



# A TECHNIQUE FOR VERIFYING AND CORRECTING A MILLED POLYURETHANE DEFINITIVE CAST FOR NONSEGMENTAL IMPLANT RESTORATION IN AN EDENTULOUS JAW

**Wei-Shao Lin, DDS,<sup>a</sup> Bryan T. Harris, DMD,<sup>b</sup>  
Michael J. Metz, DMD, MSD, MS, MBA,<sup>c</sup> and  
Dean Morton, BDS, MS<sup>d</sup>**

School of Dentistry, University of Louisville, Louisville, Ky

This report describes a technique that uses an acrylic resin verification device and polyvinyl siloxane impression to verify and correct the analog position in a milled polyurethane definitive cast with removable periimplant soft tissue replica for a nonsegmental implant restoration in an edentulous jaw. (*J Prosthet Dent* 2014;112:658-662)

The accuracy of the definitive stone cast for an implant restoration can be affected by different impression techniques and the cast fabrication process. Although higher accuracy has not been proved with a single impression technique, a systematic review reported that more studies reported that the splinting technique<sup>1</sup> produced a more accurate conventional implant impression.<sup>2</sup> During the definitive stone cast fabrication process, displacement of the implant components and dimensional change of the dental stone can introduce discrepancies in the definitive stone cast.<sup>3</sup> The use of a verification device to confirm the accuracy of the definitive stone cast was first proposed by Knudson et al<sup>4</sup> in 1989. A verification device also can be used as an analog transfer template to correct the position of one or more implant analogs in the definitive stone cast and provide a rigid scaffolding for the framework pattern.<sup>5,6</sup> In a retrospective study,<sup>7</sup> the verification device and cast were shown to ensure a clinically passive fit of the metal frameworks for the implant-supported, fixed complete dental prostheses, regardless of fabrication technique (computer-aided design and computer-aided manufacturing or lost-wax technique) and the number of implants.

Digital data acquisition at the implant level has provided a contemporary impression technique for implant restoration by using a scannable impression coping (Scan body; Straumann) and an intraoral digital scanner (iTero; Align Technology). A computer-aided design and computer-aided manufacturing-fabricated milled definitive polyurethane cast can then be obtained from a production center (iTero; Align Technology). Although several clinical reports<sup>8,9</sup> have described digital data acquisition at the implant level and computer-aided design and computer-aided manufacturing-fabricated milled definitive polyurethane casts for implant restorations, the accuracy of this digital pathway has not been extensively studied. One clinical pilot study<sup>10</sup> assessed the applicability and accuracy of intraoral scans by using scannable impression copings (Scan Body; Straumann) and an intraoral digital scanner (iTero; Align Technology) of patients treated with a 2-implant mandibular overdenture and splinted framework. The researchers found that the distance and angulation errors of intraoral scans were too large to fabricate well-fitting frameworks on implants in edentulous mandibles. They concluded that the main reason for the unreliable scans

seemed to be the poor reference points for intraoral scanning, caused by mucosa in the edentulous jaw with little variation in texture and height. The verification device and cast were proposed for use in conjunction with this digital pathway to ensure the passive fit of the nonsegmental definitive prosthesis in a clinical report for the edentulous maxilla.<sup>9</sup>

This article describes a technique that uses a device to verify and correct the analog position in a milled polyurethane definitive cast with a removable periimplant soft tissue replica for nonsegmental implant restoration in an edentulous jaw. The milled polyurethane definitive cast with corrected analog position can be used as a working cast in the subsequent treatment for articulation, tooth arrangement, and completion of the definitive restoration. The removable periimplant soft tissue replica provides the soft tissue profile necessary for contouring the intaglio surface of an implant-retained or implant-supported definitive prosthesis. The verification stone cast that results from the verification device can be used in conjunction with a milled polyurethane definitive cast to provide accurate interimplant spatial relationships during the definitive prosthesis

<sup>a</sup>Assistant Professor, Department of Oral Health and Rehabilitation.

