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CAD/CAM

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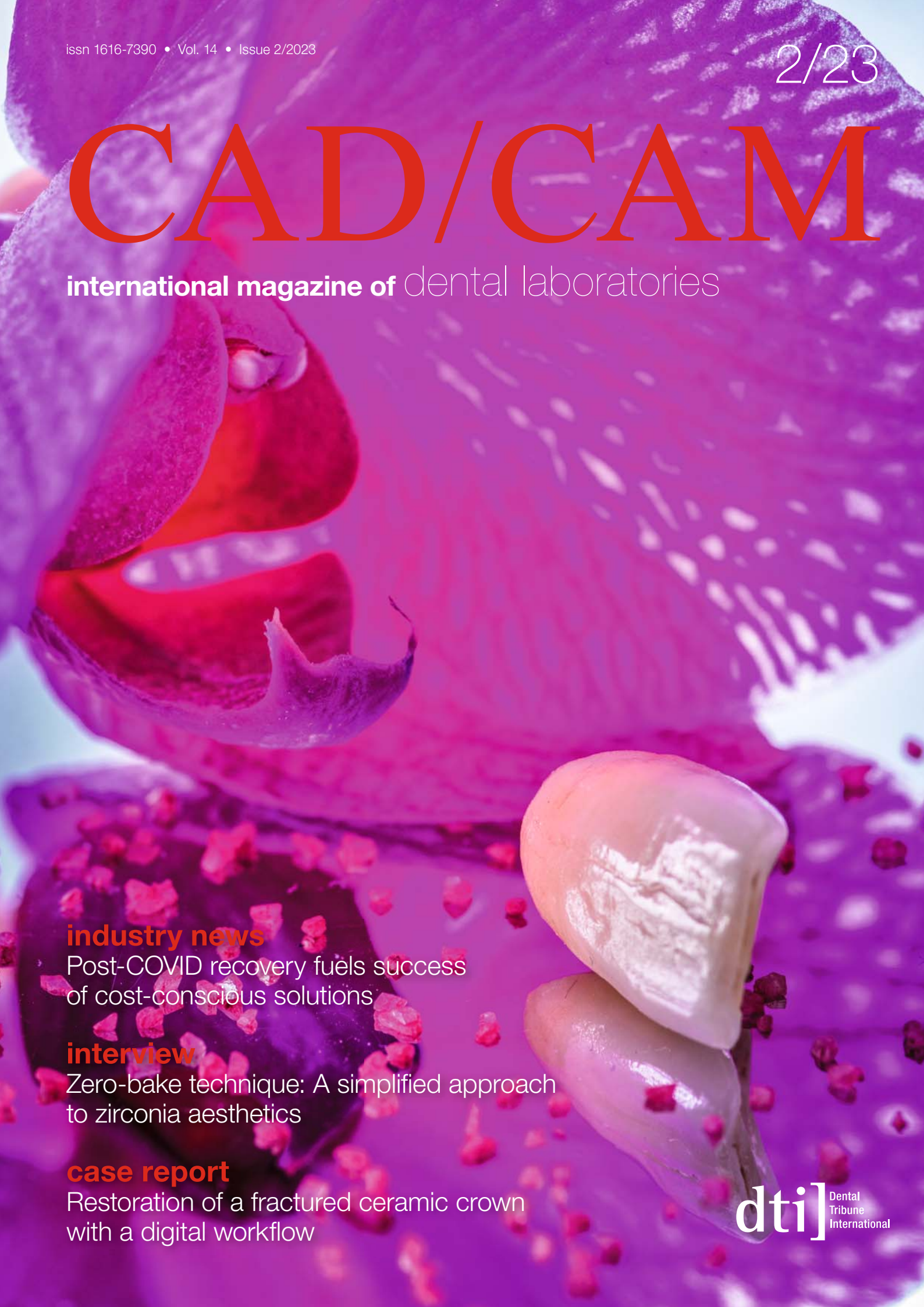

industry news
Post-COVID recovery fuels success of cost-conscious solutions

interview
Zero-bake technique: A simplified approach to zirconia aesthetics

case report
Restoration of a fractured ceramic crown with a digital workflow

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Magda Wojtkiewicz

Managing Editor

To mill or to print? That is the question

The introduction of CAD/CAM milling and 3D-printing technologies to dentistry has significantly reduced the possibility of inaccuracies in the fitting of prosthetic restorations. These new technologies have gained the appreciation of dental professionals as well as patients, who have realised that they no longer have to tolerate the unpleasant aspects of conventional impression taking or attend several appointments for a restoration. Patients enjoy the benefits of receiving a permanent crown in a single visit and dental professionals the shorter, cleaner and more predictable workflow. Many dentists, laboratory owners, dental assistants and dental technicians agree that digital impressions and digital technologies for design and manufacture will soon replace conventional methods of fabricating dentures, splints, bridges, crowns and even veneers. Increasingly, it is not just milling but also 3D-printing technology that is being used to produce CAD/CAM dental restorations. How does a laboratory or dentist know which is better: milling or 3D printing? The answer depends on what do you need the most—speed, exceptional accuracy and aesthetics, or lower costs?

The first aspect to consider is the material from which the final restoration is to be made. Milling uses many different materials (e.g. titanium alloy, cobalt–chromium–molybdenum alloy, PEEK, and other polymers, and PMMA and other resins) but ceramic materials, such as leucite and lithium disilicate glass-ceramics, which are the most natural-looking replacements for missing tooth substance and are available in a wide range of shades and translucencies, give most predictable, durable and highly aesthetic results. 3D printing works with a vast number of different materials too, including non-precious metal alloys (e.g. cobalt–chromium and titanium alloys), composite resins and ceramics—however, these are single-coloured, so the printed restorations may require more finishing than milled restorations.

The second thing to consider is convenience. Nowadays, 3D printing is faster than milling, and according to many dental professionals, 3D printing is easier to use than milling, but this is a very subjective opinion and largely depends on the workflow the user is accustomed to. Many dentists who own chairside milling machines use them only in easier cases where a single crown or inlay is required and send orders for other restoration types to the dental laboratory for more reliable and detailed results.

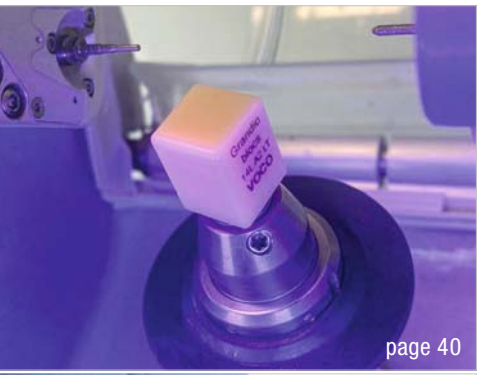
Another important factor is accuracy. In this regard, 3D printers do not have a clear advantage over milling. However, milling tools are limited as milling machines cannot be made smaller than the tools they use. Because milling is a removal process and printing is an additive process, 3D printers are better able to create curves, holes, and very small and complicated shapes than milling machines are.

Cost is usually important for both dental professionals and patients. 3D printers are becoming increasingly affordable, which is great for technology-minded dentists and laboratory owners. Industrial 3D printers are still expensive, but the average cost of each product fabricated is cheaper compared with milling. In addition, 3D printing enables the fabrication of multiple parts at once, and it produces little or no waste.

The possibilities of using 3D-printing technology in dentistry seem endless, but there is still much to discover and learn. Milling is still the most predictable technology to use for permanent fixed restorations, guaranteeing consistency and enabling the highest aesthetics. We can expect that as 3D-printing technology continues to evolve, this method of fabrication will play an ever greater role in transforming the field of dentistry.

Sincerely,

Magda Wojtkiewicz
Managing Editor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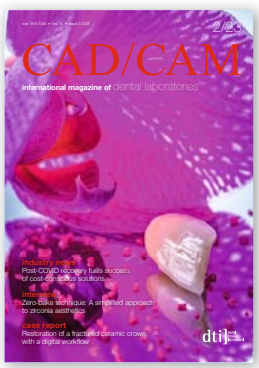

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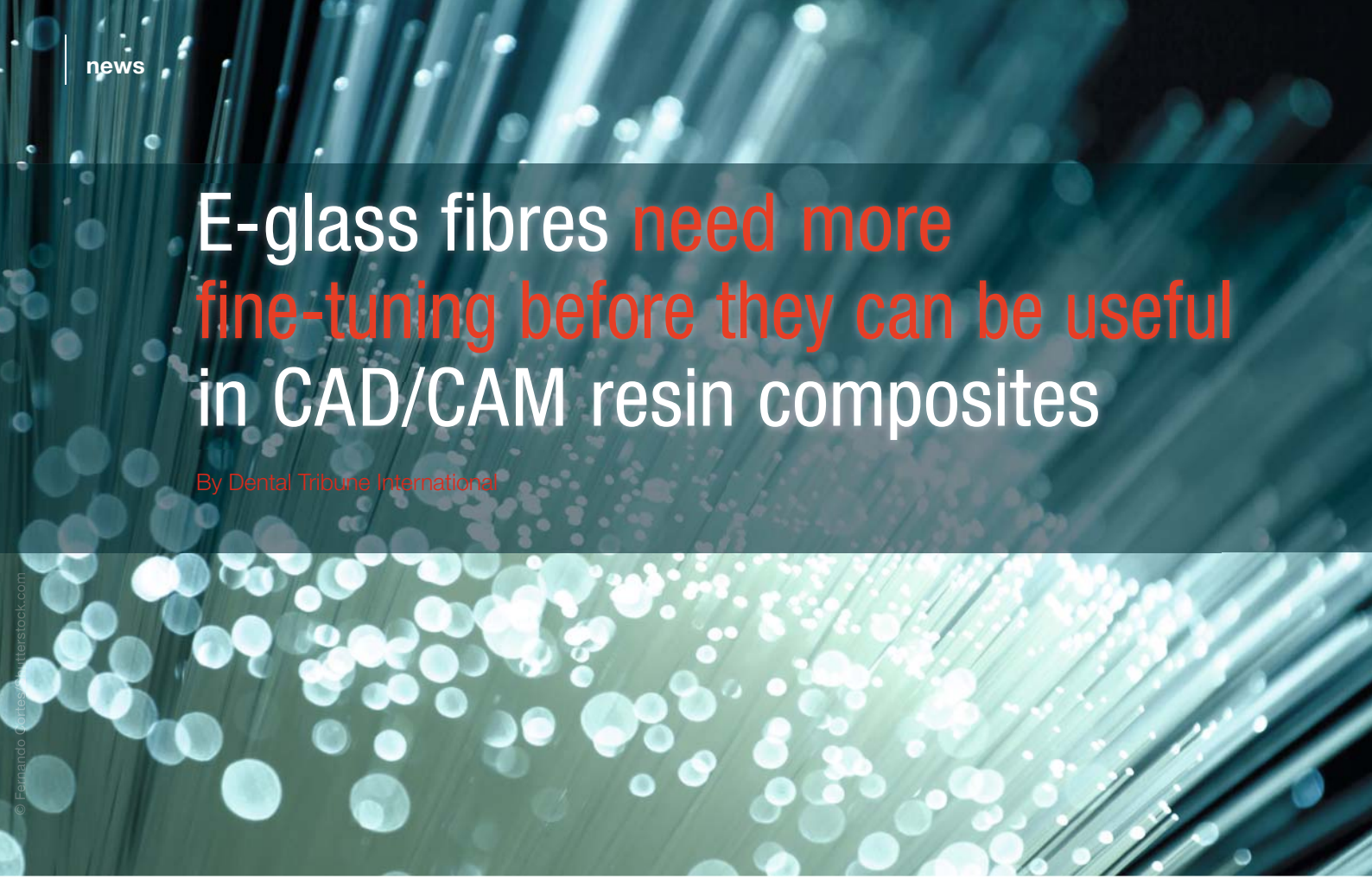

E-glass fibres need more fine-tuning before they can be useful in CAD/CAM resin composites

By Dental Tribune International

Dental restorations often rely on CAD/CAM resin composites for their precision and reliability. However, ensuring the longevity and durability of these restorations remains a challenge. The integration of bidirectional E-glass fibres beneath the composites offers potential benefits in enhancing fracture resistance and directing crack propagation, thus potentially minimising catastrophic failures. A recent study has delved into understanding these dynamics further, finding that the exact placement of fibre layers under the composites needs consideration in order to balance resistance and risk of catastrophic failure.

Endodontically treated teeth are more prone to fractures and often have a reduced lifespan compared with non-treated teeth. The main challenge is preventing fractures below the cemento-enamel junction, which can cause unrepairable root fractures. While endocrowns and overlays have emerged as alternatives to traditional restorations, concerns remain. A promising approach to reinforcing restorations is the use of composites reinforced with fibre, especially glass fibre, and such reinforced composites possess superior mechanical properties compared with particulate-filled resins.

The researchers in the study sought to determine whether the presence and position of E-glass fibre reinforcement affects the restoration's load-bearing capacity, fatigue resistance and fracture pattern. To do so, they created 90 specimens composed of a bidirectional fibre-reinforced composite layer between a superficial layer of a CAD/CAM resin composite of different thicknesses and a particulate-filled resin substructure of different thicknesses, the CAD/CAM layer simulating the coronal restoration and the particulate-filled resin simulating the resin composite core build-up of an endodontically treated tooth. They used 30 specimens of unreinforced CAD/CAM resin composite as control.

Half of the samples underwent compressive loading and the other half cyclic loading. The former showed that the control samples had the highest load at failure and that breaking force decreased with reducing CAD/CAM resin composite thickness. Under compressive loading, the CAD/CAM resin composite displayed high resistance, especially when integrated with a fibre layer, which directed crack propagation laterally. The cyclic loading showed that the fractures typically occurred at lower stress levels than those defined by maximum strength. Notably, the layer thickness of the CAD/CAM resin composite played a significant role in fatigue resistance. Thicker layers had higher resistance, but the positioning of the fibre layer had implications for stress distribution. Specimens with balanced tensile and compressive stresses showed that the fibre layer deviated the crack, indicating the potential for reducing non-restorable tooth fractures. Analysis of the fracture surfaces, using stereomicroscopy and scanning electron microscopy, elucidated fracture origins and directions.

Editorial note: The study, titled "Exploring the influence of placing bi-directional E-glass fibers as protective layer under a CAD-CAM resin composite on the fracture pattern", was published online on 19 September 2023 in Dental Materials*, ahead of inclusion in an issue.*

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Techniques for taking impressions of clefts in infants have not changed in over 70 years. New research has probed the advantages and acceptability of the use of intra-oral scanners.

Intra-oral scans may present more humane option for evaluating clefts in infants

By Anisha Hall Hoppe, Dental Tribune International

Clefts of the lip and/or palate and alveolar bone are the most common congenital anomalies of the head and neck and result in feeding, psychological, craniofacial and speech challenges. In infants, care may involve preoperative appliances, for which impressions of their clefts are required. Conventional impression taking techniques pose risks like ingestion and suffocation. A study at Alexandria University has assessed the reliability of digital versus conventional impressions in reproducing unilateral cleft lip and palate in newborns and found digital impressions to be as accurate but more acceptable for guardians.

The study involved seven infants aged 0–28 days diagnosed with complete unilateral cleft lip and palate. Impressions of their clefts were taken with the conventional method using an irreversible hydrocolloid impression material and with an intra-oral scanner. Stone models of the conventional impressions were scanned, creating virtual 3D models, and the intra-oral scans were saved as virtual 3D models and 3D-printed.

The virtual models from both methods were superimposed to compare the alveolar arch width and alveolar cleft defect. The maximum alveolar arch width and maximum distance between the premaxillary segments were measured on the physical models from both techniques using vernier callipers. The superimposed 3D scans of the conventional and digital impressions showed significant differences in three of the cases. However, the calliper measurements showed no significant variation between the conventional and digital impressions.

Additionally, the infants' guardians completed a questionnaire on their acceptance of both impression techniques, and their answers revealed a distinct preference for the digital method. Two significant findings were that the guardians felt that the conventional method was more invasive and that they believed their infant had suffered during its application.

The study indicates a shift away from traditional impressions owing to associated risks and the stress it places on both patients and guardians. Digital impressions emerged as safer and preferred because they minimised risks to infants as well as eased guardians' concerns. The study also showed that digital impressions are accurate and efficient. Digital impression taking also offers the advantage of creating reliable models for future treatment planning and provides visual aids to parents that showcase the potential improvements in their infant's condition.

Editorial note: The study, titled "Diagnostic evaluation and guardian assessment of using digital impression in neonates versus the conventional techniques", was published online on 30 August 2023 in the Alexandria Dental Journal*, ahead of inclusion in an issue.*

Will a scan aid actually help with intra-oral implant scans?

New research suggests using scan aids has both pros and cons

By Dental Tribune International

The use of intra-oral scanners for full-arch digitisation of edentulous arches with multiple implants has not been recommended, owing to significant errors. A study by researchers in Freiburg and Berlin in Germany compared the accuracy of intra-oral scans for multiple implants with and without the use of a scan aid. The goal was to understand the potential improvements the scan aid could provide in the context of edentulous arch scans, assessing parameters such as linear deviation, precision and software recognition of scan bodies. The findings highlight the role of scan aids in improving registration of scan bodies and reducing linear deviation in intra-oral scans.

Having less distinct anatomical surface morphology, the edentulous jaw makes it difficult to stitch intra-oral scan images accurately to form a complete virtual model, and the intra-oral environment can introduce additional inaccuracies. Efforts to overcome these issues have included devices that create an optical bridge or increase the scannable surface, aiming to minimise stitching errors, but require additional time-consuming steps that add complexity to the process. Nonetheless, these devices have been shown to improve scanning accuracy.

A prior study introduced an optical bridge for universal use that can be adjusted chairside and is easy to handle. It tested three different designs and materials for trueness, precision and clinical applicability. The most user-friendly and accurate scan aid had an irregular design and a grey colour. The aim of the current study was to evaluate the accuracy of this universal 3D-printed scan aid *in vivo*.

The study used a case–control format, scanning implants in the edentulous jaw with and without the universal scan aid. Twenty-two participants with an edentulous arch and at least three implants were selected. The patients had received CAMLOG SCREW-LINE, SICace (SIC invent) or Straumann Standard Plus implants, and system-specific scan bodies were used. Two types of intra-oral scanners, the CS 3600 from Carestream Dental (CS) and TRIOS 3 from 3Shape (TR), were employed. The scans were capped at 9 minutes, because it has been found that repeated scanning does not increase accuracy in areas with minimal surface morphology.

Failure to register the scan body during scanning was reported for 25% of Straumann, 20% of Camlog and 8% of SIC scan bodies. For the CS scanner, 83% of scan bodies were successfully scanned with the scan aid and 70% without, compared with 96% and 86%, respectively, for the TR scanner.

The scan aid statistically significantly minimised the total mean linear deviation when using the CS scanner. However, for the TR scanner, there was no difference.

As for precision, statistically significant differences were found between the two scanners when the scan aid was not used. The scan aid decreased precision significantly for the TR scanner. Other parameters showed increased variability, particularly regarding precision within each group of scan bodies, suggesting that the scan aid's usefulness might be influenced by the specific scanning technology used.

For instance, the CS scanner uses active triangulation, which may be more prone to errors in edentulous arch scans and could benefit more from the scan aid than the TR scanner, which uses confocal microscopy. The use of the scan aid also improved the software's recognition of scan bodies for both scanners.

The authors cautioned about the interpretation of accuracy regarding the results, owing to inherent errors in extra-oral reference models and potential deviations related to scan body height. They concluded that, while the scan aid can significantly improve linear deviation with the CS scanner and enhance software recognition of scan bodies, it may also lead to increased variability in precision.

Editorial note: The study, titled "Enhancing intraoral scanner accuracy using scan aid for multiple implants in the edentulous arch: An in vivo study", was published in the August 2023 issue of Clinical Oral Implants Research.

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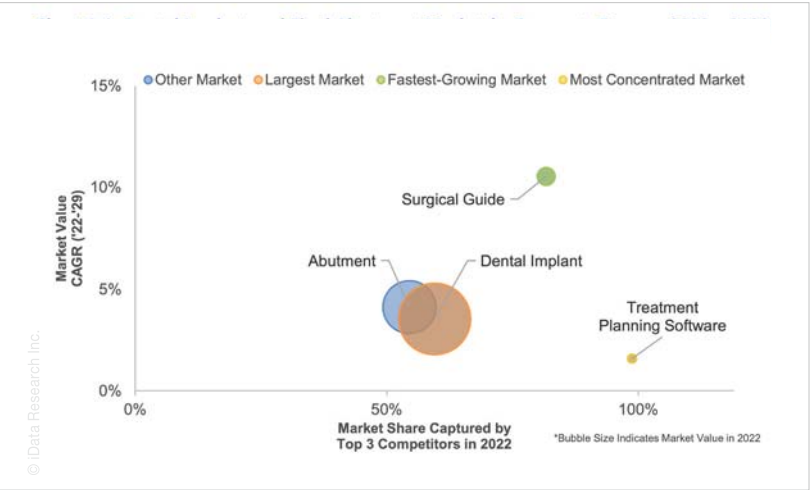
Post-COVID recovery fuels success of cost-conscious dental implant solutions and digital dentistry

By Elena Generalova, Canada

The long-awaited post-pandemic recovery and reopening of dental practices for patients after the COVID-19 pandemic has not only produced a spike in the growth of dental procedures but also highlighted the need to reconcile the damage done to the industry, including supply chain issues, economic hardship and global inflation. Patients and dental professionals have grown more sensitive to cost and, as a result, are more open to discount and value implant products. The growing acceptance of these more affordable products is set to shift the dental implant market.



