THE JOURNAL OF PROSTHETIC DENTISTRY

DENTAL TECHNIQUE

Integration of intraoral scanning and conventional processing to fabricate a definitive obturator: A dental technique

Hatem Alqarni, BDS, MS,[a] Mathew T. Kattadiyil, BDS, MDS, MS,[b] Ruth Aponte-Wesson, DDS, MS,[c] Mohammed Alfaifi, BDS,[d] and Hussain Alsayed, BDS, MSD[e]

ABSTRACT

Clinical challenges occur when treating patients with maxillofacial defects with digital technology. This report describes a technique that combines intraoral scanning to fabricate a milled record base along with the conventional processing to fabricate a definitive maxillary obturator prosthesis. (J Prosthet Dent 2021;126:596-9)

An obturator is a maxillofacial prosthesis that is used to close a congenital or acquired tissue opening, primarily of the hard palate and/or the contiguous alveolar and soft tissue structures.[1] For edentulous patients who require an obturator for maxillofacial defects, achieving an accurate impression can be difficult; however, an accurate impression is essential to the success of the prosthesis.[2]

Advancements in digital technology have led to the use of computer-aided design and computer-aided manufacturing (CAD-CAM) technology in the design and fabrication of computer-engineered complete dentures (CECDs).[2-4] Intraoral scanners have been used to digitally capture edentulous arches, although the technique has challenges. Capturing key anatomic areas, the extension of soft tissue for appropriate prosthesis border extension and peripheral seal, the impact of lips, cheeks, and other musculature for appropriate cameo surface morphology of the prosthesis, and determining the compressibility of the posterior palatal seal area can be challenging with scanning technology.[5-7] Another limitation of intraoral scanners is the disruption of the scanning process by movement of the soft tissue, which alters the morphology of the site.[8]

CECDs have the advantages of fewer appointments, reduced chair time, and the elimination of the need for impression material.[2-6] The technology has numerous applications in maxillofacial prosthetics.[2] To avoid disruption of the virtual stitching of the scans in the process, artificial landmarks have been used when scanning a long edentulous span. This technique has also improved the trueness and precision of the scans.[9] Pressure-indicating paste (Pressure Indicator Paste; Mizzy Inc) and zinc oxide-eugenol cement (Temp-Bond; Kerr Corp) have been used as fiduciary markers for this technique.[10]

A 72-year-old woman sought treatment to replace her worn and unstable maxillary obturator prosthesis as seen in Figure 1A. The clinical examination revealed a maxillary defect as a result of squamous cell carcinoma treated with surgical resection followed by radiation therapy 10 years previously. Flabby tissue and inflammation were seen at the center of the anterior maxillary alveolar ridge. The patient reported that she had a severe gag reflex, and intraoral impressions were exceptionally problematic. Treatment options were discussed, and a milled record base fabricated with an intraoral scanning protocol was selected to facilitate the fabrication of the definitive maxillary obturator.

[a]Teaching Assistant, Prosthetic Dental Science Department, College of Dentistry, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia; Fellow, Department of Head and Neck Surgery, Section of Oral Oncology and Maxillofacial Prosthodontics, The University of Texas M.D. Anderson Cancer Center, Houston, Texas.
[b]Professor and Director, Advanced Specialty Education Program in Prosthodontics, Loma Linda University School of Dentistry, Loma Linda, Calif.
[c]Associate Professor, Department of Head and Neck Surgery, Section of Oral Oncology and Maxillofacial Prosthodontics, The University of Texas M.D. Anderson Cancer Center, Houston, Texas.
[d]Graduate student, Advanced Specialty Education Program in Prosthodontics, Loma Linda University School of Dentistry, Loma Linda, Calif.
[e]Assistant Professor, Department of Prosthetic Dental Sciences, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

