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DENTAL TECHNIQUE

In-office fabrication of a definitive cast and duplication of an interim implant-supported fixed acrylic resin complete denture

Lambert J. Stumpel, DDS

ABSTRACT

The information contained in an interim implant-supported fixed acrylic resin complete denture is a starting point for fabricating the definitive restoration. Duplicating this information in an expedient, precise, and sanitary fashion is desirable so that the interim restoration can be returned to the waiting patient. A technique is described to fabricate an accurate definitive polyvinyl siloxane cast with laboratory analogs bonded to a prepolymerized, dimensionally stable, composite resin baseplate. A screw-retained polyvinyl siloxane duplication of the interim denture is related to this cast. This combination allows for most of the relevant information of the interim denture to be communicated to the dental laboratory. (J Prosthet Dent 2016;■:■-■)

Immediate and delayed loading of dental implants with an interim implant-supported fixed acrylic resin complete denture is an established protocol.[1-6] As osseointegration can be achieved and maintained with the acrylic resin prosthesis, a supporting metal framework is not needed.[7] Unfortunately, acrylic resin in itself is not sufficiently durable to withstand occlusal forces over an extended time, fracture rates for interim implant-supported fixed acrylic resin complete dentures range between 14% and 88%.[8-10] As a result, a more durable definitive prosthesis and corresponding prosthetic procedures are needed.

The definitive cast on which the definitive prosthesis is fabricated should be a close duplication of the intraoral situation. Various impression techniques have been developed. Splinted impression copings appear to be the most reliable method of transferring the intraoral implant position.[11-13] The interim implant-supported fixed acrylic resin complete denture can be considered a splinted impression, and the use of this prosthesis to generate the definitive cast has been described previously.[14] The interim implant-supported fixed acrylic resin complete denture has almost all the information needed to produce a definitive prosthesis. The objective is to duplicate this information so that it can be used in the dental laboratory. Although dental stone is most often used to generate casts, it has negative characteristics because of its expansion.[15] Dental stone undergoes delayed expansion up to 96 hours, with 22% to 71% of the expansion occurring after 2 hours.[16-18] Removing the impression from the cast after 96 hours has been suggested to control this delayed expansion.[19]

Various techniques have been described to control the expansion of dental stone. Rubber tubes are placed over the implant analogs and the impression is cast. Upon setting and expansion of the stone mass, the tubes are removed, and the small spaces around the analogs are filled with stone.[20] Another approach discusses the use of a clear acrylic resin base which is dimensionally stable and reduces the volume of dental stone.[21,22] The technique described here builds on these 2 concepts. A prepolymerized composite resin base is perforated to allow a small space around the implant analogs; this space is then filled with a small volume of a low-viscosity light-polymerized composite resin. Composite resin does experience volumetric shrinkage (1.54% to 2.11%)[23] upon polymerization. Laboratory composite resin has been reported to have a 1.175% linear polymerization shrinkage. While 80% of the shrinkage occurs in the first 17 minutes,[24] dimensional changes have been noted for up to 7 days afterward.[25]

Private practice, San Francisco, Calif.

Figure 1. Immediate loading interim implant-supported fixed acrylic resin complete denture supported by 4 zygomatic implants.

The remainder of the cast is made with a polyvinyl siloxane (PVS) cast material. This cast has the information of the relative implant position and the intaglio of the interim implant-supported fixed acrylic resin complete denture. The same PVS cast material is used to create a duplication of the remainder of the information encoded within the acrylic resin interim prosthesis.

This workflow has been found to be precise, fast, and sanitary. It can be used in the dental office while the patient waits for the return of the interim prosthesis.

