THE JOURNAL OF PROSTHETIC DENTISTRY

DENTAL TECHNIQUE

Simplified fabrication of an implant-supported framework with luted abutment cylinders

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ABSTRACT

A technique is described to generate a framework for an implant-supported fixed complete denture. The main advantage of the described technique is the low production cost of a framework that has high strength, passive fit, and distinct retentive structures for each denture tooth. (J Prosthet Dent 2016;■:■-■)

Studies of the immediate loading of dental implants have shown that osseointegration can occur and be maintained with an implant-supported fixed complete denture.[1-6] The inclusion of a metal framework is not mandatory to obtain and maintain osseous bonding.[7] Although an acrylic resin complete denture can function for a time, eventually, fatigue of the acrylic resin will result in fractures. Fracture rates of between 14% and 88% have been reported in implant-supported fixed resin complete dentures.[8-10] As a result, the metal framework commonly made for implant-supported fixed dentures mainly functions to support the resin and denture teeth while secondarily contributing to the reciprocal splinting of the supporting implants. Conventionally, this framework was cast in gold.[11]

Passive fitting of the framework to the implants was deemed necessary to maintain osseointegration.[12] Subsequent research has shown that some level of misfit does not impede osseointegration.[13,14] However, misfit has been shown to increase mechanical complications.[15-20] Precision of fit has therefore remained an important component of the prosthetic workflow.

With the introduction of computer-aided design and computer-aided manufacturing (CAD-CAM), frameworks could be fabricated that were more precise than cast frameworks.[21] Before the introduction of dental CAD-CAM, the adhesive abutment cylinder luting concept was developed to create passive frameworks. Titanium cylinders are bonded with a composite resin into a custom metal framework which has a small space to allow for passivity of fit,[22-27] resulting in a framework with excellent fit to the supporting implant.[28]

Although the adhesive abutment luting technique was introduced over 25 years ago, it remains a rarely used technique and most frameworks are made with CAD-CAM technology. Although CAD-CAM will produce a well-fitting framework, it has some disadvantages compared with the adhesive cylinder luted framework. Titanium, which is predominately used as material for CAD-CAM frameworks, is not as strong as the base metal used for the luted framework and results in a thicker or less robust framework. In addition, creating the appropriate retentive features necessary for the support of denture teeth and acrylic resin with CAM has always been challenging.

Last, there is a considerable economic difference. Although it remains difficult to compare pricing, the estimated costs in the author's home market are as follows. Total laboratory cost for the in-office production of a 4-implant adhesive abutment cylinder luting framework is $330 ($200 for 4 cylinders [CAL-Cylinders; Attachments Intl Implant Direct], $130 to cast the framework). The laboratory cost for a 4-implant CAD-CAM produced framework including prosthetic screws is between $799 (David Casper, VP, Glidewell Laboratories, personal communication, 2016,) and $1568 (MaryKay McCoy, Nobel Biocare, personal communication, 2016).

The technique described here presents a straightforward workflow to make an appropriate framework in burn-out resin which can be cast in base metal. Green 0.3-mm spacers create a space which will be filled with

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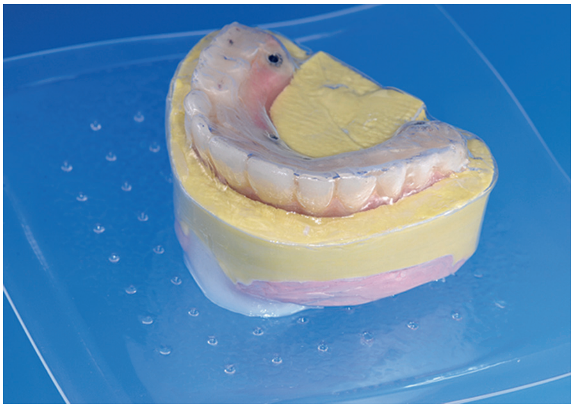

Figure 1. Soft vacuum-formed shell covering resin interim implant-supported fixed complete denture and land area of cast.

Figure 2. Occlusal section cut, leaving buccal cusp tips and incisal edges.

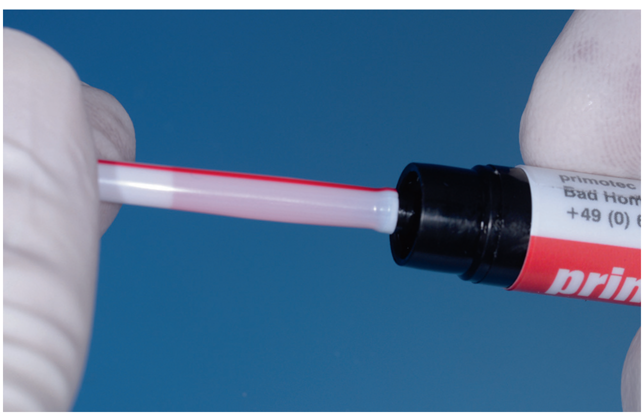

Figure 3. Plastic straw filled with low-viscosity laboratory resin and light polymerize to create resin bar.

