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2/21

ceramic implants

international magazine of ceramic implant technology

research
Room for improvement

case report
Restoring aesthetics in the mandible

events
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Georg Isbaner

Managing editor

Recognition of two-piece systems

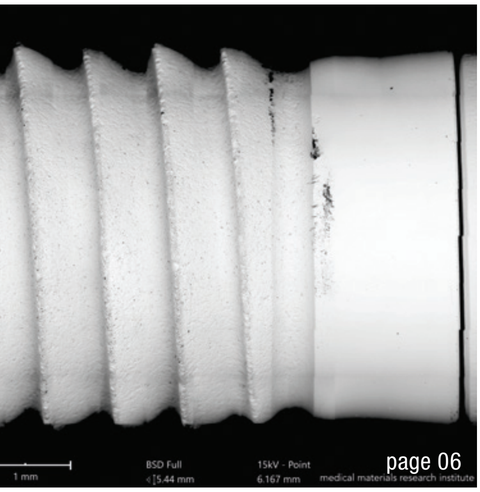
The past months have been game-changing for ceramic implantology. For one, manufacturers of two-piece ceramic implant systems are able to refer to new and reliable scientific long-term data. Besides the already known favourable soft-tissue reaction, the data indicates superior osseointegration compared to titanium systems. We are proud to have been able to exclusively interview Dr Roland Glauser, Switzerland, during the 2021 International Dental Show. Dr Glauser elaborates on the study design and the most important findings of the longitudinal study he conducted together with Dr Peter Schüpbach, Switzerland. On top of that, he provides insightful photo material (pages 42 and 43).

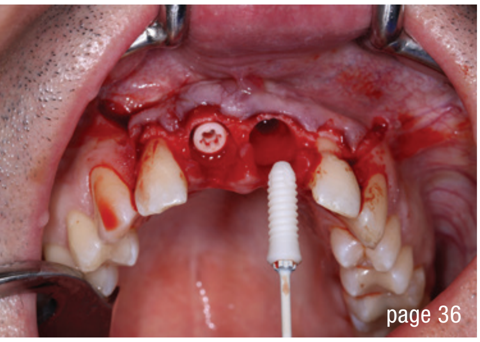
Modern one-piece ceramic systems have been a tried and tested option in implant therapy for a long time. "However, based on scientific statements and recommendations of professional associations, two-piece ceramic implants are still often denied this recognition with the argument that there is a lack of scientific evidence and consequently a lack of medical necessity for this type of implant", it reads in a statement of the European Society for Ceramic Implantology (ESCI), which will exclusively be pre-published here in full (pages 54 and 55). In accordance with their role as a scientific and unbiased expert society and after scrutinising all hitherto available empirical data, the ESCI adopted a consensus paper concluding that the use of two-piece ceramic systems is deemed safe based on scientific evidence and that these systems may now be regarded as a suitable clinical option for implant therapy.

Contributing to the two above-mentioned theoretical aspects, one must mention that the reality in dental clinics and continuing education is further along. There is plenty of proof in the present ceramic implants—**international magazine of** ceramic implant technology. Several research articles, case reports, reviews of recent ceramic implantology events and previews of those that will take place in the near future testify of an extraordinarily active community. That is why the website ceramic-implants.info has been founded a few months ago and a matching LinkedIn-community has been established. In this way we stay abreast of the eclectic need for information of our readers and users. Stay up to date with us and follow us on LinkedIn and be sure not to miss anything.

Enjoy your read.

