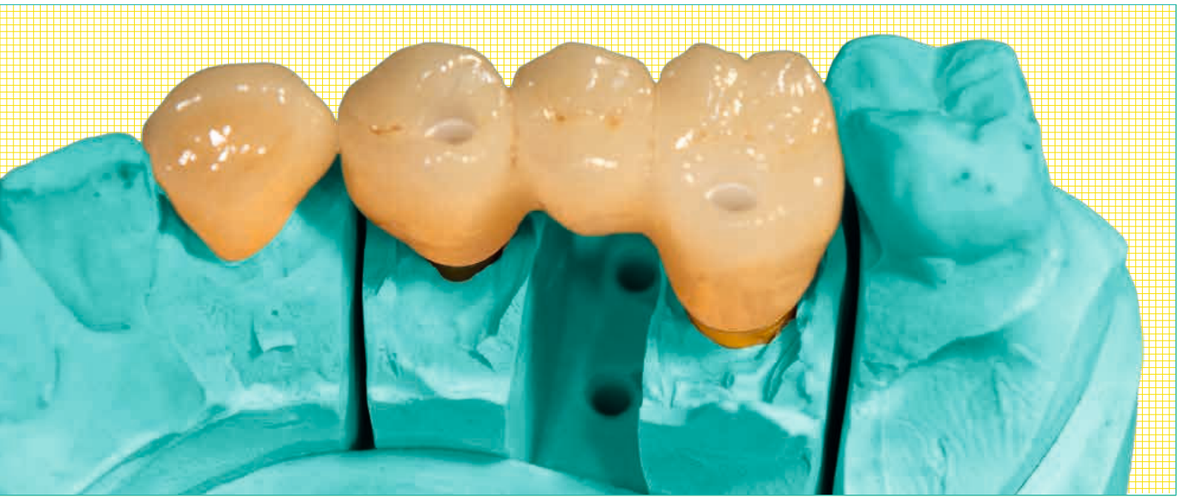
Full Ceramic Implant Treatment in the Molar Area

Michael Leistner



Ceramics are known for their excellent aesthetic properties, outstanding biocompatibility, and low plaque buildup. With the introduction of CAD/CAM technology in dentistry, high-performance ceramic material, specifically zirconia, has been successfully utilized for prosthetic restorations, significantly expanding the scope of all-ceramic treatments. Zirconia also plays a crucial role in the field of ceramic implants.

As early as the 1960s, attempts were made to use ceramics, specifically aluminum oxide at the time, as implant material. However, the low fracture toughness of the material used and the consequent reduced fracture resistance of the implants led to the failure of this concept. Modern ceramic implants are made from zirconia, and they can achieve survival rates comparable to titanium implants. It is important to note that, just like with restorative materials, not all zirconia is the same. There are significant differences in chemical composition, manufacturing processes, as well as the shape and roughness of implant surfaces. Consequently, these differences result in variations in terms of osseointegration, stability, clinical manageability after insertion, and so on.

Case Study

Below is a case study where a 67-year-old patient, after losing teeth 24, 25, and 26, was provided with a screw-retained zirconia bridge supported by two zirconia implants (in the region of teeth 24 and 26). Additionally, the patient received a full ceramic crown on tooth 23. Figure 1 illustrates the situation at the patient's initial consultation before the implantation procedure. A metal-free restoration was of utmost importance to him.

The key aspects to consider when opting for a full ceramic dental treatment from root to crown are typically encapsulated by patients in the following keywords: metal-free, biocompatible, durable, and aesthetic. By using a ceramic implant, the potential for intolerances related to metals found in titanium and titanium implants (such as nickel, vanadium, aluminum) can be eliminated. Titanium has been shown to release titanium ions that can accumulate in surrounding soft tissues and trigger inflammation.[1] Additionally, the fact that zirconium dioxide has been successfully employed as a biologically oriented solution in various medical fields for decades further supports its use as an implant material.

