Immediate implantation with platelet-rich fibrin and immediate loading

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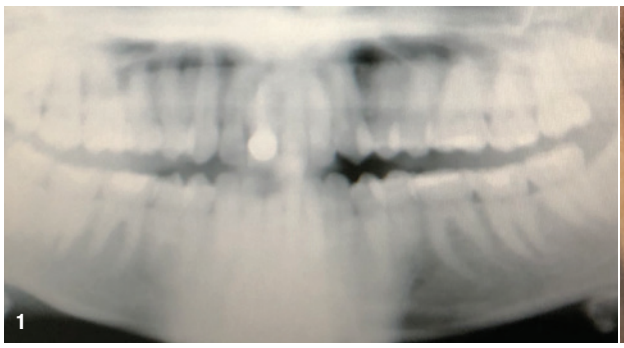
Since Brånemark first described dental implantology many years ago, the waiting time for implantation and loading has changed owing to material and implant surface characteristics. After osseointegration was defined, different implant materials were produced. Today, titanium is the most preferred material, but mixed materials of titanium and zirconia have been developed for dental implantology in addition to titanium, and zirconia implants with metal-free content are available. After much clinical feedback, some authors have pointed out that adverse immune reactions to titanium oxide can occur and cause biological complications after many years.[1] Titanium implant components may also be visible and cause discoloration of the gingiva as a result of bone resorption and recession of the peri-implant soft tissue.[2] Zirconia ceramics have been proposed as an alternative material for dental implants. The reasons for zirconia preference as an implant material are especially its high biocompatibility and aesthetic white colour. Mechanical features such as a low modulus of elasticity and thermal conductivity have made zirconia ceramics an alternative as well.[3] Animal studies have proved that osseointegration can be achieved with this material.[1] Both *in vitro* and *in vivo* studies have proved that there is better soft-tissue healing and integration around zirconia implants compared with titanium implants. In addition, zirconia has a low surface energy, which allows less bacterial colonisation on its surface, and thus less peri-implant infection occurs.[4] A meta-analysis of studies conducted between 2004 and 2017 showed that zirconia implant survival rates had significantly increased and that the fracture incidence of zirconia oral implants had significantly reduced from 3.4% to 0.2%.[5] Regarding commercially available zirconia implants, clinical data up to and after five years of functional loading has reported survival rates of 95%.[6–10]

Zirconia plays an important role in implant dentistry, not only as the preferred crown material but also as the material of choice for fabricating healthy dental implants.[11] Owing to the aforementioned advantages and the increasing demand for aesthetic and metal-free material in implant dentistry, research on the clinical use of zirconia implants is currently increasing.[4] This paper presents the surgical and prosthetic steps for an immediately placed anterior zirconia implant.

Case report

The 30-year-old female patient was referred to our clinic owing to the discoloured gingiva around her right central incisor. The tooth had undergone root canal therapy and been restored with a crown. Previous local chronic infection had caused a small defect in the buccal wall bone (Fig. 1). The patient had a high smile line, and because of the bone loss and thin gingiva, a titanium abut-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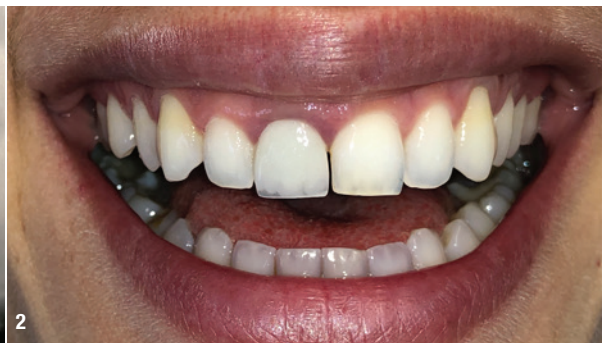
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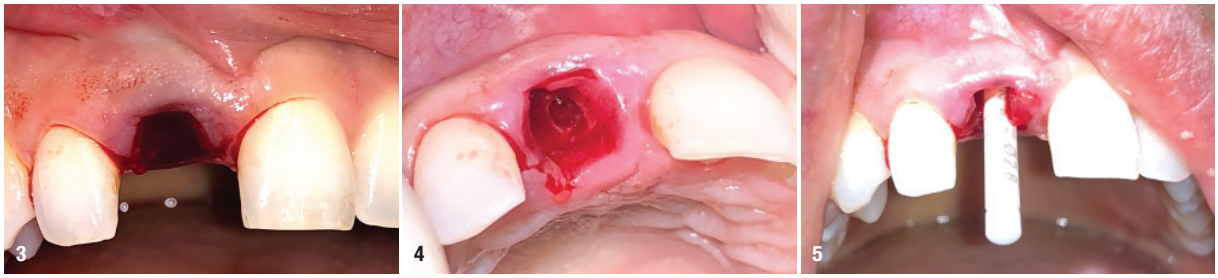
Fig. 1: Pre-op radiograph of the patient. **Fig. 2:** Intra-oral view of the patient before extraction.



