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3/20

# digital

**international magazine of** digital dentistry

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A new patient experience

## news
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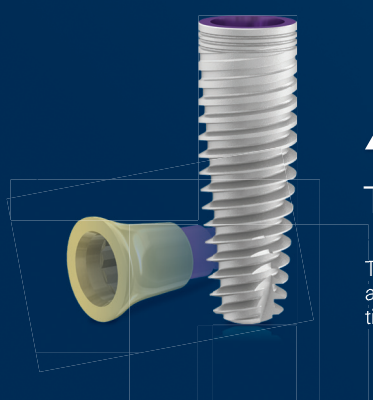
dti Dental Tribune International

# IT'S SIMPLE WHEN YOU HAVE ALL THE OPTIONS



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**Dr Scott D. Ganz**

Editor-in-Chief

# COVID-19 times

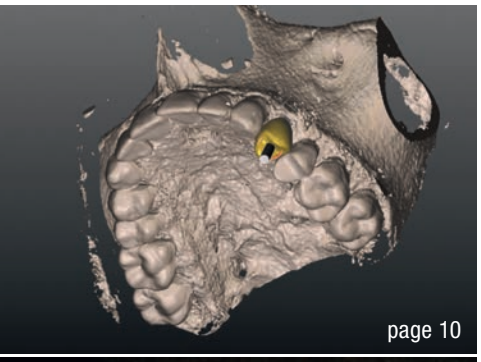
**Here we are in the autumn of 2020** in a situation that most of us would never have dreamed would happen. Our offices were closed for weeks and months owing to the global pandemic that has dramatically changed the way that we live, socialise, travel, interact, shop, eat, educate others and ourselves, and practise our profession. Major and minor meetings and hands-on workshops have been cancelled or postponed indefinitely. For many, the everyday practice of dentistry has been limited in many ways, including the need for extra personal protective equipment and enhanced infection control necessitated by the aerosol spread of the potent virus. Of course, this affects the clinicians who practise dentistry, our staff, dental laboratory technicians, industry suppliers, local and regional sales representatives, and many other people. To summarise, SARS-CoV-2 has influenced every aspect of our lives, becoming the new normal for everyone, as I indicated in our previous issue.

This is now several months later, and we are perhaps in the middle of a strong second or even third wave of infections. Regrettably, in many regions of the world, the response to SARS-CoV-2 has become political, many leaders not accepting the recommendation of scientists who traditionally have been evidenced-based truth-tellers. If there is one saving grace, it is our experience and understanding of technology and the tools that can help us survive this time of the pandemic with a little less pain—and this is especially true for the readership of digital.

Most of our educational venues have gone “virtual” – meaning that many of us are spending more and more time in front of our computer screens. We are now routinely interacting with our colleagues, associates, family members and others using remote communication technology on our computers or our incredible smartphones, which have become a universal means of instant global communication. Fortunately, in our profession, our digital workflows are already in place: we are used to sending and receiving files or interacting with a computer simulation, assessing a digital radiograph or CBCT scan, and working with software applications to review, plan and design treatment plan objectives. Within the confines of the current COVID-19 limitations, it has become apparent that those with enhanced digital skills will have a distinct advantage.

As always within the pages of this current edition of digital, you will find interesting articles, concepts, clinical applications and much more from some of the brightest minds and most talented clinical practitioners and educators in our profession. Please enjoy this latest offering while staying safe, practising social distancing, washing hands and wearing masks to protect those around you. Let us all do our very best to get through these difficult times of managing our professional and private lives with the anticipation that life will return to a pre-COVID-19 existence of normality, sooner than later.

Dr Scott D. Ganz
Editor-in-chief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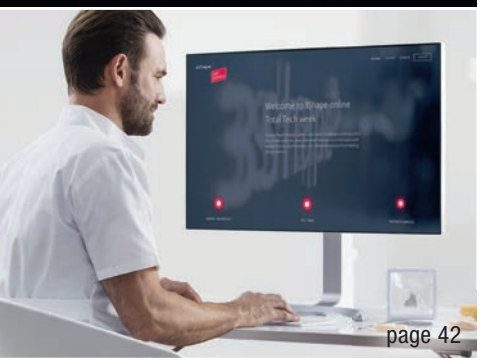
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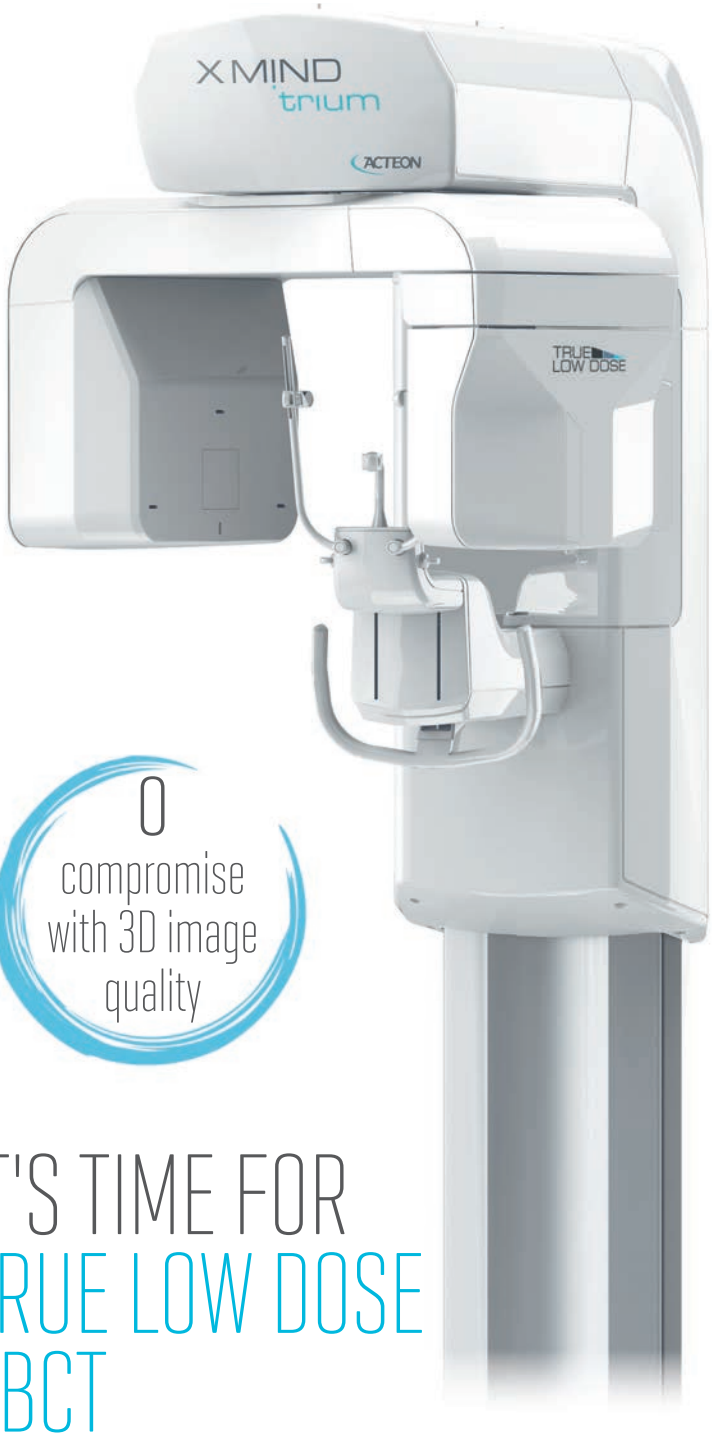


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# EAO Digital Days delivers online content in an entirely new way

By Franziska Beier, Dental Tribune International

Prof. Henning Schliephake is chair of EAO Digital Days. *(Image: © Henning Schliephake)*

**This year's** Annual Scientific Meeting of the European Association for Osseointegration (EAO Digital Days), which had been scheduled to take place in Berlin in Germany, has taken on a completely new digital format. EAO Digital Days was broadcast from 5 to 11 October and presented a colourful mixture of live shows and on-demand videos. Prof. Henning Schliephake, chair of EAO Digital Days and EAO president, shared how the organisers have jazzed up the programme in order to create a scientific conference structure in a virtual environment.

**Prof. Schliephake, many dental events have been cancelled this year owing to the SARS-CoV-2 crisis. What led to the decision to turn the EAO congress into an online event?**

This decision had to be considered very thoroughly and was extremely difficult to make, as the EAO congress represents one of the highlights of the year in implant dentistry in Europe. We had been expecting up to 5,000 participants however, and at the time of decision-making, the city of Berlin had prohibited events with more than 1,000 people in attendance. As a result, we would only have been able to make the scientific content available to a very limited number of people. Moreover, even with that limited number of participants, rules such as social distancing, the wearing of masks and limited access to the exhibition area would have applied. As the unique atmosphere of our congress is based on lively interaction between all participants and speakers, both in the lecture halls and in the exhibition area during breaks, this would have severely damaged the nature of the congress and its educational character. As a consequence, we decided to transform the format of the congress into a digital one that would allow both unlimited dissemination of scientific content and interactivity.

**What has been challenging about turning the congress from an in-person event into a digital one?**

Maintaining the interactive character that I have just mentioned in a digital lecture session has been one of the challenges. Additionally, we were aware that, by the time EAO Digital Days was due to take place, most people would be quite sick and tired of watching the traditional type of webinar. Therefore, we had to develop an entirely new format that would catch the attention of the viewers

by not only providing new and fascinating content but also delivering it in a way that has not been seen before.

**What was new for attendees of EAO Digital Days who were used to the traditional format?**
First of all, the programme was broadcast in the evenings, allowing participants to easily enjoy the shows after work. Secondly, the event was not just a compilation of webinars; it mirrored the complete structure of a scientific conference in a virtual environment. Eight different channels provided abstract sessions, e-poster sessions, virtual exhibition booths, sponsors' lounges and EAO membership lounges that attendees could choose from. And thirdly, our flagship channel, Channel 1, broadcast the core scientific content and was structured like a TV show, running from 7:00 p.m. to 11:30 p.m. CET during the first four evenings. This channel presented focus sessions that provided clinical and practical knowledge, guided by a moderator, and expert question sessions that, in addition to providing expert knowledge, offered the possibility of audience interaction. The real heart of each of the four evenings was the prime time debates in which a group of experts gathered and discussed certain topics. Short "champion" stories told by scientists and clinicians lightened up the evenings, which were concluded by a late-night show featuring an eminent person from the implant dentistry community.

**What were some of the topic highlights?**
EAO Digital Days focused on three major areas. Firstly, we wanted to show the great potential of digital implant dentistry, but also its limitations. In order to do so, we discussed fully guided versus dynamic navigation and how to use digital data in complex interdisciplinary cases. Based on this discussion, the relevance to the relationship between practitioners and patients was demonstrated, and it was evaluated whether patients appreciate the improvements associated with digital implantology. A second area of innovation that was addressed is bio-

"The real heart of each of the four evenings was the prime time debates"

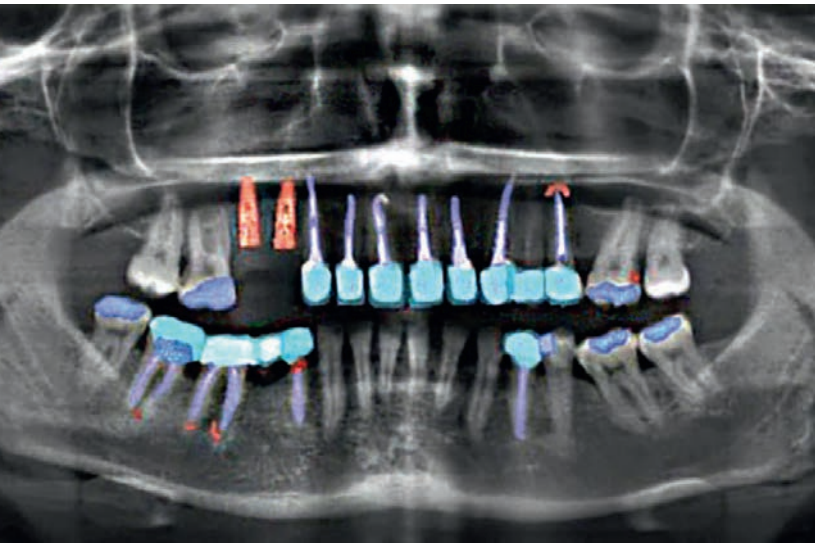
technology, including the latest developments in bioactive and anti-infective implant coatings and the progress that bioprinting has made in tissue repair and reconstruction in deficient areas. In addition, we took on some of the ongoing controversies about implant placement in growing individuals and the combination of teeth and implants in prosthetic treatment concepts. And finally, we showed live soft-tissue repair surgeries, which were presented directly from the operating rooms and discussed by our expert guests in the studio.

**The EAO is an important association for implantologists and periodontists. Apart from moving the EAO congress to an online event, how is the EAO handling the SARS-CoV-2 pandemic, and how are you supporting your members in these challenging times?**
The EAO is committed to our members, and since all of them are affected by this pandemic, we try to provide support on different levels. We have offered expert knowledge on the management of dental offices and the treatment of patients under COVID-19 circumstances in a recent "Just Ask" session that is available online. Furthermore, we have devoted €50,000 for European research on the development of a vaccine against the virus in a crowdfunding approach. On the Friday of EAO Digital Days, we dedicated one session to an update on the management of daily work under conditions of COVID-19 and discussed matters such as protection measures.

*Editorial note: More information about EAO Digital Days can be found at digitaldays.eao.org.*

# Artificial intelligence-based analysis of dental radiographs saves time in patient care

By Dental Tribune International



A newly developed software program detects caries, infections and restorations such as crowns, implants and root canal fillings in dental radiographs and marks its findings in colour. *(Image: © BIH)*

**Dentists at Charité**—Universitätsmedizin Berlin, together with data scientists and programmers, have developed dentalXrai Pro—a software program that allows dental practitioners to perform the analysis of radiographs based on artificial intelligence (AI). The new software was designed to help dentists identify pathologies and restorations more accurately and in less time in order to provide optimal treatment and improve communication with patients.

Prof. Falk Schwendicke, chief medical officer and co-founder of the project and head of the Department of Oral Diagnosis, Digital Health and Health Services Research at Charité, said in a press release: "[dentalXrai Pro] raises dentistry to a standardised, high-quality level and immensely speeds up the analysis of X-rays, so that dentists can use the time more effectively for talking to patients".

## Large data set of dental radiographs

Since most dental practices already take digital radiographs, these can be easily transmitted to dentalXrai Pro. In order to deliver a pre-analysed image within a very short time, the browser-based software accesses high-performance computers and a whole range of algorithms.

These algorithms are the result of in-depth software training using a very large data set of dental radiographs, including panoramic and bitewing images. Dentists from around the world identified tens of thousands of pathological changes and traces of previous dental treatments on the radiographs.

This data was then fed to the artificial neural networks, enabling them to distinguish between different findings, such as caries, infections and root canal fillings.

## dentalXrai as a digital second opinion in the dental practice

"AI is not responsible for the dental examination and does not reach decisions on the treatment," emphasised Schwendicke. It does, however, facilitate the process for dental professionals and includes patients in the diagnosis. According to Schwendicke, this "second opinion of a digital colleague" helps to create trust between dentists and their patients.

In the coming months, the focus will be on sales. "We want to use our networks and find business partners who can bring our software to dental practices," said Schwendicke. The project was funded by the Digital Health Accelerator of the Berlin Institute of Health (BIH). "We saw that the project had great potential and benefits for patients from the very beginning," commented Thomas Gazlig, director of BIH Innovations.

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# Guided implantology: The SMART Guide

Drs Mark Antal & George Freedman, Hungary & Canada

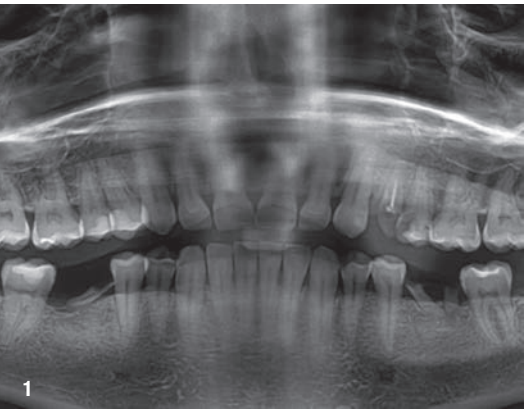
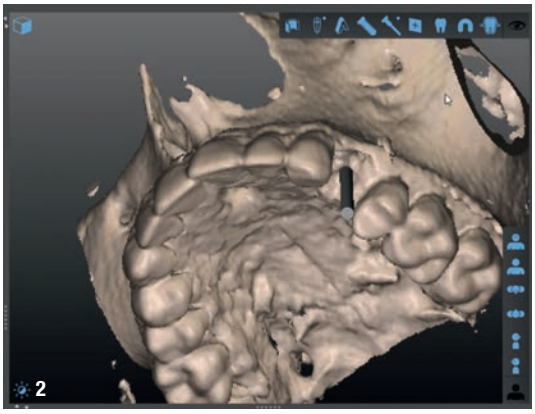
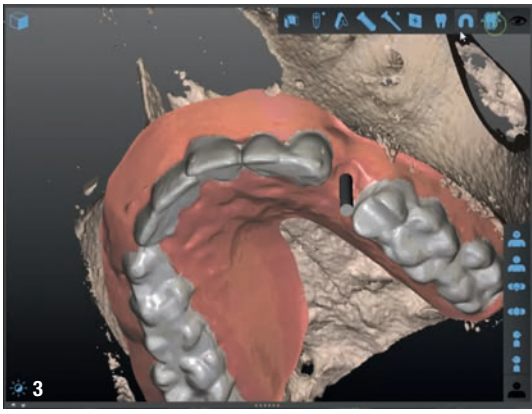




**Fig. 1:** Panoramic radiograph. **Fig. 2:** Virtual model of fractured tooth #24. **Fig. 3:** Virtual model of fractured tooth #24 with SMART Guide visualisation.

## Introduction

The tremendous proliferation of implant services worldwide has created a need for simplified and more predictable treatment guidance modalities. There are currently a number of surgical guide platforms available, but most systems are strictly limited to specific implant catalogues, typically the products sold by the surgical guide provider. Other surgical guides are open systems and allow the practitioner to use any dental implant. The practitioner has the options of freehand, partially guided and fully guided implant placement surgery. Guided surgery has been reported to have results that are more accurate than those of freehand surgery. Computerised treatment planning and guided surgery provide improved accuracy, predictability and patient care.

