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CAD/CAM

international magazine of digital dentistry

case report
A multidisciplinary digital approach to a complex case

trends & applications
A challenge in dental computerised photogrammetry

cone beam supplement
Use of CBCT bone densitometry for pre-surgical decision-making

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ACTEON

Dr Scott D. Ganz

Editor-in-Chief

Do we have the time to learn?

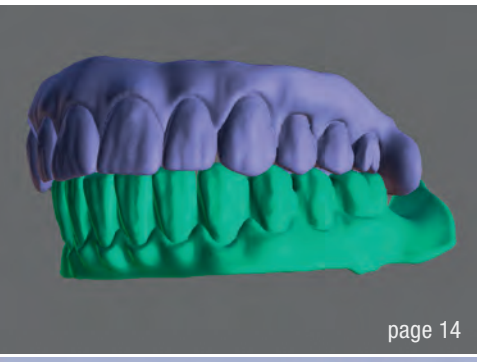
We live in a world where technology is evolving almost faster than we can keep up with it. We have digital radiographs, digital panoramic radiography, CBCT, CAD/CAM, intra-oral scanning, stereolithography and 3D printing, guided surgery with static and dynamic navigation, robotic navigation and surgery, and artificial intelligence making their mark within the dental arena. Computers are gaining speed and incredibly fast graphics processing power, yielding improved displays of dizzying resolution. We have 50+ MP cameras in our cell phones and Apple's newest generation iPhone 11 even has three cameras! The Internet is everywhere with Wi-Fi access at faster and faster speeds to send our data around the globe in fractions of a second, allowing us to video-chat instantaneously via our smart watches, phones, tablets and computers.

Regardless of the technology, it will continue to evolve and become an integral part of society. In our niche of dentistry, we have every reason to embrace technological advances because these can enhance our approach to conventional treatment while helping to provide alternatives to treatment modalities that should impact our patient's quality of life. However, there are problems with racing to keep up with the fast pace of change. How do we absorb all this incredible technology? How do we implement these changes in our daily practice? Are there enough educational opportunities available to teach proper use and appreciation of the newest and boldest technologies? Do we have enough time to spend on learning?

Clearly, the advent and incorporation of 3D imaging and interactive treatment planning software has provided clinicians with new tools for improved diagnostics because we can visualise and assess patient anatomy far better that we ever could with 2D imaging modalities. The incorporation of intra-oral scanning allows clinicians to digitise the oral environment and merge this with the DICOM data from a CBCT scan, a synergy that greatly enhances the diagnostic process. We can take this information and export the data into a CAD system to virtually assess occlusion and fabricate restorations or surgical guides via milling or 3D printing. Almost every day, another device is introduced to the marketplace. The real question is not how powerful the technology is, but who is going to teach us how to use it properly and whether we can spare enough valuable time to learn. We must remember that it is not the computers that make the decisions; it is a combination of clinical experience, imagination, and utilisation of technology that aids us all in making educated decisions for our patients.

The purpose of our CAD/CAM magazine is to provide a platform for dissemination of knowledge. We greatly appreciate all the authors who put pen to paper and document their work for inclusion in one of our issues, and of course all our readers who take the time to read and digest the wonderful work that is shared in each issue. Knowledge is one of the most important keys to success and we need to make the necessary time to keep up with progress.

Dr Scott D. Ganz
Editor-in-Chief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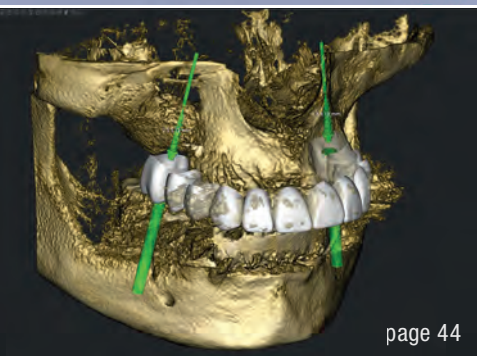
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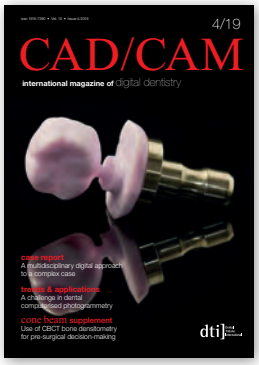

