

Guided maxillary arch implant restoration: Language and cross-border collaboration are no barrier with hybrid workflow

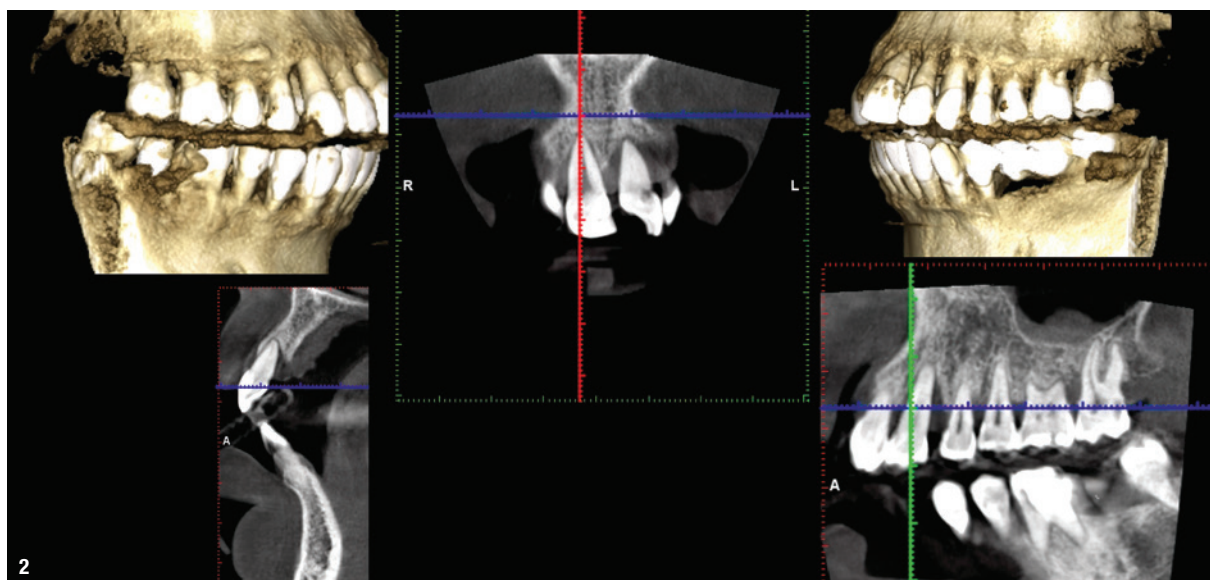
Dr Florian Obădan & Jorge Reyes Minguillán, Romania & Spain

The rehabilitation of a failing maxillary dentition requires comprehensive planning and appropriate tools to execute a treatment which will meet the patient's expectations and accomplish the biological principles for long-term successful restoration. Nowadays, digital workflows aid clinicians in achieving this accuracy with holistic treatment planning. Digitisation in implant dentistry has ensured that the dental technician and the clinician are in sync at every step of planning and execution, as the exchange of data between them can be done remotely with the click of a button. Guided implant placement ascertains the precise transfer of the virtually planned implant positions to the surgical site. This pre-planned implant positioning facilitates immediate loading, as the provisional prosthesis can be milled and kept ready prior to the surgery, requiring only minor relining and adjustments after the surgery. Guided implant placement with immediate loading not only restores function, aesthetics and the patient's confidence instantly, but also has high patient ac-



ceptability owing to the minimised surgical trauma, post-operative discomfort and reduced treatment duration.

The following case report showcases the planning and execution of the SKY fast & fixed full-arch protocol (bredent





medical) with synchronisation of a complete digital workflow between a dental technician in Spain and a clinician in Romania who do not speak a common language.

