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DENTAL TECHNIQUE

CAD-CAM acrylic resin prosthesis superstructure: A technique for fabricating an implant-supported fixed complete denture

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ABSTRACT

The implant-supported fixed complete denture is a common treatment option in implant prosthodontics but has shortcomings that include the high wear rate of the acrylic resin denture material and the displacement of denture teeth from the denture base. This report describes a method for fabricating implant-supported fixed dental prostheses using computer-aided design and computer-aided manufacturing technology. (J Prosthet Dent 2019;121:378-80)

Implant-supported fixed complete dentures have been widely used for rehabilitating edentulous mandibular arches.[1] One of the common problems with this type of implant-supported restoration is the high wear rate of acrylic resin denture materials against porcelain restorations or natural teeth.[1,2] This often necessitates frequent maintenance of the prosthesis, especially in patients with bruxism. The high wear rate of the acrylic teeth and base material will also eventually decrease the occlusal vertical dimension, leading to changes in facial esthetics, prosthesis esthetics, a compromised occlusal scheme, and increased interferences.[2]

The other commonly cited complication for this type of prosthesis is the displacement of denture teeth from the processed denture base.[3] Though relatively straightforward to repair, the displacement of a tooth can be embarrassing for the patient as anterior teeth are usually the first to be involved.[4] Furthermore, even when the prosthesis is repaired, the likelihood of recurrence is high.[4]

Limited space is another limiting factor in the provision of an implant-supported fixed prosthesis. Implants need to be placed with a certain interarch distance to create room for implant components, metal substructure, acrylic resin material, and denture teeth. A minimum of 12 to 15 mm of space has been suggested for mandibular implant-supported fixed prostheses using acrylic resin material and denture teeth.[5-7] Alternative restorative materials (metal-ceramics or zirconia) and designs are available that require less restorative space.[5-7] However, if the definitive prosthesis to be delivered is an implant-supported fixed complete denture, the vertical dimension of occlusion or a compromised occlusal plane may need to be increased to place a mechanically sound restoration. A technique is described to address the issues of denture tooth displacement and limited restorative space.

TECHNIQUE

1. Complete a diagnostic tooth arrangement before fabricating the bar.
2. Design the bar based on the tooth arrangement.
3. Mill or cast the metal framework with sufficient space for the superstructure.
4. Based on the diagnostics, arrange the denture teeth on the framework.
5. Clinically evaluate the prosthesis.
6. Following patient and clinician approval of esthetics and occlusal vertical dimension, scan (Scan

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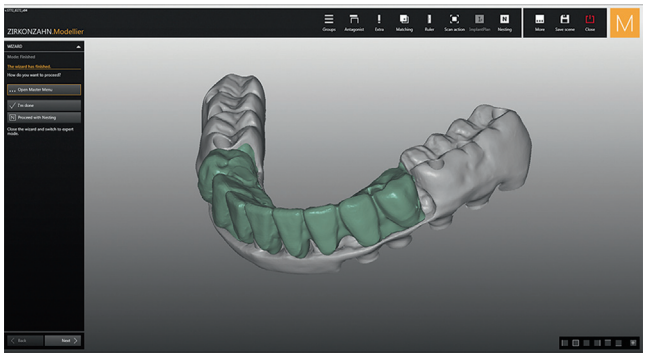

Figure 1. One-piece milled polymethyl methacrylate superstructure designed in computer-aided design software. Intimate fit to metal substructure with positive vertical and horizontal stops achieved.

Figure 2. Appropriate shade of polymethyl methacrylate selected and superstructure milled.

