# A Novel Digital Approach Using Extended Design Scan Bodies for Intraoral Scanning and Fabrication of Full-Arch Implant-Supported Restorations: A Proof-of-Concept Case Report and Technical Notes

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***Purpose:*** To address the challenges of obtaining accurate digital impressions for the fabrication of fixed restorations on multiple implants in full-arch edentulous cases. ***Materials and Methods:*** An approach to the use of extended design scan bodies (EDSBs) and advanced digital technologies in full-arch implant rehabilitation is presented. Clinical and laboratory treatment sequences are illustrated, focusing on intraoral scanning, restorative materials, and digital fabrication techniques. ***Results:*** EDSBs provide accurate digital impression results, maintaining precision over longer distances and proving effective for both fixed and removable implant restorations. ***Conclusions:*** Using EDSBs with L-shaped and T-shaped extensions creates a stable reference framework during scanning, overcoming the lack of reliable landmarks on edentulous mucosa and enhancing digital impression accuracy and clinical outcomes. *Int J Prosthodont 2026;39:105–119. doi 10.11607/ijp.9279*

Digital impressions are becoming increasingly popular due to their potential for enhancing accuracy, efficiency, and patient comfort compared to conventional impression techniques.[1,2] Unlike traditional methods that involve silicone or polyether materials, digital workflows eliminate several steps such as tray selection, dispensing and setting of impression materials, disinfection, and stone cast production. Intraoral scanning has been recommended for single-unit or short-span implant rehabilitations and have demonstrated sufficient precision.[3] The position of intraoral scan bodies (ISBs) can be captured using a scanning device and transferred to a virtual implant position within the dental arch. However, several factors have been reported to adversely impact the precision of intraoral implant scans. These factors include ambient lighting, the scanning pattern, and the design of the ISBs, such as their material, geometry, and retention features.[4–6] Although the ideal ISB design for optimizing IOS accuracy remains uncertain, it has been observed that polymer ISBs may

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suffer degradation with repeated usage and sterilization procedures.[7] Additionally, patient-related factors also affect scan precision. These include the specific arch being scanned (maxillary vs mandibular), the position of the implant within the arch, interimplant distance, implant depth, and angulation.[8,9]

The widespread use of digital impressions for full-arch implant rehabilitation remains controversial due to concerns about accuracy, particularly in achieving high trueness and precision over large spans with multiple implants.[9–11] Challenges such as the lack of stable morphologic landmarks on the edentulous mucosa, image stitching errors, and difficulties capturing clear images of scan bodies and surrounding tissues often compromise the accuracy of conventional intraoral scanners. As the interimplant distance increases, deviations may lead to misfits in the final prosthetic framework. To address these issues, various devices have been advocated for the creation of a physical splint or to expand the scannable surface area through optical splinting.[12–17] These scan aids aim to improve the trueness of complete-arch digital implant scans by enhancing the morphologic landmarks during the stitching process. However, their use often requires additional clinical steps or custom fabrication, increasing time and complexity.

To overcome these limitations, newly designed "ready to use" scan bodies have been introduced. These scan bodies incorporate rigid extensions that effectively minimize the distances between the scan bodies, sometimes overlapping the spaces between them and virtually bridging them. This approach can potentially mitigate common issues without the need for custom fabrication of scan aids or extra clinical procedures. It has been shown that the maximum 3D deviation that will still allow for a clinically acceptable fit of a restoration is 59 μm, while the minimum deviation that will result in a clinical misfit is 72 μm.[18] A recent in vitro study using modified scan bodies with wing-like extensions observed a maximum 3D deviation of 37.5 μm for edentulous arches with large interimplant distances, indicating that extended scan bodies meet the acceptable standards of accuracy required for clinical use.[19] Huang et al[20,21] conducted laboratory studies and evaluations in beagle dogs to assess the efficacy of single-arm titanium alloy scan bodies. Their findings suggest that scan bodies with extensional structures significantly improve the trueness and precision of digital impressions compared to conventional scan bodies.

Recently, a novel type of scan body (Smart Flags, Apollo) has been commercially released. Supplied in a set, each is individual and distinctive in design and marking. Made from a combination of titanium alloy and polyetheretherketone (PEEK), they feature extensional structures in an L-shape and T-shape. These innovative scan flags are designed for digital splinting and are intended to provide a passive fit for full-arch implant-supported prosthetic restorations. However, further quantitative and qualitative data are needed to substantiate these claims.

The objective of this article is to propose a protocol for the use of advanced digital technologies and extended design scan bodies (EDSBs) in full-arch implant rehabilitation. It includes a comprehensive review of the benefits and practical considerations, illustrated through three clinical case reports. These cases will demonstrate the complete workflow for four to six implants in the edentulous arch, from digital impression taking to the placement of a final screw-retained full-arch bridge, bar-supported removable restoration, and a case for immediate implant function. Each case will address various aspects, including different implant loading protocols, restorative materials (eg, acrylic, titanium, zirconia), and technical considerations related to fabrication within a digital workflow.

## CASE REPORT 1: ONE-PIECE SCREW-RETAINED FULL-CONTOUR MAXILLARY ZIRCONIA STRUCTURE ON MULTIUNIT ABUTMENTS WITH MULTI-TITANIUM BASES

### Patient and Initial Surgical Records

After the extraction of the last remaining right first molar, a 65-year-old female patient was fitted with a modified maxillary complete denture, based on her previous partial prosthesis. Four titanium implants (Camlog Screw Line) were placed in the regions designated by the Fédération Dentaire Internationale (FDI) as tooth 14, 12, 23, and 25, with diameters of 3.8 and 4.3 mm and lengths ranging from 9 to 11 mm. Following a 4-month healing period for osseointegration, the implants were uncovered during stage-two surgery, and healing abutments (Gingiva former, wide body, GH 2 mm, Camlog) were installed. The treatment protocol and workflow are outlined in Fig 1.

### Prosthetic Phase I—Intraoral Scanning Process

At 2 weeks after soft tissue healing, an intraoral scan (IOS) of the edentulous maxilla's morphologic profile was obtained with healing abutments in place (TRIOS 5, 3Shape). The base of the converted provisional full denture was relined intraorally with addition-curing silicone (Aquasil Ultra, Dentsply Sirona) to capture the mucosal profile, including the palatal rugae. A second extraoral IOS was used to digitally image the denture base. After removing the healing abutments, four straight multiunit bar attachments with 2-mm gingival height and a uniform prosthetic platform were screwed onto the implants (both Camlog; Fig 2). EDSBs with L- and T-shaped extensions (SmartFlag scanbodies, Apollo) were selected to minimize spaces between the implants and mounted

