and Altered Cast Impression Technique

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Abstract

One of the most challenging prosthodontic situations to treat is the distal extension cases combined with any sort of fixed treatment, like Kennedy's Class I or II cast partial denture case having anterior crowns. The problem in these ranges from clinical difficulties like reduced inter-arch space and lab problems like the accuracy of the surveyed crowns and the fit of two opposing partial dentures to the ability to satisfy the patient, especially if the patient is young and is unable to opt for implants due to financial issues. Abutment teeth for removable partial dentures might need crowns and construction of these surveyed crowns is a very demanding procedure technically. As it is the abutment for a partial denture, it must include provision for the different components of removable partial denture along with following the standard tooth preparation procedures. The removable partial denture design should be ready before commencing any procedure as it decides the choice of restorative materials as well as the alteration in wax patterns and veneering details in the lab. Also, the pressure from the occlusal forces tends to move the free-end saddles due to the displaceability of the mucosa. The altered cast technique prevents this movement as the impression of the mucosa is made under controlled pressure. This article provides an overview of a technique for the fabrication of full coverage crowns to be used in conjunction with removable partial dentures using altered cast technique.

Clinical Implications: Proper communication between the dentist and the lab leading to nicely fitted surveyed crowns and a well extended removable partial denture having a good ridge-to-denture relationship will be able to provide improved function as well increased comfort to a partially dentate patient.

Keywords: Surveyed Crowns; Free End Saddle; Altered Cast Technique; Stable Denture

Abbreviations

RPD: Removable Partial Denture; GERD: Gastroesophageal Reflux Disease

Introduction

Frequently, there is a need to put crowns for carious or attrited teeth which are abutments for a removable partial denture. Such crowns are known as the surveyed crowns. The tooth preparation for such teeth follows the standard guidelines and principles as well as

it incorporates special features to accommodate the components of the RPD like the rests, proximal plates, and direct retainers. For these reasons surveyed crowns include the surveying of the wax pattern of the crowns in the lab to make it parallel to the path of insertion. The wax pattern also includes the fabrication of the classic rest seats, long or short guide planes as well as the buccal and lingual height of contours depending on the choice of direct retainers. Careful treatment planning is necessary to achieve a predictable result [1].

To preserve what is remaining is one of the main objectives while rendering any removable prosthodontics treatment. Also, the patient’s comfort as well as improved functions is the dentist’s main goal. The compressibility of the mucosa leads to movement of the free-end saddles under occlusal load. The altered cast technique involves the functional impression making of the distal extension area, thereby, decreasing the movement of the partial denture under masticatory loads [2]. This technique of fabricating removable partial dentures, originally described more than 60 years ago, improves the residual-ridge-to-dentition relationship of the prosthesis [3]. This potentially increases patient comfort and satisfaction and also preserves the remaining supporting structures.

Case Report

A female patient aged 39 years came to the Department of Prosthetic Dental Sciences, College of Dentistry, Jazan University, with the chief complaint of missing upper and lower back teeth. The patient presented with mild chronic generalized gingivitis and staining. As part of a complete intra-oral examination, the teeth were examined clinically for caries, loss of attachment, pocket depth, occlusal interferences, and mobility. Also, OPG and full mouth radiographs were made to confirm the clinical findings. The patient was diagnosed with symptomatic irreversible pulpitis in teeth # 17, 24 and 45, defective restorations in teeth # 17, 26, multiple carious teeth, and remaining roots for teeth #18, 16, 15, 14, 27, 28, 34, 35, 36, 37, 38, 46, 47, 48 (Figure 1a and 1b). The palatal surfaces of maxillary anterior teeth were attrited. The patient gave a past medical history of acid reflux for the past few years and was taking omeprazole 20 mg (acid reducer) daily. The findings were suggestive of GERD [4]. The freeway space [4] was evaluated as 3 mm. Maxillary and mandibular alginate impressions were made and the diagnostic casts were mounted for proper assessment of the plane of occlusion and to formulate a treatment plan.

Figure 1a and 1b: Maxillary arch and mandibular arch (preoperative view).

Diagnostic wax up [5] was done according to the treatment plan. Oral prophylaxis was done, extraction of hopeless teeth was carried out, and carious teeth were excavated and temporized with glass ionomer cement. Root canal treatment was carried out for teeth #17, 24

and 45. The periodontal condition was re-evaluated. Definitive restoration were then carried out for teeth # 17, 13, 12, 11, 21, 22, 23, 24, 33, 34, 44, 45 (Figure 2a and 2b). Post and core were then done for teeth # 17, 24 and 45 which were to be crowned later on. Crowns were also planned for the teeth #13, 12, 11, 21, 22, 23 to prevent further palatal attrition.

