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practice management

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¹ Norton MR, Astrom M. The influence of implant surface on maintenance of marginal bone levels for three premium implant brands: A systematic review and meta-analysis. Int J Oral Maxillofac Implants 2020;35(6):1099-111

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Dr Scott D. Ganz

Editor-in-Chief



Cap·ture

—an image capture device is a hardware or electronic device that captures images and converts them into a digital format

The history of photography spans nearly two centuries, beginning with the invention of the camera in the early nineteenth century. The earliest form of photography, known as camera obscura, existed long before the invention of the camera itself. This optical device projected an external scene on to a surface inside a darkened room. It was not until the 1820s that Joseph Nicéphore Niépce captured the first permanent photograph in a process called heliography, using a pewter plate and bitumen of Judea. This pivotal moment marked the birth of photography as we know it.

In 1839, Louis Daguerre introduced the daguerreotype, a process which drastically improved photographic methods by utilising polished silver-plated copper. The image was developed with mercury vapour, creating detailed and vivid portraits that quickly gained popularity. Concurrently, William Henry Fox Talbot developed the calotype, a process which produced negatives on paper, allowing for multiple prints from a single exposure. This innovation laid the groundwork for modern photographic printing methods.

As the nineteenth century progressed, photography evolved rapidly, driven by technological advancements. The introduction of glass plates in the 1850s and 1860s offered better image quality and sensitivity, culminating in the creation of roll film by George Eastman in 1885. Eastman founded Kodak, making photography accessible to the masses with the slogan, “You press the button, we do the rest.” This ushered in the snapshot culture, democratising photography and leading to widespread adoption.

The twentieth century saw great progress, particularly in professional photography. Colour photography emerged in the 1930s, Kodachrome film capturing vibrant hues.

After World War II, innovations such as the introduction of automatic cameras and single-lens reflex systems further transformed the field. Meanwhile, photojournalism thrived, shaping public opinion during pivotal moments in history.

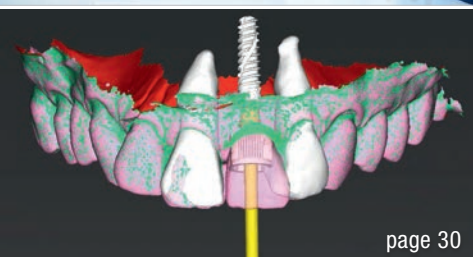
The shift to digital photography in the late twentieth century revolutionised the medium yet again. The first digital camera was developed in 1975 by Steven Sasson at Kodak, but it was not until the 1990s that digital cameras became commercially viable. The subsequent rise of high-megapixel sensors in the 2000s marked a significant leap in image quality. Today, digital cameras often exceed 100 MP, allowing photographers to capture extraordinary detail and enabling new avenues for creativity.

From chemical processes to sophisticated digital technology, the history of photography embodies innovation, artistic expression and the relentless pursuit of capturing reality, 200 years of progress which now allows high-resolution photography on our mobile telephones. The impact on dentistry has been profound, as evidenced by the introduction of the intra-oral scanner to capture and then digitise the oral cavity for diagnostic and restorative purposes. The process of digitisation for dentistry has evolved rapidly, the most recent development being extra-oral photogrammetry to increase speed, precision and accuracy for implant restorations—this has been newly surpassed by the introduction of *intra-oral* photogrammetry! Keep up with the latest advances in the digital workflow with our latest issue. Welcome to the future of dentistry!

Respectfully,
Dr Scott D. Ganz
Editor-in-Chief



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From chairside to cyberspace: Why every dental practice needs cybersecurity

Part 1 of a four-part series on helping practices get prepared

Anne Genge, Canada

Dentistry's cyber problem

The rapid rise of digital dentistry has given dentists worldwide many benefits, but it has also increased risks. Dental teams must learn to leverage these technologies safely to keep sensitive patient information secure. This article is the first in a four-part series designed to help dentists secure their practices in a more connected world. Each part will cover a critical area of cybersecurity: identifying cyber threats, taking proactive measures, and creating a robust disaster recovery plan. Future installments will explore specific threats and solutions tailored for dental professionals. Whether you read one part or all four, this series will provide insights to help protect your practice from cyberattacks and safeguard patient data.

Why cybersecurity matters more than ever

Cybersecurity is one of the greatest challenges of the twenty-first century. It is not just a problem of government or big business; cyber risk affects everyone. Most people now have technology embedded into every part of their lives. Every connection, everywhere, creates some level of risk.

There are currently over 13 billion records originating from data breaches that are accessible on the dark web, a marketplace for cybercriminals to sell, trade and use stolen data to attack both individuals and organisations.¹ This statistic indicates that nearly everyone has experienced a breach of some kind. Although this does not mean that we will all become victims in a worst-case scenario, it does mean that we are all potential targets.

Since most successful attacks come through e-mail and more than 90% of cyberattacks start with phishing, it is easy to see why anyone with an e-mail address must act to assess the legitimacy of e-mails.² Cybercriminals exploit human weaknesses by using social engineering tactics to trick individuals into granting access or providing login credentials.

Why are dental practices at risk?

Small and medium-sized businesses, including dental offices, often assume that they are too small to be on a hacker's radar, but cybercriminals are aware of this mindset and exploit it. This view-point is understandable, as cybersecurity seems to be a concern only for large corporations. The reality is that dental practices handle sensitive data—patient records, financial information and health histories—all valuable to cybercriminals. This

type of data can be sold on the dark web, used to steal identities or leveraged to extort the practice and its patients. Unlike large companies, many dental practices lack the resources for advanced cybersecurity, and small businesses generally do not have the same defences as larger enterprises, making them more vulnerable.³ Considering that over thirteen billion stolen records are now on the dark web, every organisation, no matter its size, is a target.⁴

The high stakes of a cyberattack

If you are wondering what the worst is that could happen from a hack, consider the following:

- **Financial losses:** The cost of recovering from a cyberattack can be staggering. For the healthcare industry, including dental practices, the average cost per record in a data breach is reported at approximately US\$429 (€412*), according to IBM's *Cost of a Data Breach Report 2024*.⁵ This figure reflects several factors, such as notification, recovery, regulatory expenses and lost business. Healthcare, having stringent data privacy requirements, typically incurs the highest breach costs across industries.
- **Reputation damage:** Trust is the foundation of your relationship with patients. If their personal data is compromised, that trust can be damaged, leading to loss of patients and a tarnished reputation that is challenging to rebuild.
- **Privacy compliance violation:** Privacy regulations vary globally, but healthcare providers universally have an obligation to protect patient data. Non-compliance can result in significant fines and legal issues, particularly regarding the US Health Insurance Portability and Accountability Act of 1996 and Regulation (EU) 2016/679 EU (General Data Protection Regulation).

Operating systems and the cloud—understanding the risks in your technology environment

There is no one-size-fits-all cybersecurity solution for dental practices. Operating systems and the cloud introduce varying cybersecurity risks:

- **Microsoft Windows:** Most dental practices run on Windows, and Windows systems offer flexibility. However, they are frequently targeted by cybercriminals. More than 80% of malware is designed for Windows systems.⁶ Regular software updates, antivirus tools, and robust network defenses including firewalls, safeguards, and security awareness training are essential. Carefully choose your e-mail services as well to ensure proper filtering since a majority of cyber attacks come through e-mail.
- **Apple's macOS:** Though less frequently targeted, macOS is not invincible. As more practices use Apple devices, the potential for attacks will likely rise. Users of macOS should stay updated whenever patches are available, use security tools such as firewalls and safeguards, as well as security awareness training for all team members. Carefully choose your e-mail services as well to ensure proper filtering since a majority of cyber attacks come through e-mail.

- **Cloud:** As dental practices adopt cloud platforms, managing patient records and billing comes with added security concerns. 80% of cloud breaches are caused by misconfiguration such as improper security controls, access management that leaves data exposed, unsecured backups, and lack of two-factor authentication that adds an important second layer of defense in case credentials are stolen.⁷ Using strong passwords and multifactor authentication, as well as regularly reviewing security settings, is critical.

Understanding the variety of risks across different technology environments helps to underscore the need for a comprehensive approach to cybersecurity. Whether your practice uses Windows or macOS or is cloud-reliant, the articles in this series will provide the steps you need to protect patient data, maintain operational continuity, and build a cyber-resilient practice.

What you can do right now

Assess your practice's cybersecurity by asking the following questions:

- Are systems secured with proper defenses and monitored for intrusions?
- Are your staff trained to spot phishing e-mails?
- Do you have a response plan for a cyberattack?

If you are unsure about any of these, do not worry; you are not alone. Most dental practices feel unprepared initially. My goal with this series is to help you take manageable steps to reduce your risk. Cybersecurity can be simplified, and by following the guidance in this series, you will be on your way to significantly enhancing your practice's security. Stay tuned for Part 2, where we will discuss the specific cybersecurity threats dental practices face—such as phishing scams and ransomware—and the tactics cybercriminals use and how to counter them.

* Calculated on the OANDA platform for 24 November 2024.



Editorial note: Please scan the QR code for the list of references.

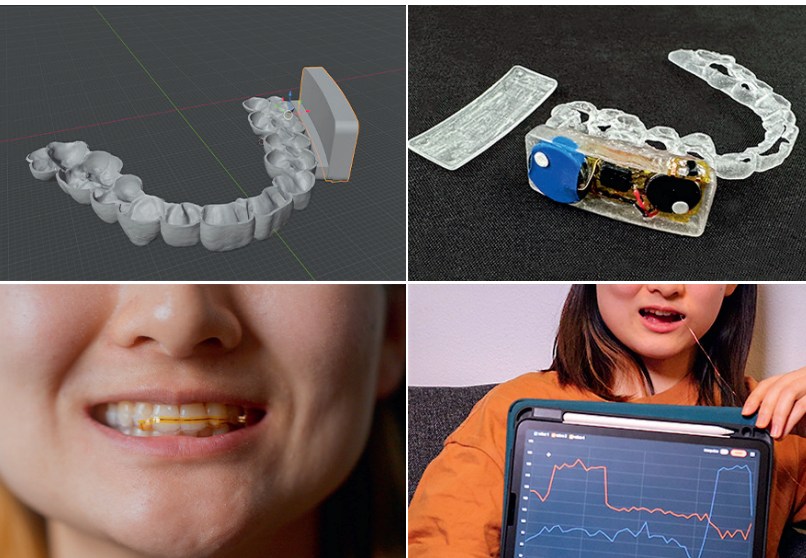
about



Anne Genge is a multi-certified privacy and cybersecurity expert who has won global awards for her work in cyber risk management, ransomware prevention, and cybersecurity education for healthcare providers. For more than 20 years, she has been a technological innovator and educator in Canada, working closely with practice owners, dental teams, and IT providers to protect patient and practice data and to enable compliance with privacy regulations.

New interactive mouthpiece with hands-free control paves way for advances in health data

Dental Tribune International



The new MIT MouthIO interactive mouthpiece. (Images: © Sebastian Krog; MIT CSAIL)

Most wearable electronics are worn on the skin, and intra-oral devices are rare. Researchers at Massachusetts Institute of Technology's Computer Science and Artificial Intelligence Laboratory and Aarhus University have created MouthIO, a dental appliance with sensors and feedback systems that allows for hands-free device control and health monitoring via in-mouth interactions. Unlike traditional voice-activated devices, this retainer-like appliance allows users to control technology using their mouths, a potential breakthrough for those with motor impairments.

The transparent MouthIO is customised from a dental scan and modelled using a special plug-in in the design software Blender. This plug-in allows users to create a personalised device and integrate electronic components like batteries, temperature sensors, accelerometers and touch detectors. Once designed, the appliance is 3D-printed in dental resin for a snug, customised fit.

Key features of MouthIO include its ability to monitor oral activity such as bruxism and to control devices by registering tongue taps on sensors embedded in the appliance. For instance, tongue taps can transmit commands

to scroll a webpage, using the mouth for hands-free interaction.

According to Dr Michael Wessely, senior author of a paper on the appliance and head of the Interactive Matter Lab at Aarhus University, MouthIO represents an opportunity to integrate wearables in the mouth—a challenging but largely unexplored space owing to the mouth's complex shape and moisture. The device's potential for real-time health insights, like monitoring jaw movements or detecting bacteria, makes it promising for healthcare applications, as dentists are interested in exploring these new possibilities.

MouthIO's modular design provides two main formats: a full-coverage appliance and an open-bite version that leaves teeth partially exposed. This open-bite design avoids speech issues like lisping, making the device comfortable for extended wear. During testing, participants favoured this format, and one experiment showed that it could warn users with a vibrational alert when a beverage exceeded a safe temperature.

Producing MouthIO costs around US\$15 and takes just 2 hours to print. Dr Wessely and his team are further refining the appliance, including creating a lingual or palatal version for greater comfort and invisibility and exploring additional placements in the mouth, such as on the cheek or palate. They also plan to integrate wireless charging and communication.

Through its user-friendly design, affordability and adaptability, MouthIO showcases the potential of wearable technology in non-traditional hands-free spaces. The researchers aim to conduct longer studies to optimise it for everyday use and further establish its place among assistive and health-monitoring technologies.

Editorial note: The study, titled "MouthIO: Fabricating customizable oral user interfaces with integrated sensing and actuation", was published online on 11 October 2024 in UIST '24: Proceedings of the 37th Annual ACM Symposium on User Interface Software and Technology.



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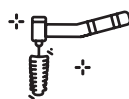
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The third quarter of this year saw the continuation of dental market turbulence that began with the SARS-CoV-2 outbreak in early 2020.

Dentistry lacking bite amid sluggish market trends

Jeremy Booth, Dental Tribune International

Third-quarter financial results from the largest dental manufacturers show that the industry is not out of the woods yet. In the US, the stability of Henry Schein's dental equipment distribution business and reports of strong diagnostics sales hinted at improving consumer sentiment; however, such highlights remained sparse, and growth was mainly seen outside of the most established dental markets. Financial reports for the period underscored the ongoing retreat from direct-to-consumer (D2C) orthodontics as well as growing demand for dental implants in Asian and South American markets.

Align Technology reports mixed results

The world's largest aligner treatment provider continued to grow its teen shipments in the third quarter. A total of

236,300 aligner cases were shipped to young patients, a year-on-year increase of 6.7% and 9.1% more cases than in the prior quarter. Align's earnings from imaging systems and CAD/CAM services continued a similarly positive trend, increasing by 15.6% year on year to reach US\$191 million (€171 million*).

CEO Joseph M. Hogan told analysts that a record number of teen case starts in China and more than 25,000 Invisalign Touch-Up cases had boosted the company's results. Total aligner shipments reached 617,220, up by 2.5% year on year and down by 4.0% sequentially, and the company banked US\$978 million in sales for the period, 1.8% more than it did a year earlier. Align nonetheless fell short of its earnings outlook for the period, owing to what Hogan described as "more pronounced seasonality for clear aligners than expected,

as well as continued weak consumer sentiment and a soft dental market, especially in the United States”.

Hogan said: “Overall, [third-quarter] results were mixed and reflect strong system and services year-over-year revenue growth as well as good clear aligner volume in [the] Asia-Pacific, [Europe, Middle East and Africa (EMEA)], and Latin America regions, partially offset by declines in the United States. As recently reported by many analysts and third-party research firms, the underlying dental market in the United States remains sluggish and our doctor customers cite similar trends.”

Align announced in its results that it plans to implement a global restructuring plan that includes redundancies in all operating regions. The position of managing director of the Americas region, executive vice president and chief marketing officer—held since August by Raj Pudipeddi—has been eliminated, and Align said it anticipates that the plan will incur severance-related costs of some US\$30 million.

Envista sales drop by 4.8%

Sales at Envista Holdings in the third quarter totalled US\$601 million, representing a year-on-year drop of 4.8%, or US\$30 million. Envista, whose portfolio of companies includes Nobel Biocare, Ormco, DEXIS and Kerr, reported negative core sales growth of 5.2% and 5.6% for its specialty products and technologies, and equipment and consumables businesses, respectively.

Envista CEO Paul Keel told analysts that the results were in line with the company’s expectations, given the difficult operating environment. Keel explained: “Dental market growth still remains slow, slower than the historical 3–5% that we all know over time, and quite a bit slower than the post-COVID run-up. Now, there are a couple of early signals that things will or may improve moving forward. People point to interest rates coming down, and then of course, unmet patient demand is still very high. But, at present, there just isn’t enough tangible evidence of improvement to expect an imminent upturn anytime soon.”

Eric Hammes, chief financial officer at Envista, reminded analysts of the global weakness in dental diagnostics sales and said that sharp declines had been observed in Europe and China during the quarter. Bucking the trend, the North American diagnostics market increased modestly in size for the third consecutive quarter. “The quarter did play out much like we had thought,” Hammes commented, adding that the uptick in diagnostics sales in the US and positive trends in orthodontics had been encouraging.

Straumann Group maintains steady growth

Having a growing stake in profitable implant markets in Asia and South America, Straumann Group appears once again to have navigated a turbulent quarter more successfully than its competitors. Group sales for the period amounted to CHF 585.5 million (€623.8 million*), and the company boasted 7.7% year-on-year sales growth. On an organic basis, where the impacts of currencies and acquisitions are excluded, year-on-year growth reached 11.2%.

Regarding the company’s regional performance, Straumann posted CHF 216.4 million in sales for its stalwart EMEA region, a year-on-year gain of 11.2%. Germany, Spain, Italy and Belgium were the main contributors to EMEA revenue growth. Speaking to analysts, CEO Guillaume Daniellot said: “[In] North America, we see a less dynamic picture due to the effect of the unfavourable macroeconomic environment.” Daniellot explained that high interest rates had affected the US market, stemming patient flow at dental practices and large dental support organisations as well as growth in implant and orthodontic treatments. North America sales totalled CHF 162.9 million for the quarter, down by 1.4% year on year.

Asia-Pacific revenue reached CHF 149.4 million, a year-on-year increase of 16.5% that was primarily driven by sales of premium and challenger implants. Daniellot pointed out that the region had achieved double-digit revenue growth even without the Chinese market, driven by markets like Thailand, India and Malaysia. Dental Tribune International reported earlier this year that Straumann’s business in Asia is growing. Asia-Pacific sales accounted for 23.4% of Straumann’s entire business in the first nine months of this year, compared with 19.6% in the comparable period of 2023. Over the same period, the value of US sales as a share of Straumann’s total revenue slipped by nearly two percentage points.

Latin America continued to be a solid earner for Straumann, despite a difficult year-on-year comparison. The company banked CHF 56.8 million in Latin American sales, 2.3% more than it did in the third quarter of 2023, when year-on-year growth of 15.9% was recorded. Daniellot said to investors that the challenger implant brand Neodent was the main growth agent, backed by orthodontic sales in Brazil and Mexico. Straumann said in its earnings results that it had laid the foundation stone for a manufacturing and distribution facility in Curitiba in Brazil during the quarter—the company’s third such facility. Aiming to foster international expansion of Neodent, the site will cover some 40,000 m² and is slated for operation by the end of 2026.



Dental implant sales were an important source of revenue growth during the third quarter of this year.

Dentsply Sirona suspends Byte, records goodwill impairment charge

For the third quarter, Dentsply Sirona posted US\$951 million in sales, representing a flat year-on-year increase of 0.5%. The company's essential dental solutions business recorded net sales growth of 6.6%; however, negative sales growth of 2.3%, 4.6% and 0.4% was attributed to its connected technology solutions, orthodontic and implant solutions, and Wellspect HealthCare businesses, respectively. US sales were strong, growing by 5.0% year on year, and those in Europe and remaining markets declined by 1.8% and 3.0%, respectively. The company posted a net loss of US\$494 million, owing to a non-cash charge of US\$495 million for the impairment of goodwill relating to its orthodontic and implant solutions business. Outgoing Chief Financial Officer and Executive Vice President Glenn Coleman explained to investors that the goodwill impairment charge "was the result of sustained macroeconomic pressures, legislative challenges impacting Byte and weakened demand and competitive pressures in implants".