Given the wide selection of high-quality implants that can be utilised by the dental practitioner, the very large variation in implant cost to the dentist and the regional disparity in product access, it makes more sense to

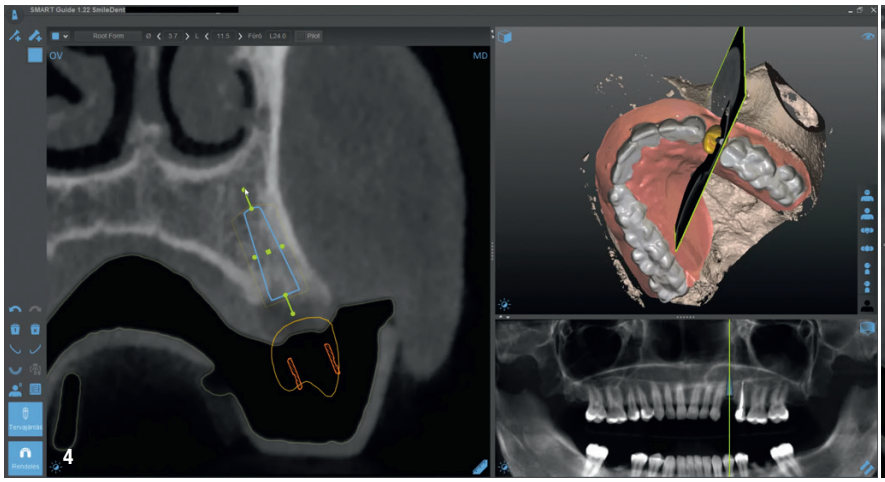
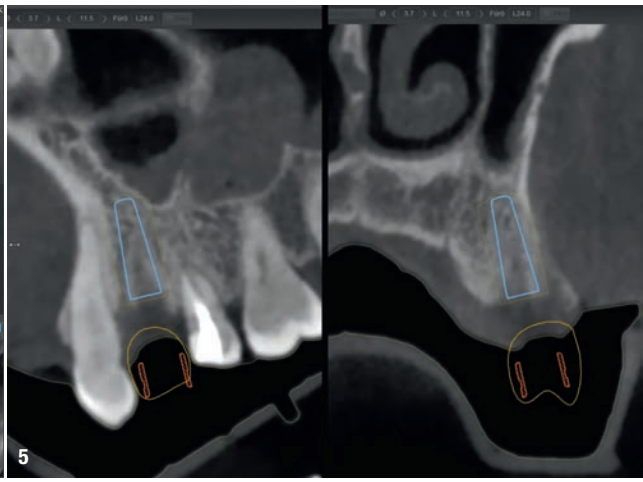



**Fig. 4:** Planned implant in occlusal vertical view. **Fig. 5:** Planned implant in occlusal vertical and mesial and distal views.

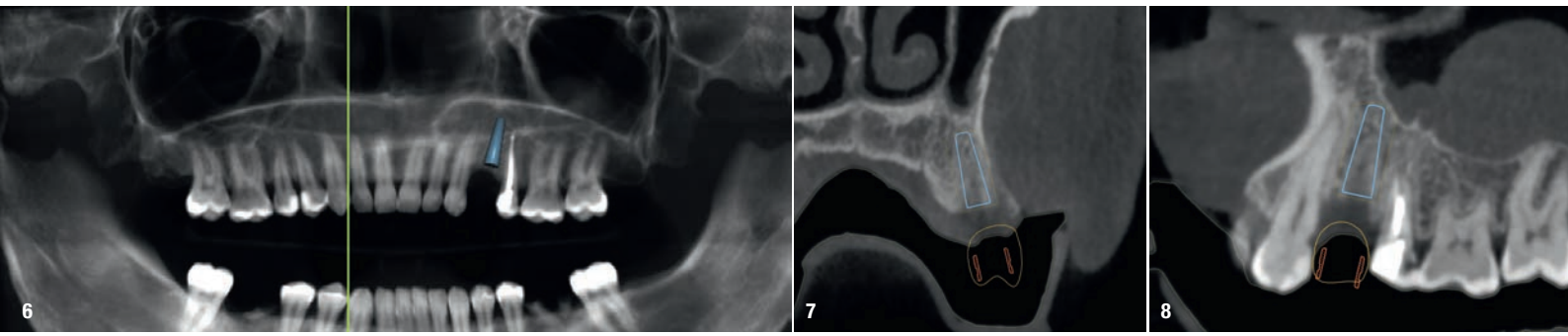


**Fig. 6:** Panoramic view of the planned implant in the SMART Guide software. **Figs. 7 & 8:** Zoomed-in view of the planned implant in the SMART Guide software.

develop a treatment plan based on the patient's needs and anatomical suitability rather than on a specific implant manufacturer's product lines. Thus, the ideal guidance system can be adapted to a variety of implant brands and types, offering recommendations that are patient-centred rather than product-centred.

The SMART Guide Technology System (dicomLAB Dental) provides complete case analysis and preparation shortly after imaging, enabling immediate treatment planning for any type of implant placement. It is possible to set the implant length in 0.5 mm increments and the diameter in 0.1 mm increments. The surgical protocol of the

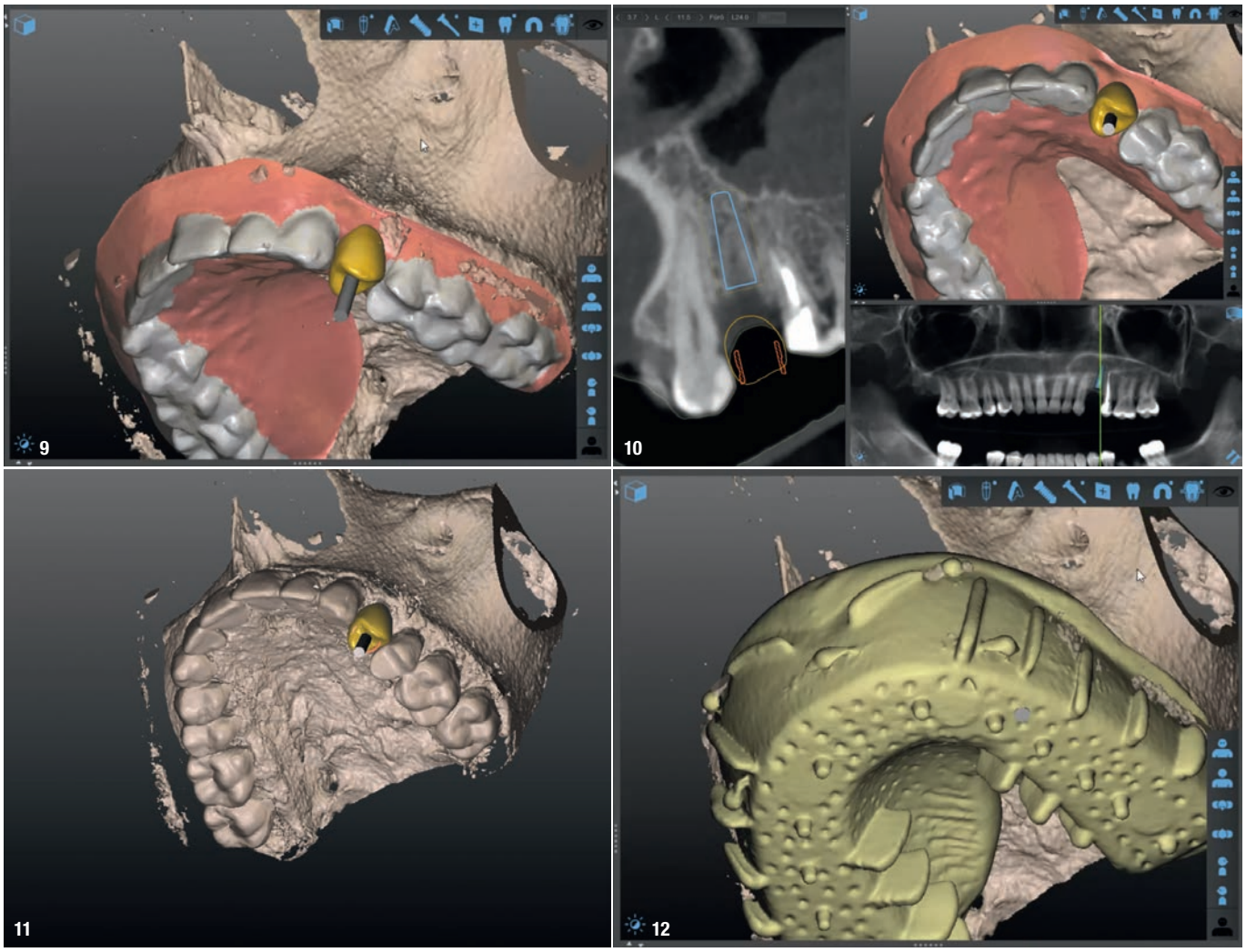
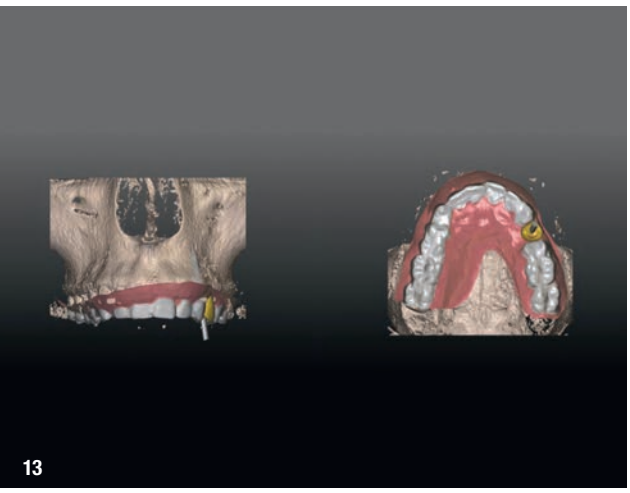
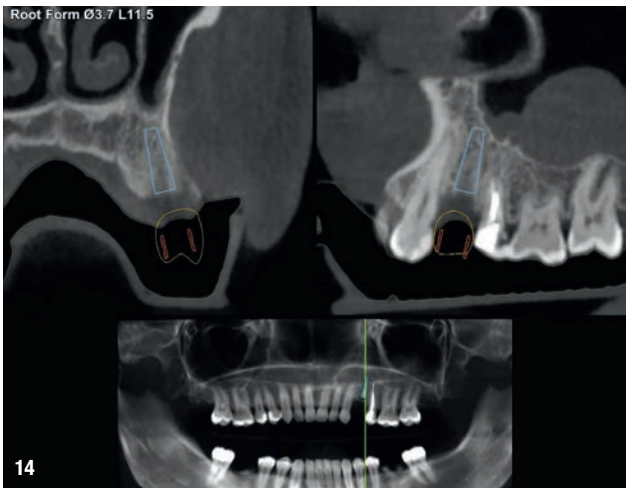


**Fig. 9:** Digital tooth set-up visualisation in the SMART Guide software. **Fig. 10:** Implant for fractured tooth #24 planned. **Fig. 11:** Planned implant in 3D visualisation in the SMART Guide software. **Fig. 12:** SMART Impression Tray visualisation in the SMART Guide software.





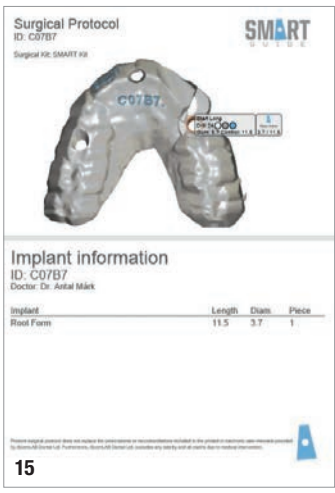



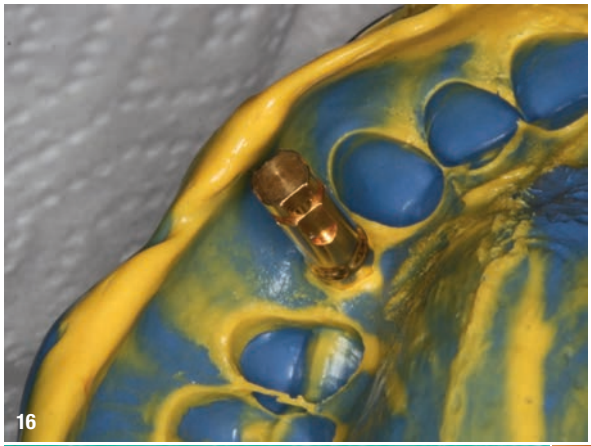

**Fig. 13:** First preview images of the case in SMART Cloud. **Fig. 14:** Second preview image of the case in SMART Cloud. **Fig. 15:** SMART Guide surgical protocol.

system is entirely dependent on the properties of the implant selected by the practitioner. The shape of the implant is also at the discretion of the dentist: conical or cylindrical shapes can be selected.

## Case presentation

The following provides a detailed, step-by-step presentation of a case in which planning and surgery were both accomplished with the assistance of the SMART Guide system. A 39-year-old female patient presented with a fractured maxillary left first premolar.

The tooth had previously undergone endodontic treatment; a subsequent vertical fracture of the root and unrestorable coronal structure made the case for an implant treatment (Figs. 1–3).



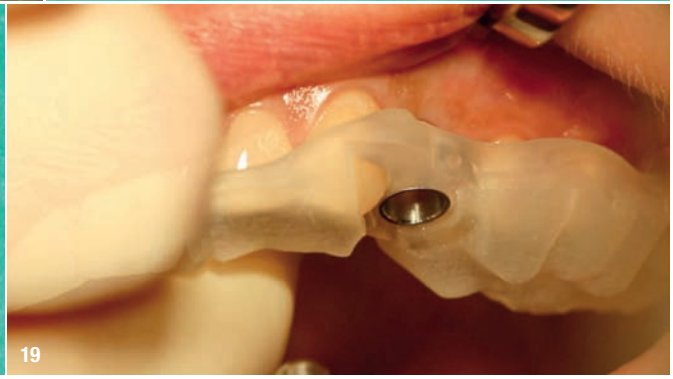



**Fig. 16:** Abutment for the model, in the impression. **Fig. 17:** The surgical guide after arrival. **Fig. 18:** The surgical guide after sterilisation. **Fig. 19:** The surgical guide in the patient's mouth.

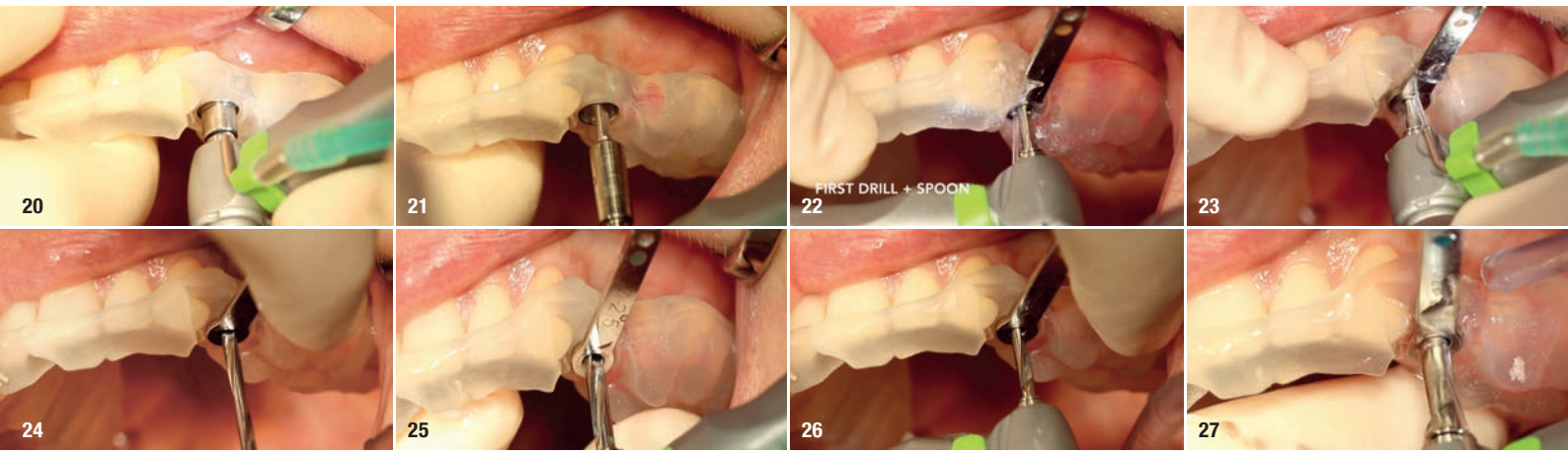



**Fig. 20:** Preparation. **Fig. 21:** START long drill. **Fig. 22:** The first drill goes in with the spoon to stabilise the drill. **Fig. 23:** The first drill with its spoon. **Fig. 24:** Inserting the first drill through the surgical guide after the START drill. **Fig. 25:** The second drill with its spoon. **Fig. 26:** Inserting the second drill. **Fig. 27:** The third drill with the corresponding spoon.

The remainder of tooth #24 was extracted. In order to avoid any complications due to residual bacteria or possible periapical or periradicular infection, a two-month healing time was set. After the initial healing, a CBCT scan was taken and an intra-oral impression of the patient was taken with a custom-made plastic impression tray and C-silicone. This is the SMART Guide simple CBCT protocol. This approach has some limitations, as the superimposition of the CBCT scan on to the silicone impression requires the presence of a minimum of eight sound teeth as reference points on the dental arch to be treated. The silicone impression must be scanned with an extra-oral scanner for the digital superimposition of the CBCT scan on to the impression. Another option is to use an intra-oral scanner. The same limitations regarding sound teeth apply, however. The reference teeth must be sound or restored with metal-free restorations; any metal restorative components, such as amalgam fillings, porcelain-fused-to-metal crowns or bridges, or metal posts, interfere with the CBCT data acquisition.

After the CBCT scan of the patient and the scanned impression had been completed, both data sets were uploaded, without patient-identifying information, to SMART Cloud. The SMART Guide centre then checked the quality of the images.

In cases in which the patient is completely edentulous or there are not enough metal-free, sound or restored teeth to provide the required minimum eight reference points, the double CBCT scan technique can be employed. This procedure entails taking an initial impression

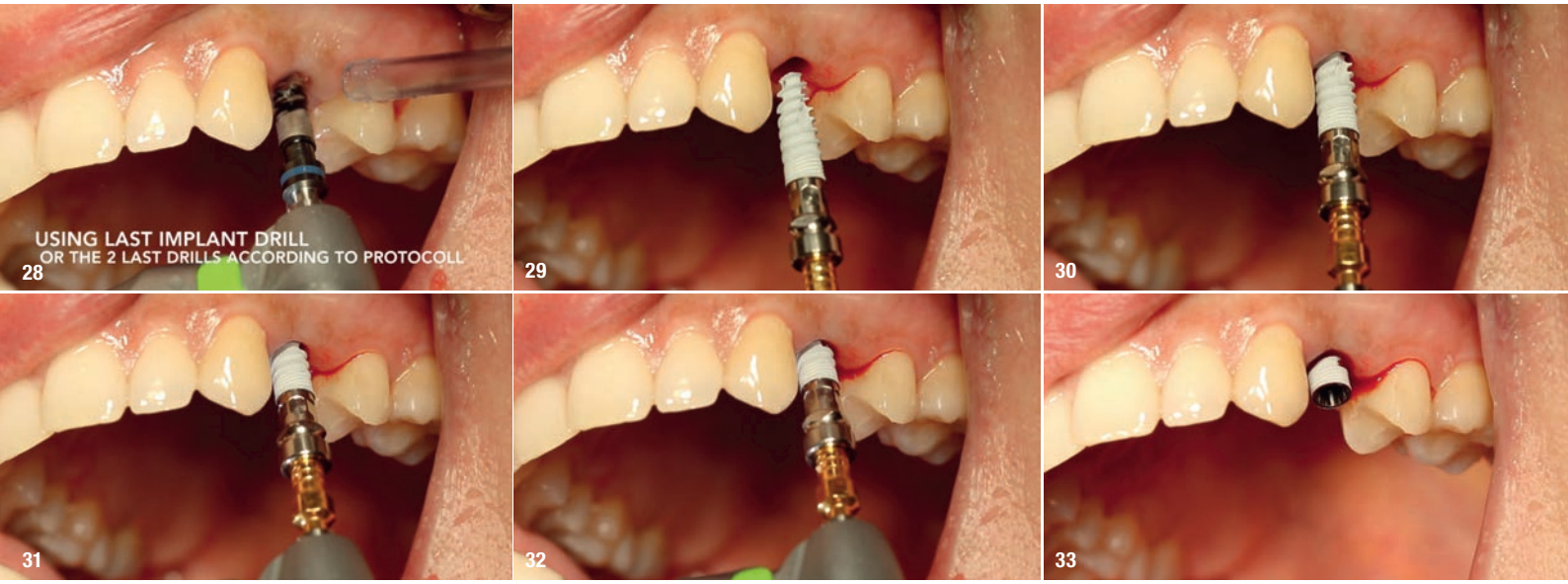



**Fig. 28:** After the preparation, the implant drills are used up to the last drill needed. **Figs. 29–33:** Implant insertion.

