Immediate placement and loading of ceramic implants in the aesthetic region: One-year follow-up—two case reports

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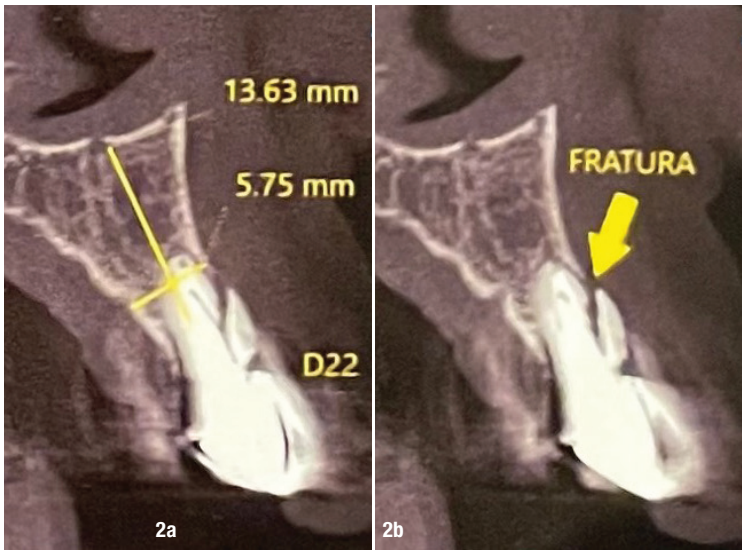
In the late 1990s, yttria-stabilised zirconia (Y-TZP) emerged as a versatile and promising material with wide applicability in implant dentistry. Among the advantages of this material, its white colour and opacity stand out, these properties allowing it to mimic the appearance of natural teeth. Owing to its mechanical properties, mainly the ability to withstand high masticatory loads, zirconia has been used not only for creating restorations but also for the manufacture of ceramic implants.[1]

Y-TZP implants, in addition to being resistant and aesthetic, are highly biocompatible implants, have low affinity for bacterial plaque, are capable of stimulating osteogenic cells during the osseointegration process and boast corrosion resistance and radiopacity.[2] These characteristics have made these ceramic implants a possible substitute for titanium implants in oral rehabilitation, achieving predictable and reliable results.[3] The aim of the present study is to report two clinical cases of ceramic implantation in the aesthetic region using a surgical and prosthetic approach free of metal.

Fig. 1: Situation on initial clinical examination.



Figs. 2a & b: CBCT image showing the vertical root fracture.

Case reports

The patients were referred to one private clinical centre in Rio de Janeiro in Brazil with the need for extraction and immediate placement and loading of single implants in the aesthetic region. In order to carry out the correct planning and diagnosis, the patients were asked to undergo a CBCT scan, a periapical radiograph and intraoral photographs. The patients were non-smokers and were in good general health, without any systemic condition. Although the patients had good plaque control, they underwent supragingival scaling and root planning. This study was submitted to the ethics committee of the Universidade do Estado do Rio de Janeiro and approved (No. 5.598.463). The patients were previously invited to participate in and informed about the study and signed informed consent to participate, and all ethical aspects were followed.

