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# implants

international magazine of oral implantology



**case report**

Soft-tissue substitute versus autologous tissue

Screw-retained solution for terminal dentition

**interview**

Advancing technologies in ceramic implantology—AI sets new milestones in dental treatment

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**Dr Georg Bach**

President of the DGZI

# Here’s to new endeavours for the year!

Dear colleagues and friends,

**The board of the German Association of Dental Implantology (DGZI)** has set ambitious goals for this year. Following our agenda for the board’s term of office, we intend to focus primarily on the area of knowledge transfer and knowledge creation. Our experience with the relaunch of our curriculum, especially since the introduction of the online modules, has been extremely positive—and not only in terms of a significant increase in the number of graduates. We are very pleased about this, of course, but even more so about the positive feedback, especially from younger colleagues who have completed our curriculum—we have clearly recognised the needs of a new generation and understood how to satisfy these with a suitable training programme. There is no doubt that this will be the starting point for further activities.

Based on the sustained momentum from our incredibly important and very successful annual congress in Hamburg last autumn, we are already focusing on the DGZI highlight of this year. It may still seem a long way off, but our next International Annual Congress is already on the horizon. It will take place in Düsseldorf this year. You can look forward to a high-calibre, exciting and attractive programme that will cover many relevant issues in implantology.

We have also succeeded in engaging distinguished speakers, and moreover, the North Rhine-Westphalian metropolis is always worth a visit and is sure to please everyone, including our international guests. The international relationships and even more so the global friendships and networks that the DGZI has forged over more than five decades have supported our growth as the oldest European specialist society and must be maintained. This is an important part of our annual programme.

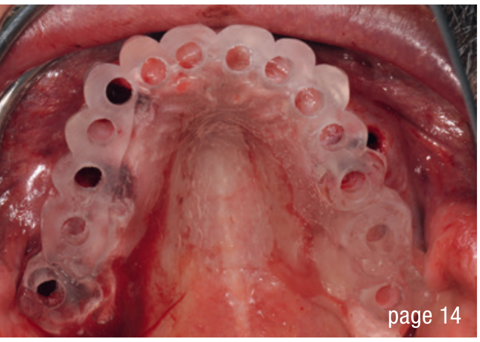
As you can see, dear colleagues, there will be a great deal going on this year too, but be assured that, even with all the focus on the activities described, our commitment as a practitioner society remains unwavering: to uphold our credo of promoting excellent implantology for dentists in private practice.

In this spirit, I would like to send you my warmest regards and wish you much pleasure in reading this first issue of *implants* in 2024!

Yours,

Dr Georg Bach

President of the German Association of Dental Implantology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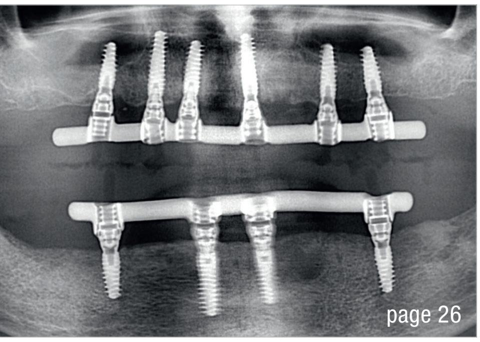
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Cover image courtesy of CleanImplant Foundation, www.cleanimplant.com

# Soft-tissue substitute versus autologous tissue

## Enhancing vestibular depth and tissue thickness with porcine-derived acellular dermal matrix to ensure peri-implant health—a case report

Dr Yazad Gandhi, India

**The existence or development** of a sufficient peri-implant soft-tissue cuff seems to play a significant role in influencing both the dimensions of the surrounding bone and soft tissue as well as the seamless integration of the superstructure into the peri-implant environment.[1] This also contributes to establishing a condition free of inflammation over the long term.[1] Although numerous studies over the years have proved that keratinised tissue around an implant is essential to enhance the protective environment for the crestal bone,[2] Wennström and Derks suggest that further research is required to explore the importance of keratinised tissue around implants and determine the precise amount of soft tissue necessary to effectively prevent peri-implant disease.[3] Nonetheless, there is indirect evidence suggesting that enhancing soft tissue over the long run has a positive impact on peri-implant health.[1] This case report advocates the use of porcine dermis as a soft-tissue substitute, instead of autologous tissue, to augment the tissue thickness (facially as well as vertically) in second-stage implant surgery to gain vestibular depth, facial tissue thickness and vertical tissue thickness at the crest and maintain peri-implant health.

### Case presentation

A female patient in her fifties approached our facility with the desire to have her edentulous posterior maxillary quadrants rehabilitated with a fixed restoration. She was in good health and had fair oral hygiene. CBCT scans were obtained (CS 9600, Carestream Dental; magnification: 1.4×; voxel size: 75 µm; exposure time: 5.5–40.0 seconds; continuous scan mode). Her scans revealed poor posterior maxillary dentition that would need to be extracted and hard-tissue deficient for implant placement (Figs. 1 & 2).

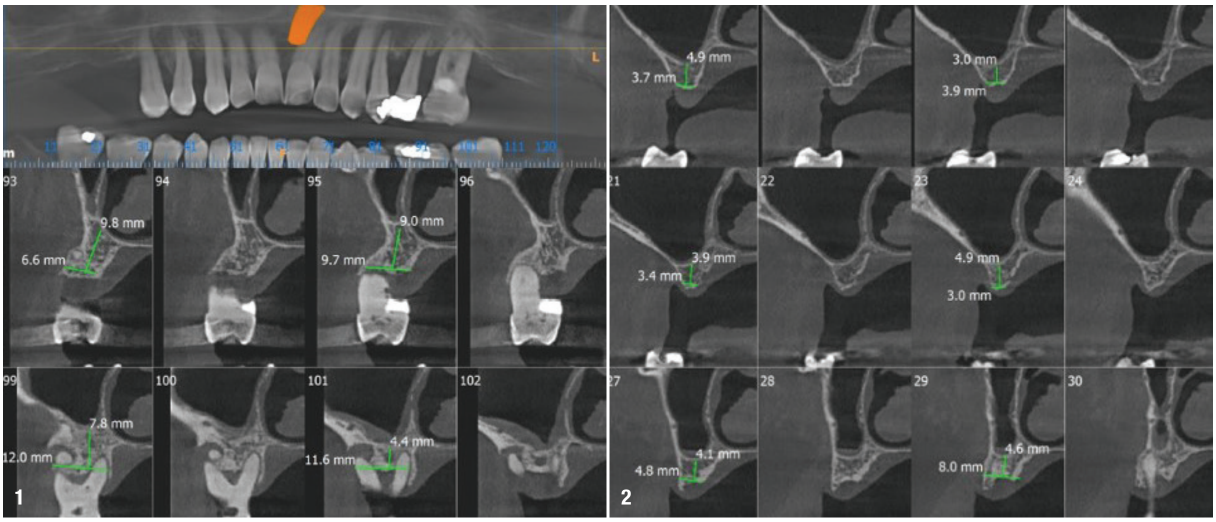


**Fig. 1:** Preoperative scans revealed mutilated posterior dentition along with poor bone quantity in the vertical and horizontal vector. **Fig. 2:** Good sinus health was confirmed prior to treatment planning by radiological as well as clinical methods.

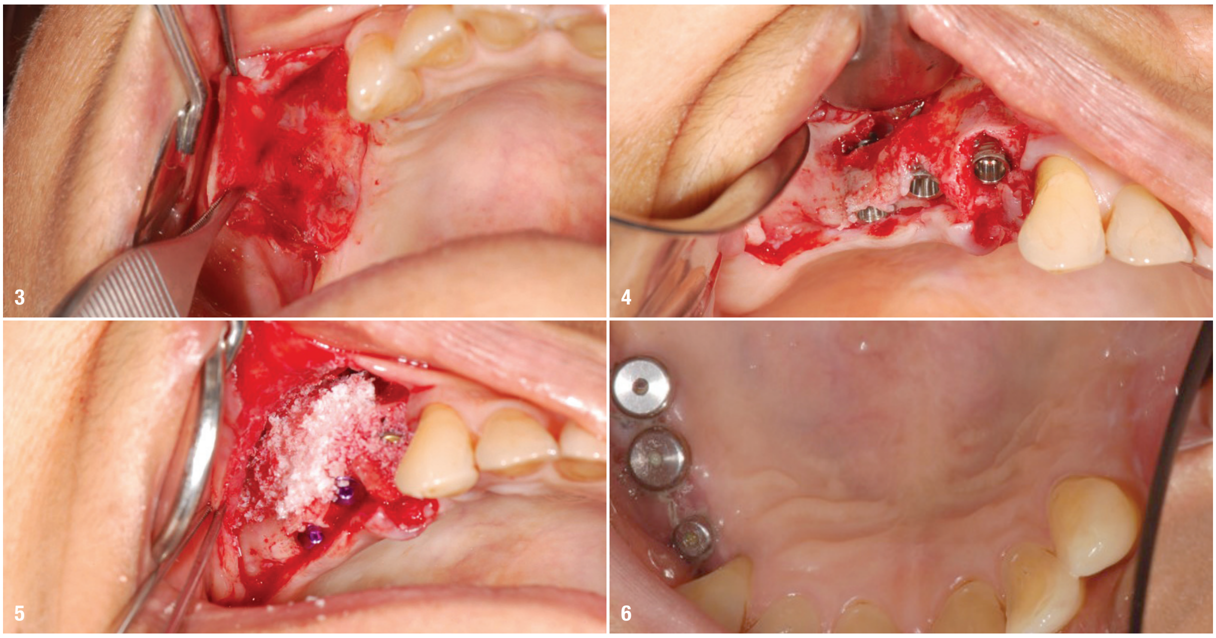


**Fig. 3:** An apically repositioned flap was made (split tissue thickness) to relocate the non-bound tissue away from the crest and gain vestibular depth. **Fig. 4:** Lateral window sinus augmentation was carried out and three CONELOG PROGRESSIVE-LINE implants (BioHorizons Camlog) were placed in regions 16 (4.3 × 9.0 mm), 15 (4.3 × 9.0 mm) and 14 (3.8 × 11.0 mm). **Fig. 5:** The biomaterial used for augmentation was autogenous bone obtained with a Micross scraper (Osteogenics) mixed with MinerOss XP (BioHorizons Camlog). A cross linked collagen Membrane Mem-Lok (BioHorizons Camlog) was used to cover the site. Augmentation was done to restore the vertical and horizontal deficit. **Fig. 6:** After a waiting period of six months bone maturation was optimal to proceed, but there was lack of adequate crestal keratinised tissue along with deficient vestibular depth.

Lateral window sinus augmentation was planned on the posterior of the right as well as the left maxillary quadrants. The patient was advised to undergo a thorough periodontal protocol including prophylaxis, root planning and subgingival curettage, which was deemed necessary prior to the surgical appointment. Informed consent was obtained after thorough discussion of a detailed treatment plan that involved immediate implant placement and hard-tissue augmentation. The patient was also informed of the possibility of a second-stage soft-tissue surgery.

## Surgical procedure

Local anaesthesia was administered by way of nerve blocks as well as infiltration using 2% lignocaine with 1:200,000 epinephrine along with 0.5% bupivacaine. After lateral window sinus elevation, three CONELOG PROGRESSIVE-LINE implants (BioHorizons Camlog) were placed in regions 16 (4.3 × 9.0 mm), 15 (4.3 × 9.0 mm) and 14 (3.8 × 11.0 mm; Figs. 3 & 4). This region was grafted to correct the vertical and horizontal deficits using autogenous bone scrapings collected with a Micross bone scraper (Osteogenics) and MinerOss XP (2 $cm^3$; BioHorizons Camlog) and covered with a cross-linked 20 × 30 mm collagen barrier (Mem-Lok, BioHorizons Camlog; Fig. 5). Closure was obtained using 4/0 Vicryl sutures. The same procedure using similar biomaterials was carried out in the maxillary left quadrant after two weeks using three CONELOG PROGRESSIVE-LINE implants in regions 24 (4.3 × 11.0 mm), 25 (4.3 × 9.0 mm) and 26 (4.3 × 9.0 mm).

After a waiting period of six months of bone maturation, it was observed that there was lack of adequate crestal keratinised tissue along with deficient vestibular depth (Fig. 6). Therefore, an apically repositioned split-thickness flap was planned. Porcine dermis (NovoMatrix, BioHorizons Camlog; Figs. 7a & b) would be used as a poncho, stock healing abutments securing the dermis at the crestal aspect and sutures at the facial aspect under the split flap (Figs. 8 & 9). With a single procedure, adequate bound-down tissue and vertical soft-tissue thickness at the crest was achieved. This is imperative to prevent crestal bone loss, according to Linkevicius et al.[2] The implants on both sides were restored with CONELOG pre-milled abutments and cement-retained zirconia crowns (Fig. 10).

## Observations

An obvious increase in the hard tissue was seen in the vertical dimensions from 3 to 4 mm preoperatively to 11 mm postoperatively. The postoperative vestibular depth was 6 mm, measured from the crest anteriorly, and 4 mm at the posteriormost locations (Figs. 11a & b). A vertical soft-tissue thickness of ≥ 2 mm was observed at the crest together with the gain in peri-implant keratinised soft-tissue thickness (Figs. 12a & b).

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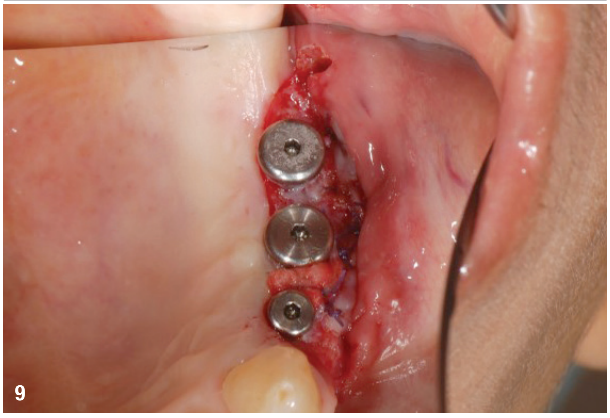

**Figs. 7a & b:** A tissue punch is used to prepare the porcine dermis (NovoMatrix) as per the implant locations. **Fig. 8:** The gingival formers used as a poncho provide stability to the crestal tissue. **Fig. 9:** Porcine dermis (NovoMatrix) was used as a poncho along with stock gingival formers and left exposed at the crest. The dermis was simply tucked under the palatal tissue and secured along with the apically repositioned flap using stay sutures Vicryl 5/0.

## Discussion

The absence of keratinised mucosa and vestibular depth has been speculated to play a significant role in the development and aggravation of peri-implant inflammation.[1, 4, 5] Consequently, some patients may require additional surgical procedures, which may be performed simultaneously with either an augmentative or non-augmentative treatment, in order to improve the condition of their peri-implant soft tissue. Studies on autogenous soft-tissue grafts have demonstrated significant increases in peri-implant keratinised mucosa width, peri-implant soft-tissue thickness and peri-implant supracrestal tissue height.[1] However, the need for additional surgical sites, the resulting high postoperative discomfort, and inadequate quality and quantity of tissue can potentially compromise clinical outcomes.[6]

Allogeneic dermal matrix and xenogeneic collagen matrix have been proposed as alternatives to autogenous soft-tissue grafting as a means of bypassing these limitations.[7, 8] Allogeneic dermal matrices come in various thicknesses, and selecting the appropriate thickness for a particular procedure can be critical. Using a graft that is too thick or too thin for the intended purpose can lead to suboptimal results. Several studies on porcine-derived collagen membranes have shown favourable clinical outcomes in peri-implant soft-tissue surgery.[9] Since these collagen matrices maintain their mechanical stability, they are able to support cell adhesion, cell proliferation and blood vessel ingrowth, resulting in fully functional tissue.[10–12]

A preliminary *in vitro* study demonstrated that the proprietary tissue processing method of NovoMatrix allows rapid growth of blood vessels and fibroblast adhesion

**Fig. 10:** CONELOG premill contour abutments were used and monolithic zirconia crowns cemented onto the milled abutments.