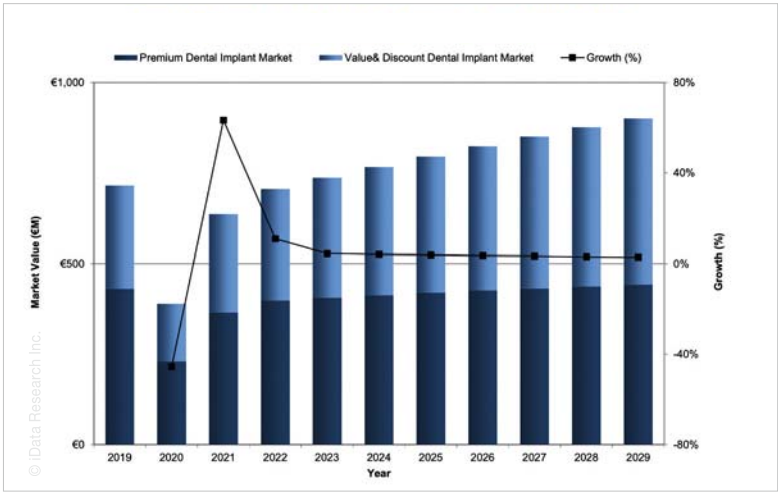


Chart 1: Dental Implant and Final Abutment Market by Segment, Europe, 2022–2029. **Chart 2:** Dental Implant Market by Segment, Europe, 2022–2029.

The most prominent difference between premium, value and discount implant solutions is the cost, premium brands costing several times more than value or discount brands. These price differences not only reflect research and development and quality assurance expenses, but also include additional costs such as the inclusion of training programmes, dental practice support and extended service from the manufacturer.

Owing to the high cost of dental treatment and limited coverage, cost-effectiveness has been always at the forefront of the dental industry, and the permanent crisis era of post-COVID recovery has only fuelled the need for lower-cost implants. Dental insurance coverage remains limited and is usually provided under an employment benefits package. While the overall market growth will continue to be constrained by reimbursement and unemployment rates, the lack of it, to some extent, will drive the need for cost-sensitive and affordable treatment.

Historically, premium dental implant companies have dominated the competitive landscape in Europe, but they have recently faced increased competition from value and discount brands. In addition, the premium segment market is mainly shared by four main companies: Dentsply Sirona, Envista Holdings Corp., the Straumann Group and ZimVie. The growing prevalence of local manufacturers and an increasingly cost-sensitive consumer demographic have contributed to overall price depreciation in the total dental implant market that has been fuelled by a growing share of the value and discount segments in the total dental implant market value. The combined market share of the value and discount segments is projected to be over half of the total dental implant market value by the end of the forecast period.

Similar to the dominance of premium implants, stock abutments have historically prevailed as the predominant segment of the final abutment market. Recent improvements in manufacturing capability and product affordability have resulted in the rapid growth of the CAD/CAM abutment segment relative to the stock abutment and custom-cast abutment segments. CAD/CAM abutments offer significant improvement in aesthetics and clinical outcomes. The segment became the largest segment in the total final abutment market in 2022, closely followed by the stock abutment segment.

Digital dentistry

Further development and adoption of digital dentistry will continue to drive the growth in the dental implant and bone grafting material markets. Driving

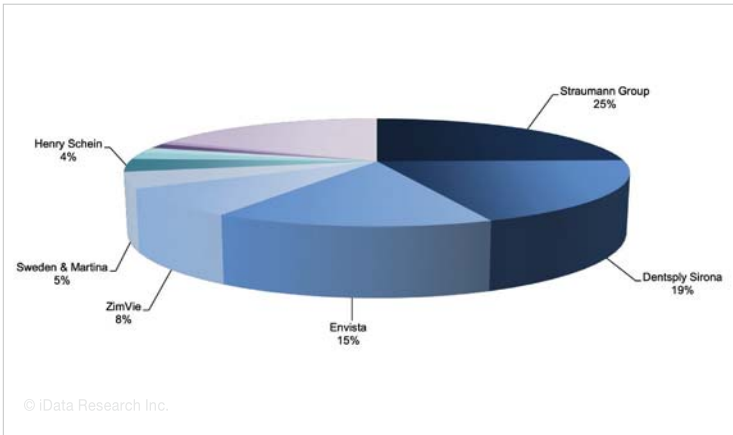


Chart 3: Leading Competitors, Dental Implant Market, Europe, 2022.

the CBCT scanner market is the development of computer-guided surgery software for treatment planning and implant placement. Based on the treatment plan, the dentist also has the option of using a surgical guide to assist in placement of the implants. CAD/CAM technology is increasingly being used to manufacture customised final abutments as well, thereby creating a more stable and aesthetic restoration.

Dental manufacturers invest in the digital dentistry transformation via collaborations with start-ups, education centres and other companies globally to expand technological capabilities, outreach and local experience. The Straumann Group, for example, has invested in China to establish a Straumann manufacturing, innovation and education centre by 2029. The company also founded a new technological and innovation centre in Switzerland.

Open-architecture systems enable integration with other components, even those from different manufacturers. Companies producing CAD/CAM abutments are opening their systems to make the process of sending a scan easier for dental professionals. Nobel Biocare's system, for example, can now receive CAD files from 3Shape scanners too. Dentsply Sirona too has opened its CEREC software to support compatibility and a smooth workflow.

Closed systems used to be the only option in the early days of CAD/CAM development, limiting the dentist's choice of components to a single manufacturer. The shift towards open CAD/CAM systems makes the process of ordering CAD/CAM abutments more accessible to the market and is therefore expected to increase the demand in volume for CAD/CAM products. In addition, it allows for cross-promotion of a broader range of products from different manufacturers.

Recent significant events relating to digital dentistry market

In May 2023, Henry Schein announced the acquisition of Brazilian company S.I.N. Implant System. The company specialises in value dental implant solutions and has been expanding into the US market. Henry Schein is planning to integrate S.I.N. into its Global Oral Reconstruction Group. The combined forces of the two companies are set to form a global supply of dental implant and bone regeneration materials to address the growing demand in both emerging and developed markets. The acquisition is expected to be completed in the second half of this year.

> "Companies producing CAD/CAM abutments are opening their systems to make the process of sending a scan easier for dental professionals."

In April 2023, ZimVie announced the launch of RegenerOss CC Allograft Particulate and RegenerOss Bone Graft Plug, extending the company's dental bone grafting portfolio, primarily focusing on the North American market. Both products are processed by RTI Surgical and marketed by ZimVie.

In April 2023, Medentika, a member of the Straumann Group since 2016, announced the launch of a brand awareness campaign for its MPS multiplatform portfolio of dental implants and prosthetic components. The campaign is called "This is MEDENTiKA".

In March 2023, ZimVie introduced the CAD and FULL SUITE modules for its RealGUIDE digital dentistry software platform at the International Dental Show in Germany. The FULL SUITE integration provides a seamless workflow between the CAD module and RealGUIDE's existing Plan, App and Guide modules, offering a one-stop solution for surgical and restorative treatment.

In February 2023, BEGO and Rapid Shape announced their partnership allowing Rapid Shape customers to process BEGO's Varseo materials on Rapid Shape's D20+, D30+ and D50+ printers. This allows users of those 3D printers to produce a broad range of restorative solutions with BEGO's VarseoSmile and VarseoWax materials.

In January 2023, Nobel Biocare announced its acquisition of Mimetis Biomaterials, a spin-off from the Biomaterials, Biomechanics and Tissue Engineering group of the Polytechnic University of Catalonia in Spain. Nobel and Mimetis have partnered in the development of materials since 2016, the newest product of which is creos syntogain, the latest-generation synthetic bone grafting material developed by Mimetis. Through its partnership with Mimetis, Nobel has been able to expand its portfolio of regenerative solutions.

In its annual report for 2022, the Straumann Group announced 2023 additions to its portfolio, including value dental implant systems, abutments, grafting materials and growth factor. This included an Anthogyr line extension with the Axiom X3 tissue-level implant, the extension of the BLX and TLX implant family lines, an addition to the Variobase abutment family and the Zygoma-S implant designed for the zygoma anatomy-guided approach. The company also announced the continuous global roll-out of cerabone plus, a bovine bone grafting material with sodium hyaluronate, starting with Germany, Austria, Switzerland and the Nordic countries. The company also announced the global release of the Medentika multiplatform and implant system. Other new products are the fully tapered TLX tissue-level implant system for immediate protocols, the Neodent two-piece screw-retained zirconia–zirconia connection implant with a tapered design and the Neodent Helix GM Narrow implant, also for immediate protocols. The company is planning a continuous global roll-out of its Emdogain growth factor, featuring the latest extension of its indications to flapless surgery and peri-implant therapy.

about

Elena Generalova is analyst team leader at iData Research. She specialises in research projects on the medical technology industry, including the global market for dental materials and the European market for dental implants, bone grafting materials and other biomaterials for dentistry.

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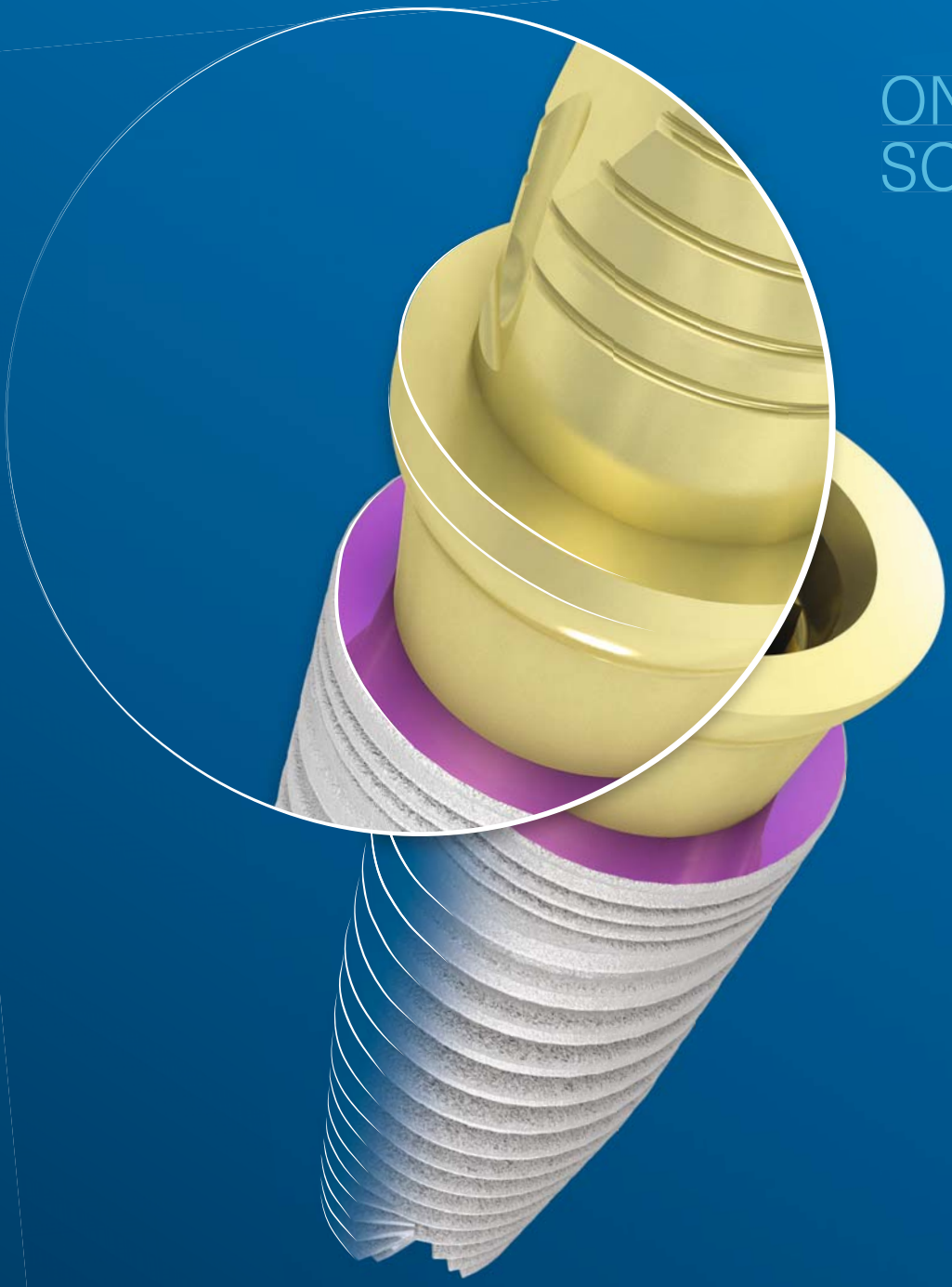

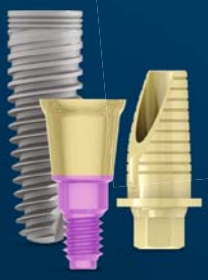

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Redefining implant therapy with digital planning, guided placement and use of CONNECT abutments

By Dental Tribune International

Dr Juan Arias Romero has a private clinic in Madrid in Spain and he often contributes to journals and provides courses and lectures on topics related to periodontics, implantology and aesthetic multidisciplinary dental treatments.

According to implantology and periodontics specialist Dr Juan Arias Romero, a new synergy between digital planning, guided implant placement and the use of MIS Implants Technologies' CONNECT abutments has the potential to redefine implant dentistry. In a free webinar available on demand on MIS Implants Academy platform, Dr Arias addresses hard- and soft-tissue management in aesthetically compromised cases and how digital tools can help clinicians to plan for and achieve the best possible outcome.

Dental patients are increasingly motivated by aesthetics, and Dr Arias reminds us that the success of a case depends as much on the position and architecture of the tissue as it does on the final position, colour, shape and size of the teeth. Digital dentistry makes it possible for clinicians to plan tissue and implant position before treatment, and this improves the predictability and quality of the treatment outcome.

Dr Arias explained to Dental Tribune International that his lecture, titled "Hard and soft tissue management as well as digital control in the aesthetic outcome", addresses the realm of digital planning in dentistry, exploring the revolutionary advancements that technology has brought to the field. He said: "As we embark on a journey into the realm of guided implant placement and the use of CONNECT abutments through digital precision, we will explore how digital tools and techniques have enhanced precision, efficiency and patient outcomes in various dental procedures."

Delving into the intricacies of guided implant placement through a number of case studies, Dr Arias demonstrates how computer-generated surgical guides enhance accuracy and predictability during surgery and how harnessing the power of intra-oral scanners and specialised software can enable dental professionals to create treatment plans that are tailored to each patient's anatomy and to the desired outcome. The lecture also demonstrates how CONNECT abutments can provide unparalleled precision when used together with CAD/CAM software and how digital technologies enable improved decision-making when it comes to the fit, function and aesthetics of each case.

Additionally, webinar participants gain insights into a range of digital tools, such as 3D imaging, intra-oral scanning and CAD/CAM, and into the integration of digital solutions in treatment planning, restoration design and overall patient care. The lecture also addresses the collaboration between clinicians and dental laboratories.

The webinar is intended for all dentists who want to explore the field of digital dentistry and have an interest in the management of hard and soft tissue for aesthetic outcomes. Dr Arias hopes that the presentation will empower dental professionals with the knowledge and tools needed to embrace the future of dental implant procedures. Participants have the chance to earn continuing education credits upon completion of a quiz. More information can be found at www.mis-implants-academy.com.

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CEREC or 3D printing: Which technology for in-office manufacturing?

Dr Rainer Seemann & Max Milz, Germany

For over 35 years, CEREC has been the go-to solution for the fabrication of high-quality restorations in the dental practice, offering the speed and convenience of single-visit dentistry to both patients and clinicians. Every year, five million restorations are milled on CEREC machines around the world.

Now an exciting technology for in-office manufacturing is following in the footsteps of CEREC: in-office 3D-printing solutions leverage some of the same technologies as CEREC, such as accurate intra-oral scanning and CAD/CAM software. The difference lies in the manufacturing process: milling high-strength materials versus depositing resins in a process known as digital light processing (DLP).

With the introduction of every new technology, a question arises: will the new method replace or complement the existing technology? Dentsply Sirona is the only company offering both in-office manufacturing technologies at scale. This gives us a unique view on which technology is most suitable for which indications to enable excellent results for both patients and practices. In a nutshell, milling is ideal for manufacturing high-quality permanent restorations made from materials with extensive clinical track records and expected survival rates of over ten years. In-office 3D printing is most suitable for temporary applications, such as temporary restorations, surgical guides, models and splints.

In-office 3D-printing deposits liquid resins in a stepwise manner, allowing for the creation of complex designs. Printer resins suitable for the fabrication of dental devices are those with a maximum filler content comparable to that of flowable dental composites and have lower strength values compared with materials utilised in milling systems. This is because the printing resin must be light-polymerised and high levels of filler diffract light and lower polymerisation efficiency.

Recently, some resin brands have launched new materials marketed as ceramic restorative materials. While these materials contain ceramic particles as fillers, they technically are still lightly filled composite materials with strengths that do not exceed 150 MPa. High-strength milling materials for CEREC, such as glass-ceramic, zirconia and highly filled composites, however, have three to six times greater strength (530–850 MPa).[1] These types of milling materials are backed by clinical evidence that demonstrates their suitability for use in definitive dental restorations. By nature of the DLP printing requirements, 3D-printing materials lack comparable long-term durability, making 3D printing most suitable for (complex) temporary applications, such as surgical guides, bite splints, models and other plastic appliances. At the current stage of technology and given the lack of solid clinical evidence, caution is warranted for the printing of permanent crowns, even if advertisements for these materials imply the production of ceramic restorations. They remain, in fact, composite resin crowns.

Milling and 3D-printing technologies can be combined to reduce labour and increase predictability in clinical procedures. For example, to restore an edentulous space with an implant, a printed surgical guide and provisional restoration can be fabricated with a 3D printer, and the definitive crown can be manufactured in the CEREC milling machine—all within one digital treatment plan.

Implementing CEREC in a practice follows a well-established workflow with a history of more than 35 years. When employing in-office 3D printing, it is important to consider the complete process, involving printing, cleaning and polymerising. Conventional 3D printing requires the use of chemicals such as isopropanol for cleaning. Safe use of isopropanol necessitates a fume hood for ventilation and personal protective equipment to protect the operator. Additionally, to ensure patient safety, special dental polymerisation units must be used in order to guarantee complete polymerisation of the printing resin. Advanced printing solutions automate printing and post-processing to ensure staff safety and save valuable staff time.

Economic factors ultimately drive the adoption of technologies in dental practices. Both CEREC and in-office 3D printing are highly attractive for dental practices owing to the improved practice efficiency, supporting the business case for investment in this technology. Both technologies serve different indications, and dentists' decision to invest should be based on the benefits to their practice.

An important economic factor for crowns is the revenue for different types of crowns. Clinically proven permanent crowns made from glass-ceramic or zirconia command two to three times higher prices than do composite resin crowns.[2] Printed crowns may play a role in the value segment, but to make the same revenue, a dental practice would have to place two to three times as many composite restorations versus ceramic crowns. Using long-term proven materials such as zirconia also lowers the risk of rework that may arise from newer printed composite materials with limited clinical data.

In conclusion, in-office 3D printing is a highly attractive technology that will enrich dentistry. At its current level of development and research, it is highly suitable for intermediate, temporary restorations and temporary applications, like night guards, guides and models. This technology complements the strength of the proven CEREC technology for rapid manufacture of clinically proven permanent restorations. A dental practice using both technologies effectively can expect satisfied patients and growth in revenue and margins.

Editorial note: More information about 3D printing and CEREC can be found on Dentsply Sirona's website, www.dentsplysirona.com. The list of references can be found at dentsplysirona.com/en/lp/cerec-or-3d-printing.html.

about

Dr Rainer Seemann is vice president for global clinical research at Dentsply Sirona. Furthermore, he is a professor in the department of operative, preventive and paediatric dentistry at the University of Bern in Switzerland. He worked in several positions at the dental school and clinic of Charité—Universitätsmedizin Berlin in Germany before he joined Dentsply in 2006. From 2014 to 2015, he worked as senior business development manager in Hong Kong. Dr Seemann studied dentistry in Berlin, obtained his PhD in 2005 and holds an MBA in healthcare management.