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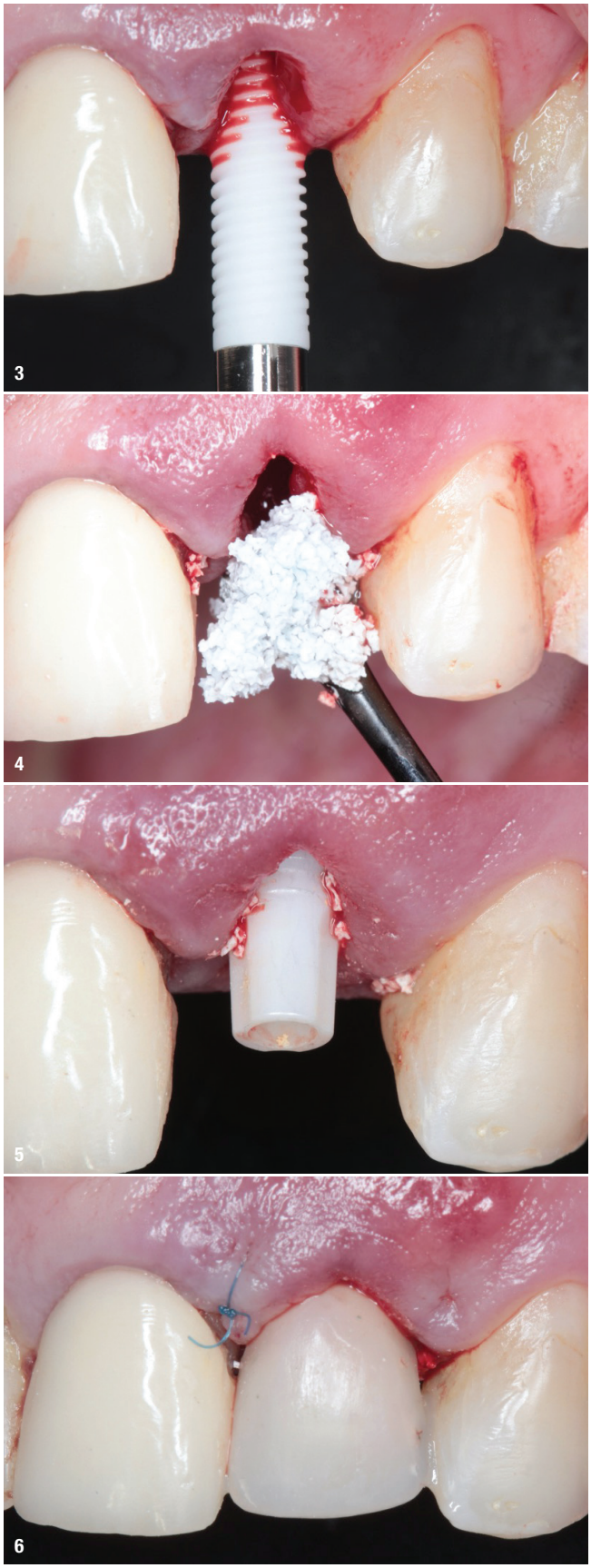

Fig. 3: Placement of the Zi implant. **Fig. 4:** Filling of the gap with bone grafting material. **Fig. 5:** Cemented zirconia abutment. **Fig. 6:** Immediate post-op situation with the provisional crown cemented.

Case 1

A 66-year-old female patient who was a smoker presented with the main complaint of a broken anterior tooth. On clinical examination, it was noted that the maxillary left lateral incisor had a metal-ceramic crown with a partially displaced cast metallic core (Fig. 1). The CBCT examination showed the presence of a vertical root fracture due to recurrent caries (Fig. 2). Given the clinical and radiographic situation, the proposed treatment was the extraction of the tooth in question, followed by immediate placement of a ceramic implant and immediate restoration with a crown.

The extraction was performed atraumatically with the aid of periotomes and forceps and a 3.75 × 13.0 mm two-piece ceramic implant (Zi, Neodent) was placed in the fresh alveolus (Fig. 3). The insertion torque was 35 Ncm, and this primary stability allowed for immediate loading. It should be noted that the implant was placed according to the manufacturer's recommendations at the level of the bone crest, and the gap was filled with bone substitute (maxresorb, botiss biomaterials; 0.5 cm^2 of 0.5–1.0 mm; Fig. 4). A 4.5 × 5.0 × 2.5 mm (regular) zirconia abutment (Zi CR abutment) was seated (Fig. 5), and a provisional restoration was made with light-polymerising composite resin and cemented on the abutment (Fig. 6). At the end of the surgical procedure, a radiograph was taken (Fig. 7).

The three-month postoperative period was uneventful, and after this period, the patient returned to begin the final prosthetic phase. The final prosthesis was fabricated from monolithic zirconia using a digital workflow (Virtuo Vivo intra-oral scanner, Straumann; Figs. 8 & 9) and cemented on to the abutment with a dual adhesive cement (RelyX U200, 3M; Fig. 10). After 12 months of follow-up, the periapical radiograph showed the stability of the bone (Fig. 11).

After cementing the crown, it was observed that a new crown was needed for the adjacent tooth, the maxillary left central incisor, owing to the discrepancy in colour and dental anatomy. This prosthesis was also fabricated from monolithic zirconia using a digital workflow (Fig. 12) and cemented onto the prepared tooth with a dual adhesive cement (RelyX U200; Fig. 13).