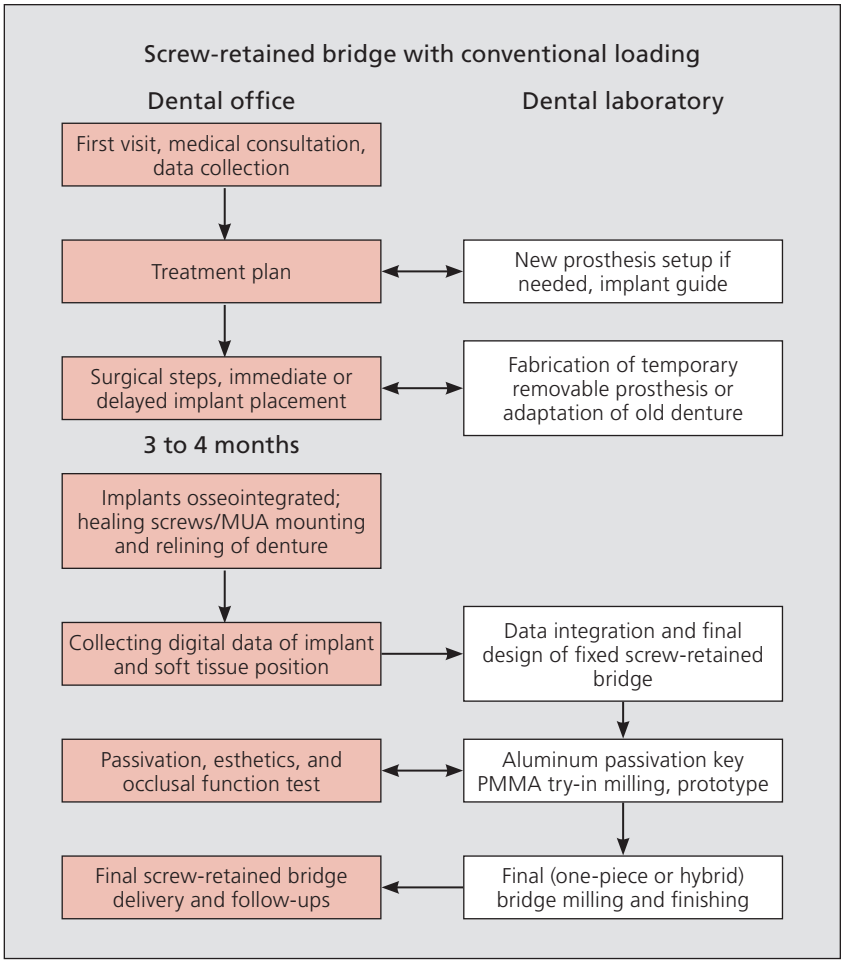


**Fig 1** Clinical and laboratory workflow for a screw-retained maxillary zirconia bridge.

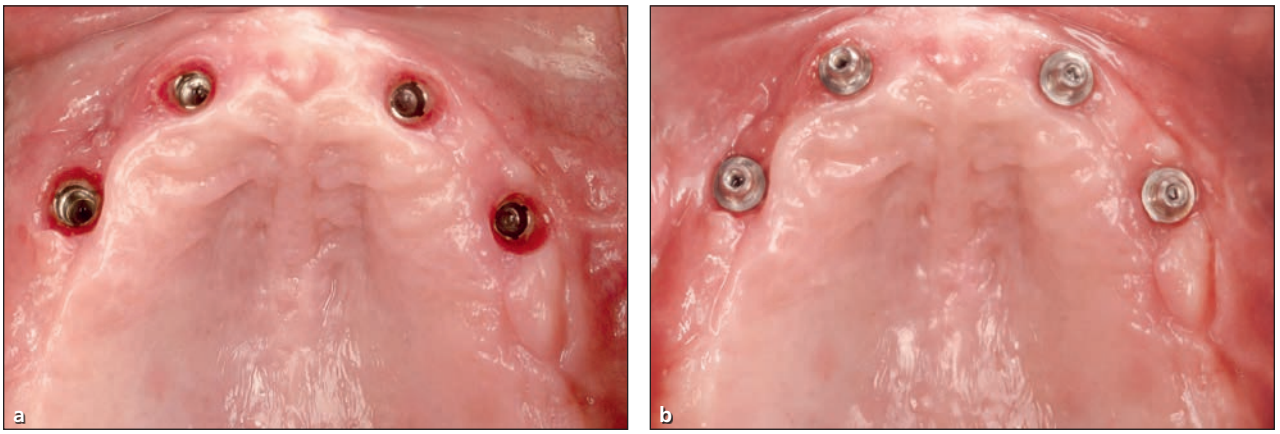


**Fig 2** *(a)* Occlusal view of four maxillary osseointegrated implants after removing the healing abutments. *(b)* Occlusal view of straight multi-unit bar attachments with uniform prosthetic platforms screwed onto the implants.

to the bar attachments (Fig 3). An intraoral scan with the EDSBs captured the positions of the implants (TRIOS 5), followed by a scan of the opposing mandibular arch and occlusal relationship with the temporary full denture in place. All IOS records were saved separately and sent to the laboratory via an internal digital cloud.

### Laboratory and Technical Phase I—IOS Evaluation, Digital Matching, Master Cast Printing, and Prototype Fabrication

After downloading and integrating the design library containing the virtual design of the EDSBs and related components (Apollo) into a CAD laboratory software

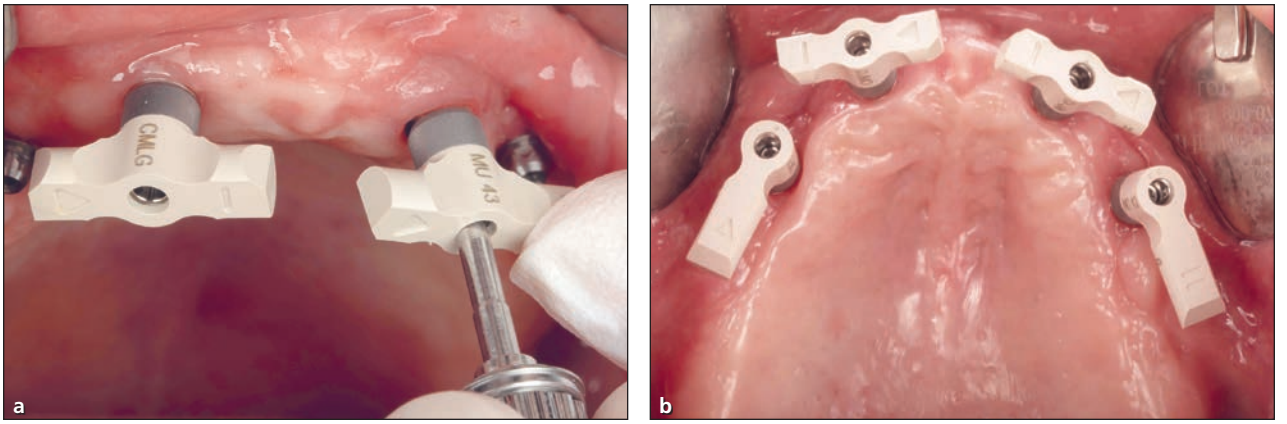


**Fig 3** *(a)* Frontal view of intraoral screwing EDSBs with T-shaped extensions onto bar attachments. *(b)* Occlusal view of EDSBs with L- and T-shaped extensions in place prior to intraoral scanning.

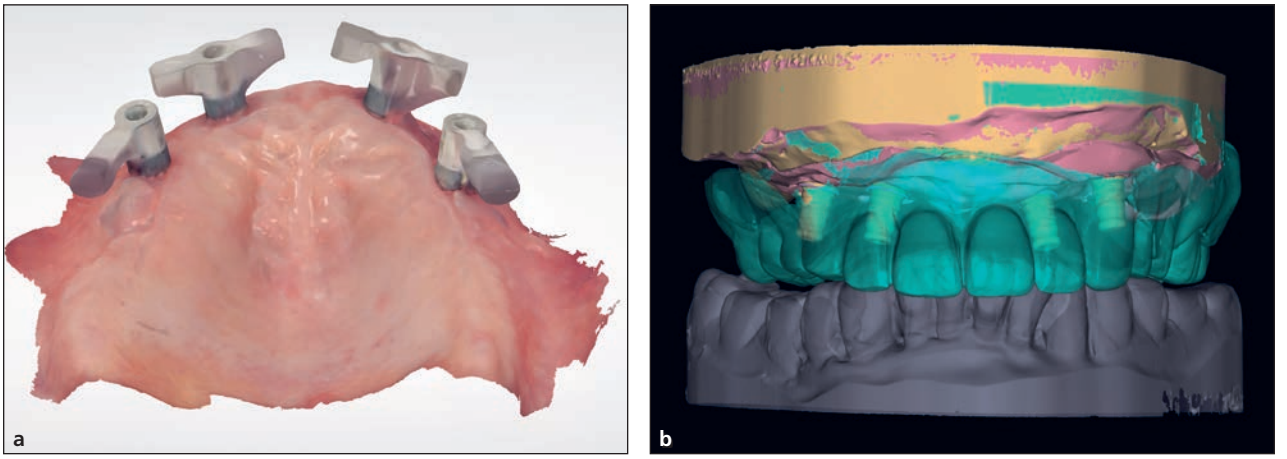


**Fig 4** *(a)* 3D scan result with EDSBs displayed in CAD laboratory software. *(b)* 3D CAD design of PMMA temporary maxillary structure in occlusion with opposing mandible.

(Exocad DentalCAD Software 2024, Exocad), the digital files of the maxilla, both with and without EDSBs, were aligned for accurate positioning of the implant analogs and for bite registration in a 3D print model (NYTE3D Model, NYTE3D; Fig 4a). 3D models of the maxilla and the opposing mandible were printed (DPR 10 Material, Carbon), along with gingival masks for the peri-implant region (FotoDent Gingiva, Dreve Dentamid) using a 3D printer (Carbon M3, Carbon). The model base was printed, including the hollow molds for inserting the corresponding laboratory analogs (One Lock Digital Analogue, Apollo). After CAD design and 3D printing of the temporary polymethyl methacrylate (PMMA) resin structure (ARGENPMMA Multilayer Disc, Argen Dental; Fig 4b), the printed models of the maxilla and mandible were articulated with the PMMA structure (Fig 5a). The occlusion was checked, the structure was polished, and the anterior gingival area was stained pink with resin stains (Gradia Plus and Optiglaze Color, GC). Other parts of the PMMA structure, particularly the functional occlusal surfaces, were left unstained (Fig 5b). Before the prosthetic try-in of the temporary resin bridge, laboratory titanium bases (Multi-Titanium Bases, Apollo) were luted into the basal openings of the PMMA structure after shortening (G-Multi Primer and G-CEM One, GC; Fig 6).

### Prosthetic Phase II—Prototype Restoration Try-in

The one-piece, screw-retained, full-contour PMMA maxillary bridge was placed intraorally on the multiunit bar attachments as a prototype and secured with the appropriate bridge screws (Fig 7). Occlusion was checked and minimally adjusted. The fixed PMMA bridge remained temporarily in the patient's mouth to allow for adaptation to the new occlusal situation. If significant occlusal adjustments or a basal relining had been needed, a situation scan could have been taken and sent to the laboratory for further refinement.

