Digital workflow with a metal-free surgical guide and zirconia implant

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In recent years, ceramic implants have become an attractive and reliable alternative to titanium implants. With the advancement of digital implant dentistry and increasing use of metal-free surgical guides, there should be reliable guided surgery options available to place such implants.[1–3] There are different kinds of surgical guide designs available in the current market. The ideal guide should be produced defect-free; should offer precision, a perfect fit and high primary stability; and should aid exact reproduction of the planning.[4] Furthermore, the surgical guide should be robust and thus not be affected by transport, storage and sterilisation. In addition, the guide design should allow clear visual inspection and easy irrigation. Finally, the use of this guided system should not lead to an increase in the cost of the operation.[5–8] Companies manufacturing guided systems for dental implant placement offer surgical guides of almost similar design: they are tooth-, mucosa- or bone-supported, and mostly made out of resin, and drilling and implant holes are placed within the body of the guide itself. These drilling holes usually receive metal sleeves of various diameters to guide successive drills.[9,10] In this case report, we used a metal-free fully guided system (2ingis) for the placement


Fig. 1a


Fig. 1b

Figs. 1a & b: Missing tooth #36. **Figs. 2a–d:** Digital planning with SMOP software.


Fig. 2a

Fig. 2b

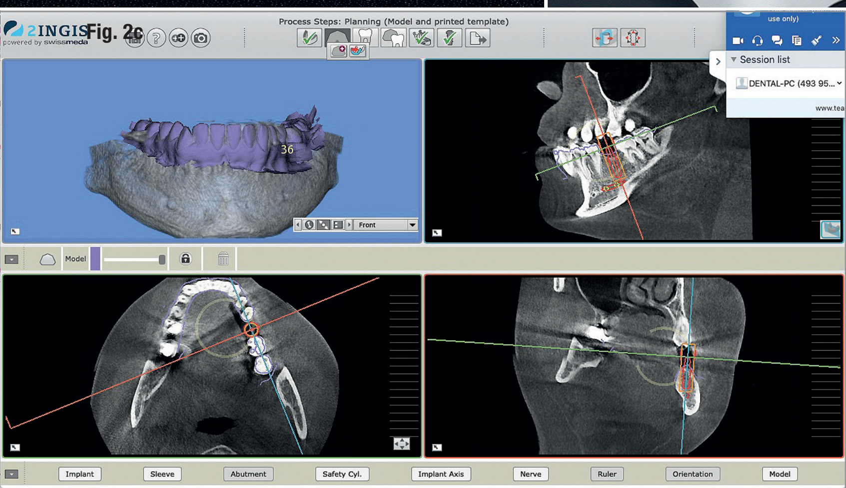
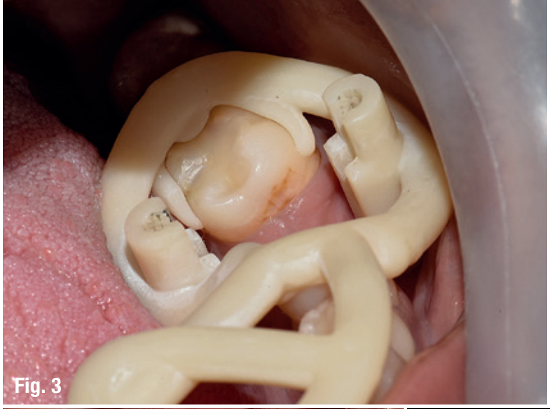
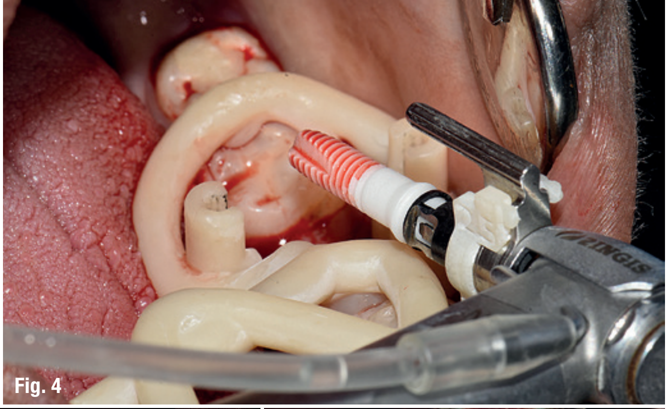
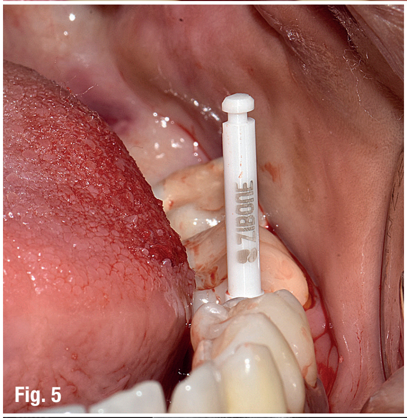