Dentsply Sirona announced on 24 October that it had suspended sales and marketing of its Byte D2C aligners and impression kits, including the shipment of new and recent orders. The decision to suspend Byte sales was made in consultation with the US Food and Drug Administration,

pending an internal review of the US regulatory requirements relating to D2C aligner treatment. The company said that the regulatory environment had been adversely affecting its Byte business model. Based in Los Angeles in the US, Byte was founded in 2017 to provide at-home treatment for malocclusion via a network of licensed US general dentists and orthodontists. Dentsply Sirona acquired the company in December 2020 for US\$1.04 billion (€846.6 million**) in cash.

CEO Simon Campion told investors: "We are not at a point in our analysis to make a definitive decision concerning Byte and we are thoroughly evaluating strategic options, which may include a discontinuation of some or all of this business. Our decision will be data-driven, taking into account the legislative environment, recent performance, longer-term prospects and the ongoing regulatory review, which may take time and require additional investment."

Dentsply Sirona lowered its organic sales outlook for the full year, taking into consideration macroeconomic pressures in the US market and the review of Byte.

* Calculated on the OANDA platform for 30 September 2024.

** Calculated on the OANDA platform for 31 December 2020.

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New digital 3D models for forensic odontology education

Anisha Hall Hoppe, Dental Tribune International



Digital 3D models are a more accessible substitute of human remains in the study of forensic odontology.

Advancing technology in forensic odontology is vital to further improving the accuracy and reliability of dental identification, bite mark analysis and age estimation, ultimately improving the effectiveness of criminal investigations. Digital 3D technology specifically has become increasingly important, not only for teaching and training but also for legal communication in courtrooms. In a new study, researchers at the University of Dundee created digital 3D models illustrating how human teeth and commonly used dental materials are affected by various physical and chemical agents. They have made their models available on Sketchfab.

Forensic odontologists often encounter teeth damaged by accidents, violence or disasters, presenting challenges in identification. The ability to digitally replicate dental trauma enables consistent, hands-on training and provides a valuable educational resource for forensic odontology students and professionals. Additionally, using these digital models helps overcome logistical challenges associated with traditional cadaver-based learning.

The study consisted of two parts, both of which entailed exploring the need for specific dental damage models and then creating suitable digital 3D models. The first part involved a survey among forensic odontologists and students regarding their view on whether digital 3D models would be useful for revision or learning and assessing their knowledge and understanding of the types of dental damage commonly seen in forensic cases.

The survey results indicated varying levels of knowledge among participants regarding specific types of dental damage. For instance, although 84% correctly identified pink teeth associated with postmortem conditions, only 25% could accurately apply the Ellis and Davey classification system for tooth fractures. The participants reported that the forms of dental damage they most frequently encountered were trauma and postmortem missing teeth, followed by incineration. Pink teeth were the least common, suggesting that this phenomenon may not be frequently observed in forensic cases. Based on the participants' answers, the researchers created a digital 3D model that simulated restored and unrestored burnt teeth, postmortem pink teeth and traumatic injuries.

The second part of the study was informed by a previous systematic review of experimental research on high-temperature effects on dental materials. The researchers then created a digital 3D model which illustrated the impact of different agents of damage, including fire, acids and water, on various prosthetic and restorative materials.

The creation of realistic visual references and interactive experiences for understanding dental damage could potentially transform the teaching of forensic odontology and aid in legal contexts by improving the visual presentation of evidence.

Editorial note: The study, titled "Dental damage: Creating 3D anatomical models to illustrate destructive effects on human teeth", was published in the December 2024 issue of Morphologie.



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Intra-oral scanner manufacturers also need to evaluate their suggested scanning protocols according to new research.

Researchers look at accuracy of more cost-effective intra-oral scanners

Dental Tribune International

Most research focuses on high-cost intra-oral scanners, but there is insufficient evaluation of cheaper alternatives to inform their successful clinical application. A new study has evaluated the accuracy of digital models generated using lesser-known intra-oral scanners and with a laboratory scanner. It found that the scanning path recommended by the manufacturers might not provide the most accurate results, self-calibration systems may further reduce accuracy and the number of prepared teeth and their position can influence accuracy.

The study, conducted by researchers at the George Emil Palade University of Medicine, Pharmacy, Science,

and Technology and by private clinicians in Romania, involved scanning maxillary and mandibular arches on an articulated simulator cast before and after tooth preparation using the NeWay laboratory scanner (OPEN TECH 3D) and the Virtuo Vivo (Straumann) and Evo I.O. Scan (FUSSEN) intra-oral scanners. 3D measurements were performed using ZEISS INSPECT software in both the sagittal and transversal planes, comparing digital model data against reference values obtained through manual measurements. The accuracy was analysed based on discrepancies observed across the different scanners and preparation conditions.



Room for improvement

Full-arch scans are generally less accurate than segmental scans, especially in the posterior regions. However, the data gathered during the study showed the opposite, with the lowest values actually measured in the transversal plane in the posterior regions. This suggests a need for more sophisticated scanning protocols or enhanced scanner designs to improve consistency across the full arch.

The laboratory scanner generally outperformed the intra-oral scanners in terms of accuracy, in agreement with previous research findings. Laboratory scanners are less susceptible to distortions caused by indirect digitisation steps and variations in impression materials. However, the intra-oral scanners demonstrated accuracy within an acceptable range, particularly in limited edentulous areas or shorter prosthetic spans. The values for the transversal measurements in the maxilla were more consistent for the non-prepared models, whereas the prepared models showed increased deviations.

Environmental factors, such as lighting conditions during scanning, also play a role in scanner accuracy. Previous studies suggest that optimal lighting conditions for intra-oral scanning are achieved in dimmer environments, as bright lights can interfere with the scanning process. In this research, the scans were conducted under controlled *in vitro* conditions. Because this may differ from actual clinical environments, the results' applicability to dental practice may be limited.

Clinical implications

In clinical practice, these findings have implications for choosing intra-oral scanners for different restorative procedures. While laboratory scanners may still be preferred for more complex restorations requiring high precision, intra-oral scanners can offer sufficient accuracy for shorter spans or single restorations. The study underscores the importance of frequent scanner maintenance and calibration to avoid inaccuracies during scans. Additionally, the results suggest that manufacturers should provide evidence-based guidance on optimal scanning techniques to improve outcomes in digital dentistry.

The limitations of this study include a small sample size of scanners, the controlled *in vitro* conditions that do not perfectly replicate the oral environment and the reliance on manual measurements as reference values, which may introduce human error. Further research is needed to validate these findings in clinical settings, explore alternative scanning protocols and investigate a wider variety of scanners, including those with more advanced functionalities.

Editorial note: The study, titled "An evaluation of the accuracy of digital models—an in vitro study", was published online on 29 September 2024 in Dentistry Journal.

Scanning protocols could be universalised

Scans generally showed increasing discrepancies the further they were from the scan's starting point. Distortions were more prominent for models with multiple tooth preparations, particularly for the mandibular models. The results for non-prepared models revealed fewer discrepancies compared with prepared models, suggesting that tooth preparation may affect the precision of digital impressions. For all mandibular models, the least variation in measurements was noted in the distance between the central fossa of tooth #47 and tooth #37, particularly for non-prepared models scanned with intra-oral scanners.

The researchers suggested that the accuracy issues observed were linked to the scanning protocol and scanner calibration. Scanning paths followed the manufacturers' recommendations, but these paths are not universally supported by scientific research. The discrepancies indicate that different scanning directions may be needed to enhance accuracy. Even self-calibrating scanners may require manual calibration to ensure optimal functioning, as poor calibration can lead to distorted scans.



A new era in US dental imaging: AI-driven, safe and patient-centric solutions

Ali Arabnejad & Dr Kamran Zamanian, Canada

The US dental imaging market is undergoing a transformation, driven by emerging technologies and evolving practitioner demands. Innovations in artificial intelligence (AI), ultra-low radiation techniques and cloud-based data management are setting new benchmarks in diagnostic efficiency and patient safety.^{1,2}

As these advancements are integrated into daily practice, orthodontists and general dentists are exploring modern imaging solutions that promise enhanced precision and adaptability. In light of these innovations rapidly transforming the industry, we delve into how new approaches and technologies are influencing the future of dental imaging in the US in this article.

Technological trends driving change

AI-powered diagnostics and predictive analytics

The integration of AI into dental imaging systems can enhance diagnostic accuracy by identifying conditions such as dental caries and periodontal disease with high precision. As AI algorithms have evolved, they have enabled the provision of real-time feedback to practitioners, minimising diagnostic errors and enabling pre-emptive treatments. The adoption of these systems is growing, and US Food and Drug Administration clearance for AI-powered dental tools is increasing. Predictive capabilities may lead dentists to prefer imaging devices with embedded diagnostic features, potentially setting a new standard.

Advancements in intra-oral scanners

Intra-oral scanners are rapidly evolving, offering enhanced accuracy, speed and ease of use in capturing digital impressions. These devices are now integrating features like real-time feedback and built-in AI,³ ensuring precise imaging and reducing the need for retakes. Furthermore, advancements in colour scanning technology enable practitioners to capture highly detailed, realistic images, aiding in better diagnosis and treatment planning.

Cloud-based image management and teledentistry

Cloud technology is revolutionising how dental practices manage patient data. Secure cloud platforms compliant with the US Health Insurance Portability and Accountability Act allow dentists to store and share radiographic images across various locations, supporting multi-practice networks and remote consultations.² As teledentistry expands, particularly in underserved areas, cloud-based imaging will enable smoother workflows. Practices may increasingly favour imaging systems compatible with cloud solutions, marking a departure from traditional models.

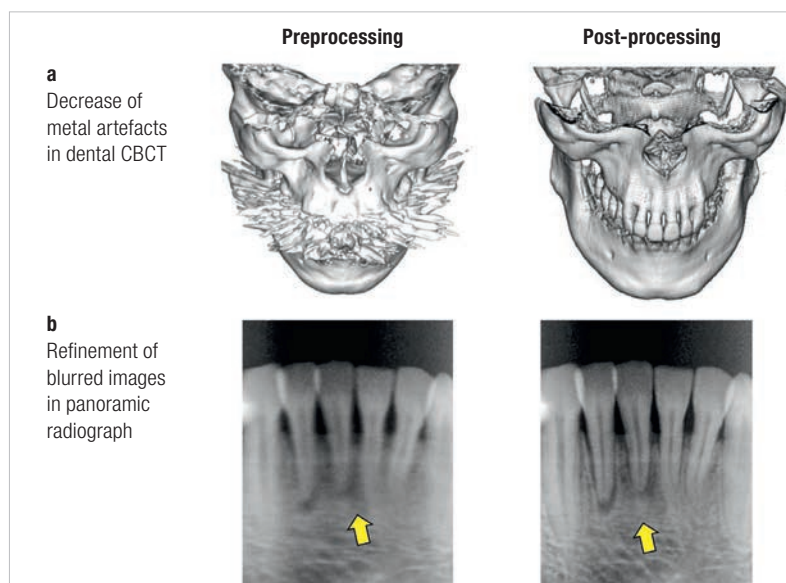
Shifts in practitioner preferences and market dynamics

Growing demand for CBCT and modular imaging systems

The CBCT segment is experiencing significant growth, driven by advanced diagnostics and cosmetic dentistry services.⁴ Modular CBCT systems provide interchangeable 2D and 3D components. Such flexibility is likely to encourage many practices to invest in modular systems over traditional imaging solutions, and indeed they are already gaining popularity among US dentists. Leading companies such as Carestream Dental, the Acteon Group and Midmark have all released modular CBCT systems in the past few years, underlining the increasing popularity of these versatile imaging solutions.

Transition to devices with larger fields of view

A trend towards CBCT systems with larger fields of view is emerging as practitioners seek devices that offer comprehensive imaging capabilities. This shift may reshape purchasing patterns, devices with larger fields of view gradually replacing those with smaller ones. In their product lines, manufacturers like Carestream, Planmeca and PreXion are increasingly emphasising devices with larger fields of view owing to their ability to capture more information, which is essential for modern dental practices. Models with smaller fields of view are being either phased out or relegated to specific-use cases, signalling a market transformation.



Post-processing employing artificial intelligence (AI) in dental CBCT images **(a)** and panoramic radiographs **(b)** significantly reduces metal artefacts and enhances image clarity. These improvements in image quality support more accurate diagnosis, exemplifying the transformative impact of AI in dental imaging.⁶

Demand for advanced intra-oral scanners in orthodontic practice

The intra-oral scanner market, led by innovations like Align Technology's iTero series, features products that integrate seamlessly with orthodontic systems such as Invisalign. This technology expedites treatment planning and enhances the patient experience, solidifying intra-oral scanners as essential for many practices. Growing demand may drive competitors to develop similarly integrated systems.

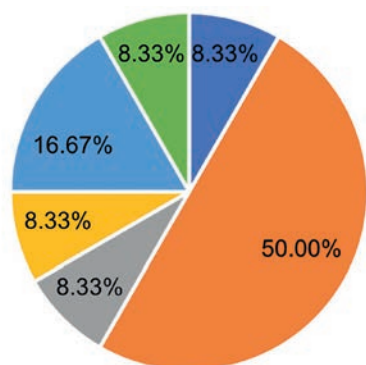
Emerging products and potential disruptors

Next-generation 3D-imaging devices and hybrid systems

Companies like Carestream Dental and Envista Holdings are advancing 3D imaging with devices tailored to general practitioners. Carestream's launch of the CS 8200 3D Access demonstrates a move towards making 3D imaging more accessible. Such hybrid systems integrating AI diagnostics and ultra-low radiation are poised to disrupt the market.

Integration with digital treatment planning tools

Imaging devices are increasingly incorporating digital treatment planning software.⁵ For instance, Align Technology's integration of its iTero intra-oral scanners with Invisalign supports faster, more accurate treatment planning. These benefits of integration may potentially drive practices to favour devices with embedded planning functionalities. This convergence of diagnostics and planning into a single system may lead



■ Geomagic Qualify (Oqton) ■ Geomagic Control X (Oqton) ■ WearCompare (Andrew Keeling)
■ RStudio (Posit) ■ TRIOS Patient Monitoring (3Shape) ■ Mountains (Digital Surf)

Main software and tools used for dental wear evaluation.⁷

to greater consolidation in the market, and companies offering all-in-one digital platforms are likely to gain an edge.

Rise of patient-centric imaging solutions

Modern dental imaging is shifting towards patient-centred approaches, emphasising safety, comfort and engagement. Devices that offer minimal discomfort and quicker results can enhance the patient experience, a significant factor in today's competitive healthcare environment. As consumer expectations evolve, manufacturers may prioritise ergonomic and user-friendly designs, making these deciding factors for dental practices considering new equipment.

Impact on the competitive landscape

Strategic positioning and new entrants

Companies like KaVo, Align Technology and Dentsply Sirona hold substantial market share across various imaging segments. However, as digital workflows and integrated systems become the norm, the market may see increased competition from technology-centric newcomers, particularly those specialising in AI and cloud solutions. The ongoing shift could also spur more mergers and acquisitions as established competitors seek to diversify their portfolios and newcomers aim to gain market foothold.

Price competition and economic accessibility

The growing preference for high-tech, low-radiation and AI-enabled devices has introduced intense price competition. Practices often have to balance budget constraints with the need for the latest technology, and this requirement has created opportunities for cost-effective alternatives, particularly for small and medium-sized practices.

Companies offering affordable, modular options may gain traction, potentially disrupting higher-priced traditional products.

The road ahead

The US dental imaging market stands at a pivotal juncture. The industry is embracing the unprecedented innovation offered by AI-enhanced diagnostics, ultra-low radiation technology and cloud-enabled workflows. Success will hinge on economic accessibility and seamless integration into workflows. As competition heightens, dental practices are likely to prioritise devices that blend safety, efficiency and patient-centric care. The coming years will reveal which companies will redefine the standards of dental imaging in the US.



Editorial note: Please scan the QR code for the list of references.

about



Ali Arabnejad is a research analyst at iData Research, specialising in the medical device industry. He is responsible for spearheading syndicated research projects that contribute to market insights that support industry stakeholders in developing strategies and innovations which may ultimately lead to advancements

in medical practice or technology. Arabnejad's extensive contributions include leading publications such as the ear, nose and throat report series, as well as the comprehensive infusion therapy report series.



Dr Kamran Zamanian is the CEO and founding partner of iData Research. He has spent over 20 years working in the market research industry, focused specifically on medical devices used to support the health of patients all over the globe.

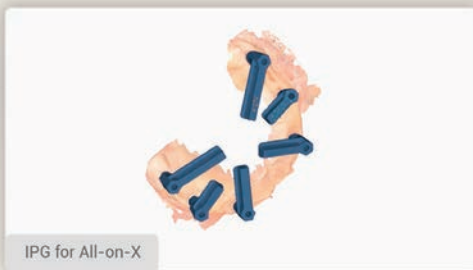
about iData Research

For 19 years, iData Research has been a strong advocate for data-driven decision-making within the global medical device, dental and pharmaceutical industries. Through its custom research and consulting solutions, iData Research empowers its clients with trustworthy data, enabling them to make important strategic decisions with confidence. More information can be found at idataresearch.com.

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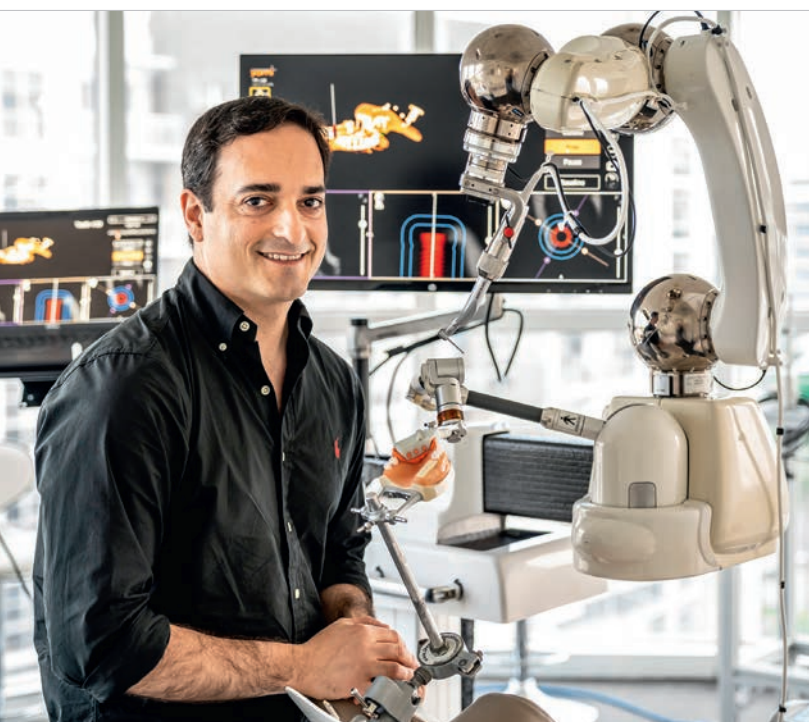


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Robotic revolution in dental implantology: A new standard with Neocis's Yomi system

An interview with Dr Alon Mozes

Magda Wojtkiewicz, Dental Tribune International



Dr Alon Mozes, CEO of Neocis.

Robotics has continued to advance across various medical fields, and dental implantology is no exception. Neocis's Yomi system, the only robotic assistant for dental surgery with US Food and Drug Administration (FDA) clearance, is transforming the way dental professionals approach implant procedures. Robotics offers unprecedented precision, efficiency and patient comfort, and systems like Yomi are helping to streamline complex cases and improve outcomes. In this interview, Dr Alon Mozes, CEO of Neocis, discusses the advantages of robotics over certain conventional methods in implantology, such as dynamic navigation and surgical guides, and explores the unique capabilities of the Yomi platform. Addressing key factors such as cost considerations and impact on patients, Dr Mozes explains why robotics is becoming a critical tool for modern dental practices and how Yomi's technology could soon become the industry standard.

