

Background

Tooth-supported static computer-aided implant surgery (S-CAIS) has contributed to the high precision of prosthetically driven implant placement compared to bone- and mucosa-supported guides¹. In long distal extension or edentulous areas, implant position accuracy may be reduced due to potential bending and movement of tooth-supported guides². However, bone-supported guides require a large amount of flap reflection and multiple guides to determine fixation pin positions with a mucosa-supported prosthesis (fig 1 a-g). The aim of this presentation is to demonstrate a case of a novel method to design tooth- and bone-supported guides to improve guide stability and surgical procedures.

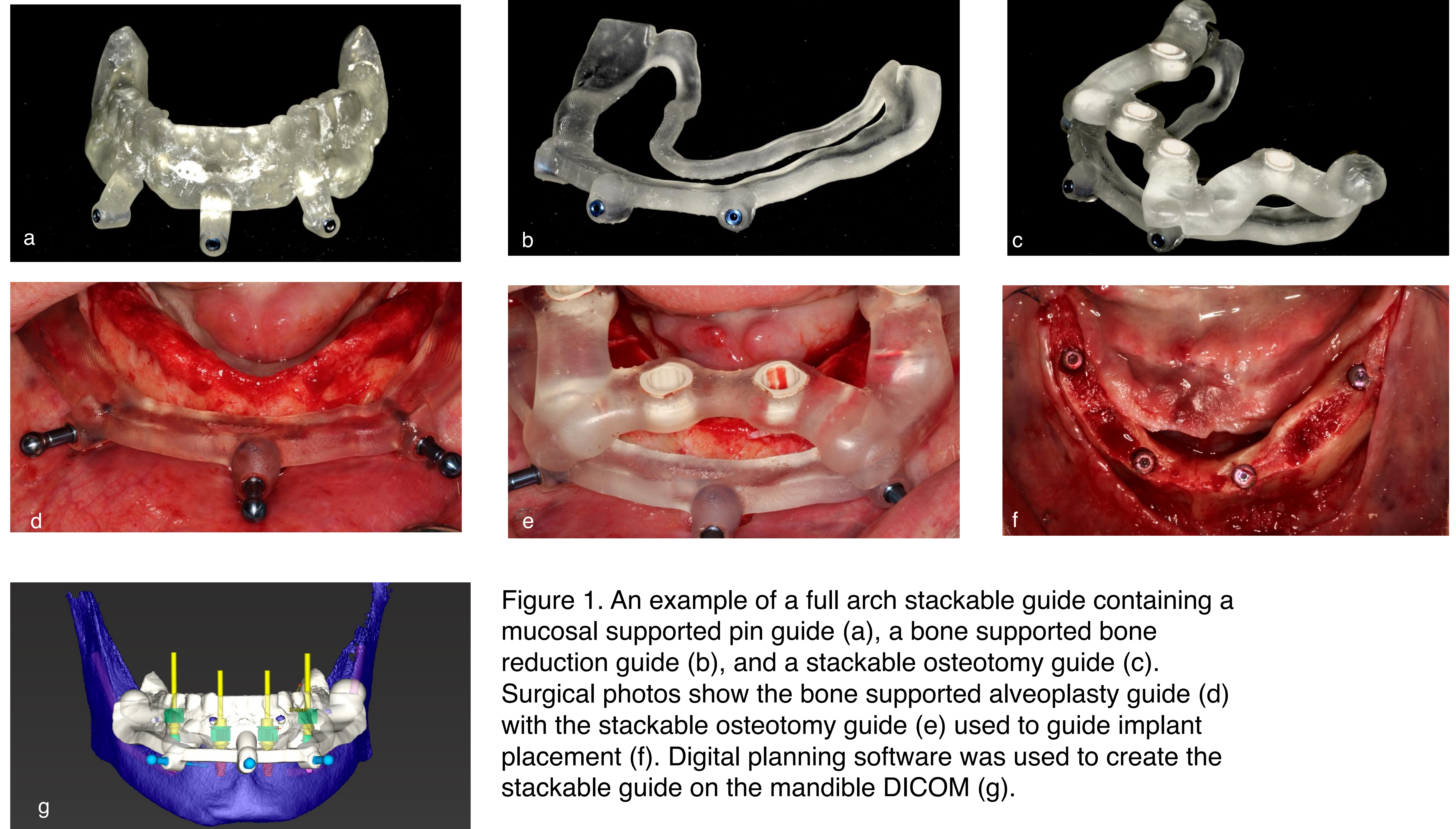


Figure 1. An example of a full arch stackable guide containing a mucosal supported pin guide (a), a bone supported bone reduction guide (b), and a stackable osteotomy guide (c). Surgical photos show the bone supported alveoplasty guide (d) with the stackable osteotomy guide (e) used to guide implant placement (f). Digital planning software was used to create the stackable guide on the mandible DICOM (g).

