Replacement of two incisors with zirconia implants

Literature

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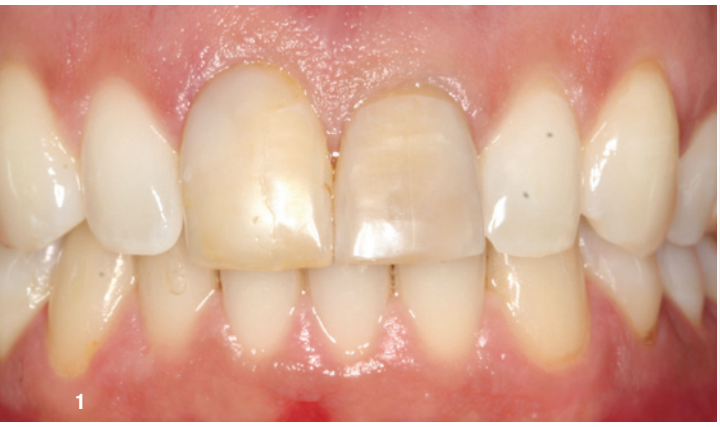
Modern implant dentistry is a continuously changing discipline in which high-tech approaches are involved to optimise the treatment results. An increasing number of cases are performed with guided surgery systems or even with navigated implant placement.[1, 2] The complete digital workflow, including cone beam computed tomography (CBCT) scans, intra-oral scans and prosthetic 3D printing, is nowadays gaining in importance.[3] Moreover, we are seeing changing trends in the applied implant materials. For more than 60 years, titanium was the primary implant material used. Recently, a shift towards biological approaches can be seen in society overall: green energy supply, clothes recycling and biological food products. As a significant consequence, the use of more biocompatible, metal-free and non-toxic materials in oral rehabilitation is booming. Therefore, zirconia (a very biocompatible material) is playing an important role in implant dentistry, not only as the actual preferred crown material but also as the material of choice for fabricating "healthy" dental implants.[4]

Several reasons can be highlighted for this paradigm change in implant material: firstly, zirconia is a white material, offering better aesthetic results than greyish titanium, especially in patients with a thin biotype; secondly, zirconia is extremely biocompatible, showing perfect soft-tissue adaptation and limited plaque retention;[5] thirdly, zirconia is metal-free; fourthly, the material is very strong (in many respects even stronger than titanium); fifthly, it has not been associated with peri-implantitis (yet); and lastly, zirconia is a really bio-inert material with no (tribo-)corrosion. Types VI and V of commercial pure titanium, on the contrary, show high levels of tribo-corrosion, which could explain the growing increase of titanium allergy and which could also be related to the growing incidence of peri-implant infections.[6] These important aspects are the main reasons why zirconia could be the future of implant dentistry.[7] The case presented in this article is a clear example of the optimal application of ceramic dental implants in an aesthetic prosthetic anterior rehabilitation. It involved the replacement of two infected teeth with two two-piece zirconia implants.