Max Milz is group vice president for connected technology solutions at Dentsply Sirona. He joined the company in January 2021 to lead its clinical software and services business and to drive the transition to a new cloud platform. He is responsible for the company's equipment, software and cloud platform businesses globally, including imaging, CAD/CAM and dental chair units. Previously, he was at Siemens for 12 years, working across the company's businesses with a focus on strategy and digital transformation, particularly in the healthcare and digital automation businesses. During his time at Siemens, he worked across the globe, including in China for five years. Milz holds a master's degree in public policy from Harvard University in the US and a master's degree in environment, law and economics from the University of Cambridge in the UK.

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“Digital technologies are fundamentally changing the dynamics of our industry”

An interview with Stephan Kreimer, a master dental technician from Germany

By Iveta Ramonaite, Dental Tribune International

Stephan Kreimer is a dental CAD/CAM specialist and advisor for digital dentistry and 3D printing. He is also the managing director of a dental laboratory in Warendorf in Germany. In this interview with Dental Tribune International, he discusses his personal journey from a conventional to a digital laboratory and weighs up the advantages of integrating dental technologies into one’s workflow.

Stephan Kreimer

Mr Kreimer, when did you first start working in the dental field, and what led you to a career in dentistry?
Technology has always been an interest of mine. Since 2009, I have been able to combine this interest in technology with dentistry through my education in dental technology. At the time, my parents were operating a conventional dental laboratory in Germany that made little use of digital technologies such as CAD/CAM.

After completing my master’s in dental technology, I took over as managing director of our family laboratory. I was betting strongly on innovative technologies such as CNC milling and 3D printing and closed collaborations with leading manufacturers, including 3Shape and Formlabs. Smartly combining the passion for aesthetics and craftsmanship, which is inherent to our industry, with the enormous potential of digital technologies is definitely the way forward.

Your dental laboratory has eagerly adopted digital technologies into its workflow. Could you tell us more about it and discuss some of the digital solutions you are using?
It has been a journey. We started as a conventional dental laboratory and have been operating with traditional workflows for over 30 years. In 2009, we adopted our first CAD software but outsourced all of our digital production to service providers. Things changed quickly when we invested in our first 3D printer, a Formlabs Form 2, in 2016. At the time, the system was not optimised for dentistry, but it was clear that it had great potential. Within the less than five years since then, most of our customer base has adopted intra-oral scanners and we scaled our digital production capabilities significantly. Today, we use an imes-icore milling machine and multiple 3D printers that run almost 24/7 and work with both 3Shape and exocad. Around 70% of our customers send us digital impressions.

How did you integrate digital technologies, including 3D printing and CAD/CAM, into your laboratory?
It was definitely through trial and error. Especially in the early days, which was just a few years back, 3D printing was not well optimised for a dental workflow. Interfaces to materials, software and other workflow requirements have not been coordinated well between different manufacturers. This has led to the formation of a highly active international community of dental technicians who exchange through social media what they have learned. Personally, I've learned a lot from my peers around the world, and I'm equally giving back to the community and the manufacturers. Dentistry is at the intersection of multiple disciplines, and we need to have good communication to make progress.

The rate of innovation in digital dentistry is extremely high. We now see manufacturers coordinating much better and creating more accessible ecosystems that are much easier to use. At the same time, most of the potential is still untapped and will become apparent as we undergo significant transformations within our industry.

Having worked with digital technology for over a decade now, what benefits do you see of using dental technology, especially 3D printing, in a dental laboratory?
To me, dental technology is about combining the best of two worlds: analogue and digital. We still need and will continue to need traditional craftsmanship to meet the high requirements for individualised aesthetics in complex cases. At the same time, the holistic digital workflow works well in an increasing number of areas, enabling significant increases in efficiency while maintaining or improving overall quality. Digital fabrication in particular enhances production speed and reproducibility.

Dentistry is constantly evolving. What lies ahead for dentistry, and what dental technology is most likely to shape its future?
In my view, we are now at a point where most of the industry understands and embraces the vast potential of digital technologies. At the same time, we are just about to move from an early adopter stage to the early majority stage when it comes to the adoption of digital technologies. In Germany, for example, only 15% of dental practices are using intra-oral scanners, much less than in the US. However, the trend towards digital impressions is accelerating fast!

We are undergoing a paradigm shift in dentistry because digital technologies are fundamentally changing the dynamics of our industry. We will see entirely new business models, and together we will establish new standards of care. It is an exciting time, and for those who embrace this change, there will be many opportunities.

Aspen Dental's digital denture transformation

An interview with Eric Kukucka

By Dental Tribune International

The world of removable prosthodontics is rapidly growing, and Eric Kukucka is one of the foremost experts in the space. Recently, he made the transition from private practice to vice president of clinical removable prosthetics and design technologies at dental service organisation Aspen Dental. Dental Tribune International (DTI) spoke with him about his involvement in the development of digital denture technologies, the exciting advancements in the field of digital dentures and obstacles to their adoption.

Eric Kukucka

Mr Kukucka, for how long have you been a denturist? What attracted you to this field?
I've been a denturist since 2010, and there were several factors that initially brought me to this field. Dentures are a thriving business, so the promise of financial reward was attractive. I also love being able to work with my hands. As I grew in my career, I delighted in being able to give people back their smiles and their quality of life, and the monetary appeal became secondary. I quickly learned that there is no greater reward than being of service to others.

What kick-started your digital denture journey?
About ten years ago, I was working with Ivoclar, which is a worldwide dental company that produces a range of products and systems for dentists and dental technicians. I was lecturing for Ivoclar as well as working on various research and development projects related to materials for removable prosthetics. In 2014, I was shown the alpha prototype of the Ivoclar digital denture, and I was blown away! The product was so impressive and so disruptive that I knew I wanted to be part of it right from its infancy.

Being a denturist provided me with the unique perspective of working on the clinical and the lab side, so I was well positioned to work on the multifunctional validation of the product as we conducted the alpha testing. Over the years of testing, we implemented many different iterations of workflows, material processes and manufacturing concepts. This also led to the development of advanced milling technologies able to fabricate a monolithic denture that was both white and pink in one single uninterrupted manufacturing process. Development of scanning technology also continued, and we were able to move from desktop scanners to more innovative and handheld wireless intra-oral scanners that could scan not only inside the mouth but also physical impressions and gypsum models.

During this evolution, I also developed a relationship with the counterpart that was working with Ivoclar on the digital dentures, a company named 3Shape. 3Shape produces desktop and intra-oral scanners as well as dental design software for all types of dental restorations. As part of the collaborative Ivoclar–3Shape team, I also helped develop scanning strategies for the TRIOS intra-oral scanners, so I've been able to see the journey of digital dentures all the way from conception through to more widespread use and to being a valued component in any dental facility that prides itself on employing the latest technology in the field.

Have these digital denture workflows changed in the years since?
One of the best features of digital dentures from a training and implementation perspective is that when moving from analogue to digital, the clinical workflow can remain the same. While there are more efficient workflows that allow for greater flexibility, dental professionals who are providing removable prosthetic therapy do not need to change their current workflow when they switch to digital dentures. The biggest change that comes with digital dentures is data acquisition, how the data captured clinically is rendered in the design software, the manufacturing methodology, and the process that supersedes it.

However, for those who want to overcome the challenges of conventional workflows, there are various methods for the delivery of dentures in two appointments rather than the traditional three to five appointments that may be necessary with more conventional methods.

To capture that efficiency, the biggest change we've seen is the process and workflow for immediate dentures. With an intra-oral scanner, dental professionals can scan the patient's oral cavity, render a design and then deliver the dentures at the next appointment when the teeth are being extracted. This technology has been revolutionary both on the clinical side and on the lab side, because we can now digitally visualise where a patient's natural teeth were and where the new teeth will be. This truly provides unparalleled results for the clinician and the patient.

Another revolution of digital denture technology is the ability to deliver the final denture at the try-in stage. In the conventional analogue process, dental professionals have to perform a wax try-in, where all of the teeth are individually set in wax. This is a very labour-intensive and technique-sensitive process that requires extreme care and is prone to human error as well as material deficiencies, which can result in extensive and expensive corrective measures. In contrast, with digital dentures, you can deliver that same quality—or even higher quality—dentures for a fraction of the cost to the clinic and in a fraction of the time at that try-in appointment. Moreover, if the denture isn't completely correct, making adjustments is efficient, effective and predictable by applying the changes via the software with a few keystrokes and mouse clicks.

Today, at our Aspen Dental locations that offer digital dentures, there is an over 80% success rate at that denture delivery appointment. Just think: if you fit 100 dentures a month and 80% of the time you deliver those dentures successfully, you will have gained 80 appointments in your schedule that month. That means new and existing patients aren't waiting as long resulting in an increase in more available chair time that can be used to deliver high quality removable therapy to more patients.

> "For dental laboratory technicians, digital dentures offer consistency in the design process and greater customisation."

What benefits does the digitalisation of the denture process bring for the clinician, the dental laboratory technician and the patient?
First and foremost, the most significant benefit for all three parties is the ability to electronically preserve the patient's initial data acquisition, whether that is a scan of the teeth, dentures or edentulous oral cavity, as well as the preservation of the final design file of the restoration. For the patient, the electronic preservation of that data means that, if a patient loses a denture, a replacement denture can be fabricated within 24–48 hours without having to take another impression or come in for any additional appointments. That's simply not possible with conventional dentures. In addition, digital dentures have greater retention, stability and strength than dentures produced in the analogue manner. It's important to note that digitally manufactured prostheses have a uniform thickness feature that provides the patient with true physiological comfort.

For dental laboratory technicians, digital dentures offer consistency in the design process and greater customisation. For clinicians, the improved workflow, efficiency and accuracy of digital dentures reduce

the chair time needed per denture patient. The use of digital dentures results in fewer postoperative adjustments, thereby freeing up operating chair time for clinicians to provide care to a greater number of patients.

Are there any common obstacles that prevent dental professionals from adopting and integrating digital workflows?

Resistance to change applies in every profession, and the dental industry is no exception. Often, we have reservations about adopting new technologies or techniques because what we've been doing has been working—that if it isn't broke, don't fix it mentality comes into play. There's also some resistance to the cost associated with switching to digital technology as well as the shift from conventional manufacturing to subtractive or additive manufacturing, namely 3D printing. I understand that clinicians are hesitant to work with a technology that uses different materials and manufacturing processes and has financial ramifications. My message to those clinicians would be to try out the technology by providing removable prosthetic treatment to a few patients. Partner with a manufacturing centre or lab that is skilled in digital dentures and do five, ten, 15 cases until you are comfortable with the process and can see the benefits for yourself. Then, it's much easier to make that investment.

> “The biggest change that comes with digital dentures is data acquisition, how the data captured clinically is rendered in the design software and the manufacturing methodology.”

After over a decade in private practice, why did you choose to join Aspen Dental?

Before I joined Aspen, I was an industry leader lecturing at some of the most prestigious conferences in the world, as well as publishing articles, working on various research and development projects and co-authoring textbooks. I truly valued private practice and loved working in research and development and, most importantly, treating patients with removable therapy. Fast-forward to January 2021, when Aspen Dental decided to go digital with its dentures. Dr Sundeep Rawal, the senior vice president of implant support at Aspen and a long-time colleague, asked me to come on board as a consultant to use my skills and knowledge to help shepherd Aspen through the digital transformation. This was a great opportunity, so I agreed. I very quickly fell in love with the organisation, not just because of its commitment to digital technology, but also because I was able to convey my clinical knowledge and skills to our dentists through our various onboarding programmes and learning and development initiatives.

I helped establish the curriculum alongside our vice president of clinical support, Dr Andrew De La Rosa, and when we first delivered the learning programme, I asked every dentist in the room how many dentures they had done in dental school. In the room of 30 dentists, the average had made just two dentures. That’s when I realised, in an organisation where we do half a million dentures a year and someone can graduate and go into an office and do up to 100 dentures a month with very little experience, I could have an enormous impact on hundreds of thousands of patients and hundreds of dentists. Our chief clinical officer, Dr Arwinder Judge, asked me whether I wanted to make a change and come join Aspen Dental full time on the clinical team. Without hesitation, I decided to sell my private practices and join Aspen full time, not just to help lead the digital transformation, but also to improve the quality of the removable prostheses we deliver here at Aspen Dental, irrespective of whether those are produced digitally or using analogue methods. Ultimately, it was the organisation’s mission and the clinical support team that attracted me, but the ability to provide countless dentists, dental technicians and team members with the training they need to deliver the best possible removable prosthetic experience to patients is what made me fully commit to Aspen Dental. I am honoured to be part of the clinical support team here at Aspen Dental and truly changing the way we deliver care to millions of patients every year!

Zero-bake technique: A simplified approach to zirconia aesthetics

An interview with Giuliano Moustakis

By Kuraray Noritake Dental

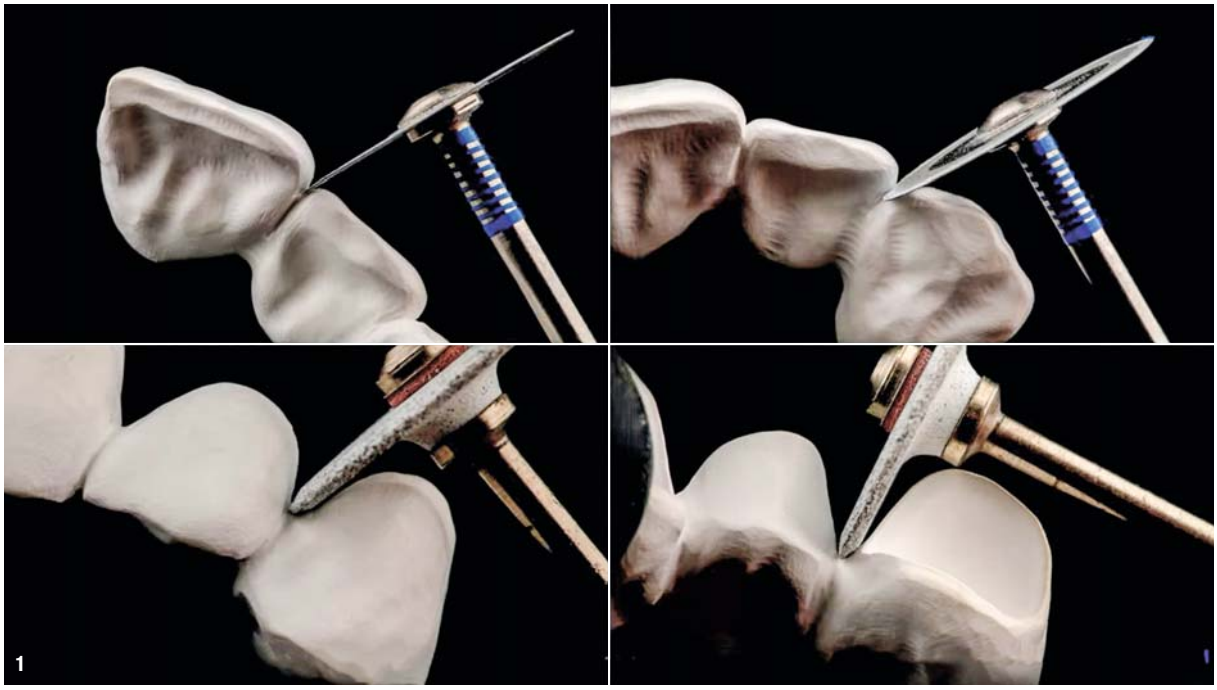

Fig. 1: Working out the details in the interproximal area with rotary disc-shaped instruments.

The percentage of restorations made of zirconia in a monolithic (full-contour) design is steadily increasing. As an enabler of this development, companies like Kuraray Noritake Dental have introduced high-performance zirconia materials with well-balanced optical and mechanical properties, along with innovative finishing solutions. A popular example is KATANA Zirconia YML with its multi-layered flexural strength, translucency and colour structure. Combined with Esthetic Colorant for KATANA Zirconia and CERABIEN ZR FC Paste Stain, it is very well suited for a simplified approach to zirconia aesthetics: the zero-bake technique. In this interview, we had a conversation with dental technician Giuliano Moustakis about its benefits and areas of application.

Mr Moustakis, why is there a need for a new technique related to the finishing of monolithic zirconia restorations?

Like many users of restorative materials, I truly believe that the trend towards monolithic zirconia restorations is here to stay. The reason is that there is a huge number of patients who place great value on high-quality dental treatments, but have a limited budget. Many of them are interested in metal-free restorations that blend in nicely with the surrounding dentition and are able to withstand the test of time. Reasonable cost is more important to them than highest-end aesthetics. The new materials available on the market allow us to produce restorations with the desired properties, but we need to think about how to combine them in the most effective way to be able to respond to patients' demands, including the financial one.

Please would you describe the zero-bake technique?

This technique is based on a monolithic restoration design carried out in the preferred design software. In this step, it is important to focus on a natural surface morphology—about 80% of the morphology is realised in the digital manufacturing procedure. After milling, some morphological details (the last 20%) are added with hand instruments. My personal set of instruments consists of two kinds of diamond discs

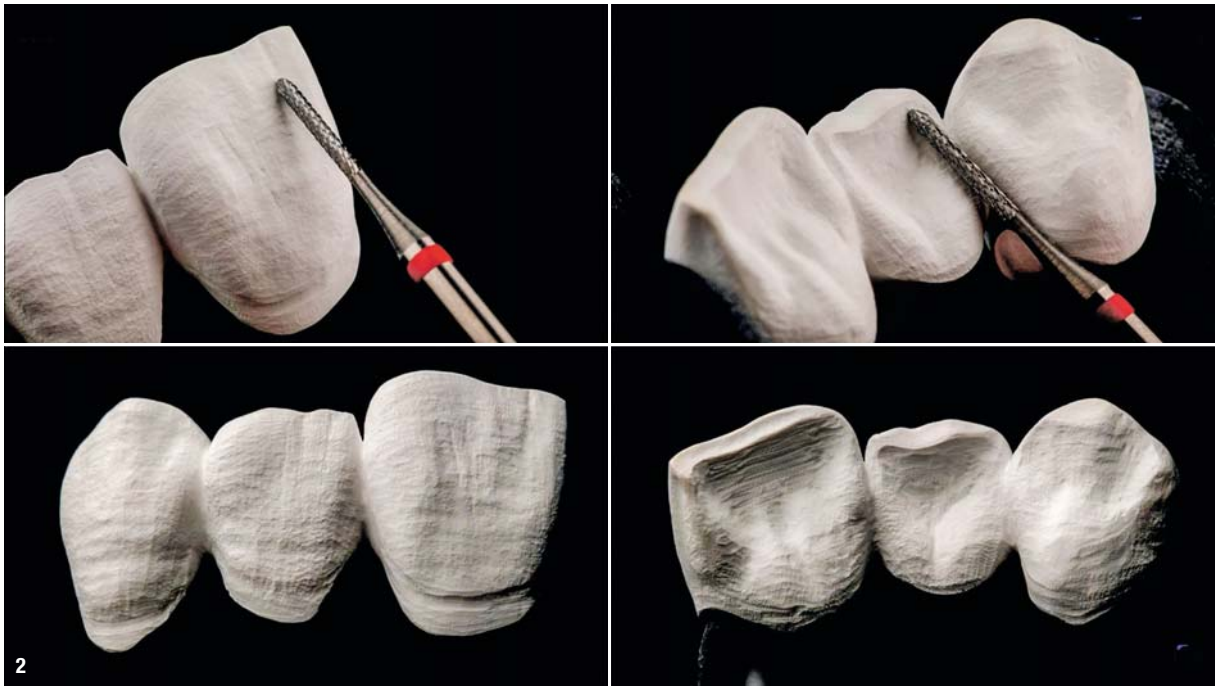

Fig. 2: Integration of the micromorphology with a round-ended straight carbide bur.

used for the interproximal areas of bridges (with virtually no pressure), a round-ended straight carbide bur (fine), Panther stones and a zirconia-blade carving instrument. However, any set of instruments that feels comfortable in the hands of the user may be selected for this task. Taking into account the volumetric shrinkage during sintering and the final polishing and glazing, the structure created is ideally slightly over-contoured and clearly defined. It is definitely worth investing time in this preparatory step, as it will make our work much easier later in the process. After surface texturing, selected colours of Esthetic Colorant for KATANA Zirconia—specific dyeing liquids designed for the imitation of natural optical effects—are applied to the surface.

Do you have any recommendations on how to proceed with this set of liquids?