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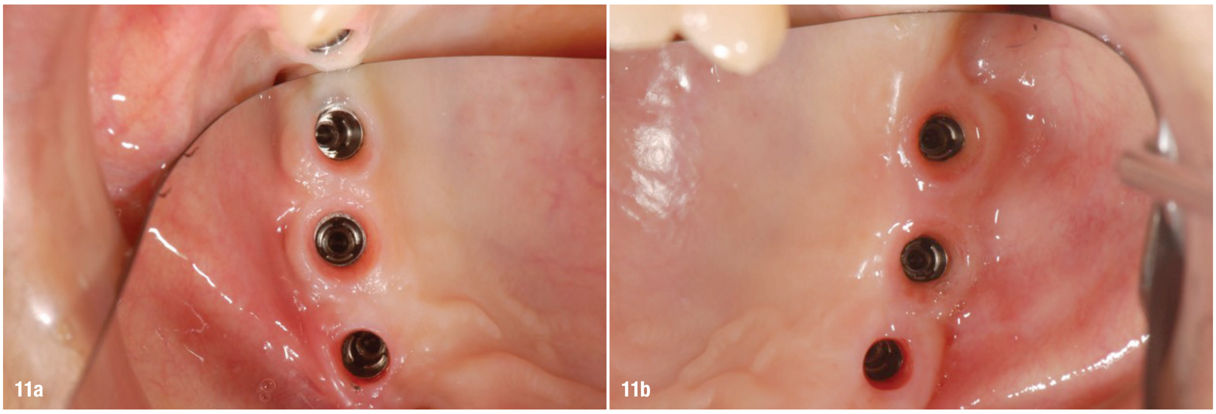


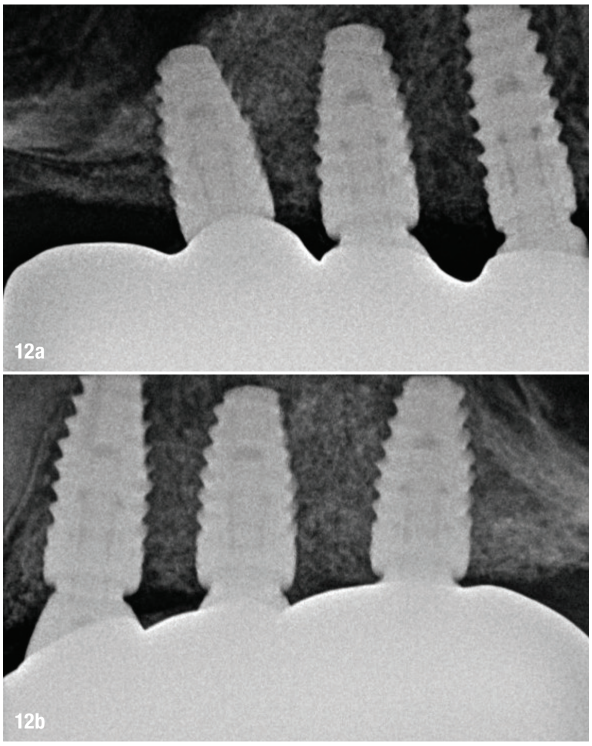

**Figs. 11a & b:** Adequate keratinised gingiva was gained, and vertical soft-tissue thickness was achieved. Post-op vestibular depth on the right was 6 mm as measured from the crest anterior as well as posterior locations.

and proliferation with a minimal inflammatory response (data on file at Allergan).[13, 14] An individual layer of this matrix can be sectioned and superimposed to achieve the desired thickness.[9] The poncho technique, coupled with the split-thickness flap, allows the periosteum and muscle insertion to be preserved so that periosteal vascularisation of the bone can be retained and soft tissue is available for suturing.[9] A remarkable increase in the post-operative vestibular depth and soft-tissue thickness after the use of porcine-derived dermal matrix demonstrates that one can achieve a favourable clinical outcome in terms of peri-implant tissue health, comparable to autogenous soft-tissue grafting.

## Conclusion

Porcine dermis is a viable alternative to autologous soft-tissue grafts and provides optimal gains in soft-tissue quality and quantity. Its uniform thickness and handling characteristics give it an edge over its predecessors. It also gives the clinician the freedom to augment a larger region given that there is no dearth of tissue, which would be the case if we used autologous tissue, and favourable clinical outcomes can be gained in terms of peri-implant health.

Literature




**Figs. 12a & b:** Post-op X-ray reveals good adaptation and seating of the restoration on the right and the left side.

## about the author

**Dr Yazad Gandhi** attended dental school at King George's Medical College where he graduated with honours. He completed his Masters in Oral & Maxillofacial Surgery from the same institution. He is a key opinion leader for BioHorizons, Geistlich and Fellow of the ITI and the Director of Fusion Education, an organisation that conducts CDE courses for dental surgeons across India. Dr Gandhi has several national and international publications to his credit. He maintains a specialty practice at a private facility in Mumbai along with attachment to multispeciality hospital.

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Dr Yazad Gandhi

# Full-arch: Full rehabilitation of the upper jaw—Part 1

Literature

Dr Dr Michael Rak, Norbert Wichnalek, Arbnor Saraci & Lukas Wichnalek, Germany

**The complete rehabilitation** of a compromised residual dentition is a great challenge both implantologically, functionally and aesthetically. Especially the demand for fixed dentures with their aesthetically and functionally satisfactory implementation is high. In addition, there is a growing interest among patients for biocompatible dentures and surgical concepts that take biological criteria into account. Biological dentistry with metal-free implants and dental prostheses made of zirconium oxide can meet this demand at a high level. In the first part of the article, the authors discuss the assessment of the patient's condition, the preparation of the patient and the surgical procedure of extracting the remaining teeth as well as the immediate insertion of the implants. The second part describes the prosthetic restoration of the patient.

## The case

The 41-year-old patient presented to our practice with the wish for a total rehabilitation of his periodontally and cariously compromised residual dentition in the upper and lower jaw. In addition, a biologically neutral and metal-free overall restoration was particularly important to him.

## Clinical findings

In the upper jaw, there was a residual dentition in region 15 and 17 as well as two root remnants in region 13 and 15 *in situ* (Figs. 1 & 2). He had a partial denture in the upper jaw. All four remaining teeth had already undergone endodontic treatment and had been radiographically whit-

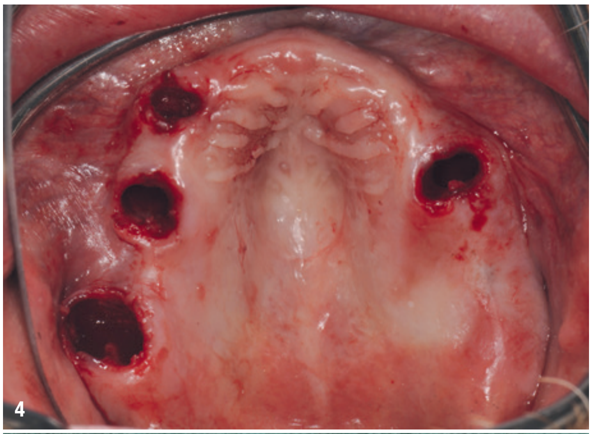
**Figs. 1 & 2:** In the maxilla, there was a residual dentition in region 15 and 17 and two root remnants in region 13 and 15 *in situ*. The patient was previously restored with an aging partial denture. **Fig. 3:** All four remaining teeth had already undergone endodontic treatment and had been radiographically whitened to varying degrees apically. The root remnant in region 13 had an apical overcrowding of 4–5 mm in length and low bone density was noted in region 27 and 28.

ened to varying degrees. The root remnant in region 13 had an apical overcrowding of 4–5 mm in length. Furthermore, a low bone density was detected radiographically in region 18 as well as 27 and 28 on the CBCT (Fig. 3). Overall, the remaining teeth in the upper jaw were no longer worth preserving. In the mandible, teeth 37, 36, 45 and 47 showed carious lesions. Tooth 46 was devitalised, cariously destroyed and showed extensive apical whitening radiographically. The remaining teeth in the mandible were vital. In region 38 and 48, a severely reduced bone density was also measured in the CBCT. During the examination, we found moderate chronic periodontitis in both the maxilla and mandible.

## Biological dentistry

In addition to the functional and aesthetic aspects of the intended restoration, it is also important to consider the physiological and pathophysiological processes in modern treatment planning. Immunology, toxicology and the effect on the autonomic nervous system are of great importance for dentistry. Essentially, three important pillars of biological dentistry need to be considered: metal vs metal-free, endodontics and fatty degenerative osteolysis of the maxillary bone (FDOK).

Chronic, cavity-forming fatty osteolytic diseases of the jaw such as FDOK or the neuralgia inducing cavity-forming osteolysis (NICO), which was first described pathologically, are still controversially discussed in oral and maxillofacial surgery today. FDOK in the medullary canals of the jaw bones can be identified as a lesser-known source of RANTES/CLL5 overexpression. The chemokine RANTES interferes with bone metabolism as a result of complex metabolic processes that are pathologically derailed (such as after tooth extraction), leading to osteolysis in the jaw areas affected by FDOK. Adipocytes have a pathogenetic effect via RANTES expression in the local FDOK and a systemic effect on the immune system.[1] The fields of biological dentistry offer healthy people appropriate treatment options that have minimal or no effect on the body. Even in chronically ill people, biological dentistry treatment approaches that address the individual causes can eliminate potentially stressful factors and restore the original situation in a biologically compatible way. This is done without compromising the aesthetic quality of the teeth, mouth and jaw, and allows for both local and systemic sustainable treatment. In our dental-technical team, we have been combining the principles of biological dentistry with the advantages of plasma treatment of all medical instruments (since 2017) since 2013 (laboratory side). This allows us to take a holistic approach to treatment. Ceramic implantology is a biologically neutral alternative to titanium implantology. Titanium has a high immunological tolerance and does not trigger allergy (lymphocyte nativation). In contrast to ceramics, however, titanium has the potential property of activating tissue macrophages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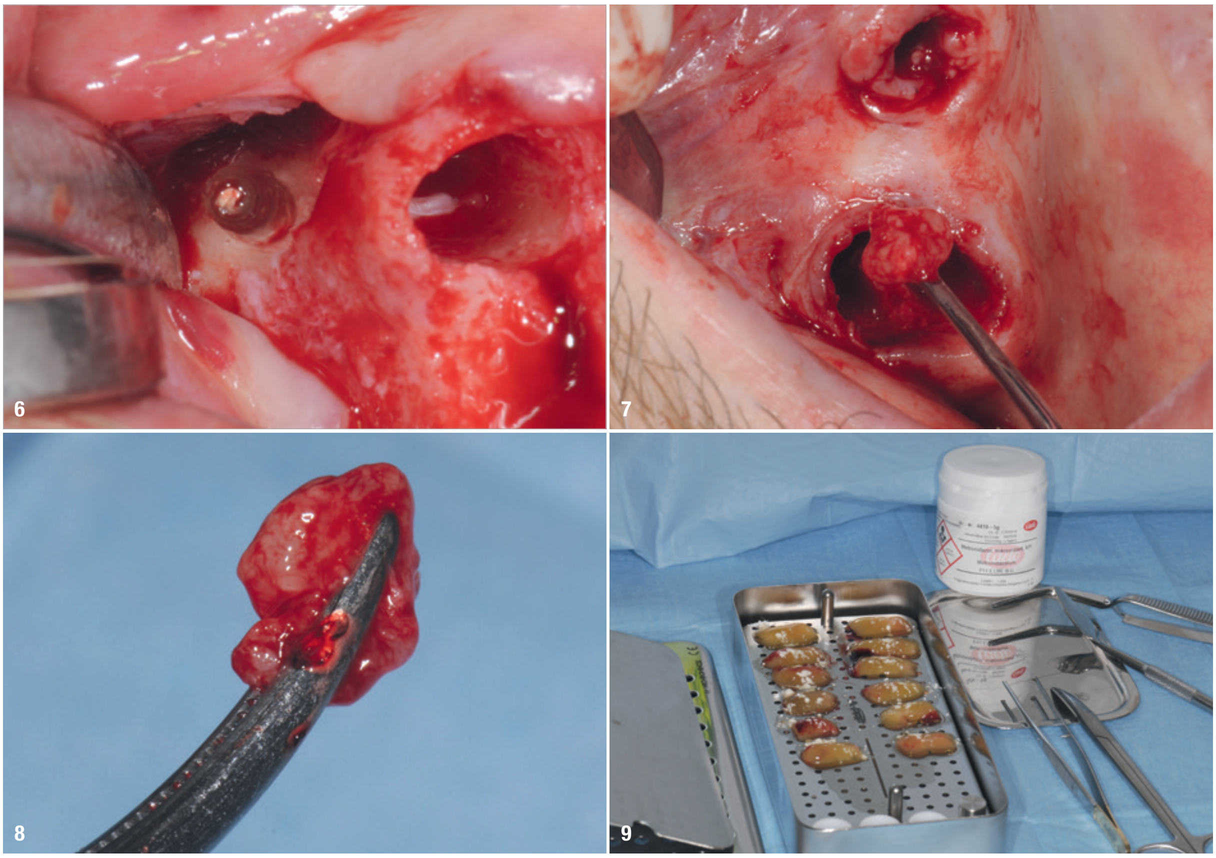
**Figs. 4 & 5:** Extraction of the residual dentition and cysts in the maxilla. In region 13, the overcrowded filling material in the jawbone was also removed from the buccal side, which was present apically of the root apex over 4 to 5 mm.

to varying degrees and promoting the release of proinflammatory cytokines such as TNF-α and interleukin-1. These key cytokines promote tissue and bone resorption and can lead to implant loss in the long term. The intensity of the inflammatory reaction of the tissue macrophages to the titanium particles further depends on the genetic tendency to inflammation, which is predisposed differently in each person.

Endodontic treatment is increasingly criticised because it often leads not only to local failures in the long term, but can also affect the overall system. For one thing, not only is the main nerve pulled during endodontic treatment, but the lymphatic system and blood supply are also cut off. This means that a sufficiently extensive supply of immune cells is no longer possible in the paro-endodontic area. As a result, bacteria settle in the tubular system without being reached by immune cells. This causes the bacteria to produce toxins, which release mercaptan and thioethers, which cause the pro-inflammatory cytokines INF-gamma and IL-10 to be released. A vicious cycle that usually leads to chronic inflammation. With modern immunological test methods such as the effector cell test, the triggers of these chronic inflammations can be found. In addition,



**Figs. 6–9:** The cysts were localised and removed in the maxilla in regions 15, 25 and 27. The A-PRF membrane was moistened with metronidazole and prepared for use.

the toxin load can also be measured directly locally by the OroTox on each root-filled tooth.

The fatty degenerative osteolysis of the jaw bone could be detected with current studies as an area that expresses the cytokine RANTES to a very high degree. The process of chronic inflammation puts the entire system under stress, so that the sympathetic part of the autonomic nervous system is permanently active. The consequences of this can promote the development of chronic disease symptoms. Furthermore, toxins of the FDOK stored in the fatty tissue can be transported via the axon into the brain by means of retrograde transport.