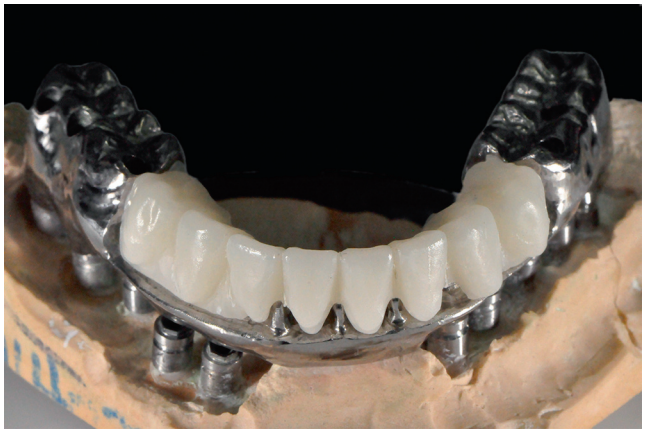

Figure 3. PMMA superstructure fitted to metal base.

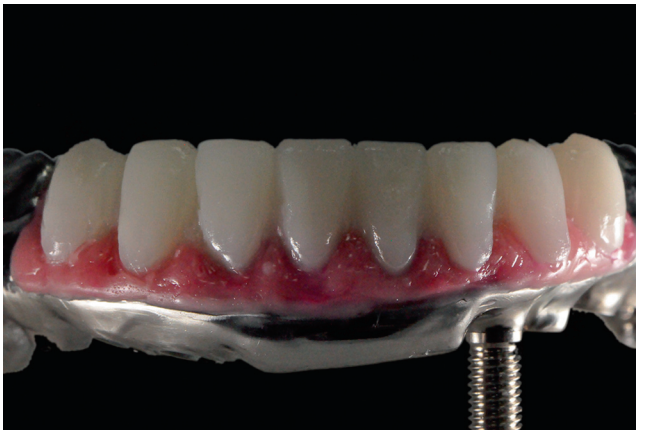

Figure 4. Gingival areas waxed. Denture then flasked and processed.

S600 ARTI; Zirkonzahn) the completed framework with denture teeth in wax.
7. Remove the denture teeth and wax.
8. With the software (Zirkonzahn; Modellier), design a 1-piece polymethyl methacrylate (PMMA) superstructure with intaglio space to mate intimately with the milled metal substructure (Fig. 1).
9. Mill a PMMA (Temp Premium A1-B1; Zirkonzahn) superstructure in the appropriate shade (Fig. 2).
10. Fit the superstructure to the milled metal substructure and lute with acrylic resin (Fig. 3).
11. Wax and festoon the prosthetic gingival areas (Fig. 4).
12. Flask, process, and finish the denture in PMMA (Lucitone; Dentsply Sirona).
13. Deliver the prosthesis (Fig. 5).

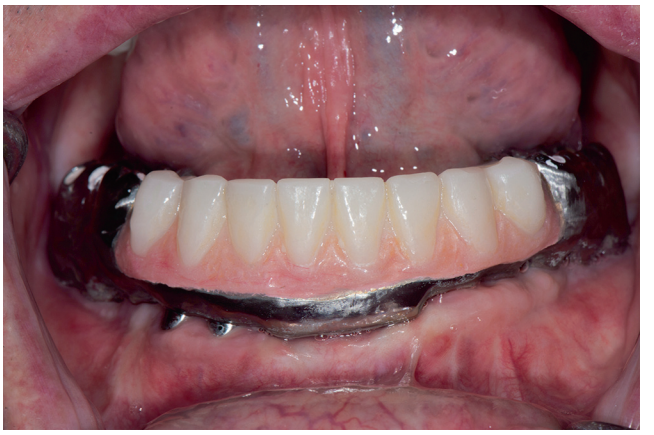

Figure 5. Completed prosthesis delivered.

DISCUSSION

In this method, a 1-piece, milled PMMA resin superstructure replaced traditionally arranged denture teeth. The goal of this technique was to reduce the loss of denture teeth from the prosthesis and allow for rapid and predictable maintenance of the denture. This is accomplished by milling an identical PMMA superstructure as needed when wear occurs (Fig. 6A, 6B). The replacement of the worn superstructure is a predictable and efficient process.

