Placement of one- and two-piece ceramic implants

Two treatment models in one patient

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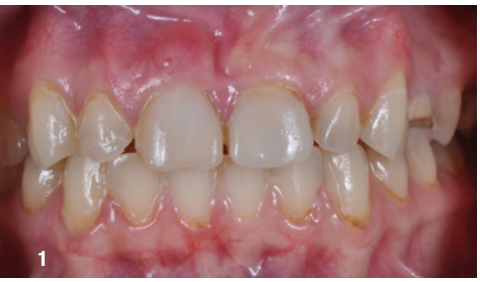
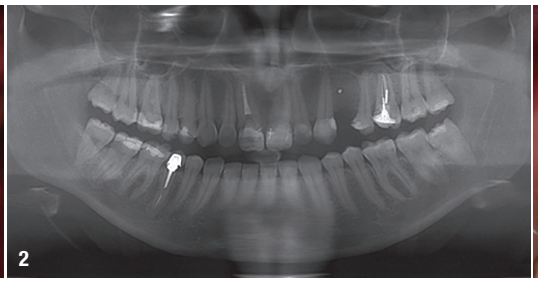




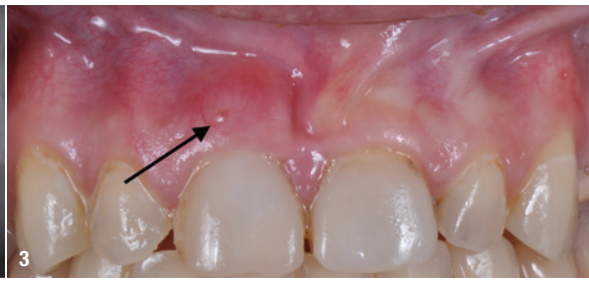
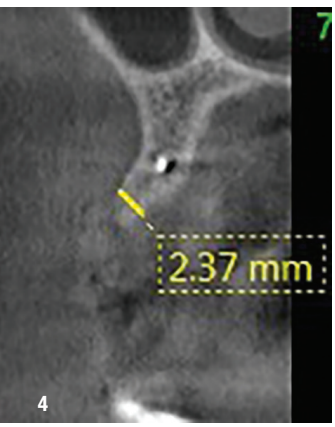
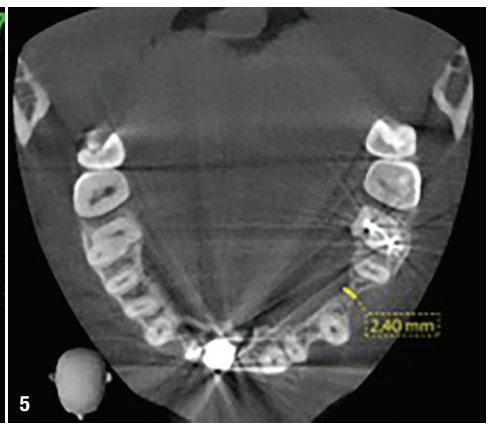


Fig. 1: Pre-op intra-oral view. **Fig. 2:** Pre-op panoramic radiograph. **Fig. 3:** Fistula formation at tooth #11.

Introduction

In recent years, there has been a tendency to avoid the use of metals in dentistry. On the one hand, patients demand aesthetic solutions, and from this point of view, metallic materials are of course inferior to ceramics. On the other hand, there is also a steadily growing number of patients who, for biological reasons, do not want any metallic materials in the oral cavity. Ceramic implants are thus increasingly perceived as an alternative to titanium implants that meet increasingly heightened aesthetic demand. The only ceramic material that currently meets the requirements for strength, biocompatibility and aesthetics is zirconium dioxide (zirconia). The fragility of zirconia materials is known. For this reason, in recent years, reinforced single-piece and even two-piece zirconia implants have started to be produced in different diameters. One-piece zirconia implants are preferred in the posterior region, where occlusal forces are intense, and two-piece zirconia implants are preferred in the anterior region. While immediate implant placement after tooth extraction is a frequently preferred method, especially in titanium materials, to prevent soft-tissue loss and bone resorption, methods such as platelet-rich fibrin (PRF) use and ozone applications to increase regeneration have been used extensively in the clinic in recent years.[1,2] Although there have not been enough clinical cases to state this definitively, the placement of zirconia implants in immediate extraction sockets together with PRF, ozone and autogenous or non-autogenous grafting materials gives very successful results.





