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ceramic implants

international magazine of ceramic implant technology

case report
Digitally customised asymmetrical zirconium dental implant

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These days are full of change—socially, economically, biologically, and ecologically. The world is not the same anymore. What will future bring, what will be left behind? Many questions—who has the answers? Please let these thoughts buzz in the room.

In this issue of *ceramic implants*, I would like to invite you to read the printed content with pleasure and with humility. Please let us all consider ourselves privileged—we got the opportunity to visit school, graduate from university and pursue our professions. Some of you are dedicated to research, others to practice. There is one thing we have in common: we have the same goal—we want to make a difference. We participate in our networks and in our exchanges—in what we read, in what we discuss at conferences.

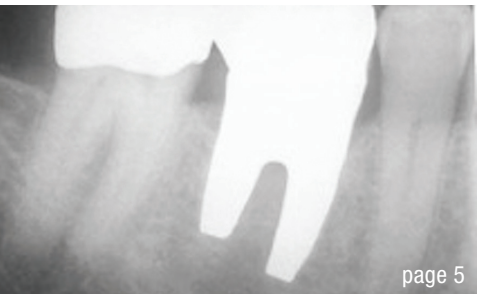
The last issue of the year is very special to me. It challenged me a lot because I had the beautifully painful task to choose from so many great inputs. This issue no. 3 shares with you the latest case reports with most individualistic approaches, reviews on wonderful conferences, and at the same time looks towards the future—what is possible if we bring together AI and dentistry ...

“Share your knowledge. It is a way to achieve immortality.”—with this in mind and with these words from Dalai Lama XIV, I would like to thank all authors and our partners from industry for your constant support. I would like to thank friends for trusting into this wonderful publication.

Sincerely,
Timo Krause

Timo Krause, Germany
Editorial Manager

Timo Krause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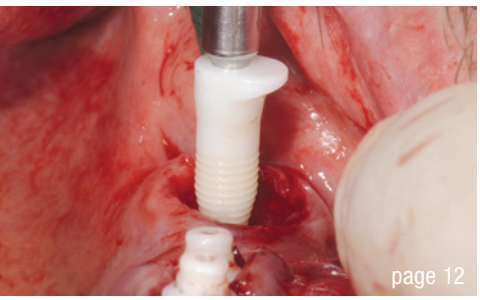
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Digitally customised asymmetrical zirconium dental implant

Replacement of a mandibular molar—Surgical and prosthetic aspects

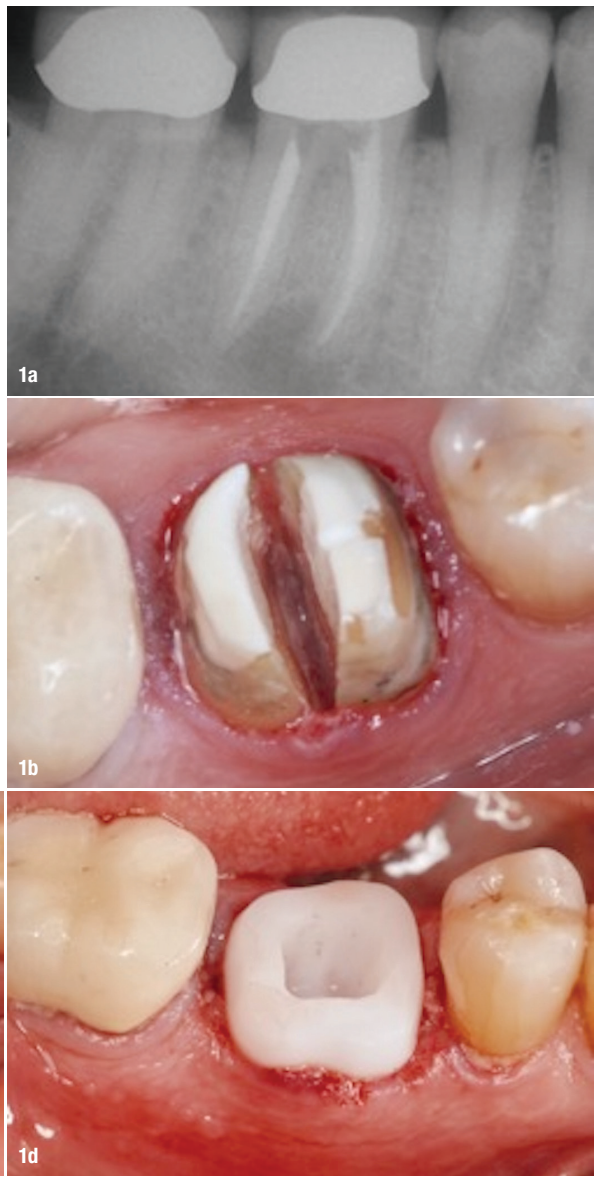
Dr Dumitru Gogarnoiu, Jonathan Korostoff, DMD, PhD, Rodolfo Gianserra & Melania Gogarnoiu, DMD, USA & Italy

Abstract

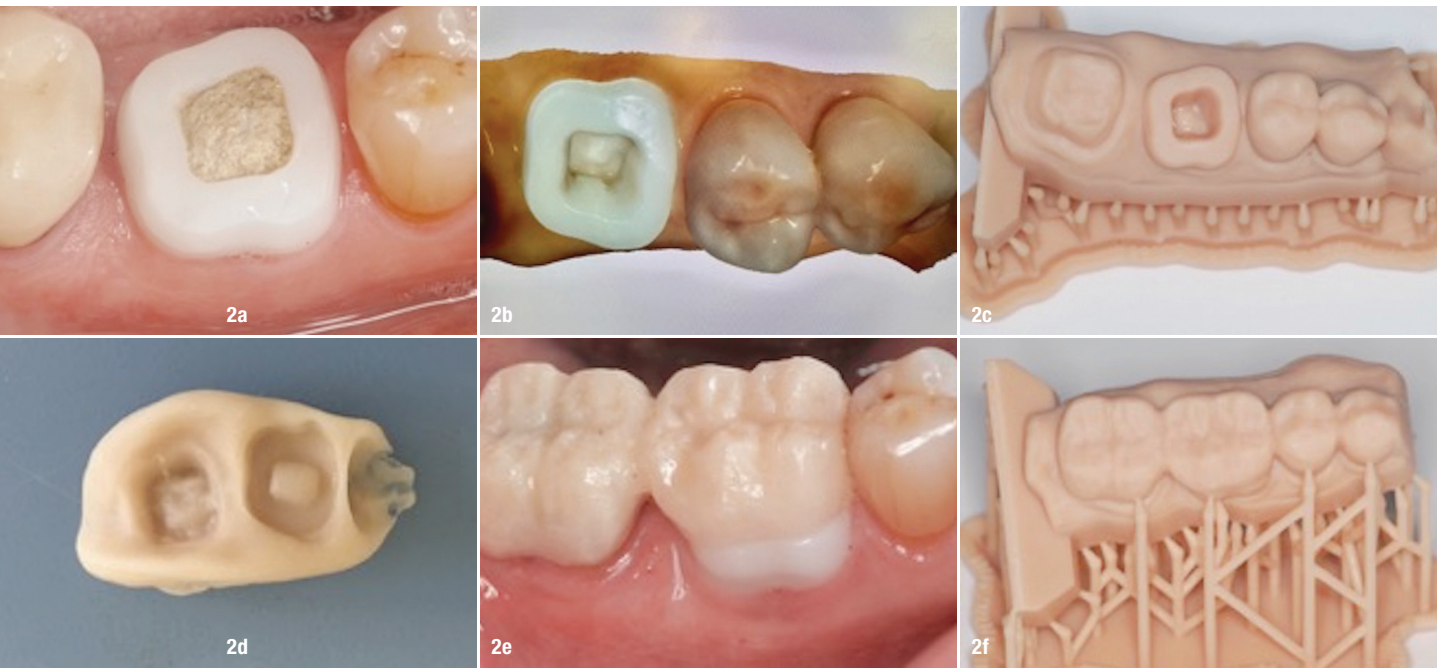
To reduce the overall treatment time required for replacement of a tooth with an implant-supported crown, clinicians will place the fixture immediately after an extraction. Under appropriate circumstances, especially in the anterior aspects of the jaws, this approach yields highly predictable functional and aesthetic results. In the posterior areas of the jaws, the anatomy of roots often compromises the available volume of bone to the extent that it is not possible to achieve primary stability of an immediately placed implant. To circumvent this issue, a customised two-piece implant system was designed in which the shape of the intraosseous component corresponds to the actual anatomy of the extracted tooth. The case report describes the implant and illustrates how it can be immediately placed following extraction of a mandibular molar that had a hopeless prognosis.

Introduction

Although initially intended to support mandibular fixed full-arch restorations by following very rigid surgical and



Figs. 1a–d: Extraction of tooth #30 and placement of customised zirconium implant. Radiograph demonstrating periapical pathology on #30 **(a)**. Hemisection of #30 to facilitate minimally traumatic extraction **(b)**. Extraction socket with intact buccal alveolar bone **(c)**. Zirconium implant in place demonstrating immediate support of adjacent peri-implant soft tissues **(d)**.



Figs. 2a–f: Provisionalisation of the zirconium implant. Healthy peri-implant soft tissues six months after implant placement **(a)**. Scanned digital impression **(b)**. 3D-printed model derived from digital impression **(c)**. Block carving of provisional crown **(d)**. Provisional restoration cemented in place **(e)**. 3D-printed model derived from digital scan of the provisional restoration **(f)**.

prosthetic protocols,[1] implants are now placed via either immediate[2–4] or delayed approaches and subsequently used to support dentures, crowns and/or bridges (fixed partial dentures) to address partial edentulism in all parts of the mouth. Often, extraction of a molar with the intention of replacing it with an implant-supported crown is achieved via a delayed protocol due involving placement of a bone graft to preserve the morphology of the alveolar ridge.[5] In other situations, the walls of the socket are not intact, requiring an actual guided bone augmentation procedure to re-establish sufficient volume for implant placement. Both approaches typically yield a flat crestal bone profile that does not restore the normal osseous architecture present around healthy teeth. This, in part, contributes to less-than-ideal aesthetic results and crestal bone resorption.

The morphology of the portion of natural teeth that is positioned between the bone crest and gingival margin (transition zone) is highly variable, ranging from the rather simple ovoid shape of mandibular incisors to the highly complex rhomboidal shape of maxillary molars. With the implants in use today, dentists and laboratory technicians must reproduce this aspect of a tooth with the starting point being the round symmetrical platform of the fixture, in essence, attempting to “fit a square peg into a round hole”. This necessitates a supracrestal soft-tissue thickness of 3 to 4 mm to facilitate development of an appropriate emergence profile for the future crown. It is critical to consider this in the context of the biologic width associated with implant-supported restorations, which also typically varies from 3 to 4 mm. If the supracrestal soft tissue is thinner and the implant is placed at the bone crest, remodelling of the bone occurs to naturally re-establish the biologic width while simultaneously providing sufficient soft-tissue thickness for restorative purposes. Alternatively, clinicians will artificially provide space for reformation of the biologic width by placing the implant subcrestally. This can lead to additional bone remodelling such that an infra-bony defect develops around the implant that is then subject to further breakdown. Furthermore, this results in the abutment–implant interface being positioned subcrestally and it is well established that a zone of inflamed connective tissue can form in this area.[6] Thus, to provide sufficient space for the biologic width and tissue thickness for the emergence profile of the crown, a clinician could be creating a scenario that is highly susceptible to future crestal bone loss.

In this case report we describe a novel approach to replacing mandibular molars with a customised tooth-shaped implant that positions the abutment–implant interface supracrestally. The design of this implant will facilitate immediate placement in molar sockets, minimise the extent of crestal bone loss and yield highly aesthetic results.

Case report

A 70-year-old male physician with a non-contributory medical history presented with a compromised mandibular right first molar (#30) that was deemed to have a

Patent

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[1] Brunello G, Rauch N, Becker K, Hakimi AR, Schwarz F, Becker J. Two-piece zirconia implants in the posterior mandible and maxilla: A cohort study with a follow-up period of 9 years. Clin Oral Implants Res. 2022 Dec;33(12):1233-1244. doi: 10.1111/clr.14005. Epub 2022 Oct 31. PMID: 36184914.

[2] Glauser, R., Schupbach, P. Early bone formation around immediately placed two-piece tissue-level zirconia implants with a modified surface: an experimental study in the miniature pig mandible. Int J Implant Dent 8, 37 (2022). https://doi.org/10.1186/s40729-022-00437-z

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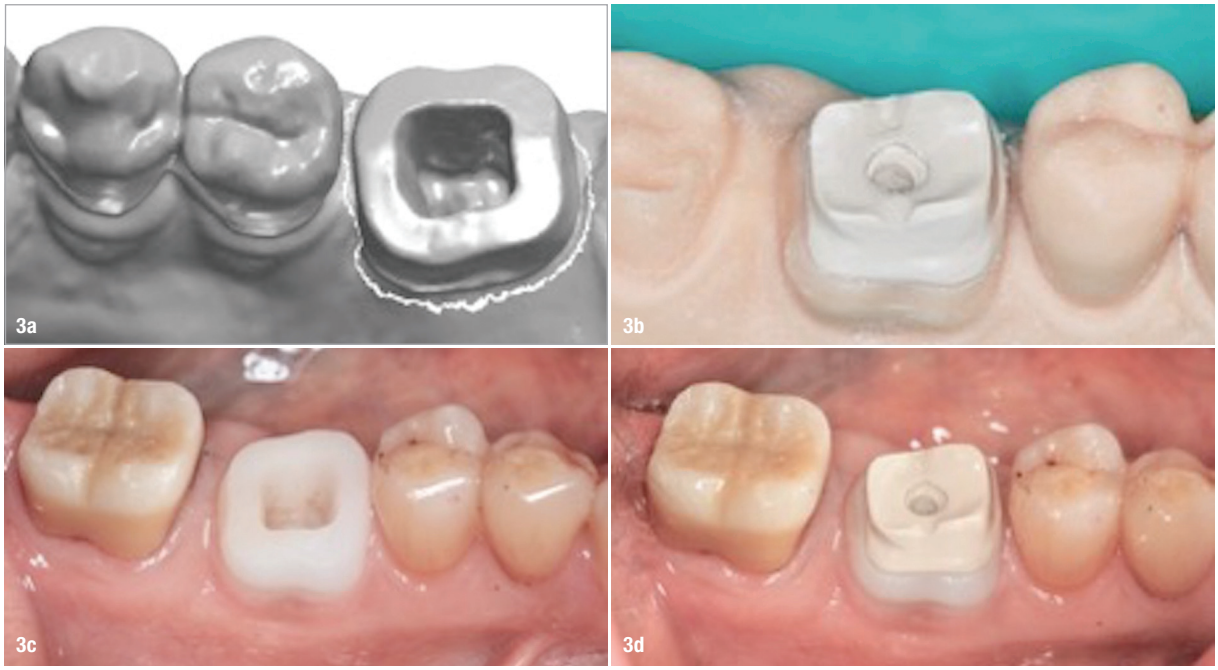


Figs. 3a–d: Fabrication of the abutment. Digital design of abutment **(a)**. Abutment milled from PEEK exhibiting adequate retention and resistance form for the future crown. A venting hole is present to allow complete seating of the abutment during cementation **(b)**. Implant–abutment interface prior to cementation of the abutment **(c)**. The abutment cemented in place **(d)**.

hopeless prognosis due to a failed endodontic procedure (Fig. 1a). He was offered three treatment options:

1. a removal partial denture,
2. a three-unit tooth supported-bridge from #29 through #31 or
3. an implant-supported crown.

