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DENTAL TECHNIQUE

A digital workflow for fabricating an immediate implant-supported interim crown with a positioning device and screw-access channel

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ABSTRACT

Interim crowns for immediately placed implants have been fabricated by using a prefabricated thin-walled hollow crown attached to an interim abutment. This article describes an alternative digital workflow for fabricating an immediate monolithic implant-supported interim restoration with a prefabricated screw-access channel and a positioning device. The workflow is based on prosthetically driven implant planning with computer-aided design and computer-aided manufacturing (CAD-CAM). This approach reduces the chair time required to adapt a thin-walled hollow crown to an interim abutment and forming a screw-access channel. The technique also eliminates the use of large amounts of relining resin material that can affect the color match of a thin-walled hollow crown in esthetically challenging locations. (J Prosthet Dent 2026;135:711-715)

Immediate implant-supported interim restorations, placed within 48 hours after implant surgery without occlusal contact, have been reported to provide functional, esthetic, and psychological benefits, particularly in the anterior esthetic zone[1–5] (Fig. 1). Conventional techniques have frequently used the intraoral adaptation of a prefabricated interim thin-walled hollow crown to an interim abutment or an elastomeric impression for laboratory fabrication.[6–9] Computer-aided design and computer-aided manufacturing (CAD-CAM) techniques have been used along with digital scans and cone beam computed tomography (CBCT) to fabricate prosthetically driven implant-supported interim restorations.[10] Such techniques require considerable chairside time and can result in patient discomfort, with a risk of contamination of the surgical site.[10]

Compared with the digital fabrication of thin-walled hollow interim restorations,[11–13] the present digital technique was used to produce an immediate monolithic implant-supported interim crown with a prefabricated screw-access channel along with a positioning device.

TECHNIQUE

1. Obtain intraoral digital scans of maxillary and mandibular arches using an intraoral scanner (TRIOS 5; 3Shape A/S) and export the datasets in standard tessellation language (STL) format.
2. Import the digital scans into a software program (DentalCAD; exocad GmbH) and generate diagnostic virtual casts (Fig. 2).
3. Virtually extract the remaining root of the maxillary right central incisor and create a virtual diagnostic design of its crown (Fig. 3). Export the design as an STL file for use in an implant-based CAD software program (DentalCAD 3.1 Rijeka; exocad GmbH) to assist in prosthetically driven implant position planning.
4. Use a software program (DentalCAD; exocad GmbH) to design a positioning device that connects the virtual diagnostic design of the maxillary right central incisor to the adjacent dentition, ensuring stable seating during placement (Fig. 4A).
5. Superimpose the maxillary virtual diagnostic cast with the implant-planning virtual cast that contains the planned implant with an extended occlusal

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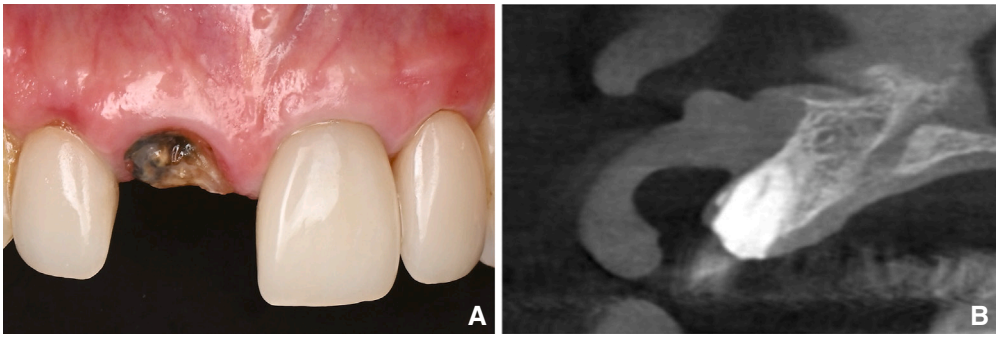

Figure 1. Preoperative condition. A, Frontal view of maxillary arch showing remaining root of maxillary right central incisor. B, Sagittal cross-sectional CBCT view of remaining root of maxillary right central incisor. CBCT, cone beam computed tomography.

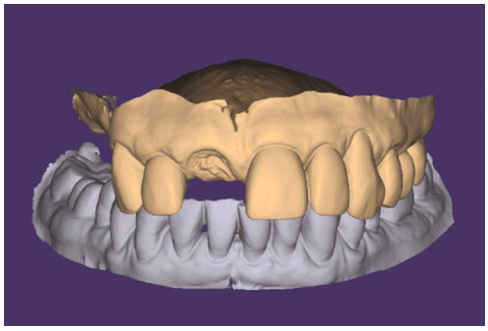

Figure 2. Diagnostic virtual casts of maxillary and mandibular arches obtained from intraoral digital scans.