Figs. 3–5: Atraumatic socket preparation with a combination of zirconia drills.

ment and implant may have reflected through the gingiva, causing aesthetic complaint (Fig. 2). A zirconia implant was therefore suggested to the patient for its biological, aesthetic and physical properties. For better, faster and infection-free healing, the use of platelet-rich fibrin (PRF) was also suggested, and blood was collected from the patient's forearm into vacuum blood collection tubes. Under local anaesthesia, tooth #11 was extracted atraumatically, the cavity was curetted and the implant socket was prepared with zirconia drills (Figs. 3–5). The vacuum blood collection tubes were centrifuged horizontally for 8 minutes at 2,300 rpm and leucocyte- and platelet-rich fibrin (L-PRF) collected (Figs. 6 & 7). The extraction socket was then disinfected with ozone application for 1 minute (Fig. 8). A Zeramex XT two-piece zirconia implant of 4.2 mm in diameter and 12.0 mm in length (Dentalpoint) was then placed immediately (Figs. 9 & 10). To provide bone–implant contact, the gap left in the socket was filled with L-PRF (Fig. 11). No sutures were used. A provisional crown was prepared with the patient's old crown, and it was cemented temporarily (Figs. 12–14) in order to preserve the socket.

Antibiotics (twice a day), analgesics and an oral rinse containing 0.2% chlorhexidine were prescribed. Also, postoperative care was explained to the patient. A panoramic radiograph was taken to evaluate the implant placement (Fig. 15).

After two months of healing, the need for gingivectomy arose (Fig. 16). The gingivectomy was performed with a diode laser, taking the zenith of the symmetrical central incisor as a reference. An impression was taken to prepare a second provisional crown for better soft-tissue adaption and healing.

After ten weeks of healing, the stability of implant was measured, and an implant stability quotient value of 72 was found. This was sufficient for definitive restoration, and thus an impression was taken. After checking of colour, gingival adaptation and occlusal forces, a definitive IPS e.max crown (Ivoclar Vivadent) with a zirconia abutment was cemented (Figs. 17–19). A last check after cementation was done radiographically (Fig. 20). Soft-tissue healing was close to perfect, and the patient was satisfied with the aesthetic result (Fig. 21).

Discussion

Since the dental titanium implant has been used as a treatment for partial or total edentulism, various biological and technical complications have been reported. These are calculated as 7% for soft-tissue complications after five years, 5% for bone loss over 2 mm and 7% for aesthetic complication.[1] Thus, the need for a better material which can solve these complications has emerged over decades. The first ceramic material used for dental implants was alumina. It showed good osseointegration, but the mechanical properties of this material are insufficient in the long term.[2] Zirconia ceramic was then proposed as an alternative. Zirconium is a mined grey-white metal, and zirconia is a ceramic that is an oxide of zirconium.[4] *In vitro* studies have shown good biological responses to zirconia and no adverse reactions.[1] Besides its biological advantages, zirconia implant has good mechanical properties (a high flexural strength of