Figs. 4 & 5: CBCT image of insufficient bone volume at area #24.

Initial clinical situation

A 35-year-old female patient presented with a request for general restoration of her teeth (Fig. 1). The patient was healthy and had an unremarkable medical history. The patient had problems in two different areas for which implant surgery could be considered. The first was a dental gap where tooth #24 had been missing for many years. The second was tooth #11 that had undergone root canal therapy previously (Fig. 2). The tooth, which was reported as mobile by the patient, was observed to have a fistula formation buccally (Fig. 3). It was also noticed that this tooth had a horizontal crown fracture under the gingiva. The treatment of these two areas is the subject of this case report.

Treatment planning and preoperative measures

A standard treatment planning protocol was followed. A CBCT scan was taken in order to evaluate the bone volume in the edentulous area and to evaluate tooth #11. After evaluation with CBCT and clinical intra-oral examination, a decision was made to extract the mobile tooth #11 and to place a zirconia implant in the edentulous area immediately. Since the defect was in the aesthetic anterior region and the patient had a thin gingival biotype, it was decided to insert a two-piece zirconia implant to avoid a greyish appearance and to satisfy the patient's expectations maximally. The width of the bone in the edentulous area #24 was found to be insufficient for implantation (Figs. 4 & 5). It was decided to increase the bone thickness by autogenous augmentation and then insert the implant. Every aspect of the treatment was shared with the patient. Moreover, she was given vitamin C and D supplements for one week preoperatively in order to strengthen the immune system and accordingly to provide better healing of bone and soft tissue. The use of the same vitamin supplements was continued for two weeks postoperatively.

Surgical procedure of tooth #11

Since the procedure would be in the aesthetic anterior region, it was intended that the patient would not be toothless after the surgical procedure. Before starting the surgical procedure, impressions were taken from the patient for a provisional restoration. After local anaesthesia, the extraction of the fractured tooth #11 was done atraumatically. A flap was opened in order to be atraumatic in the extraction of the tooth, whose crown and root were separated from each other (Fig. 6). At first, a dental extraction forceps was used in the root extraction of the tooth after the crown had been removed. In order not to damage the surrounding tissue and not to traumatise the soft tissue, the tooth was extracted with minimal movements without using an elevator. After the extraction of the tooth, the infected tissue in the area was completely cleaned with curetting. Severe loss of the anterior wall of bone due to the fractured crown was seen at the area. Ozone (Ozone DTA J-500, APOZA) was applied for 60 seconds to ensure disinfection of the extraction socket (Fig. 7). With ozone gas, it was aimed to decrease the amount of bacteria at the region,[3] increase the amount of oxygen carried by accelerating the blood circulation[4] and contribute to the decontamination around the implant.[5] The cavity was prepared using zirconia drills (ZiBone, COHO Biomedical Technology) in combination with metal drills (Zeramex, Dentalpoint; Figs. 8 & 9). Autologous bone chips were collected during the implant cavity preparation. Meanwhile, two tubes of blood were taken from the patient's forearm. Vacuum blood collection tubes (two 10 ml tubes) were used for preparing the PRF. The blood samples taken were centrifuged horizontally

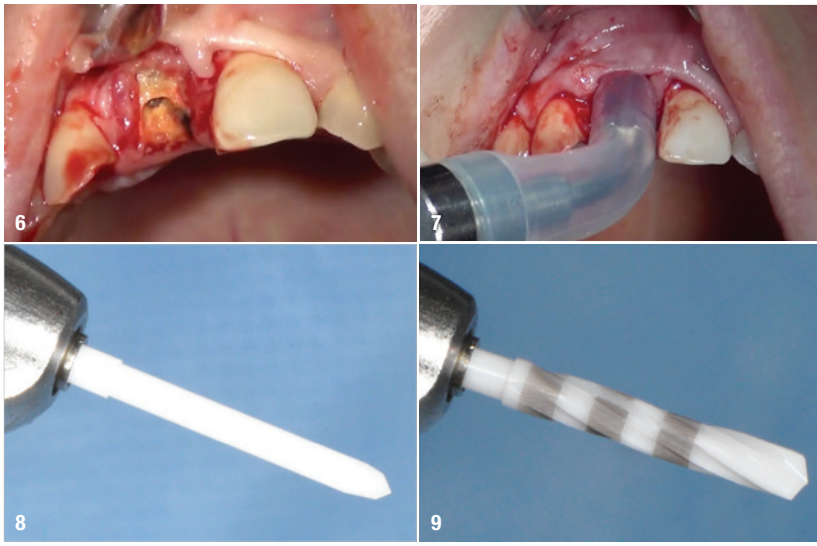


Fig. 6: Granulation tissue at fractured tooth #11. **Fig. 7:** Ozone application to the extraction socket of tooth #11. **Figs. 8 & 9:** Ceramic drills.

