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Vincent Fehmer, MDT
Editor-in-Chief

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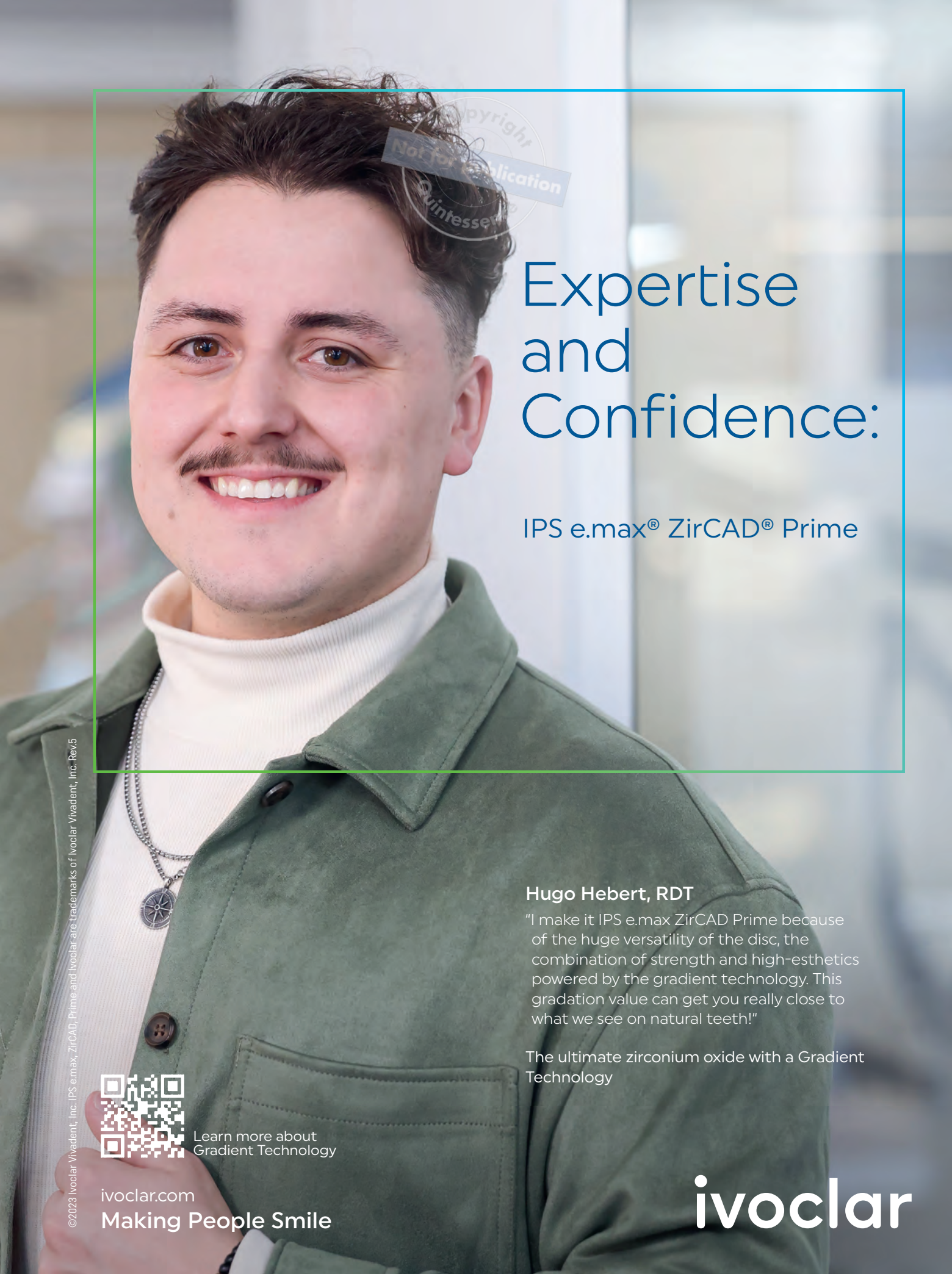

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QDT 2024

QUINTESSENCE OF DENTAL TECHNOLOGY
Volume 46

Editorial:
Nurturing Excellence in Dental Technology

Dear Reader,

As we dive into the 46th volume of *Quintessence of Dental Technology* (QDT), I find myself humbled by the unwavering trust and support from you and from our restorative teams providing nothing but outstanding clinical excellence and documentation. You are the driving force behind our commitment to push boundaries in the field of dental technology. Thank you for inspiring us to keep going!