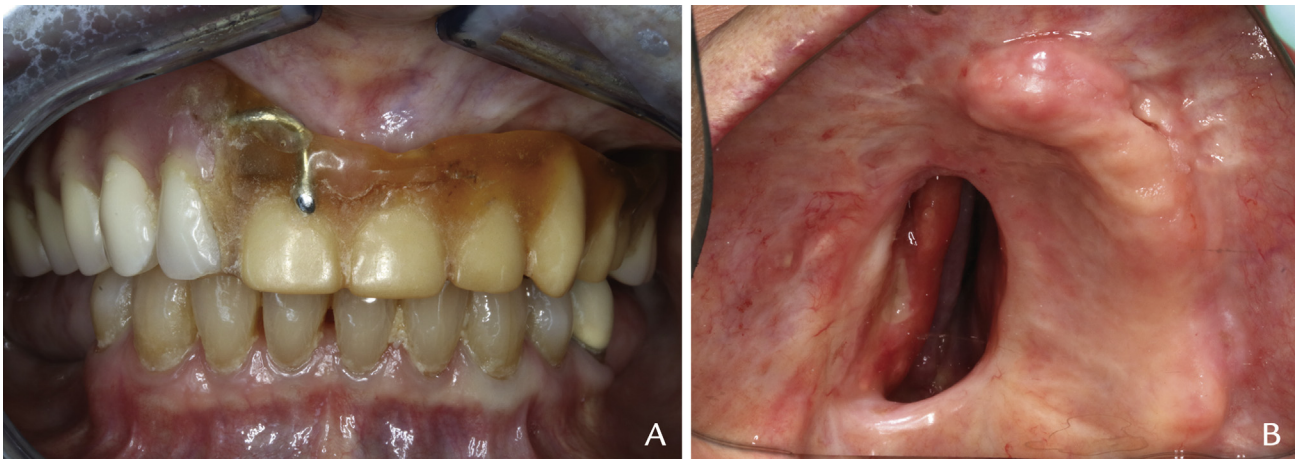

Figure 1. A, Pretreatment intraoral view at approximate occlusal vertical dimension showing existing maxillary obturator. B, Occlusal view of maxillary arch defect.

TECHNIQUE

1. Determine the extent of the defect size (Fig. 1B).
2. Place composite resin (Tetric EvoFlow; Ivoclar Vivadent AG) on the maxillary arch and apply tissue adhesive (PeriAcryl 90; GluStitch Inc) to secure it (Fig. 2).
3. Scan the maxillary arch by using an intraoral scanner (TRIOS 3; 3Shape A/S) (Fig. 3A) being careful to minimize movement of the lip and cheeks.
4. Send the standard tessellation language (STL) file of the scan and laboratory authorization form requesting a milled record to the manufacturer (AvaDent; Global Dental Science [GDS]) for the fabrication of a milled polymethyl methacrylate (PMMA) denture base (Fig. 3B).
5. Review the digital design images and suggest modifications if needed before providing approval for the milled record base fabrication (Fig. 3C, 3D).
6. Insert the milled PMMA trial base (Fig. 3E) and perform adjustments as needed. Use soft reline material (Coe-Soft; GC America) to stabilize and improve the retention for the maxillary denture base.
7. Fabricate a maxillary occlusion rim (MOR) in wax (Hygenic medium-soft no.3 pink wax; Coltène) on the milled denture base. Modify the MOR to provide appropriate visibility (height) and labial fullness.
8. Determine the correct occlusal vertical dimension using a preferred assessment technique. Then, make a facebow record, followed by centric relation by injecting polyvinyl siloxane occlusal registration material (Vanilla Bite; Den-Mat Holdings, LLC) into the space between the MOR and the dentate opposing arch.
9. Make a preliminary impression of the opposing dentate arch with irreversible hydrocolloid (Jeltrate Alginate Fast Set; Dentsply Sirona) impression material.
10. Record the midline, incisal edge, and cervical area for denture teeth, and select the denture tooth mold and shade.
11. Send the relined denture base with the maxillomandibular relation records, impression of the opposing arch and completed laboratory authorization form indicating type of acrylic resin (Lucitone 199; Dentsply Sirona), occlusal scheme, tooth shade, and size to the dental laboratory for

