



Introduction

Implant rehabilitation can be particularly challenging in young adult patients with partial edentulism and advanced periodontitis, especially when it involves the anterior region. Utilizing **innovative digital technologies** can enhance precision and aid in achieving **predictable and superior esthetic results**. This clinical case report describes an **interdisciplinary, complete digital workflow** combining guided implant placement, photogrammetry, 3D-printed prototypes, and digital smile design.

Case Presentation

A **33-year-old** systemically healthy female patient presented to the graduate prosthodontics clinic with a partially edentulous mandible and a **chief complaint of poor esthetics and function** due to her missing teeth (fig 1.) and was seeking a fixed prosthesis. She was diagnosed with **Stage IV Grade C Periodontitis**.

Digital Technology was used to complete prosthetic treatment plan was in three phases:

Phase 1: 3D cone-beam computed tomography (CBCT), intra-oral scans, digital smile design and digital planning software were utilized for a prosthodontically-driven implant plan (figs. 2 and 3).

Phase 2: A **bilateral tooth-supported surgical guide** was designed and **3D-printed** to complete the implant osteotomies, followed by **serial extraction of remaining mandibular teeth**. Second molars were maintained to retain the VDO and interim prosthesis (figs 2 and 3).

Phase 3: **Photogrammetry technology** was utilized to digitize implant locations. Intraoral scans were made at the new VDO established with the wax try-in, followed by tissue scans. Digital design software was utilized in designing and fabricating **interim PMMA and final zirconia prostheses**.

Initial presentation and Surgical Phase



Fig. 1: Initial visit. Generalized periodontal inflammation present (Stage IV Grade C Periodontitis).