In this volume, we again have the privilege of featuring contributions from some of the best restorative teams in our domain. This issue is particularly special, as we showcase complex cases and focus on how digital technologies can help to simplify treatment. The contributing authors are committed to breaking down these complex cases into step-by-step documentation so readers can understand the intricate procedures. Moreover, we emphasize the pivotal role of proper diagnosis and documentation—the cornerstone of successful dental treatment. The ability to create a comprehensive picture of a patient's oral health is an art that, when perfected, leads to informed decisions and patient satisfaction.

In our relentless pursuit of excellence, we have witnessed the transformative power of modern technology. It is not merely a tool to be more efficient and avoid technical complications; it is the key to delivering predictable and accurate treatment outcomes. However, in today's world, we must also strive to ensure that these outcomes are affordable for the general population.

As we venture together into this 46th volume of QDT, I am excited to share with you the latest advancements and insights in the world of dental technology. Together, we will continue to nurture excellence, foster innovation, and make a positive impact on the lives of our patients.

Thank you for your continued trust in QDT. Stay curious, and always be inspired.

Sincerely,

Vincent Fehmer

Image courtesy of Luis Quintero, DDS, runner-up in our QDT 2024 cover contest.

Full-Arch Implant-Supported Zirconia Bridge:

Digital Tools for Planning, Guided Surgery, and Prosthetics

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Restoring the teeth of patients who have lost their natural teeth or whose existing teeth are severely damaged is a complex and lengthy process. Thankfully, modern technologies and tools have made it easier to speed up specific processes and reduce the number of visits required. However, it is important to find a balance between minimizing patient visits and allowing enough time for proper healing and stabilization of soft and hard tissue. In this article, we outline the stages and tools used in our clinic to ensure the highest standard of dental care for our patients.

Prosthetically driven planning refers to an approach wherein the desired final prosthesis should be the inspiration source for surgical planning and implant placement rather than vice versa (Figs 1 to 4). Implant treatment can be especially useful in treating edentulous patients not only to replace missing teeth but also to restore function, esthetics, and speech.

Here are the steps involved in providing prosthetically driven planning of immediately loaded implants with screw-retained full-mouth bridges to edentulous patients or those with terminal dentition who require immediate implant loading.

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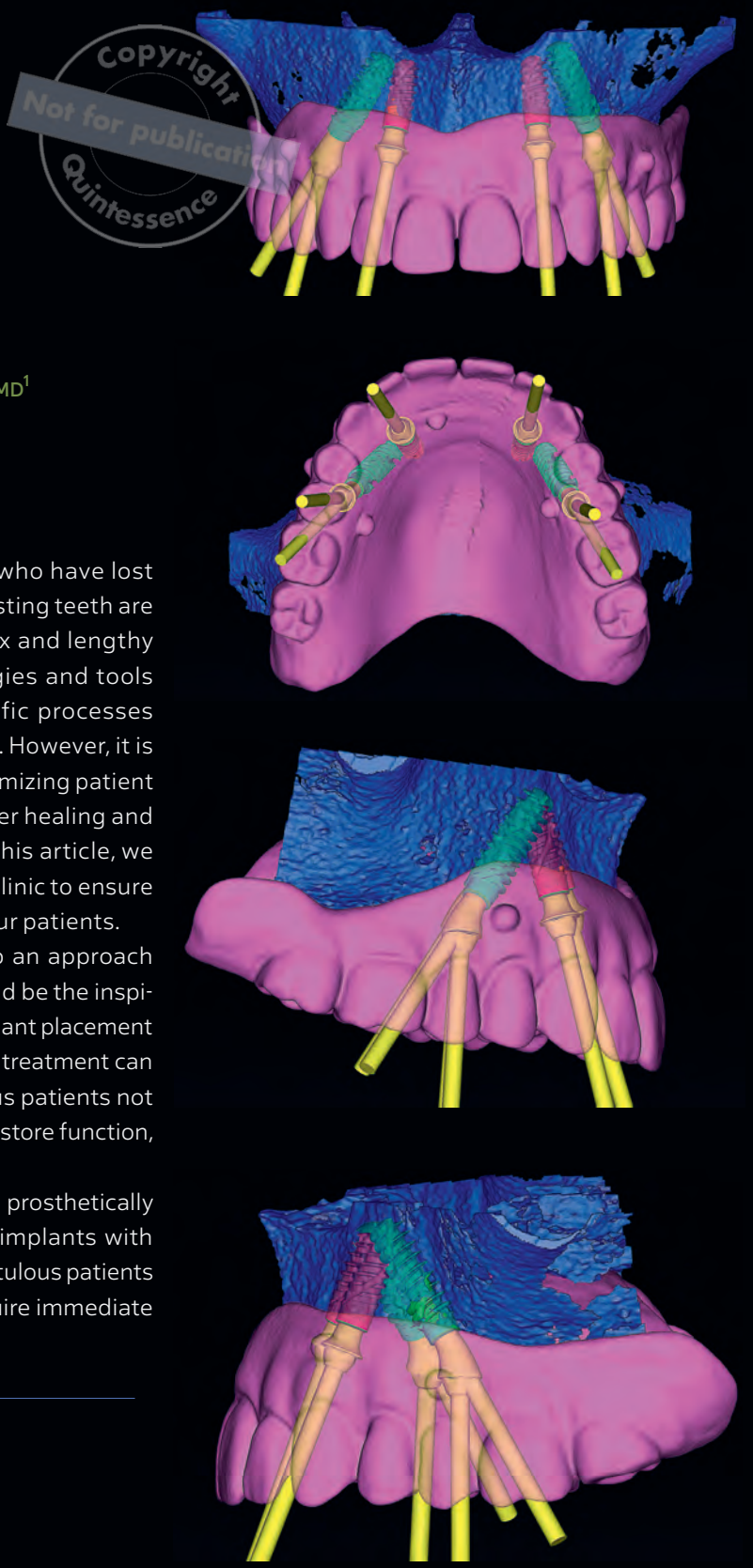


