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The right measures at the right time

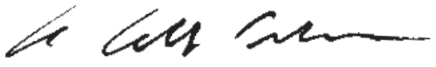
It was certainly one of the more memorable press conferences in recent dental history that Henry Schein held online on late Thursday afternoon at the end of February. Stanley M. Bergman, chairman of the board and CEO of Henry Schein, elaborated on questions about moral duties and entrepreneurial responsibility in times of a global health crisis. All over the world, people are losing trust in their governments, according to Bergman. It has become apparent that businesses are able to react more swiftly to the challenges posed by the pandemic than are governmental institutions owing to their innovation strength and flexibility. Procurement of validated personal protective equipment and especially vaccine development come to mind here. Bergman spoke in favour of global efforts to improve material and infrastructural requirements of healthcare systems to better fight the current and future pandemics.

In Germany, political entities and expert dental associations quickly switched to crisis mode, implementing improved hygiene guidelines in order to maintain dental care during lockdown. In an unprecedented response, it was the dental practices themselves who streamlined their patient management, readjusted their already outstanding hygiene protocols and implemented infection protection in shift operations, and thus strongly consolidated patients' trust in dental care. In doing so, Germany-based dentists set an international example.

The latest numbers from the German statutory occupational accident insurance association for non-state healthcare and welfare institutions in the Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW) prove that, not only patients, but also practice staff are well protected against infections by consistent hygiene measures. In 2020, the BGW recorded 19,774 reportable occupational suspected cases of SARS-CoV-2—only 85 of which were related to the dental profession. Of course, these figures only hold true for Germany. Nevertheless, they bolster dental offices worldwide, because they indicate that, for dentists and their staff, a sustainable way out of the crisis with comparatively few infections is possible by appropriate crisis management in combination with a high standard of hygiene.

In this spirit, I wish you pleasant reading of the new implants—**international magazine of** oral implantology, continuously safe practice management and a great deal of courage to support your patients. After all, implantology is an integral part of sustainable healthcare!

Yours,



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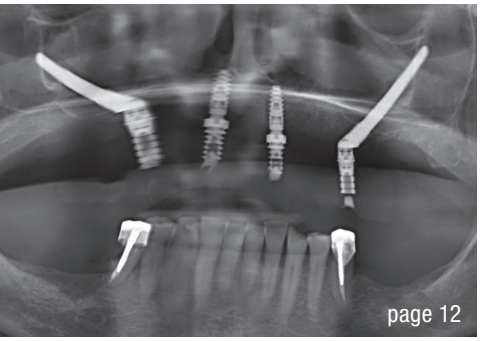
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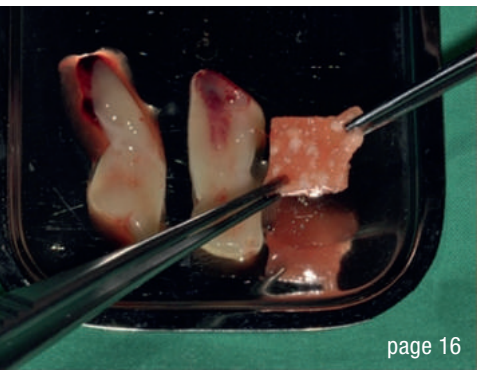
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The key role of vitamin D in immune health and regeneration

The evidence for supplementation

Prof. Shahram Ghanaati, Dr Karl Ulrich Volz & Dr Sarah Al-Maawi, Germany & Switzerland

A healthy immune system is the basis of general good health and a good immune defence. It has been proved that individual habits, nutrition and the environment have an influence on our health.[1] A balanced and healthy diet in particular is the key to a healthy human body. An unbalanced diet can seriously impair the immune system and increase the risk of chronic disease as a result.[1] In the last decade, chronic diseases such as diabetes mellitus, obesity and cardiovascular disease have surged sharply in various countries. A major reason for this is an increasingly unhealthy living environment and increasingly unhealthy lifestyle choices, especially in industrialised countries.[2] The role of food components and especially vitamins has become increasingly important in various areas. In 1928, the German biochemist Adolf Windaus was awarded the Nobel Prize in Chemistry for his work on the correlation between sterols and vitamins, which sparked further research interest in vitamin D.[3]

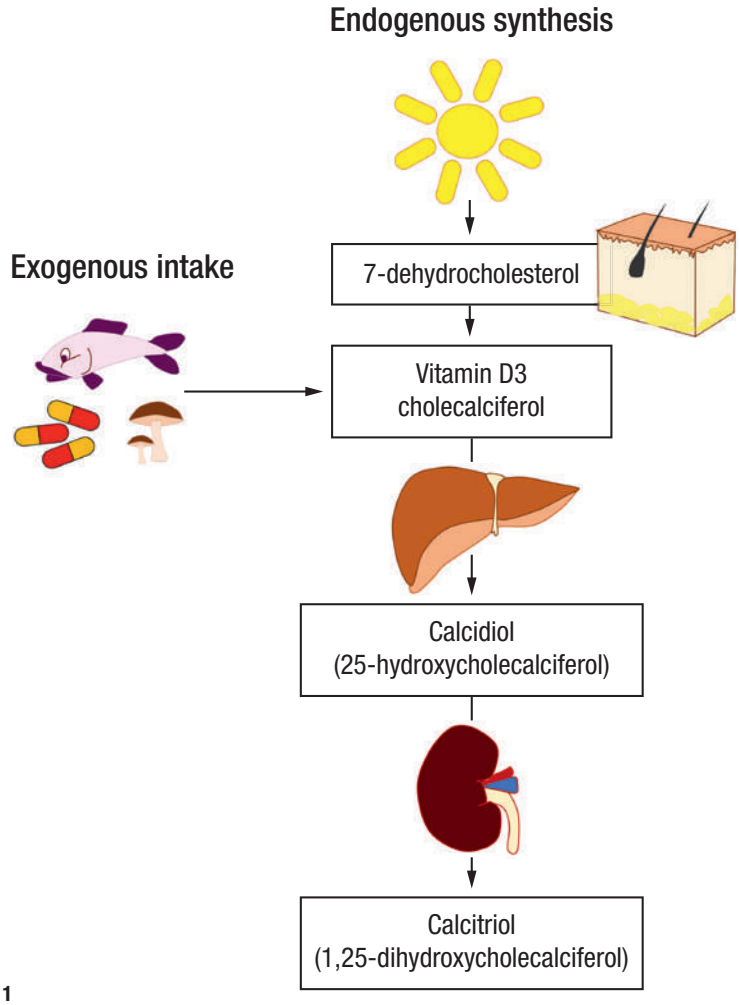

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Fig. 1: Diagram for endogenous synthesis and exogenous vitamin D3 intake.

Vitamin D can be produced in a physiological way in the human body. Sunlight is essential for this endogenous synthesis, which takes place primarily in the skin, where 7-dehydrocholesterol is converted into cholecalciferol (vitamin D3) by UVB rays. In order to reach its biologically active form, cholecalciferol undergoes further conversion steps in the liver (calcidiol) and in the kidney (calcitriol). The latter is the biologically active form of vitamin D and acts as a transcription factor. After binding to the vitamin D receptor, calcitriol regulates the expression of various proteins in the cell. The physiological mode of action of calcitriol therefore resembles that of a hormone and not that of a vitamin. That is why vitamin D, as a precursor of calcitriol, should rather be regarded as a prohormone (Fig. 1).[4,5] The connection between vitamin D and parathyroid hormone was recognised shortly after its discovery. Within this context, the regulatory effect of vitamin D on the mineral balance of the body and in particular the regulation of calcium and phosphate levels was emphasised.[6–8] Furthermore, it was established quite early on that vitamin D plays an important role in mineralisation and bone formation. Consequently, many studies have focused on the influence of vitamin D on skeletal health and the treatment of diseases such as osteoporosis. These findings have contributed to vitamin D being primarily associated with bone health in the public perception.

However, some studies have shown the positive effect of vitamin D on the immune system too and thus on the general health of the body. Several studies have shown that vitamin D has a preventive effect on chronic diseases such as diabetes mellitus, hypertension and cardiovascular dis-

ease.[9] Studies also report its potential anti-inflammatory and antiviral effects.[10] In this context, it has been shown that vitamin D supplementation in pupils could reduce the incidence rate of influenza virus infection.[11] These rather new findings and the immunomodulatory effects of vitamin D demonstrate the importance of maintaining healthy vitamin D levels in the body. Since endogenous vitamin D synthesis is compromised by relatively short exposure to sunlight in most countries, the need for exogenous supply is becoming increasingly important. However, the intake of vitamin D through food seems to be insufficient in the general population, which has contributed to a global vitamin D deficiency pandemic.[12] This pandemic has already been documented and reported in numerous studies in various countries.[13] Nevertheless, its importance is still mostly under-estimated in most countries.

The concept of supplementation with vitamin D preparations was first introduced in the 1940s. Today, 90 years later, there are still no uniform recommendations regarding the dose to be taken. One of the reasons for this is the historical development and the association of vitamin D with bone health and the new knowledge about its further extensive capabilities. Although there is a growing amount of data on the non-skeletal effects of vitamin D and its preventive role in many chronic diseases, current dose recommendations are still based solely on bone requirements. Another issue is the difficulty in standardising methods for the determination of serum vitamin D levels. This review therefore focuses on the non-skeletal effects of vitamin D and its supplementation dose based on randomised controlled clinical trials. It provides an overview of the new findings and treatment protocols.

Immune system booster in the case of chronic and infectious disease

There is increasing interest in the study of the immune system-supporting mechanisms of vitamin D. Interestingly, the majority of body cells express vitamin D receptors on their surfaces, which emphasises the multimodal action of vitamin D. Owing to its regulatory effect, the active form of vitamin D as a hormone can intervene in the synthesis of various cytokines and regulate them according to their condition.[14] It has been shown that vitamin D inhibits the production of pro-inflammatory cytokines, whereas it up-regulates the synthesis of anti-inflammatory signal molecules.[5] In this way, it exerts its immunomodulatory effect and supports the differentiation of lymphocytes into Th2 cells and regulatory T cells.[14] This could explain its potential preventive influence in chronic and infectious diseases. However, these mechanisms of action still remain largely unexplained for the respective indications.

The correlation between vitamin D levels and the prevalence of various chronic diseases has been shown in several clinical studies. A meta-analysis of 25 prospective cohort studies has shown that low vitamin D levels increase the risk of developing cardiovascular disease. In about 10,000 patients, the risk of cardiovascular disease was about 44 % higher than in people with healthy vitamin D levels.[15] Another study showed a correlation between vitamin D levels and the development of hypertension. It examined 8,155 patients suffering from hypertension and vitamin D deficiency. After the vitamin D deficiency had been eliminated, 71 % of the patients no longer showed any symptoms or had measurably high blood pressure.[16] A positive influence of vitamin D has also been demonstrated in the development of Type 2 diabetes mellitus. It was shown that the number of patients in a prediabetic stage and with a vitamin D deficiency was significantly lower than in the untreated group, once the vitamin D deficiency had been eliminated.[17]

Furthermore, the potential of an anti-infectious or antiviral effect of vitamin D has been increasingly investigated in recent years. As a result, vitamin D has gained greater significance as a preventive or adjuvant therapy.[11,18] A systematic review has shown that a vitamin D deficiency is associated with a higher viral load in hepatitis B patients.[19] Furthermore, it was shown that vitamin D can inhibit a herpesvirus infection through its anti-inflammatory and supportive defence effect.[20] In addition, studies have shown that vitamin D supplementation reduces the prevalence of influenza infections during influenza outbreaks.[21] Another meta-analysis showed that the number of certain vitamin D receptor polymorphisms involved in processing of vitamin D correlates with an increased risk of a viral infection. Based on the vitamin D-mediated improved immune defence and its potential role as an antiviral agent, its importance in the prevention of viral diseases is increasingly being investigated. Especially in the COVID-19 pandemic, vitamin D supplementation can play an important role in preventing and defeating infection.[22]

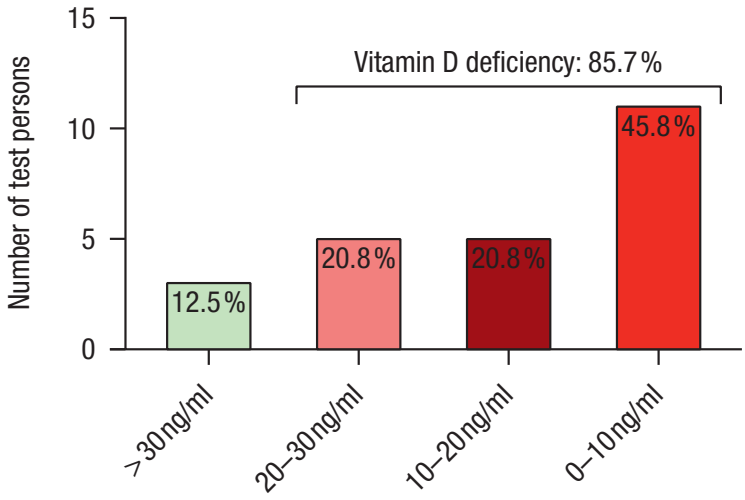

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Fig. 2: Distribution of vitamin D levels according to a pilot study conducted by the Clinic for Oral and Maxillofacial Plastic Surgery at Goethe University Frankfurt am Main.

Determination of vitamin D levels and definition of hypovitaminosis

Vitamin D is a lipophilic molecule that is transported in the blood by carrier proteins. Approximately 80 % of these molecules are bound to the vitamin D binding protein in this manner. A further 10–15 % are bound to albumin and the rest circulates freely in the blood. The determination of the vitamin D level as part of a routine examination involves measuring the total concentration of all these forms. The 25(OH)D serum concentration is widely recognised as a reliable marker of vitamin D levels.[12] Similar to other vitamins and blood components, the vitamin D concentration is usually expressed in nanograms per millilitre (ng/ml) or in nanomoles per litre (nmol/l). Both units are used, depending on the individual testing laboratory. Here, it must be noted that 1 nmol/l equals 0.4 ng/ml. The definition of a healthy vitamin D level and thus hypovitaminosis is a matter of much debate. In the literature, a vitamin D level of less than 30 ng/ml (75 nmol/l) is considered a vitamin D deficiency (hypovitaminosis).[13,19,23,24] In various countries, studies have reported a general vitamin D deficiency. Observational studies have documented that the prevalence of vitamin D levels of below 20 ng/ml (50 nmol/l) is as much as 24 % in the US, 37 % in Canada and 40 % in Europe.[13,24] The German Robert Koch Institute reported that 58 % of 18- to 79-year-olds in Germany have a level of below 20 ng/ml (50 nmol/l).[25] This vitamin D deficiency pandemic was recognised as such several years ago. However, not much has been done in terms of supplementation and defining a sufficient dose. A pilot study examined the vitamin D levels of medical staff in the clinic for oral and maxillofacial plastic surgery at Goethe University in Frankfurt am Main in Germany. Out of 24 participants, 85.7 % had a vitamin D deficiency with a value below 30 ng/ml, whereas 45.8 % even had a value of below 10 ng/ml (Fig. 2). It is important to emphasise that a healthy vitamin D value is considered to be between 40 ng/ml and 60 ng/ml.

Current guidelines for vitamin D supplementation

Given that, in most cases, endogenous synthesis of vitamin D is insufficient owing to limited exposure to sunlight, the body's vitamin D intake should also come from food or dietary supplements. The amount of vitamin D absorbed can be expressed in two units: micrograms (µg) and international units (IU). One microgram equals 40 international units (1 µg equals 40 IU). These units

must be considered when administering vitamin D. Since in most cases vitamin D intake via food is insufficient for the body's needs, supplementation with vitamin D preparations is an utmost necessity. In the literature, the current recommendations for doses to be administered are largely inconsistent and are mainly based on the estimated requirements of maintaining optimal bone health. The recommendations range from 400 IU/day to 4,000 IU/day. The European Food Safety Authority recommends a dose of 600 IU/day for healthy adults.[22] A similar recommendation, a dose of 400 IU/day, has been published by the Scientific Advisory Committee on Nutrition in the UK.[26] The Institute of Medicine Committee in the US recommends a dose of 600 IU/day for adults under 70 years of age and a dose of 800 IU/day for those over that age.[27] The American Association of Clinical Endocrinology recommends a dose of 1,000–4,000 IU/day.[28] The recently updated reference values of 2012 from the German

Category	Dose	Administration duration	Initial concentration	Targeted concentration	Side effects
Prevention in pupils[21]	1,200 IU/day	12 months	Not specified	Not specified	None
Cancer, cardiovascular disease[30]	2,000 IU/day	12 months	29.8 ng/ml	41.8 ng/ml	None
Diabetes mellitus[17]	4,000 IU/day	12 months	28.0 ng/ml	52.3 ng/ml	None
	4,000 IU/day	24 months	28.0 ng/ml	54.3 ng/ml	None
Ventilated patients in intensive care[31]	50,000 IU/day	5 days	23.2 ng/ml	45.0 ± 20.0 ng/ml	None
	100,000 IU/day	5 days	20.0 ng/ml	55.0 ± 14.0 ng/ml	None
Test persons with a vitamin D deficiency[32]	25,000 IU/fortnight	2 months	7.6 ng/ml	19.0 ng/ml	None
	25,000 IU/week	1.5 months	8.0 ng/ml	25.0 ng/ml	None
	25,000 IU/week	2 months	8.4 ng/ml	35.6 ng/ml	None
Test persons with a vitamin D deficiency[33]	1,000 IU/day	5 months	28.8 ng/ml	33.6 ng/ml	None
	5,000 IU/day		27.0 ng/ml	64.0 ng/ml	None
	10,000 IU/day		26.0 ng/ml	89.6 ng/ml	None
Breast cancer patients with bone metastasis[34]	7,000 IU/day	4 months	< 20.0 ng/ml	Not specified	None
Psychiatric clinic[24,35]	5,000 IU/day	12 months	24.0 ng/ml	68.0 ng/ml	None
	10,000 IU/day	12 months	25.0 ng/ml	96.0 ng/ml	None
Test persons with a vitamin D deficiency[36]	100,000 IU/month (3,000 IU/day)	36 months	24.4 ng/ml	54.0 ng/ml	None
Multiple sclerosis[37]	20,000 IU/day	12 months	21.6 ng/ml	44.0 ng/ml	None
Multiple sclerosis[38]	50,000 IU/week (7,142 IU/day)	6 months	15.3 ng/ml	33.7 ng/ml	None
Asthma, rheumatic arthritis, rickets, tuberculosis in the 1930s and 1940s[24,39]	60,000–600,000 IU/day	Not specified	Not specified	Not specified	Hypercalcaemia as a result of over-physiological vitamin D concentrations

Table 1: Overview of the vitamin D doses administered in selected randomised clinical studies.