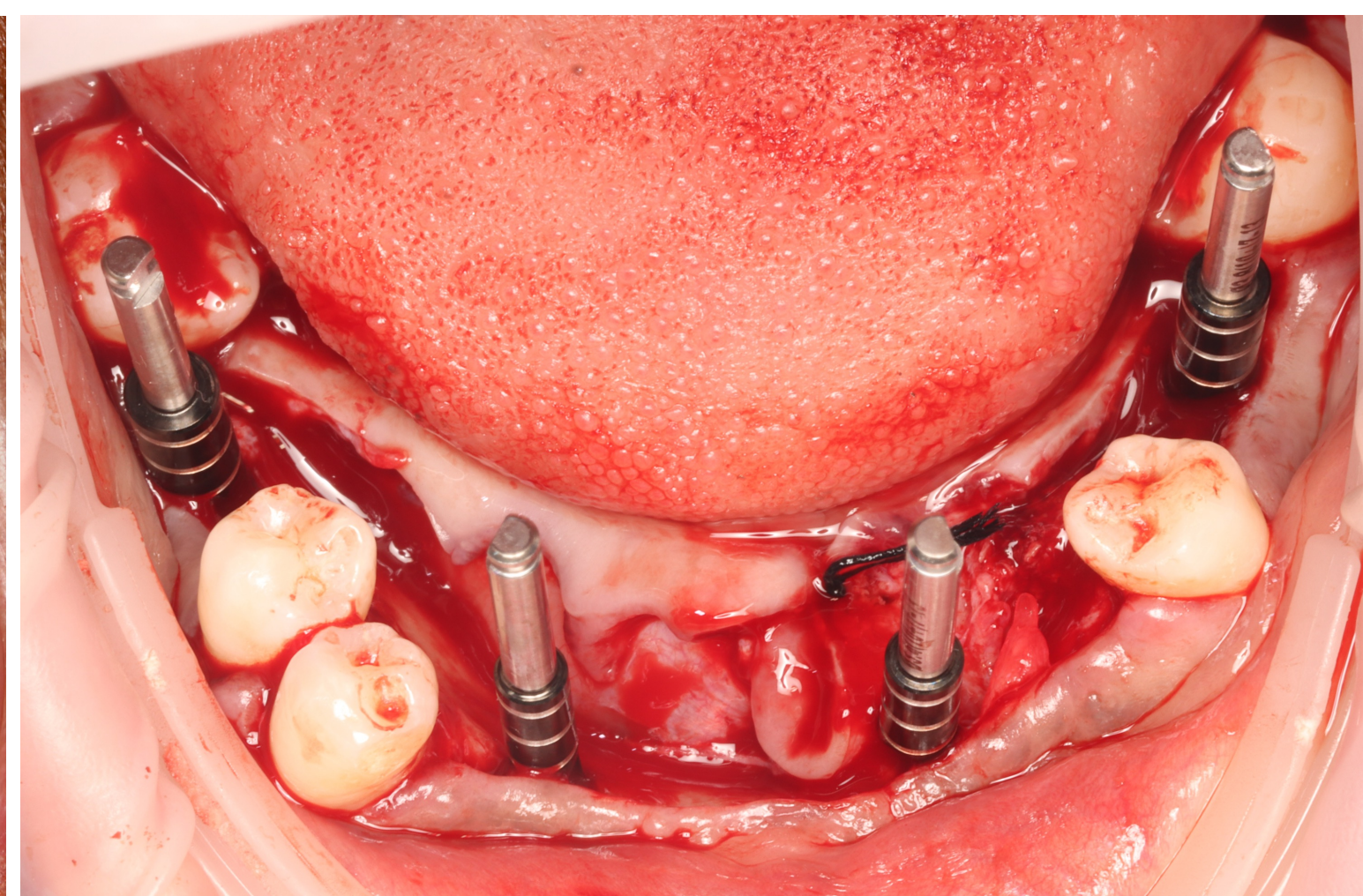


Fig. 2: Initial osteotomy preparations utilizing fully-guided surgical protocol.