FIGS 1–4
Prosthetically driven implant planning based on preferable tooth position.

FIGS 5/6
Establishing correct vertical dimension and verification of lip support with wax rims.

1. Clinical Assessment

Before initiating any process, a thorough clinical assessment must be undertaken of the patient's oral health, dental needs, and esthetic expectations. Clinicians and patients may hold different views regarding what constitutes esthetic success; an understanding must be reached between them both.

2. Determination of Prototype Prosthesis

The initial step in creating the ideal prototype prosthesis is identifying its size, shape, color, and positioning of teeth. Wax occlusal rims help to establish the correct bite position, the vertical dimension, and the position of teeth (Figs 5 and 6) while giving an idea of patient lip support and smile line, which can be verified by additional cephalometric radiograph examination. Cephalometric analyses help to fully understand a patient's facial profile and maxillomandibular relationship (Fig 7).

To ensure accurate function, it is important to plan for canine and anterior guidance as well as dynamic occlusion during speech and chewing movements. The Zebris JMA system (Jaw Measurement Analysis) is a perfect tool for this purpose. It records the mobility of the mandible and all degrees of movement. By analyzing the data, any issues with jaw movement that may affect the patient's dental rehabilitation can be identified (Fig 8).

Dental photography and software like SmileFy or Smilecloud can be invaluable tools in achieving and verifying the position of teeth (Figs 9 and 10).

FIG 7 2D cephalometric examination and analysis helps in understanding the facial profile and maxillomandibular relationship.