Case presentation

A middle-aged woman presented to the dentist's clinic in Alexandria in Romania with a mobile central incisor, seeking a long-term highly aesthetic solution. A full-mouth clinical assessment and radiographic examination with a dental panoramic tomogram and CBCT scan (Figs. 1 & 2) were carried out. Based on the severity, complexity of management and extent of distribution, a diagnosis of generalised severe periodontitis with potential loss of dentition was made, and the patient was advised to undergo total extraction of the maxillary teeth (other than the terminal molars) and immediate placement of implants and their immediate loading using the SKY fast & fixed treatment protocol.^{1–4}

Preoperative phase

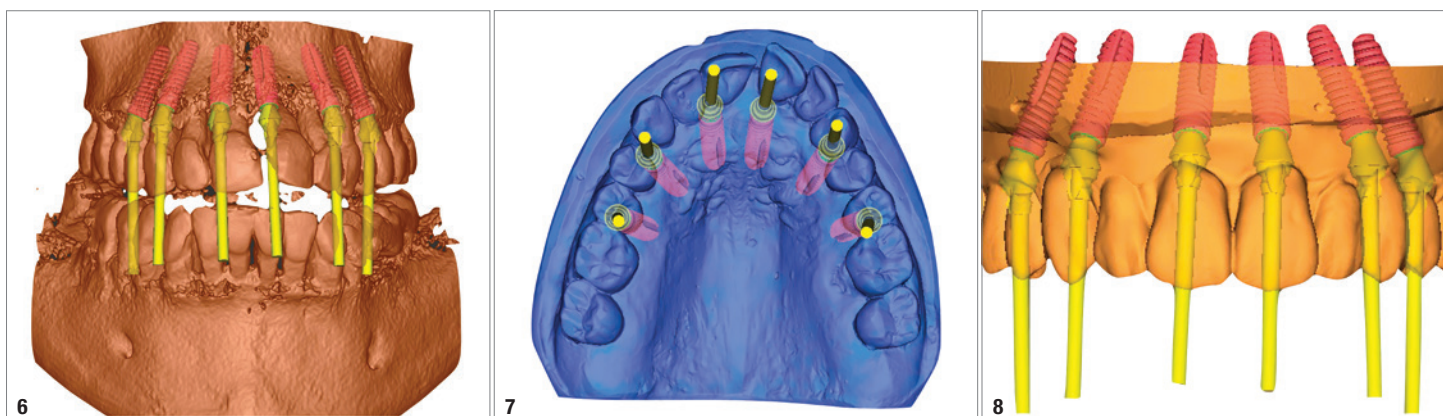
High-resolution intra-oral images and profile pictures were taken (Figs. 3–5). Preliminary impressions were made with irreversible hydrocolloid (alginate), as there was a possibility of tooth loss (owing to severe tooth mobility) with the use of silicone-based materials for impression taking. The resulting models were scanned using the

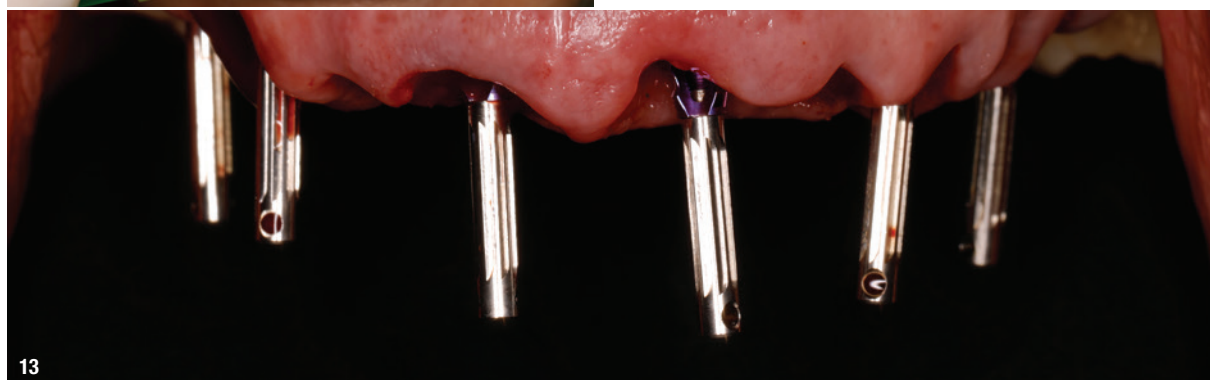
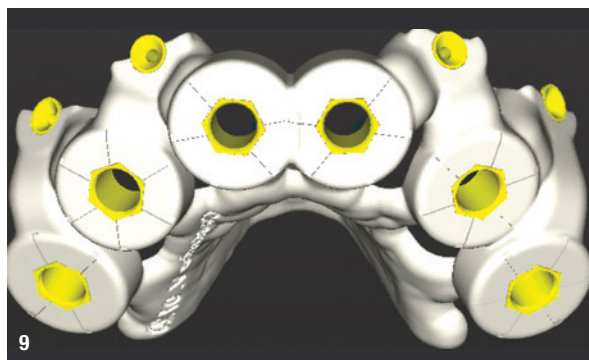
laboratory 3D scanner, and the STL files, radiographs and images were transferred to the dental technician in Madrid in Spain.

