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It’s difficult to watch certain television commercials, read a newspaper, see an online advertisement, a webinar, social media content or a recorded video without hearing about “teeth in an hour”, “teeth in a day”, “teeth tomorrow”, “immediate loading”, “immediate restoration”, or some variant. Patients are continually being told that they may be candidates for an “immediate” solution to their lifelong problems by having all of their “bad” teeth removed and replaced with an implant-supported restoration in one day, two days or a week. So, what is the rush? Are these concepts driven by science or strategic marketing by dental implant manufacturers, large group dental practices or individual practitioners, or due to patient demand?

Patients who have failing dentition generally have been in this condition for a long time. Certainly, there are individual tooth failures that occur owing to various circumstances, but when it involves a complete maxillary or mandibular arch, or both, the process of bone loss, tooth mobility, abscess formation or soft-tissue inflammation must have been chronic. Are we clinicians to expect that we can solve all of these problems with advanced technologies that will deliver the magic wand of instant rehabilitation?

For the past several decades, the scientific literature has supported immediate treatment protocols that can deliver single-tooth to full-arch reconstructions with accuracy, consistency and predictability. Therefore, clinicians may want to deliver high-quality care to patients and significantly shorten the treatment time involved in dental implant procedures, but should these immediate implant-supported procedures be considered for every patient without consideration of conventional dental solutions such as root canal therapy, apicectomy, crown lengthening, or crown and bridge alternatives? Does the new digital workflow provide clinicians and dental laboratory technicians with improved tools to facilitate these accelerated treatment modalities? Is the rush justified?

Of course, these questions may relate mostly to an individual clinician’s training and education in diagnosis, treatment planning, and surgical and restorative skill set. Perhaps education is the key, and today there are many opportunities to gain the skills necessary to make decisions for each patient, to determine whether immediate or delayed implant protocols are warranted. The goal of Dental Tribune International and this publication is to provide the readership with concepts, philosophies, clinical illustrations and treatment modalities currently available so that clinicians can make educated decisions. Don’t rush! Take time to enjoy this latest issue and expand your universe.
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Patients who present with a terminal natural dentition in the maxillary arch offer both surgical and restorative challenges for the clinician. A formal diagnostic protocol is essential to determine viable treatment options and to facilitate the desired aesthetic and functional outcome. This can include impressions for study casts, two-dimensional periapical radiographs or panoramic radiography, medical history and current list of medications, and diagnostic wax-ups.

Traditional concepts have advocated first extracting the remaining teeth in a phased approach with socket bone grafting to allow the ridge proper time to heal prior to placement of implants in strategic positions months later. During the interim, the patient would receive an immediate complete maxillary denture. It had been postulated that by allowing the ridge to heal after tooth extraction a certain percentage of bone resorption will occur, especially under the forces of mastication transmitted from the immediate denture. Ideally, the vertical dimension of occlusion will be maintained, as well as an acceptable aesthetic appearance based on sound prosthodontic conventions. The healing phase usually requires three to six months to allow the underlying bone to mature. If either a fixed
or removable implant-supported restoration is desired, a CBCT scan will help determine ideal receptor sites based upon the volume and quality of the maxillary alveolar bone. Once the implants are placed a subsequent three-to-four-month healing phase has been required to allow for osseointegration prior to loading and fabrication of a provisional and then final prosthesis.

Technology has evolved for both clinicians and dental laboratory technicians. The adoption of CBCT and interactive treatment planning software have empowered the implant team with state-of-the-art diagnostic tools and new digital workflows allowing for enhanced treatment alternatives and reduced treatment times for patients presenting with a terminal dentition in the maxillary arch.1 While there may be teeth presenting with a hopeless prognosis, the use of three-dimensional imaging modalities may reveal enough bone volume and bone quality for implant placement after tooth extraction. If an appropriate number of implants can be placed in strategic positions and found to be stable enough at the time of insertion, the restorative plan can be accelerated. However, rehabilitating the maxilla directly with immediate extractions and an immediately loaded implant reconstruction takes careful collaboration with the dental laboratory and may lead to unpredictable aesthetic outcomes. The goal of this case presentation is to demonstrate that digital dentistry can help in predicting the aesthetic outcome before any surgical procedure is engaged.

Case Presentation

Clinical Assessment

A 46-year-old Caucasian male presented as a referral with a pre-existing failing condition of the maxillary dentition (Fig. 1). The patient complained of dental pain, bleeding gums and loose, mobile teeth. Clinically an oral examination revealed tooth mobility, generalised bone loss in both the maxilla and the mandible, generalised bleeding upon probing, multiple subgingival deposits and a malodor (Fig. 2). There was a diastema between the right and left central incisors and other spaces were evident upon inspection. Medically, he had an ASA 2 with Type 2 diabetes that was controlled with medication.

The patient was evaluated for a surgical and restorative implant-supported solution for the hopeless prognosis of the maxillary arch. To accurately assess the patient’s clinical reality a CBCT scan was obtained. The CBCT analysis revealed multiple alveolar bone deficiencies such as: dehiscence, fenestration, vertical and horizontal bone loss and periapical lesions (Fig. 3).

Final diagnosis

Generalised acute periodontitis in both the maxilla and the mandible. The prognosis for the existing dentition was poor and further planning was necessary to determine the most acceptable course of treatment for either delayed or immediate implant placement and immediate restoration as per the patient’s desires. The referring dentist had also disclosed that the patient had been inconsistent with his dental follow-ups. Therefore, before proceeding with any advanced treatment scenario, the patient’s motivation needed to be assessed since complex treatments necessitate cooperation, time commitment, and compliance from the patient. After reviewing the requirements with the patient, consent was granted and the patient elected to start treatment for his maxillary arch and engaged maintenance treatment for his mandibular arch.
Data collection included 2-D photographs, alginate impressions, a large field of view (FOV) CBCT scan (Carestream select 9600, Kodak) and a maximum intensity projection (MIP) bite registration. A smile analysis revealed that in maximal lip retraction position only a portion of his teeth were exposed, and no gingival tissue was present within the smile zone. Hence, it was determined that the transition line of the definitive patient’s prosthesis transition would be under the upper lip. It is therefore critical to understand the existing and desired aesthetic condition to facilitate the diagnostic and treatment planning phase as a predictor of the eventual functional and aesthetic outcome.²

When presented with hopeless teeth in the maxilla with the desire for an implant supported restorative solution, the treatment protocol often dictates a complete extraction scenario followed by the placement of an adequate number of root form implants needed to support an immediate provisional bridge.³–⁵ However, the aesthetic outcome of this procedure can be unpredictable due to a lack of appreciation of the soft tissue and the uncertainty of the vertical and anterior-posterior position of the final fixed prosthesis.

Previously it was proposed that a “patient acceptance prosthesis” be used to simulate the desired restorative outcome⁶ which has been followed with recent advances in computer simulation, intraoral scanners, and the merging of different datasets.⁷ The purpose of this paper is to review two innovative protocols that address the accuracy and predictability of full arch extraction and immediate implant placement for fixed implant-supported restorations.
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Innovation No. 1: Smile evaluation

A 2-D digital photograph was taken with the patient’s maximum smile. The photograph was then loaded into a smile design software (3D Smile Designer, Getursmile; Fig. 4), equipped with a specific tool set utilised to complete an accurate smile assessment followed by digital smile design work-up (Fig. 5). When the smile design was completed, the proposed simulations were presented to the patient for comment and ultimately consent to start treatment to obtain the desired aesthetic outcome (Figs. 6a & b). The true innovation relates to transitioning from the 2-D simulation to the 3-D reality with the capability of mounting to an articulator (Panadent). The principle of triangulation established a relationship between the pre-operative 2-D photograph overlaid onto the articulated stone cast of the maxillary arch (Fig. 7). Once the registration process was confirmed, the next 2-D simulation photograph was laid onto the cast to facilitate a real 3-D wax-up (Fig. 8). The wax-up was designed to replicate the simulation of the proposed image of the patient onto the articulator as an accurate prediction of the tooth position and aesthetic outcome within the frame of the patient’s face. Advanced tools allow the computer application control of the different objects based on their density or opacity referred to by the author as “selective transparency”.

The analogue 3-D wax-up model was then digitised utilising a desktop optical scanner and converted to an STL file (standard triangulation language) allowing for manipulation in various software applications. Once the aesthetic plan was confirmed, potential implant receptor sites for the root form implants could be evaluated from the CBCT dataset as simulated within the interactive treatment planning software (SimPlant, Dentsply Sirona). The ideal position for each implant was then determined (Fig. 9). The integration of 3-D images allows the surgeon, restorative dentist, and the dental laboratory technician to plan the position of the implant in a “reverse-engineering” process to match the implant to the prosthesis, or “restoratively-driven” planning (Figs. 10 & 11a–f). The goal is to achieve a precise and predictable position of the implants and the prosthesis in accordance to the simulation proposal.

Advanced features of segmentation with the merged dataset of the 3-D designed prosthesis simulation was then modified by removing the soft tissue while maintaining the arrangement of the teeth (Figs. 12 & 13). The STL file of the prosthetic design was then exported for CAD/CAM processing of a polymethyl methacrylate (PMMA) prosthesis with incorporated screw-access channels within its structure to accommodate the temporary screw-receiving implant abutments. To partially eliminate the uneven topography of the bone and to achieve the required bone width and volume for the implant recipient sites, bone reduction was necessary (Figs. 14–16). As more sophisticated computer diagnosis and treatment planning was developed for producing surgical guides for implant placement, a bone reduction template originally introduced by Ganz could be produced to accurately manage the bone to accept a secondary stereolithographic bone-supported surgical guide to drill osteotomies for each implant as per the planning scenario (Figs. 17 & 18).

Implant timing

Based upon a review of the CBCT scan it could be pre-determined that the patient presented with a soft bone density profile. Therefore, it was decided to review each potential receptor site carefully to position six implants in the maxilla (Nobel Biocare, Tapered Replace Conical Connection) to maximise the immediate load protocol. Over the past 30 years it has been well-documented that the standard surgical and restorative procedure to rehabilitate the edentate maxilla or mandible

Fig. 12: Virtual removal of the soft tissue around the teeth. That space will be filled by the patient’s soft tissue after healing. Fig. 13: Pre-op composite photograph: patient face view, maxilla CBCT’s, computer stereolithographic surgical guide and PMMA fixe bridge.
with an implant-supported restoration would best be served with four to six implants.\textsuperscript{12} To avoid vital structures and to avoid the necessity of bone grafting an acceptable treatment protocol involves implants that are tilted posteriorly which also serve to increase the anterior-posterior distance to improve the restorative foundation.\textsuperscript{13, 14}

After a review of the maxillary anatomy, it was decided to place four of the implants at a posterior tilted angle to avoid bone grafting in the maxillary sinus and the canine area. The osteotomies were positioned with the surgical guide fixated to the maxilla for stability. Each implant was placed and torque values and Resonance Frequency Analysis (RFA) were recorded. Once the implants were fixated to the maxilla, the immediate load protocol requires that the surgeon or restorative clinician match the prosthesis to the implants. To facilitate a screw-retained prosthesis it was determined that screw-receiving multi-unit abutments (MUA) be utilised at the time of implant placement (Nobel Biocare, Fig. 19). Multi-unit abutments can vary in tissue cuff height and angulation. Angulated multi-unit hexed abutments provide an additional challenge to both the surgeon and restorative dentist. The rotational position of the anti-rotational feature (hex) of the implant in the bone needs to match the multi-unit abutment angulation to allow for the emergence of the temporary titanium screw-retained sleeve within the channel provided in the prosthesis. The importance of this step cannot be underestimated as the prosthesis needs to fit passively onto each abutment. This rotational timing can be achieved by the markings on the surgical guide which correlate to the internal hex of the implant.