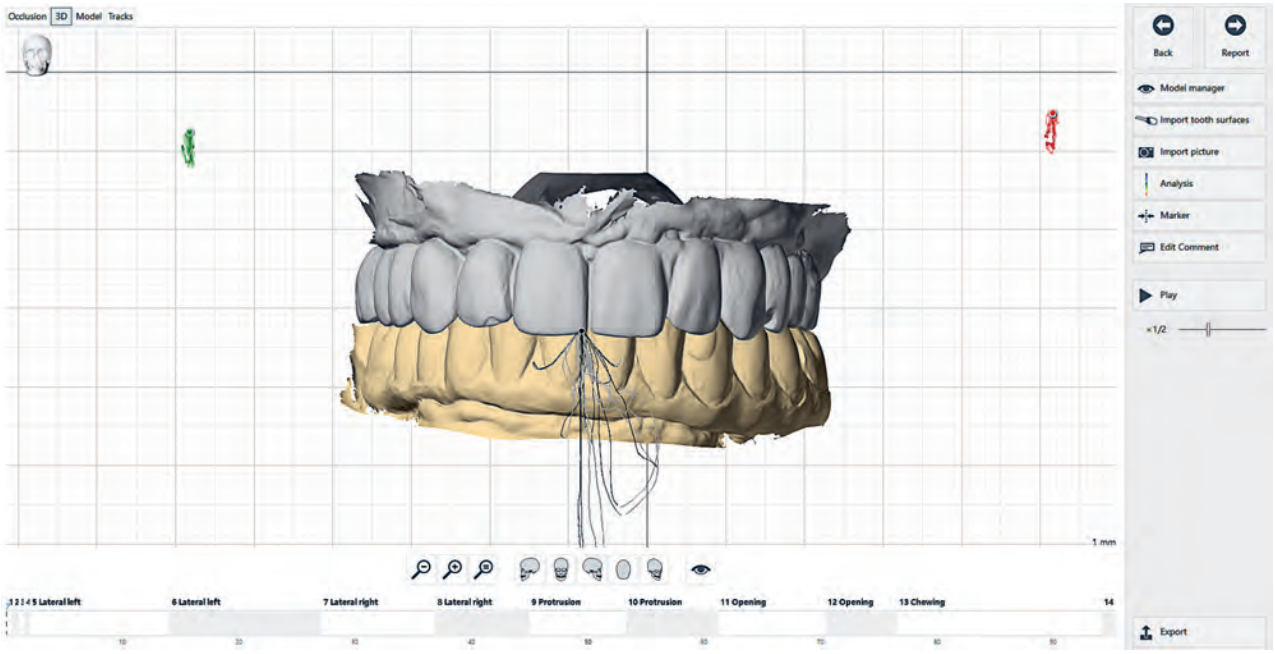
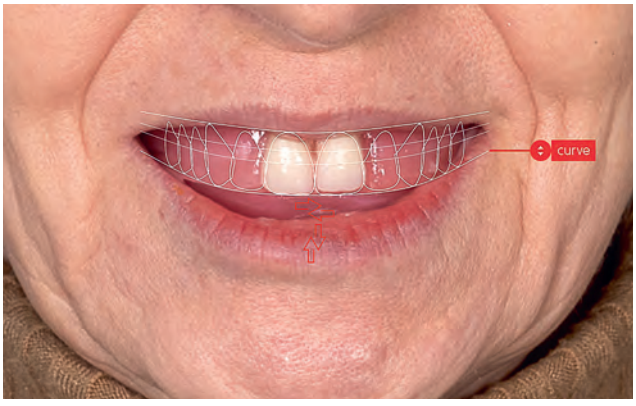


FIG 8 Record of the mobility of the mandible performed with Zebris JMA system.



FIGS 9/10 Diagnosing esthetic appearance of the restoration based on dental photographs and cloud-based software SmileFy.

FIGS 11/12 3D-printed radiographic guides prepared for the dual scan technique.

3. Radiographic Guide and CBCT

To provide an accurate visualization of prosthesis placement relative to existing bone tissue, imaging techniques such as the dual scan technique can be used. In the dual scan technique, patients are imaged while wearing a radiopaque template of their intended prosthetic design (Figs 11 and 12). The radiographic guide allows the clinician to visualize where the prosthesis will ultimately reside on existing bones, thereby enabling implant placement that optimally supports the planned prosthetic design. Implant placement decisions are therefore guided by prosthetic considerations.

4. Integrating Imaging Data with the Prosthetic Plan

When combined with advanced surgical planning software such as coDiagnostiX (Dental Wings), imaging data relating to bone quantity and quality can be combined with a second scan of a radiographic guide or digital design of the prosthesis (Fig 13). This allows clinicians to virtually place implants in optimal positions considering both prosthetic requirements as well as surgical considerations (Figs 14 and 15). This step makes it possible to segment specific tissues (like bone and soft tissues) and add objects like provisional bridge designs.