TECHNIQUE

1. Place 2 sheets of customized tray light-polymerizing acrylic resin (Triad TruTray; Dentsply Intl) together. Cut a trapezoid shape of approximately 60×50×40 mm. Polymerize it in a light-polymerizing unit (Triad 2000; Dentsply Intl). Prepolymerize this baseplate at least 7 days before use.
2. Confirm intraorally that the interim implant-supported fixed acrylic resin complete denture fits accurately. Evaluate the design of the intaglio surface. If modification is necessary, make an impression of the space between the prosthesis intaglio and the edentulous ridge with a polyether material (Impregum Soft; 3M ESPE), because this material will not bond to the cast PVS (Fig. 1).
3. Attach laboratory analogs to the titanium cylinders of the interim implant-supported fixed acrylic resin complete denture.
4. Mark the location of the laboratory analogs on the composite resin baseplate with articulating paper. Then use a rotary instrument to perforate the baseplate to allow passive fitting of the laboratory analogs (Fig. 2).
5. Connect the implant analogs to the composite resin baseplate with a high viscosity composite resin material (Primopattern LC Gel; Primotec). Light polymerize (Fig. 3).
6. Mix laboratory PVS (Lab Putty; Coltène) and position the composite resin baseplate with the occlusal surfaces in a horizontal position. Adjust the periphery of the PVS to create a border for boxing wax (Fig. 4).
7. Heat the baseplate wax (Dental Wax Soft; Moyco), cut it in 2 rectangular sections, and box the PVS.
8. Fully cover the interim restoration by injecting cast PVS (Mach-Slo; Parkell) (Figs. 5, 6).
9. After the cast PVS has set, remove the boxing wax, unscrew the interim implant-supported fixed acrylic resin complete denture, and adjust land areas with a scalpel (Bard-Parker 22; Becton-Dickson AcuteCare) (Fig. 7).
10. Reposition the interim implant-supported fixed acrylic resin complete denture. Perforate the lingual land area with a rotary instrument to

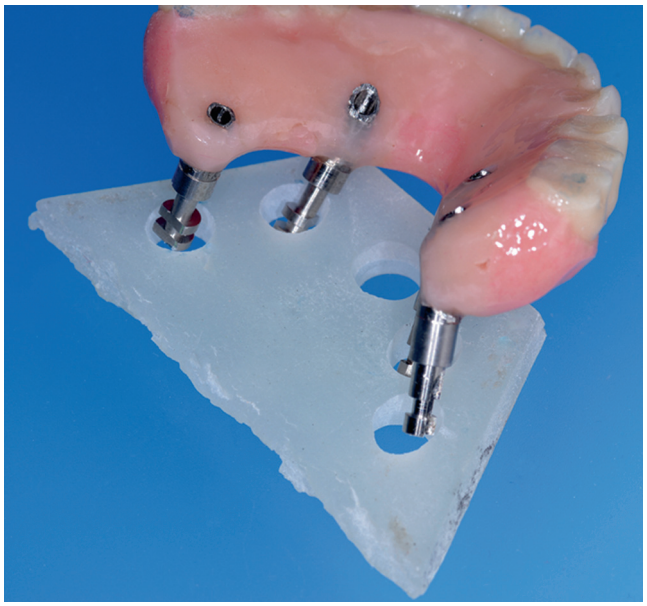

Figure 2. Prepolymerized composite resin baseplate with perforations for laboratory analogs.

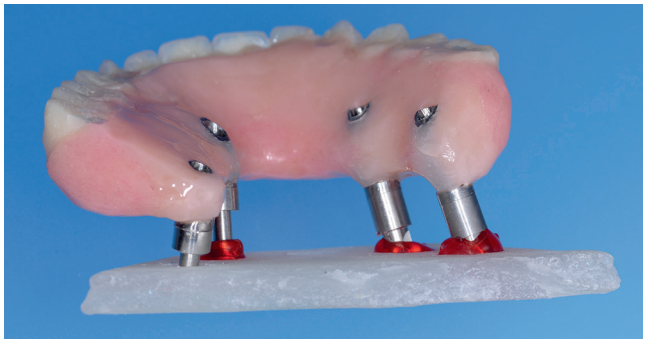

Figure 3. Individual analogs bonded with visible light-polymerizing laboratory composite resin to prepolymerized base.

Figure 4. Polyvinyl siloxane base made to level occlusal plane and create foundation for boxing wax.

Figure 5. Cast polyvinyl siloxane injected.

Figure 6. Polyvinyl siloxane cast after removal of boxing wax.