for 8 minutes at 2,300 rpm in the HORIZON 6 Flex PRF device (Drucker Diagnostics) to make them ready for use in the PRF application (Figs. 10–12).

After preparation of the implant socket, one piece of PRF membrane was inserted into the cavity together with a two-piece zirconia implant (Zeramex; diameter: 5.5 mm; length: 10.0 mm), achieving primary stability (Figs. 13–15). The implant collar was sunk 1 mm into the bone to ensure primary stability and enhance aesthetics by promoting a good emergence profile. Gaps around the implant were supported by a mixture of liquid PRF, autologous bone

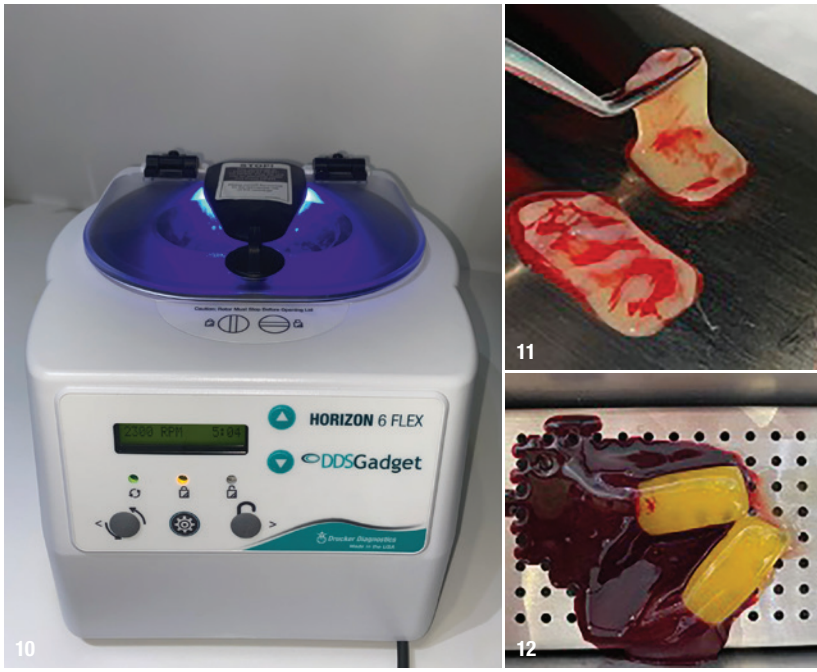


Fig. 10: The centrifuge used. **Figs. 11 & 12:** Platelet-rich fibrin production.