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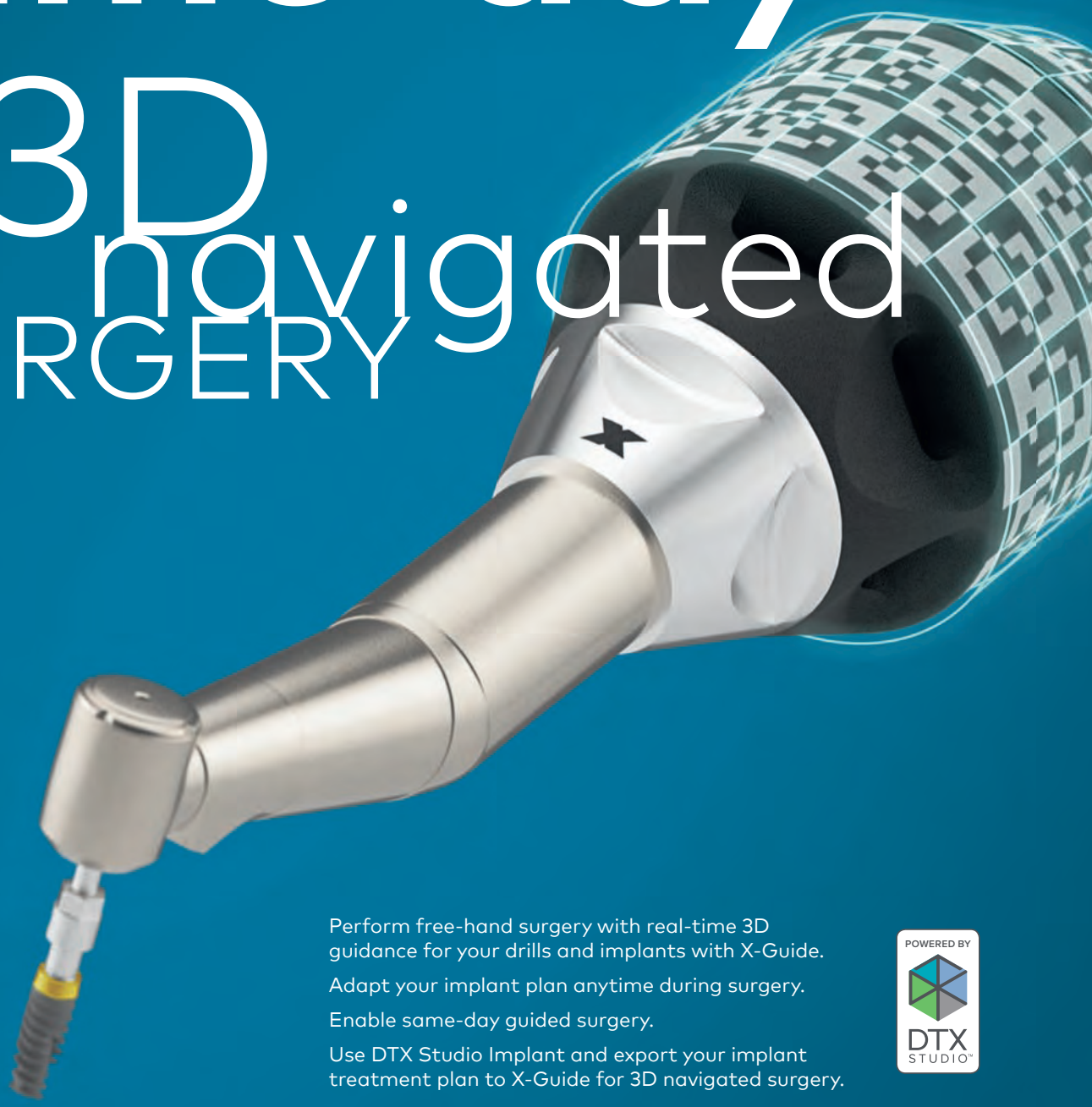