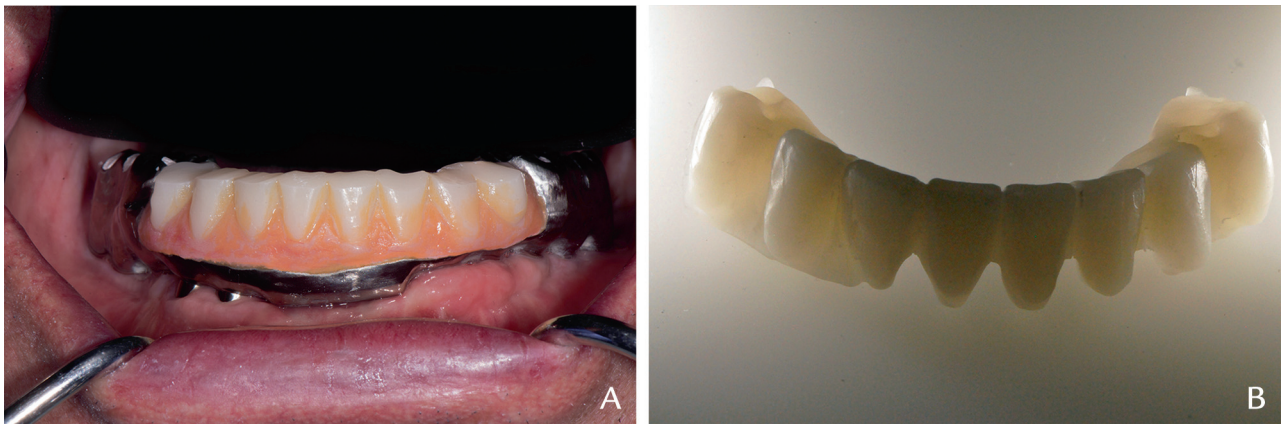

Figure 6. A, As expected, polymethyl methacrylate wore over time but did not debond. Maintenance for this prosthesis is straightforward and efficient. B, Stored digital file of acrylic resin superstructure used to mill replacement. This will be bonded to existing metal framework and finished, allowing rapid and predictable restoration of denture to its original state.

The advantages of this technique are as follows: increased resistance to dislodgement and tooth loosening; can be used in situations with limited restorative space as there are no denture teeth and the lingual and intaglio forms can be modified to increase the material thickness for strength without the need to increase the vertical dimensions for teeth—the titanium framework and the milled PMMA superstructure can overlap in the vertical dimension while retention is maintained in the horizontal dimension; increased bonding surface area; ease of processing; inexpensive maintenance; improved reproducibility when resurfacing is required—horizontal and vertical stops are designed into the milled PMMA superstructure; the digital file can be given to patients, sent to another clinician or laboratory, or stored in the patient's electronic records for future use; and intimate adaptation to the Ti framework—the milled PMMA superstructure can be fabricated to have a uniform space between it and the Ti framework, producing a uniform thickness of heat-polymerized denture base acrylic resin.

Milled PMMA teeth are not wear or stain resistant when compared with commercially available highly cross-linked or composite resin layered PMMA denture teeth. Although the cost of milled PMMA is lower, the increased need for replacement may lead to increased maintenance costs.[8] Other disadvantages of this technique include that it requires access to a digital scanning unit and appropriate milling machine and the milled PMMA teeth are monochromatic and may require customization for esthetics.

SUMMARY

The computer-aided design and computer-aided manufacturing acrylic resin prosthesis superstructure allows the use of an implant-supported fixed prosthesis while providing a mechanism for overcoming its greatest limitations, wear and breakage of the denture teeth. The 1-piece milled PMMA teeth should prove more resistant to chipping and tooth displacement. This treatment option may be useful in fully edentulous implant patients restored with 1 arch in zirconia and the other with a more resilient acrylic resin over a metal substructure.

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