Could you tell us more about your vision for the role of robotics in dental implantology? In what types of cases or patient demographics do you see robotics being particularly beneficial?

I think robotics will become the standard of care for dental procedures. Our Yomi platform has already placed more than 60,000 implants, and this figure is growing exponentially. Yomi can be beneficial across a wide variety of clinical cases: emergent cases where a patient walks in with trauma, like a cracked tooth, and needs immediate replacement; single-implant cases where the clinician may have to work with precision in the aesthetic zone; difficult-to-reach posterior implant sites where angulation is tough to achieve and there's no room for surgical guides; and complex full-arch cases with few anatomical references and challenging bone conditions. Every implant case can benefit from the expert guidance provided by robotics, combined with the clinician's skills.

How does a robotic technology like Yomi differ from dynamic navigation systems? What distinct advantages does robotics bring?

Robotics is an entirely different category from navigation. Navigation is simply an on-screen visual cue, like GPS on your phone. You wouldn't want to focus exclusively on the map on your phone while driving down the highway. There's nothing in navigation that physically prevents you from making a mistake. Our key opinion leaders like to say that you get to watch your mistake on-screen as you make it.

Robotics, however, physically guides the dentist so that he or she can't deviate from the plan. It's also easy to change the plan to cater for any intra-operative surprises; a few clicks of the mouse and the digital plan is updated, and the robot can guide to a new location. The haptic feedback provided by the robot ensures that the dentist won't hit a nerve, sinus, nearby tooth root or any other anatomical structure that should be avoided.

From your perspective, what are the primary advantages of using robotics in dental surgeries?

There are numerous advantages to using robotics in dental surgeries. The accuracy is unsurpassed by any other modality. This was shown in a recent landmark study by Dr Jay M. Neugarten.¹ This accuracy helps provide safety and confi-

dence regardless of procedural complexity. With haptic guidance, Yomi can also enable flapless procedures, which have been shown to promote faster healing and result in less pain. There is also an impact on practice workflow because Yomi's efficiency, especially in full-arch cases, can greatly speed up operations. Ultimately, most practices are seeking to grow their businesses, and robotics is a huge boon for patient flow, marketing opportunities and case acceptance rates. By showcasing their state-of-the-art technology and superior approach to dental surgery, practices can effectively distinguish themselves and attract more patients.

How does the Yomi system compare with competing technologies—if there are any? Could you highlight some unique features or benefits of the Yomi system?

Yomi is the only FDA-cleared robotic system for dental surgery. There aren't really any competing robotic solutions. Aside from navigation, surgical guides are the other primary form of guided dental surgery, but these have many drawbacks: delays and costs with custom manufacturing, clunky clinical workflows, obstructed surgical site visualisation, reduced irrigation leading to bone overheating and a completely analogue workflow that makes on-the-fly changes impossible. The greatest competition is simply the freehand approach. We saw a similar curve in orthopaedic robots before at MAKO Surgical. Some dentists believe their hands don't make mistakes. However, the adoption curve accelerates as dentists discover the clinical and financial benefits of the Yomi platform, especially after experiencing the aha moment once they use it. This is how Yomi is becoming a new standard of care.

Investing in robotics can be a significant expense for dental practices. What are the main cost factors for practitioners considering robotic systems for dental surgery?

As with any new technology, there is a cost, but the return on investment is clear. The Yomi platform is priced affordably so that any practice can justify the purchase. There is ample opportunity to take advantage of efficiencies and grow the practice, allowing Yomi to pay for itself in a relatively short time.



Yomi robotic technology is revolutionising implant surgery by offering increased clinical precision and efficiency.

Looking ahead, how do you see the adoption of robotics evolving in the field of implantology? What might encourage more dental specialists to integrate robotics into their practices?

We continue to install more Yomi systems across the US and add more functionality to the platform, aiming for a fully digital dental workflow that includes surgical planning, restorative planning and both surgical and restorative implementation. As more dentists see neighbouring practices adopting robotics and become aware of the clinical and business benefits, we expect to see Yomi systems in every practice.

In terms of patient experience and outcomes, what improvements have been observed with robot-assisted implantology, and how does this have an impact on practitioner–patient interactions?

Patients have become some of the best advocates for Yomi, and testimonials can be found on our website. They mention the minimal pain and quick treatment, often marvelling at the improvement if they compare a Yomi-placed implant with a previous free-hand implant. For dentists, this means happier patients and better referral opportunities, both of which help the practice grow.

Reference

1. Neugarten JM. Accuracy and precision of haptic robotic-guided implant surgery in a large consecutive series. *Int J Oral Maxillofac Implants*. 27 Feb 2024;39(1):99–106. doi: 10.11607/jomi.10468.

Dr Leo Haydt from Highland Implant Center in North Carolina in US, operating with Yomi. According to clinicians, robotic technology increase accuracy and aesthetics in dental implant procedures through visual and physical guidance and a simple digital workflow. (All images: © Neocis)





Max Milz, group vice president of connected technology solutions at Dentsply Sirona.

Transforming digital dentistry: Exploring Primescan 2 and the future of **connected technology**

An interview with Dentsply Sirona's Max Milz and Kevin Boyle

Magda Wojtkiewicz, Dental Tribune International

During **Dentsply Sirona World** in Las Vegas in the US this year, Dental Tribune International had the opportunity to speak with Max Milz, group vice president of connected technology solutions, and Kevin Boyle, senior vice president and chief technology officer, about the company's innovative Primescan 2 intra-oral scanner. Designed as the first cloud-native intra-oral scanning solution, Primescan 2 integrates with DS Core, a robust cloud platform, reshaping workflows and enabling seamless data access across devices. In this interview, Milz and Boyle discuss the role of artificial intelligence (AI) and cloud technology in advancing clinical outcomes and efficiency, as well as patient care. They also explain how Primescan 2 facilitates in-house fabrication and optimises decision-making between 3D printing and milling. As digital transformation accelerates in dentistry, this interview highlights Dentsply Sirona's commitment to connected dentistry and its vision for the future of patient-centric care.

How do you see Primescan 2 shaping the future of digital dentistry as the first cloud-native intra-oral scanning solution, and what sets it apart from other scanners on the market?

Milz: The launch of Primescan 2 signals a new era of digital patient care. Powered by the direct integration with our cloud platform DS Core, Primescan 2 is the first intra-oral scanning solution that can scan to any Internet-connected device and does not need a dedicated computer. I believe that, with the rise of cloud solutions such as Primescan 2, we are moving beyond digital dentistry into an era of connected dentistry, an era driven by precision, collaboration and patient-centred care.

Without question, the market for intra-oral scanners is very dynamic. For us, our customers' satisfaction is the deciding factor: what do they need in order to achieve excellent clinical outcomes in their daily practice while also making their practice efficient? This gives rise to new



Kevin Boyle, senior vice president and chief technology officer at Dentsply Sirona.

requirements from dentists, and we incorporate these into our development processes. In creating Primescan 2, we did not want to simply keep up with the demands of today by launching another wireless scanner. We wanted an innovative scanning solution that would make full use of the possibilities of digital dentistry and cloud scanning to help our customers confidently do their best for their patients and practice.

Our cloud platform stands out with a comprehensive set of capabilities. In DS Core, all cases, orders, files and messages to labs can be managed from one central place. Dentists and staff can also flexibly use DS Core for a wide range of clinical workflows, not just to facilitate data transfer to labs.

For this, DS Core also integrates a broader set of data in one place, including X-rays, Dentsply Sirona and third-party intra-oral scans, and other media files. This enables enhanced patient consultations that utilise more than just the intra-oral scan, meaningfully supporting patient communication and treatment acceptance.

Furthermore, DS Core seamlessly connects to the large Dentsply Sirona equipment ecosystem. By leveraging cutting-edge cloud technology, DS Core is driving a new era of cloud-connected solutions such as Primescan 2.

One of the key advantages of digital solutions is the optimisation of workflows in dental offices and laboratories. How does Primescan 2 specifically help save staff time and increase efficiency, and what impact do you expect it to have on daily clinical operations?

Milz: With the wireless and cloud-native capabilities of Primescan 2, it's possible to turn any room into a scanning

room. Scanned data is automatically processed and stored on DS Core so that the scanner is immediately ready for use with the next patient. All the following steps, including patient consultations, lab ordering and treatment planning, can take place on any Internet-connected device in the practice. The whole workflow is designed to improve practice efficiency. It also allows for easy delegation to other dental professionals in the practice team, freeing up dentists' time for patient consultations and ensuring that they have access to the relevant patient data as soon as they enter the room.

Overall, Primescan 2's integration with DS Core streamlines the entire workflow, all further steps being initiated from the platform. However, dentists are free to choose which lab they want to work with for each case. They can also decide to produce appliances and models directly in the practice. Users can employ Primescan 2 in the way that suits them best for each case.

The role of cloud platforms in dentistry is becoming increasingly significant. Could you explain the benefits of a cloud-based approach, particularly in relation to DS Core and Primescan 2?

Boyle: DS Core is the driving force behind all our connected solutions, cloud technology being at the heart of this new era of modern dental care. The DS Core cloud platform delivers a fully integrated ecosystem where devices, software, practices and labs are all seamlessly connected. Software updates are automatic, data transfer happens in seconds, all communication can take place via one channel and the complexities of modern practice management are greatly simplified. Because scans are directly captured in the cloud using Primescan 2, data can be managed on DS Core and accessed anytime, anywhere.

“Primescan 2 is the first intra-oral scanning solution that can scan to any internet-connected device and does not need a dedicated computer.”

—Max Milz, Dentsply Sirona

Furthermore, because all data is stored remotely in the cloud with Primescan 2, it reduces the need for additional expenses associated with storing scan data on local systems or devices within the practice.

The presence of AI in dental offices is growing. How does Primescan 2 utilise AI to improve accuracy and clinical outcomes?

Milz: We’re certainly seeing the rise of AI in the dental industry and some incredible examples of how it can be used to enhance dentists’ expertise. At Dentsply Sirona, we’re actively working on providing our customers with AI-assisted solutions. For Primescan 2, for example, we use AI in many areas. The scanning process itself (e.g. the intelligent rotation of the model to show the user where holes in the model are), the prep margin and the model orientation are just a few examples.

Dentsply Sirona has deployed machine learning and other AI technologies in our offerings to create customer value since 2007, and it is our goal to empower our customers with these along the entire patient journey—covering patient engagement, diagnosis, treatment planning, manufacturing and patient follow-up. We have been using AI for over a decade in areas such as CEREC.

By analysing vast amounts of data at great speed, AI—or *assisted intelligence* as I like to call it—can help predict outcomes, identify potential issues early, optimise treatment plans and drive design and fabrication processes with precision. We are still unlocking the vast potential that digital dentistry and AI have for professionals and patients alike, but without a doubt, AI-supported solutions can make treatments easier, safer and better in terms of accuracy and patient satisfaction.

With the ongoing debate between printing and milling in dentistry, how does Primescan 2 influence the decision-making process? In what scenarios do you see it playing a pivotal role in choosing between these two fabrication methods?

Milz: We hear plenty of debate about whether practices should invest in 3D printing or chairside milling, and our answer is that they are better together. The technologies complement each other excellently in a digital practice environment. 3D printing is most suitable for

the production of removable appliances, such as surgical guides, dentures, guards and splints, as well as for models, whereas milling is the go-to manufacturing solution for fixed restorations, such as crowns, bridges, inlays and onlays.

Primescan 2 provides very high flexibility when it comes to workflows, and this can help practices expand the services they offer to patients and grow their businesses. It is an excellent starting point for in-house fabrication using milling or 3D printing—or both. Indeed, after scanning, practices can choose to design and manufacture appliances in-house using the 3D-printing Primeprint Solution or CEREC Primemill, use DS Core Create to outsource design or securely send files to partner labs via DS Core.

Primescan 2 represents a significant leap in intra-oral scanning technology. Could you share insights into the research and development efforts that went into creating this solution and the key innovations that differentiate it from its predecessors?

Boyle: Primescan 2 is based on many years of careful research, development and testing, along with close collaboration with customers and technological innovators. It was a long time in the making, but we are proud to have delivered the first cloud-native intra-oral scanning solution.

Primescan 2 features the same patented scanning technology and well-loved speed and accuracy of Primescan, plus the excellent new cloud capabilities made possible through the integration with DS Core. The scanner is now wireless and hardware-independent for improved versatility and flexibility—allowing scanning to take place on any Internet-connected device—and a redesigned scanner tip offers improved comfort for patients.

Looking ahead, how does Primescan 2 fit into Dentsply Sirona’s broader vision for the future of digital dentistry? What can dental professionals expect in terms of upcoming innovations or advancements in digital tools and technologies from Dentsply Sirona?

Boyle: As we move into a new era of connected dentistry, our innovations such as Primescan 2 will continue



Primescan 2 is the first cloud-native intra-oral scanning solution.

to be powered by DS Core, offering seamless integrations that greatly simplify day-to-day workflows, foster collaboration between practices and labs, and allow for a patient-centred approach to care. New, advanced materials are allowing for highly personalised restorations when combined with digital workflows, and dental-dedicated MRI, which we are developing together with Siemens Healthineers, has the potential to further advance diagnostic imaging.

The advancement of dental care has consistently been shaped by innovative technologies and methods. By staying curious and open to change, prioritising lifelong learning and consistently focusing on patient needs, dental professionals can fully embrace the opportunities presented by connected dentistry and confidently move forwards into the digital age of patient care.

We are now entering the era of connected dentistry, thanks to the merging of cloud technology, AI and other exciting advancements. Cloud computing enables practices and labs to work together on treatment planning and design from any location, allowing for smooth data exchange and effortless communication. At the same time, AI can process vast amounts of information at great speed to help dental professionals anticipate and enhance treatment outcomes.

How does the introduction of Primescan 2 align with Dentsply Sirona's overall strategy to drive digital transformation in dental practices and labs? What are the primary goals and challenges in advancing this digital shift within the industry?

Boyle: At Dentsply Sirona, we have consistently been at the forefront of innovation, pioneering the beginnings of digital dentistry with CEREC back in 1985, introducing the first digital X-ray unit, launching DS Core, continuing to develop the first dental-dedicated MRI—and now creating the first cloud-native intra-oral scanning solution. Primescan 2 marks the beginning of a new era in digital patient care, and we see it as an exciting start to a future full of opportunities to bring other cloud-native solutions to the market.

We are committed to this new era of dentistry and are embracing connected technologies with open arms. We envision a future where technology acts as both a tool and a bridge to connect dentists, labs and patients in ways never seen before. As with any transformation, the industry needs to be willing to adapt and evolve by remaining curious and committed to lifelong learning. It's a time of rapid change and possibilities, but I am excited for what the future has in store.

“Cloud-based scanning and solutions within DS Core are truly revolutionary”

An interview with Dr Melonie MacDonald

Iveta Ramonaite, Dental Tribune International



Dr Melonie MacDonald.

Dr Melonie MacDonald is a seasoned dentist, having over 30 years of experience, and the owner of Citadel Dental in St. Albert in Alberta in Canada. In this interview with Dental Tribune International, she shares her insights into the transformative power of digital dentistry. As an early adopter of cutting-edge technology, including Dentsply Sirona’s cloud-based solutions, Dr MacDonald discusses how these advancements have revolutionised her dental practice, enhancing patient care and business efficiency.

Dr MacDonald, what motivated you to transition to Primescan 2, and how has it transformed your workflow and practice efficiency?

When I started my practice four years ago, I wanted to embrace technology fully. I began with an intra-oral scanner and quickly moved to Primescan AC and a full CEREC system. We soon realised how powerful it was to show patients their scans—this greatly improved patient education and treatment acceptance. We started scanning every patient during exams and recalls, and my hygienists were thrilled by how much easier it became to explain patients’ oral conditions to them.

CEREC was a game-changer for efficiency. Being able to prepare, manufacture and insert a crown within 90 minutes not only enhanced the patient experience, but also increased business productivity. We eliminated lab costs, bringing that revenue in-house, and patients loved the convenience of single-visit appointments.

As my practice grew, we expanded from four to nine operatories and needed another scanner. When Dentsply Sirona offered me the chance to beta-test Primescan 2, I eagerly agreed. I expected that my team would stick to the original Primescan, but they quickly preferred the ease of Primescan 2, especially because of its direct-to-cloud scanning and seamless integration with DS Core. The ability to use existing status scans for treatment saved me valuable time, and designing on a separate workstation freed up the scanner to serve more patients.

As a dentist with your experience, what excites you most about the potential of cloud-based intra-oral solutions like Primescan 2 for practitioners and patients?

Cloud-based scanning and solutions within DS Core are truly revolutionary. Having all scans stored securely in one place allows us to compare past and current scans easily, helping patients make informed treatment decisions.



Dr Melonie MacDonald says that digital technology has played a vital role in driving the growth and economic value of her dental practice. (All images: © Melonie MacDonald)

“Cloud storage eliminates the need for expensive hardware (...) reducing costs and increasing flexibility.”

Sharing information with patients is as simple as sending an e-mail, and collaborating with specialists or labs on one platform has never been easier.

Software updates now happen automatically, and there is no need for manual checks. With DS Core’s infrastructure, new features roll out even faster. Cloud storage eliminates the need for expensive hardware, allowing us to run operatories on tablets, reducing costs and increasing flexibility.

The rapid development of artificial intelligence (AI) is incredibly exciting. AI will help us make more accurate diagnoses and enhance patient education, enabling informed decisions. I’ve witnessed amazing advancements over my 30 years in dentistry, including digital radiographs and CAD/CAM technology. Dental MRI and ex-

panded AI capabilities are on the horizon, and I believe we’re entering the most exciting era yet.

How has adopting Primescan 2 contributed to the growth of Citadel Dental in terms of patient satisfaction and return on investment?

Digital technology has been crucial to the growth and economic value of Citadel Dental. My investments in cutting-edge tech not only benefit us now, but will also increase the value of my practice when I retire. Patients appreciate seeing their full-mouth scans, and new patients often choose us because they know that we employ the latest dental technology. Our lab costs are down by 95%, and production has increased dramatically. Patients are happier, our team is more engaged, and recruiting new staff has been effortless—everyone wants to work in a state-of-the-art facility.

Immediate implant placement in the aesthetic zone: Two-year follow-up

Dr Alejandro Lanis, Chile



Introduction

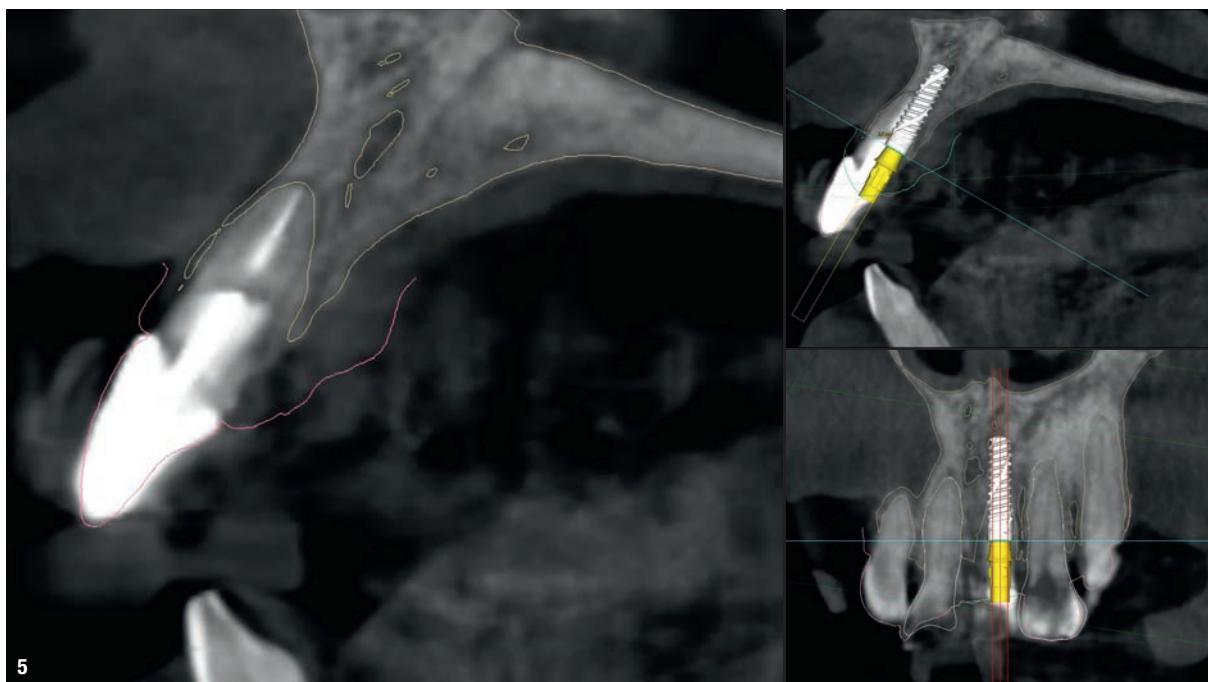
Immediate implant placement and loading have become increasingly prevalent in modern dentistry, especially in the aesthetic zone, where patients typically desire both functional and aesthetic outcomes. This approach involves the insertion of an implant immediately after tooth extraction, followed by the placement of a provisional or definitive restoration when indicated. The predictability of such procedures depends on meticulous diagnosis and selection of appropriate surgical and restorative protocols as well as materials, all of which are critical to ensuring both immediate success and long-term stability.

