

Stackable guides for the immediate restoration of dental implants

Benefits of the digital process chain

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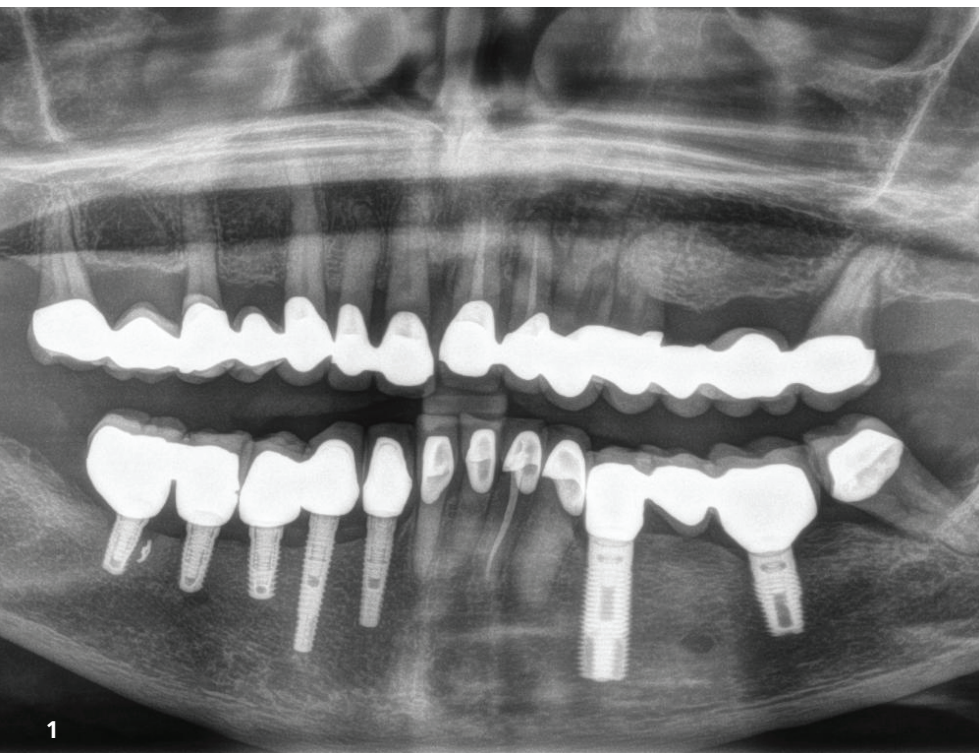
Stackable guides—multi-part surgical guides—translate the benefits of the digital process chain into efficiency and reproducibility when inserting implants, even in complex situations such as immediate implant placement and immediate restoration.

Guided implant placement combined with 3D diagnostics and the superimposition of intra-oral scan data has made significant advances over the past few decades.^{4,8} While in the early days of using surgical guides, the aim was to achieve better implant positions for the subsequent prosthetic restoration, in recent years more minimally invasive surgical techniques

have been developed and the dental procedures for immediate restorations have been optimised.^{5,16} One innovative method that is becoming increasingly important is the use of stackable guides (multi-part surgical guides) for immediate restorations. They ensure that implants can be placed in a guided manner and that the prepared prosthetic restoration can be accu-

rately fixed using reference points.⁶ Thanks to the multi-part approach, the surgical guides remain securely in place during the immediate restoration—something that is not always possible after tooth extraction, as extractions invariably change the clinical situation.¹ This technique offers many advantages in terms of precision, efficiency and patient comfort.

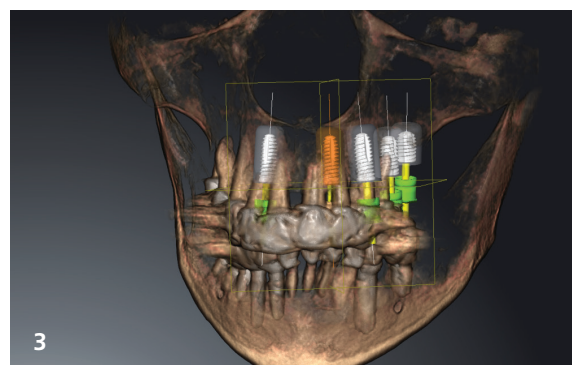
Preoperative diagnostics



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Fig. 1: Initial diagnosis using panoramic radiograph (Orthophos, Dentsply Sirona). Loosened bridge 21–27. **Fig. 2:** Intra-oral scan (iTero, Align Technology) after removal of tooth 27. **Fig. 3:** CBCT with initial implant planning (SICAT 2.3, SICAT).