## Planning and therapy

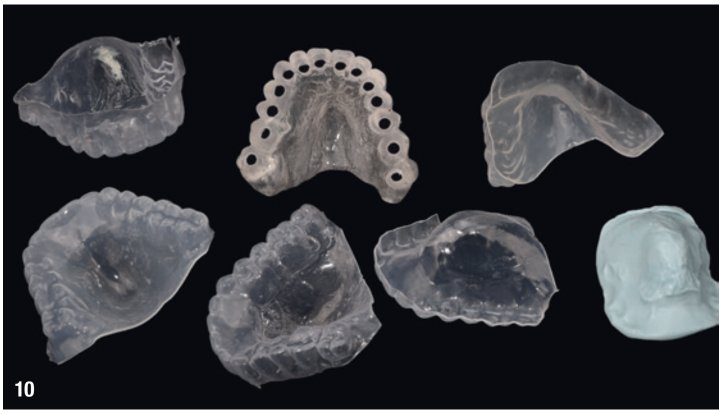
The surgical intervention was planned on the basis of a CBCT X-ray. In a first step, situation models of the upper and lower jaw were made and the dental planning was discussed. The aim was a prosthetic rehabilitation of the upper jaw made of zirconium oxide on eight SDS zirconium oxide implants and a single SDS zirconium oxide implant in the lower jaw. In order not to risk any blocking of the sutura palatina mediana and not to obstruct cranial breathing, the restoration in the upper jaw was divided into three parts. The grinding protocol of the temporary restoration was to serve us for the transfer of the chewing pattern.

## Supplements protocol

The patient was instructed to take a supplement protocol that significantly promotes both bone regeneration and healing. First and foremost, the intake of vitamin D3 and its co-factors—vitamin K2, magnesium, calcium and boron—is essential to optimise bone metabolism and increase the rate of bone formation. In addition, the patient should take amino acids and B vitamins to support regeneration and tissue formation. One day before the planned surgery, a four-day intake of a herbal preparation with antibiotic effect was started. This was to minimise the perioperative risk of infection. The measurement of the vitamin D3 level showed a value of 90 ng/ml.

## Surgical intervention

On the day of the procedure, the patient received a single-shot infusion of Clindamycin 600 mg for infection prophylaxis and a vitamin complex infusion for optimal bone regeneration. Afterwards, the patient's blood was drawn to prepare twelve plasma Choukroun's platelets (A-PRF = advanced platelet-rich fibrin).



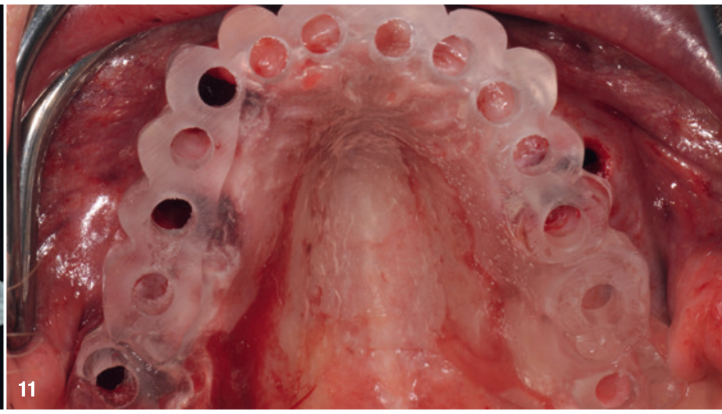


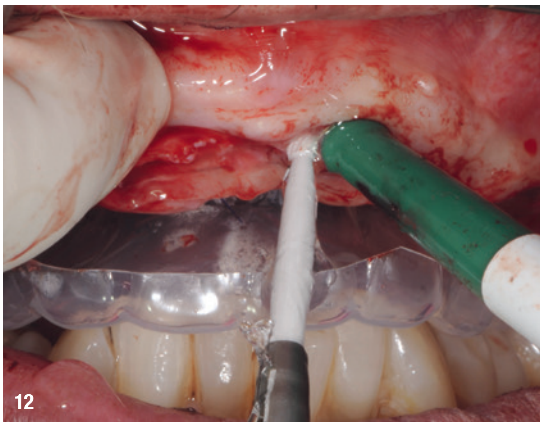
**Fig. 10:** The various surgical aids—an orientation drill guide and various transparent control foils—that the laboratory had prepared for us in advance were now used. **Fig. 11:** The orientation template showed us the optimal fit of the planned implants.

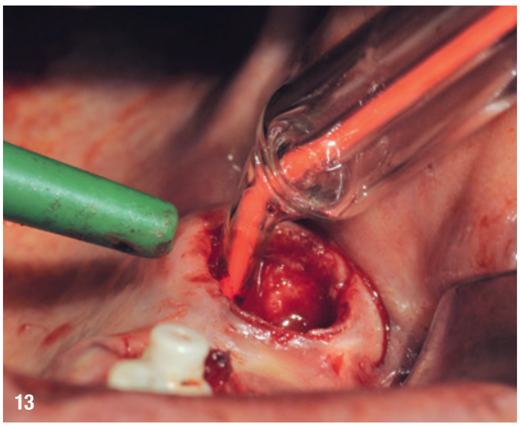
The preferred all-ceramic implant system (one-piece version SDS1.1 and two-piece version 2.0, Swiss Dental Solutions) consists of a Y-TZP-A material. This is an yttrium-stabilised, tetragonal zirconium oxide polycrystal. Both the one-piece and two-piece implant systems have a 3 mm high tulip that is placed on tissue level. This gives the practitioner the opportunity to adjust the insertion depth according to the existing gingival height. In this case, a total of eight implants with a diameter of 4.6 and 5.4 mm were used with a tulip width of 6 mm. Before the surgical interventions, the situations with and without the inserted maxillary prosthesis were imprinted and a digital duplicate of the prostheses was made. Afterwards, the FDOK restoration was carried out first.

## FDOK rehabilitation and implantation

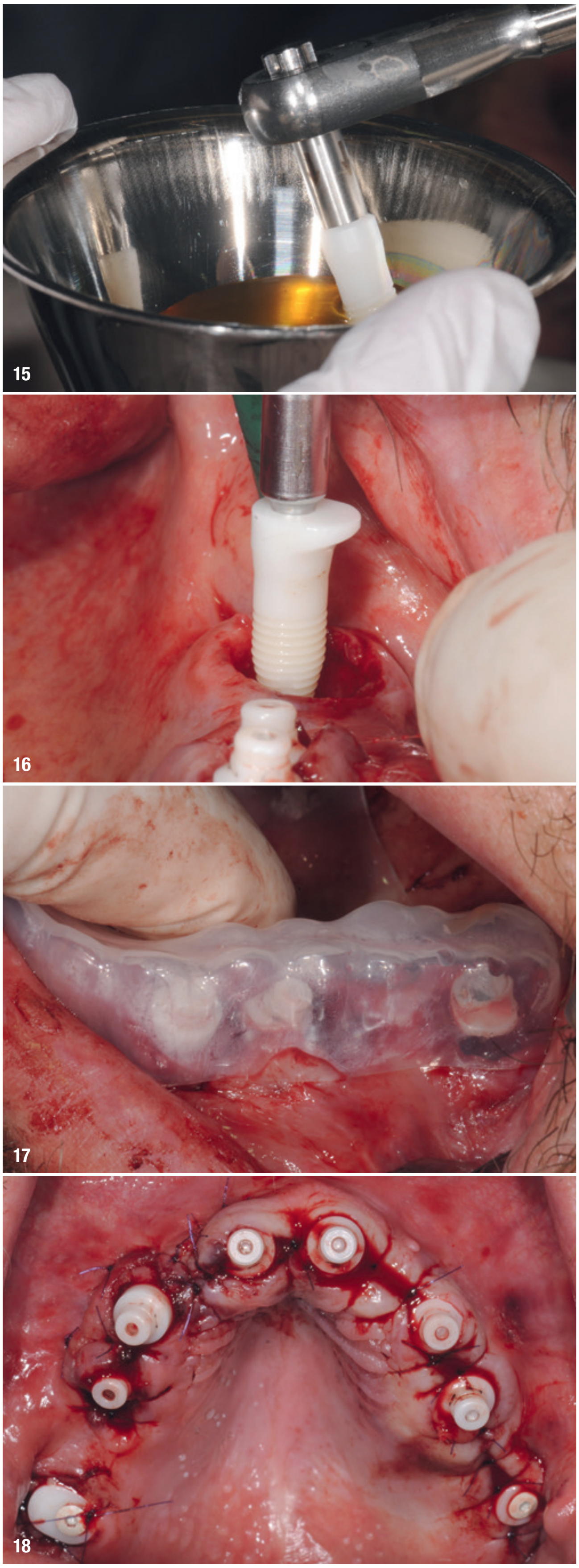
The term "fatty degenerative osteolysis of the jaw bone", abbreviated FDOK, describes chronic inflammatory processes in which osteoimmunological expression of IL-6 and TNF-α are permanently under-regulated for optimal bone healing, but which would be necessary initial for optimal bone regeneration. Instead, the jawbone may respond with RANTES overexpression, which acts as a stress factor if this overexpression persists. As a result, dissolution of the bone substance occurs, which manifests itself in the form of fatty degenerated bone. NICO treatment is of great importance because jawbone osteitis can have multiple negative effects on overall health. The ongoing inflammatory processes and abnormal structural changes in bone tissue release cytokines that interfere with important cellular functions throughout the body. The surgical approach follows a strict surgical protocol that is consistent with the principles of biological dentistry. The incision is gentle and respects the position of the blood vessels. NICO is removed using piezosurgery, followed by ozone therapy and the application of plasma membranes (A-PRF) and careful saliva-proof suturing. Successful treatment requires the use of an accompanying "bone healing protocol". The prescription of vitamins and micronutrients helps the body to recover optimally.

In the present case, the extraction of the remaining teeth and cysts in the maxilla was carried out first. In addition, in region 13, the overcrowded filling material in the jaw-






**Figs. 12–14:** The markers were placed, the alveoli were ozonated and the eight SDS implants pre-treated with plasma were inserted one by one using A-PRF membranes.




**Figs. 15–18:** The cavities of the alveoli were filled with A-PRF, the implants wetted with the A-PRF exudate and inserted.

bone, which presented itself apically of the root tip over 4 to 5 mm, was removed from buccally (Figs. 4–9).

This was followed directly by minimally invasive NICO restoration in region 18, 28, 38 and 48 as well as in region 27, as already described, using piezosurgery. To do this, we first opened the respective ridge section and then the tuber in the upper jaw using piezosurgery and in the lower jaw retromolar using piezosaw. In region 27, the fatty degenerated tissue was removed circularly through the drill tunnel. It is very important to strictly follow our surgical protocol so that the inferior alveolar nerve is not further irritated. Now we loosened the FDOK areas until the cavities bled in without fat and only healthy bone presented itself in the cavity. The areas were then disinfected with ozone for one to three minutes to sterilise the area and stimulate bone metabolism. In dentistry, the natural gas ozone is used medically in a concentration compatible with health to kill germs and viruses.[2] In their study from 2020, Takao et al. documented another positive effect through the use of plasma in implantology. In this publication, the effects of treating nano-ZR implants with cold atmospheric plasma were investigated. While plasma treatment does not affect the roughness of the implant, superhydrophilicity could be achieved. *In vitro* and *in vivo* studies measured faster and better protein, cell and bone adhesion, suggesting that plasma treatment is useful as a prosthetic treatment option for patients with metal allergy.[3] Plasma surface activation also improves the conditions for complete osseointegration.[4] Now the buccal lamella in the maxilla is reduced to minimise the existing bone volume in the tuber in terms of recurrence prevention. Finally, A-PRF membrane is inserted in the maxilla and mandible. Now the various surgical aids—an orientation drill guide and various transparent control foils—that the laboratory had prepared for us in advance were used (Fig. 10). The orientation template showed us the optimal fit of the planned implants like a kind of drilling log (Fig. 11). For better healing, the alveoli were cleaned in advance using ozone and the SDS implants were inserted one by one using A-PRF membranes (Figs. 12 & 13). For this purpose, both the cavities of the alveoli were filled with A-PRF and the implants were wetted with the A-PRF exudate and inserted (Figs. 15–17). The advantages of A-PRF lie in its high protein and platelet content. Platelets in particular have a high amount of growth factors that accelerate bone regeneration. Various studies showed the advantages of A-PRF wetting in extraction sockets. In GBR (Guided Bone Regeneration)/GTR (Guided Tissue Regeneration), the A-PRF membrane provides improved dimensional stability of the bone com-

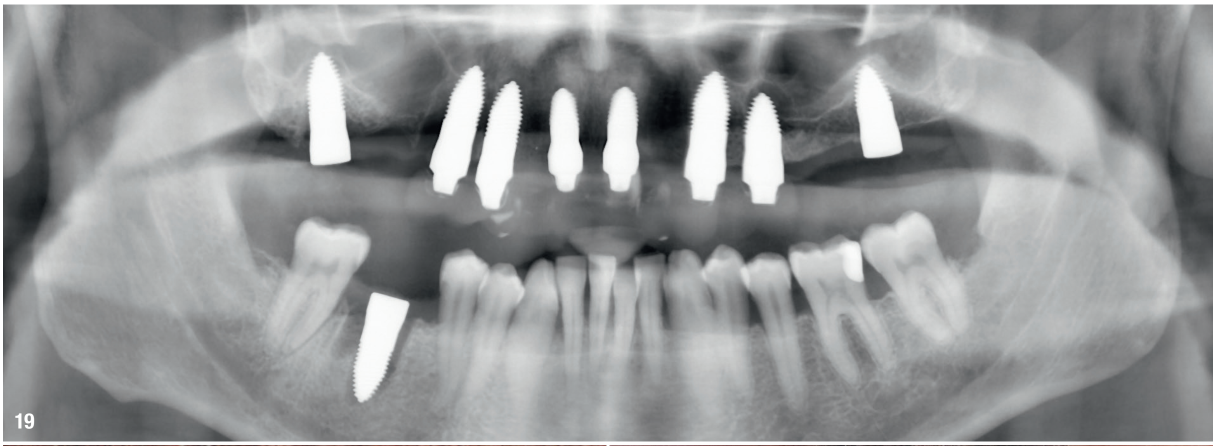


**Fig. 19:** Finally, the correct seating of all implants was checked with the help of an X-ray. **Figs. 20 & 21:** The inserted long-term provisional fixation presented the final result we were aiming for and a patient who was already happy.

pared to the natural healing process. It has been shown that filling the extraction sockets with PRF reduces the risk of osteomyelitis almost tenfold. Thus, the PRF membrane ensures improved and accelerated bone regeneration and healing, as well as maintaining the quality and density of the residual alveolar ridge. The risk of infection is also significantly reduced.[5–8] Thus prepared, the best conditions were created for healing of the inserted implants without complications. The opened areas were closed with atraumatic sutures and a neural therapy with procaine and Traumel was started. Finally, the correct seating of all implants was checked with the help of an X-ray, the long-term provisional fixation was inserted and the occlusion meticulously checked and adjusted. The final result we were aiming for can already be seen at this point (Figs. 18–21).

## Preview

While in the first part of the article the authors dealt with the special features of the patient's case during the assessment of the findings, the detailed preparation of the patient as well as the surgical procedure for extraction of the residual dentition and immediate placement of the implants, they will discuss the prosthetic restoration of the patient in the second part.