The dental technician used exocad for the digital mock-up and e-mailed it to the clinic. The CAD was printed (the model without the teeth, the model with the new tooth set-up and the teeth detached from the model) using a 3D printer. The STL files were used for planning the ideal prosthetic positions of the implants (six 4 × 14 mm copaSKY implants, bredent medical). CoDiagnostiX (Dental Wings) was used for planning the implant positions, as well as the appropriate abutments (Figs. 6–8). The surgical guide was fabricated based on the virtually planned ideal positions of the six implants (Figs. 9 & 10). The provisional prosthesis was designed in Madrid by the dental technician, but milled and kept ready prior to surgery in Romania.

Surgical phase

The procedure was done under local anaesthesia with articaine with 1:100,000 adrenaline. Atraumatic extraction of all the maxillary teeth except the terminal second molars (as they served as a vertical stop for maintaining occlusal height) was done, and the extraction sockets were thoroughly curetted to remove the granulation tissue. After mechanical debridement, to ensure complete disinfection of the site, antimicrobial photodynamic therapy was per-



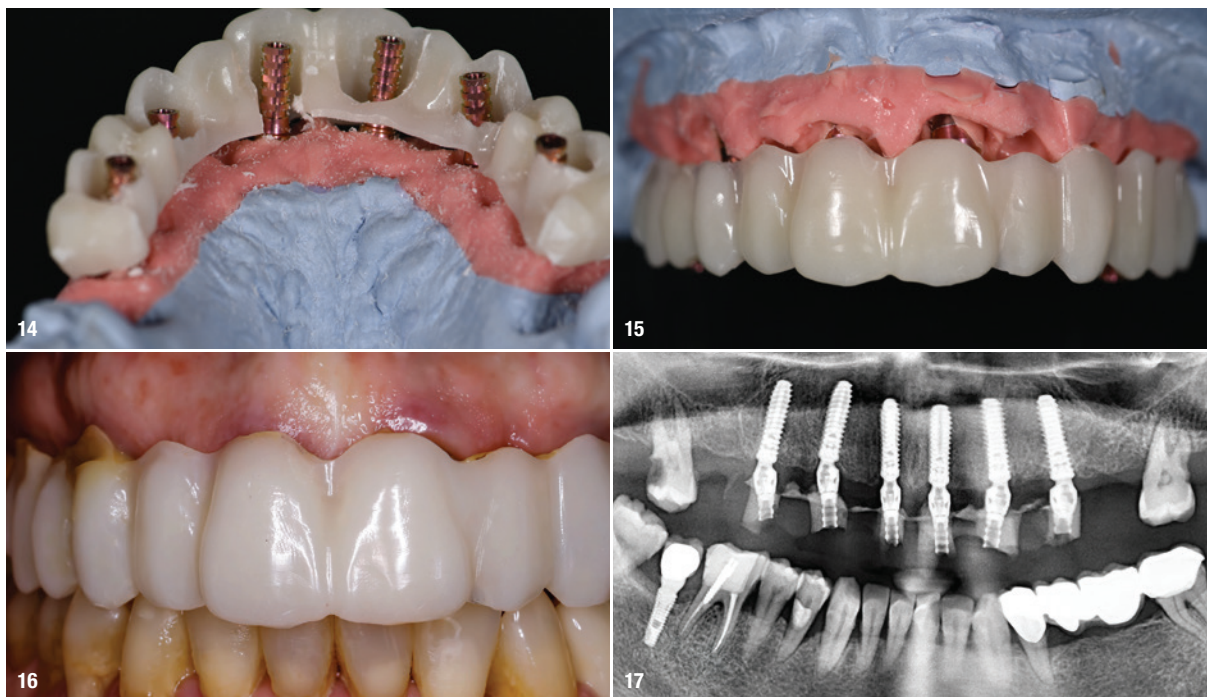


formed. A blue photosensitiser (methylene blue) was applied inside each socket and left in situ for 60 seconds to stain the bacteria. After rinsing off of the liquid, each socket was then exposed to the diode laser for 1 minute. This ensures focused antibacterial action by destruction of the bacteria in the biofilm by singlet oxygen molecules. The procedure was completely flapless to minimise surgical trauma, and it facilitated seamless seating of the surgical guide. The surgical guide was stabilised intra-orally with four fixation pins placed buccally (Fig. 11). The surgical kit was used for fully shaft-guided implant placement, which is more convenient than the sleeve-in-sleeve and spoon systems. It is based on the principle of maximum safety when reaching the drilling depth and angulation by guiding the drills through the high-precision drill sleeve (Fig. 12). Sequential drilling was done, and primary stability of more than 40Ncm was obtained for all six implants, facilitating predictable immediate loading. Titanium abutments were installed on all six implants, and a closed-tray impression was taken (Fig. 13). The milled provisional prosthesis was placed on the quickly poured model to make the holes in the