

DENTAL TECHNIQUE

A predictable all-digital workflow to retrofit a crown to an existing removable prosthesis



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Abutment tooth preparation is essential to the design of a removable partial denture (RPD). Unfortunately, owing to the biomechanical challenges created by RPDs, abutment teeth are more likely to require additional treatment.¹⁻³ As a result, dentists are often faced with the decision to either retrofit a new dental restoration to support an existing RPD or replace the otherwise functional removable prosthesis along with the restoration. If the existing RPD is clinically acceptable and the periodontal status of the abutment tooth is sound, the dentist and patient may elect to fabricate a restoration to reproduce the existing tooth contours.

Traditional methods of addressing this problem typically begin with a thermoformed or elastomeric stent of the existing abutment, a definitive cast of the prepared abutment tooth, and a resin index molded between the prepared tooth and the existing RPD to capture the contours required to fit the clasp. This can be accomplished intraorally or on a definitive cast created from a pick-up impression of the prepared tooth and RPD.⁴ Similarly, a resin analog can be formed between the stent and the prepared tooth and adjusted intraorally to fit the RPD.⁵ In these methods, the resin analog is sent to the dental laboratory, the resin margins are cut back and waxed, and the restoration is pressed or cast. An alternative method involves making a polyvinyl siloxane index between the prepared tooth and the RPD and sending the index to the laboratory for fabrication of a resin analog of the clasp

ABSTRACT

The task of fabricating a new crown under an existing removable partial denture presents challenges for the dentist, technician, and patient. The main concern is accurately communicating the configuration of the rest, retentive clasps, and reciprocal elements to the laboratory technician without temporarily depriving the patient of the prosthesis. A variety of solutions involving stone cast alterations and elastomeric or resin indexes have been used for this task. However, these methods require significant additional time and technique-sensitive work by the operator and technician. More recent approaches using digital technologies require many of these traditional steps, each of which introduces potential inaccuracy and labor cost. This updated approach eliminates the inaccuracies associated with manual manipulation by the technician by leveraging contemporary intraoral scanning technology and a completely digital workflow to predictably and accurately fabricate a crown under an existing prosthesis. (*J Prosthet Dent* 2019;121:876-8)

assembly itself to which the abutment can be waxed.⁶ Regardless of the technique, there are numerous steps that require close attention, and each step carries an increased risk for error. The inherent dimensional change of each material used must also be accounted for. Even in the hands of skilled practitioners, these methods can be tedious and time consuming. Leveraging a digital workflow for this task reduces the number of steps throughout the process and therefore the potential for error. Computer-aided design and computer-aided manufacturing (CAD-CAM) technologies are now widely used for the fabrication of indirect restorations and have been shown to be equivalent or better than conventional impressions for short-span restorations with regard to marginal fit and contour replication.⁷⁻¹²

TECHNIQUE

1. Capture an intraoral scan of the quadrant containing the unprepared abutment tooth, the opposing dentition, and an interocclusal record (TRIOS 3;

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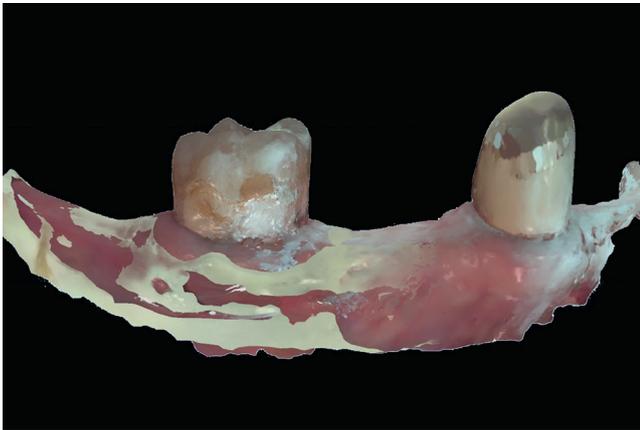


Figure 1. Preoperative scan of existing first molar abutment tooth. Note existing metal-ceramic crown on canine maintained throughout treatment.

3Shape A/S). A thermoformed or elastomeric impression can be made at this time if desired for fabricating an interim restoration. This preoperative scan will be used in step 3 as a cast to fabricate the new crown (Fig. 1).