Case 2

A healthy 70-year-old female patient presented with the main complaint of toothache in the region of the maxillary left lateral incisor. Upon clinical examination, it was noted that the tooth had a metal–ceramic crown and had not undergone endodontic

Fig. 7: Post-op radiograph. **Fig. 8:** Scan body in position for intra-oral scanning. **Fig. 9:** Intra-oral scan. **Fig. 10:** Cementation of the final zirconia crown. **Fig. 11:** Periapical radiograph showing stability of the bone after 12 months. **Fig. 12:** Intra-oral scan of the maxillary left central incisor for a new crown. **Fig. 13:** Situation at conclusion of the case.

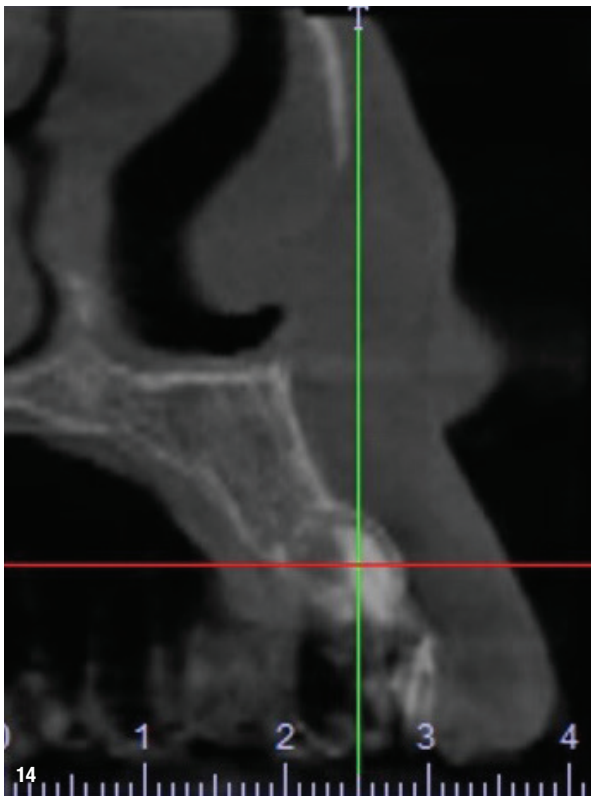

Fig. 14: CBCT image showing periapical periodontitis.

treatment. The CBCT scan showed the presence of an endodontic lesion of greater than 5 mm, and the patient wanted the tooth extracted (Fig. 14). Given the clinical and radiographic situation, the proposed treatment was tooth extraction, immediate placement of a ceramic implant and immediate restoration with a 17° angulated abutment and a provisional crown.

Like in the previous clinical case, the extraction was performed atraumatically, and curettage and cleaning of the fresh alveolus was performed. After that, a 4.3 × 13.0 mm two-piece ceramic implant (Zi) was placed to an insertion torque of 45 Ncm (Fig. 15). A 4.0 × 5.0 × 2.5 mm (narrow) 17° angulated zirconia abutment (Zi CR abutment) was seated (Fig. 16), and a provisional restoration was made with self-polymerising resin and cemented on to the abutment (Fig. 17). At the end of the surgical procedure, a radiograph was taken (Fig. 18).

The three-month postoperative period was uneventful, and after this period, the patient returned to begin the final prosthetic phase. The final prosthesis was fabricated from lithium disilicate (IPS e.max, Ivoclar Vivadent) using an analogue workflow with impression material (addition-cured silicone, Yller) and cemented on to the abutment with a dual resin cement (RelyX U200; Fig. 19). Prior to cementation, the health of the peri-implant tissue around the ceramic implant was observed, as was the maintenance of the soft tissue, including the mesial and distal papillae (Fig. 20). After 12 months, the patient returned and a radiograph was taken, on which the maintenance of the bone around the implant was observed (Fig. 21).

Discussion

The literature shows that titanium implants have achieved excellent and predictable results over the last decades, are biologically tolerable and exhibit excellent mechanical properties. However, it is important to point out that titanium implants have aesthetic disadvantages, especially when placed in patients with a thin gingival biotype in the anterior region. Ceramic implants avoid the metallic shadow of the implant or abutment under the tissue.[4]

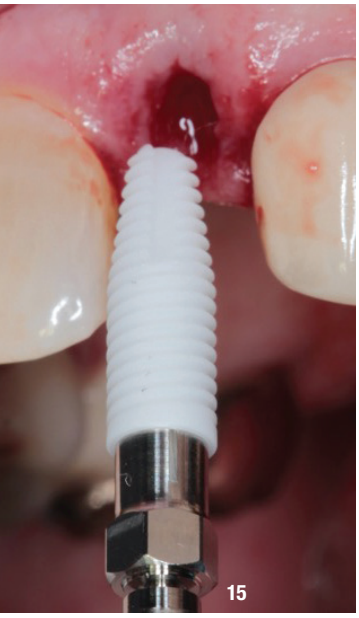

Fig. 15: Placement of the Zi implant. **Fig. 16:** Cemented zirconia abutment. **Fig. 17:** Immediate post-op situation with the provisional crown cemented.