After discussing the risks and benefits associated with each approach the patient decided on the third option. From casual discussions, he was extremely familiar with our work on the customised implant system and, understanding the experimental nature of the device, requested that one be used to replace his tooth. Informed consent was obtained for the procedure.

A CBCT demonstrated ample alveolar bone height and width for implant placement without the need for augmentation. The same CBCT scan was used to design and fabricate the implant construct from a zirconium dioxide block (yttrium-stabilised tetragonal zirconia polycrystalline) using computer-aided design/computer-aided manufacturing technology. The custom implant construct did not reproduce the entire natural tooth but did incorporate root-form and transgingival elements both of which mimicked the actual morphology of the patient's tooth. In contrast to traditional bone level implants, this design placed what would be considered as the implant–abutment interface in a supragingival position. Furthermore, the coronal aspect of the implant–abutment construct was not flat but was designed with slants in the mesiodistal and buccolingual dimensions to accommodate the natural ten-degree lingual angulation of mandibular molars. The gingival collar of the construct was polished while the transition zone and sub-osseous aspects of the implant were sandblasted with 50-micron aluminium oxide. The implant was cleaned, autoclaved, and maintained in a sterile package.

Local anaesthesia was administered via buccal and lingual infiltration injections adjacent to #30 using 4% Septocaine and 1:100,000 epinephrine. The tooth was sectioned buccolingually and the roots extracted in a minimally traumatic manner (Figs. 1b & c). The implant construct was press fit into the extraction site resulting in complete obliteration of the sockets (Fig. 1d). The hole in the coronal aspect of the construct was sealed with cotton and Cavit (3M ESPE). Postoperative instructions were reviewed with the patient as were prescriptions for Ibuprofen (600 mg, one tablet q6–8h PRN pain) and Amoxicillin (500 mg q8h for seven days). The patient tolerated the procedure well and was reappointed for a follow-up visit.

At the one-month follow-up visit, the patient denied any postsurgical complications and healing was progressing normally (Fig. 2a). The patient was seen six months later for insertion of a provisional restoration. The peri-implant soft tissues were found to be healthy and there was no radiographic evidence of bone loss around the implant. The old metalloceramic crown on #31 was removed to address recurrent caries and deteriorating margins followed by preparation for a full coverage crown. A digital

impression was taken of the implant at site #30 and prepared tooth #31 (Fig. 2b). The provisional crowns were fabricated out of acrylic using a block carving technique and cemented in place (Figs. 2c & d). An additional impression was made with the provisional restorations in place (Fig. 2e). The two STL files created from the digital impressions were merged into the 3Shape software (3Shape) to design the implant abutment, the implant-supported crown, and the conventional crown for #31. The implant abutment was digitally designed and milled from PEEK block material (Figs. 3a–c). After sandblasting and priming, the abutment was permanently cemented (Fig. 3d).

Digital versions of the final crowns were designed, and the files transferred to a milling machine (Figs. 4a–d). The restorations were milled from unsintered zirconium blocks (Fig. 5a), chromatised with liquid paint shade A4 (Fig. 5b) and subsequently sintered (Fig. 5c). Seven months post placement, the crowns were seated in the patient's mouth, adjusted, glazed extra-orally and polished. The crowns were then cemented with RelyX Unicem 2 (3M) resin cement. The restorations provided adequate support for the adjacent soft tissues and were aesthetically acceptable to the patient (Figs. 6a & b). A periapical radiograph was taken that confirmed the seating of the crowns and showed the intimate fit of the implant within the sockets of the extracted tooth (Fig. 6c).

Discussion

With appropriate case selection, immediate placement and restoration of implants is safe and yields predictable outcomes when replacing incisors, canines, and premolars. For numerous reasons, the same level of predictability has not been achieved in molar sites. To point out is the lack of adequate bone volume to achieve primary stability of the immediately placed implant. To address this issue, several groups have evaluated the use of customised one-piece implants mimicking the anatomy of natural teeth.[7, 8] The reported clinical outcomes have been mixed such that these types of fixtures are not a component of the armamentarium of modern-day implant dentistry.[9–11] Thus, this represents one clinical scenario that warrants development of alternatives to the implants currently on the market.

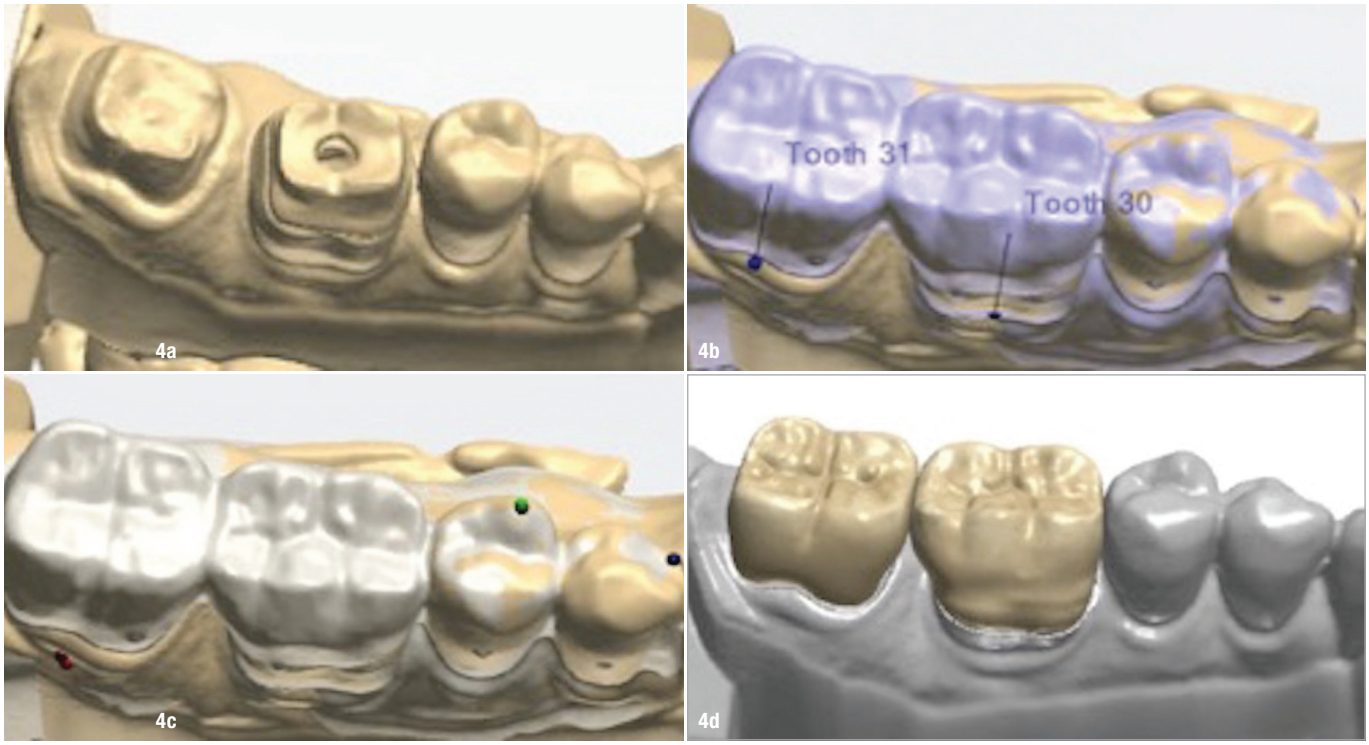
Recognising the potential benefits of customised root-form implants and appreciating the previously demonstrated deficiencies of the one-piece systems, a prototype of a unique two-piece customised implant system has been developed to be used for immediate placement following extraction of mandibular molars. Since this is a two-piece system, it avoids the necessity for immediate loading. Based on our fundamental knowledge regarding the wound healing response of alveolar bone and the overlying soft tissue following implant placement, the components were designed to minimise crestal bone loss while providing an environment that facilitates the fabrication of restorations with ideal emergence profiles. This case report describes the successful replacement of a compromised mandibular right first molar (#30) with this customised two-piece zirconia implant–abutment system.

The design of the implant and abutment incorporate several properties that should lead to quicker healing, reduced pre- and post-loading crestal bone loss, enhanced peri-implant soft-tissue health and improved aesthetic outcomes relative to conventional bone level implants. Since the shape of the implant is based on the anatomy of the patient's tooth, no site preparation is required for its placement. Minimally traumatic extraction of the tooth via a flapless approach is followed by press fitting the implant into the socket resulting in intimate contact with the adjacent alveolar bone allowing for quick and uneventful healing. By mimicking the shape of the natural tooth in the transition zone between the bone crest and gingival margin, the soft tissue is constantly supported in its natural configuration, greatly diminishing the likelihood of recession. Furthermore, the tissue level design of the implant positions the implant–abutment interface supracrestally permitting the biologic width to form on the fixture itself thereby mitigating the likelihood of crestal bone resorp-

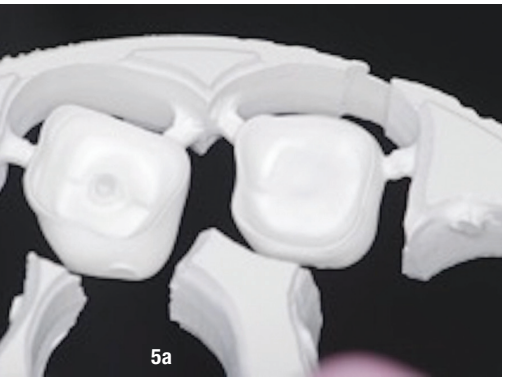
tion. Finally, the two-piece nature of the system permits a load-free period for osseointegration.

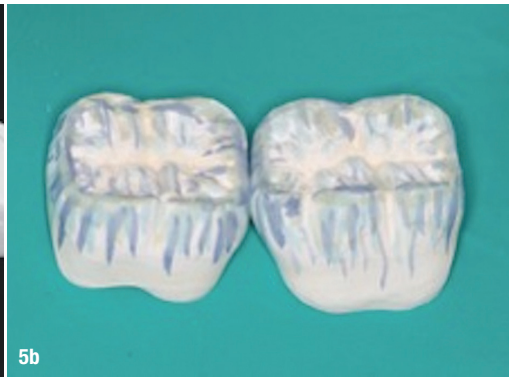
After careful consideration of the existing literature, different materials were chosen for fabrication of the implant versus the abutment. The implant itself was fabricated out of zirconia to take advantage of the multiple desirable properties of the material.[12, 13] Zirconia is a biocompatible material with the capacity to osseointegrate with surrounding bone. It possesses good mechanical properties including a high flexural strength and hardness, both of which are enhanced due to the thickness of the implant compared to the far narrower currently available implant designs. Recent research also suggests that biofilm formation occurs less readily on zirconia fixtures as opposed to titanium implants.[13] The abutment was fabricated from polyetheretherketone (PEEK), a high-performance thermoplastic material with a compressive strength similar to that of dentine and bone.[14] This property allows the material to dampen the effect of the occlusal load exerted on the implant once it is in function. Collectively, the combination of the biophysical and biomechanical properties of zirconia and PEEK should allow for long-term success of the implant and restoration.

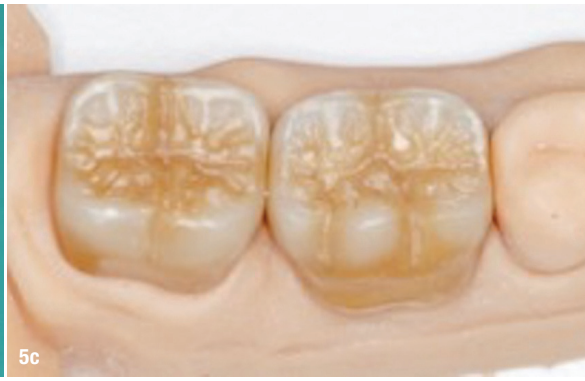
From the restorative perspective, the design of the prototype has numerous advantages over implants currently being used on a routine basis. First, the supracrestal position of the implant–abutment interface provides easy optical access for intra-oral scanning. Thus, it is possible to utilise digital impression techniques as opposed to more tedious and potentially recession-inducing analogue approaches. Second, because the supracrestal aspect of the implant mimics the shape of the tooth being replaced, the emergence profile can be developed without the need for excessive soft-tissue depth. With conventional implants, the emergence profile of the future crown must develop from the relatively narrow, round, and symmetric implant platform to a configuration that reproduces the morphology of the tooth at the gingival margin.[15] This asymmetric aspect of molars is much wider than implants in both the mesiodistal and buccopalatal/buccolingual dimensions. To properly support the adjacent soft tissues the laboratory technician must create an emergence profile that exhibits a very abrupt change in size and shape such that the crown ultimately resembles a "lollipop" as opposed to a natural tooth. The tooth-shaped design of the new implant allows for an anatomically correct emergence profile in association with a relatively shallow peri-implant sulcus. This is likely to facilitate biofilm removal by patients and therefore reduce the incidence of peri-implant mucositis or peri-implantitis. Third, eliminating screw-based retention of the implant-supported crown to cemented retention reduces the likelihood of common complications such as screw loosening and fracture. Of course, there is a current bias against cement-retained crowns because of their higher incidence of peri-implant soft-tissue disease. The position of the implant–abutment interface makes complete removal of excess cement predictable, negating this as an issue. Collectively,



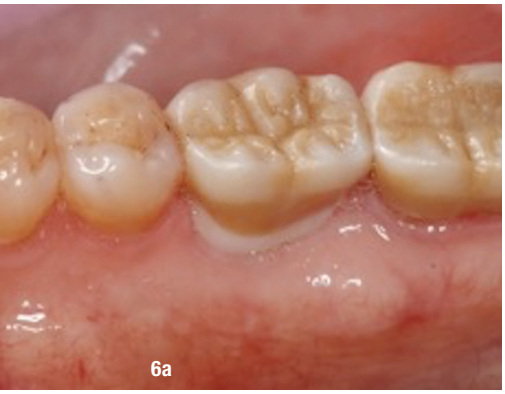
Figs. 4a–d: Design of final crowns. STL file of the implant abutment site #30 and prepared #31 **(a)**. STL file of scanned provisional restorations in place **(b)**. Merged files shown in a and b **(c)**. Digital version of final crowns **(d)**.

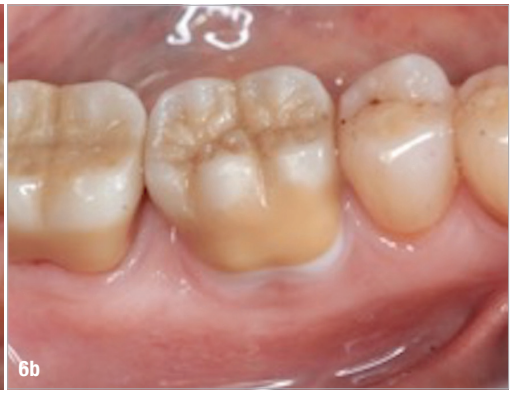


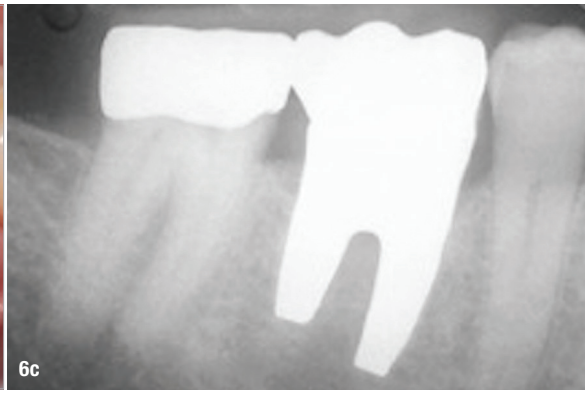




Figs. 5a–c: Production of final crowns. Final milled zirconium crowns prior to removal of nesting connections **(a)**. Wet staining of final crowns to achieve final shade of A4 **(b)**. Final monolithic zirconium crowns post-sintering **(c)**.