2. Prepare and scan the abutment tooth, verifying adequate clearance between the existing prosthesis and the abutment tooth preparation (Figs. 2, 3).
3. Merge the image files to generate the 3-dimensional design from which the restoration is milled.¹³ Overlay the preoperative scan with the definitive scan of the prepared abutment tooth to design the new crown for milling (Fig. 4).
4. Mill the new abutment crown using an established CAM method. For this patient, a translucent zirconia was used (Katana STML; Kuraray Noritake Dental Inc), although any monolithic milled material would be acceptable. As the opposing arch was restored with a tissue-supported complete denture, it was determined that some strength could be sacrificed for improved esthetics with low risk of fracture.
5. Clinically confirm the seating, marginal fit, and occlusal contacts of the crown with the existing RPD and cement (Fuji Plus; GC America, Inc) (Fig. 5).

DISCUSSION

Preoperative contours can be precisely duplicated with this technique, predictably recreating appropriate orientation of the crown relative to the rests, retainers, and connectors of the removable prosthesis. Unlike with elastomeric impressions, unsatisfactory areas of the scan can be selectively removed and rescanned (rather than making a new impression). The files can be archived and reused should other teeth in the initial scan require restoration in the future. This preoperative scan can streamline and standardize laboratory tasks, potentially



Figure 2. Monolithic zirconia crown preparation.

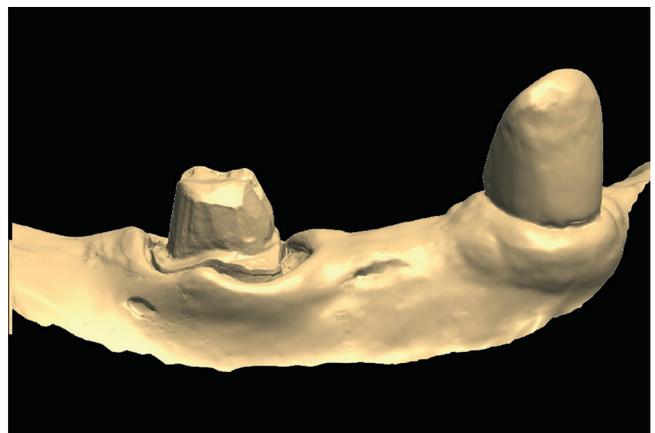


Figure 3. Scan of monolithic zirconia crown preparation.

reducing the cost of retrofitting a crown to an existing prosthesis. Most importantly, patients can retain their removable prosthesis while the replacement restoration is being fabricated. Because of its simplicity, this technique could be applied to retrofit restorations to other removable appliances, such as occlusal devices or orthodontic retainers or to replicate desirable functional or esthetic contours when new restorations are required. As CAM has expanded to include a wide variety of metal, ceramic, and resin dental materials, this technique can now be applied to nearly any clinical situation.

This technique requires that the existing abutment tooth is intact in the critical areas that contact the RPD, although Lee¹⁴ reported a method to circumvent this potential obstacle. An additional consideration is the cost and learning curve involved in adopting intraoral scanning technology and software for imaging, design, and fabrication.

SUMMARY

Contemporary CAD-CAM technology offers significant advantages in the retrofitting of a crown to an existing