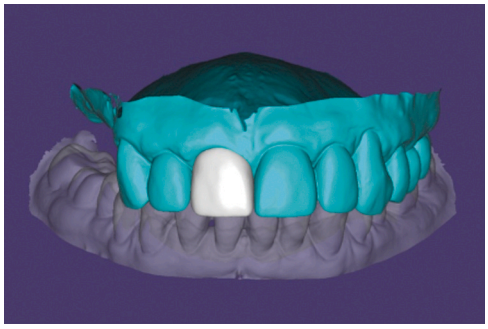

Figure 3. Virtual diagnostic design of maxillary right central incisor created using software program (DentalCAD; exocad GmbH) after digital extraction of remaining root. Virtual design used for implant planning.

tube, allowing accurate alignment of the immediate implant interim restoration with the implant plan (Fig. 4B, C). Export the superimposed implant virtual cast with the immediate implant interim restoration as a single STL file.

6. Import the STL file into a mesh-editing and 3D printing software program (Autodesk Meshmixer; Autodesk Inc). Select and separate the occlusal tube (Fig. 5A) and the interim restoration with the positioning device from the virtual cast (Fig. 5B). Convert both separated objects into solid models (Fig. 5C). Subtract the occlusal tube from the restoration to generate the screw-access channel (Fig. 5D, E). Finalize the interim restoration with the planned screw-access channel (Fig. 5F).
7. Fabricate the immediate implant interim restoration with the positioning device and screw-access channel using a 3D printer (SprintRay; SprintRay Inc) (additive manufacturing) or a milling machine (Arum 5X-200; Doowonid) (subtractive manufacturing), depending on available clinical resources. For this patient, subtractive manufacturing was used.
8. Extract the remaining root of the maxillary right central incisor and place the implant with bone grafting (Bio-Oss; Geistlich Pharma) of the gap where indicated (Fig. 6A, B).
9. Seat the prefabricated immediate implant interim restoration using the positioning device to ensure accurate alignment and passive fit (Fig. 6C-E) and then remove it.
10. Place the interim abutment, modify as needed, and tighten the abutment screw manually. Reposition the crown over the abutment and modify the access channel as needed. Connect the crown to the abutment using a resin with a chemical composition similar to that of the fabricated crown (PREMIOtemp; primotech USA). Trim the positioning device after all adjustments to the critical and subcritical zones,[14] more recently referred to as esthetic, bounded, and crestal (EBC) zones.[15] Confirm the occlusion and emergence profile and seal the screw-access channel with a polytetrafluoroethylene tape (Medical Grade Conformable White PTFE Teflon Tape; CS Hyde Co) and a light-polymerizing flowable composite resin (Filtek Supreme Ultra Flow; 3M ESPE). Verify esthetics and soft-tissue support (Fig. 6F, G).
11. Make a periapical radiograph to verify the fit of the interim abutment and the presence of any excess material (Fig. 6H).

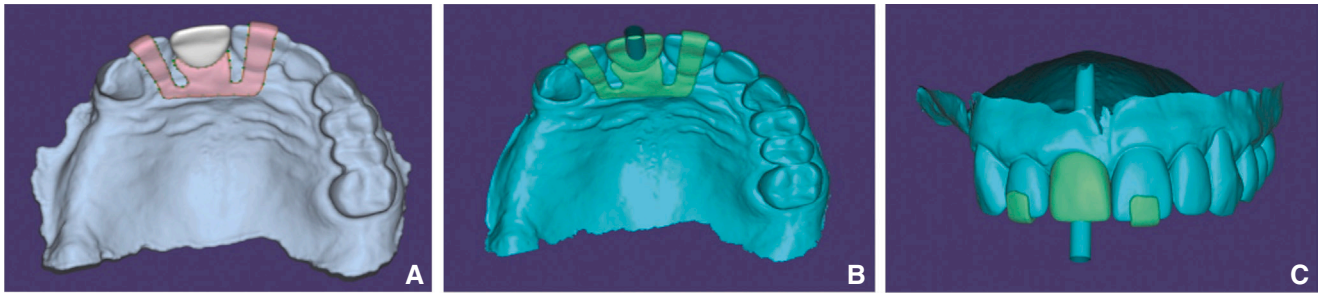

Figure 4. A, Occlusal view of positioning device connecting diagnostic design of maxillary right central incisor to adjacent dentition using software program (DentalCAD; exocad GmbH). B,C, Maxillary diagnostic virtual cast used to fabricate immediate implant interim restoration, superimposed with implant plan virtual cast that included extended occlusal tube.