[1] (Reference citation is missing in the provided text)

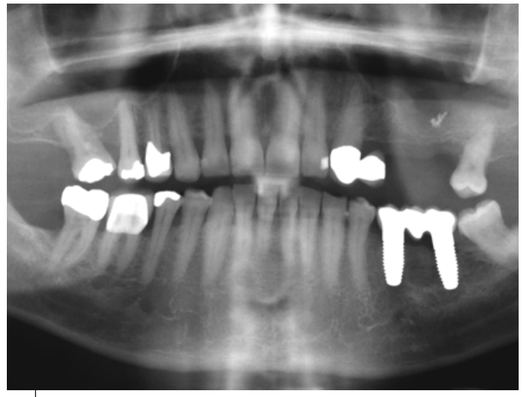


Fig. 1: OPG (Orthopantomogram) at the patient's initial consultation with measuring sphere.

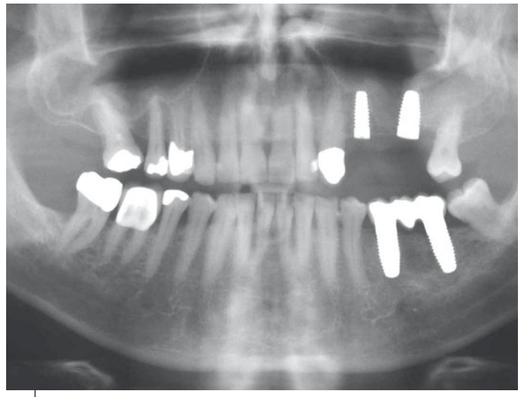


Fig. 2: OPG (Orthopantomogram) after implantation.

The choice of material used in dental implants is indeed a crucial factor. Many patients are already aware, through their own research, of the tissue-friendly and plaque-resistant properties of the material. Zirconia, in fact, offers significant added value compared to titanium implants due to its lower rate of long-term complications such as peri-implantitis[2]. The reduced plaque buildup simplifies hygiene for the patient and supports gum health[3]. Zirconia also has a reputation for being exceptionally durable. Moreover, its aesthetic potential is evident: While titanium implants may appear dark through the gingiva, a ceramic implant closely resembles the natural tooth root in terms of color and translucency.

Zirconia Implants

Two Zeramex XT implants (Dentalpoint) with diameters of 4.2 mm and 5.5 mm and a length of 10 mm were inserted. Figure 2 shows the situation after the implantation.

Thanks to its two-part, reversibly screw-retained design, the ZERAMEX XT implant offers significant prosthetic flexibility while remaining a straightforward and clear system. It is placed 1.6 mm supra-crestally (optionally up to 0.6 mm). The implant thread is designed to achieve high primary stability. The bone chip reservoir at the implant tip simplifies implant insertion. The ceramic implant is made from pre-sintered zirconia ATZ blanks. After final shaping of the outer and inner geometry of the implant, there is no thermal process (sintering) or post-processing. This ensures high precision is achieved, and there will be no alteration in the material structure. The so-called ZERAFIL surface is a microstructured implant surface that enables convincing osseointegration of the dental implants. The success rate of ZERAMEX implants with ZERAFIL surface ranges between 96.7% and 98.5% depending on the system[2]. The hydrophilic implant surface is processed through sandblasting and etching, allowing osteoblasts to adhere to it effectively.

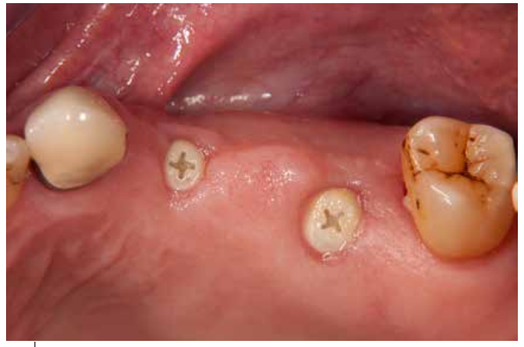


Fig. 3: Situation three months after implant placement.