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A multidisciplinary digital approach to a complex case

Surgical, aesthetic and occlusal procedure planning for implant-supported full-arch prostheses

Dr Antonio Lipari, Dr Mario Perotti, Marco Marzolla & Dr Valerio Bini, Italy

Fig. 1

Fig. 2

Introduction

Thanks to digital technology, a growing number of edentulous or partially edentulous patients with residual malocclusion and dysfunction can now be offered a good-quality customised and aesthetically pleasing prosthesis as well as long-term restoration of occlusal function. The surgical planning and execution required to achieve correct occlusion can now be realised with the assistance of a variety of digital tools, with an accuracy that in the past would have required a great deal of time and resources to achieve. This article reports a digital approach that makes a complex workflow easier to manage and that has the advantage of wider access to high-quality customisation of surgical management and aesthetic and occlusal design.

Case presentation

The case concerns a 58-year-old male patient (Fig. 1) with no relevant medical history. There was clinical evi-

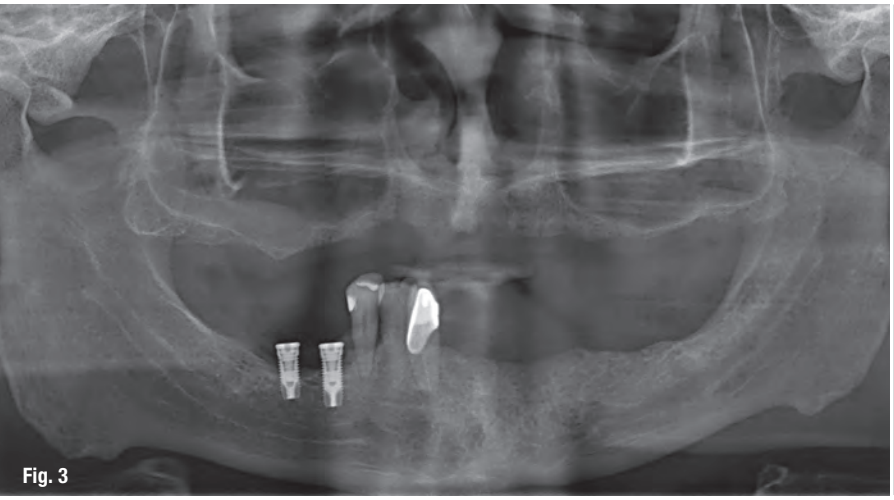


Fig. 3

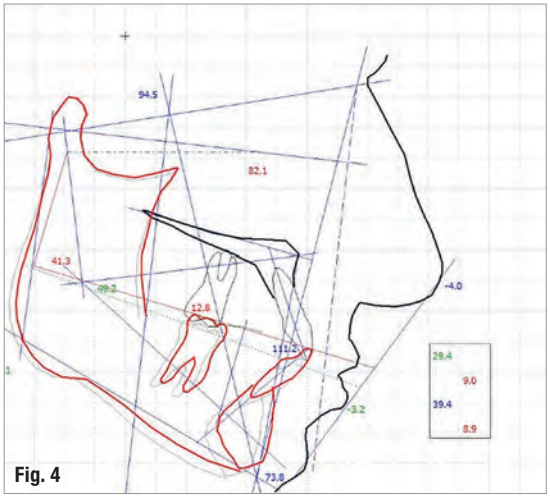
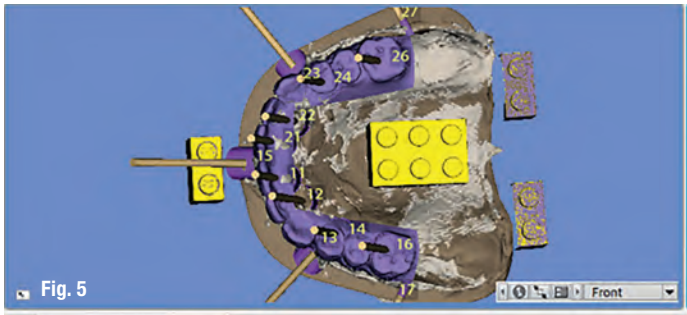
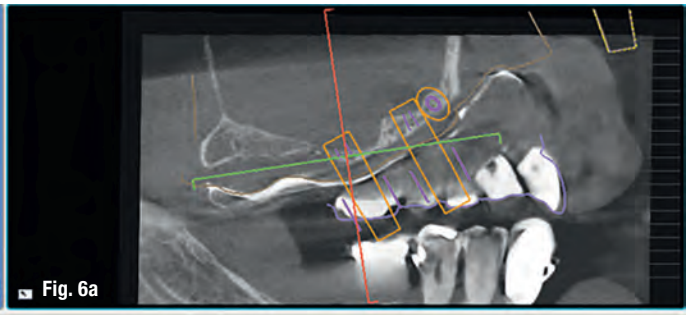
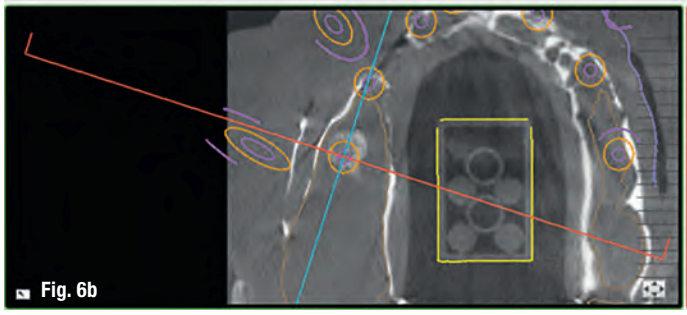
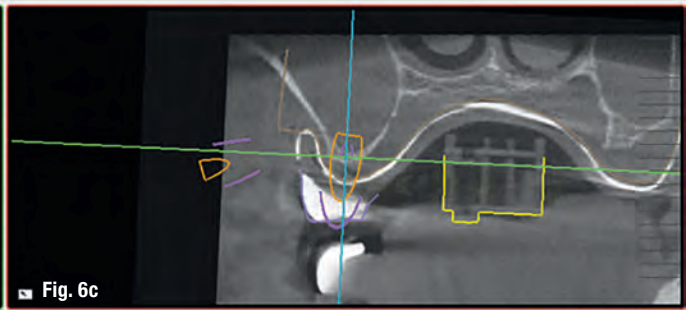