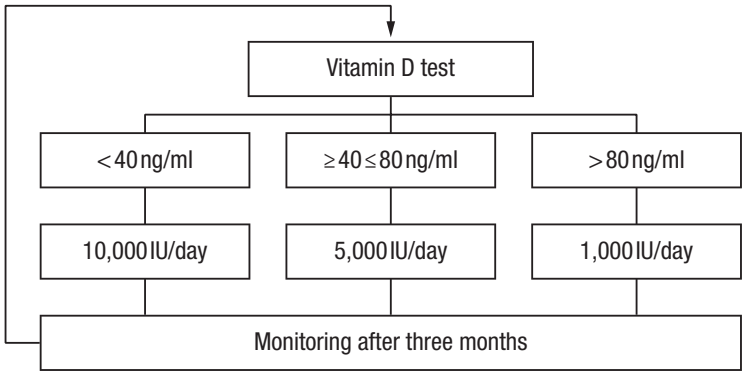

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Fig. 3: Vitamin D3 dose recommendation of the authors for healthy adults.

Nutrition Society estimate the need at 400 IU/day for children and 800 IU/day for adults.[25] The US research institute GrassrootsHealth collected data on the safety of a dose of 10,000 IU/day and found no undesirable side effects.[24,29] The European Food Safety Authority also classifies a dose of 10,000 IU/day as safe, but recommends no more than 4,000 IU/day.[22]

Clinical supplementation protocols in randomised controlled clinical studies

As opposed to the recommendations of various authorities and institutions, relatively high doses of vitamin D have been administered in randomised controlled clinical trials, and these have in most cases led to the support of therapy. Various clinical supplementation protocols have been used with doses ranging from 1,000 IU/day to 100,000 IU/day. Two different strategies have been pursued: one option is to administer a relatively high dose, such as 100,000 IU, once a month to raise and maintain vitamin D levels; and the other option is to supplement with an adequate daily dose (between 5,000 IU/day and 10,000 IU/day) to cover the body's daily requirements. Most studies have documented an observation period of up to one year and have paid particular attention to the analysis of the dreaded side effect of vitamin D intoxication. However, no vitamin D intoxication was observed in any of these studies. A detailed overview of the respective studies is given in Table 1. Not long after the discovery of vitamin D and the recognition of its role in maintaining mineral balance, many diseases, such as asthma, rickets and tuberculosis, were treated in the 1930s and 1940s with extremely high daily doses of vitamin D (between 60,000 IU/day and 600,000 IU/day). These studies reported hypercalcaemia as a result of over-physiological vitamin D concentrations, which led to growing concern regarding vitamin D supplementation. It is important to note that these studies were carried out with much higher doses than the ones currently administered.

Authors' dose recommendation for healthy adults

Today, the importance of vitamin D for the general health of the body and the immune system is well documented. A vitamin D value of between 40 ng/ml and 80 ng/ml should be aimed for. In contrast to the doses recommended by various associations, there is increasing evidence in current research that a relatively high daily dose is necessary to reach these values. However, there are no uniform guidelines at this point. Based on the investigated data, we recommend a daily dose that is adapted to the individual needs of the patient. In the case of a vitamin D deficiency (< 40 ng/ml), a dose of 10,000 IU/day should be administered for three months to compensate for the deficiency. As a maintenance dose for a vitamin D level in the range of 40–80 ng/ml, a dose of 5,000 IU/day is recommended. If the level is higher than 80 ng/ml, it is advisable to reduce the dose to 1,000 IU/day. The vitamin D level should be checked every three months in order to adjust the dose to the individual needs of the patient (Fig. 3). When supplementing vitamin D, it is equally important to take the patient's medical history into consideration and, in the case of compromised organ function or metabolic disease, to individualise the dose accordingly.

Prof. Shahram Ghanaati Author details

Dr Karl Ulrich Volz Author details

Dr Sarah Al-Maawi Author details

about the author

Frankfurt am Main-based **Prof. Shahram Ghanaati** is a specialist in maxillofacial surgery and oncology. In 2013, he was appointed Director of the University Cancer Center of the Frankfurt University Hospital. He is the Senior Physician and Deputy Director of the Department of Oral and Maxillofacial Plastic Surgery of the Frankfurt University Hospital. In addition, he is the Director of the research laboratory FORM-Lab (Frankfurt Orofacial Regenerative Medicine).

contact

Prof. Shahram Ghanaati
Universitätsklinikum Frankfurt
Theodor-Stern-Kai 7
60590 Frankfurt am Main, Germany
Phone: +49 69 6301-3744
shahram.ghanaati@kgu.de

Literature

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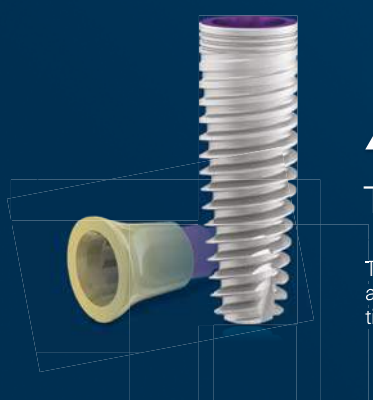

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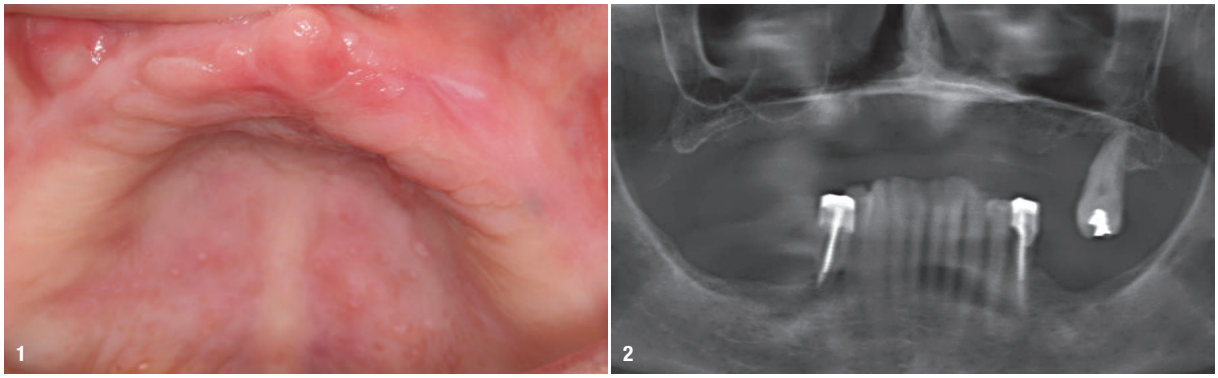

Fig. 1: Initial situation (after third molar extraction). **Fig. 2:** Panoramic radiograph.

Initial situation

A 66-year-old female patient presented to the dental office of the author complaining about her partial denture (she had one remaining natural tooth), which was unstable, caused discomfort and had a poor aesthetic appearance. This denture had been in place for 20 years and had been deficient for more than 15 years.

The patient was a non-smoker and healthy and did not take any medication. The soft tissue was quantitatively and qualitatively in good shape (Fig. 1). There were no molars in the mandible. The panoramic radiograph showed a lack of bone in the posterior of the maxilla (Fig. 2).

Treatment planning

The CBCT scan showed remaining bone in the canine region on both sides and confirmed a lack of bone in the posterior of the maxilla on both sides. The remaining tooth (a third molar) was planned to be removed on the left side, as well as a small piece of root under the mucosa (Figs. 3–5). It was decided to place two regular implants in the anterior area, combined with two Straumann zygomatic implants (one on each side), in order to provide the patient with a complete screw-retained fixed restoration immediately after the surgery. The anatomical situation in the posterior area was classified ZAGA 1/2, and thus two round zygomatic implants were to be inserted. The main advantages

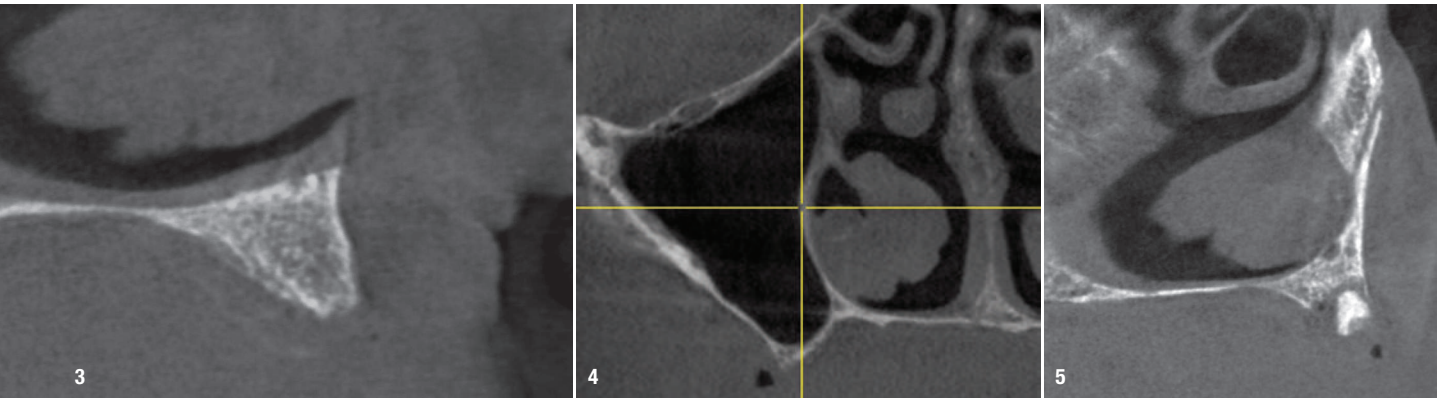

Fig. 3: CBCT scan showing remaining bone. **Fig. 4:** CBCT scan showing the right side. **Fig. 5:** CBCT scan showing the left side with a remaining root piece.

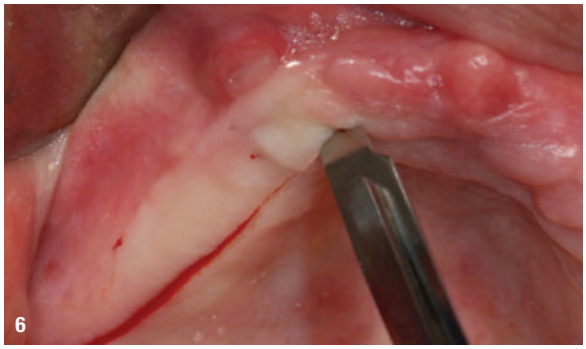
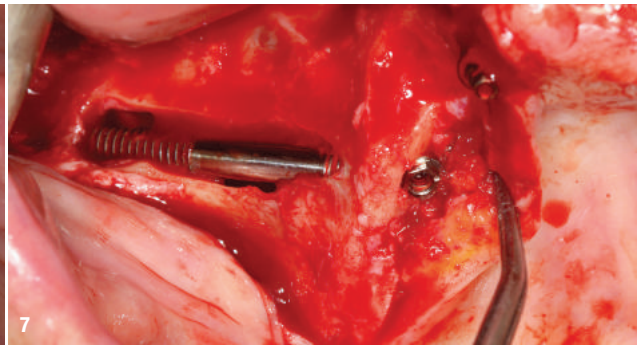

Fig. 6: A large incision was made. **Fig. 7:** Zygomatic implant on the right side.

of this type of implant is that the small-diameter rough surface at the apex of the implants leaves enough space available and the machined threaded part underneath the abutment permits excellent initial stability, which is decisive for performing immediate loading securely.

Surgical procedure

The procedure was conducted under local sedation. The surgery was performed in two phases, first on the right and then on the left side, in order to decrease the time of bone exposure to the environment. This is known to facilitate short-term healing by decreasing swelling. A large incision was made, slightly on the palatal side from the top of the crestal bone, in order to easily dispose the keratinised tissue around the abutment at a later time (Fig. 6). The incision was made starting from the distal part of the tuberosity up to the incisive papilla. An Anthogyr Axiom PX implant (diameter: 3.4 mm; length: 10.0 mm) was placed in the canine region to an insertion torque of 40 Ncm, allowing for immediate loading. A regular multi-unit abutment (gingival height: 1.5 mm; diameter: 4.8 mm; Anthogyr) was screwed on the top to 25 Ncm and covered with a healing cap. For placement of the zygomatic implant and in accordance with the ZAGA 1/2 classification, a long window was created at the anterior wall of the sinus in order to place the head of the zygomatic implant as close as possible to the remaining alveolar crest. This improves comfort for the patient and allows for easier cleaning procedures in the future. The classical drilling procedure, using a round bur and a single drill, was performed, and the implant (ZAGA round Straumann zygomatic implant; length: 40 mm; Institut Straumann) was inserted and tightened to 50 Ncm (Fig. 7). It is important to note that the head of the implant must be fully surrounded by bone, which provides two major advantages: a high level of initial stability and better gingival health, preventing future inflammation.

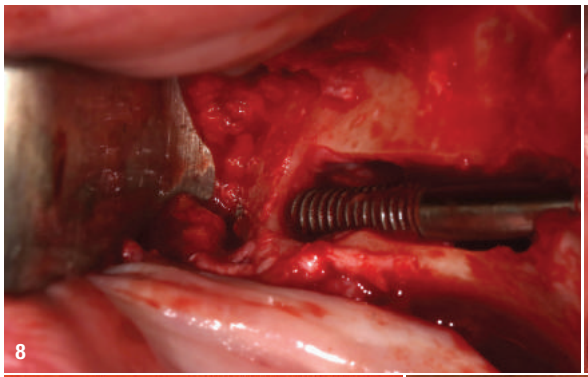
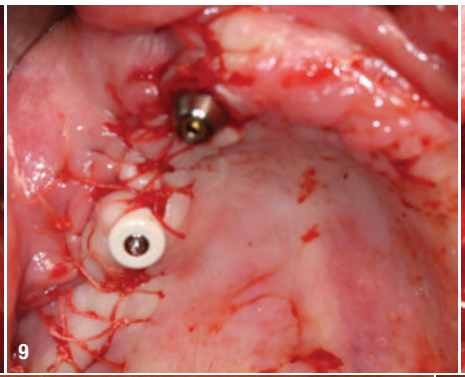
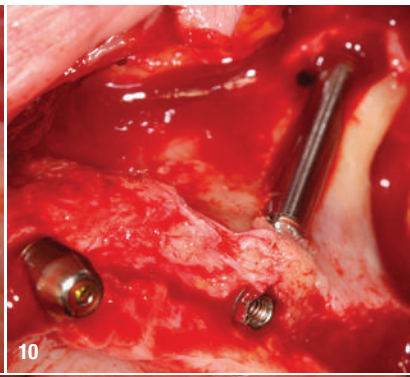
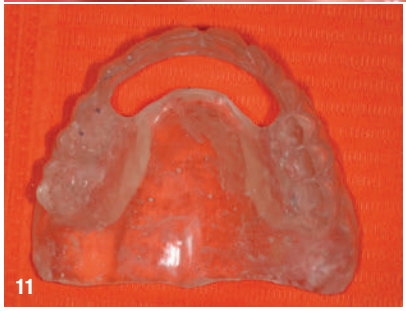
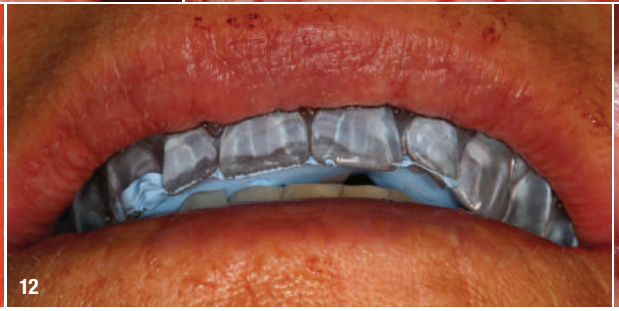
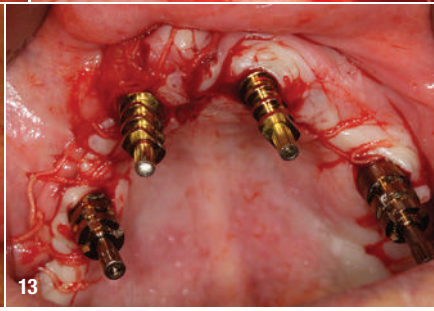

Fig. 8: Note the emergence of the zygomatic implant. **Fig. 9:** Sutures. Note the keratinised tissue around the implant. **Fig. 10:** Zygomatic implant on the left side. **Fig. 11:** Resin occlusal rim with anterior window. **Fig. 12:** Occlusal registration. **Fig. 13:** Transfer copings screwed in place.