The fixed-detachable prosthesis was fabricated with open channels that allowed the temporary titanium sleeves on each MUA to project through the prosthesis. The empty channels made to accommodate the implant temporary titanium abutment sleeves can allow for vertical displacement of the prosthesis. Care must be taken to position the prosthesis carefully onto the abutments usually accomplished with a previously fabricated silicone bite index to properly manage the occlusion. The voids between the temporary sleeves and the prosthesis was then filled with a luting material (SmartCem 2, Dentsply Sirona). Care must be taken to position the prosthesis carefully onto the abutments usually accomplished with a previously fabricated silicone bite index to properly manage the occlusion. The voids between the temporary sleeves and the prosthesis was then filled with a luting material (SmartCem 2, Dentsply Sirona). Care must be taken to position the prosthesis carefully onto the abutments usually accomplished with a previously fabricated silicone bite index to properly manage the occlusion. The voids between the temporary sleeves and the prosthesis was then filled with a luting material (SmartCem 2, Dentsply Sirona). Care must be taken to position the prosthesis carefully onto the abutments usually accomplished with a previously fabricated silicone bite index to properly manage the occlusion. The voids between the temporary sleeves and the prosthesis was then filled with a luting material (SmartCem 2, Dentsply Sirona). Care must be taken to position the prosthesis carefully onto the abutments usually accomplished with a previously fabricated silicone bite index to properly manage the occlusion.
ment of the prosthesis before fixating it to the implant abutments. Potential movement may be minor and may not have any repercussion on the aesthetic outcome. If not well positioned, any vertical movement can affect the occlusion of the prosthesis. Occlusion adjustments will then be required causing increased chair and surgical time that the patient must undergo.

Innovation No. 2

As previously stated, the prosthesis can move vertically on the titanium MUs before being luted to the titanium sleeves. This process could cause a loss of precision while seating the prosthesis and lead to restorative or surgical complications while complicating the occlusion adjustments at the initial delivery. Traditionally, the pairing of the prosthesis is made in a freehand manner. The current innovation was made to bypass this intuitive pairing, to predictably seat the prosthesis as the initial plan and achieve little to no occlusal adjustments. A prototype seating 3-D stereolithographic prosthetic guide was designed and printed, to be inserted between the implants’ occlusal surface and the prosthesis (Fig. 20). The “seating guide” allows for a precise positioning of the prosthesis replicating the laboratory mounting (Fig. 22a). Once the prosthesis is luted to the temporary titanium abutment sleeves, the seating guide is removed and the space occupied by the guide will be filled with the patient’s soft tissue (Fig. 23). After fixating the bridge with a luting cement (SmartCem 2, Densply Sirona) a minimal occlusal adjustment was required (Fig. 24). Occlusion was balanced in static and dynamic movements and recorded with a digital occlusal analysis device (Tekscan).

Discussion tilted implants

Common inquiries about tilted implants are: force load on tilted implants, cantilever length, marginal bone loss and the patient’s preference towards minimally invasive treatment alternatives (avoiding bone grafting procedures). Bevilacqua et al. conducted a study to compare and analyze, via 3-dimensional (3-D) finite element analysis, stresses transmitted to tilted versus vertical implants and the surrounding peri-implant bone in the maxilla. The results demonstrated that tilted distal implants with the consequent reduction of the posterior cantilever length, (regarding implant rehabilitation of an atrophic maxilla) rigidly splinted with a fixed prosthesis, decreased the stress in the peri-implant bone and framework.

Del Fabro et al. completed a comprehensive literature review of 758 articles to compare the crestal bone level change around axially placed vs tilted implants supporting fixed prosthetic reconstructions for the rehabilitation of partially and fully edentulous jaws after at least one year of function. The review demonstrated that the tilting of implants does not induce significant alteration in crestal bone level change as compared to conventional axial placement after one year of function. This trend was maintained for up to five years of function. Malo et al. compared marginal bone loss and implant success after a five-year follow-up between axial and tilted implants inserted for full-arch maxilla rehabilitation.

In a study of 891 patients with 3,564 maxillary implants rehabilitated according to the “All-on-4” treatment concept, the results conveyed that axial and tilted implants showed comparable mean marginal bone losses of \(1.14 \pm 0.71\) and \(1.19 \pm 0.82\) mm respectively. The five-year follow-up concluded that tilted implants behave similarly with regards to marginal bone loss and implant success in comparison to axial implants in full-arch rehabilitation of the maxilla.

Pommer et al. proceeded to perform a MEDLINE search of the literature to evaluate: patient satisfaction, oral health-related quality of life, and patients’ preferences toward minimally invasive treatment options for graft-less rehabilitation of complete edentulism by means of dental implants. Their conclusion was that little evidence on patients’ preferences towards minimally invasive treatment alternatives vs bone augmentation surgery could be iden-
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tified from within-study comparison. Patient satisfaction was generally high with graftless solutions for implant rehabilitation of completely edentulous jaws. Comparative research is still needed to substantiate the positive appeal to potential implant patients and possible reduction of the indications for invasive bone graft surgery.

A literature review for the advantages of tilted implants was described by Asawa et al.8 Several advantages of tilted implants were listed as follows:

1. Stability even in minimum bone volume: longer implants can be used in minimum bone volume with the advantage of increased bone-to-implant contact and a reduced need for vertical bone augmentation.
2. Good clinical results.
3. Eliminates the need for bone grafting which can be invasive with unpredictable outcomes.19
4. Can usually be performed in patients with various systemic conditions which are often contraindications for bone grafting.19
5. Angulations allow placement that avoids anatomical structures.20
6. Biomechanical advantage in using tilted distal implants rather than distal cantilever units.21
7. Reduction in length of cantilevers without performing bone grafting or sinus lifting.22
8. Effective and safe alternative to maxillary sinus floor augmentation procedures23 and to pneumatized maxillary sinus.24

9. Distally tilted implants produced improved force transmission compared to vertical implants.25
10. Excellent prognosis in short-medium term,26 as well as long term.27

Considering all these advantages, placement of an angulated implant while avoiding invasive procedures like sinus lift and bone augmentation procedures, is a feasible treatment option.28

Conclusion

Several protocols are currently available to immediately provisionalise and then restore an implant-supported dentition in the maxilla. “All-on-4” protocols29–31 are well represented in the literature. However, the All-on-4 protocols lack the ability of having a preview of the patient’s outcome before the surgery. Even if a photographic simulation is achieved, the dental laboratory will empirically position the teeth on the cast without any metric relation to the pre-op photographic simulation. The All-on-4 protocol includes a conversion technique31, 32 to modify a complete denture to a fixed provisional bridge. This technique usually requires a lengthy clinical process with occlusal adjustments. In some cases, the occlusal level can be offset from the natural horizontal line or the mid-line can be different from the aesthetic requirements.

Other immediate protocols that are computer driven, such as nSequence (NDX nSequence) and Guided Smile™ Chrome™ (ROE Dental Laboratory) do have a precise seating of the fixed prosthesis but do not have a formal aesthetic pre-determination of the patient’s smile. DSD 3-D Planning (Spain) offers similar services but requires training, many more photographic and video collection, and specific software applications over their internet-based network.33, 34 The current concept was developed to simplify the process of delivering aesthetic full arch immediate loading protocols.

Clearly these new developments offer crucial advantages since aesthetics are a sensitive part of treatment acceptance. Certain limitations are involved in these
clinical innovations. The first step in the process involves taking a photograph of the patient smile. Care must be taken when this photograph is captured to ensure that it reflects the patient’s maximum smile. If the transition line between the prosthesis is visible in the aesthetic zone, the described approach will not be applicable. As the author has published previously having the transition line in the aesthetic zone can require supplemental treatments such as: Botox lip relocation preparing a removable prosthesis with a vestibular extension that will end under the patient’s maxillary lip, or osteoplasty to reduce the vertical position of the maxilla.

Another potential limitation is the selection of the angulated abutments for tilted implants. When selecting angulated abutments, one must choose computer guided surgery software that includes a library for the original design of these abutments. Otherwise, pairing the prosthesis to the angulated abutments will be at risk if the components differ from the virtual design. Additionally, if the surrounding bone is not sufficiently cleared, the MUAs get lodged against the bone and will not fit and a “bone-profiler” may be required to ensure that the abutment will seat fully on the implant.

Other basic metrics are necessary for an immediate load scenario. Bone density and resonance frequency analysis (RFA) and implant stability quotient (ISQ) are useful to assure a predictable immediate loading success. In any event, pre-planning a backup scenario is imperative if a surgical complication occurs such as: bone fracture on extraction or implant placement, root tip fracture, or loss of the buccal bone plate. Digital technology is quickly becoming an important and essential attribute to all phases of clinical dentistry. The current innovations certainly have a promising future. Time and attention to details are essential to mastering these emerging technologies.

Digital dentistry, including CBCT imaging, interactive treatment planning software, the increased use of rapid prototyping/3-D printing, and improved CAD/CAM and printed materials can help predict the aesthetic outcome before the surgical procedures involved with an immediate implant rehabilitation of terminal dentition in the maxilla, or, as the author has stated, “before the scalpel ever touches the patient.” It firmly confirms that the adage, “It’s not the scan, it’s the plan” has more importance than ever.

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Implant retreatment

Dr Philippe Leclercq, France; Jean-François Martinez, France & Michael Brüsh, Germany

When working with dental implants, a number of specific rules must be followed regarding both the implant surgery and the prosthesis itself (fixed prosthesis tending to have a more favourable prognosis than overdentures). If these rules are not adhered to, the results are often unsatisfactory, requiring retreatment.

In such cases, and despite the patient’s desire to quickly forget the previous treatment, a very strict protocol must be followed, specifically concerning the length of healing periods. Despite an increase in the overall treatment duration, this will ensure success of each stage of treatment. The implant retreatment case outlined in this article will emphasise these different stages in this type of clinical situation.

Initial case

At the age of 28, the patient was involved in a traffic accident, which resulted in significant trauma to her maxilla, including the loss of her central and lateral incisors and left canine. The shock also led to the loss of alveolar bone in the same area. The first premolars were absent, probably owing to previous orthodontic treatment.

The original treatment consisted of placing two implants in the residual bone and an anchorage reinforcement screw-retained bridge to maintain a removable prosthesis, which included five teeth and a large false gingiva (Fig. 1).