What is a stackable guide?

A stackable guide is a specially fabricated, multi-part guide that is created for guided implant placement based on a three-dimensional radiological data set, a digital scan of the jaw and a digital reconstruction of the intended prosthetic restoration. The individual parts of the guide are stacked on top of each other, hence the term "stackable guide".⁶ Each part of the guide has a specific function at various stages of the procedure.

How to use stackable guides

Due to the complexity of designing stackable guides, thorough preliminary implant planning is essential. This process requires a detailed analysis of both the available bone structure and the desired prosthetic outcome. Once the anatomical and prosthetic requirements for immediate restoration are met, the radiological data is exported in DICOM format. Simultaneously, the intra-oral scan and prosthetic design generated by the CAD/CAM system are exported in STL format for direct import into the implant planning software.

In addition to the precise implant positioning based on anatomical and prosthetic criteria, the basal guide design is determined. This guide is then attached to the alveolar ridge with fixation screws, known as anchor pins.^{7,13}

- The basal guide is designed to prevent interference or collisions with instruments during tooth extraction. The basal guide is equipped with at least three pegs, which ensure proper alignment and positioning of subsequent guides in the stackable system. For precise positioning of the basal guide, an additional guide is created to rest on the teeth scheduled for extraction.
- This positioning guide provides the basis for accurate placement of subsequent guides and helps secure the temporary restoration.
- The static drilling guide, which defines the exact positions of the drill sleeves, is designed based on the implant plan.

Planning and design of the stackable guide

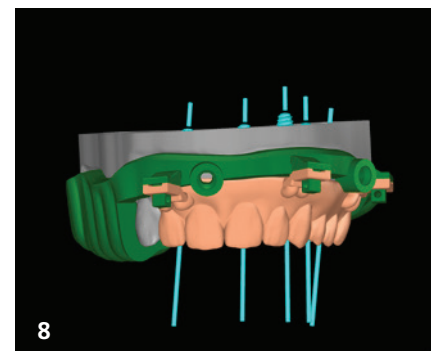
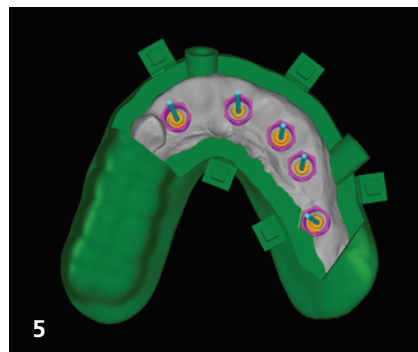
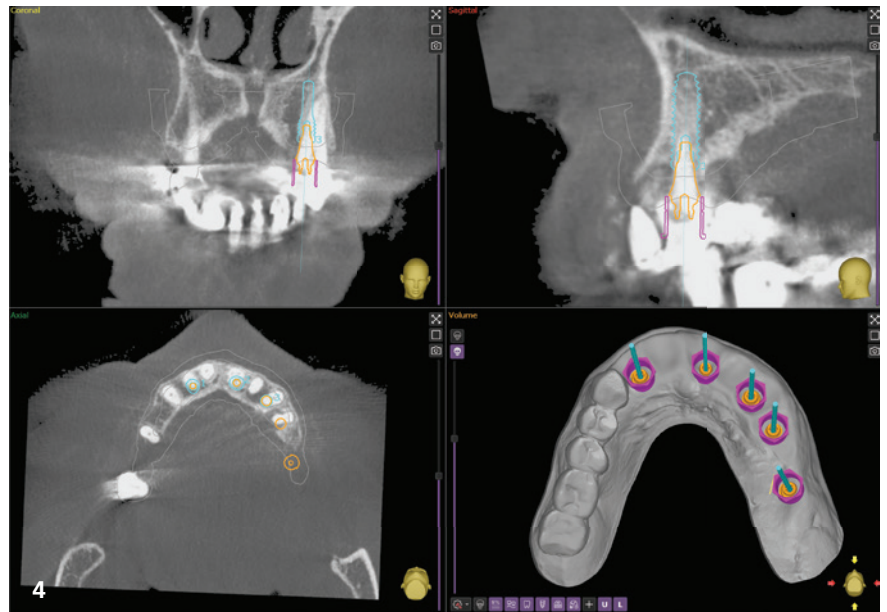


Fig. 4: Definitive implant planning following the decision to use a stackable guide. **Fig. 5:** Design of the basal guide after defining implant positions (ImplaStation, ProDigiDent). **Fig. 6:** Design of the positioning guide for the basal template. **Fig. 7:** Design of the drilling guide holding the primary sleeves. **Fig. 8:** Design of the temporary restoration with fixation on the basal template.