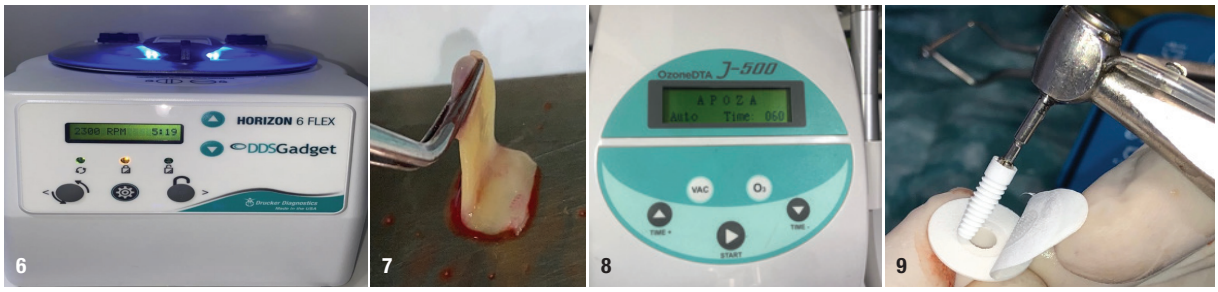


Fig. 6: Horizontal centrifuge machine. **Fig. 7:** Platelet-rich fibrin collection. **Fig. 8:** OZONE DTA J-500 machine (APOZA). **Fig. 9:** Zeramex XT implant.

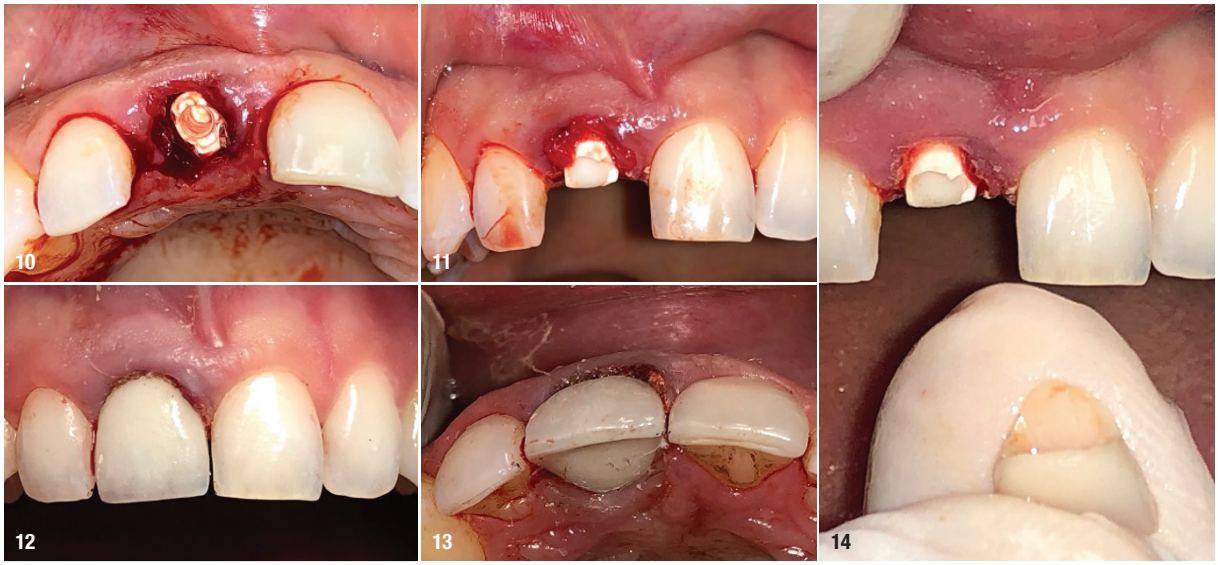


Fig. 10: Implant *in situ*. **Fig. 11:** Gaps between the bone walls and implant filled with platelet-rich fibrin. **Figs. 12–14:** Provisional crown cementation.