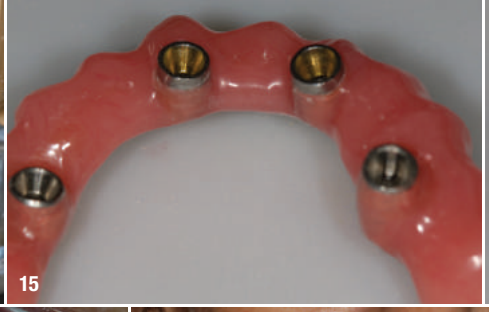
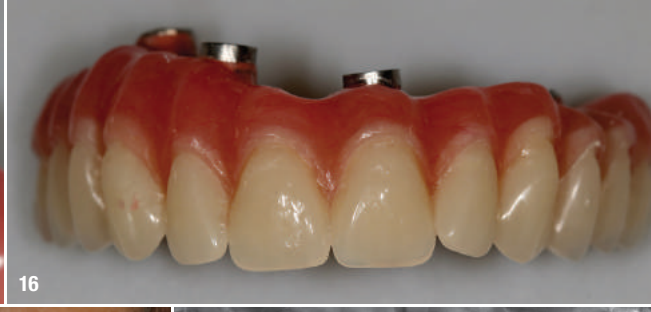
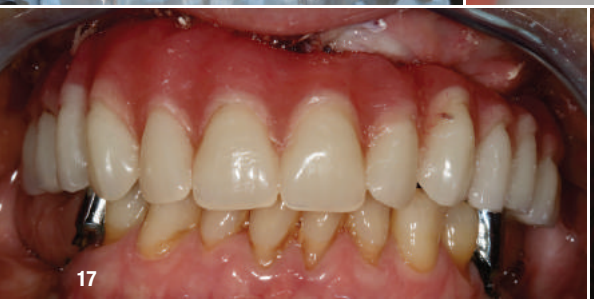
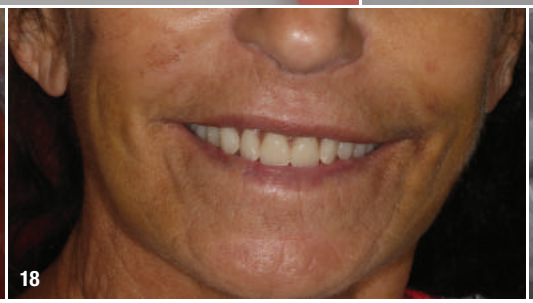
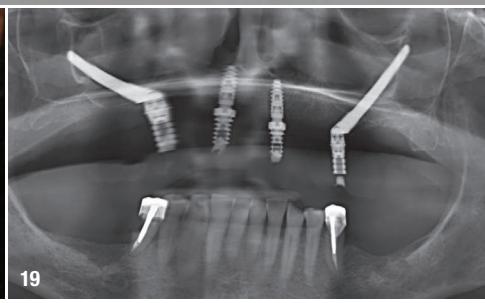

Fig. 14: Template filled with occlusal registration paste used to transfer the model to the articulator. **Fig. 15:** Note the convex shape of the bridge. **Fig. 16:** Frontal view. **Fig. 17:** Clinical situation 3 hours post-op. **Fig. 18:** The patient's new smile. **Fig. 19:** Control dental panoramic tomogram.

Another important parameter for surgical success is the ability to visualise the emergence of the apex of the zygomatic implant at the buccal face of the zygomatic bone. Thus, the surgeon can be sure that the implant is properly in place (Fig. 8). A Straumann multi-unit abutment (gingival height: 1.5 mm; Institut Straumann) was placed, tightened to 35 Ncm and covered with a healing cap. Resorbable sutures were used to close the flap, and particular attention was paid to the soft-tissue management around the abutment, resulting in a thick amount of keratinised gingiva around the abutment (Fig. 9). The second phase of surgery followed the same pattern: a regular implant placed in the anterior (Anthogyr Axiom PX implant; diameter: 3.4 mm; length: 10.0 mm; multi-unit abutment; gingival height: 1.5 mm; diameter: 4.8 mm) and a second ZAGA round Straumann zygomatic implant of 40 mm in length with a 1.5 mm multi-unit abutment placed posteriorly. As for the right side, the anatomical situation (ZAGA 1/2) allowed for the placement of a cervical emergence close to the top of the bone crest with surrounding bone around the implant (Fig. 10). The initially elevated flap was closed with resorbable sutures.

Prosthetic procedure

At the second appointment, an aesthetic try-in was validated by the patient in order to obtain her agreement on the shape and shade of the teeth. This enabled the manufacture of a translucent resin occlusal rim by simple duplication of the try-in (Fig. 11). This approach authorised the occlusal registration, by filling the resin occlusal rim with occlusal registration paste (JET BLUE BITE, COLTENE; Fig. 12) to stabilise it, before placing the material between the two jaws. The exact positions of the implants were registered with a plaster impression, using screwed transfer copings and an open tray (Fig. 13).

Laboratory procedure

The master model was cast in plaster and mounted on a semi-adjustable articulator by means of the template (Fig. 14). The pre-existing acrylic bridge was connected to the temporary titanium cylinders, previously covered with silane to improve the adhesion of the PMMA to the titanium. The bridge must be smooth and convex in all directions (Fig. 15). This hinders plaque retention and eases hygienic maintenance, both parameters which contribute greatly to the long-term prosthetic success (Fig. 16). Approximately 3 hours after the surgery, the bridge was screwed in place, the occlusion was controlled and the ability of the patient to reach every part of it with an interproximal brush was confirmed (Fig. 17). Follow-up instructions regarding mastication (to avoid hard food and eat only what can be cut with a fork) were given, and four appointments were scheduled to double-check the healing process. The patient was invited to show her new smile, and she expressed a high level of initial satisfaction (Fig. 18). A control panoramic radiograph was performed, which confirmed the accurate placement of the implants and superstructure (Fig. 19).

Acknowledgement: The author thanks Jean-Michel Moal, dental prosthetic technician at Verdino dental practice in France, for his outstanding contribution.

about the author

Dr Jean-Baptiste Verdino is a French dentist who graduated from Aix-Marseille University in France in 1985. He currently runs an exclusive private practice in Hyères in France specialising in implant dentistry. In addition, he is an internationally published author with a specific interest in zygomatic implants.

contact

Dr Jean-Baptiste Verdino
13 Avenue Gambetta
83400 Hyères
France
Phone: +33 4 94650551
docjbv@cabinetverdino.fr

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Effectively designing the aesthetic zone

Prof. Bilal Al-Nawas, Dr Keyvan Sagheb, Dr Stefan Wentaschek & Dr Yasmin Habibi, Germany

Medical history

An otherwise healthy 65-year-old male patient presented with a tooth 12 that was not worthy of preservation, and a request for implantological restoration (Figs. 1a–c). The initial situation shows a crown that is clearly angulated vestibular, and inflamed, slightly reddened and swollen vestibular mucosa with partial loss of the papillary tips. First, atraumatic extraction of tooth 12 was performed with preservation of the alveolar walls (Fig. 2a). The vestibular lamella was already resorbed due to the inflammatory process (Fig. 2b) caused by a longitudinal fracture (Fig. 2c). Complementing this, the alveolus was reconstructed in terms of ARP (Alveolar Ridge Preservation) using autologous platelet and fibrin concentrate (platelet-rich fibrin–PRF) in combination with the β-tricalcium phosphate collagen matrix (CERASORB® Foam, curasan; Figs. 3a–c). In order to achieve optimal shaping of the soft tissue, the gap was provisionally addressed with a removable interim prosthesis.

Pre-surgical planning

After a healing phase of 6 months (Figs. 4a–c), the pre-implantological planning was carried out using digital volume tomography and an X-ray template. Evaluation

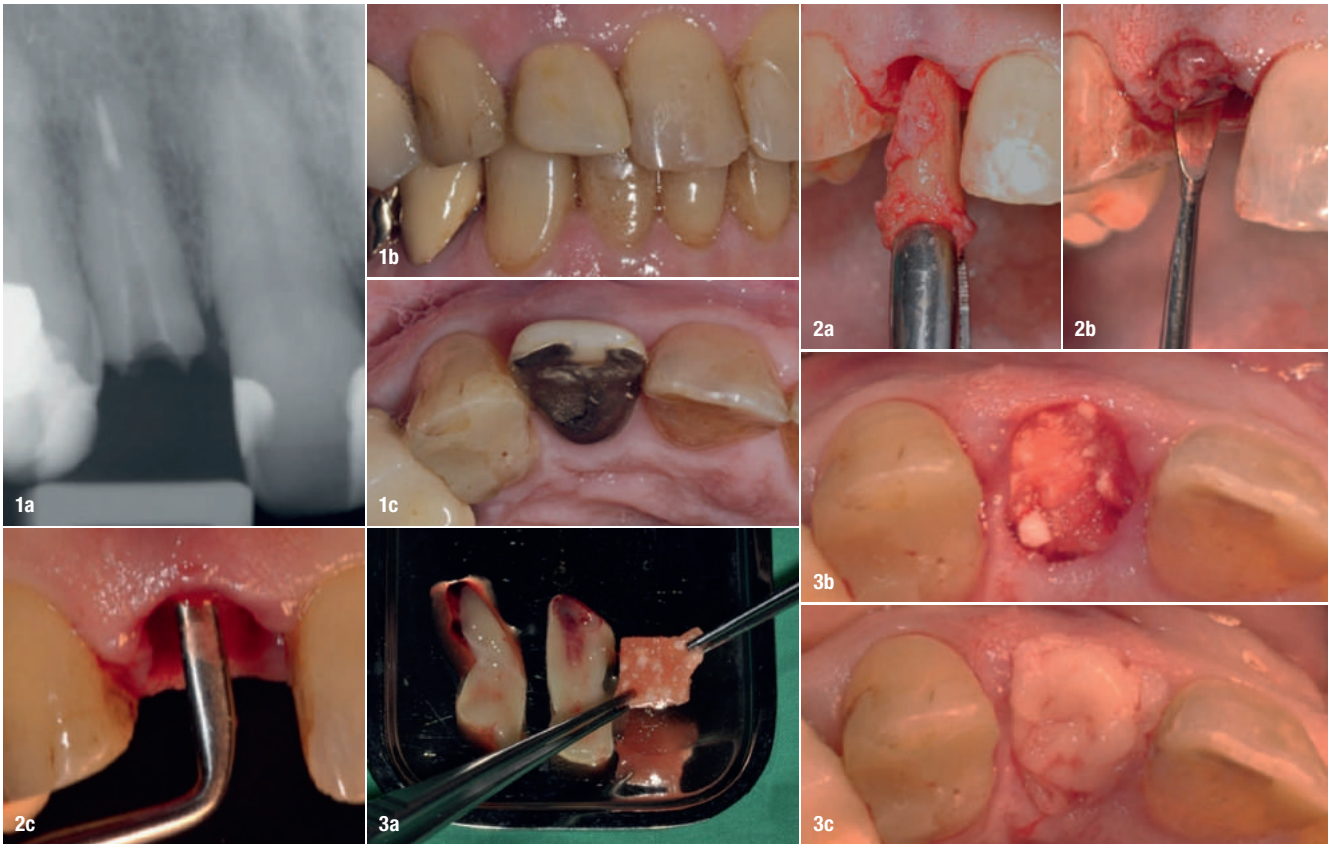


Fig. 1: The initial clinical situation with tooth 12 having a longitudinal fracture and not worthy of preservation. **Fig. 2:** Atraumatic tooth extraction **(a)** with curettage of the granulation tissue **(b)** and inflammatory loss of the vestibular bone lamella **(c)**. **Fig. 3:** ARP using I-/A-PRF in combination with the β-tricalcium phosphate collagen matrix CERASORB® Foam **(a)**, filling of the non-intact extraction socket with the biologised β-tricalcium phosphate collagen matrix CERASORB® Foam **(b)**, socket seal with the A-PRF **(c)**.

showed sufficient osseous reconstruction of the alveolar bone, allowing smooth axial alignment of the implant in accordance with the planned prosthetic crown (Fig. 5). In order to achieve an additional effect on the shaping of the soft tissue, a vestibular pedicled roll flap technique was used for implant placement (Figs. 6a–d). Thus, additional thickening of the vestibular mucosa was achieved.

Due to the very good primary stability and for soft tissue conditioning, transgingival healing was carried out with a narrow healing abutment in order to create more space for the mucosa to regenerate.

With the aid of an orienting drilling template, a maximally palatal as well as steep insertion axis of the implant was

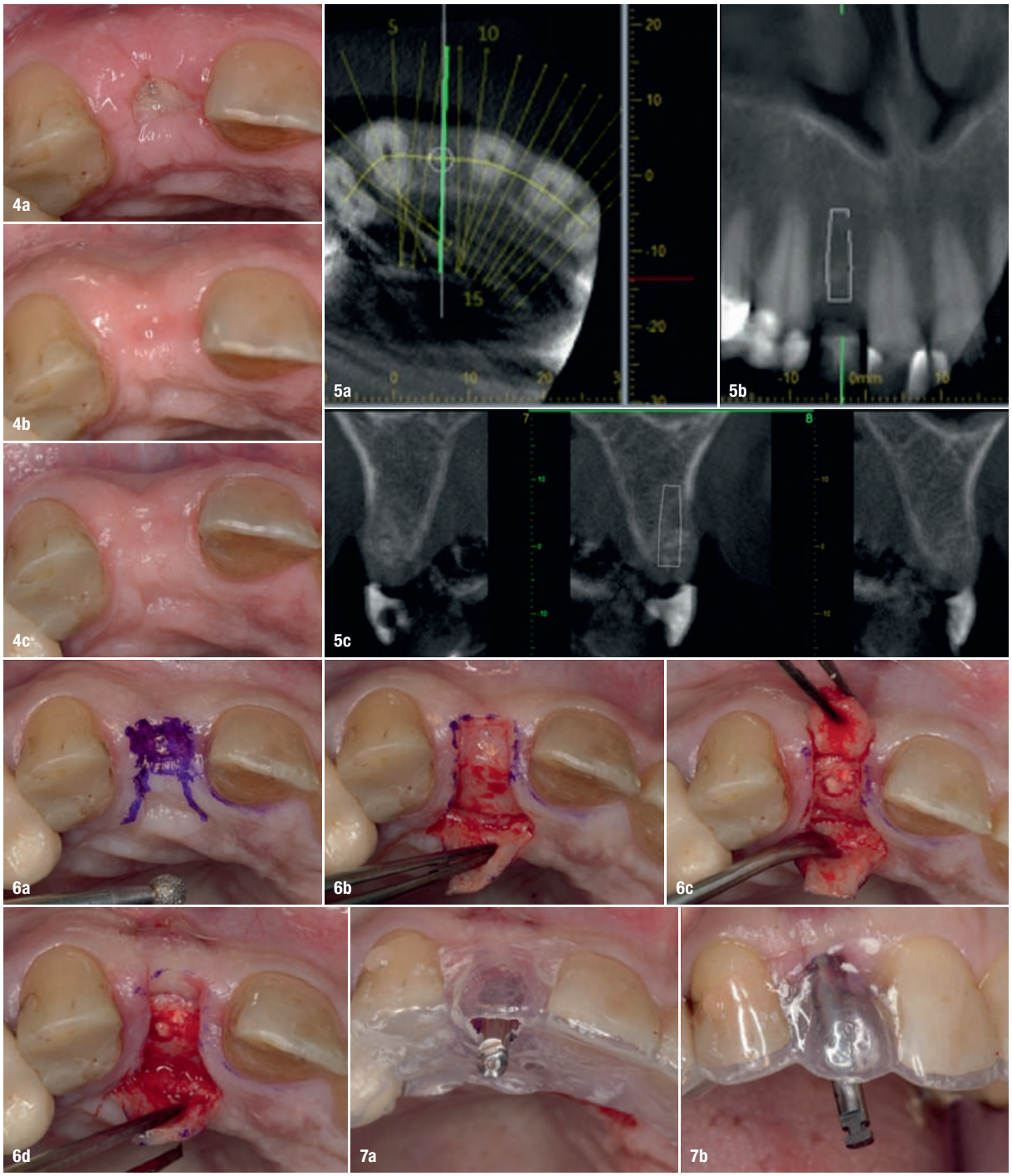
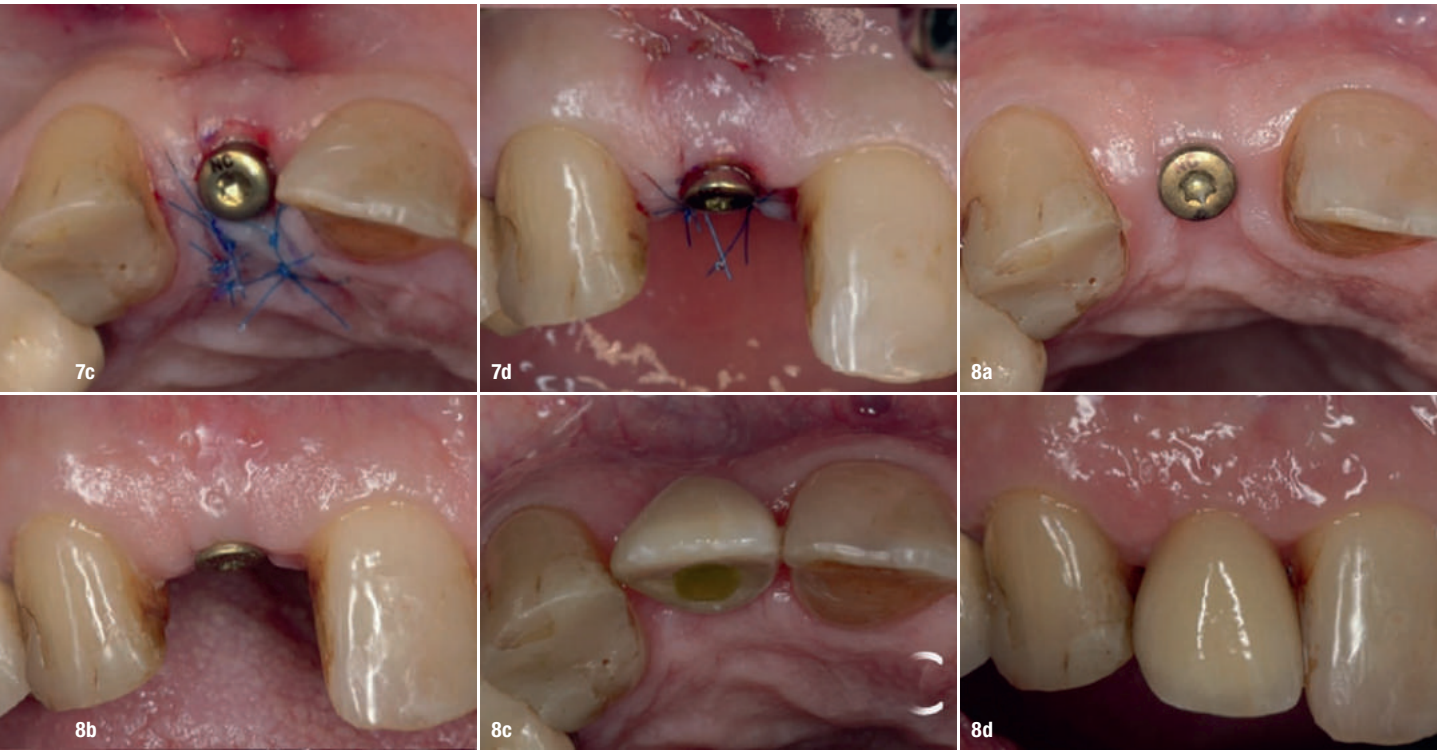


Fig. 4: Course of alveolar healing after 10 days **(a)**, 4 weeks **(b)** and 6 months **(c)**. **Fig. 5:** The planning DVT with X-ray template shows sufficient bone stock for implantation after primary prosthetic alignment. **Fig. 6:** In order to thicken the vestibular mucosa on the implant, a vestibular pedicled roll flap **(a–d)** was formed during implant placement. **Figs. 7a & b:** Implant placement was carried out with the aid of an orienting drilling template to ensure optimal prosthetic implant alignment.