A significant advancement in this area is the development of implant systems specifically designed to meet the demands of immediacy. The BLX implant

(Straumann), created for challenging clinical scenarios where immediate insertion and loading are indicated, is a prime example. Fabricated from Roxolid (Straumann), an alloy combining titanium and zirconia, the BLX implant provides enhanced strength, allowing for smaller diameters without compromising stability. This characteristic is particularly beneficial for preserving hard and soft tissue, which are crucial for achieving optimal aesthetic outcomes in anterior restorations.

Additionally, the TorcFit connection further augments the implant's versatility, offering a secure and flexible interface between the implant and the abutment. This is essential for attaining optimal results in immediate restoration cases. One notable advantage of the TorcFit connection is that the abutment's transmucosal design is the same from the healing abutment to the definitive abutment. This unique feature prevents

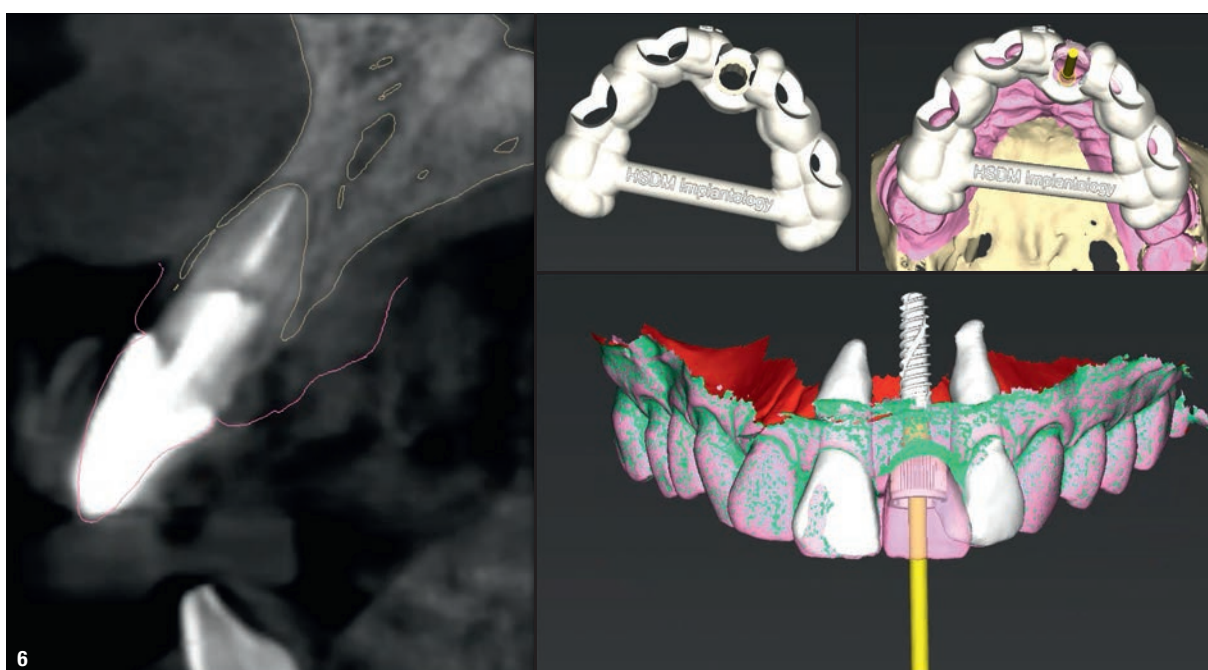


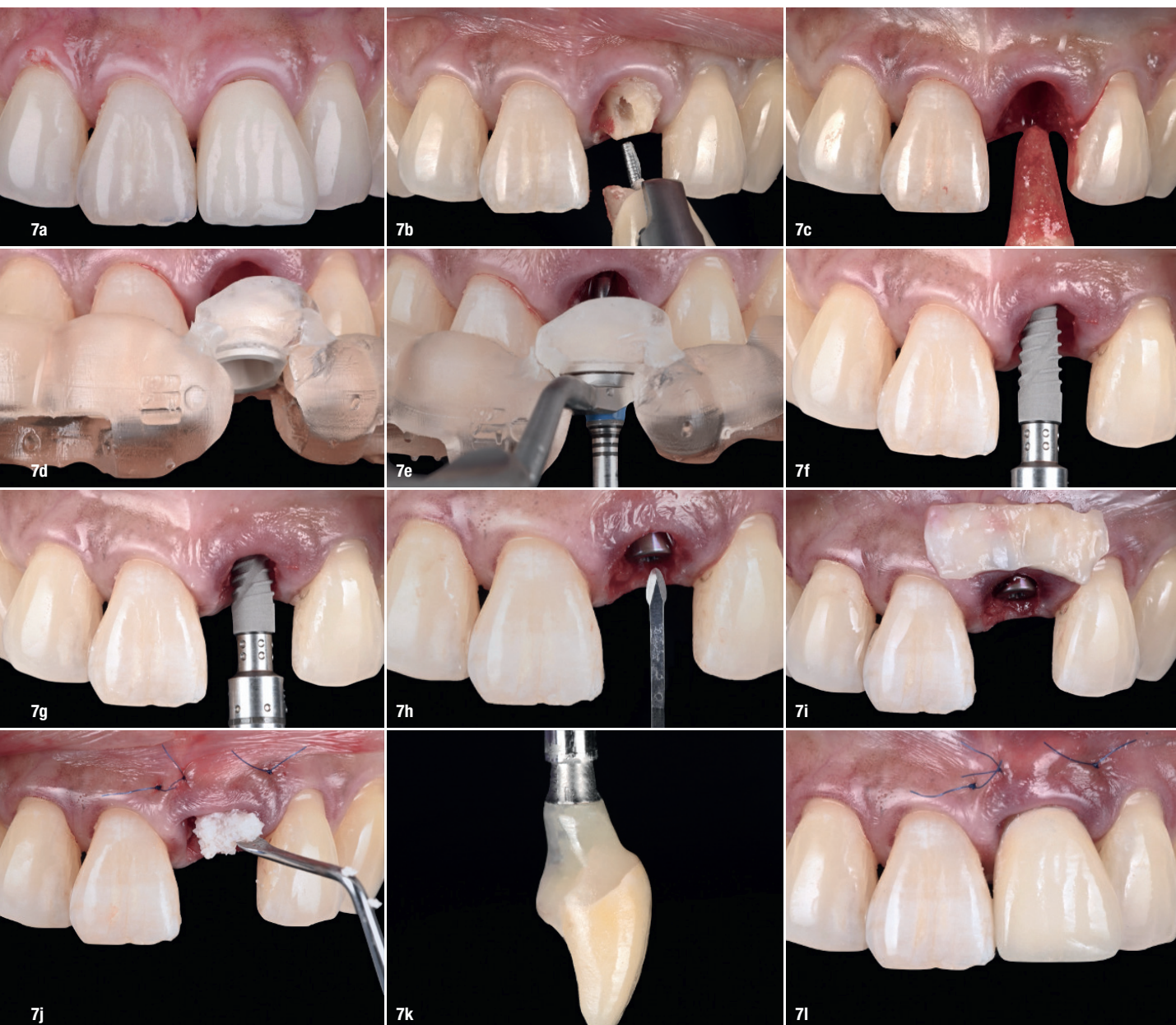


bone remodelling due to the connection and disconnection of restorative components during the restorative phase.

This case report presents the successful treatment of a hopeless anterior tooth using the BLX implant. The patient underwent immediate implant insertion and loading and was followed up over a period of two years after the delivery of the definitive restoration. The outcome demonstrated not only the functional stability of the implant–prosthesis complex but also

“The CBCT analysis demonstrated a favourable anatomical situation for extraction, immediate implant placement and immediate loading.”





the high level of aesthetics that was maintained over time, highlighting the efficacy of the BLX implant system in achieving reliable and lasting results in the aesthetic zone.

Initial situation

A 62-year-old healthy female patient (ASA Class I), a non-smoker with no history of medication use or allergies, presented to our clinic with complaints of pain and crown mobility at tooth #21. The patient expressed a desire to restore function while preserving aesthetics and a natural appearance.

During the intra-oral examination, it was observed that the patient had multiple dental restorations and a crown

on tooth #21 (Fig. 1). Probing revealed depths of less than 3 mm around all sides of the crown on tooth #21, and there was no bleeding or suppuration noted upon probing (Fig. 2). The patient's plaque index was 8%, and there were no signs of inflammation. She mentioned that she had undergone a periodontal cleaning prior to the consultation. However, the crown was mobile, and a horizontal fracture was observed clinically (Figs. 3 & 4).

The CBCT scan confirmed a horizontal fracture of tooth #21, which had previously undergone root canal treatment and been restored with a post and a crown. The CBCT analysis demonstrated a favourable anatomical situation for extraction, immediate implant placement and immediate loading (Fig. 5). The treat-



ment was classified as complex according to the International Team for Implantology's SAC classification.

Treatment planning

Based on the tomographic results, the suggested treatment plan for the patient involved the following steps:

1. digital planning and design of a surgical guide with coDiagnostiX (Dental Wings) for static computer-aided implant surgery to enhance the 3D position of the implant based on a prosthetically driven approach (Fig. 6);
2. extraction of the hopeless tooth #21 due to the horizontal fracture;
3. immediate implant placement;
4. filling of the space with cerabone (botiss biomaterials) and use of a connective tissue graft in the buccal zone;
5. immediate loading using a preselected Variobase (Straumann) and the patient's same crown;
6. definitive restoration with a screw-retained monolithic zirconia CAD/CAM crown.

This treatment protocol was selected based on the favourable anatomical conditions observed during the clinical examination and CBCT analysis, which included a preserved buccal bone wall, intact interproximal bone peaks, and adequate bone density and volume to engage the implant in a favourable

“Appropriate contour management of provisional restorations directly influences the shaping of the emergence profile.”

prosthetically driven position. The aim was to provide the patient with both function and aesthetics soon after the procedure and to maintain the emergence profile during the healing phase.

Surgical procedure

The patient was premedicated with 2 g of amoxicillin, administered 1 hour prior to the surgical procedure. Local anaesthesia was administered using 2% lidocaine with 1:100,000 adrenaline. The atraumatic extraction of tooth #21 was performed using a flapless approach to reduce the risk of a buccal bone wall fracture and avoid soft-tissue damage. After the extraction, the site was thoroughly debrided, the surgical guide was placed and the drilling protocol was performed according to the manufacturer's instructions. A BLX implant (3.5 × 14 mm, regular base, SLA surface) was then placed in the extraction socket with the aid of the handpiece at a speed of 15 rpm, achieving a 55 Ncm insertion torque. The space was filled with cerabone, and a connective tissue graft





was harvested from the palate and placed with a tunnel technique in the extraction site. Implant stability was assessed according to the implant stability quotient, achieving a score of 77, which allowed for immediate loading. A regular base/wide base Variobase abutment (gingival height: 3.5 mm) made of TAN, a titanium alloy, was utilised. The extracted crown was used to pick up the abutment with resin, and the provisional restoration was polished to prevent irritation and accumulation of biofilm. It was adjusted to ensure no occlusal contact with the opposing arch during both centric and eccentric movements. The provisional restoration was screwed in, hand tightened and sealed with PTFE and composite resin (Fig. 7).

Healing had been uneventful by the time of the suture removal appointment ten days later. The patient was scheduled for periodic follow-up appointments.

Appropriate contour management of provisional restorations directly influences the shaping of the emergence profile. Key factors include making necessary adjustments, regularly reshaping, timing modifications appropriately and respecting biological principles. The results observed at four and six months demonstrate how these practices contribute to achieving the desired aesthetic and functional outcomes for the definitive restoration (Figs. 8–10).

Definitive prosthetic procedure

After six months, there being adequate tissue healing and a properly created emergence profile, the final impression was taken using an intra-oral scanner. A monotype scan body was screwed into the implant (Figs. 11 & 12), and scans were performed of both the upper and lower jaws. The bite registration was digitally transferred for precise alignment.

Based on the STL file generated from the scans, a full-contoured screw-retained monolithic zirconia crown was designed and enhanced with a labial layer of porcelain material. This crown was bonded to a regular base/wide base Variobase abutment (Fig. 13).

In the mouth, the restoration's interproximal fit and marginal integrity were evaluated. The occlusion was checked in centric and eccentric positions, and the aesthetic aspects were verified. The crown was then secured to a torque of 35 Ncm and sealed with PTFE and composite (Figs. 14 & 15). Comprehensive oral hygiene instructions were given.

The patient underwent follow-up evaluations to assess the function and longevity of the prosthetic components and overall clinical outcomes. At the one-year follow-up, the restoration showed excellent clinical and radiographic outcomes and good tissue health, and there were no signs of complications (Figs. 16 & 17). By the two-year follow-up, the restoration was continuing to perform well, and there were no issues concerning the implant or abutment. The soft tissue remained healthy, and the occlusion was well aligned (Figs. 18 & 19).



“The restoration maintained excellent function and aesthetics, having stable prosthetic components and healthy surrounding tissues.”

Treatment outcomes

The patient's treatment outcomes were highly successful, the restoration performing well at both the one-year and two-year follow-ups. The restoration maintained excellent function and aesthetics, having stable prosthetic components and healthy surrounding tissues. Overall, the patient expressed great satisfaction with both the functional and the aesthetic results, demonstrating the long-term success and stability of the treatment.

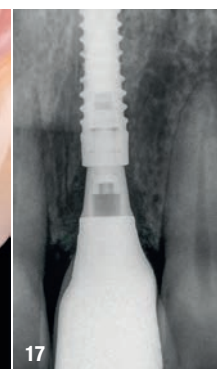
The patient stated: “I was very concerned about my situation, since I'm a very social person and my front tooth was moving. I was also feeling pain. After my evaluation and treatment plan presentation, I was confident in taking the decision to proceed with an implant after the extraction of the fractured tooth. I was impressed by the level of technology that is being used today and how easy it is for patients to get involved with our treatments and decisions. My surgery was performed without any complications and, to be honest, was way less invasive than what I had imagined. The whole treatment was finished in less than eight months, and I'm very happy with the result. It looks very natural, and I returned to my social activities with confidence.”

Author's testimonial

The patient appeared very stressed by her aesthetic concerns regarding the mobile fractured anterior tooth. After the analysis and with the aid of digital planning, I was able to reassure her and present the planned treatment option to her in a transparent and comprehensive manner. After the decision had been taken to proceed with the treatment, all the planning was accurately transferred to her mouth using static computer-aided implant surgery. The selection of the appropriate implant placement protocol, the careful management of hard and soft tissue, and the allowance of sufficient time for healing resulted in a stable and beautiful result.



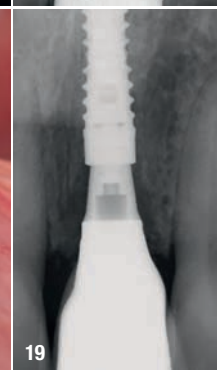
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about



Dr Alejandro Lanis graduated from the University of Valparaíso in Chile in 2008 and completed a three-year residency programme in oral and maxillofacial implantology at the University of Chile in Santiago. Additionally, he holds an advanced diploma in marketing and health administration from the University of

Chile's business school and an advanced certificate in medical education from the Pontifical Catholic University of Chile's School of Medicine in Santiago. In 2013 and 2014, he was an International Team for Implantology scholar at the University of Michigan School of Dentistry in Ann Arbor in the US. During his career, he has been dedicated to the practice of advanced prosthodontics, oral implantology and digital dentistry. From 2022 to 2024, he served as director of the Advanced Graduate Education Program in Implant Dentistry at Harvard School of Dental Medicine in Boston in the US.

Dr Lanis is a recognised international lecturer in digital dentistry, oral implantology, aesthetics and prosthodontics. He is a fellow of the International Team for Implantology, where he serves on the education committee, and an ambassador of the European Association for Osseointegration. He is a member of the International College of Prosthodontics, Academy of Osseointegration and American Academy of Cosmetic Dentistry. He has published several scientific articles in specialist journals and books.

Vertical ridge augmentation using a customised CAD/CAM titanium mesh and computer-guided surgery for implant and prosthetic rehabilitation of a severe bone defect

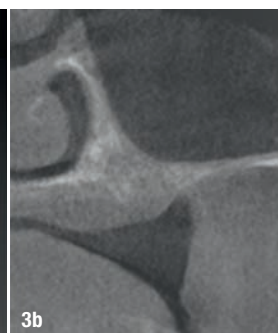
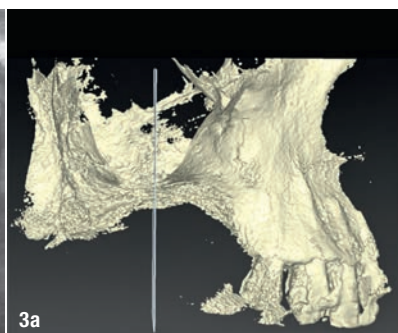
Drs Alessandro Cucchi, Sofia Bettini, Lucia Tedeschi, Serena Sorge & Giulio Bellon, Italy



Introduction

The most important innovation in recent years in the field of guided bone regeneration (GBR) is represented by customised CAD/CAM titanium meshes, which allow for personalisation based on the patient's specific anatomy and are manufactured through laser sintering processes before surgery.¹⁻⁵ These meshes make the treatment of vertical bone defects simpler, faster and safer, making it less operator-dependent and achieving clinical and radio-

graphic results that are comparable or superior to other regenerative techniques.⁶⁻⁹ Recently, semi-occlusive or fully occlusive CAD/CAM titanium meshes have also been introduced, and they have shown similarly favourable results.¹⁰⁻¹² From a histological, histo-morphometric and micro-CT perspective, the bone tissue regenerated using these meshes has shown more than adequate characteristics for achieving osseointegration,¹³⁻¹⁵ especially for the long-term maintenance of implants under functional loading.¹⁶

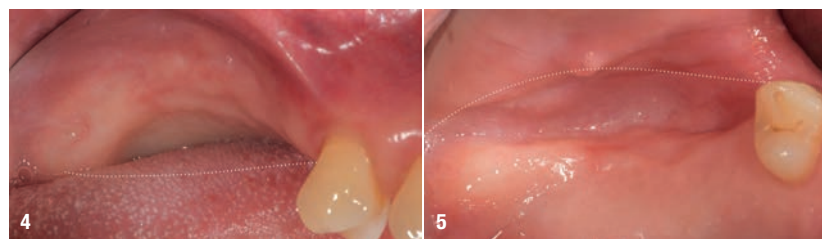


Another important innovation is the double-layer closure technique based on the use of the buccal pad of fat for areas subjected to vertical GBR. This technique has significantly reduced the rate of exposure and infection, consequently increasing the success of GBR.¹⁷

This case report aims to illustrate, step by step, the treatment of a severe bone defect located in the upper jaw using a customised CAD/CAM titanium mesh combined with the buccal pad of fat, and the subsequent implant and prosthetic treatment using computer-guided surgery, in order to show how new technologies and digital workflows can simplify the treatment of complex cases.