Initial situation

This 37-year-old female patient presented to our clinic at the end of 2016. Her ASA score was I and she claimed to have never smoked. Her alcohol consumption was moderate. In 2013, this patient was involved in a minor car accident, causing damage to her maxillary anterior teeth. In particular, teeth #11 and 21 sustained significant trauma. An endodontic treatment was only performed on tooth #21 at that time. On tooth #11, no endodontic treatment was indicated by her former dentist. This tooth showed severe untreated root caries in combination with an inadequate distal composite filling on our initial radiograph. Both central incisors had buccal composite restorations (Fig. 1). On both apices, cystic inflammation was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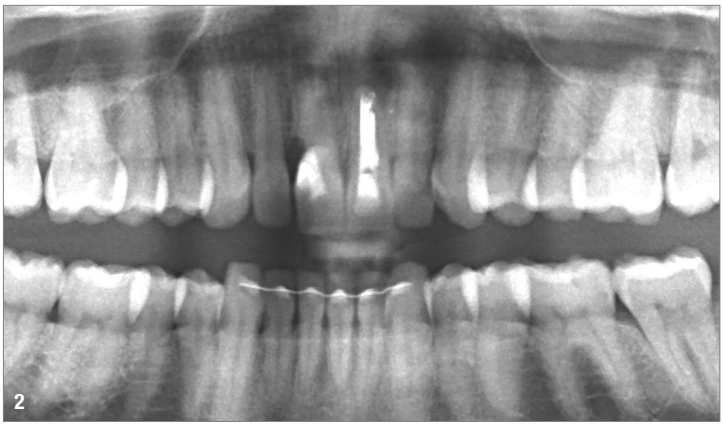
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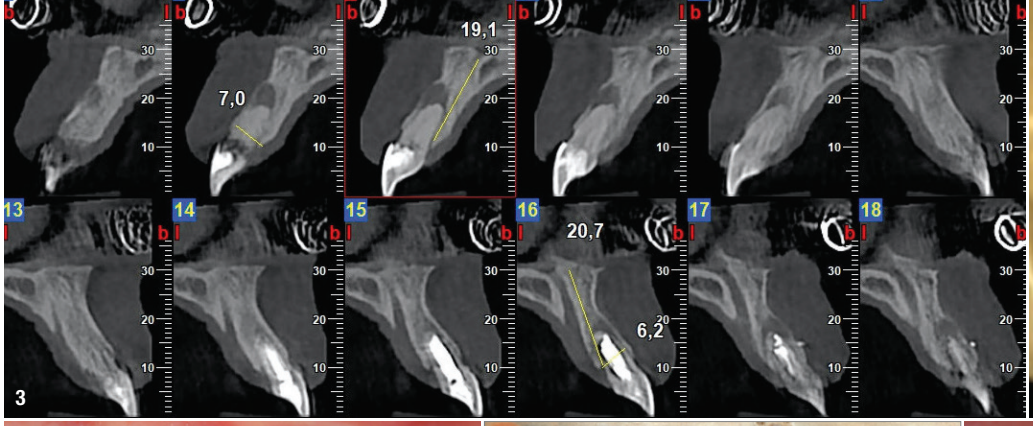
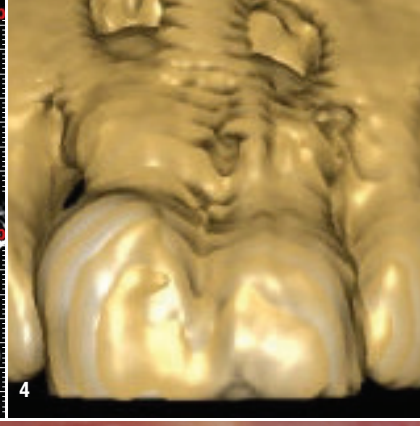
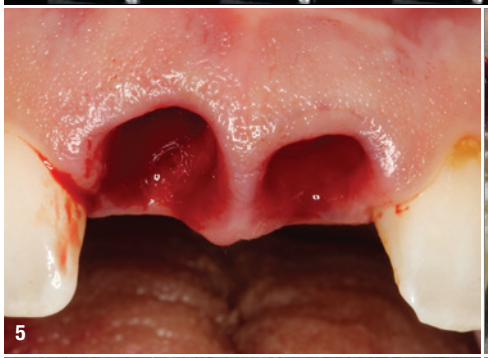
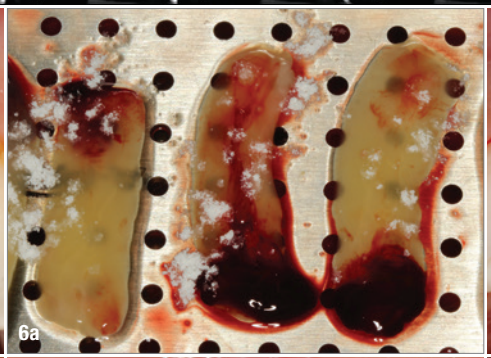
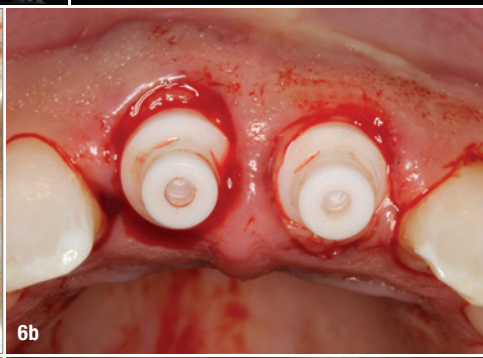
Fig. 1: General intra-oral situation at baseline in 2016. **Fig. 2:** The panoramic radiograph.

