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DENTAL TECHNIQUE

Use of a dual-purpose implant scan body to obtain both digital and analog records for complete arch fixed implant restorations

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ABSTRACT

A technique is described for capturing relative dental implant positions for an implant-supported fixed prosthesis in a completely edentulous arch with a novel implant indexing apparatus that also functions as a scannable verification device. A series of intraoral scans are made to record the contours and occlusal records of the existing prosthetics and soft tissue. The individual scans are aligned by using a dental software program to design either an interim or definitive prosthesis. The technique reduces the time needed to gather the records dental laboratory technicians require to fabricate a complete arch implant-supported prosthesis. (J Prosthet Dent 2025;133:36-42)

Intraoral scanners (IOSs) have become popular for making rapid and accurate records, but accurately capturing the relative positions of multiple implants in a completely edentulous arch is challenging.[1–4] Patients with severe mandibular resorption, excessive soft or unattached tissue,[5] high salivary flow, the presence of blood after surgery, and limited opening are difficult to scan accurately.[1,2] Scanning systems and techniques have been developed to improve accuracy, including the use of custom devicess[6–13] and prefabricated components.[14–21] Scan bodies combined with interim or immediate prostheses have been used to obtain accurate implant positions and alignments by using an IOS extraorally.[19,20] Laboratory studies have reported that custom devices have led to improved scanning accuracy with the use of additional geometries to assist scanning.[7–9,14] Photogrammetry employs a technique that uses an additional scanner in concert with an IOS to obtain both implant and soft tissue records,[22] eliminating reliance on the IOS for implant position accuracy by capturing the implant positions simultaneously with special scan bodies.[22,23] Photogrammetry does not allow the fabrication of a physical cast for many prostheses, a problem in situations when a physical cast would be beneficial, such as for cementing Ti-bases[24] or to evaluate prosthesis passivity before the patient's appointment.[25–27]

Impression verification has been a common technique to ensure accurate records and minimize the misfit of complete arch prostheses.[28] This article describes a technique using a dual-purpose dental implant indexing device (OptiSplint; Digital Arches LLC) that doubles as both abutment-level scan bodies for fixed complete arch prostheses and as a physical device that can be scanned or used to create a verified stone cast.

TECHNIQUE

1. Scan the existing abutment level complete arch fixed interim prosthesis using an IOS (Primescan; Dentsply Sirona) to create a Pre-Op Scan. Additionally, scan the opposing arch and interocclusal relationship (Fig. 1A).