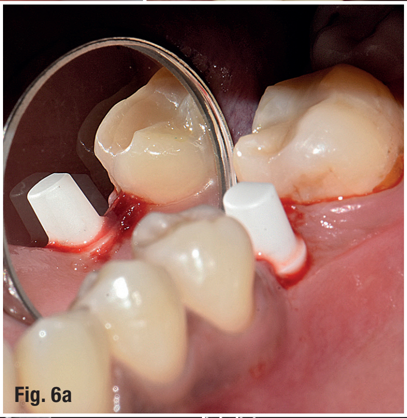
Fig. 2c

Fig. 2d









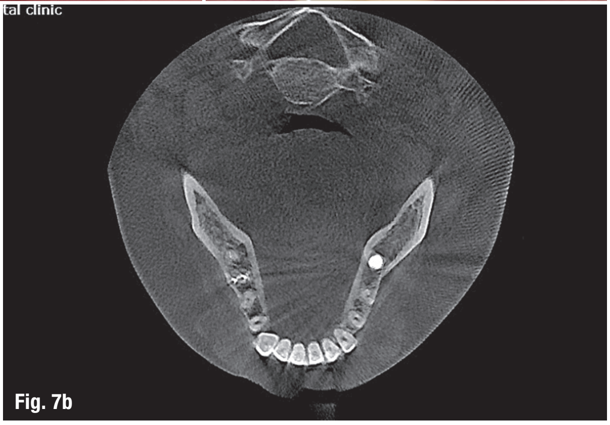


Fig. 3: Stabilisation of guide. **Fig. 4:** Implant placement. **Fig. 5:** Ideal position of implant. **Figs. 6a & b:** Immediately post-op **(a)**; seven days post-op **(b)**. **Figs. 7a & b:** CBCT scan.

of a ZiBone zirconia dental implant (COHO Biomedical Technology) for missing tooth #36 (Figs. 1a & b).

Planning phase

The manufacturing of the surgical guide was done using CAD/CAM technology. The design of the guide was first worked out on a computer with CAD software (SMOP, Swissmeda) after the DICOM and STL files had been uploaded (Figs. 2a–d). Guide stability by dental supports was sought preferentially. Finally, the surgical guide was printed in try-in resin using a NextDent 3D printer (3D Systems).

Surgical phase

During the surgical phase, flapless surgery was performed and the specific surgical kit (2ingis) was used along with the instruction manual provided. It included a contra-angle handpiece (W&H) with guide forks of different lengths (depending on the patient's mouth opening, the edentulous span and the depth of drilling). It also has depth wedges, a ring with two arms (to be inserted into the guide tubes in the same way as for the drilling guide fork) to guide the implant holder during manual placement of the implant, a metal trephine to cut the gingival tissue, and zirconia drills which allow flattening of the bone crest and performing of the initial drilling (pilot drill), respectively. Zirconia drills were then used for the rest of the drilling sequence, using depth wedges when necessary. The instruction manual was followed, which listed the drills needed throughout the surgery phase. With the surgical guide remaining in place, the implant was placed with the contra-angle handpiece in the planned site with good primary stability, and the desired torque of 35 Ncm was achieved (Figs. 4–6b).

Prosthetic phase

The provisional restoration was prepared and fixed soon after intra-oral scanning (TRIOS, 3Shape) of the abutment part of the zirconia implant (Fig. 8). The crown was