Figs. 7c & d: In a condition of good primary stability, transgingival healing could be initiated with a narrow healing abutment. **Fig. 8:** Prior to the final restoration, bland peri-implant soft tissue with sufficient volume **(a & b)** was seen. The far-palatal and steep angulation of the implant axis allowed a screw-retained restoration in the final prosthetics **(c & d)**. Four weeks after placement of the final crown, the peri-implant soft tissue situation was satisfactory, but complete reconstruction of the papilla tips was not achieved.

selected in order to enable screw-retained restoration with the future crown and simultaneously achieve a broad vestibular hard- and soft-tissue volume (Figs. 7a–d). Thus the implant axis deviates significantly from the former natural tooth axis. A tapered implant design with a diameter of 3.3 mm was selected in order to both account for the clinical dimension of the gap and guarantee high primary stability of the implant for transgingival healing.

Prosthetic restoration

After a healing phase of three months, the final prosthetic restoration was initiated under satisfactory hard- and soft-tissue conditions (Figs. 8a & b). By implementation of the pre-prosthetic planning of the implant axis, it was possible to achieve a screw-retained solution for the single-tooth crown (Figs. 8c & d). The final prosthetic restoration is a fully ceramically veneered high-gold crown for avoidance of an adhesive gap. Replacement of the adjacent plastic filling on tooth 23 could have been considered for harmonisation of the aesthetics. Nevertheless, the patient's aesthetic requirements were met, especially in view of the initial clinical situation. The patient was very satisfied with the result, although objectively no reconstruction of the papilla tips was achieved. However, further "maturing" of the papillae over the course of time is to be expected.

about the author

Prof. Bilal Al-Nawas is a Germany-based dentist specialised in maxillofacial and plastic surgery. From 1986 to 1996, he has been studying medicine and dentistry in Frankfurt, Saarbrucken and Zurich. He obtained a PhD in dentistry in 1993 and a PhD in medicine in 1997. Today, he is the Medical Director and Head of the Department for Oral and Maxillofacial Surgery, Plastic Surgery at the University Medical Center of the Johannes Gutenberg-University Mainz.

contact

Prof. Bilal Al-Nawas
University Medical Center of the
Johannes Gutenberg-University Mainz
Head of the Department for Oral
and Maxillofacial Surgery, Plastic Surgery
Augustusplatz 2
55131 Mainz, Germany
al-nawas@uni-mainz.de

Author details

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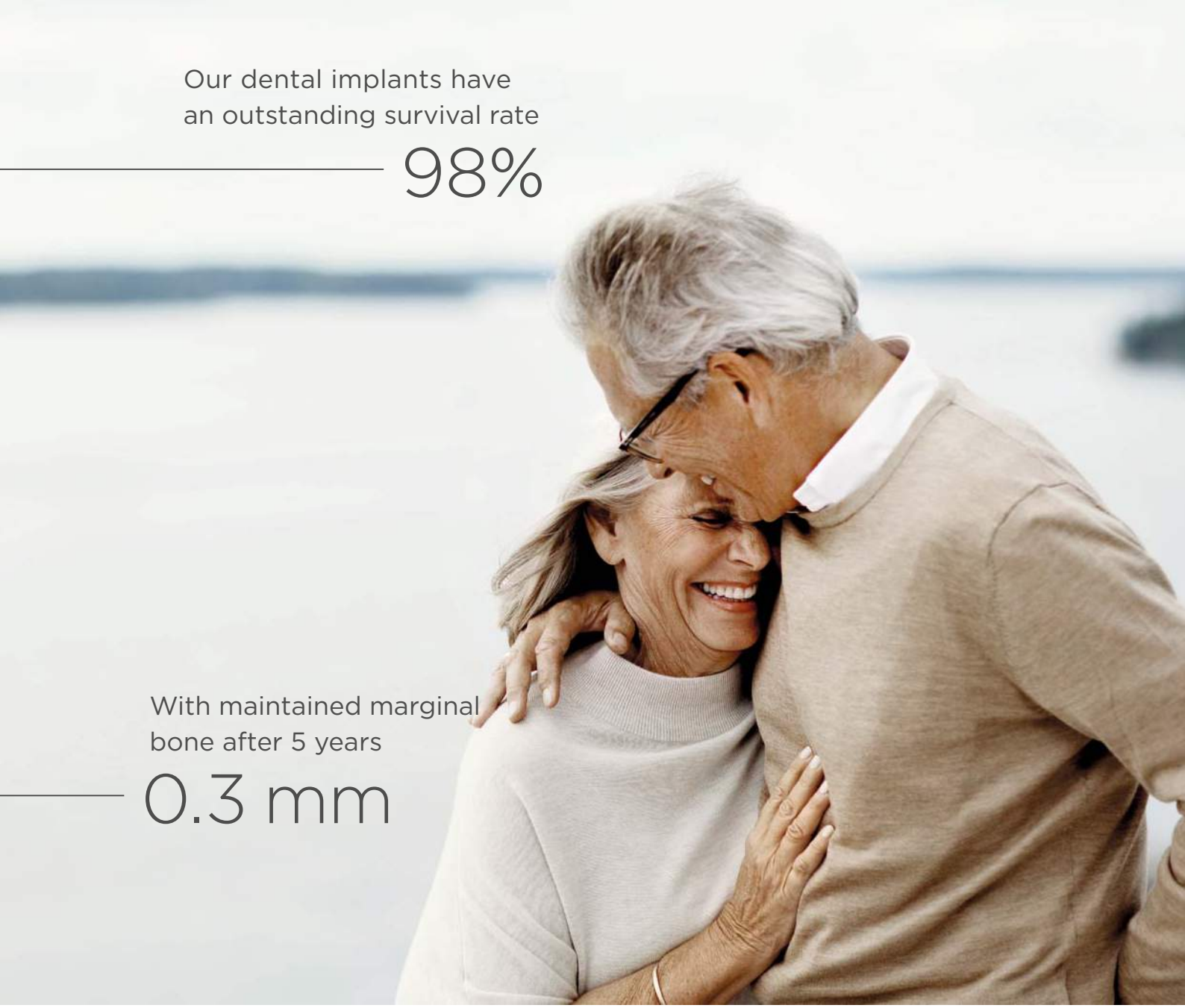

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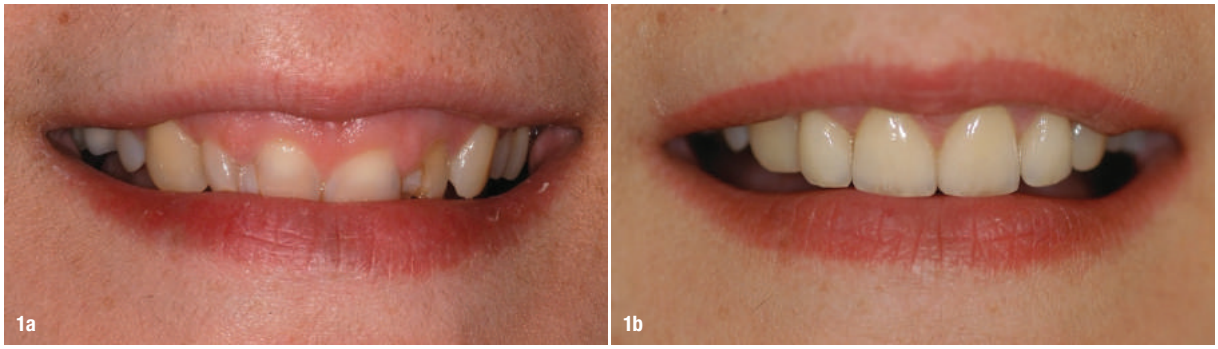
Pre-prosthetic periodontal plasty with the Er:YAG laser

Dr Fabrice Baudot, France



Figs. 1a & b: Pre-op situation: unattractive gingival smile and alteration of dental structures **(a)**, post-op situation **(b)**.

A minimally invasive approach is a global philosophy that has extended to all medical disciplines (there have been nearly 100,000 publications on this subject since 1992), and periodontics is not at the margin of this general trend. The objectives of this approach are to improve the operative and postoperative comfort of patients and to optimise the results of interventions. The Er:YAG laser is a microsurgical tool in the service of this concept. Thanks to its novel operating mode, it allows the clinician to perform operations in accordance with all the criteria of a minimally invasive approach. Tissue is treated on the basis of respecting vascular and anatomical structures in a microsurgical manner, thus reducing postoperative effects and improving the reliability of the results.[1] To illustrate the microsurgical operative capacities of the Er:YAG laser, we present in the following a clinical case of pre-prosthetic periodontal preparation which was performed by tissue sculpting and without a flap.

Case presentation

The female patient came to the consultation for an aesthetic and functional evaluation of the maxillary anterior sector. She complained about the condition of her teeth and the unattractive appearance of her gummy smile. She had received several professional opinions before, and all of them included crown lengthening surgery by osteotomy via a full-thickness access flap. This prospect frightened the patient, which was why she was looking for an alternative approach. We suggested Er:YAG laser-assisted pre-prosthetic periodontal plasty under an operating microscope.

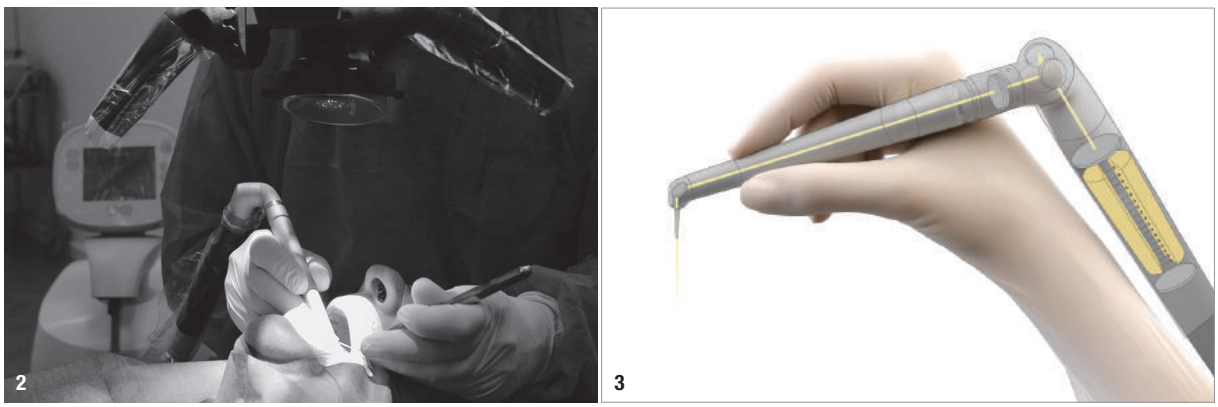
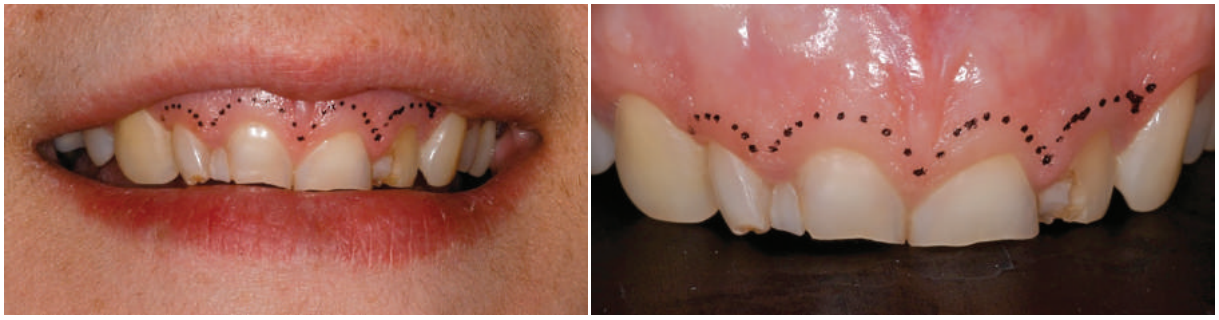


Fig. 2: Intervention with Er:YAG laser under an operating microscope. **Fig. 3:** The applicator of the Er:YAG laser (2,940 nm) is very ergonomic. The laser is in the handpiece.



Figs. 4 & 5: Surgical planning.

The clinical examination and analysis of the smile revealed alteration of the dental structure of the four incisors, excess superficial periodontal tissue, short crown heights and a gummy smile (Figs. 1a & b). The pre-prosthetic analysis of the smile discussed in accordance with the patient's wishes led to the indication of a homothetic plasty of the periodontal tissue around the four incisors of about 3 mm.

Surgical protocol

Thanks to its ultra-precise photo-ablative effects, the Er:YAG laser allows truly flapless crown lengthening (Figs. 2 & 3). In this case, tissue plasty was performed by subtractive sculpting of all periodontal tissue. We then proceeded to the controlled layer-by-layer ablation of the various tissues composing the periodontium: keratinised epithelium, connective tissue, bone tissue and periodontal ligament. Tissue sculpting was done in accordance with pre-prosthetic aesthetic planning and performed entirely under high magnification under visual control in order to remain within the ablative dimension of the Er:YAG laser, which is approximately 30 µ/s (Figs. 4 & 5). It is considered a rather quick procedure, since the surgeon does not need to elevate and suture a flap and therefore saves time. The different tissue layers are directly sculpted with only one surgical tool. This type of intervention on four teeth does not take more than 45 minutes.

At the end of the procedure, the cementum layer was removed by gentle polishing with a fine multiblade milling cutter according to the protocol proposed by Becker et al. in 1998 (Fig. 6).[2] Although it cannot be performed with the Er:YAG laser, this step is crucial in order to avoid postoperative tissue rebound. In combination with good osteoplasty, which allows the biological space to be restored, it guarantees the stability of the tissue architecture obtained after the operation.[3] The patient reported having experienced a relatively pleasant postoperative phase. There was no oedema or delay in healing often induced by the elevation of a flap. The patient was advised to apply a hyaluronic acid gel for two to three days for wound protection. In this context, the use of autologous blood concentrate platelet-rich fibrin can also be recommended. A wound like this, which has been treated with a dental laser and is stimulated by its irradiation, heals very quickly, and the healing potential of the periodontal ligament is enormous. After the healing phase at six weeks postoperatively, temporary restorations could be placed after the preparation of the four incisors (Figs. 7 & 8). At eight weeks postoperatively, the definitive restorations were tried in and placed for finishing and adjustment (Figs. 9 & 10).

