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Digital Workflow for Double Full-Arch Implant Rehabilitation with a novel Scan Body

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Introduction

The incorporation of digital technology in restorative dentistry has presented itself with great advantages and certain challenges. The accuracy of complete-arch digital implant impressions has been well documented in dental literature, and promising results have been reported based primarily on in vitro data. During fixed implant rehabilitation and prior to fabrication of prosthesis prototype, complete-arch impressions with the double digital scanning (DDS) technique are necessary; namely, a first intraoral scan of the three-dimensional (3-D) implant positions and a second intraoral scan of the contours of the interim prosthesis. However, the superimposition of multiple intraoral Standard Tesselation Language (STL) files has been identified as a major challenge. This has been attributed to the absence of stable intraoral landmarks. Certain techniques have been described in an effort to overcome this obstacle, namely the use of self-adhesive fiducial markers or surgical anchorage pins. All of these techniques present with their own limitations.

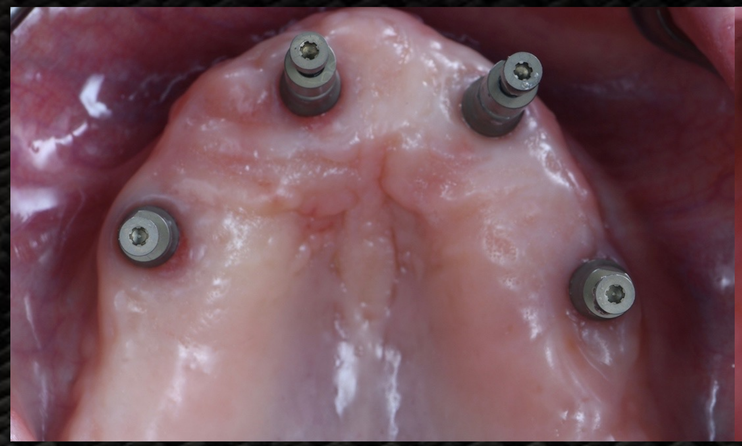
Purpose

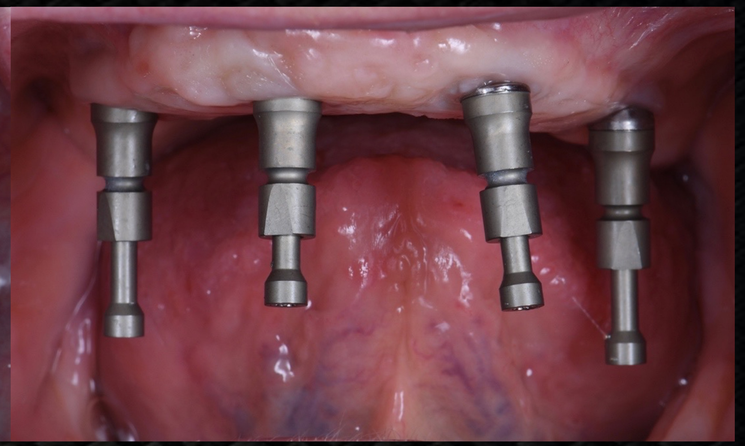
The purpose of this clinical report is to present a complete digital workflow for fabrication of zirconia implant supported complete-arch definitive restorations.

Case Report

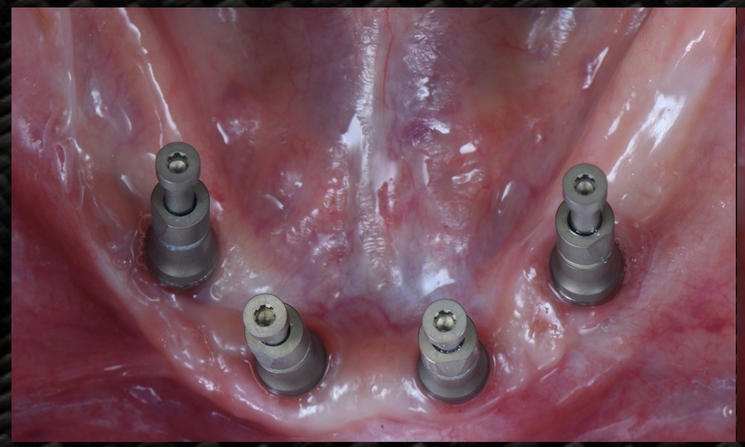
A 79-year-old female patient presented for fabrication of complete-arch zirconia definitive prostheses.