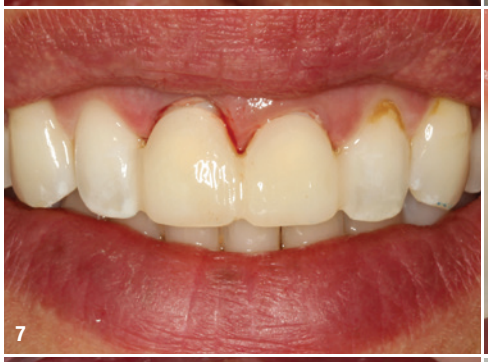


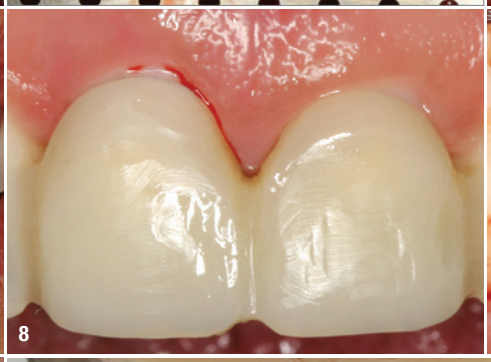


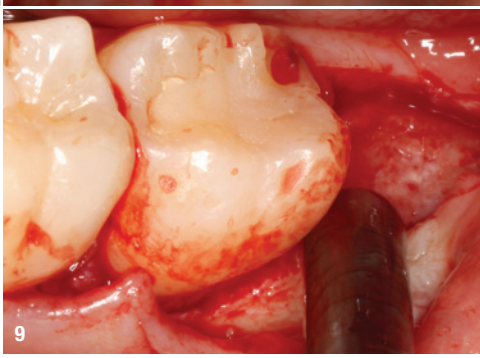


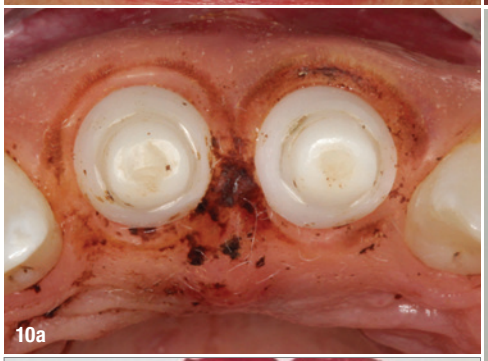


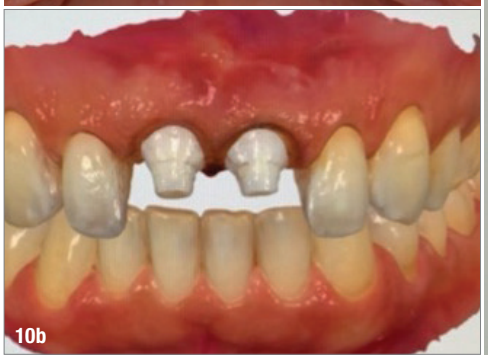