Figs. 6a–c: Insertion of final crowns. Buccal and lingual views, respectively, of final crowns cemented in place demonstrating form and colour **(a & b)**. Radiograph of cemented crowns demonstrating proper fit of crowns and adaptation of the implant to the bone of the extraction sockets **(c)**.

these properties render the technical aspects of restoring the prototype closer to those utilised for natural teeth as opposed to conventional implant-supported crowns.

Since Brånemark first introduced endosseous implants to the dental profession, much has been learned regarding the interrelationship between the device, surrounding bound and adjacent soft tissue. Furthermore, significant advances in our understanding of the biology of wound healing and osseointegration have been made over the last 20 years. By taking this information into consideration when designing the device described in this case report, it integrates concepts that distinguish it from previous iterations of implants mimicking the shape of natural teeth.[16,17]

Conclusion

The predictability of success in replacing teeth in unique situations, such as immediate replacement of molars, could be greatly enhanced through the utilisation of this customised implant. In the world of digital design and manufacturing we should not be limited by conventional concepts but strive to develop implant systems that more closely mimic the form and function of natural teeth.

Literature

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

Literature

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

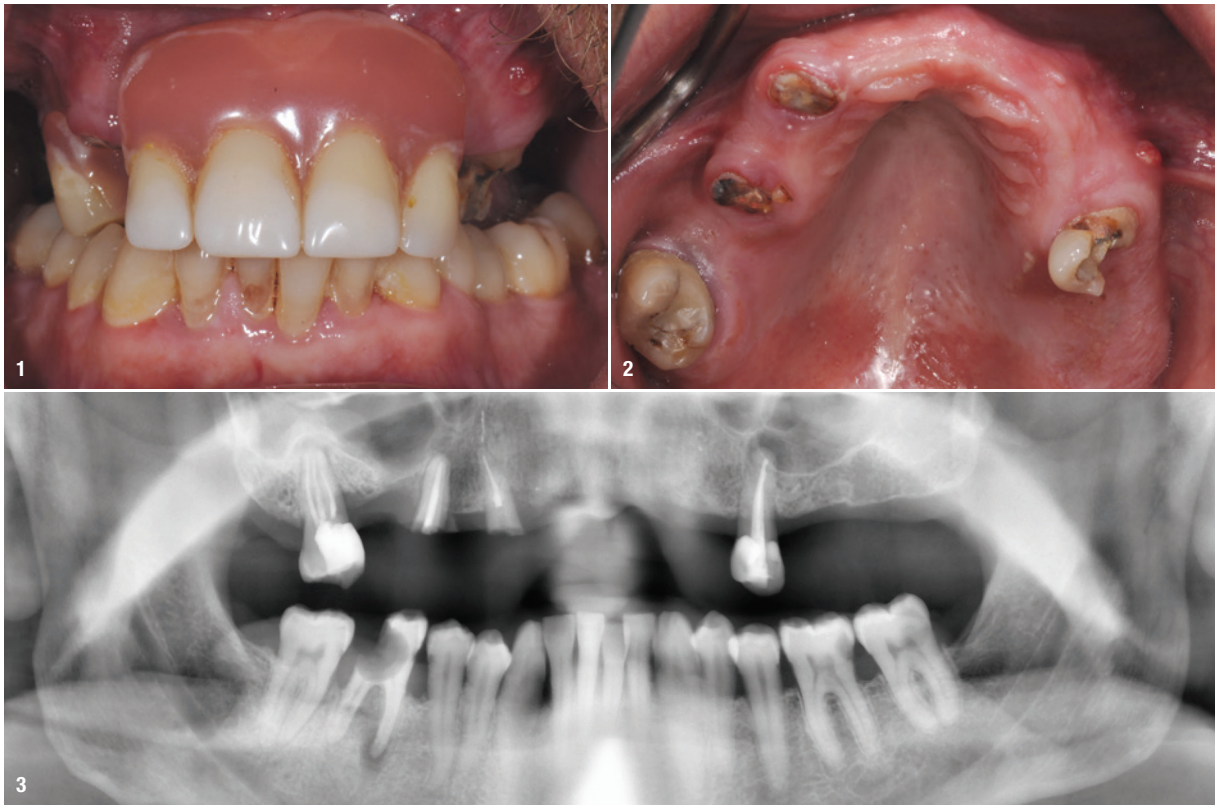
The complete rehabilitation of a compromised residual dentition is a great challenge both implantologically, functionally and aesthetically. Especially the demand for fixed dentures with their aesthetically and functionally satisfactory implementation is high. In addition, there is a growing interest 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*. He 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.

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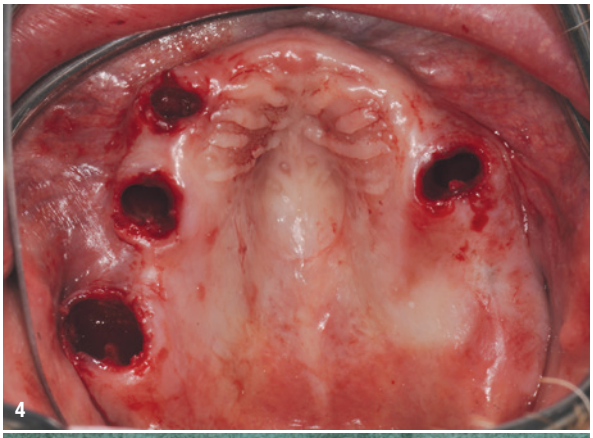
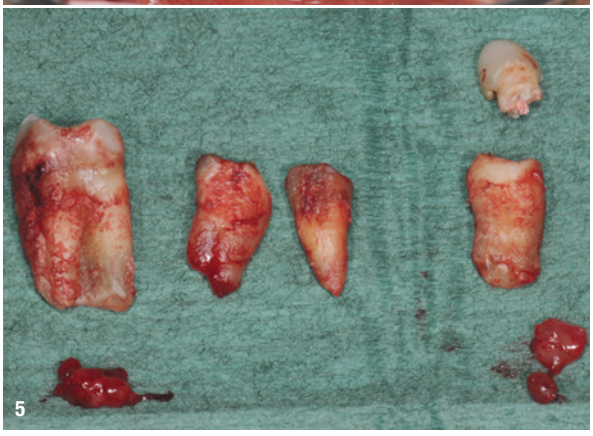
ened to varying degrees. The root remnant in region 13 had an apical overcrowding of 4–5 mm in length. Furthermore, a low bone density was detected radiographically in region 18 as well as 27 and 28 on the CBCT (Fig. 3). Overall, the remaining teeth in the upper jaw were no longer worth preserving. In 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

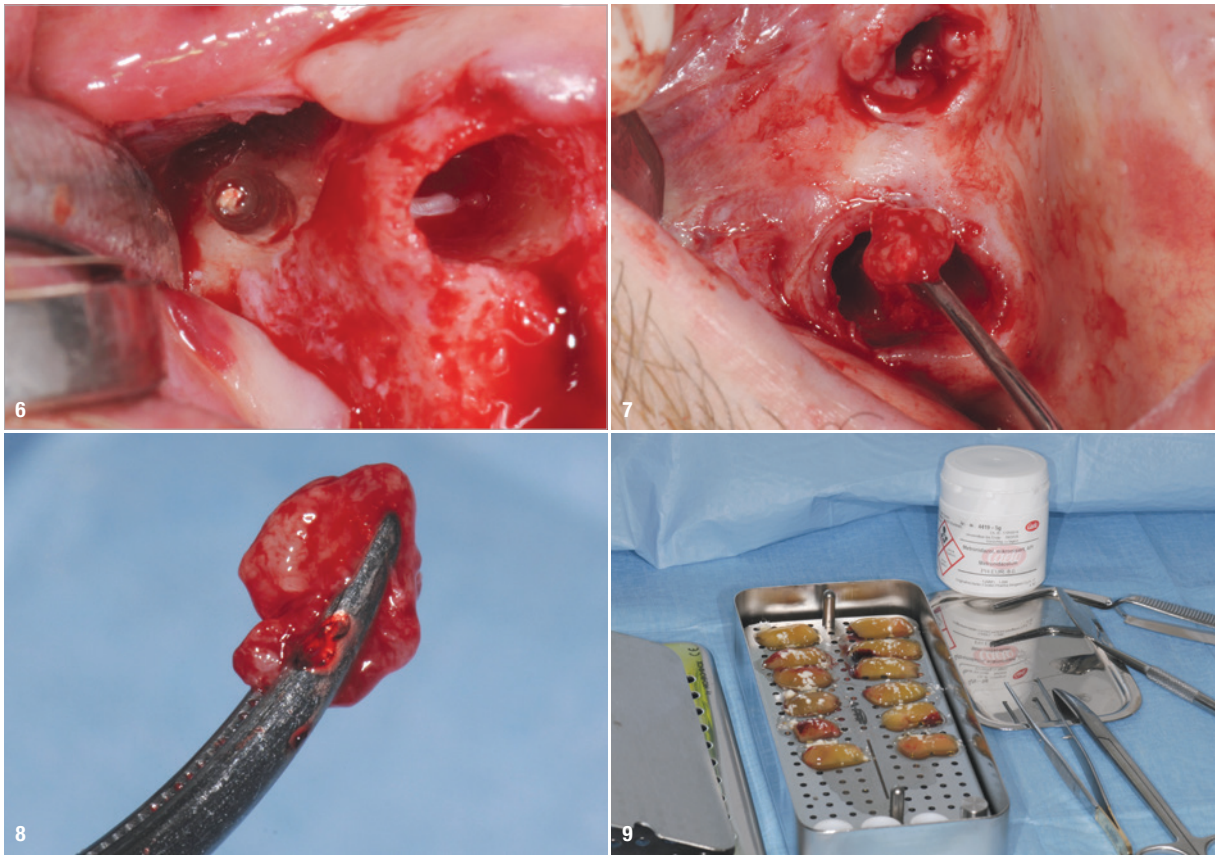




Figs. 4 & 5: Extraction of the residual dentition and cysts in the maxilla. In region 13, the overcrowded filling material in the jawbone was also removed from the buccal side, which was present apically of the root apex over 4 to 5 mm.

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).

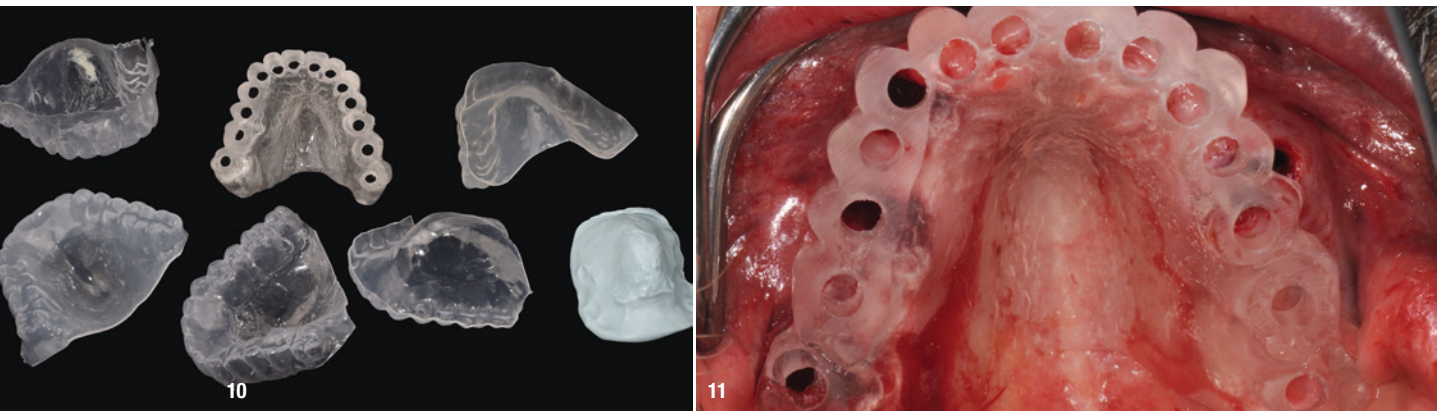


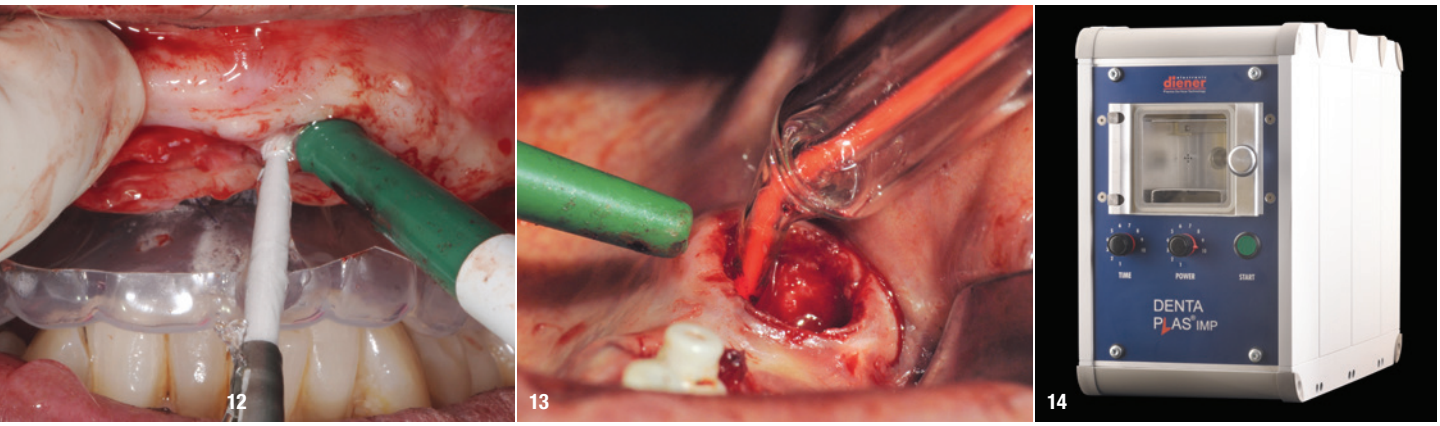
Fig. 10: The various surgical aids—an orientation drill guide and various transparent control foils—that the laboratory had prepared for us in advance were now used. **Fig. 11:** The orientation template showed us the optimal fit of the planned implants.

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 are placed, the alveoli are ozonated and the eight SDS implants pre-treated with plasma are inserted one by one using A-PRF membranes.