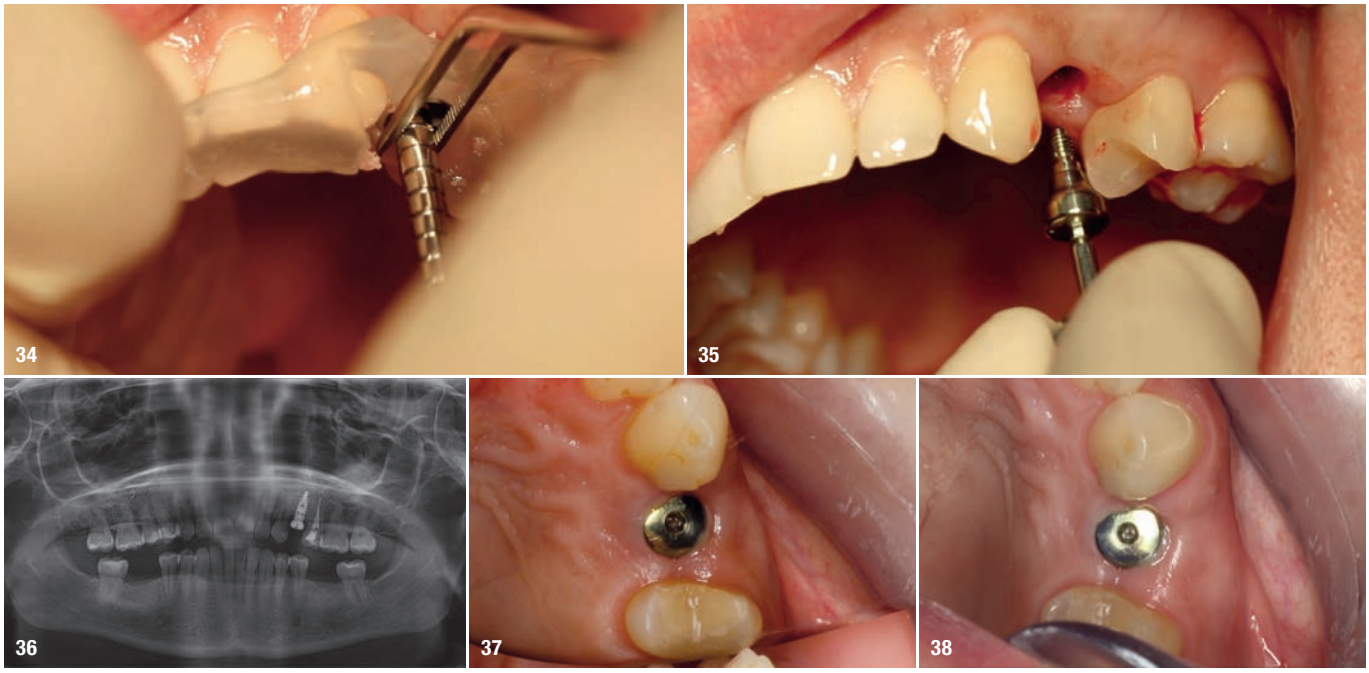



**Fig. 34:** Checking vertical position through the surgical guide with depth control. **Fig. 35:** Healing cap insertion. **Fig. 36:** Post-op panoramic radiograph. **Figs. 37 & 38:** Healing.

of the patient and then positioning radiopaque gutta-percha markers on the tray. The patient wears this tray intra-orally during the second CBCT scan. Thus, there are two separate CBCT scans, one of the gutta-percha-marked tray extra-orally and one of the marked tray intra-orally. This process ensures a precise fit in those cases in which the number of sound tooth reference points is limited.

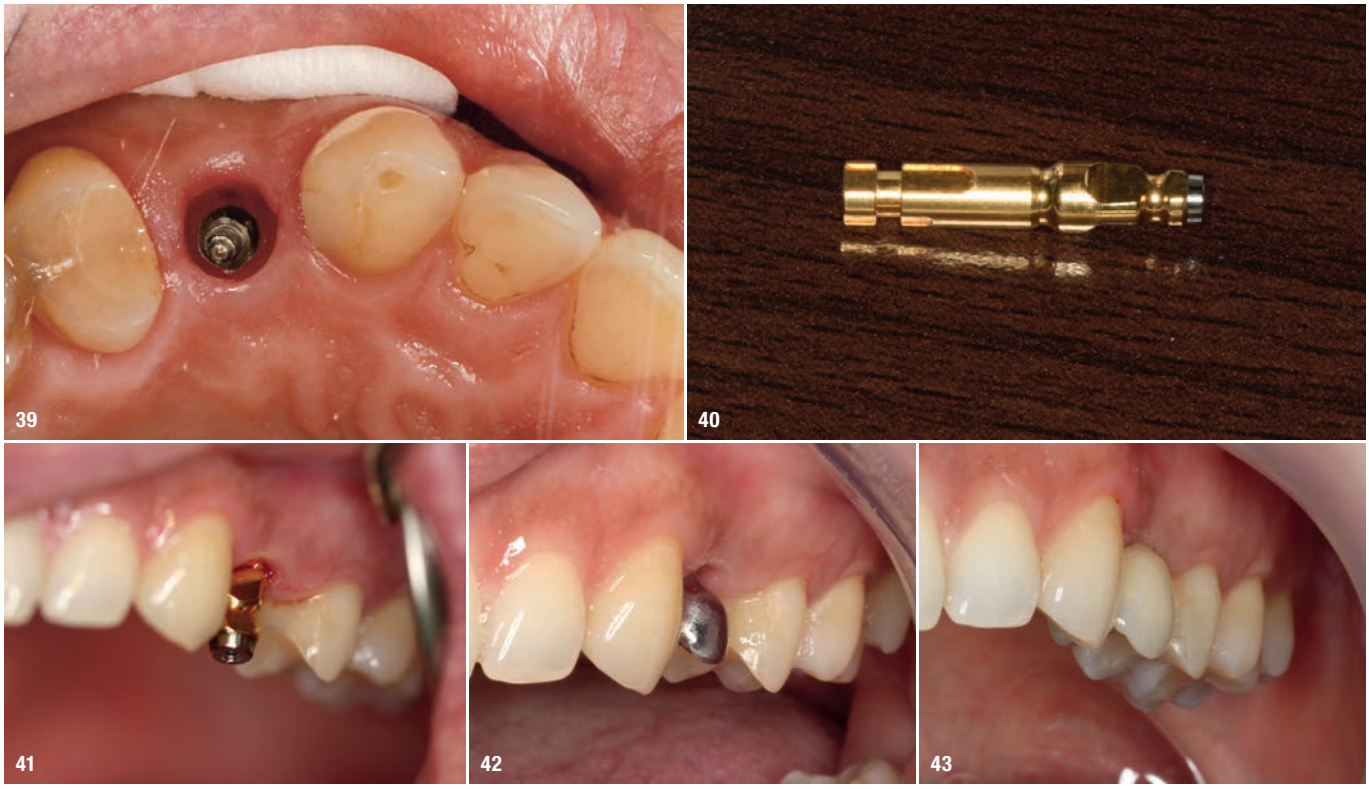



**Fig. 39:** Implant is exposed. **Fig. 40:** Abutment. **Fig. 41:** Abutment inserted. **Fig. 42:** Before the final step. **Fig. 43:** The missing tooth #24 replaced using the SMART Guide.

Once the SMART Guide centre has prepared the case, the operator receives a notification e-mail or text. This is typically within approximately 4 hours after successful data upload. The practitioner then downloads the patient data to the practice computer on which the SMART Guide software has previously been installed. It is now possible to plan the optimal positioning (location, angulation, depth and diameter) of the implant, considering the implant properties (length, diameter and shape; Figs. 4–8).

In the current example, the replacement of the extracted maxillary left first premolar with an implant and an implant-borne crown is demonstrated. The software makes it possible to visualise the bone, the soft tissue and the intra-oral impression taken of the patient. The software then suggests a crown shape, which assists with the planning of the implant angulation and the ideal emergence profile of the restorative crown. The recommended shape considers the anatomical properties of the adjacent and opposing teeth and the soft-tissue condition. In cases in which screw-retained crowns are planned, this process is essential in ensuring proper location for optimal angulation and access to the retention screw (Figs. 9–12).

Once the planning phase has been completed, it is possible to ask for a treatment plan review by a contracted expert implant specialist on the SMART Guide system who is able to mentor the practitioner. This approach offers confirmation of treatment approach and direction prior to any surgical steps. For those who are less experienced in treatment planning, this is an invaluable safeguarding service. A comprehensive pre-planning service (that begins immediately after data upload) is also available. In all cases, however, the final decision is always at the discretion of the operator. Further planning and modifications are always possible before the SMART Surgical Guide is ordered.

A short time after it is ordered, the printed surgical guide arrives at the practice. It is a good idea to sterilise it in an autoclave. Along with the printed surgical guide, the operator is provided with a specific surgical protocol for the planned implant (Figs. 13–19).

During the actual implant placement surgery, the sequence that is recommended on the attached drilling protocol chart should be followed. The surgical kit of the SMART Guide system consists of drills 20.0 mm, 24.0 mm and 28.0 mm in length, each with a diameter of 2.0 mm, 2.5 mm, 3.0 mm and 3.5 mm (Figs. 20–27).

The final drilling step is done with the final core drill of the selected implant system, to the proper depth and diameter to ensure perfect implant placement. The final implant drill can also be used without the surgical guide, since the direction and depth of the bone preparation will already have been pre-established with the SMART Guide. The bony housing will already have been prepared to a size which almost matches that of the intended implant (Figs. 28–43).

## Conclusion

The SMART Guide Technology System offers a versatile implant placement guidance system that can be adapted to most implant brands and types, making implant surgery patient-centred (rather than product-centred), more predictable and more efficient.

## about

**Dr Mark Antal** is an assistant professor at the Faculty of Dentistry of the University of Szeged in Hungary. After earning his DMD, he specialised in operative dentistry and oral surgery, completing internships at Martin Luther University Halle-Wittenberg in Germany and Boston University and New York University in the US. He previously served on the Education Committee of FDI World Dental Federation and is an honorary lifelong member of the International Association of Dental Students. He is a member of the Magyar Esztétikai és Restauratív Fogászati Társaság (Hungarian Association for Aesthetic and Restorative Dentistry) and the MAGYAR FOGORVOSOK IMPLANTOLÓGIAI TÁRSASÁGA (Hungarian Dentists Society of Implantology).

A graduate of McGill University in Montreal in Canada, **Dr George Freedman** maintains a private practice limited to aesthetic dentistry in Toronto in Canada. He is adjunct professor of dental medicine at Western University of Health Sciences in Pomona in California in the US and a visiting professor and director of the MClinDent programme in restorative and cosmetic dentistry at BPP University in London in the UK. He is the author or co-author of 14 textbooks, his most recent being *Contemporary Esthetic Dentistry* (Elsevier, 2012), and of more than 800 dental articles and numerous webinars. He serves on the editorial team of *REALITY* and is the international editor-in-chief of *Dental Tribune*. He lectures internationally on aesthetic restorative dentistry, adhesion, composites, implants, oral health maintenance, porcelain veneers, 3D printing and other dental technologies. Dr Freedman is a regent and fellow of the International Academy for Dental-Facial Esthetics and a diplomate and chair of the American Board of Aesthetic Dentistry. He is a founder and past president of the American Academy of Cosmetic Dentistry and a founder of the Canadian Academy for Esthetic Dentistry and the International Academy for Dental-Facial Esthetics. Dr Freedman is a recipient of the Smigel Prize in Aesthetic Dentistry (New York University College of Dentistry).

# Fully edentulous jaw rehabilitation according to the Straumann Pro Arch concept using BLX with guided surgery

Dr Leandro Soeiro Nunes, Brazil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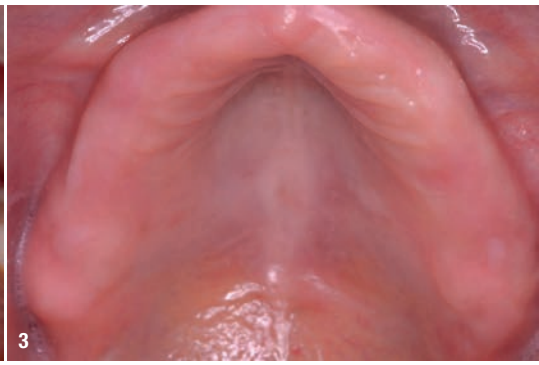
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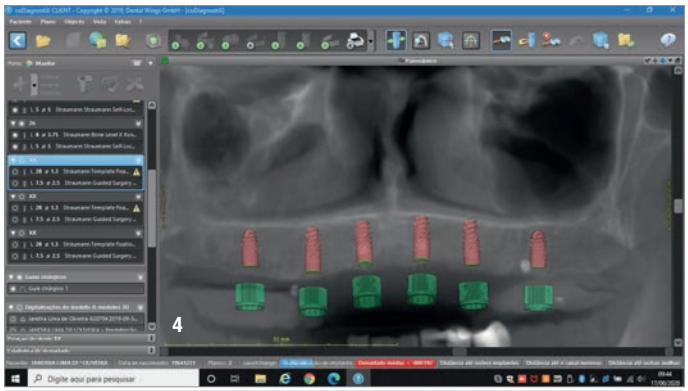
## Introduction

Implant rehabilitation of the edentulous maxilla is challenging owing to local anatomical conditions, bone quality and prosthetic design, among others. The implant distribution in the maxilla is a very important factor for long-term success. Besides that, the number of implants, primary stability and the material of the restoration are crucial factors for predictability and a satisfactory outcome. The new BLX implant (Straumann) presents interesting features that allow higher primary stability even in compromised situations, and this encouraged us to perform immediate loading in the edentulous case presented here.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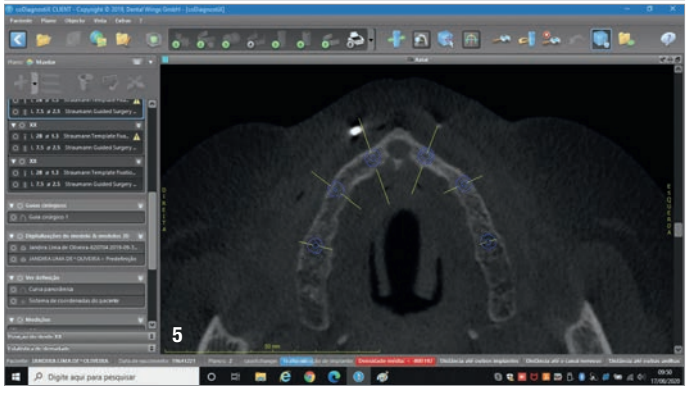
## Case presentation

This female patient presented to the clinic with a maxillary denture (Fig. 1), which demonstrated low stability, and she had poor masticatory function. Poor aesthetics was also a complaint, but the functional aspect was more crucial for her. After the clinical examination (Figs. 2 & 3) and CBCT analysis, we planned six implants,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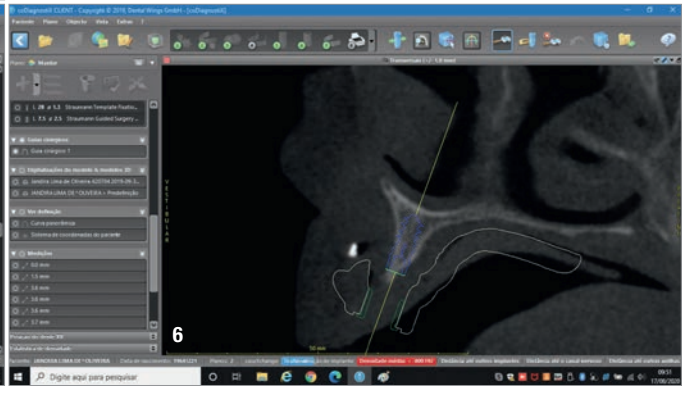
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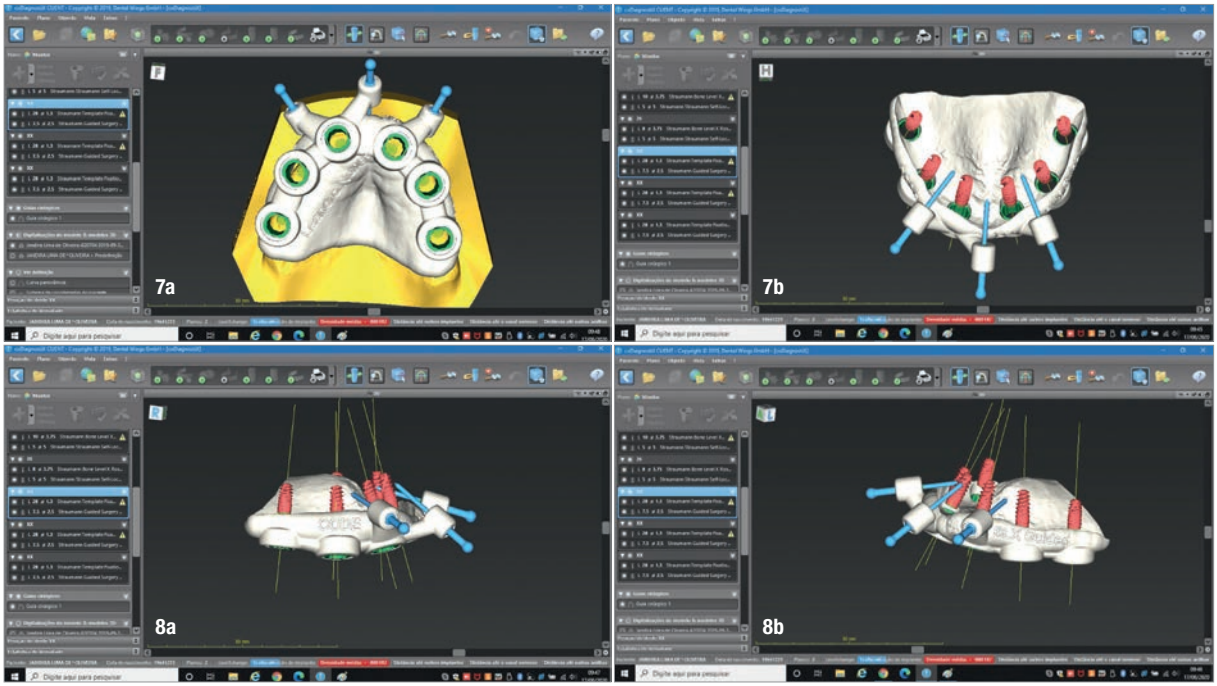
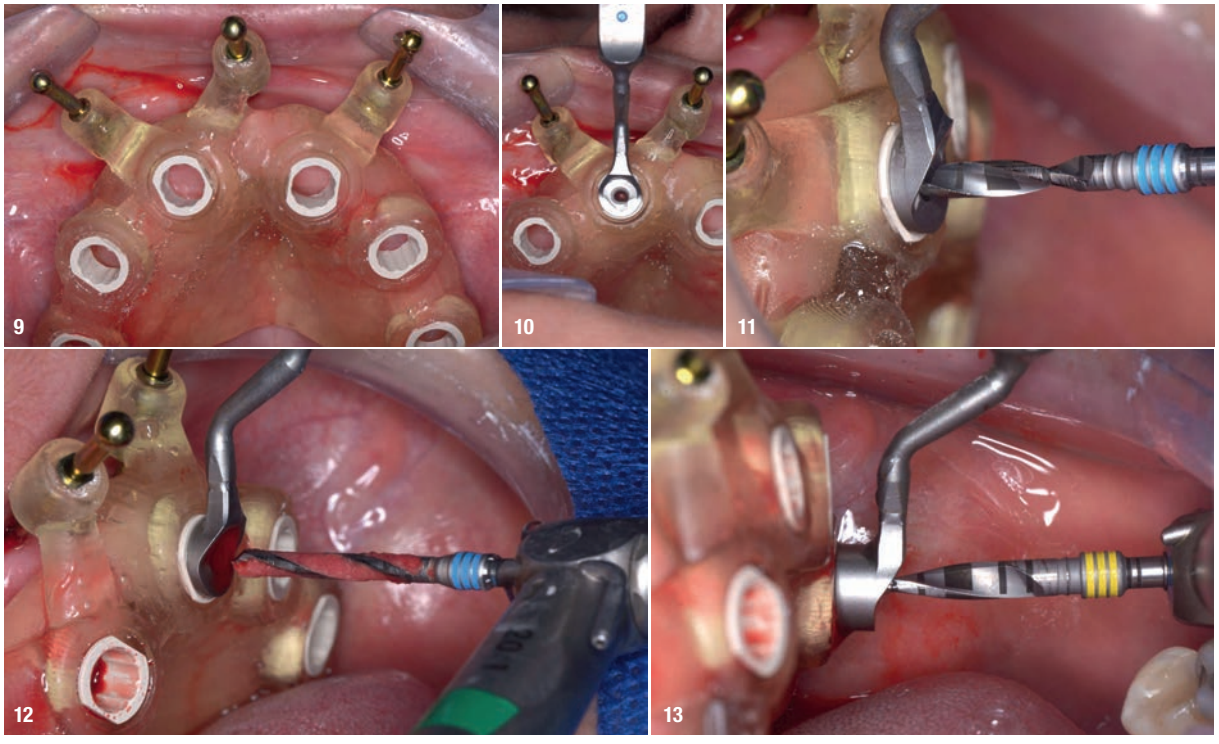



all straight, in order to support a fixed full-arch prosthesis (Fig. 4). The provisional prosthesis was produced prior to the implant placement. The surgical guide was printed to perform a static guided surgery.

