

DENTAL TECHNIQUE

# A digital technique for fabricating implant-supported interim restorations in the esthetic zone



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Placing a customized interim restoration at the time of flapless post-extraction socket implant placement may minimize the amount of cervical contour change at the facial aspect of the ridge<sup>1</sup> and preserve both the vertical and the labiopalatal dimensions of peri-implant soft tissue.<sup>2</sup>

An interim restoration contoured to mirror the cervical morphology of the extracted tooth may initiate the tissue-maintaining healing process.<sup>3,4</sup> Moreover, an interim restoration is a fundamental step in contouring the peri-implant soft tissue,<sup>5</sup> which is crucial in the esthetic zone. Several techniques have been proposed for fabricating an implant-supported interim restoration intraorally or extraorally immediately after implant placement.<sup>6</sup> However, the conventional methods of fabricating an interim restoration after surgery take chairside time. A digital approach for fabricating an interim matrix before surgery has been proposed.<sup>7</sup> Because the actual guided implant placement position and direction would not be exactly as planned,<sup>8</sup> the interim restoration is cemented to the abutment after surgery rather than before surgery.<sup>7</sup> However, the method of determining the intraoral position of the interim restoration was not described. To minimize chair time, an interim implant-supported restoration with an ideal emergence profile and intraoral 3-dimensional (3D)

## ABSTRACT

A digital technique for fabricating an implant-supported interim restoration is presented. The labial cervical architecture of the natural tooth is captured before extraction and registered to form the emergence profile of the interim restoration. A well-contoured interim restoration is fabricated before surgery and connected to the immediately placed implant with a customized interim abutment. (*J Prosthet Dent* 2018;119:540-4)

position may be fabricated before surgery and placed immediately after surgery.

This article describes a digital technique that allows preoperative fabrication of a well-contoured interim restoration, particularly at the labial cervical contours, replicating the 3D anatomy of the natural tooth while taking into account the desired tooth position.

## TECHNIQUE

The planned treatment consisted of an implant-supported replacement of a fractured left maxillary central incisor after trauma (Fig. 1).

1. Make intraoral digital scans of the maxilla, the mandible, and the interocclusal records at maximal intercuspal position, using an intraoral scanner (TRIOS; 3Shape) before tooth extraction. Save the digital scans as a 3Shape exchange format (.3ox) file named File A (Fig. 2A).
2. Scan the bony structures and teeth in the maxilla and mandible in the semi-open mouth position, using cone beam computed tomography (CBCT)