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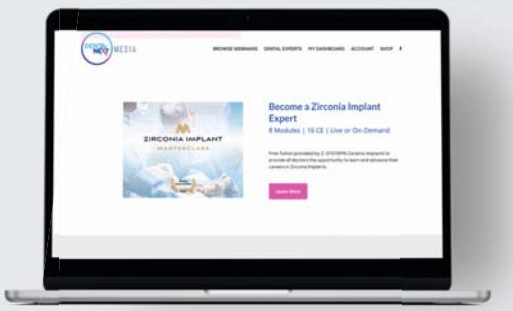

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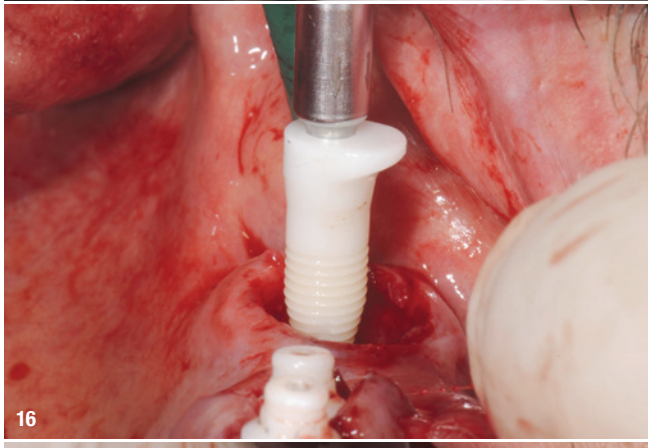
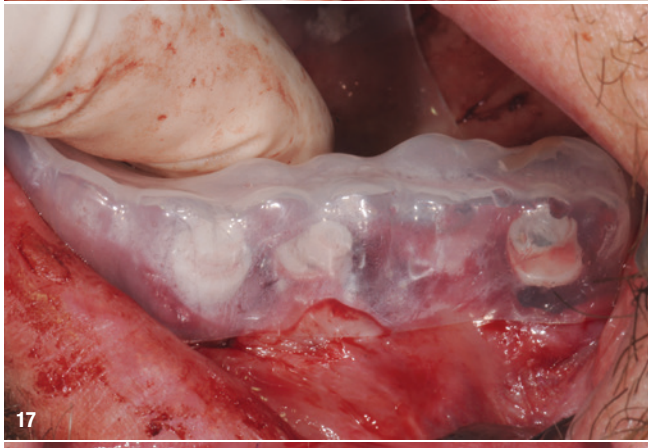
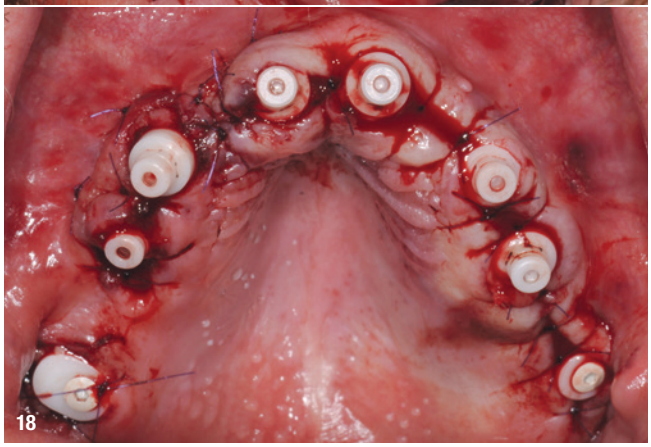


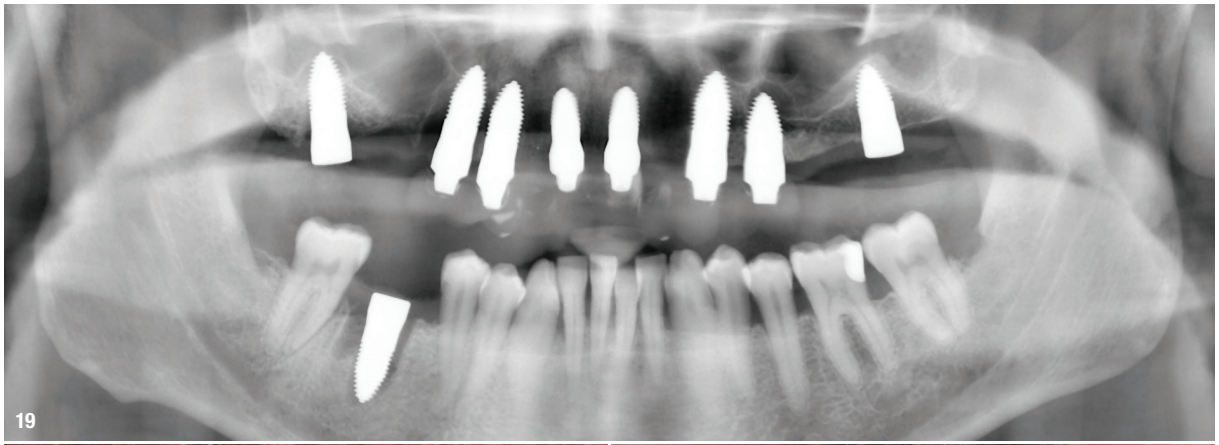


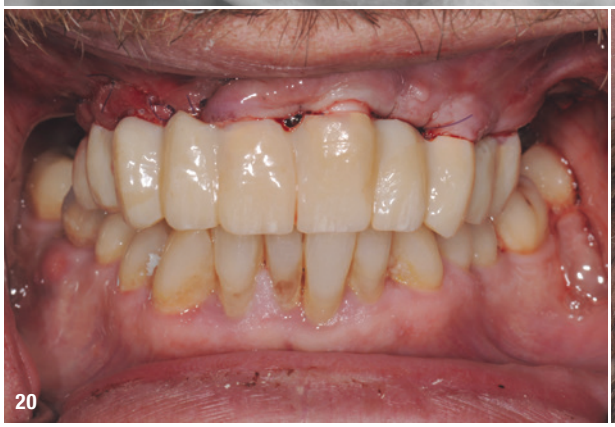


Figs. 15–18: The cavities of the alveoli were filled with A-PRF, the implants wetted with the A-PRF exudate and inserted.

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-





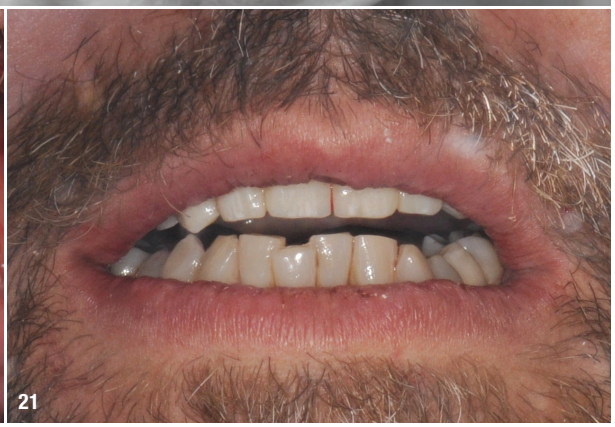


Fig. 19: Finally, the correct seating of all implants was checked with the help of an X-ray. **Figs. 20 & 21:** The inserted long-term provisional fixation presented the final result we were aiming for and a patient who was already happy.

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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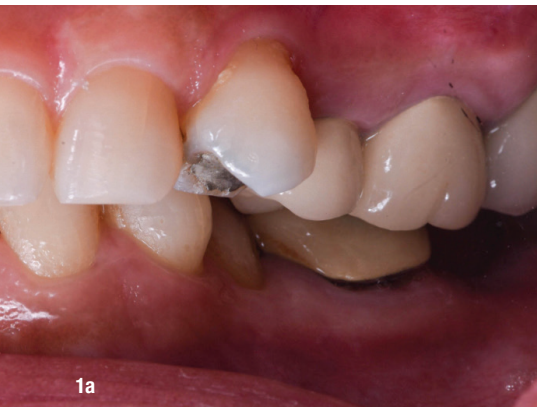
Zirconia implants: New treatment option for the partially edentulous posterior mandible

Dr Phongphan Chinnahathaiwat, Thailand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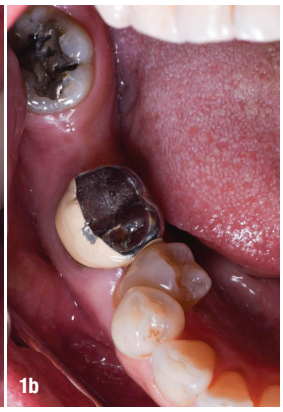
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Introduction

Zirconia implants have become firmly established in implant dentistry. Patient demand for metal-free solutions is increasing, and the development of new biomaterials, micro-rough surface techniques and improved treatment protocols has enabled practices to use zirconia dental implants as a reliable treatment alternative to titanium dental implants. Multiple studies have demonstrated that zirconia implants cause little to no inflammation of the peri-implant soft tissue and allow for a high degree of epithelial attachment. In addition, these implants have a more natural look, and therefore provide better aesthetics. Furthermore, they do not contain metal components, making them ideal for people with metal sensitivities and patients who prefer their implants to be metal-free. The patient should be informed about the pros and cons of both material options and be involved in the decision-making process when a zirconia implant is proposed as a treatment option (Figs. 1a–5d). This case report describes the replacement of mandibular posterior teeth with zirconia dental implants.

Clinical situation and treatment planning

A 49-year-old healthy female patient had already received titanium implants in the right upper quadrant at my clinic one year ago and she requested a new restoration for a missing molar (tooth #37) and a solution for the third molar (tooth #38; Fig. 1a). The left mandibular first molar had been restored with PFM non-precious more than ten years ago. The absence of the left mandibular second molar occurred without being memorised, and the left mandibular third molar was not extracted thus far. The panoramic radiograph and CBCT scan showed mild crestal resorption around #37 and the third molar had been displaced mesially to the distal part of the edentulous region #37 (Fig. 2). The third molar was scheduled for extraction. The patient was informed about ceramic implants as an alternative to titanium implants and the Zeramex zirconia dental implant system (Dentalpoint) as a metal-free solu-


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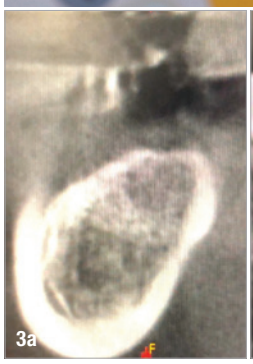
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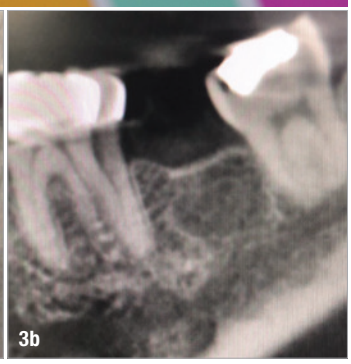
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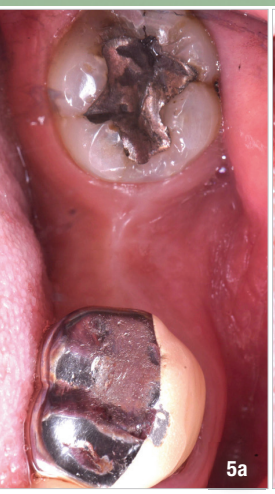

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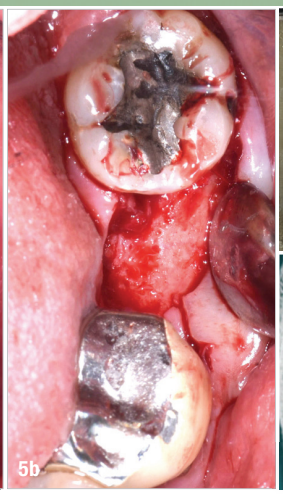

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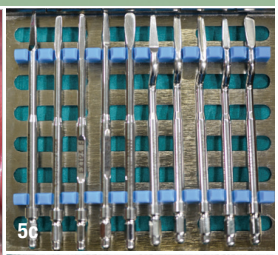

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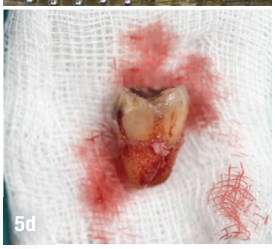

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tion. The patient opted for a zirconia implant. The main reason for her decision was to avoid the aging effect of metal particles from the conventional titanium surface, which would enter her body via peri-implant vessels in the future.

Surgical and restorative protocols

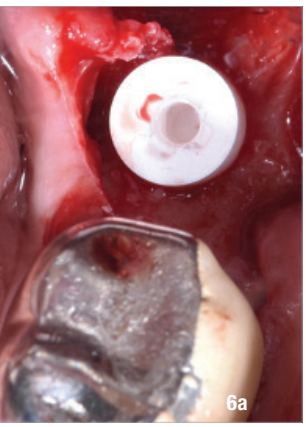
Atraumatic tooth extraction on tooth #38 (the third molar) was performed prior to implant bed preparation on the partially edentulous ridge in the #37 area. Surgical guidelines for the drilling protocol were followed, and a 5.5 × 8.0 mm two-piece zirconia dental implant (Zeramex XT) was inserted for the restorative tooth #37 (Figs. 5a–6d). The implant was inserted with a torque of 20 Ncm at the connection level sub-gingivally (1–2 mm). The flap was closed, and the sutures semi-submerged. The transgingival shoulder with its smooth surface provides the bonding conditions for the peri-implant soft-tissue attachment. The implant was covered with a healing cap *in situ*, and the site was closed without grafting, with replacement of the closure screws and replacement of the gingiva former (height: 3 mm) without sutures (Figs. 7a–c). After two weeks, the implant impression was taken using an alumina-based coping (Figs. 8a–c). The abutment was prepped with medium grit tapered diamond according to the abutment preparation guideline and finished and polished with superfine grit tapered diamond and heatless frame stone burs respectively. The monolithic external-staining zirconia crown with screw channel on the occlusal table was fabricated with a milling machine and cementation was performed extra-orally with dual-cure cement (RelyX Ultimate, 3M ESPE) on the sandblasted zirconia abutment. The final prosthesis was placed as a screw-retained prosthesis with a carbon fibre-reinforced high-performance PEEK polymer VICARBO screw by tightening to 25 Ncm and sealing the screw hole with Teflon tape and resin composite. The occlusion was checked (Figs. 9a–d). The fit of the abutment–implant connection was checked using panoramic radiography. The soft tissue looks healthy and keratinised.

Clinical outcomes

The treatment result showed excellent tissue healing. No inflammation or prosthetic problems occurred during the follow-up period (Figs. 9a–d).