Materials & Methods

Digital Workup:

A patient presented with an edentulous span from #20-28 with existing teeth and implants in positions #18,19, 29-31. A mandibular full arch DICOM and 3D surface scanner data were imported into an implant planning software and registered in the same coordinate. Implant positions of #20, 23, 26, 28 were determined based on the prosthetic restoration position. Once the implant positions were finalized, the segmentation model of the mandible was combined with a 3D surface scanned model where #20-28 were digitally erased. As DICOM and 3D surface scanner original model has been previously merged, a 3D model was generated with same coordinates (fig. 2). The surgical guide was designed with tooth- and bone-support utilizing the combined model. The surgical guide was then 3D printed and post-processed following the manufacture's protocol (fig. 3).

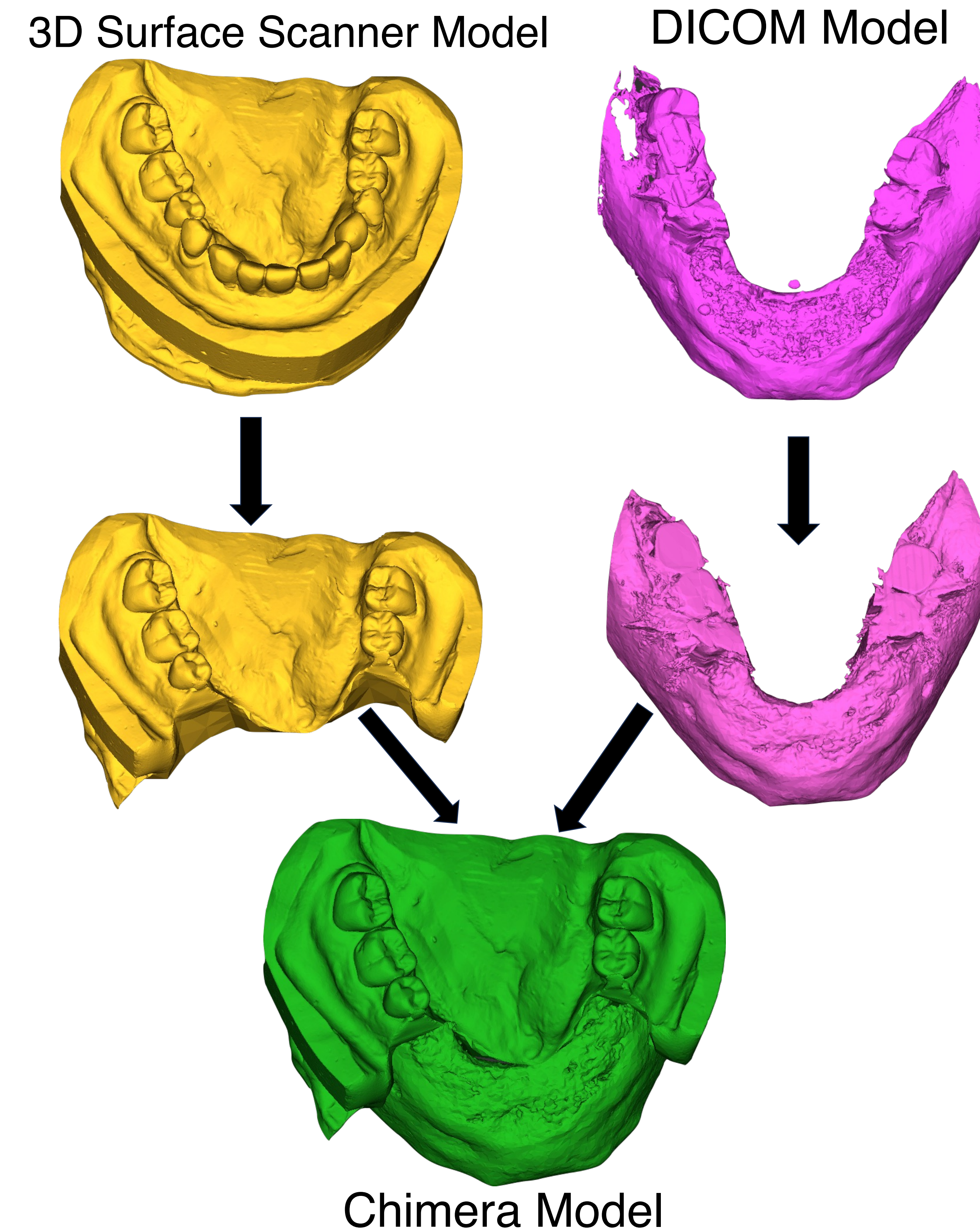


Figure 2. Workflow of creating the chimera 3D model. A 3D surface scan model had #20-28 area erase and was combined with a DICOM model of the mandible to create a 3D mesh