Just follow the colour reproduction of the adjacent natural teeth. With Esthetic Colorant, we want to create

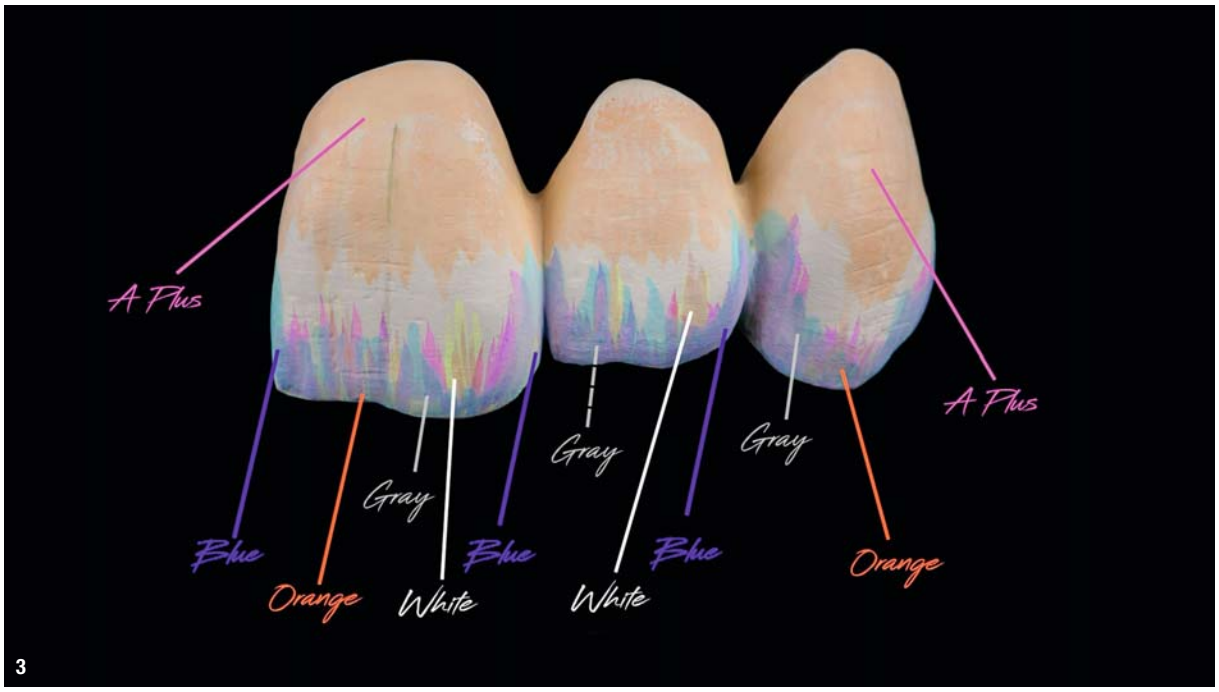

Fig. 3: Basic chromatic map for individualisation in the anterior region.


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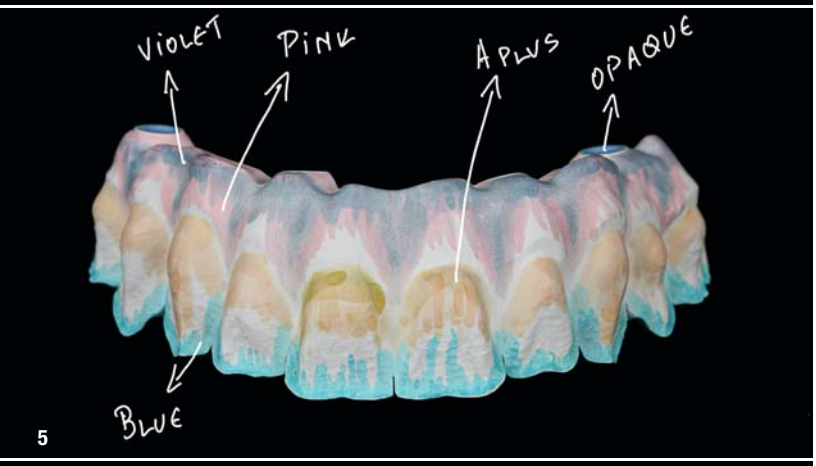

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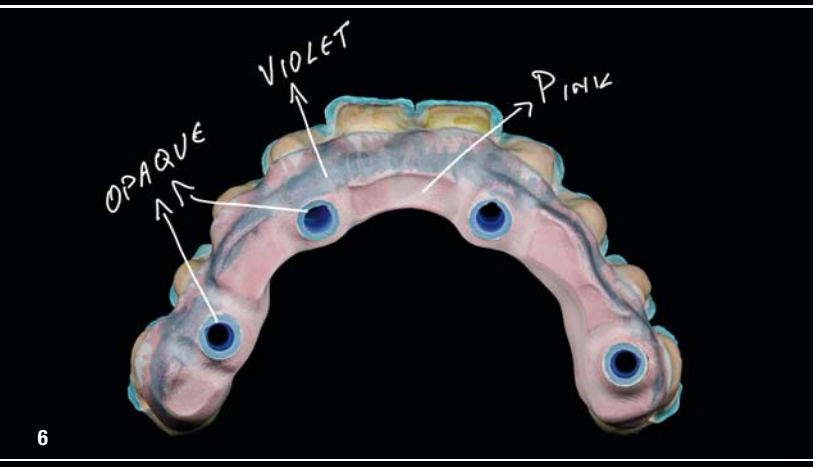

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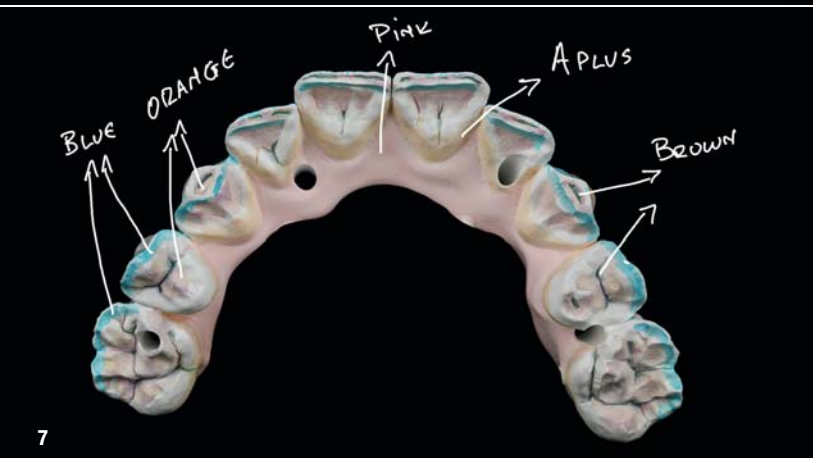

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beautiful illusions, and nature is our best source of inspiration. To be able to copy what we see, however, we need to understand the properties and behaviour of the materials we are using. Consequently, I strongly recommend testing them extensively, for example practising on remnants of zirconia blanks before moving on to real patient cases. The duration of the testing period should depend on the outcomes, which should be highly predictable by the time the materials are used in the first patient case. I experimented and practised with Esthetic Colorant for about six months and used it in the first case after one month of practising.

Nowadays, there are five effect liquids which I use on a daily basis in almost every case:

1. A plus—used mainly in the vestibular cervical and palatal cervical and mamelon areas to increase the chroma of A dentine shades;
2. BLUE—used to reproduce the bluish enamel colour found in the area of the incisal edges and occlusal cusps;
3. GRAY—used (often in addition to BLUE) to reproduce the greyish enamel colour found on the incisal edges and occlusal cusps;
4. ORANGE—used to give an orange appearance to the cervical area and to intensify the contours of the mamelons; and
5. BROWN—used to reproduce the dentine colour in the cervical area and to darken the colour in the main groove.

In addition, there is a liquid with a special function I value highly: OPAQUE. This modifier liquid is applied on the intaglio surface of a restoration to mask discoloured or metal abutments. In order to intensify the effects of this and other liquids, they may be applied to a single spot up to three times.

How do you apply Esthetic Colorant, and what are the steps that follow once you have applied the liquids?
For application, I use the dedicated Liquid Brush Pen for Esthetic Colorant. It allows for a controlled application of the desired amount of liquid and thus supports predictable outcomes. Once all Esthetic Colorant liquids have been applied, it is essential to dry the zirconia at a temperature between 80 and 200 °C for a minimum of 30 minutes. During application of the liquids and drying, any contact with metal must be prevented. Therefore, the brushes used during application must be metal-free, and the same holds true for the tray. By adhering to this rule, discoloration is effectively prevented. The subsequently selected sintering

Fig. 4: Restoration after sintering. **Fig. 5:** Frontal view of a complex restoration, including gingival parts, with information on where to apply which shade of Esthetic Colorant. **Fig. 6:** Basal view of the restoration with OPAQUE applied to mask the screws and VIOLET and PINK to add colour to the gingival parts. **Fig. 7:** Occlusal view with colour recommendations.

Fig. 8: Example of a dentine core restoration. The surface morphology was refined with a Panther stone.

protocols are not affected by the effect liquids—and this is true for all types of zirconia from the KATANA Zirconia Multi-Layered series. Once sintered and cooled, the surface of the restoration is finished with a set of polishing instruments. My tip in this context is to be careful not to destroy the micromorphology created in the pre-sintering step. To add the final gloss and natural fluorescence, the surface is treated by sandblasting for the application of CERABIEN ZR FC Paste Stain, fixed in a single glaze firing procedure.

Does the technique also work without glazing?
Yes, it is definitely possible to do without this step. In that case, however, the restoration will not offer a fluorescent effect. Whenever a restoration is finished without glazing, the surface must be perfectly polished. If completely smooth, the hardness of the material will not cause any harm to the opposing dentition.

What are the main indications for the zero-bake technique?
Personally, I use it most often in the context of complex restorations and in the posterior region, especially when the available space is limited. It allows for minimal wall thicknesses, and the surface is—when well polished—more antagonist-friendly than a lithium disilicate surface. In other cases, and depending on budget, digitally produced dentine core crowns are a great option. The dentine core is milled from KATANA Zirconia YML and the enamel added using CERABIEN ZR Luster porcelains. Esthetic Colorant, CERABIEN ZR Internal Stains and CERABIEN ZR FC Paste Stain may be added for individual effects. Compared with traditional full porcelain layering, this concept is quicker, involves a lower shrinkage, offers a high stability due to the specific framework design and requires a thinner wall thickness (e.g. 0.6 mm dentine core plus 0.6 mm porcelain).

Why is it important to develop new design and finishing concepts nowadays?
To my mind, a lack of time is the greatest issue of modern dental technology. Owing to a lack of skilled personnel and an expected decrease in the number of dental laboratories in many countries around the globe, we have to keep looking for concepts that help us reduce the time pressure and make our work easier. While simplifying procedures, however, we need to provide for the same or even higher-quality outcomes. This is exactly what I wanted to achieve when starting to develop the zero-bake technique. My personal gain is more free time.

Why do you share your ideas with others by working as an instructor and lecturer?
I simply enjoy interacting with my peers, equipping them with knowledge and helping them benefit from good ideas.

about

Giuliano Moustakis has more than 30 years of expertise as dental technician. He was born in Greece but currently resides in Germany, where he has a laboratory in Falkensee. He studied dental technology in Athens in Greece and over the years has completed further studies in Germany and Japan, including the maxillofacial prosthetic technician programme of the International Association for Surgical Prosthetics and Epithetics, advanced education in functional diagnostics of the temporomandibular joint and the implant prosthetics curriculum for dental technicians of the Deutsche Gesellschaft für Zahnärztliche Implantologie (German association of dental implantology). He has been a global instructor at Kuraray Noritake Dental since 2019.

Extremely minimally invasive mock-up-guided veneer preparations in the aesthetic area

Dr Alessandro Pezzana, Italy

Fig. 1a: Initial situation. Teeth in intercuspal position, frontal view. **Fig. 1b:** Initial situation. Teeth in protrusion, frontal view.

This clinical case describes an aesthetic approach to the anterior dentition using veneers. The differential thickness of each veneer was obtained on the basis of extremely minimally invasive preparations. Such preparations are less invasive for enamel integrity than veneer preparations carried out directly on the tooth. The controlled preparations were carried out using a working mock-up created on a wax-up that closed the diastemas between the anterior teeth.

Case report

A 25-year-old male patient came to the practice to resolve an aesthetic problem regarding the anterior dentition, namely the gaps between his teeth. This had become such a problem for him that he avoided showing his teeth in photographs. He had high aesthetic expectations of treatment and desired complete closure of the anterior diastemas.

The patient was in good general health and did not report any medical problems. He was certain that his oral hygiene was good, which was supported by the fact that he did not have any caries.

Records and diagnosis

An intra-oral physical examination, vitality test and probing were conducted, periapical radiographs were taken and initial tooth colour was assessed. There were no signs or symptoms of periodontal disease. The patient had previously had orthodontic treatment requiring the extraction of the third molars. At the time of the appointment, the patient had excellent Class I canine and molar occlusion. The maxillary arch presented with a diastema and further gaps between the central and lateral incisors. The diagnosis was diastemas after orthodontic therapy.

Treatment plan

The treatment method adopted aimed to afford better conservation of the dental tissue than is possible with conventional veneer preparation performed directly on the tooth. This extremely minimally invasive approach

Fig. 2: Initial photograph showing a detail of the maxillary arch. **Fig. 3:** Occlusal photograph of the anterior sextant.

would be achieved with a mock-up for advanced aesthetic dentistry permitting controlled preparation, that is, preparation that is calibrated on the different thicknesses of the mock-up. This basis would be used to create semi-indirect veneers for space closure (Type IIB veneers according to Magne and Belser).[1]

Treatment

During the first appointment, photographs (Figs. 1–3) and alginate impressions of the dental arches were taken. After photographic study of the case, the necessary aesthetic and functional corrections were performed by means of an analogue diagnostic wax-up phase. The wax-up was transferred to the patient's mouth in the form of a mock-up that he tested in his mouth for a few days prior to the operative session. At the following appointment, this was used as a working mock-up for calibrated preparation, that is, a mock-up-guided approach for extremely minimally invasive, controlled tooth reduction.

To simulate the final result as already seen with the analogue wax-up as accurately as possible, the waxed-up model was scanned.[2] For moulding the mock-up from the wax-up (Figs. 4a & b), a silicone index was created on the wax-up (Fig. 4c). Composite (Structur 3, VOCO) was injected into this silicone key to create the mock-up. The diagnostic mock-up was temporarily cemented (Provicol QM Aesthetic, VOCO) in the patient's mouth for a few days until the operative session.

At the next appointment, the mock-up took on the role of a working guide for controlled preparation. Controlled-thickness reduction grooves were made in the mock-up for orientation, as they were used to determine the depth of the preparation and thus the desired material thickness of the veneers (Fig. 5). For providing clear orientation, the guiding grooves were marked with a pencil (Fig. 6). Where the residual mock-up remained, the tooth was intact (extremely minimally invasive preparation). Only in the areas where the mock-up had been completely ground down was there an effective preparation of the tooth structure (Fig. 7). Compared with conventional veneer preparation, for which the dentist grinds the tooth structure directly from the beginning, this procedure allowed for much more conservative tooth reduction. It was decided not to intervene in the lateral and protrusive movement.

The first step was to perform window or Walls, Steele and Wassell Type A preparations,[3] meaning that the preparations were only carried out on the vestibular aspect, without finishing margins and without any reduction of the incisal edge. However, an incisal butt joint margin was carried out to cover the incisal edge without any vertical reduction in the palatal area. It has been shown that such a covering of the incisal edge achieves a higher survival rate than preparations with a palatal chamfer.[4,5]

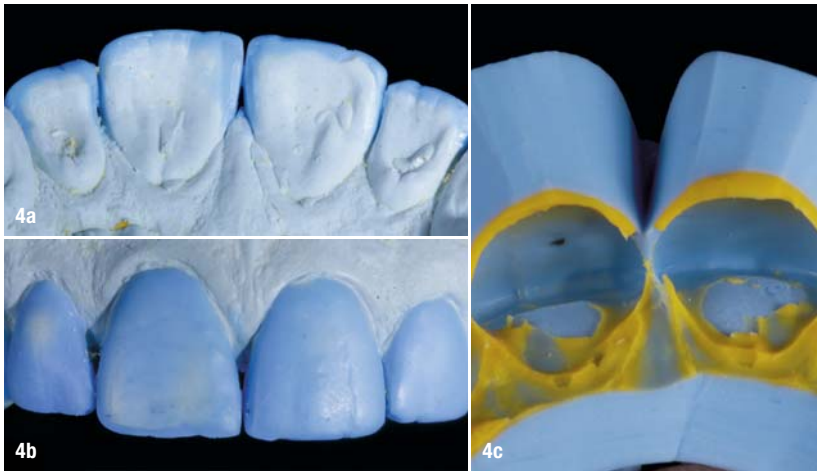


Fig. 4a: Analogue wax-up on the gypsum model, palatal view. **Fig. 4b:** Analogue wax-up on the gypsum model, vestibular view. **Fig. 4c:** Silicone index for moulding the mock-up in composite for the provisional restoration.

Fig. 5: Operative phase in which the mock-up acted as a guide for highly conservative, controlled preparations. **Fig. 6:** Guide grooves marked with pencil for calibrated preparation primarily on the composite. **Fig. 7:** Mock-up removed with pencil marks where the preparation would continue directly on the tooth (sacrificing the mock-up spared healthy hard tissue).

Fig. 8a: Completed extremely minimally invasive preparations without finishing lines ready for digital impression taking. **Fig. 8b:** First veneer fabricated by digital milling.

Once the final preparations had been obtained (Fig. 8a), they were scanned, initiating the digital phase of the workflow that ended with the fabrication of the veneers using a CAD/CAM milling unit (M2 Teleskoper, Zirkonzahn). The veneers were made of a highly filled nano-ceramic hybrid material (Grandio blocs, Shade A2, low translucency; VOCO; Fig. 8b).

Once they had been cleaned, the prepared teeth were rinsed thoroughly and dried with a gentle jet of compressed air. The veneers were inserted carefully by exerting slight pressure. The chromatic effect met the expectations of both the patient and the clinician (Figs. 9 & 10). Before being finished and polished, the veneers created using CAD/CAM technology underwent chromatic characterisation so that the pigmentation (FinalTouch, VOCO) was fixed under this thin layer of composite.

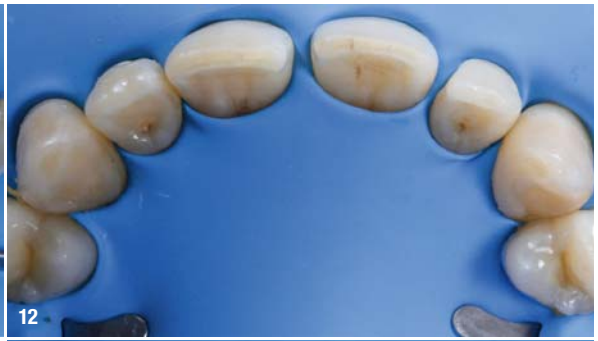
The dental dam used to obtain isolation was secured using special cervical clamps for incisors (clamp #212, Hu-Friedy; Figs. 11 & 12). This was followed by proper adhesive priming of the surfaces to be luted to one another (inner surfaces of the restorations and surfaces of the prepared teeth). As a protective measure in view of the subsequent clinical steps, the adjacent surfaces that were not to be covered were isolated using PTFE tape.

The tooth surfaces were then conditioned, first by pretreatment with glycine powder, which through micro-abrasion increases the retentive potential of the bonding (Fig. 13). Etching was then performed using 35% orthophosphoric acid (Vococid, VOCO) for 20 seconds (Fig. 14). The acid was then removed by suction and rinsing for 20 seconds, and the surface was dried with compressed air to obtain a matt chalky white appearance. The universal adhesive (Futurabond U, VOCO) was applied and gently rubbed for 20 seconds using a brush (Single Tim, VOCO; Fig. 15). The solvent was then evaporated thoroughly with compressed air for at least 5 seconds to obtain a thin, immobile and shiny layer of adhesive, which was polymerised from various directions using a high-power LED curing light (Celalux 3, VOCO) for 10 seconds each time, in accordance with the manufacturer's instructions. This created a matt–shiny preparation surface that was evenly coated with adhesive.

"The working mock-up ensures greater thickness control of the veneers before proceeding with the precision impression for the digital design of the final veneers."

For the pretreatment of the inner surfaces of the veneers, abrasive sandblasting with 25–50 µm particles of aluminium oxide was performed at 1.5–2 bar pressure, and a silane adhesive coupling agent (Ceramic Bond, VOCO) was applied and left to act for 60 seconds and then dried for 5 seconds. The veneers were finally cemented using a dual-polymerising universal luting composite (Bifix QM, VOCO; Fig. 16). The veneers were inserted (Fig. 17) and fixed by means of polymerisation at marginal level using a Celalux 3 mesially and distally from the vestibular side, followed by mesial and distal polymerising from the palatal side. In order to avoid an oxygen inhibition layer and thus avoid poor polymerisation,

Fig. 9: Veneer fit test. **Fig. 10:** CAD/CAM veneers after characterisation, finishing and polishing.



a glycerine gel was applied to all margins prior to polymerisation (Liquid Strip, Ivoclar). By means of this oxygen inhibition gel, a significant improvement of the adhesive margins could be achieved. The glycerine was rinsed off, and at the end of the setting time of approximately 3 minutes, it was then possible to proceed with elimination of the excess material using a metal instrument and dental floss, interproximally. The interproximal contact zones were finished using abrasive strips. After checking the occlusion and making corrections in accordance with conventional functional concepts, normal finishing and polishing was performed using diamond polishers (Dimanto, VOCO). The patient was completely satisfied with the significant improvement in his smile (Figs. 18–22).