Fig. 4





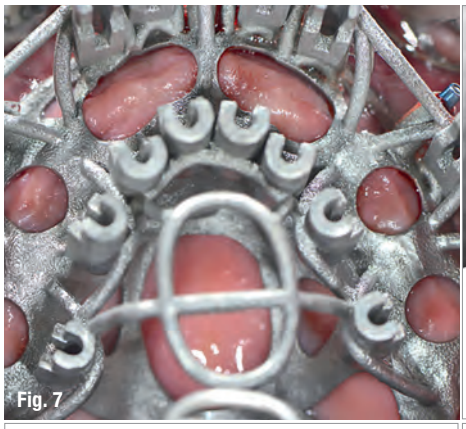


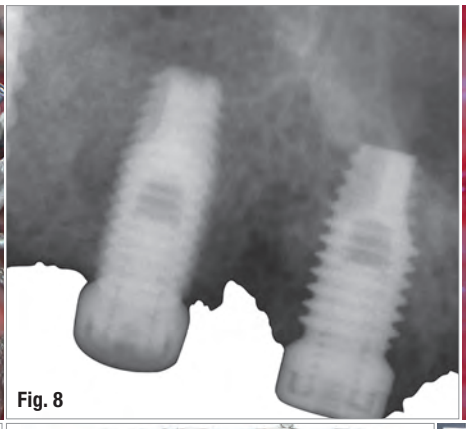


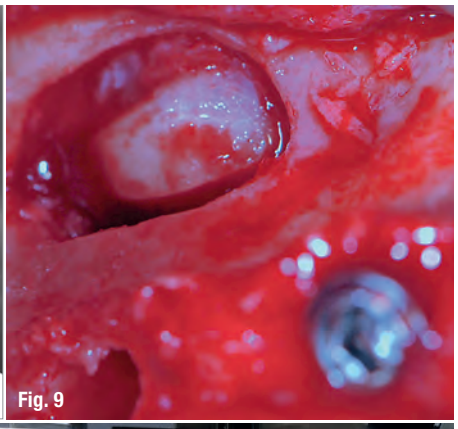
dence of tooth and bone loss as result of periodontitis and previous poor-quality dental treatment, the use of inappropriate removable dentures with compromised aesthetics, and crossbite malocclusion (Fig. 2) with dysfunctional symptoms. Edentulism and bone loss in the maxillary arch and the presence of three teeth and two implants with a poor periodontal prognosis were evident in the clinical examination and radiographic images (Fig. 3). The patient required fixed maxillary and mandibular implant-supported full-arch protheses.

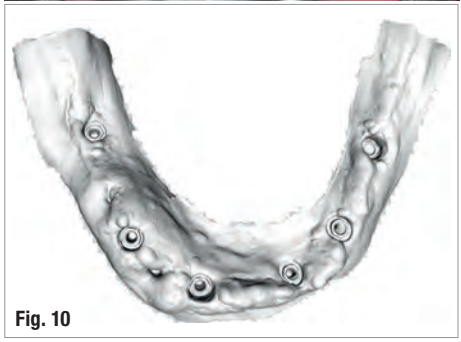
After removal of the residual teeth and implants, the patient was fitted with two removable dentures in the reference position, which improved jaw alignment, vertical dimension of occlusion, overbite, overjet, speech and aesthetics.

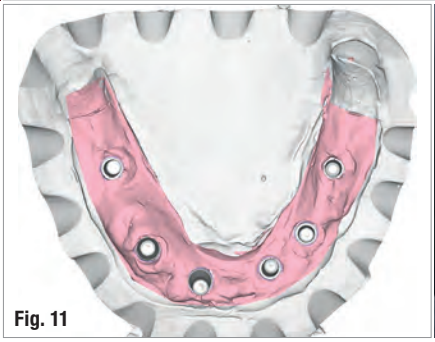
A cephalometric tracing on a lateral radiograph was done to obtain an initial aesthetic and functional evaluation of the case (Fig. 4), and this was followed by prosthetic and surgical (Fig. 5) planning.