<sup>b</sup>Associate Professor, Department of Oral Health and Rehabilitation.

<sup>c</sup>Assistant Professor, Department of General Dentistry and Oral Medicine.

<sup>d</sup>Director, Advanced Education in Prosthodontics; Professor and Chair, Department of Oral Health and Rehabilitation.

fabrication process to ensure the passive fit of nonsegmental implant restorations.

**TECHNIQUE**

1. Make the definitive implant-level impression with an intraoral digital scanner (iTero; Align Technology) and scannable impression copings (Scanbody; Straumann) (Fig. 1A), and process the digital impression in a dental laboratory (Roy Dental Laboratory) and transmit the information to a production center (iTero; Align Technology) for fabrication of the milled polyurethane definitive cast.

2. On receipt of the milled polyurethane definitive cast, manually insert the removable implant analogs (RN Reposition analog; Straumann) into the definitive cast (Fig. 1B), and fabricate a

verification device<sup>8</sup> with individual segments by using the temporary abutments (RN synOcta post for temporary restoration, Bridge; Straumann) and light-polymerizing acrylic resin (Triad Denture Base; Dentsply Prosthetics).

3. Evaluate and lute all segments of the verification device with autopolymerizing acrylic resin (Pattern Resin LS; GC America) (Fig. 2A) and obtain a verification stone cast with Type IV dental stone (Resin Rock; Whip Mix Corp) (Fig. 2B).<sup>8</sup>

4. Transfer the verification device onto the milled polyurethane definitive cast and evaluate fit (Fig. 3A). If there is any discrepancy observed, then identify and remove the analog that is inaccurately positioned from the definitive cast (Fig. 3B).

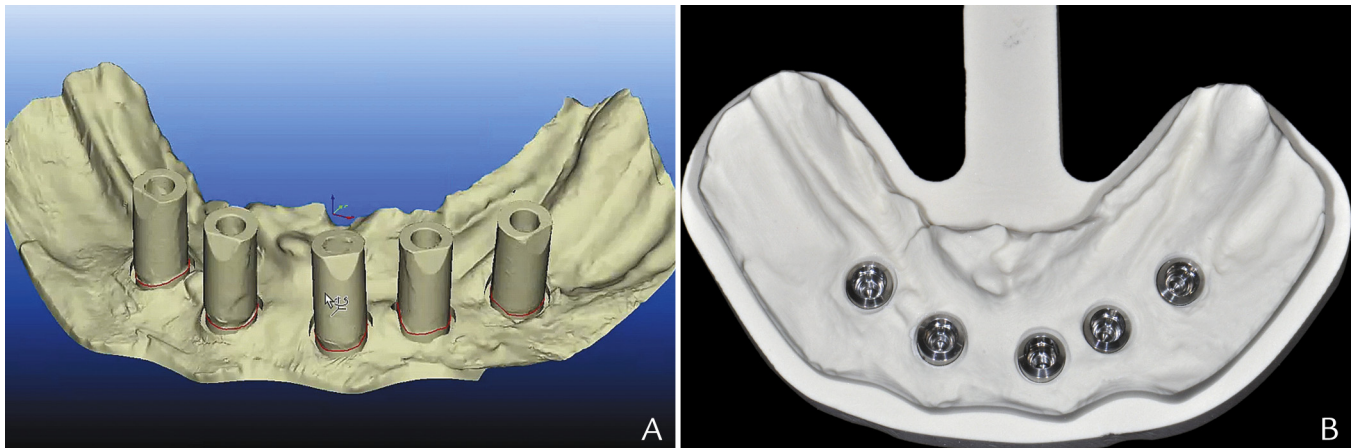
5. Replace the verification device on the milled polyurethane definitive

cast to confirm the fit of the verification device on the remaining analogs (Fig. 3C). Replace the removed analog into the milled polyurethane definitive cast.