Figs. 1 & 2: Initial prostheses: Lip support was ensured by a large false gingiva, and fractured cosmetic material at the right maxillary canine was evident. The patient’s smile showed the prosthetic teeth placed off-centre and an infiltration at the right lateral incisal level. Fig. 3: Examination after three years revealed a negative short-term prognosis for the implants owing to significant recession at the right implant and hyperplastic tissue. Fig. 4: The framework was unscrewed, abutments removed and implants easily removed. Fig. 5: Implant removal site showing even greater deterioration in bone volume. Figs. 6 & 7: The grafts were harvested from the chin symphysis and firmly attached by surgical screws in the recipient site.
Dissatisfied with the treatment, the patient was re-examined three years after the initial treatment. The patient’s smile showed an infiltration at the right lateral incisal level and that the prosthetic teeth were placed off-centre. The lip support, ensured by a large false gingiva, was correct. The cosmetic material of the right maxillary canine was fractured (Figs. 1 & 2).

Once the patient’s prosthesis had been removed and an examination of the site conducted, an extremely negative prognosis was determined for the implants (Fig. 3), which is often the case with maxillary overdentures. The right implant showed a loss of the majority of its vestibular bone, causing significant recession. The tissue was hyperplastic, making hygiene difficult. The framework was off-centre presumably because of the implants, which explained the off-centre axis of the prosthetic teeth.

Over the past several years, many authors have observed recurrent gingival inflammation as a reaction to using implants for this indication. Engquist noted a gingival increase in 25 per cent of the cases; Naert et al. showed that out of 86 overdentures (6 maxillary, 80 mandibular), 8 observed gingival hyperplasia, primarily in the maxilla (9.3 per cent); and Jemt et al. observed that after one year out of 92 maxillary overdentures, 19 patients showed gingival hyperplasia (20.9 per cent), 13 patients had one gingival correction and five had two corrections. In a 1993 study on maxillary overdentures, Smedberg et al. observed: “The results show that the prevalence (p < 0.05) for Lactobacillus, Prevotella (subspecies) and yeasts in the subjects with removable prostheses was significantly higher than in subjects with fixed prostheses. Removable prosthetics were accompanied by a more aggressive peri-implant plaque.” In view of our patient’s unsatisfactory treatment results, it was thus decided to restart treatment completely.

**Retreatment**

The retreatment followed an extremely precise protocol, especially regarding the length of the healing periods. To begin, dental impressions were taken to create a resin-based temporary removable prosthesis. The prosthesis included palatal support to relieve the vestibular gingival tissue as much as possible. An aesthetic fitting of the appliance was conducted to straighten the axis of the incisors.

**Implant removal**

Owing to insufficient osseointegration, the removal of the implants was fairly easy (Fig. 4). Removal was accomplished with the aid of an implant removal tool.

Immediately after implant removal, the temporary removable resin prosthesis with palatal support was inserted. To permit the rapid elimination of inflammatory residue, it was contra-indicated to suture the recipient implant site.

Figs. 8 & 9: The properly compressed PRF membranes permitted complete coverage of the surgical site, in this instance on the maxilla. Fig. 10: Panoramic radiograph showing the grafts to be correctly healed and satisfactorily adhered to the recipient bone sites. Fig. 11: Increased vestibular bone volume allowed positioning of the teeth at the crestal bone level and reduction of the false gingiva. Fig. 12: A key of the added wax was taken and fabricated in clear casting resin.
Assessment after implant removal

Three months after implant removal, a clinical and radiographic assessment was conducted. The assessment showed further significant vertical bone loss and loss in bone volume (Fig. 5). Significant vertical bone loss is difficult to correct owing to random gingival recovery. It was thus decided to augment the bone volume by performing a chin bone graft.

Bone graft

Anaesthetic was administered in the maxillary and mandibular anterior region. For the mandible, the sample was taken from the cortical bone and a section of the cancellous bone by piezoelectric surgery. The grafts were harvested from the chin symphysis, as close as possible to the mandibular inferior ridge to avoid disturbing the incisor’s sensitive innervation, which can be a frequent complication of the procedure. The vestibular cortical bone scar was perforated with a small round bur, allowing for rapid revascularisation of the grafts. The grafts were then positioned and secured in place with mini-screws (Figs. 6 & 7).

To increase success, a blood sample was taken and centrifuged according to the Choukroun platelet-rich fibrin (PRF) technique in order to recuperate the fibrin clots. The clots were compressed between two compresses to evacuate the serum and to form the membranes which were then applied to the surgical site and in the mandibular harvesting sites (Figs. 8 & 9).

Pre-implant prosthetic study

After four months, according to radiographic examination, the tissue had healed and the bone mass appeared stable (Fig. 10). New impressions were taken to prepare for the next step in treatment: the implant drilling guide. After four months of healing, the increased vestibular bone volume allowed positioning the teeth at the crestal bone and reduction of the false gingiva using additional wax (Fig. 11). A key of the added wax was taken and fabricated in clear CAD/CAM 3 2018

Fig. 13: The reopened site showing correct graft integration, a notable increase in cortical bone and excellent vascularity. Fig. 14: Testing of the sterilised surgical drilling guide proved drilling would be at the centre of the reconstructed bone ridge. Fig. 15: Aadva self-tapping implants were placed. Fig. 16: All five implants equipped with threaded cover screws and the surrounding tissue sutured. Fig. 17: Loaded implants, healing abutments in situ. Fig. 18: The healing abutments were removed and replaced with pick-up impression copings secured with self-curing resin. Figs. 19 & 20: Removal of the impression and fitting of the impression copings with their laboratory equivalent. Fig. 21: Model of the framework, temporarily including the canine, cast in pattern resin.
casting resin. The implant positions were decided on and finalised by drilling placement holes, determining the exact position of the implants (Fig. 12). The correct positioning of implants in relation to the future prosthesis is an important prerequisite for aesthetic and functional success.

Implant placement
Local anaesthesia was administered and the bone site reopened. The site showed correct integration of the grafts, a notable increase in cortical bone and excellent vascularity throughout the site (Fig. 13). The sterilised surgical drilling guide was tested and showed that drilling would in fact be at the centre of the reconstructed bone ridge (Fig. 14).

After removal of the screws stabilising the grafts, the guide was placed and drilling (using physiological saline solution) completed. Five Aadva (GC Tech.Europe) self-tapping Grade 5 titanium microstructure implants were inserted by slow drilling (Fig. 15). Aspiration with physiological saline solution was not used at this time so that the first contact with the titanium oxide would be the patient’s blood, thus promoting the implants’ osseointegration. This specific implantation technique was validated by Brun et al. All of the implants were equipped with threaded cover screws and the surrounding tissue was sutured (Fig. 16).

To minimise risks, the implants were left unloaded for four months, as immediate loading of a site such as this one could have proven to be problematic.

Implant loading and impressions
After four months, the implants were loaded using an apically positioned flap. The healing abutments were placed and the flap sutured around them (Fig. 17). Radiographic analysis and especially a percussion test showed the implants’ perfect osseointegration. After 15 days of gingival healing around the abutments, they were removed and the impression copings were placed and secured with a self-curing resin (Fig. 18). Impressions were taken and the healing screws were reinserted (Figs. 19 & 20).

Validation prosthesis
Rather than calling the appliance at this stage a “temporary prosthesis” or “provisional prosthesis”, it is more...
appropriate to call this temporarily placed prosthesis, a “validation prosthesis of the implanto-occluso-prosthetic concept recommended to the patient”. Over the course of several months, this prosthesis validates
- the osseointegration of the implants;
- the aesthetic aspect, especially for the anterior teeth;
- phonation, which is also important for the maxillary anterior region;
- the patient’s ability to correctly clean the prosthesis; and occlusion and, in this case, the ability of the anterior to guide the disclusion of the canine groups in protrusion.

This prosthesis serves as a model for the final prosthesis. It is made with easily modifiable material like resin, but with a metal framework to guarantee a certain level of rigidity. In the first step, a model of the framework, which temporarily included the canine to increase stability, was cast in pattern resin (Fig. 21). The model was then scanned (Aadvia, GC Tech.Europe; two cameras, 2 MP, precision: 10 μm) before being transferred to a machining centre (GM 1000, GC Tech.Europe; Figs. 22–24).

Once back from the machining, the titanium framework was tested on the working model and its stability was verified (Figs. 25 & 26).

The cosmetic material (UNIFAST III resin; surface rendering: OPTIGLAZE color, GC Tech.Europe) was then placed on the framework (Fig. 27). The bone graft permitted a maximum reduction of the vestibular false gingiva.

In the following step, the prosthesis was attached in the mouth with screws and the necessary occlusal verification was conducted, including maximum intercuspation, protrusion and lateral excursion. The natural canine on the right was also equipped with a verification tooth. It should be noted, that in lateral excursion on the left, with the antagonist being the original tooth equipped with its periodontal ligament receptors, the canine function was retained; however the group function, which is usually preferred, was neurophysiologically inept (Figs. 28 & 29).

The patient’s smile showed that the incisors were now well balanced and in line with the face’s sagittal plane. Lip support appeared to be correct and, as often is the case, this would all be validated by the patient’s surrounding friends and family (Fig. 30).

After three months, the validation prosthesis was removed in order to examine the areas where mucosa had been compressed and dental hygiene difficult. These areas were corrected and the validation prosthesis reinstalled (Fig. 31).

Final prosthesis
After six months, all of the parameters were validated. The final prosthesis was then fabricated as an exact copy
of the validation prosthesis, but in a more durable material: zirconia for the framework and ceramic for the aesthetic material.

As with the titanium validation prosthesis, the framework and the coping for the right canine were scanned and transmitted to the machining centre. They were then tested on the working model (Figs. 32 & 33). After fitting of the zirconia framework, the ceramic was cast using the exact parameters validated by the resin prosthesis (MB Dentaltechnik, Figs. 34 & 35).

In the following step, the final prosthesis was installed and the correct occlusion verified: maximum intercuspation, protrusion and lateral excursion. The screw channels were filled with composite (Figs. 36 & 37).

The final cosmetic check-up, validated by the resin prosthesis, showed the lip support with the new extremely reduced false gingiva to be correct (Figs. 38 & 39). This was achieved owing to the bone graft.

Regular check-ups

Retreatment was regularly monitored with patient check-ups (Fig. 40). All implant treatments, no matter of what type, must be rigorously monitored in all treatment phases, but a retreatment requires even more diligence. A patient affected by the failure of a previous treatment will not accept even the smallest problem. To this end, the role of healing periods is thus essential to retreatment success.

Editorial note: A list of references is available from the publisher.

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Mandibular dental reconstruction

The mandibular reconstruction described in the following case report was performed using the Astra Tech Implant System® EV and the SmartFix® concept (Dentsply Sirona Implants).

The patient selected to have her mandibular dentition comprehensively rehabilitated with an implant-supported fixed prosthesis utilising four implants. The remaining five teeth demonstrated a suitable vertical dimension of occlusion in centric relation with the occlusal plane providing acceptable phonetics and aesthetics (Fig. 1). A panoramic radiographic image was taken to record the dentoalveolar status at the time when the patient initially presented (Fig. 2). The previous, failed posterior fixed dental prosthesis was removed prior to definitive treatment planning.

Following cone beam computed tomography (CBCT) based planning, the patient’s remaining mandibular teeth were extracted. Implant treatment planning was performed in the SimPlant software (Dentsply Sirona Implants) revealing the proposed position of the teeth in occlusion and the estimated position of anterior implants (OsseoSpeed EV) and posterior implants (OsseoSpeed Profile EV) within the confines of the proposed final prosthesis (Fig. 3).