Figure 4. Assembly of prosthetic screw, titanium cylinder, 0.3-mm green spacer, and yellow burn-out waxing sleeve.

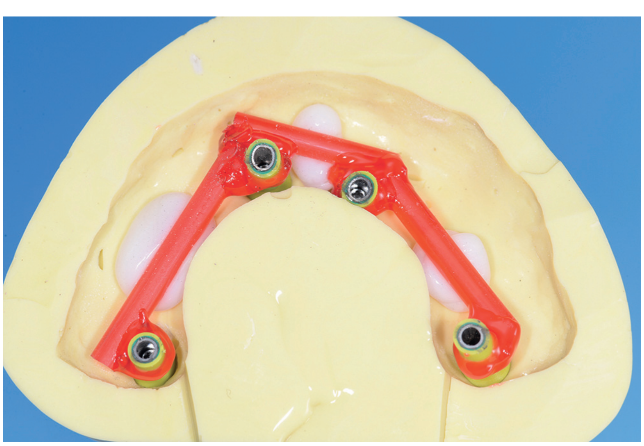

Figure 5. Prepolymerized resin bars connected to yellow burn-out sleeves. Note resin bars supported by soft nonsetting plastic block-out material.

Figure 6. Soft nonsetting plastic block-out material placed at level of tooth support pins.

composite resin. The titanium cylinders are bonded to the cast framework, intraorally or on a verified definitive cast as has been previously described.[22-26] Prefabricated resins bars have undergone polymerization shrinkage of the laboratory resin.[29] Limiting the volume of resin which will deform because of shrinkage does decrease the

Figure 7. Low-viscosity light-polymerizing laboratory resin injected based on individual tooth position.

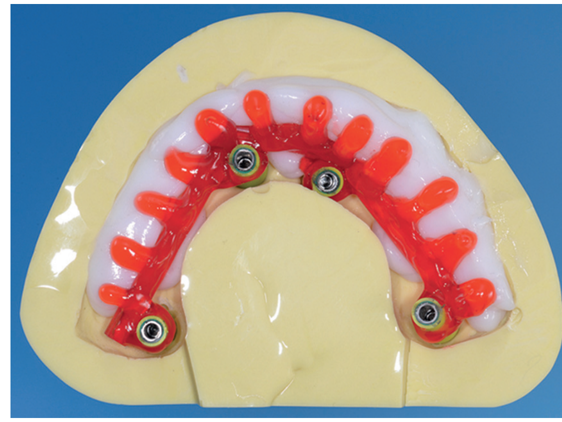

Figure 8. Dedicated metal support pin for each denture tooth.

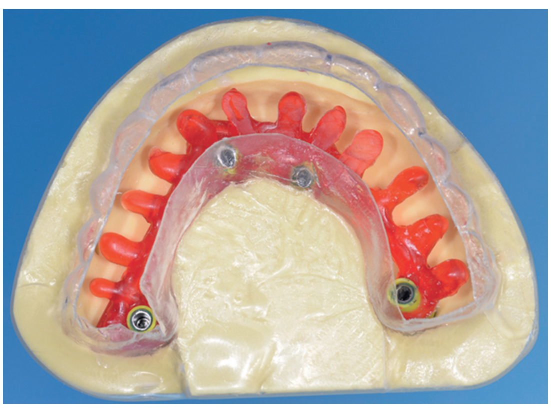

Figure 9. Vacuum-formed shell with precise relationship of future framework to denture teeth and resin volume.

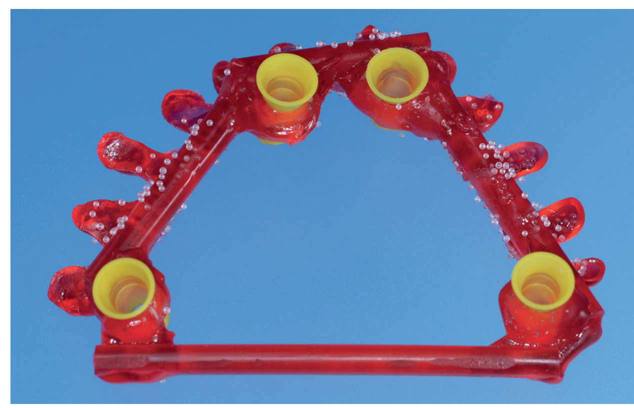

Figure 10. Resin framework ready for casting. Note absence of green spacers; this will create 0.3 mm of freedom between titanium cylinders and cast framework.

