Metal-free rehabilitation of the posterior mandible using ceramic implants

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Dental implant therapy is widely regarded as the gold standard for the replacement of missing teeth, with titanium implants demonstrating long-term success and predictability. However, increasing patient demand for metal-free alternatives, driven by aesthetic concerns, hypersensitivity, and personal preferences, has led to the development of ceramic implant systems, particularly zirconia-based implants.

Zirconia implants offer several advantages, including excellent biocompatibility, low plaque affinity, favourable soft-tissue response, and superior aesthetics due to their tooth-like colour.[1–3] Early-generation ceramic implants were predominantly one-piece systems, limiting prosthetic flexibility. More recently, two-piece zirconia implant systems, have been introduced, allowing screw-retained restorations and improved prosthetic versatility.[4]

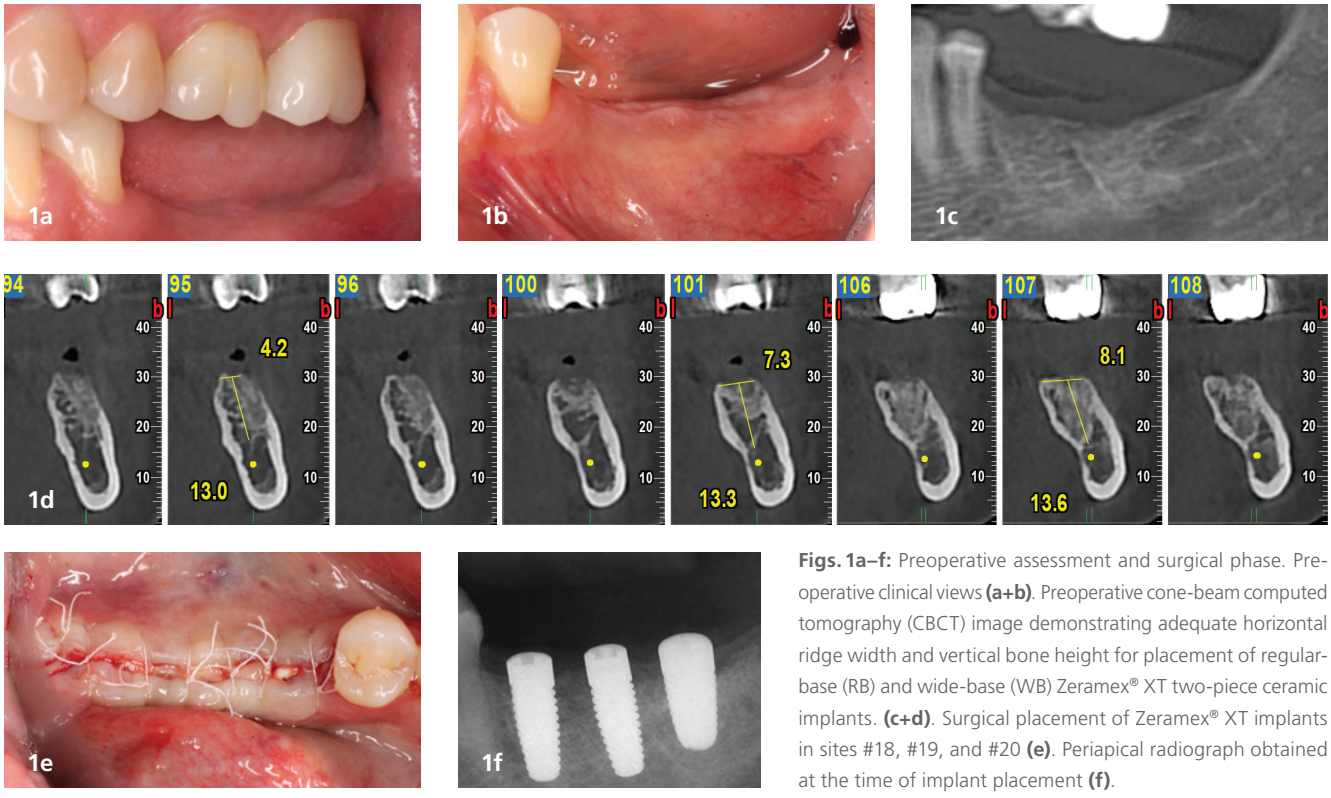
This report describes the rehabilitation of a posterior mandibular edentulous segment using Zeramex XT ceramic implants, with emphasis on surgical, prosthetic, and clinical outcomes.

Case presentation

A 43-year-old female patient, with no relevant medical history and in good systemic health, presented for rehabilitation of the missing mandibular left posterior dentition at sites #18, #19, and #20. The patient expressed a clear preference for a completely metal-free treatment approach and therefore declined placement of titanium implants.

Preoperative assessment

Clinical examination demonstrated an edentulous posterior mandibular segment



Figs. 1a–f: Preoperative assessment and surgical phase. Preoperative clinical views **(a+b)**. Preoperative cone-beam computed tomography (CBCT) image demonstrating adequate horizontal ridge width and vertical bone height for placement of regular-base (RB) and wide-base (WB) Zeramex® XT two-piece ceramic implants. **(c+d)**. Surgical placement of Zeramex® XT implants in sites #18, #19, and #20 **(e)**. Periapical radiograph obtained at the time of implant placement **(f)**.

corresponding to sites #18, #19, and #20 (Figs. 1a+b). The soft tissues appeared healthy, and no local contraindications to implant therapy were identified. A comprehensive radiographic evaluation was performed, including cone-beam computed tomography (CBCT), to assess the available bone volume and anatomical conditions at the planned implant sites. CBCT analysis demonstrated adequate horizontal ridge width and sufficient vertical bone height to accommodate placement of Zeramex® XT two-piece ceramic implants in the intended positions, including the use of regular-base (RB) and wide-base (WB) implant configurations as indicated by the local anatomy (Figs. 1c+d).