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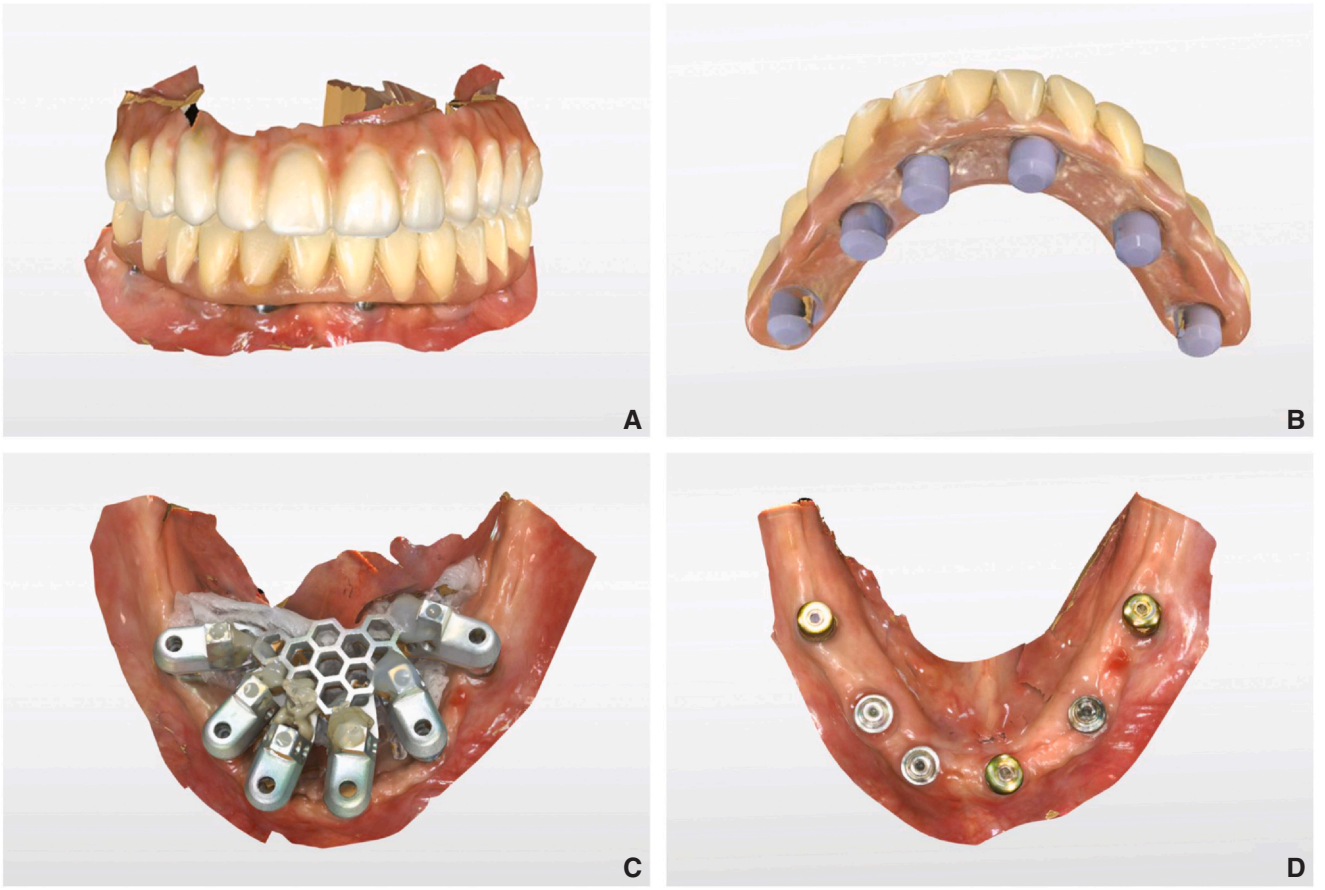

Figure 1. Intraoral scans. A, Mandibular preoperative scan, maxillary opposing scan, and interocclusal registration scan. B, Biocopy scan with alignment markers (Analog ScanCaps; Digital Arches LLC) in place. C, IO OptiSplint Scan. D, IO Tissue Scan.

2. Remove the interim prosthesis. Snap alignment markers (Analog ScanCap; Digital Arches LLC) into the connections on the interim prosthesis and visually confirm that the markers are fully seated with no visible gap between the interface of the markers and the prosthetic connections. Scan the entirety of the interim prosthesis and the attached alignment markers (Analog ScanCaps; Digital Arches LLC) to create a Biocopy Scan (Fig. 1B).
3. Seat OptiSplint scan bodies (OptiSplint Scan Body; Digital Arches LLC) onto the abutments (MIS; Dentsply Sirona). Hand-tighten each scan body into place. Evaluate the metal frame (OptiSplint Frame; Digital Arches LLC) and adjust it, if necessary, with a high-speed handpiece (MASTERmatic Lux M25 High-Speed; Kavo Kerr) or with cutters (Cutting Tool; Digital Arches LLC). Confirm that the frame is within 1 to 2 mm of either the vertical or horizontal wing components of the scan bodies to reduce the effect of polymerization shrinkage. Connect the frame to the scan bodies with flowable composite resin (Aelite Flo; Bisco Inc), dual-polymerizing resin (Stellar DC Resin, White; Taub Products), or autopolymerizing resin (Pattern Resin LS; GC America). Use gauze if needed to prevent saliva from pooling on the scan bodies while applying the resin. Light polymerize the resin as needed.
4. Scan the assembled OptiSplint device and crestal soft tissue with an IOS (Primescan; Dentsply Sirona) to create an IO OptiSplint Scan (Fig. 1C). Scan (Primescan; Dentsply Sirona) the soft tissue with abutment healing caps in place to create an IO Tissue Scan (Fig. 1D).
5. Unscrew the scan bodies and retrieve the assembled device (OptiSplint; Digital Arches LLC). Confirm that it is assembled rigidly. Reseat the interim prosthesis.
6. If Ti-bases will be used in the fabrication of the prosthesis, connect the implant abutment analogs to the OptiSplint device and pour a stone patty cast with Type IV resinous die stone (Ivory Resin XH; ETI Empire Direct) according to the manufacturer's instructions (Fig. 2).
7. After the stone has set, remove the device (OptiSplint; Digital Arches LLC), place alignment markers (Analog ScanCaps; Digital Arches LLC)

Figure 2. OptiSplint stone patty cast.