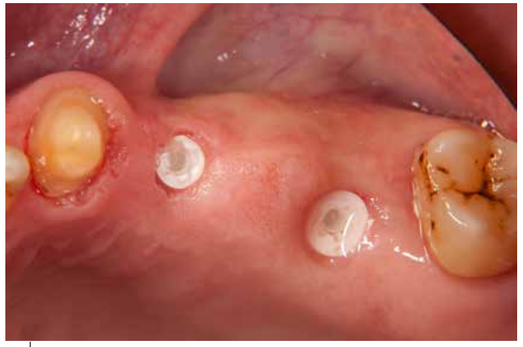


Fig. 4: Situation after the preparation of tooth 23 and exposure of the implants.

Fig. 5: Screwed-in impression posts (open transfer).

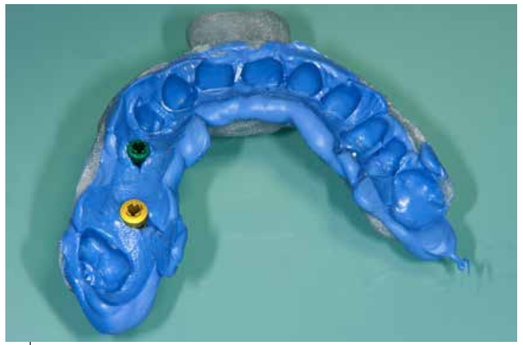


Fig. 6: Impression of the implants using a custom tray.

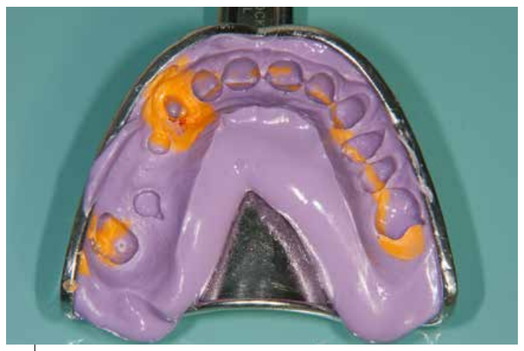


Fig. 7: Impression of the crown using hydrocolloid.

Fig. 8: Centric occlusion bite registration.

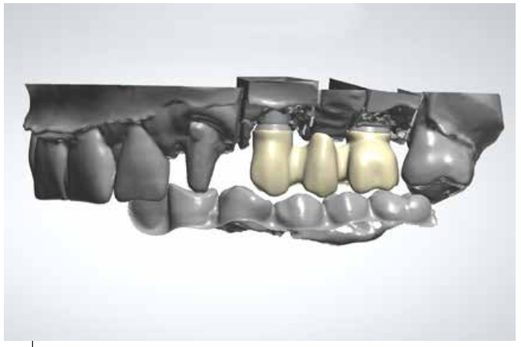


Fig. 9: The framework design above the abutments in the CAD software.

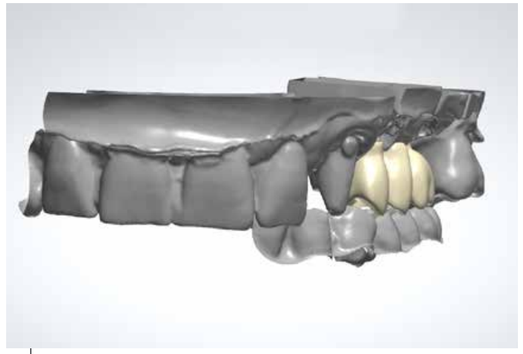


Fig. 10: View of the computer-generated framework from the mesiobuccal perspective.

Fig. 11: Illustration of the drilling holes for occlusal screw placement.

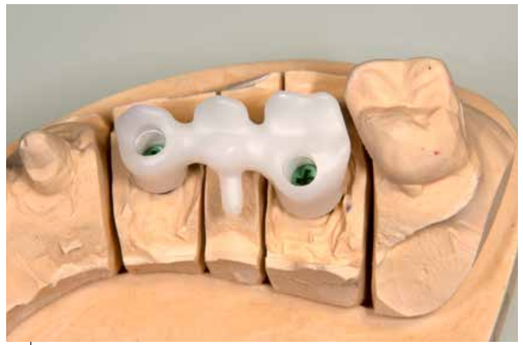


Fig. 12: The milled framework on the occlusal model.