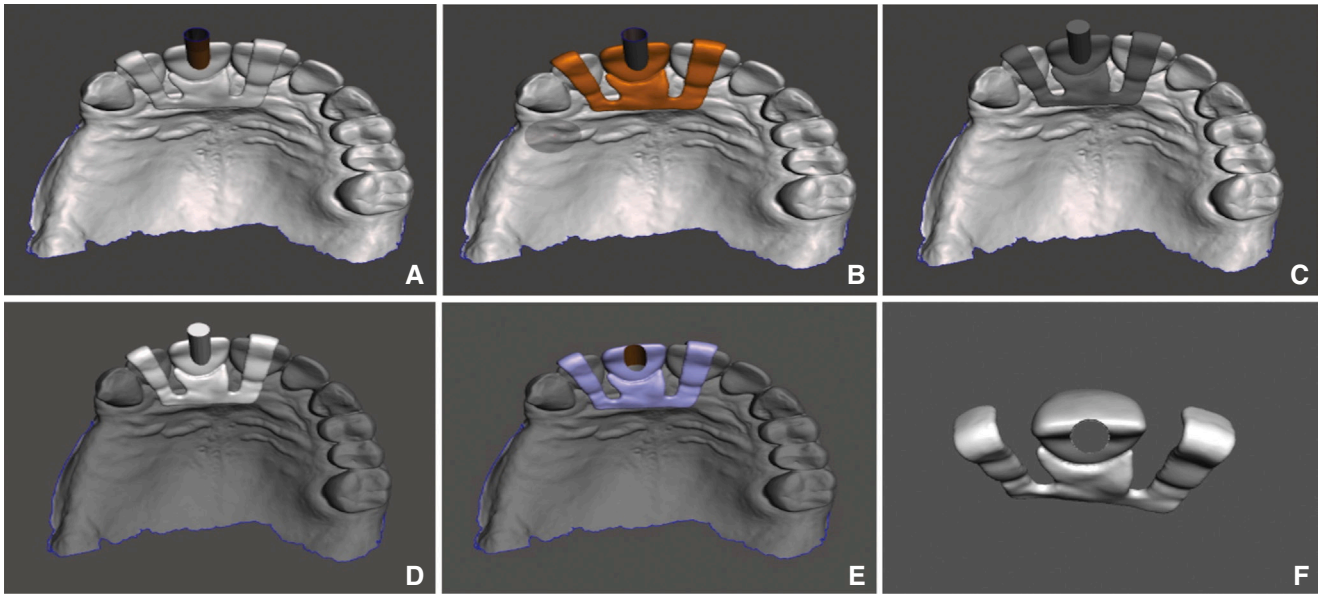

Figure 5. A mesh-editing and 3D printing software program (Autodesk Meshmixer; Autodesk Inc) used to create screw-access channel in designed restoration (occlusal views). A, Tube selection and separation from virtual cast. B, Interim restoration with positioning device selection and separation from virtual cast. C, Both separated objects converted into solid models. D, E, Subtraction of tube from restoration to create screw-access channel. F, Completed interim restoration with planned screw-access channel. 3D, 3-dimensional.

12. Evaluate the peri-implant soft tissue at a 1-month recall visit to confirm the proper emergence profile (Fig. 6I).

DISCUSSION

In previously published digital workflows, the immediate implant interim crown was often fabricated as a thin-walled hollow restoration without a prefabricated screw-access channel.[11–13] At the time of surgery, the thin-walled hollow crown required intraoral relining with composite resin to connect it to an interim abutment.[11–13] Although effective, this approach necessitated a considerable volume of composite resin, increased chairside time, and risked compromising the structural integrity of the layered restoration. The relining procedure also introduced a risk of contaminating the surgical site and altering the color match of the thin-walled hollow crown to adjacent teeth.