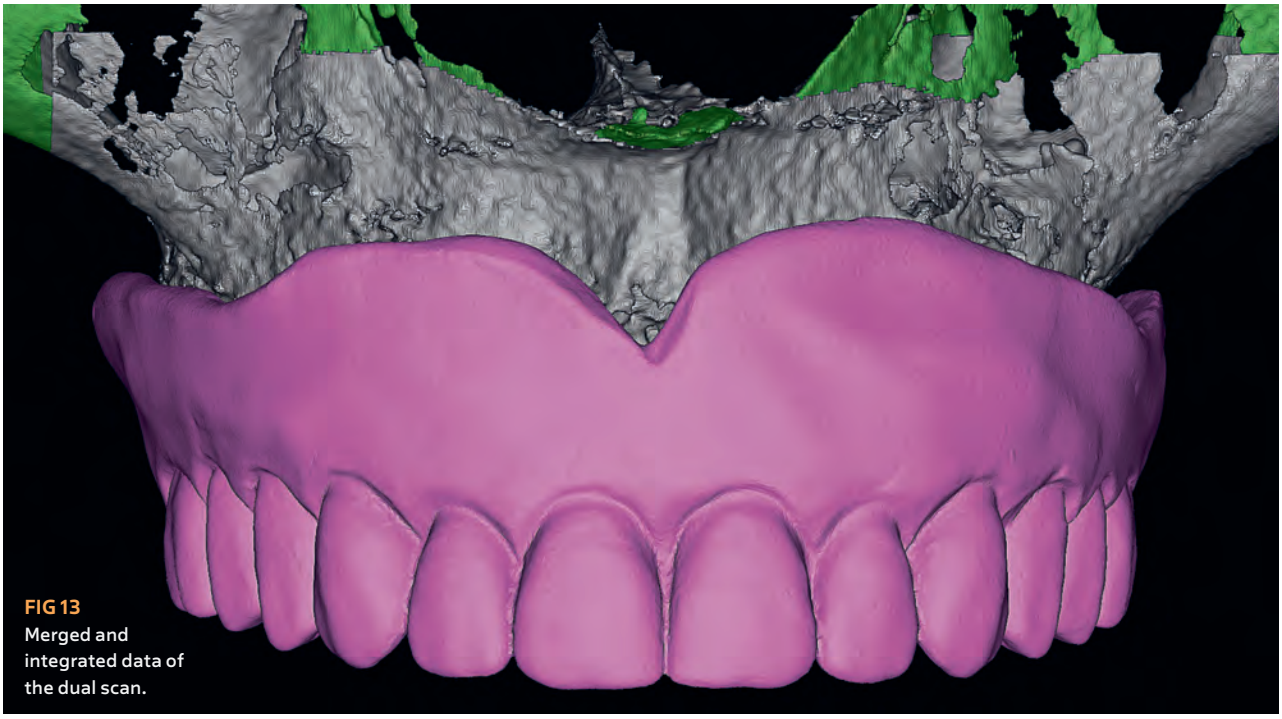
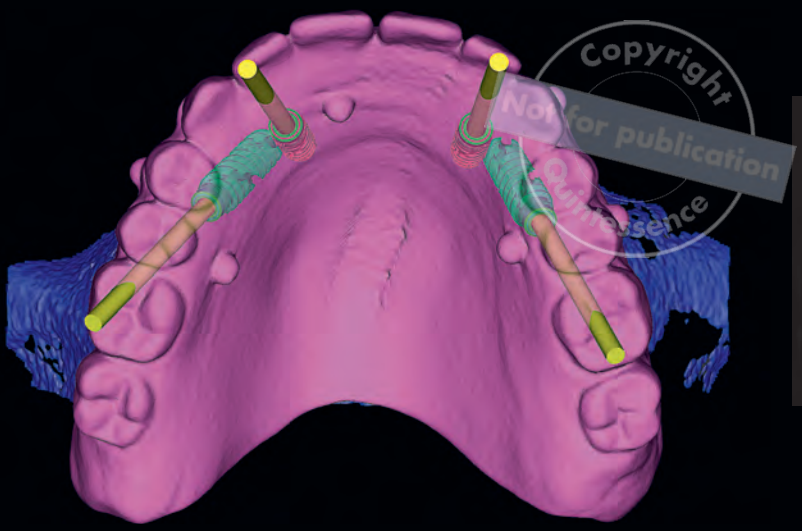
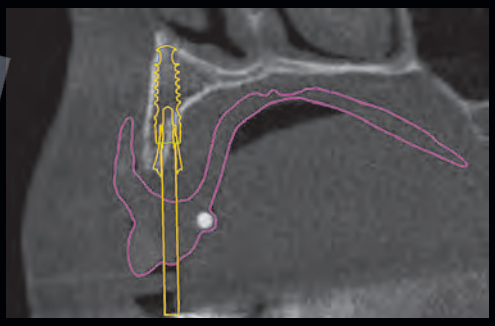


FIG 13 Merged and integrated data of the dual scan.





FIGS 14/15
Data integration in the coDiagnostiX software.

5. Digital Planning of the Surgical Guide

After finalizing the design of a prosthesis, a surgical guide is created to assist with the placement of implants and abutments during surgery, ensuring that they are positioned precisely as intended.