Figure 2a and 2b: Intraoral pictures after the extractions, RCTs, restorations, and post and core done.

Maxillary preliminary impressions were then made with irreversible hydrocolloid and study casts were obtained. The study casts were placed on the surveyor for examination, determining the path of insertion and designing of the metal framework (Figure 3a and 3b).

Figure 3a and 3b: Maxillary and mandibular RPD design.
Maxillary Kennedy’s Class II modification 1 and mandibular Kennedy’s Class I cast partial dentures were planned. Both the dentures were tooth and tissue supported. The maxillary denture had its tooth support from mesio-occlusal rest on teeth # 17 and 24 and cingulum rest on tooth # 13. The mesial guide plane was planned on tooth # 17 and the distal guide plane on teeth # 13 and 24. The direct retainers were simple C clasp for tooth # 17, combination clasp for tooth # 13, and RPI for tooth # 24. The cingulum rest on tooth # 13 also served as an indirect retainer. The anteroposterior strap was chosen as the major connector.

The mandibular denture had its tooth support from mesio-occlusal rest on tooth # 45 and cingulum rest on tooth # 33 as the cingulum was prominent. Short distal guide planes were planned for both teeth # 45 and 33. The direct retainers were RPI for tooth # 45 and I bar for tooth # 33. The mesio-occlusal rest on tooth # 44 served as the indirect retainer. The lingual bar was chosen as the major connector.

In the present case, as the teeth # 17, 24, 45 were root canal treated and were abutments for removable partial dentures, so the crowns were surveyed crowns for them. Tooth # 13 was also planned to be crowned in the treatment planning and so it also served as the surveyed crown. Tooth # 44 had occlusal caries and was supposed to have an indirect retainer, so it was decided to have a surveyed crown on tooth # 44 as well. Teeth # 17, 24, 44, 45 had mesial occlusal rest planned in the surveyed crown. The crown for tooth # 13 had cingulum rest planned on the palatal surface of the crown. Crowns for teeth # 17, 13, 24, 44, and 45 were surveyed crowns as discussed. Crowns were also to be fabricated for teeth #12,11,21,22 and 23 as planned.

The preparation of the teeth for metal-ceramic crowns was then started according to standard procedures (Figure 4a and 4b). Adequate occlusal clearance to accommodate the occlusal rest seat for surveyed crowns was made sure. The final impression was made using a two-step putty-light body impression technique. Ditching and die-cutting were done for the final cast obtained. Abutments were then waxed up till the full contour. The full contour wax-up was then cut back to allow for the 1 mm of veneering porcelain after the metal try in [6]. Rest seats, guiding planes, and axial contours were developed in wax to fit the design of the RPD. The wax pattern was modified to make it parallel to the path of insertion. The finished pattern was casted and polished and the metal try was done (Figure 5a and 5b). After the metal try in, ceramic layering was done to accommodate the appropriate height of contour and the location of the undercut [1]. A bisque trial was carried out. Following the necessary clinical procedures to fit the crown to the tooth and the adjacent and opposing teeth, final verification of the crown contours was made on the surveyor and intra-orally. The metal-ceramic crowns were then permanently luted in place with the resin cement and the steps to fabricate the RPD were commenced (Figure 6a and 6b).
Cingulum rest and distal guide plane were prepared for tooth # 33 and the final mucostatic impression of the maxillary and the mandibular arch was made with PVS elastomeric impression material (Figure 7a and 7b). Secondary casts obtained were placed on the surveyor for examination and design of the cast framework.

Figure 5a and 5b: Metal try in.

Figure 6a and 6b: Maxillary and mandibular cemented crowns.

Figure 7a and 7b: Final mucostatic impression of the maxillary and mandibular arch.

Once verified, the master casts were duplicated, refractory casts were obtained, and the design was transferred from the master cast to the refractory cast. Investing and casting was completed. The completed framework was examined to ensure that it fits the cast accurately (Figure 8a and 8b).

Figure 8a and 8b: Maxillary metal framework.