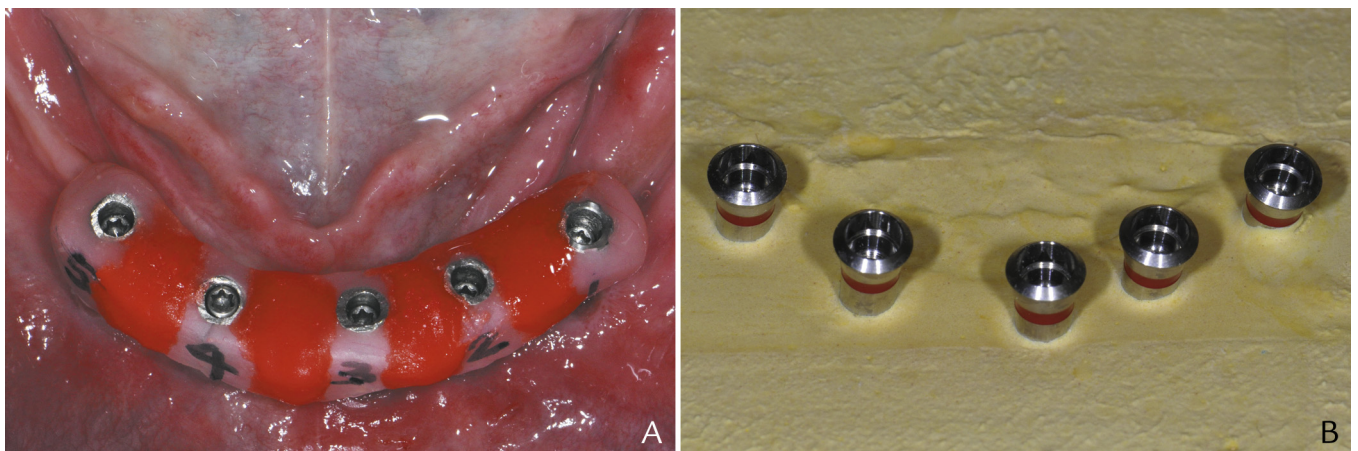
6. Place closure screws (Closure screws; Straumann) on all analogs and make an impression of the milled polyurethane definitive cast with low viscosity polyvinyl siloxane material (AFFINIS Putty super soft; Coltène/Whaledent Inc) (Fig. 4).

7. Remove the identified analog with inaccurate positioning from the definitive cast and attach it to the verification device. Enlarge the analog receiving space in the definitive cast with a laboratory carbide cutting instrument (Fine Staggered Tothing; Brasseler USA) (Fig. 5A).