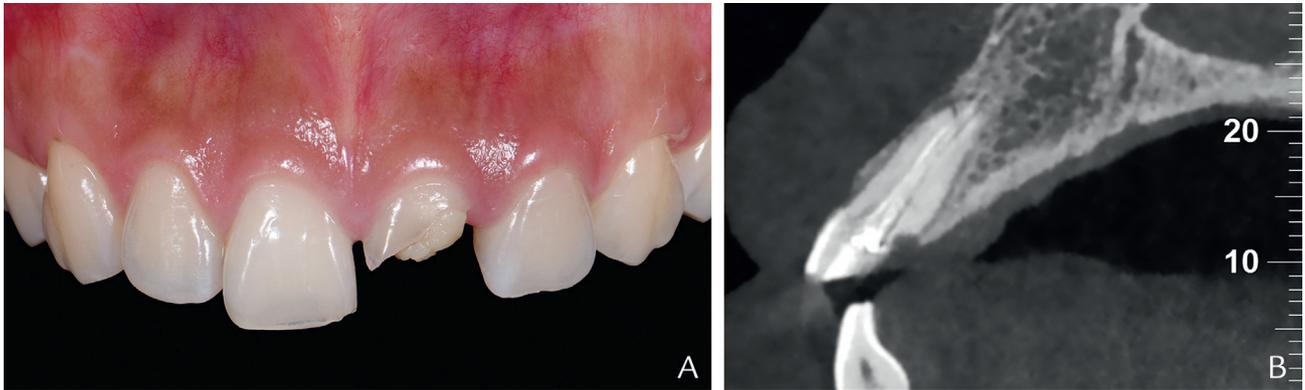
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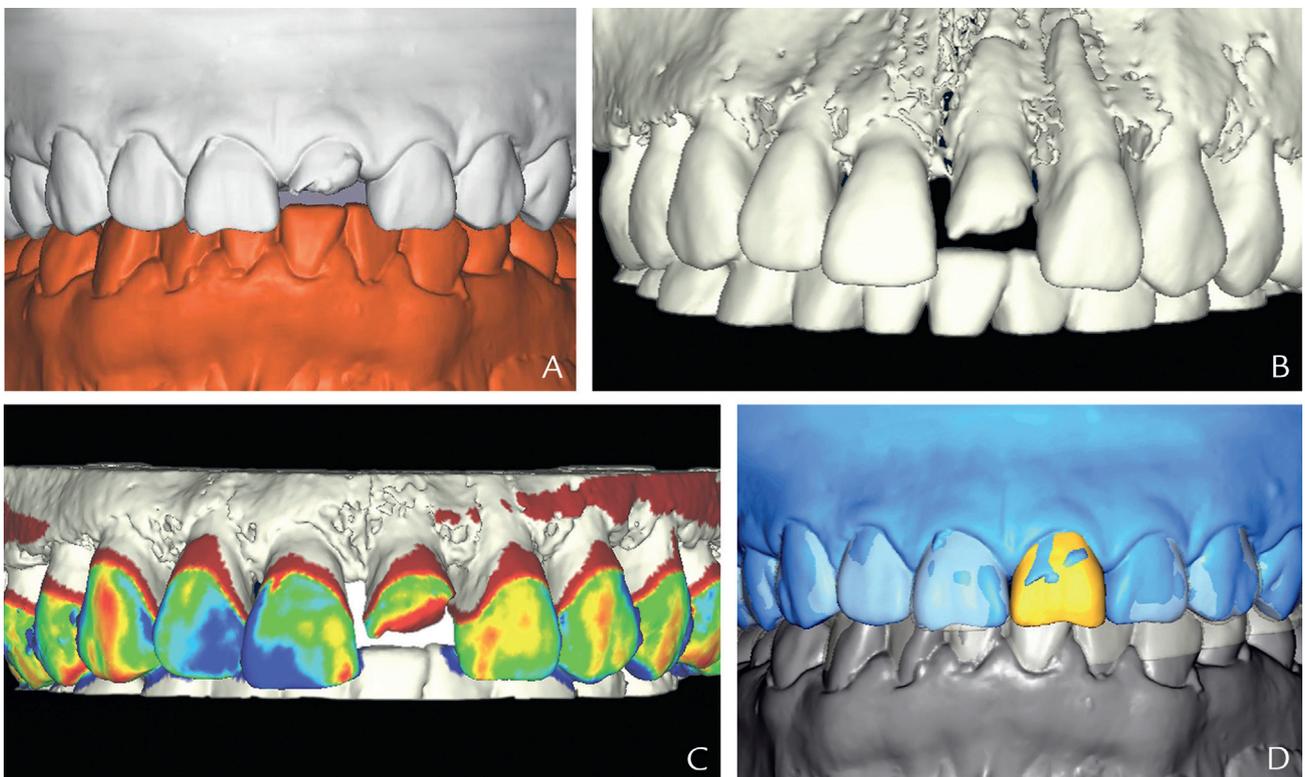
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**Figure 1.** Maxillary left central incisor after trauma and before extraction. A, Intraoral view. B, Cross sectional sagittal plane of CBCT. CBCT, cone beam computed tomography.