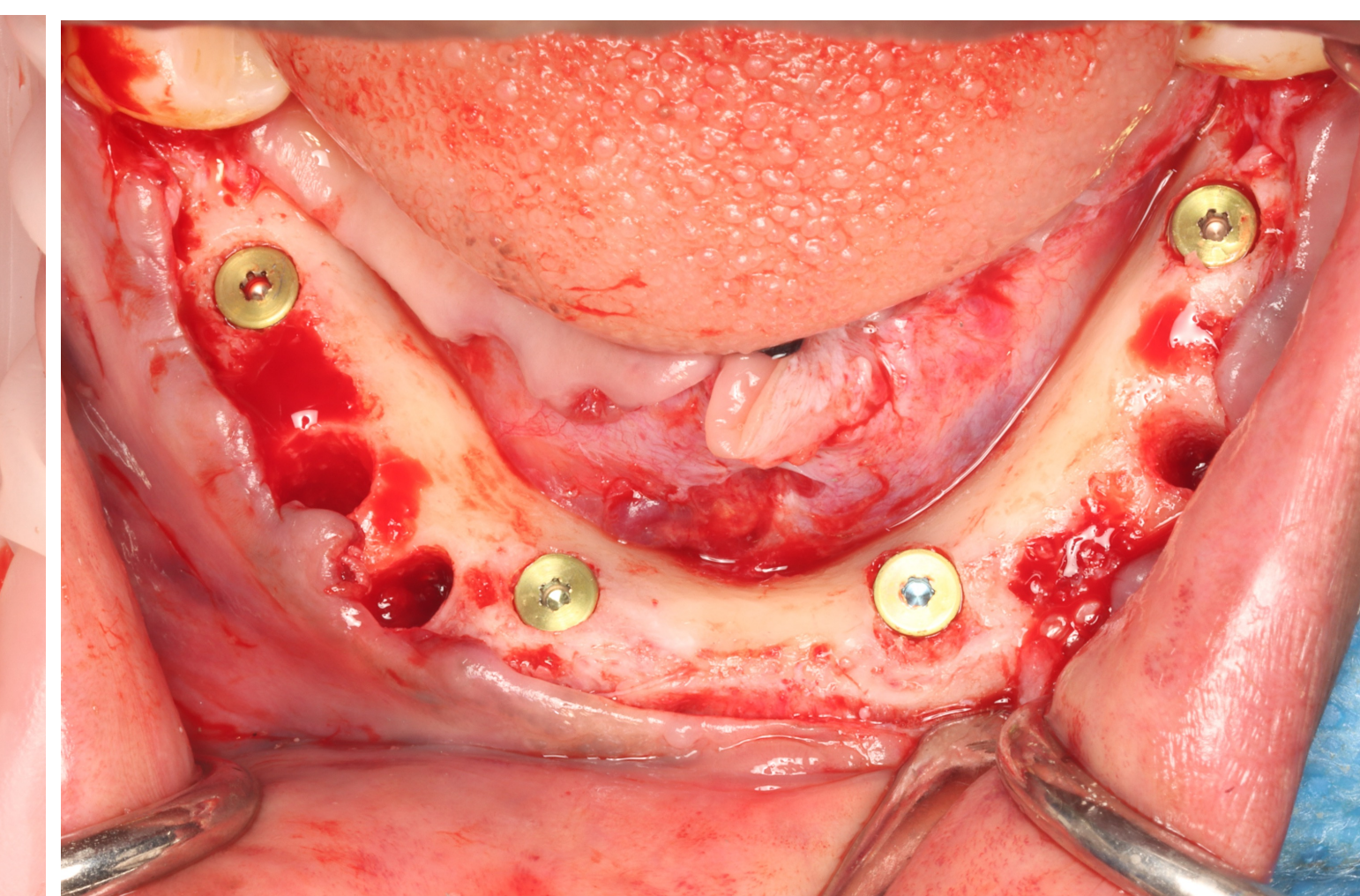


Fig. 3: Final implant positions post-extraction of premolars. Molars maintained for the VDO



Fig. 4: Final implants position of maxillary implants during the healing phase.