## Treatment planning

Using coDiagnostiX (Dental Wings), we could see that there was enough bone into which to place the implants (Fig. 5), apart from two regions that would need bone grafting (Fig. 6). Six straight positioned implants were planned with an adequate cross-arch distribution to support the masticatory forces and avoid cantilevers (Figs. 7a & b). The Straumann BLX implants would be placed using a surgical guide (Figs. 8a & b), and the provisional prosthesis would be screwed on to the implants just after the surgery as part of the immediate loading protocol.

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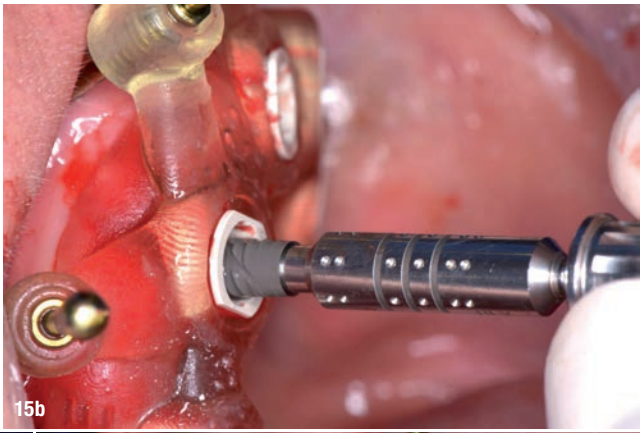
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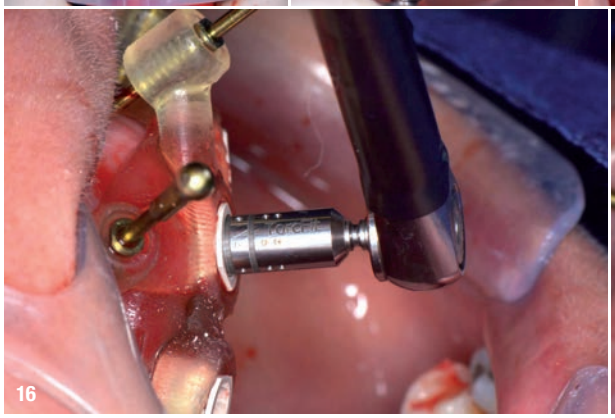
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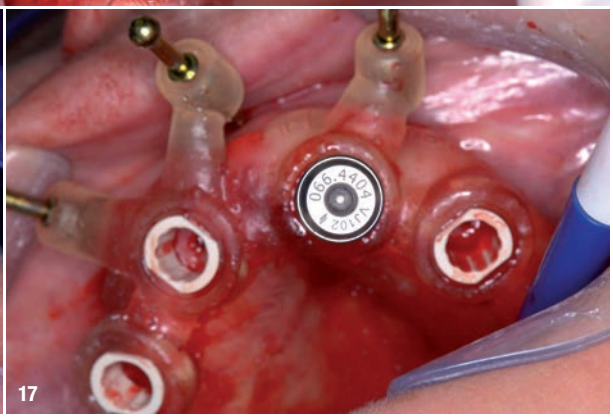
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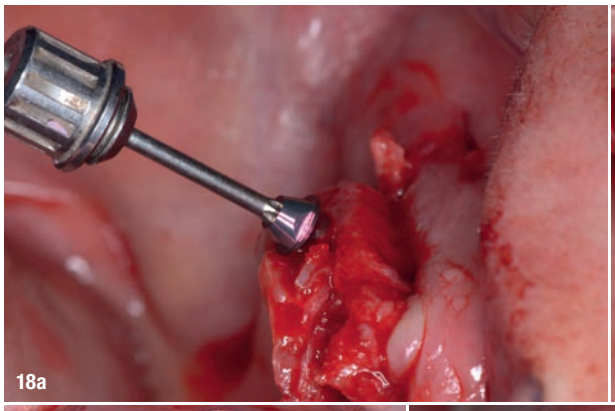
## Surgical procedure

A flapless surgical procedure was planned for the implant placement, and afterwards, a small flap was elevated only in the regions where we expected implant exposure. The surgical guide fitted perfectly to the mucosa (Fig. 9), which had been scanned with a laboratory scanner, and it was fixed with fixation pins. The site preparation with the VeloDrill (Straumann) ran smoothly, and the sites were underprepared in order to achieve appropriate primary stability in soft bone conditions (Figs. 10–13). The six implants were placed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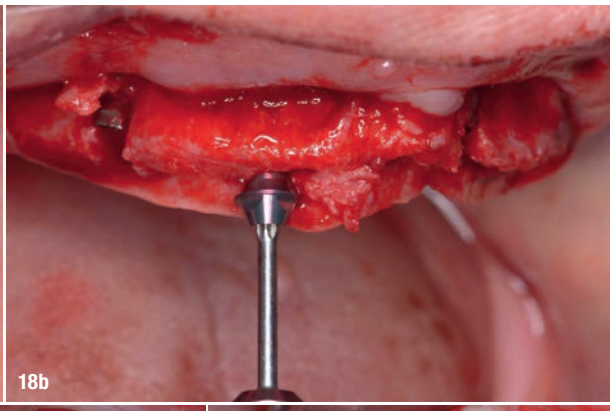
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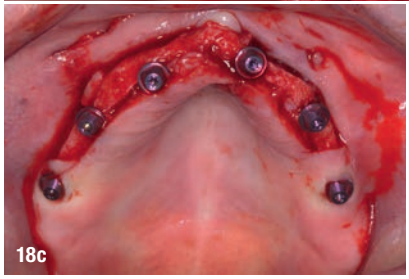
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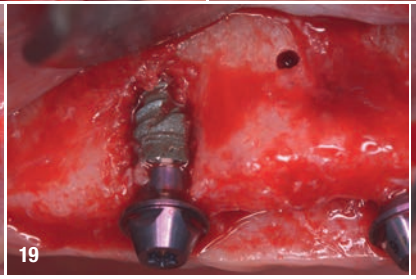
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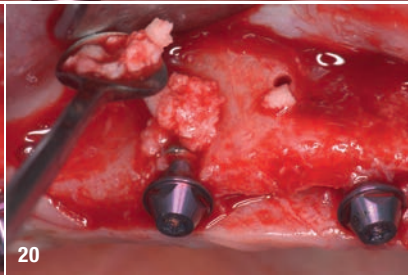
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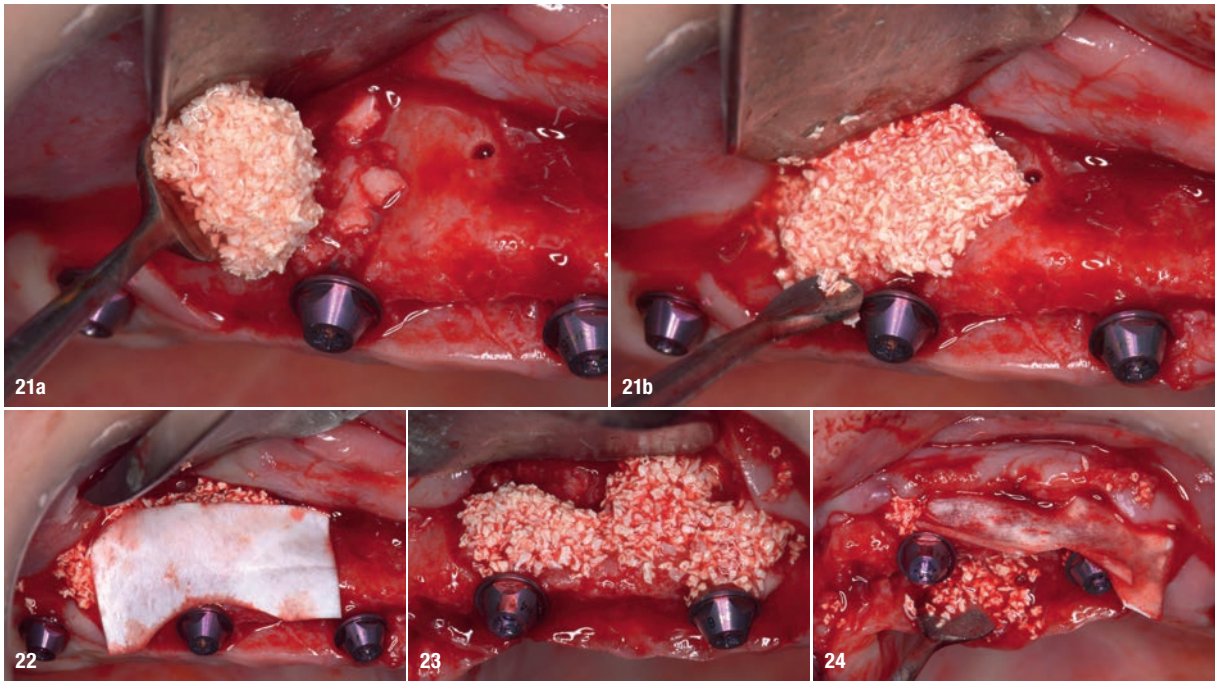


with the rachet, and the Straumann surgical torque control device indicated primary stability, measured as being above 35 Ncm, allowing the implants to be loaded immediately (Figs. 14–17).

After the implant placement, a small flap was elevated in the regions with pre-planned implant exposure. The screw-retained abutments were screwed on to the implants (Fig. 18). Over the exposed implant surfaces (Fig. 19), we performed guided bone regeneration utilising the Buser concept, placing autogenous bone chips as the first layer in contact with the implant (Fig. 20). Over the autogenous bone, we augmented the volume with a layer of biomaterial (cerabone, botiss biomaterials)


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and covered it with a collagen membrane (Jason, botiss biomaterials; Figs. 21–24). The provisional copings were screwed on to the abutments, and after suturing, we started to capture the provisional copings within the prosthesis.

## Prosthetic procedure

The provisional prosthesis was produced prior to the surgery, based on the wax-up (Figs. 25–28) and implant planning done on coDiagnostiX. Six small holes


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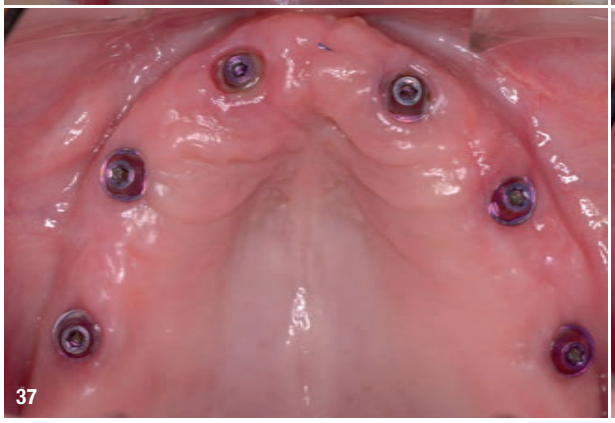
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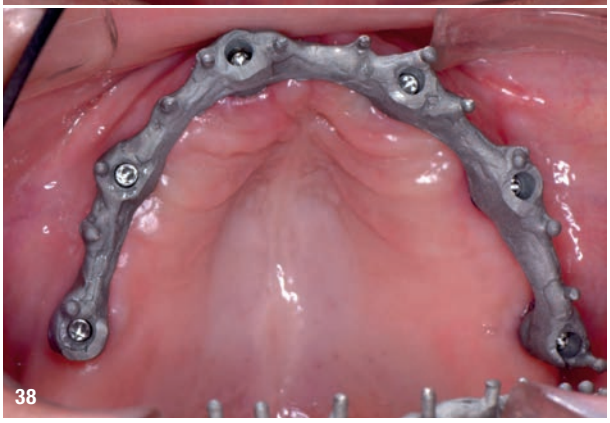
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were created in the printed models, based on the surgical guide (Figs. 29–31). Following the same orientation, six holes were created in the provisional prosthesis (Figs. 32–34). After suturing, we inserted the prosthesis over the implants to capture the final implant positions. With flowable composite, we connected the provisional prosthesis with the provisional titanium copings (surgery performed together with Dr Cristiane Juchem; Figs. 35 & 36). The final adaptation was performed chairside, and after some minutes, the restoration was screwed on to the screw-retained abutments. After three months, the temporary restoration was replaced by the definitive restoration (Figs. 37–44).

## Treatment outcome

Immediate loading in edentulous patients is a well-documented procedure that has similar implant and restoration survival rates to those of delayed loading. The possibility of performing small adaptations to the provisional restoration produced before the surgery is a very good way to compensate for the small deviations that can occur in guided surgery.

## about

**Dr Leandro Soeiro Nunes** graduated from the Federal University of Rio Grande do Sul in Porto Alegre in Brazil and specialised in oral and maxillofacial surgery in 2006 at the Universidade Luterana do Brasil in Canoas in Brazil. For his master's degree, which he undertook at the University of São Paulo in Bauru in Brazil, he evaluated the biological behaviour of biomaterials in sinus lift procedures, and for his doctorate, completed at the Pontifical Catholic University of Rio Grande do Sul in Porto Alegre, he compared the biological behaviour of different implant surfaces. In 2010, he moved to Berne in Switzerland to join the International Team for Implantology (ITI) scholarship programme headed by Prof. Daniel Buser at the University of Bern. Dr Nunes is an ITI fellow, ITI study club director in Porto Alegre and teaches implantology at the Associação Brasileira de Odontologia, seção Rio Grande do Sul (Rio Grande do Sul section of the Brazilian association of dentistry). He also runs his own private practice focused on oral surgery, implant therapies and bone regeneration He can be contacted at leandrosnunes@gmail.com.

# Overdenture solutions for today's economy

Dr Ara Nazarian, USA

**Fig. 1:** Retracted pre-op smile view. **Fig. 2:** Retracted pre-op frontal view.

## Introduction

In today's economy, we have seen dramatic changes in lifestyle, health and income. Because of this, we have seen patients delay dental treatment until their condition finally becomes very painful. Although patients may want full-mouth dental implant treatment with fixed restorations, this may not always be something that fits into their budget. As dental providers, we need to offer our patients a variety of different treatment options in order to restore their dentition to proper form and function. This article focuses on the steps involved in providing denture and overdenture treatment in addition to extractions, grafting and dental implant placement.

## Case presentation

A patient presented to my practice for a consultation wanting to restore his smile. He complained of generalised discomfort in his mouth owing to the caries and periodontal disease that was readily apparent (Figs. 1 & 2). Previously, the patient had had teeth removed, on different occasions, when there was severe pain or infection. However, this time, he wanted to have a plan and be proactive in any suggested treatment that would fit into his budget. He had already been informed by several dental providers that he would probably need all his remaining teeth removed owing to his advanced periodontal disease, so he was aware that this might be the case.

## Planning

At the consultation appointment, the patient was informed that we would require a CBCT scan to assist us in accurately diagnosing his dental conditions. Using the CS 8100 3D (Carestream Dental), a CBCT scan was taken so that we would be able to identify the areas of infection and

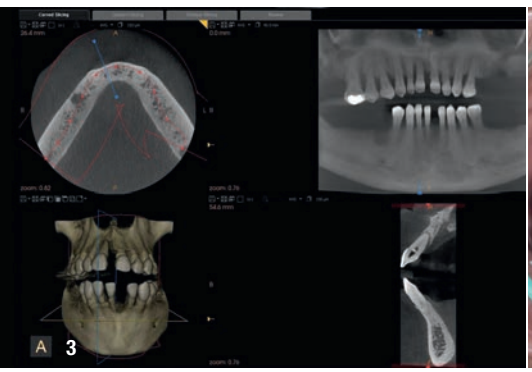

**Fig. 3:** CBCT scan obtained using the CS 8100 3D (Carestream Dental). **Fig. 4:** Pre-op bite registration with Futar (Kettenbach). **Fig. 5:** Immediate dentures.


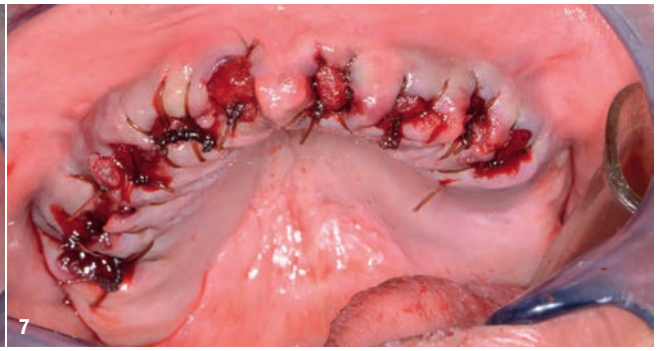

**Fig. 6:** Physics Forceps used for extractions (GoldenDent). **Fig. 7:** Area grafted and sutured.

decay, but also the areas remaining bone for dental implant placement (Fig. 3). Since the patient had expressed his concern about cost, our goal was not only to find a treatment modality that would restore aesthetics and function economically in terms of cost, but also to provide a treatment that could potentially be upgraded in the future.

Preliminary impressions for immediate dentures were obtained using Silginat (Kettenbach), a cost-effective elastomeric polyvinylsiloxane impression material. Orthodontic retractors were utilised in order to ensure that the patient was accurately biting in centric occlusion when capturing the bite registration with fast-setting Futar bite material (Kettenbach; Fig. 4). Photographs of the patient's smile and midline were acquired in order to properly inform the dental laboratory (Advanced Implant Dental Lab) of any changes that were desired, including tooth position, tooth size and arch form for the immediate dentures (Fig. 5).