The direct contact with the implant and a secure attachment to the implant surface can be achieved.[4] Figure 3 shows the situation three months after the implant placement. The percussion test on the implants provides information about whether adequate bone integration has occurred. A clear sound indicates good osseointegration, while a dull sound suggests more of a soft tissue integration.

Zirconium Dioxide Prosthesis

For the impression taking, the implants were exposed, and tooth 23 was prepared to ceramic standards (Fig. 4). In the case of well-integrated implants, gingival tissue often proliferates over the healing abutments, despite open healing, as is also known with titanium implants. If necessary, such overgrowths can be easily removed with a tissue trimmer (NTI-Kahla). The instrument is used with the turbine without water, only with the supply of air, and has good cutting performance in the gum tissue. The (insertion and) removal aids make it easy to remove the healing caps. Before taking the impression, it is recommended to clean the implant inner geometries. This is because often there are still contaminants present, such as blood residues from the surgery or food particles if the healing cap was not tightly sealed.

The impression of the implants was taken using a custom tray and Virtual Monophase (Ivoclar Vivadent) (Figs. 5 and 6). This non-crosslinked impression material has excellent hydrophilic properties and accurately represents fine details. The impression for the crown was taken using hydrocolloid (OPTILOID Pro Pak, Optiloid). Subsequently, a centric bite registration was performed (Kanibite, KANIEDENTA).

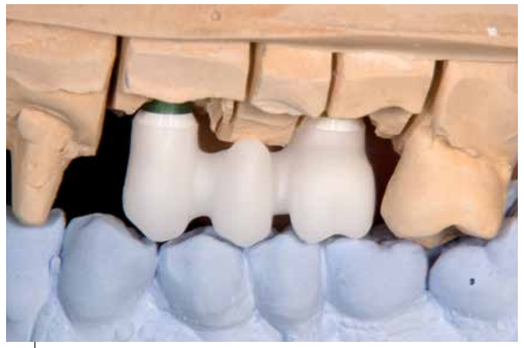


Fig. 13: The milled framework on the model in occlusion.

Fig. 14: Layers of ceramic veneering.

Fig. 15: Layers of ceramic veneering on the buccal side.

Fig. 16: Buccal view of the finished, already bonded bridge and crown.

Fig. 17: Occlusal view.

Fig. 18: Palatal view.

Fig. 19: Bridge prepared for occlusal screwing.

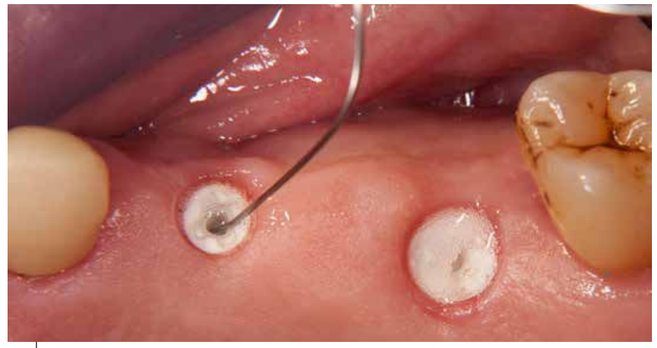


Fig. 20: Cleaning the exposed implants with H2O2, three weeks after gingival retraction.

The complete case was undertaken (Fig. 8). For the virtual scaffold design, the models were scanned (3Shape / Kulzer), and the data were further processed in CAD software (Eckelmann). Figures 9 to 11 show the finished design of the bridge framework with the virtually placed drill holes for direct screwing onto the implants. Milling was performed using the zirconium dioxide Zolid ht+ white (Amman Girrbach) with a corresponding milling system (Eckelmann) (Fig. 12 and 13). For veneering, the ceramic system IPS e.max Ceram (Ivoclar Vivadent) was used (Fig. 14 to 18). The ZERAMEX XT Abutments were bonded to the framework with the self-curing bonding composite Multilink Hybrid Abutment (Ivoclar Vivadent). After removing excess adhesive residues and polishing the adhesive joint, the bridge was ready for occlusal screwing (Fig. 19).