Prosthetic Phase: Photogrammetry and Esthetic Rehabilitation

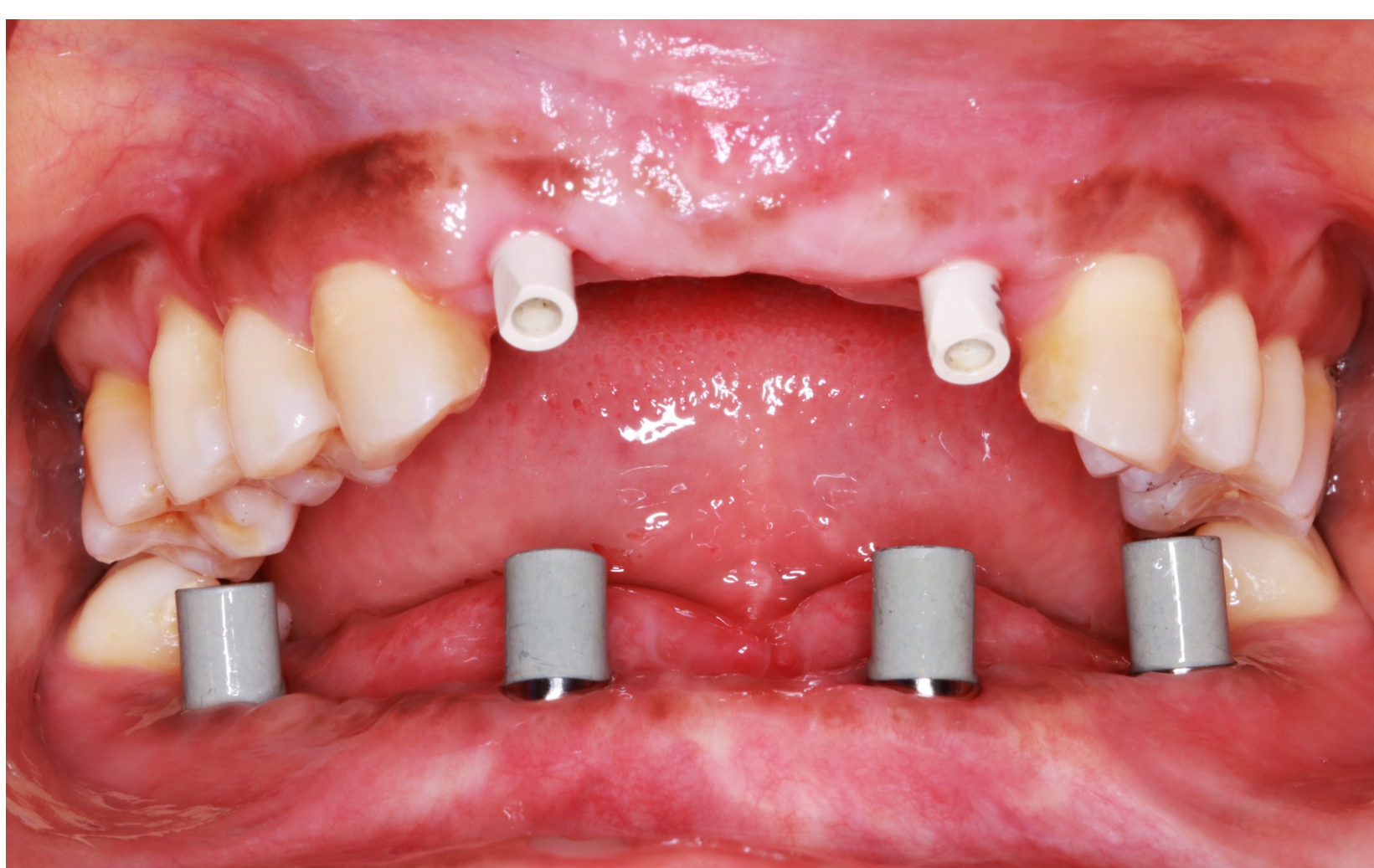


Fig. 4: Straumann scan bodies seated for digital impressions of #7 and #10. Multiunit caps seated to obtain a soft-tissue record.