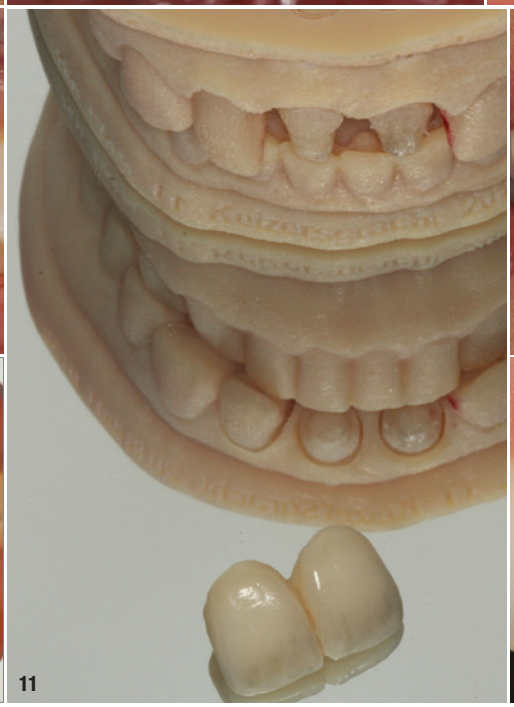


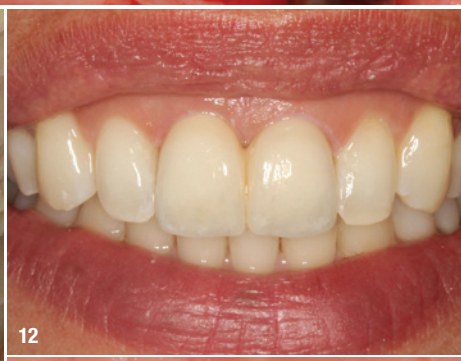












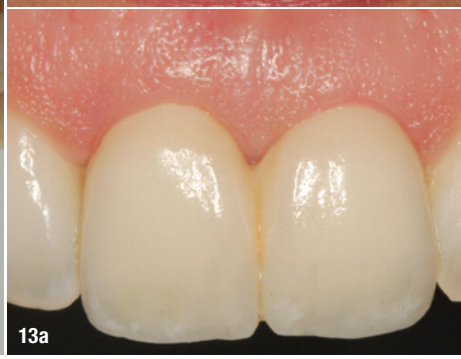
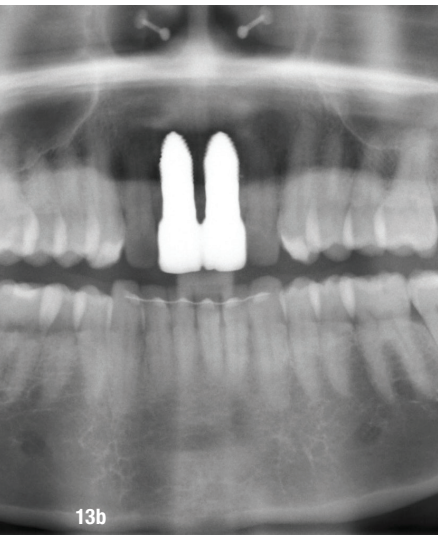
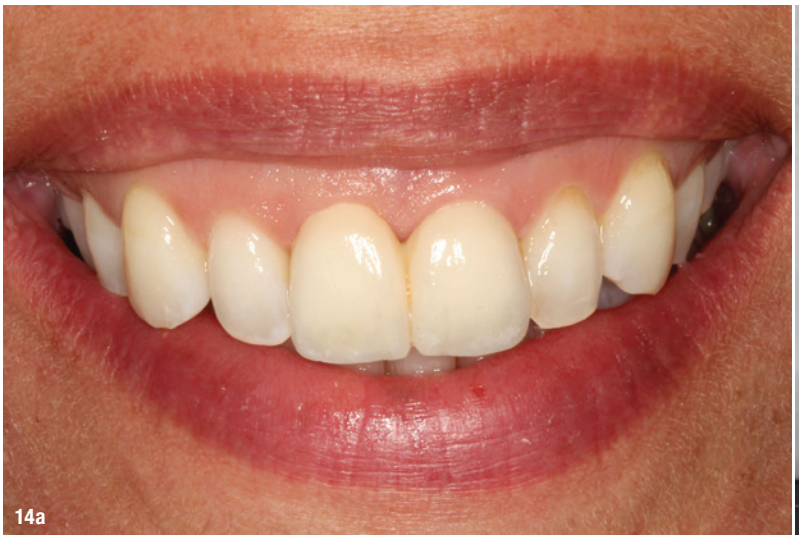