8. Attach the verification device-analog assembly onto the definitive

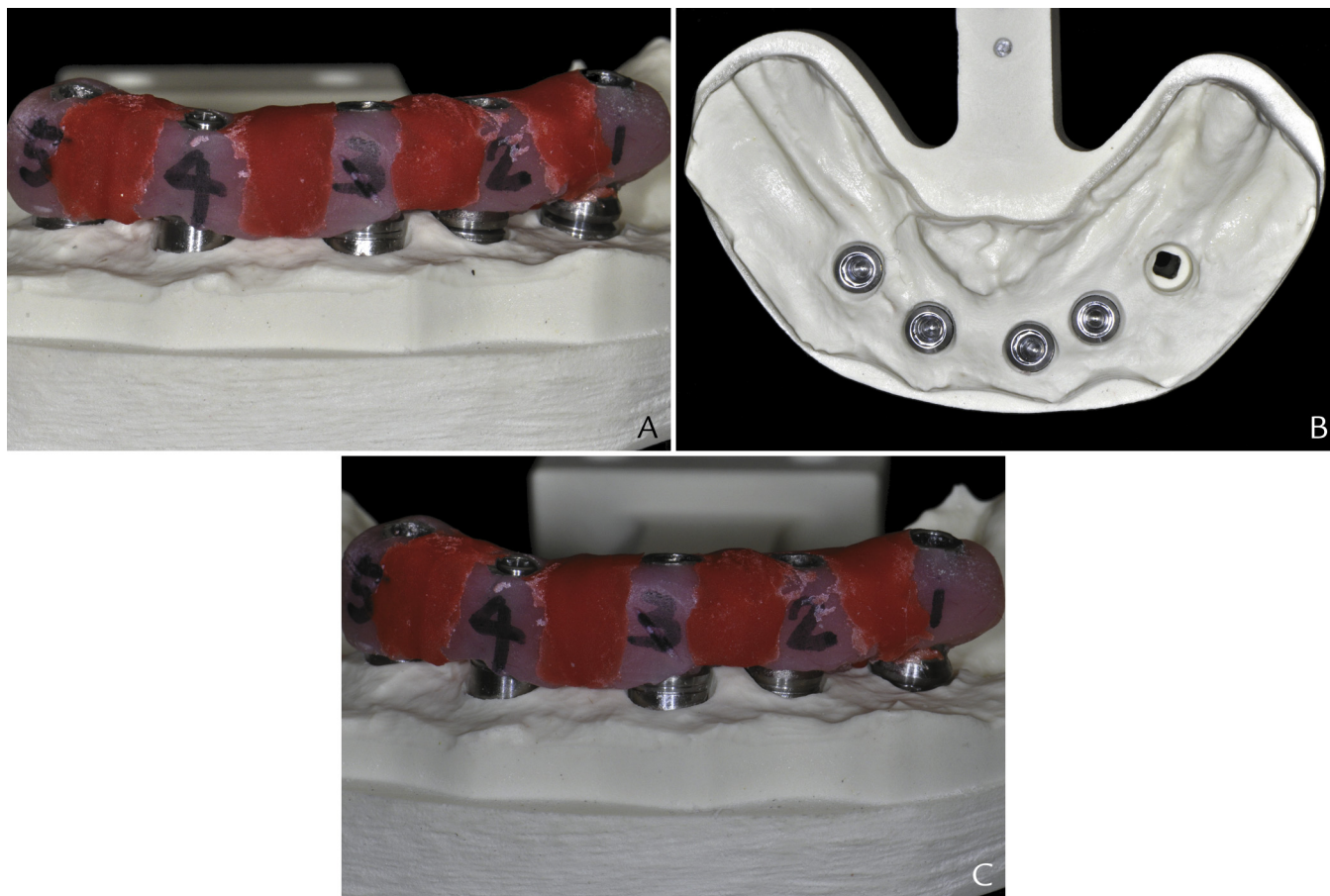


**1** A, Complete digital impression acquired with intraoral scanner. B, Milled polyurethane definitive cast with all removable implant analogs in place.

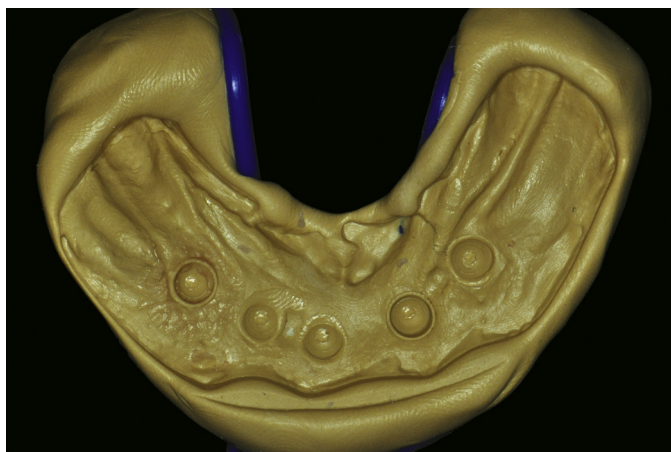


**2** A, All individual segments of verification device were luted intraorally with autopolymerizing acrylic resin. B, Verification stone cast.