After surgical placement of the four implants, an alveolectomy was performed using a pilot guide approach. In the next step the appropriate abutments were placed in a tilted anterioposterior configuration to increase distribution according to the “Rules of 10” by Cooper et al. Thus the abutments were torqued to 25 Ncm. Anteriorly, straight abutments were used. Owing to its flexibility the polyether ether keton (PEEK) abutment holder was used to avoid the tongue and cheek and to confirm parallel alignment with the other three abutments (Fig. 4). Cylinders were then placed onto the abutments using the appropriate screws. According to the clinician’s choice of opaque material the cylinders were filled with vinyl polysiloxane (VPS) impression material to protect the screws. Polymerisation sleeves were consequently placed on each abutment below the designated finishing line in order to protect the freshly sutured incision line (Fig. 5).

A CAD/CAM milled provisional was provided at the time of implant placement (Fig. 6). After attaching the prosthesis to the temporary cylinders using a closed mouth technique to assure its position in centric relation, the prosthesis was veneered with pink composite material to replicate mucosal and alveolar architecture. It was then attached to the abutments using Multibase EV Bridge Screws torqued to 15 Ncm (Fig. 7). Following this combined surgical and restorative treatment session a panoramic radiograph was taken revealing the alveolectomy, the relative implant positions, the angular correction using the posterior 17 degree multibase abutment and the general position of the radiolucent prosthesis (Fig. 8).

After eight weeks of uneventful healing, the relative health of the peri-implant mucosa was checked. The patient was extremely satisfied with the fit, function and aesthetics of the interim prosthesis (Fig. 9). The relatively immature nature of the mucosa and modest inflammation was observed on the alveolar ridge crest. The peri-implant mucosa adjacent to the abutments, however, proved to be well adapted to the cylinder margins and free of inflammation (Fig. 10).

In the next step a prosthetic guide was printed from the previously taken CAD/CAM files in order to design the milled poly(methyl methacrylate) (PMMA) prosthesis. The guide was used during surgery to assess the position of the implants and to help align the non-indexed 17 degree multibase abutments (Fig. 11). The occlusal view of the prosthetic guide demonstrated the orientation of the cylinders to the proposed prosthesis’ occlusal table and incisal edges (Fig. 12).

A final impression was taken within the prosthetic guide by attaching the cylinders to the prosthetic guide using flowable composite. The mucosa/prosthesis interface was subsequently impressed by washing the impression with low viscosity VPS impression material (Fig. 13).

After completing the impression step, the prosthetic guide was used to record centric relation, thus the position of the implants, the vertical dimension of occlusion and the centric relation could be accurately transferred to the laboratory. The incorporated tooth position and morphology provided the technician with all information regarding the planned (and desired) tooth position, phonetics and aesthetics (Figs. 14 & 15).

The final monolithic zirconia prosthesis was delivered and detailed supportive therapy instructions were provided. The practitioner should note that when proper alveolectomy is performed, the prosthesis will measure at least 10 mm in height. Further gingival ceramic should be
Fig. 1: Intraoral appearance of the pre-treatment dental condition.

Fig. 2: Panoramic radiographic image demonstrating the initial dentoalveolar status.

Fig. 3: Implant treatment planning performed with SimPlant software (Dentsply Sirona Implants).

Fig. 4: Multibase Abutment EV (Dentsply Sirona Implants) placed at a torque of 25 Ncm.

Fig. 5: Multibase EV Temporary Cylinders (Dentsply Sirona Implants) filled with VPS material placed onto the abutments.

Fig. 6: Polymerisation sleeves placed on each abutment to protect the incision line. CAD/CAM milled PMMA provisional sitting loosely over the abutments demonstrating the correct alignment of abutment and cylinders.

Fig. 7: Prosthesis attached to the temporary cylinders.

Fig. 8: Postsurgical panoramic radiograph.

Figs. 9 & 10: Eight-week postsurgical check-up: Peri-implant mucosa is well adapted to the cylinder margins and free of inflammation, modest inflammation on the alveolar ridge crest.

Fig. 11: Prosthetic guide used during surgery for assessment of implant position and to help align the abutments.

Fig. 12: Occlusal view of the prosthetic guide.

Fig. 13: The prosthetic guide being used for final impressions.

Fig. 14: Prosthetic guide used for recording centric relation.

Fig. 15: Intaglio surface view of the copings picked up in an open-tray impression using a stock dentate impression tray.
displayed beneath the cervical contours of the mandibular teeth (Figs. 16a & b, 17). The bonded titanium cylinders within the monolithic zirconia prosthesis are a critical bonding step that must be performed with care (Fig. 18).

At the time of final prosthesis delivery, the oral mucosal healing had progressed. The patient’s hygiene efforts had improved and the peri-implant mucosal architecture included the presence of keratinised tissue surrounding the abutment–cylinder interface (Fig. 19). The occlusion demonstrated bilateral symmetric contacts with the maxillary natural dentition as verified using shim stock. Only minor polishing was required to achieve this result. The screw access holes were filled with Teflon tape and colour-matching flowable composite resin in order to achieve a maximum aesthetic result (Figs. 20 & 21).

Figs. 16a & b: Buccal view of the final monolithic zirconia implant-supported fixed prosthesis with veneered gingival ceramic (Lee Culp, Sculpture Studios). Fig. 17: Facial view of final prosthesis. Fig. 18: Occlusal view revealing bulk of material designed to assure long-term function. Fig. 19: Progressed oral mucosal healing and keratinised tissue surrounding the abutment–cylinder interface upon final prosthesis delivery. Fig. 20: Intraoral occlusal view of the final prosthesis following delivery. Fig. 21: Facial view of the patient’s smile upon delivery of the mandibular prosthesis.

Literature

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Join the largest educational network in dentistry!
Incorporating CAD/CAM solutions for full-mouth dental implant reconstructions

Dr Ara Nazarian, USA

Patients facing the loss of their natural dentition have more treatment options than ever before. The traditional complete denture, once the standard of care for the fully edentulous patient, is slowly but surely giving way to fixed full-arch implant restorations as their superior stability, function and aesthetics become more well known. Further, prosthetic materials have advanced in leaps and bounds, and monolithic zirconia can now be milled for fixed full-arch indications. By moving beyond acrylic and its vulnerability to wear, chipping, stains and fracture, this adds long-term durability to the qualities that make the fixed implant prosthesis the ultimate restorative option for fully edentulous cases.

Owing to the versatility of dental CAD/CAM technology and the material properties of monolithic zirconia, high-strength restorations can be fabricated for the fully edentulous patient in various configurations. For example, because of its flexural strength of up to 1,465 MPa, BruxZir Solid Zirconia (Glidewell Laboratories) can be milled into thin layers and maintain the high level of durability for which the material has become known. This allows for the fabrication of restorations ranging from the monolithic zirconia full-arch implant prosthesis, which resembles a screw-retained hybrid denture in form, to cementable prostheses that attach to custom abutments in the manner of traditional crown and bridge work.

While the screw-retained monolithic zirconia full-arch implant restoration has grown increasingly popular in recent years, the cementable alternative is well suited for many patients. When sufficient hard and soft tissue are present, prostheses can be designed that emerge directly from the gingiva, creating the aesthetics and feel of natural dentition. Additionally, the use of custom abutments to support a cementable full-arch bridge allows for low-profile restorations with minimal faciolingual width. This is appealing to many patients and can indicate a fixed solution in cases of limited vertical clearance.

Cementable monolithic zirconia implant prostheses can be fabricated in various designs as described by Dr Carl Misch’s prosthetic classifications. While they are most commonly indicated in fixed prosthesis (FP) 1 and 2 cases, in which the prosthetic teeth rise from the gingivae like natural teeth, they can also be used in FP3 cases, where the monolithic prosthesis includes pink gingival areas in order to reconstitute the soft tissue. Whichever prosthesis type is indicated, the precision of dental CAD/CAM technology and versatility of full-contour zirconia allow the entire restoration to be milled from a single block of the material, adding to the overall strength.
All of these prosthesis types afford bone preservation, improved dental function, psychological benefits and enhanced quality of life associated with fixed implant prostheses, which come the closest to natural dentition of all restorative options.2, 3

The use of custom abutments for this type of restoration—and all cementable prostheses for that matter—is essential, as it allows for the creation of margins that are gingival or just slightly subgingival, enhancing crown retention, cervical soft-tissue margins and the final emergence profile.4, 5 The precision and flexibility in prosthetic positioning allowed for by custom abutments also make it easier to achieve a passive fit for the restoration and correct for divergent angulation of implants.

The following case report features a full-mouth reconstruction via cementable full-arch BruxZir bridges over Inclusive Titanium Custom Abutments (Glidewell Laboratories). The treatment protocol for this type of restoration will be illustrated, as well as the general parameters for determining whether this solution is indicated for the individual patient. Standard denture technique, digital treatment planning and CAD/CAM technology were used to achieve an excellent result in an aesthetically challenging case.

Case presentation

A female patient in her mid-fifties presented for treatment with an edentulous maxilla and grossly decayed, hyper-erupted mandibular dentition (Figs. 1 & 2). The patient was a heavy smoker, had not seen a dentist in several years, and was not taking proper care of her remaining teeth owing to pain and discomfort. The patient’s maxillary denture had become increasingly loose-fitting since losing her teeth nearly a decade prior. Her desire for a restoration that felt and functioned more like natural teeth led her to my practice, where she could undergo the surgical and prosthetic phases of treatment under one roof. Intra-oral and radiographic evaluation indicated sufficient bone volume for full-arch implant therapy.

Treatment options were presented to the patient for her edentulous upper arch and non-restorable mandibular dentition, including various combinations of fixed and removable implant prostheses. This involved a discussion of complete edentulism and its problems, consequences and solutions, the effect of tooth loss on oral health, and the differences in stability and function afforded by each treatment option. Dental financing programmes were explained, which is an important part of treatment presenta-
tion, as it can help make implant therapy feasible for patients who cannot cover the entire cost upfront.

The patient strongly desired fixed restorations, as she had grown quite frustrated with her removable maxillary denture over the years. In addition, the patient had a pronounced gag reflex, making the fixed option optimal because it would free up the palate. An FP 3 prosthesis was required for the patient’s maxillary arch, which had undergone substantial bone resorption and gingival recession. The tissue contours would also need to be recreated in the mandible, where bone levelling was required to remove undercuts, create an ideal occlusal table, properly seat a bone-supported surgical guide and establish adequate bone width in which to place the implants.

The anatomy of the patient’s ridges called for a cementable solution, as the labiolingual bone volume required that several of the implants be tilted in a manner that would have required access holes too far to the facial aspect if screw-retained prostheses were to be prescribed. This would have been especially problematic for this patient, as cigarette smoking tends to darken the composite used to seal the screw access holes. The patient also desired prostheses that occupied as little faciopalatal space as possible, further indicating a cementable solution. Thus, custom abutments would be utilised to correct the angulation of the implants and support full-arch BruxZir restorations. The monolithic construction of the FP 3 prosthesis, in which both the gingival areas and teeth are milled from the same block of solid zirconia, would ensure the longest-lasting restoration possible.