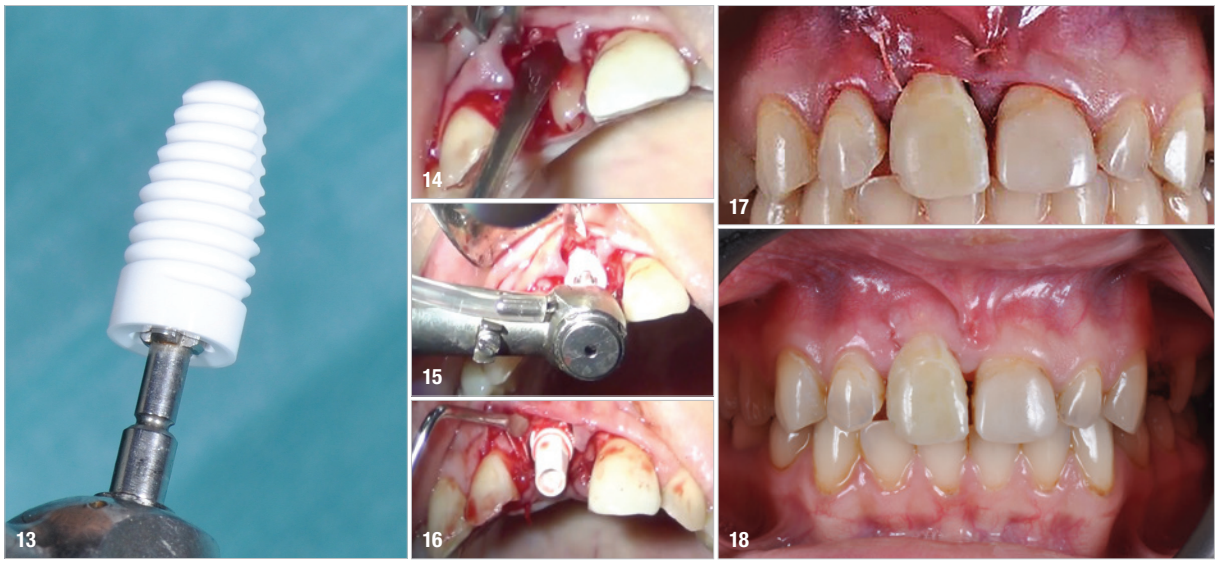
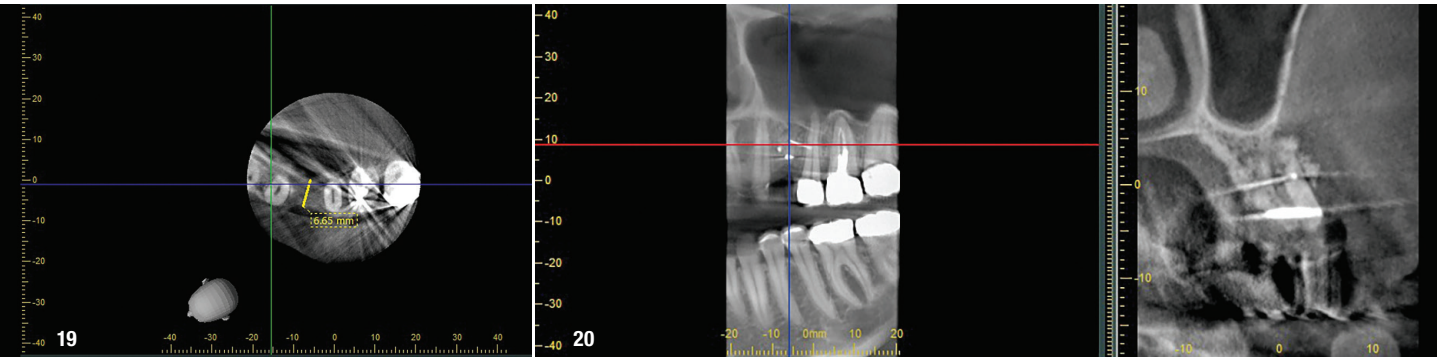


Fig. 13: Two-piece zirconia implant. **Fig. 14:** Platelet-rich fibrin insertion into the extraction socket of tooth #11. **Fig. 15:** Placement of the zirconia implant into the socket over the platelet-rich fibrin. **Fig. 16:** Seating of a 1 mm gingival height straight abutment over the implant. **Fig. 17:** Immediate loading of the provisional crown. **Fig. 18:** Post-op situation after two weeks of healing at area #11.

chips and solid PRF. It was aimed to accelerate the healing of hard and soft tissue in the area with PRF application. At the same time, this application contributed to the increase of vascularisation and regeneration.[6] In this surgery, the use of an artificial bone graft was not required. A straight 1 mm abutment was placed on to the implant (Fig. 16), and the surgical area was stitched up with resorbable VICRYL RAPIDE 4/0 surgical suture thread (Ethicon). After the wound area had been sutured, a provisional restoration was prepared for the patient based on the previously taken impression. The acrylic crown was immediately loaded (Luxatemp, DMG; Durelon, 3M ESPE; Fig. 17). The occlusion was adjusted until there was no contact from the opposing tooth. Amoxicillin and clavulanic acid (Augmentin 1 g, GlaxoSmithKline; twice a day), diclofenac potassium (Cataflam, Novartis) and a 0.2% chlorhexidine mouthrinse were prescribed for postoperative care. A panoramic radiograph was taken for control purposes after the procedure was completed. The provisional crown and soft tissue were checked again after two weeks, at which point the condition was found to be good (Fig. 18).