All risks, benefits and alternatives were fully described to the patient and any questions fully answered. Upon listening to the various treatment options, the patient decided to have all his remaining teeth extracted and those sites grafted. In the maxillary arch, the patient would be getting a complete denture, whereas in the mandibular arch, he would be getting an overdenture retained by four dental implants.

In order to assist the patient with this investment, financing options using a third-party payment option (Alphaeon Credit) were discussed. This consideration was a very important part of facilitating acceptance of his care, since it made the cost of treatment more economical.

Once anaesthesia was acquired, we started removing the teeth in the maxillary arch using the Physics Forceps (GoldenDent; Fig. 6). Since the Physics Forceps act like a Class I lever, the only force applied with the beak is on the lingual aspect of the tooth. With the beak positioned at the lingual cervical portion, the soft bumper is placed on the buccal alveolar ridge at the approximate location of the mucogingival junction. While the beak grasps the tooth, the bumper acts as the fulcrum, providing leverage and stability for the beak. Extraction is accomplished with slight wrist movement rotation in the buccal direction for about 30–60 seconds, depending on the length and curvature of the roots.

Once the teeth in the maxillary arch had been removed, any granulation tissue remaining within the sockets was removed using a curette (GoldenDent), and any sharp areas of the alveolar crest were levelled with a bone bur (GoldenDent). OsteoGen plugs (Impladent) were placed in each socket to facilitate bone growth within the sockets over a four- to five-month period for future implant placement if the patient desired. Using resorbable sutures, the OsteoGen plugs were further stabilised and the tissue sutured (Fig. 7).


**Fig. 8:** Try-in of immediate denture. **Fig. 9:** Chairside soft denture relining material. **Fig. 10:** Dispensing SOFRELINER TOUGH (Tokuyama Dental) into immediate denture.

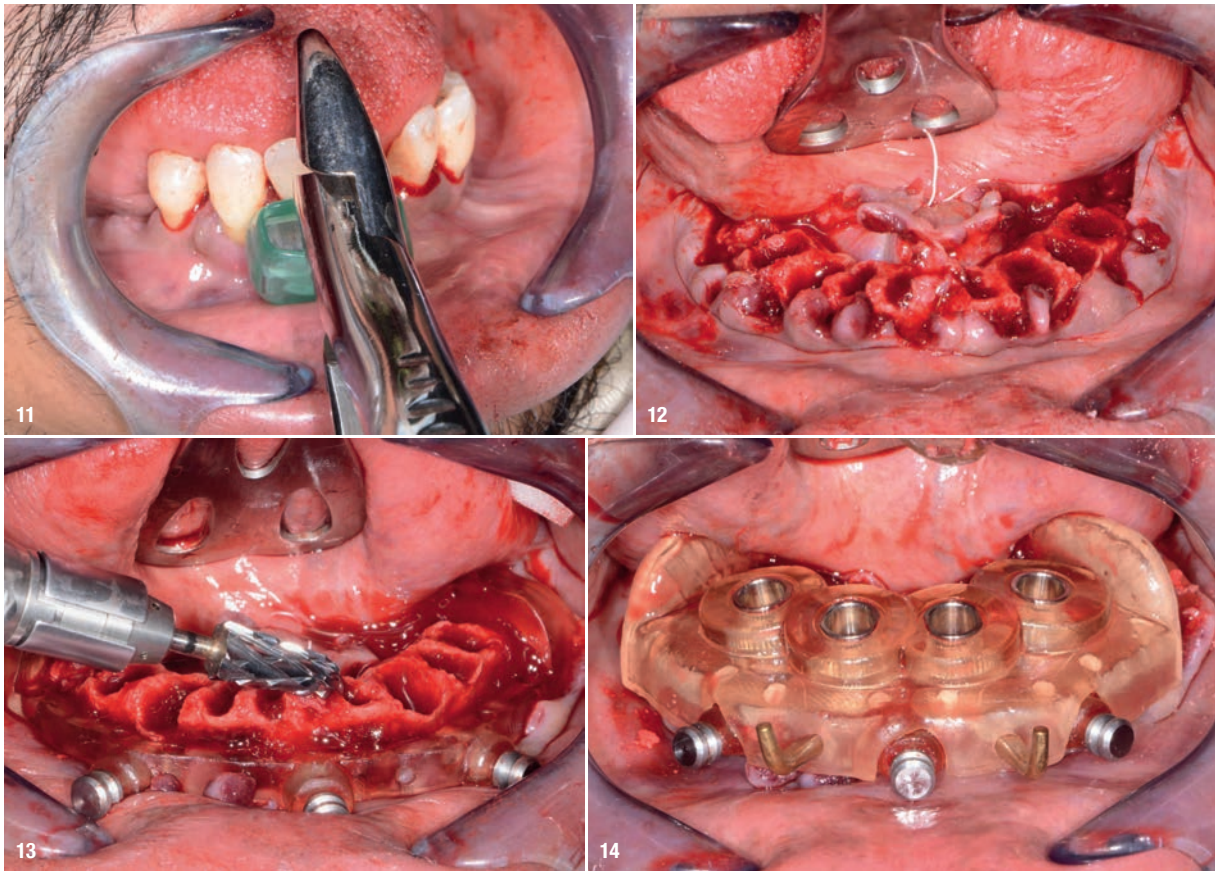

**Fig. 11:** Removing mandibular teeth. **Fig. 12:** Remaining ridge after tooth removal. **Fig. 13:** Levelling bone using a CBCT-based guide. **Fig. 14:** Positioning implant surgical guide.

The immediate maxillary denture was tried in to confirm passive placement as well as for a visual inspection of the patient's midline (Fig. 8). Once this had been confirmed and the immediate denture had been fully seated, a self-autopolymerising silicone-based soft relining material (SOFRELINER TOUGH Medium, Tokuyama Dental) was used to line the inner aspects (Figs. 9 & 10). According to the manufacturer, SOFRELINER TOUGH is designed to provide long-lasting consistent relief with outstanding durability for up to two years, superb stain and odour resistance, and excellent adhesion to the denture.

Similar to what was done in the maxillary arch, the Physics Forceps were used to remove the remaining teeth in the mandibular arch (Fig. 11). The remaining sockets were curetted to remove any debris or granulation tissue. Once the sockets had been cleaned out, the bone levelling guide (Advanced Implant Dental Lab) was positioned over the mandibular ridge (Fig. 12). This bone levelling guide is used as a reduction guide to eliminate any undercuts while creating a levelled area with sufficient width for dental implant placement (Fig. 13). Once the ridge had been completely levelled to the height of this

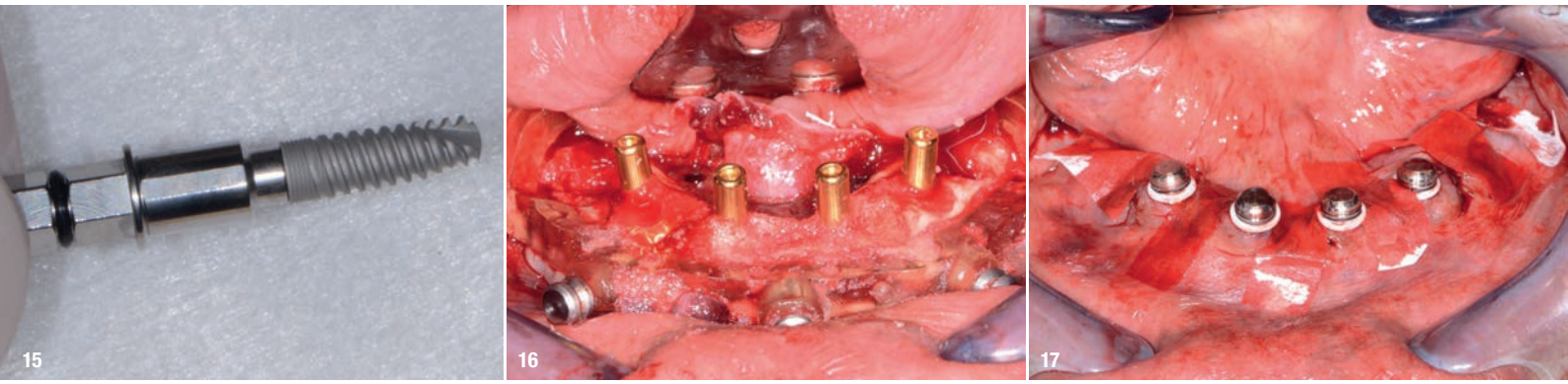

**Fig. 15:** Seven dental implant (MIS Implants Technologies). **Fig. 16:** Overdenture attachments inserted, followed by grafting material. **Fig. 17:** Overdenture housings ready for the pick-up of attachments.

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**Fig. 18:** Chairside hard denture relining material TOKUYAMA REBASE II (Tokuyama Dental). **Fig. 19:** Immediate post-op retracted view. **Fig. 20:** Retracted post-op smile view.

guide, the next layer, which was the implant surgical guide, was placed over it (Fig. 14). Using the MGuide Set (MIS Implants Technologies), the drilling sequence for four Seven (MIS Implants Technologies) dental implants was initiated. This computer-based planning system enhances both accuracy and effectiveness for a more ideal implant placement procedure. The drills in the MGuide kit are designed with built-in stoppers to allow precision preparation and placement to the planned depth and positions without the need for keys.

The four 3.75 × 13.00 mm Seven dental implants (Fig. 15) were torqued to the desired depth at approximately 50 Ncm. Once the implants had been fully inserted, four 5 mm high Zest LOCATOR attachments (Zest Dental Solutions) were inserted within the implants using the Zest tool. Using a torque wrench with the appropriate adapter, the Zest LOCATOR attachments were tightened to 30 Ncm (Fig. 16). The internal aspect of the dental implants having been sealed, bone grafting putty material (GoldenDent) was injected into any remaining voids in the bone (Fig. 17). Using resorbable sutures, primary closure was accomplished around the locations of the implants. In order to avoid tearing the sutures during the pick-up procedure of the Zest housings, small strips of C-fold towel were used to cover any exposed areas of the sutures.

Since the bone had been levelled with the guide, there were no interferences detected between the denture base and attachments in the anterior portion of the immediate denture. Using TOKUYAMA REBASE II chairside hard denture relining material (Tokuyama Dental; Fig. 18), the female components of the Zest LOCATOR attachments would be picked up. Since this material is free of methyl methacrylate, it does not have a strong odour or taste, and it generates very minimal heat.

The first step in the pick-up process was to brush on a thin coat of TOKUYAMA REBASE II adhesive included in the TOKUYAMA REBASE II kit into the area of the overdenture attachments. This would enhance the chemical retention between the denture base and the hard relining or pick-up material. KY lubricant was applied to the surrounding surfaces of the denture to prevent unwanted adherence of excess material. Once the powder and liquid of TOKUYAMA REBASE II had been mixed, the material was placed into a plastic dispensing syringe and injected into the internal anterior portion of the mandibular immediate denture as well as on to the receptor attachments.

The prosthesis was held in position by the patient biting in centric occlusion (Fig. 19). After approximately 3 minutes, the overdenture with the incorporated retention caps was removed and any excess material was removed with a trimming bur. The bite of the maxillary immediate denture with soft relining opposing the mandibular overdenture was verified and any interference eliminated (Fig. 20).

## Conclusion

As we see more and more patients presenting with dental issues requiring full-mouth rehabilitation, we need to offer a variety of different treatment modalities to accommodate their aesthetic and functional needs in addition to fitting their budget. Overdentures are a great treatment option for these patients, and they can later be upgraded to fixed restorations with additional dental implant therapy.

## about

**Dr Ara Nazarian** maintains a private practice in Troy in Michigan in the US with an emphasis on comprehensive and restorative care. He is a diplomate of the International Congress of Oral Implantologists.. He has conducted lectures and hands-on workshops on aesthetic materials, grafting and dental implants throughout the US, Europe, New Zealand and Australia.

# The future is now: Revolutionising dentistry with digital dentures

By Iveta Ramonaite, Dental Tribune International


Recent advancements in denture software have facilitated the transition to a fully digital workflow, and dental professionals are invited to embrace the benefits of digital dentistry.

**Whereas it was previously impossible** to imagine a dental laboratory adopting a fully digital workflow, digital dentistry has already redefined the previously established dental procedures and empowered dental professionals and clinicians to take the leap and immerse themselves in a digital future. The benefits of dental technology can be clearly seen in the introduction of digital dentures—not only has this facilitated denturists' and dental clinicians' work by offering more flexibility and efficiency, but it has also improved the patient experience and enabled patients to become more involved in their own care.

"I have been working with 3Shape for about five years. In the beginning, using denture software was not one of my goals; nonetheless, curiosity about the innovation and computer-aided design offered by 3Shape allowed me an opportunity to appreciate what appeared to be, for the first time, a real game-changer," Dr Lucio Lo Russo, associate professor of oral disease at the University of Foggia's School of Dentistry in Italy, told Dental Tribune International. "Since then, huge developments have been made in denture software, and it can now be considered essential for those who want to exploit the benefits of innovation and the related opportunities in dental practices and laboratories," he added.

According to Russo, using digital dentures offers higher standardisation. This, in turn, manifests itself in higher quality and a great reduction in processing time and, consequently, increases efficiency and profitability. He noted that switching to digital technology for the fabrication of dentures also results in changes to clinical and laboratory approaches. He stated: "No more physical impressions, no more physical casts, no time-demanding procedures. Each step is precisely defined and optimised to save time and enhance effectiveness."

## A clean and enjoyable experience

Germen Versteeg, a denturist and the owner of DTL Mediaan, one of the first fully digital dental laboratories, told Dental Tribune International that besides obvious advantages such as cost-efficiency, improved denture workflow and scaled-up production, working with digital dentures makes the job much cleaner. Whereas it used to be a messy process, leaving fine layers of dust on the working surfaces, Versteeg compared walking into a denture shop now with walking into a wellness centre: "It feels like home and it's really clean," he said. "We have a smile design room. So when people come in for the first time we drink a cup of coffee, and we discuss their new smile."

Dr Lucio Lo Russo, University of Foggia's School of Dentistry. *(Image: © 3Shape)*

Germen Versteeg, denturist. *(Image: © 3Shape)*

Using digital dentures also puts more power into the hands of the patients. Versteeg said: "The patients themselves are in charge of their aesthetics, and they can discuss the aesthetics with the help of 3D simulations."

Versteeg noted that fabricating a new denture is fairly uncomplicated, since it only involves creating a 3D picture of the patient, simulating a new smile and scanning the mouth with an intra-oral scanner, such as 3Shape's TRIOS. He went on to explain that people used to find wearing dentures quite off-putting. However, since it is a necessity rather than a choice, Versteeg believes that people should wear dentures with confidence: "So why can't we make it a sexier thing, something to be proud of?"

## Endless possibilities

For those thinking about transitioning to a fully digital production workflow, Versteeg explained that 3Shape software is highly sophisticated. Whether one wants to work with dental models, intra-oral scanners or impressions, all these and more options are already in the software. "You have the flexibility to work in your own way," Versteeg commented. Additionally, the software possesses older tools, making the transition so much smoother for more conservative dental professionals.

When using a digital workflow, a completely new denture can be made in two to three appointments. This saves time compared with fabricating dentures in a conventional analogue way and consequently boosts patient comfort. Another clear advantage of using digital dentures is reproducibility. Versteeg explained that, when a patient loses a denture or wants to improve the previous one, the denturist has the option of quickly accessing the software, where the back-ups of all CAD/CAM denture designs are saved, and printing or mailing a new denture in very little time.

## What 3Shape brings to the table

When talking about his experience with using 3Shape denture software, Versteeg explained that both parties benefit from the cooperation. The dental laboratory provides input and points out the improvements that need to be made in the software or in the workflow, and 3Shape immediately considers the laboratory's needs and constantly updates the software. As he noted, 3Shape specialises in IT, and dental laboratories perform clinical work, which means that both parties need to give feedback and exchange information that will help improve software quality and increase laboratory productivity.

"The great thing about 3Shape is that they listen to the end user. And I think that's something that makes them really stand out from all other companies," Versteeg explained.

## Go all the way

To make the most of the digital workflow and to truly benefit from it, Versteeg encouraged dental professionals to take the leap and go fully digital from the very beginning. As he highlighted, digital dentures are already being used today, and with every passing day, those who still have not adopted a digital workflow are falling further behind the technology.

"Even in more developed countries, there are millions of edentulous people who have limited access to oral treatments for biological or financial reasons. We still need effective and efficient rehabilitation of edentulous patients that is focused on their functional needs and favours access to treatment," Russo noted. "Digital technologies applied to removable prosthodontics have the potential to make such treatments affordable for these patients and also profitable for oral healthcare providers," he concluded.

# Positioning digital impression technology in today's dental practice

Dr Robert A. Lowe, USA



**Fig. 1:** A pre-op view of teeth #16, 15 and 14 prior to preparation for indirect ceramic replacements owing to marginal breakdown and recurrent decay. **Fig. 2:** A diode laser (Gemini, Ultradent Products) is used to trough around the preparation ahead of taking the digital impression. **Fig. 3:** An occlusal view after using the diode laser around the preparations prior to capturing the digital impression.

## Introduction: Masterful final impressions

The excellence and marginal fit of definitive laboratory restorations can only be as good as the master dies and impressions from which they are created. The precision of the master impression cannot be compromised. Marginal detail and tooth structure apical to the restorative margin are both necessary elements of an acceptable final impression. It is essential for the dentist to critically reject all but the perfect master impression. The traditional impression uses an elastomeric material that is injected around the preparations and loaded into an impression tray, then placed into the oral cavity, where it sets to a rigid consistency. The set impression is removed from the oral cavity minutes later, disinfected and sent to the laboratory with an opposing arch impression and interocclusal records. The laboratory thus has a duplicate of the patient's mouth on which to fabricate the prescribed restoration.

CAD/CAM dentistry and a digital workflow have developed technologies whereby preparations are scanned by a device similar to an intra-oral camera and sent to the laboratory via e-mail, giving a milling machine all the necessary digital information to create precise master models, dies and completed restorations without any conventional impression materials. Clinically, this is advantageous; the master models are more accurate, and scanned impression taking can be more comfortable for the patient than conventional impression taking (gag reflex, man-



**Fig. 4:** An occlusal view of the retraction around the preparations prior to capturing the optical impression. **Fig. 5:** The model and master dies created from a polyvinylsiloxane impression are shown with the completed ceramic restorations in place. **Fig. 6:** An occlusal view of the ceramic restorations after cementation.

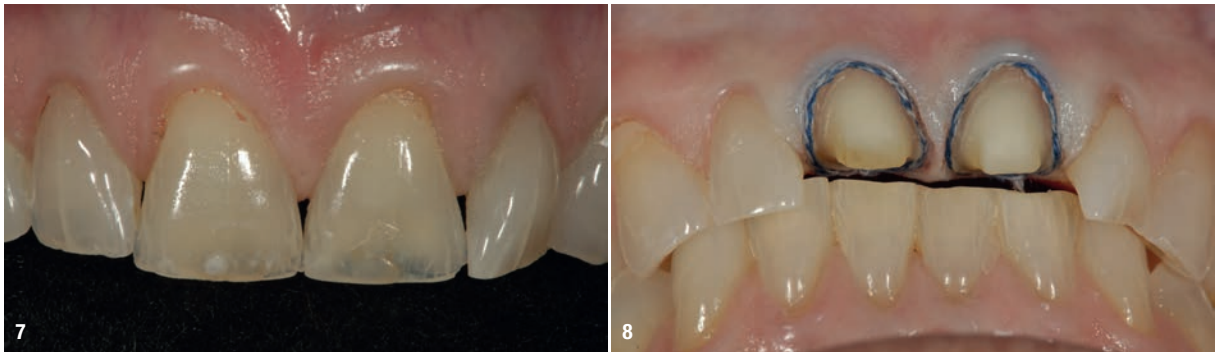

**Fig. 7:** A facial pre-op view is shown of teeth #12 and 11 prior to preparation for full-coverage ceramic restorations. The teeth had excessive palatal wear due to occlusal considerations thinning and weakening the remaining tooth structure. **Fig. 8:** The preparations are shown after the #00 and 1 retraction cords are in place.

dibular tori, etc.). Some patients also just do not do well with a mouth full of gloop that takes several minutes to set. A discussion of digital scanning and traditional impression taking techniques follows.