Discussion

The Zeramex dental implant system is designed for a broad range of indications, from the single-tooth to multiple-tooth restoration. It performed extremely well in the case presented, with conventional and immediate implant placement in the infected socket. The surgical and prosthetic protocols are comparable to those of titanium implants. These are important factors for the successful integration



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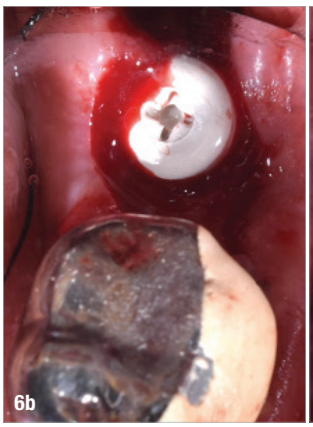

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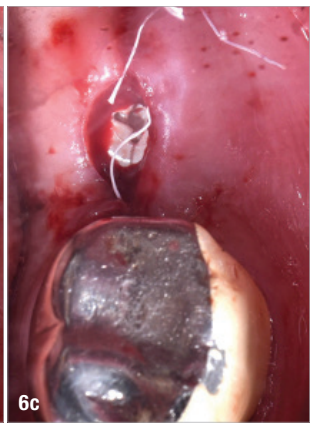

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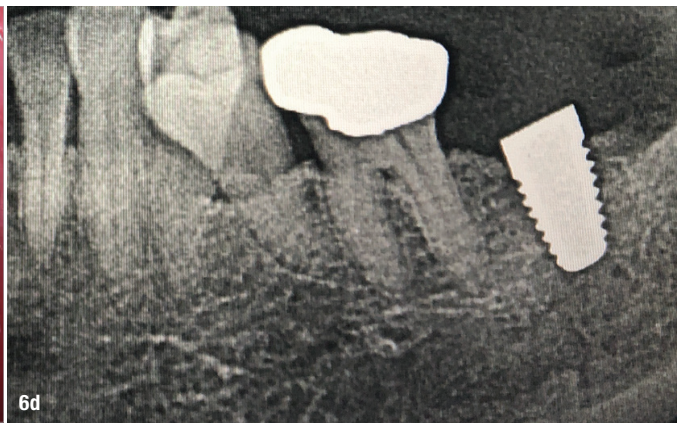

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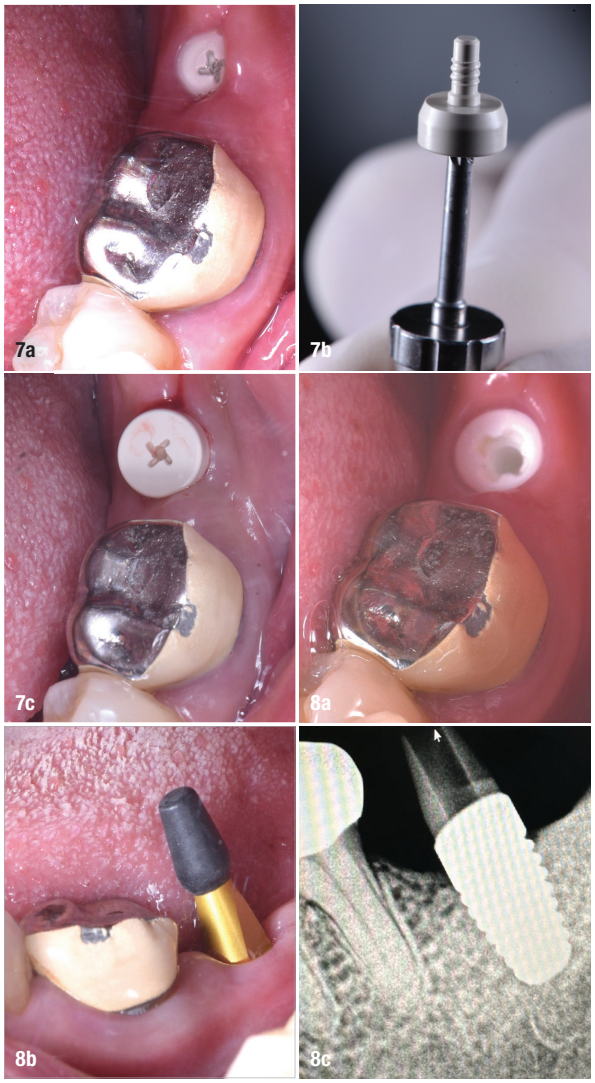

of a new dental implant system into daily dental practice. My main reasons for using the Zeramex dental implant system in the case presented were as follows: the implant used is designed to support a natural soft-tissue appearance, especially in patients with a thin mucosa biotype (Fig. 9b). Zirconia tends to exhibit lower plaque accumulation and bacterial adhesion than titanium—the surface of these implants is micro-rough and hydrophilic for successful osseointegration, while the implant collar (according to the user manual illustration of surface roughness, the first 0.6 mm are machined/smooth) is designed for better soft-tissue attachment and a reduced inflammatory response. Zeramex implants also offer an advantage in terms of mechanical strength: they are made of BIO HIP Alumina Toughened Zirconia (ATZ), which results in improved hardness, flexural strength, and toughness. They offer great restorative flexibility thanks to the two-piece screwed internal connection. Conical micro-threads around the cortical bone allow for better primary stability and axial loading.

about the author

Dr Phongphan Chinnahathaiwat, DDS (Srinakharinwirot University, Bangkok, Thailand) has been in private dental implantology practice since 2019. He is a fellow of the International Congress of Implantology (ICOI) and holds a certificate of the advanced education programme in implant dentistry (Srinakharinwirot University). Dr Chinnahathaiwat is founder and CEO of James Implant Academy (JIA).

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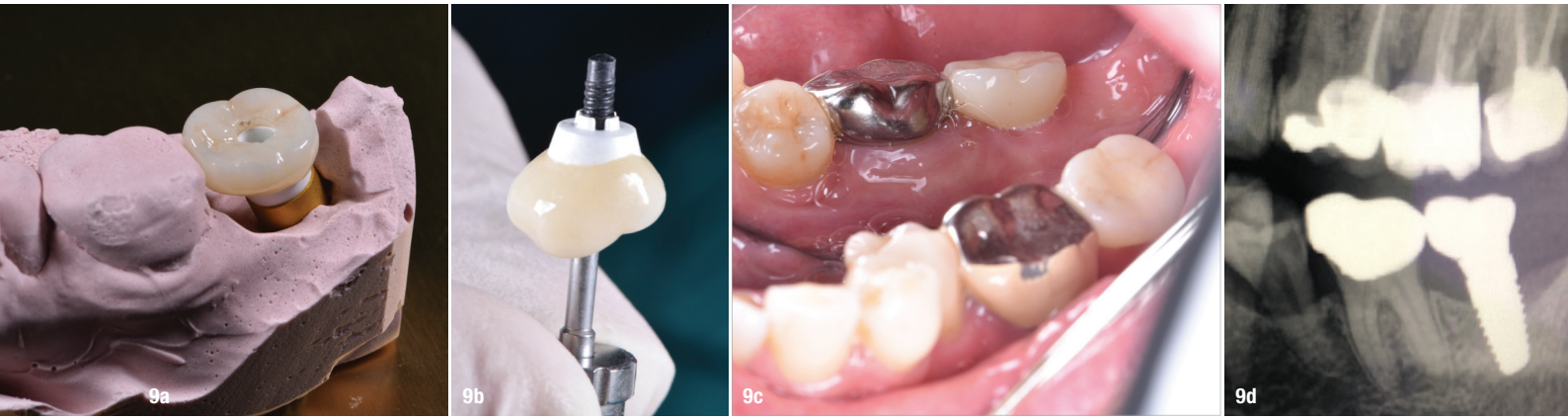

1-piece and 2-piece ceramic dental implants

Curd Bollen* & Martin Jörgens**, The Netherlands

Ceramic dental implants have long ceased to be hype, on the contrary, they can offer a significant addition to the daily dental implant practice. Not only their favourable aesthetics play a significant role, but also their ability to work completely metal-free is of added value, surely for patients with a proven allergy for grade 5 titanium, containing the hyperreactive components vanadium and aluminium.

The fact that furthermore peri-implantitis seems to appear only incidentally, is an important supporting argument for their use as well.

Whereas the original design of zirconia implants was formerly always of a 1-piece/1-phase structure (monobloc design), nowadays also 2-piece/2-phase designs (hybrid concept) are widely utilised to restore missing teeth.

This article will compare the advantages and disadvantages of 1-piece versus 2-piece ceramic implants based on clinical, scientific, and patient related criteria.

Finally, some general recommendations towards the use of ceramic dental implants in daily practice will be formulated.

Fig. 1: A 1-piece and a 2-piece ceramic dental implant (Z-Systems: Z5m & Z5-BL).

Introduction

Ceramic dental implants are a relatively new type of dental implants made from the ceramic material zirconia (zirconium dioxide—ZrO_2).[1] In the past, ceramic implants were predominantly made of aluminium oxide (Al_2O_3), which was a far too brittle material for oral rehabilitation, which led to multiple implant fractures, causing a widespread rejection in their application, leading to a global stigmatisation of ceramic dental implants.[2]

Recently, ceramic dental implants are becoming increasingly popular again due to their aesthetic appeal and biocompatibility.[3, 4] Unlike traditional titanium implants, ceramic implants have a whitish colour, making them virtually indistinguishable from natural teeth, especially when the patient presents with a thin gingival biotype.[5] In such cases, the hint of grey titanium in combination with a high smile line, is an aesthetic letdown.

Additionally, ceramic implants are hypoallergenic, making them a suitable option for patients with metal allergies.[6] Actually titanium allergy can be detected in dental implant patients, even though its estimated prevalence is quite low (0.6%). A higher risk of positive allergic reaction was found in patients showing post-op allergy compatible responses (allergic symptoms) after implant placement or unexplained implant failures.[7]

These implants also have a lower thermal conductivity compared to metal implants, which can reduce sensitivity and discomfort in the mouth often experienced as unpleasant by the patient.[8]

Whereas ceramic implants are still relatively new, research has shown promising results in terms of their long-term success rates and durability.

The choice between a 1-piece/1-phase implant versus a 2-piece/2-phase implant is a more recent phenomenon. At the early days of ceramic dental implants, all these implants were produced as a monobloc, i.e. an implant with an integrated abutment (Fig. 1).[9]

In the dental implant community, there is still a lot of discussion on the place of ceramic dental implants in the rehabilitation of (partial) edentulous patients. A majority still considers zirconia implants as a transient phenomenon, whereas others consider it as the ultimate breakthrough in implant dentistry.[10] Scientific research has however shown that ceramic implants can be a valuable alternative to titanium implants.

On 1-piece/1-phase implants, there are more studies published since they are already much longer on the market. Already in the seventies, Sammy Sandhaus and Thomas Driskell were publishing groundbreaking work. Both proved separately the great opportunities of working with ceramic 1-piece implants.[11, 12]

Only more recently 2-piece/2-phase ceramic implants entered the dental implant market (Table 1).

Due to their later release on the market, these 2-piece/2-phase implants have less scientific data available, and the existing data span up to ten years.[13, 14] Although the medium-term results are excellent after five to six years, the German Association of Oral Implantology (DGI) made a warning in their recent S3 guideline.[15, 16] Thiem and coworkers confirm the feasible use of one-piece zirconia implants as an addendum/alternative to titanium implants. However, no conclusion regarding the application of two-piece ceramic implant systems can be drawn based on the existing data. So, they suggest recommending these implants only after the patient has been informed in detail about the lack of long-term clinical data.

Criteria

Based on eight different criteria, the differences and advantages/disadvantages between 1-piece and 2-piece ceramic dental implants will be discussed.

1. Design

With a 1-piece implant, the implant and the abutment are fused to one simple monobloc. Therefore, there can't be any bacterial leakage between the implant and the abutment because there is no joint as with the 2-piece implants, where there is always a gap detected between the implant and the abutment.[17] This means furthermore that the temporary or final crown finally must be cemented on top of the implant. There is a wide range of these implants commercially available (Table 2).

The more complex 2-piece implants consist of two or three parts: the implant body itself, the abutment, and the abutment retention screw. In case of a cementable abutment, there is of course no abutment screw. The retention screw can be fabricated out of titanium, gold, carbon, or zirconia (Fig. 2).

It's important to follow the manufacturer instructions for applying to correct torque on these screws: titanium screw is 25 Ncm; carbon screw is 25 Ncm; zirconia screw is 12 Ncm; gold screw is 15 Ncm! Currently, there is only a limited number of 2-piece implants on the dental market (Table 2).

Brand	Product	Cemented abutment	Srewed abutment	Screw material
Z-Systems	Z5-BL/Z5-TL	no	yes	ceramic or titanium
Zeramex	XT/P6	no	yes	carbon
Nobel Biocare	NobelPearl	no	yes	carbon
Straumann	Pure	no	yes	titanium
Zircon Medical	Patent	yes	no	–
WITAR	AWI	no	yes	direct*
Neodent	Zi	no	yes	titanium
Camlog	CERALOG	no	yes	titanium or gold
SDS	Bright/Value	yes	yes	peek
TAV	W	no	yes	titanium

*Ceramic abutment directly screwed into the implant (no additional screw).

Table 1: Detailed overview of the 2-piece/2-phase ceramic implants and their components.

Fig. 2: Different abutment retention screws: titanium (Neodent)—carbon (Zeramex)—zirconia (Z-Systems)—gold (Camlog).

2. Surgery

The first stage surgical procedure for both implant types is identical, although for 1-piece implants a flapless approach can be appropriate. The flapless technique for 1-piece implants shows however statistically significantly more bone loss which might be indicative for future problems.[18]

Only in a 2-stage approach for 2-piece implants, a second surgery is necessary, connecting the healing abutment to the implant. Healing abutments are mostly made from PEEK or PEKK.

1-piece ceramic implants	2-piece ceramic implants
Z-Systems: Z5m/Z5m(t)	Z-Systems: Z5-BL/Z5-TL
Straumann: Pure Monotype	Straumann: Pure
Camlog: CERALOG Monobloc	Camlog: CERALOG Hexalobe
Zircon Medical: Patent 1-piece	Zircon Medical: Patent 2-piece
SDS: Bright	SDS: Bright/Value
TAV: W-1	TAV: W-2
Witar: AWI 1-piece	Witar: AWI 2-piece
ZiBone	ZiBone
Medical Instinct: Bone Trust	Neodent: Zi
Fair Implant: Fair White	Zeramex: XT/P6
Ceraroot	Nobel Biocare: NobelPearl
Tree Oss Ceramic	SIC: SIC White
bredent: WhiteSky	

Table 2: Overview of 1-piece and 2-piece ceramic dental implants.

Because it is not always allowed to prep 1-piece zirconia implants (always carefully look at the manufacturer recommendations!), their immediate correct surgical positioning is of utmost importance.[19]

Therefore, it can be advantageous to initially use guided surgery for these procedures, helping to avoid incorrect inclination of the abutment component of the implant.[20] For 2-piece implants this problem is less significant, since most commercial brands offer angulated or preparable abutments in their portfolio.

Whether 1-piece or 2-piece implants are installed, always low drilling speeds should be applied, surely when ceramic implant drills are applied. Drills made of ceramics don't conduct the warmth, leading to overheating of the bone in the osteotomy.[21] The latter doesn't lead to implant failure but induces significant crestal bone loss during healing and a final lower percentage of bone-to-implant contact.[22] These drilling speeds start around 800 rpm for the first drills, reducing to 400 rpm for the last drills. The advised tapping for D1-D2 (and D3) bone should be performed at 15 rpm.[23]

It is of utmost importance to check the individual recommendations of the manufacturer before using the respective drill sequences.

3. Loading

Since for ceramic implants almost always bone tapping is utilised, the primary stability of these implants is often insufficient for direct loading.[24] Therefore, delayed, or late loading are mostly recommended for 2-piece implants. Moreover, in the aesthetical front area, a 2-phase technique can help to improve the gingival aesthetic outcome as shown by Suchetha and co-workers.[25]

1-piece implants are due to their design anyway directly loaded. To reduce these immediate loading forces, most

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Fig. 3: PEEK protection caps for 1-piece implant (Z-Systems, Z5m).

brands offer silicone or PEEK protection caps to place over the abutment after installing the implant. These shock absorbers also protect for gingival overgrowth during the required healing time (Fig. 3).

4. Prosthetics

The prosthetic procedure of a 1-piece implant is almost completely identical to the prosthetic process for natural teeth. Both, analogue and digital impression are possible. Due the high affinity of the soft tissue towards zirconia, often excess gingiva must get reduced by retraction cords or (diode) laser.[26] Implant analogues are not really required in this method.

For 2-piece implants, the procedures are identical as for titanium 2-piece implants: analogue or digital impression, open or closed tray. Different brand-related scan bodies are available and here an implant analogue is always needed for the further laboratory handling. It is still of the highest importance to use the original components, delivered by the respective manufacturers, since printing of these individual components does not offer the same accuracy yet.[27]

5. Sizes

The offer in diameters and lengths is rather limited for 1-piece as for 2-piece ceramic implants. Table 3 shows the ranges in diameters and lengths of the actual most common used ceramic dental implants.

The available diameter ranges from 3.3 (Straumann) to 7 mm (SDS). The lengths range from 6 (SDS) to 16 mm (bredent). The average diameter is 4.2 mm and the average length is 10.8 mm. With these sizes almost all indications are properly covered.

Considering design there are parallel and tapered implants available. Most of the implants are not self-tapping. Therefore, almost in all situations, bone tapping is advised before implant installation.

For the 2-piece implants there is large variety of internal connections. Not every connection offers the same stability (Fig. 4).