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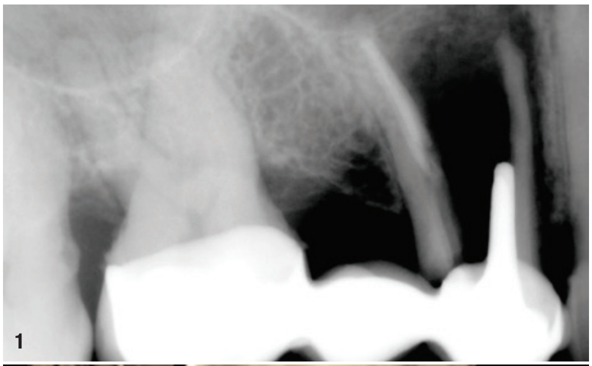
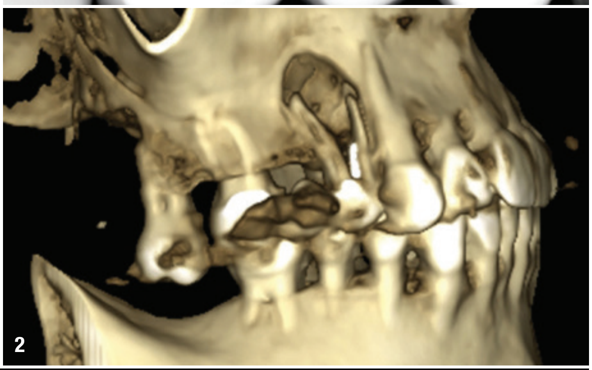
# Implant-prosthetic rehabilitation:

## One-stage surgery with post-extraction, hard- and soft-tissue augmentation, periodontal regeneration and immediate fixed prosthesis

Dr Stefano Scavia, Italy

**The predictable application** of hard- and soft-tissue regenerative techniques has made it possible to pursue the goal of prosthetically guided implant treatment. In cases of severe osteolytic lesions with extensive impairment of the alveolar bone and loss of one or more teeth, the traditional approach to fixed rehabilitation involves planning a multistage surgery. The scientific literature has demonstrated the effectiveness of guided bone regeneration techniques, indicating resorbable devices as the first choice in horizontal regeneration. However, major regenerations involving a significant vertical defect have required the use of non-resorbable devices. Nonetheless, scientific evidence has demonstrated the effectiveness of resorbable devices even for bone regeneration in cases with limited vertical bone. Furthermore, increasing importance is being given to the management of soft tissue, which in some cases can be combined with implant treatment to obtain adequate supra-crestal mucosal thickness. In addition, periodontal regeneration of an infrabony defect can be performed with guided bone regeneration when the surgical sites are adjacent. When possible, the combined



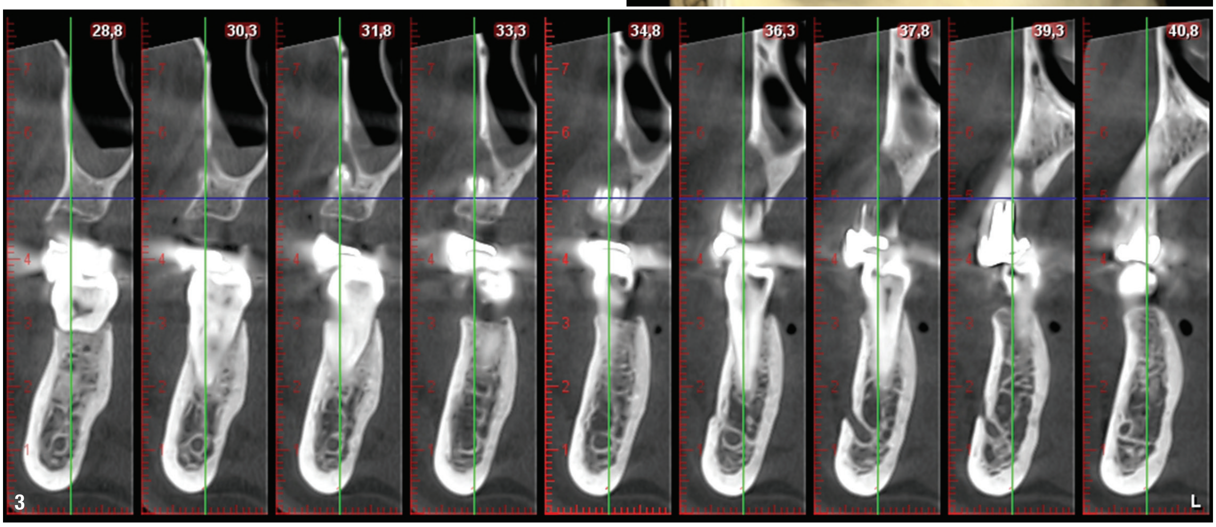




**Fig. 1:** Pre-op evaluation. Vertical fracture of the root of tooth #14 rehabilitated with a long intra-canal metal pin. **Fig. 2:** Pre-op evaluation. Wide periradicular infrabony injury with vertical bone loss. **Fig. 3:** Pre-op evaluation. Wide periradicular infrabony injury with vertical bone loss.

application of several techniques allows fewer surgeries and optimisation of the healing process.

## Case presentation

A 49-year-old female patient presented to our clinic in Milan in Italy reporting mobility and pain in the maxillary right quadrant, corresponding to the area of a fixed bridge from tooth #14 to tooth #16—tooth #15 was missing. Based on the general anamnesis, the patient was classified as ASA I, and she was a non-smoker. After a clinical and radiographic check-up, both intra-oral and CBCT, a vertical fracture of the root of tooth #14 rehabilitated with a long intra-canal metal pin was evident (Fig. 1). The compromised root had caused a wide periradicular infrabony injury with vertical bone loss of up to 12.0 mm vestibularly and 3.5 mm palatally (Fig. 2). In site #15, the residual alveolar process measured 7.0 mm high and 7.5 mm wide. In addition, a mixed two- and three-walled infrabony periodontal defect with a probing depth of 5 mm was found mesially around tooth #16 (Fig. 3).

The patient desired a fixed rehabilitation that would not involve healthy teeth or a large number of surgeries. A virtual case resolution project was then created, according to the guidelines of regeneration and guided prosthetic implantology.[1] Based on clinical evidence, the literature and the surgeon's skill, a one-stage surgery was planned that would involve a bone condensation technique using magneto-dynamic technology[2–4] and the use of intramucosal implants with a UTM (ultrathin threaded microsurface) hybrid neck surface (Prama, Sweden & Martina), capable of promoting both soft-tissue integration and osseointegration.[5, 6]

## Materials and methods

The week before the operation, the patient underwent a complete oral hygiene session. The day of surgery, it was verified that the full-mouth plaque score was less than 20%, and after that the patient rinsed with 0.2% chlorhexidine digluconate for 1 minute. Local anaesthesia was performed with articaine (40 mg/ml) and adrenaline (0.01 mg/ml). The surgical procedure involved the separation of the pontic in site #15 from the crown of tooth #16 and an atraumatic extraction of the fractured tooth #14 (Figs. 4 & 5). A full-thickness flap was elevated and the extensive osteolytic lesion removed (Figs. 6–8). At site #15, the implant site was prepared with magneto-dynamic osteotomes of circular cross-section and conical shape with increasing diameter (Magnetic Mallet, Meta Ergonomica) and



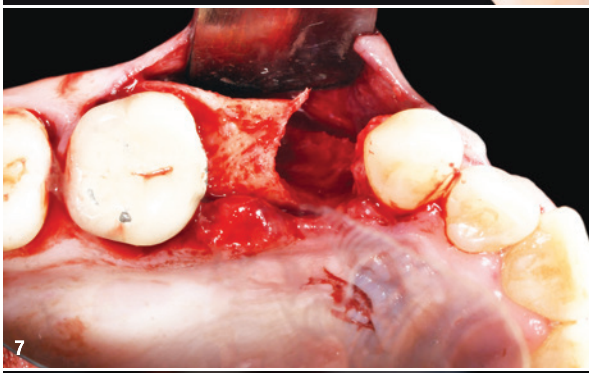





**Fig. 4:** Separation of the bridge from the pontic in site #15 to the crown of tooth #16. **Fig. 5:** Atraumatic extraction of the fractured tooth. **Fig. 6:** Full-thickness flap elevation, vestibular view. **Fig. 7:** Full-thickness flap elevation, occlusal view. **Fig. 8:** Removal of the extensive osteolytic lesion.

a concomitant crestal sinus lift (vertical gain of 6–10mm; Fig. 9). The sinus lift technique (PRO SCV Sinus Lift, RESISTA) allowed us to obtain floor deformation and detachment of a bone operculum of about 3mm in diameter, increasing the height of the infrabony prepared implant site path by at least 2mm, for better bone–implant contact and primary stability.[7, 8] A fibrin haemostatic sponge was inserted into the sinus prior to implantation to protect the sinus membrane from biomaterial granules, followed by the grafting of a cross-linked collagen and hydroxyapatite matrix (OSSIX Bone, Datum Dental; Fig. 10). The implant site was underprepared to further increase primary stability and implant insertion torque, and the implant was then positioned (Fig. 11).[9] A rigid cross-linked collagen membrane (OsseoGuard, Zimmer Biomet) was fixed palatally with #5/0 resorbable PGA monofilament sutures (Fig. 12). In site #14, bone condensation was performed in the digitally planned implant position with magneto-dynamic osteotomes. The residual bone, apical to the defect, was compacted and shaped together with the maxillary sinus floor, gaining additional vertical bone in the apical direction of 2mm.[10, 11] An implant with a UTM intramucosal neck of 2.8mm high was inserted into site #14 about 2.0mm more apical than the implant inserted into position #15, which had an intramucosal neck of 1.8mm high, and both were placed to a torque of between 20 and 25Ncm.

After the implant placement, degranulation of the periodontal defect of the mesial root surface of tooth #16 was performed, followed by scaling, root planing and decontamination with 24% EDTA gel.[12] Simultaneous guided bone regeneration and periodontal regeneration were performed, using a high-porosity porcine-derived carbonate apatite (Zcore, Osteogenics Biomedical) mixed with cross-linked hyaluronic acid (hyaDENT BG, BioScience; Figs. 13 & 14). The membrane was fixed vestibularly with titanium micro-tacks 3.0mm long and 2.5mm in diameter (Geistlich Pharma) and, through a hole drilled on the membrane, to the transmucosal healing screw provisionally placed on the implant at site #15 (Figs. 15 & 16). A layer of cross-linked hyaluronic acid was placed on the root of tooth #16 involved in the periodontal defect. After complete fixation of the membrane, a matrix (mucoderm, botiss biomaterials) was perforated and placed around the neck of implant #15 (Fig. 17). The vestibular flap was lengthened by periosteal releasing incision, followed by the brushing technique, and then repositioned coronally. It was closed by first intention with #5/0 PGA monofilament double-layer sutures over the collagen matrix. After removal of the transmucosal screw in site #15, a provisional fixed prosthesis was screwed on to implant #15 and cemented with a metal wing on tooth #13 (Fig. 18).

After six months of healing and conditioning, a control radiograph was performed (Fig. 19), and the provisional prosthesis was removed. The supra-crestal soft tissue appeared to be free of inflammation, and a pink mucosal cone was appreciable above the prosthetic UTM neck connection of the implants (Fig. 20). Single crowns were realised on implants #14 and 15, and the old metal–ceramic crown on tooth #16 was replaced, having been provisionally maintained and separated from the rest of the bridge. After one year, clinically and radiographically, we observed perfect integration of the implants, maturation of the augmented sinus at implant #15 and resolution of the periodontal defect affecting tooth #16 and of the wide bone defect at implant #14 (Figs. 21 & 22).

## Discussion

Ridge augmentation techniques are characterised by horizontal, vertical or 3D hard-tissue augmentation. The prerequisites for the success of these techniques concern various parameters. The type of membrane used is primary. It must be able to create an isolated, rigid, fixed space.[13] For this reason, non-resorbable membranes have been regarded as indispensable for larger augmentations with a significant vertical component, whereas some authors have reported cases treated successfully with rigid, slowly resorbable devices, such as cross-linked collagen membranes, for 3D augmentations whose vertical component is reduced.[14, 15] The success of 3D augmentations also requires the presence of other factors considered indispensable, such as supporting structures (tenting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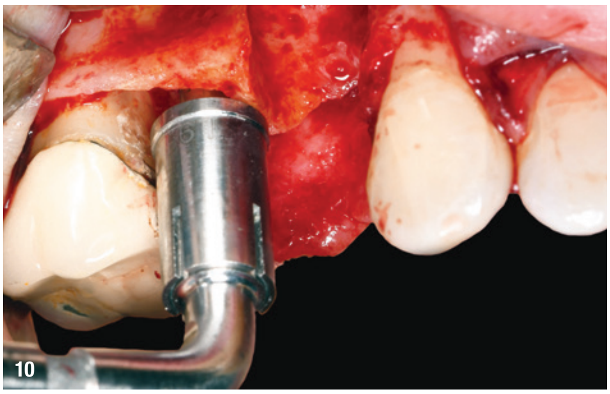
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**Fig. 9:** Preparation of the implant site in region 15 with bone condensing osteotomes. **Fig. 10:** Crestal sinus lift in site #15.

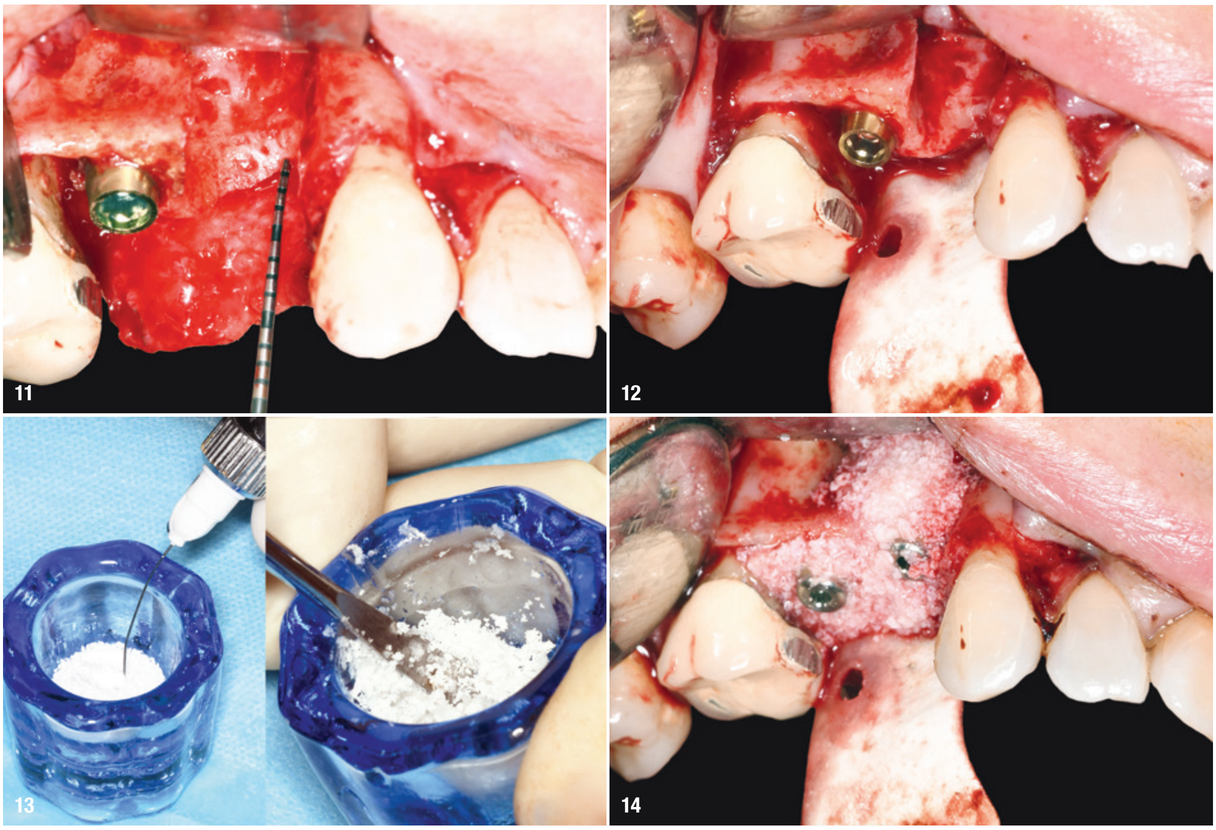



**Fig. 11:** Implant inserted into site #15. **Fig. 12:** Palatal fixation of the rigid cross-linked collagen membrane with sutures. **Fig. 13:** Preparation of a mix of high-porosity porcine-derived carbonate apatite with cross-linked hyaluronic acid for grafting. **Fig. 14:** Implant inserted into region 14 and both sites grafted.