The positions of the fixation screws must be carefully checked to ensure that they do not interfere with the planned implant positions. In the final design step, the STL data set is overlaid onto the prosthetic res-

toration design, and the guiding elements are added to complete the guide structure. The stackable guide thus consists of three parts and an immediate temporary restoration. The four corresponding data

Fabrication of the stackable guide

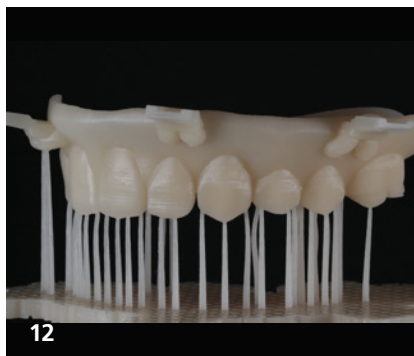
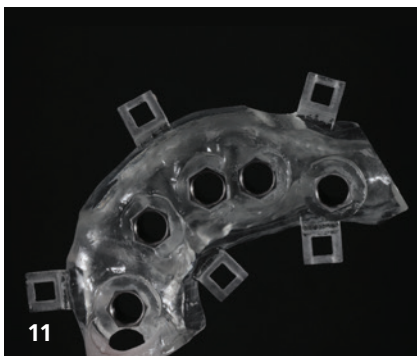
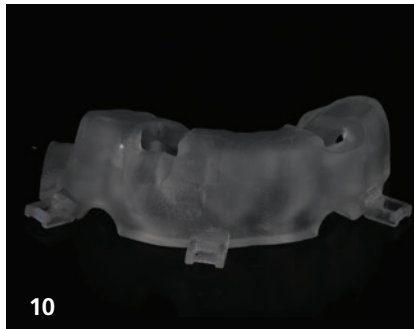
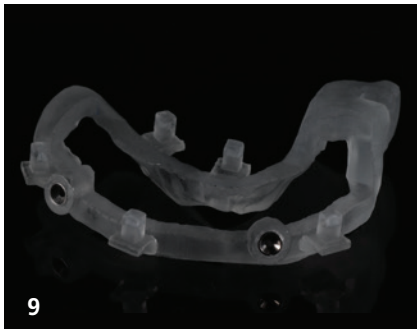


Fig. 9: Basal guide milled from PMMA with drill sleeves for fixation pins (SKY pro guide, bredent medical).

Fig. 10: Positioning guide with openings for position control on the teeth scheduled to be extracted.

Fig. 11: Drilling guide with primary sleeves (SKY pro guide, bredent medical) for the selected implant system. **Fig. 12:** 3D-printed temporary restoration before removal of the supporting structures.

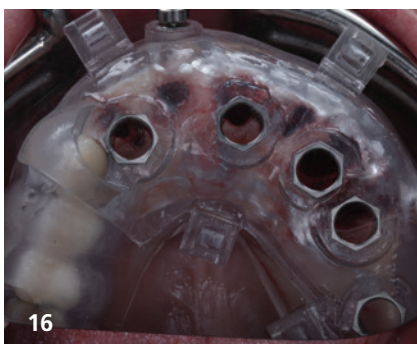
sets are exported from the planning program as STL data and can be printed or milled, depending on the material selected.

Strict adherence to the specified sequence of application of the stackable guides is crucial for successful implementation.⁷ As tooth extraction is often necessary, only the basal and intermediate guides can be tried in first. If the positioning guide can be placed accurately, the basal guide can be secured in place with the anchor pins.

When the positioning guide has been removed, any teeth or existing restorations scheduled for extraction can be addressed. Next, the static navigation guide is inserted, and the implant beds are prepared using the appropriate implant system instrumentation.

Once the implants are accurately positioned, the navigation guide is removed, and the abutments are placed to accommodate the prepared prosthetic restoration. The temporary restoration is placed on the basal template, and the titanium cylinders are cemented to secure the restoration.