## Restorative margin placement is dictated by the restorative material chosen

Current aesthetic materials allow the restorative margin to be located supra-crevicularly (above the gingival tissue), equi-crevicularly (at the free gingival margin) or intracrevicularly (in the gingival sulcus). Porcelain-fused-to-metal crowns are typically more aesthetic with intracrevicular margin placement. All-ceramic restorations can often be placed at the free gingival margin, or in the case of contact lens porcelain veneers, slightly supragingivally, which is the ideal location for dentine and enamel bonding procedures. It is important to remember that an optical scanner cannot see through the gingival tissue or through fluid (haemorrhage or crevicular fluid) in the sulcus. The optical scanner must clearly see the restorative margin as well as the tooth or root surface just apical to the margin to create an accurate master die. Digital impression accuracy therefore requires appropriate tissue management and retraction.

## Tissue management for optical scanning is the same as for conventional impressions

The digital scanning workflow makes it convenient to scan the opposing arch while the anaesthetic is setting in. Depending upon the number of teeth, or types of restorations that are planned, a quadrant or full-arch scan is indicated. Once the preliminary preparation data has been entered into the patient's record, the software instructs the operator which views are required. After completing equi-crevicular or intracrevicular tooth preparation, the soft tissue surrounding the preparation must be retracted, or deflected away from the margin, such that there is no fluid contamination in the sulcus prior to the scanning process. There are several ways to accomplish this task.

### Two-cord tissue retraction

A two-cord impression technique is utilised for master impressions for full-coverage (circum-coronal) and facial veneer restorations (both intracrevicular and equi-crevicular margins). First, a #00 cord (Ultrapak, Ultradent Products) is packed around each preparation margin, starting from the lingual area proximal to the facial, then back through the remaining proximal area to the lingual area. The excess cord at both lingual ends is trimmed, and the ends

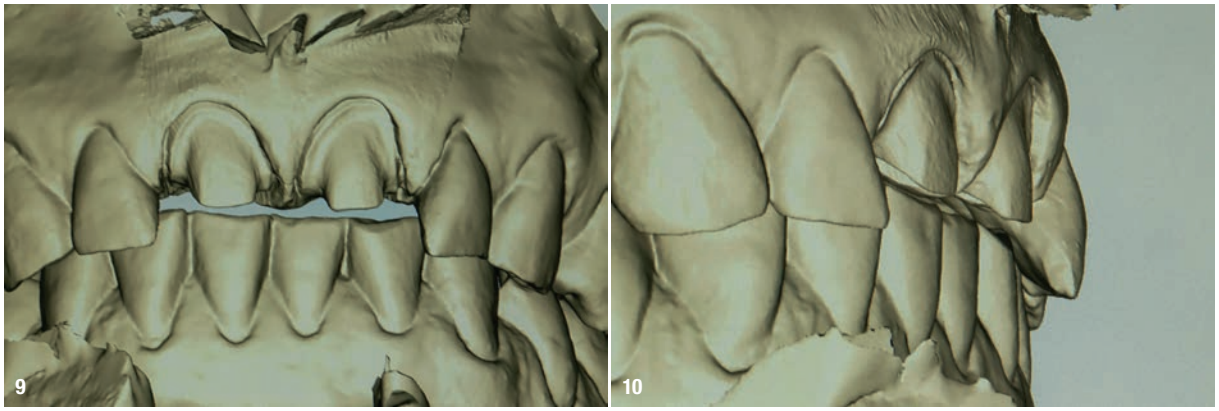

**Fig. 9:** A view of the scanned impression of the preparations from the facial aspect. Note the amount of retraction present, for clear visibility of the root surfaces of the prepared teeth. **Fig. 10:** This lateral view is shown after the image was rotated to evaluate clearance between the preparation and opposing incisal edges.

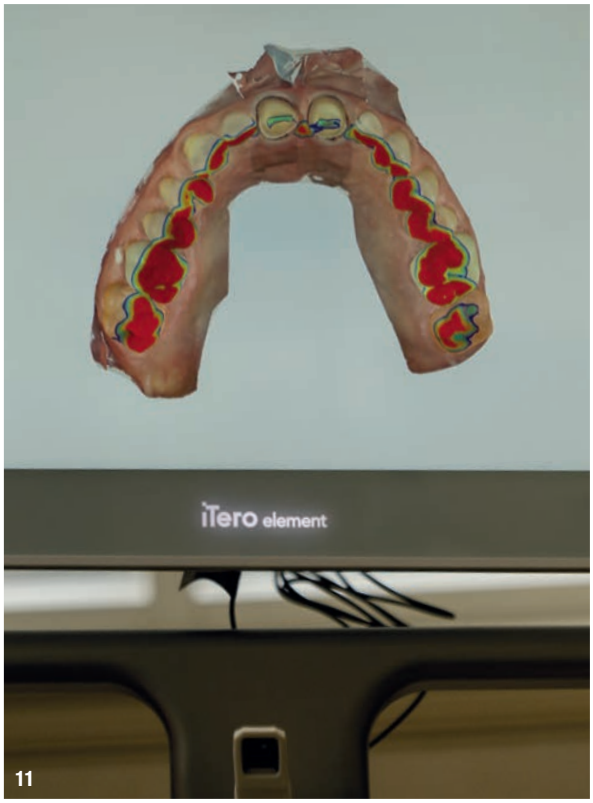


**Fig. 11:** This scan showing occlusal stops further helps to determine whether there is enough reduction for the proper thickness of restorative material. If more space is required, additional preparation followed by re-scanning stitches in the altered elements to the original scan.

of the cord are tucked into the lingual gingival sulcus such that their ends abut. If desired, the cords may be soaked in a haemostatic solution and then dried with a 2×2 in. gauze prior to placement. Next, a #1 cord (Ultrapak) is placed on top of the #00 in the same fashion as described. The preparation is cleansed with dentine desensitiser on a cotton pledget. The #1 cord is then teased out of the sulcus, using an explorer tine, from the facial aspect of each preparation, and the amount of retraction is evaluated. The optical impression should capture not only the entire restorative margin, but also about 0.5 mm of the tooth or root surface apical to the margin. If the marginal gingiva adjacent to any restorative margin rebounds to contact the tooth or margin, a small segment of a larger-diameter cord (#2) is placed into the affected area for an additional minute and then removed prior to scanning. This added retraction should be sufficient to create a space between the tooth surface and the inner lining of the gingival sulcus. The goal of retraction is to create a moat (space wherein the optical scanner clearly sees the margin and tooth surface) around the castle (tooth preparation).

### Troughing the gingival sulcus with a dental laser

Troughing creates a space between the preparation margin and the soft tissue with a diode laser. In many cases, troughing alone will allow adequate visualisation of the restorative margin and emergence profile for an accurate scan. Additionally, lasers are helpful in haemostasis, very easily and quickly creating the ideal scanning environment. Troughing is recommended only when there is enough horizontal thickness and attached gingiva (keratinised tissue) present such that troughing will not result in the loss of vertical tissue height or invasion of the mucogingival junction. Be wary of thin perio-types and low crest bone positions relating to biologic width, as they are prone to gingival recession. Overall, a diode laser is much more predictable than electrosurgery where gingival troughing is indicated. Electrosurgery instruments generate an unpredictable zone of necrosis (particularly in thin sulcular environments) and can cause excessive recession and gingival sloughing. Since laser troughing necrosis is reportedly much less, excessive collateral damage is less likely. It is still good practice to use mechanical (cord) tissue retraction, particularly in the aesthetic zone (facial aspect). Gingival troughing is indicated for localised gingival excess, chronic inflammation and areas outside the aesthetic zone. The ultimate goal is to capture the margins and 0.5 mm of root surface apical to the margin. This allows the laboratory to create an appropriate emergence profile.




**Fig. 12:** A digital camera (EyeSpecial C-III, SHOFU Dental) is used to take an isolate shade photograph to send to the ceramist to help match shade and place characterisation for the case. **Fig. 13:** The preparations are shown at the delivery appointment after removal of the provisional restorations. **Fig. 14:** The completed ceramic restorations are shown on the digital model prior to placement (restorations created by DAL Ancer Dental Laboratory in Chicago in the US).



**Fig. 15:** The restoration of teeth #11 and 12 after cementation are shown with a black background to highlight characterisation placed by the ceramist.
**Fig. 16:** A retracted full frontal view of the case in centric occlusion after cementation.

In some cases, retraction cord can also be used to displace tissue tags that may be left from laser troughing (Figs. 1–6).

## Digital scanning of the prepared tooth

Digital scanners can quickly scan half-arch and full-arch cases by video streaming. Most enable the practitioner to view the scan in real time to ensure that all critical areas are covered and the segments can be stitched together. The digital software allows the dentist to review, in 3D, the case upon scan completion prior to sending the information to the laboratory. In fact, the software indicates critical area occlusal clearance of the prepared tooth. Should there be inadequate space for an optimal restoration, the dentist can make immediate corrections and re-scan, and the software will correct the virtual model. This eliminates the need for reduction copings and/or additional patient visits. The entire scanning process for the average case takes about 2 minutes from start to finish (Figs. 7–16).

## A comparison of digital scanning and conventional impression taking

The rapid advent of impression scanning technology has not resulted in an equally rapid decline of conventional impression materials. The main roadblocks, common to all new technologies, are cost and return on investment. The typical full-arch conventional impression (heavy-bodied tray material and injectable light-bodied) costs approximately US$10. Most associated procedural costs (model work, pouring, duplicate dies, etc.) are included in the laboratory per unit fee. Digital scanners can cost US$20,000 or more and often generate additional processing fees that are passed along to the dentist and the laboratory for the convenience of creating each digital model. The advantages of digital models include that they are not made of dental stone. Digital models are milled to a consistent accuracy; there is no possibility of inaccuracy due to improper powder–water mix ratios (dental stone), chipping or abrasion of the dies, etc. The digital image can be manipulated in 3D to preview all aspects of the prepared arch, the opposing arch and the model in occlusion. If further reduction for restorative material clearance is needed, the preparation can be corrected immediately and the scan updated. Many scanning clinicians promote the digital technique as less invasive for the patient (no mouth full of gloop during the impression, or gagging). Each dentist must determine individually whether the benefits offset the cost. A well-made conventional impression including all preparation margins and emergence profiles can yield a quality definitive restoration in the hands of an excellent dental technician.

Last but not least, there can be no comparison between the artistic ability of a skilled ceramist and the programming of milling machines to create the high levels of anatomical and occlusal detail. In many cases, occlusal anatomical detail and ideal occlusion are sacrificed for the speed and lower cost of monolithic milled restorations. Again, the choice is up to the individual dentist, but these are points to consider. Some practitioners prefer milled substructures with custom anatomical characterisation placed with powder and liquid by the ceramist. Another option on the horizon is an in-office tabletop device that scans a conventional impression and converts it to digital data which can then be transmitted online to the laboratory. This may prove to be a less expensive means of integrating digital workflow with conventional impression methods. Only time will tell.

*Editorial note: This article originally appeared in* Oral Health Magazine*, and an edited version is provided here with permission from Newcom Media.*

## about

**Dr Robert A. Lowe** graduated *magna cum laude* from the then Loyola University School of Dentistry in Chicago in the US in 1982. He maintains a private practice in Charlotte in North Carolina in the US and publishes and lectures internationally on aesthetic and restorative dentistry. Dr Lowe can be reached at boblowedds@aol.com.

# Virtual reality and orthodontics: A new patient experience

Dr Yassine Harichane, France

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**Imagine the following scenario:** your patient arrives, both relaxed and calm, at your practice. Although the patient is visiting the practice for the first time, he is familiar with it and knows its interior well. Without further introduction, the patient takes a seat in the dental chair, and the orthodontic procedure is performed quickly and comfortably with patient compliance. There are no complications or tension, and the treatment is easily achieved. Imagine such a soothing and comfortable environment in which to treat patients. Now imagine this very same scenario through the eyes of the patient. One can see that it could actually be a comfortable experience. This is not some hypothetical futuristic utopia; this is actually happening now, and the aforementioned points are some of the many benefits of virtual reality (VR).

VR is a process that entails immersing the viewer in a 360° environment. By turning his head left, right, up or down, the patient can visualise a real or an artificial environment. The spectator could be immersed in the Caribbean Sea surrounded by corals or in a Canadian forest (Fig. 1). The operation is simple: the participant wears a lightweight and comfortable headset in which a smartphone is inserted (Fig. 2). Owing to the gyroscopic sensors, the smartphone will project a matching image corresponding to the movements. If the patient raises his head, he will see the sky or the ceiling, and if he lowers his head he will see his feet. This technique is made possible by a 360° shot using a dedicated camera (Fig. 3) and simple editing software (Fig. 4). The result is simply astonishing as we find ourselves projected into a place that may vary from actual tourist sites to virtual scenarios as in video games. The applications in orthodontics are numerous and at present we are exploiting only a tiny part of its potential functions. The possibilities might be endless. Hence, it might become possible for

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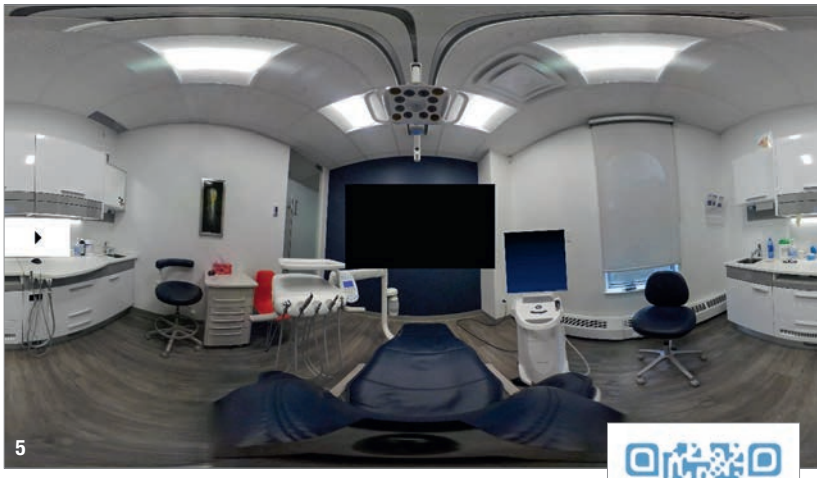
the patient to visit the dental office from his home, where he can visualise the front desk, admire the treatment rooms or view the cleanliness of the sterilisation room (Fig. 5). The aim is to offer a virtual visit of the practice to allow the patient to choose a quality clinic, as well as familiarise himself with the space before his first appointment. Once physically seated in the chair, the patient can wear the VR headset during the treatment and visualise a restful environment of his choosing. From here on, it is solely a matter of preference, as the patient might enjoy the beach, a VR video of Honolulu, or maybe even climbing a mountain. Any VR video is acceptable, as long as it achieves its purpose: calming the patient during a treatment session. Thus, everything becomes less tense, and the patient is relaxed. This might also be convenient for the dentist, as he can then execute whatever treatment is necessary as quickly and efficiently as possible.

Convincing the patient to undertake an orthodontic treatment is one thing, convincing him to follow the relevant recommendations is another. Obtaining patient compliance is not easy, especially in the case of younger patients. Furthermore, dentists have an unfortunate notorious association with pain and suffering, which might induce anxiety in a patient. Again, VR can be applied here to divert the attention of the most dynamic patients. Another aspect worthy of mention regarding the benefits is the intellectual retention of instructions on hygiene procedures, for example, which might be dependent on support. It is plausible to assume that verbal instructions on hygiene may be forgotten once the patient has left the clinic. Most orthodontic practices provide only leaflets, but few patients retain these or follow their recommendations. A VR video featuring the practitioner or team members might have a much greater impact on follow-up care at home. The message could be pre-recorded and viewed on demand by the patient. The aims of this format is that it can provide different intellectual integration between information, which is connected to a stream of visual and auditory stimuli. The clinician might wish to promote the patient retaining the provided information in an easier way to achieve greater clinical success. For example, youngsters might remember their favourite movie line by heart, as opposed to information provided by their dentist. This is because it demands less of youngsters to remember words that are connected with pictures.

For the health practitioner, VR may yield an unexpected, but welcome, advantage in terms of professional education (Fig. 6). Many of us have not been able to attend a conference on the other side of the world for logistical reasons. In the near future, it will be possible to attend an orthodontic congress and listen to international speakers while sitting comfortably at home. Similarly, the demonstration of a new therapeutic technique will be easier with a VR video rather than plunging into a detailed explanation in an article without any illustration. The trainer can record his or her procedures with a 360° camera to allow the student



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to learn through immersion the technical movements and ergonomics of the technique being taught.

It would be an understatement to claim that VR provides an alternative to conventional styles of learning. Although it is far from perfect, it allows a wider spread of knowledge and a totally immersive pedagogy. VR is changing the way we work, learn and treat our patients. We have seen over time an evolution of orthodontic care by improving patient comfort. We are not just dealing with a set of teeth fixed into a bone mass appended to a skull, but with a person whose positive experience will inevitably lead to clinical success. Similarly, orthodontic education has evolved over time, since the transmission of knowledge is no longer done with a Kodak Carousel slide projector, but with sophisticated presentation software, incorporating photographs and clinical videos. VR is paving the way to a higher degree of evolution regarding how to understand our environment, whether it is an environment of care or work. As with tourism or cinema, VR offers many opportunities in the field of health. Orthodontics is entering into a 360° revolution focused on the patient experience.

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## about

**Dr Yassine Harichane** graduated from the Paris Descartes University and conducted several research there. He is an author of numerous publications and a member of the Cosmetic Dentistry Study Group (CDSG) at the Paris Descartes University in Paris, France.

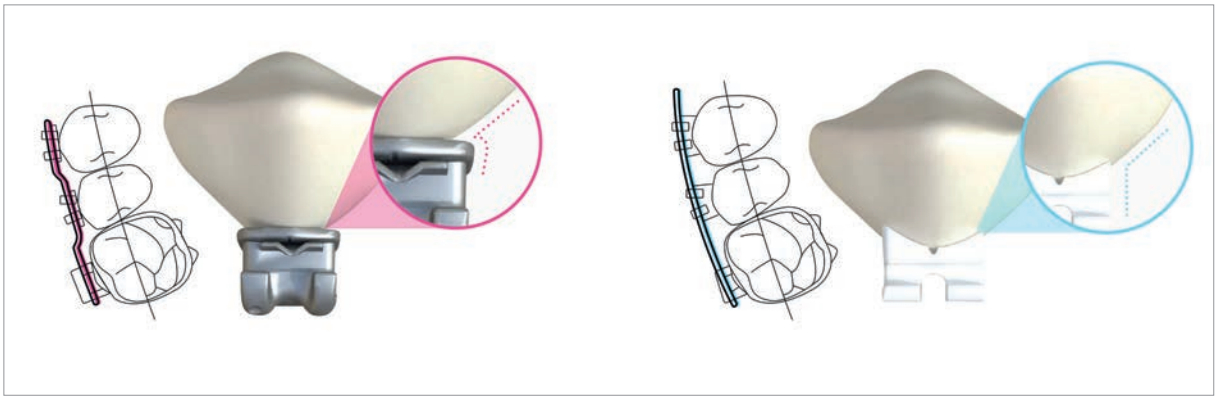
# Digital orthodontics company raises funds for 3D-printed brackets

By Jeremy Booth, Dental Tribune International

Dr Alfred Griffin III said that LightForce brackets reduce practice visits—a crucial factor for patients and orthodontists and their teams during the pandemic.