Figure 3. Assembled OptiSplint device with alignment markers seated.

into the connections of the scan bodies (Fig. 3), and scan with a desktop scanner (Freedom HD; DOF). This scan, the Optisplint Desktop Scan, will serve as the primary scan body scan.

8. Align the scans.
   a. Align the Biocopy Scan to the Preop Scan of the existing interim prosthesis using the prosthesis as common data for the "best fit matching" operation (DentalCAD 3.0 Galway; exocad GmbH) (Fig. 4).
   b. Align the OptiSplint Desktop Scan (the primary scan body scan) to the Biocopy Scan using the alignment markers (Analog ScanCaps; Digital Arches LLC) on both scans as common data for the "best fit matching" procedure (DentalCAD 3.0 Galway; exocad GmbH) (Fig. 5).
   c. Align the IO OptiSplint Scan to the aligned assembly above by using the Optisplint device as common data (DentalCAD 3.0 Galway; exocad GmbH) (Fig. 6).
   d. Finally, align the IO Tissue Scan to the IO OptiSplint Scan using the inter-implant soft tissue as common data (DentalCAD 3.0 Galway; exocad GmbH) (Fig. 7).
9. With the required scans aligned (Fig. 8), design the prosthesis by following the software program's wizard (DentalCAD 3.0 Galway; exocad GmbH).
10. Print (Envision One RP; Desktop Health), (Flexcera Smile Ultra +; Desktop Health), wash, polymerize, (Otoflash; Desktop Health), characterize (anaxgum; anax dent GmbH), stain, and glaze (Optiglaze Color; GC Corp) the prosthesis.

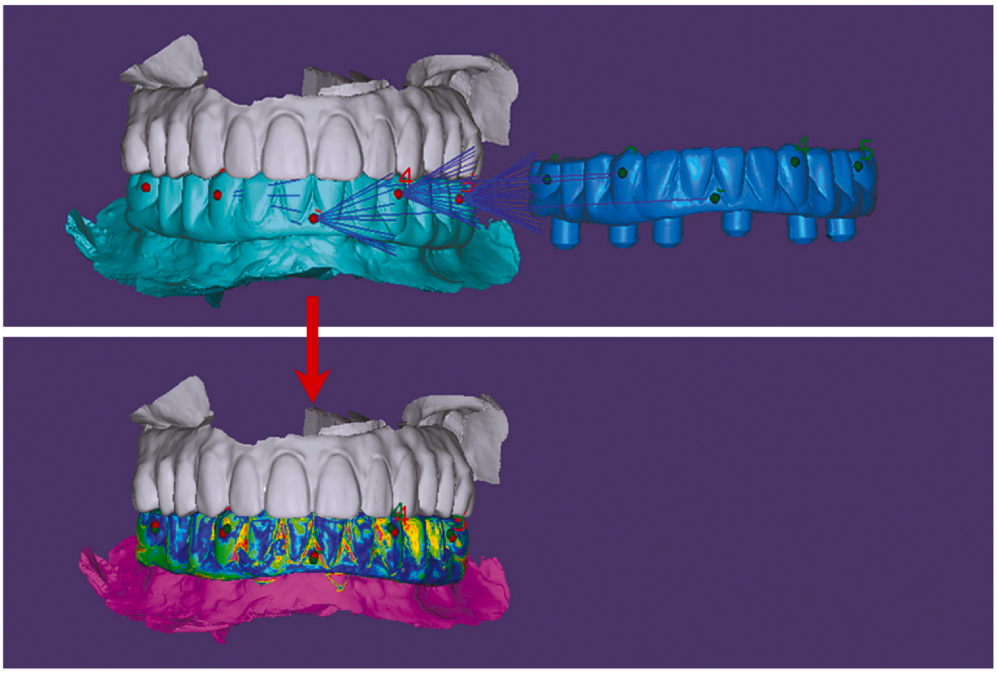

Figure 4. Point alignment of Biocopy Scan to Pre-Op Scan followed by "best fit matching" operation using teeth as common data.