Georg
Managing editor





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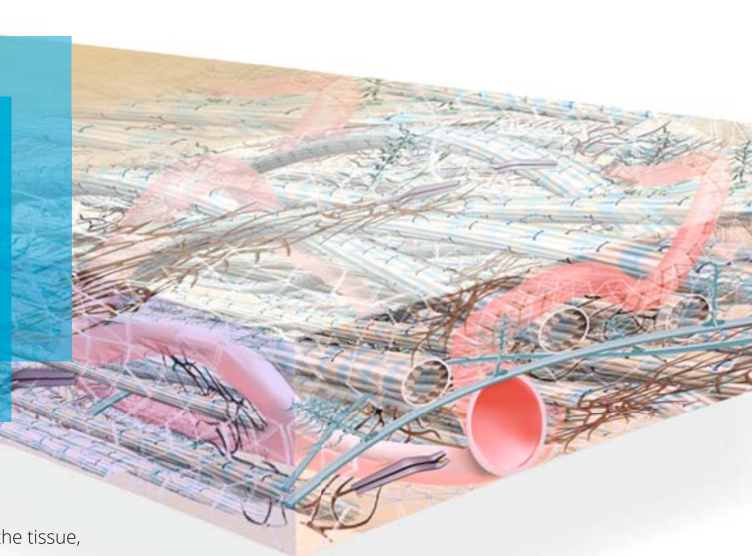
Soft tissue augmentation

BIOHORIZONS® biologics



NovoMatrix™ Reconstructive Tissue Matrix – the next generation material

NovoMatrix™ Reconstructive Tissue Matrix is an acellular dermal matrix derived from porcine tissue intended for soft tissue applications. The proprietary LifeCell™ tissue processing is designed to maintain the biomechanical integrity of the tissue, which is critical to support tissue regeneration.

Indications

- Localized gingival augmentation to increase keratinized tissue (KT) around teeth and implants
- Alveolar ridge reconstruction for prosthetic treatment
- Guided tissue regeneration procedures in recession defects for root coverage

Product features

- Consistent thickness (1 mm)
- Pre-hydrated
- Controlled source

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Bone tissue augmentation

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MinerOss™ A The allograft for outstandingly fast bone remodeling [1]

The scientific evidence shows that allografts are the second best option to patient's own bone compared to other bone substitutes. [2]

Benefits of MinerOss™ A human bone substitute [1, 3–5]

- Optimal osteoconductivity
- Fast graft incorporation
- Complete remodeling potential

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[1] Wen et al. J. Periodont. 2019, 1, 734.
[2] Schmitt et al. Clin Oral Implants Res. 2013, 24, 576.
[3] Kloss et al. Clin Oral Implants Res. 2018, 29, 1163.
[4] Solakoglu et al. Clin Implant Dent Relat Res. 2019, 21, 1002-1016.
[5] Kloss et al. Clin Case Rep. 2020, 8, 5.
References available at: www.biohorizonscamlog.com/references_minerossa

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Room for improvement

Remarkable impurities found on randomly chosen ceramic implants

Dr Dirk U. Duddeck, Germany

This article summarises a recent peer-reviewed study that is a follow-up to a pilot study conducted in 2019 that focused on titanium-made implants and scientifically validated the implant quality assessment process utilised by the non-profit organisation CleanImplant Foundation. The new study examines five ceramic implant systems, which were purchased anonymously (blind shopping): implants from two Swiss manufacturers, as well as implants from a Taiwanese, a German and an Israeli company. The results will be published in the *International Journal of Oral & Maxillofacial Implants*. Three sterile-packed samples of each implant system were examined using scanning electron microscopy and a complex image-mapping technique, resulting in a large high-resolution image that covered the entire sample from the implant shoulder to the apex in material contrast. Contaminants were analysed by elemental analysis. Conspicuous impurities were then chemically identified using time-of-flight secondary ion mass spectrometry. In addition, the surface topography of all systems was evaluated, and different roughness values were compared. Finally, a search for clinical studies was conducted of the PubMed database, of the suppliers' websites and by written request to the individual implant manufacturers.