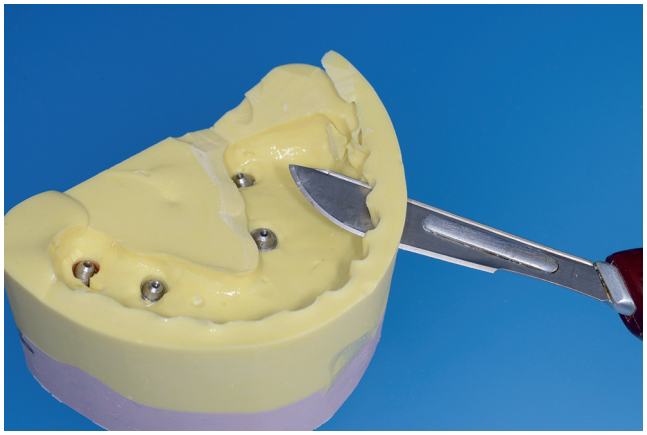

Figure 7. Scalpel used to create smooth and even land area.

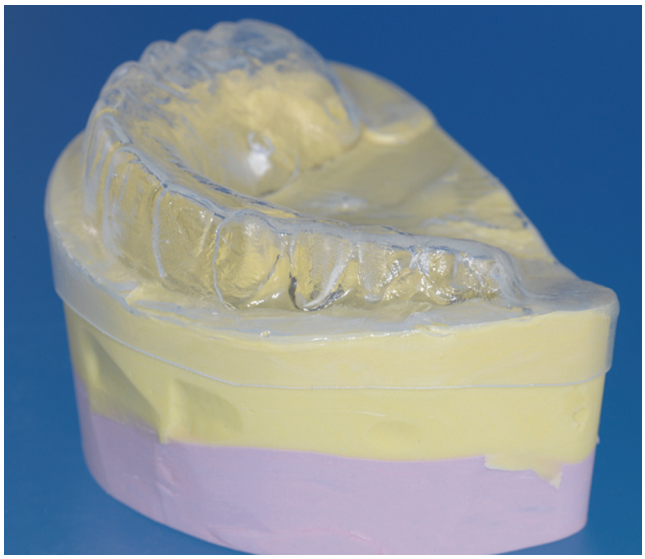

Figure 8. Duplicating vacuum-formed shell captures shape of interim prosthesis and relationship to definitive cast.

Figure 9. Polyvinyl siloxane device supports flexible vacuum-formed shell.

improve vacuum airflow. Use soft duplicating vacuum-forming material (Essix 1-mm Bleach Tray and Model Duplication Material; Dentsply Intl) to create a duplicate of the interim restoration and land areas of the definitive cast (Fig. 8).

11. Cut the vacuum-formed shell, leaving 10 mm beyond the land areas.

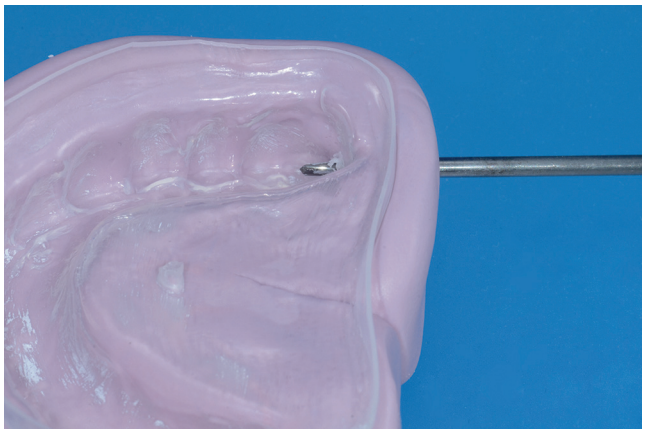

Figure 10. Assemble vacuum-formed shell and polyvinyl siloxane device. Perforate to create access for polyvinyl siloxane syringe.

Figure 11. Inject cast polyvinyl siloxane.

Figure 12. Screw-retained polyvinyl siloxane duplicate of interim implant-supported fixed acrylic resin complete denture in relation to definitive cast.

Figure 13. Intraoral view of screw-retained polyvinyl siloxane duplicates of interim implant-supported fixed acrylic resin complete dentures.