Benefits of the Er:YAG laser in this type of intervention

Among all medical lasers, the Er:YAG laser has a wavelength with the property of being the most absorbed by water. This gives it ultra-precise ablative effects at low energy levels. The thermal alteration layer is at 30 µ, which allows microsurgical tissue sculpting while preserving adjacent tissue.[4] It acts selectively on tissue that is characterised by its water load gradient. The most hydrated tissue is irradiated first by the laser beam while preserving the less hydrated tissue from ablation. In the clinical case presented here, the tissue sculpting was thus perfectly safe. The first layers of soft tissue (epithelial and connective tissue) were removed without any risk of touching the bone. The considerable difference in water load be-

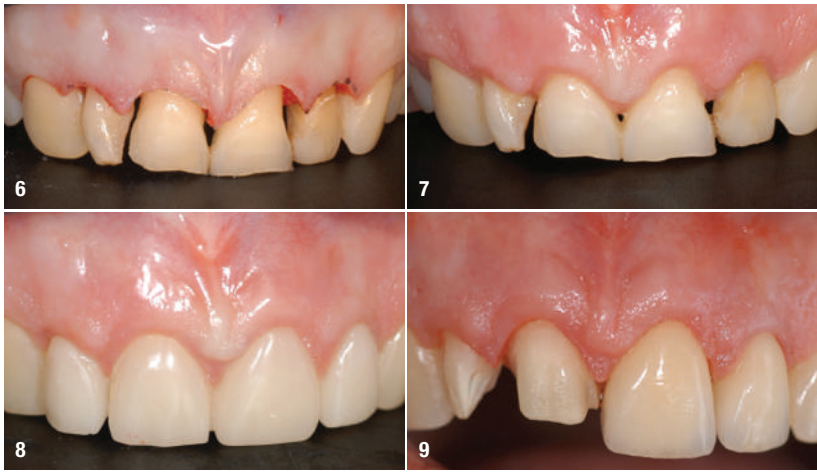
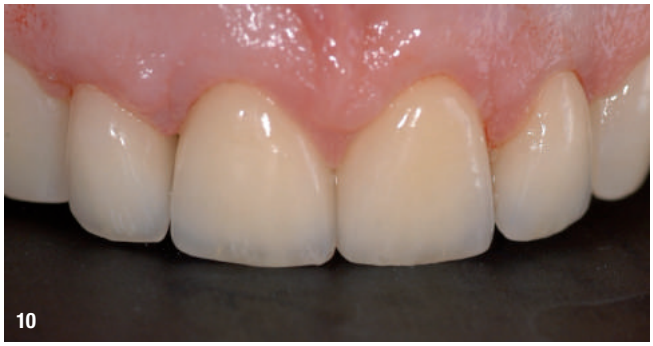


Fig. 6: Immediate post-op result. **Fig. 7:** Post-op result at six weeks. **Fig. 8:** Post-op clinical view with temporary restorations, also at six weeks. **Fig. 9:** Clinical view of the try-in of the definitive restorations. Periodontal stability at eight weeks was acquired.



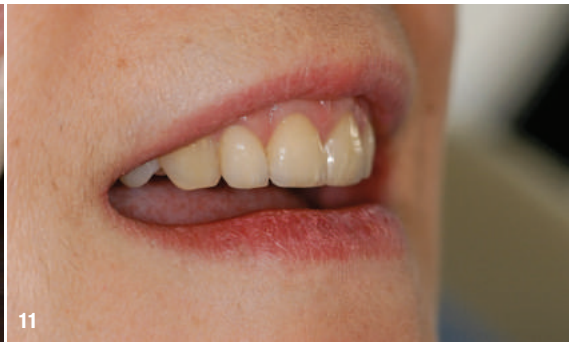


Fig. 10 Definitive restorations in place on the day of placement at eight weeks postoperatively. **Fig. 11:** The final outcome brought complete satisfaction to the patient.

tween soft tissue and bone allows very precise selective ablation. Under high-magnification optical guidance, the surgeon can operate layer by layer by subtraction in a microsurgical manner. Once the bone has been removed from the soft tissue, it is possible to sculpt the bone in order to restore the biological space around the root homothetically and safely for the dentine and cementum by relying on the difference in water load between bone and dentine. The decreasing water load gradient at this level is conducive to safe ablation with the Er:YAG laser. Under visual control, the periodontal ligament is irradiated simultaneously to the bone while preserving the tooth root.

To perform this microsurgical operation, the surgeon has six setting parameters at his or her disposal: three adjustment parameters to determine the power of the laser beam on the machine (i.e. the amount of energy transmitted to the targeted tissue; frequency of impacts; and water flow rate, which allows modulation of the effect of the delivered power) and three parameters in the surgeon's hand (i.e. the distance between the beam and the target, beam angulation, and exposure time). By modulating these different parameters, the surgeon sculpts the tissue being operated on according to his or her surgical planning.

Compared with conventional instrumentation, the Er:YAG laser offers the following advantages:

- It improves operating ergonomics (the surgeon operates with only one instrument on both soft and hard tissue; ultra-precise selective action on different tissue layers; clearance of the operating field rinsed by the laser spray, which allows operation without bleeding).
- The layer-by-layer approach allows a flapless procedure.
- The excellent water absorption of the Er:YAG laser allows surgery in the very restricted space of the sulcus without altering the adjacent tissue.
- Tissue sculpting is a novel procedure compared with conventional incision and milling. It allows simple and intuitive intervention in complete safety.
- The postoperative results are excellent because the vascularisation of the operated tissue is preserved and the adjacent tissue is not traumatised by the elevation of a flap. Also, healing is quicker.[5]
- The Er:YAG laser decontaminates tissue by its bactericidal effects.[6,7] Thus, the perfectly clean surgical field heals all the better. Bacteraemia is reduced compared with conventional instrumentation.[8]

Conclusion

In the clinical case described in this article, the Er:YAG laser allowed us to perfectly meet the patient's expectations (Fig. 11). Her smile was restored corresponding to her desires by preparing the periodontal tissue without creating a flap. The treatment result was considered stable at the follow-up after five years. As we have seen, this type of intervention is simple, reliable and secure. It is perfectly accessible within the framework of a general dental practice. There needs to be more research on the Er:YAG laser in the future, and it deserves to be integrated into our workflows owing to its great versatility.

about the author

Dr Fabrice Baudot is a French dentist specialised in periodontics and implantology. He currently leads a practice that focuses on laser-assisted microsurgery. His therapeutic approach is always based on minimally invasive surgery. Dr Baudot is frequently invited to speak at international dental conferences, and he is the author of numerous scientific publications. In addition, he is one of the founding members of the European Academy of Ceramic Implantology.

contact

Dr Fabrice Baudot
Impasse des Trois Pointes 65
34980 Saint-Gély-du-Fesc
France
Phone: +33 4 99060060
dr.baudot34@orange.fr

Author details

Literature

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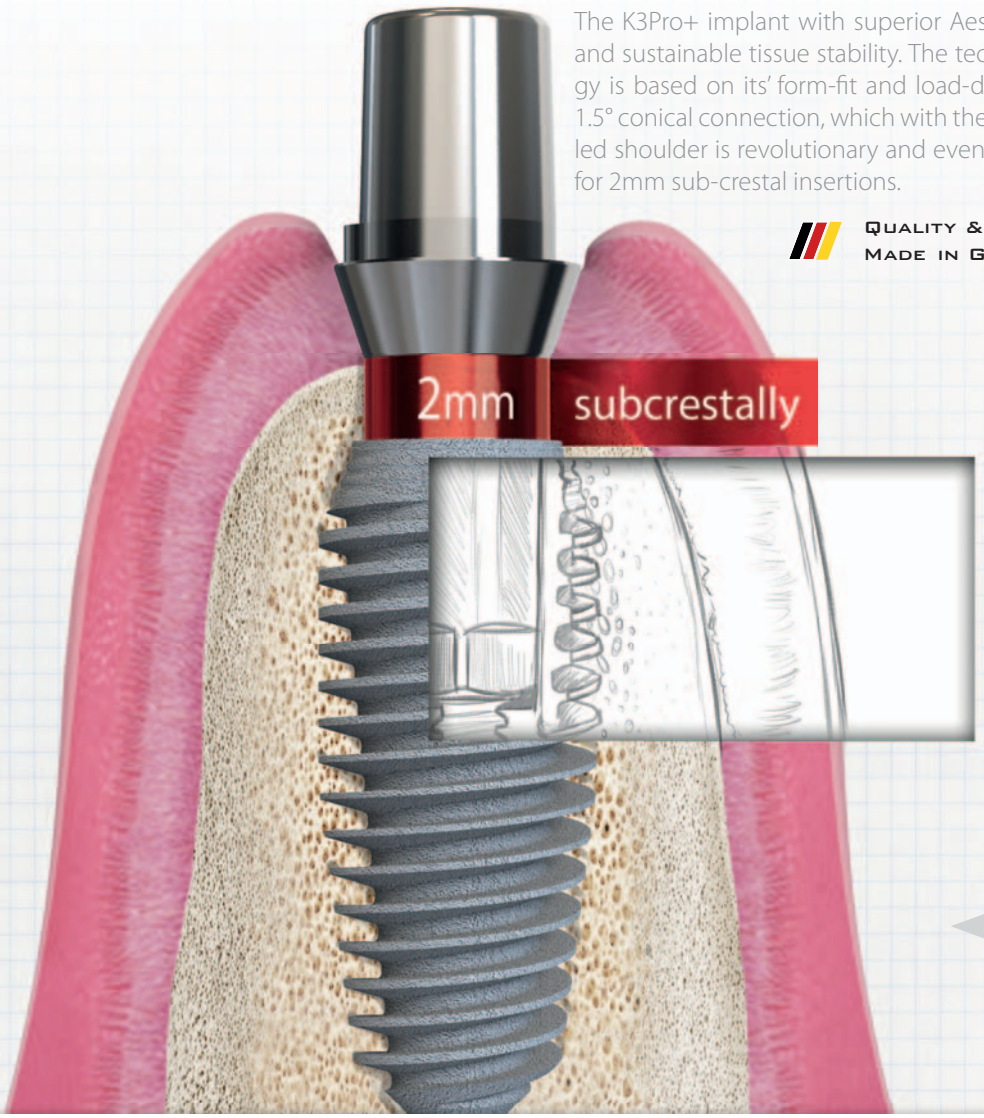

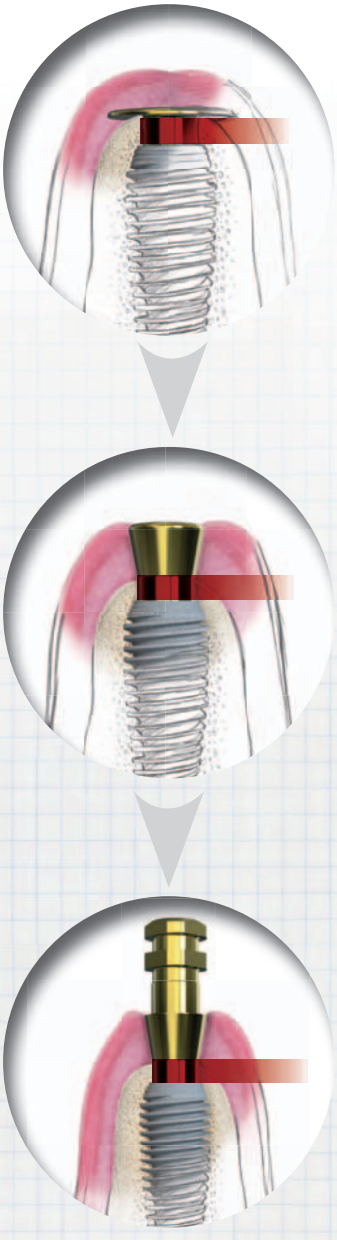

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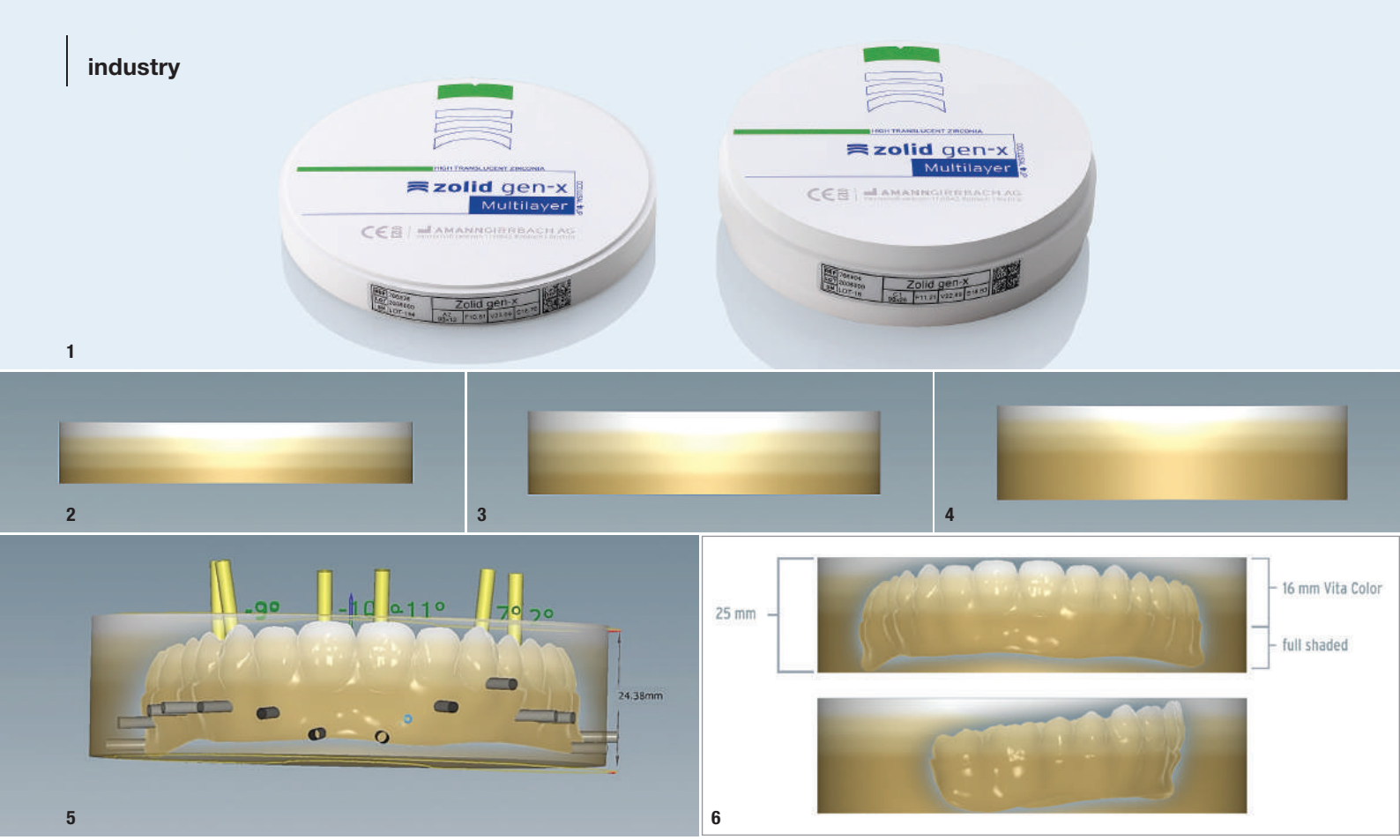

Fig. 1: Zolid Gen-X is available in all common heights on the market (12, 14, 16, 18, 20, 22, 25 mm). – **Fig. 2:** Zolid Gen-X 16 mm. **Fig. 3:** Zolid Gen-X 22 mm with proportionally increased polychromatic shade content. **Fig. 4:** Zolid Gen-X 25 mm with extended monochromatic gingival component. **Fig. 5:** Visualisation of the shade distribution of a nested restoration made of Zolid Gen-X with the Ceramill Match 2 CAM software. **Fig. 6:** Optimally aligned restorations with a high gingival component ("REAX" bridge) to achieve the correct VITA shade while observing the asymmetrical shade distribution.

Aesthetics for all intends and purposes

Optimising outcomes in implant restorations

Dipl.-Ing. Axel Reichert, Austria

Industrial multilayer pre-shaded zirconium-oxide blanks have established a strong positive trend in the dental market for quite some time now and form part of the established state-of-the-art across a wide variety of facets in terms of integrated colour design. They ensure simple, fast and highly accurate reproducibility of colour and translucency in everyday laboratory work. For the user to be able to assess which underlying "optics" are hidden in the blank, nesting concepts are often necessary. However, these must first be imparted to the user so that the desired tooth shade prevails after sintering. If additional pronounced gingival sections are to be added, which of course cannot meaningfully be accounted for in terms of shade in a tooth-coloured blank, then a simple "symmetrical" or evenly distributed shade gradient is often no longer sufficient for this purpose. In these cases, users can choose the aesthetic and high-strength Zolid Gen-X zirconia with integrated shade gradient from Amann Girrbach (Fig. 1). Zolid Gen-X is available in 16 VITA shades, two Bleach shades and all common heights on the market.