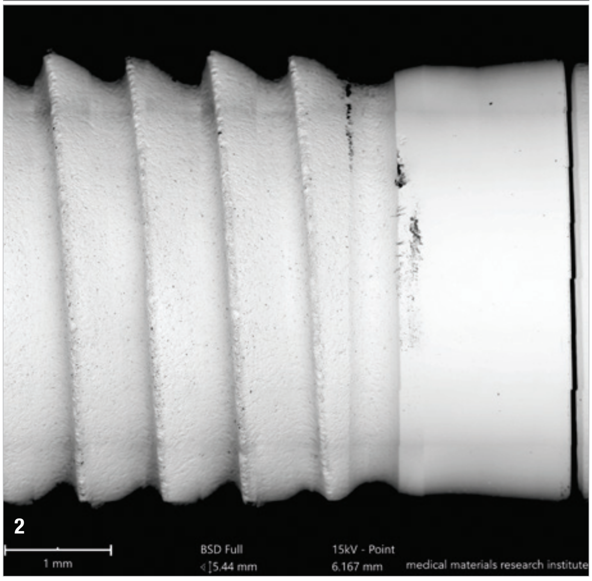

Fig. 1: Organic contaminants in a crack at the implant shoulder. **Fig. 2:** Plastic (polyoxymethylene) particles from the implant packaging on the first implant thread.

The Swedish-German research team from Charité Universitätsmedizin—Berlin (Duddeck and Florian Beuer), Sahlgrenska Academy at the University of Gothenburg (Tomas Albrektsson and Ann Wennerberg) and Malmö University (Christel Larsson), supported by the International University of Agadir (Jaafar Mouhyi), revealed some unexpected results. While the surfaces of two of the investigated implant systems were found to be largely free of particles, the other systems examined revealed significant carbon-containing organic impurities on their surfaces (Fig. 1). Subsequent time-of-flight secondary ion mass spectrometry analysis identified these contaminants as polysiloxanes, erucamide, aliphatic hydrocarbon compounds, fatty acid esters, talc and even polyacetal (polyoxymethylene; Fig. 2).

Remarkably, the study showed that in one system the sterile packaging itself was the cause of substantial plastic contamination on the sterile implant's surface—some of the contaminants were millimetres in size. Dodecylbenzenesulphonic acid (DBSA) was also detected on samples of two implant systems, which suggests that the manufacturers' cleaning process of the ceramic implants examined was insufficient. DBSA is an aggressive surface-active cleaning agent classified as hazardous by the U.S. Environmental Protection Agency. Four of the ceramic implant systems examined had a moderately rough implant surface. Only one ceramic implant system showed minimal surface roughness. Clinical studies were documented for three ceramic implant designs, and these had a follow-up period of up to three years and results ranging from 82.5 to 100% survival. The two other implant systems did not provide properly conducted clinical records.

The results of this study demonstrate that it is technically possible to fabricate largely residue-free zirconia implants. However, the large number of significant contaminants found in this analysis is a cause for concern, as every factory-related contamination may provoke unwanted adverse biological effects. It is worth noting that all systems evaluated in this study had CE markings or had received U.S. Food and Drug Administration marketing clearance. According to the authors, practitioners should always assume that foreign substances and contaminants can lead to undesirable biological effects—unless they have been proved harmless and not an impediment to the process of osseointegration. This precautionary principle should always be the guiding principle for any medical treatment, the authors concluded.

Editorial note: The article, "Quality assessment of five randomly chosen ceramic oral implant systems: Cleanliness, surface topography, and clinical documentation", referred to in the text is in press. Printed versions of the publication can be requested at publication@cleanimplant.org.

about the author

Dr Dirk U. Duddeck studied biology and dentistry and specialised in oral implantology. He is a guest researcher at Charité—Universitätsmedizin Berlin and founder and head of the non-profit organisation CleanImplant Foundation, both in Berlin in Germany.

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Measuring bone density by intra-oral ultrasound for secure implant insertion

Dr Johann Lechner, Germany

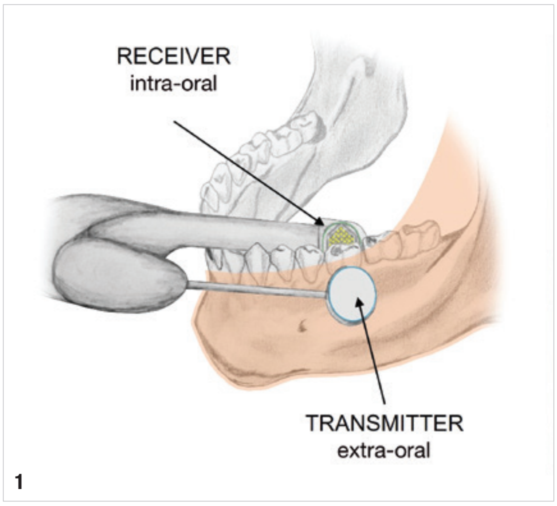

Fig. 1: Schematic representation of the positioning of the transmitter and receiver (left). Practical application of CaviTAU® with intra-oral measurement, using LED light for exact definition of the measurement area (right).

