



BACKGROUND

The ideal implant supported replacement for an unrestorable tooth should replicate the original tooth's form and function both during in the healing phase and the definitive restoration. Using a custom anatomic healing abutment helps to preserve the natural emergence guiding soft tissue and reducing food accumulation and plaque buildup which can lead to biologic and mechanical complications. This case presentation documents a technique in which a customized temporary healer can be prefabricated prior to implant surgery unlike previously reported post-surgery techniques.

OBJECTIVES

Pre-plan and design a custom healing abutment prosthesis for an immediate implant based on the patient's natural root form by utilizing artificial intelligence (AI)-assisted technologies to promote natural emergence for the final implant prosthesis.

CASE PRESENTATION & TECHNICAL STEPS

A 45-year-old patient presented for consultation for an immediate implant for #29 after root fracture. No significant medical conditions were noted. CBCT and intraoral scans were captured for static computer assisted implant surgery (sCAIS). Prosthetically-driven single immediate implant planning for an ideal placement of a screw-retained restoration in an implant planning software was conducted. AI segmentation of the teeth and mandible resulted in an STL file of #29 in its entirety. The crown of the tooth was virtually sectioned from the rest of the intraoral jaw scan and combined with the root form from the segmented tooth, resulting in an accurate combined crown-root tooth. An abutment which corresponded to the same cuff height and chimney diameter as the temporary coping was chosen from the software's catalog. A boolean difference was performed between the newly created virtual tooth and the abutment with an access-hole-creator, resulting in the final custom healer. The resultant STL file was imported into a 3D-printing software and printed with a temporary crown resin. The result was a custom, prefabricated, healing abutment which could be luted to the temporary coping after guided immediate implant placement.