prosthesis to facilitate intra-oral relining with Qu-Resin and Qu-Connector (bredent medical) to ensure a passive fit of the screw-retained prosthesis (Figs. 14 & 15). The titanium copings were picked up in the provisional prosthesis after relining, finished and polished extra-orally, and inserted on to the implants to a torque of 18Ncm (Figs. 16 & 17). The provisional prosthesis was kept out of all eccentric contact, and light centric contacts were maintained. Biomechanical principles were applied by preventing cantilevers which could weaken and fracture the provisional prosthesis.

The patient was instructed to avoid hard food, and oral hygiene instructions were reinforced. She was extremely satisfied with her new smile and regained her confidence.

Prosthetic phase

The patient was recalled after eight months for the final prosthetic phase. Intra-oral scans were taken for fabrication of the final prosthesis (Fig. 18), the intention being to



plan, start and finish the case completely digitally. This, however, was not possible because there was a mismatch in fitting the components which the laboratory had milled for verification on the printed models. The decision was made to go the analogue route.

Titanium copings were inserted, and after confirmation of proper seating with a panoramic radiograph, intra-oral splinting of the copings was done to ensure accurate impression taking. Putty and light-bodied wash impressions were taken, carefully packed and sent to Madrid for fabrication of the final prosthesis (Figs. 19a & b).

After obtaining the master model, the dental technician made the design of the framework, milled it in PMMA and sent it to the clinic. The provisional prosthesis, having a passive fit, because it was fixed intra-orally, was used as a verification key for the master model. Because there was a passive fit, the framework was cemented on to the pre-fabricated copings with DTK-Adhesive (bredent medical) on the model by the dental technician (Figs. 20 & 21).

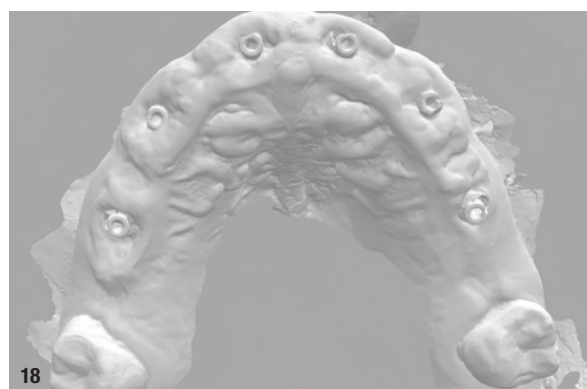
The solution for the long-term restoration was determined based on the inter-arch distance and passivity of fit, as well as protection of the implants. The choice of material for the definitive prosthesis framework was laser-sintered titanium with composite build-up teeth (Figs. 22–24). The laser-sintered titanium, being produced with an additive method, did not have undercut areas, and it was fabricated by the dental technician in Spain.