To ensure that the shade gradient of the tooth section is optimally matched with regard to the height of the res-

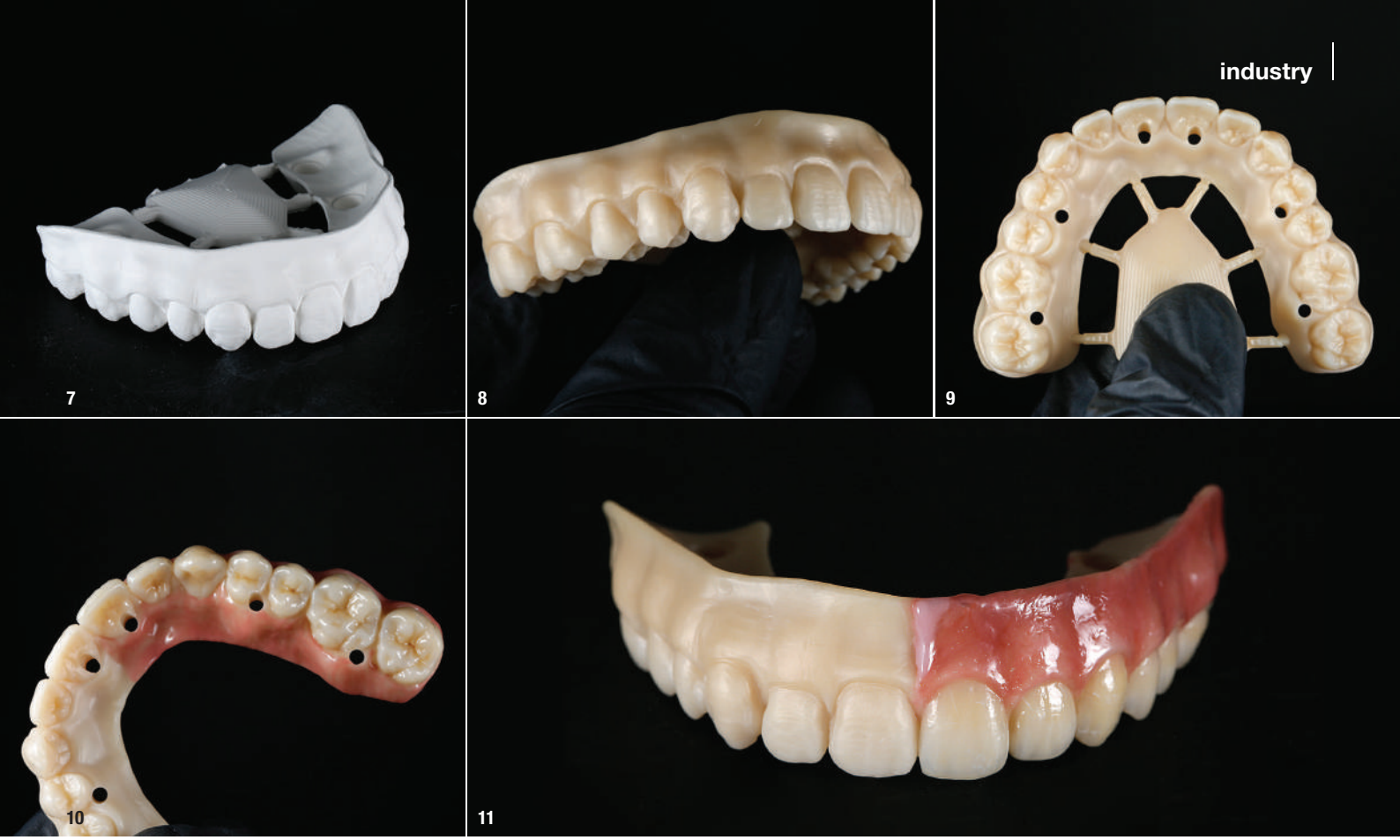

Fig. 7: Zolid Gen-X 25 mm REAX restoration prior to sintering. **Figs. 8–11:** Zolid Gen-X 25 mm REAX restoration customised with MiYO Liquid Ceramic, Benjamin Votteler (Votteler Dentaltechnik).

toration, the relationships between restoration height, tooth sections and colour distribution of the blanks to each other needs to be observed. For this reason, the incisal proportion of all Zolid Gen-X blanks was designed proportional to the blank height: the higher the blank, the greater the incisal proportion. The correct selection of the blank height is therefore decisive for an optimal shade gradient over the entire restoration. However, for a 25 mm high blank, this "symmetrical" polychromatic distribution makes little sense, as tooth or tooth crown proportions of this height do not exist in reality. For this reason, the Zolid Gen-X 25 mm blank is a special variant—preferably for implant-supported restorations with an additional high gingival component (Figs. 2–4).

If the Zolid Gen-X 25 mm blank is divided virtually into four horizontal layer sections, it appears as a 16 mm blank in terms of shade—with polychromatic and monochromatic colour components. Using the Ceramill Match 2 nesting module from Amann Girrbach, the underlying colour distribution of the blank can be visualised (Fig. 5). For 14-unit full restorations, the contours of the Spee and Wilson curves make it difficult to place all teeth optimally and evenly in the shade scheme of the blank. Alignment is therefore often selected to achieve the best possible shade distribution for the aesthetically important anterior tooth region. By using 5-axis milling machines, the fabrication of a full restoration strongly inclined or turned in the blank no longer poses a technical problem. However, if a gingival component is added, this often either no longer fits into the blank used so far and/or one has to accept deficits in the desired aesthetics due to the only suitable alignment option.

The "asymmetrical" layer distribution of the Zolid Gen-X 25 mm blank allows making ideal use of the most common average height (16 mm) for good and direct shading by providing more "ground clearance". This ensures a good basis for the anterior tooth aesthetics. The extended monochromatic colour portion below the 16 mm shade gradient in the blank thus enables a good compromise between aesthetics and unlimited use for ideal implementation (Fig. 6).

contact

Dipl.-Ing.
Axel Reichert
R&D Team Leader
Materials at Amann Girrbach
Herrschaftswiesen 1
6842 Koblach, Austria
Phone: +43 5523 62333-0
austria@amanngirrbach.com

Author details

Making your work flow in implant dentistry

Dentsply Sirona, Sweden

At any dental clinic, workflow is very important for business success and patient satisfaction. To reach these key goals, dental practices need to have smart implant workflow solutions in place. In addition, you want to experience flow when treating patients—it will help you overcome challenges, feel confident and find solutions to complex cases. Making your work flow in implant dentistry revolves around identifying the smoothest and most convenient workflow for each customer, and making sure to deliver whatever is needed to ensure that. With a vast, world-class assortment of products and solutions for implant treatment, there are complete solutions that create the best possible workflow and make work flow better.

Workflow with Astra Tech Implant EV and Azento

You might say that a workflow is like a machine. Take out its key part, and it just does not run like it should. Astra Tech Implant EV is such a part. The way it is designed. How you can place it. The handling experience. Its long-term functionality. How it promotes aesthetics decades from now. All that matters. Some of it is directly noticeable, while some is only evident in the future. Still, they all influence your workflow. When you know that the implant works and acts like expected, you relax, trust it and focus on your main task—improving the everyday life of your patients. When you do this, you rid them of dental worries, which help them feel better and more confident to do the things that trigger their flow in life. A user of Astra Tech Implant EV knows all this—how the parts of the machinery fit perfectly to form a smoother and efficient process.

The right solution and digital tools can improve your workflow, help to reduce bottlenecks and infuse better team flow at your end. One example of this is Azento, the all-in-one box solution for single tooth replacements. It reduces the costly instrument and materials inventory. You get a fully guided surgical solution. And it is designed to take away time-consuming procedures in order to streamline the workflow, so the team can focus on the core tasks. The result? You stand a better chance of having flow at work, which ultimately boosts your business success. So the sights are set on creating the best possible workflow solutions for implant dentistry professionals by identifying customer-unique solutions that secure high quality treatments while saving time and effort.

contact

Dentsply Sirona
Aminogatan 1
41321 Mölndal, Sweden
www.dentsplysirona.com/makingyourworkflow

CURAPROX

PERIOPLUS+

CITROX®

SWISS PREMIUM ORAL CARE

Low CHX concentrations with additives effective against biofilm

Curaden, Switzerland

A recent study at the University of Bern in Switzerland has yielded important findings on one of the most frequently used agents in dental care—chlorhexidine digluconate (CHX)—and the relatively newly discovered Citrox, both of which are in Curaprox's Perio plus range of mouthwashes, toothpaste and oral gel. According to the results, Perio plus formulations have a stronger inhibitory effect on plaque regrowth than do solutions with the same amount of CHX but no additional ingredients.

How do CHX and Citrox act in favour of oral health?

CHX is an effective broad-spectrum biocide, antiseptic and disinfectant agent that combats a wide range of Gram-negative and -positive bacteria, yeasts, fungi, and many other kinds of microorganisms. CHX has been proved to have a significant effect on dental plaque formation and accumulation, and therefore the agent is used in prophylaxis and treatment of dental caries, gingivitis and periodontitis. There are various concentrations of this formula in many specialised oral care products, suitable for both short- and long-term use.

A lesser-known ingredient is Citrox, a formulation of soluble bioflavonoids obtained from bitter orange that has a documented broad spectrum of antimicrobial, antiviral and antifungal activities against microorganisms present in the mouth. Furthermore, Citrox is praised for being non-toxic and non-allergenic, and not altering taste or staining teeth. The study by the University of Bern shows that Citrox combined with poly-l-lysine and CHX in the formulation of Perio plus supports the anti-biofilm activity and that this mixture can be even more effective than pure CHX of the same concentration.

What formulations were tested?

The study aimed to analyse, *in vitro*, new formulations containing Citrox and CHX regarding their antibacterial activity against planktonic bacteria and their potential to inhibit

biofilm formation or act on existing biofilms. The experiment tested five such oral healthcare products: four mouthrinses and one gel—all of which were from the Perio plus product line by Curaden. The mouthwashes contained the following concentrations of CHX: 0.20% CHX (Curaprox Perio plus forte); 0.12% CHX (Curaprox Perio plus protect); 0.09% CHX (Curaprox Perio plus regenerate); and 0.05% CHX (Curaprox Perio plus balance). The gel formulation contained 0.50% CHX (Curaprox Perio plus focus). All of the tested Perio plus products contained CHX, Citrox and poly-l-lysine, xylitol and PVP-VA. The negative control was a 0.9% w/v sodium chloride solution, and the positive controls were CHX solutions without additives at three different CHX concentrations.

How the researchers approached the analysis

Fifteen different bacterial strains were used in the experiments, in two settings—the first was designed to mimic cariogenic biofilm and the second was designed to emulate periodontal biofilm. The cariogenic biofilm was formed of all streptococcal strains, *Actinomyces naeslundii* and *Lactobacillus acidophilus*. The periodontal biofilm consisted of *Streptococcus gordonii*, *Actinomyces naeslundii*, *Fusobacterium nucleatum*, *Campylobacter rectus*, *Parvimonas micra*, *Eikenella corrodens*, *Prevotella intermedia*, *Capnocytophaga gingivalis*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Filifactor alocis* and *Treponema denticola*. Two different experimental designs were employed: application of the product after mechanical removal of biofilm to investigate the influence on biofilm formation and application to established biofilm.

Key findings: Even low concentrations of CHX with additives are effective

The results showed that Perio plus CHX formulations were effective against the selected oral bacteria responsible for biofilm masses that are known to cause periodontal disease. The most important finding is that even the low-concentration CHX formulations with additives slowed down cariogenic biofilm formation to a greater extent than did additive-free solutions with the same or even higher concentration of CHX. The exact anti-biofilm efficacy depended on the CHX concentration. In the case of the 0.2% CHX concentration (Perio plus forte), there was a proven effect even in its activity on already existing biofilm.

New approach for home-based dental care to combat plaque

The findings of the study have clinically proved that the unique formula of Perio plus is more effective than CHX alone in limiting the formation of oral biofilm. Overall, the activity of these advanced CHX formulations was highly effective in reducing biofilm formation, but less so in removing periodontal biofilm that had already formed. Therefore, it is important to emphasise the importance of proper mechanical removal of biofilm by scaling and root planing in the initial therapy for periodontitis. For more-effective home treatment, these procedures can be followed by the application of the tested Perio plus CHX and Citrox formulas, since it has been clinically proved that they are beneficial against oral microorganisms that cause many common dental diseases.

New findings on the Perio plus products and their effect on biofilm:

- Perio plus forte mouthrinse (0.2% CHX) and Perio plus focus gel (0.5% CHX) were the only solutions of all those tested that significantly reduced the activity of cariogenic biofilm.
- Perio plus forte killed all cariogenic bacteria in established biofilm.
- Perio plus protect mouthrinse (0.12% CHX) was as effective as a pure concentration of 0.2% CHX in delaying biofilm growth.
- All products from the Perio plus range can also reduce biofilm masses that are known to cause periodontal disease.

contact

Curaden AG
Riedstrasse 12
8953 Dietikon
Switzerland
Phone: +41 44 7444646
www.curaden-dentaldepot.ch

Literature

Implant integration made predictable

Prof. David L. Hoexter, USA

In recent years, the public's acceptance of oral implants has been dramatically positive. People are living longer and desire an enhanced quality of life. Being able to eat all the foods they enjoy due to improved mastication, not requiring the full dentures of their grandparents, comfortably eating and speaking at the dinner table not only with their children but with their grandchildren, provides greater confidence and enjoyment of life. Implant aesthetics has also played a major role in improved appearance and social confidence.

Fig. 1: Hoexter Luxators: series of instruments designed to facilitate the removal of roots by mesial-distal movement, allowing the preservation of buccal and lingual bone during extraction, while allowing the practitioner to visualise the operating area in comfort and ease. The instruments are available in different incised edges and sizes for various sized teeth and comfortable angulations.

Numerous shapes, sizes, widths, surface treatments, different groove surfaces, and other variations in design, have been developed to ensure predictable integration of the oral implant, thus facilitating prosthetic restoration and return of function. But what about the implant surgical site. How can it be optimised to ensure predictable integration? One of the practitioner's pressing questions today is if and when to extract. Will there be enough bone after extraction to support endosseous implants and their prosthetic restorations to function as desired. It is generally advisable to extract sooner rather than later, as there is more bone available to support an implant. In waiting you take a risk that you might end up with less bone. The bottom line is—the more bone available, the more predictable the integration of the implant. Predictability leads to success.

In the history of dental extractions, getting the debilitated tooth out of the oral cavity as quickly and as painlessly as possible, has been paramount. After anaesthesia, luxating buccal-lingually is usually the next step. The theory behind this concept is that the buccal bone is usually the thinnest zone of bone retaining the tooth, and thus it provides the least resistance. Anatomically, the buccal plate of bone is usually much thinner than the palatal or lingual. However, the easier extraction toward the buccal results in the loss of more buccal bone. Healing depends on the blood supply, primarily from the osseous walls of the extraction site. The constant pressure from the buccal-lingual luxation leads to ischemia in the remaining thin plate of buccal bone. This ischemia leads to further resorption and loss of the buccal wall.

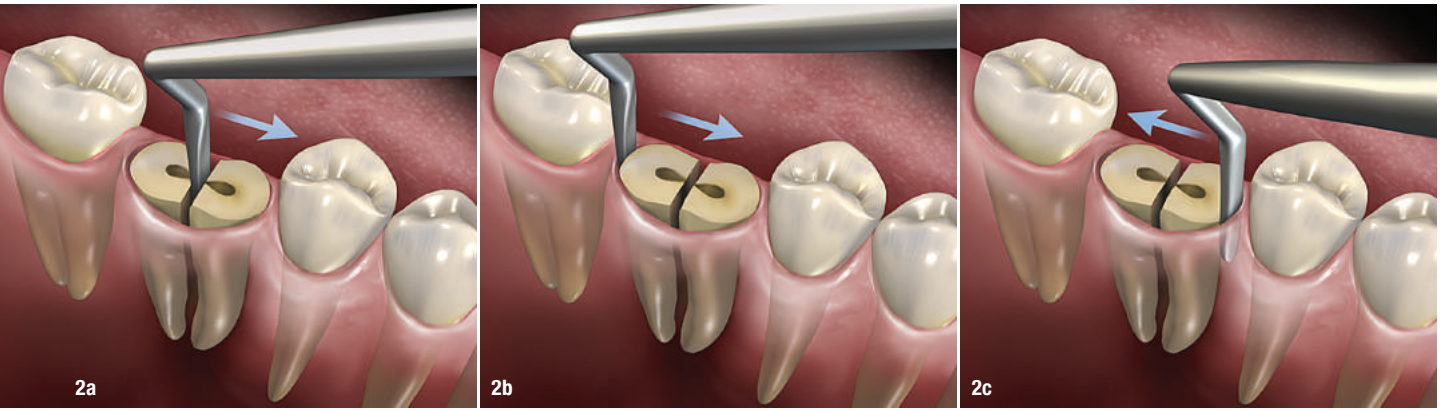

Fig. 2: The Hoexter Luxator in the septal area of the mandibular molar. The force is directed toward the mesial **(a)**; the Hoexter Luxator placed at the distal of the mandibular molar with the force directed in a mesial direction **(b)**; the Hoexter Luxator placed at the mesial of the mandibular molar. The force is directed in a distal direction. With the constant mesial-distal pressure, the root is easily made mobile and removed, thus preserving the buccal and lingual bone **(c)**.

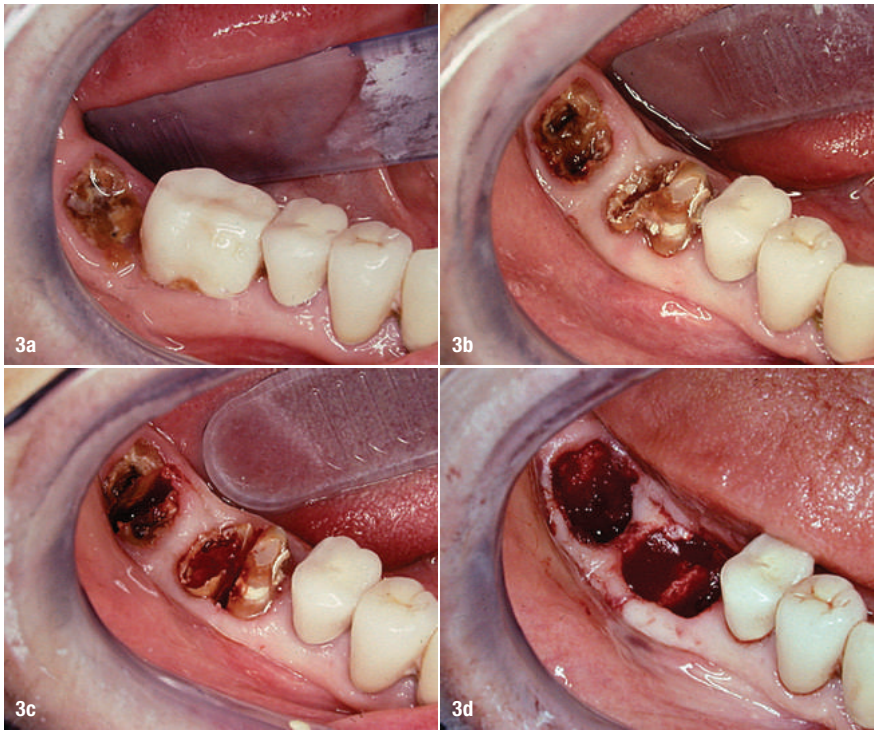

Fig. 3: Case presentation: Tooth #47 with the temporary crown off, showing caries and broken tooth structure **(a)**; tooth #46 with its temporary crown now off, exposing extensive caries and poor prognosis for both #46 and #47 **(b)**; tooth #46 crown portion divided into two halves **(c)**; all four root sockets and even the osseous septum of #46 are preserved by luxating mesial-distally **(d)**.