Surgical Guide Design and Printing

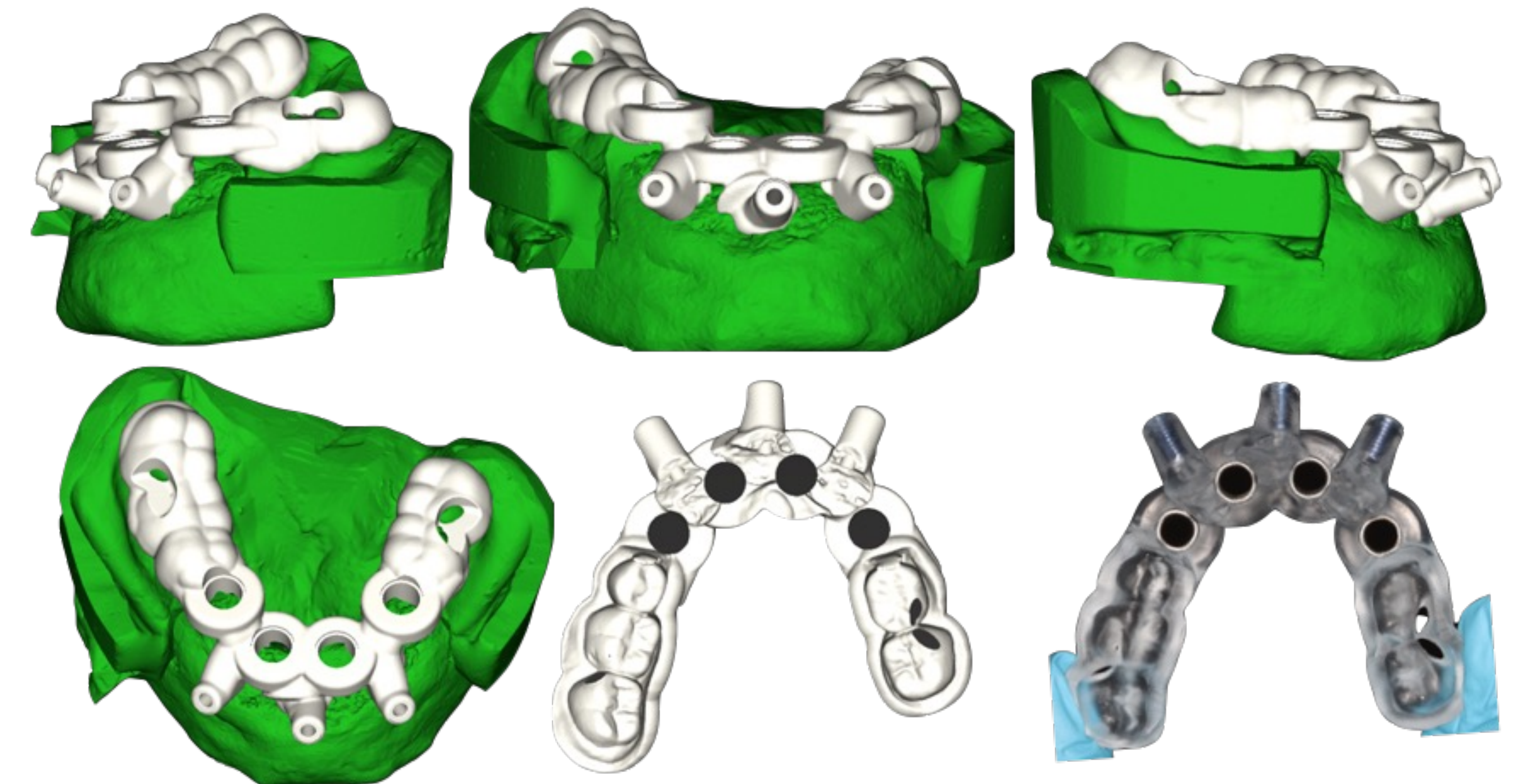


Figure 3. (above) A surgical guide was designed digitally off the combined 3D mesh with tooth and bone support, then 3D printed.