### Laboratory and Technical Phase II—Zirconia Framework Milling and Microlayering

Based on the satisfactory passive fit of the PMMA prototype bridge, the identical CAD design was used

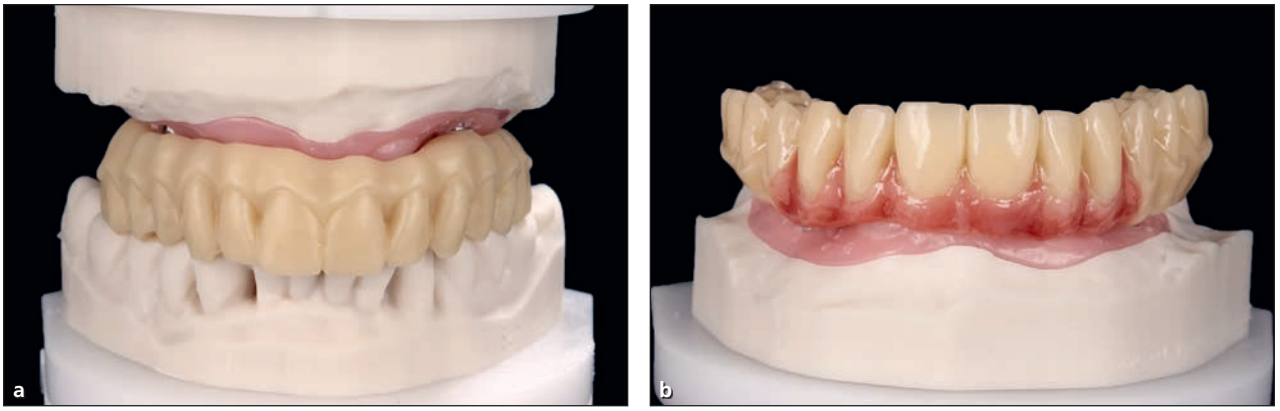


**Fig 5** *(a)* Printed models articulated with maxillary temporary PMMA resin structure. *(b)* Maxillary full-resin structure after polishing and anterior gingival pink staining. Posterior and functional occlusal surfaces were left unstained.

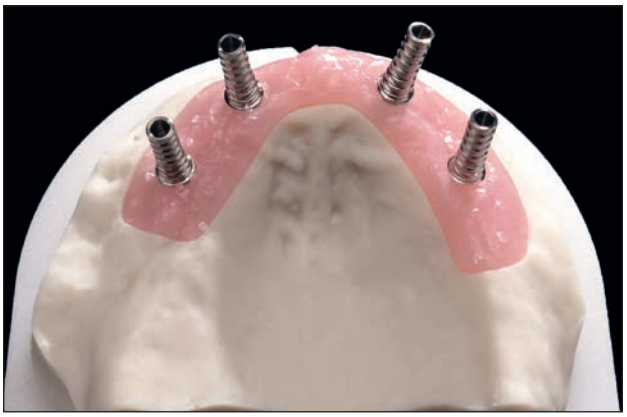

**Fig 6** Customizable laboratory titanium bases (multi-titanium bases) were luted into the basal openings of the PMMA structure after trimming.

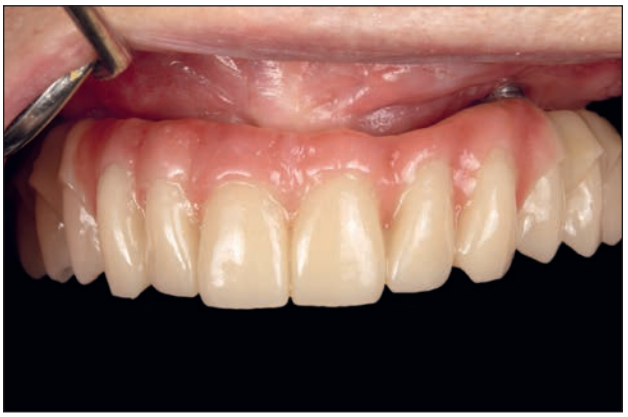

**Fig 7** Intraoral view of screw-retained, full-contour PMMA maxillary bridge on multiunit bar attachments as temporary prototype.

to fabricate the full-contour multilayer zirconia bridge through high-definition milling (Dyamach DS1 powered by ARGEN, HD-Milling, Dyamach; Fig 8). After minor finishing, the zirconia structure was then veneered using a multilayering technique (Initial IQ One SQIN, GC) after minor finishing. The functional occlusal and palatal surfaces of the zirconia structure were left unveneered. Laboratory titanium bases (Multi-Titanium Bases) were luted into the basal openings of the zirconia structure (G-CEM One) prior to delivery.

### Prosthetic Phase III—Placement of Full-Contour Screw-Retained Zirconia Structure

After intraoral removal of the prototype PMMA maxillary bridge, the final full-contour zirconia structure was secured to the multiunit bar attachments using occlusal bridge screws (Fig 9). The screw access holes were filled with teflon tape (PTFE tape, W.L. Gore & Associates) and composite (Tetric EvoFlow, Ivoclar) and then polished. The occlusion was carefully checked to ensure proper alignment.


**Fig 8** Full-contour zirconia bridge, CAD/CAM fabricated from a multilayer zirconia ceramic disc by high-precision milling prior to further processing.

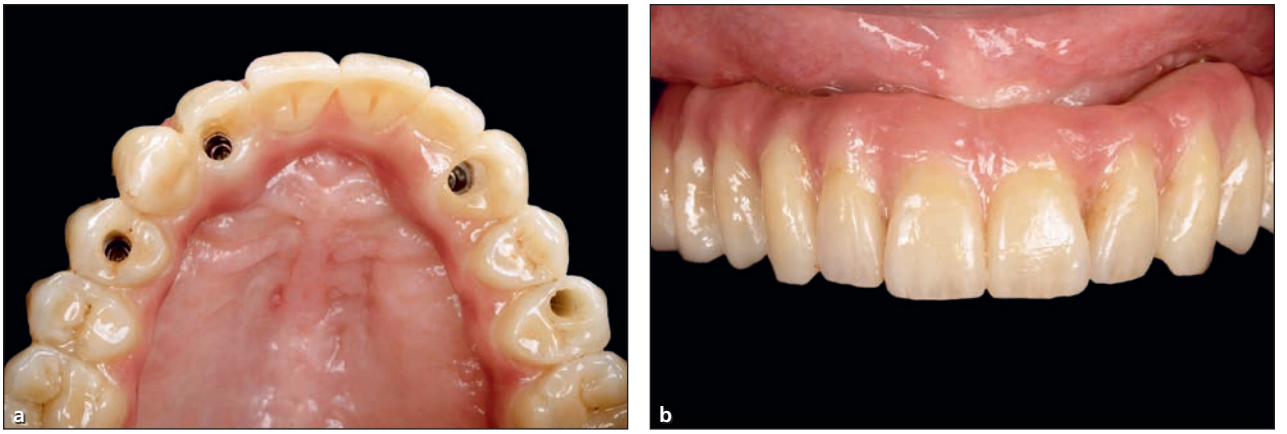

**Fig 9** *(a)* Occlusal view of screw-retained, full-contour zirconia bridge with multilayer veneering. The functional surfaces of the zirconia structure were left unveneered. Screw access holes were filled with Teflon tape and composite. *(b)* Labial view of the screw-retained, full-contour zirconia bridge with multilayer veneering.

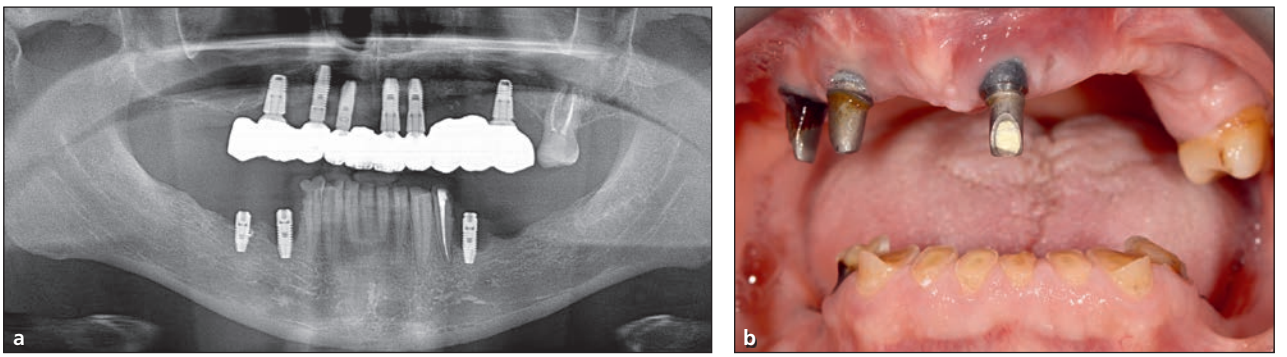

**Fig 10** *(a)* Radiograph of initial situation showing peri-implantitis around implants in the maxilla and mandible. *(b)* Initial clinical situation.