Clinical application



Finally, the anchor pins of the basal splint are removed, and the retaining screws of the titanium cylinders are loosened so that the temporary restoration can be finalised. Once osseointegration is complete, the final prosthetic restoration can be fabricated and placed.

Advantages of stackable guides

Stackable guides provide a precise, guided approach to implant placement, ensuring that implants are positioned with close attention to prosthetic requirements.⁴ This precision reduces the risk of implant misplacement and complications, particularly during the final prosthetic restoration, by ensuring that the implants are correctly aligned from the outset.^{11,12}

Early loading of the implants promotes intensive and early bone remodelling, sig-

nificantly improving the quality of osseointegration.¹⁰ By placing the implants according to prosthetic requirements, abutments can be accurately preselected, simplifying intraoperative logistics and reducing the need for later adjustments. This allows optimal use of the one-abutment-one-time concept, which contributes to long-term stable bone levels by minimising repeated interventions at the implant site.¹⁵

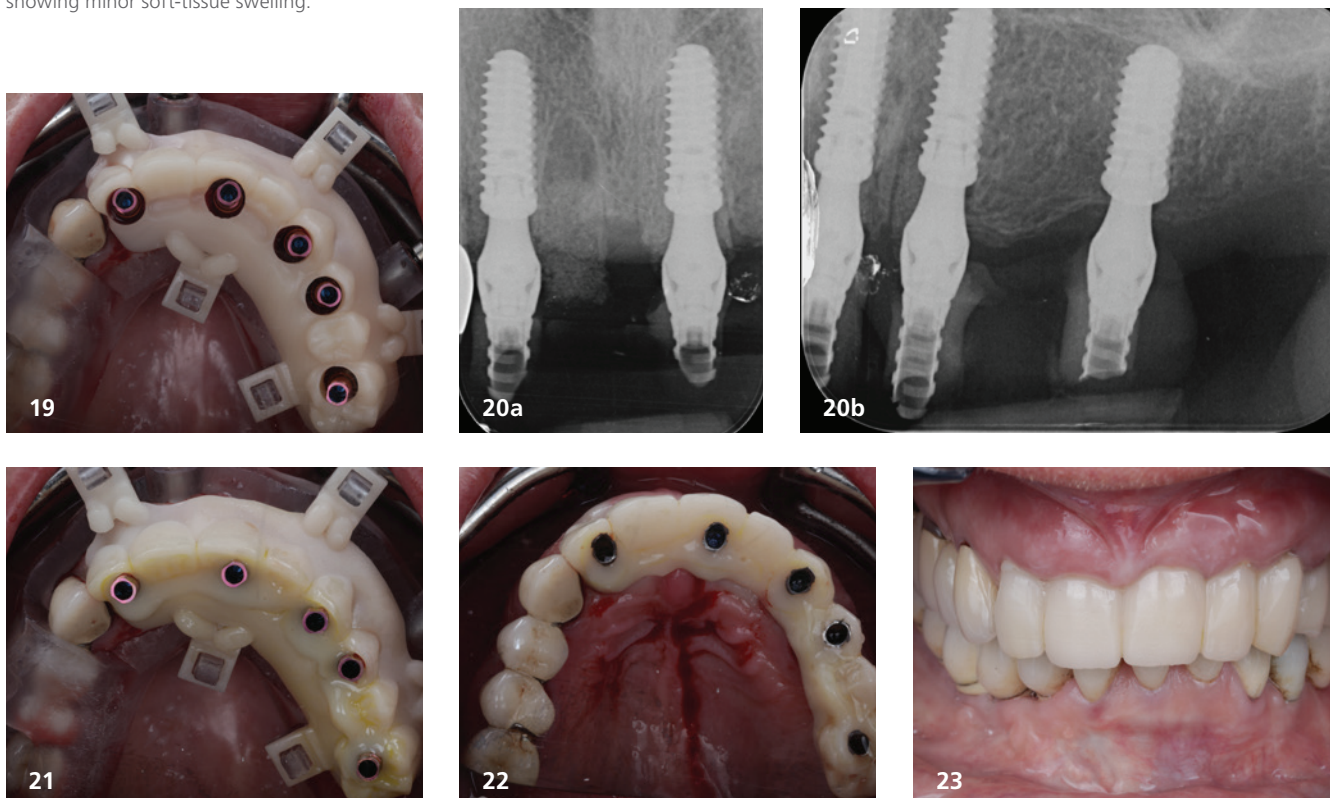
Moreover, by predetermining implant positions through meticulous guide planning, the overall surgery time is significantly reduced, as no intraoperative adjustments are required.¹⁴ This efficiency is particularly beneficial for the placement of temporary restorations, which, without stackable guides, would depend on rough anatomical landmarks and typically yield less accurate results.