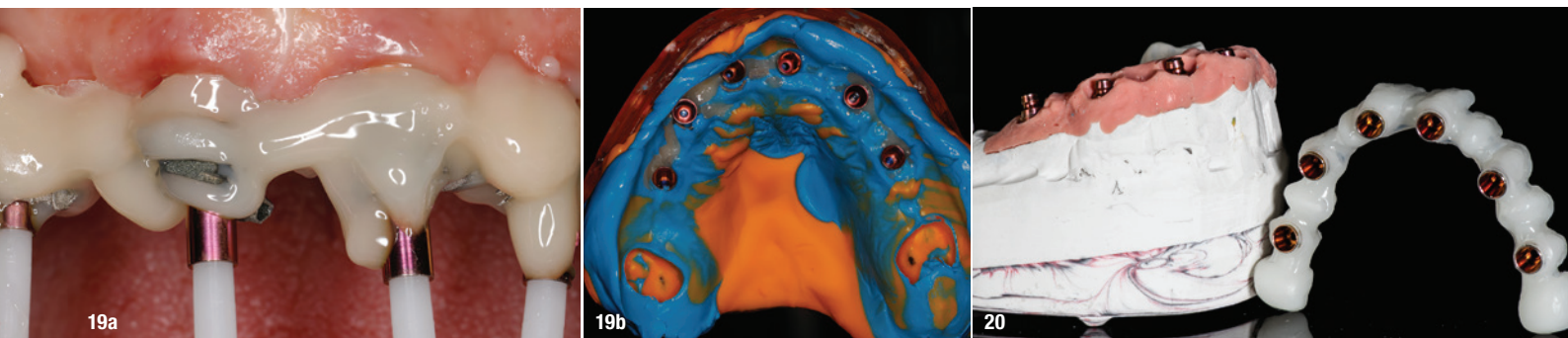
Canine-guided occlusion was established without difficulty. Function and aesthetics were restored satisfactorily

for the patient, and the final outcome was extremely gratifying for the surgical and prosthetic team (Figs. 25 & 26).

Discussion

Chronic generalised periodontitis can result in insidious loss of periodontal attachment, tooth mobility and poor prognosis of teeth. The SKY fast & fixed treatment protocol aims for immediate restoration of function and aesthetics for management of failing dentition. A recent study by Slutzkey et al. concluded that, if the prerequisites for immediate loading, such as high primary stability of $\geq 30\text{Ncm}$, splinting of the implants via a provisional prosthesis and the use of bone-level implants with a sand-blasted and acid-etched surface, are fulfilled, then full-arch fixed restorations supported by a combination of axial and tilted implants can be a viable treatment option to rehabilitate the terminal dentition of patients suffering from severe generalised periodontitis.⁵



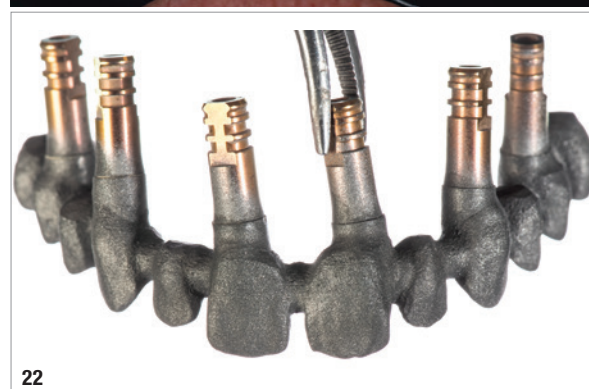


Immediate implant placement with the application of antimicrobial photodynamic therapy has made the procedure more predictable. Antimicrobial photodynamic therapy was used in the current case at the point of extraction of the diseased and compromised teeth to ensure disinfection and better osseointegration of the implants. Antimicrobial photodynamic therapy has gained much attention as a non-invasive and biocompatible approach that can be employed to prevent biological complications associated with implants.⁶ Histological and histo-morphometric analyses have demonstrated significantly better results for immediate implant placement in sockets decontaminated by mechanical debridement with the adjunctive use of antimicrobial photodynamic therapy.⁷ The sites which received this combined therapy led to osseointegration of the implants without evidence of inflammation; conversely, evidence of peri-implantitis was observed where antimicrobial photodynamic therapy was not used.⁷