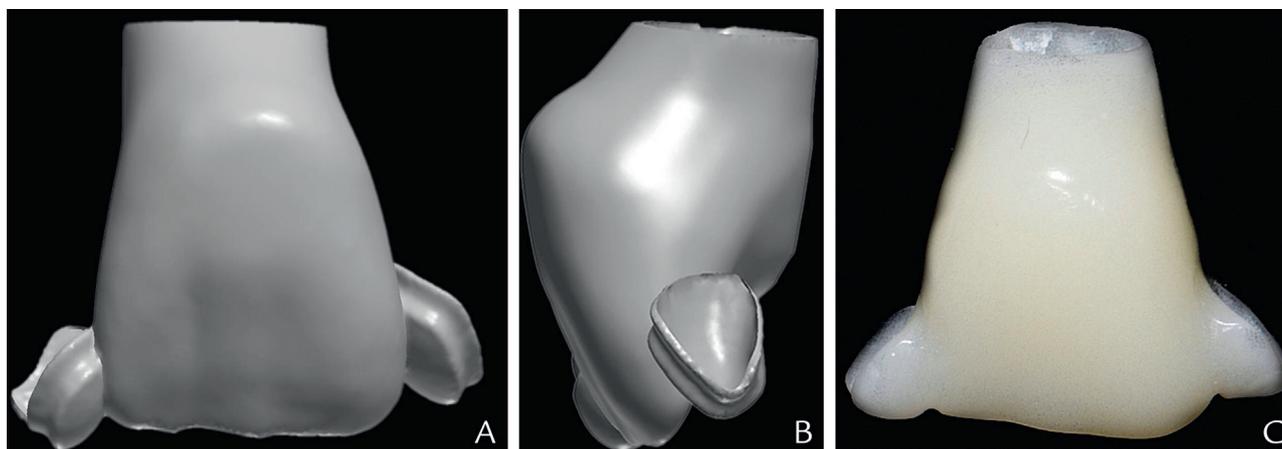


**Figure 2.** A, Digital scan. B, CBCT file. C, Files A and B merged. D, Digital cast with virtual restoration. CBCT, cone beam computed tomography.

(NewTom VG; Quantitative Radiology). Save the CBCT file in a digital imaging and communications in medicine (DICOM) file named File B (Fig. 2B).

3. Import files A and B into digital dental software (Segma dental CAD; Segma). Use the “best fit” algorithm for merging both files by registering the clinical crowns into a single digital file, which is saved as File C (Fig. 2C). Design the virtual restoration and save it as File D. The crown shape and form should mirror the contralateral natural tooth (Fig. 2D).

4. Plan the insertion direction and 3D position of implant placement. Design and print the surgical guide (Perfactory Desktop Digital Dental Printer; EnvisionTEC).
5. Design the interim restoration before surgery (Fig. 3). Copy the crown shape and contours from the virtual restoration named File D. The labial cervical contour replicates the tooth anatomy obtained from the CBCT. Preserve an interim abutment access with 1.0-mm tolerance to allow for any deviation of actual and planned implant position. In addition, leave adequate space for the autopolymerizing acrylic resin which will be used to connect



**Figure 3.** Interim restoration designed and fabricated before surgery. A, Front view. B, Lateral view. C, Milled interim restoration.

the interim restoration to the interim abutment. Design 2 incisal wings, which should have a common path of insertion with the interim abutment, to assist the fit of the interim restoration after surgery.

6. Fabricate the interim restoration with a digital milling machine (model 5X-200; Segma) and a computer-aided design and computer-aided manufacturing (CAD-CAM) block of poly(methyl methacrylate) material (PMMA disk; Yamahachi).
7. After flapless extraction of the left maxillary central incisor, place an implant (Astra; Dentsply Sirona) immediately under guidance, with a primary stability of 40 Ncm of torque at placement. Place a preconditioned interim titanium abutment (Fig. 4) and place polytetrafluoroethylene (PTFE) tape into the screw access chamber.
8. The digitally fabricated interim restoration should passively fit with no interference in any position (Fig. 5). The incisal wings should sit on the adjacent teeth precisely, determining the exact position of the interim restoration. Spot attach the interim restoration to the interim abutment with an auto-polymerizing composite resin (Nature; Nissin). Once the resin has polymerized, remove the newly formed screw-retained interim restoration, fill in the remaining void areas with the autopolymerizing composite resin, and cut off the incisal wings.
9. Finish the interim restoration with fine diamond rotary instruments, polish it with cotton wheels, steam clean it, and insert and tighten it to 15 Ncm (Fig. 6). Seal the screw access hole with PTFE tape and a light-polymerizing flowable composite resin (Beautiful flow; Shofu). Remove any occlusal contacts in centric or eccentric occlusion.
10. After the maturation and stabilization of the peri-implant mucosa, transfer the soft tissue contours to the definitive restoration (Fig. 7) using a digital technique.<sup>9</sup>