Discussion

Based on an analysis of the scientific literature concerning the closure of anterior diastemas, a semi-indirect approach using nano-hybrid composite veneers was chosen.[6] The clinical indication of diastema closure classifies the veneers used for this case as Type IIB according to the Magne–Belser classification.[1] Since feldspathic ceramic veneers were outside the patient's budget, such an indirect technique was ruled out. The direct layering technique was ruled out because the patient had high aesthetic expectations. It was decided to use veneers

Fig. 11: Isolation of the operative field using a dental dam, frontal view. **Fig. 12:** Isolation of the operative field using a dental dam, occlusal view. **Fig. 13:** Isolation using PTFE and appearance of the sandblasted surfaces. **Fig. 14:** Orthophosphoric acid etching of a substrate that was still enamel thanks to the extremely minimally invasive approach adopted. **Fig. 15:** Application of the adhesive luting agent to the surfaces to be bonded. **Fig. 16:** Bifix QM luting system (VOCO) applied to the tooth #21 stump and PTFE tape covering the adjacent teeth. **Fig. 17:** Insertion of the veneers.

Fig. 18: Final result, frontal view. **Fig. 19:** Final result, right lateral view. **Fig. 20:** Final result, left lateral view.

on both the central and the lateral incisors, as this would make it possible to obtain more harmonious relative dimensional proportions.

The wax-up must first be transferred to the mouth in the form of a provisional prototype with a dual clinical function as a diagnostic mock-up for aesthetic and functional aspects and as a working mock-up for calibrated preparation, that is, a guide for controlled, extremely minimally invasive tooth reduction.[7] The diagnostic mock-up is the composite provisional restoration for the usual in-mouth fit test, and it allows immediate and effective communication with the patient and makes it possible to test in-mouth tolerability for a few days prior to the operative session. These prototypes fitted on the individual teeth have a wow effect on patients, as they provide an in-mouth preview of the aesthetic results to be achieved. In the initial stages of tooth preparation, the working mock-up for controlled preparation is calibrated based on the physical dimensions of the mock-up. With controlled preparation, the provisional restoration is gradually destroyed, resulting in a far more minimally invasive preparation than that performed directly on the tooth. Using special calibrated burs, this preparation ensures the most enamel-sparing thicknesses possible and the highest aesthetic and functional characteristics. The working mock-up ensures greater thickness control of the veneers before proceeding with the precision impression for the digital design of the final veneers. The adhesive protocols described were compared with authoritative sources (Magne)[8] and with recent literature (Blatz et al.).[9]

Fig. 21: Teeth in intercuspal position one year after the treatment, frontal view. **Fig. 22:** Teeth in protrusion one year after the treatment, frontal view.

Conclusion

Full patient satisfaction was achieved. The success of the treatment was due to the combination of two factors: minimal tooth preparation and complete closure of the diastemas without adverse repercussions on shape, proportions or chromatic integration.

This case has demonstrated that less is better. Indeed, mock-up-guided veneer preparations reduce the biological sacrifice of the tooth to a minimum while guaranteeing function and maximising the long-term aesthetics. This approach also demonstrates how conventional and digital workflows can be combined effectively.

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about

Dr Alessandro Pezzana graduated in dentistry from the University of Turin in Italy in 2012. Since 2013, he has been practising in his own practice, Studio dentistico Pezzana e Togno, in Omegna in Italy. He also teaches and researches aesthetic and adhesive dentistry at the University of Turin. Dr Pezzana's areas of expertise are aesthetic restorative dentistry, endodontics and dental photography. He can be contacted at alessandro.pezzana@hotmail.it.

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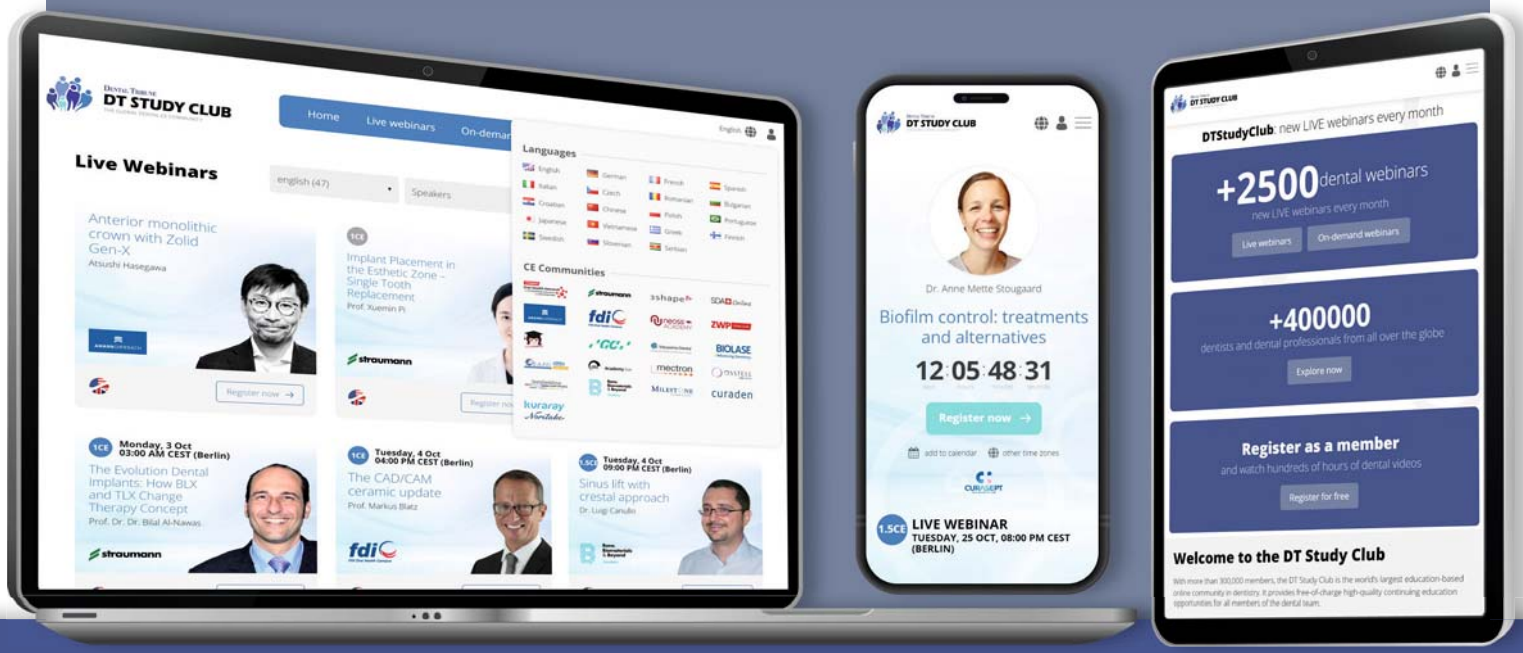

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Restoration of a fractured ceramic crown with a digital workflow

Dr Joseph Sabbagh, Lebanon

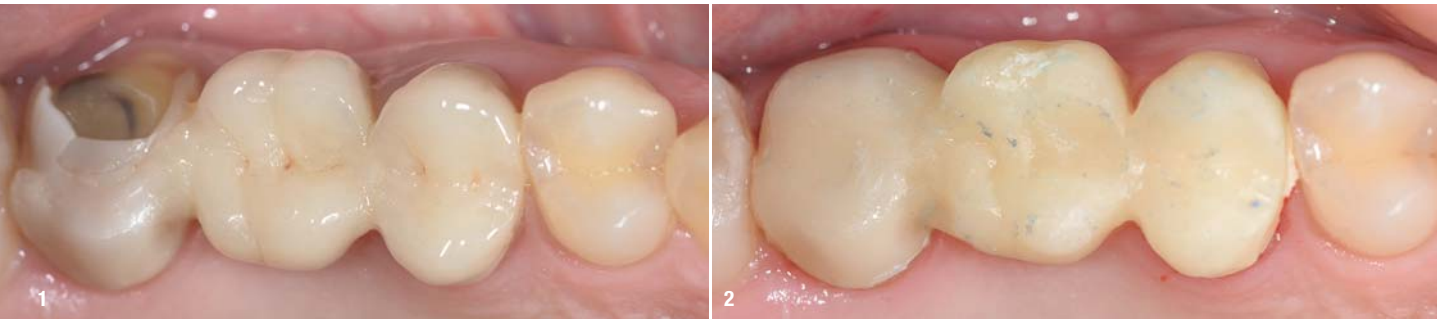
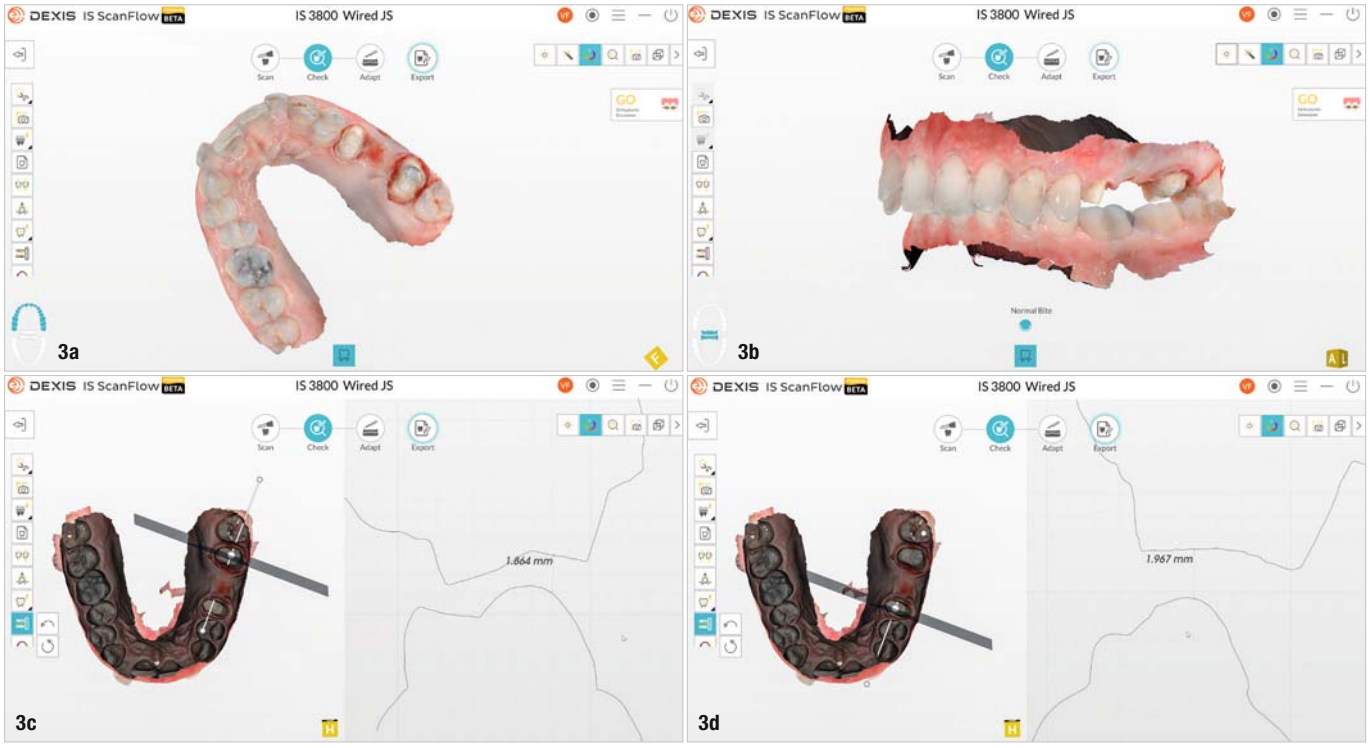


Fig. 1: Pre-op view of the fractured ceramic crown. **Fig. 2:** Placement of a temporary resin bridge.

The following case presents the restoration of a fractured ceramic crown with a three-unit bridge using a digital workflow. A 38-year-old female patient presented to our dental practice complaining of discomfort in the maxillary left area. The clinical examination revealed a fractured ceramic crown on the posterior abutment (tooth #27) of a three-unit bridge (from tooth #25 to tooth #27) placed seven years earlier by her previous dentist (Fig. 1).

The first step was to remove the old bridge and to check the abutment preparation. A temporary resin bridge was placed with Temp-Bond (Kerr; Fig. 2).



Figs. 3a–d: Digital impression taking with the intra-oral scanner.

Figs. 4a–d: 3D-printed models with the new layered zirconia bridge. **Fig. 5:** Internal and external surfaces of the zirconia bridge. **Fig. 6:** Post-op view of the cemented restoration.

One week later, a digital impression was taken using an intra-oral scanner (DEXIS IS 3800; Fig. 3) and sent via the DEXIS IS Connect platform to the dental laboratory. In the laboratory, the design and milling of a new zirconia bridge were performed.

Four days later, the new layered zirconia bridge was sent to the practice along with 3D-printed models (Fig. 4). The final zirconia bridge emphasises the quality and precision of a digital workflow (Fig. 5).

After the try-in, the final restoration was cemented in the mouth using glass ionomer cement (Fuji I, GC). Six weeks later, the patient came back for a postoperative check-up, during which perfect contact points and good adaptation with the soft tissue were seen (Fig. 6).

This case demonstrates the successful integration of cutting-edge dental technology, precise craftsmanship and meticulous care in providing our patient with a durable, functional and aesthetically pleasing zirconia bridge, ultimately improving her oral health and comfort.

Editorial Note: Please scan this QR code for more information about digital workflow with DEXIS.

about

Dr Joseph Sabbagh obtained his master's degree in restorative dentistry and his PhD in biomaterials from the Université catholique de Louvain in Belgium. He worked as an associate professor at the Faculty of Dental Medicine of the Lebanese University in Beirut in Lebanon for a number of years and now practises in Beirut and Brussels in Belgium. Dr Sabbagh is active in clinical and *in vitro* research, having a particular interest in biomaterials, aesthetic dentistry and endodontics, and has had over 25 scientific papers published in indexed journals. He is a member of various associations and boards.

Endocrowns milled from CAD/CAM composites for high strength and flexibility

Drs Lucas J. Echandia & Martin I. Ibañez, Argentina

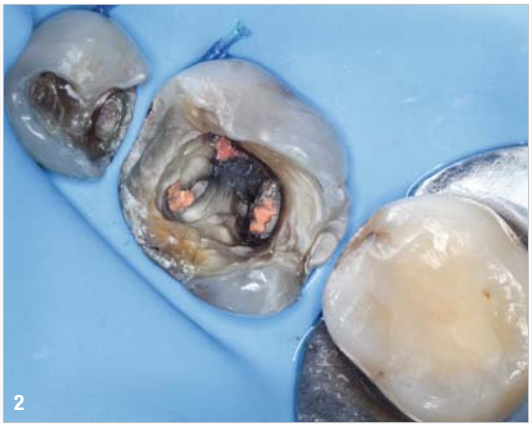


Fig. 1: Initial situation: failure of periodontal anatomical integrity due to overcontoured amalgam filling in tooth #45, and cracked and lost amalgam on tooth #46. **Fig. 2:** Dental dam isolation for removal of the old restoration from tooth #45 using ultrasonic instrumentation. **Fig. 3:** Matrix system positioned for correct adaptation of the margin on tooth #45.

Introduction

In the case described in this article, the patient benefited from the innovative clinical use of a high-quality milled composite material (Grandio blocs, VOCO) for indirect restorations in the posterior sector. The advantages over direct restorations described here are better aesthetic results, flexibility and easy handling without any of the usual inconveniences, such as volume shrinkage, air bubbles between the increments or incomplete polymerisation.

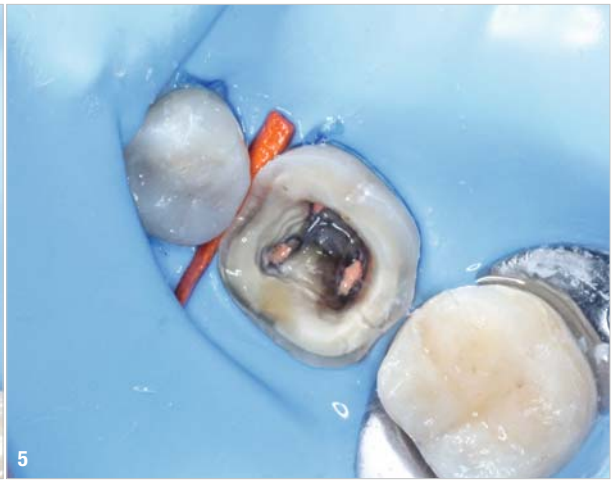


Fig. 4: Building the distal wall to convert the cavity from a Class II to a Class I configuration. **Fig. 5:** Completed filling with Grandio.

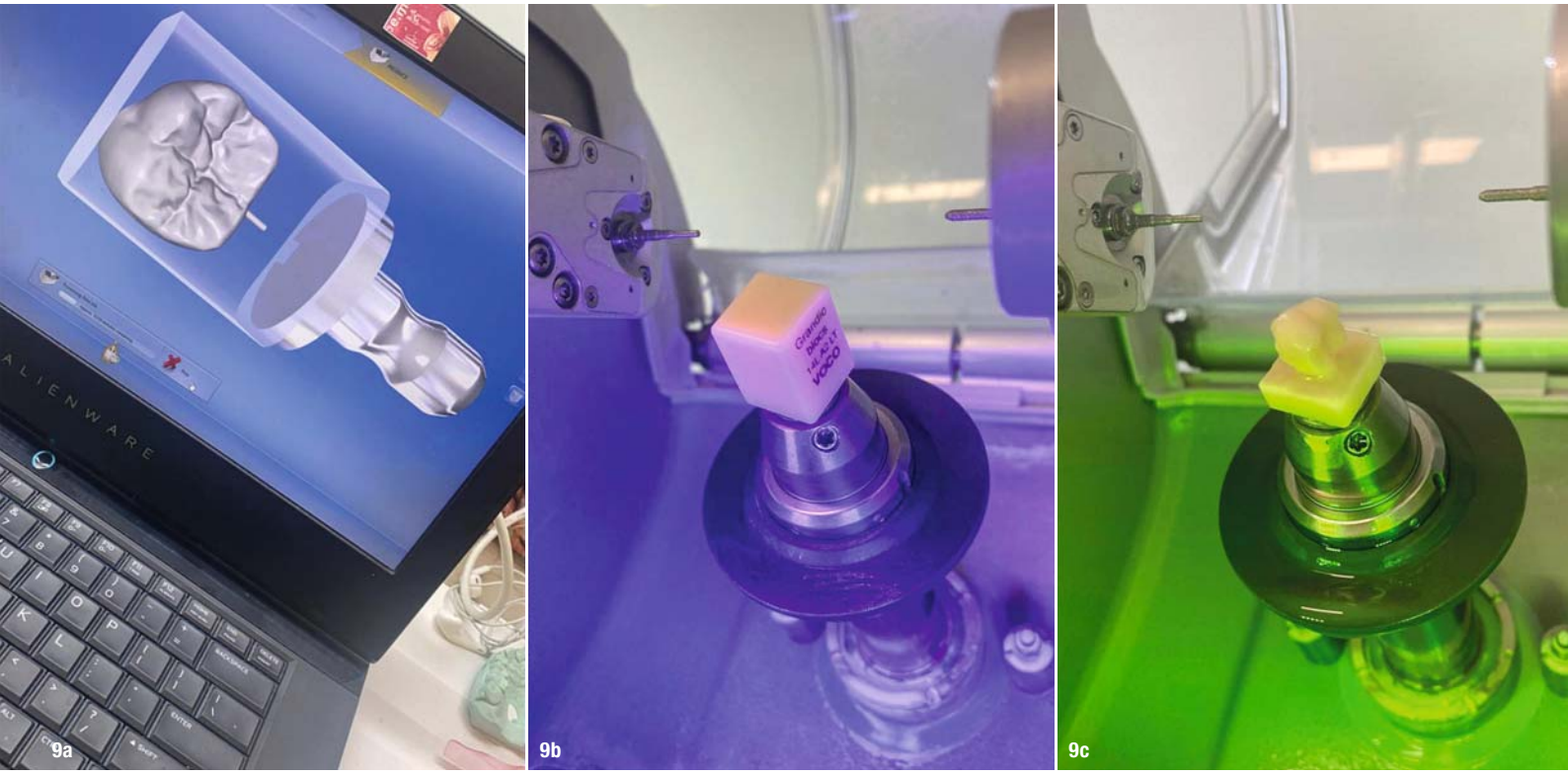
Fig. 6: Occlusal view of the pulp chamber and cavity after preparation for the milled endocrown. **Fig. 7:** Tooth #46 before the intra-oral scan. **Fig. 8:** Clip F temporary filling to allow the patient to rest during the milling process.