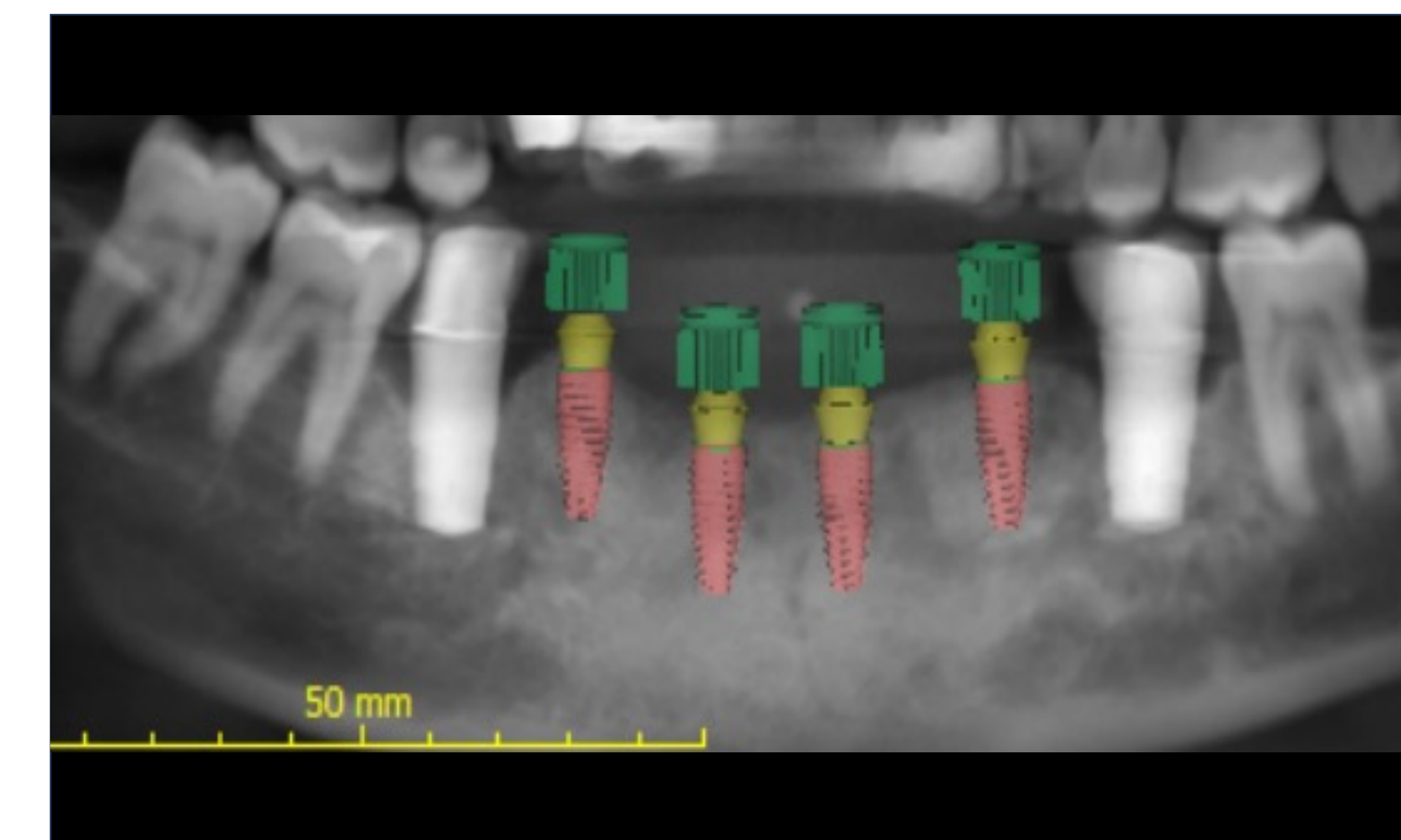


Figure 4. (left) A panoramic view of the planned implant positions.

Materials & Methods

Surgical Procedure:

Intrasulcular incisions were made on #18, 19, 29, 31 and a crestal incision was made from site #20-28. A midline vertical releasing incision was performed. A full thickness mucoperiosteal flap was raised and the static guide was seated on the preexisting teeth and implants, and in the anterior on bone. Seating was verified through the viewing windows on preexisting teeth. The guide was secured with 3 pins. Implants were placed, using the fully guided protocol, in positions #20, 23, 26, 28. Scan bodies were inserted and linked with resin and an intraoral scan was taken. Additionally, an analog impression was taken of scan bodies using a bite registration material. Implants in positions #20 and #26 had mild implant dehiscence and were grafted at the time of placement. Tissues were approximated and primary closure was achieved (fig. 4a-h).