The patient returned for the records appointment, where maxillary and mandibular impressions were taken so that immediate temporary dentures could be fabricated for delivery at the surgical appointment. CBCT scanning was performed using a CS 8100 3D scanner (Carestream Dental) to provide the information needed for virtual treatment planning. The 3-D data obtained from the CBCT scans was used to determine the ideal length, width and placement of the implants in the key positions of the patient’s edentulous arches, including the first molar, first premolar, canine and central incisor regions (Figs. 3–6). From the digital treatment plan created by 3D Diagnostix, bone-level surgical guides were produced for the maxilla and mandible (Figs. 7 & 8).

The Hahn Tapered Implant (The Hahn Tapered Implant System) was selected for the procedure because the pronounced thread design would help achieve optimal positioning and primary stability. The tapered shape and wide range of sizes also simplified the task of situating the implants in the key positions around the arch. Its conical internal hex connection results in a very stable seal between the implant and prosthesis, which is beneficial for crestal bone preservation and soft-tissue health.3

Fig. 7: Surgical guide for maxillary implants. Fig. 8: Surgical guide for mandibular implants. Fig. 9: Placement of maxillary surgical guide. Fig. 10: Paralleling pins placed. Fig. 11: Hahn dental implant being inserted. Fig. 12: Healing caps placed.
At the surgical appointment, intravenous sedation was administered to the patient. The bone-level surgical guide was seated over the patient’s maxilla once the tissue had been reflected, and the fixation pins were tightened (Fig. 9). The implant osteotomies were created following the simplified surgical protocol of the Hahn Tapered Implant System. Eight implants were placed from second molar to second molar in the maxillary arch (Figs. 10 & 11). Healing abutments were connected to the implants to help prepare the soft tissue for the restorative phase (Fig. 12).

Next, the patient’s untreatable mandibular teeth (Fig. 13) were extracted using the Physics Forceps (GoldenDent), a flap was reflected, and an alveoloplasty was performed. A bone-supported guide was seated in order to control the location and angulation of the implant osteotomies (Fig. 14). As the Hahn Tapered Implants were threaded into place, their deep, sharp threads engaged the walls of the socket sites and helped maintain proper position toward the lingual aspect. Because of anticipated tissue swelling as a result of the bone leveling procedure, 5 mm high healing abutments were connected to the implants in the lower arch (Fig. 15). The immediate dentures were soft-relined with Mucopren (Kettenbach) to seat over the Hahn Tapered Implant Healing Abutments, the hourglass shape and undercuts of which provided a degree of retention that enhanced dental function for the patient during healing (Fig. 16).

Four months later (Figs. 17 & 18), the healing abutments in the maxillary arch were surgically exposed and the tissue appropriately approximated and allowed to heal. Approximately two to three weeks later, Hahn Tapered Implant Impression Copings were seated and closed-tray impressions taken with a polyvinylsiloxane material (Panasil, Kettenbach), as was a bite registration (Futar, Kettenbach). Because the immediate dentures were well fitting and satisfactory to the patient, duplicates were provided to the laboratory to aid the restoration design process.

Based on the impressions, the laboratory poured and scanned stone models, creating a digital representation of the patient’s arches on which the designs for custom abutments and the cementable restoration were created. Inclusive Titanium Custom Abutments were fabricated with corresponding PMMA Smile Composers.

The patient returned for clinical evaluation of the prosthetic design. The custom abutments were delivered using laboratory-provided acrylic delivery jigs, which helped ensure proper orientation during seating (Fig. 19). Owing to the precision of the digital design process, the fit of the custom abutments was ideal, establishing margins that were at or a slight distance from the gingival surface. This simplified the removal of excess cement from the margins and illustrates the advantages of CAD/CAM-produced abutments.
The PMMA Smile Composers were seated over the custom abutments, and slight alterations were made to fine-tune the gingival margins, length of teeth, and bite (Fig. 20). A bite registration was taken with the try-in bridges in place.

The PMMA Smile Composers were returned to the laboratory along with photographs, the bite registration and instructions for minor modifications, including lowering the gingival margins of the mandibular prosthesis and raising the gingival margins of the maxillary prosthesis. The laboratory scanned the adjusted PMMA try-in bridges, made the requested alterations to the prosthetic designs, and milled the final prostheses from BruxZir Solid Zirconia.

The final restoration was delivered at the next appointment and established accurate fit, function and interocclusal relationship (Figs. 21 & 22). No adjustments were needed for the monolithic zirconia prostheses because of the PMMA try-in process, which captured the precise modifications needed for proper form and aesthetics. Final radiography confirmed complete seating of the BruxZir restoration on the Inclusive Custom Implant Abutments. The patient was extremely happy with the reconstruction of her maxillary and mandibular arches, which restored aesthetics, dental function, comfort and confidence.

Conclusion

The accuracy of dental CAD/CAM technology and the versatility of prosthetic materials allow practitioners considerable flexibility in restoring the edentulous arch. For clinicians who prefer a cementable solution or cases in which bone anatomy precludes a screw-retained prosthesis, the monolithic zirconia restoration over custom abutments excels in restoring the teeth, as well as the hard and soft tissue of the fully edentulous patient.

Editorial note: A list of references is available from the publisher.

about

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Digital workflow and application of PRF and ozone therapy in oral rehabilitation

Drs Miguel Stanley, Ana Paz, Catarina Rodrigues & Diogo Mendes, Portugal

Introduction

The digital revolution has changed the world and dental medicine is no exception. We live in the digital era: we have the materials and techniques that allow us to develop a totally digital workflow, allowing dental medicine to grow to a new level, becoming faster and more efficient, when combined with scientific and clinical knowledge.

Clinical case

In November 2017, a 39-year-old female patient came to an initial appointment at White Clinic owing to tooth pain (tooth #16). A clinical and radiographic examination were performed, including a periapical radiograph, CBCT scan (Carestream 9500, Carestream Dental), and intra- and extraoral photographs (Figs. 1–3).
In the clinical and radiographic evaluation, it was observed that tooth #16 presented an invasive cervical resorption at the mesiobuccal root. The treatment plan established was dental extraction with immediate implant placement. The tooth had been previously re-treated endodontically and restored with a definitive ceramic crown. Due to the current situation of the tooth, although the protocol in White Clinic is to preserve teeth, it had indication for immediate extraction. Also due to the lack of time, our digital team was not able to produce a surgical guide for the implant placement. Therefore, the treatment plan, included a surgical phase and a digital prosthetic phase.

The surgical treatment phase started with extraction of tooth #16, followed by excision of the root cyst and alveolar curettage (Figs. 4a & b). For good disinfection of the alveolus, ozone therapy (Ozone DTA, Apoza) was applied (Fig. 4c), taking into account the antimicrobial action of ozone, which prevents the development of the inflammatory process, favouring cellular recovery and consequently improving the postoperative healing. Once the alveolus had been disinfected, the implant bed was prepared with a sequence of implant drills from the AnyRidge surgical system (AnyRidge Surgical Kit, MegaGen; Fig. 4d). The bone defects were filled with a bone xenograft of porcine origin (Gen-Os, OsteoBiol), mixed with i-PRF (injectable platelet-rich fibrin; PRF process by Choukroun; Figs. 5a & b). Afterwards, bone densification was performed through a sequence of Densah drills (Densah Burs, Versah; Fig. 6a). This type of drill allows the clinician to perform a bone densification process.

Once the implant bed had been prepared, a 7 × 10 mm implant (AnyRidge) was placed. After placement, the ISQ (Implant Stability Quotient) was measured with a stability meter (Mega ISQ, MegaGen), and the value was 72. According to the ISQ scale, this represents high stability (Fig. 6b). A 10 × 7 mm healing screw (AnyRidge) was placed, along with a plug of A-PRF (advanced platelet-rich fibrin; PRF process by Choukroun) in order to accelerate the healing process, and sutured with 4/0 polypropylene (Hu-Friedy; Figs. 7–10). After the surgical procedure, the White Clinic postoperative protocol was applied: application for eight minutes of the ATP38 laser (Swiss Bio Inov), based on the principle of Low Level Laser Therapy that acts on the cellular metabolism and provides a better and faster postoperative healing. The patient was instructed to use a 0.2% hyaluronic acid gel (Gengigel, Ricerfarma) and 0.1% hyaluronic acid mouthwash (Gengigel First-aid, Ricerfarma) for one week after surgery, with the goal of accelerating the healing process. One week after surgery, the sutures were removed, ozone was used to disinfect the area around the implant, and the ATP38 was applied for eight minutes to promote healing.

In March 2018, four months after the surgery, the prosthetic phase was started. An impression was taken with an intraoral scanner (CS 3600, Carestream Dental) using scan bodies for an impression at the implant head (MegaGen; Figs. 11a & b). The information was sent to the Anatomic Lab, where a crown was designed using a CAD programme. After the design of the crown had been finished, the information was sent to a milling machine (Amann Girrbach) and the crown was milled (Fig. 12).
One week after the preparation, the definitive crown in monolithic zirconia was attached and the occlusion tested using T-Scan technology (Tekscan; Figs. 13a–c & 14).

Discussion

The main success indicator for dental implants is primary stability, which is one of the prerequisites for achieving osseointegration. This is affected by factors such as bone quantity and quality, surgical placement procedure, and implant shape and coating.

This stability can be measured with a device that analyses the resonance frequency of the implant after its placement. The software converts the received hertz waves to a numerical value called ISQ on a scale ranging from 1 to 100. The manufacturer’s instructions suggest that a stable implant has an ISQ higher than 65 and an unstable implant less than 50. However, these values differ from one author to another.

Nowadays, we have several options that can help us achieve a successful rehabilitation with implants. One of them is the use of a fibrin membrane rich in platelets (PRF). This has the ability to reduce the healing period and improve bone regeneration. The use of PRF as a covering membrane allows rapid epithelialisation of the site surface and represents an effective barrier against the penetration of epithelial cells within the bone defect.

Öncü and Alaaddinoglu evaluated the impact of implant coating with L-PRF (leukocyte- and platelet-rich fibrin). The stability of the implant was measured by ISQ. The use of L-PRF in the implant insertion resulted in statistically significant ISQ values that continuously increased over time. Boora et al. reported early bone remodelling around implants coated or not with L-PRF at
the insertion. Implants coated with L-PRF showed 50% less initial bone loss after both one and three months, respectively. Nowadays, centrifugation protocols have been optimised, called the low speed concept of centrifugation, resulting in A-PRF and i-PRF. These new protocols seek to obtain a greater number of platelets, in order to increase the healing capacity, and leucocytes, therefore also increasing the regenerative capacity.

Furthermore, positive effects on bone regeneration and implant surgery have been suggested when PRF is applied. Given its ease of preparation, low cost and biological properties, PRF can be considered as a reliable treatment option. Although the application of PRF during implant placement or for the treatment of peri-implant defects is quite recent, several studies have already shown clinical benefits, such as higher ISQ values and marginal bone resorption.