The purpose of using implant software is to plan the placement of the implants in prosthodontically driven positions.⁸ The advantages of guided surgery are that the patient's chair time is decreased, the surgery is more predictable and less stressful, the implants are placed in a restoratively driven manner, and the case difficulty is learned ahead of time.⁹⁻¹¹ In other words, guided surgery in full-mouth implant rehabilitation has also made immediate restoration of function and aesthetics easier and more precise and has improved treatment acceptability by the patient. However, in full-arch rehabilitation, the provisional restorations cannot be cemented to abutments before surgery owing to passivity concerns, as seen in the current case report.¹² The pre-milled breCAM.multi-COM prosthesis (bredent medical) was relined intra-orally to ensure passivity of the prosthesis.

Full-arch fixed rehabilitation by means of guided surgery and immediate loading of implants placed in fresh extraction sockets appears to be a reliable and successful procedure.¹³ Selection of the final prosthesis material was done based on the inter-arch distance (from implant platform/ridge crest to incisal edge/occlusal plane of opposing dentition).¹⁴ Various materials were considered before making the final choice.

High-impact polymer composite teeth with a BioHPP (ceramic-reinforced PEEK) framework was considered; however, the amount of inter-arch space necessary to achieve mechanical stability and fracture resistance of the framework was not available. Porcelain Fused to Metal was also excluded, because of the lack of adequate rigidity of the metal framework. The modulus of elasticity of the ceramic is not optimal in this case. To protect both the implants and the antagonist arch, a titanium framework was selected, on which the technician set up the teeth from composite, a well-established soft-bite restorative material. The framework was made by laser sintering because of the improved qualities of the surface of the metal compared with those of milled titanium. Cobalt–chromium was not considered because of evidence of reactivity of this alloy in the oral environment.¹⁵ For long-term success, a passive and perfect fit was achieved using prefabricated prosthetic components.





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Conclusion

Advances in materials science and the boom of digitisation and digital workflows in dentistry have provided an array of options for tackling the same clinical situation. This means that there are more treatment options for the various clinical indications. In addition, the interoperability of devices and software systems, the possibility of connecting over video calls and the ease of transferring a large number of data sets over the internet make cross-border collaboration a reality even in cases such as this one, where the clinician and dental technician did not speak a common language, except for the language of digital dentistry. It is clear that clinical decisions should not be solely based on trends, but supported by thorough treatment planning with the technical, surgical and restorative teams, based on expertise, comfort and confidence of the clinician in synchronisation with the dental technician to convert the virtual planning into reality for long-term success. The comfort and safety of the patient should be in focus if increased patient satisfaction at affordable cost is to be achieved.

Acknowledgements

We would like to acknowledge dental technician Vasile Bacila from Slatina in Romania and dentist Dr Magdalena Eugenia Obădan of Implant Consult in Alexandria in Romania.

about the author

Dr Florian Obădan has attended numerous courses to specialise in his techniques, practising in countries such as Romania, India, Georgia, and Armenia. In 2015, he founded the Implant Consult clinic in the city of Alexandria, which offered a different perspective and approach to the idea of a dental clinic. He graduated from university in Craiova in 2001, and since then he has been practising in the field of dentistry. Supported by his family, he attended advanced training courses, and through his perseverance and desire, Dr Obădan realised in 2009 the first Fast and Fixed implant in Romania, thus contributing to the innovation of a difficult field by applying a safe, predictable treatment, which offers the possibility of recovering teeth in a single day, by implant.

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