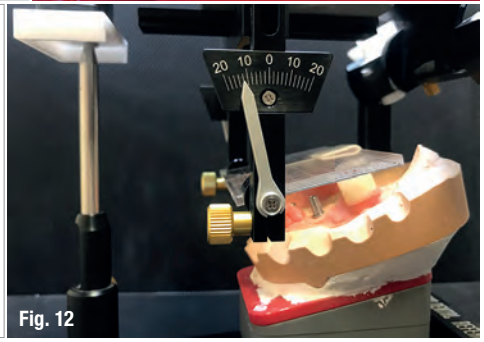












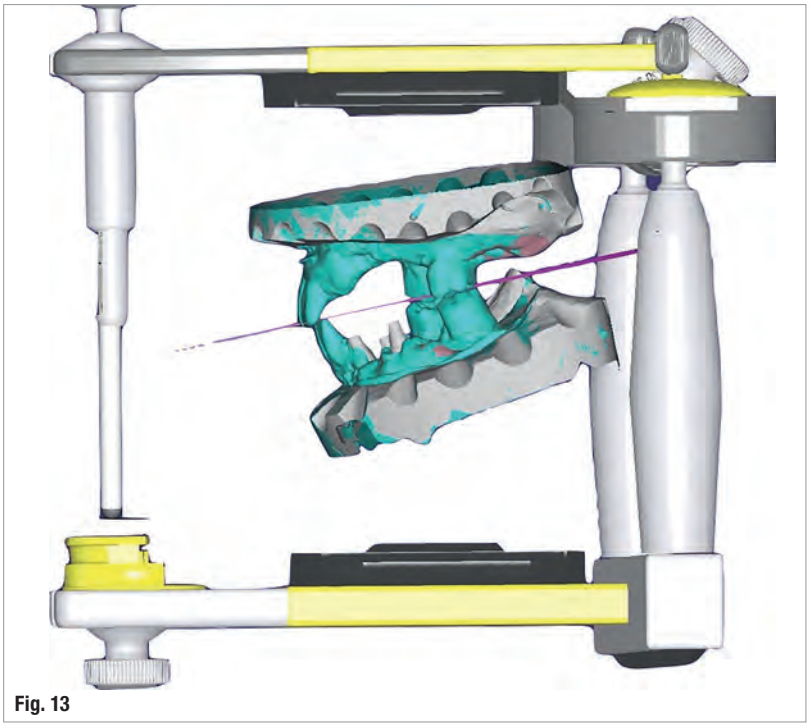


Fig. 13

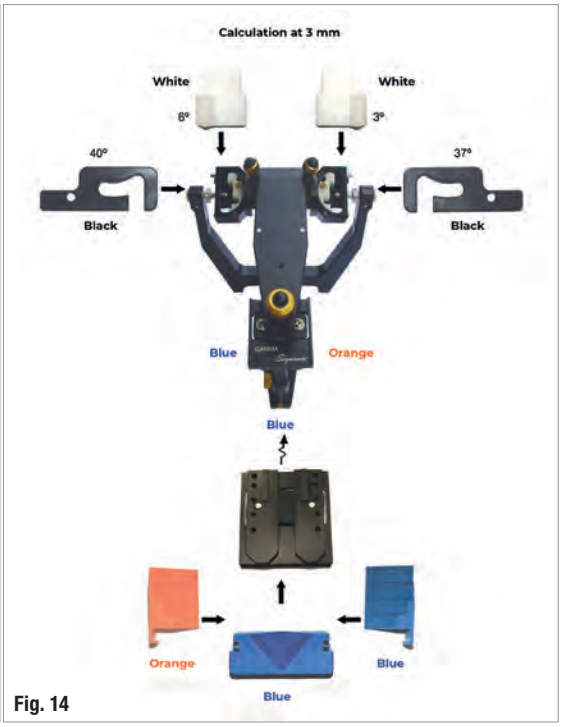


Fig. 14

The characteristics of the prostheses determined the surgical plan (SMOP, Swissmeda; Figs. 6a–c) and two surgical guides were subsequently laser-sintered (2INGIS), locating both implant positioning and, for the maxillary arch, the bilateral maxillary sinus lift sites. Implants were thus positioned as planned (Figs. 7 & 8), except for those in the posterior maxilla, where maxillary sinus lifts were bilaterally performed (Fig. 9).

After two months, an intra-oral scan (Fig. 10) was taken and the 3D-printed models subsequently obtained were stone-based and re-virtualised (Fig. 11) using a desktop scanner (inEos X5, Dentsply Sirona). Jaw alignment and implant positioning were also accurately recorded by duplicating the interim prostheses and intra-orally fixing the transfer positions on to the copies, whose fit and occlusion had to be