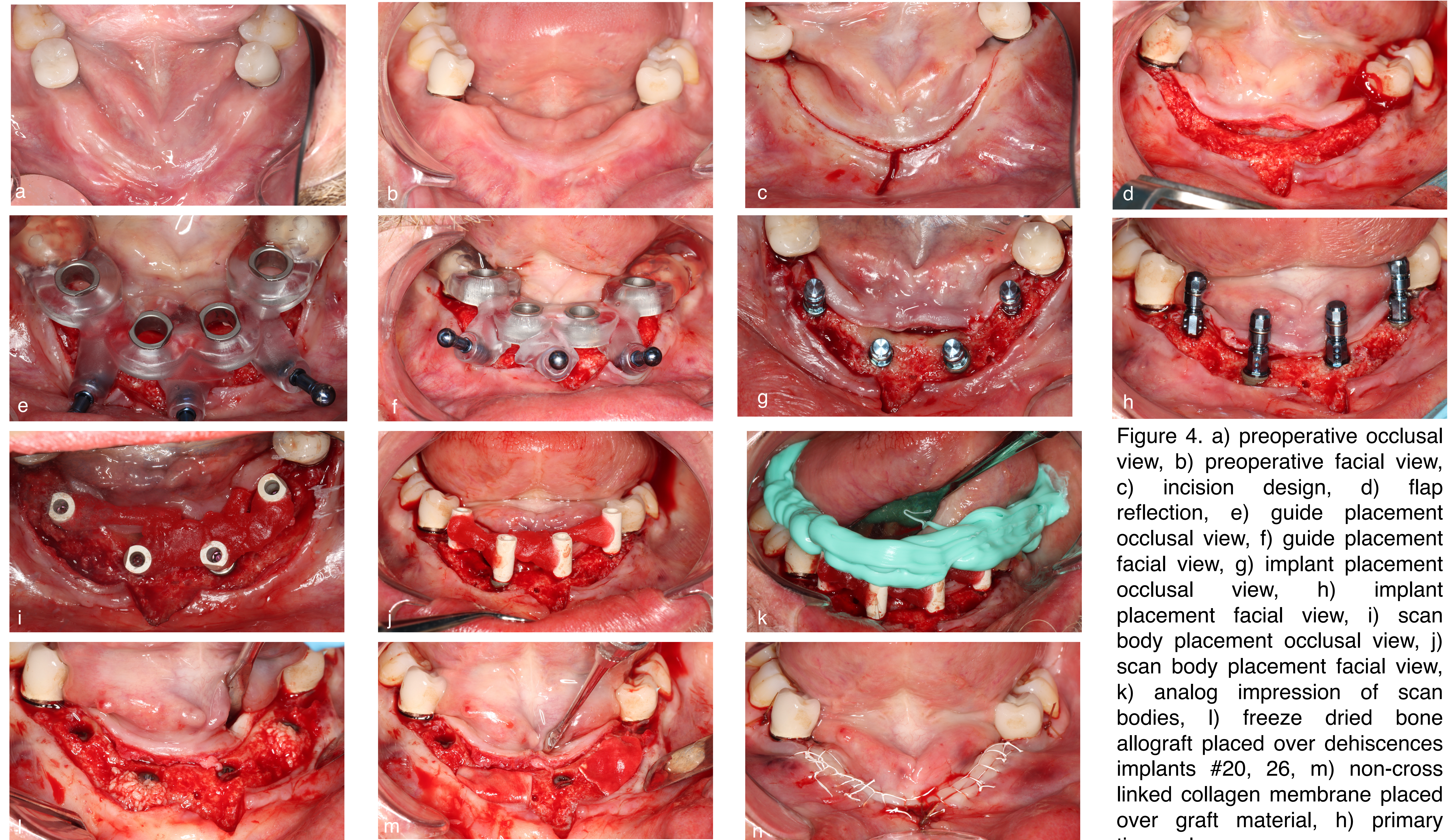


Figure 4. a) preoperative occlusal view, b) preoperative facial view, c) incision design, d) flap reflection, e) guide placement occlusal view, f) guide placement facial view, g) implant placement occlusal view, h) implant placement facial view, i) scan body placement occlusal view, j) scan body placement facial view, k) analog impression of scan bodies, l) freeze dried bone allograft placed over dehiscences implants #20, 26, m) non-cross linked collagen membrane placed over graft material, n) primary tissue closure

Results

The surgical guide did not show any bending or movements due to the adequate support from posterior teeth and anterior bone simultaneously. Upon confirmation of the stability, fixation pins were utilized to stabilize the guide. Implant osteotomies were completed through the guides based on the guided surgical protocol and all implants were placed. The implant positions were located within the alveolar housing and showed appropriate the parallelism. The intraoral scan of the implants with scan bodies was used to create a milled provisional prosthesis, which was successfully delivered at the time of second stage implant exposure (fig. 5a-j).

Conclusion

Within the limitations of this clinical case, the result suggested that the combination of tooth- and bone-supported surgical guides can improve guide the fit and implant positions. More standardized studies will be required to verify the efficacy of this technique.

References

1. Raico Gallardo YN, et al. Accuracy comparison of guided surgery for dental implants according to the tissue of support: a systematic review and meta-analysis. *Clin Oral Implants Res.* 2017 May;28(5):602-612. doi: 10.1111/clr.12841. Epub 2016 Apr 8. PMID: 27062555.
2. El Kholi K, et al. Influence of surgical guide support and implant site location on accuracy of static Computer-Assisted Implant Surgery. *Clin Oral Impl Res.* 2019; 30: 1067–1075. <https://doi.org/10.1111/clr.13520>
3. Rosenfeld AL, et al. Prosthetically directed implant placement using computer software to ensure precise placement and predictable prosthetic outcomes. Part 2: rapid-prototype medical modeling and stereolithographic drilling guides requiring bone exposure. *Int J Periodontics Restorative Dent.* 2006 Aug;26(4):347-53. PMID: 16939016.