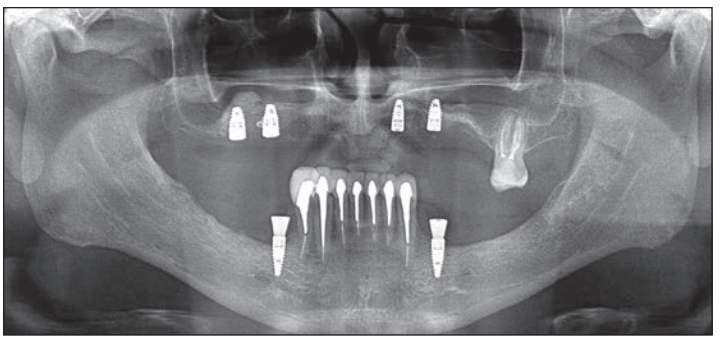

**Fig 11** Panoramic radiograph of newly placed implants after sinus elevation and guided bone regeneration.

## CASE REPORT 2: REMOVABLE, EXTENDED PEEK BRIDGE WITH CERAMIC CROWNS AND COMPOSITE GINGIVA ON TWO TITANIUM RETENTION BARS WITH EQUATOR ATTACHMENTS ON MULTIUNIT ABUTMENTS

### Patient and Initial Surgical Records

A 51-year-old male patient presented for revision of a challenging implant treatment completed 14 years earlier. In the maxilla, he had received a fixed ceramic-fused-to-metal cemented bridge supported by six standard titanium abutments. In the mandible, implants had been placed but never prosthetically restored, and the remaining teeth were severely worn due to inadequate occlusion (Fig 10). The patient discontinued treatment after the maxillary superstructure was cemented and never returned for follow-up. All implants showed signs of peri-implantitis and required explantation. The first stage of treatment involved bilateral sinus elevations and guided bone regeneration. A complete maxillary denture was delivered post surgery. After the healing period, four titanium screw implants (Straumann) were placed in the most regenerated bone regions (FDI tooth positions 16, 14, 22, and 24), with implant diameters of 3.3 mm and lengths ranging from 8 to 10 mm (Fig 11). Four months later, the implants were uncovered, and multiunit abutments (Screw-Retained Abutments, Straumann) were inserted and covered with protective caps. Figure 12 outlines the continuing treatment protocol and workflow.

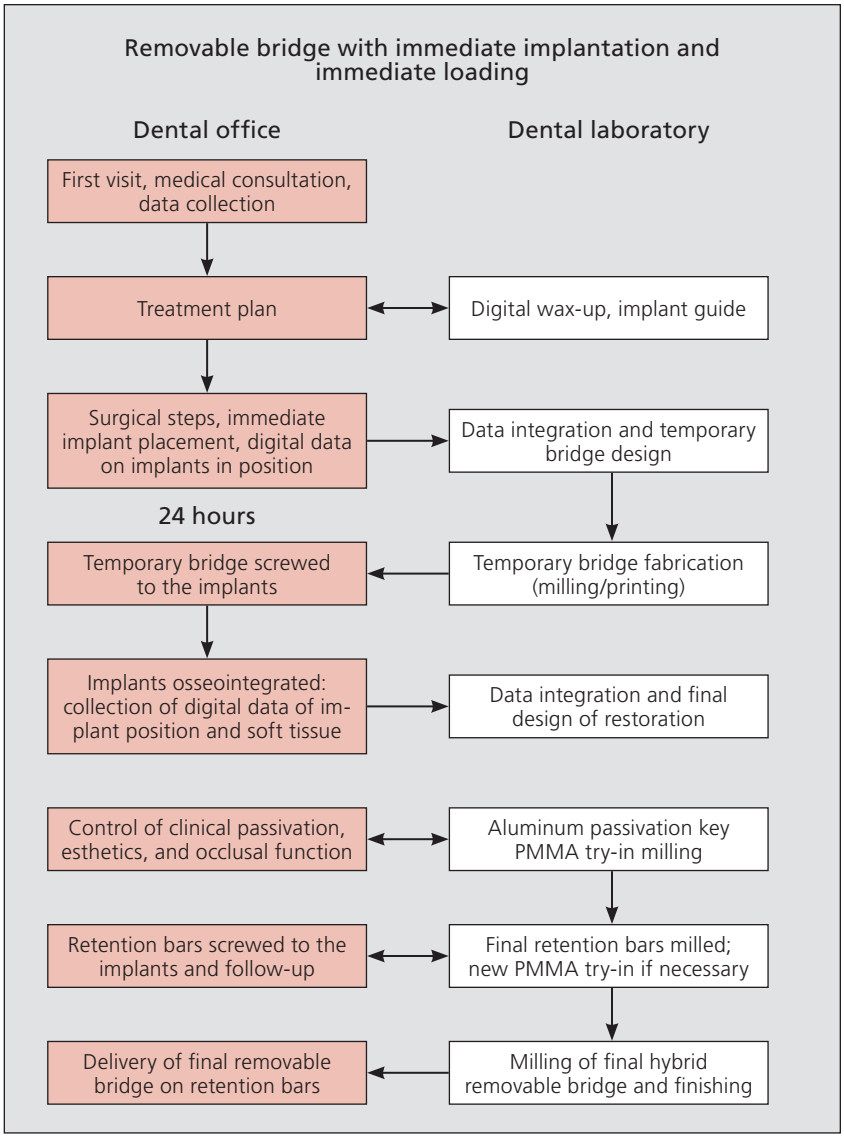


**Fig 12** Clinical and laboratory workflow for PEEK removable bridge with ceramic crowns and composite gingiva on two titanium retention bars.

### Prosthetic Phase I—Intraoral Scanning Process

At the next visit, 1 week later, an IOS of the edentulous maxilla with the multiunit abutments was obtained (Dexis IS 3800). The palatal portion of the provisional full denture was intraorally relined with high-precision silicone (Honigum Light Body, DMG Dental) to capture details of the palatal mucosal surface. A second IOS scan was taken extraorally to digitally image the denture from, booth the palatal and occlusal sides, providing a 360-degree 3D view (Fig 13). L-shaped EDSBs (SmartFlag scanbodies) were selected to minimize long spans between the implants and mounted onto the multiunit abutments with corresponding screws (Fig 14). A third intraoral scan, with the EDSBs digitally captured the positions of the four implants in the edentulous maxilla (Dexis IS 3800; Fig 15). Finally, the opposing mandibular arch and the occlusal relationship were scanned intraorally with the temporary full denture in place. All IOS data were sent to the laboratory via an internal digital cloud.

### Laboratory and Technical Phase I—IOS Evaluation, Digital Matching, and Prototype Fabrication

After downloading and integrating the design library with the virtual models of the EDSBs and corresponding components (Apollo Implant Components) into the CAD laboratory software (Exocad Dental CAD Software 2024), the digital files of the maxilla, both with and without EDSBs, were aligned to ensure correct implant positioning (Fig 16). A new CAD design of the temporary polymethylmethacrylate (PMMA) resin structure was created based on the prescanned temporary prosthesis, then milled (Adite PMMA Monolayer, Adite) along with an aluminum passivation key. The passivation key was designed and milled from the multiunit level to check