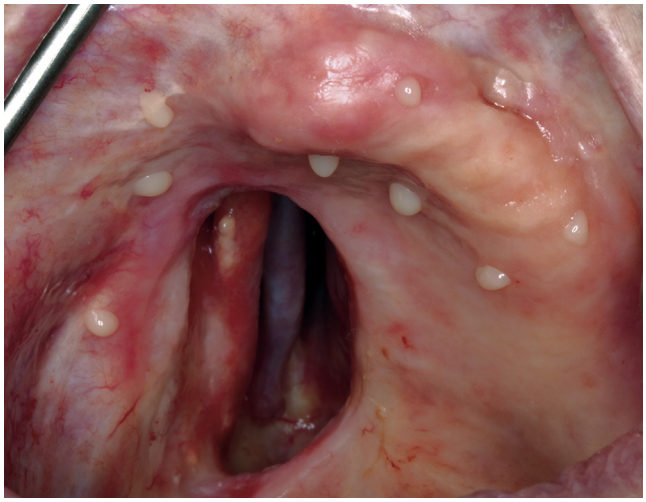

Figure 2. Occlusal view of maxillary arch with composite resin markers attached to maxillary arch with tissue adhesive.

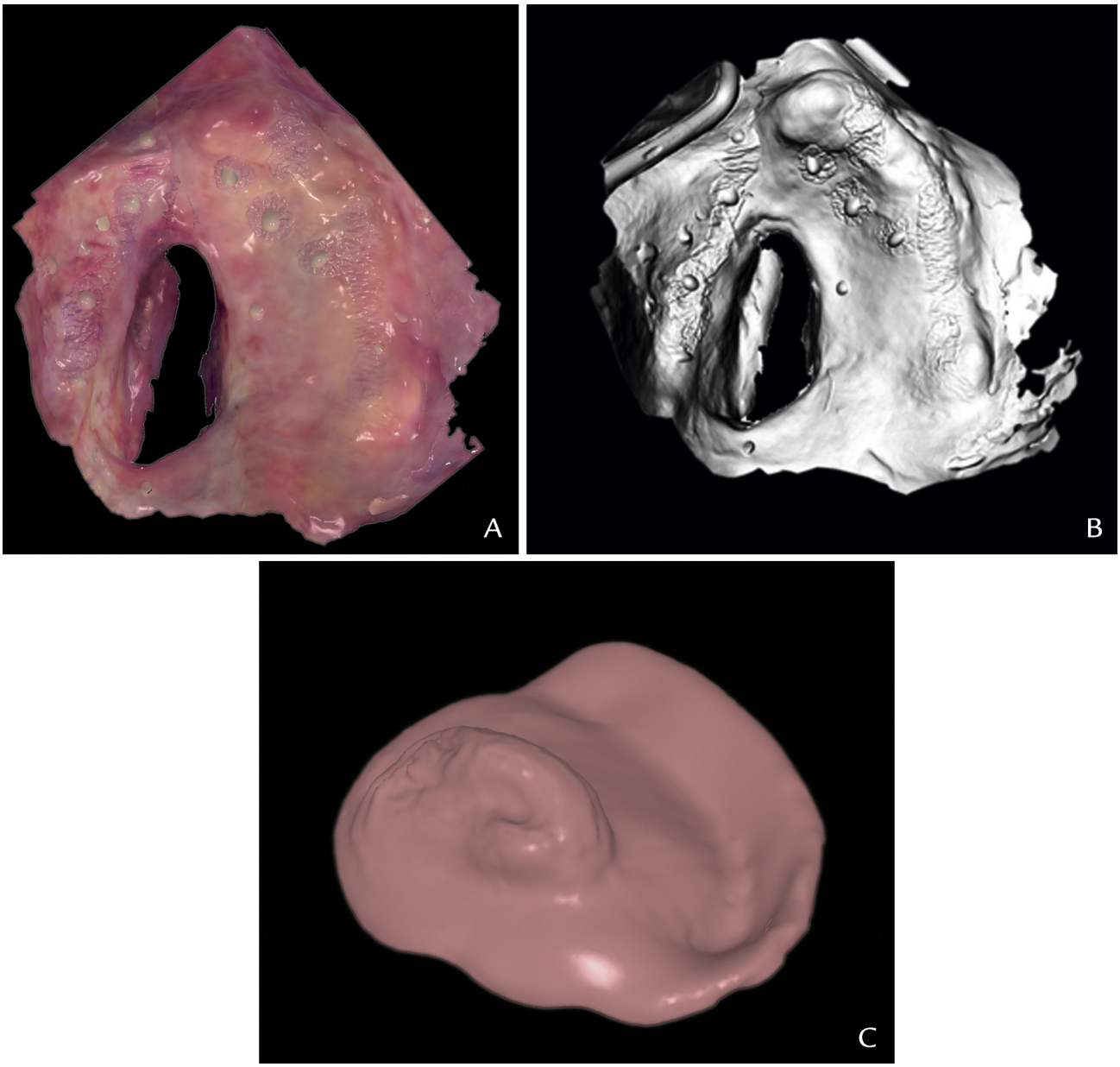

Figure 3. A, Maxillary complete-arch intraoral scan. B, Color rendered standard tessellation language file. C, Intaglio surface view.

fabrication of the definitive obturator by using a conventional processing technique.

12. Adjust the definitive maxillary obturator prosthesis as needed (Fig. 4). Provide home care and hygiene instructions and schedule follow-up appointments.

DISCUSSION

Fabrication of a definitive maxillary obturator prosthesis for the completely edentulous, resected maxilla is challenging in many ways. It is essential that an accurate impression be made of the surgical defect to capture the wall defect and the remaining maxilla. With elastomeric impression materials and a patient with a severe gag reflex, there is a