Figure 11. Cast framework. Note 0.3 mm of freedom between metal cylinders and cast framework.

Figure 12. Titanium cylinder and metal framework coated with luting composite resin.

overall deformation of the resin pattern framework which will be cast in base metal. A vacuum-formed shell allows the framework to be appropriately designed in relation to the position of the denture teeth and the surrounding acrylic resin.

TECHNIQUE

1. Position the resin implant-supported fixed complete denture onto a verified cast. The system allows maximum correction of 0.3 mm in the x- and y-axis

Figure 13. Excess composite resin removed after intraoral bonding of titanium cylinders into cast framework.

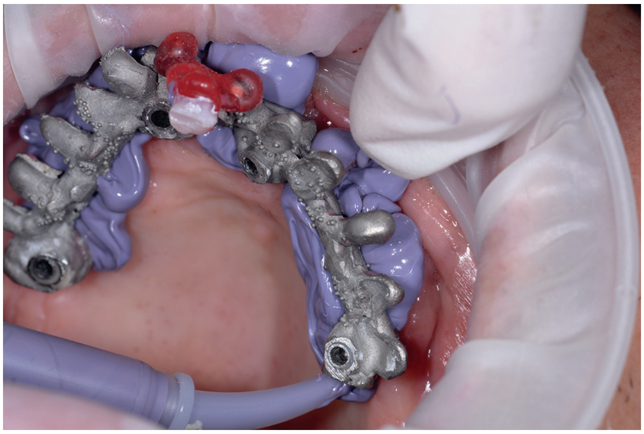

Figure 14. Completed passive fit framework, impression of soft tissue, and anterior device for occlusal registration.

and up to 5 mm in the z-axis. These maximums should be considered to prevent the need for framework modification through laser welding or soldering. Perforate the lingual land area of the cast with a rotary instrument to improve vacuum airflow. Use soft duplicating vacuum-forming material (Essix 1-mm bleach tray and model Dupl. Vac; Dentsply Intl) to create a duplicate of the provisional and land areas of the definitive cast (Fig. 1).

2. Cut out the occlusal section of the vacuum-formed shell. Maintain the buccal cusps and incisal edges (Fig. 2).
3. Fill a plastic straw (5 inch White with Red Stripe Sip Swizzle Straw; Royal) with high-viscosity burn-out laboratory composite resin (Primopattern LC Gel; Primotec). Light polymerize and remove plastic casing (Fig. 3).
4. Assemble titanium cylinder, green spacer, and yellow burn-out waxing sleeve (CAL-cylinder; Attachments International Implant Direct) onto laboratory analogs (Fig. 4). Cut to length to fit below the vacuum-formed shell.
5. Place a small mass of soft nonsetting plastic block-out material (Model Bloc; TAK System, Inc) between the implant analogs.
6. Position sections of the prepolymerized composite resin into the mass of soft nonsetting plastic block-out material against the yellow burn-out cylinders and connect with low-viscosity composite resin. Light polymerize (Fig. 5).
7. Place a roll of soft nonsetting plastic block-out material between the acrylic resin framework and the buccal intaglio of the vacuum-formed shell. Flatten so that the surface of the soft nonsetting plastic block-out material is at a level just below the cervical margins of the denture teeth (Fig. 6).
8. Starting at the resin bar, inject sections of laboratory resin onto the nonsetting plastic at the level of each denture tooth. Light polymerize (Figs. 7-9).
9. Remove the resin bar from the cast. Remove the green 0.3-mm spacers.
10. Coat the resin framework with adhesive (Retentionkleber; Bredent GmbH) and add 0.6-mm resin retention beads (Retentionbead; Bredent GmbH).
11. Add a prepolymerized resin crossbar for stability (Fig. 10).
12. Cast in base metal (Simplicity NT white ceramic alloy; American Dental Supply, Inc) Remove the cross bar (Fig. 11).
13. Bond the cylinders into the framework with dual-polymerizing composite resin (Panavia F; Kuraray Dental) according to previously described techniques (Figs. 12-14).

SUMMARY

A technique is described which allows for the rapid generation of a low-cost adhesive abutment cylinder luting metal framework for an implant-supported fixed complete denture, resulting in a passive fitting framework with ideal support for resin and denture teeth. The use of base metal gives the framework greater strength at low volume compared with titanium frameworks.

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