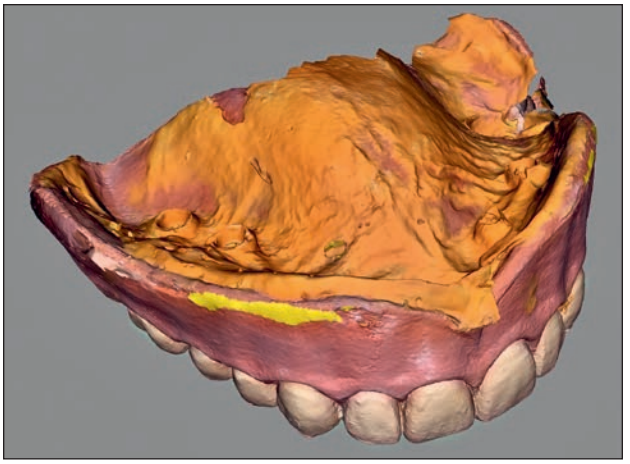

**Fig 13** 360-degree scan of the relined temporary prosthesis in the scanner software.

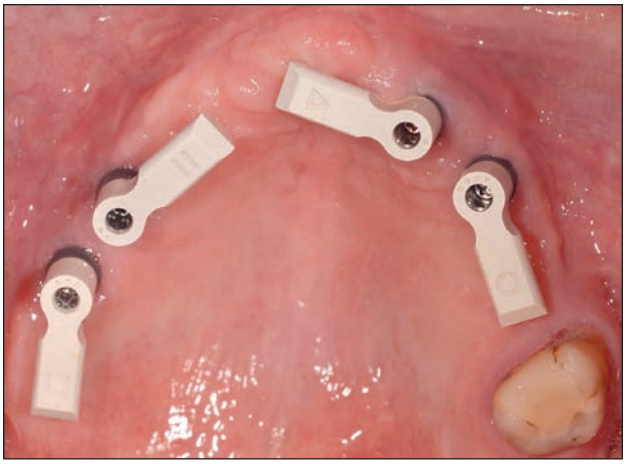

**Fig 14** Occlusal view of EDSBs with L-shaped extensions in place prior to intraoral scanning.

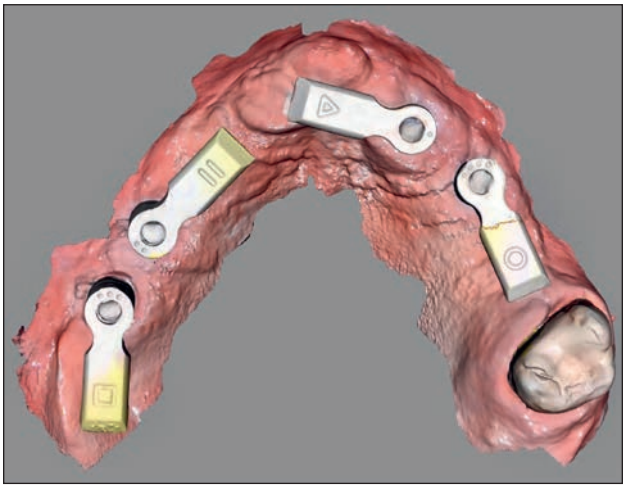

**Fig 15** 3D scan result with EDSBs displayed in scanner software.

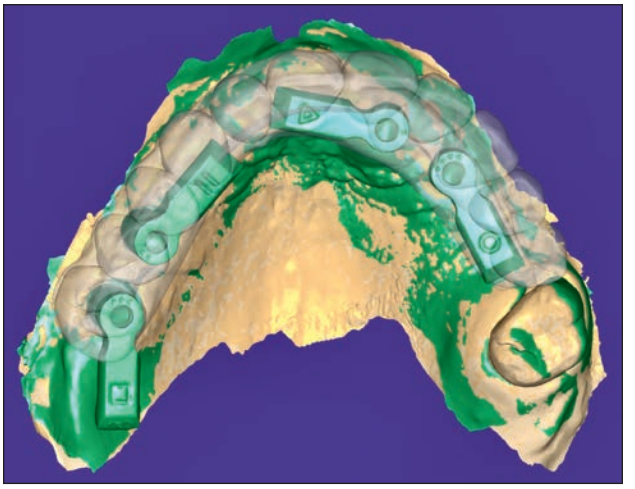

**Fig 16** Superimposed implant and tooth positions on 3D CAD design (Exocad) for the PMMA prototype structure.

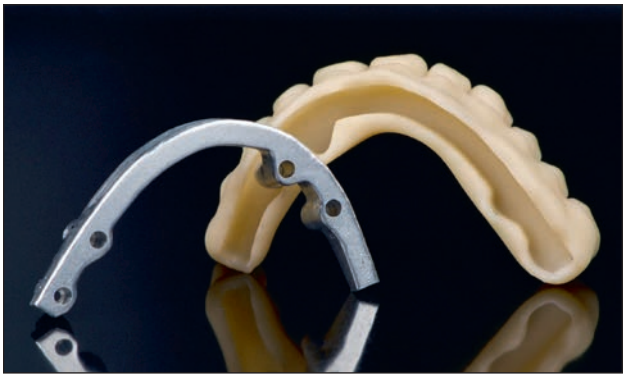

**Fig 17** Maxillary PMMA prototype bridge and milled aluminum bar.

the passive fit, serving as internal support for the PMMA try-in rail (Fig 17). Before delivery to the dental office, the fit of the temporary structures was checked, and the components were cleaned and polished.

### Prosthetic Phase II—Prototype Restoration Try-in

The aluminum passivation key was screwed intraorally onto the multiunit abutments, and X-rays were taken to assess the passive fit. Next, the PMMA resin structure was cemented with temporary cement (TempBond Clear, Kerr Dental) over the aluminum bar (Fig 18). The occlusion was checked against the corresponding mandibular temporary, and a new occlusal bite was recorded. The results were presented to the patient for approval of the final tooth shape. Photographs of the face with the PMMA structure were taken.

### Laboratory and Technical Phase II—Removable Bridge and Retention Bar Milling

Based on the favorable esthetic outcome of the PMMA prototype bridge and the clinically passive fit of the aluminum bar, the duplicated CAD design was used to fabricate the removable bridge and position the titanium retention bars (Fig 19). Two titanium retention bars

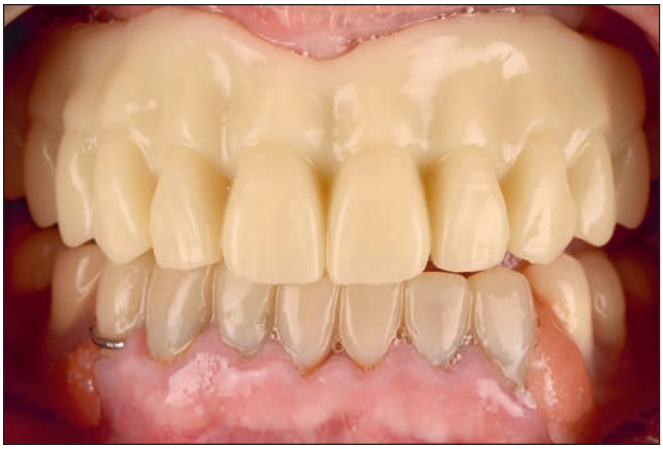

**Fig 18** Try-in of maxillary PMMA prototype on aluminum bar in situ.

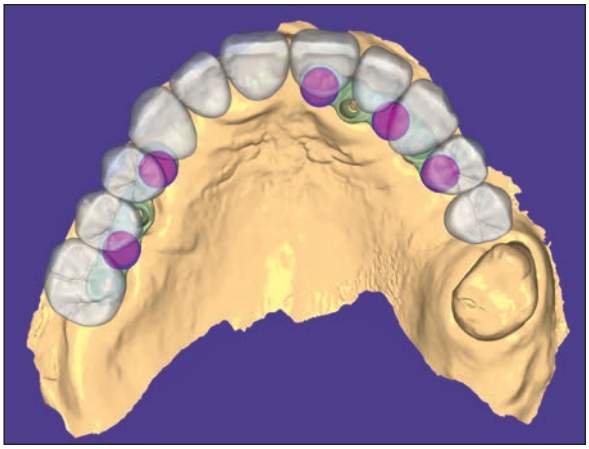

**Fig 19** 3D CAD design of retention bars with additional attachments (Equator, Rhein83) custom-fitted to the final tooth positions.

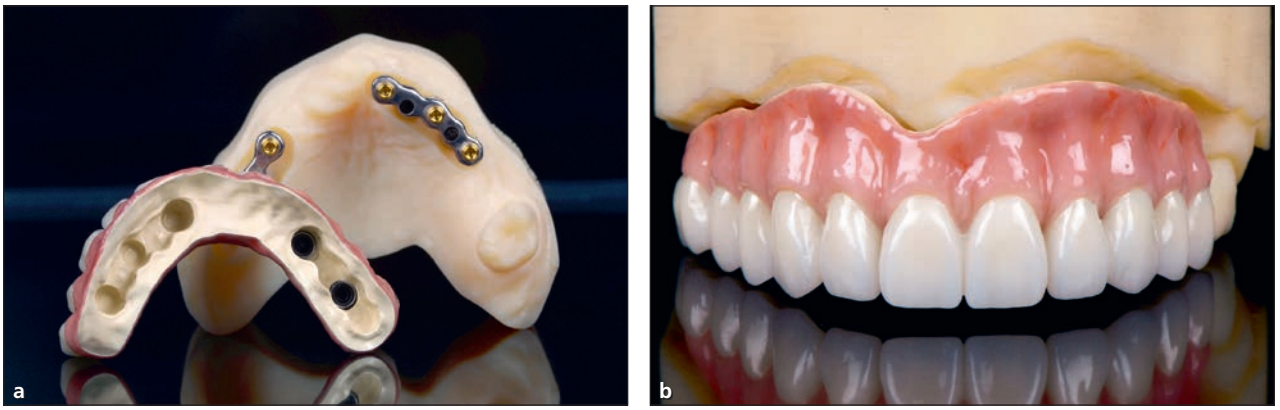


**Fig 20** *(a)* Final removable extended PEEK bridge together with retention bars on 3D-printed model. *(b)* Removable superstructure featuring zirconia crowns and composite gingiva over a PEEK framework.

(Ti6Al4V ELI Grade 23, Titanium Industries) were milled to support the superstructure, incorporating provisions for Equators (OT Equators, Rhein 83). The removable bridge was milled from PEEK with a cut-back (BioHPP,), leaving space for the zirconia crowns (Pritidenta $ZrO_2$ Multi Translucent Plus, Pritidenta). The 11 zirconia crowns were milled separately, with design confirmation based on the PMMA temporary. A 3D model was printed to verify the fit and ensure passive integration of both superstructures prior to delivery (Fig 20). After cementing the crowns onto the PEEK superstructure, the gingival portion of the removable bridge was covered with composite material (Cermage, Shofu) and glazed (GC Optiglaze).

### Prosthetic Phase III—Placement of Full-Contour Screw-Retained Zirconia Structure

The retention bars were screwed to the implant multiunit abutments with a specified torque, and screw access holes were filled with Teflon tape and composite material (Gradia Direct, GC). The final, removable bridge was seated in its definitive position (Fig 21). Occlusion was carefully checked to ensure proper alignment. The patient was instructed on how to properly insert and remove the bridge for effective hygiene maintenance.