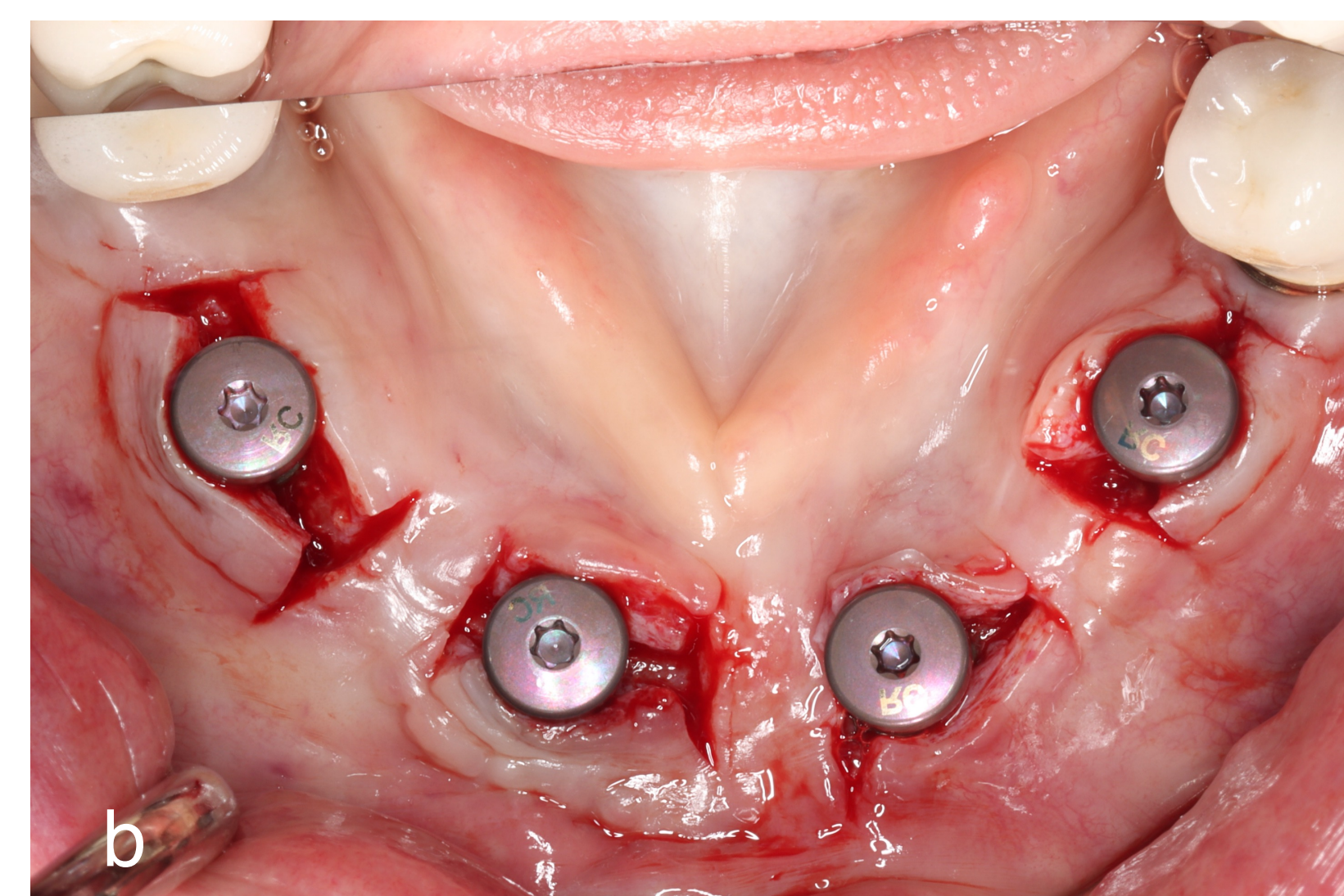
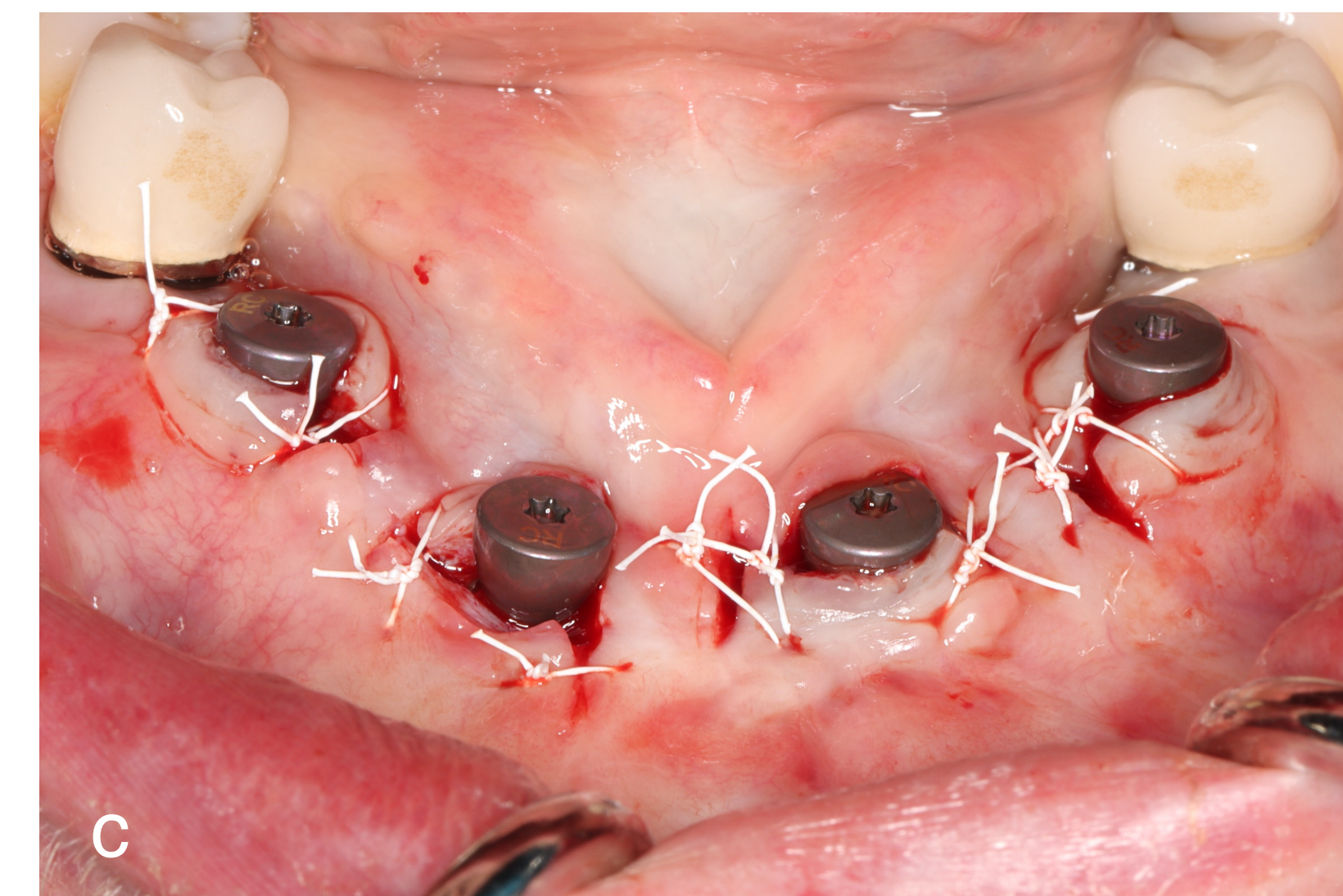
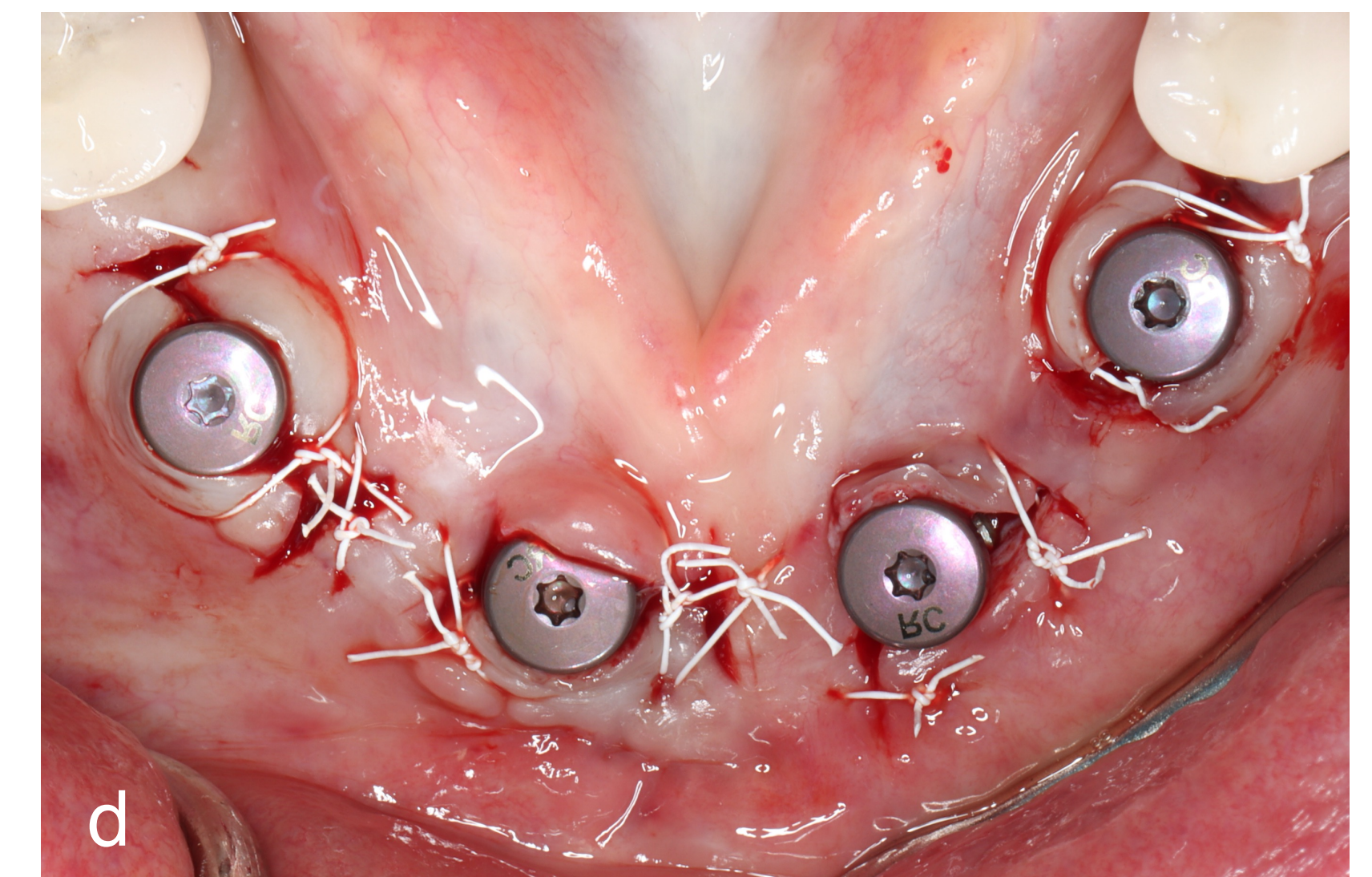
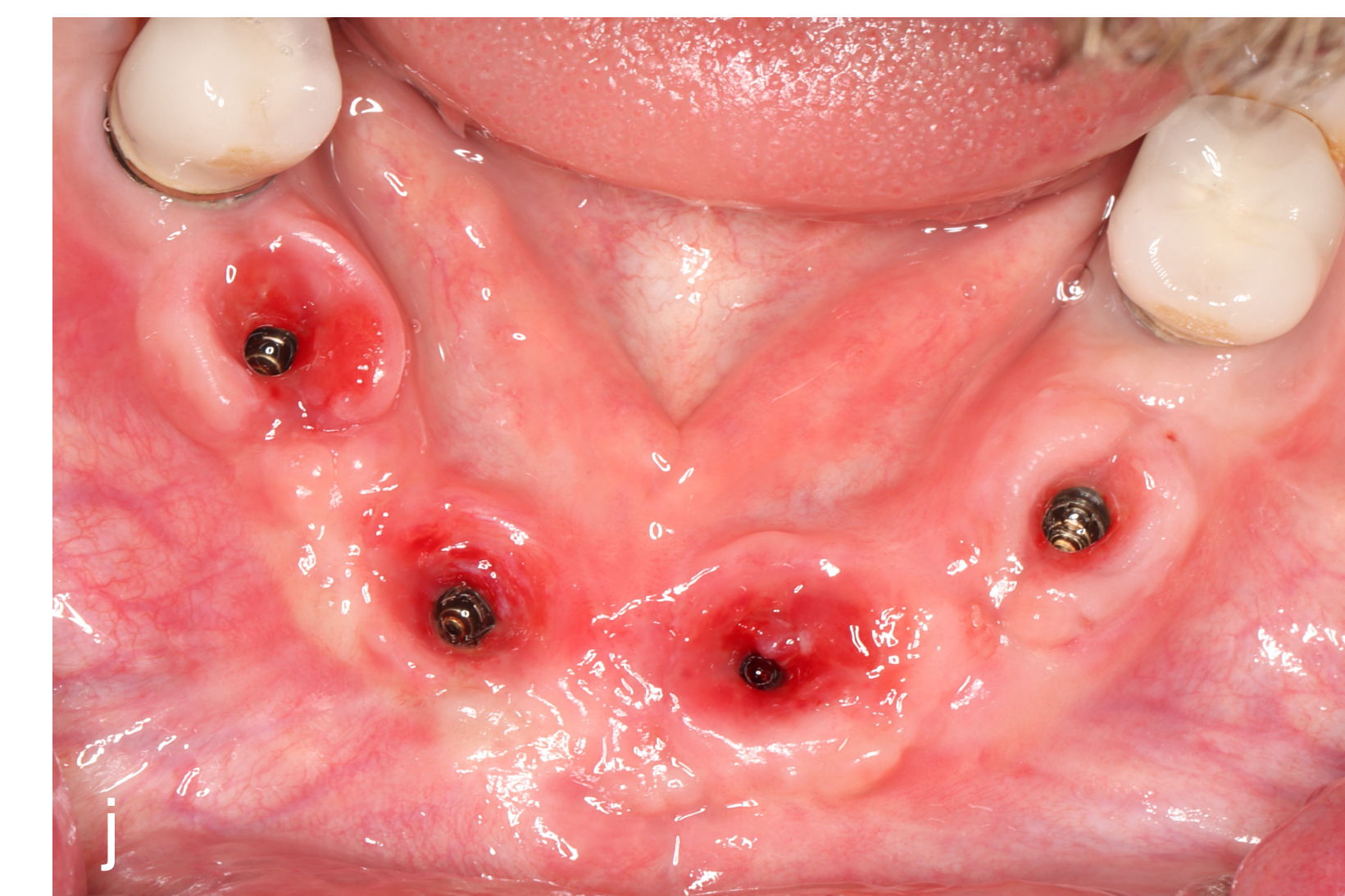


Figure 5. a) 3 month follow up from implant placement, b) incision design for implant exposure with healing abutments in place c) facial view of tissue closure after second stage implant exposure, d) occlusal view of tissue closure after second stage implant exposure, e) right lateral view of provisional implant supported fixed partial denture (FPD), f) left lateral view of provisional implant supported FPD, g) occlusal view of provisional implant supported FPD, h) patient smiling with provisional implant supported FPD, i) facial view of tissue healing 2 weeks after implant exposure, j) occlusal view of tissue healing 2 weeks after implant exposure