The area will now heal with a depression in the buccal plate as well as some occlusal resorption.

The buccal depression leads to problems in oral hygiene and aesthetics. Also, correct placement of the implant is now more challenging since the buccal depression has moved the remaining bone lingually (palatally). The implant needs to be placed in adequate bone to succeed. Since the implant must be located where the bone is, the placement will be lingual to the original tooth being replaced. This may create a situation requiring a prosthesis that is over-extended toward the buccal (similar to a buccal cantilever) to assure proper occlusion, potentially placing undue stress on the implant. The goal must be to preserve as much bone as possible by preventing bone loss, especially the buccal plate, during extraction. Instruments have been developed by the author for use during extraction for this specific purpose. The Hoexter Luxators (HuFriedy; Fig. 1) are designed to be used expressly in a mesial-distal motion, to avoid any buccal pressure. The design ensures that the practitioner maintains the correct angle in mesial or distal pressure on the root to be extracted, thereby ensuring a predictable result.

The Hoexter Luxator technique relies on the premise that it is easier to extract a single root rather than a multi-rooted tooth. The practitioner, after applying local anaesthetic, removes the crown of the posterior tooth horizontally at the CEJ, exposing the individual roots. Now, the Hoexter Luxator is placed (Figs. 2a–c) in the desired location and moved with slight pressure in a mesial-distal direction. The root will become quite mobile and easily removed. During the procedure, there should be no pressure on the buccal plate of bone. The result is a void with osseous walls intact, that can induce osseous regeneration. This includes the buccal wall as well as the mesial, distal, lingual and probably some interseptal bone. All remaining osseous walls will be productive in guiding the positive regeneration of bone. This will result in bone regeneration in the

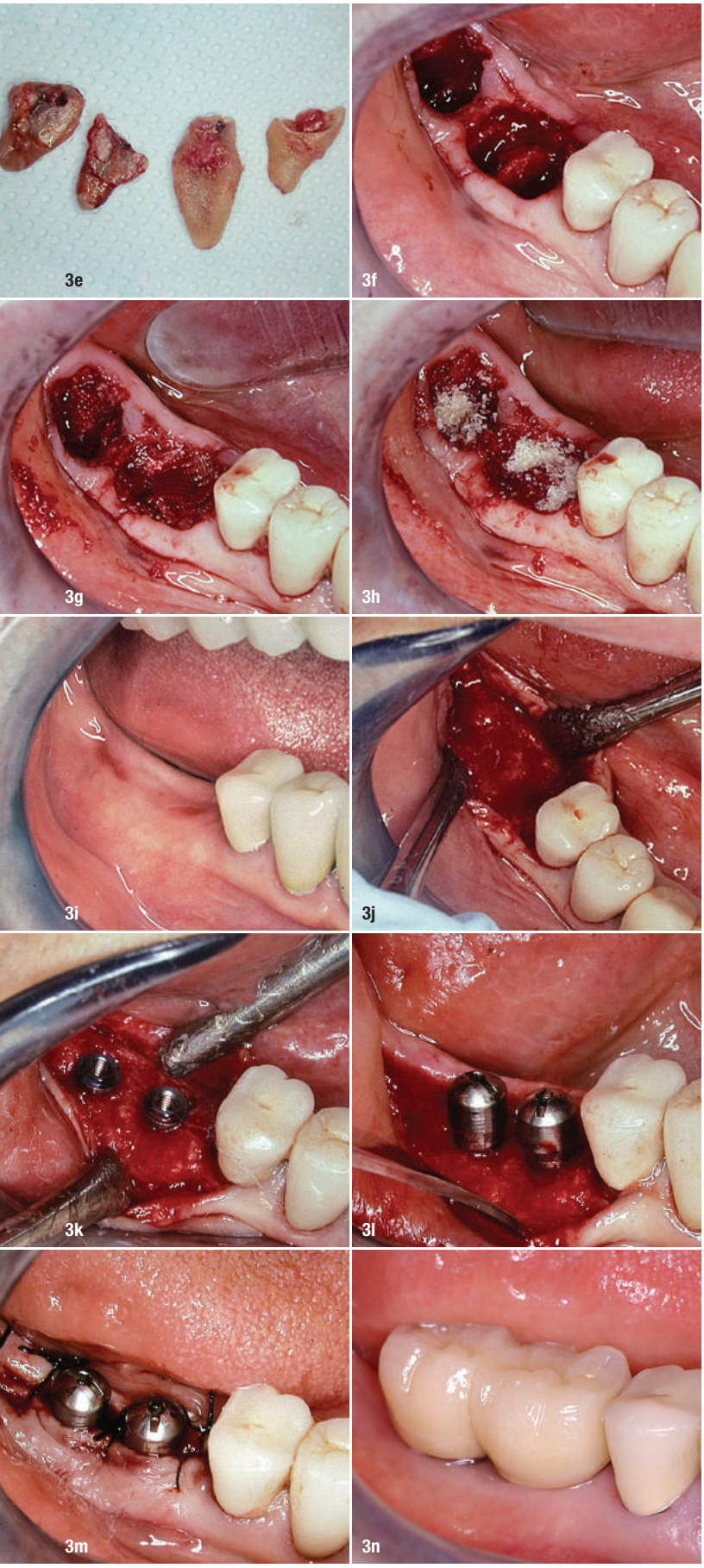

Fig. 3: Case presentation: All four of the roots easily luxated out **(e)**; blood clots in the #46 and #47 sockets **(f)**; osseous graft material inserted into the sockets **(g)**; resorbable membranes placed over the grafts, before suturing **(h)**; lower right area three months post-op **(i)**; exposed regenerated bone area three months later. Note the full ridge of bone regenerated buccal-lingually as well as mesial-distally **(j)**; implants inserted at bone level **(k)**; implant healing abutments in place **(l)**; keratinised area of the mucogingival flap now sutured at the correct level **(m)**; final buccal view of the restored prosthesis with healthy keratinised tissue **(n)**.

entire previous void, eliminating the resorptive depression of the buccal bone and the elimination of the oral hygiene, aesthetic and restorative challenges.

After the mesial-distal luxation and removal of the individual roots, leaving the intact walls of extracted roots, it is suggested to utilise an osseous resorbable material and regenerative bone graft material. A GTR technique using a resorbable barrier membrane to cover the osseous graft is placed under the flap margins and sutured in place, which, after the correct healing time, will result in bone regeneration that will support an endosseous implant in the correct supported position (Figs. 3a–n). The practitioner will be able to provide the optimal prosthetic replacement—one in occlusal harmony, physiologically-shaped for best function, aesthetically pleasing, and easy to maintain.

about the author

David L. Hoexter DMD, BA, FIADFE, FACD, FICD is Director of the International Academy for Dental Facial Esthetics and Clinical Professor of Periodontics and Implantology, Temple University School of Dental Medicine. A Diplomate in the International Congress of Oral Implantology, American Society of Osseointegration, and the American Board of Aesthetic Dentistry, he publishes and lectures internationally. Dr Hoexter has been awarded thirteen fellowships, including FACD, FICD, and Pierre Fauchard. His practice in New York City is limited to periodontics, implantology and aesthetic surgery.

contact

Prof. David L. Hoexter
DDS, DMD, FACD, FICD
Clinical Professor of Periodontology
and Implantology
Temple University, Philadelphia, USA
300 East 74 Street, Suite 4ABC
New York City, NY 10021, USA
DrDavidLH@gmail.com

Author details

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The PROGRESSIVE-LINE implant system is based on an implant that is geared to facilitate immediacy concepts such as immediate placement and restoration. With highly efficient protocols for the implant bed preparation for all bone types, the well-thought-out features of this apically tapered implant are particularly advantageous in soft bone. The new PROGRESSIVE-LINE FLEX tray offers practical benefits for the surgical team, and is cost and time efficient for the dental clinic. The FLEX tray is as small as a postcard!

With a reduced number of instruments required for surgery, FLEX offers an efficient drilling protocol for multi-implant cases. This streamlining means efficiency during and after surgery. The drills are clearly marked with colour-coded lines that serve as a guide throughout the drilling protocol. In addition, the instruments for implant placement are organised according to a surgeon's preferred surgical placement procedure. Finally, efficiency and ease of use during surgery is ensured with the visual drill-marks for guidance orientation for drill-depth during surgery. This is all combined in a tray, which has been validated for automated cleaning* and sterilisation. These benefits make the FLEX tray a win-win solution for the whole dental team. Find out more today!

* Ratchet and holding key cannot be cleaned inside the kit; ratchet must be disassembled for cleaning. See reprocessing work instruction.

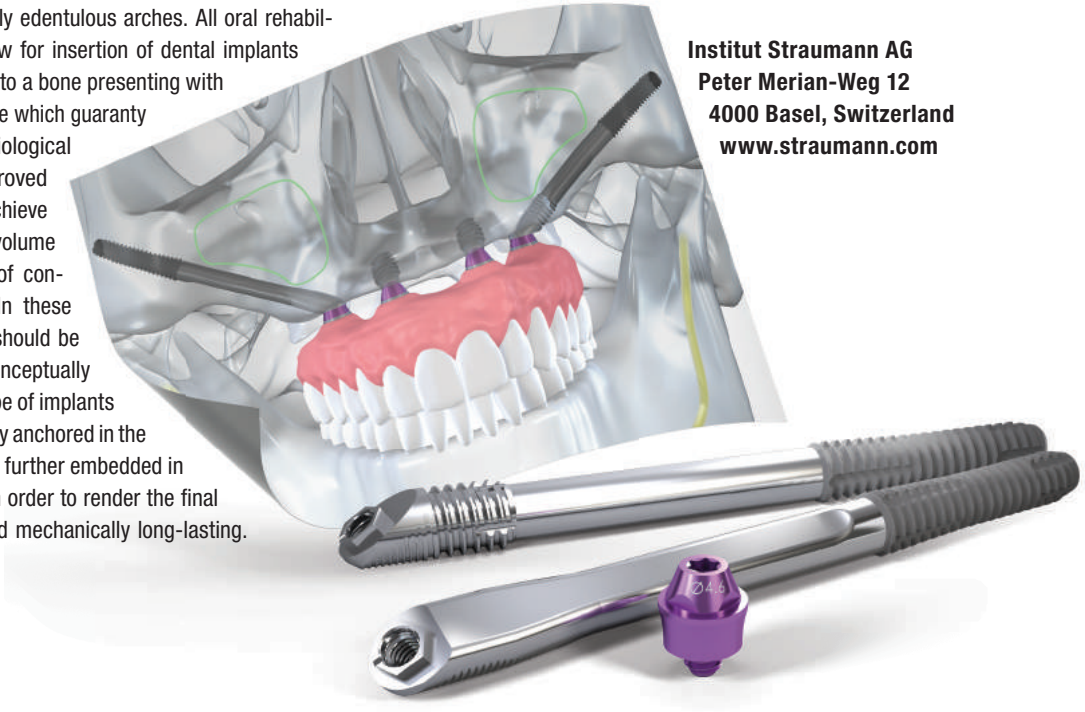
Camlog Biotechnologies GmbH
Margarethenstrasse 38
4053 Basel, Switzerland
www.biohorizonscamlog.com

Straumann

Treating atrophic maxillae with Straumann Zygomatic Implants

Edentulism is caused by non or too lately treated oral diseases such as dental decays, periodontitis, trauma or cancer. Nowadays, the percentage of completely edentulous patients is declining but this trend is offset by the growth of the ageing baby boomer population which gives rise to an increase in the numbers of completely edentulous cases. By 2020, an estimated 160 million patients present with one or both fully edentulous arches. All oral rehabilitation procedures shall allow for insertion of dental implants supporting synthetic teeth into a bone presenting with adequate strength and volume which guaranty mechanical stability and biological durability. Bone grafting proved to be often unsuitable to achieve adequate maxillary bone volume and permit the placement of conventional dental implants. In these cases, zygomatic implants should be meaningfully considered. Conceptually it makes sense to get this type of implants with its apical extremity firmly anchored in the zygomatic bone and its body further embedded in as much bone as possible in order to render the final rehabilitation biologically and mechanically long-lasting.

With this objective in mind Straumann developed new zygomatic implant designs (called Straumann Zygomatic Implants ZAGA Round and ZAGA Flat) based on anatomical placement and conservative surgical procedure which consequently contribute to the preservation of the maxillary bone envelope and a simplified management of soft tissues.



Institut Straumann AG
Peter Merian-Weg 12
4000 Basel, Switzerland
www.straumann.com

Curaden

Curaprox Perio plus: CHX, but not as you know it

Curaprox Perio plus is a pioneering antiseptic range that contains chlorhexidine (CHX), but not as you know it. The mouthwashes, gel and toothpaste are naturally enhanced with Citrox. As such, Perio plus paves the way towards organic antiseptics with minimal side effects. A recent study by researchers at the University of Bern has found the unique formulation of Perio plus to be especially effective. According to the study, Perio plus has a stronger effect on plaque regrowth than solutions with the same amount of CHX but no additional ingredients. Thanks to the added benefits of natural antibacterial agents such as Citrox—a flavonoid mix extracted from bitter orange—patients can switch to lower doses of CHX more quickly, avoiding side effects and oral dysbiosis during treatment. Moreover, Citrox, in combination with the beta-cyclodextrins in the Perio plus regenerate formulation, could provide a valuable adjunct in reducing the viral load of oral and nasopharyngeal microbiota, potentially including SARS-CoV-2. Perio plus mouthwashes are available in different CHX concentrations, ranging from 0.20% to 0.05%, for individualised treatment. The Perio plus support toothpaste and focus gel contain 0.09% and 0.50% CHX, respectively. Perio plus contains no alcohol or sodium lauryl sulphate. The support toothpaste, focus gel and regenerate mouthwash contain hyaluronic acid to promote tissue regeneration. Importantly, Perio plus's pleasant fresh mint taste is a real compliance booster for patients.

Curaden AG
Amlehnstrasse 22
6010 Kriens, Switzerland
www.perioplus.com

MIS

New 16 mm drill kit for conical connection implant procedures

As part of the company's continuing effort to offer comprehensive solutions for guided surgery procedures in all clinical scenarios, this spring, MIS released their new MGUIDE kit for 16 mm conical connection drills used in implant placement procedures. The new kit has already been implemented in MSOFT, the MIS software used for guided procedure planning, and is offered through an automatic update. This new offering extends the existing solution for this range of implant lengths that were not previously available. The kit includes all drills for a complete procedure, as well as the addition of a marking drill which is intended for extraction sites. Orit Kario, MIS Digital Solutions Product Manager, highlights the marking drill, explaining that "it was designed for this specific kit and enables drilling within sockets, providing an added value in immediate placement procedures within extraction sites. The drill's design allows to drill in through the socket wall. In addition, the same kit may be used for both standard and narrow sleeve drills.

MIS Implants Technologies GmbH
Simeonscarré 2
32423 Minden, Germany
www.mis-implants.com

Amann Girrbach

One zirconia for all indications

Amann Girrbach has expanded the portfolio of Zolid Gen-X zirconias, thus further reducing the complexity of material selection. The highly translucent zirconia with a natural colour gradient is now available in all heights and shades commonly in use on the market. From now on the blanks are available in 12, 14, 16, 18, 20, 22 or 25 mm heights, eliminating all height limitations. The latter is particularly suitable for large-span, implant-supported restorations with a gingival section. The blanks now also cover the complete range of shades. They are available in 16 A–D VITA shades and two bleach shades. With its integrated colour and translucency gradient, Zolid Gen-X zirconia is the material of choice for virtually all common zirconia indications. The flowing colour and translucency gradient is a perfect imitation of nature. With this all-rounder, laboratories can significantly reduce their inventory and save time-consuming selection processes based on the indication and positioning of the respective restoration. At the same time, users can rely on the advantages of the Zolid HT+ material, which has been proven since 2017 and which forms the basis for Zolid Gen-X. With a flexural strength of 1,000 MPa, it meets almost every requirement for the stability of the restoration.

Amann Girrbach AG
Herrschaftswiesen 1
6842 Koblach, Austria
amanngirrbach.com

curasan

Complete bone regeneration with CERASORB® Foam

CERASORB® Foam is a multi-porous composite material made from collagen and pure-phase β-TCP granules of different sizes and densities. The granules are embedded in the collagen component and are fixed by its fibres. CERASORB® Foam has particularly user-friendly properties. Moistened with blood from the defect or mixed with autologous thrombocyte and fibrin concentrate, the material can be modelled and inserted into the defect precisely and comfortably. The large contact area with the surrounding vital bone allows bone-forming cells to tap into the material and also facilitates the absorption of nutrients and proteins. In addition, CERASORB® Foam is an ideal scaffold for various antibiotics. The special CERASORB® collagen matrix ensures a high level of volume stability after the collagen, which is more rapidly absorbed, has broken down. The high porosity of the granulate, in turn, offers the newly forming bone a stable framework. CERASORB® Foam is completely broken down and replaced by autologous, healthy bone. Over 200 publications prove its success (a list of literature can be provided by curasan upon request).

curasan AG
Lindigstraße 4
63801 Kleinostheim, Germany
www.curasan.de

Fotona

New MarcCo™ handpieces for photobiomodulation and pain management

Fotona, one of the leading manufacturers of medical laser equipment, has released a new line of handpieces for its award-winning LightWalker laser system that are designed for more effective photobiomodulation (PBM) and pain management treatments. The new MarcCo™ handpiece line features a modern ergonomic design that is engineered to enable fast and simple non-invasive PBM treatments, such as for peri-implantitis, to ensure faster healing with reduced pain and inflammation. PBM therapy is known to help dilate blood vessels and improve blood circulation while also accelerating tissue regeneration and cell metabolism. The new MarcCo™ handpieces are available in three sizes (up to 43 mm spot diameter), utilise sterilisable spacers and are compatible with Fotona's LA adapter for greater user-friendliness and safety when used intraorally.