Introduction

In the medical field, ultrasonography is widely used to image various types of soft tissue. In principle, images of structures in the body are generated by analysing the reflection of ultrasonic waves. To derive useful information concerning the status of jawbone, different ultrasonic techniques must be employed, as the ultrasonic waves are almost completely reflected at the bone–soft-tissue interface. The *in vivo* measurement of ultrasonic velocity in human cortical bone was introduced as a rapid, reliable and non-invasive method which could be used to analyse the mechanical properties of bone.[1] Is a newly available ultrasonic device for the radiation-free measurement of bone density (CaviTAU®; Digital Dental & Healthcare Technology) suitable for visualising the condition of jawbone density?

Is the jawbone ready for implant insertion?

Researchers have reported microscopically proven chronic ischemic/inflammatory or fatty degenerative osteonecrosis of the jawbone (FDOJ):[2] FDOJ was found in >50% of 154 clinically and radiographically unremarkable edentulous jaw areas into which dental implants were to be placed. The following question is therefore justified: can aseptic bone necrosis pose a risk to implant placement?[3] The currently available literature offers an insight into anecdotal reports of "poor quality" alveolar bone discovered during implant surgery in edentulous sites. This poses a risk for the uninterrupted osseointegration of implants.[4] Aseptic bone necrosis has been reported after surgery, trauma and immunosuppressive therapy.[5,6] The evolution of aseptic necrosis is documented in the maxillomandibular region, particularly after osteotomies.[7,8] It has been found that micromotion of implants in soft bone is consistently high and that this can result in failed osseointegration. Scientists—such as those who have reported FDOJ from the Division of Periodontics of the University of Maryland School of Dentistry in Baltimore in the US1—speak of the phenomenon of a chronic ischemic/inflammatory or FDOJ. This pathology is thus internationally recognised and was first included in the tenth revision of the International Statistical Classification of Diseases under "aseptic ischemic osteonecrosis".

Assessing stability of the bone bed with ultrasound

Whether implants can be embedded in the jaw for extended periods depends primarily on the condition of the bone. In the anterior of the lower jaw, conditions are usually ideal. However, in the upper jaw, the bone is naturally less dense. The dentist often only notices whether an implant will stay in place here when drilling or when cutting the thread for the implant into the bone, and even this impression can be deceptive: "There is no reliable method for predicting the success of dental implant insertion before the dental procedure," according to Prof. Robert Sader from the clinic for oral and facial plastic surgery at the Frankfurt university hospital in Germany. One solution is determining the density of the bone using ultrasound. This is because the propagation of ultrasonic waves in bone tissue depends on its density: the more stable the bone, the faster the waves move through it. Scientists at Johannes Gutenberg University Mainz have now investigated for the first time whether the method also allows conclusions to be drawn on the condition of the jawbone. Prof. Bilal Al-Nawas from the clinic for oral and maxillofacial surgery has investigated ultrasonic transmission velocity (UTV) in the lower jaw and pelvic bone of pigs. The results indicate that UTV is an accurate measurement of the level of mineralisation: bone sections with a critical bone density that would prohibit implant insertion were detected by the method in 75% of cases. Thus, determining the quality of the bone in the jaw with the help of ultrasound may even be more effective than radiography.[9] Torque and UTV were used to assess the bone implant sites in these studies.[10] UTV can be used to analyse the mechanical properties of the teeth after *in vitro*, *in situ* and *in vivo* loading.[11]

Is there an intra-oral technique to measure bone density?