Digital planning uses specialized software, such as coDiagnostiX, to identify optimal implant locations and angulations as well as prosthetic abutment positions. Gingival height and angle options for prosthetic abutments may be selected from within the software's library. Measuring angles between implants and abutments provides additional insight into acceptable deviation and assists in establishing the insertion path for restorative work. Construction of a surgical guide for edentulous cases entails several steps to ensure accurate implant placement and access for drills. The specific techniques and materials used for guide fixation and drill access may differ depending on individual operator preferences, patient-specific needs, and available technology.

Bone-supported surgical guides gain their support from the alveolar ridge. These surgical guides can be used by partially or fully edentulous patients and utilize bony structures for stability and accuracy during implant placement. Bone-supported guides may require extra flap reflection to access, making fabrication more complicated (Fig 16).

Magnetic or stackable guides can be an ideal solution to address numerous limitations. Their construction consists of three layers in the majority of cases:

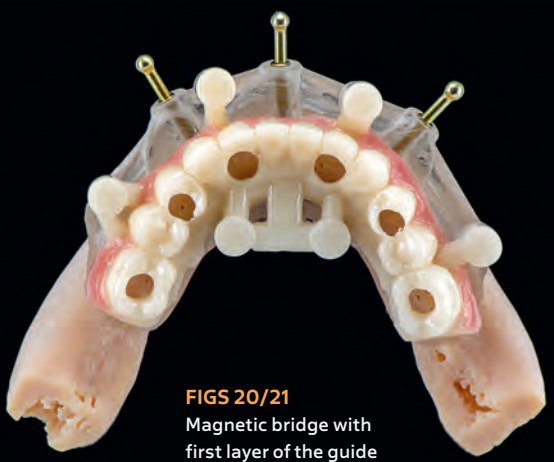
1. The template base can be placed directly onto bone, mucosa, and teeth using pins as anchor points to secure its positioning on bone surfaces. It serves as the basis for further layers, and its positioning determines the positioning of the other elements and magnets; depending on indication, it may act as a template for bone-reduction procedures (Fig 17).
2. An osteotomy template serves as the second layer. After its fixation, the surgeon conducts bone preparation and implant placement. Final implant depth and internal index position for abutment orientation are achieved using markers marked on the template and the implant carrier (Fig 18).
3. The provisional magnetic bridge forms the third layer (Figs 19 to 21). Its spatial position is decided at the planning stage in relation to the patient's head coordinates.

FIG 16
Bone-supported guide printed with the verification bone model.

FIG 17
First layer of magnetic template base for the maxillary treatment supported on the palate and fixed with vestibular and palatal pins.

FIG 18
Second layer for osteotomy and implant insertion fixed in position with magnets.

FIG 19
The third layer is a PMMA magnetic bridge.



FIGS 20/21
Magnetic bridge with first layer of the guide fixed on the bone of the mandible.

6. Fabricating the Surgical Guide and Provisional Restoration

Once the surgical guide design has been finalized, it is saved and exported in STL format (Fig 22). Based on this data and the technology used for printing, the file is prepared by the dedicated nesting software for the 3D printing process.

The surgical guide is typically printed using a 3D printer compatible with dental applications, such as SLA (stereolithography), DLP (digital light processing), or PolyJet printers. A biocompatible resin explicitly designed for surgical guides is used during printing; layer by layer, it is cured to create an accurate surgical guide. Support structures may be needed during this process to support overhangs and complicated geometries and will later be removed.

After printing, surgical guides may undergo post-processing steps to eliminate excess resin and achieve their desired surface finish. Post-processing may involve rinsing with a cleaning solution or using a post-curing device to ensure complete polymerization of the resin (Figs 23 and 24). Before surgery, the guide must undergo a disinfection/sterilization process following medical hygiene standards.

The provisional bridge Is made of PMMA (polymethyl methacrylate), and after milling, it is cut and finished. In the final stage, magnets are glued in the orientation following the base (first layer) of the template (Fig 25).

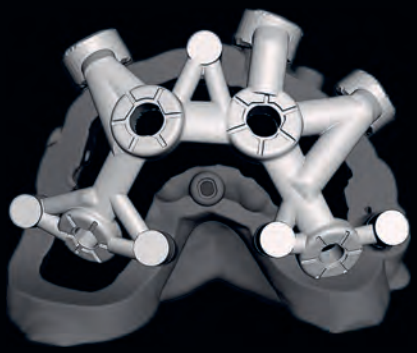


FIG 22 Designed surgical guides are saved in STL format for production.

FIGS 23/24 Surgical guides after removal of support material and cleaning.

FIG 25 PMMA bridge after finishing with magnets glued into the housings.