Another technique that has proven to be an asset in the success of oral rehabilitation with implants is ozone therapy. This ozone-based tool has an antibacterial effect resulting from the oxidative action on cells, damaging the cytoplasmic membranes of certain organisms, such as bacteria, viruses, fungi and parasites, without, however, the ability to damage healthy human cells. Thus, ozone has the following advantages: accelerates the healing of soft tissue (increases the rate of physiological healing), controls opportunistic infections, reduces scarring time after extraction (forms a pseudomembrane over the alveolus and protects it from physical and mechanical aggression) and aids in bone regeneration. The literature suggests that the post-extraction socket must be prepared conventionally and disinfected with ozone for about 40 seconds, followed by placement of the implant. In this way, we avoid infections and improve bone regeneration. A further study showed that in ozone-treated implants there was regeneration of periodontal cells similar to those around natural teeth.

In modern digital dentistry, the four basic phases of work are image acquisition (through scanning), data preparation/processing (through CAD software), production (CAM systems), and clinical application on patients. The dental preparation can be scanned outside the oral cavity, on the plaster model, or inside the oral cavity by an intraoral scanning system. Optical impressions have several advantages over conventional impressions. Among them, the most important is the reduction of patient stress and discomfort. Moreover, they are time-efficient and can simplify clinical procedures for the dentist, especially for complex impressions (in patients with undercuts and/or
in oral implantology, when multiple implants are present). In addition, optical impressions eliminate plaster models, saving time and space, and allow for better communication with the dental technician. Finally, optical impressions improve communication with patients and are therefore a powerful marketing tool for the modern dental clinic.17, 18

Regarding accuracy as compared with conventional impressions, optical impressions are equally accurate for individual restorations or three- to four-unit bridges on natural teeth and on implants. Conversely, conventional impressions still appear to be the best solution currently for long-span restorations, such as fixed full prostheses on natural teeth and implants (with a higher number of prosthetic abutments).17 Significant differences in trueness have been found among different optical impressions. For each scanner, the trueness was higher in a partially edentulous model than in a fully edentulous model.19

Conversely, the disadvantages of using optical impressions are the difficulty in detecting deep margins in prepared teeth and in the case of bleeding, the learning curve, and the purchasing and maintenance costs.17

Nowadays, we also have the possibility to superimpose the information related to the teeth and gingivae, received from the intraoral scan, over the bone-related information acquired with CBCT. It is therefore possible to plan the optimal positioning of implants with software to guide the surgery. Planning data is transferred to a surgical template that can be physically fabricated in various ways and with different materials. This guide will help the surgeon correctly position the implants without needing to raise a flap.18

After obtaining the digital model, we proceed to the preparation of the virtual part through the CAD software that defines the geometry of an object, while CAM programming directs the fabrication process.20 The CAD/CAM process eliminates current conventional processes, such as the melting and subsequent manipulation of the material after the mechanical working of the same. Pieces made by the CAD/CAM process have a more precise fit compared with conventional methods for dental prosthetic manufacture.21

The main concern with CAD/CAM restorations lies in the marginal fit. However, nowadays CAD/CAM parts show an adaptation with gaps of only around 40 μ.16, 22, 23

**Conclusion**

The use of new technologies in dentistry, such as the application of PRF, ozone therapy and intraoral scanners, has contributed significantly to the success of rehabilitation with dental implants, reducing the time for implant placement and for their restoration.

*Editorial note: A list of references is available from the publisher.*

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Fast, functional aesthetic solution for anterior tooth trauma

Dr Martin Weber, Germany

CEREC and oral surgery? In times when patients go to a practice to receive complete, aesthetic, state-of-the-art treatment as quickly as possible, I think they go together very well. I did not always think so. Certainly, CEREC was always interesting; I have used it since 2003, but I did not always find the results convincing. In 2014, I had a closer look at an event in Salzburg, Austria, and learnt two things: the system had been further developed, and in particular, the precision had been improved considerably. It fits well in my practice; I use it almost every day because I have many patients who have busy jobs and do not have much time. I experience a great workflow in the practice that gives me maximum flexibility. Depending on the indication and the patient’s wishes, I can decide whether to make the restoration myself or outsource it to a laboratory, which I often do for more elaborate bridges. Then, I send the scan directly to my partner laboratory via Sirona Connect—that is very reliable.

I mainly use conventional ceramic materials (VITA ENAMIC, VITA Zahnfabrik; CEREC Blocs C PC, Dentsply Sirona; IPS e-max and Telio CAD, Ivoclar Vivadent; and Celtra Duo, Dentsply Sirona) to treat my patients. The possibility of using implants in the premolar and molar region with screw-retained all-ceramic crowns is especially interesting. Sintering or crystallisation in the CEREC SpeedFire furnace is fast and fits smoothly into the workflow.

The advantage for my practice, where I also employ two other dentists, is obvious. We produce laboratory tasks right in the practice and have the entire workflow under control, and our patients are satisfied. They are still really impressed by the technology today. They are treated immediately, have no problems thanks to the precise fit, and feel like they are involved because they can watch us create the design and view the planning process live in CEREC. And yes, patients do talk about that with their friends and family. This case study shows how the digital processes, including implant planning, with CEREC work.

Treatment of an anterior tooth trauma with an immediate implant

The female patient, born in 1989, came to my practice with problems at tooth #21 caused by a childhood trauma. The gingival margins were reddened and bled when probed. The intraoral radiograph showed post-traumatic resorption of the root, and the tooth could therefore not be preserved (Figs. 1 & 2). The tooth was to be replaced by an implant with an all-ceramic crown immediately after extraction. To plan the procedure, a 3-D radiograph (Orthophos XG 3D, Dentsply Sirona) was taken. It was important to assess the available horizontal and vertical bone and evaluate apical osteolytic processes after the failure of endodontic treatment and in the region of the crestal bone due to progressive dentinal resorption. The integrity of the vestibular lamina was preserved, and there was sufficient apical bone to allow immediate implantation with immediate loading (Fig. 3).

After scanning the upper jaw, tooth #21 was deleted in CEREC to simulate the initial postoperative situation. The prosthetic proposal for tooth #21 was used to optimise implant planning and to produce the surgical guide (Figs. 4 & 5). In the implant planning software (Galileos Implant, Dentsply Sirona), the prosthetic proposal was superimposed over the CBCT data for the optimal positioning of the implant. In this way, sufficient vestibular distance was ensured, and the correct size of the implant for optimal primary stability could be selected (Fig. 6).

When extracting tooth #21, it was important to preserve the vestibular lamina to allow immediate implantation. For this reason, the Sharpes’s fibres were carefully severed with a periosteal, and the tooth was gently removed (Fig. 7). The tooth had pronounced dentinal resorption, confirming the previously made diagnosis (Fig. 8). The SiroLaser Blue (Dentsply Sirona) with a wavelength of 970 nm was used to disinfect the alveolus. An OsseoSpeed EV 4.8–15 mm implant (Astra Tech Implant System, Dentsply Sirona) was inserted immediately using a surgical guide (SICAT OPTIGUIDE, SICAT; Fig. 9). At > 35 Ncm, sufficient primary stability was achieved.

After the intraoperative scan with a ScanPost (Dentsply Sirona) to complete the temporary restoration, the vestibular alveolus was filled with a bone substitute material (Figs. 10 & 11).
Fig. 1: Single-tooth exposure of tooth #21 after recurrent marginal gingivitis. Owing to the initial diagnosis of extensive resorption, the tooth could not be preserved.

Fig. 2: Initial situation: tooth #21 exhibited marginal redness of the gingiva that bled when probed.

Fig. 3: The initial situation in 3-D in the Sidexis 4 imaging software (Dentsply Sirona) showed good apical bone substance with the possibility of immediate implantation.

Fig. 4: Tooth #21 was deleted in CEREC to simulate the initial post-op situation.

Fig. 5: The prosthetic proposal was also used as the basic file for producing the surgical guide with the gap at position #21.

Fig. 6: The intraoral CEREC scan superimposed over 3-D image data for optimal positioning of the implant in the Galileos Implant planning software.

Fig. 7: Gentle extraction preserving the vestibular lamina.

Fig. 8: The resorption of tooth #21, external view. This confirmed the accuracy of the diagnosis from the imaging procedure.
Designing the temporary screw-retained crown included processing the composite crown (Telio CAD) produced with CEREC and extraorally attaching the TiBase (Telio CAD, Ivoclar Vivadent on Dentsply Sirona TiBase). The crown was screwed *in situ*, and the screw channel was sealed with composite (Figs. 12 & 13).

The situation after the temporary restoration (Fig. 14) was aesthetic and free of inflammation. The temporary was positioned 0.5 mm short of occlusion. The patient came for a follow-up after one week. At this visit, we used the soft laser (SiroLaser Blue, wavelength of 660 nm) to activate wound healing (Fig. 15).

Four months after this treatment, the patient came to the practice for the final restoration. We had previously sent the scan to the partner laboratory via the Sirona Connect portal. There, the abutment was designed with the inLab software (Dentsply Sirona), milled and attached with a titanium base.

The temporary was then removed, and the abutment was inserted using a transfer key. The vestibular contour was completely preserved (Figs. 16 & 17). After sealing the screw channel with a PTFE strip, an all-ceramic, custom-veneered crown was inserted for a perfect aesthetic outcome of the anterior tooth (Fig. 18).

**Coordinated system supports the workflow**

For this case, I used the digital workflow from Dentsply Sirona. After having tested different systems, it proved to be especially efficient and easy. The individual steps, from imaging and diagnosis using the scan, ordering the surgical guide and planning surgery up to producing the temporary restoration and the final prosthesis, are very well coordinated. The interface to SICAT is included in the planning software and enables one-click ordering. Even if I do not use a surgical guide for every implantation, I find it to be very useful depending on the indication.

I also use laser in my practice depending on the indication. In the case of this patient, there was an inflammatory process at the tooth (granuloma). With the laser, I can achieve thorough disinfection of the alveolus and also activate wound healing.

I found that the CEREC Software 4.5.2 has brought another major advance in the accuracy of fit compared with the preceding versions. In addition, it is fast and reliable. The optimised processes proved to be especially advantageous for implants, as in this case. I particularly appreciate the option of implementing screw-retained solutions with CEREC. In my practice,
I place more than 100 implants a year with CEREC—I generally use screw-retained crowns. They considerably reduce the risk of peri-implantitis owing to the absence of cement.

For implants in the anterior tooth region, I produce long-term temporaries with CEREC. They have the significant advantage in that they do not look like temporaries, do not feel like temporaries to patients, and thus ensure better quality of life. The patients are also convinced of this. The follow-up radiograph (Fig. 19) before the final restoration with a custom-veneered ceramic crown showed good osseointegration of the implant. The gingivae were externally completely free of inflammation.

Discussion

Given the great aesthetic demands and the need for rapid results, thorough consideration must be given to the options available for treating anterior teeth. In my view, conservation by means of conventional techniques was not possible in this case owing to the comprehensive and advanced internal resorption of tooth #21 due to previous trauma. Upon extracting this tooth, it was particularly evident that it was not worthy of conservation (Fig. 8). The young age of the female patient and the integrity of the adjacent teeth meant that a bridge was ruled out as an alternative. In light of the favourable anatomical situation with fully conserved vestibular bone lamella, immediate implantation was the optimal treatment option for improved conservation of the bundle bone and, along with it, the hard and soft tissue. The fixed provisional crown supported the soft tissue, was aesthetically pleasing and offered the patient a highly satisfactory solution. Moreover, the digital workflow offered the patient additional comfort (impression without a tray).