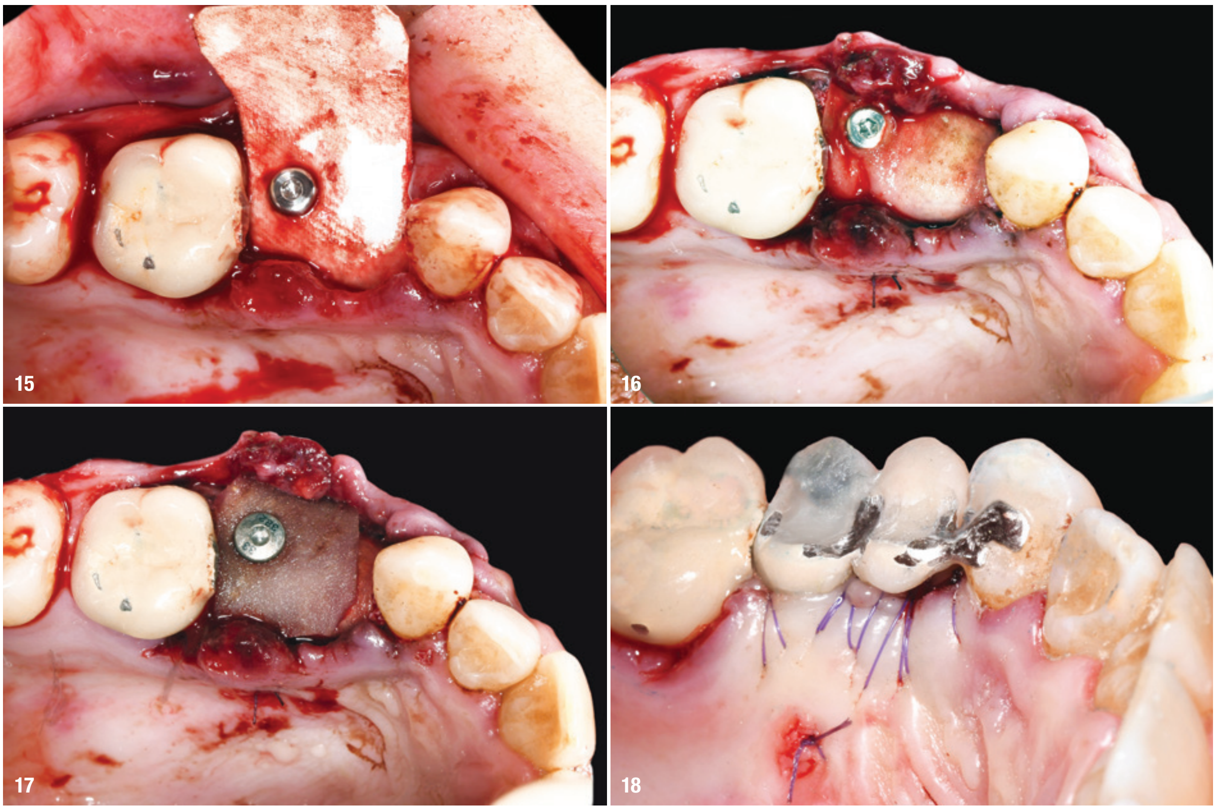
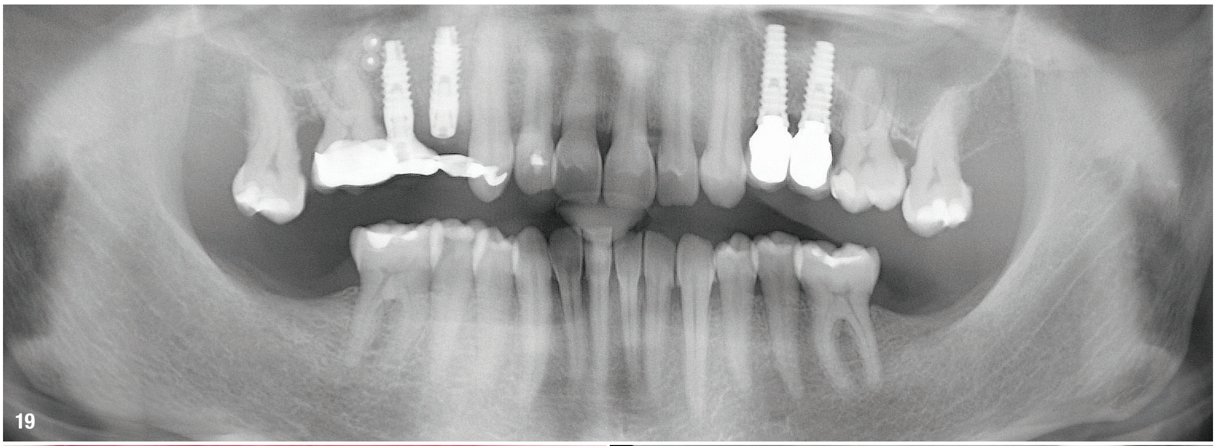
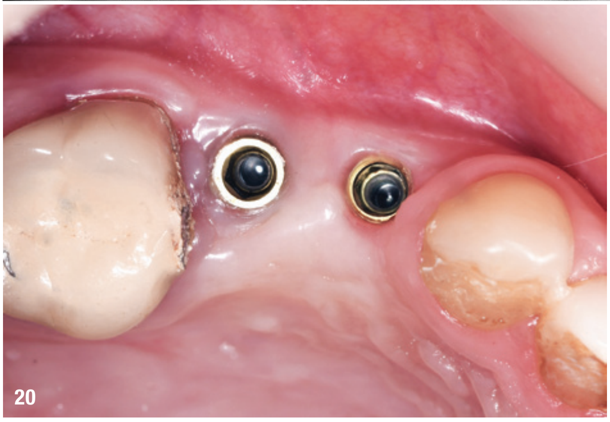



**Fig. 15:** Membrane fixed with the transmucosal healing screw provisionally placed on the implant in #15. **Fig. 16:** Membrane vestibularly fixed with titanium micro-tacks. **Fig. 17:** Porcine-derived acellular dermal matrix placed over the membrane and around the neck of implant #15. **Fig. 18:** Suturing and fixation of a provisional fixed prosthesis screwed on to implant #15 and cemented on to tooth #13 with a metal wing.





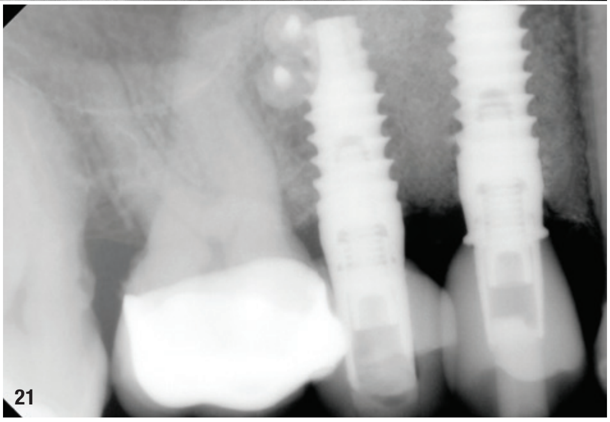


**Fig. 19:** Post-op radiographic check after six months. **Fig. 20:** Supra-crestal soft tissue at six months after removal of the provisional fixed prosthesis. **Fig. 21:** Post-op radiographic check at one year.

screws, implants themselves, etc.), fixing devices (sutures, pins, micro-screws, etc.) and grafting materials, which, in addition to being osteoconductive, require a component that improves the supply of autologous growth factors.[16] For this last characteristic, the gold standard is still the autograft, but recently, biological agents such as the cross-linked hyaluronic acid used in this case report have been making gains, being capable of improving the formation and support of the clot, as well as enhancing the supply of autologous growth factors.[17–19]

The philosophy of the intramucosal implant involves the positioning of the rough, sandblasted and etched portion strictly intraosseously and the UTM neck in a hybrid manner between the hard and soft tissue. The different UTM neck heights of 1.8 and 2.8 mm therefore allow the implant to be placed at different depths using the different lengths available on the market.[5, 6, 20, 21] This is particularly useful in implant treatments associated with regenerative techniques, where tissue healing and remodelling cause postoperative shrinkage during the healing phase that is not entirely predictable.[22] Magneto-dynamic technology also allows implant sites to be prepared using bone condensation techniques, improving the primary stability of implants even when placed into areas with very small volumes of native bone.[23, 24]

Soft-tissue management is also an aspect now considered indispensable in oral regenerative techniques. The thickness of the peri-implant supra-crestal soft tissue, the amount of keratinised gingiva and the maintenance or restoration of a proper mucogingival line are of primary importance. The technique of choice in restoring adequate quality to supra-crestal soft tissue remains autologous connective tissue grafting, traditionally performed in association with major bone regeneration as free gingival graft, but recently alternative solutions favouring connective tissue grafting as the augmentation technique are becoming more established.[25] It appears that a deep connective tissue graft not only reduces the contraction typical of free gingival grafts, but over time improves the quantity of the soft tissue through creeping attachment. When an improvement in soft-tissue quality is not essential, but an increase is sufficient, biological substitutes have proved to be a viable alternative in order to reduce the invasiveness of treatment. Indeed, the literature reports increases of 1.0–1.5 mm in thickness achievable with biological substitutes based on porcine-derived dermal matrix grafted at partial thickness or subperiosteally.[26, 27]

## Conclusion

The use of a rigid, cross-linked, bone-fixed and -supported resorbable membrane is effective in correcting defects


**Fig. 22:** Post-op clinical check at one year.

with a small vertical component. Bone condensation makes it possible to increase primary stability even in the case of limited residual bone volume. The UTM neck facilitates the fixing of a collagen matrix, allowing the maturation of hard and soft tissue. The application of a regenerative surgical protocol for the management of an intrabony periodontal defect adjacent to the site to be regenerated is effective. The application of a minimally invasive approach with the possibility of exploiting surgical access to an edentulous site to manage the periodontal regeneration of an adjacent natural tooth makes the clinical outcome even more successful. Combining multiple techniques with few surgeries allows optimisation of the healing processes as well as reduction of the overall treatment time, in addition to lower invasiveness of the therapy.[28]

Literature

## about the author

**Dr Stefano Scavia** completed his DDS in 2003 at the University of Milan in Italy and in 2008 obtained a second-level master's degree in implantology and oral surgery. He lectures in this master's programme at the School of Medicine and Surgery of the University of Milano-Bicocca and the elective course in minimally invasive surgery as part of its dentistry degree programme. Dr Scavia founded the Minimal Invasive Dental Academy in Milan and is a certified member of the Italian Academy of Osseointegration and a member and speaker of the National Association of Italian Dentists.

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Dr Stefano Scavia

# Screw-retained solution for terminal dentition

## Tissue-level implants and no multi-unit abutments

Dr Gian Battista Greco, Italy

**Full-mouth rehabilitation** of the terminal dentition with implant-supported screw-retained prostheses represents the gold standard of dental rehabilitation today.[1, 2] In the planning phase, once the patient's general medical condition has been evaluated, a multitude of aspects must be taken into consideration, involving the patient's hard and soft tissue and the morphology that the prosthetic frameworks will have to assume in order to comply with functional (mastication, deglutition and phonation) and aesthetic requirements.

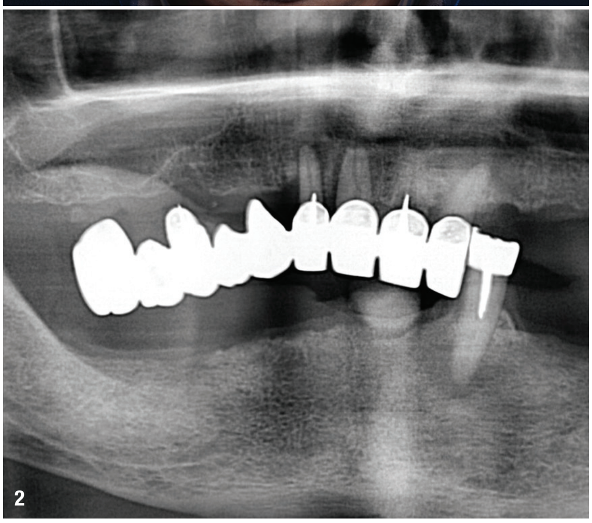


**Fig. 1:** Pre-op smile. **Fig. 2:** Pre-op panoramic radiograph.

In cases where many or all of the functional parameters (overjet, overbite, vertical dimension of occlusion, inclination of the occlusal plane, median and occlusal plane cant, etc.) are altered, it may be useful to precede guided surgery with a phase of rehabilitation, even a short one, through removable prostheses in order to be able to test our design and possibly correct it in the postoperative phase. To this end, sagittal skeletal assessment through orthognathic analysis is very useful in guiding the clinician towards the functionally and aesthetically ideal result.[3]

Furthermore, with regard to the possibility of performing immediate functional loading, it will be important to assess bone density through a CBCT examination and to choose an implant with a morphology suitable for obtaining an implant insertion torque sufficient for the purpose. The use of guided surgery will shorten the surgical time and minimise implant placement errors.[4]

### Patient history

A non-smoker and systemically healthy 72-year-old male patient came to our clinic complaining of difficulty chewing owing to mobility of his maxillary fixed prosthesis (Fig. 1). On radiographic examination, the four incisors were found to be present in the maxillary arch, which clinically showed a high degree of periodontal and structural compromise (Fig. 2). In the mandibular arch, the patient had only the left canine remaining, to which a removable partial prosthesis was attached.

### Treatment plan

The patient expressed a desire to receive a fixed prosthetic solution anchored on implants. We decided to initially construct a removable prosthesis (maxillary arch) to correct the anterior and sagittal parameters, and the mandibular canine would be left in place until guided surgery.