The fundamental suitability of ultrasound for determining bone density and thus the length of time implants are in place has already been scientifically validated.[9–11] With ultrasonic devices, dentists can check jawbone quality to predict the success of dental implant insertion. The innovative CaviTAU® is a suitable ultrasonic device for transferring the mentioned findings into routine daily practice: CaviTAU® therefore offers application-oriented reliability for dental implantologists and prevents premature implant loss.[12]

What is CaviTAU®?

CaviTAU® generates an ultrasonic wave and passes that wave through the jawbone. This wave is produced by an extra-oral transmitter and then detected and measured by a receiving unit that is positioned intra-orally. Both parts (i.e. the sender and receiving unit) are fixed in a parallel position using a single handpiece. The size of the CaviTAU® receiving unit is configured such that it may be easily placed inside the mouth of a patient. CaviTAU® uses 91 piezoelectric elements that are arranged hexagonally. The jawbone must be positioned between the two parts of the measuring unit. With respect to the parts of the measuring unit to be placed inside the patient's mouth, the acoustic coupling between those parts and the alveolar ridge is performed with the aid of a semi-solid gel. The contact between the jawbone and both the extra-oral ultrasonic transmitter and intra-oral ultrasonic receiver (Fig. 1, left) is optimised and individualised using a special ultrasonic gel cushion that was developed for this purpose. The results are shown on a colour monitor that displays different colours depending on the degree of attenuation. Thanks to the latest computerised miniaturisation of the measuring units, CaviTAU® now offers a wide range of applications. The CaviTAU® display is able to capture the following physical structures in the dentoalveolar region, with the corresponding colour variations of 91 colour columns per cm^2: (a) solid bone in the marginal cortical area (green or white/light blue); (b) healthy medullary cancellous bone (green or white/light blue); (c) chronic inflammatory medullary cancellous bone with fatty degenerative components (red or black/dark blue); (d) fatty nerve structures (yellow/light blue); and (e) extremely dense and complex structures such as teeth, implants and crowns (green or white/light blue; Fig. 2).

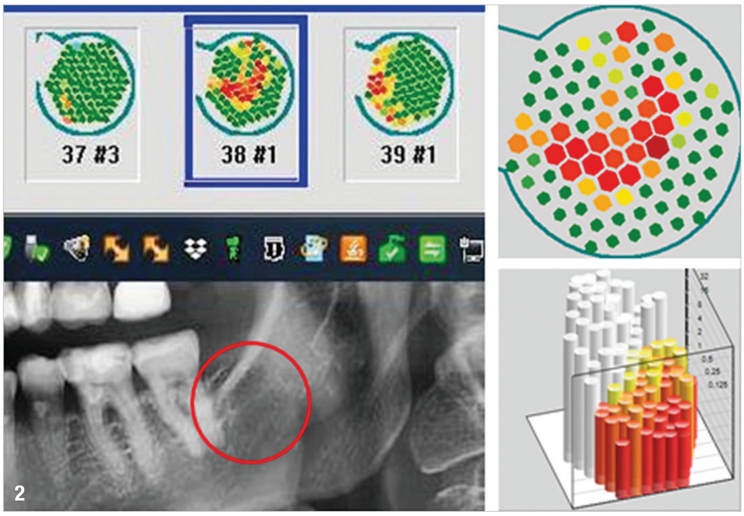

Fig. 2: Example of an inconspicuous radiographic image in area #38 (red circle). In contrast, measurement of bone density in area #38 compared with healthy tooth #37 (top left) with ultrasound shows conspicuous red areas in 2D and 3D representation (right).

How to forecast the success of dental implants

The measurement of the quantitative ultrasonic transmission rate (UTV) has been established as an innovative, objective, valid and reliable method for repeated, non-invasive measurements of bone quality before dental implantation.[9–12] The use of a small UTV device in this study enabled the recording of intra-oral UTV values in a large and heterogeneous patient population.[12] Assessment of alveolar ridge UTV could provide a method for identifying critical bone quality before implant insertion or for monitoring bone healing (mineralisation) after