**LightForce Orthodontics** is a digital dentistry platform that provides orthodontists with fully customised 3D-printed tooth-moving tools. Its customisable 3D brackets are the first of their kind on the market, and they are designed to reduce patient visits and treatment duration. The company launched LightForce this year, after five years of research and development, and has now raised $14 million (€12 million) in funding for the further development and commercialisation of the system.

The LightForce treatment process begins with the orthodontist sending a scan of a patient's teeth and a treat-



3D-printed brackets that can adapt to achieve a desired final tooth position for that unique patient. *(All images: © LightForce Orthodontics)*

ment plan to the company's technicians, who then create customised brackets and trays. The system uses ceramic material that is specially formulated for 3D printing, but which is otherwise virtually identical to that used in injection-molded brackets.

The founder of the company, Dr Alfred Griffin III, told Dental Tribune International that the digital workflow resembles that used in clear aligner therapy. "LightPlan is the proprietary treatment software developed by LightForce that enables mass-customised braces," he said. "Doctors have complete control over every aspect of the treatment plan and can utilise a simple cloud-based interface for adjustments and approvals."

"Our treatment plans are unique to each individual patient and largely follow the clear aligner workflow," Griffin continued. "Where our technology diverges is when the orthodontist uploads the patient's scan to our LightPlan software, which enables the doctor to adjust the teeth virtually in order to create a perfect smile and bite for that unique patient, enabled by automatically designed braces."

Griffin explained that the LightPlan software generates bracket files, which are then printed at LightForce's centralised manufacturing plant in Cambridge. The brackets are then delivered to the orthodontist's office about a month later.

## Increased personalisation using digital tools

LightForce aims to provide treatment for malocclusion, which is as individual as each patient is. "A person's lips, jaws, teeth and smile are individual, and it's important to customise the tools that impact his or her face," Griffin explained. "3D printing provides the ideal solution for patients, as it allows for customisation and uses modern technology to address an age-old problem. We've found 3D printing to be the best solution for orthodontic applications because it enables complete personalisation for each patient—it can print complex geometries, in this case unique tooth morphology that would otherwise be unavailable to patients."

He added: "On the one hand, we believe that the days of bracket prescriptions are numbered; on the other hand, we welcome the days of 'tooth prescriptions' for mass-customised appliances like aligners and 3D-printed brackets that can adapt to achieve a desired final tooth position for that unique patient." Griffin said that, in the future, he expects that there will be a rapid expansion of 3D-printing technology within the dental industry.

LightForce Orthodontics was founded in 2015. Over the last five years, Griffin and his team have undertaken extensive research and development for what is now the company's eponymous treatment platform. No one could have predicted that the 2020 launch of the bracket system would take place in the midst of a global pandemic, but it seems that the outbreak of SARS-CoV-2 has not hampered the company's plans.

LightForce says that orthodontists should "move teeth, not brackets."

> "Our treatment plans are unique to each individual patient and largely follow the clear aligner workflow."

"In light of the ongoing pandemic, technology that reduces in-person dental visits is crucial not only for patients but also for the orthodontists and their teams that are caring for them," Griffin said.

Hundreds of orthodontists throughout the US are already providing treatment using LightForce brackets. Griffin said that the company will use its newly acquired funds to further develop its technology and product offerings and to scale its operations in order to meet what he called a recent surge in demand for more efficient dental technologies.

The funds were raised in a Series B funding round that was led by investors Tyche Partners, Matrix Partners and AM Ventures.

# “If you can dream it, you can do it with exocad”

By Monique Mehler, DTI

**Fig. 1:** Prior to moving to Sonora, I was a full-time dental school professor at two universities: Loma Linda University and the University of Nevada Dental School. *(Image: © Michael Scherer)*

**As an industry innovator and enthusiast** in the field of dental implants, dentures and digital technology, Dr Michael Scherer is an expert in his field and knows how to handle the hybrid environment of dental clinic and laboratory. When he is not working as a prosthodontist at his practice in Sonora in California in the US, or enjoying his great love of nature when going scuba diving, hiking or skiing, Scherer enjoys speaking at educational conferences of all sizes. At the exocad Insights 2020 event in Darmstadt in Germany, Dental Tribune International met with Scherer to talk about his lecture at the event in which he discussed what dentists can do with exocad, described his experience with the software and explained why digital dentistry is the future.

**Dr Scherer, in your lecture you spoke about the use of exocad in your dental practice that also includes a practice laboratory. Can you tell me a little bit more about that?**
As prosthodontists we tend to have a bit of a hybrid role between laboratory technician and clinician. A big part of what I do with any kind of CAD software, but especially with exocad, is utilising digital dentistry in creative ways. So much of my practice and day-to-day workflow involves dealing with comprehensive cases, especially for patients who need dentures, overdentures or full-arch fixed prostheses. I share the practice with my wife, who is an orthodontist. Between the two of us, we have a sizeable dental office where it is possible to have a full laboratory set-up as well. I have a full-time technician in my office who works for both of us on our treatment cases.

My average day focuses as much as possible on digital dentistry because that is what motivates many of my patients to come to my practice. Everybody thinks a Californian dentist must practise in Hollywood or near the beach, but that is not the case for us at all. We are based in a semi-rural area that is only 45 minutes away from Yosemite National Park and feels like the Bavaria of California. People drive 3–5 hours to get to my office. So if I can create a digital workflow where I can do the obvious things, but also maybe some less obvious things, then that is a motivator for them.

**How did you come across exocad’s software solutions, and how long have you been using them?**
I am part of a new generation of dentists, and even though I look like I am 22 sometimes [laughs], I have been practising for close to 15 years. In the early stages of my career, everybody told me: “Well, digital dentistry is great, but you need to change what you do in dentistry to get it to work.” At the time, the technology was still in its infancy. However, I grew up with computers, as my parents knew that they were going to be the next big thing. So, I had a computer in my hands at the age of 3, which was really young, but it meant that, when I started practising dentistry, it was easy for me to integrate digital technology into my work.

I have used exocad for a pretty long time. We used it in its early stages in some of my residency training. When I really started using it seriously was probably five years ago, about the time when I needed it for that full laboratory application in my practice. And then I was able to use it extensively, especially with dentures, when Plovdiv came out. The latest, or now the second latest, version of exocad was really serious with regard to digital dentures and it has been really awesome using it.

**Do you feel that most of your colleagues have started to adapt to digital solutions in their practices, or would you say that there are still a lot of dentists holding**


**Fig. 2:** During his lecture, titled "What a dentist can do with exocad", Scherer explained how he uses the software in his everyday workflow. *(Image: © Michael Scherer)*
**Fig. 3:** At exocad Insights 2020, Dr Michael Scherer discussed the role of exocad in his combined clinical and laboratory dental practice and how the software can be used in daily clinical practice. *(Image: © Monique Mehler, DTI)*

**on to analogue ways? What would you say to them in order to convince them to go digital?**
The one thing that is interesting about the last couple of versions of exocad is that it has become even more simple to do complex tasks. Before, you would have had to take all these workarounds and use special ways to accomplish something, but nowadays, especially with the newest version, exocad Galway, so much of that is built into the software already. That is a tremendous enhancement and will make it possible for the average clinician to be able to jump into CAD as well. Certainly, digital design is an intimidating part of the process for a lot of dentists, and if you can simplify the digital design side as well as streamline it, then many more will jump on board.

There are still quite a few dentists who are using analogue workflows, and there is nothing wrong with that. You can still do great dentistry using polyvinylsiloxane impressions and stone models. What these dentists probably do not realise is that, if they send the work out to a technician, he or she is very probably using a digital workflow. So, the question is whether this technology will improve the clinician. Possibly yes, possibly no. What I would ask that clinician is: why wait? The future is now, and without a doubt, the analogue workflow will eventually disappear. Will it be going away rapidly? I don't think so. As dentists, we tend to be pretty cautious and conservative when it comes to things like that. This is for a good reason, and it is something I would expect. I would want my dentist to be sure and able to say: "Yes, this will work."

In my personal opinion, intra-oral scanning, for example, is beyond having been proved and should be considered part of the standard of care. There are a lot of laboratories using 3D printing and milling, but it is also true that you can do some great dentistry with analogue techniques. For now, the mixed approach will probably be applicable; however, in the near future, it is inevitable that a shift will happen.

**So, in the clinical environment, you use exocad software every day. If you had to pick one word to describe the exocad software and what it does for you, what would that be?**
I don't know if I can put it into one word, but in one phrase it would be "limitless possibilities". If you can dream it, you can do it with exocad. Well, maybe "freedom" would be one word for it then. Certainly, the company has used that term before, and I agree. Part of what exocad does is that it allows your software to be free and it allows your mind to be free while using it. When you really start to look at how the software fits into a dental practice, it is streamlined so you don't have to be too creative with it, and it just works. But if you want to take that next step, you can go ahead and do that because you have the freedom to do so.

**Are there any limitations you would like to mention or things you would like to see improved?**
There are always ways to improve. You know, if we ever reach a point where something can no longer be improved, then what is the point anymore? Improvement can occur anywhere and everywhere. The question is: what can be dreamed up next? What it comes down to is that there is a fine line between striving for simplicity and adding new features. The key is a good hybrid blend between simplicity and comprehensiveness, and this is where exocad shines.

**Digital dentistry is a very fast-paced field. What are your expectations in terms of innovations in the near future?**
You know, I am not really someone who can predict the future. What I certainly hope for is that we strive to grow more digital and comprehensive and adapt slowly towards that. The real future is the ability to transfer the basic factors of the workflow, starting from scanning over to designing and manufacturing. We find that happening with ChairsideCAD and all the other dentist-directed software from exocad. Clearly, the future is a harmony between clinician and laboratory.

# “The digital revolution in dentistry will accelerate, and we aim to be front runners”

## An interview with Dr Wolfgang Reim, CEO of Amann Girrbach, and Patrick Amann, head of marketing at Amann Girrbach

By Claudia Duschek & Jeremy Booth, Dental Tribune International

**Amann Girrbach** is a pioneer of CAD/CAM technology and is now recognised as one of the leading innovators in digital dental prosthetics worldwide. The Austrian full-service provider initiated a strategic paradigm shift some time before the SARS-CoV-2 crisis, and it now finds itself in the midst of the digital revolution. Dental Tribune International spoke with CEO Dr Wolfgang Reim and Head of Marketing Patrick Amann about the effects of the pandemic, the ongoing digitisation of dental practice and the 2021 International Dental Show (IDS).

**The SARS-CoV-2 pandemic has plunged almost all sectors of the global economy into crisis, and dentistry is no exception. How has Amann Girrbach fared over the past few months?**

*Reim:* The crisis has not left us unaffected. Interestingly, March of this year was the month with the highest turnover in our company’s history to date. However, in the last week of March, we experienced our biggest slump in incoming orders—a decline of 70 to 75%. At that point, the scale of the crisis and the fact that it could result in a turning point in the industry became clear to us.

Dr Wolfgang Reim, CEO of Amann Girrbach, in conversation with Dental Tribune International. *(All images: © Amann Girrbach)*


When the SARS-CoV-2 crisis cleared the international dental calendar, Amann Girrbach created its own virtual trade fair booth: the Digital Dental Show.

We needed to act, and so we introduced a number of measures—such as pushing our employees to work from home and initiating a range of activities regarding digital collaboration. In addition, we put our strategic focus on digital transformation of most aspects of doing business and, for example, introduced the first virtual trade fair booth in our industry with great success.

**What do you think the medium- and long-term effects of the crisis will be?**

*Reim:* The materials business has proved to be relatively stable in the pandemic. However, capital goods have been particularly affected, owing to laboratories being hesitant to make major investment decisions during the crisis. We are noticing a slow recovery concerning capital goods—especially in the German market—and are closely monitoring developments worldwide.

We see a significant risk for the future in those countries, however, where patients have to make high out-of-pocket payments for restorations, such as the US. Here, it remains unclear as to how much patients will be willing or able to pay for elective restorations, for example, and this will likely affect us negatively for the coming two to three years.

But there are also positive effects from this crisis. We believe that the market penetration of digital workflow processes is now being accelerated. This will tend to support a company like ours and accelerate growth. We are focusing strongly on this aspect through our innovation pipeline and have already invested heavily in two areas: research and development and digital transformation.

> "This wider structural change was already underway before the crisis—the pandemic has simply accelerated its development and further paved the way for digital transformation"—
> Dr Wolfgang Reim,
> CEO of Amann Girrbach

**Amann Girrbach had already taken up the cause of digital transformation before the coronavirus outbreak. What has changed with regard to the company's strategy, and what goals are you now working towards?**
*Reim:* We have started a relatively drastic transformation in the last six months. In our opinion, this wider structural change was already underway before the crisis—the pandemic has simply accelerated its development and further paved the way for digital transformation. We want to support our customers in this transformation.

We have been focused on the digitalisation of dental workflows since the early stages. In recent months, we have further refined this strategy, fully gearing our internal structures and product development towards digital transformation. During the crisis, we have recruited experts and begun new collaborations that will play a major role in the transformation of how we serve our customers. Thanks to, among others, the investment in Amann Girrbach by the Berlin-based investor group Project A and our partnership with the e-commerce specialist Spryker, we have a number of highly professional partners at our side. Together with Amann Girrbach, their know-how and network of software experts are now paving the way for a new digital ecosystem—AG.Live—which aims to make our interaction with laboratories and dental practices even more efficient and to generate a superior customer experience.

**Dental technologies are constantly being developed to simplify workflows and digitise an industry that used to exist on a purely analogue level. How does Amann Girrbach take this development into account?**
*Reim:* The digitalisation of dental technology is an unstoppable development that is not purely industry-driven, but also relates to technological progress in itself. All developments indicate that the future will bring fewer haptic workflows. Because of this, we have long aligned our product development and internal processes with digital outcomes.

In terms of our core business, this means that we remain a hardware manufacturer and developer. However, we believe that this alone is no longer enough for the future; we must also digitise our interaction with customers and help them to work more efficiently in their process environments. With AG.Live, we are developing a virtual platform that makes it easy for our customers to progress in digitalisation by providing them with wide-ranging transparency, more efficient processes and greater customer service.

The digital revolution in dentistry will accelerate, and we aim to be front runners.

*Amann:* The transformation of Amann Girrbach is a huge commitment. We take the philosophy of digital change very seriously, and we are actually making fundamental changes to the company. We are very resolute in taking this step—especially now—and the changes that are being made are not partial or superficial, but holistic, in nature.

In order to meet growing demand, Amann Girrbach opened another production facility at its location in Austria in 2017.

On that note, it must be said that the entire production process in the laboratory of today is already digital, but that laboratories stand alone in this respect. Patient management, as well as the communicative and interdisciplinary steps in between, is for the most part still handled as it was in the 1960s. The decisive second half of digitisation is still missing, so to speak. It will take several more years before the next steps in this process are taken, but when they are, we will remain at the forefront by supporting our customers on their way through digital transformation with definitive and practical solutions.

**What advantages does AG.Live offer to your customers?**
*Amann:* Strategically, AG.Live is one of the biggest projects that we have ever undertaken. We are striving to solve the conflicting priorities of interdisciplinary end-to-end communication. In addition, we are moving into the areas of e-commerce, customer relationship management, remote support and digital training. We don't want to create conventional isolated solutions that are then laboriously linked. Instead, we are focused on creating an integrated system that is clear and easy to use for the customer and which brings real added value.

*Reim:* Ultimately, the focus of the entire development is on improving the patient's restoration and the efficiency of the laboratory. AG.Live will enable us to provide consulting services for materials and procedures as well as targeted offers based on user profiles. Perhaps we will be able to tackle these goals as early as 2022.

**What are your plans for the upcoming IDS, which is scheduled to take place in Cologne in Germany in March 2021?**
*Reim:* We have been following the development of the pandemic and IDS closely, and we do not believe that large trade fairs will be possible in the near future. IDS thrives on full stands and personal interactions centred on the products on display at the booth; this is not conceivable under the current circumstances. On top of this, international travel will continue to be limited. Therefore, we have come to the conclusion that our participation in the forthcoming IDS should be cancelled. We nevertheless remain open to the digital offerings of IDS, as our product development pipeline on the hardware and consumables side is full, and the products are scheduled to be presented in spring. Either there will be a suitable digital platform for this with IDS, or we will use our own digital platform. We can well imagine presenting the products again in the context of a virtual trade fair booth as we did at the beginning of the pandemic, in order to try to simulate the feel of a fair as far as possible.

*Amann:* From our point of view, under the current circumstances, it is not possible to ensure safe and meaningful participation in IDS for the exhibitor, nor would our participation be responsible with respect to our customers and employees, as the risk of an infection with SARS-CoV-2 is too high.

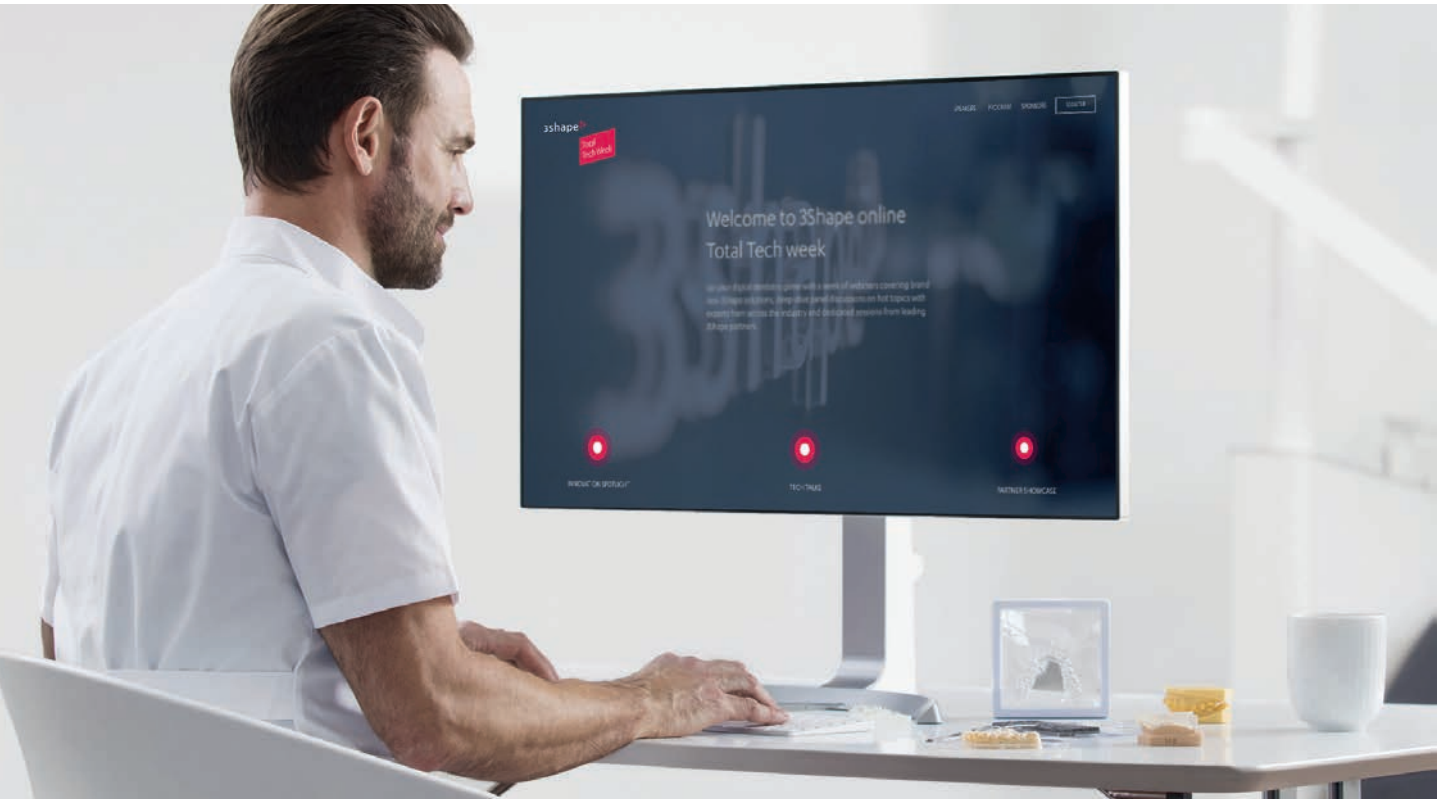
"From our point of view, under the current circumstances, it is not possible to ensure safe and meaningful participation in IDS for the exhibitor"— Patrick Amann, head of marketing at Amann Girrbach

In addition to new products, we will be breaking new ground next year with non-haptic products as well as digital themes in order to tap into new target groups, so IDS will still be an important event for us. However, I am doubtful that the event organisers can roll out a technically flawless platform offering on such a broad basis for the entire industry. Participation at IDS must also be worthwhile from a financial perspective, and we currently do not see the considerable investment that we make in the fair every two years as being justified in 2021.