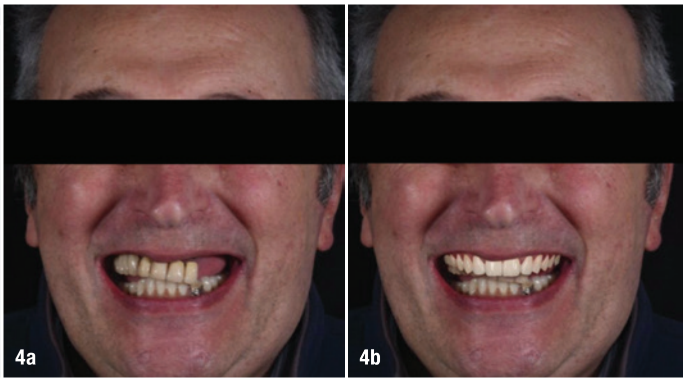




**Fig. 3:** Pre-op intra-oral scan. **Figs. 4a & b:** 2D digital smile planning, before **(a)** and after **(b)**.

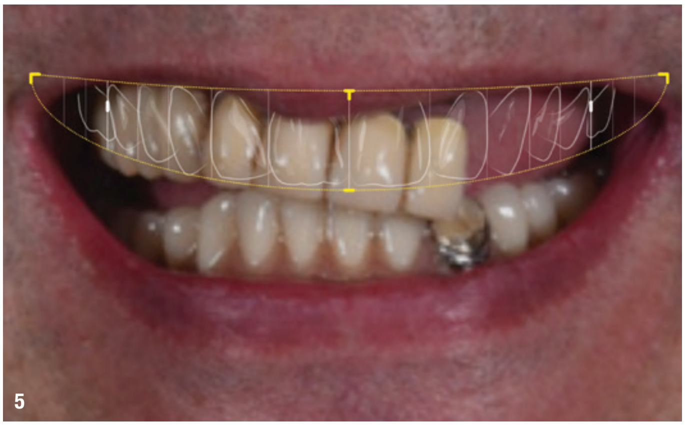
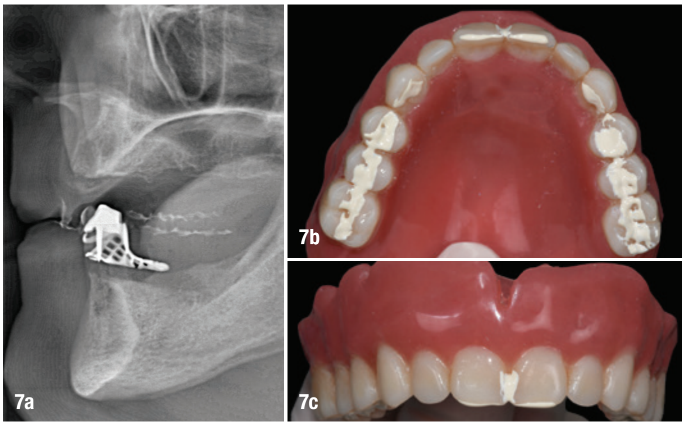
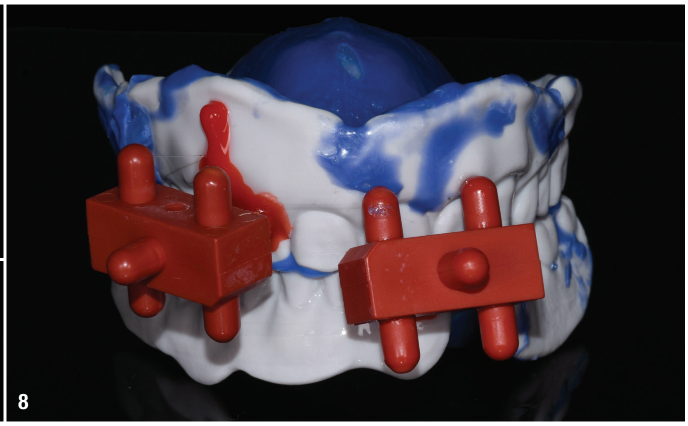


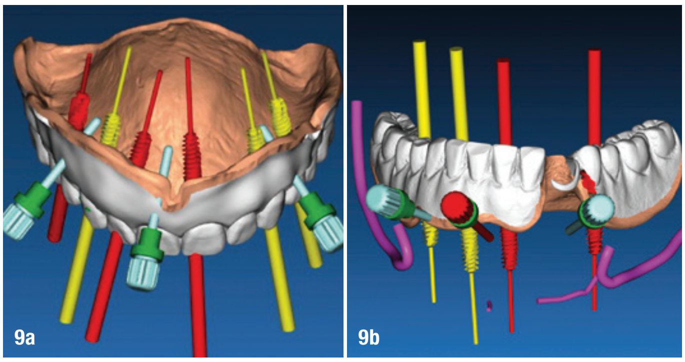


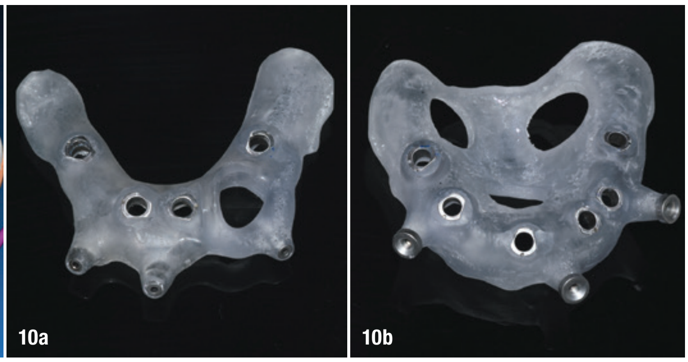
**Fig. 5:** 2D digital smile planning, close-up. **Fig. 6:** Appearance of the maxillary removable prosthesis.



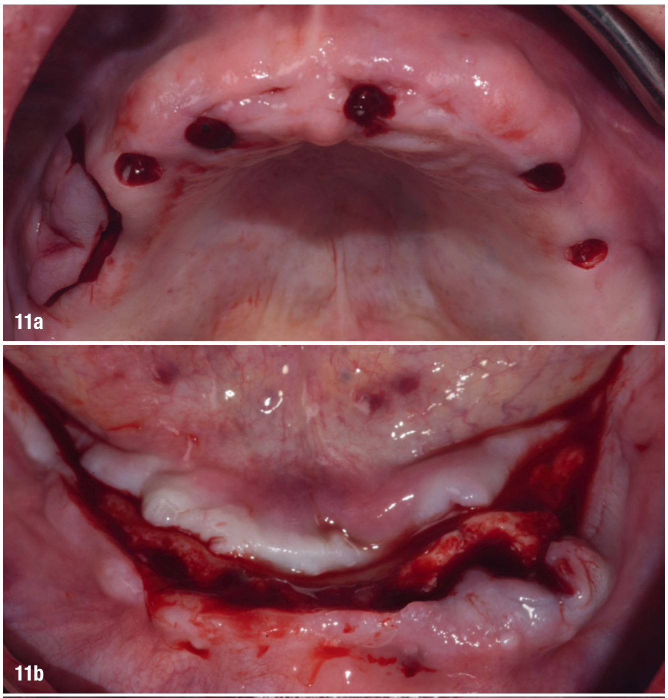



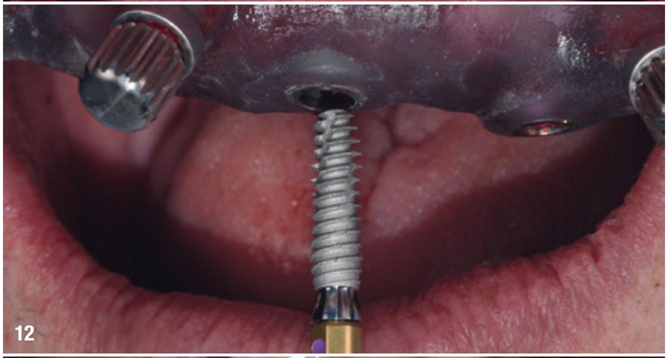

**Figs. 7a–c:** Lateral profile radiograph **(a)** and radiopaque cement applied to the removable prosthesis **(b & c)**. **Fig. 8:** 3D markers applied to the maxillary and mandibular prototypes.

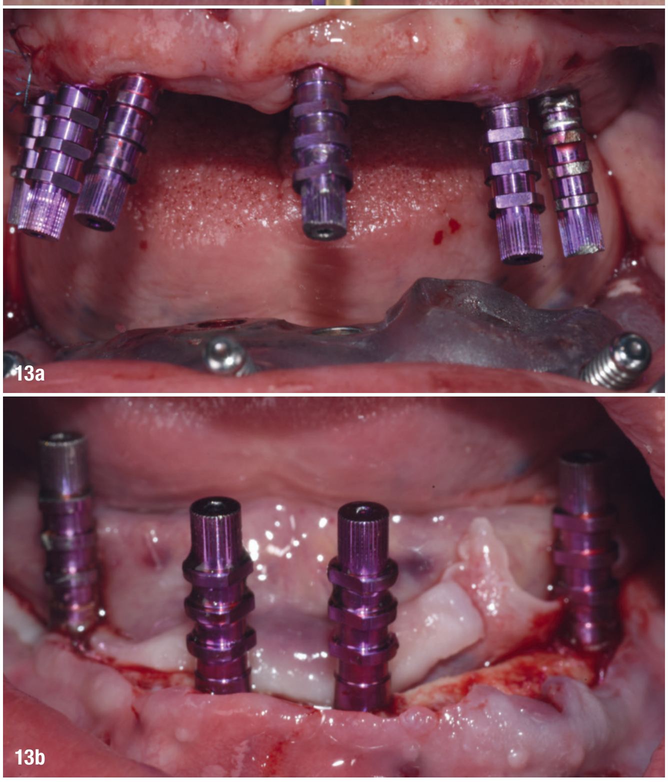



**Figs. 9a & b:** 3D view of the implant planning, maxilla **(a)** and mandible **(b)**. **Figs. 10a & b:** Mandibular **(a)** and maxillary surgical guides **(b)**.




An intra-oral scan (TRIOS 3, 3Shape; Fig. 3) and a 2D digital smile design were then performed (Smilecloud, Straumann; Figs. 4 & 5). With this data, the laboratory (Nuova Eliodent) constructed the maxillary removable prosthesis with a fully digital flow.

Under local anaesthesia, the four maxillary incisors were extracted, and the removable maxillary prosthesis was delivered. The prosthesis still showed some cant in the frontal plane (Fig. 6) probably due to the mandibular occlusal plane; therefore, a lateral profile radiograph was taken after applying radiopaque temporary cement (TempBond, Kerr) on the maxillary prosthesis to highlight the course of the occlusal plane and the position of the incisors (Fig. 7). Orthognathic analysis revealed the need to raise the occlusal plane posteriorly and revealed the tilt of the occlusal plane on the frontal plane (adjusting the two lines).

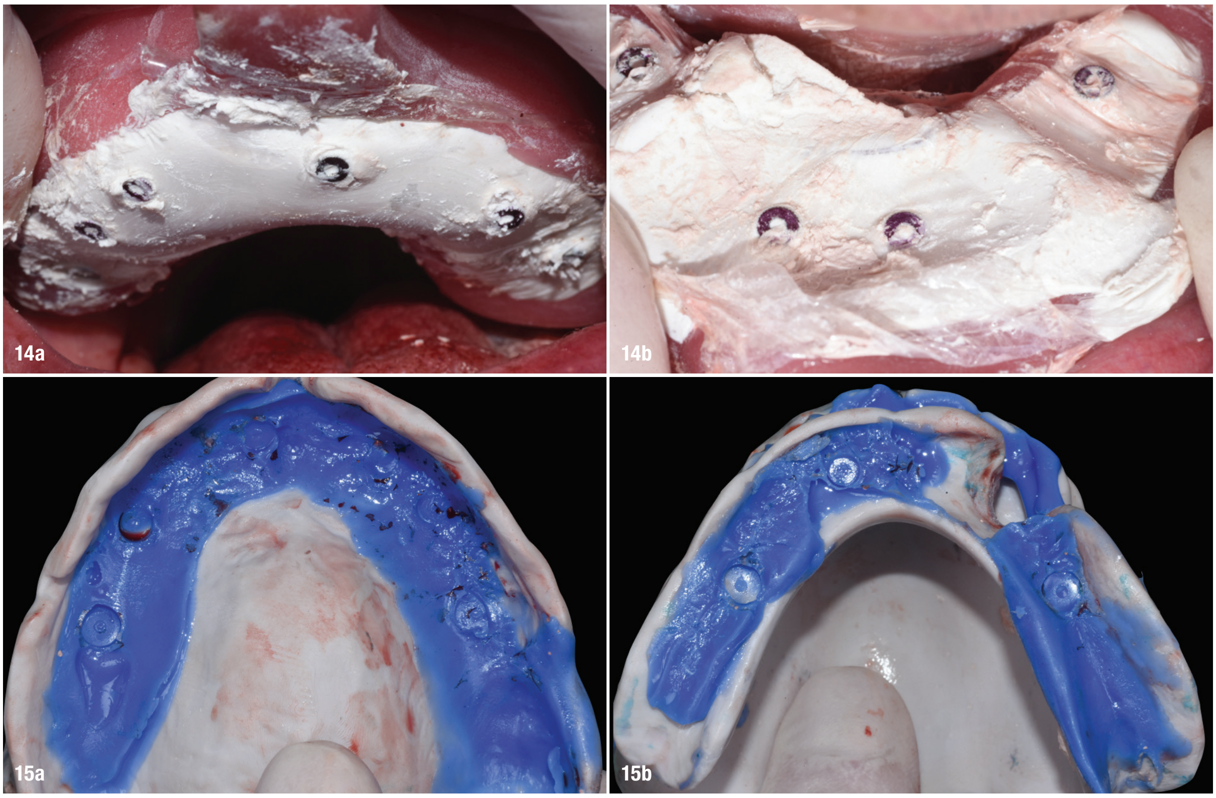
The prostheses were then scanned in the clinic and duplicated in the laboratory and the necessary corrections effected digitally using two extra-oral 3D markers (3DIEMME). The two resin prototypes were relined, and the intermaxillary relationship was determined (Fig. 8). Next, a CBCT scan was performed, and the files were sent to the laboratory, which performed CBCT and STL matching within the guided surgery software (RealGUIDE, 3DIEMME).

The placement of ten implants (Axiom X3 Tissue Level, Anthogyr) with a narrow (4 mm) prosthetic platform was planned, six in the maxillary arch and four in the mandibular arch (Fig. 9). The laboratory constructed two surgical guides (INTEGRAL fully guided surgery, Anthogyr; Fig. 10), the corresponding silicone splints for guide placement and two open trays for plaster impression taking with the pick-up technique. The two prototypes already used for CBCT scanning were used to determine the intermaxillary relationship.

## Surgical procedures

Two months after delivery of the removable maxillary prosthesis, bimaxillary guided surgery under venous sedation was performed. The osteotomies in the maxillary arch were performed flapless

**Figs. 11a & b:** Maxillary **(a)** and mandibular arches before osteotomy preparation **(b)**. **Fig. 12:** Axiom X3 Tissue Level implant before its placement. **Figs. 13a & b:** Maxillary **(a)** and mandibular arch pick-up impression copings placed **(b)**.




**Figs. 14a & b:** Maxillary **(a)** and mandibular arch plaster impressions **(b)**. **Figs. 15a & b:** Adaptation of the prototypes to the healing screws.

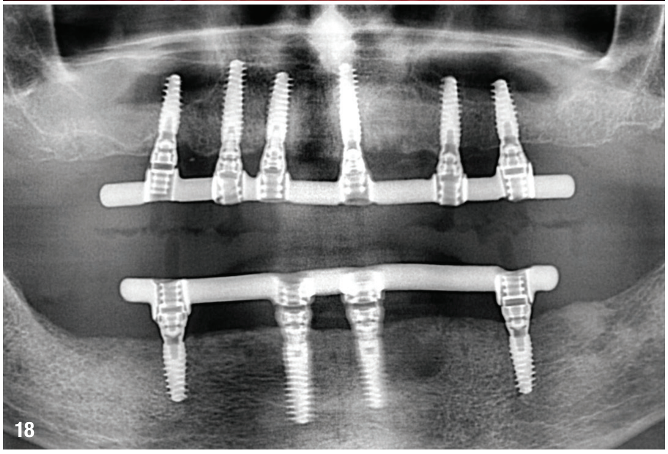


**Fig. 16:** Screw-retained maxillary and mandibular temporary prostheses. **Fig. 17:** Post-op view 24 hours after implant placement. **Fig. 18:** Post-op panoramic radiograph 24 hours after implant placement.