Case presentation

Case history

A 58-year-old female patient came to the dental practice for a routine dental appointment and had lost an amalgam restoration the previous day. The patient was apparently in good health and had no systemic conditions. Her dental history revealed that about 16 years previously root canal therapy had been performed on tooth #46, and the tooth had subsequently been treated with an amalgam filling. Pointing to the tooth, she said that she must have broken the tooth and lost a little piece of it the day before. When asked whether she had any symptoms, she replied that she had no complaint regarding any of her teeth.

> "The advantages over direct restorations described here are better aesthetic results, flexibility and easy handling [...]."



Figs. 9a–c: Creation of the CAD for the endocrown **(a)**. Grandio blocs A3 LT block ready for milling **(b)**. Endocrown milled from Grandio blocs **(c)**.

Fig. 10: Final endocrown upside down. **Fig. 11:** Final endocrown after chromatic characterisation of the occlusal grooves and fissures with FinalTouch and subsequent polishing.

The patient wished to receive a clear explanation of the reason for her clinical problem and subsequent treatment. She then asked for an aesthetic and functional restoration in the shortest time possible.

Records and diagnosis

Radiographically, no carious lesions were detected. The periapical radiograph of tooth #46 showed a relatively non-homogeneous endodontic filling characterised by poor condensation and incomplete apical sealing because the gutta-percha did not fill the whole circumference of the apical foramina. Nevertheless, this tooth had been asymptomatic for 16 years, so it was decided not to opt for endodontic retreatment. The radiograph also showed an overcontoured filling in tooth #45.

The clinical examination revealed an amalgam filling over the asymptomatic root of tooth #46 and the overcontoured amalgam filling in tooth #45, which had facilitated inflammatory and hyperplastic changes to the surrounding gingival margin, and tooth #46 had lost several coronal areas of the residual hard tissue and most of its lingual wall and presented with some microcracks on the residual surface (Fig. 1). Tooth #45 did not show any clinical symptoms on the pulp vitality test.

The diagnosis concluded:

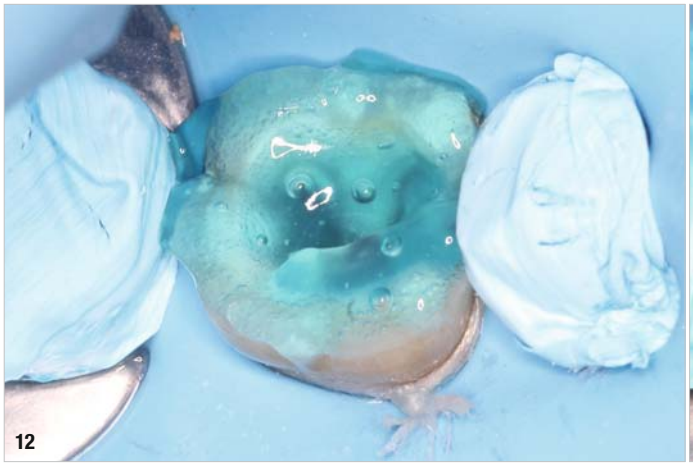
- endodontic underfilling in tooth #46;
- fractured dental restorative material with loss of material on tooth #46;
- various enamel cracks on tooth #46;
- contour of the existing restoration of tooth #45 biologically incompatible with oral health; and
- marginal overcontouring of the filling in tooth #45.

Treatment steps

The main therapeutic objective was rehabilitation of function and aesthetics with a direct restoration (replacement of the amalgam filling in tooth #45, since the tooth was vital) and an indirect restoration (endocrown on tooth #46). The secondary objective was to avoid multiple appointments.

After the removal of the old fillings and isolation with a dental dam (Nic Tone) to achieve a dry working field, the treatment was performed on the two teeth (Fig. 2). A W8 clamp hook (Hu-Friedy) was used to keep the dental dam in place. The sectional matrix was stabilised along the axial distal wall of the cavity of tooth #45 using Unimatrix R (TDV Dental; Fig. 3).

For the adhesive preparation of tooth #45, Vococid 35% phosphoric acid gel (VOCO) was used to perform a



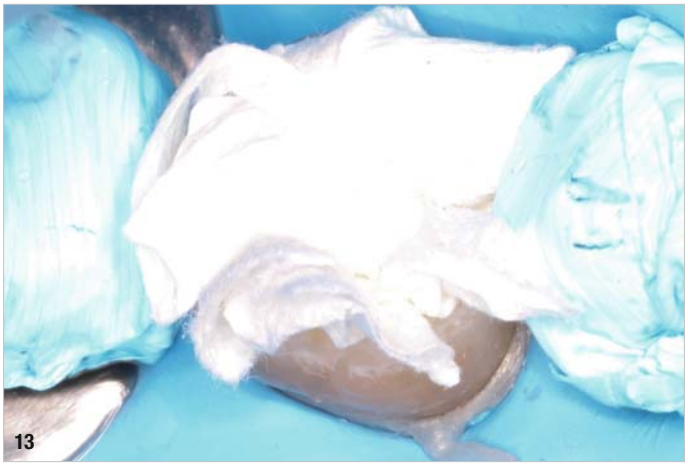


Fig. 12: Total etching of both enamel and dentine with a 37% phosphoric acid gel. **Fig. 13:** Drying of tooth #46 with absorbent paper strips instead of airflow to avoid overdrying of the dentine.

selective-etching technique on the enamel. The precautionary etching step was followed by application of the adhesive agent Futurabond U (VOCO), which was applied to both the enamel and dentine.

The direct restoration of tooth #45 used the light-polymerising, nano-hybrid composite Grandio. We rebuilt the distal wall, initially with Grandio, in order to convert the Class II configuration into a Class I cavity design (Fig. 4). This strategy was chosen to make the handling of the proximal and occlusal filling easier. To achieve this, a regular incremental layering technique was used (Fig. 5). Finally, we performed finishing and polishing of the occlusal surface of tooth #45.

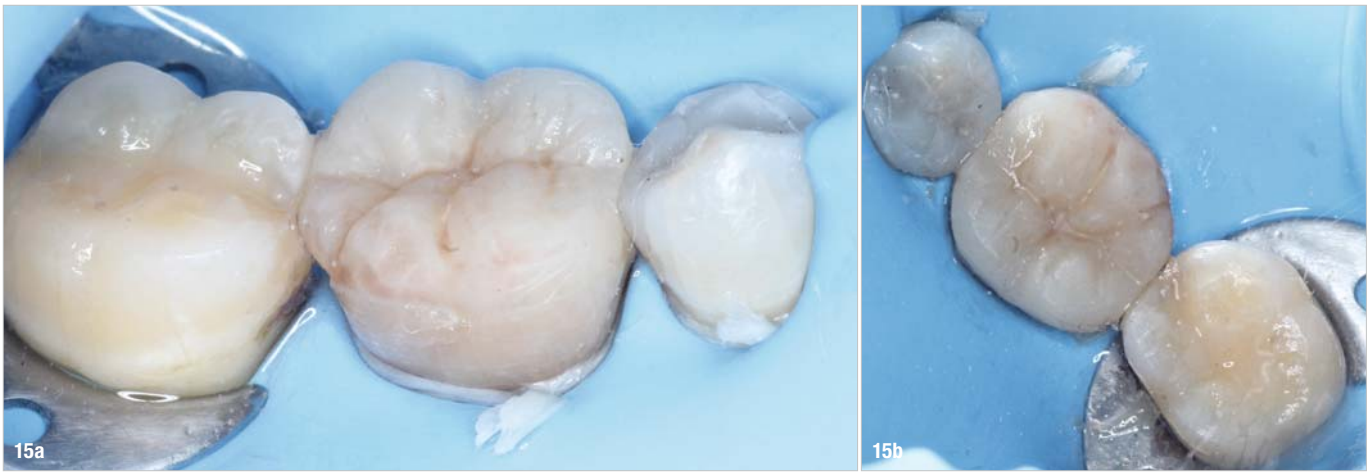
For the endocrown on tooth #46, we first revised the pulp chamber using ultrasonic tips (Helse Ultrasonic) and then the tooth cavity with various rotary instruments. We performed minimal shoulder preparation in accordance with the conventional rules for ceramic restorations, avoiding undercuts and preserving minimum thicknesses (Fig. 6). An intra-oral scan of the revised surfaces was performed with the TRIOS intra-oral scanner (3Shape; Fig. 7). After that, a temporary filling with Clip F (VOCO) was prepared for the time needed for chairside manufacture of the indirect restoration (Fig. 8).

The next step was the creation of the digital design for the endocrown with inLab CAD Software (Dentsply Sirona) and 10-minute endocrown fabrication using a low-translucency Grandio blocs block (A3 LT) processed with the CEREC MC XL milling machine (Dentsply Sirona; Fig. 9). After the endocrown had been milled (Fig. 10), it was pretreated and chromatic characterisation was performed with FinalTouch characterisation material (VOCO) for a more natural result.

Fig. 14: Securing the endocrown by applying slight pressure allowed excess luting material to ooze out at the preparation margins.

According to the manufacturer's instructions for use, since Grandio blocs is made of a nano-hybrid composite, there is no indication for etching with hydrofluoric acid or phosphoric acid. Instead, the pretreatment was performed with 25–50 µm aluminium oxide particles to sandblast the inner surfaces of the restoration to be luted and the occlusal grooves and fissures for subsequent chromatic characterisation. The oxide dust produced was removed using a suction device, and an ultrasonic bath was used to clean the pretreated restoration, which was then dried with oil-free air, followed by final cleaning with medical alcohol (optional).

After pretreating the occlusal grooves and fissures and the application of Futurabond U, a maximum layer



Figs. 15a & b: Light polymerisation after removal of the excess luting material.

Fig. 16: Astonishing results with excellent marginal adaptation and aesthetics. **Fig. 17:** Occlusal adjustments and articulation confirming the astonishing results.

thickness of 0.5 mm of FinalTouch was applied over these areas. Light polymerisation was performed with the Celalux 2 LED curing light (VOCO) for 20 seconds, followed by finishing and polishing of the indirect restoration with diamond polishers (Dimanto, VOCO; Fig. 11).

New isolation of the working field was performed and the temporary filling removed to prepare tooth #45 for cementation of the endocrown. Total etching of both the enamel and dentine with a strong (37%) phosphoric acid gel (Etch-37, BISCO) was performed (Figs. 12 & 13).

The inner surface of the restoration was then silanised for 60 seconds using a brush wet with the silane coupling agent Ceramic Bond (VOCO) and then gently dried with oil-free air. During this phase, we paid careful attention to avoid touching the surfaces to be luted.

The dual-polymerising permanent luting system used on the inside surface of the restoration to be luted always requires a suitable bonding agent. The bonding agent selected for this purpose was the dual-polymerising universal adhesive Futurabond U, which we applied to the inner surface and rubbed with a disposable brush (Single Tim, VOCO) for 20 seconds and, afterwards, we dried off the adhesive layer using oil-free dry air for 5 seconds in order to remove any residual solvent. Polymerisation of the bonding agent took 10 seconds with the Celalux 2, which has a high light intensity of 1,000 mW/cm².

Permanent adhesive cementation of the endocrown was done with Bifix QM (VOCO), a radiopaque, dual-polymerising composite-based luting system for the permanent adhesive luting of metal, ceramic and composite restorative pieces. We had a maximum working time in reduced light of about 2.5–3.5 minutes. We applied Bifix QM directly on to the prepared areas and secured the endocrown by applying gentle pressure (Fig. 14).

Fig. 18: Occlusal view of the excellent final results.

> “[...] milled CAD/CAM composite resin endocrowns are not only a more conservative approach but also more stable [...].”

The chemical setting time is 3 minutes. Once we had removed the excess Bifix QM with a foam pellet (Pele Tim, VOCO) and a disposable brush (Single Tim, VOCO), it was possible to considerably reduce the polymerisation time using additional light polymerisation. This light setting was performed at the luting margins with the Celalux 2 for 20 seconds from the vestibular side and a further 20 seconds from the lingual side (Figs. 15).

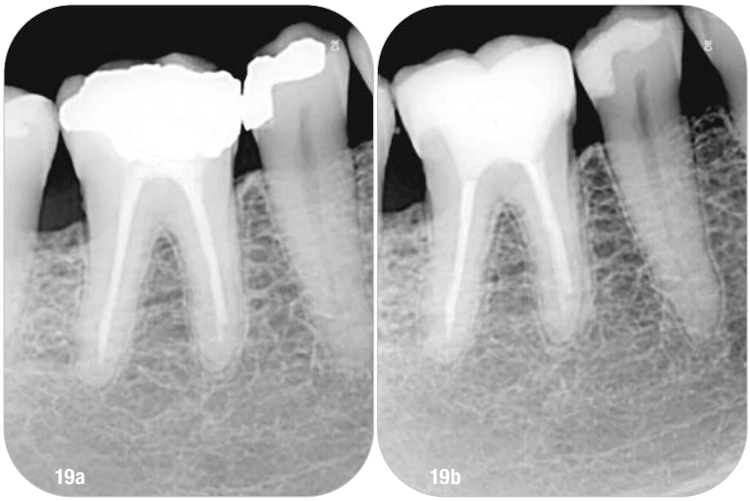
Results and discussion

The fully aesthetic and functional results were remarkable and were achieved in a single chairside session, to the full satisfaction of both patient and dentist (Figs. 16–19).

This patient was treated with an endocrown because of the impossibility of a direct restoration owing to the insufficient thickness of the remaining walls 16 years after root canal treatment. This helped avoid unnecessary loss of healthy tooth structure, was time-saving, as post-endodontic treatment with a build-up followed by a regular ceramic overlay would have required multiple sessions, and it had a lower cost of the treatment for the patient.

Restoration with an endocrown posed a lower risk of chemical failure owing to fewer adhesive interfaces. In the case of a build-up and overlay, we would have had two adhesive interfaces (dental tissue to build-up and build-up to crown or overlay), instead of just one (dental tissue to endocrown). Similarly, there was a lower risk of biomechanical failure of an endocrown than with more invasive preparation, for example with metal posts.

The most recent scientific evidence demonstrates that milled CAD/CAM composite resin endocrowns are not only a more conservative approach but also more stable over time than ceramic indirect restorations. When restoring endodontically treated teeth, endocrowns produced using composite resin materials showed more uniform stress distribution and higher fracture resistance.



Figs. 19a & b: Comparison of the pre- and post-treatment radiographs. Initial periapical radiograph characterised by an overcontoured dental filling in tooth #45 and endodontic underfilling in tooth #46 **(a)**. Final periapical radiograph confirming the good adaptation of both restorations **(b)**.

Conclusion

This new approach using CAD/CAM-fabricated endocrowns reduces the disadvantages associated with endocrowns produced in laboratories or those made of ceramic materials.

Acknowledgement

The authors would like to thank the patient for her efforts and willingness to allow us to solve the case with this new approach. One week later, her husband underwent the same treatment with a Grandio blocs CAD/CAM-fabricated endocrown.

about

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The copyCAD 3: Crown legacy

Dr Yassine Harichane, France

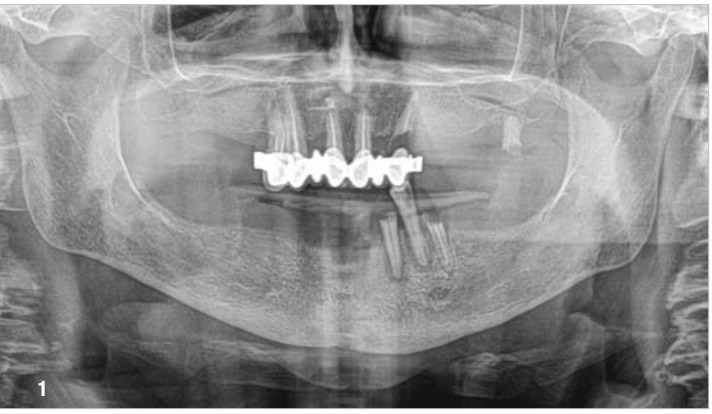


Fig. 1: Pre-op panoramic dental radiograph. **Fig. 2:** Close-up of the patient's granddaughter's teeth.

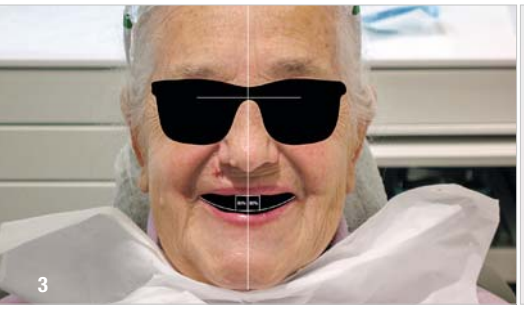
Introduction

You may remember the movie *TRON: Legacy*, in which young Sam Flynn dives into the game *Tron* to find his father. He discovers a virtual world thanks to an incredible paternal legacy. The film emphasises the importance of familial transmission and the opportunities offered by digital technology. In this article, we aim to demonstrate the value of this in a dental context by presenting a clinical case of transmission from a granddaughter to a grandmother that used technological tools that open up a world of possibilities.

In our first article ("The copyCAD", CAD/CAM *2/2020*), we demonstrated how to restore a smile by copying and pasting dental anatomy. In the next article ("The copyCAD 2: Complete success for a complete denture", CAD/CAM *2/2021*), we described the technique of copying and pasting a provisional complete prosthesis to fabricate a final prosthesis. In this article, we will merge the two approaches by creating complete prostheses from a natural smile. Join us on this digital adventure!

Case report

An 83-year-old patient presented for consultation with a diagnosis of unsuitable fixed restorations and unusable dental support (Fig. 1). The treatment plan involved creating an immediate removable complete provisional prosthesis for both jaws before considering definitive prostheses and focused on aesthetic restoration. Despite having had her fixed restorations for years, the patient was not happy with them. The patient was accompanied by her 34-year-old granddaughter, who had a unique smile with natural aesthetics and flaws (Fig. 2), and the patient agreed to have her prostheses created based on her granddaughter's dental anatomy.



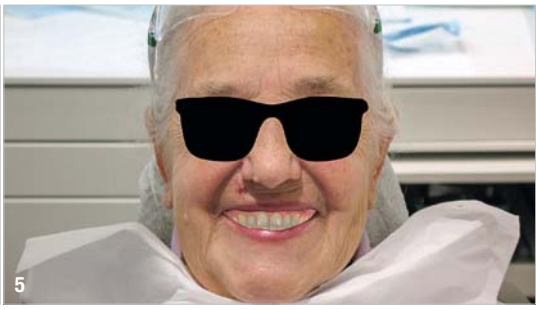
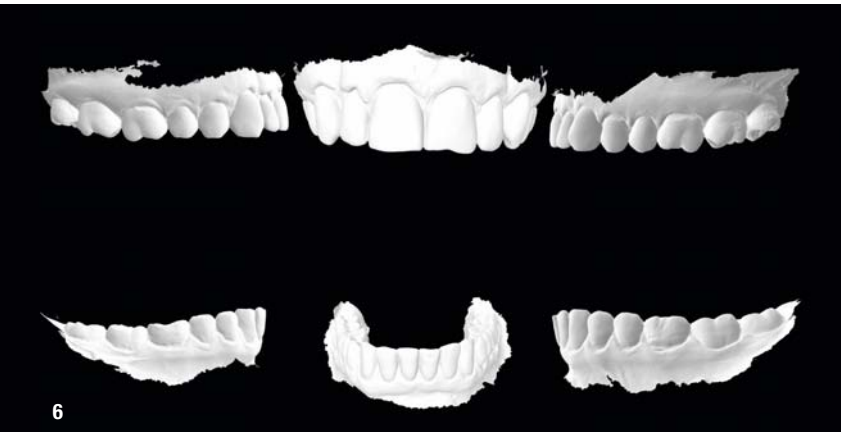


Fig. 3: Analysis of the facial and smile aesthetics. **Fig. 4:** Intra-oral scan of the patient's granddaughter's teeth. **Fig. 5:** Simulation of the treatment results.