6. Costs

The use of 1-piece implants is relatively less expensive since there is only need for a full ceramic crown that can be cemented on top of the implant–abutment complex. For 2-piece implants, there is always the need for extra components: ceramic abutments and abutment retention screws. These extra components mean not only an extra cost in their purchase from the manufacturer, but also an extra cost in the laboratory handling, making the final cost of a 2-piece ceramic implant substantially higher.

7. Complications

The main complication for oral implants is the absence of lack of osseointegration. With the actual ceramic materials, the success rates of zirconia implants are comparable with those of titanium implants. After all, zirconia and titanium implants show a similar soft- and hard-tissue integration capability. Titanium however, tended to demonstrate an accelerated initial osseointegration compared to zirconia. It is meanwhile also clear that zirconia implants against that do not show better clinical results as titanium implants.[28,29] So both systems seem to have comparable clinical outcomes.

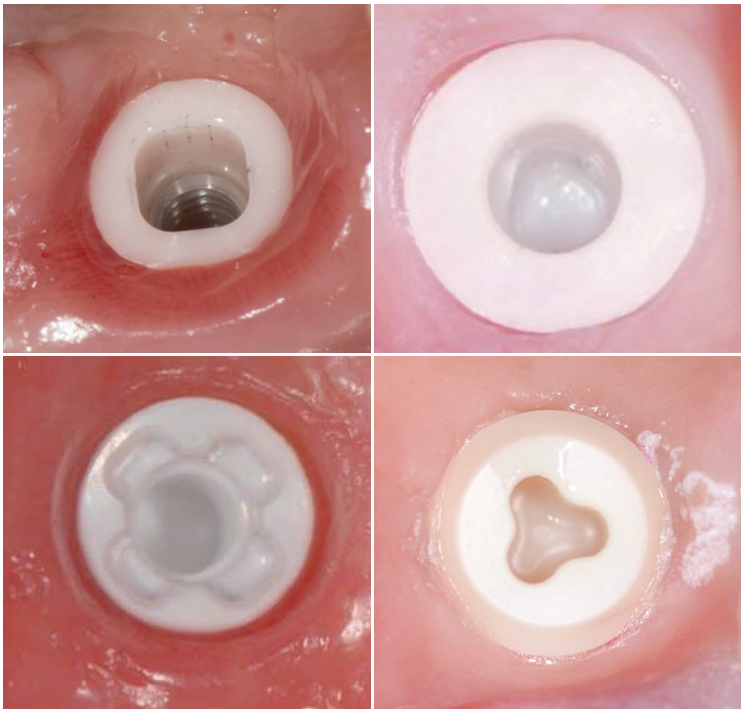

Fig. 4: Different internal connections of different ceramic implant brands (clockwise): Pure (Straumann)—Z5c (Z-Systems)—Patent (Zircon Medical)—Zeramex (DentalPoint).

With 1-piece implants, the cementation of the crown can cause cement rests that can remain present subgingival. These toxic cement rests can easily induce peri-implantitis.[30] Therefore, the meticulous removing of all excess cement after cementation of the crown, is of utmost importance.[31]

As mentioned before, the wrong positioning (i.e. inclination) of a 1-piece implant that may not be grinded postoperative, is a major problem. Here the only solution is explantation.

2-piece ceramic implants can offer different complications. Abutment screw loosening and abutment screw fracture are the main problems.[32]

Therefore, it is essential to apply the exact prescribed torque value when installing the abutment or the crown. The more components used, the higher the risk for complications.

As far as actual scientific literature concerns, there seems to be less peri-implantitis around ceramic implants in comparison with titanium ones.[33, 34] A peer explanation on this phenomenon is still waiting for now.

Brand	Range of diameters	Range of lenghts
Z-Systems	3.6–5 mm	8–12 mm
Zeramex	3.5–5.5 mm	8–14 mm
Straumann	3.3–4.8 mm	8–14 mm
Nobel Biocare	3.5–5.5 mm	8–14 mm
Camlog	4 mm	8–12 mm
Zircon Medical	4.1–5 mm	7–13 mm
SDS	3.2–7 mm	6–14 mm
TAV	3.6–4.8 mm	8–14 mm
bredent	3.5–4.5 mm	8–16 mm
ZiBone	3.6–5 mm	8–14.5 mm
Tree Oss	3.7–4.3 mm	10–13 mm
Ceraroot	3.5–6.5 mm	8–14 mm
Neodent	3.75–4.3 mm	10–13 mm
WITAR	3.9–6 mm	8–14 mm
Fair Implant	3.7–4.3 mm	10–13 mm
Neodent	3.5–5.5 mm	8–14 mm

Table 3: Range in diameters and lengths of different commercially available ceramic dental implant systems.

8. Patients perspective

Probably this is an underestimated and neglected factor in daily clinical decision making. Patients prefer minimal invasive therapy, minimal morbidity, minimal number of appointments and minimal costs. When comparing 1-piece and 2-piece implants, it is obvious that patients will prefer their therapy with 1-piece implants, because this concept offers the most advantages for them.

Moreover, the recent S3 guideline on ceramic implants by the German Association of Oral Implantology, advises all practitioners to warn their patients that there is still insufficient scientific data to support the unlimited use of 2-piece ceramic dental implants.[16] The latter should therefore in fact always be consented before applying 2-piece implants in practice.

Conclusions

In implant dentistry, it can be stated that 1-piece implants offer meanwhile the same prognosis as 2-piece implants. Moreover, recent studies indicate clearly that 1-piece as well as 2-piece ceramic implants show excellent clinical results. However, 2-piece ceramic dental implants don't offer sufficient long-term scientific substantiation yet to support their overall use in daily practice. Therefore, always an extended informed consent should be offered to patients receiving a therapy with 2-piece zirconia implants.

The use of 2-piece zirconia implants will increase since they offer much more versatility than 1-piece implants. This higher versatility will unfortunately result in a raise of the costs for the practitioners and consequently for the patients.

Future randomised controlled trials will have to confirm the promising results of 2-piece zirconia implants.

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Literature

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Contaminants on ceramic implants: Do manufacturing deficits compromise their value?

Ken Serota, DDS, MMSc, USA

With new developments in biomaterials science and industrial technology, the profession has recognised that the long-term success of zirconium dioxide implants is demonstrably comparable to that of titanium. However, despite best manufacturing and packaging practices, the presence of contaminants and pollutants at the bone–implant interface of any implant material can initiate an inflammatory response with consequential bone resorption. There is a pressing need for the industry to recognise the inherent value of screening dental implant devices for these toxic compounds to obviate the bio-interface reactions they can cause in the early phase of osseointegration (Figs. 1 & 2).

Particulate and thin film contaminants on the implant surface are identified by using a unique combination of analytic techniques. The precise location of impurities is detected using a scanning electron microscope (SEM) with additional elemental analyses by energy dispersive X-ray spectroscopy (EDS) performed in a particle-free cleanroom. The chemical compound of these contaminants is identified by subsequent time-of-flight secondary ion mass spectrometry (ToF-SIMS). Both analytical tasks are performed in officially accredited testing laboratories according to DIN EN ISO/IEC 17025:2018, thereby ensuring that all analyses are precise and unbiased.

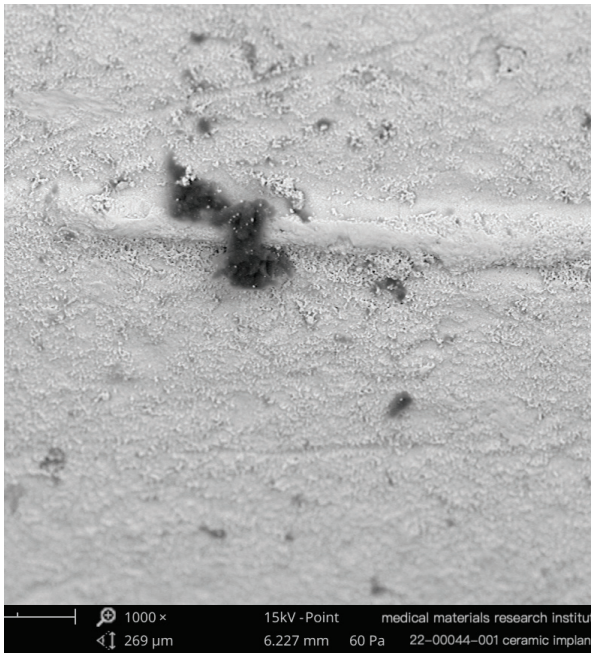

Fig. 1: SEM image revealing significant carbonaceous contaminants on the shoulder of a sterile packaged ceramic implant.

The identification of Didecyldimethylammonium chloride (DDAC) on a sterile packaged ceramic implant, as shown in Figure 1, is alarming. DDAC is a cell-toxic quaternary ammonium compound used as a biocide and pesticide. It causes the disruption of intermolecular interactions and the dissociation of lipid bilayers. This ceramic implant type is claimed to be “innovative and safe” by the responsible provider and legal manufacturer.

For the past eight years, the CleanImplant Foundation has worked with a growing group of industry partners to ensure particle-free implant production. It has introduced a quality seal for tested, verified clean implants, the “Trusted Quality Mark” (www.cleanimplant.org), an acknowledgement of these manufacturers’ tireless efforts on behalf of the profession. The criteria for implants that are largely free of foreign particles were defined in guidelines published in a 2017 consensus paper. The renowned scientists of the Foundation’s Scientific Advisory Board decide on the receipt of the quality seal through a peer-reviewed process. To sustain the use of the Trusted Quality seal, a random selection of five samples of the implant system is subjected to a rigorous, independent analysis every two years.

The demand for implant dentistry continues unabated. It has long been understood that the wear, friction, and biofilm formation in the corrosive oral environment associated with titanium can promote inflammatory reactions and bone destruction in the surrounding tissues, the very essence of why the transition to ceramic implants. However, ceramic implants compromised with plastic residues and cell-toxic biocides are no less a danger.

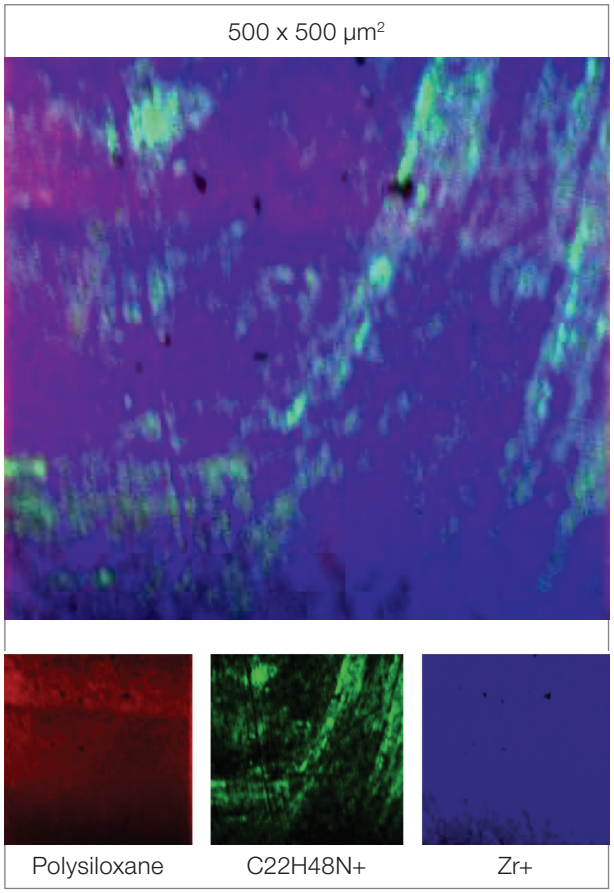

Fig. 2: ToF-SIMS visualisation of plastic residues (Polysiloxane) and a quaternary ammonium compound (C22H48N+) on the ceramic implant shown in Figure 1.

There is no ethical conundrum in dentistry. Contaminants on the surface of an implant constitute a contaminated implant. This is not a difficult puzzle or problem to solve. We have the means to prevent this; it can be done, it must be done, and there is no excuse for it not being done. Companies owe this to clinicians, patients, and to themselves. We are a health science profession; the health of our patients and the science behind the materials we use warrant unprecedented and unimpeachable quality standards. There must be trust within the circle of care giving, that is the ultimate reward of service.

Ken Serota is the representative for CleanImplant North America, a globally active non-profit organisation based in Berlin, Germany.

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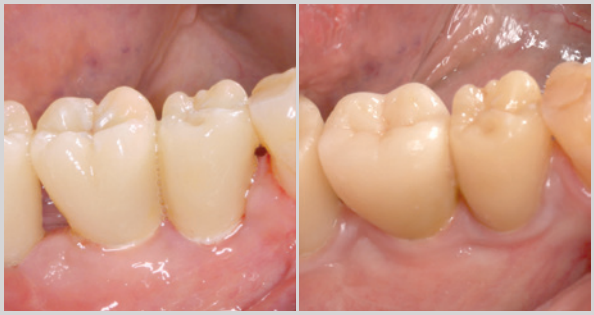
First long-term study on two-piece zirconia implants published

No peri-implantitis after nine years of implant function



Figs. 1a&b: Excellent aesthetics: Increase in keratinised gingiva between baseline (left) and the nine-year follow-up (right; © Brunello et al. 2022[1]).

The nine-year study results at a glance:

- No cases of peri-implantitis
- High implant survival
- Healthy and stable soft tissue (bleeding on probing [BOP]: 12.9%; maximum mucosal recession [MR]: 1 mm)
- No implant fractures
- Stable plaque indices (PI), probing depth (PD), and BOP at two- and nine-year follow-ups
- Increase in keratinised gingiva between baseline and the nine-year follow-up

The first long-term study on two-piece zirconia dental implants has been published—in *Clinical Oral Implants Research*—closing a major research gap.[1] Over a period of nine years, the independent study, conducted at Heinrich Heine University Düsseldorf in Germany, examined integrated implants of the Patent™ brand (Zircon Medical) placed in the posterior region, which is subjected to higher occlusal loads.[1] The research team, led by Prof. Jürgen Becker, who is director of the Department of Oral Surgery, concluded that the Patent™ Dental Implant System provides a predictable and long-term tooth replacement solution, as it was able to maintain healthy and stable hard and soft tissue over the nine years of follow-up.

After nine years of implant function, none of the implants developed peri-implantitis, the mean bleeding on probing was 12.9% and the maximum mucosal recession was 1 mm. The plaque indices, pocket depths and bleeding on probing at the two- and nine-year follow-ups remained stable.

High aesthetics was achieved by the clinical improvements of the soft tissue, showing an increase in keratinised gingiva between baseline and the nine-year follow-up (Figs. 1a&b). No implant fractures were reported.

Significance of the study

Prior to this study, there had been no long-term observations of two-piece zirconia implants. The implant systems currently available on the market typically undergo fewer long-term studies, and the existing studies are often limited to observation periods of a maximum of five years. On one hand, many of the implant systems that have undergone long-term scientific observation are no longer on the market. On the other hand, new product lines are being introduced so rapidly that scientific evaluation over longer periods is not being conducted.[2]

“Studies have shown that complications after implant placement, including peri-mucositis and peri-implantitis, occur often within the first five years and significantly increase after eight years, posing a risk for developing general diseases. Therefore, it was important for us to provide independent scientific data on the clinical success of the Patent™ Dental Implant System that extends beyond these time frames”, commented Marco Waldner, CEO of Zircon Medical, in view of the remarkable nine-year results.

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

An Interview with Dr Shepard DeLong, 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 more and more intelligent, accurate, and reliable. We had the great opportunity to interview Dr Shepard DeLong about his approach, findings, and experience with AI in dentistry and oral implantology.

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?
I had the opportunity to use an AI diagnostic tool with one of my patients yesterday. I asked, "How does it make you feel to see me using artificial intelligence as an aid in my diagnosis of your health?" Immediately the patient said, "I think it is a good thing...as long as, you are taking your own experience and knowledge to interpret what it means. I reassured them that was the case and that when AI is used with care and expertise it 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 doctor and patient.