Fig. 3: The CBCT evaluation of teeth #11 and 21 at the end of 2016. **Fig. 4:** Presence of fenestrations at both teeth; dehiscences are absent. **Fig. 5:** Immediately after the extraction of teeth #11 and 21 and the removal of periapical cysts. **Fig. 6a:** The prepared A-PRF membranes. **Fig. 6b:** The two immediately placed ceramic implants wrapped in the A-PRF membranes. **Fig. 7:** Direct provisional restorations *in situ* (note the asymmetrical gingival level of the crown margins). **Fig. 8:** Soft-tissue situation two weeks after the small tunnel graft with connective tissue at tooth #11. **Fig. 9:** The neuralgia-inducing cavitational osteonecrosis was opened, and a connective tissue graft from the distal tuberosity of tooth #37 was simultaneously harvested. The osteonecrosis was completely cleared, and the cavity was filled with an A-PRF plug. **Fig. 10a:** Prepared abutments and laser-corrected gingiva before intra-oral scanning (occlusal view). **Fig. 10b:** Intra-oral scanned situation. **Fig. 11:** The 3D model and two ceramic crowns. **Fig. 12:** Definitive cemented crowns *in situ*. **Fig. 13a:** Clinical situation six months later.





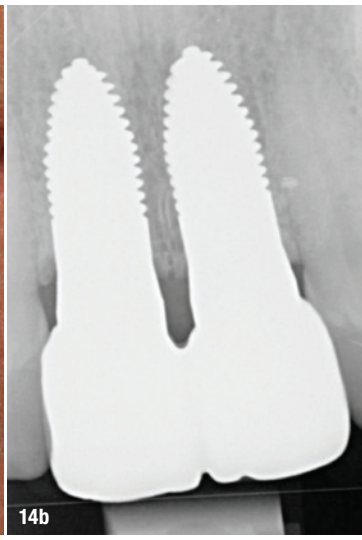


Fig. 13b: Panoramic radiograph after six months. **Fig. 14a:** Clinical situation two years after initial surgery. **Fig. 14b:** Periapical radiograph after two years.

detectable (Fig. 2). The patient complained of diffuse pain at the apical area of tooth #11 especially. Slight mobility of teeth #11 and 21 was detected. An additional CBCT scan was taken in order to evaluate the endodontic treatment of tooth #21 and the apical situation of tooth #11 (Fig. 3). The radiographic situation clearly revealed that both teeth were unsalvageable and had to be removed at the earliest. The buccal bone plate of both teeth showed two clear fenestrations, but no dehiscences (Fig. 4). It was therefore decided that immediate implantation, after extraction, was a proper indication for this case.

Implant placement

Two weeks later, the patient was scheduled for surgery under local anaesthesia. Both teeth were carefully and atraumatically extracted without raising a flap. Tooth #11 showed a root fracture (Fig. 5). Both cysts were meticulously removed, and the alveoli were extensively disinfected with ozone therapy. Both fenestrations were clearly detectable. Before the surgery, five tubes of venous blood were collected through venepuncture of the right median cubital vein. The blood tubes were used to prepare concentrated growth factors (A-PRF technique according to Choukroun[8]). All the tubes were used to prepare concentrated growth factor-rich membranes. Before application, all the membranes were impregnated with metronidazole powder (40 mg/ml). After strictly following the drilling protocol of the implant system (SDS Swiss Dental Solutions), an A-PRF membrane was plugged into the apical part of the prepared osteotomy to fill up the fenestration. Afterwards, the two selected implants (SDS1.1–4.6, 4.6 × 14.0 mm) were wrapped in the other previously prepared A-PRF membranes and were placed following the SDS protocol (Figs. 6a & b). High initial stability was obtained for both implants.