In contrast with those of previous publications, the present technique uses a milled monolithic immediate implant interim crown with a prefabricated positioning device and incorporated screw-access channel; this requires less adjustment to accommodate the implant interim abutment, thereby reducing the potential for contamination of the surgical site. Because the interim restoration is fabricated as a monolithic restoration rather than a thin-walled hollow crown, it reduces chair time and the volume of resin material required when creating the desired emergence profile. The prefabricated screw-access channel, based on implant planning, also streamlines chairside procedures by minimizing crown modifications. The addition of a digitally designed positioning device ensures accurate and

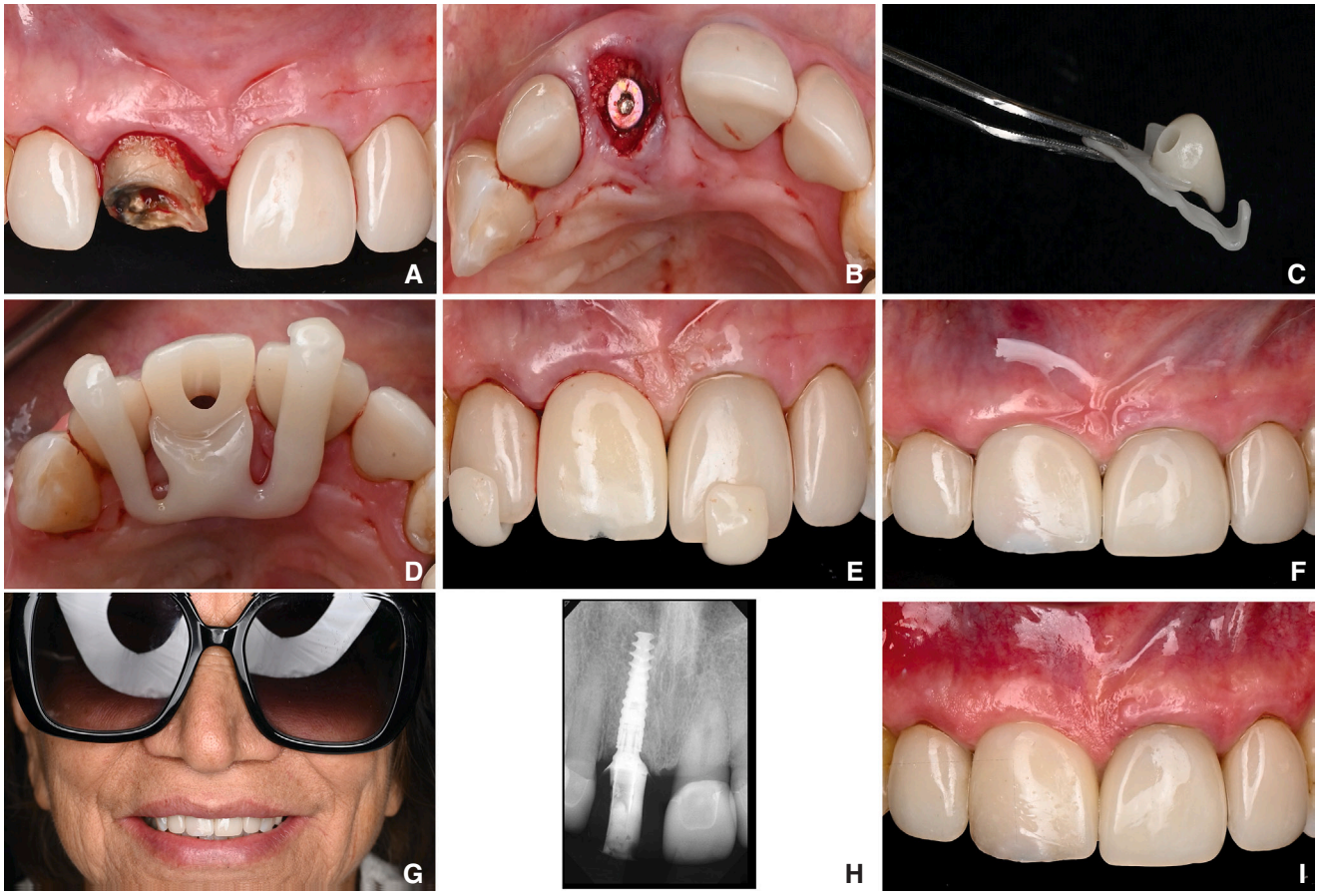

Figure 6. Clinical procedures. A, Extraction of remaining root of maxillary right central incisor. B, Implant placement and bone grafting of gap. C-E, Design and seating of milled immediate interim restoration. F, Frontal view of immediate implant-supported fixed screw-retained interim restoration in place. G, Extraoral view of patient's smile after placement of restoration. H, Periapical radiograph showing placed implant with seated restoration. I, Frontal view of seated interim restoration in 1-month recall visit.

passive seating relative to the adjacent teeth, facilitating the transfer of the digital plan to the clinical situation.

