



BACKGROUND

The prosthetically-driven approach to dental implant surgery prioritizes the final restorative outcome, ensuring that implant placement aligns with optimal esthetic, functional, and biomechanical requirements. Guided implant surgery plays a critical role in executing this approach by providing a template for accurate implant placement, minimizing deviations in angulation, depth, and position. Computer-aided implant surgery has proven particularly reliable for single-tooth restorations, where tooth-supported guides offer stable and predictable outcomes. However, challenges arise in free-end situations, such as distal extension edentulous spans, where guided accuracy is lower compared to tooth-borne cases.

OBJECTIVES

This case study evaluates the design, fabrication, and surgical application of a combined tooth-bone supported static computer assisted implant surgery (sCAIS) for use in a free-end edentulous site, focusing on its effectiveness in achieving the prosthetically-driven implant.

CASE PRESENTATION & TECHNICAL STEPS

A 58-year-old patient presented for an implant consultation for tooth #19. Preoperative CBCT and intraoral scans were obtained for sCAIS planning. The case was imported into an implant planning software (Blue Sky Plan), where prosthetically-driven planning was performed to optimize placement for a screw-retained restoration. AI jaw segmentation was employed which generated an STL file of the mandible. A standard sCAIS was designed and, together with the segmented mandible, was exported to a 3D modeling software (Meshmixer). A bone support was precisely and strategically placed to support the distal free-end portion of the guide in addition to the anterior tooth-supported component. The new guide was then 3-D printed and utilized in a fully-guided implant surgery. The combination of both tooth and bone supported components in a single sCAIS guide facilitated precise implant placement for tooth #19, with optimal alignment for the screw-retained restoration, consistent with the preoperative plan. No intraoperative complications, such as guide instability were observed, and the surgical procedure was efficient. Postoperative evaluation confirmed accurate implant positioning and early soft tissue healing, aligning with the planned prosthetic outcome.

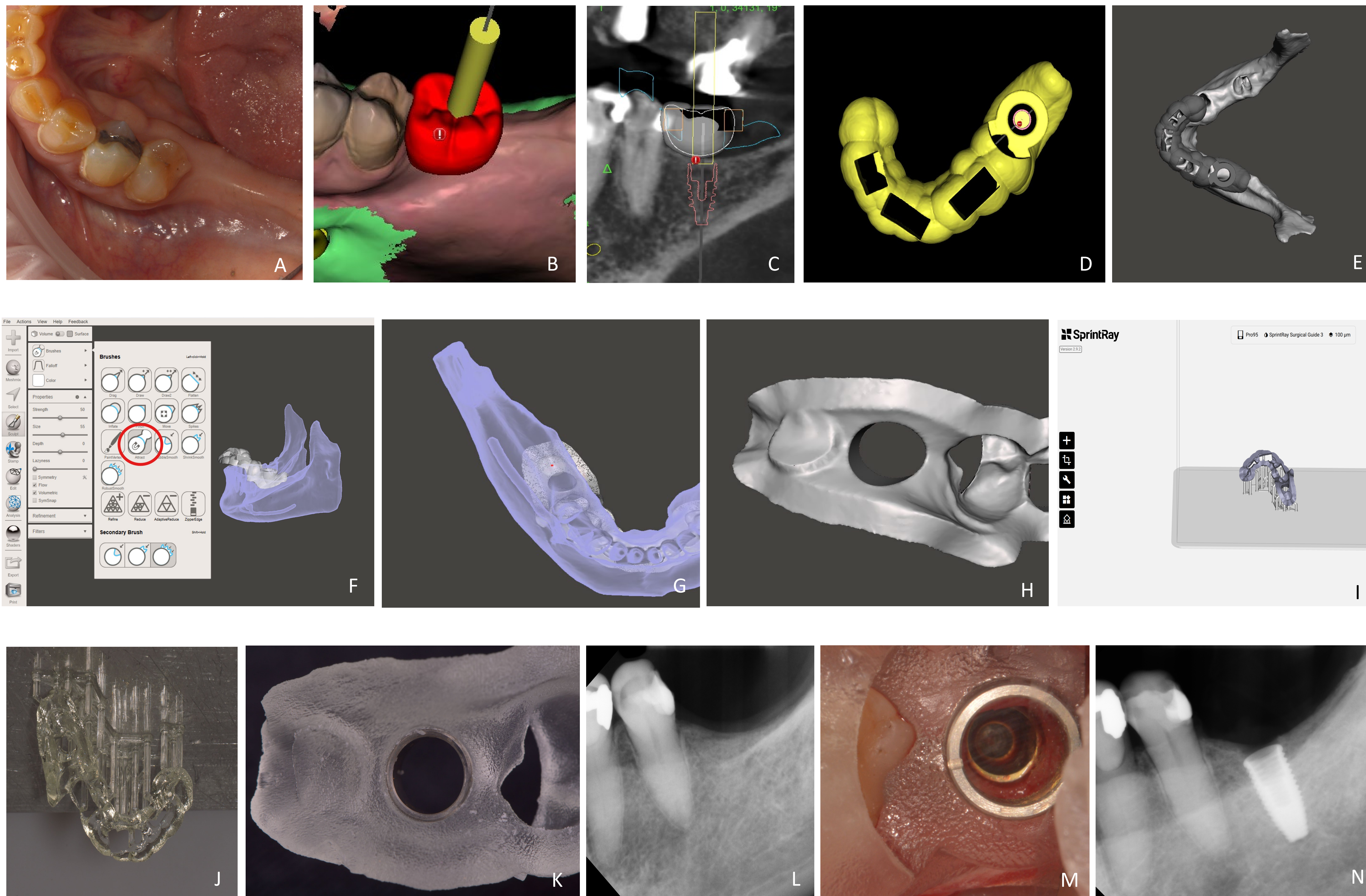


Figure 1. (A) Pre-op photo of #19 site. (B) Digital wax up and implant access plan. (C) Implant planning for NobelParallel RP 4.3x10mm. (D) Implant surgical guide STL. (E) Exported surgical guide and mandible STL in Meshmixer. (F) Adding the bone support by using the “Attract” tool. (G) Designing the support site. (H) Final surgical guide design. (I) Nesting in 3D printing software. (J) 3D printed guide. (K) Intaglio view of tooth-bone supports adjacent to implant site. (M) Pre-op radiograph of #19 surgical site (L) Fully-guided implant placement. (N) Final radiograph of implant placement.

DISCUSSION

The findings of the current case study underscore the potential advantages of using a combination bone and tooth-supported surgical guide in free-end implant cases, aligning with the principles of prosthetically-driven implantology. By replacing the mucosa-supported component with a bone support, the guide achieves greater stability during surgery, addressing the primary limitation of mucosa compressibility observed in tooth-mucosa supported guides. The use of bone supports in the guide design, however, necessitates flap elevation, which introduces additional surgical complexity, including increased operative time, patient discomfort, and potential risks such as tissue trauma or delayed healing. Despite this drawback, the improved accuracy offered by bone-supported anchorage may outweigh these challenges, particularly in free-end cases where traditional tooth-mucosa guides have shown lower accuracy rates.

CONCLUSION

The combined tooth-bone supported sCAIS guide, offers a reliable approach for implant placement in free-end edentulous sites. This method enhances guide stability, ensures prosthetically-driven implant positioning, and supports favorable soft tissue outcomes. Further studies are needed to validate its broader applicability and long-term success.

References

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