Patient had previously received 4 implants (Helix GM, Neodent, Curitiba, Brazil) in each edentulous arch. At the time of implant placement, multi-unit abutments (GM mini conical, Neodent, Curitiba, Brazil) were torqued in each implant to the manufacturer's recommended values. Immediately loaded acrylic interim prostheses were delivered the same day of the implant surgery.

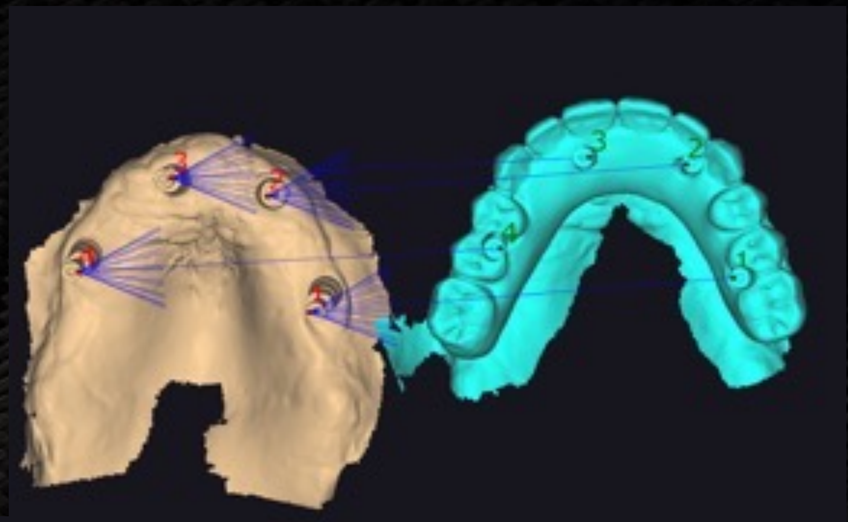




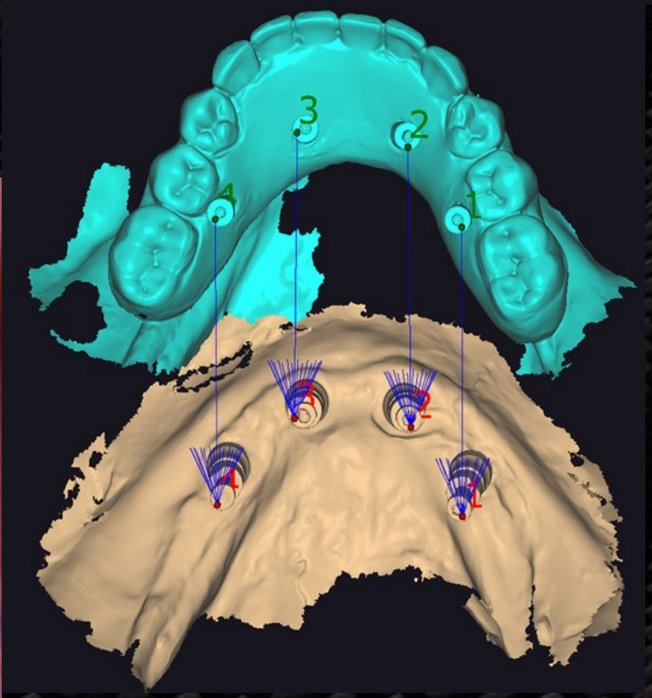
Interim prostheses were initially removed, and implant osseointegration along with tthe health of peri-implant soft tissues was confirmed. Then modified double digital scanning (DDS) technique was used to acquire the digital data for the fabrication of complete arch zirconia prostheses. Then, novel scan bodies with long scannable impression pins, were hand tightened on multi-unit abutments.



An intraoral scanner (IOS) (TRIOS® 4, 3Shape A/S, Copenhagen, Denmark) was used for complete-arch abutment level digital impression for each arch. The interim prostheses were then reinserted intraorally, stabilized with the same scannable impression pins and a second intraoral digital impression was done.



The impression pins were then removed and replaced by the regular prosthetic screws to scan the maxillomandibular relationship with the interim prostheses. One additional digital impression was done extra orally to capture the intaglio surface of the existing interim protheses (this scan may be optional).



The STL files of the abutments, the interim prostheses, the intaglio surface and their interocclusal relationship were imported in CAD software (Exocad DentalCAD, exocad GmbH, Darm-stadt, Germany). The files were superimposed using the head of the scannable impression pins serving as a reference and stable landmark.