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Fig. 15: Situation after one week: activation of wound healing with a soft laser of 660 nm.  
Fig. 16: Inserting the abutment with the transfer key.  
Fig. 17: Complete preservation of the vestibular contour.  
Fig. 18: Final image immediately after inserting the crown with an ideal red–white aesthetic.  
Fig. 19: Ideal osseointegration four months post-op.
In addition to the primary wishes of the patient regarding prosthetic treatment, namely safety, comfort and aesthetics, are the need for an efficient treatment process, high cost-effectiveness and a minimal number of therapy sessions. Owing to the possibilities offered by CAD/CAM, these desires can in many cases be fulfilled. While a dental technician is indispensable for complex and aesthetically demanding restorations (e.g. in the anterior region), single-tooth restorations (e.g. inlays, partial crowns and complete crowns) can in many situations be realised within the dental practice. For the patient, this has the great advantage, among others, that only one therapy session is needed. Various materials are suitable for such an indication. Mainly, these are materials from the large family of glass-ceramics, which in combination with the adhesive technique optimally fulfil the requirements for conservation of dental hard tissue, biocompatibility, stability and aesthetics.

**Overview of dental ceramics in everyday clinical practice**

The diversity of materials in everyday prosthetic practice is constantly increasing, especially regarding dental

![Fig. 1: Different nice milling blanks.](image-url)
ceramics. For the practitioner, it is important to maintain an overview in order to select the optimal material for the indication. Dental ceramics can be broadly divided into ceramics with a glass phase (e.g. silicate ceramics and glass-infiltrated ceramics) and ceramics without a glass phase, the oxide ceramics (e.g. zirconium dioxide). Differences exist in, among other things, the materials’ photo-optical properties and characteristics (e.g. flexural strength and fracture toughness). To perform single-tooth restorations chairside, a high-strength glass-ceramic is often used, such as lithium disilicate ceramic or lithium silicate ceramic. To obtain the final strength level of 360–400 MPa, these ceramics are crystallised after milling. There are also pre-crystallised blanks available that only need to be polished. However, in this case, the strength is greatly reduced. For several months, the family of CAD/CAM glass-ceramics has been augmented with a further class of materials: lithium aluminosilicate ceramics (n!ce, Straumann).

Pre-crystallised and high strength

In terms of materials science, the n!ce fully crystallised glass-ceramic is a lithium disilicate reinforced with lithium aluminosilicate. Its flexural strength is 350 MPa (± 50). Its great advantage is its easy and efficient processing. The range contains blanks in two translucency levels: HT (high translucency) and LT (low translucency). Both translucency levels are available in different shades (Bleach, A1, A2, A3, B2 and B4 of the VITA classical shade guides) and cover a large number of restorative indications in everyday clinical practice. The fully crystallised milling blocks were developed specially to fabricate complete crowns, partial crowns, inlays, onlays and veneers. The blanks are compatible with different block holders for different milling machines (Fig. 1). The glass-ceramic blocks can therefore be processed with conventional milling machines and require no investments in additional hardware or software. The material can be milled, polished and seated without crystallisation firing. This saves time and effort in daily practice. Individual characterisation is possible if required.

Case report

Initial situation
The patient wished to have the large-surface amalgam fillings in the upper and lower jaw (Figs. 2a & b) removed.

Figs. 2a & b: The patient desired replacement of the large-surface amalgam fillings in the upper (a) and lower jaw (b) with full-ceramic restorations.

Figs. 3a–c: The prepared teeth are readied for intraoral digitalisation (intraoral scanning).

Fig. 3a

Fig. 3b

Fig. 3c
Figs. 4a & b: Illustrative image of the CAD construction in the posterior segment of the maxilla.
Figs. 5a & b: CAD construction in the mandible.
Fig. 6: Milling of a nice restoration.
Fig. 7: Polishing of a nice restoration.
Fig. 8: The teeth are conditioned for adhesive bonding of the glass-ceramic restorations.
Fig. 9: Restorations inserted in the mandible.
Figs. 10a & b: Occlusal view after the treatment: glass-ceramic crowns (a), composite fillings and a bridge of lithium disilicate (b).
and replaced with full-ceramic restorations created with the least possible effort. These were single-tooth restorations (partial crowns). In the maxillary posterior region, a bridge restoration was indicated, which was produced from lithium disilicate ceramic. All other indirect single-tooth restorations were to be fabricated from n!ce. The material is biocompatible and relatively strong without additional crystallisation firing, while featuring natural photo-optical properties.

Preparation
The aim was a new minimally invasive treatment performed within the dental practice. No functional disorders were present and no periodontal abnormalities were identified either. A vitality test was performed on all of the teeth and a positive result was found up to tooth #46. This tooth had undergone root canal therapy.

After anaesthesia and fitting of the rubber dam, the amalgam fillings were removed and the teeth were prepared in a minimally invasive way for full-ceramic restorations (Figs. 3a–c). The restoration guidelines for n!ce are a rounded design, with no angles or sharp edges, and a shoulder preparation with rounded inner edges and/or chamfer. The manufacturer specifies 1 mm as the minimum layer thickness for complete crowns and partial crowns, which was complied with in the preparation.

Construction and milling
Digital impressions of the situation were captured with an intraoral scanner. To prevent mirror images or undesired reflections, the teeth were first dried to the maximum extent. This was followed by bite registration (scan) and importation of the data into the CAD software. The scans were checked and artefacts were removed. After the virtual model calculation and assignment of the jaws with the bite register, the preparation boundary could easily be marked and the insertion axis defined with a few clicks. The automated, biogeneric initial suggestion of the software was a valuable aid in constructing the restorations. Only minor changes were made to the initial suggestion. The restorations were constructed within a short time (Figs. 4 & 5) and the data was transferred to the CAM machine. In the milling preview, the design was finally checked, for example for values below the minimum wall thickness. The n!ce blocks were then secured and the restorations were milled (Fig. 6). Milling was performed in the fine mode and took about 25 minutes.

Completion
After removing the milled restorations from the machine, the milling pins of the blank were removed with a fine-grain arkansas stone. The restorations milled from n!ce showed finely tapered margins and a 1:1 reproduction of the construction. On trial placement in the mouth, the fit was judged as very good. At some sites, the approximate contact points were adjusted as required. Final polishing of the restorations outside the mouth produced a high-gloss finish. For a natural appearance, the n!ce restorations can be polished with a standard polishing set for lithium disilicate glass-ceramic. A classical polishing protocol was used in this case—coarse burs, ceramic polisher, zirconium oxide polishing paste (Zirkopol, Feguramed) and brushes (Fig. 7)—and the restorations were then cleaned in an ultrasonic bath. The complete crowns and partial crowns were then ready to be fitted. An additional crystallisation firing as for comparable materials is not necessary for n!ce.

Insertion
The insertion of restorations in the mouth was performed with an adhesive under rubber dam isolation. The same adhesive cements used for lithium disilicate can be used for n!ce. Before insertion, the ceramic restorations were cleaned with phosphoric acid (30 seconds). Conditioning of the bonding surface was performed according to the protocol, with 20-second etching with a 5% hydrofluoric acid gel. After cleaning and conditioning the teeth, final insertion of the restorations was performed (Figs. 8 & 9), and the functional criteria underwent a final check. The two small amalgam fillings in teeth #34 and 35 were replaced with direct composite fillings.

Conclusion
In combination with the intraoral scanner and the chairside CAM machine, n!ce glass-ceramic offers the possibility of fabricating indirect single-tooth restorations easily, safely and comfortably within the dental practice. The lithium aluminosilicate ceramic is supplied in the fully crystallised state; thus, no crystallisation firing is necessary. Mill, polish, seat—the procedure described offers high comfort for the patient and high productivity in everyday practice.

about
Dr Johannes Beiter holds a Master of Science in Periodontology and Implant Therapy and specialises in these fields. Since 2012, he has been a dentist specialising in oral surgery.
Scan as precisely as possible

InEos X5 precision scanner celebrates anniversary

The Dentsply Sirona inEos X5 is a highly specialised extraoral scanner that has established itself in thousands of laboratories around the world. Since its launch, it has constantly been in high demand. This year, Dentsply Sirona is celebrating the fifth anniversary of this precision scanner—a good time to have a look at the factors for the inEos X5’s success.

An important prerequisite for the successful production of a prosthesis is that the initial situation in the patient’s mouth must be scanned as precisely as possible to achieve the desired fit and minimise the need for reworking. In a digital workflow, the qualities of a model scanner such as the Dentsply Sirona inEos X5 play an important part.

Proven precision for a wide range of indications

Five-axis robot kinematics and structured-light scanning make the inEos X5 an all-round scanner. Both models and impressions can be scanned digitally, so the scanner can be used for many different indications. Its high precision has been checked in laboratory tests according to DIN EN ISO. The accuracy of the standard bridge test specimen was demonstrated to be 2.1 μm ± 2.8 μm; 1.3 μm ± 0.4 μm was verified for the standard inlay test specimen. For this reason, the inEos X5 is exceptionally suitable, especially for implant treatments. Precisely determining the implant position yields excellent conditions for exact restoration results, even for long-span screw-retained bridges and bars at the implant level.

“Since the launch of the inEos X5 five years ago, the demand for precise digital processes has remained very high,” said Jörg Haselbauer, Global Product Manager of CAD/CAM Laboratory Software at Dentsply Sirona. “The positive feedback from our customers in labs confirms this over and over again. I am certain that, in the future, even more dental technicians will benefit from the advantages of the inEos X5!”

Open for flexible use

The user friendliness of the inEos X5 is due in part to its large, open working range for direct, barrier-free access to the scan object and the possibility of placing all commonly used articulators in it. Depending on the case, automatic or manual scanning can be selected. The scan data recorded with the inEos X5 can be flexibly integrated into the further workflow, either via STL export or via wireless data transfer to the inLab CAD software. The inEos X5 is always delivered with a high-performance PC linked to the scanner and the software licence, with no additional recurring licence fees.

For more information on the inEos X5 laboratory scanner and all other components of the inLab system, see www.dentsplysirona.com.
**Highest level of digital impressions**

**Planmeca Emerald—new crown jewel of intraoral scanning**

The new Planmeca Emerald intraoral scanner has set the bar for capturing digital impressions. With unprecedented speed and accuracy, it represents the highest level of scanning available in the world today.

Planmeca Emerald has been designed with premium usability in mind and provides superior accuracy and outstanding speed in all situations. Owing to its small size and light weight, the scanner offers exceptional control and is comfortable for patients. Planmeca Emerald’s seamless, autoclavable and exchangeable tips make infection control measures simple and efficient. The scanner’s two buttons also allow it to be operated without touching a mouse or keyboard, and it can even be controlled from a foot pedal when connected to a dental unit. The scanner’s plug-and-play capability allows it to be effortlessly shared between different rooms and laptops.

Planmeca Emerald has the flexibility to support various workflows. It can be used for a wide range of treatment modalities and offers benefits across several disciplines, such as implantology, orthodontics, prosthodontics and maxillofacial surgery. With open export and import options, regular updates and constant new features becoming available, the company continues to evolve and improve the scanner even further.