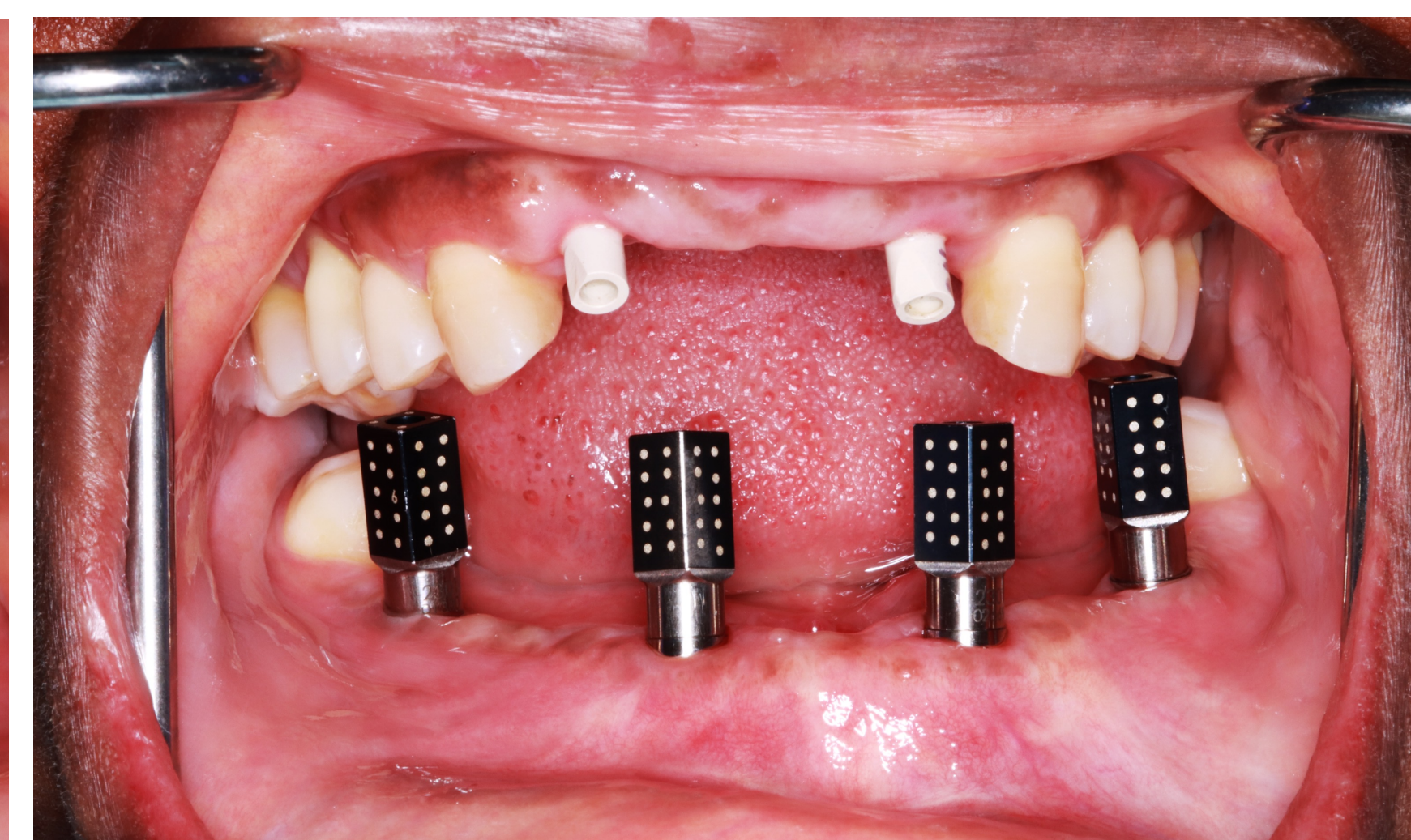


Fig. 5: Scan bodies (ICAM Body) screwed onto the multiunit abutments. Scan bodies are positioned allow maximum visualization of targets. Photogrammetry technology utilized to digitize implant positions.



Fig. 6: Lower full arch prototype and upper anterior prototype in occlusion at the new VDO.



Fig. 7: Full frontal view in smile with interim implant fixed prosthesis showing improved esthetics.