risk of dislodging a portion of the impression material into the surgical site. The described technique avoids this complication and provides the patient with a more comfortable procedure for prosthesis fabrication.

Various methods of fabricating a definitive obturator prosthesis with an intraoral scanner have been proposed.[2] The use of composite resin to visualize the tissue and obtain an accurate intraoral scan enabled an accurate milled denture base. Then, a soft tissue reline material captured the ideal extension and minimized the gag reflex. The milled denture base served as custom tray, making it possible to fabricate an obturator.

Limitations of the technique include inadequate extension of the borders and the sulcus because of tissue

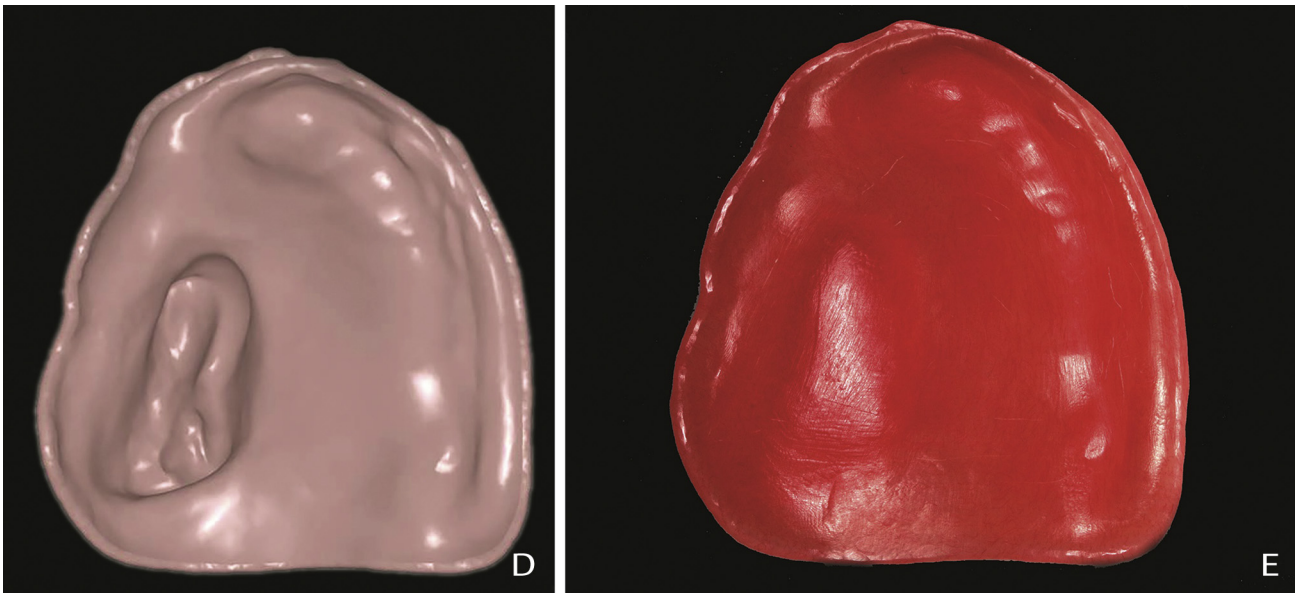

Figure 3. *(Continued).* D, Occlusal view of digital design images before obtaining final approval and requesting milled base. E, Milled record base.