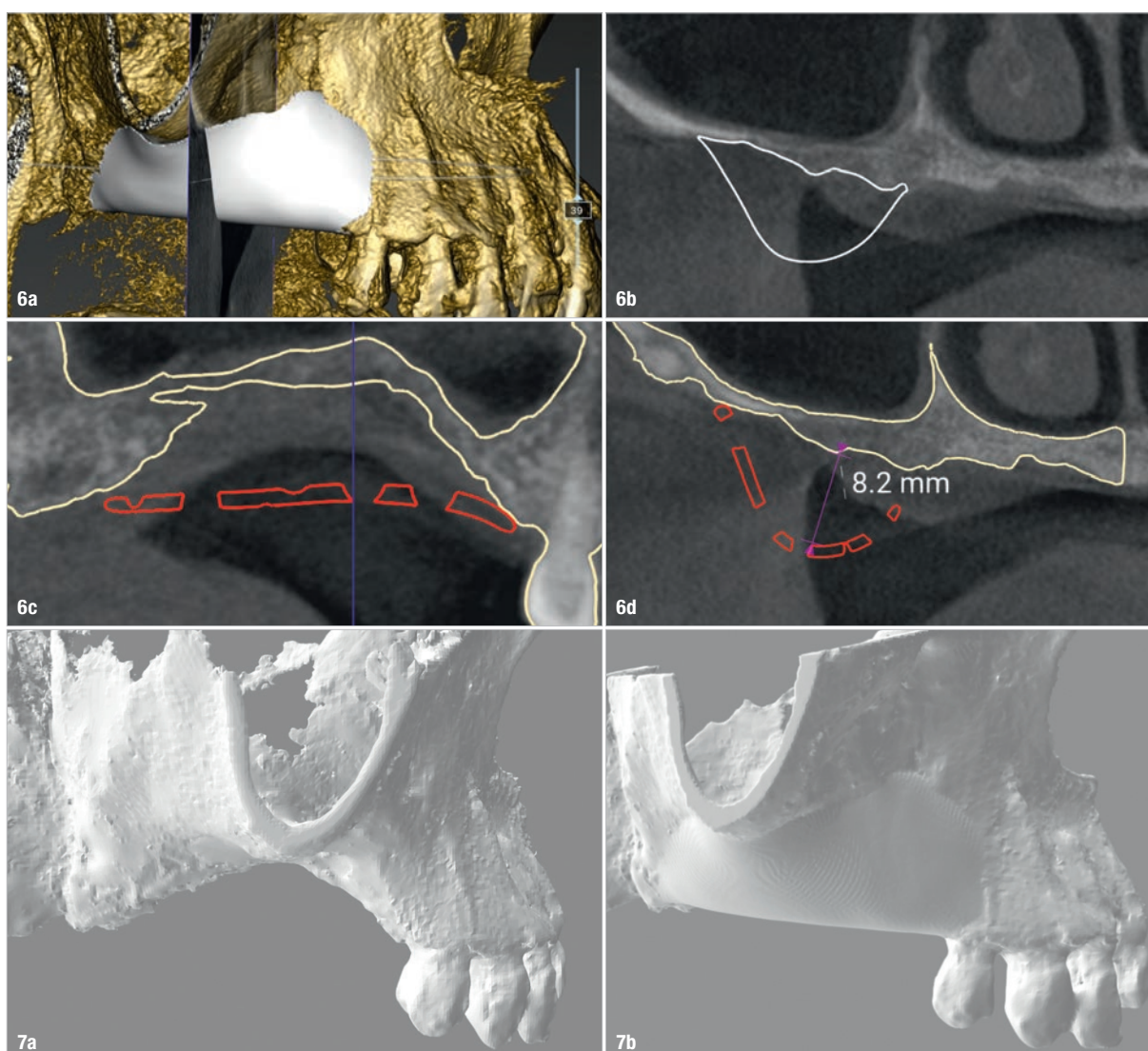
Case report

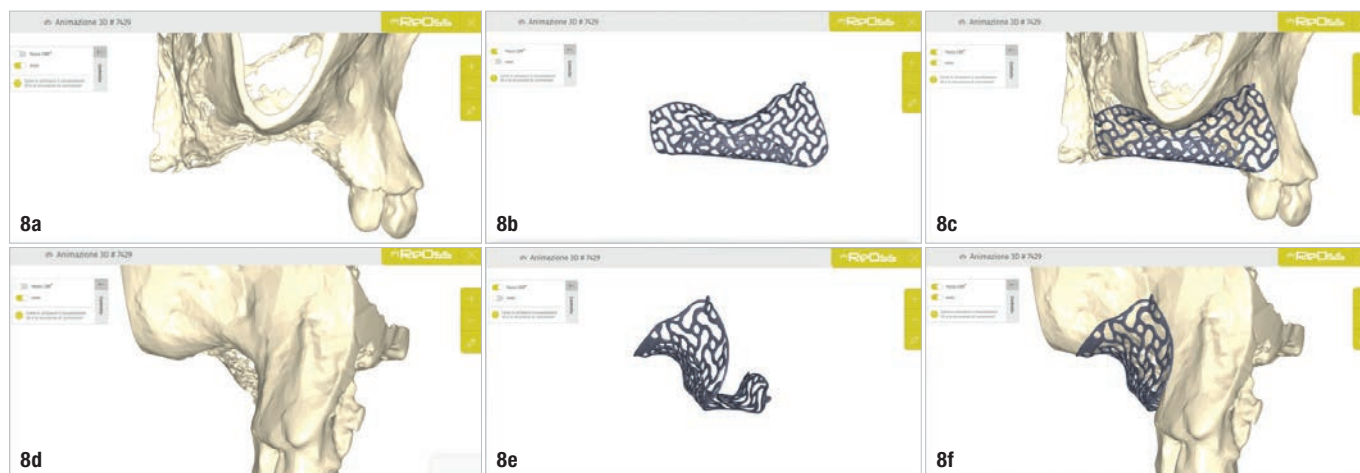
A 62-year-old female patient (ASA Class I), a non-smoker and with normal glucose levels, with previously treated periodontal disease, presented for implant and prosthetic rehabilitation of the upper jaw (Fig. 1). Radio-



graphic analysis, performed through a dental panoramic tomogram and CBCT scan, revealed the presence of a vertical bone defect in the right posterior sextant, due to the complete loss of the alveolar process (Figs. 2, 3a & b). The clinical examination showed the severity of the bone defect, which had resulted in an obvious volume deficiency in both the horizontal and vertical dimensions (Figs. 4 & 5).

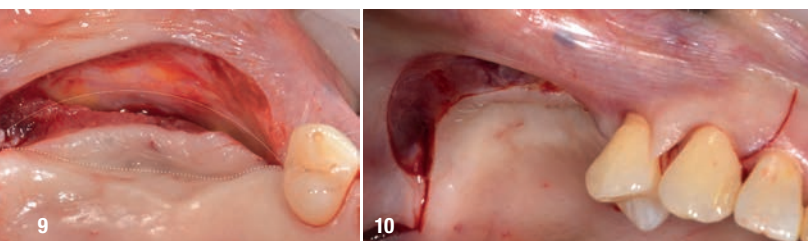
After discussing the treatment options with the patient, the first-choice treatment was accepted. This would





involve the reconstruction of the alveolar process and subsequent rehabilitation with single crowns on implants.

The treatment plan was developed using a fully digital workflow. The DICOM files obtained from the preoperative CBCT scan were used to generate a 3D reconstruction of the maxilla, which allowed for the virtual design of the ideal bone volume for the placement of three implants in sites #15, 16 and 17 (Figs. 6a–d, 7a & b). Subsequently, the customised mesh corresponding to the increased volume in the patient's maxilla was created virtually (Figs. 8a–f).



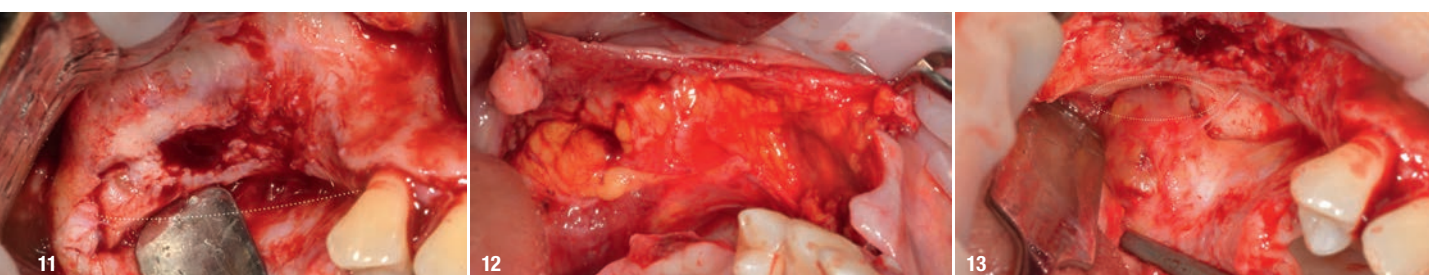
2 ml of diazepam) were performed, along with local anaesthesia using 4% articaine and 1:100,000 adrenaline.¹⁸

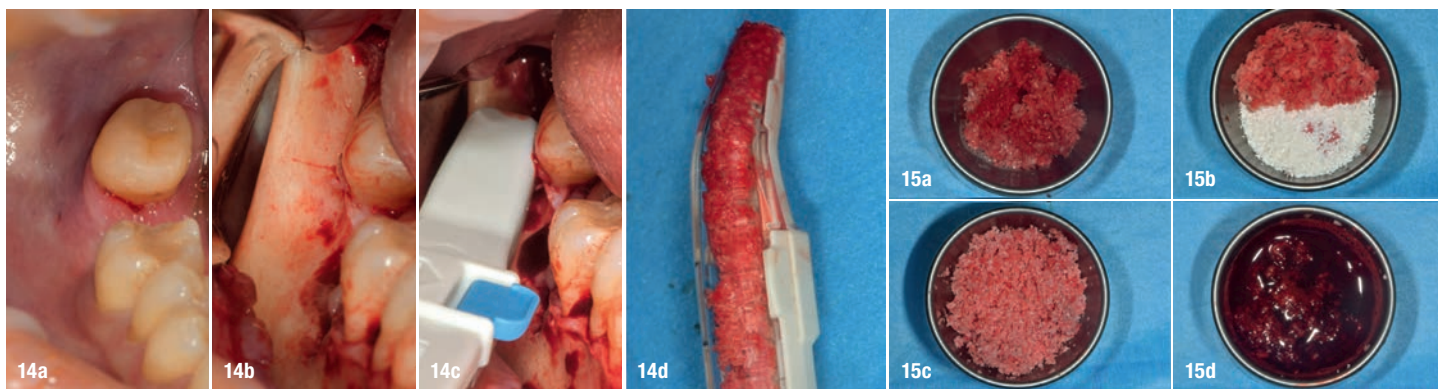
The surgery began with a semilunar incision into the alveolar mucosa on the buccal side of the area to be treated, associated with two vertical vestibular incisions (Figs. 9 & 10).¹⁹ A full-thickness flap was then elevated on the buccal side and subsequently mobilised with a periosteal incision, followed by a superficial dissection to separate the mucosal layer from the underlying muscle (Figs. 11 & 12). A full-thickness flap was also elevated on the palatal side, isolating the greater palatine artery (Fig. 13).

A horizontal incision was made along the mandibular ramus to harvest about 2 cm³ of autologous bone using a bone scraper (SafeScraper TWIST, Meta Technologies; Figs. 14a–d). The grafting material was then prepared by mixing a 50:50 ratio of autologous bone to deproteinised bovine bone matrix (Geistlich Bio-Oss, small granules), to which peripheral venous blood taken from the patient was added to promote coagulation (Figs. 15a–d).

On the day of the reconstructive surgery, antibiotic prophylaxis (2 g of amoxicillin with clavulanic acid and 500 mg of metronidazole), anti-inflammatory prophylaxis (20 mg of piroxicam), oral cavity disinfection (oral rinsing with povidone-iodine for 1 minute, hydrogen peroxide for 2 minutes and a 0.2% chlorhexidine mouthwash for 3 minutes) and conscious sedation (2 ml of delorazepam and

Subsequently, the customised CAD/CAM titanium mesh (Yxoss CBR, ReOss) was taken from the double sterile pouch and filled with the grafting material (Figs. 16a & b). The mesh was then positioned in place and fixed with four osteosynthesis screws (BT screw, BTK) to achieve absolute stability (Figs. 17a & b). It was then covered with a native collagen resorbable membrane (Geistlich Bio-Gide),





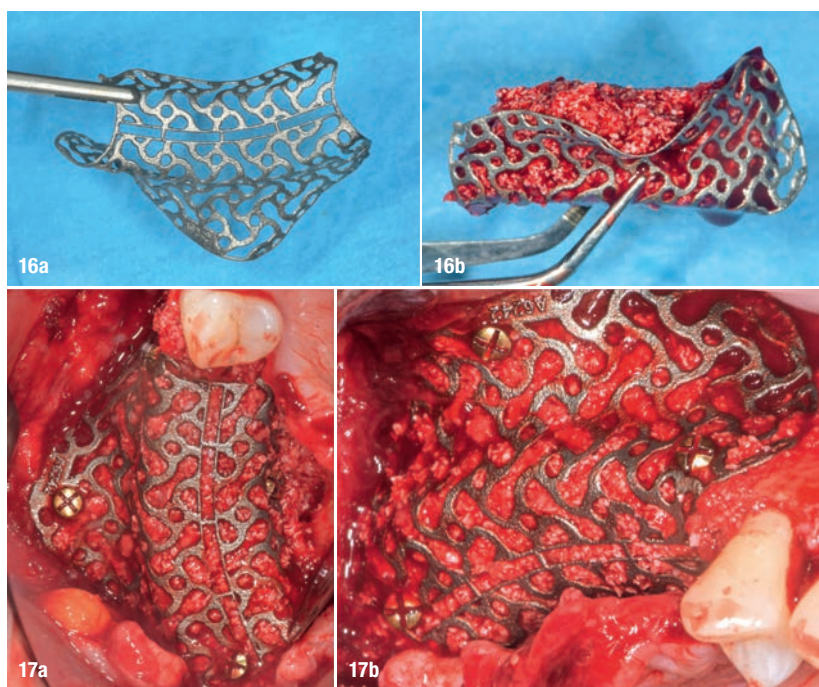
which was stabilised with titanium tacks (MCbio, Geistlich; Fig. 18).

As it is a tissue extremely rich in pluripotent cells, capable of differentiating to promote healing by first intention of the treated area, the buccal pad of fat was isolated and advanced before closing the primary flap to reduce the risk of exposure and infection of the underlying mesh (Fig. 19).¹⁷ Finally, the buccal and palatal surgical flaps were sutured using a double line of sutures, the first consisting of horizontal mattress sutures and the second of single or double interrupted sutures (GLYCOLON, Resorba; Figs. 20a & b, 21a & b).

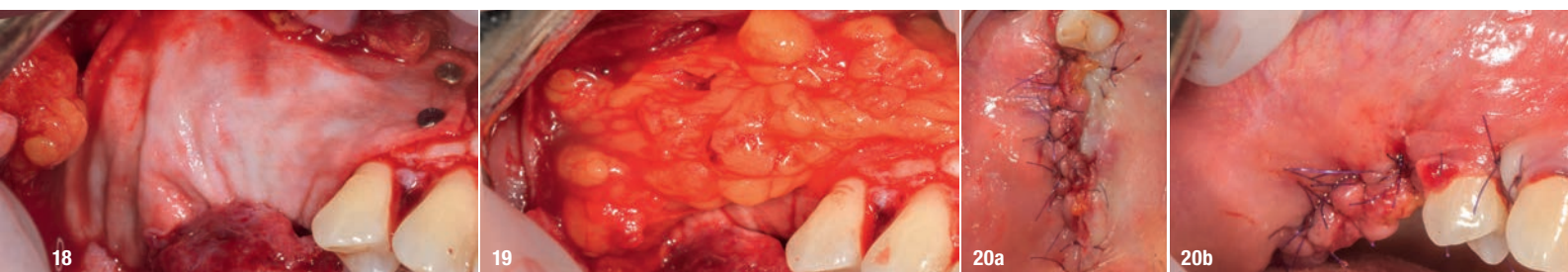
After surgery, the patient followed a postoperative protocol that included antibiotic therapy (1 g of amoxicillin with clavulanic acid and 250 mg of metronidazole every 8 hours for seven days) and oral cavity disinfection with a 0.2% chlorhexidine mouthwash for 2 minutes, three times a day, for 14 days.

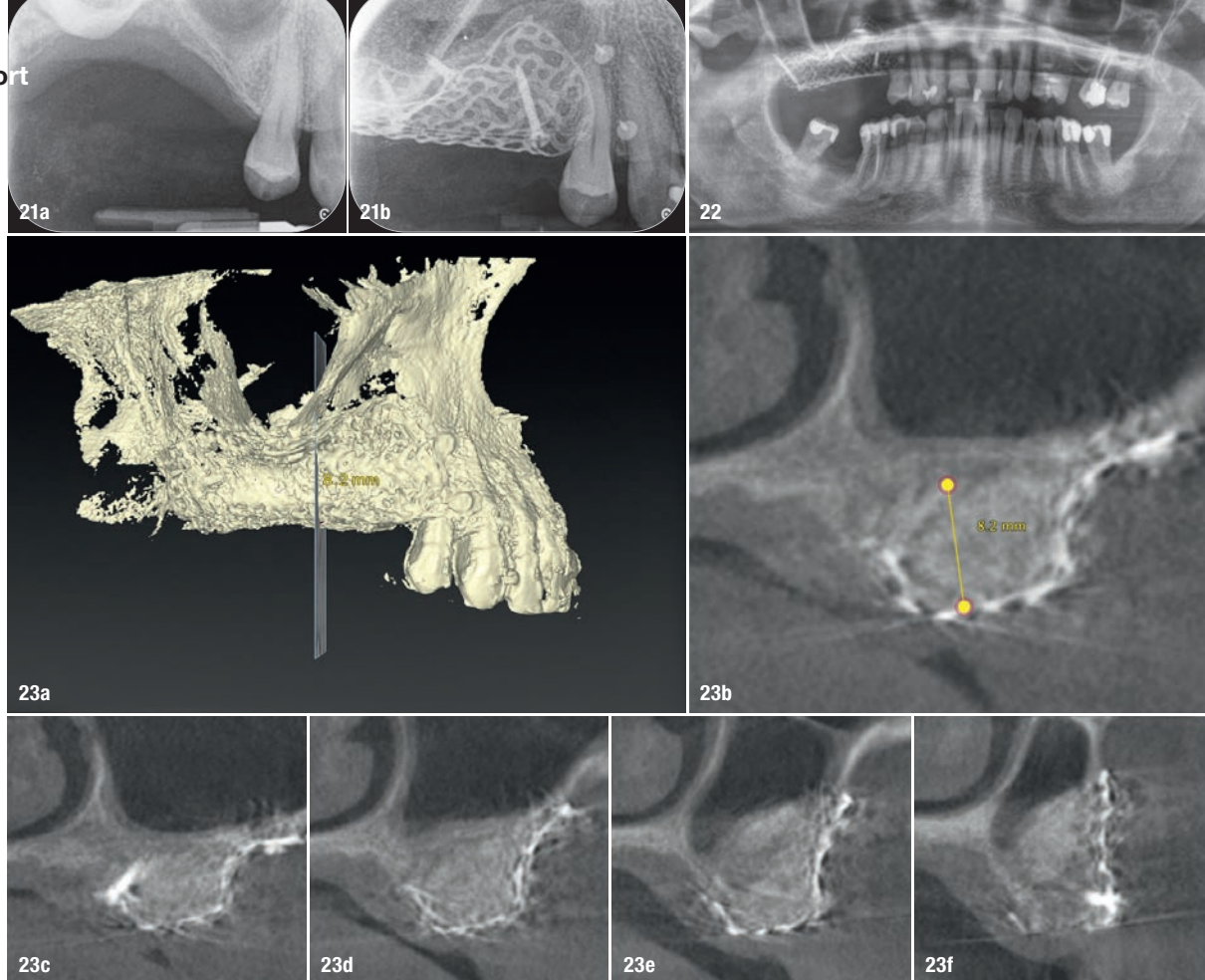
After 14 days, the sutures were removed, postoperative data was collected, dehiscence or exposure of the mesh was excluded, and a dental panoramic tomogram was taken (Fig. 22). The patient reported a low level of pain, rated at 0 on a visual analogue scale of 0 to 10, and an average intake of 1.6 tablets of a non-steroidal anti-inflammatory drug per day during the first two weeks. The patient also reported significant swelling, a small external bruise on the face and difficulty opening her mouth. According to the postoperative symptom severity questionnaire, a score of 32 was recorded, indicative of moderate postoperative discomfort.