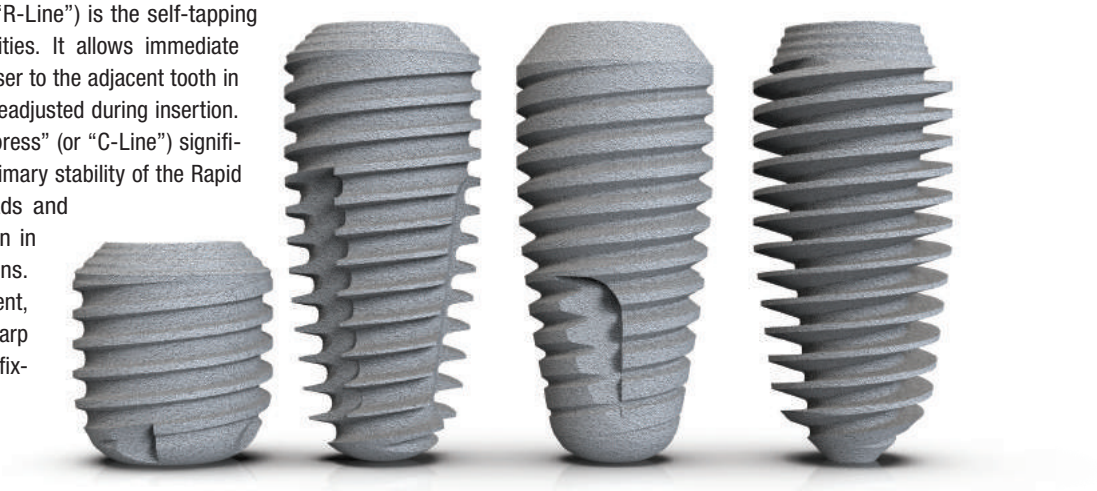
Fotona d.o.o.
Stegne 7
1000 Ljubljana, Slovenia
www.fotona.com

Argon Dental

An implant for every indication

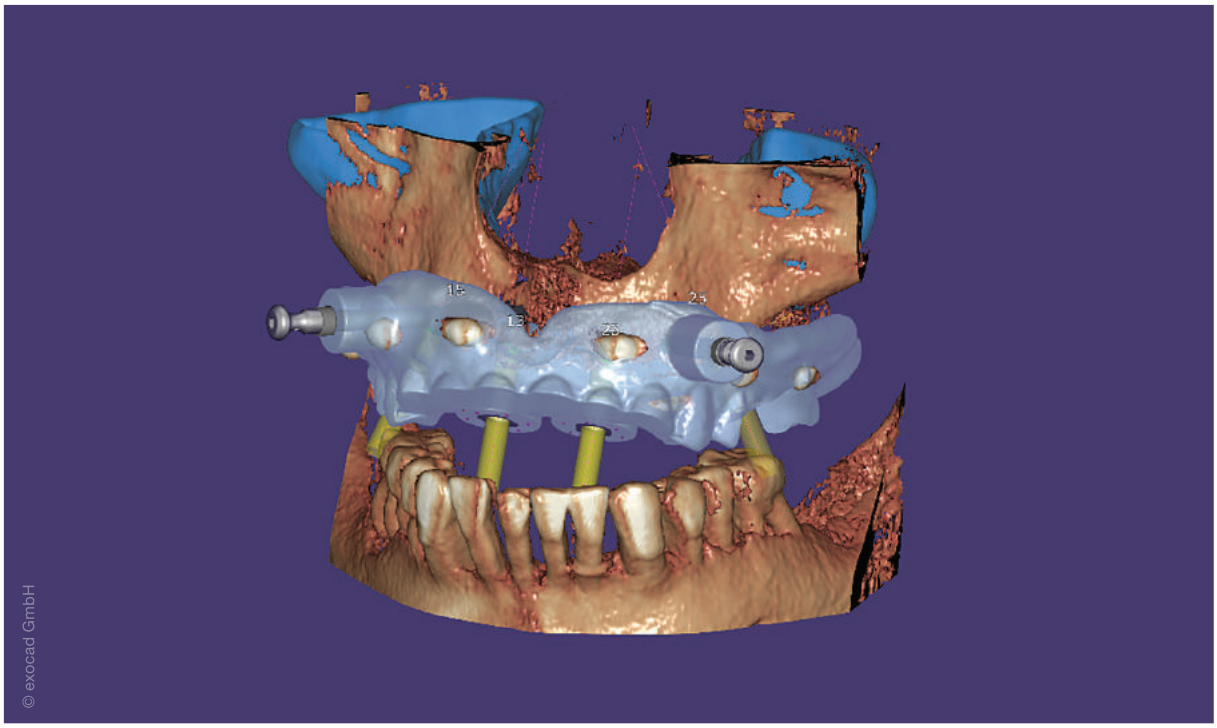
According to fastidious implantologists worldwide, the increasing success of the K3Pro implant system is owed to its well-known capabilities to sustainably preserve bone and soft tissue, its great aesthetics, its great value and, above all, its unrivaled versatility. With only two prosthetic diameter-related platforms and a wide range of lengths and diameters, every indication can be treated with long-term success, thanks in particular to the four different thread designs: the "Sure" (or "S-Line") is characterised by a cylindrical outer shape and is particularly aimed at customers who wish to precisely pretap hard bone all the way to the end of the cavity, and who appreciate a high bone-to-implant contact value (BIC). The "Rapid" (or "R-Line") is the self-tapping all-rounder for all bone qualities. It allows immediate loading and can be moved closer to the adjacent tooth in the apical region and can be readjusted during insertion. The newcomer K3Pro+ "Compress" (or "C-Line") significantly increases the known primary stability of the Rapid with its larger cutting threads and enables safe implant insertion in extremely soft bone conditions. In immediate implant placement, this novel and particularly sharp thread type enables the firm fixation to the wall of the extraction socket, and the plateau design allows for healing exclusively by blood coagulation. The well-proven "Short" line, with lengths starting at just 5.5 mm and diameters starting at 4 mm, complements the portfolio for cases with vertically reduced bone levels—in these difficult situations, the renowned tissue-preserving long-term qualities of K3Pro are indispensable.

Argon Dental
Franz-Kirsten-Straße 1
55411 Bingen am Rhein, Germany
www.argon-dental.de



exocad

New exoplan 3.0 Galway now available



In December 2020, exocad announced the availability of exoplan 3.0 Galway, the latest version of its implant planning software. The new release supports planning of edentulous cases, including design of surgical guides.

"We are excited to announce the release of exoplan 3.0 Galway and enthused about the new possibilities it presents for guided surgery," said Tillmann Steinbrecher, exocad CEO. "Exoplan 3.0 Galway will provide dental practices and laboratories with a digital workflow that offers maximum flexibility and builds on exocad's mission to make CAD design as easy as using an app on a cell phone."

Exoplan 3.0 Galway is a powerful, open, and efficient software package for virtual implant planning. Customised surgical guides can be designed using the Guide Creator software module, and then produced on site—in a laboratory, dental practice, or an external production centre. The software comes in a new, modern user interface, inspired by the Google Material Design system. With more than 40 new features, as well as enhancements to over 60 existing functionalities, the Galway release represents a major expansion of capabilities in guided surgery and improved integration with DentalCAD, exocad's dental CAD software.

Key highlights of exoplan 3.0 Galway include: Planning of edentulous cases and design of the respective surgical guides, including necessary tools, such as dual scan protocol, anchor pin placement, and fixation guide; surgical and fixation guides can be freely designed or based on a prosthesis scan; new tools to speed up the entire planning process; improved implant selection dialog; automatic panoramic curve detection; more implant libraries, now with over 500 implant systems and over 8,500 implants from more than 80 manufacturers; virtual tooth extraction on optical scans; possibility to easily mark sinus cavity and check if implants are intruding.

All exocad solutions are based on the same technical platform with an open architecture, ensuring the seamless functionality of the digital workflow: from virtual prosthesis-oriented implant planning with exoplan and designing surgical guides with Guide Creator, to planning and producing the implant-supported, temporary, and final restorations with DentalCAD, exocad's dental CAD software.

"As the world's premier OEM supplier of dental CAD software, we provide the symbiosis of prosthetic and implant planning," said Steinbrecher. "Users can achieve predictable results in a cost- and time-efficient manner, which can ultimately result in increased customer satisfaction." Exoplan 3.0 Galway is now available in the EU and other select markets.

exocad GmbH
Julius-Reiber-Straße 37
64293 Darmstadt, Germany
exocad.com
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The ISMI newsletter keeps you up to date with the latest scientific trends, products, and events on a regular basis. It also features user reports as well as a wide range of information and tips on the subject of metal-free implantology.

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As a member of ISMI, your membership fee includes a subscription of the independently published English language magazine *ceramic implants—international magazine of ceramic implant technology*. Published twice a year, the magazine offers specialist articles and event reports as well as industry- and science-related news from the international world of metal-free implantology. In addition, *ceramic implants* provides information about manufacturers and their latest products.

ISMI e.V. Office Leipzig
Holbeinstraße 29 | 04229 Leipzig | Germany
Phone: +49 800 4764-000 | Fax: +49 800 4764-100
office@ismi.me | www.ismi.me

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CareCapital acquires Neoss:

Dr Gottlander becomes CEO

CareCapital Advisors Limited, an equity investor focused on the dental and oral care industry, announced an agreement to acquire Neoss Limited. CareCapital is one of the largest dental investors in the world, having invested more than US$1 billion in the sector, and provides a patient and collaborative environment for dental entrepreneurs and talented executives to realise their customer-centric visions. Neoss is a leading global dental implant company committed to designing intelligently simple solutions that provide reliable and cost-effective patient care with excellent long-term results. The Neoss brand is synonymous with innovation and quality, which has underpinned Neoss' market leading performance in 2020 despite the coronavirus pandemic. In conjunction with the transaction, Dr Robert Gottlander has been appointed President and Chief Executive Officer of Neoss. With over forty years of dental industry experience, Gottlander has a proven track record in developing and commercialising dental solutions.

Source: Neoss

ceramic implants

The international medium for ceramic implant technology

Today, the implant material zirconium dioxide is considered to be on par with titanium owing to its advantages in regard to tensile strength, osseointegration and prosthetic flexibility. Recent years have seen a rapid evolution of metal-free implant systems and the demand for the highly aesthetic, bio-inert and metal-free material zirconia is steadily increasing. In order to keep up with these developments, clinicians need a dedicated magazine that presents the latest industry innovations and their application possibilities. Published twice a year, *ceramic implants—international magazine of ceramic implant technology* has become an international leading medium for metal-free implantology and is regarded a powerful independent platform for the incredibly active international ceramic community. The magazine features research findings, practice-oriented specialist articles, event previews and reviews, as well as industry news on the latest in product innovation. Additionally, it provides comprehensive insight into the activities of various international expert societies. Being an unbiased and independent platform for everyone involved is what distinguishes *ceramic implants*. The magazine is published by the leading dental publisher OEMUS MEDIA AG and the next instalment will be out in April 2021. For an annual subscription (€30 plus shipping) or a free hard copy, contact subscribe@oemus-media.de.

ceramic implants e-paper

Source: OEMUS MEDIA AG

A new award for high

Production standard of ceramic implants

In January this year, the CeramTec Group, a world innovation leader for advanced ceramics, was awarded the “Certified Production Quality” seal by the CleanImplant Foundation in Berlin. “Although the approval of medical devices is largely regulated in every country, large studies still find numerous dental implants with significant particulate contamination from the production process,” said Dr Dirk Duddeck, CEO of the CleanImplant Foundation. “There are too few controls on dental implants. Users need more safety and better, reliable guidance to avoid putting patients at unnecessary risk.” Based on the globally established CleanImplant consensus guideline on the cleanliness of dental implants, the independent non-profit organisation is also awarding a certification to contract manufacturers, producing implants for various trade brands. The certificate not only confirms high production quality. At least twice a year, the implants’ purity is also monitored through unannounced inspections in accredited testing laboratories, using a scanning electron microscope before the final packaging and sterilisation process. Providers of implants produced by CeramTec do not only benefit from the new award in the context of medical device regulation. The CleanImplant Foundation also facilitates access to the coveted “Trusted Quality Mark” for sterile-packaged end products, which is awarded after the SEM analysis of five randomly selected samples of the same type and a final peer review of all results.

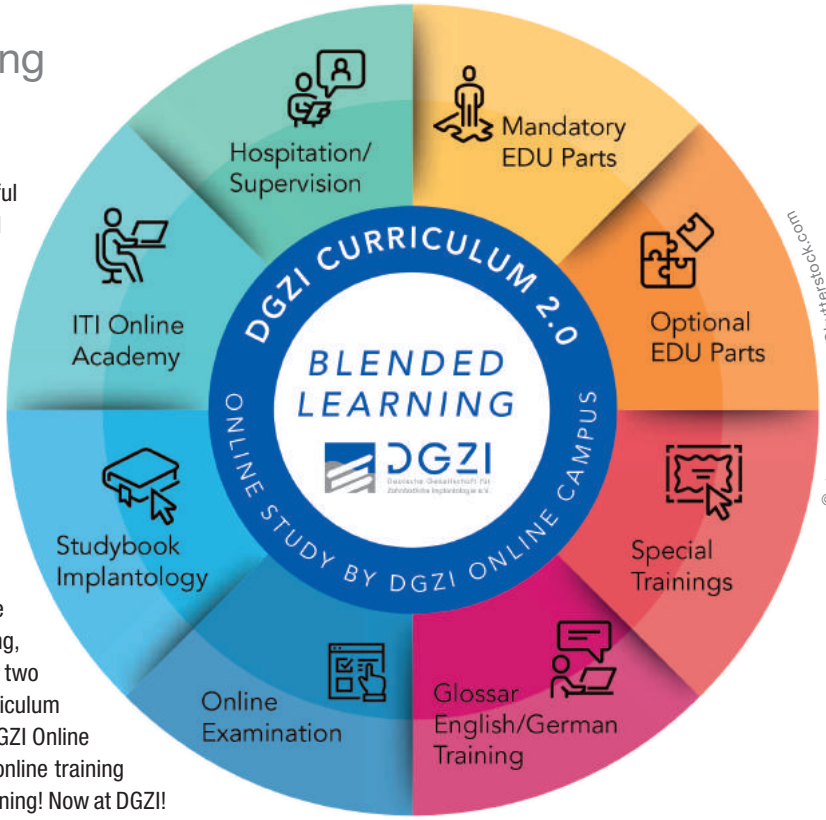
Dr Dirk Duddeck, CleanImplant Foundation, presents the certificate to Dr Hadi Saleh, CEO of the CeramTec Group. *(Photo: © CleanImplant Foundation)*

Source: CleanImplant Foundation

DGZI Online Campus

International online training wherever you are

The structure and content of DGZI’s successful implantology curriculum was revised in 2019. All participants now have access to the ITI Academy, where young dentists with little experience in implantology can learn the basics of implant dentistry. All participants in the curriculum will start their training in the new “DGZI Online Campus”. This has been completely redesigned and enables e-learning from all devices and from anywhere you have online access. The theoretical basics of implant dentistry are well presented and taught in separate modules. Each module ends with a learning success check, which can be practised as often as required in advance in test examinations. After successful online training, three practice-related compulsory modules and two therapy-related optional modules follow. The curriculum is supported by special learning materials of the DGZI Online Campus. Start with the new concept of the DGZI online training at home or wherever you are—that is Blended Learning! Now at DGZI!



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Contact: sekretariat@dgzi-info.de; info.vollmer@t-online.de

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www.eao.org

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Publisher
Torsten R. Oemus
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CEO
Ingolf Döbbecke
doebbecke@oemus-media.de

Member of the Board
Lutz V. Hiller
hiller@oemus-media.de

Chairman Science & BD
Jürgen Isbaner
isbaner@oemus-media.de

Chief Editorial Manager
Dr Torsten Hartmann
(V. i. S. d. P.)
hartmann@dentalnet.de

Editorial Council
Dr Rolf Vollmer
info.vollmer@t-online.de

Dr Georg Bach
doc.bach@t-online.de

Dr Suheil Boutros
SMBoutros@aol.com

Editorial Office
Georg Isbaner
g.isbaner@oemus-media.de

Johannes Liebsch
j.liebsch@oemus-media.de

Executive Producer
Gernot Meyer
meyer@oemus-media.de

Product Manager
Timo Krause
t.krause@oemus-media.de

Art Director
Alexander Jahn
a.jahn@oemus-media.de

Designer
Franziska Schmid
grafik@oemus-media.de

Customer Service
Marius Mezger
m.mezger@oemus-media.de

Published by
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Tel.: +49 341 48474-0
Fax: +49 341 48474-290
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DGZI
DGZI Central Office
Paulusstraße 1
40237 Düsseldorf, Germany
Tel.: +49 211 16970-77
Fax: +49 211 16970-66
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