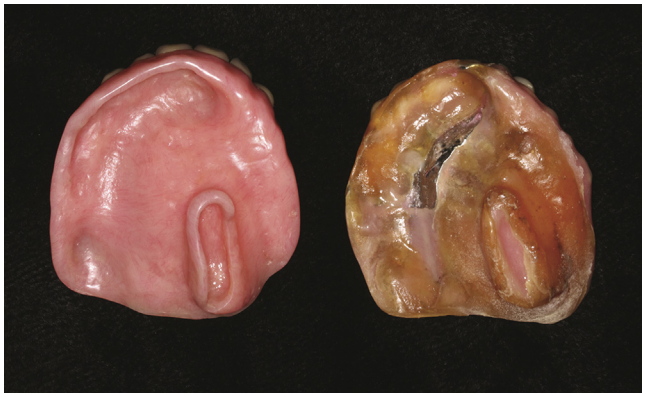

Figure 4. Intaglio surface view comparing definitive maxillary obturator prosthesis (left) with existing prosthesis (right).

mobility and the inability of the intraoral scanner to capture these areas. To overcome this limitation, a combination of intraoral scanning and the conventional method was used. The patient tolerated the procedure well because the amount of reline material used was much less than the impression material needed for a conventional impression. Studies are needed to determine the stability of prostheses created with this method and develop a method of easily fabricating an entire prosthesis along with an obturator by using a fully digital workflow.

SUMMARY

The combination of intraoral scanning and conventional processing was used to fabricate a definitive maxillary obturator prosthesis. This technique eliminated the need for uncomfortable conventional impression techniques, facilitating and shortening dental treatment for patients with maxillofacial defects.

REFERENCES

1. The glossary of prosthodontic terms. Ninth edition. J Prosthet Dent 2017;117(5S):e1-105.
2. Tasopoulos T, Chatziemmanouil D, Karaiskou G, Kouveliotis G, Wang J, Zoidis P. Fabrication of a 3D-printed interim obturator prosthesis: a contemporary approach. J Prosthet Dent 2019;121:960-3.
3. Kattadiyil MT, AlHelal A. An update on computer-engineered complete dentures: literature review on clinical outcomes. J Prosthet Dent 2017;117:478-85.
4. Goodacre CJ, Garbacea A, Naylor WP, Daher T, Marchack CB, Lowry J. CAD/CAM fabricated complete dentures: concepts and clinical methods of obtaining required morphological data. J Prosthet Dent 2012;104:34-46.
5. Bidra AS, Taylor TD, Agar JR. Computer-aided technology for fabricating complete dentures: systematic review of historical background, current status, and future perspectives. J Prosthet Dent 2013;109:361-6.
6. Kattadiyil MT, AlHelal A, Goodacre BJ. Clinical complications and quality assessments with computer-engineered complete dentures: systematic review. J Prosthet Dent 2017;117:721-8.
7. Goodacre BJ, Goodacre CJ. Using intraoral scanning to fabricate complete dentures: first experiences. Int J Prosthodont 2018;31:166-70.
8. 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.
9. Kim J, Amelya A, Shin Y, Shim J. Accuracy of intraoral digital impressions using an artificial landmark. J Prosthet Dent 2017;117:755-61.
10. Lee JH. Improved digital impressions of edentulous areas. J Prosthet Dent 2017;117:448-9.

Corresponding author:
Dr Hatem Alqarni
The University of Texas MD Anderson Cancer Center
1400 Pressler Street
Houston, TX 77030
Email: Dr.hatem@hotmail.com

https://doi.org/10.1016/j.prosdent.2020.04.024