After nine months, a second CBCT scan was performed to assess the regenerated bone volume and plan the computer-guided surgery (Figs. 23a-f). The STL files



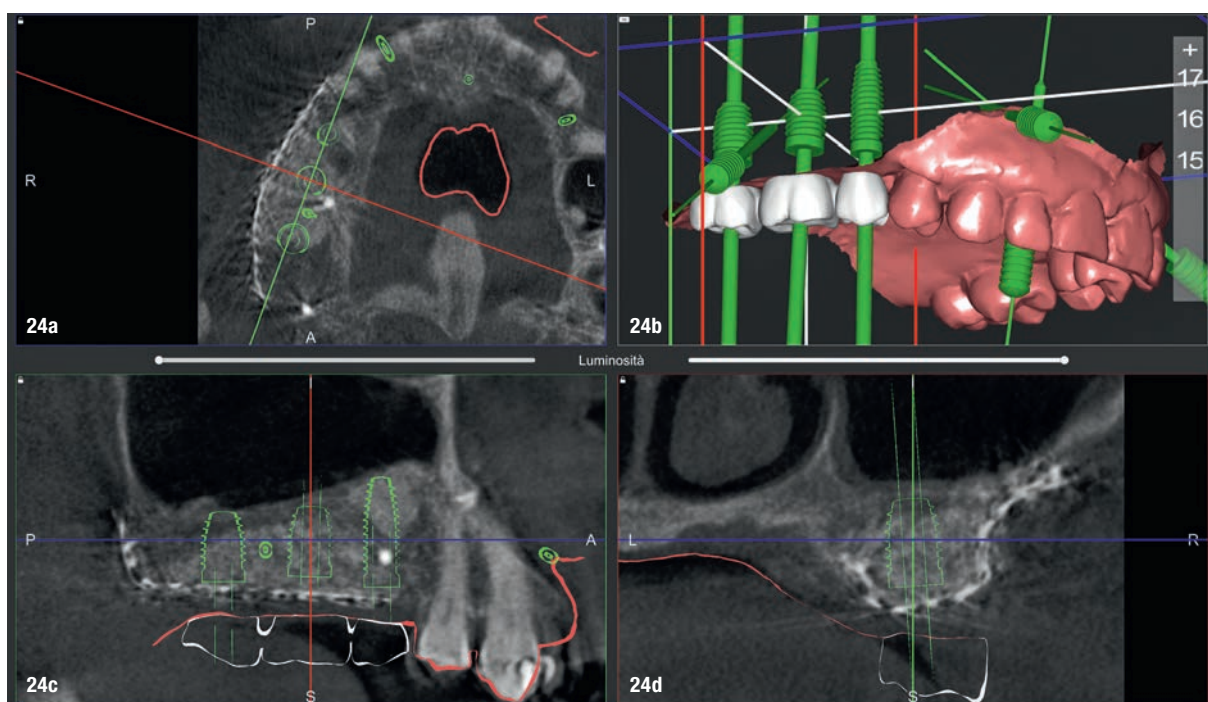
obtained from the intra-oral scan, and the DICOM files from the CBCT scan were used to plan implant placement through computer-guided surgery (naviMAX, Biomax; Figs. 24a-d).

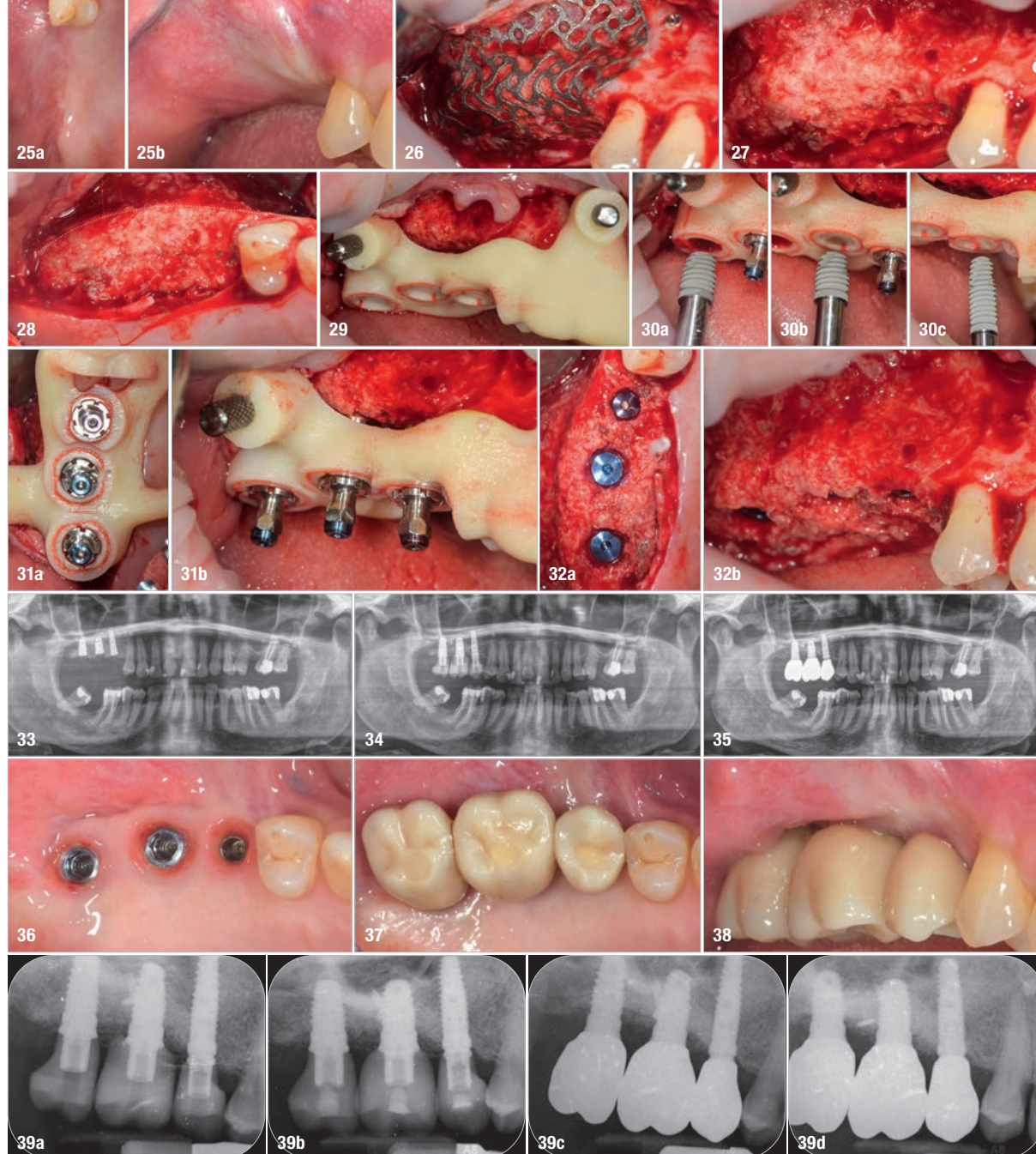




On the day of implant surgery, a para-crestal horizontal incision was made to expose the mesh and remove it, after the removal of the titanium screws and the new bone that had formed over the mesh (Figs. 25a & b, 26). Clinical examination showed complete regeneration of the vertical defect and the absence of pseudo-periosteum or thin pseudo-periosteum (< 1 mm), corresponding to the

pseudo-periosteum Type 1 according to the Cucchi classification (Figs. 27 & 28).²⁰ Subsequently, the surgical guide was placed and fixed in the planned position, the implant sites were prepared with progressive dedicated drills and three conical implants (T3, ZimVie) were placed in sites #15, 16 and 17 according to the prosthetically guided plan obtained from the guided surgery software





(Figs. 29, 30a–c, 31a & b). The implants were covered to allow for proper osseointegration, and first intention closure was performed (Figs. 32a & b). After implant placement, a dental panoramic tomogram was taken (Fig. 33).

After three months, the implants were exposed through an apically positioned flap to increase the amount of keratinised tissue on the vestibular side of the implants and to realign the mucogingival junction, previously shifted towards the palate. Flared healing screws were placed to promote proper transmucosal healing. After one month, single ceramic crowns were placed for the first functional loading and temporary restoration while waiting for complete bone maturation (Fig. 34). After six months, the crowns were replaced with zirconia crowns for the final functional loading and the definitive restoration (Figs. 35–38). Clinical and radiographic follow-ups at the first functional loading, at six months, 12 months and 24 months showed the health of the peri-implant tissue and the maintenance of peri-implant bone levels (Figs. 39a–d).

Acknowledgements

We would like to extend our deepest gratitude to all the team members involved in the successful completion of this case.

Special thanks goes to Cracco Mariano, who meticulously crafted the ceramic crowns used in this case.



Editorial note: Please scan the QR code for the list of references.

about

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Intra-oral photogrammetry: The next step in full-arch implant precision

Redefining digital accuracy in implant dentistry

Drs Isaac D. Tawil & Scott D. Ganz, US, Dr Alessandro Pozzi, Italy



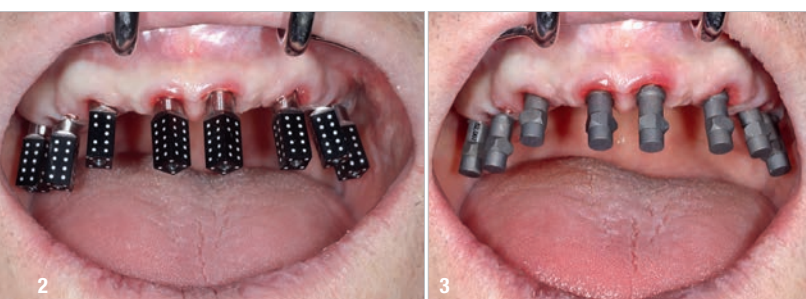
The dental industry is rapidly evolving, driven by technological innovations that are transforming patient care, diagnosis and treatment planning. The shift from film to digital radiographs has greatly enhanced the clinician's ability to interpret caries and pathology while improving patient communication. Over the past 20 years, these 2D images have been augmented with 3D images, made possible with CBCT, and interactive treatment planning software. Physical impressions for crown and bridge dentistry have been modernised with intra-oral scanning, creating the first digital workflows when combined with milling machines in the dental laboratory and then in the dental office. Dental implants can now be restored with information gained from specific scanning abutments

designed to capture the intra-oral position of the implant and surrounding tissue with an intra-oral scanner and software that seamlessly transfers this data to the dental laboratory and clinician.

While intra-oral scanning has been widely adopted for single-tooth restorations, its application in capturing multiple implants—particularly in full-arch cases—presents unique challenges. Therefore, one area undergoing significant transformation is the accurate capture of multiple implants, especially full-arch implants, which is typically a complex process that demands a high level of precision. As intra-oral scanning falls short in accuracy, photogrammetry was developed to provide the exactness necessary to allow the dental laboratory technician to design superstructures that will fit passively on multiple implants without the need for a physical verification index. Innovative technology has been effective as a solution to intra-oral scanning to achieve this level of precision, yet a soft-tissue scan is still required to capture the soft tissue. Additionally, despite the positive aspects of photogrammetry, it is an expensive addition for a clinician because both devices are needed to capture all of the intra-oral data that is needed for the restorative process. This is where intra-oral photogrammetry (IPG), an emerging technology, comes into play, redefining accuracy and efficiency in full-arch implant procedures.

The digital transformation in dentistry

For decades, clinicians relied on physical impression techniques to create models of the oral cavity. These conventional methods involve using physical materials to capture the shapes and contours of teeth, soft tissue, tooth preparations and more recently implant positions. Physical impressions also often require retakes, leading to patient discomfort, contamination with blood and saliva, increased chair time and additional associated costs. Although these analogue materials can be effective, they are prone to deformation, patient movement and inaccuracies, making it difficult to achieve the precision required

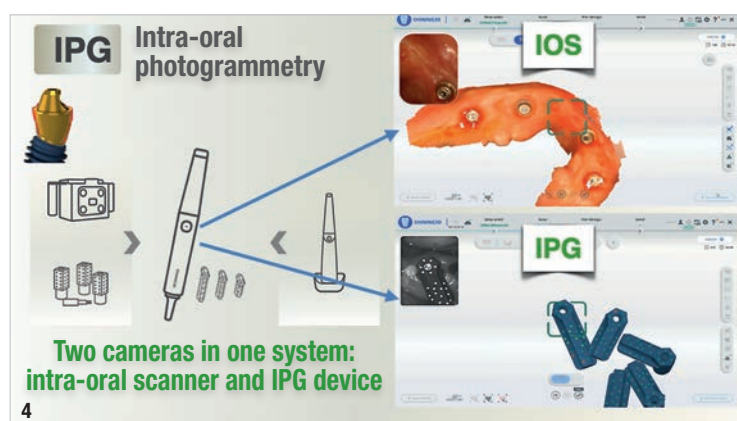


for complex implant cases. To overcome the issues of analogue impression materials and related laboratory protocols, intra-oral scanning was introduced, offering clinicians a digital solution that simplifies the impression process. Using a handheld device, clinicians and dental assistants can quickly capture a 3D digital image of the patient's oral cavity, and this image can then be used to create virtual models and prostheses designed with advanced CAD/CAM software.

However, intra-oral scanning has its own set of challenges for natural tooth preparations, and single and multiple implants, particularly the capture of full-arch implants. When scanning large areas, such as a full arch with multiple implants, errors can accumulate owing to the limitations related to the native topography of the oral cavity, the curve of the arch, necessary software stitching algorithms, image overlap and inherent distortions. The goal of implant and prosthetic treatment is to provide an aesthetic and functional treatment outcome that is dependent on a passive fit of the prosthesis to the implants. The limitations of intra-oral scanning can significantly affect the predictability of prostheses because even minor discrepancies can lead to major alignment errors and fitting problems, which if left undetected can lead to complications and implant failure. Therefore, despite their usefulness in allowing for digital workflows for many procedures, conventional intra-oral scanners often fall short in full-arch implant cases, making their treatment especially complex and prone to inaccuracies.

Understanding the limitations of intra-oral scanning for full-arch cases

Intra-oral scanners capture a series of images in rapid succession, and through the magic of software algorithms, these are then stitched together to form a virtual 3D model. While this technique is effective for single-tooth restorations, it is prone to errors when larger areas are scanned, especially when multiple implants are involved such as for full-arch reconstruction. The main issue arises from the need to align each captured image (scanning abutment) correctly with the next. When the scanner moves from one segment of the arch to another, even small alignment errors can lead to a loss of accuracy, creating cumulative errors that affect the passivity and final fit of the prosthesis, which may not seat correctly, resulting in poor fit and function. Moreover, intra-oral scanners often are unable to maintain a consistent line of sight over the entire arch, especially in areas where there are obstructions, such as the cheeks, the tongue or pre-existing restorations. This can lead to incomplete data capture, further compounding the problem. Another issue with conventional intra-oral scanning in full-arch cases is related to soft-tissue capture. Full-arch implant restorations often involve complex soft-tissue structures that need to be accurately represented in the digital model.

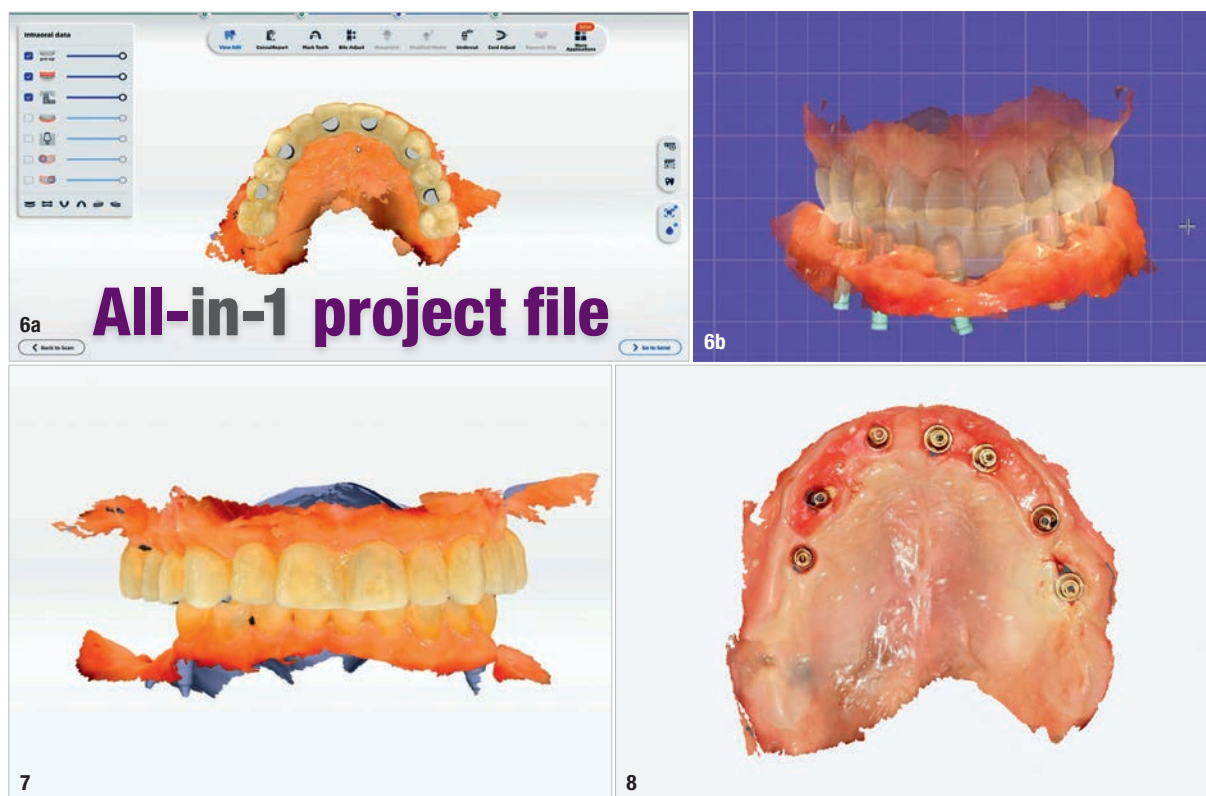


Conventional intra-oral scanners can have difficulty capturing the subtle details of this soft tissue, leading to inaccuracies in the intaglio surface of the final prosthetic design. These limitations make it difficult to achieve a precise and predictable fit, particularly when implants are placed at different angles or depths.