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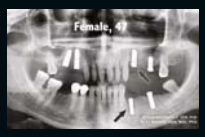

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Over the years, ceramic materials have been the subject of investigation and clinical application as a potential alternative to titanium, and increasingly, zirconia has stood out as a promising alternative.[5] Among its beneficial properties is its colour, which is similar to that of natural teeth, making this material especially relevant in the aesthetic region,[6] which we observed in the present study. This similarity enables adequate light transmission at the critical interface between the marginal gingival tissue and prosthetic components.[6]

With the development of CAD/CAM, this high-strength ceramic is becoming the first choice for restoration of implants in the aesthetic region.[7] In addition to its aesthetic advantages, monolithic zirconia has several excellent mechanical characteristics, such as high fracture toughness, resistance to fatigue, high flexural strength, significant corrosion resistance and radiopacity,[8] strengthening its viability for use for a range of restorations, from single crowns to complete dentures, supported on implants in the anterior and posterior regions.[9] In both regions, zirconia crowns have shown high survival rates.[10]

In Case 1, a digital workflow was employed, and a monolithic zirconia crown was fabricated, whereas in Case 2, an analogue workflow was followed, and a lithium disilicate crown was fabricated. In both cases, satisfactory aesthetics were achieved; however, the possibility of performing a digital workflow, in addition to being more accurate regarding the final result, reduces the number of adjustments and is more comfortable for the patient.[7]

Biologically, zirconia provides reduced plaque build-up and excellent hard- and soft-tissue integration, equivalent to that of titanium.[11] In the current literature, studies show that zirconia implants present similar or even better results regarding these measures when compared with titanium implants.[12,13] Furthermore, zirconia, like titanium, is a biocompatible material and favours the health of the peri-implant soft tissue,[14] as was observed after 12 months of follow-up in the two cases reported here. In Case 2, we observed the health of the soft tissue around the ceramic implant, particularly the collagen fibres present in the region.

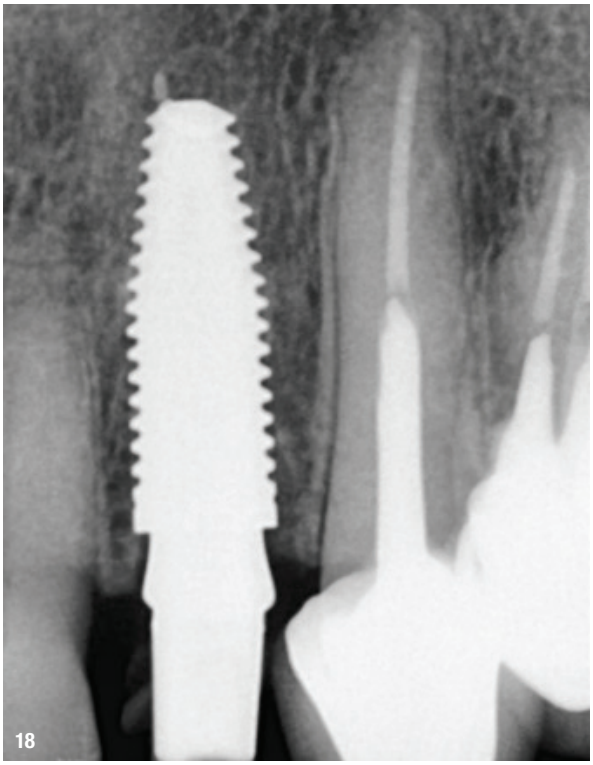

Fig. 18: Post-op radiograph.