Figure 14. New prosthesis based on information contained in polyvinyl siloxane duplicates of provisional implant fixed acrylic complete denture and definitive cast.

12. Mix laboratory PVS (Lab Putty; Coltène) and place over the vacuum-formed material (Fig. 9).
13. Remove the PVS device and vacuum-formed shell from the cast upon setting. Assemble and make 2 access holes (Fig. 10).
14. Remove the interim implant-supported fixed acrylic resin complete denture from the cast and lubricate the cast with petroleum jelly (Vaseline; Unilever). Place 2 interim titanium cylinders (Temporary Abutment; Nobel Biocare) and adjust the length to fit within the vacuum-formed shell. Place plastic healing caps (Healing Cap Multi-unit; Nobel Biocare) on the remainder of the implant analogs.
15. Position the assembly of PVS device and vacuum-formed shell on the definitive cast, ensuring proper fit. Inject cast PVS (Mach-Slo; Parkell) into the access hole until the material extrudes from the second access hole (Fig. 11).
16. Remove the device and vacuum-formed shell upon setting of the PVS material. Unscrew the PVS duplicate of the interim implant-supported fixed

acrylic resin complete denture and remove the flask as needed (Fig. 12).

17. Place the PVS duplicate of the interim implant-supported fixed acrylic resin complete denture intraorally and record the occlusal relationship (Fig. 13).
18. Return the interim implant-supported fixed acrylic resin complete denture to the patient.
19. Use the definitive cast, PVS duplicate of the interim implant-supported fixed acrylic resin complete denture, and occlusal registration to fabricate the definitive implant-supported fixed prosthesis (Fig. 14).

DISCUSSION AND SUMMARY

An interim implant-supported fixed acrylic resin complete denture contains most of the information needed to initiate the production of the definitive prosthesis. The technique presented here allows for expedient in-office fabrication of a PVS definitive cast with a prepolymerized, dimensionally stable, composite resin baseplate and bonded analogs. A PVS duplicate of the interim prosthesis is related to this definitive cast, allowing transfer to the dental laboratory of most of the pertinent information needed to fabricate a definitive restoration. This workflow allows for the rapid return of the interim implant-supported fixed acrylic resin complete denture to the patient while obtaining accurate information in a clinical setting.