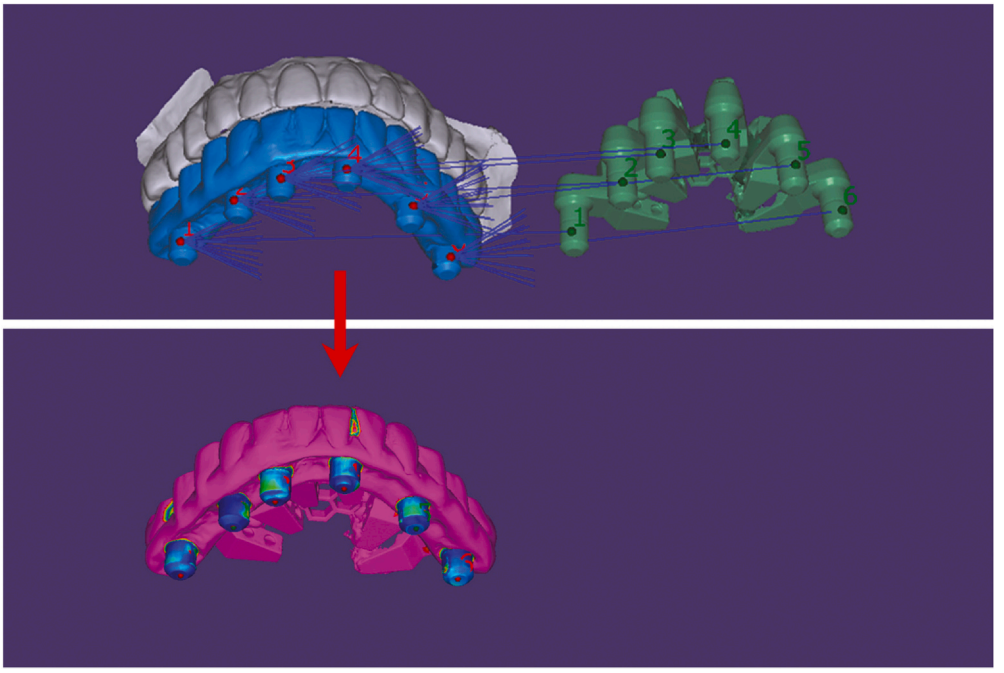

Figure 5. Point alignment of OptiSplint Desktop Scan to Biocopy Scan followed by "best fit matching" operation using alignment markers as common data.

11. Cement Ti-bases (Mist IC; Imagine) to the new prosthesis on the stone cast by using metal primer (Monobond Plus; Ivoclar AG), composite resin primer (SR Connect; Ivoclar AG), and luting cement (Multilink Hybrid Abutment; Ivoclar AG) according to the manufacturer's instructions.
12. Complete polymerization submerged in glycerin to overcome the oxygen inhibition layer.