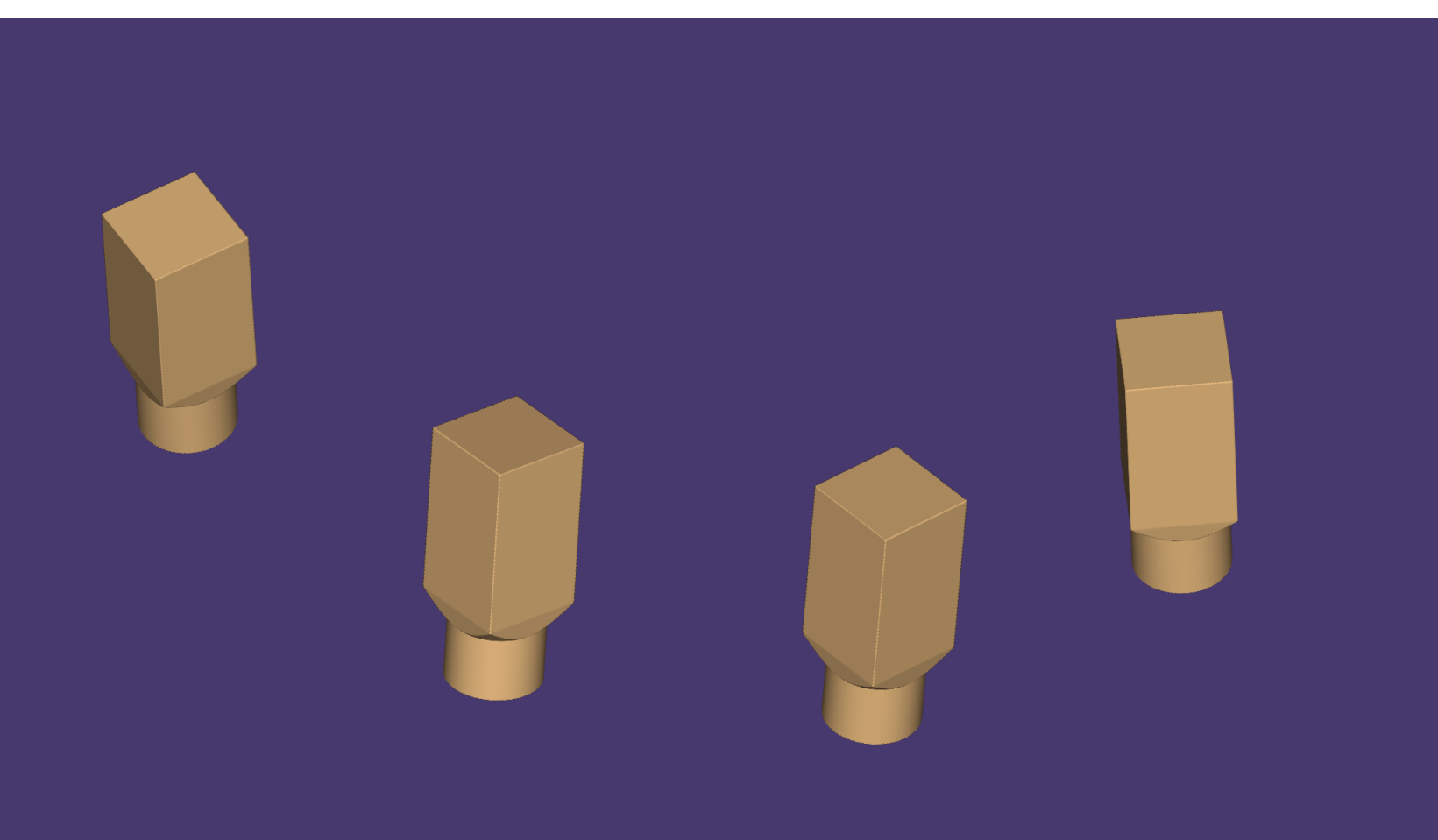


Fig. 8: Verification of implant registration using designated software. Scan bodies are highlighted once implant positions are obtained.