Surgical procedure of area #24

After the implant operation of the anterior region, autogenous augmentation surgery was planned in this region after CBCT measurement of the left premolar region. Under local anaesthesia and intravenous sedation, the left mandible retromolar area of the patient was selected as a donor site. The autogenous bone block was taken from this area and fixed to area #24 with the help of micro-screws. PRF was applied to the region to support regeneration. After three months for this area to heal, the bone thickness formed was measured by CBCT again and it was seen that it had reached sufficient thickness for implant placement (Figs. 19 & 20). The area was opened for the second time under local anaesthesia and prepared for the one-piece ZiBone implant with zirconia drills. Ozone was applied to the area before the implant (diameter: 4 mm; length: 10 mm) was placed. After implant placement, the autogenous augmentation area was supported with a collagen membrane and PRF in the buccal direction and closed with silk suture thread (Figs. 21 & 22).



Figs. 19 & 20: CBCT view after autogenous augmentation of area #24.

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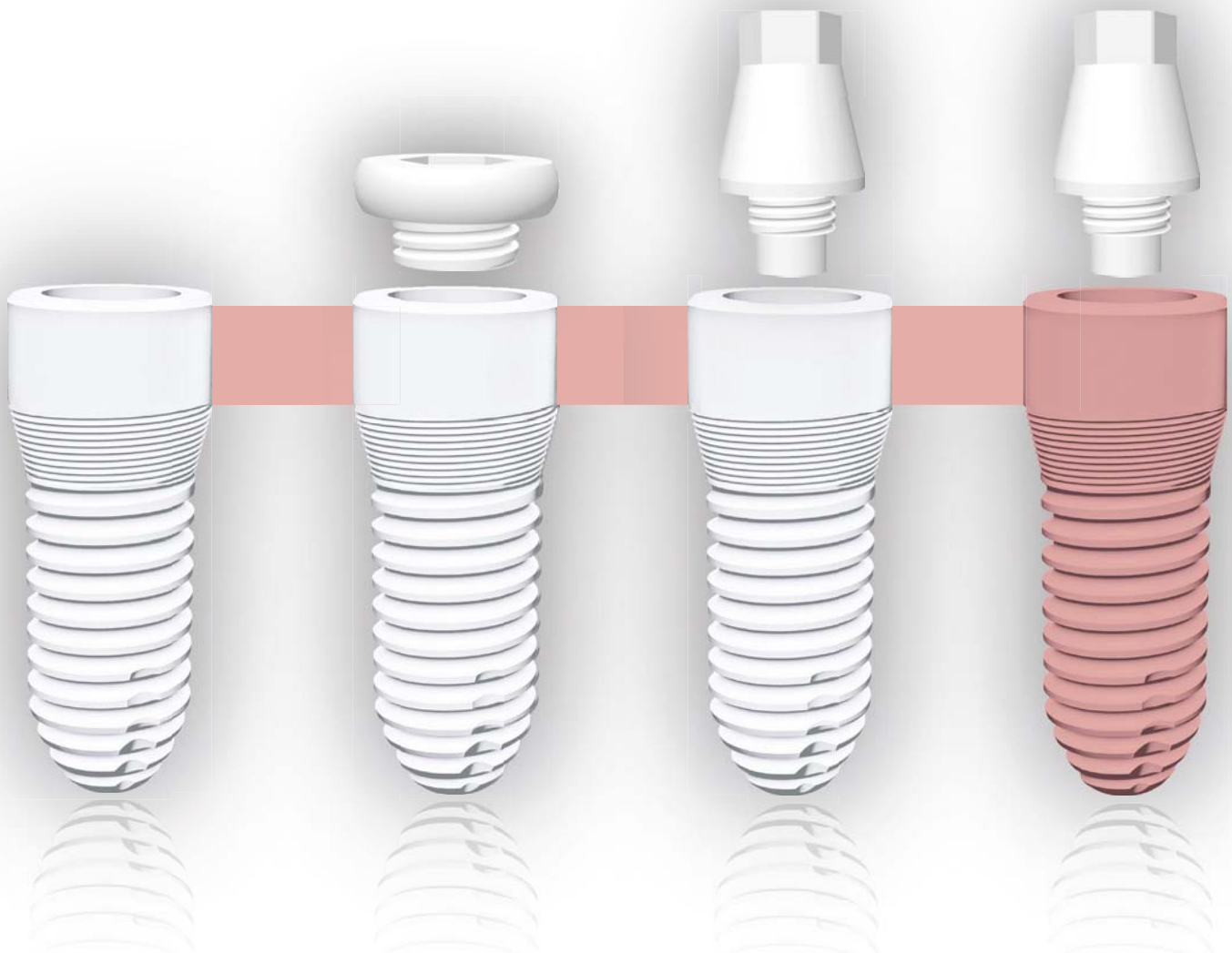