900–1,200 MPa, hardness of 1,200 Vickers and a Weibull modulus of 10–12), making it the best alternative. In most animal studies, bone–implant contact was found to be more than 60% and osseointegration was as successful as with titanium counterparts. One study even found that bone healing was better with zirconia. Bacterial adhesion was lower with zirconia implants. This is important because it is the first stage of peri-implant mucositis and peri-implantitis. Zirconia also promotes early formation of the biological width and mucosal seal, which prevents infection and thus early marginal bone loss.[2, 3] It also definitely shows better interaction with gingival soft tissue than metal alloys do. Zirconia prosthetic components and zirconia implants offer superior aesthetics compared with other materials.[4]

As zirconia ceramics were introduced, fracture resistance was a concern. Therefore, to avoid this, one-piece implants were manufactured. However, it has been found that one-piece zirconia implants have a high early fracture rate. This could be a consequence of healing under loading and the immediate occlusal forces acting on a one-piece implant. Abutment options may also be inadequate. To overcome these problems, two-piece zirconia implants were introduced to the market.[3]

As zirconia implants have continued to improve and micro-roughened surfaces of zirconia implants have been manufactured, reliable fracture toughness and strength have been shown, as well as better osseointegration and, of course, better survival rates, similar to those of conventionally used titanium implants.[5, 6, 8] Recent experimental studies have shown that the latest generation of zirconia implants with micro-roughened surfaces have very similar osseointegration values compared with titanium implants. In a 2016 paper, the survival rate for zirconia implants after one year of function was 92% for single crowns. For titanium implants, this