Initially, ceramic implants were predominantly one-piece implants.[15] These single-body implants have reduced

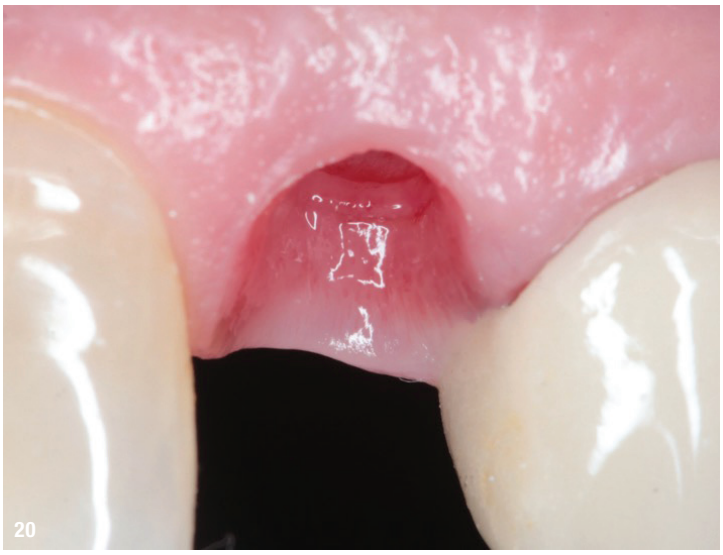

Fig. 19: Cementation of the final lithium disilicate crown. **Fig. 20:** Healthy soft tissue around the implant.

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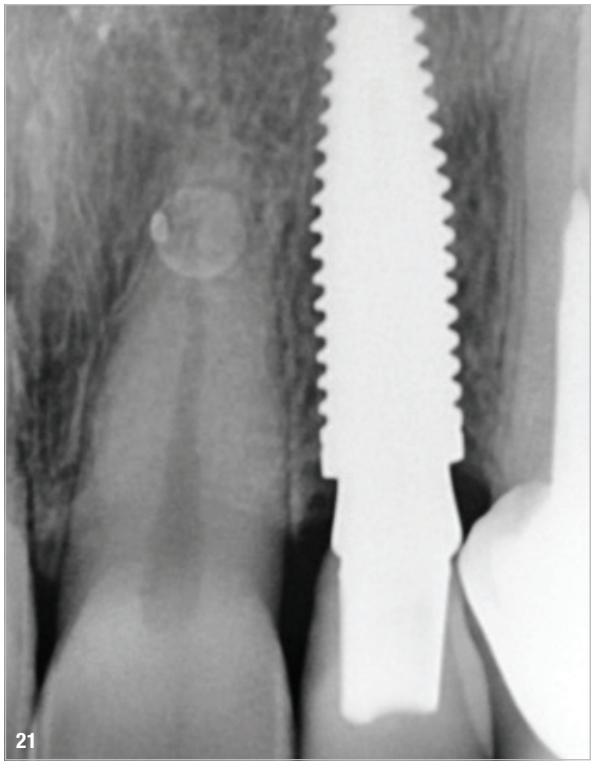

Fig. 21: Final radiograph.

prosthetic versatility, since there is no possibility of angling the prosthetic component, which may be critical in the aesthetic region.[16] However, these single-piece implants have the advantage of having a transmucosal abutment as part of the implant unit, thus avoiding the presence of an implant–abutment micro-gap and nullifying the micro-movements between the abutment and the implant.[17] There are few studies on single-piece ceramic implants with long follow-up periods, and most of them have a low sample size.[18]

In order to address the limitations of single-piece implants, a separate implant body and abutment were designed, thus providing greater prosthetic options. Two-piece zirconia implants have been found to have high success rates, similar to those found in titanium implants.[19] Zirconia abutments are widely used in regions with high aesthetic demand, presenting high biocompatibility and mechanical resistance.[20] In the present study, it was decided to use a two-piece implant in order to have more prosthetic options, and Case 2 required the use of an angulated abutment owing to the positioning of the bone. In this case, it would have been difficult to use a one-piece implant without the need for abutment preparation.

Conclusion

The main objective of this case report was to present the clinical and radiographic performance of ceramic implants placed in the aesthetic region in two patients, who were followed up for 12 months. The soft and hard tissue were maintained over the follow-up period.

The Zi two-piece ceramic implant system used in the two cases described proved to be a safe and reliable alternative in oral rehabilitation of the aesthetic region. Further studies will need to be carried out to confirm our findings, and the cases presented here will continue to be monitored.

Literature

about the authors

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