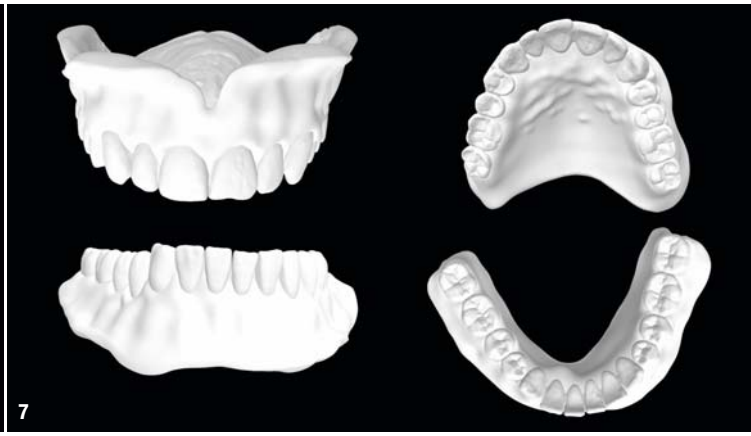


Fig. 6: Intra-oral scan STL file. **Fig. 7:** Virtual design of the dental prostheses.

In the dental practice, the first step was to take a digital impression and photographs of the patient. A facial analysis similar to Digital Smile Design (DSD) was performed to define important points, such as the midline and the incisal edges (Fig. 3). To incorporate the dental anatomy of the granddaughter, her smile was recorded in 2D and 3D using photographs and a digital impression of her dental arches (Fig. 4). A 2D pattern was drawn from the photographs and integrated into the grandmother's DSD (Fig. 5). The treatment plan was then validated by the patient, and the information and impressions were sent to the dental laboratory.

In the dental laboratory, the dental technician created a virtual assembly of the patient's dental arches.

"[...] the patient agreed to have her prostheses created based on her granddaughter's dental anatomy."

The missing posterior teeth were replaced by creating a prosthetic base with commercial teeth. For the anterior teeth, the DSD was used to determine the position of

Fig. 8: 3D-printed try-in prostheses.

Fig. 9: Smile with the 3D-printed try-in prostheses. **Fig. 10:** Close-up with the 3D-printed try-in prostheses.

the midline and the incisal edges. The technician virtually removed the grandmother's anterior teeth while maintaining the virtual landmarks. Using the digital impression of the granddaughter's teeth (Fig. 6), the dental technician imported the anterior teeth into the design using the STL file. The teeth were positioned one by one, respecting the virtual landmarks, resulting in functional and aesthetic prostheses (Fig. 7). The try-in prostheses were 3D-printed and sent to the dental office (Fig. 8).

During the second appointment, the residual teeth were extracted, and the 3D-printed try-in prostheses were placed. Despite anaesthesia, aesthetics and function could already be assessed. On the second postoperative day, the patient evaluated and validated the aesthetics and function (Figs. 9 & 10). Modifications can still be made at this stage and communicated to the dental technician. However, in this clinical case, no changes were necessary.

The next laboratory step involved creating the provisional prostheses by duplicating the try-in prostheses validated by the patient. The base and teeth were separated virtually. The artificial gingiva was milled from a pink resin disc, and the prosthetic teeth were milled from a Shade B1 resin disc according to the patient's preference. The teeth were bonded to the base using an adhesive following the manufacturer's instructions. The result was impressive from both a technical and aesthetic standpoint (Fig. 11).

At the dental office, the patient returned for a check-up to monitor healing and have the sutures removed. The provisional prostheses were tried in (Figs. 12 & 13). The function was preserved thanks to minimally invasive

Fig. 11: 3D-printed provisional prostheses.

Fig. 12: Close-up with the 3D-printed provisional prostheses. **Fig. 13:** Lateral views with the 3D-printed provisional prostheses.

surgery, which preserved the bone crests, and retention and support were confirmed. The aesthetics exceeded the expectations of both the patient and her granddaughter, both of whom had not imagined that such a high level of technical performance was possible. The dentist–prosthetist duo were thrilled by the satisfaction expressed by the patient and her granddaughter (Fig. 14).

Conclusion

Transmitting a legacy to one's descendants is a profoundly human and natural act. It can encompass a lifetime's accumulated wealth, exceptional knowledge or fundamental moral values, among many others. However, when this transmission occurs in the opposite direction, from descendants to ancestors, it becomes particularly remarkable, especially when it involves passing on a smile. Typically, a child possesses a unique anatomical signature of their smile, making it challenging to determine the influence of the father or the mother. However, in this clinical case, a granddaughter transmitted the anatomical characteristics of her smile to her grandmother. This legacy enabled the patient to regain youthfulness in the most natural way possible.

This transmission was made possible solely by the capabilities of modern technological tools, allowing for digital copy–paste procedures. The dentist–prosthetist duo can now replicate an individual's smile with astonishing precision and seamlessly apply it to another individual. When the donor and recipient are connected by family ties, the crown becomes a precious legacy that is passed between the generations.

Disclosure
The author did not report any disclosures.

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"The aesthetics exceeded the expectations of both the patient and her granddaughter [...]."

Fig. 14: Post-op situation.

about

Dr Yassine Harichane graduated from the former Paris Descartes University in France and conducted a number of research projects there. He is an author of numerous publications and a member of the cosmetic dentistry study group at the University of Paris. He can be contacted at yassine.harichane@gmail.com.

Treatment of severe oral pathology in pre-geriatric patients: A proposal for a clinical protocol for same-day dentistry

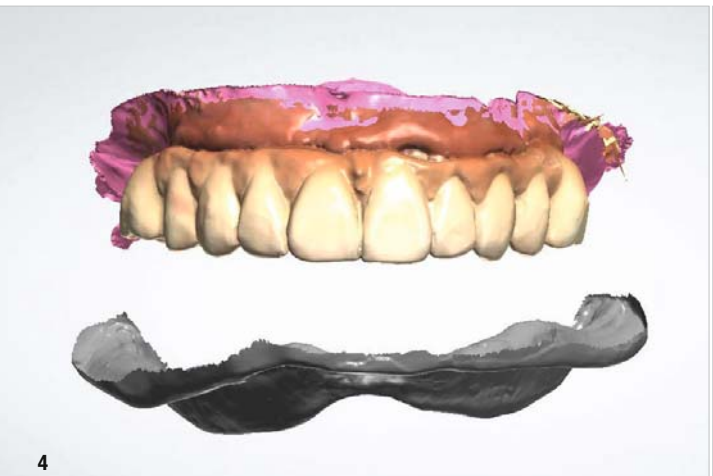
Dr Mauro Fazioni, Nicolò Surico, Rita Consolaro & Dr Stefano Orio, Italy

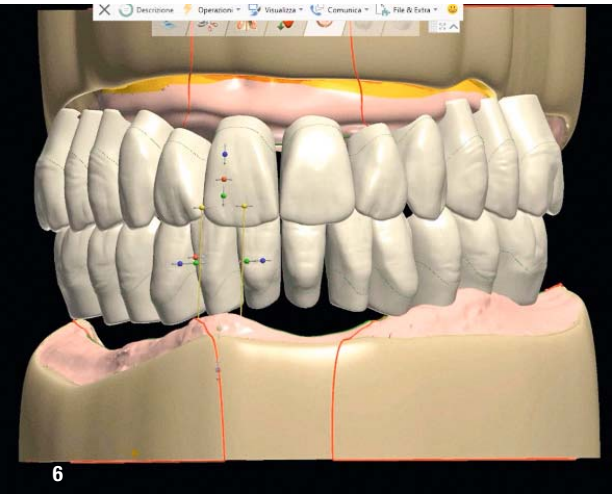
Fig. 1: Initial facial photograph. **Fig. 2:** Intra-oral photograph of the initial situation. **Fig. 3:** Areas of chronic inflammation of transmucosal tissue evident after removal of the maxillary prosthesis. **Fig. 4:** Intra-oral scans of the maxillary and mandibular arches. **Fig. 5:** Virtual removal of the maxillary prosthesis in exocad software.

Introduction

Modern restorative and prosthetic dentistry have undergone significant advances over the last five years. Innovations in dental materials have truly transformed clinical applications by improving the performance of restorations in the oral cavity. Clinicians can now achieve ultrathin restorations using the current generation of hybrid composites, highly aesthetic zirconia and reinforced glass-ceramics, to name a few, and restorations from these materials are achievable through simpler procedures in the dental laboratory.

This achievement is possible thanks to digitalisation procedures that guarantee greatly improved design techniques and the fabrication of medical devices in the laboratory utilising modern milling technologies. When applied in the laboratory, these tools provide manufacturing options that substantially expand the range of potential treatments. In-house methods can employ almost any manufacturing procedure, working with dry to wet ceramic composite materials, hybrids, metals,





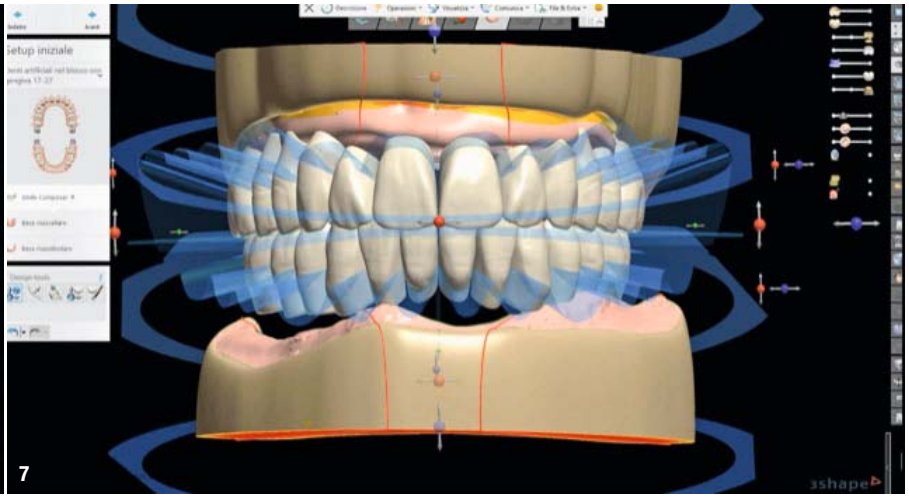


Fig. 6: Maxillary and mandibular prostheses designed with Ivotion libraries. **Fig. 7:** The R5 is compatible with the unique Shell Geometry of the Ivotion disc.

etc., in contrast to external milling centres, which frequently standardise production protocols, limiting applications.

The dentistry department of the IRCCS Ospedale Sacro Cuore Don Calabria, a hospital in Negrar in Italy, has been investigating clinical care models for dental pathologies that clinicians will face in the coming years. Understanding and comprehending these emerging diseases means developing tools that are capable of addressing the needs of future patients, and the treating team needs to be able to handle these new methods of addressing patient needs and diseases. The following are some important emerging fields of interest:

- applying artificial intelligence for diagnosis, previewing, 3D modelling and treatment simulation;
- restorative approach to same-day dentistry in terms of materials and methods;
- treatment of severe oral pathology in pre-geriatric patients involving same-day dentistry;
- dental malocclusions and orthodontic treatment with aligners;
- treatment of severely worn dentition with in-house procedures; and
- risks of and clinical strategies for clear aligner therapy.

Description

Adult patients with severe or extremely severe oral disease compromising the functions of the stomatognathic system are becoming increasingly prevalent. Unlike in the past, these patients are fully integrated into society. The lifestyle and dietary habits of these patients, even when they are older than 75 or 80, are comparable to those of younger adults, particularly in terms of their expectations. Clinically, these patients present with severe signs and symptoms that are frequently seen in other systemic diseases, including:

> “Clinicians can now achieve ultrathin restorations using the current generation of hybrid composites (…).”

- compromised masticatory ability;
- spontaneous oral pain;
- recurrent infections of the mouth and oral tissue;
- deterioration of the dental system;
- periodontal disease; and
- xerostomia.

Changes in physical appearance are an important component of modern ageing, especially for people over 65.

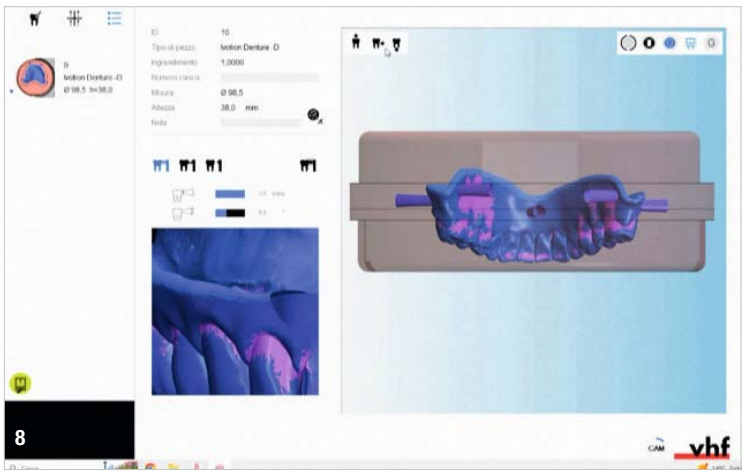


Fig. 8: Denture in the vhf CAM software module for the R5.

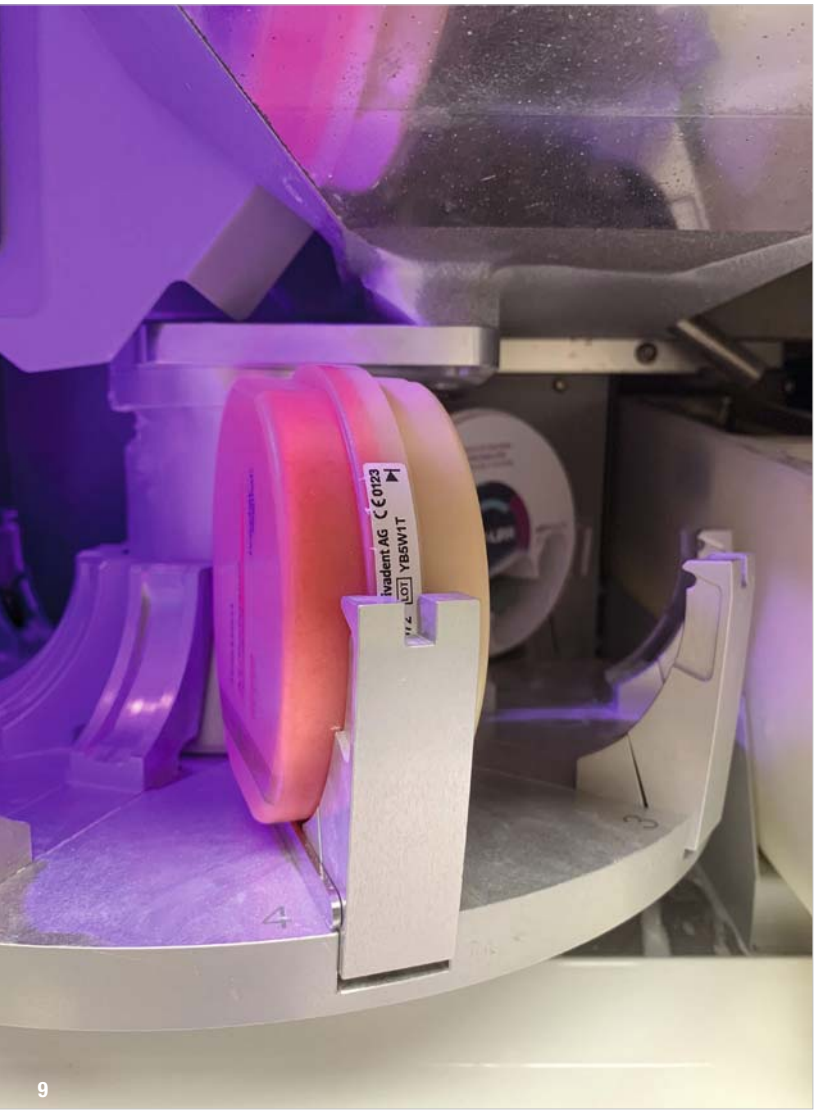


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Fig. 9: Adapter plate with the Ivotion disc inserted. **Fig. 10:** Extremely high level of morphological and surface detail produced with the simultaneous monolithic milling of the pink aesthetics and the teeth.

"A deficiency in dental occlusion has the same impact as inflammation from periodontal disease in changing the alveolar bone structure."

Age-related changes in the anatomical and functional integrity of the oral cavity have an effect on more than just dental health; they also affect the pathogenesis of systemic disease and nutrition. A deficiency in dental occlusion has the same impact as inflammation from periodontal disease in changing the alveolar bone structure.

One of the greatest challenges to overcome is the need to minimise the number of appointments while continuing to provide effective treatment. Recently, materials with high aesthetic and functional predictability have been introduced to the market, enabling rehabilitation of the completely edentulous arch in a very short amount of time. The intra-oral impression can be instantly accessed in the patient's habitual intercuspation. Condylar determinants can be evaluated realistically with a digital facebow, combined with CBCT, and masticatory movements can be reproduced. Full-arch reconstruction with complete dentures is possible using 3D modelling software in just a few minutes, providing an accurate assessment of recovery of the vertical dimension of occlusion. It has become possible to reconstruct the integrated functional and aesthetic profile initially shared with the patient using simulations.

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Materials and methods

For teeth and prosthetic bases, cross-linked PMMA from the Ivotion denture system (Ivoclar) is recommended. Thanks to its unique Shell Geometry, it allows for excellent outcomes with a single milling, thus optimising time significantly. Optimisation of time and results are made possible by the use of the latest-generation, innovative milling machines that are extremely accurate and compatible with all commonly used milling techniques. A modern system that provides the technician and clinician with incredibly

> “Production of complete prostheses with this digital workflow is 100% accurate and predictive regarding timing.”

precise milling details, compatible with a same-day dentistry regimen, is the R5 five-axis milling machine (vhf camfacture).

Clinical case

A 75-year-old female patient in good mental and physical health presented with an implant-supported denture in the maxillary arch with widespread peri-implantitis and burning mouth syndrome (Figs. 1–3). In the lower jaw, she presented with a removable complete denture, abraded teeth and incongruence between the base and alveolar process. The patient reported pain and bleeding in the maxillary arch with compromised stability of the mandibular denture.

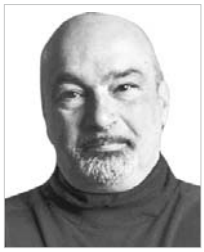
The 3D files of the prostheses were exported to the Ivotion denture system’s specific CAM module (Ivoclar Vivadent Manufacturing; Figs. 4–6). The prostheses were milled using the Ivoclar-exclusive Shell Geometry processing capability of the R5 (Figs. 7–9). In 4 hours, the complete maxillary and mandibular prostheses had been fabricated (Fig. 10). For the maxillary prosthesis, we immediately relined it after removing the framework that had been screwed to the prosthesis and then screwed it in (Fig. 11). Re-evaluation with a digital facebow and data comparison were made possible by remote control (Figs. 12 & 13).

Conclusion

Full-mouth restoration in a single session was made possible by the method of intra-oral scanning of the arches, immediate prosthetic design and milling of the Ivotion discs using the R5. Based on our clinical findings, this technique optimises time as well as expenses for the complete rehabilitation procedure in the same-day dentistry protocol. Production of complete prostheses with this digital workflow is 100% accurate and predictive regarding timing. The latest technology allows for highly precise evaluations of the accuracy of occlusal determinants, release planes and simulation of masticatory movement. The patient receives rehabilitation of both arches and accurate reconstruction in a single day.

Fig. 11: Denture *in situ*. **Fig. 12:** Extra-oral situation at the four-week check-up. **Fig. 13:** Detail of the morphology and texture of the anterior teeth at four weeks.

about



Dr Mauro Fazioni graduated with a DDM from the University of Verona in Italy in 1992. Since 2005, he has been a consultant in the research and development department of some of the most important digital dentistry companies on the topics of intra-oral scanning, prosthetic design software, guided surgery and machinable materials applied in fixed prosthodontics and implant restorations. In 2017, he founded MCD Consulting, a company specialising, among others, in digital head and neck investigations, clinical protocols for head and neck reconstructions, and head and neck laboratory prototypes.

In 2020, he founded the Accademia Italiana di Odontostomatologia Digitale (Italian academy of digital dentistry), an independent study group on digital applications in dentistry and maxillofacial surgery. He began collaborating with the digital dentistry department of IRCCS Ospedale Sacro Cuore Don Calabria, a hospital in Negrar in Italy, in 2020.
He speaks and publishes on same-day dentistry and protocols in digital dentistry. He can be contacted at mauro@fazioni.com.

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Dr Stefano Orio is the director of the dental centre of the IRCCS Ospedale Sacro Cuore Don Calabria, a hospital in Negrar in Italy.