**3** A, Misfit of verification device on analogs numbers 1, 2, and 3 was noted. B, Analog number 1 was found with inaccurate positioning and removed. C, Verification device was replaced on definitive cast to confirm fit with remaining analogs.



**4** Impression of milled polyurethane definitive cast.

cast. Ensure that the analog in the new position has sufficient (2-3 mm) space and does not interfere with the surrounding polyurethane material. Enlargement of the analog receiving space in the definitive cast can be repeated until no interference is detected (Fig. 5B).

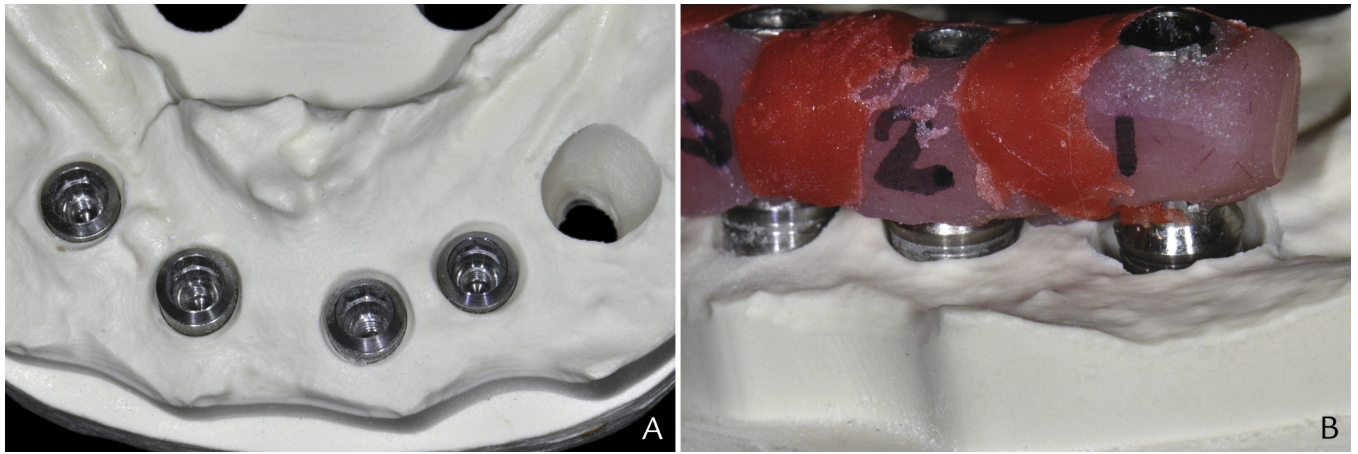
9. Mix and inject autopolymerizing acrylic resin (Pattern Resin LS; GC America) into the enlarged analog receiving space and secure the verification device-analog assembly to the definitive cast. Ensure the top portion of the analog (3-4 mm) is not covered by the acrylic resin.

10. Remove the verification device after polymerization of the autopolymerizing acrylic resin (Pattern Resin LS; GC America) (Fig. 6A). Place a closure screw (Closure screw; Straumann) on the repositioned removable implant analog and inject polyvinyl siloxane material (Softissue Moulage; Kerr Dental) with a syringe (Disposable curved utility syringe; Henry Schein) around the analog (Fig. 6B).