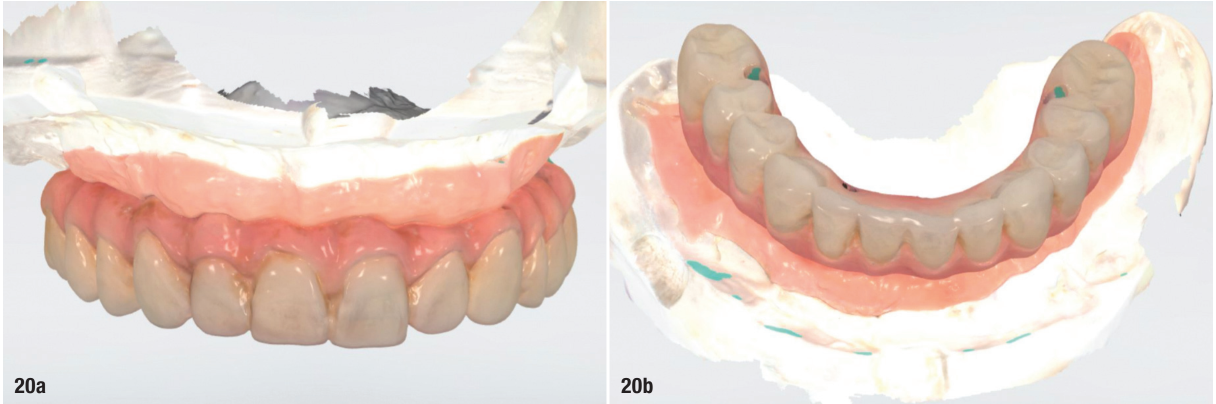
with the exception of position #16, since it required a small guided bone regeneration procedure (Figs. 11a), in addition to a transcrestal sinus lift using the Osteo Safe system (Anthogyr). The osteotomies in the mandibular arch were performed after raising a mucoperiosteal flap to allow for osteoplasty in the area of position #33 and to preserve keratinised soft tissue (Fig. 11b).

Implant insertion torques ranged from 35 Ncm to 50 Ncm (Fig 12). Pick-up impression copings were then connected directly to the heads of the implants, without the interposition of multi-unit abutments (Fig. 13), and plaster impressions were taken (Fig. 14). Two prostheses screwed directly to the heads of the implants were planned to be fabricated using the inLink prosthetic connection system (Anthogyr). Then, after connecting the healing screws, the intermaxillary relationship was recorded by relining the two prototypes on to the healing screws (Fig. 15).

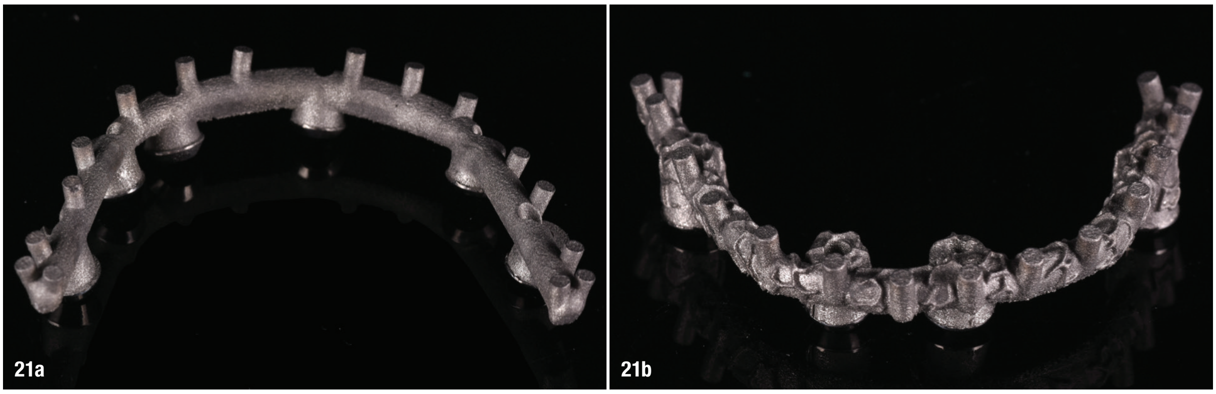
The laboratory then constructed two screw-retained prostheses by making two milled titanium bars that were bonded to the inLink (stock) abutments (Fig. 16). The prostheses were delivered to the patient without local anaesthesia 24 hours after the guided surgery (Fig. 17). Occlusal adjustments were performed to optimise the static and dynamic intermaxillary relationship. A dental panoramic X-ray (or radiograph) was then performed, and it showed the perfect connection of the prosthetic structures (Fig. 18).

After five months, the prostheses were unscrewed and mounted on to the master models. The appearance of the peri-implant soft tissue was satisfactory (Fig. 19). Scans (TRIOS 3) of the prostheses on the models were taken (Fig. 20), and the intermaxillary relationship was then determined in the mouth. The laboratory then produced two new prototypes incorporating a 1 mm reduction

**Figs. 19a & b:** Soft-tissue healing at five months, maxilla **(a)** and mandible **(b)**.




**Figs. 20a & b:** Extra-oral scans of the maxillary **(a)** and mandibular temporary prostheses **(b)**.




**Figs. 21a & b:** Cobalt–chromium CAD/CAM structures (Simeda, Anthogyr), complete maxillary **(a)** and complete mandibular structures **(b)**.


**Figs. 22a & b:** Mandibular final screw-retained prosthesis, occlusal **(a)** and intaglio surfaces **(b)**.


**Figs. 23a & b:** Maxillary final screw-retained prosthesis, occlusal **(a)** and intaglio surfaces **(b)**.



**Fig. 24:** Intra-oral view of the final fixed restorations. **Fig. 25:** Final smile.

in the vertical dimension of occlusion at the mandibular arch (the exposure of the mandibular incisors was excessive, and the patient exhibited slight difficulty swallowing). The two prototypes were tested in the mouth and relined with elastomer to take the soft-tissue impression. The laboratory then designed the final prostheses, and the files were sent to the Simeda manufacturing centre (Anthogyr) to make two inLink milled bars in cobalt–chromium (Fig. 21). The material chosen for the final prostheses, for both the gingival and tooth portions, was PMMA (Figs. 22 & 23). The patient was informed of the need for tooth replacement every five to eight years, depending on the degree of wear found during periodic controls. The two screw-retained prostheses were then delivered, and the screws were tightened to 25 Ncm as prescribed by the manufacturer (Figs. 24 & 25). Finally, a radiographic check was performed (Fig. 26).

## Conclusion

The treatment performed did not lead to any surgical or prosthetic complications. The use of the INTEGRAL guided surgery system reduced the surgical time and avoided implant placement errors. The morphology of the chosen implant allowed for rapid and accurate implant placement and provided adequate torque for immediate functional loading. In addition, Anthogyr's inLink connection reduced the surgical time and the rehabilitation costs because no multi-unit abutments were used. Overall, both the clinical team and the patient expressed a high degree of satisfaction with the result achieved.

Literature

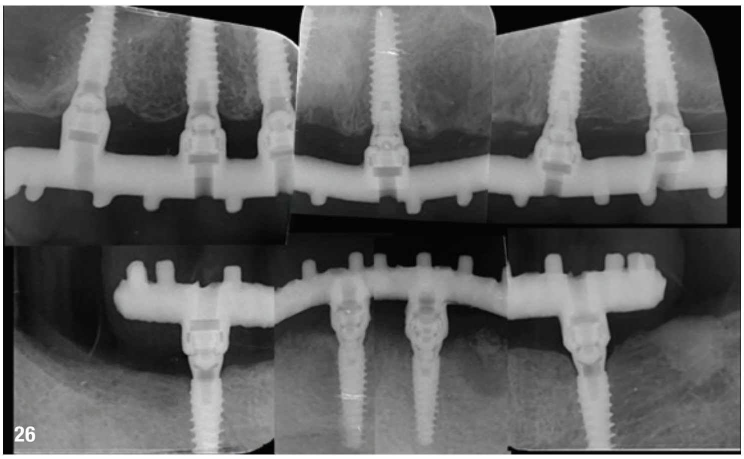



**Fig. 26:** Control radiograph.

## about the author

**Dr Gian Battista Greco** graduated in dentistry and dental prosthetics from the University of Trieste in Italy in 2000. He completed a biennial course in prosthetics and implant prosthetics with Dr Stefano Gracis, Milan, Italy in 2008 and a biennial course in periodontal and peri-implant plastic surgery with Prof. Giovanni Zucchelli, Bologna, Italy in 2017. He is in private practice in Milan and has a main focus on implant-supported prosthetic therapy, periodontal plastic surgery and cosmetic dentistry.

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Dr Gian Battista Greco

# Advancing technologies in ceramic implantology—AI sets new milestones in dental treatment

An interview with Dr Shepard DeLong, owner of the holistic dental practice Lotus Dental Wellness, USA

**Artificial intelligence (AI)** in dentistry has started to bloom in recent years. From a dental perspective, applications of AI can be classified into diagnosis, decision-making, treatment planning and prediction of treatment outcomes. Computer programs for dental use are becoming increasingly intelligent, accurate and reliable. OEMUS MEDIA had the great opportunity to interview Dr Shepard DeLong, who is known for his use of and knowledge on advanced dental technologies and their application to holistic dental care, about his approach, findings and experience with AI in dentistry and implantology in particular.

**The integration of AI in dentistry can have various effects on the dentist–patient relationship. From your perspective, what are the major benefits of using AI in the dental practice in this regard?**

I had the opportunity to use an AI diagnostic tool with one of my patients yesterday. I asked the patient how it made her feel to see me using AI as an aid in my diagnosis of her health, and she said that she thought it was a good thing as long as I employing my own experience and knowledge to interpret the AI findings. I reassured her that this was the case and that when used with care and expertise AI is becoming an invaluable tool. Actually, the biggest benefit I see is that I am less likely to miss a meaningful finding, and it greatly enhances trust between dentist and patient.


© Shepard DeLong

**Have you been able to further individualise treatment plans since you implemented AI in your office?**

Our dentists and patients at Lotus Dental Wellness have all experienced the benefits of cutting-edge technology for almost a decade. Each patient already receives very individualised care with every case and treatment. AI only enhances our sensitivity and ability to stay true to a preventive, minimally invasive, accurate diagnostic and treatment workflow. Now, if it is not used, patients will ask for it. Some of the data is still anomalous, so it can be overwhelming or hard to explain. Overall, it adds value for me and my patients.

**Does it save time? How efficient is the use of AI in your office?**

Yes, it saves time, because it draws out and quantifies findings that may otherwise be unremarkable. In the case of periodontitis and bone loss, I found myself making different treatment recommendations based on seeing measurements of the cemento-enamel junction to the crest visible on routine radiographs. The severity of caries is also now quantified, so decision-making is facilitated, as well as risk assessment.

**Can AI tools help address dental anxiety among patients? How do patients perceive the trustworthiness of AI-driven diagnostic and treatment recommendations?**

I think the key here is that care, compassion and the goal of improving well-being drive the entire dentist–patient relationship when it is functioning properly. With the aid of AI, trust no longer relies solely on a dentist's personality or powers of persuasion, both of which are pretty irrelevant to quality of care. Much of what drives patient anxiety is the loss of control or of confidence that what is being done is the right thing. AI helps with that.

**Let's dig a bit deeper into the clinical aspects and benefits of AI to your work and your routines in your clinic. We know that you are using a robotic surgery aid. What is it exactly that you have implemented? What are specific challenges in oral surgery utilising a robot?**
This question strikes close to home. I pour my soul into advancing technology for the dental industry. In almost every way, the quality of care, the beauty of form and the nuts and bolts of strength and function have been enhanced with digital workflows. The ease of operating has increased for our dentists, and our practice has a cult-like following of believers. Good ergonomics and long-term well-being of dentists and other members of the dental team are part of our core values. Robotic surgery for implant placement is the latest addition in our office. Our commitment is not only to electronic, digital or AI-driven tech but to biotech and biomaterial advancement too. We are the only team in the world dedicated to the placement and restoration of zirconia dental implants utilising dynamic navigation and robotic assistance in all but the unavoidable freehand cases.

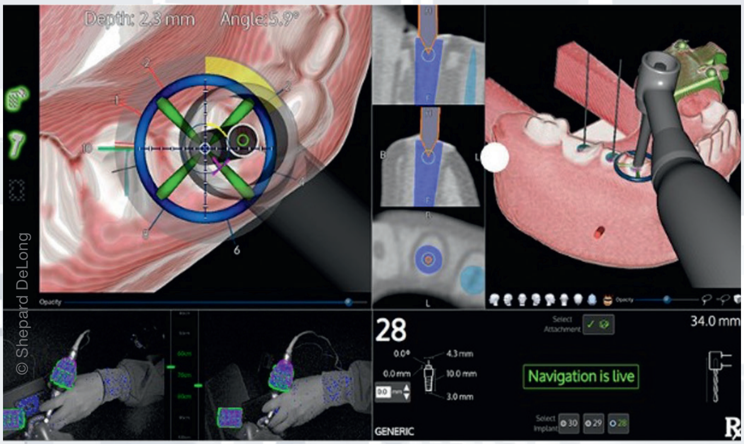
The challenges are still great. It's 8 p.m., and I literally just finished a dual-arch ceramic implant case for which, after much planning, the robotic workflow had to be abandoned. This can happen. Time, cost and new obstacles are all part of the puzzle, but we have gotten glimpses of the future. Terms like "ultra-precision" started to pop up as we planned in robotic software, then we were able to make micro-modifications during surgeries, and the results have been fantastic. For the early adopters that have made their way through CEREC or digital dentistry, CBCT, and guided and ceramic implantology, we can already see the other side.

**Does AI contribute to the diagnostic phase of treatment planning in oral surgery? How do AI algorithms assist in analysing patient data such as obtained from CT scans or 3D imaging for optimal implant placement?**
I would lean heavily on companies like 3DDX, ImmersiveTouch, CAD-Ray or Anatomage to do segmentation and deeper analysis of CBCT data. Implant positioning for the various ceramic systems I use still requires significant thought and prosthetic tweaking so that our placement and restoration are near ideal. There are some tools in use within YomiPlan software, things like automatic segmentation of the sinus cavity to aid in sinus lifts, but the software is not yet predictably mapping for us. Nerve segmentation is still through third-party software or radiology services.

Robotic surgery conducted by Dr Shepard DeLong and Dr Travis G. Hunt.

**And how does the incorporation of dental robots enhance the precision and efficiency of oral surgery procedures?**
This is something that I got great perspective on last year at the first Mayo Clinic Robotics and Advanced Surgical Technologies symposium. Other surgical specialties were discussing the overwhelming adoption of robotics in enhancing patient outcomes. Freehand skills, static guides and dynamic navigation all can lead to excellent outcomes, but robotics allows a less skilled surgeon to perform at or near the level of the best, especially when mentored, and it demands that dentists keep learning and practising so that the results continue to improve. I've been using the term "ultra-precision" to describe some of what I have seen during surgery and, even more impressively, during restoration of zirconia dental implants placed utilising robotics.

**We have learned that the implementation of dental robots works wonderfully with titanium implants. You are using zirconia implants. What are the differences and challenges for both the surgeon and the robot-based system, if any?**
It has been a remarkable year and a half! We have now placed four ceramic implant systems—SDS, CeraRoot, Zeramex/Nobel and Z-SYSTEMS—successfully and fully guided. It was laborious to get all the companies to work




together to put the sizes and shapes into the software as fast as possible, and yet we placed a lot of implants while calculating all the data the software didn't have right yet. Other challenges include carrier systems and implant mounts that are not retentive enough or too retentive for the rigidity and freedom of a robotic arm and incorporated dental handpiece. Also, driver lengths, hand-based carriers and low maximum torque values add to the challenges.