Limitations of this technique include its dependence on accurate digital planning and the precision of the implant placement relative to the prosthetically driven plan. Any discrepancies in digital alignment or surgical execution may compromise the fit of the prefabricated immediate implant interim restoration. Additionally, access to the CAD software program, 3D printing, or milling equipment may not be available in all clinical settings.

SUMMARY

This technique article describes an alternative digital workflow for fabricating an immediate monolithic implant-supported interim crown with an incorporated screw-access channel and a positioning device. Unlike conventional or thin-walled hollow crown digital methods, this milled interim crown minimizes the amount of required relining material used to finalize the restoration and decreases chair time by eliminating the need to form a screw-access channel.

REFERENCES

1. Kan JYK, Rungcharassaeng K, Lozada JL, Zimmerman G. Facial gingival tissue stability following immediate placement and provisionalization of maxillary anterior single implants: A 2- to 8-year follow-up. *Int J Oral Maxillofac Implants*. 2011;26:179–187.
2. De Rouck T, Collys K, Cosyn J. Single-tooth replacement in the anterior maxilla by means of immediate implantation and provisionalization: A review. *Int J Oral Maxillofac Implants*. 2008;23:897–904.
3. Rungcharassaeng K, Kan JYK, Yoshino S, et al. Immediate implant placement and provisionalization with and without a connective tissue graft: an esthetic evaluation. *J Esthet Restor Dent*. 2012;24:385–394.
4. Block MS, Mercante DE, Lirette D, et al. Prospective evaluation of immediate and delayed provisional single-tooth restorations. *J Oral Maxillofac Surg*. 2009;67:89–107.
5. Grunder U. Stability of the mucosal topography around single-tooth implants and adjacent teeth: 1-year results. *Int J Periodontics Restorative Dent*. 2000;20:11–17.
6. Lindeboom JA, Frenken JW, Dubois L, et al. Im- mediate loading versus immediate provisionalization of maxillary single- tooth replacements: A prospective randomized study with BioComp implants. *J Oral Maxillofac Surg*. 2006;64:936–942.
7. Cooper LF, Raes F, Reside GJ, et al. Comparison of radiographic and clinical outcomes following immediate provisionalization of single-tooth dental implants placed in healed alveolar ridges and extraction sockets. *Int J Oral Maxillofac Implants*. 2010;25:1222–1232.
8. Testori T, Galli F, Capelli M, et al. Immediate nonocclusal versus early loading of dental implants in partially edentulous patients: 1- year results from a multicenter, randomized controlled clinical trial. *Int J Oral Maxillofac Implants*. 2007;22:815–822.

9. Schincaglia GP, Marzola R, Giovanni GF, et al. Replacement of mandibular molars with single-unit restorations supported by wide-body implants: immediate versus delayed loading. A randomized controlled study. *Int J Oral Maxillofac Implants*. 2008;23:474–480.
10. Stapleton BM, Lin WS, Ntounis A, et al. Application of digital diagnostic impression, virtual planning, and computer-guided implant surgery for a CAD/CAM-fabricated, implant-supported fixed dental pros- thesis: A clinical report. *J Prosthet Dent*. 2014;112: 402–408.
11. Oh KC, Jeon C, Park JM, Shim JS. Digital workflow to provide an immediate interim restoration after single-implant placement by using a surgical guide and a matrix-positioning device. *J Prosthet Dent*. 2019;121:17–21.
12. Donker VJ, Raghoebar GM, Vissink A, Meijer HJA. Digital workflow for immediate implant placement and chairside provisionalization in the esthetic zone. *Case Rep Dent*. 2022;2022:5114332.
13. Garcia-Torres F, Jurado CA, Rojas-Rueda S, et al. Immediate implant therapy with full-digital workflow to replace a central incisor. *Dent J ((Basel))*. 2025;13:73.
14. Su H, Gonzalez-Martin O, Weisgold A, Lee E. Considerations of implant abutment and crown contour: Critical contour and subcritical contour. *Int J Periodontics Restorative Dent*. 2010;30:335–343.
15. Gomez-Meda R, Esquivel J, Blatz MB. The esthetic biological contour concept for implant restoration emergence profile design. *J Esthet Restor Dent*. 2021;33:173–184.

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