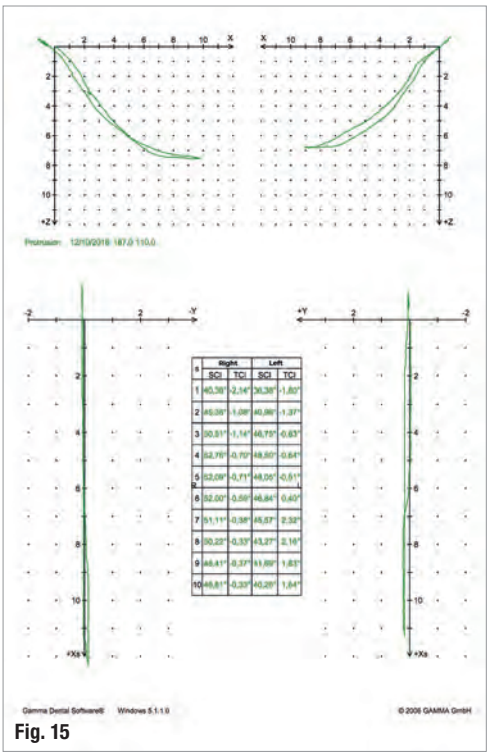


Fig. 15

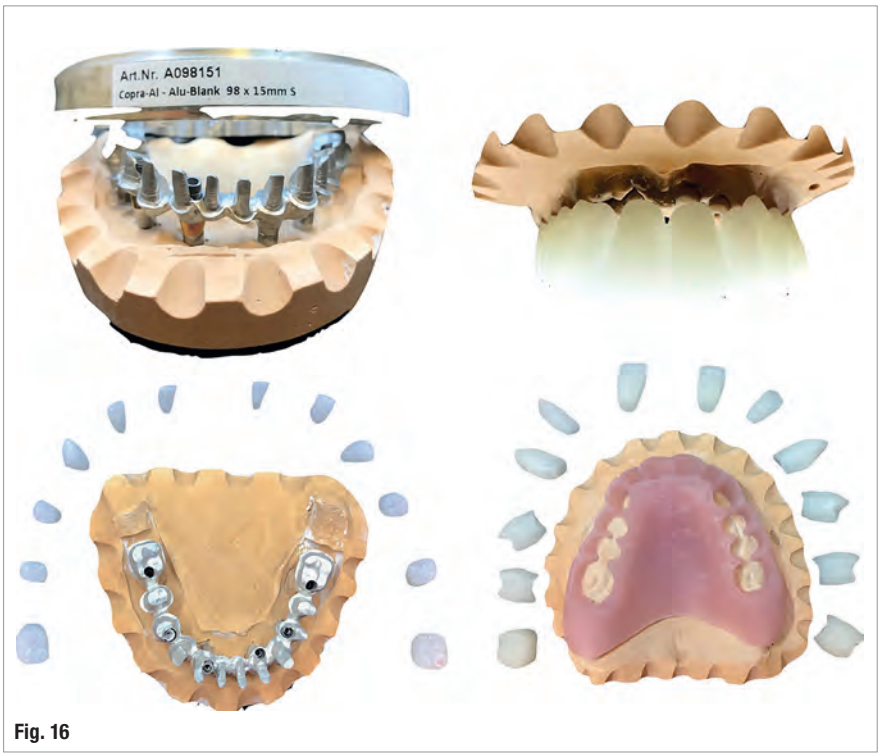


Fig. 16

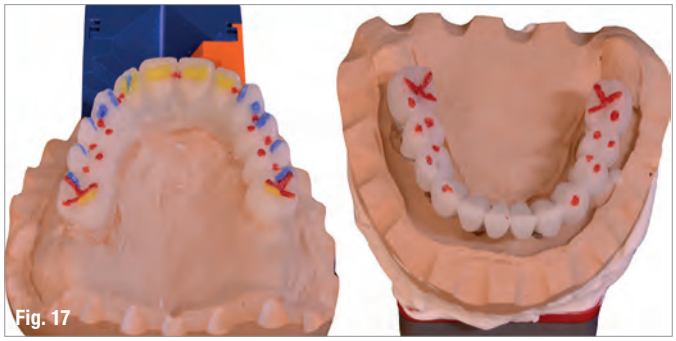


Fig. 17


Fig. 18

checked for complete accuracy. The jaw relation was used for mounting the casts, which were fixed on mounting blocks with a facebow in a fully adjustable arcon articulator (Reference SL, GAMMA). The central incisors and first molars were assembled bilaterally at an inclination of 12° to the occlusal plane (Fig. 12), which was previously defined using cephalometric tracing.