The maxillary and mandibular metal frameworks were then checked intra-orally. Altered cast technique was to be carried out for the mandibular distal extension. A visible light cure (VLC) sheet was attached to the edentulous part of the mandibular framework and cured to serve as the custom tray (Figure 9a and 9b). The fit of the metal framework to the teeth and soft tissues was checked and border molding was done in the edentulous area to the proper extension using the Virtual (Ivoclar Vivadent, Amherst, NY) putty impression material (Figure 10). Finger pressure was applied to the parts of the framework that came in contact with the teeth and the final impression was made using the Virtual (Ivoclar Vivadent, Amherst, NY) light body silicon paste (Figure 11). The final cast was obtained which was altered in the laboratory. Two saw cuts were made perpendicular to each other. The location of the first cut was 0.5 mm to 1.0 mm distal to the most distal remaining tooth and was made perpendicular to the edentulous ridge extending from the outer edge of the cast to 6.0 to 7.0 mm medial to the lingual vestibule. The second cut was made parallel and medial to the edentulous ridge, extending from the most posterior aspect of the cast to the most medial aspect of the first cut [2] (Figure 12). Grooves were then made on the cut surface of the cast for mechanical interlocking with the newly poured stone. The framework was completely seated on the cast and was fixed in place with sticky wax (Figure 13). The whole assembly was poured with the die stone using the beading and boxing method (Figure 14 and 15). The working altered cast was finally ready (Figure 16). The usual steps in the fabrication of removable partial dentures were then carried out like the jaw relation and try in procedures using the Whipmix articulator [7]. Maxillary and mandibular denture delivery was done and post-delivery instructions were given (Figure 17-19b). The patient was recalled after 1 week, 1 month and 3-4 months for clinical follow-up and every 6 months for follow up. The patient was very satisfied with the treatment.

Figure 9a and 9b: Mandibular metal framework- An acrylic resin custom tray attached to the mandibular metal framework.
Figure 10: Border molded tray for the desired extension.

Figure 11: Final impression made using zinc oxide eugenol impression paste.

Figure 12: Cast with two saw cuts perpendicular to each other on either side of the saddle.

Figure 13: Seating of the framework on the cast with sticky wax.

Figure 14: Final impression with beading and boxing.

Figure 15: Pouring the final cast.
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Figure 16: An altered cast.

Figure 17a and 17b: Maxillary and mandibular try in.

Figure 18a: Maxillary and mandibular cast partial denture delivery (frontal view).

Discussion

The treatment planning process is the most critical aspect of prosthodontics. The role of the potential abutment teeth becomes really important in situations involving removable partial dentures and abutment crowns. Surveyed crowns become mandatory if the abutment teeth are carious, worn out, or improperly positioned mesiodistally, faciolingually or supra erupted, in order to make them suitable abutments [1]. The components of the RPD design and the functional requirements of the tooth, both should be taken care of by the surveyed...
crows. Involvement of the marginal ridges and occlusal surfaces for Class II amalgam or inlay restorations on a tooth planned for an RPD rest seat should generally indicate that tooth for an onlay or crown. If the survey lines on the teeth are acceptable, an onlay or three-quarters crown restoration is sufficient. Otherwise, the desired survey line can be marked using the surveyor and achieved by adding or reducing porcelain. When esthetics is not a concern, complete metal crown restorations are better options as it eliminates the cumbersome procedure of a metal-ceramic crown. Carrying out the fixed restorative treatment independent of the RPD design considerations can lead to major problems.

Because of its ease and predictable results, making use of altered-cast techniques during the distal-extension RPD preparations is highly recommended. Uniform stress distribution over the residual ridge is possible when the distal extension bases are recorded in functional form leading to minimum possible movement of the denture base and less food impaction below the dentures [11,12]. The vertical displacement of the abutments and tissues over the residual ridge under 4N of force is approximately 20 μm and 500 μm [13]. The difference in resiliency between hard and soft tissue support is the reason for making the impression of the ridges in the functional state and that of the teeth in the anatomic state. Also, the material used to register the ridge differ from that used for registration of the teeth [14]. In the present case, putty addition silicone was used for border moulding and light body silicone as a final impression material which has been proven to produce a little amount of tissue displacement as compared to other impression materials [15].

Conclusion

It is important to pay attention to the fixed as well as the removable component of the treatment in combination cases. Fabricating a surveyed crown for an RPD abutment tooth is a complex procedure. Following the entire treatment planning and the preparation design accurately can lead to excellent results. Also, recording the edentulous ridge in functional form stimulates the underlying bone and distributes the forces uniformly. The altered cast technique allows the prosthesis to derive its support simultaneously from the teeth and the denture base.

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Conflict of Interest

None.

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