"Alone we can do so little, together we can do so much"—Helen Keller

By Jerko Bozikovic, Belgium

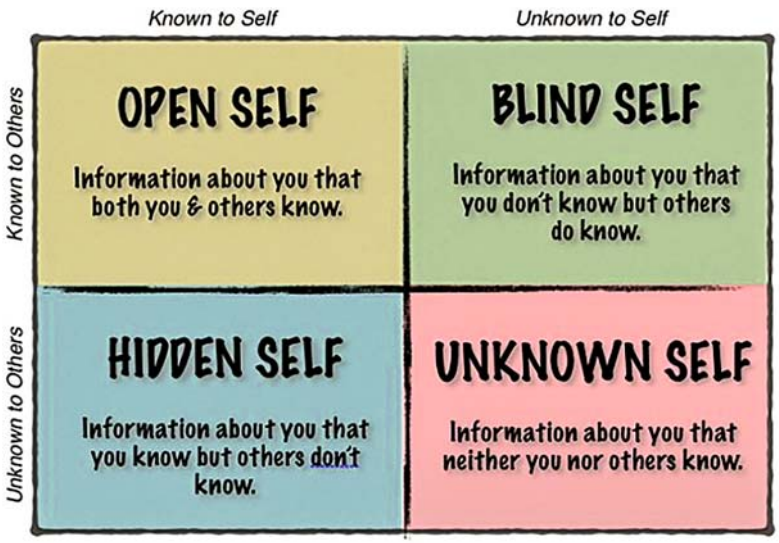
We are entering the fourth quarter of this year but let us get back to 2023 resolutions. Have you made any as a team in your clinic? Have you taken the time to reflect how the year before went, what went well, what were some points of improvement? Have you taken time and space to celebrate as a team how you managed to do the best you all could in the recent quite challenging times? Have you taken time to sit together as a team and create plans for the whole year together? How would you like the next year to look like as a team and as a practice? Have you considered individual staff's goals as well as team goals in the short, mid- and long term? This is important because we all know you cannot run the show without having a strong, motivated and engaged team.

TEAM—together everyone achieves more

Let us talk about how you can involve your team so that members become more engaged, more skilled and more motivated. There are some key points I want to discuss. The invitation to you is to see whether you already have integrated them or whether these might be some ideas to explore.

Communication

No team functions if their communication is poor. Good communication requires that there are enough occasions where communication plays a leading role in content and form for successful interactions.



Johari window.

Are there enough formal moments, like meetings, where you can go over responsibilities? These are moments when it is clarified who has responsibility for what and who can step in when needed into which task or role. Meetings should not be long and boring or one-way communication. Involve your team members, for example by having them present some aspects of their job so that others learn from it too or share some patient success stories as well as how they dealt with some challenging situations. This gives opportunity for great fun and moments of growth.

Do you have a clear framework for which communication tools are to be used in which context (e-mail, phone, chat, Teams, in person, etc.)? I have seen in many teams that this framework is often not clear.

Are there enough informal moments for team communication, like sharing lunch together? We need time at work where we cultivate the relationship between the team members in a way that is not always related to work. A great example is the social custom of *fika* in Sweden and Finland, when work or other daily activities are interrupted in order to get together, drink tea or coffee, or eat something. It happens at a scheduled time and is deliberately used to pause and socialise. Conversations around work are consciously avoided, and the intention is to enhance team spirit and relationships.

"Talent wins games, but teamwork and intelligence win championships."
—Michael Jordan

Open feedback culture

Nothing is as important for a well-oiled team as having an open feedback culture. Feedback should not be kept only for official occasions, like evaluations, but should be given on a daily basis. Here are some tips on how to do this:

- Find a balance between positive and constructive feedback. People really become demotivated if they do not know how their work is being perceived. Giving compliments from time to time creates wonders. Not getting feedback often is a cause of demotivation and people leaving the company or practice.
- Receiving occasional constructive feedback is also crucial. If we are not told what we can improve, then we cannot grow and might risk making the same mistakes. We need to be aware that most people have the intention to do their job well, and yet we need to give feedback sometimes. That means

"Effective teamwork begins and ends with communication."
—Mike Krzyzewski

> “It takes humility to seek feedback. It takes wisdom to understand it, analyse it and appropriately act on it.”
> —Stephen Covey

that they are not aware of doing something that is not desired, otherwise they would not do it, so that is a blind spot for them—the Johari window explains perfectly what that blind spot is all about (Fig. 1). A great sentence to use in addressing this is “I have seen you doing something I don’t think you are aware of, otherwise you would not do it.” This prompts a direct response from the other person asking what the thing mentioned is, creating an opportunity for engagement. Introducing feedback this way avoids being harsh.

– When feedback is given, always give feedback on behaviour, never on personality. We need to separate these, but many may perceive it to be the opposite. The person receiving the feedback may feel like he or she is being attacked personally rather than being given feedback on something he or she has done. To avoid this, you could start such a conversation with “I want to give you feedback on something I have seen you doing, not on who you are.”
– A nice way of creating this open feedback culture comes from the bestseller *The One Minute Manager* by Ken Blanchard (it is quite an old book, but the ideas are still very relevant): spend 1 minute with each team member every day giving feedback, one day on something positive and the other day on something to be improved. This feedback should be given in all directions, top-down, bottom-up and lateral. Do not be scared to also ask for some feedback from your team members.

Delegation

Delegating is probably one of the most difficult and scariest things to do and yet crucial for any team to function. Sometimes, delegation is avoided because of limiting beliefs, such as thinking you have no time to train people, they will not do what needs to be done, they are not responsible or capable enough to do it, or nobody does it better than you do it. Recognise some of these? And yet, the benefits are so incredible: more motivation, more engagement, people finding the necessary means, people assuming more responsibility. You cannot know nor do everything yourself, so helping your business grow does not mean working harder and doing more, but working smarter, and delegating is one of these smarter ways to work.

When you delegate, it is important to check what you can ask of whom. Is the person already competent or do you need to train that person? Will you delegate only tasks or also responsibilities? It is very important to have that clear in your mind and in your communication to the relevant people.

Creating a good framework for how to delegate will be a game changer. Here are nine steps for efficient delegation. Check which ones you are already following and which ones you could improve on:

1. Determine the task clearly.
2. Select the individual or team you want to delegate to.
3. Evaluate capabilities and training needs if required.
4. Explain the reasons why you want to delegate.
5. Communicate the desired results clearly.
6. Determine the resources that the individual or team can count on (people, time, tools, etc.).
7. Set deadlines: state what needs to be done by whom and by when.

8. Support and communicate throughout the entire delegation process.
9. Provide feedback on the results at the end of the task or project.

Wrap-up

Team members are precious; it is important to foster a wonderful relationship with them. They often have more contact with the patients than you have, so value them, give them responsibilities, be honest with them, inspire them, motivate them and let them make their own choices too. Every day, I work with teams in the corporate world and in dental clinics, and to determine whether the business or practice is thriving it is enough to see how the team is doing. If they are bonded, aligned, open, proactive, the clinic will thrive; however if there is not a strong team, one can feel it in the clinic and see it in the results. Therefore, investing in your team and enabling your team to invest in themselves and each other might be a great resolution for the next year!

Editorial note: This article was first published in aligners—international magazine of aligner orthodontics, *Vol. 2, Issue 1/2023 and an edited version is provided here.*

"Delegation requires the willingness to pay for short-term failures, in order to gain long-term competency."
—Dave Ramsey

about

Jerko Bozikovic is a specialist in communication skills, emotional intelligence, time and stress management, leadership and change management. He is fascinated by human behaviour and finds working with people on personal development to be a daily challenge and blessing. He speaks seven languages and has offered his training courses in four languages since 2001. He embraces and embodies the motto "Love the life you live; live the life you love". He can be contacted via LinkedIn.

Transition to a modern digital laboratory

Four ways for dental laboratories to benefit from digital workflows

"For a lab, every second counts," according to Lee Culp, certified dental technician and CEO of Sculpture Studios, a dental laboratory in Apex in North Carolina in the US. The use of intra-oral scanners by dentists is booming, and coupled with a dental laboratory's need for speed, this could soon mean that CAD/CAM, once considered by some laboratories a more efficient and predictable way to work, may soon become the only way for all laboratories to work. Here are four cost-effective ways that 3Shape can power the transition to a modern digital laboratory.

CAD workflows with AI-powered indications

The backbone of a laboratory's digital workflow is 3Shape Dental System CAD software. From designing simple crowns to designing dentures, 3Shape Dental System's intuitive next-next and artificial intelligence-supported (AI-supported) workflows make designing fast and predictable. 3Shape Dental System gives users everything they need to create and share restorative proposals with their customers digitally. They can then send designs off for production to a growing range of fully integrated mills and 3D printers with 3Shape Produce. In addition, the software uses AI technology to make mundane workflow tasks like sectioning teeth more efficient. However, 3Shape AI does even more. It integrates seamlessly with 3Shape Automate, the company's AI-driven design service, and with 3Shape Design Service. Laboratories needing design help can take advantage of the two fully integrated design services 24/7. Turnaround time for 3Shape Automate is as little as 5 minutes.

Fast precision scanning

For now, laboratories may still need to convert analogue impressions to digital models. 3Shape's award-winning desktop scanners make this simple. There is a 3Shape laboratory scanner for every budget in the company's wide range of scanners, which includes the recently released F8 dual-model scanner and four Generation E scanner models. The new F8 laboratory scanner is engineered for efficient dual-model scanning workflows and enables articulator scanning. Its innovative design allows laboratories to do more in less time with fewer scanner interactions and workflow steps.

Laboratory management software

"With my laboratory management software from 3Shape, I do everything from callbacks, retention, financial measurements, production measurements, case tracking and more. And I do it all from my phone," said Culp. 3Shape recently launched its cloud-based 3Shape Lab Management Software. It enables laboratories to organise every case, whether analogue or digital, transform client relationships, manage client expectations and effortlessly collaborate across teams while streamlining every task to make the laboratory run more efficiently.

Support and ongoing training

3Shape's LabCare service package is the safest way to ensure success and secure an investment. LabCare provides unlimited software upgrades, support, hands-on training, events and unique product discounts. However, it is completely optional, and instead, users can choose 3Shape's basic non-subscription package at no additional cost.

Go digital now

By going digital, dental technicians will experience efficiency gains and accuracy improvements. The best part is that laboratories can start small, as 3Shape solutions are scalable.

www.3shape.com/en/software/dental-system

DEXIS IOS Solutions expands its portfolio and ecosystem

New end-to-end digital workflows for dental practitioners

DEXIS IOS Solutions is pleased to announce the expansion of its portfolio and ecosystem through new digital end-to-end workflows. The new and enhanced workflows are designed to align with the objective of DEXIS IOS Solutions to support dental practitioners in accelerating their workflows, resulting in increased productivity and an improved patient experience. To reinforce this objective, DEXIS IOS Solutions is focused on three crucial principles: ease of use, productivity and practice expansion. Practitioners can now easily expand their range of services through aligner and denture treatments, as well as in-house printing, offering their patients personalised and innovative care.

The new prescriptive workflows are being developed concurrently with ongoing innovations in the broader portfolio of Envista Holdings Corp., beginning with a new orthodontic workflow in combination with Ormco's Spark clear aligners that enables practices to easily add aligner therapy to their treatment options. A new patient engagement app within DEXIS IS ScanFlow enables practitioners to show patients a simulated outcome of their orthodontic treatment, enabling them to visualise the treatment outcome chairside. Integrated digital transfer of the data sets to the Spark software streamlines the process, facilitating prompt treatment.

"By further integrating DEXIS IOS Solutions into the broader Envista offerings, we are providing dentists with the solutions they need to provide exceptional and personalised care for their patients. We are committed to helping dental practitioners improve patient outcomes and grow their practice through digital innovation," said Amir Aghdaei, president and CEO of Envista.

DEXIS IOS Solutions has also collaborated with SprintRay's 3D-printing ecosystem for definitive ceramic crowns to simplify in-office printing and make same-day restorations a reality. SprintRay Cloud Design leverages artificial intelligence to streamline the design of crowns, appliances and surgical guides within minutes. Practitioners can scan their patients with any DEXIS intra-oral scanner and upload the data set directly from either DTX Studio Clinic or IS ScanFlow to the SprintRay portal, eliminating the need to manually select files, enter redundant patient information and design the restoration or appliance.

"By combining DEXIS intra-oral scanners with SprintRay's ecosystem, dental practitioners can offer same-day delivery of crowns and appliances, increasing their productivity by completing more procedures in a shorter amount of time," said Aghdaei. "Offering same-day restorations can give practitioners a distinct competitive advantage, as patients often prefer the convenience of single-visit appointments, enabling dental practitioners to expand their services and attract patients seeking fast and convenient dental treatment."

To further enhance the capabilities of the DEXIS IOS Solutions portfolio, IS ScanFlow (Version 1.0.9) now includes a denture scanning workflow that streamlines the treatment planning process by combining the capture of the bite registration and prosthesis along with the edentulous and denture scans, eliminating the manual process of matching and aligning data sets by the laboratory. The software also provides embedded scan tips to optimise and simplify the edentulous data acquisition.

In addition, DEXIS IOS Solutions is introducing the IS 3800 wired scanner, which offers the same high-speed performance as the award-winning IS 3800W wireless scanner. The IS 3800 wired scanner is highly ergonomic and weighs just 190 g without the cable, making it one of the lightest intra-oral scanners available. It complements the IS 3800W scanner, which weighs only 240 g and is the lightest wireless intra-oral scanner in the industry.

The latest DEXIS IOS Solutions innovations provide dental practitioners with access to intuitive technology that simplifies and streamlines treatment, thereby boosting productivity. With an extended ecosystem and diverse range of new treatment options, practitioners can partner with Envista for access to prescriptive end-to-end workflows or opt for open workflows, which enable collaboration with their preferred laboratory or manufacturer. The new workflows further align with Envista's intention to digitise, personalise and democratise dental care, supporting dental practitioners in the provision of optimal patient care through enhanced productivity and predictability of treatment.

For more information about DEXIS IOS Solutions' products and services, visit our website.

www.dexis.com

Durable temporary restorations with a high accuracy

V-Print c&b temp from VOCO for 3D-printed composite temporary restorations

Germany-based dental material manufacturer VOCO has expanded both the use of additive production techniques and its V-Print family with its latest material development, V-Print c&b temp. This new 3D-printing material offers a practical solution for the manufacture of even multi-unit temporary restorations in complex prosthetic treatment in the digital workflow.

Digital designs mean patients can be involved from even before treatment begins. The restoration is planned, designed and visualised digitally, giving predictable results for both the dentist and the patient. Additive production allows numerous design possibilities compared with the subtractive alternative. With V-Print c&b temp, patients receive durable temporary restorations with a high accuracy of fit before the final restoration is produced.

Highly filled composite with great flexibility

Using V-Print c&b temp to fabricate temporary restorations provides expanded possibilities such as characterisation, simple repair if needed and shape adjustments with composite in the course of treatment. The high surface quality allows simple processing and polishing. The translucency and natural fluorescence of V-Print c&b temp exceed all aesthetic demands of a temporary restoration.

V-Print c&b temp is a highly filled composite and categorised as an EU Class IIa medical device. Its exceptional physical properties, such as high flexural strength (132 MPa), low abrasion (119 µm) and low water absorption (18 µg/mm³), make V-Print c&b temp ideal for long-term temporary restorations too, as confirmed by our laboratory tests.

www.voco.dental

All about the patient: The 2024 ITI World Symposium

By ITI Foundation

The ITI World Symposium is back and better than ever. In Singapore from 9 to 11 May 2024, more than 50 world-renowned speakers will present at the world's largest scientific implant dentistry event. Building on the highly successful online edition, the 2024 ITI World Symposium will once again put patients at the centre of the action.

Over three days, more than 4,000 participants will experience real patients and their stories on stage. The speakers will discuss various treatment options based on the latest scientific evidence. Additionally, world-class clinicians will provide commentary on exclusively recorded clinical procedures live on stage.

"With our unique, patient-centred programme, we aim to combine practical, clinical insights with the discussion of scientific findings," explained International Team for Implantology (ITI) President Dr Charlotte Stilwell. "We ran a survey in our community last year to identify the topics of greatest relevance currently, and these form the core of our scientific programme: soft-tissue management, guided bone regeneration/bone augmentation, immediate implants, peri-implantitis and the digital workflow."

Registration for the ITI World Symposium is open at worldsymposium.iti.org. ITI members as well as those who register early will benefit from significant discounts.

Long-awaited Digital Dentistry Show to premiere in Berlin in June 2024

By Dental Tribune International

Now is an exciting time for dentistry. Technological innovations lie at the heart of the profession and are significantly advancing personalised dental care. To provide a platform to celebrate digital innovations in the field and educate the dental team, DDS.Berlin has collaborated with the Digital Dentistry Society, and they are bringing a highly immersive experience to the capital of Germany—the Digital Dentistry Show.

Scheduled for 28 and 29 June 2024 at the Arena Berlin, the event promises to deliver engaging educational and social opportunities with a special focus on digital products and the digital workflow in dentistry.

Through live product presentations, workshops, discussion sessions and an exhibition, the 2024 Digital Dentistry Show seeks to provide attendees with first-hand knowledge of digital dental products and services and to offer space for personalised advice and face-to-face interactions with industry leaders. With the focus on robust

The 2024 Digital Dentistry Show will offer cutting-edge knowledge and skills that will help dental professionals better navigate technological advancements in the field. Located in Berlin's Alt-Treptow inner-city district, the 6,500 m² Arena Halle offers high-quality professional infrastructure. *(All images: © Markus Nass)*

The Badeschiff is a picturesque floating public swimming pool area overlooking the Spree river.

The Escobar is an extension of the Badeschiff that includes a covered bar area.

research evidence, the scientific programme will feature presentations by prominent opinion leaders, including Drs Henriette Lerner, Alessandro Cucchi, Mirela Feraru, Howard Gluckman, Fabrizia Luongo and Setareh Lavasani, and cover a wide range of topics, such as artificial intelligence, the digital workflow in maxillofacial surgery and full-arch rehabilitation, and digital bone surgery. Attendees will have the opportunity to earn valuable continuing education credits.

Besides a strong educational aspect, the 2024 Digital Dentistry Show will serve as a social hub for dental experts, professional organisations, manufacturers and publishers who are looking to form or expand their network of like-minded, future-oriented individuals.

To be hosted at one of Berlin's industrial pearls, the unique event location offers a rich history and a distinctive modern feel.

The adjacent Escobar and the Badeschiff spaces will enhance the relaxed and jovial atmosphere, underlining the informal and engaging nature of the show.

The 2024 Digital Dentistry Show is expected to attract over 2,000 eminent dental professionals from around the world. You are invited to be one of them!

More information on registration and the scientific programme can be found online at the event's official website at dds.berlin.

Attendees will also have access to the Sonnendeck of the Escobar, where they will be able to enjoy delicious food and drinks.

International events

GNYDM 2023

24–29 November 2023
New York, USA
www.gnydm.com

5th EAS Congress

29 February – 2 March 2024
Valencia, Spain
www.eas-aligners.com

ADF 2023

28 November–2 December 2023
Paris, France
www.adfcongres.com

exocad Insights 2024

9–10 May 2024
Palma de Mallorca, Spain
www.exocad.com/insights2024

CIOSP 2024

24–27 January 2024
São Paulo, Brazil
www.ciosp.com.br/en

ITI World Symposium 2024

9–11 May 2024
Singapore
www.iti.org/start

AEEDC 2024

6–8 February 2024
Dubai, UAE
www.aeedc.com

ROOTS SUMMIT

9–12 May 2024
Athens, Greece
www.roots-summit.com

159th Chicago Dental Society Midwinter Meeting

22–24 February 2024
Chicago, USA
www.cds.org/midwinter-meeting

DDS.Berlin

28–29 June 2024
Berlin, Germany
www.dds.berlin

How to send us your work

Please note that all the textual components of your submission must be combined into one MS Word document. Please do not submit multiple files for each of these items:

- the complete article;
- all the image (tables, charts, photographs, etc.) captions;
- the complete list of sources consulted and
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Text length

Article lengths can vary greatly—from 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or fewer words to do the topic justice, then please make the article as long or as short as necessary.

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

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

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We also ask that you forego any special formatting beyond the use of italics and boldface. If you would like to emphasise certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers. Please do not use underlining.

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.

Should you require a special layout, please let the word processing programme you are using help you do this formatting automatically. Similarly, should you need to make a list, or add footnotes or endnotes, please let the word processing programme do it for you automatically. There are menus in every programme that will enable you to do so. The fact is that no matter how carefully done, errors can creep in when you try to number footnotes yourself.

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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Please number images consecutively throughout the article by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate these in a group (for example, 2a, 2b, 2c).

Please place image references in your article wherever they are appropriate, whether in the middle or at the end of a sentence. If you do not directly refer to the image, place the reference at the end of the sentence to which it relates enclosed within brackets and before the period.

In addition, please note:

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- These images must be no smaller than 6 x 6 cm in size at 300 DPI.
- These image files must be no smaller than 80 KB in size (or they will print the size of a postage stamp!).

Larger image files are always better, and those approximately the size of 1 MB are best. Thus, do not size large image files down to meet our requirements but send us the largest files available. (The larger the starting image is in terms of bytes, the more leeway the designer has for resizing the image in order to fill up more space should there be room available.)

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