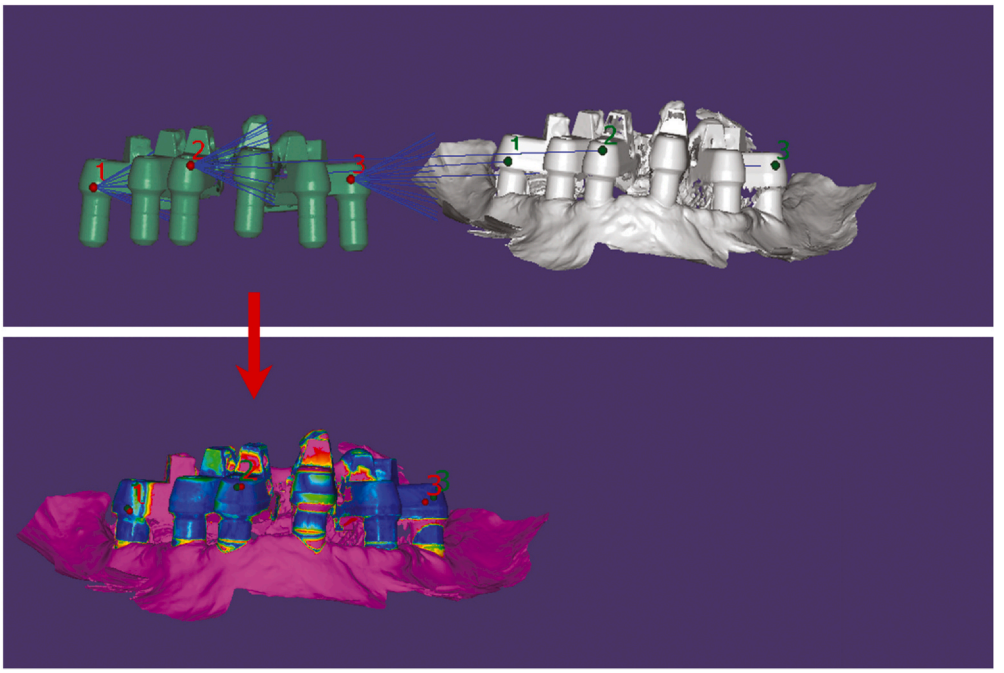

Figure 6. Point alignment of IO OptiSplint Scan to Desktop OptiSplint Scan followed by "best fit matching" operation using scan bodies as common data.

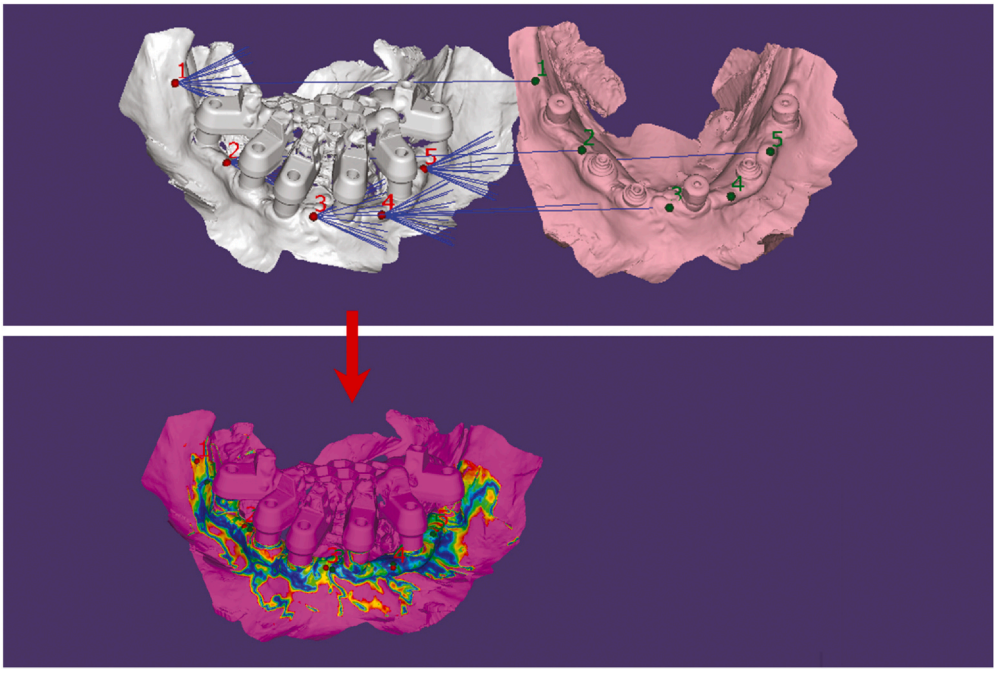

Figure 7. Point alignment of IO Tissue Scan to IO OptiSplint Scan followed by "best fit matching" operation using soft tissue as common data.