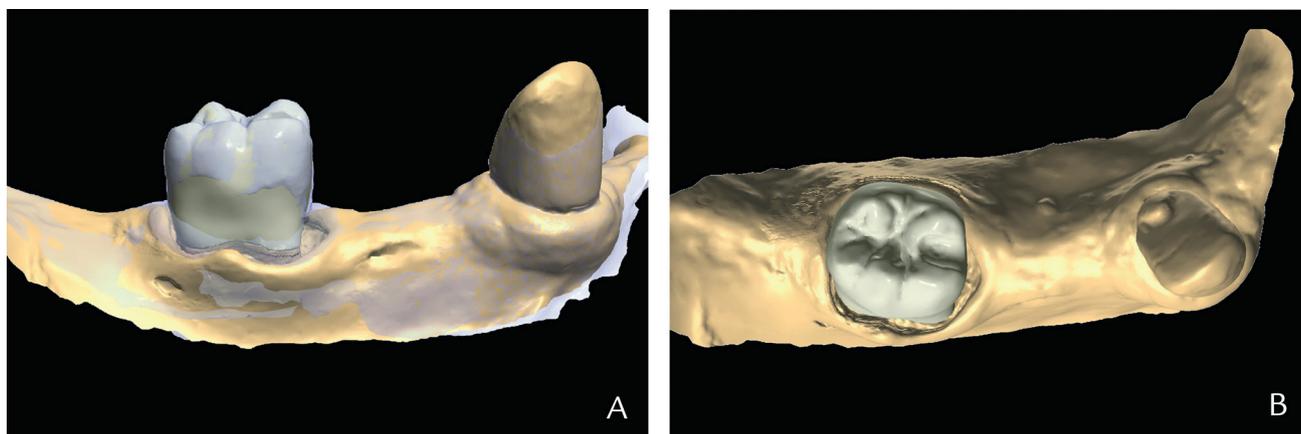


Figure 4. Scans merged for fabrication of new abutment crown. A, Preoperative. B, Postoperative.



Figure 5. Definitive restoration cemented. A, Without RPD. B, With RPD. RPD, removable partial denture.

RPD. The method described here requires no casts, impressions, or indexes and reduces technique-sensitive steps for the clinician and technician.

REFERENCES

1. Tada S, Ikebe K, Matsuda K, Maeda Y. Multifactorial risk assessment for survival of abutments of removable partial dentures based on practice-based longitudinal study. *J Dent* 2013;41:1175-80.
2. Bergman B, Hugoson A, Olsson C. Caries, periodontal and prosthetic findings in patients with removable partial dentures: a ten-year longitudinal study. *J Prosthet Dent* 1982;48:506-14.
3. Mihalow D, Tinanoff N. The influence of removable partial dentures on the level of *Streptococcus mutans* in saliva. *J Prosthet Dent* 1988;59:49-51.
4. Macpherson JR, Evans DB. Fabricating crowns to fit existing removable partial dentures: an illustration of two techniques. *J Prosthodont* 1993;2:199-205.
5. Jackson AD, Butler CJ. Fabrication of a new crown and provisional to an existing removable partial denture. *J Prosthodont* 1995;4:200-4.
6. Seo J, Ahn S. Fabrication of a metal-ceramic crown to fit an existing partial removable dental prosthesis using ceramic pressed to metal technique: a clinical report. *J Adv Prosthodont* 2014;6:241.
7. Abdel-Azim T, Rogers K, Elathamna E, Zandinejad A, Metz M, Morton D. Comparison of the marginal fit of lithium disilicate crowns fabricated with CAD/CAM technology by using conventional impressions and two intraoral digital scanners. *J Prosthet Dent* 2015;114:554-9.
8. Ahlholm P, Sipilä K, Vallittu P, Jakonen M, Kotiranta U. Digital versus conventional impressions in fixed prosthodontics: a review. *J Prosthodont* 2016;27:35-41.
9. Boitelle P, Mawussi B, Tapie L, Fromentin O. A systematic review of CAD/CAM fit restoration evaluations. *J Oral Rehabil* 2014;41:853-74.
10. Papadiochou S, Pissiotis A. Marginal adaptation and CAD-CAM technology: a systematic review of restorative material and fabrication techniques. *J Prosthet Dent* 2018;119:545-51.
11. Pradiés G, Zarauz C, Valverde A, Ferreira A, Martínez-Rus F. Clinical evaluation comparing the fit of all-ceramic crowns obtained from silicone and digital intraoral impressions based on wavefront sampling technology. *J Dent* 2015;43:201-8.
12. Renne W, Ludlow M, Fryml J, Schurch Z, Mennito A, Kessler R, et al. Evaluation of the accuracy of 7 digital scanners: an in vitro analysis based on 3-dimensional comparisons. *J Prosthet Dent* 2017;118:36-42.
13. Paek J, Noh K, Pae A, Lee H, Kim H. Fabrication of a CAD/CAM monolithic zirconia crown to fit an existing partial removable dental prosthesis. *J Adv Prosthodont* 2016;8:329.
14. Lee J. Completely digital approach to fabricating a crown under an existing partial removable dental prosthesis by using an intraoral digital scanner in a single appointment. *J Prosthet Dent* 2016;115:668-71.

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