REFERENCES

1. Maló P, de Araújo Nobre M, Lopes A, Francischone C, Rigolizzo M. "All-on4" immediate-function concept for completely edentulous maxillae: a clinical report on the medium (3 years) and long-term (5 years) outcomes. Clin Implant Dent Relat Res 2012;14:139-50.
2. Balshi TJ, Wolfinger GJ. Conversion prosthesis: a transitional fixed implant-supported prosthesis for an edentulous arch–a technical note. Int J Oral Maxillofac Implants 1996;11:106-11.
3. Nikellis I, Levi A, Nicolopoulos C. Immediate loading of 190 endosseous dental implants: a prospective observational study of 40 patient treatments with up to 2-year data. Int J Oral Maxillofac Implants 2004;19:116-23.
4. Wolfinger GJ, Balshi TJ, Rangert B. Immediate functional loading of Brånemark system implants in edentulous mandibles: clinical report of the results of developmental and simplified protocols. Int J Oral Maxillofac Implants 2003;18:250-7.
5. Niedermaier R, Stelzle F, Riemann M, Bolz W, Schuh P, Wachtel H. Implant-supported immediately loaded fixed full-arch dentures: evaluation of implant survival rates in a case cohort of up to 7 years. Clin Implant Dent Relat Res 2016 May 15. http://dx.doi.org/10.1111/cid.12421. [Epub ahead of print].
6. Maló P, de Araújo Nobre M, Lopes A, Ferro A, Gravito I. Complete edentulous rehabilitation using an immediate function protocol and an implant design featuring a straight body, anodically oxidized surface, and narrow tip with engaging threads extending to the apex of the implant: a 5-year retrospective clinical study. Int J Oral Maxillofac Implants 2016;31:153-61.
7. Thomé E, Lee HJ, Sartori IA, Trevisan RL, Luiz J, Tiossi R. A randomized controlled trial comparing interim acrylic prostheses with and without cast metal base for immediate loading of dental implants in the edentulous mandible. Clin Oral Implants Res 2015;26:1414-20.
8. Agliardi E, Panigatti S, Clericò M, Villa C, Malò P. Immediate rehabilitation of the edentulous jaws with full fixed prostheses supported by four implants: interim results of a single cohort prospective study. Clin Oral Implants Res 2010;21:459-65.
9. Malo P, de Araujo Nobre M, Lopes A. The use of computer-guided flapless implant surgery and four implants placed in immediate function to support a fixed denture: preliminary results after a mean follow-up period of thirteen months. J Prosthet Dent 2007;97:S26-34.
10. Collaert B, De Bruyn H. Immediate functional loading of TiOblast dental implants in full-arch edentulous maxillae: a 3-year prospective study. Clin Oral Implants Res 2008;19:1254-60.
11. Papaspyridakos P, Gallucci GO, Chen CJ, Hanssen S, Naert I, Vandenberghe B. Digital versus conventional implant impressions for edentulous patients: accuracy outcomes. Clin Oral Implants Res 2016;27:465-72.
12. Papaspyridakos P, Benic GI, Hogsett VL, White GS, Lal K, Gallucci GO. Accuracy of implant casts generated with splinted and non-splinted impression techniques for edentulous patients: an optical scanning study. Clin Oral Implants Res 2012;23:676-81.
13. Del'Acqua MA, Arioli-Filho JN, Compagnoni MA. Mollo Fde A Jr. Accuracy of impression and pouring techniques for an implant-supported prosthesis. Int J Oral Maxillofac Implants 2008;23:226-36.
14. Balshi TJ, Wolfinger GJ, Alfano SG, Cacovean JN, Balshi SF. Fabricating an accurate implant master cast: a technique report. J Prosthodont 2015;24:654-60.
15. Wise M. Fit of implant-supported fixed prostheses fabricated on master casts made from a dental stone and a dental plaster. J Prosthet Dent 2001;86:532-8.
16. Michalakis KX, Asar NV, Kapsampeli V, Magkavali-Trikka P, Pissiotis AL, Hirayama H. Delayed linear dimensional changes of five high strength gypsum products used for the fabrication of definitive casts. J Prosthet Dent 2012;108:189-95.
17. Michalakis KX, Stratos A, Hirayama H, Pissiotis AL, Touloumi F. Delayed setting and hygroscopic linear expansion of three gypsum products used for cast articulation. J Prosthet Dent 2009;102:313-8.
18. Heshmati RH, Nagy WW, Wirth CG, Dhuru VB. Delayed linear expansion of improved dental stone. J Prosthet Dent 2002;88:26-31.
19. Stumpel LJ 3rd, Haechler WH, Bedrossian E. A predictable precision cast for multi-unit screw-retained implant prosthesis: rationale and technique. J Calif Dent Assoc 2003;31:765-70.
20. McCartney JW, Pearson R. Segmental framework matrix: master cast verification, corrected cast guide, and analog transfer template for implant-supported prostheses. J Prosthet Dent 1994;71:197-200.
21. Zeiser MP. A new model design. A Plexiglas base effects a high degree of perfection. ZWR 1981;90:40-1.
22. Zeiser MP. Master model. Osterr Zahnprothet 1980;4:9-12.
23. Cattani-Lorente M, Godin Ch, Bouillaguet S, Meyer JM. Linear polymerization shrinkage of new restorative composite resins. Eur Cells Mater 2003;1:40-1.
24. Lynde TA, Schulman LB, Meiers JC, Whitehill JM. Dimensional stability of two visible light-cured indirect inlay/onlay resin composite materials. Am J Dent 1996;9:153-6.
25. Boberick KG, McCool J. Dimensional stability of record bases fabricated from light-polymerized composite using two methods. J Prosthet Dent 1998;79:399-403.

Corresponding author:
Dr Lambert J. Stumpel
450 Sutter St
San Francisco, CA 94108
Email: LambertStumpel@pacbell.net