Stackable guides also eliminate the need for bite position corrections, as the temporary restoration is incorporated without deviations, improving patient comfort and accuracy. This reduces the burden on both the patient and the dental professional by eliminating the need for time-consuming dental adjustments at the end of the procedure. As a result, an ideal aesthetic and functional outcome can be achieved immediately after surgery.¹⁶

Disadvantages and challenges

While stackable guides offer numerous advantages, it's crucial to acknowledge the associated disadvantages, particularly the considerable time, expertise, and resources required for planning and production. Creating these guides involves using specialised software, and one should

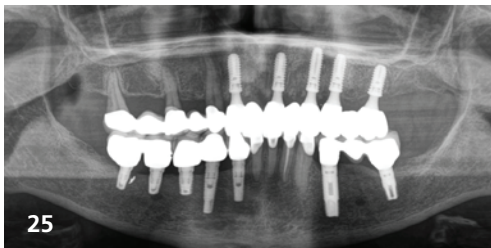
Fig. 13: Initial situation with a non-salvageable restoration 12-25. **Fig. 14:** Placing the positioning guide with the basal template. **Fig. 15:** Basal guide with fixation pins in place after tooth extraction. **Fig. 16:** Secured drilling guide for guided implant placement (SKY pro guide, bredent medical). **Fig. 17:** Guided implant placement using the drilling guide (copaSKY, bredent medical). **Fig. 18:** Abutments with titanium cylinders to hold the temporary restoration. **Fig. 19:** Precisely positioned temporary restoration before bonding the titanium cylinders. **Fig. 20:** Temporary restoration cemented in place with the basal guide. **Fig. 21:** Finished temporary restoration at the end of the procedure, following removal of the basal guide. **Figs. 22a & b:** Radiographic control showing subcrestally placed implants with the bridge abutments (copaSKY, bredent medical). **Fig. 23:** Checking the restoration on the first postoperative day, showing minor soft-tissue swelling.



Definitive prosthesis



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Fig.24: Preparation of the final intra-oral scan with scan bodies at abutment level. **Figs.25:** Radiographic control of the mock-up during the prosthetic phase. **Fig.26:** Definitive restoration. Analogous shaping of the soft tissue and bridge pontics.

not underestimate the learning curve associated with mastering such tools.⁹

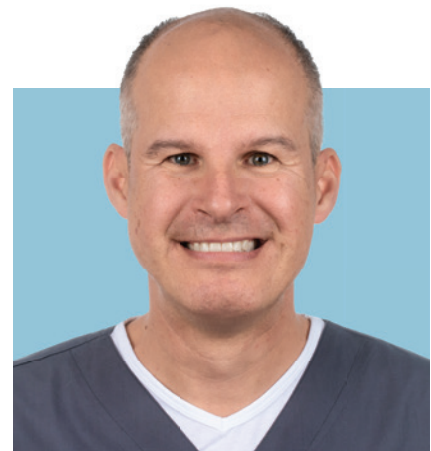
In practices without the necessary in-house expertise, these tasks can be outsourced to specialised laboratories. Harnessing the benefits of stackable guides requires strict adherence to a specified procedural sequence. Deviations from the sequence could limit the effectiveness of the guides. In terms of material selection and guide connections, magnets or metal basal templates are recommended over plastic pins.^{2,3}

However, intraoperatively, magnets have shown limited fixation strength, which increases the risk of subsequent templates becoming loose during surgery. While metal basal guides offer superior stability, their fabrication is complex and resource-intensive. In most cases, a carefully produced 3D-printed basal template offers sufficient stability for the procedure.

Conclusion

Stackable guides represent a significant innovation in immediate implant placement with immediate restoration. They provide significant advantages in terms of precision, efficiency, and patient comfort,

though they also come with challenges, particularly regarding costs and technological demands. The integration of stackable guides into the first 3D planning programs has simplified their application and reduced the planning effort. However, the learning curve associated with their use should not be overlooked. With proper preparation, stackable guides significantly reduce treatment time, particularly for fitting the temporary restoration in full-arch immediate restorations, making this protocol increasingly favoured.



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References



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