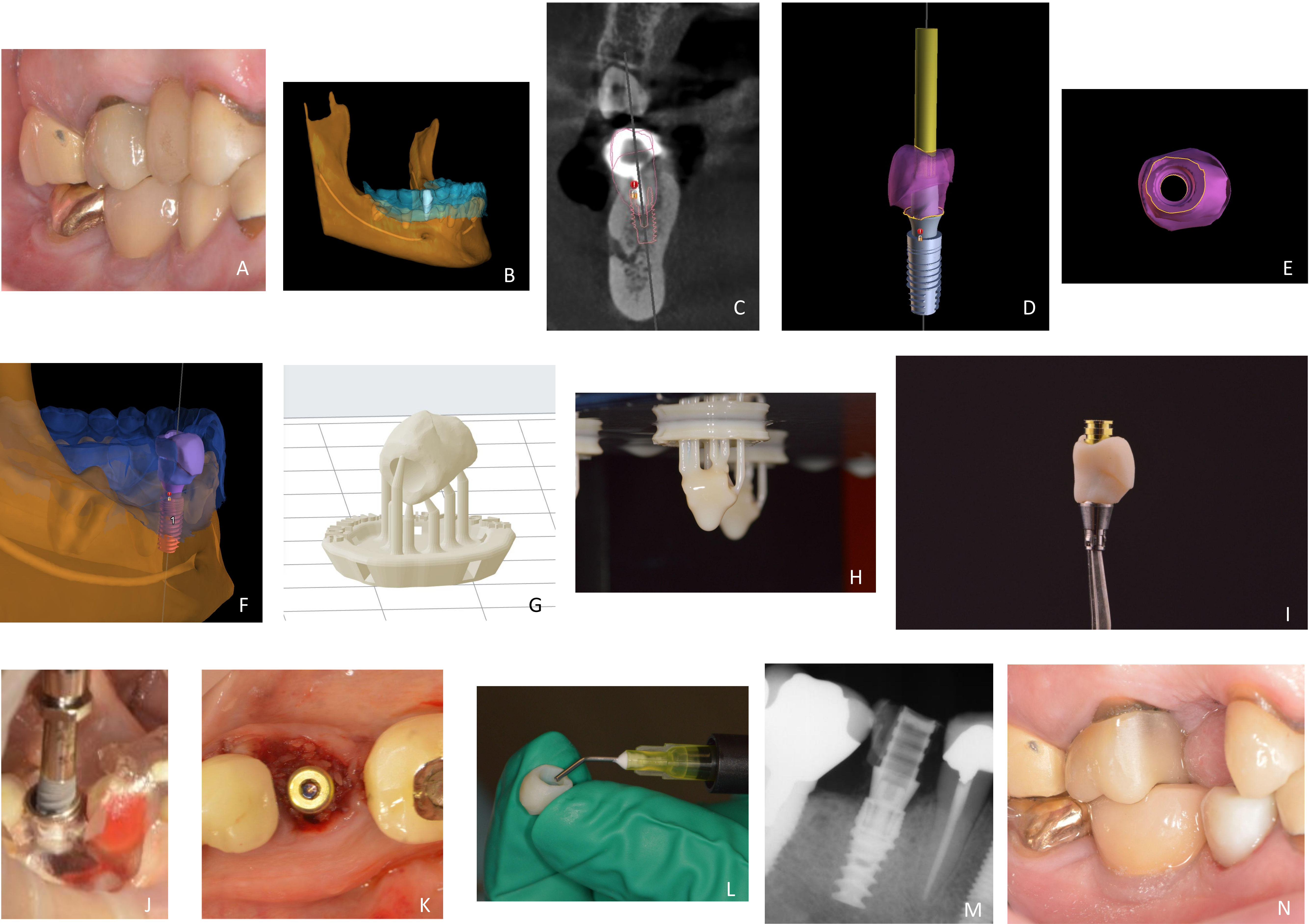


Figure 1. (A) Pre-op photo of #29. (B) Segmented mandible and #29 overlaid by the lower intraoral scan. (C) Implant planning for NobelActive RP 4.3x10mm. (D) Boolean difference between combined crown-root form and temporary abutment, as well as a 4mm access-hole-creator. (E) Apical view of resultant anatomical healer. (F) The anatomic healer virtually in place per the surgical plan. (G) Imported STL file in PreForm for nesting. (H) Printed prosthesis in temporary crown resin prior to post-processing. (I) Anatomic healer seated on the temporary snap coping. (J) Fully-guided, immediate implant placement. (K) Implant in place with buccal gap grafting with 70/30 cortico-cancellous allograft material. (L) Luting of custom healer onto temporary snap coping with light-curable flowable composite. (M) Final radiograph. (N) Final photo of #29 custom healer in place after occlusal adjustments.

DISCUSSION

Pelekanos, et al. discussed the benefits of contouring the transmucosal tissue around an implant and concluded that macrodesign and composition of the anatomical healing abutment or temporary prosthesis used during transmucosal contouring are crucial elements for establishing biologic and prosthetic conditions that minimize early bone remodeling, improve esthetic outcomes, and reduce the possibility for future peri-implant inflammation. The ideal time to promote proper transmucosal anatomic contours is at the time of immediate implant placement due to access of natural emergence profile. Prefabricating a customized healing abutment or temporary prosthesis ahead of the planned surgical appointment can reduce chair time, promote ideal healing, and increase patient acceptance.

CONCLUSION

Custom healing abutments based on a patient's anatomic root-form can be reliably pre-planned and manufactured with the assistance of AI, 3D printing, and other functions in implant planning software.

References

- Bhola, M., L. C. Jacobs and S. Kolhatkar (2015). "Immediate implants for aesthetic success: New guidelines." Journal of the International Clinical Dental Research Organization 7(Suppl 1): S138-S147.
- Bishara, M., G. M. Kurtzman and E. S. Krause (2020). "Implant Restorations: Establishing a Proper Emergence Profile." Compend Contin Educ Dent 41(8): e16-e20.
- Glenn, C. (2024). Making Anatomically Accurate Custom Tissue Formers and Immediate Load Implant Crowns. YouTube.
- Hinds, K. F. (1997). "Custom impression coping for an exact registration of the healed tissue in the esthetic implant restoration." Int J Periodontics Restorative Dent 17(6): 584-591.
- Levine, R. A., D. R. Dias, P. Wang and M. G. Araújo (2022). "Effect of the buccal gap width following immediate implant placement on the buccal bone wall: A retrospective cone-beam computed tomography analysis." Clin Implant Dent Relat Res 24(4): 403-413.
- Pelekanos, S. and I. Vergoullis (2023). "Clinical Advances in Implant Transmucosal Contouring for Single Implant Sites: Prosthetic and Biologic Considerations." Int J Periodontics Restorative Dent 43(3): 301-310.
- Ruales-Carrera, E., P. Pauletto, K. Apaza-Bedoya, C. A. M. Volpato, M. Özcan and C. A. M. Benfatti (2019). "Peri-implant tissue management after immediate implant placement using a customized healing abutment." J Esthet Restor Dent 31(6): 533-541.
- Scutellà, F., T. Weinstein, R. Lazzara and T. Testori (2015). "Buccolingual implant position and vertical abutment finish line geometry: two strictly related factors that may influence the implant esthetic outcome." Implant Dent 24(3): 343-348.