© Shepard DeLong

Have you experienced improvements for even more individualised and personalised treatment plans ever since you implemented AI to your daily routines?
Our doctors 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 preventative, 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 routines?
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 after seeing numbers with CEJ to crest measurements being visible on "routine radiographs". The severity of caries is as well now quantified, so decision making is facilitated, as well as risk.

Can AI tools help in addressing dental anxiety or fear 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 wellbeing drive the entire doctor–patient interaction when it is functioning properly. With the aid of AI, trust no longer relies solely on a doctor's personality, or powers of persuasion, both of which are pretty irrelevant to quality of care. Much of what drives patient fear

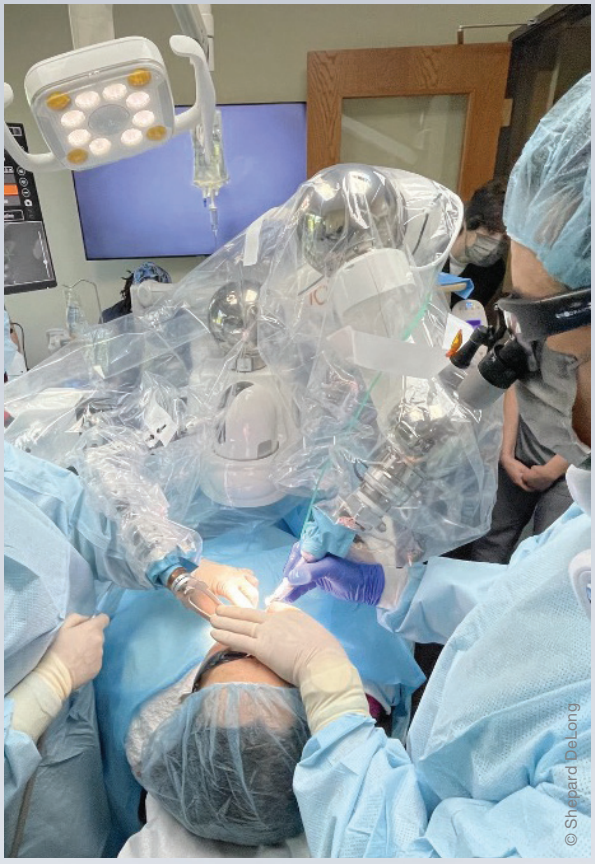
and anxiety is the loss of control or confidence that what is being done is the right thing. AI helps with that.

Please let us dig a bit deeper into the clinical aspects and benefits of your work and your routines in your clinic. We know that you are using robotic surgery aid. What is it exactly that you 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 doctors and our practice has a "cult-like" following of believers. Good ergonomics and long-term well-being of doctors and the dental team are part of our core values. Robotic surgery is the latest addition, and we utilise robotics for implant placement. Our commitment is not only to electronic, digital or AI-driven tech, but to biotech and biomaterials advancement. We are the only team in the world dedicated to the placement and restoration of Zirconia dental implants utilising dynamic navigation, and robotic assistance on all but the unavoidable freehand cases.

The challenges are still great. Its 8 p.m. and I literally just finished a dual-arch ceramic implant case which, after much planning, the robotic workflow had to be abandoned. This can happen. Time, cost, 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 are 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, 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 CT scans or 3D imaging, for optimal implant placement?
I would lean heavily on companies like 3DDX, Immersive Touch, Cad-Ray, or Anatomage, to do segmentation and deeper use of CBCT data. Implant positioning for the varied ceramic systems I use still requires significant thought and prosthetic "tweaking" so that our placement and restoration is near ideal. There are some tools in use within YOMI plan software, things like auto segmentation of the sinus cavity to aid in sinus lifts, but the software is not yet predictably mapping for us yet. Nerve segmentation is still through third party software or radiology services.

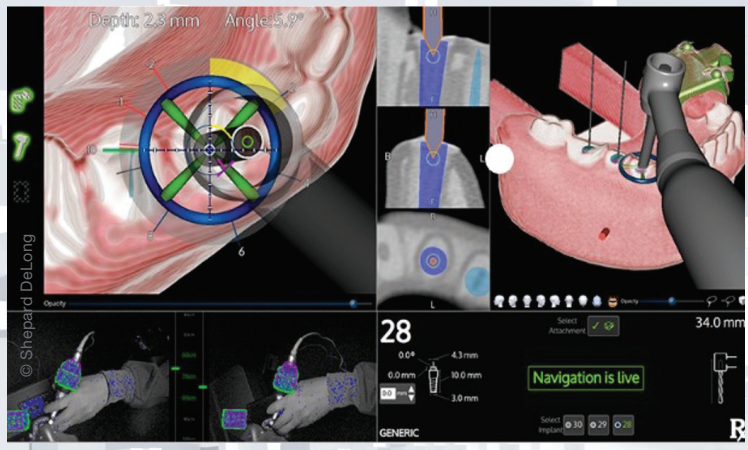
And how does the incorporation of dental robots enhance the precision and efficiency of oral surgery procedures?
This is something that I got great perspective on last year at the Mayo Clinic's first conference on Robotics and



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

Advanced Surgical Technologies. Other surgical specialties were discussing the overwhelming adoption of robotics in enhancing patient outcomes. Freehand skills, static guides, 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 doctors keep learning, practicing so that the results continue to improve. I've been using the term "ultra-precision" to describe some of what I was seeing, during surgery, and even more impressively, during restoration of zirconia dental implants placed utilising robotics.

We have learned that the implementation of dental robots worked wonderful with general implant material. You are using zirconia implants. What are the differences, what are the challenges—for both the surgeon and the robot-based system? Are there 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 fixture mounts that are not retentive enough, or too reten-



tive to deal with the rigidity and freedom of a robotic arm and incorporated dental handpiece. Also, driver lengths, hand-based carriers, and low maximum torque values added 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 trend 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 the surgery itself, considering factors like bone density and tissue response?
This is where the "haptic guidance" of the Yomi robot as well as the freehand feel of the X-Guide allows the surgeon to feel the bone. Visualisation of the surgical site with physical guidance is where Yomi shines. During surgery with the X-Guide the surgeon's eyes must be on the screen, with Yomi you get both, freehand tactile feel, 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, it 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 the era of new and exciting discoveries in dentistry. Please share this journey with us and give us a few concluding words.
I know that the readers of *ceramic 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 will look forward to continuing our conversation and journey!

about the interviewee

Dr Shepard DeLong is a 3rd generation dentist in Portland, Oregon, USA. He holds a BS from Portland State University, DMD from Oregon Health and Sciences University and completed a General Practice Residency at The Queen's Medical Center in Honolulu, Hawaii. He is a member of AMED, IAOCI, EACim, IAOMT, and has served as a mentor for CEREC-doctors. He was formerly an associate at the first LEED certified, high-tech, eco-friendly practice in the US. He is on the forefront of digital evolution, and development of novel technological workflows in dentistry. He has a part-time position at Pure Health Dentistry on the island of Maui, Hawaii and owns Lotus Dental Wellness, in Lake Oswego, Oregon. He is a residency site director for the MSc Implantology programme at the University of Jacksonville, and lectures on ceramic implantology, robotics, lasers, and digital dentistry. His latest project has been sharing the profound advantages of combinational technologies for the health of both doctor and patient. He can be reached at drdelong@lotusdentalwellness.com.

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Implant dentistry without peri-implantitis

An Interview with Marco Waldner, CEO of Zircon Medical Management AG | Patent™, Switzerland

No peri-implantitis after nine years—in a recent independent long-term study, the two-piece Patent Dental Implant System has challenged established definitions of implant success.[1] In this interview, Marco Waldner, founder and CEO of Zircon Medical, the manufacturer of Patent, discusses the study results and the importance of thinking long term in implant dentistry.

How can the study's findings of no peri-implantitis with the two-piece Patent™ be explained?
The development of the Patent™ Dental Implant System was driven by a singular objective: to prevent biological complications such as peri-implantitis from occurring. This is the differentiating factor that sets us apart from other manufacturers. The culmination of our efforts has now been validated through a rigorous scientific study, revealing a complete absence of peri-implantitis, low rates of peri-mucositis, and minimal marginal bone loss.

How does Patent™ accomplish this feat?
In developing this implant system, we followed sound reasoning, considering where peri-implantitis originates—in the soft tissue—and what triggers it—bacteria. Therefore, our primary aim was to establish exceptionally robust soft-tissue attachment so that bacteria simply cannot penetrate past the implant into the tissue. While zirconia is renowned for its favourable soft-tissue response compared with other materials, this property alone does not prevent peri-implantitis. The key lies in optimising the surface quality of the transmucosal portion of the implant for strong and sustained adhesion of soft tissue. We've achieved exactly this with our exclusive Patent™ ceramic, which boasts a unique material composition and is processed using a patented production method.

Fig. 1: The Patent™ Dental Implant System was developed with the goal of avoiding biological late-term complications and ensuring long-term performance.

Can you explain how the Patent™ System works?
The system combines three pivotal components within a comprehensive treatment concept aimed at promoting long-term healthy tissue and sustained performance. Beyond the aforementioned transmucosal requirements, we recognised that we must avoid a microgap at the critical crestal bone level. Research unequivocally indicates that such a microgap significantly amplifies the risk of biological late-term complications, including peri-implantitis. The logical deduction: Patent™ needed to have a soft-tissue-level design and be made entirely of zirconia.

The endosteal implant body, purposefully designed to respect biology, facilitates atraumatic insertion and healing. The Patent™ concept also involves an innovative prosthetic approach: A glass fibre post with dentine-like properties serves as the abutment and attenuates the masticatory forces and transfers them to the implant and the bone favourably. This solution perfectly complements the material properties of the entire system, ensuring long-term stability, sealing against bacteria and offering complete reversibility compared with other connections.

Implants made of ceramic, however, have had mixed results. In the past, they were prone to either fracture or osseointegration issues. Does Patent™ have these problems too?
If one doesn't respect the specific material properties of zirconia, problems can occur. From experience, we know that one cannot simply apply existing geometries or surface treatment methods to a different material and expect the same results. This is precisely why other manufactur-

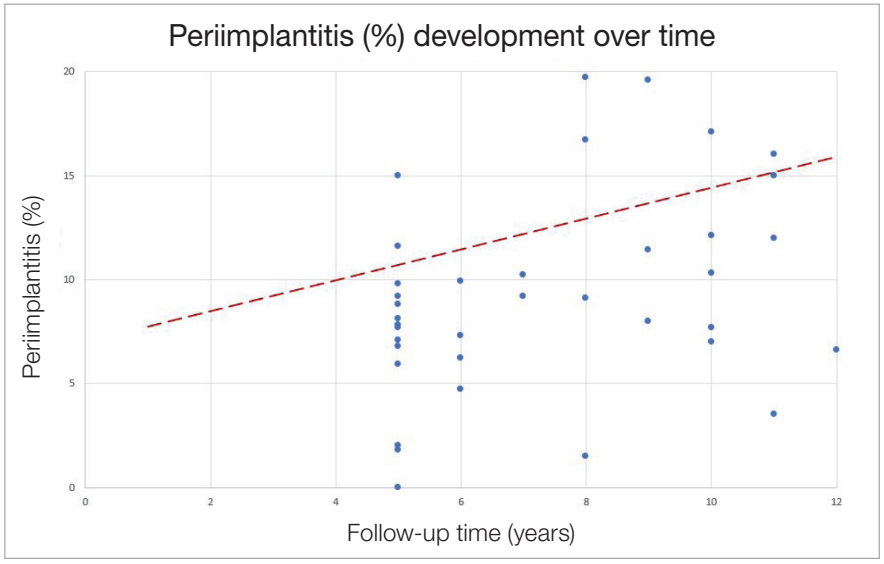

Fig. 2: An analysis of 53 studies suggests that peri-implantitis increases with the time the respective implants have been in function.[2–54] Blue = documented peri-implantitis (%) in the evaluated studies; red = trend line of the collected data.

ers tend to deliver worse results with their zirconia implants than with their titanium systems.

In the case of Patent™, we developed an entirely new and highly complex manufacturing process that expertly balances predictable osseointegration with exceptional fracture resistance. Furthermore, the Patent™ System comprises meticulously designed and harmonised individual components, which together yield exceptional biological, aesthetic and functional long-term results.

You've demonstrated the absence of peri-implantitis in one study, whereas other manufacturers have conducted numerous studies. Couldn't it just have been luck this one time?
One could interpret it in a different way: Other manufacturers weren't able to show that peri-implantitis does not occur with their systems, even in hundreds of studies. The independent study conducted on Patent™ at the Heinrich Heine University Düsseldorf is the only study that has demonstrated no peri-implantitis—even over a period of nine and a half years.

Who is your typical user?
Patent™ caters to practitioners seeking an implant system that not only performs well over an extended period, but also sustains the health and stability of the hard and soft tissue. Those prioritising reliable tissue integration, sustained soft-tissue health, no bone loss and aesthetically pleasing outcomes inevitably turn to our solution.

Zircon Medical, the company behind Patent™, is now an independent entity. How do you distinguish yourselves amidst the industry giants?
We follow a clear strategy of zero peri-implantitis. This singular focus sets us apart from the competition. Peri-implantitis rates have been alarming for quite some time now, particularly if one considers that there is not a single therapeutic approach able to resolve existing peri-implantitis. Therefore, the goal must be to minimise the risk of peri-implantitis or to prevent it altogether. As the nine-year study on Patent™ has conclusively demonstrated, this goal is indeed achievable. Plus, hundreds of Patent™ users have witnessed this long-term treatment success in their daily practice too.

Literature

about the interviewee

Zircon Medical founder and CEO **Marco Waldner** on the results of the independent long-term study at the Heinrich Heine University Düsseldorf in Germany:[1] "With Patent™, we are pursuing a zero peri-implantitis strategy."

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Consensus-based clinical recommendations

Findings of the 7th ITI Consensus Conference published and available.

At its 7th ITI Consensus Conference, the ITI gathered together more than 90 professionals from all over the world to review the current state of evidence in five areas of topical interest in implant dentistry: surgical techniques, technology, oral medicine, patient benefits as well as implant placement and loading protocols. Based on 13 previously submitted review papers, the participants of the three-day conference prepared consensus statements, clinical recommendations, and recommendations for future research in the following five areas:

- The role of bone dimensions and soft-tissue augmentation on procedures on the stability of clinical, radiographic, and patient-reported outcomes of implant treatment
- Technological developments in implant prosthetics
- Materials and antiresorptive drug-associated outcomes in implant dentistry
- Patient benefits following implant treatment in partially and fully edentulous patients
- Implant placement and loading protocols

"Implants are now a common occurrence in daily practice and consensus-based clinical recommendations are a vital component in an evidence-based approach to implant therapy. Our statements and clinical recommendations will guide the implant dentistry community for the coming five years," said ITI President Charlotte Stilwell. "Open access to all the findings of our Consensus Conferences ensures that as broad an audience as possible can apply the latest evidence-based treatment approaches in their daily practice."

The findings of the 7th ITI Consensus Conference held in Lisbon in May 2023 are now available. Published as a free open-access online supplement to *Clinical Oral Implants Research*, the review papers and reports can be accessed and downloaded from the ITI website as well as the Wiley Online Library.

contact

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SUMMARY SEMINAR EACim 2023

After the 3rd international congress held in Paris last June, EACim has just organised its 2nd major event for 2023. This was a seminar on ceramic implant prosthetics in partnership with the Société de Médecine Dentaire Belge (SMD), which took place in Brussels in September at the Hotel Le Plaza.