Full Ceramic End Result

Figures 20 and 21 show the exposed implants after three weeks of gingival shaping (ZERAMEX XT Gingivaformer). The connection geometries were initially cleaned with H2O2 and interdental brushes, then the bridge was screwed in place using a torque wrench (25 N/cm) (Fig. 22). During this process, the screw conforms to the contours of the implant and then rests directly on the ceramic over a large surface area. This results in a very compact connection with a so-called press fit. The centerpiece of the connection is the VICARBO screw. It functions as a bolt that anchors the structure in the implant. The extremely hard ceramic is combined with a very rigid, carbon fiber-reinforced PEEK material. Similar to reinforced concrete, the ceramic absorbs compressive forces while the VICARBO screw counteracts tensile forces. The carbon fibers are integrated longitudinally into the material to achieve exceptionally high performance. During production, the carbon fibers are not damaged, preserving their function. The implant-abutment connection based on the VICARBO screw is patented. The screw gets its dark color from the carbon fibers. The conical seating of the screw is designed to achieve a tight fit in the abutment without generating lateral forces that could damage the abutment. The screws were covered with Teflon tape (Fig. 23), and the screw channels were sealed with flow composite (Tetric Ceram Flow, Ivoclar Vivadent) (Fig. 24).

Figures 25 and 26 show the final result in the patient's mouth immediately after the full ceramic crown was also attached to tooth 23, while Figure 27 shows the post-prosthetic treatment panoramic X-ray (OPG). The patient's request for a metal-free treatment has been fully met: a 100% metal-free solution has been achieved, where not only the implant and prosthesis but also the screw are metal-free.

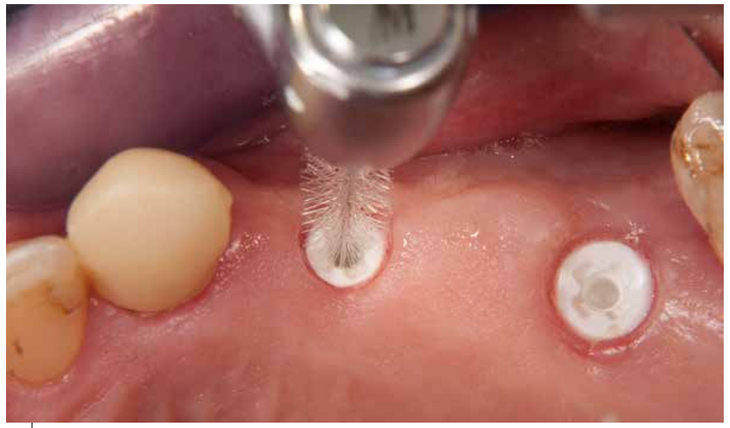


Fig. 21: Cleaning the connection geometry with interdental brushes.

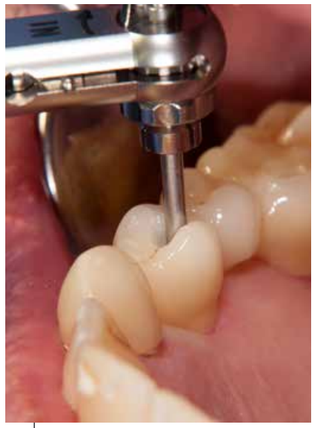


Fig. 22: Placing and screwing the bridge with a ratchet.

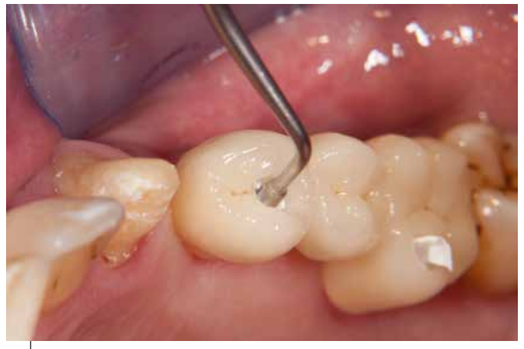


Fig. 23: Covering the screws with Teflon tape.