## CASE REPORT 3: ONE-PIECE SCREW-RETAINED, FULL-CONTOUR MAXILLARY ZIRCONIA STRUCTURE WITH INTERNAL TITANIUM BAR ON MULTIUNIT ABUTMENTS

### Patient and Initial Surgical Records

A 47-year-old female patient presented for complex prosthetic reconstruction (Fig 22). After a complete examination, the treatment plan was reviewed with the patient and accepted. During the first surgery, all remaining periodontally compromised and unstable teeth in the maxilla were extracted atraumatically, followed by immediate implant placement and loading with a temporary PMMA bridge. Five titanium screw implants (Straumann

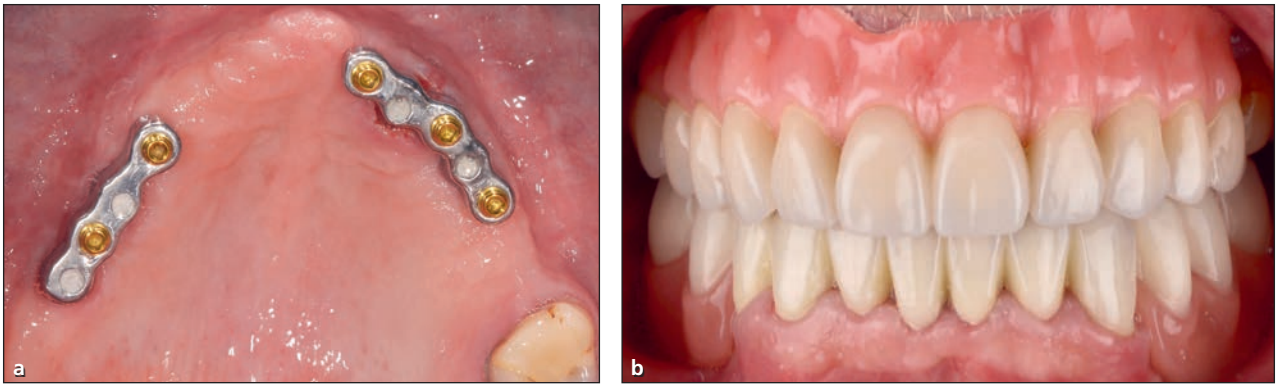


**Fig 21** *(a)* Intraoral palatal view of titanium retention bars with Equator attachments mounted on four implants via multiunit abutments. *(b)* Frontal view of final rehabilitation in the maxilla and mandible.

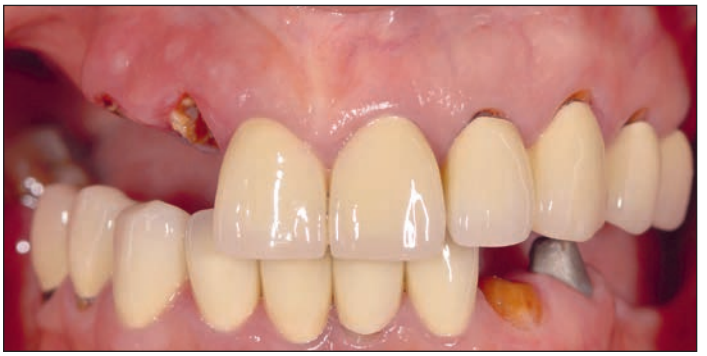

**Fig 22** Frontal view of initial situation.

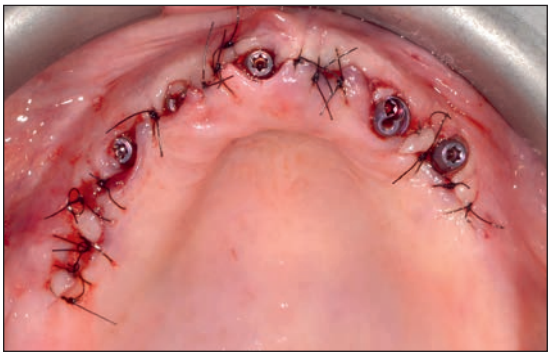

**Fig 23** Palatal view of maxilla after multiple extractions with immediate implant placement and multiunit abutments in place.

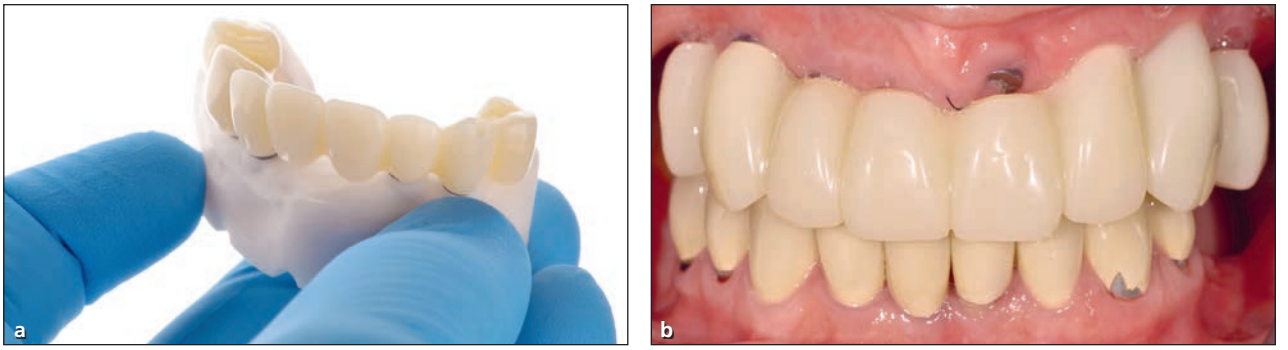


**Fig 24** *(a)* Maxillary PMMA structure was cemented extraorally with titanium bases and used as a temporary bridge for immediate loading. *(b)* Clinical frontal view of temporary PMMA structure on four implants 2 days after surgery.

BLX) were placed in FDI tooth positions 14, 12, 21, 22, and 24, with implant diameters ranging from 3.5 to 4.5 mm and lengths from 8 to 10 mm (Fig 23). A temporary PMMA bridge (Adite PMMA Monolayer) with titanium abutments (Multi-Titanium Bases) was fabricated by the dental laboratory on the same day and secured to multiunit abutments (Straumann Screw-Retained Abutments) after surgery. The eight-unit temporary bridge extending from the right to the left maxillary premolar was placed on four implants excluding tooth position 21 (FDI) due to low insertion torque (Fig 24). After 6 months of healing and osseointegration, the temporary bridge was unscrewed, and healing was assessed. The final prosthetic reconstruction was discussed with the patient, and a multiunit abutment was placed on the remaining implant at tooth position 21 (FDI). Figure 25 illustrates the treatment protocol and procedure.