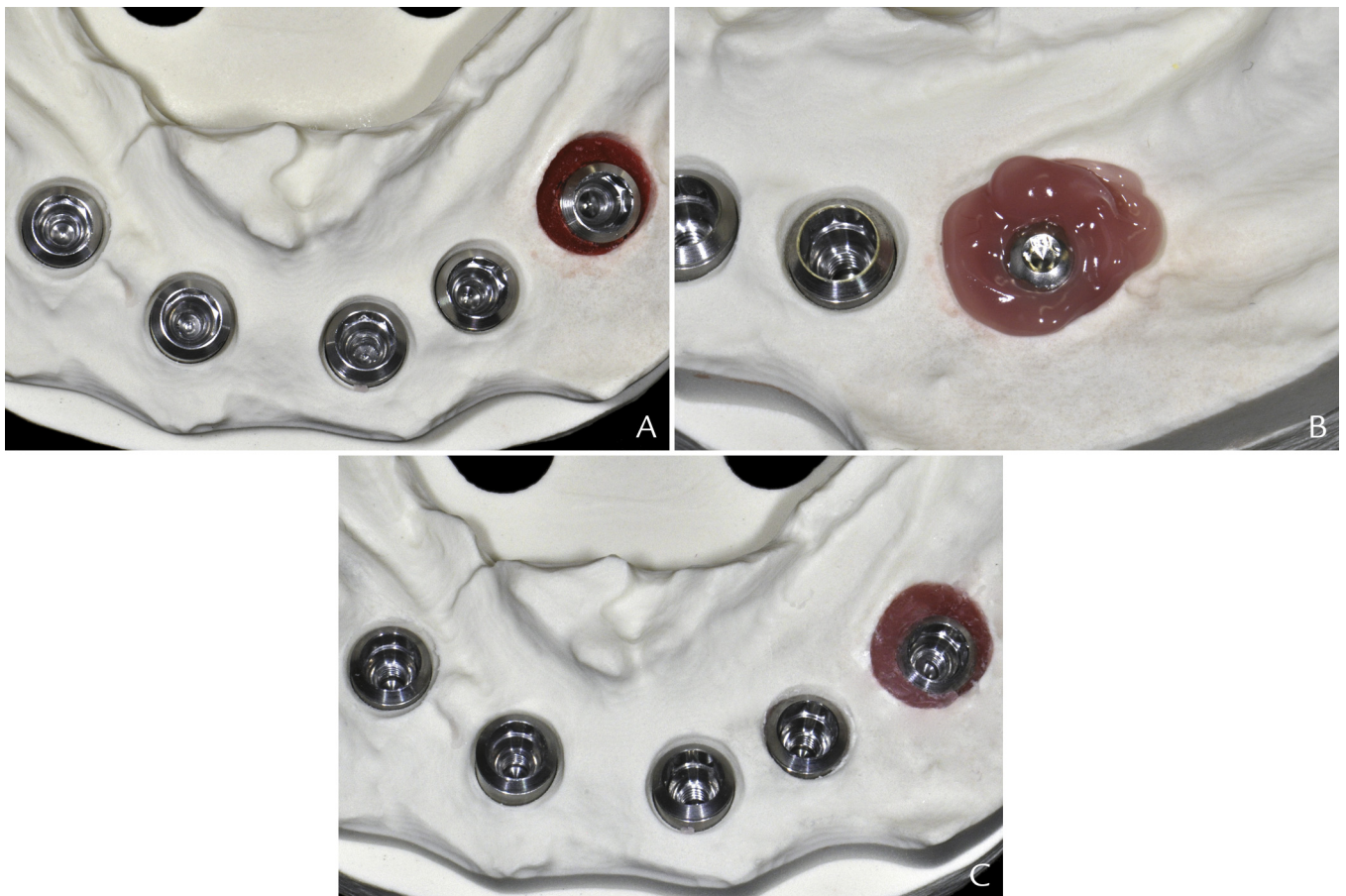
11. Place the impression made with low viscosity polyvinyl siloxane material (AFFINIS Putty super soft; Coltène/Whaledent Inc) on the definitive cast. Remove any excessive polyvinyl siloxane material around the analog with a scalpel (BD Bard-Parker; BD Medical) (Fig. 6C).

## DISCUSSION

This report describes a technique for verifying and correcting an analog



**5** A, Analog-receiving space was enlarged. B, Verification device-analog assembly was placed into definitive cast, and adequate space was ensured between analog and surrounding polyurethane material.