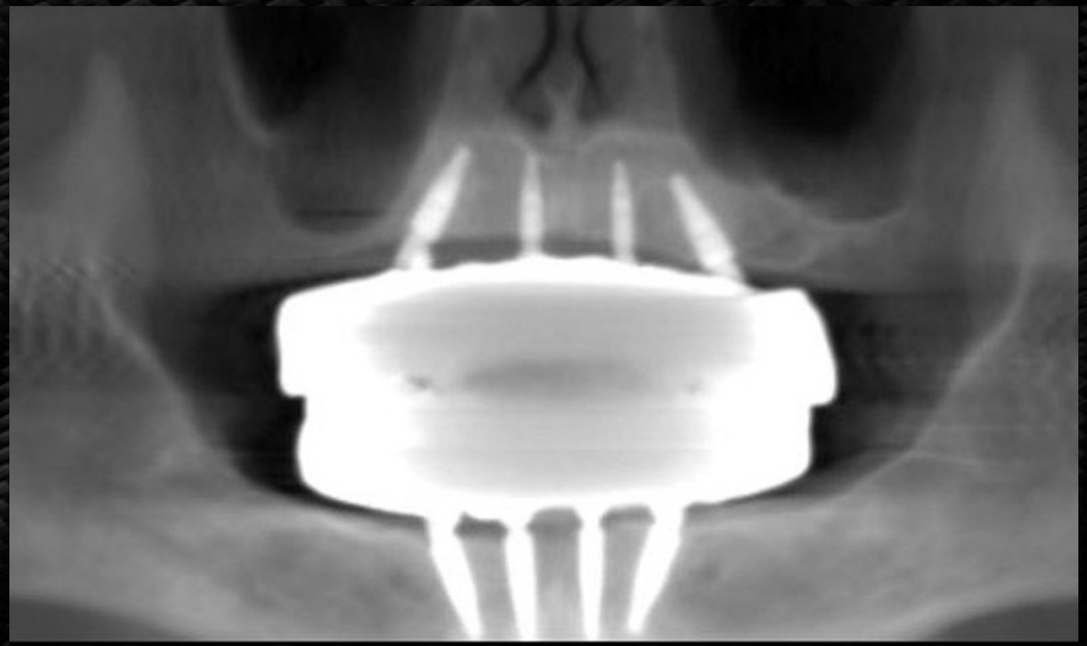
During the delivery appointment, the zirconia prostheses were tried in patient's mouth. Accuracy of fit was evaluated with one screw test and periapical radiographs. Patient's approval was obtained, and prostheses were delivered. Hygiene and maintenance protocol were discussed with the patient.

Prototype prostheses were subsequently milled in poly-methyl methacrylate (PMMA) based on the interim prostheses using computer aided manufacturing (CAM) software for evaluation in patient's mouth. At the next clinical visit, the fit, occlusion and esthetics of these prototypes were confirmed intraorally.

Then, definitive prostheses were CAM milled out of the master STL file using Zirconia Discs (XTCERA, Zubler, USA). The milled prostheses were sintered, and the gingival area was layered with feldspathic porcelain DC Ceram 9.2 (Ceramay GmbH & Co, Neu-ULM, Germany). Prior to the delivery appointment, titanium inserts (neo mini conical titanium abutments, Neodent, Curitiba, Brazil) were cemented in the intaglio of the zirconia prostheses with resin cement (Fusion ZR, TaubProducts, New Jersey, USA).

This technique allows for a prosthesis prototype that can be used by the clinician as a verification jig and can also be used by the patient to evaluate esthetics, phonetics, and approve the function before CAM milling the final zirconia prosthesis In cases where the intaglio surface does not adapt well to the tissue or the esthetic or occlusal modifications needed are minor, they can be addressed chairside directly on the prototype. The modified prototype can then be rescanned as a reference for fabrication of the definitive zirconia prosthesis, eliminating the need for a new prototype. Utilizing the current technique, the clinician has also the option to proceed with fabrication of the zirconia prosthesis without the intermediate step of the prosthesis prototype.

The limitations associated with the present technique apply similarly to all prostheses that are fabricated through complete digital workflow. It requires an initial investment for the digital equipment and there is additional cost associated with maintenance and software upgrades. Potential factors that could affect the quality of the intraoral scans could be the inter-implant distance, the length of the scanning paths, the height of the interim prostheses and the degree of divergence between implants. These factors could play a role in the accuracy of the STL superimpositions. None of these factors described above affected the clinical outcome in this clinical case.



Conclusions

The presented technique protocol with the novel scan body overcomes the limitation of attaching fiducial markers on soft tissues during the double digital scanning (DDS) technique and utilizes screwed scanning pins as stable landmarks for the STL files superimposition. This technique can be used in both maxillary and mandibular arches with success irrespective of timing of implant placement.

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