**Figure 4.** Screw-retained interim abutment.

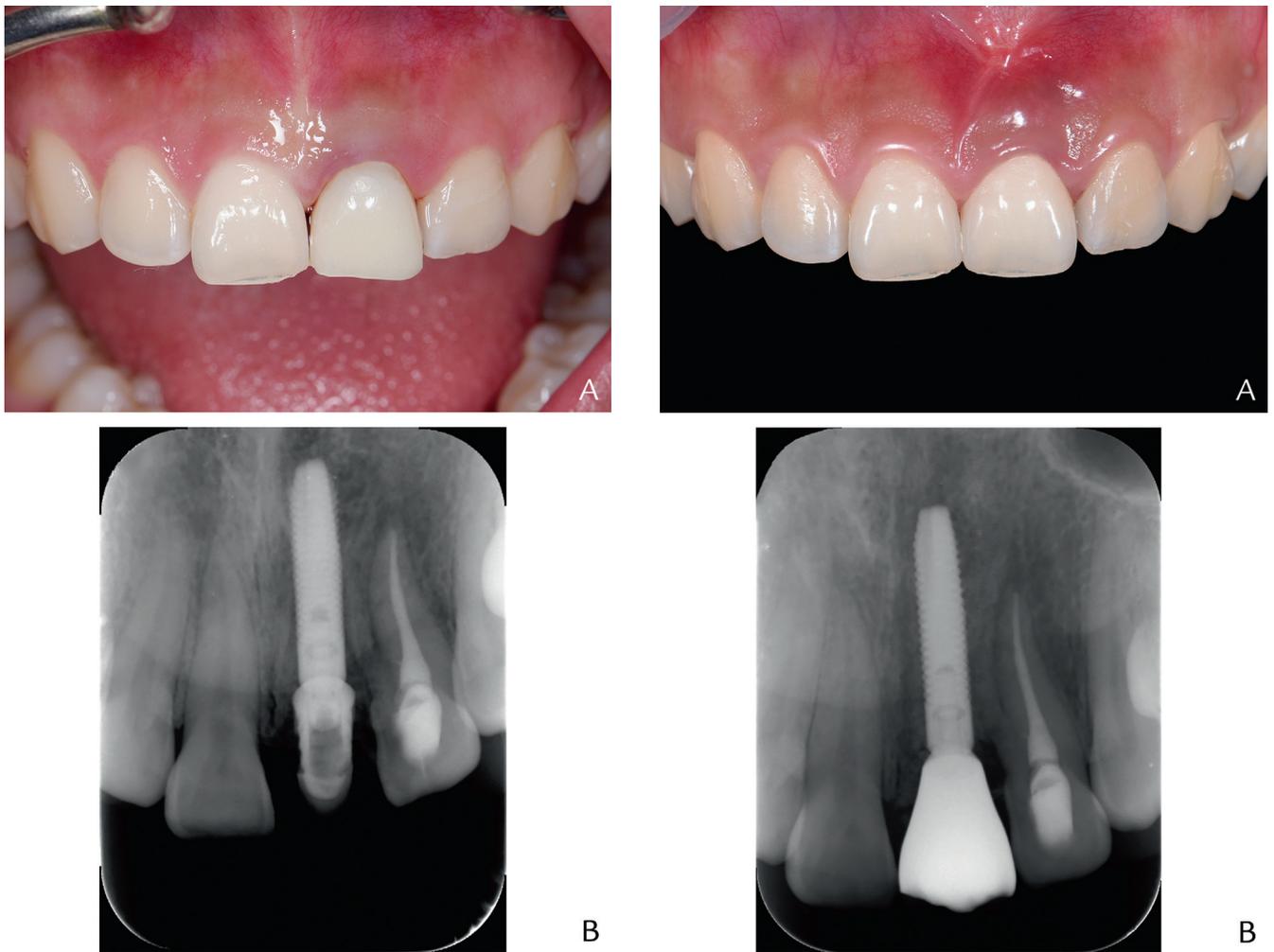
## DISCUSSION

The present digital technique facilitates fabrication of an interim restoration before surgery, which may reduce the time required for immediate restoration after surgery. Moreover, this technique helps preserve the natural emergence profile of the tooth to be extracted and replicates the labial cervical contours to facilitate a clinically pleasant and harmonious treatment outcome.

The cervical contours and position of interim restorations are essential for an immediate restoration. Currently available CBCT, intraoral scanning devices, and dental software allow clinicians and technicians to obtain the supragingival and subgingival anatomy of the tooth before extraction. The cervical contours of the interim restoration, which mimic natural tooth anatomy, support the gingival architecture and seal the extraction socket. In addition, the incisal wings are designed to ensure the accurate fit and seating of the interim restoration after surgery. Once the wings have been placed on the adjacent teeth without any obstruction, the position of the



**Figure 5.** Interim restoration inserted without obstruction. A, Labial view. B, Incisal view.



**Figure 6.** Interim restoration in place. A, Intraoral view. B, Periapical radiograph.

**Figure 7.** Definitive restoration in place. A, Intraoral view. B, Periapical radiograph.

interim restoration is satisfied according to the design requirement. If the interim crown fit is not passive, the interim abutment and/or its access within the crown should be adjusted.

This technique requires the extracted tooth to have ideal cervical architecture that is to be preserved and replicated in the interim restoration; otherwise, the emergence profile should be ideally contoured virtually or clinically.

## SUMMARY

This technique article describes a digital technique that allows the fabrication of an interim restoration that replicates the cervical contour of natural teeth before surgery. This may save chairside time while placing a high quality immediate interim implant-supported restoration in the esthetic zone.

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## Noteworthy Abstracts of the Current Literature