The rise of photogrammetry in dental implantology

To address these drawbacks, the dental community turned to photogrammetry, a technique that uses multiple photographic images taken from different angles to calculate the precise 3D coordinates of fixed points. Photogrammetry has been widely used in industries such as metrology, engineering and aerospace for its high precision, and it has recently made its way into dentistry. In dental applications, photogrammetry involves using specialised scan markers attached to implants to serve





as reference points for the photogrammetric device. The device then calculates the exact positions of these markers, allowing for the precise capture of implant positions.

Extra-oral photogrammetry (EPG) devices, which are handheld and positioned outside the patient's mouth, capture multiple images of the markers from various angles (Fig. 1). The images are then processed and merged into a single 3D model using specialised software. EPG has been shown to achieve micrometre-level accuracy in capturing implant positions, making it a valuable tool for complex full-arch cases.

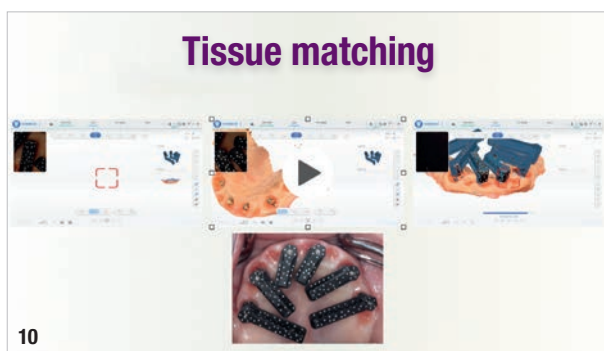
EPG systems do however have certain limitations. The extra-oral nature of the system requires a stable platform

and consistent lighting conditions, making it less adaptable for intra-oral use. Additionally, EPG systems typically require separate scans for the implants (Fig. 2) and the surrounding soft tissue (Fig. 3). These separate data files are then exported and sent via the Internet or cloud to the dental laboratory technician, who will manually merge the files utilising dental CAD software. This process is time-consuming and requires a high level of technical expertise, thus limiting its practicality for everyday clinical use. Additionally, there are only a handful of manufacturers of EPG devices, resulting in high purchase costs. Therefore, owing to its complexity and cost and the need for a separate intra-oral scanning device to capture the soft tissue, EPG is not widely used outside of specialised centres and advanced prosthodontics practices. These restrictive issues led to the development of a more streamlined approach: IPG.

Introducing intra-oral photogrammetry

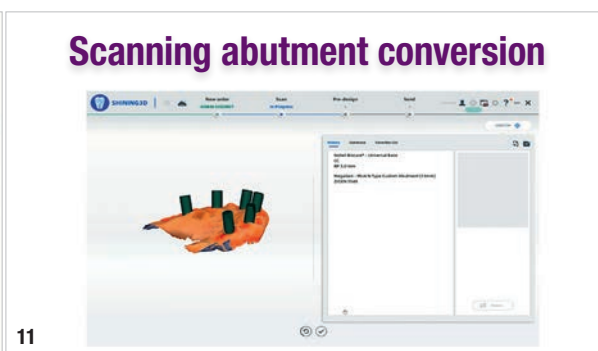
IPG is a breakthrough technology that combines the precision of photogrammetry with the convenience of intra-oral scanning. Unlike EPG systems, IPG allows clinicians to capture both implant positions and the surrounding tissue in a single scan, without the need for separate images from two different capturing devices and thus the need for manual data merging. The IPG system uses a handheld intra-oral device equipped with two cameras, one for intra-oral scanning and one for IPG (Fig. 4). The system utilises specific





high-accuracy coded intra-oral markers to accurately capture the spatial relationships between implants (Fig. 5).

The utilisation of IPG for full-arch implant reconstruction begins once the implant surgery has been completed and multi-unit abutments have been secured to each implant. A conventional intra-oral scan of the tissue at the multi-unit level is acquired, followed by placement of the specially coded horizontal scan markers on to the multi-unit abutments connected to the implants. The markers, which are of three different lengths, are designed to be easily distinguishable by the scanner, ensuring that each one is captured accurately. The scanner's software identifies and tracks these markers in real time, allowing it to precisely measure their positions relative to each other. This real-time capture eliminates potential errors caused by patient movement or changes in lighting conditions, which are common pitfalls in conventional intra-oral scanning. Once the implant positions have been captured, the scanner defaults to its intra-oral scanning camera and moves on to capture the surrounding soft tissue, jaw relationships and adjacent teeth. This integration of both hard and soft tissue into a single digital model streamlines the workflow, reducing the time and effort required to create a comprehensive digital representation of the patient's oral anatomy (Figs. 6a & b). The resulting model can be directly transferred to CAD/CAM software (Fig. 7) for immediate use in the design of the restorations.

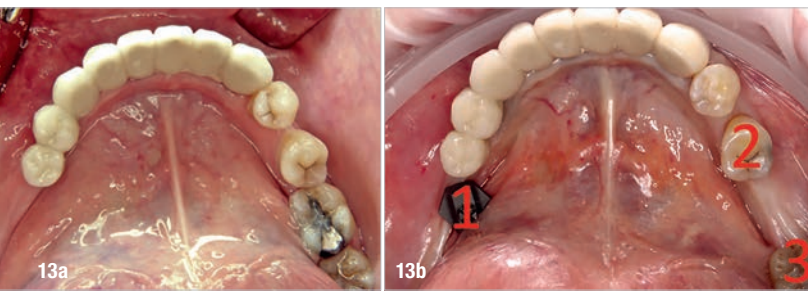


Case demonstration: Dentate arches

For healed ridges after implant placement, a simplified workflow is employed by leveraging both intra-oral scanning and IPG technologies. If a provisional prosthesis is present, an initial intra-oral scan of the prosthesis, opposing arch and occlusion is conducted. Once this has been captured, the provisional prosthesis is removed, and a subsequent intra-oral scan is performed to document the position of the multi-unit abutments in relation to the soft tissue (Fig. 8). After this, the horizontal scan markers are placed on to the abutments (Fig. 9), and the IPG camera is then utilised for a quick photogrammetric capture of these markers, ensuring that the acquisition overlaps the scan markers relative to one another for enhanced precision. Increasing the number of overlapping images obtained allows for faster and more accurate registration of each scan marker within the software.

Next, the workflow transitions back to the intra-oral scanning camera, which is used for scan matching (Fig. 10). To optimise the results, capturing at least two sides of the arch is recommended. The scan marker data and soft-tissue data will automatically merge, providing a comprehensive virtual digital model. At this stage, the scan markers can be digitally converted (Fig. 11) into the preferred scanning abutment type (by manufacturer), as the software supports an extensive library of options. Once complete, the final file is exported or transmitted via the cloud to the laboratory of the clinician's choice for further processing and prosthetic fabrication.





The most intriguing application of the combined intra-oral scanning and IPG device is in the realm of surgical interventions. A major challenge when using photogrammetry in surgical cases has been the maintenance or adjustment of the vertical dimension of occlusion (VDO). Conventionally, EPG systems have relied on fiducial markers, which can be effective but present difficulties in accurate matching in third-party software after surgery. This can often necessitate the use of pre- and post-surgical CBCT scans with radiopaque markers to determine VDO and bone reduction. However, this method introduces additional radiation exposure and presents challenges in acquiring clean images, particularly after prolonged surgical procedures.

The scan matching capabilities of IPG have proved to be highly beneficial in overcoming these challenges. For dentate surgical cases, preserving a few strategic teeth before extractions (Fig. 12) can greatly simplify the matching process for the scan markers. Initial scans are taken with the remaining teeth, capturing the opposing arch and occlusion. After non-essential teeth have been extracted, bone reduction can be performed if necessary, implants are placed and multi-unit abutments are connected. Once the multi-unit abutments are in place, scan markers are inserted and captured using the IPG camera. The intra-oral scanning system then matches these to the remaining teeth, ensuring seamless alignment. After this step, the remaining teeth can be extracted, grafting can be performed as needed and a final tissue scan can be captured, providing data for the emergence profile and

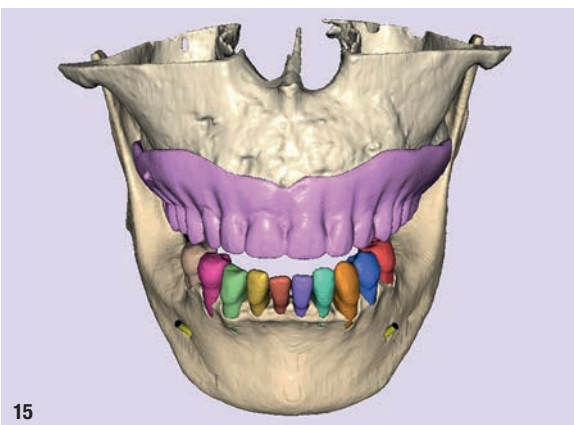
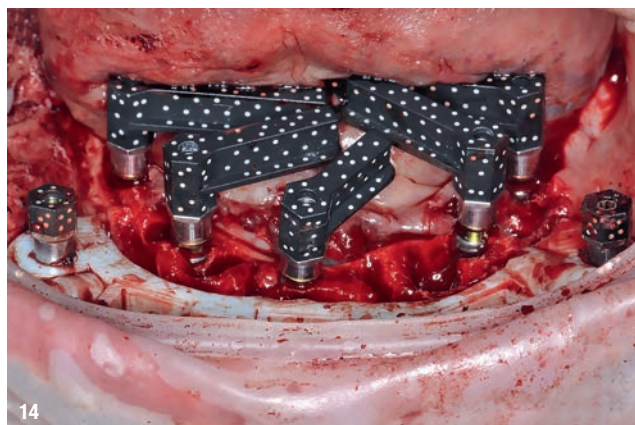
pontic site design. An all-in-one project file can then be utilised for prosthetic design.

If the preserved teeth are not ideally positioned or interfere with the surgical procedure, alternative fiducial markers can be used to facilitate scan matching (Figs. 13a & b). Bone screws, surgical bars or other stable reference points can be employed, as the software is capable of recognising any device that remains consistently present from the initial scan for the duration of the surgery (Fig. 14). These markers or remaining natural teeth help maintain the VDO throughout the entire surgical and design process, ensuring accuracy and predictability for the final restorative outcome.

Case demonstration: Edentulous arches

For patients with edentulous arches, utilising a well-fitting denture can greatly enhance the efficiency and accuracy of data acquisition (Fig. 15). One conventional method involves taking a denture wash impression to capture the healing caps, providing a stable reference for matching to the IPG scans (Figs. 16a–e). This technique is similar to EPG, for which a 360° scan of the denture wash impression is performed to capture comprehensive data. Alternatively, small openings can be created within the denture to accommodate fiducial markers, establishing reliable reference points relative to the removable prosthesis. These markers enable precise alignment of the IPG scan data with the intra-oral scan data, ensuring that the VDO remains consistent throughout the procedure. Once this alignment has been verified, a detailed soft-tissue scan is performed to capture essential data for pontic site design, which can then be integrated into an all-in-one project file for streamlined prosthetic planning and fabrication.

These advanced techniques highlight the versatility and precision of the integrated intra-oral scanning and IPG workflow, which offers a robust solution for both routine and complex implant cases. By leveraging the strengths of photogrammetry and intra-oral scanning,





clinicians can achieve higher levels of accuracy, minimise chair time and deliver highly precise provisional prostheses faster without the need for a conversion prosthesis. This increases clinicians' confidence in providing provisional screw-retained prostheses or definitive monolithic full-arch prostheses, ultimately improving patient outcomes. This integration sets a new standard for digital workflows in implant dentistry, paving the way for more predictable and efficient management of complex restorative procedures.

Discussion: The benefits of IPG

IPG technology presents numerous benefits that make it an appealing option for clinicians working on complex implant cases. The system offers enhanced accuracy compared with conventional intra-oral scanners, which are often unable to maintain precision over larger areas, leading to distortions and poorly fitting restorations. IPG overcomes these challenges by utilising coded markers that establish a stable reference throughout the scanning process, ensuring high precision, even in full-arch cases. Recent trials have indicated that IPG can achieve positional accuracy of less than 20 μm in multi-implant scenarios, making it one of the most precise digital methods available today. One of the key advantages of IPG technology is its streamlined workflow, which simplifies the digital process by capturing all the necessary data in a single scan and efficiently converting the files. This eliminates the need for multiple scans or manual alignment of data points, enabling clinicians to transition seamlessly from scanning to designing and fabricating the restoration. The integration of fiducial markers within the workflow further ensures precision by maintaining consistent alignment throughout the entire surgical procedure. In complex cases where preserving some natural teeth is

necessary, utilising fiducial markers up until scans are completed allows for continuous and accurate software alignment without interruptions.

In addition to improved accuracy and workflow efficiency, the simplified, all-in-one-device configuration of IPG has demonstrated the potential to considerably reduce chair time compared with conventional impression techniques, offering a substantial time-saving advantage for both clinicians and patients. By capturing both implant position and surrounding soft tissue in a single pass, the overall time required for impression taking is substantially minimised. This leads to shorter patient appointments, fewer retakes and an overall enhancement of the clinical workflow. The minimisation of errors is another critical benefit of IPG technology. The implementation of coded markers ensures precise recording of all implant positions, significantly lowering the risk of alignment discrepancies, which are often observed with conventional intra-oral scanning methods. This heightened accuracy results in a more predictable outcome and a superior fit of the definitive prosthesis, thereby decreasing the likelihood of adjustments or costly remakes. Additionally, these markers can be converted into scanning abutments, allowing them to be exported as unified project files, which helps mitigate technical errors during subsequent CAD software processing.

IPG allows for comprehensive data capture. The ability to capture both hard and soft tissue in a single scan results in a digital model that is a more complete and accurate representation of the patient's oral anatomy. This comprehensive capture leads to better-fitting prostheses, fewer adjustments during the restorative phase and an overall more efficient treatment process. With all these advantages, IPG is setting new standards for accuracy,

Table 1: Extra-oral photogrammetry vs. intra-oral photogrammetry

Two devices, an intra-oral scanner and an EPG device	One device, combining an intra-oral scanner and an IPG device
Additional software for matching the scan marker/scanning abutment to tissue	Simplified matching of the scan marker/scanning abutment to tissue
Increased time for conversion of the scan marker/scanning abutment position to the implant position	Efficient conversion of the scan marker/scanning abutment position to the implant position
Separate files require manual matching in CAD software, e.g. exocad, 3Shape, Dental Wings	All-in-one CAD file population
Expensive scan marker/scanning abutment	Affordable scan marker/scanning abutment

workflow efficiency and patient satisfaction in complex implant dentistry (Table 1).

The future and benefits of IPG technology

As with any emerging technology, the true potential of IPG is still being explored. Future advancements include the integration of software that employs artificial intelligence (AI) to further enhance accuracy by automatically detecting and correcting minor errors during the scanning process. AI has the potential to refine the scanning process by identifying and addressing inconsistencies in real time, providing immediate feedback to clinicians and reducing the risk of inaccuracies.

Another area of potential growth is the development of multi-modal imaging systems that combine IPG with other imaging technologies, such as CBCT and facial scanning. This integration enables clinicians to create a comprehensive digital model or dental avatar that includes both intra-oral and extra-oral structures, providing a more holistic view of the patient’s anatomy. Multimodal systems can help clinicians better understand the relationship between implants and facial structure and contours, improving treatment planning and outcomes.

The integration of these technologies not only provides a more detailed digital representation of the patient’s anatomy but also allows for better communication and collaboration among dental professionals. For example, orthodontists, oral surgeons and prosthodontists could work together using a single unified digital model to plan and execute complex treatments more effectively. This collaborative approach leads to more predictable results and a higher standard of care for patients.

The adoption of IPG technology in full-arch implant procedures has the potential to significantly affect clinical outcomes and patient satisfaction. One of the most important benefits of IPG is its ability to provide a more accurate digital model without the need for a verification index or physical model. This approach is faster and less invasive for the patient and provides better-fitting restorations. A well-fitting prosthesis not only enhances the

patient’s comfort and function but also reduces the risk of complications such as peri-implantitis, bone loss, and prosthesis or even implant failure. Additionally, IPG technology allows for the expedited creation of digital mock-ups and simulations that can be used to educate patients about their treatment options. By visualising the potential final outcome before the procedure is completed, patients can have a clearer understanding of the treatment process and what to expect. This transparency can help build trust and improve patient compliance, as they feel more involved in the decision-making process. Moreover, IPG enables a more streamlined workflow, reducing the time required for impression taking and prosthetic fabrication, using only *one* device instead of two. This efficiency translates into shorter treatment times, fewer appointments and less time spent in the dental chair for patients. For individuals undergoing complex full-arch restorations, this reduction in treatment time can significantly improve their overall experience and satisfaction. In suitable cases when timing is essential and with a fully equipped dental office, it is possible to surgically place implants, scan the patient with IPG technology, send off the files to the laboratory technician for immediate design of a full-arch screw-retained prosthesis, receive the STL file back from the laboratory technician, 3D-print, stain and glaze the prosthesis in the office and deliver it to the patient on the same day.

The path forward:
Integrating IPG into routine practice

The journey to integrating IPG into routine practice begins with understanding its role in enhancing the accuracy and predictability of full-arch implant procedures. Successful integration requires not only investing in technology but also investing in training and support. Dental professionals must be adequately trained to handle the nuances of photogrammetry, from fiducial marker placement to data interpretation, in order to leverage the full potential of IPG systems.

Implementing IPG also requires a shift in mindset, from a conventional intra-oral scanning or impression-taking approach to a more sophisticated, data-driven process.

Practices must consider how IPG fits into their current workflows and be willing to adjust as needed to accommodate the new technology. This may involve upgrading existing equipment, revising digital workflows and adopting new protocols for capturing and analysing implant positions. Collaboration with technology providers and ongoing professional education will be key to making this transition successful.

As digital technologies continue to evolve and become more accessible, the boundaries of what is possible in dental implantology will continue to expand. IPG is just one example of how innovation is reshaping the field, offering clinicians new tools to enhance precision, streamline workflows and improve patient outcomes. By embracing these advancements, dental professionals can stay at the forefront of their field and continue to provide the highest standard of care.

Conclusion

IPG represents a new standard in digital dentistry for full-arch implant capture. By combining the precision of photo-

grammetry with the convenience of intra-oral scanning, IPG offers a streamlined, accurate and patient-friendly solution that addresses many of the challenges associated with full-arch restorations. As technology continues to evolve with new devices and supporting software, its adoption is likely to grow, paving the way for even more sophisticated and efficient digital workflows in implant dentistry. For clinicians and patients alike, IPG offers a glimpse into the future of digital dentistry, one where precision, efficiency and patient comfort are no longer mutually exclusive.

In conclusion, IPG is more than just a new technology; it represents a paradigm shift in how full-arch implant cases are approached and executed. As it becomes more widely adopted, its impact on the field of digital dentistry will only grow, setting the stage for a future where digital workflows are not just an option but the standard of care for complex restorative and implant procedures. For both clinicians and patients, this evolution promises a future of precise, faster and more predictable treatment outcomes.

about



Dr Isaac D. Tawil received his DDS from the New York University College of Dentistry and has a master's degree in biology from Long Island University, both in the US. He is a fellow of the International Congress of Oral Implantologists and the Advanced Dental Implant Academy, a diplomate of the International Academy of Dental Implantology and a co-director of Advanced Implant Education. He has received recognition for outstanding achievement in dental implant treatment from the Advanced Dental Implant Academy, as well as the President's Volunteer Service Award for his volunteer work in places such as Honduras, Mexico, the Dominican Republic, China and Peru.

Dr Tawil lectures internationally on advanced dental implant procedures using the latest technology and teaches live surgery seminars in his office and abroad, as well as hands-on courses globally. He maintains a general private practice in New York, where he focuses on implant therapy. He can be reached at tawildental@gmail.com.