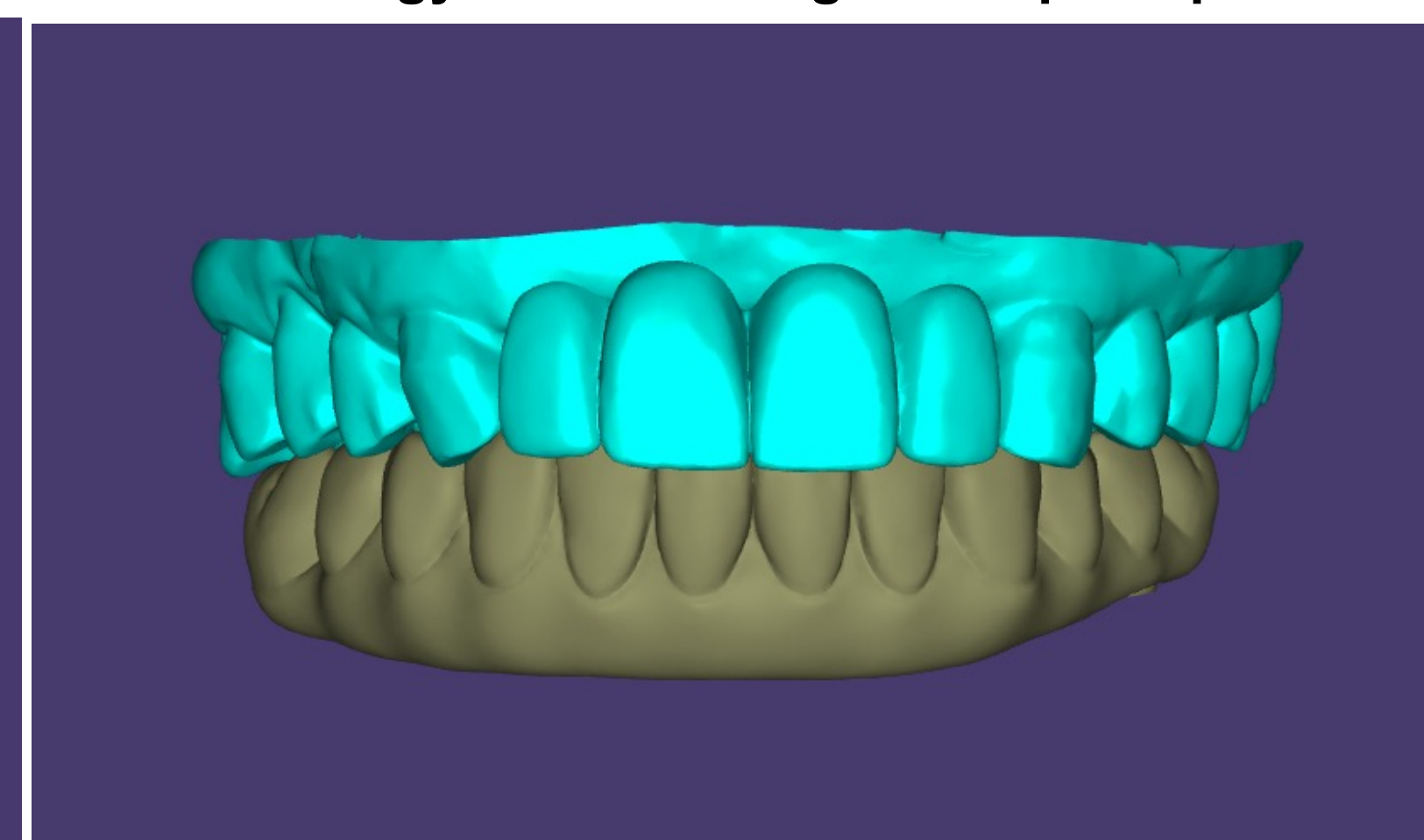


Fig. 9: ExoCAD digital software was used in designing abutments and final prostheses.



Fig. 10: Final milled-zirconia, implant-supported fixed prosthesis with titanium substructure for the edentulous mandible, and an anterior implant-retained zirconia FPD to replace maxillary incisors.



Fig. 11: Full frontal view showing final esthetic rehabilitation.

Photogrammetry in Full-arch Implant Rehabilitation

Photogrammetry is a **novel digital impression** technique that utilizes an extraoral device to **capture the precise intra-oral positions of multiple implants in full arch cases**. This technique utilizes **photographic images** to determine the **geometrical properties** and **spatial arrangement** of objects.

Step 1: Pre-operative digital scans of the wax try-in were obtained to record the new vertical dimension and incisal position using Trios 5 scanner.

Step 2 (fig 4): **Soft tissue record** was obtained with MUA healing caps using an intraoral scanner. Intraoral scan bodies were used to digitize the position of the maxillary implants

Step 3 (fig 5, 8): **Scan bodies** (ICamBody; Imetric 4D) were positioned and hand tightened on each implant, and an ICam 4D extraoral camera was used to digitize position of the implants.

Prostheses Fabrication:

CAD/CAM software was used to design and fabricate a **lower full-arch and an upper 4-unit anterior prototype**. Prototypes were delivered at the new VDO (figs 6 and 7). Anterior prototype used to assess esthetics, phonetics, midline, overjet and overbite. Final **esthetic rehabilitation** was accomplished with an **anterior implant-retained, milled zirconia FPD** to replace maxillary incisors and a **full-arch implant-supported fixed prosthesis with titanium substructure** for the edentulous mandible (figs 9-11).

Conclusion

The incorporation of **innovative digital technology** facilitates planning and execution of **full-arch implant rehabilitation** and **esthetically-challenging** cases. It also allows for the simplification of clinical and lab steps, while providing high patient satisfaction. **Photogrammetry** technology is a novel approach in accurately digitizing implant positions in full-arch implant rehabilitation.