The teeth were then scanned with a desktop scanner, and using the positions of the central incisor and distal first molar cusps for reference, they were imported in the correct spatial positions into the CAD module (exocadDentalCAD Virtual Articulator, exocad; Fig. 13). Not having a virtual Reference SL articulator available in the CAD software, a virtual SAM system (SAM Präzisionstechnik) was used, because both the articulators have the same axio-orbital reference plane, and it is possible to superimpose the geometry of the SAM on to the Reference SL. Border movement condylography (CADIAX Compact, GAMMA; Figs. 14 & 15) was also produced for setting the virtual SAM as indicated by the software (CADIAX software, GAMMA), both for the setting of the condylar and incisal guides and for the adjustment of the sagittal condylar inclination and Bennett angles.

The aesthetic digital smile design and the CAD for the patient were therefore done starting with the vir-

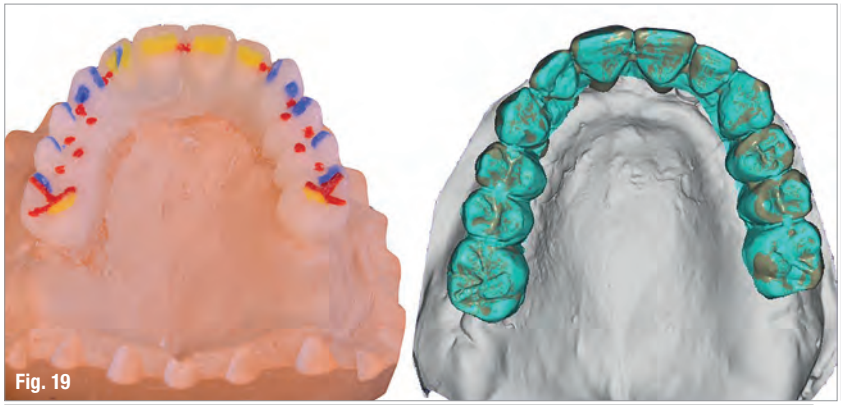


Fig. 19

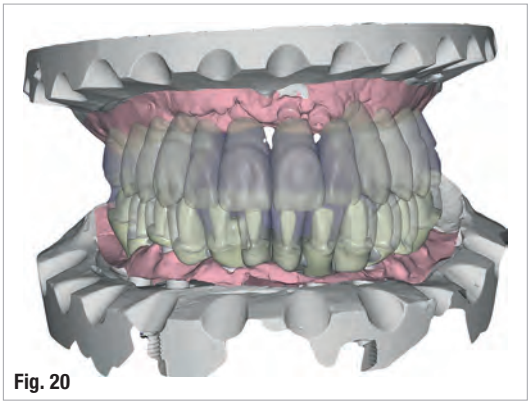


Fig. 20


Fig. 21

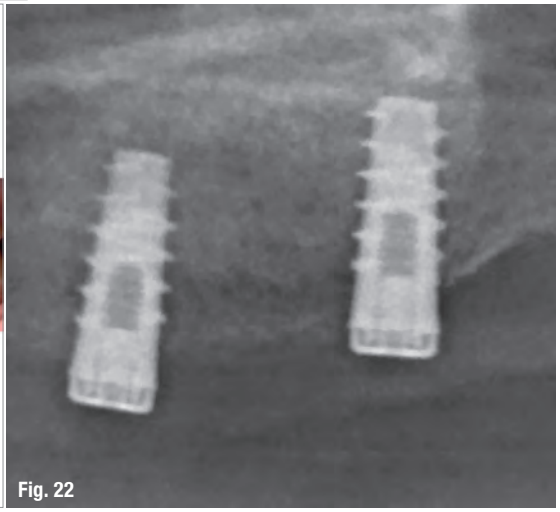


Fig. 22