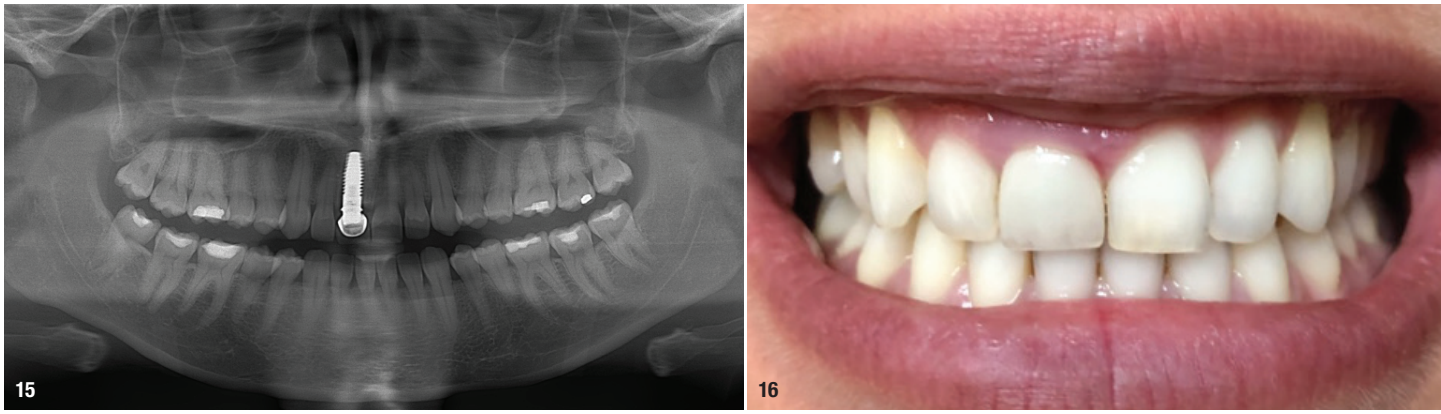
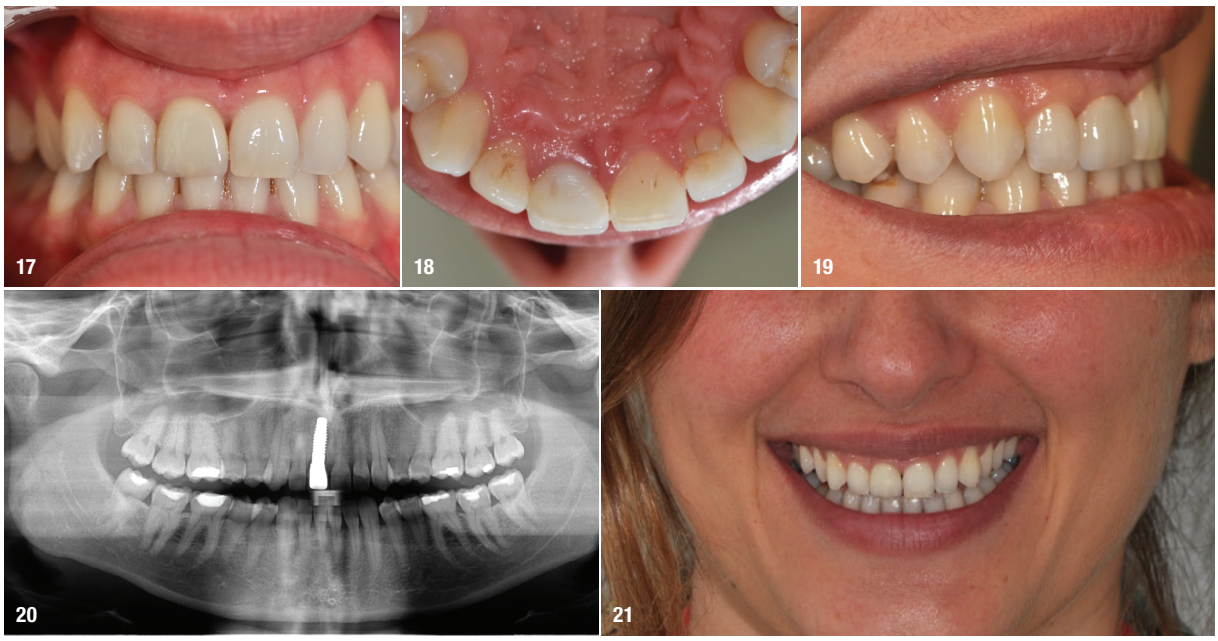


Fig. 15: Panoramic radiograph after zirconia implant and provisional crown placement. **Fig. 16:** After two months of soft-tissue healing, the need for gingivectomy was observed.



Figs. 17–19: Definitive IPS e.max crown and surrounding healthy gingiva. **Fig. 20:** Control panoramic radiograph. **Fig. 21:** The satisfied patient with the aesthetic result.

rate was 97.2% after five years and 95.2% after ten years.[3] One-piece compared with two-piece zirconia implants had no effect on survival rates, and two-year survival rates were reported to be 97.2%.[5, 12–16]

Conclusion

Owing to the demand for aesthetic and metal-free materials, the preference for zirconia ceramics has increased. Better soft-tissue healing, osseointegration ability, low bacterial adhesion, high mechanical properties and a colour close to the natural tooth colour are advantages of this material. Although the results of rehabilitation with zirconia implants are successful, further prospective clinical studies and long-term follow-up are needed. Owing to unexpected complications and the lack of information on long-term clinical outcomes and for economic reasons, most clinicians still do not recommend zirconia implants to their patients. In the next decades, the use of titanium or other metals will greatly decrease, and thanks to developing technology, zirconia could be the new gold standard.

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Literature

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Prof. Belir Atalay received his PhD in oral surgery in 2006 from Istanbul University in Turkey. He is a professor in the Department of Oral and Maxillofacial Surgery of the Faculty of Dentistry at the same university. In recent years, he has focused on ceramic implants, tissue regenerative techniques and immediate implant treatment in his own clinic and the faculty clinic.

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