Even if not a replacement of IDS, but an augmentation, we envisage organising smaller local events with our partners in order to give customers the opportunity to see the innovations on-site and not only on a virtual basis.

# 3Shape Total Tech Week pushed the boundaries of digital dentistry

By Franziska Beier, Dental Tribune International




The 3Shape Total Tech Week was one of the most important events for digital dentistry. *(All images: © 3Shape)*

**From 19 to 23 October**, 3Shape presented Total Tech Week, an online showcase of the latest digital solutions of the company and its leading global partners. Lars Christian Lund, senior vice president of corporate business development and marketing at 3Shape, spoke with Dental Tribune International about the benefits that attendees gained from taking part in the free online event.

**Mr Lund, how did 3Shape develop the idea for Total Tech Week, and what is the main goal of the event?**
Over the years, 3Shape has been present at conferences and industry events globally, and this has proved very successful in getting our latest products and innovations to the market, meeting industry professionals, getting face to face with our partners and customers, and understanding the market and its needs.

However, as we have all witnessed, things have changed in 2020. As a consequence of the COVID-19 pandemic, we at 3Shape had to put safety first. It made us rethink our approach and resulted in the 3Shape Total Tech Week—an online event which showcased the latest products and software updates from 3Shape and our partners. The aim was to push the boundaries of what digital dentistry can achieve and how it can contribute to improving treatment quality and patient experience.

**Who was the target group of the event, and which dental specialties were covered?**
3Shape Total Tech Week was intended for general dentists, dental technicians and any dental professionals who are interested in digital dentistry and for both beginners and experienced users of digital technologies. Each day of our event was dedicated to a different discipline of dentistry. On the first day, we started with laboratories; the second day was focused on digital orthodontics; general practice was addressed on the third day; the main topic of the fourth day was same-day dentistry, and the last day was all about implantology and splints.

**There were three different types of Total Tech Week sessions each day. Can you tell us a bit more about each of them?**
Yes, we hosted innovation spotlights, tech talks and partner showcases. During the first session type, 3Shape product experts talked about the latest solutions launched by our company. In addition, they announced upcoming promotions and offer tips and ideas to further improve workflows and patient experience.

The tech talks were very exciting and engaging sessions in which a panel of experts talked about their experiences with specific solutions, workflows or products, gave tips and tricks on how to achieve better results or be more efficient, or explained how to become better at your trade with a certain product or technology. During each talk, attendees had the opportunity to ask the experts questions or bring up any issues they face in their everyday work.

3Shape believes in open systems and works with some of the industry's major companies to create optimal solutions for dentists and laboratories. During the partner showcases, some of our key partners presented technologies, solutions and workflows in detail, which can help dentists to deliver quality treatments.

**Traditional congresses offer participants many opportunities to interact with speakers, peers and industry exhibitors and to try out new products first-hand. With a fully digital event, what measures have been taken to ensure this kind of interaction?**
In the past, meeting partners, industry professionals and end users has been a great experience, because we learned first-hand about the real challenges that dentists and laboratories face every day. This is important for us, because we can address these challenges when developing new products and solutions.

That's why we wanted to include this interactive element when planning Total Tech Week, and the result was the tech talks I mentioned earlier. The greatest advantage of the tech talks was that our panel members were all users themselves of the technology and therefore were able to answer users' questions from the point of view of the user.

**Which 3Shape and partner products were showcased during Total Tech Week?**
To name just a few, we talked about the latest developments in TRIOS intra-oral scanners and our fastest laboratory scanners to date, the latest Generation Red E scanners. In addition, we presented Dental System 2020's new all-in-one bridge implant workflow and the new integration with Lab Management System.

For clinics, our experts demonstrated the latest developments in 3Shape TRIOS Design Studio, highlighting even more possibilities in same-day dentistry. Another application that has new features is Implant Studio with the new hint and notification systems.

Lars Christian Lund, senior vice president of corporate business development and marketing at 3Shape.

Attendees who were interested in digital orthodontics could learn about the new integration between Generation Red E lab scanners and the Ortho System software, and the latest updates in the Clear Aligner Enterprise solution.

We hosted some great sessions by some of our partners. ClearCorrect showcased a step-by-step guide to getting started with clear aligners using TRIOS and the ClearCorrect function in 3Shape Dental Desktop. Another partner is Ivoclar Vivadent, who gave an overview of the latest in CAD/CAM technologies for chairside applications. Our design partner Full Contour demonstrated how to send orders for implant planning and surgical guide design to Full Contour through a new direct integration in Implant Planner and Implant Studio.

**What were the highlights of Total Tech Week?**
We covered a range of interesting topics, like complete denture workflows, augmented reality applications in everyday clinical practice, enhancing patient experience through a digital bonding protocol and much more.

These topics were discussed by renowned dental experts such as Erik Kukucka from the Denture Center in the US, Michelle Shippy from Full Contour in the US, Dr Jonathan Ferencz from the New York University College of Dentistry in the US, Dr Lucio Lo Russo from the University of Foggia in Italy and Minh Tran from DentalTechTips in the US. Overall, the event was highly invigorating.

*Until 31 December, all sessions of 3Shape Total Tech Week can be watched on demand at www.3shape.com/en/totaltechweek.*

The future of dentistry is digital

# Amann Girrbach—quality, made in Austria

Headquartered in the Vorarlberg state of Austria—in the far west of the country, between the Alps and Lake Constance—the dental equipment manufacturer Amann Girrbach has been leading a quiet revolution for decades. As an early pioneer of dental CAD/CAM technologies, the company knows that the future of dentistry is digital, but it also understands that it will continue to rest on precision and quality. Dental Tribune International (DTI) visited the company's home base and toured its newest manufacturing facility to find out more.


"We do it in-house"—Amann Girrbach makes all of its own machine parts so that it can vouch for every component. *(Image: © Amann Girrbach)*

Known locally as the Silicon Valley of the Alps, Vorarlberg shares borders with Germany, Switzerland and Liechtenstein and is home to a string of high-tech manufacturing facilities belonging to some of the world's best-known companies, including a disproportionate number of leading dental brands. Companies in the region enjoy creative cross-industry collaboration on projects, and they speak proudly about the Made in Austria brand. Amann Girrbach is one of them.

Patrick Amann, head of marketing at the company, met with DTI at Amann Girrbach's headquarters in Koblach and provided us with a tour of its Dentustry One manufacturing facility, located in the nearby town of Rankweil. The technology within the facility was impressive—a printer that operates so finely that it can print on the surface of water, for example, and the intelligent internal logistics system manned by autonomous robots that transport materials throughout the facility to the appreciation of the more than 100 employees.

Purpose-built in 2017 in order to meet growing demand for dental equipment and materials, the 10,000 $m^2$ production and research facility is one of the company's most advanced. Zirconia blanks, milling machines and the digital prosthetics tool Ceramill Sintron are produced here, and a range of Amann Girrbach machines are assembled. The facility has an annual production capacity of 8,500 milling machines and 600,000 zirconia blanks, and around 100 t of zirconia powder is used at the site every year. Amann told DTI that the future of dentistry is no doubt digital, but he added that quality is increasingly the deciding factor behind decision-making on the part of the company's customers. Recognition of the quality behind the Made in Austria brand is growing around the world, he said, adding that it already has a strong reputation in the dental industry.

One thing that sets the company apart from many of its competitors is the fact that Amann Girrbach makes all of its machine parts in-house. It has no third-party suppliers and can therefore vouch for every component of its machines. Amann explained that this is a crucial prerequisite for a company that stakes its reputation on the quality of each and every one of its products; he added that, often, he has to confirm this to customers. "They ask us again: really? And we're able to say yes and confirm this. We do it all in-house, and we source only the best raw materials that are processed under the strictest procedures and certified processes. This is a very important part of our manufacturing, and the service that we offer to our customers."

Additionally, Amann said that every item that is produced at Dentustry One is checked as part of the company's strict quality control measures: "We stand for precision and reliability, and we place a huge focus on the quality of our products. Quality control is an integral part of that, and that's where one of the biggest differences lies." Standing before cartons filled with hundreds of Zolid DNA blanks, Amann added: "Some suppliers may be cheaper, but they are checking perhaps one in ten of their products—if that. We check every one."

As an early pioneer of digital dental prosthetics and CAD/CAM technologies, Amann Girrbach has long been focused on the development of non-haptic solutions for the dental market. DTI's visit to the company took place during the coronavirus pandemic, and the company's CEO, Dr Wolfgang Reim, said that the global health and economic crisis had already accelerated the push towards digital solutions. Reim commented in an on-site interview: "Dentistry has gone through a relatively drastic transformation in the last six months. In our opinion, this wider structural change was already underway before the crisis—the pandemic has simply accelerated its development." He explained that the crisis has necessitated even more digitalisation within dental practice and an even greater digital focus in the development of tools and solutions for the dental industry. "We want to support our customers in this transformation," he said. "We have been focused on the digitalisation of dental practice since the very early stages. In recent months, we have further refined this strategy, fully gearing our internal structures and product development towards digital transformation."

Dedicated configuration for any clinic

# ACTEON X-Mind prime family expands

The ACTEON X-Mind prime range has been extended with two new cephalometric configurations, the X-Mind prime 2D-CEPH and the X-Mind prime 3D-CEPH, expanding the fields of application of the device to orthodontic analysis and improving diagnosis and treatment planning. The line can now offer a dedicated configuration for any clinical need, from the most basic panoramic image only to the most complete panoramic/CBCT/cephalometric one, guaranteeing a state-of-the-art implementation of the internal technology and presented in the stylish and compact design which characterises the whole range.


Premiered in September 2020, the new CEPH configurations now complete the ACTEON X-Mind prime family and retain the same key concepts of the other members. X-Mind prime devices are designed to fit any environment with their minimalistic and compact design, which, combined with their outstanding ease of operation, provides the operator and patient with the best examination experience available.

The unique innovative and effortlessly mounted solution, combined with a lightweight framework and a compact footprint, make X-Mind prime CEPH one of the easiest and most complete extra-oral solutions for any dental practice.

The new cephalostat, specifically designed for optimising patients' comfort and stability, and the smart Frankfurt plane reference integrated in the ear rod ensure quick and precise patient positioning.

Its patented collimation system allows up to 17 different cephalometric program selections, including new reduced size modes, which ensure a perfect assessment of the region of interest at the lowest radiation dose.

X-Mind prime CEPH continues the tradition of the unmatched ease of use of the X-Mind prime product line, thanks to the user-friendly interface of its virtual control panel, which leads the user through all of its functions in just a few simple steps.

The use of a state-of-the-art digital sensor, combined with the high performance of ACTEON Imaging Suite software, ensures superior image quality.

**www.acteongroup.com**

Providing dental professionals with the leading technology

# 3Shape introduces updated Generation Red E scanners

With its wide-ranging scanner portfolio, 3Shape has always provided dental professionals with the leading technology that promised to drive laboratory productivity and boost business growth. In line with its initial promise, 3Shape is now proud to introduce its newest addition to the family: the Generation Red E scanners. Both the most recent scanner, E4, as well as its predecessors, E3, E2 and E1, boast improved accuracy, speed and other advanced scanning features that help dental professionals optimise time and enhance the digital workflow.


3Shape's Generation Red E scanner. *(Image: © 3Shape)*

3Shape has more than two decades of experience in developing CAD/CAM solutions and introduced its very first dental scanner over 15 years ago. Since then, the company has been continuously advancing its scanners to stay up to date with the latest trends and to meet the needs and demands of the customer. In its latest quest to expand its portfolio, 3Shape has launched the updated high-performance Generation Red E scanners.

**Advanced scanning features and key improvements**

The E4 scanner is the fastest in the E series and can complete a full-arch scan in as little as 9 seconds. To increase customer satisfaction, the company has boosted the scan speed of the other E scanners, which are now built on the same platform as the E4. However, the updated scanners are available at the same retail price as the previous E scanners. Marc Smith, product manager at 3Shape, explained that upgrading the platform allows the whole series of E scanners to benefit from the latest technology, as well as for the company to better streamline its production line.

"By transitioning into this platform, we were able to increase the scan speed on the E1, E2 and E3 by 20% compared with the previous line of E scanners," said Smith.

Owing to the platform update, the Generation Red E scanners are currently only supported by the latest scanning software, Dental System 2020, which was released in June. Another key improvement is the updated catalogue of PCs that are compatible with the scanners as well as with other 3Shape products. Smith explained that the new line of computers has been tailor-made in terms of choosing internal components that would enhance the scanning and designing experience.

While it is usual for many dental laboratories to use closed furnaces, ovens, boilers and even certain closed scanners, the Generation Red E scanners offer an open platform that allows dental technicians to observe the scanning movements. The open scanner feature allows for more interaction with the hardware and has been greatly appreciated by users, Smith emphasised. "Our users spend a lot of time engaging with our products, so if they feel empowered to better themselves by being in control to a larger extent just by using our scanners, then that makes me very proud as a dental technician."

Another distinctive feature of the E scanners is their ability to scan a mounted articulator without dislodging the model. This is "a huge time-saver and just a really nice way of letting the users focus on the most important work, which is designing," Smith explained. Additionally, the dental models are detected automatically, so the scanning starts immediately without action by the user.

Besides these hardware and software improvements, there have been several changes in the design of the scanners. The Generation Red E scanners all have a pitch-black cabinet, which gives them an attractive dark appearance. Additionally, the signature ring in the centre of the scanner, which indicates ring size and number, is now a vivid red.

**The importance of going digital**

The benefits of having digitalised records are manifold, but implementing a digital workflow in a dental laboratory is mostly valued for the time it saves for dental technicians.

Highlighting the most relevant benefit of working in a digital laboratory, Smith noted that the Dental System 2020 software allows its users to work remotely. This flexibility of being able to work from home is especially relevant in light of the global COVID-19 pandemic. Since designers can work remotely, dentists can still be serviced even during a period of lockdown.

Owing to these and many more advantages, Smith is encouraging dental professionals to embark on a digital journey, with the assurance that scanning their dental impressions with the Generation Red E scanners will place them "well on their way to digitalising their laboratory".

**www.3shape.com**

Creativity and innovation

# MIS celebrates 25 years of making it simple


This year, MIS Implants Technologies is celebrating its 25th anniversary. During these two and a half decades, the company has taken on countless challenges, explored many developments and celebrated numerous breakthroughs. Today, MIS is an established global business and one of the major competitors on the dental implant market.

It all began on a scorching and humid August day in 1995 in the north of Israel, when the two Peretz brothers produced their first implant with a single machine in their workshop, which was actually owned by the bank. Overcoming many technical difficulties, from drilling to design, the young brothers succeeded in selling their first order of 100 implants in November that year.

With a close friend as their sales force, and a brand-new Vespa scooter Doron Peretz had won in a lottery give-away, they set out to meet their potential customers and sell their new implant. Within a few years, MIS had gained much experience, as well as new customers in Israel, Turkey, Spain and Portugal, and set its sights on a global market.

**A global emergence**

Five years after releasing its first implant, MIS set out into the big world. The young company focused its efforts on a few strategic locations, knocking on every door in Europe. However, this was a very conventional and tough market to crack. Therefore, MIS opened its own distribution channel devoted to the European market. With a new international location and a small team of dedicated sales representatives, the company exhibited at the International Dental Show in Cologne in Germany in 2001.

**Expansion**

As MIS grew, expanding from 45 to 165 employees at its headquarters, so did the market demand for its implants. This growth led to an increase of workspace and machinery between 2005 and 2010. The once sole and by then outdated apparatus was replaced by dozens of state-of-the-art machines for production, as well as inspection and quality control. It was time to move the operation to a much larger location, not far from the original building in a brand-new industrial and technological park.

**Creativity and innovation**

With the move to its new facilities and acquisition of new technology from 2010 to 2015, MIS was well on its way to a time of creativity and innovation. The research and development team was looking for innovations that would put the company on the right path towards the goal of simple products that would make a real difference. MIS looked to the market and its customers for an answer, and this led its team to implants with a conical connection, as well as the exciting new world of digital dentistry solutions.

While research and development looked for the areas and targets of innovation for the products, MIS was busy transforming the business model as well. The company began moving towards a subsidiary model, establishing localised, regional centres that would provide a distribution and support point of focus for customers around the world.

**Celebration of expertise**

After developing, working and thriving for two decades, it was time for the company to invite all its loyal customers, partners and friends to the first MIS Global Conference, in 2011. In this arena too, the MIS spirit set the pace for unforgettable, highly professional and fun conferences, drawing key opinion leaders and guests from all over the globe.

**Looking ahead to the next 25 years**

With all the amazing changes and developments which have taken MIS to where it is today, it is the company's goal to keep the focus on the same basic principles of simplicity, passion for its work, and commitment to its customers, partners and team. The company hopes that the next 25 years will be just as exciting and successful.

**www.mis-implants.com**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We can run an unusually long article in multiple parts, but this usually entails a topic for which each part can stand alone because it contains so much information.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

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## Questions?

Magda Wojtkiewicz
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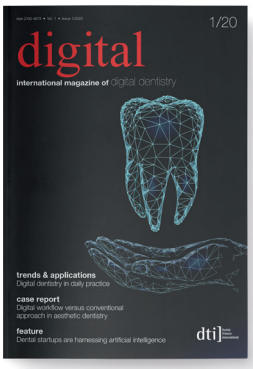


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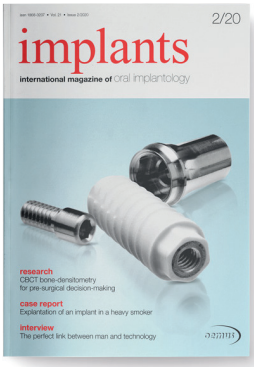


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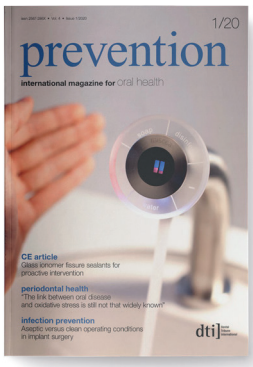


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## International Headquarters

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Holbeinstr. 29, 04229 Leipzig, Germany
Tel.: +49 341 48474-302
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