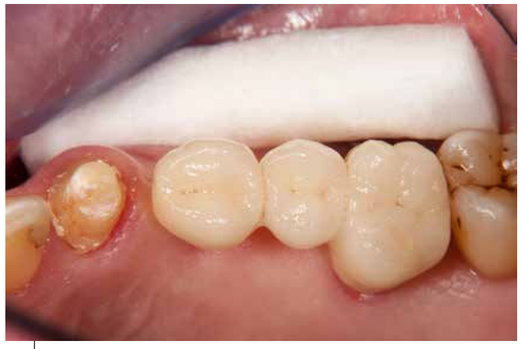


Fig. 24 The screw access points sealed with Flow Composite.

Fig. 25: Incorporated crown on tooth 23.

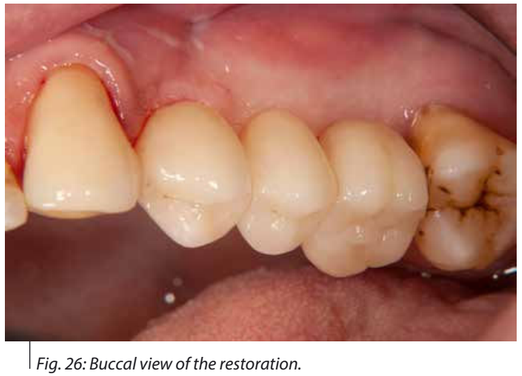


Fig. 26: Buccal view of the restoration.

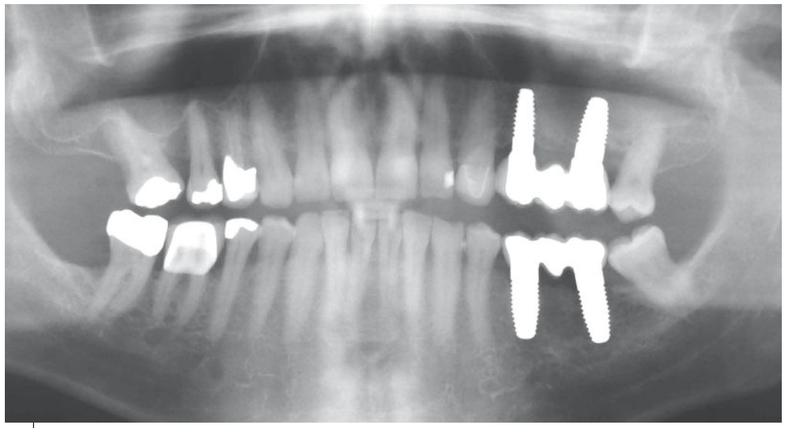


Fig. 27: OPG after prosthetic treatment.

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• 1978 – 1981: Training as a dental technician
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• 1989: Research work for Krupp Medizintechnik, focusing on titanium welding
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References

[1] Addison O, Davenport AJ, Newport RJ, Kalra S, Monir M, Mosselmans JF, Proops D, Martin RA. Do 'passive' medical titanium surfaces deteriorate in service in the absence of wear? 2012 Nov 7;9(76):3161-4. Epub 2012 Jul 25.

[2] Chappuis V, Cavusoglu Y, Gruber R, Kuchler U, Buser D, Bosshardt DD. Osseo-integration of Zirconia in the Presence of Multinucleated Giant Cells. 2016 Aug;18(4):686-98. doi: 10.1111/cid.12375. Epub 2015 Sep 17.

[3] Derks J, Schaller D, Håkansson J, Wennström JL, Tomasi C, Berglundh T. Effectiveness of Implant Therapy Analyzed in a Swedish Population: Prevalence of Peri-implantitis. 2016 Jan;95(1):43-9. doi: 10.1177/0022034515608832.

[4] Jank S, Hochgatterer G. Success Rate of Two-Piece Zirconia Implants: A Retrospective Statistical Analysis. 2016 Apr;25(2):193-8. doi: 10.1097/ID.0000000000000365.