**How does AI play a role in selecting the most suitable zirconia implant size, shape and placement for each patient?**
At this point, AI plays a negligible role in implant selection. I know this will come. As talk to text and AI can code, we will move towards an automated, ultra-precise surgical and restorative plan. For now, it is a lot of thought, experience and care that goes into making each case a success.

**In what ways can AI assist in real-time decision-making during surgery, considering factors like bone density and tissue response?**
This is where the haptic guidance of the Yomi robot and the freehand feel of the X-Guide allow the surgeon to feel the bone. Visualisation of the surgical site with physical guidance is where Yomi shines. During surgery with X-Guide, the surgeon's eyes must be on the screen. With Yomi, you get both freehand tactile feel and haptic feedback, and you can use real-time visual observations to modify surgery towards achieving great outcomes.

**How are ethical concerns addressed, such as patient consent, data security and the responsible use of AI in the context of oral surgery? Have you faced any issues on that?**
Thank you for asking. Almost all our patients have been very receptive of Yomi. Its use in our practice was preceded by X-Guide and my previous commitment to place ceramic implants exclusively. There is regulatory clearance on all these products and devices, and yet we encounter the unknown and untested when using all of them together. This is where new connections, new workflows and, ultimately, new solutions to human health problems will come from. We have a thorough understanding of risk and believe privacy, autonomy and informed consent are all paramount in modern medicine. There will be new standards of care. It is up to us to define them.

**We seem to have entered an unprecedented time of new and exciting discoveries in dentistry. Please would you share this journey with us and give us a few concluding remarks?**
I know that the readers of *implants* will take what I have said here with a proverbial grain of salt or a bit of healthy caution. I think that is wise. Let experience guide your wisdom and opinion. After you see something intriguing, promising even, follow your own intuition and go where it leads. If we utilise new ideas and technology while allowing our human knowledge and hearts to guide what to do, the results are going to build a new reality. This is just the beginning. AI, robotics, ceramic implants—the future we are creating is already here. When we see solutions, I think we must share. I look forward to continuing our conversation and journey!

## about the interviewee

**Dr Shepard DeLong** is a third-generation dentist at the forefront of digital evolution and the development of novel technological workflows in dentistry. He holds a BS from Portland State University and a DMD from Oregon Health and Science University in Portland and completed a general practice residency at the Queen's Medical Center in Honolulu in Hawaii, all in the US. He has a part-time position at Pure Health Dentistry in Maui in Hawaii and owns Lotus Dental Wellness in Lake Oswego in Oregon. He is a residency site director for the MSc in implantology programme at Jacksonville University in Florida in the US and lectures on ceramic implantology, robotics, lasers and digital dentistry. His latest project has been the sharing of the profound advantages of combinational technologies for the health of both dentist and patient. He is a member of the Academy of Microscope Enhanced Dentistry, International Academy of Ceramic Implantology, European Academy of Ceramic Implantology, and International Academy of Oral Medicine and Toxicology and has served as a mentor for CDOCS. He can be reached at drdelong@lotusdentalwellness.com.

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Lotus Dental Wellness

# MIS unveils plans for its global conference in Palma de Mallorca



**MIS Implants' much-anticipated** fifth global conference will take place from 12 to 15 September on the picturesque Spanish island of Mallorca. Geared to captivate a large audience of dental professionals from around the globe, the MIS Global Conference is a leading event in the dental implant industry, offering a comprehensive scientific programme, high-level lectures and fantastic entertainment.

This year's conference is poised to spotlight the latest trends and innovations in implant dentistry. The two-day scientific programme boasts a comprehensive itinerary, encompassing hot topics such as the smile zone, the digital workflow and tissue stability.

Prominent experts in the field form an impressive speaker line-up, featuring Dr Juan Arias Romero, Dr Serhat Aslan, Prof. Nitzan Bichacho, Dr Darko Božić, Dr Victor Clavijo, Dr Tali Chackartchi, Dr Pablo Galindo, Prof. Moshe Goldstein, Dr Gustavo Giordani, Dr Galip Gurel, Hilal Kuday, Dr Stefan Koubi, Dr Alberto Monje, Dr Ariel J. Raigrodski, Dr Ausra Ramanauskaite, Dr Isabella Rocchietta, Prof. Mariano Sanz Alonso, Dr Ignacio Sanz Sánchez and Dr Ventseslav Stankov.

Highlights of the conference include a live surgery by the well-known prosthodontist Dr Stavros Pelekanos and a special appearance by Dr Mario Alonso Puig, a human intelligence expert focusing on leadership, team building and high performance under pressure, promising an enriching and educational experience for all attendees.

Prof. Lior Shapira, a distinguished member of the scientific committee, expressed his excitement about the conference venue, stating: "We are thrilled that the next MIS Global Conference will be held in Palma de Mallorca in Spain. This beautiful island is the perfect setting for a world-class dental event, continuing the 360° Implantology tradition. The scientific committee has crafted an inspiring programme, offering networking opportunities with top-notch professionals. We eagerly anticipate welcoming dental professionals worldwide to join us for an unforgettable experience."

## Call for clinical cases

In addition to the robust scientific programme, the conference will host a clinical case competition for young clinicians that will focus on various aspects of dental implantology in contemporary patient care, including clinical applications, concepts, materials and technologies. Cases will be presented in both video and e-poster formats, allowing dental photographers to showcase their skills.

contact

**MIS Implants Technologies**
www.mis-implants.com

More information

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# A fascinating experience

## ISOI DGZI-Japan Annual Meeting

Dr Elisabeth Jacobi-Gresser, Germany

**After the first invitation** two years ago was "only" possible as an online presentation due to the ongoing pandemic travel restrictions at the time, I gladly accepted to give a presentation at the annual conference of the Japanese partner organisation ISOI on 19 November 2023 in Tokyo. This time, the title of the lecture was "Clinical Application of Zirconia Implants", while two years ago the focus was on the immunology of the implant materials titanium and zirconium.

The conference was preceded by a 13-day guided tour for me, luckily in a small group of friendly fellow travellers. From the south of the main Japanese island of Honshū with stops in the old imperial city of Kyōto and its incredible 2,000 temples, pagodas and shrines, 17 of which are UNESCO World Heritage Sites, to Beppu/Ōita with its hot springs and the adjoining volcanic landscape of the "Japanese Alps" in Aso-Kuja National Park, on to the port city of Nagasaki, which was Japan's gateway to the world in pre-modern times. There we visited the deeply touching Atomic Bomb Museum and the atomic bomb memorials, as well as Hiroshima with a visit to the Peace Museum and the Peace Park. The memory of the people killed (approx. 80,000) and the extensive destruction of the cities by the two atomic bombings is still deeply remembered and honored by the people today.


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From Hiroshima by regional train and ferry to the sacred island of Miyajima with a visit to Itsukushima Shrine, probably Japan's most beautiful Shinto place of worship. The famous and frequently photographed gate of the shrine is reflected in the water at high tide. Continued with the Shinkansen Super Express via Fuji Hakone National Park to Tokyo. Tokyo, the largest city in the world with a total of almost 36 million inhabitants, 9 million of whom live in the city centre alone, is fascinating, attractive, technically absolutely modern and altogether overwhelming.

The extremely positive experiences include the cleanliness in general, the considerate and helpful interaction with tourists, the safety and not to forget the impressive punctuality of public transportation such as the subway or the Shinkansen (super express), they were literally always "on time". This country with its harmonious blend of tradition and modernity touched and inspired me deeply. As the trip preceded the congress, I had enough time to adapt in every respect. On the evening before the conference, there was a social gathering with around 30 invited colleagues in a Spanish restaurant, as Japanese restaurants cannot offer so many seats together. The official greeting was given by the acting president of the ISOI, Dr Shinya Yoshioka.

All the speakers, including myself, briefly introduced themselves and the content of their presentations. The present colleagues were very communicative, interested and courteous.

My presentation the next morning was simultaneously translated from English into Japanese. The room was filled with over 200 listeners. After the presentation with a brief introduction to immunology and a detailed presentation of the clinical application and long-term results with one- and two-piece ceramic implants, which lasted a total of 80 minutes, there was a lively discussion. As I do not speak Japanese, I was unable to follow the other contributions in the local language, but used the time to explore this fascinating metropolis.

My "ISOI supervisor", Dr Masahiro Sugiyama, with whom I had a lively correspondence beforehand and who was responsible for the organisational matters, proved to be extremely hospitable, approachable and a perfect English speaker. I had an extremely positive all-round experience on this trip, which motivates me to travel to this wonderful country again.

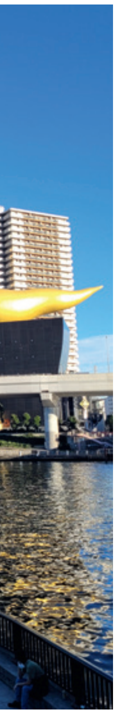

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**Fig. 1:** Tokyo in the twilight, the holy mountain Fujisan (Fujiyama) on the horizon. **Fig. 2:** The auditorium filled with over 200 participants. **Fig. 3:** ISOI (board) members: Dr Masahiro Sugiyama (4th from left) and Past-President Dr Minoru Yoshie (3rd from left). **Fig. 4:** Surrounded by speakers and organisers. **Fig. 5:** Tokyo's modern skyline on the banks of the Sumida River with the Sky Tree television tower (634 metres). **Fig. 6:** Cheerful guests at dinner.

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DGZI e.V.

# Connecting top dental professionals

## Dentsply Sirona Implant Solutions World Summit 2024 in Miami

**From 13 to 15 June**, the 2024 Implant Solutions World Summit is coming to Miami in the US, promising to deliver inspiration, confidence and passion. This state-of-the-art congress is focused on the science of implant dentistry and will offer many networking opportunities.

In demonstration of its commitment to advancing oral health and delivering innovative solutions, Dentsply Sirona has put together an exceptional programme that will feature an array of enlightening keynote presentations, engaging panel discussions and interactive workshops. Attendees can look forward to exploring the latest trends, research and breakthroughs in the field of implant dentistry.


### A scientific programme featuring leading experts in implant dentistry

The scientific programme for the 2024 Implant Solutions World Summit was developed together with the scientific chairs, Prof. Lyndon F. Cooper, dean of Virginia Commonwealth University School of Dentistry in the US, and Dr Malene Hallund, a prominent oral and maxillofacial surgeon in Denmark. Designed to empower dental professionals and foster collaboration, the dynamic programme will feature plenary sessions, breakout sessions and masterclasses. Leading experts in implant dentistry, bone regeneration and digital dentistry will share their knowledge and insights, present case studies and offer practical skills that can be applied directly in the dental clinic.

The scientific sessions will cover several key areas in implant treatment. The latest scientific research and data will be presented to reassure dental professionals of Dentsply Sirona's core commitment to clinical success, aesthetic results and patient safety. The role of bone augmentation and regeneration in implant treatment will be discussed, as well as the management of complications and control of risk factors, including the role of the patient and oral health.

### Inspiration Hub exhibition area for implant workflows and solutions

The Inspiration Hub exhibition area is where interaction, inspiration, knowledge and passion come perfectly together—it is the place to learn about implant workflows and solutions. Attendees will be able to experience the full implant treatment workflow first-hand and at their own pace together with Dentsply Sirona experts. They will be able to learn more about Dentsply Sirona's focus on scientific expertise and commitment to long-term science and future innovation, and they will have the opportunity to build their professional networks and become part of a fantastic community of implant professionals from all over the world. The exhibition will feature Dentsply Sirona's products, solutions and treatment workflows, including the EV implant family, OSSIX regenerative solutions and the cloud-based DS Core platform.

### Boosting knowledge with masterclasses

Attending a masterclass can really improve the clinician's expertise. On 13 June at the Implant Solutions World Summit, delegates will have the great opportunity to participate in one of eight parallel masterclasses presented by leading experts in the field of implant dentistry. Aimed at enhancing knowledge and skill level in implant dentistry, the masterclass programme will feature both lectures and hands-on sessions, including a cadaver course and a porcine jaw course. Besides surgical topics, it will cover practice growth, oral–systemic health, the incorporation of digital technologies and workflows for implant treatment and in the dental practice, and achieving advanced aesthetics using conometric principles.

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Dentsply Sirona

# Once you see it, you cannot unsee it!

**In March, the CleanImplant Foundation** was proud to welcome another manufacturer in the family of high-quality implant manufacturers, awarded the Trusted Quality seal. The AO Annual Meeting in Charlotte, NC, was the perfect venue to hand over the certificate of excellence to Ritter Implants.

The award was preceded by a thorough analysis of five randomly selected cross-batch implant samples from the manufacturer in the SEM (Fig. 1). In order to achieve the required quality level, a maximum of 10 foreign particles, all smaller than 50 µm, may be present on the surface of the test samples. An independent peer review process ensures compliance with the threshold values of the CleanImplant guideline and proof of clinical performance. At present, implants from the following manufacturers have been awarded the internationally widely recognised seal of quality:

- Biotech Dental
- bredent medical
- BTI Biotechnology Institute
- Champions-Implants
- Dentis
- Dentium
- Dentsply Sirona
- Global D
- medentis medical
- MegaGen
- NucleOSS
- Ritter Implants
- SDS Swiss Dental Solutions
- Southern Implants


**Fig. 1:** SEM mapping with material contrast (BSE imaging).

The results of the CleanImplant Foundation's extensive quality assessment studies show that residue-free implants are still not a matter of course (see cover illustration of this issue). It is not only small particulate carbonaceous plastic residues that lead to uncontrolled foreign body reactions, peri-implantitis, and bone resorption. An additional potential threat to the healing (osseointegration) following implant placement is posed by thin-layered residues of highly aggressive cell-toxic cleaning agents such as dodecylbenzene sulfonic acid (DBSA) or quaternary ammonium compounds—known for their use as pesticide and biocide—on the surface of some brand-new implants utilised before manufacturer packaging. Even in low concentrations, these chemicals are cytotoxic to cells and do not promote implant healing.

At the AO meeting, the new President of the Academy of Osseointegration, Prof. Jörg Neugebauer of Germany, met up with his former student, now head of the CleanImplant Foundation, Dr Dirk Duddeck (Fig. 2).

It was the now AO President, Prof. Neugebauer, as Dr Duddeck's supervisor at the University of Cologne years ago, who suggested the idea of a quality assessment of dental implants as the substance of his doctoral thesis. To date, more than 160,000 dental professionals following the CleanImplant Foundation on social media show how crucial and urgent this topic was back then and how it has lost none of its relevance still today.


**Fig. 2:** Prof. Jörg Neugebauer, President of the Academy of Osseointegration, and Dr Dirk Duddeck, Head of the CleanImplant Foundation, both Germany.

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CleanImplant

# Congresses, courses and symposia

### ITI World Symposium

9–11 May 2024
Singapore
worldsymposium.iti.org/

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### FDI World Dental Congress

12–15 September 2024
Istanbul, Turkey
www.fdiworlddental.org

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### National Osteology Symposium

26–28 September 2024
Paris, France
osteology.org

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### IAO-EAO-SIdP Joint Meeting

24–26 October 2024
Milan, Italy
congress.eao.org/milan/en/

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### 53rd International Annual Congress of DGZI

8–9 November 2024
Düsseldorf, Germany
www.dgzi.de

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### French Dental Association Annual Meeting

26–30 November 2024
Paris, France
adfcongres.com/en/homepage/


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