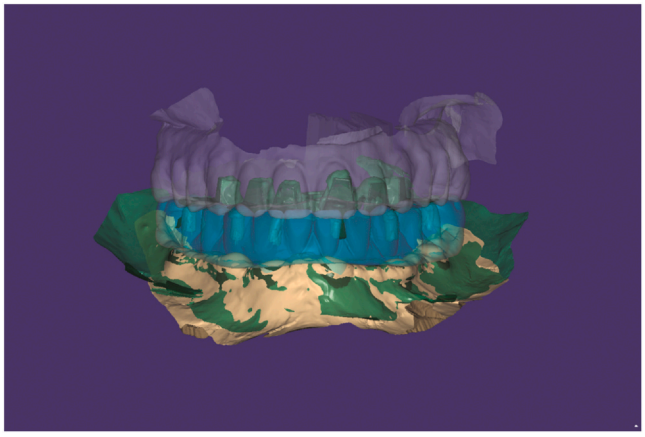

Figure 8. All required scans aligned for computer-aided design of definitive prosthetics.

Figure 9. Mandibular interim prosthesis seated in occlusion.

13. Verify passivity on the cast and seat the prosthesis (Fig. 9).
14. Confirm passivity in the patient's mouth using a 1-screw, or Sheffield, test[29,30] and radiographic examination (Fig. 10).

DISCUSSION

The key to successful scan alignment is to have clear areas of common data between the scans. Ridges that are severely resorbed with little surface area or bone-supported keratinized tissue but with unsupported mobile tissue can be difficult to scan accurately.[31] For patients that lack significant attached keratinized tissue offering the irregular topography conducive to "best fit matching" operations, tissue scan alignment markers (Multiunit ScanCaps; Digital Arches LLC) can be seated on the multi-unit abutments intraorally and captured with the IO Tissue Scan. The tissue alignment markers align directly to the OptiSplint device, which provides common data to align the IO Tissue Scan to the OptiSplint Desktop Scan. Another option would be to use the actual IO OptiSplint Scan for the IO Tissue Scan by simply using the scan data editor in the software program to delete the OptiSplint device from the IO OptiSplint Scan leaving only the gingiva for use in place of a separate IO

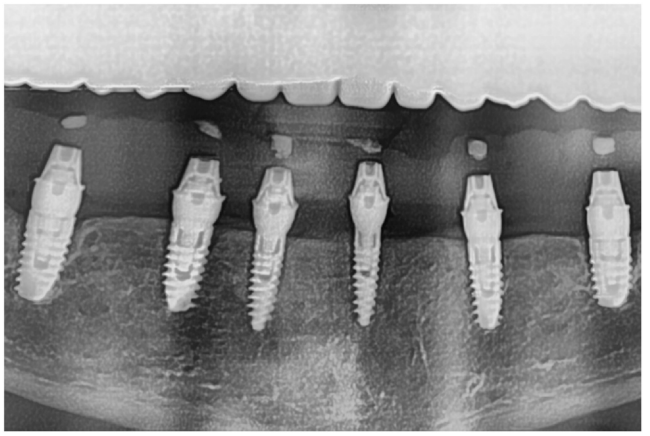

Figure 10. Panoramic radiograph.

Tissue Scan. One possible downside to this would be that the gingiva scan data directly lingual to the implant sites would not be present. Additionally, implant prosthetic connection geometries can be used for alignment[32] instead of the alignment markers described, and other ways to align scans are available. The steps used in the care of this patient were selected based on the specific patient and clinical conditions.

For prosthesis designs that require Ti-bases, questions may arise as to the accuracy of occlusion during the Ti-base cementation process, since the design of the prosthesis was done digitally. If the occlusion is in doubt, the authors recommend a clinical remount using a printed or milled prototype against an opposing printed or stone cast. The remount allows the clinician to confirm and adjust occlusion while ensuring the minimization of the Ti-base misfit on the cast before finalizing the prosthesis.

The use of scan bodies that double as a rigid device eliminates the need to fully rely on an IOS in both surgical and nonsurgical conditions for relative implant position accuracy while also allowing the clinician to use a near fully digital workflow chairside. The records are then digitized with a desktop scanner while still allowing for a cast-free laboratory workflow. Research is needed to verify the accuracy of the technique.

SUMMARY

Capturing relative dental implant positions for an implant-supported fixed prosthesis in a completely edentulous arch is described using a novel dual-purpose dental implant indexing device. The device doubles as abutment-level scan bodies and as a physical device that can be scanned or used to create a verified stone cast. The method may provide improved chairside efficiency, eliminate the need for extra verification and wax rim appointments, and reduce costs compared with other methods of record making. By using this technique, the clinician and dental laboratory can leverage the advantages of both digital and conventional workflows.

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