EACim is very proud to announce the success of this event, which brought together no fewer than 120 colleagues from all over the world (Europe, Israel, Africa, Japan, etc.) to attend lectures by international experts who gave an exhaustive presentation of the different options for prosthetic reconstructions on different zirconia implant systems.

The morning session was moderated by Dr Pierre Delmelle (SMD Scientific Committee): Dr Pascal Eppe (Belgium), after highlighting the impact of zirconia implants in the concept of immunointegration in modern implantology, showed us the interest of numerous implant-prosthetic solutions to meet the reconstructions he proposes exclusively on zirconia implants in his daily practice.

Dr Fabrice Baudot (France) reviewed the evolution of prosthetic concepts on zirconia implants and the notion of biomimicry. His expertise in periodontal and implant microsurgery has led him to develop a therapeutic concept aimed at improving patients' quality of life, in which he integrates the zirconia implant. He showed that ceramic implantology has now reached maturity, and is able to offer prosthetic solutions adapted to all clinical situations.

He addressed the notion of biomimicry in implantology, and showed that zirconia implants now enable us to offer restorations that are closer to the natural tooth.

In the afternoon session, moderated by Dr Selena Toma of UCL: Dr Marcel Wainright (Germany), associate professor at the University of Seville and world-renowned

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clinician, underlined the important role that zirconia implants can play in the preventive strategy against peri-implantitis. Through a number of clinical cases, he showed how zirconia implants could be the solution for treating complex situations following implant failures.

Dr Marc Nacar demonstrated that zirconia implantology is perfectly adapted to modern treatment plans by integrating digital treatment flows for prosthetic restorations. Zirconia implant systems have fully embraced the digital approach to implantology, and today offer simple, reliable solutions that improve the quality of life of patients and the entire treatment team.

This seminar, attended by young students, researchers and numerous professionals, demonstrates the dynamism of ceramic implantology, supported by the EACim's educational mission.

Ceramic implantology is on the road to maturity, offering a serious alternative to titanium and a preventive approach to peri-implantitis, with implant-prosthetic components closer to the natural tooth.

The EACim would like to thank all its loyal partners for supporting this event and helping to advance the practice of zirconia implantology.

We would like to inform you of a similar event to be organised by EACim in Madrid on 15 June 2024 at the University of La Salle in partnership with SCOI (Sociedad Científica de Odontología Implantológica).

We hope to see many of you at this seminar.

We encourage you to join the EACim by becoming a member, and to follow with us the path of the future of implantology.

EACim website

contact

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www.eacim-ceramic-implantology.com

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DIGITAL TRANSFORMATION in CERAMIC IMPLANTOLOGY— the future is now

3rd JCCI congress marks new frontiers and evolves

The 3rd JOINT CONGRESS for CERAMIC IMPLANTOLOGY held at the SWISS BIOHEALTH EDUCATION CENTER in Kreuzlingen, Switzerland, on 13 and 14 October, was nothing short of a remarkable gathering in the field of dental medicine.

With "DIGITAL TRANSFORMATION in CERAMIC IMPLANTOLOGY" as its central theme, the congress proved to be a pivotal event in the world of implant dentistry.

Year after year, the JCCI continues to grow in stature and reputation, and this third edition was no exception. Participants from around the globe descended upon the picturesque Swiss town to partake in this two-day intellectual feast. The venue was filled to its absolute capacity, a testament to the immense interest and enthusiasm surrounding the subject of ceramic implantology.

Moreover, this 3rd JCCI, held in 2023, featured 12 amazing speakers who presented the newest research and topics on digital transformation in ceramic implantology. Their insights will prove to be invaluable in shaping the future of the field.

In addition to the informative sessions, attendees were treated to an extraordinary experience with two live operations conducted at the neighbouring SWISS BIOHEALTH CLINIC. These live operations provided a unique opportunity to witness cutting-edge techniques and procedures in ceramic implantology, reinforcing the practical and hands-on aspect of the congress.

Throughout the congress, experts and thought leaders in the field shared groundbreaking insights into the latest advancements in ceramic implantology. Attendees had

the opportunity to engage in thought-provoking discussions and presentations, gaining invaluable knowledge that will undoubtedly shape the future of this specialised area of dentistry.

From innovations in digital imaging and treatment planning to discussions on the role of artificial intelligence in implantology, the 3rd JCCI provided a comprehensive overview of the transformative potential of digital technologies in the field. Delegates left the congress with a deeper understanding of the future landscape of ceramic implantology, inspired and equipped to enhance their practices with the latest digital tools and techniques.

As the JCCI continues to evolve and expand, its impact on ceramic implantology grows stronger, leaving no doubt that it will remain a cornerstone in the journey toward revolutionising the world of dental medicine.

One of the highlights of this year's congress was the WHITE NIGHT PARTY, held on the evening of 13 October. The event was nothing short of legendary, with a line-up that included TomX the Sax, DJ Matt Nautique, and an exciting new addition, the talented singer Rachele. As the night unfolded, the dance floor came alive with an energy that only a gathering of dental professionals can muster, celebrating the exchange of ideas and the camaraderie that the JCCI fosters.

Anticipation is already building for the 4th JOINT CONGRESS for CERAMIC IMPLANTOLOGY, slated to take place on 11 and 12 October 2024 at the SWISS BIOHEALTH EDUCATION CENTER in Kreuzlingen. Following the success of the previous editions, the 4th JCCI promises to be an even more significant event in the world of implant dentistry.

The theme for the upcoming congress, "Promising Trends in GBR" (Guided Bone Regeneration), is already generating excitement among dental professionals and researchers worldwide. This theme underscores the commitment of the JCCI to remain at the forefront of developments in the field, shedding light on the latest trends and innovations in guided bone regeneration.

The 4th JCCI is set to bring together an international array of experts, practitioners, and enthusiasts in ceramic implantology, all eager to explore and discuss the most promising advancements in guided bone regeneration.

Please use the following QR code to place your name on the non-binding booking list.

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JCCI non-binding booking list

SAVE THE DATE

Annual Meeting of ISMI

Save the Date: 8th Annual Meeting of ISMI in May in Hamburg

Under the theme "Ceramic Implants—State of the Art", ISMI invites you to its 8th Annual Meeting on 3 and 4 May 2024 at the EMPIRE RIVERSIDE HOTEL Hamburg.
Renowned experts and practitioners from home and abroad will discuss practical experiences and current trends in the use of ceramic implants, as well as biological aspects of metal-free implantology, with participants on both congress days. Parallel to the ISMI Annual Meeting, and with some joint podiums, the annual congress of the German Society for Cosmetic Dentistry e.V. (DGKZ) will take place.

The two-day event includes a pre-congress symposium and table clinics on Friday as well as scientific lectures on Saturday. Also, there will be the traditional ISMI White Night on Friday evening in Hamburg.
The programme is currently in preparation. However, interested parties can already make a reservation by sending an e-mail to event@oemus-media.de.

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Z-SYSTEMS

Breakthrough technology in dental implantology

Z-SYSTEMS ceramic implants, a pioneer and leading innovator in dental implant technology, proudly announces the official relaunch of its highly anticipated bone level and tissue level 100% ceramic, screw-retained conical connection implants. Leveraging over 15 years of research, development, and clinical expertise, Z-SYSTEMS has revolutionised the field of implant dentistry with this groundbreaking solution.
Designed to provide unparalleled aesthetics, durability, and biocompatibility, Z-SYSTEMS' bone level and tissue level ceramic implants offer a transformative alternative to traditional metal implants. These state-of-the-art implants combine the advantages of zirconia ceramics with an innovative two-piece conical connection, resulting in outstanding stability and long-term success rates.

Key features and benefits of Z-SYSTEMS bone level and tissue level ceramic implants include:
- Two-piece, screw-retained conical connection: This design ensures a micro-gap-free fit and eliminates the risk of a pump effect, delivering optimal long-term performance.
- Superior aesthetics: The tooth-coloured zirconia material closely resembles natural teeth, creating seamless and lifelike restorations.
- Enhanced biocompatibility: Z-SYSTEMS' zirconia implants biocompatible material with excellent tissue acceptance, ensuring healthy osseointegration and long-term success of the implant.
- Outstanding durability: Zirconia's exceptional strength and fracture resistance make Z-SYSTEMS' implants as durable as it and suitable for a wide range of clinical cases.

To celebrate the relaunch, Z-SYSTEMS will be hosting live surgical training sessions and other educational courses for dental professionals worldwide through the end of this year and throughout 2024. The comprehensive training programme will equip practitioners with the necessary knowledge and skills to integrate Z-SYSTEMS' ceramic implants into their practice successfully. Z-SYSTEMS will kick off the series of live surgical training courses hosted in Chicago, Los Angeles, New York City and abroad, with their first training session in November 2024. Interested participants can e-mail sales@zsystems.com for details.

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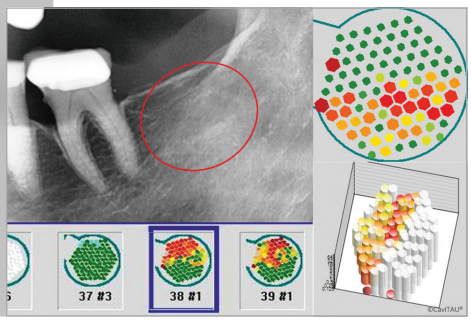
The particular strength of CaviTAU® lies in the combination of minimally invasive application and diagnosis. The software enables the interpretation of bone structures, bone composition and anatomical subtleties. This leads to a level of reporting that was previously difficult to achieve—an individualised image of each patient's jawbone. Digital colour evaluations allow easy interpretation of the condition of the jawbone.

The precision with which the ultrasound device works minimises the risk of complications and increases the chances of success of each implantation. Specifically, the chance of an accelerated healing process is increased if the ultrasound measurement performed in advance means that the implantation is carried out in a healthy jawbone.

"CaviTAU® technology is redefining the way we look at implantation," explains Dr Dr Michael Rak, renowned implantologist and user of CaviTAU®. "The combination of state-of-the-art diagnostics and predictable safety for oral surgical procedures allows us to take patient care to a new dimension."



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Dentalpoint

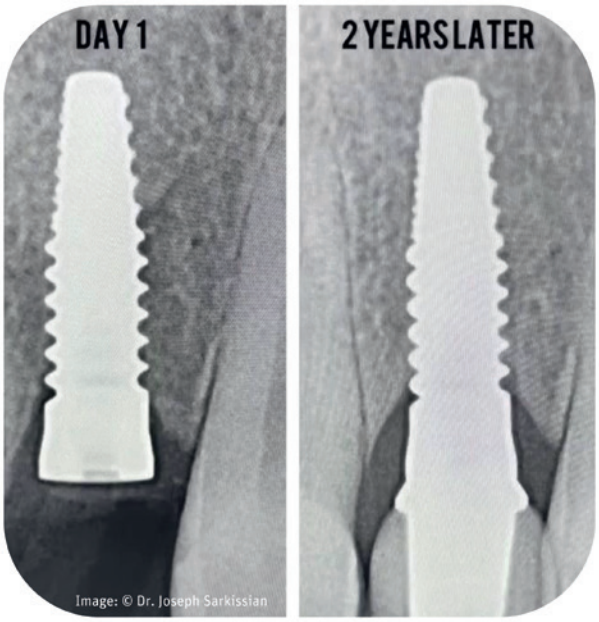
Zeramex XT—Two years follow-up proves success of the two-piece system

Zirconia, the dental material of the future, the two-piece design of the implant, the unique carbon fibre reinforced implant–abutment connection, the conventional and digital workflow as well as the outstanding clinical results are the pillars of success of the Swiss ceramic implant system Zeramex XT.

The heart of the implant–abutment connection is the VICARBO screw made of carbon re-inforced high-performance PEEK. The principle: the implant made of zirconium dioxide absorbs the compressive forces, while the VICARBO screw counteracts tensile and bending forces. The design of the external thread ensures high primary stability and the microrough and hydrophilic Zerafil surface demonstrates convincing osseointegration with a success rate of 98%.

"…Astounding bone structure after remodel revealing hard cortical bone with absolutely no bone loss from around the implant (Zeramex XT 3.5 mm placed in the anterior region) … The gum response was amazing…," points out Dr Joseph Sarkissian who has been using Zeramex XT for several years.

Studies confirm that two-piece zirconia implants show a similar bone integration compared to the titanium implants or demonstrate a significantly reduced inflammation and bone loss compared to the titanium implants.



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ZiBone

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With our state-of-the-art products, we aim to equip dentists with the tools they need to create beautiful, natural-looking smiles for their patients. We will delve into the key features and benefits of our products, and how they can enhance your practice and patient outcomes.

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- Biocompatibility: Zirconia's biocompatibility reduces the risk of allergic reactions and inflammation, fostering a healthy healing process.
- Optimal osseointegration: The advanced design of ZiBone zirconia implants with Ra 0.6 µm surface treatment, facilitates reliable osseointegration, promoting stable and successful implant placements.
- Versatility: Our products cater to a wide range of dental cases, enabling you to provide personalised solutions for each patient's unique needs. Implant dimension 3.6/4.0/5.0 with different length 8/10/11.5/13/14.5.

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bredent medical

High primary stability and aesthetic appearance

The whiteSKY implant system from bredent is among the best-documented zirconia implant systems worldwide. It has not only demonstrated excellent osseointegration and longevity in numerous studies but has also proven its efficacy in practice. In fact, the longevity of whiteSKY implants is comparable to that of titanium implants. The whiteSKY implant system offers two different implant types: the whiteSKY Tissue Line and the whiteSKY Alveo Line. The narrow whiteSKY Tissue Line implant provides sufficient space for both the hard and soft tissue and ensures an aesthetically pleasing appearance with its slightly tapered shape in the sulcus area, transitioning from the gingiva to the implant crown. The whiteSKY Alveo Line, on the other hand, is ideal for immediate loading as it fills the extraction socket. At the same time, it provides the treating doctor with the possibility to individualise the implant according to the specific requirements of the clinical case.

Optimal conditions for soft-tissue attachment and high mechanical stability

Both the Alveo and Tissue Line implants of the whiteSKY system offer optimal conditions for soft-tissue attachment due to their specially designed sulcus surface. The whiteSKY implants are made of hardened zirconia and are one-piece, which gives them particularly high mechanical stability. Thanks to the improved thread design and bone-quality-oriented surgical protocol, the whiteSKY implants achieve high primary stability, making them ideal for immediate loading. Studies have shown that immediate implant placement can improve the bone–implant contact by more than 50 per cent.

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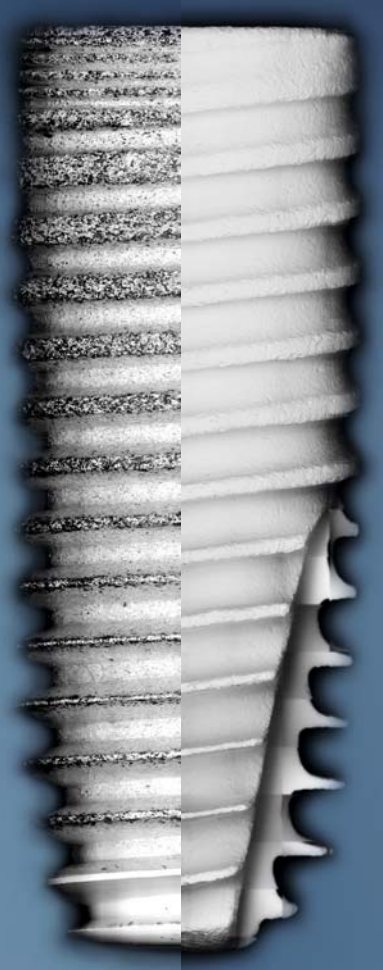

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