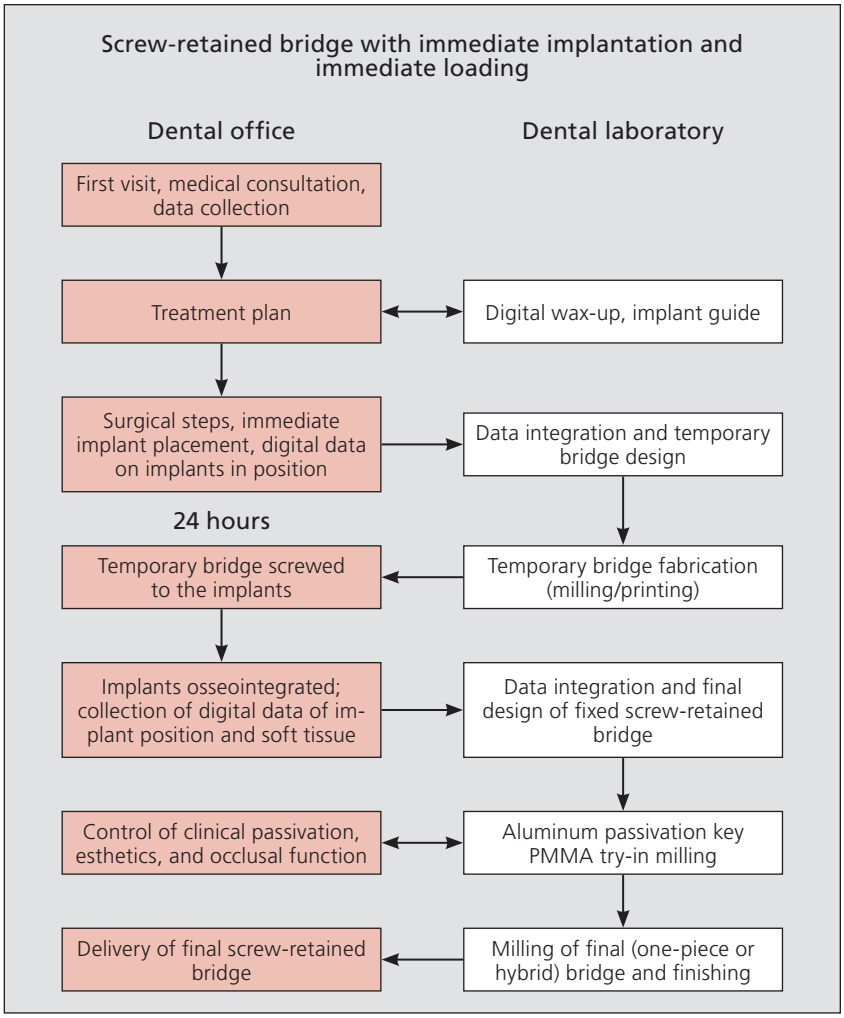


**Fig 25** Clinical and laboratory workflow for screw-retained maxillary zirconia structure with internal titanium bar.

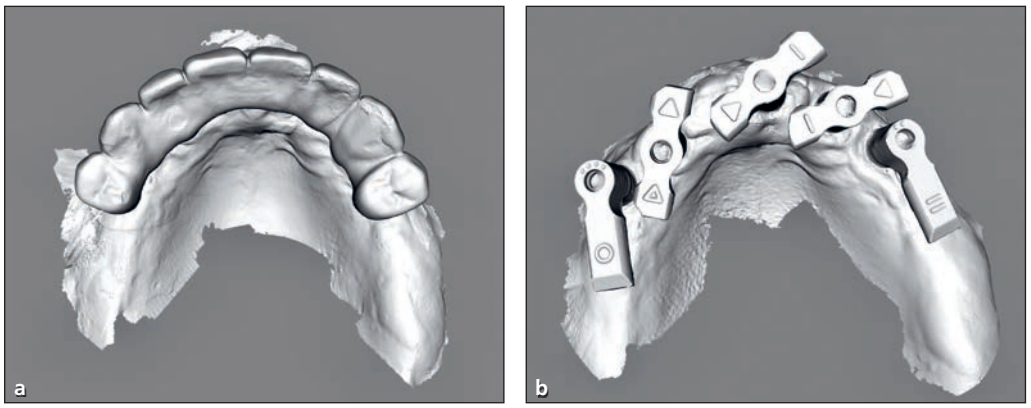


**Fig 26** *(a)* 3D scan result of PMMA temporary structure displayed in scanner software. *(b)* 3D scan result with EDSBs displayed in scanner software.

## Prosthetic Phase I—Intraoral Scanning Process

At the next visit, an IOS of the temporary PMMA bridge was taken (Dexis IS 3800; Fig 26a). After unscrewing the temporary restoration, a second IOS of the edentulous maxilla with only the multiunit abutments was taken. T- and L-shaped EDSBs (SmartFlag scanbodies) were selected to minimize long spans between implants and were screwed to the multiunit abutments. A third IOS digitally captured the EDSBs on five implants in the edentulous maxilla (Dexis IS 3800; Fig 26b). Finally, the opposing mandibular arch and occlusal relationship were scanned with the temporary bridge in place. All IOS files were sent to the laboratory via an internal digital cloud.

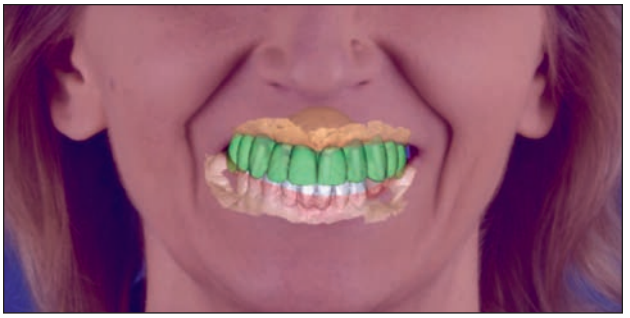

**Fig 27** 3D CAD design (Exocad) for fabrication of PMMA prototype structure.

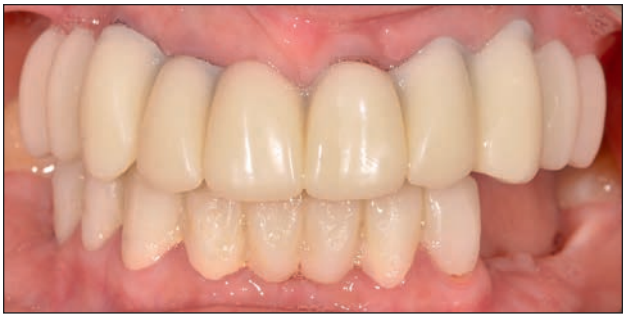

**Fig 28** PMMA prototype structure screwed onto implants for esthetic and occlusal function verification.

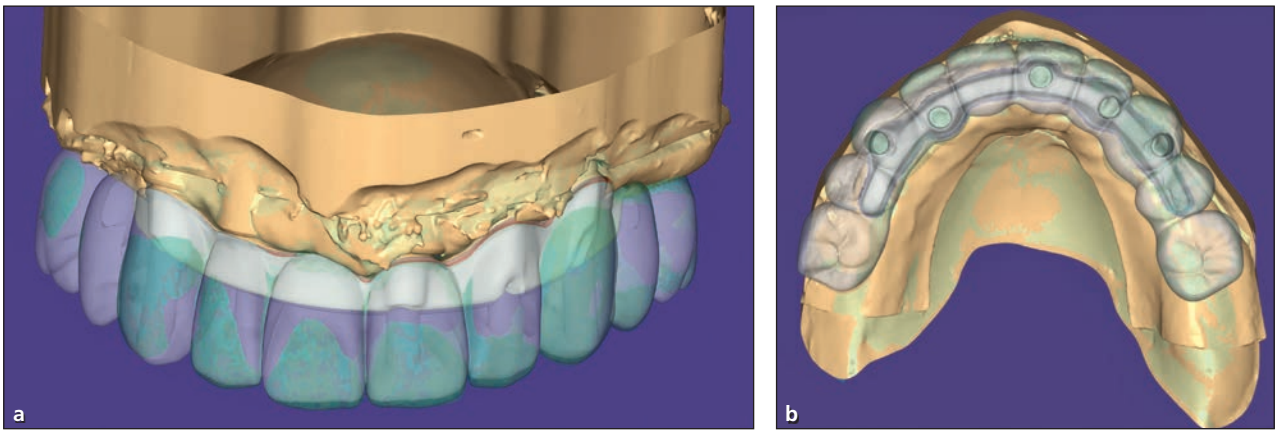


**Fig 29** *(a)* 3D labial information of PMMA try-in superimposed in CAD software for fabrication of zirconia screw-retained bridge with an internal rail for titanium bar. *(b)* 3D occlusal view of PMMA try-in superimposed in CAD software with virtual titanium bar.

### Laboratory and Technical Phase I—IOS Evaluation, Digital Matching, and Prototype Fabrication

As described in the previous clinical cases, the digital files of the maxilla, both with and without EDSBs, were aligned using laboratory software (Exocad Dental CAD Software 2024) to position the implant analogs in a 3D printed model (Asiga DentaMODEL, Asiga). The model base, including hollow molds for the insertion of laboratory analogs (One Lock Digital Analogue) was printed using a 3D printer (Asiga 4K printer, Asiga). The design of the temporary bridge was verified by importing the patient's facial profile images into Exocad software (Fig 27). After design confirmation, the temporary PMMA resin structure (Ivotion Dent, Ivoclar) was milled, luted onto the prepared titanium bases (Multi-Titanium Bases), and articulated with the printed maxillary and mandibular casts to check for occlusion. The PMMA bridge was cleaned and polished prior to delivery.

### Prosthetic Phase II—Prototype Restoration Try-in

The full-contour PMMA maxillary bridge was screwed intraorally onto the multiunit abutments (Fig 28). Radiographs were taken to confirm a passive seat, and the occlusion with the corresponding mandibular temporary bridge was clinically checked with minor adjustments. The result was presented to the patient for acceptance of the final tooth shape.

### Laboratory and Technical Phase II—Zirconia Framework on Titanium Bar Milling

Based on the favorable esthetic outcome of the PMMA prototype and its passive clinical fit, a full-contour multilayer zirconia overlay bridge with a rail for the titanium bar (IPS e.max ZirCAD Prime, Ivoclar) was fabricated from the duplicated CAD design (Fig 29). After milling, the zirconia bridge was stained and glazed with IPS Ivoclar (Ivoclar). The titanium bar was then cemented into the zirconia bridge with G-CEM One (Fig 30). The complete structure was polished prior to delivery.

### Prosthetic Phase III—Placement of Maxillary Zirconia Structure with Titanium Bar

The temporary PMMA bridge was unscrewed and the final full-contour zirconia bridge with the titanium bar was positioned onto the multiunit abutments and secured with occlusal bridge screws (Fig 31a). A thorough assessment of esthetics and occlusion was conducted (Fig 31b). The screw access holes were filled with Teflon

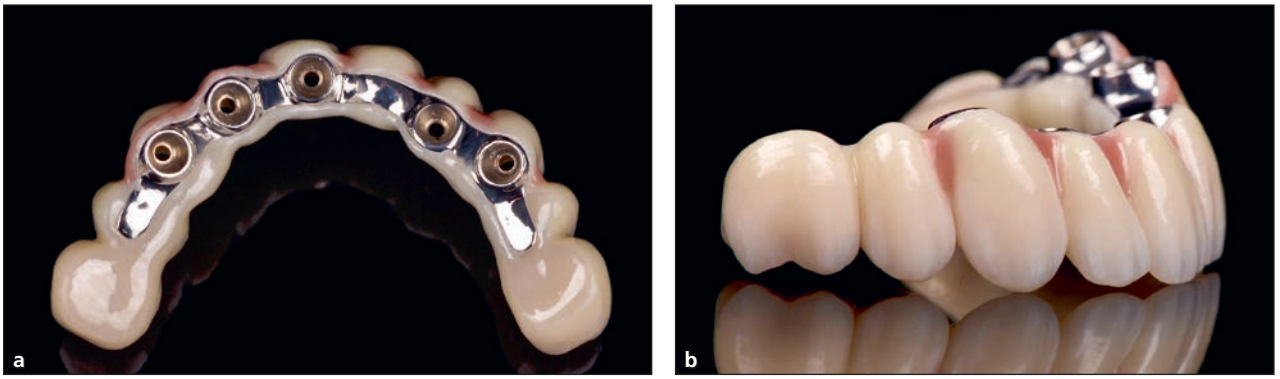

**Fig 30** *(a)* Maxillary overlay zirconia implant-supported fixed dental prosthesis milled with an internal rail and cemented with titanium bar. *(b)* Lateral view of screw-retained zirconia implant-supported prosthesis.