Dr Scott D. Ganz received his specialty certificate in maxillofacial prosthodontics from the University of Texas MD Anderson Cancer Center in Houston in the US, and this led to his focus on the surgical and restorative phases of implant dentistry and his subsequent contribution to 15 implant-related textbooks. He is a fellow of the Academy of Osseointegration, a diplomate of the International Congress of Oral Implantologists, US ambassador of the Digital Dentistry Society, president of the US branch of the Digital Dentistry Society and a co-director of Advanced Implant Education. Dr Ganz teaches at the Rutgers School of Dental Medicine in Newark in New Jersey in the US and maintains a private practice in Fort Lee in New Jersey.

He can be reached at drganz@drganz.com.



Dr Alessandro Pozzi is considered a global expert in implant dentistry and advanced technologies such as computer-guided surgery and prosthetics, dynamic navigation surgery and robotics. He received his dental degree *summa cum laude* in 1997 and has run his own private practice in Rome in Italy since then. He graduated *cum laude* in orthodontics, gnathology and temporomandibular joint dysfunction and is formally trained in the interrelated areas of oral surgery and prosthodontics. He is an adjunct associate professor at the Ronald Goldstein Center for Esthetic and Implant Dentistry of Augusta University in Georgia in the US. He is widely published and conducts clinical research on cutting-edges technologies to integrate into the digital workflow in clinical practice. He won the 2013 Judson C. Hickey Scientific Writing Award in the clinical report category and is a fellow of the Academy of Osseointegration. He is co-author of Volume 2 of the textbook

Fundamentals of Implant Dentistry (Quintessence Publishing, 2017), adopted by several universities worldwide to train their students in implant dentistry. He has lectured at the most prestigious congresses and academies since 2010 and gives international training courses on digital implant dentistry and aesthetics at his practice. He is an active member of the Italian Academy of Esthetic Dentistry and serves on the editorial boards of *Clinical Implant Dentistry and Related Research* and the *International Journal of Oral Implantology*.



Demonstration of X-Guide with FastMap navigated photogrammetry at Nobel Biocare's booth at the European Association for Osseointegration congress in Milan in Italy. (Image: © Nobel Biocare)

Nobel Biocare presents dentistry's **first navigated photogrammetry** with FastMap

Nobel Biocare

Navigated photogrammetry opens the door to a new dimension of prosthetic design for full-arch implant-borne restorations. Nobel Biocare recently launched the new FastMap navigated photogrammetry system, which offers enhanced capabilities in precise measurement and maintenance of implant positions for full-arch restorations.

Employing dedicated software and scan bodies, FastMap allows dental professionals to measure and maintain the true position of implants and abutments relative to the preoperative prosthetic plan and the patient's anatomy. This relationship is preserved during navigated procedures through the use of a patient tracker, which is registered preoperatively to ensure alignment throughout the procedure. In contrast to this capability, basic photogrammetry and physical conversions create a continuity gap, disrupting this crucial relationship.

FastMap enables the tracking of scan body locations while capturing platform-to-platform positions. It allows for the creation of a conversion-free, passive-fit CAD/CAM-produced provisional restoration that can be placed directly on to abutments. The scan bodies are interchangeable at any implant or abutment location with the same connection interface, and there is no need to correlate a scan body identifier to a specific implant or abutment location within the software. FastMap works with all Nobel Biocare multi-unit abutments as well as a

variety of abutments from other manufacturers, including Astra Tech MultiBase EV abutments, Neodent GM Mini abutments, BioHorizons multi-unit abutments and BIOMET 3i Low Profile abutments.

The system works with three or more scan bodies per jaw, providing flexibility for various clinical scenarios. If one of the scan bodies is damaged, FastMap allows dental professionals to easily replace it with a single new scan body without affecting other scan bodies.

With X-Guide dynamic navigation, a single device is used for both implant placement and photogrammetry, and no additional scanner hardware is required for surgery. The scanning device is conveniently suspended above the patient, eliminating the need for a handheld device during data capture.

FastMap integrates with established workflows of major CAD/CAM software solutions, allowing dental professionals to work with a variety of service providers and laboratories. It has an open workflow and is compatible with various 3D printers and milling devices, offering export options in STL and PLY format, which can be used with the most common prosthetic design software, including exocad.

To discover the benefits of X-Guide dynamic navigation with FastMap, visit www.nobelbiocare.com/en-int/fastmap.

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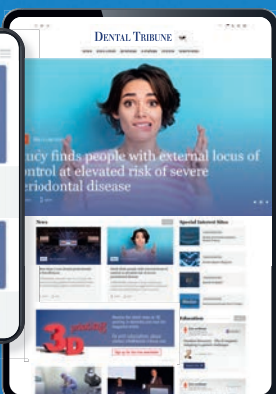
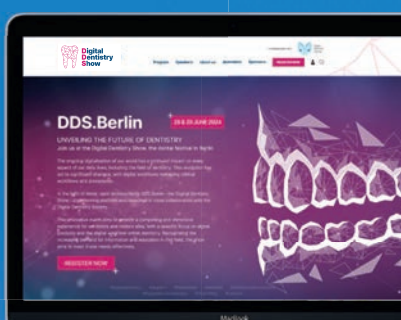




Fig. 1: MIS Implants Technologies holds its global conference every two years. The event gathers international opinion leaders and experts from across the globe.

MIS Global Conference 2024

showcases cutting-edge scientific programme

MIS Implants Technologies

This year's MIS Global Conference, held in September at the Palma Convention Centre in Palma de Mallorca, attracted over 1,500 dental professionals from around the world. Known for its comprehensive scientific programme, the biennial event has become a key meeting in the field of implant dentistry.

The fifth conference was organised in collaboration with a distinguished scientific committee consisting of Profs Lior Shapira, Mariano Sanz Alonso and Nitzan Bichacho. Attendees gathered to explore the latest trends, witness a live surgical demonstration and engage in exclusive networking opportunities. Participants also had the opportunity to attend several pre-conference hands-on workshops, including one delivered by Drs Tali Chackartchi and Ignacio Sanz Sánchez on guided surgery for advanced users.

On the first day of the conference, the programme featured three sessions focused on addressing key challenges and emerging trends in implant dentistry. These sessions covered a range of topics, including aesthetic complexities in the smile zone, strategies for preventing and managing biological complications, and advancements in areas such as bone regeneration, tissue engineering and cell therapy. Each session also included moderated discussions, allowing participants to engage with experts and deepen their understanding of these critical issues.

Fig. 2: Participants had the opportunity to try out MIS Implants Technologies products in several hands-on workshops.





Fig. 3: Tony Susino, group vice president of global implant and prosthetic solutions at Dentsply Sirona, spoke about the latest innovations. **Fig. 4:** An implant surgery was livestreamed from Athens in Greece.

A highlight of the conference was the livestreaming on the second day of the guided placement of six implants as part of full-arch rehabilitation, performed by Dr Stavros Pelekanos. This live surgery offered attendees a unique opportunity to observe state-of-the-art techniques in action. Complementary sessions focused on enhancing tissue stability and integrating digital workflows into daily practice, reinforcing the conference's commitment to advancing clinical excellence.

Commitment to innovation, clinical excellence and affordability

"MIS's long-standing reputation for delivering high-quality implant solutions was on display during the conference," said Tony Susino, group vice president of global implant and prosthetic solutions at Dentsply Sirona. "MIS has been part of the Dentsply Sirona family since 2016 and remains a strategically important part of our implant portfolio. This year's global conference showcased our commitment to science and innovation and reaffirmed our dedication to providing world-class peer-to-peer clinical education for the implant community. MIS delivers quality products at an affordable price, enabling dental professionals to provide excellent care with confidence," Susino added.

Clinical case competition

Another highlight of the conference was the clinical case competition, a long-standing tradition at the MIS Implants Technologies event. In the spirit of discovery, scientific research and innovation, participants submitted clinical cases in the lead-up to the global conference. These were evaluated by a special scientific committee, who selected 23 cases to be displayed at the conference, and four winners were awarded prizes.

"Participants in this year's MIS Global Conference left with practical, evidence-based knowledge in implant dentistry to bring back to their practices," said Dr Bichacho, professor of prosthodontics at the Hebrew University–Hadassah

Fig. 5: Dr Erick Ruben Mota Gonzalez (right) from the Dominican Republic was this year's first prize winner of the clinical case competition. The two second prize recipients were Dr Gerardo José Chacón Ramírez from Venezuela and Dr Oded Kantzucker from Israel. The third prize was awarded to Dr Bruno Kraft from Brazil. (All images: © MIS Implants Technologies)

"This year's global conference showcased our commitment to science and innovation and reaffirmed our dedication to providing world-class peer-to-peer clinical education for the implant community."
—Tony Susino, Dentsply Sirona

School of Dental Medicine in Israel. "I am proud of this year's programme, not only for its educational value but also for the opportunities to strengthen professional relationships. Those discussions, both formal and informal, are crucial for sharing experiences and advancing implant dentistry in service of providing patients with the best possible care," Prof. Bichacho concluded.

The next MIS Global Conference will be held in 2026. More information can be found at mis-implants.com.





Given the company's reputation for innovation and quality, the 2025 Nobel Biocare Global Symposium is an essential event for dental professionals committed to excellence in implantology.

Nobel Biocare Global Symposium to elevate dental workflows and enhance patient care

Dental Tribune International

The Nobel Biocare Global Symposium is returning and set to take place from 30 May to 1 June 2025 at the Bellagio Hotel and Convention Center in Las Vegas. Expected to attract some 1,500 attendees, the symposium will provide a platform for visitors to explore cutting-edge advancements in implantology, refine workflows and connect with leading industry minds from across the globe. The event programme will be revealed in January 2025

and will feature over 60 sessions, including 30 hands-on workshops and live surgical demonstrations.

Transforming treatment workflows with digital tools

Digital innovation is reshaping dental implantology. The symposium will address seamless digital workflows and provide



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attendees with practical training in the use of tools designed to enhance both accuracy and patient satisfaction. Attendees can look forward to a track dedicated to full-arch digital workflows, and hands-on sessions and masterclasses focusing on innovations such as iCam photogrammetry, dynamic navigated surgery, 3D printing, DTX Studio software, intra-oral scanning and guided surgery protocols. By trying out the latest digital solutions in implant dentistry, practitioners will be able to see first-hand how the tools simplify procedures and enable smoother treatment journeys.

Mastering complex cases and managing complications

For practitioners seeking to elevate their surgical skills, a dedicated track for full-arch surgery will address a range of topics, including initial considerations for the All-on-4 treatment concept and hands-on surgical skills for the most advanced quad zygomatic technique.

Participants attending the soft- and hard-tissue management track can expect to increase their confidence

and competency in managing complications and exploring strategies and techniques for successful long-term outcomes. This track will also include expert hands-on guidance in horizontal and vertical ridge augmentation and soft-tissue management around teeth and implants.

Enhancing practice success through marketing and development

To support the growth and sustainability of dental practices, the symposium will feature sessions on practice management, digital marketing and patient communication strategies. Ideal for practitioners aiming to expand their reach and improve operational efficiency, these sessions will provide insights into actionable strategies for building a successful and patient-centred practice.

Driving precision and collaboration for laboratories

Emphasising the critical role of the laboratory in successful implant treatment, the laboratory track will include training in analogue versus digital workflows, immediate provisionalisation, digital workflow integration and practice collaboration. These sessions are aimed at equipping dental laboratory professionals with the necessary skills to enhance their precision and efficiency and create strong partnerships with clinicians.

Live surgical demonstrations and interactive case discussions

A highlight of the symposium will be real-time knowledge gained through live surgical demonstrations. To be presented by leaders in implantology, these sessions will allow participants to observe advanced techniques in action and will enable them to gain practical insights into the management of complex cases.

An essential event for advancing dental excellence

Given the company's reputation for innovation and quality, the 2025 Nobel Biocare Global Symposium is a must-attend event for dental professionals committed to excellence in implantology. In addition to offering expert training, the event will support the building of valuable partnerships within the dental community, all set against the vibrant backdrop of Las Vegas.

Editorial note: The full agenda will be announced online in January 2025. A limited number of special offers are available through Nobel Biocare local sales representatives. For more information and contact details, visit: www.nobelbiocare.com/en-int/global-symposium-2025.

International events



São Paulo International Dental Meeting—CIOSP

22–25 January 2025
São Paulo, Brazil
www.ciosp.com.br



Dental South China 2025

3–6 March 2025
Guangzhou, China
www.dentalsouthchina.com



DS World Dubai 2025

2–3 February 2025
Dubai, UAE
www.dentsplysirona.com



International Dental Show—IDS 2025

25–29 March 2025
Cologne, Germany
www.english.ids-cologne.de



AEEDC 2025

4–6 February 2025
Dubai, UAE
www.aeedc.com



EuroPerio11

14–17 May 2025
Vienna, Austria
www.efp.org/europerio11



160th Chicago Dental Society Midwinter Meeting

20–22 February 2025
Chicago, US
www.cds.org/midwinter-meeting



Nobel Biocare Global Symposium 2025

30 May–1 June 2025
Las Vegas, US
www.nobelbiocare.com/en-int/global-symposium-2025



ICOI Winter Implant Symposium

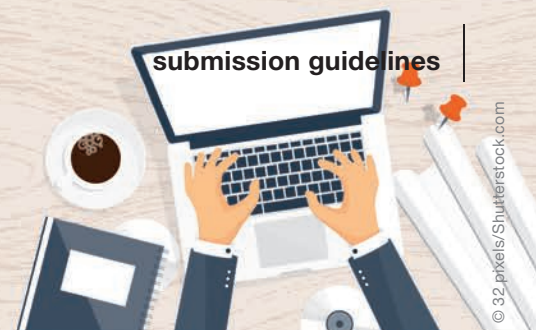
20–22 February 2025
New Orleans, US
www.icoicampus.org



FDI World Dental Congress 2025

9–12 September 2025
Shanghai, China
www.fdiworlddental.org/fdi-world-dental-congress

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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.

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Please use single spacing and make sure that the text is left justified. Please do not centre text on the page. Do not indent paragraphs, rather place a blank line between paragraphs. Please do not add tab stops.

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Any formatting contrary to stated above will require us to remove such formatting before layout, which is very time-consuming. Please consider this when formatting your document.

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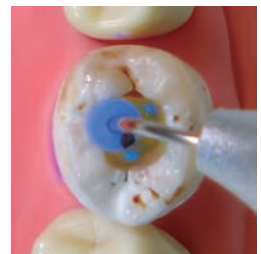
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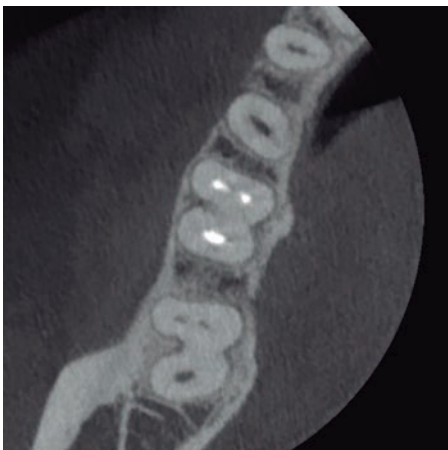
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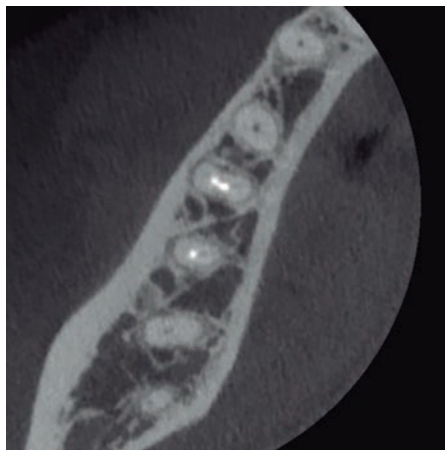
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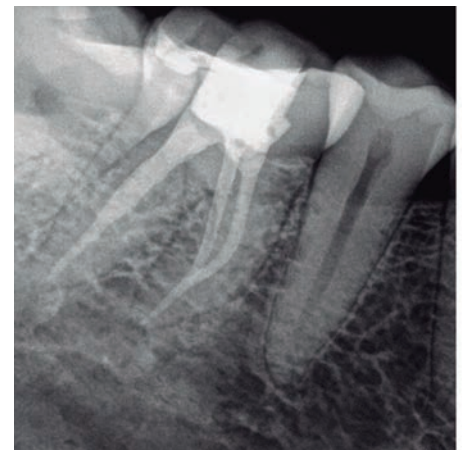
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Post-op 3D x-ray: Oval shaped canal filled with Odne™ Fill.



Post-op 3D x-ray: Fused canals filled with Odne™ Fill.



Post-op x-ray: Root canal filling with Odne™ Fill.

Clinical case, Dr. John Millar,
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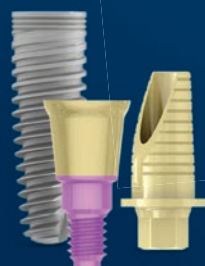
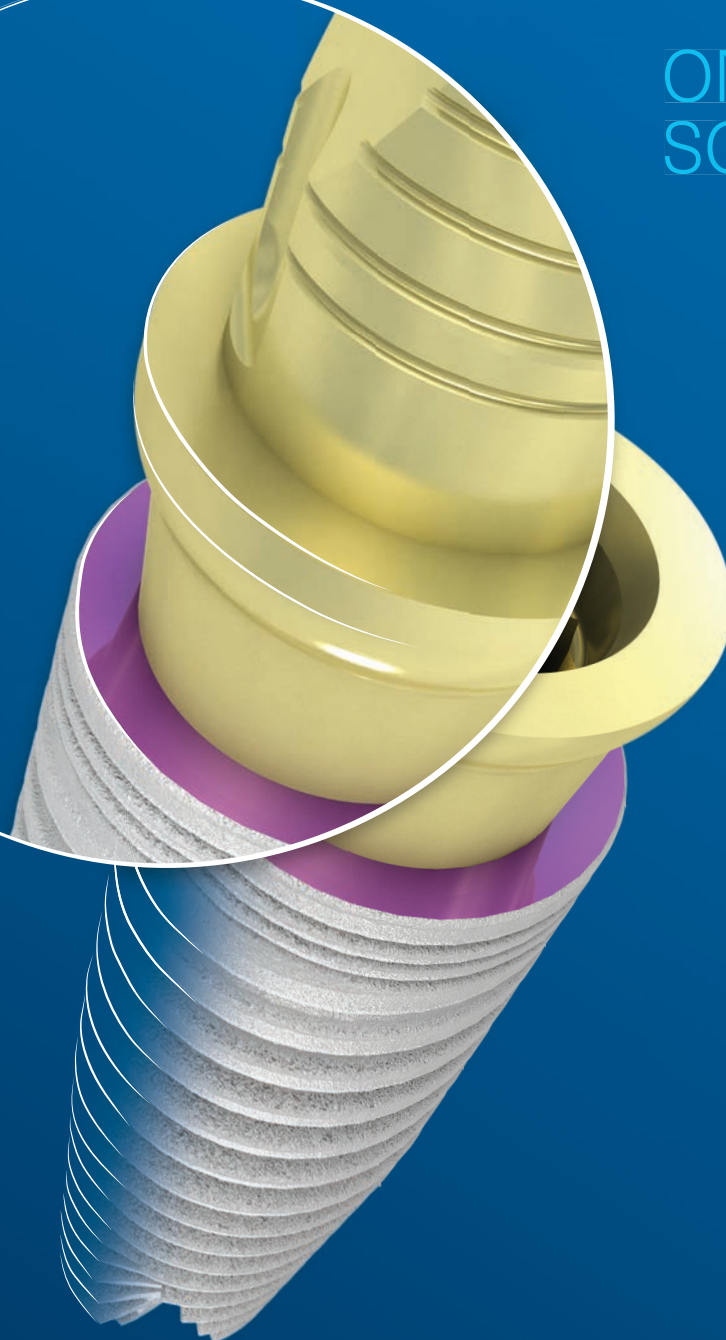
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