Planmeca Emerald is part of the Planmeca FIT chairside CAD/CAM system that integrates the entire chairside restorative workflow—from scanning to milling.

www.planmeca.com

**SEVEN implant system**

**Newly enhanced implant system**

This past June, at the EuroPerio9 congress in Amsterdam, Netherlands, MIS launched the enhanced SEVEN implant system. Several key features have been added, that make the internal hex implant even better. Its biological stability and predictable aesthetics combined with the extensive R&D process which has led to these new improvements, have given the SEVEN a potential advantage in soft-tissue preservation and growth, as well as an array of restorative benefits. The combination of its unique features may provide the dentist with higher predictability, better aesthetic results and bone preservation.

The implant incorporates the platform-switching design concept. Implants with a platform-switched configuration have been shown to exhibit less bone loss when compared to non-platform-switched implants, which may lead to soft-tissue preservation and growth. The SEVEN’s root-shaped geometry and unique thread design enable excellent primary stability, allowing for a simpler and faster implant placement. With a new, comprehensive concept for enhanced aesthetics and better bone preservation in mind, and in order to support the advanced new implant features, an additional line of concave abutments has also been added. The concave emergence profile was designed for a larger gingival volume, and along with its gold shading, offers a better aesthetic result.

MIS Implants Technologies

www.mis-implants.com
Leading laboratory technicians around the world avoid much of the expense associated with production equipment, maintenance and stock by working with NobelProcera Services instead. Best of all, getting started has never been easier. For busy technicians, NobelProcera Services now offers more support options than ever before. Here are the five facts technicians need to know about NobelProcera’s ever-expanding range of outsourcing opportunities for the scan, design and production of precision-engineered CAD/CAM restorations.

No equipment costs
Investing in new in-laboratory milling equipment is one option for expanding a laboratory’s offering. For some laboratory owners, however, the initial investment can be off-putting or even prohibitive. Maintenance costs also need to be taken into account and there is the practical consideration of finding space in the laboratory for new equipment.

Outsourcing to NobelProcera Services means laboratories can offer an expanded product range without initial investments. There is not even a need to purchase a scanner or software, as models can be sent directly to NobelProcera’s skilled technicians for scanning and design.* Alternatively, technicians can provide scan data or full designs for industrial production—the choice is theirs. The flexibility of the service is something that many technicians may find appealing. NobelProcera Services can be utilised whenever the case requires it, with no risk of expensive equipment being under-utilised.

Only precision-engineered components
NobelProcera’s centralised production facilities use advanced industrial milling technology to provide technicians with quality restorations that are designed for a precise fit. NobelProcera abutments and bars meet the required regulatory requirements, including U.S. Food and Drug Administration clearance and CE
marking. In addition, all NobelProcera restorations are backed by a five-year warranty to give technicians and their customers peace of mind, and Nobel Biocare implants restored with a NobelProcera restoration are covered by a lifetime warranty.

It is important to note that restorations from over 170 other implant platforms are also available via NobelProcera Services. Its range of innovative restorations for Nobel Biocare implants offer features that enhance ease of use, such as the angulated screw channel (ASC) option. This solution allows the repositioning of the screw access hole in cases where it would otherwise be on the facial aspect or incisal edge, or when occlusal space is limited. The cement-free ASC option can also improve retrievability.

Wide selection of scanners supported
There is a greater likelihood than ever before that a dental professional’s scanner of choice is supported by NobelProcera Services. The ambition is for as many scanners as possible to link with the service, provided they meet the high standards required for implant dentistry. Well-known brands such as 3Shape and iTero are among the manufacturers of the 25 desktop and intraoral scanners compatible for submitting cases for NobelProcera production, and the list of supported scanners continues to grow.

Intraoral scanner workflow with online ordering now available
As intraoral scanner technology continues to improve, uptake among clinical teams is likely to increase. Dental professionals who prefer to take digital impressions using intraoral scanning technology can now be catered for easily using a fully digital NobelProcera Services workflow for abutments. Technicians can submit their cases to the NobelProcera team easily using online order forms and uploading 3Shape or NobelProcera scan files. No additional software is required.

Co-packing for added convenience
CAD/CAM implant bars, abutments and crowns have been available through NobelProcera Services for some time, but the scope of services offered has now expanded. Newly added is a co-packing option that provides a simple restorative workflow for intraoral scan cases. This allows the technician to receive the NobelProcera Abutment or Crown packed together with a 3-D printed model from approved vendor Dreve. It is a helpful option when working with digital impressions, where a traditional model is not produced as a matter of course.

To learn more about the full range of NobelProcera Services, technicians can visit www.nobelbiocare.com/nobelproceraservices.

* Some products may not have received regulatory clearance or have been released for sale in all markets.

10,232 periodontists and other oral health professionals from all over the world travelled to Amsterdam, Netherlands from 20 to 23 June to learn about the latest research on periodontal disease and implants at EuroPerio9—one of the leading congresses in periodontology and implant dentistry.

EuroPerio9 participants came from 111 countries, with the Netherlands, Germany and France bringing the largest delegations from within Europe. Japan, Brazil and Mexico were the biggest groups from overseas. 25 per cent of delegates were non-European.

The scientific programme included over 1,720 abstracts that were presented in research sessions, setting another record for EuroPerio9. Additionally, 134 speakers made invited presentations in 42 lectures and special sessions. The new formats including PerioTalks, nightmare sessions, live surgery, debates, treatment planning interactive sessions, the perio contest and 3-D sessions were very popular with delegates. 308 moderated abstract and poster presentations also took place.

Congress chair, Michèle Reners, said that she would remember “the PedTalks, the Master Clinician Session on ‘Saving teeth’ and the nightmare sessions” among the memorable EuroPerio9 sessions. Søren Jepsen, chair of the scientific programme highlighted the video “Cell-to-Cell Communication—Peri-implantitis and its Prevention” as one of the sessions he enjoyed the most. He further stated: “Also the session on live surgery was quite amazing: 4,500 people sitting together quietly and concentrating on what was going on is something I had never experienced before. I think the session on the new classification of periodontal diseases is also a landmark event.” Visit www.efp.org/europerio9/programme/scientific for more details.

The session about the new classification of periodontal and peri-implant diseases, a consensus from the recent World Workshop in Chicago, drew large crowds. Significant differences with the previous 1999 classification were announced, such as the replacement of the “chronic” and “aggressive” distinctions by a model with stages and grades (see p. 48).

Intense social media interactions also played an important role at EuroPerio9. The social media team made up of volunteers from various countries, reported on every single session at the congress. For the first time, a social media wall allowed attendants to see what was trending at the meeting through the #EuroPerio9 hashtag. The newly launched EFP Instagram account now has over 1,100 followers and the EuroPerio9 playlist on the EFP YouTube channel had over 10,400 views. Facebook engagement was up 200 per cent and Twitter impressions were up 30 per cent. Regarding the EFP website, on Wednesday a record peak of 13,000 individuals looked at 54,000 pages. All three press conferences were live-streamed on Facebook.

Such record-breaking attention and attendance, as well as the presentation of leading research in periodontal science confirmed EuroPerio as the place to be for the latest news about periodontal health. EuroPerio10 will take place from 2 to 5 June 2021 at the Bella Center in Copenhagen, Denmark.

European Federation of Periodontology
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Sign up to the finest e-read in dentistry
“Knowledge changes everything”
Nobel Biocare invites dentists to 2019 Global Symposium in Las Vegas

Dental professionals should mark their calendars for the 2019 Nobel Biocare Global Symposium, which will take place from 27 to 29 June in Las Vegas in the US under the theme “Knowledge changes everything”. Featuring a change of location, programme and venue, the symposium will offer a potent combination of expert knowledge alongside new innovations to be revealed, marking a true transformation in implant treatment care.

Groundbreaking solutions, covering smarter implant designs and the next evolution in site preparation, as well as everything dental professionals need to further enhance the patient treatment journey with new digital solutions, will be available for participants to discover and experience.

In response to the increased demand for more skill-enhancing training and education, the event has expanded in size and is planned to attract up to 3,500 participants from around the globe. Compiled by a scientific committee chaired by Dr Peter Wöhrle from the US, the programme will feature some of the world’s most distinguished experts in implant dentistry and oral rehabilitation. Overall, it will bring together more than 100 speakers, including outstanding researchers, clinicians and laboratory technicians, and offer engaging podium lectures in addition to master classes and valuable hands-on courses. Participants will have the opportunity to follow different educational streams or to create their own learning programmes suited to their own individual treatment goals.

Nobel Biocare President Hans Geiselhöringer said, “Next year’s Nobel Biocare Global Symposium will mark a true transformation in implant treatment care. This major event is fuelled by the power of knowledge and the positive impact it can have on dentists’ skills, daily practice and patients, through new solutions that will change the course of innovation forever.”

The 2019 Nobel Biocare Global Symposium will take place at the Mandalay Bay hotel and convention centre. Registration for the event is now open. More information about the programme is available online at nobelbiocare.com/global-symposium-2019.
Education & Innovation Transfer

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Over the past 20 years, dentists and dental technicians have experienced the new possibilities continually being created by digitalisation. The key to success in exploiting these innovations has been and will continue to be the interaction between the members of the treating team. In this regard, the International Dental Show (IDS), which will take place from 12 to 16 March 2019 in Cologne, will offer comprehensive concepts, valuable tips and stimulating discussions.

The particular excitement of dentistry lies in the unique combination of medical, technological and aesthetic aspects in the discipline. The day-to-day work has become more diversified and sometimes challenging over the past decades, both in the practice and in the dental technician’s laboratory, owing to multifaceted requirements. A particularly effective means of meeting these demands has been the intensification of collaboration between dentists and dental technicians.

The conditions for collaboration are better than ever, because digitalisation allows spatial and time limits to be overcome. Radiographs, model scans, and a wide range of different working and planning documents can be produced in the practice and the laboratory within seconds for evaluation and discussion purposes. At the same time, overlapping digital workflows in more and more areas are increasingly facilitating cooperation between dental professionals.

“The International Dental Show will comprehensively present the current state of development of materials and processing methods, as well as new opportunities for optimal collaboration between the dentist and dental technician,” said Dr Markus Heibach, Executive Director of the Association of the German Dental Industry.

“At IDS, digital systems, planning tools, and different production options and their application within the team can be experienced first-hand and in a diversity that cannot be found anywhere else. My tip to all visitors is to talk to your dental technician or dentist in advance and visit the International Dental Show as a team!”

IDS takes place in Cologne every two years and is organised by the Gesellschaft zur Förderung der Dental-Industrie, the commercial enterprise of the Association of the German Dental Industry, and staged by Koelnmesse.
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www.ici.org

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17–18 November 2018
Hokkaido, Japan
http://jadr66.umin.jp

**EAO Congress**
11–13 October 2018
Vienna, Austria
www.eao-congress.com

**GNYDM**
25–28 November 2018
New York, USA
www.gnydm.com

**AAP Annual Meeting**
27–30 October 2018
Vancouver, Canada
www.perio.org

**ADF**
28 November – 1 December 2018
Paris, France
www.adfcongres.com

**DenTech China – Exhibition & Symposium**
31 October – 2 November 2018
Shanghai, China
http://www.dentech.com.cn

**CIOSP**
30 January – 2 February 2019
São Paulo, Brazil
www.ciosp.com.br

**Expo-Dentária**
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Questions?

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