**6** A, Repositioned analog attached with autopolymerizing acrylic resin. B, Polyvinyl siloxane material injected around the repositioned analog. C, Milled polyurethane definitive cast with corrected analog position and removable periimplant soft tissue replica.

position in a milled polyurethane definitive cast with an acrylic resin verification device for a nonsegmental implant restoration in an edentulous jaw. The verification device serves a dual purpose as a jig for fabricating the verification stone cast and as an analog transfer

template for verifying and correcting the positions of implant analogs for the milled polyurethane definitive cast. The impression of the milled polyurethane definitive cast made with low viscosity polyvinyl siloxane material serves as a template for facilitating the creation of

a removable periimplant soft tissue replica. The light-polymerizing acrylic resin (Triad Denture Base; Dentsply Prosthetics) is used to fabricate the verification device because it facilitates the uniform coverage of the temporary abutments (RN synOcta post for



temporary restoration, Bridge; Straumann) with an adequate thickness of resin and the uniform thickness of the device.<sup>1</sup> The commonly available auto-polymerizing acrylic resin (Pattern Resin LS; GC America) was used to provide a mechanical connection for joining segments of the verification device<sup>1</sup> and repositioning the implant analog in the milled polyurethane definitive cast. The verification stone cast should be immediately fabricated during the clinical appointment to prevent prolonged storage and accidental breakage of the luted 1-piece verification device. The polymerized acrylic resin (Pattern Resin LS; GC America) also can serve as a rigid medium for mechanically fixing the repositioned analog in a stable position because the manually enlarged analog receiving space is not perfectly circular and antirotational features exist on the lateral sides of the implant analog. The limitation of this technique is that a number of analogs must be in the correct position and that the verification device must be secured on those analogs. Additional patient visits, implant

components, and laboratory procedures also are required for the fabrication of the verification device and cast.

## REFERENCES

1. Rutkunas V, Ignatovic J. A technique to splint and verify the accuracy of implant impression copings with light-polymerizing acrylic resin. *J Prosthet Dent* 2014;111:254-6.
2. Lee H, So JS, Hochstedler JL, Ercoli C. The accuracy of implant impressions: a systematic review. *J Prosthet Dent* 2008;100:285-91.
3. Choi J-H, Lim Y-J, Yim S-H, Kim C-W. Evaluation of the accuracy of implant-level impression techniques for internal-connection implant prostheses in parallel and divergent models. *Int J Oral Maxillofac Imp* 2007;22:761-8.
4. Knudson RC, Williams EO, Kemple KP. Implant transfer coping verification jig. *J Prosthet Dent* 1989;61:601-2.
5. 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.
6. Vitale ND, Tung F, Goldstein G. A technique to verify or correct analogue position and soft tissue profile on an implant working cast. *J Prosthet Dent* 2009;102:137-40.
7. Ercoli C, Geminiani A, Feng C, Lee H. The influence of verification jig on framework fit for nonsegmented fixed implant-supported complete denture. *Clin Implant Dent Relat Res* 2012;14:188-95.
8. Lin WS, Harris BT, Morton D. The use of a scannable impression coping and digital impression technique to fabricate a customized anatomic abutment and zirconia restoration in the esthetic zone. *J Prosthet Dent* 2013;109:187-91.
9. Lin WS, Harris BT, Zandinejad A, Morton D. Use of digital data acquisition and CAD/CAM technology for the fabrication of a fixed complete dental prosthesis on dental implants. *J Prosthet Dent* 2014;111:1-5.
10. Andriessen FS, Rijkens DR, van der Meer WJ, Wismeijer DW. Applicability and accuracy of an intraoral scanner for scanning multiple implants in edentulous mandibles: a pilot study. *J Prosthet Dent* 2014;111:186-94.

Corresponding author:  
Dr Wei-Shao Lin  
University of Louisville  
501 S. Preston Street  
Louisville, KY 40292  
E-mail: WeiShao.Lin@Louisville.edu

### Acknowledgments

The authors thank Roy Dental Laboratory, New Albany, IN for assistance in this study.

Copyright © 2014 by the Editorial Council for  
*The Journal of Prosthetic Dentistry*.