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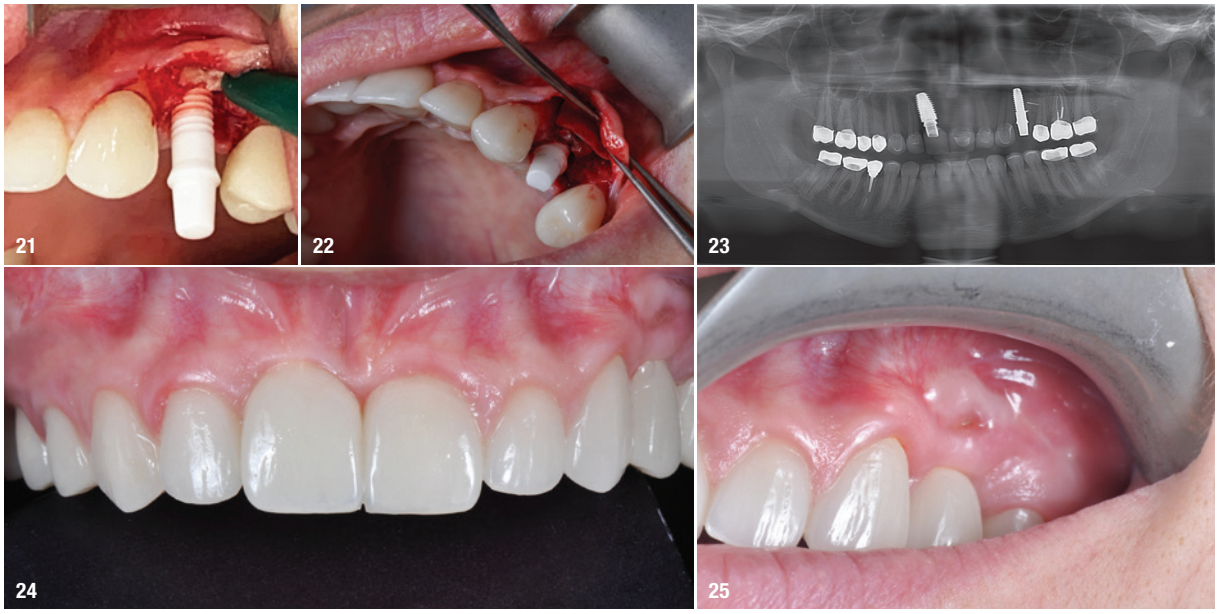

Fig. 21: Implant placement. **Fig. 22:** Collagen membrane coverage. **Fig. 23:** Post-op panoramic radiograph. **Fig. 24:** Final treatment view. **Fig. 25:** Healing after free gingival tissue flap placement over area #24.

No loading was done for four months to ensure that the implant had successfully osseointegrated.

Postoperative period

After the four-month long healing period, a panoramic radiograph was taken and the implants were evaluated with a view to the surrounding teeth. The implant stability quotient value (Osstell) was checked, and this value was found to be 77 (Fig. 23). Thereafter, impressions of the implants and teeth were taken. Loading and the permanent prosthesis stage was started. Zirconia porcelain crowns were prepared for all teeth and implants. After try-in and the patient's approval of the final aesthetics, cementation was carried out (Fig. 24). In order to thicken the gingival phenotype in the region, a free connective tissue flap was applied to area #24, making the region healthier for the future (Fig. 25).

Conclusion

First of all, for biological reasons, the use of ceramic implants has been increasing in recent years. Although the history of ceramic implant use is 30 years, the complication rate due to fragility has been reported to be very low in recent years related to the reinforced structure of ceramic implants. More comprehensive clinical and experimental studies should be carried out in order better to evaluate the fracture and osseointegration losses that may occur especially in ceramic implants. Although the failure rates are reported to be low, the use of two-piece ceramic implants in the anterior region and one-piece ceramic implants in the premolar and molar regions would be more logical and reduce the risk of complications.

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References

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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. He has been working primarily on ceramic implants, regenerative techniques and immediate loading in his clinic and at the university in recent years.

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