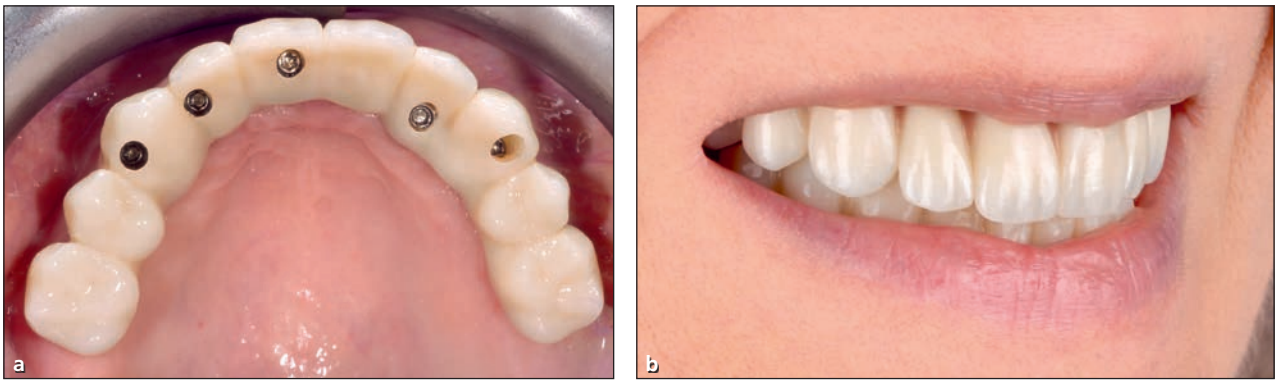

**Fig 31** *(a)* Occlusal view of screw-retained zirconia implant-supported prosthesis. Screw access holes were filled with Teflon tape and composite. *(b)* Final view of screw-retained implant-supported superstructure on multiunit abutments.

tape and composite material (Gradia Direct) before being polished for a smooth finish.

## DISCUSSION

With the rapid advancement of CAD/CAM technology in implant dentistry, the adoption of a fully digital workflow is becoming more common, with digital impressions being integral to the process. Research indicates that the results of full-arch scanning generally exhibit greater deviations compared to partial-arch scanning.[4] IOS of multiple implants in the edentulous maxilla and mandible presents numerous clinical and technical challenges that can significantly affect the accuracy and reliability of digital impression results. The scan pattern, variations in ambient lighting, and the design and material of ISBs have been reported to influence scan accuracy.[5, 8] The specific arch, implant positions, interimplant distances, and implant angulation further confound scanning accuracy and increase the risk of cumulative error and variation.[7, 9, 22] A major limitation is the lack of stable morphologic landmarks on the edentulous mucosa,[10] making it particularly complex for the scanner to accurately align and stitch multiple images, unlike IOS for single-unit or short-span implant restorations. Moreover, the presence of soft tissue between standard scan bodies can result in a considerable shift in focus for the intraoral scanner's camera, potentially compromising the clarity of the captured images. This focus shift may lead to inconsistencies in image quality and contribute to errors during the stitching process in the software. As a result, cumulative processing errors during image stitching can lead to distortion and inaccuracy over large areas. These issues ultimately reduce the precision of digital models, leading to prosthetic misfit and potential mechanical complications of all-on-x implant-supported restorations.

To address the challenge of undefined morphologic reference points on the mucosa during full-arch scanning of multiple implants, new EDSBs with L-shaped and T-shaped extensions have been introduced. The documented proof-of-concept case reports of fixed and removable implant-supported restorations demonstrate that these extensions effectively minimize the distances between the scan bodies by overlapping and virtually bridging the gaps, facilitating digital splinting.

One-piece, full-arch, implant-supported fixed prostheses on four to six implants fabricated from a variety of restorative materials have proven to be a successful treatment for patients with completely edentulous jaws.[23] However, fixed restorations, whether screw- or cement-retained, can be associated with complications. Retrospective studies have reported biologic complications such as peri-implantitis, mucositis, and mucosal recession around implants, as well as technical complications such as wear and veneer fracture for full-arch prostheses made of metal-ceramic, metal-resin, monolithic, or microveneered zirconia.[24–26] Significantly more soft tissue hypertrophy and plaque accumulation has been observed around implants supporting full-arch fixed restorations due to difficult hygiene access.[27] In particular, smoking has been linked to peri-implant mucositis. Patients with a history of chronic periodontitis, ineffective plaque control, and irregular post-implant maintenance are at a greater risk of developing peri-implantitis.[28] Therefore, careful patient selection and consideration of patient preferences vs clinical indications are essential for long-term success.

While EDSBs offer several advantages, their limitations should be carefully considered. A potential drawback is their currently limited compatibility with a small number of implant systems, as well as the higher cost associated with designing and manufacturing these specialized scan flags compared to standard scan bodies. A more general clinical limitation of EDSBs is that if the distance between implants is too small, scan flags may interfere with each other. In such cases, only scan bodies with a simpler design can be used. In addition, the implementation of EDSBs requires appropriate training of clinicians and dental technicians to ensure proper use and effective integration within the digital workflow. This additional training may present a barrier to adoption, particularly for dental teams already accustomed to traditional scanning methods.

Despite these limitations, EDSBs can significantly improve the accuracy and clinical efficacy of intraoral scanning for edentulous patients. Their design and asymmetrical modification facilitate better alignment with scanning software and reduces scanning time. Research suggests that complex geometries can improve accuracy and enhance trueness by modifying the scan body shape, potentially due to the added surface detail that enables registration algorithms to pinpoint a unique target for georeferencing.[29] This is particularly useful in full-arch reconstructions, where accurate digital impressions are critical for the fabrication of implant-supported prostheses. By minimizing the need for multiple scans and improving the ease of scan flag identification, EDSBs help to address clinical challenges such as reducing errors in final prosthetic alignment. However, further studies are needed to refine these designs and assess their long-term feasibility in different clinical settings. Future clinical research should compare EDSBs with stereophotogrammetry, which is considered the gold standard for digital data acquisition in full-arch implant reconstructions. In addition, comparison of EDSBs with the emerging concept of reverse implant scanning using temporary prostheses may be valuable in assessing prosthetic marginal adaptation in vivo.

## CONCLUSIONS

Implementing EDSBs with L-shaped and T-shaped extensions provides a stable and continuous reference framework during the scanning process. This approach mitigates the challenges posed by the lack of stable morphologic landmarks on the edentulous mucosa, thereby increasing the accuracy of digital impressions and improving overall clinical outcome.

## ACKNOWLEDGMENTS

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## Highlighted Literature

**Determining the Effect of Video Information on the Dental Anxiety Levels of Endodontic Patients: A Randomised Clinical Trial**

***Objective:*** The present study assessed the effectiveness of pretreatment education in the form of Visual Video Information (VVI) on the anxiety levels of patients during endodontic treatment steps. ***Materials and Methods***: Patients (n = 120) having single-rooted teeth with a single root canal diagnosed with asymptomatic irreversible pulpitis and/or pre-prosthetic root canal treatment were included in this study. After completing anxiety scales and a sociodemographic/dental habits survey, the patients were randomly divided into two groups. Just before the endodontic treatment, VVI was given to the video group patients, while the control group patients received routine information verbally. In both groups, a galvanic skin response (GSR) device was placed on the patients' wrists to record the stress levels during the endodontic treatment process. Anxiety scales and a feedback-satisfaction survey were administered to all patients after the treatment process. Then, statistical analysis was performed ($\alpha$ = .05)***. Results:*** This study performed 60 endodontic treatments on 60 patients (30 females and 30 males). Sociodemographic characteristics and dental treatment habits of the patients significantly affected dental anxiety scale scores ($P < .05$). VVI resulted in a significant decrease in the mean scores of anxiety before and after the treatment, but this decrease was not significant between the groups ($P > .05$). Similarly, VVI did not impact the GSR readings between the groups during treatment ($P > .05$)***. Conclusions:*** The educational VVI is effective for reducing anxiety in patients undergoing endodontic treatment. In addition, the electrodermal activity method is a promising alternative for objectively assessing anxiety levels.

**Anatürk S, Özkan HD, Saral IP, Çakar T.** *J Oral Rehabil* 2025;52:1933–1944. **References:** 50. **Reprints:** Özkan HD: hicrandonmez@hotmail.com—*Carlo Marinello, Switzerland*