No sutures were placed. Local injections with dexamethasone (4 mg/ml) were performed to reduce postoperative swelling. No antibiotics were administered, neither preoperatively nor postoperatively. The patient was asked to rinse twice per day with chlorhexidine (2 mg/ml) for a duration of 60 seconds for ten days. As for an analgesic, ibuprofen (600 mg, a maximum of four times per day) was prescribed. The patient was also instructed to take supporting vitamins D3 and K2 (15 µg and 75 µg, respectively, per day), starting one month before surgery until two months after surgery, to optimise bone quality. Immediately after implant insertion, two provisional acrylic crowns were prepared and placed with temporary cement. Both crowns were placed out of the occlusal plane, avoiding early loading of the freshly placed implants (Fig. 7).

Further surgical interventions

Owing to the apical disbalance in the soft-tissue level at both crowns, a small grafting procedure was performed two months after the implant insertion. A connective tissue graft was harvested from the tuberosity area in the third quadrant and placed with a tunnel procedure. After the graft had healed completely two weeks later, an improved aesthetic result was obtained (Fig. 8). This surgery was combined with the procedure to remove the neuralgia-inducing cavitational osteonecrosis at positions #28 and 38, according to the theory and procedures of Dr Johann Lechner.[10] The cavities were afterwards filled with A-PRF plugs (Fig. 9). After an osseointegration period of four months, the final prosthetic procedure was performed. First, the two abutments were intra-orally prepared with a diamond bur at high speed and with extensive cooling. The gingival margin was then adapted with a laser (Epic Pro, BIOLASE). Finally, a digital impression with an intra-oral scanner (3Shape) was taken (Figs. 10a & b).[11]

Definitive prosthetic restoration and recalls

Two CAD/CAM crowns were fabricated in the dental laboratory. Both crowns were prepared from zirconia and

covered with an IPS e.max layer (Ivoclar Vivadent). For stability reasons, it was decided to fuse both crowns centrally (Fig. 11). The definitive crowns were cemented with a glass ionomer cement (Ketac Cem, 3M ESPE). The radiograph showed an excellent fit at the crown–implant connection (Fig. 12). After six months, the patient was invited to a recall. The soft tissue was extremely healthy, and there was complete papillary regrowth between tooth #12 and tooth #11, tooth #11 and tooth #21, and tooth #21 and tooth #22 (Fig. 13a). The radiograph showed no signs of inflammation or marginal bone loss (Fig. 13b). Two years postoperatively, the patient was seen at another recall. The soft tissue was still very healthy. The radiograph taken at this appointment again showed no signs of inflammation or bone loss (Figs. 14a & b).

Summary

Two-piece ceramic implants are a reliable option for replacing maxillary anterior teeth. Direct placement after extraction in an infected area is possible if strict cleaning and thorough disinfection are performed. A provisional crown can be used to pre-shape soft tissue and help in the reconstruction of papillae. The final clinical outcome can be very satisfying, functionally and aesthetically. Long-term follow-ups are necessary to check the stability of the restorations.

about the author

Prof. Curd Bollen obtained his DDS in 1992 from KU Leuven in Belgium. In 1996, he received his PhD and, in 1997, his MSc in periodontics and implantology. In 2016, he completed the MClinDent programme at University of the Pacific in the US. As for his active clinical work, Prof. Bollen specialises in periodontics, implantology and halitosis. He recently joined the College of Medicine and Dentistry in Birmingham in the UK as an associate clinical professor.

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