### Comparison of accuracy between a conventional and two digital intraoral impression techniques

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**Purpose.** To compare the accuracy (ie, precision and trueness) of full-arch impressions fabricated using either a conventional polyvinyl siloxane (PVS) material or one of two intraoral optical scanners.

**Material and methods.** Full-arch impressions of a reference model were obtained using addition silicone impression material (Aquasil Ultra; Dentsply Caulk) and two optical scanners (Trios, 3Shape, and CEREC Omnicam, Sirona). Surface matching software (Geomagic Control, 3D Systems) was used to superimpose the scans within groups to determine the mean deviations in precision and trueness ( $\mu\text{m}$ ) between the scans, which were calculated for each group and compared statistically using one-way analysis of variance with post hoc Bonferroni (trueness) and Games-Howell (precision) tests (IBM SPSS ver 24, IBM UK). Qualitative analysis was also carried out from three-dimensional maps of differences between scans.

**Results.** Means and standard deviations (SD) of deviations in precision for conventional, Trios, and Omnicam groups were 21.7 ( $\pm 5.4$ ), 49.9 ( $\pm 18.3$ ), and 36.5 ( $\pm 11.12$ )  $\mu\text{m}$ , respectively. Means and SDs for deviations in trueness were 24.3 ( $\pm 5.7$ ), 87.1 ( $\pm 7.9$ ), and 80.3 ( $\pm 12.1$ )  $\mu\text{m}$ , respectively. The conventional impression showed statistically significantly improved mean precision ( $P < .006$ ) and mean trueness ( $P < .001$ ) compared to both digital impression procedures. There were no statistically significant differences in precision ( $P = .153$ ) or trueness ( $P = .757$ ) between the digital impressions. The qualitative analysis revealed local deviations along the palatal surfaces of the molars and incisal edges of the anterior teeth of  $< 100 \mu\text{m}$ .

**Conclusions.** Conventional full-arch PVS impressions exhibited improved mean accuracy compared to two direct optical scanners. No significant differences were found between the two digital impression methods.

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