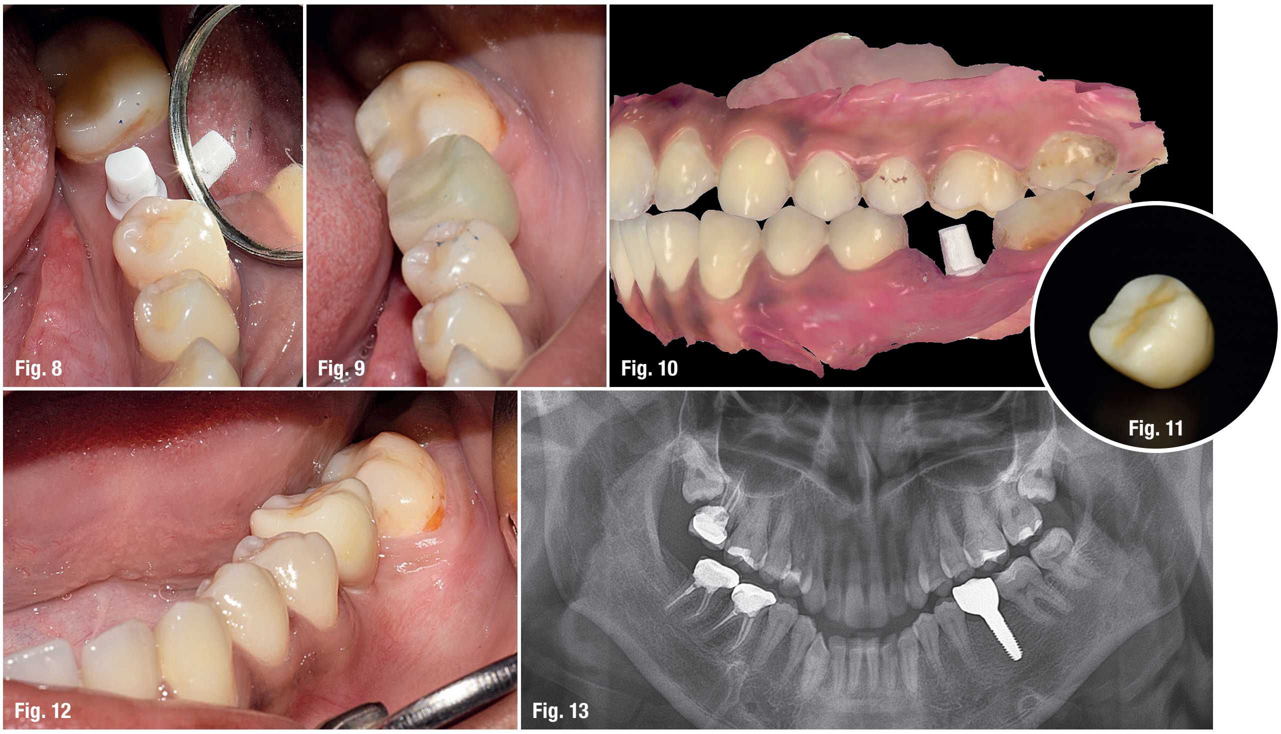


Fig. 8: Provisional restoration. **Fig. 9:** Twelve weeks post-op. **Fig. 10:** Intra-oral scan. **Fig. 11:** Monolithic crown. **Fig. 12:** Final crown *in situ*. **Fig. 13:** Final radiograph.

kept out of occlusion, and strict instructions were given to the patient. The osseointegration process was successful, and the implant was planned for restoration using a permanent monolithic zirconia crown (3M) after 12 weeks (Fig. 9). The TRIOS intra-oral optical scan was retaken with the provisional restoration seated (Fig. 10). The final monolithic crown was then designed, milled and prepared according to a completely digital workflow (Fig. 11). The crown's intaglio surface and the implant's abutment surface were cleaned and primed with a coating of Z-Prime Plus (BISCO) and was later cemented with a self-adhesive resin cement (3M ESPE). Extra cement was carefully removed using dental floss soon after the final crown had been cemented. The occlusion of the crown was checked with articulating paper. The patient was well satisfied with the treatment procedure with respect to both form and function (Figs. 12 & 13).

Conclusion

In conclusion, the metal-free surgical guide stands out from other guided systems and appears to be a significant advancement in the field of guided implant surgery. In this case report, the wide-open design of this guide allowed unrestricted irrigation and visual control under conditions comparable to those of surgeries performed without surgical guides. There was no friction of the zirconia drills on the surgical guide, which would have damaged it or contaminated the drilling hole with sleeve particles torn from the guide. This metal-free guided system seems to be ideal for placement of zirconia dental implants.

Literature

about the author

Dr Saurabh Gupta is an oral and maxillofacial surgeon from India. He is a private practitioner working as Clinical Director at the Digital Dental Design Clinic & DVG's lab (3M authorized) in India. He is Education Director/Board Member of the International Academy of Ceramic Implantology (IAOCI) and part of the Zirconia Implant Research Group (ZIRG) in the US. In addition, he is a fellow and an ambassador for the Clean Implant Foundation in Germany. At present, he is involved in many research studies on zirconia implant materials and digital dentistry.

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