Based on the combined clinical and radiographic findings, a treatment plan was established for placement of three zirconia implants at sites #18, #19, and #20. In view of the patient's preference for a metal-free rehabilitation and the favourable local hard-tissue conditions, treatment with a ceramic implant-supported fixed prosthetic restoration was selected. Platelet-rich fibrin (PRF) was additionally prepared for intraoperative application as an adjunctive measure to support soft-tissue healing and promote regenerative healing events.

Surgical phase

Implant placement was performed according to standard surgical protocols. Three Zeramex® XT two-piece ceramic implants were inserted in the mandibular left posterior region at sites #18, #19, and #20 (Fig. 1e). Specifically, two regular-base implants, each measuring 10 mm in length, were placed at sites #19 and #20, whereas one wide-base implant, measuring 8 mm in length, was placed at site #18 in accordance with the available bone dimensions and prosthetically driven treatment planning.

All implants were positioned approximately 0.6 mm supracrestally. PRF was applied at the surgical sites to enhance soft-tissue healing and support local regenerative responses. Primary stability of approximately 35 Ncm was achieved for each of the three implants, indicating adequate initial mechanical stability at the time of placement. Cover screws were then placed, and the surgical site was closed with non-resorbable expanded polytetrafluoroethylene (e-PTFE) sutures to ensure stable wound adaptation and protection during submerged healing. A periapical radiograph obtained immediately after surgery confirmed appropriate implant positioning and angulation at all three sites (Fig. 1f).

Healing and second-stage surgery

A submerged healing protocol was followed, and the implants were left to heal for four months. During this interval, healing proceeded uneventfully, with no reported biological or mechanical complications. At the four-month postoperative visit, clinical examination revealed favourable healing of the peri-implant tissues and healthy soft-tissue conditions in the treated area (Fig. 2a).

Second-stage surgery was then performed to uncover the implants. Zeramex® XT soft-tissue healing components, described as healing caps/gingiva formers, were placed at this stage to support soft-tissue contouring and maturation around the transmucosal portion of the future restorations (Fig. 2b). The peri-implant mucosa demonstrated a healthy appearance, with satisfactory tissue adaptation and no visible signs of inflammation, dehiscence, or adverse tissue response.

Prosthetic phase

After a further four-week period of soft-tissue conditioning, the prosthetic phase was initiated. Ceramic abutments were placed on the implants and secured using the VICARBO® carbon fibre-reinforced

Figs. 2a–f: Healing, second-stage surgery, and prosthetic phase. Clinical view at four months postoperatively following placement of two-piece Zeramex® XT ceramic implants **(a)**. Implant uncovering with placement of Zeramex® XT soft-tissue healing components (healing caps/gingiva formers) **(b)**. Placement of ceramic abutments secured with the VICARBO® carbon fibre-reinforced PEEK screw, with intra-oral adjustment to achieve adequate prosthetic clearance **(c)**. Cementation of definitive all-ceramic implant-supported crowns **(d+e)**. Final periapical radiograph demonstrating the completed implant-supported restoration **(f)**.

polyetheretherketone (PEEK) screw. The screws were tightened to a torque value of 25 Ncm in accordance with the restorative protocol.

Following abutment placement, intraoral adjustment was carried out to obtain adequate prosthetic clearance and optimise the alignment of the restorative components for the definitive prosthetic reconstruction (Fig. 2c).

Subsequently, final restorative procedures were completed, and definitive all-ceramic implant-supported crowns were fabricated and cemented (Figs. 2d+e). The restorations demonstrated appropriate fit, alignment, and integration within the occlusal scheme. A final periapical radiograph confirmed completion of the implant-supported prosthetic rehabilitation and showed satisfactory seating of the prosthetic components at all treated sites (Fig. 2f).

Clinical outcome

At completion of treatment, the patient had been successfully rehabilitated with a fully metal-free implant-supported restoration replacing the missing mandibular posterior teeth at sites #18, #19, and #20. The clinical and radiographic findings demonstrated stable implant placement, favorable peri-implant soft-tissue conditions, and successful delivery of the definitive all-ceramic prosthetic reconstruction.

The treatment sequence progressed uneventfully from preoperative assessment through surgical placement, healing, second-stage surgery, and definitive prosthetic restoration.

Final restoration and outcome

Definitive all-ceramic crowns were fabricated and cemented (Figs. 2d+e). Clinical outcomes included:

- Favourable soft-tissue integration
- Well-defined emergence profile
- Stable zone of keratinised gingiva
- Functional occlusion
- High aesthetic integration

Radiographic evaluation confirmed appropriate implant positioning and osseointegration. Approximately 1 mm of physiologic crestal bone remodeling was observed at the junction of the polished collar and threaded implant surface at four months post-placement.

Discussion

This case highlights the clinical applicability of two-piece zirconia implant systems for posterior rehabilitation. Historically, ceramic implants were limited by one-piece designs, which restricted prosthetic flexibility and increased technique sensitivity.[5] The introduction of systems such as Zeramex XT addresses these limitations through a screw-retained, two-piece configuration.

Zirconia demonstrates excellent biocompatibility and has been associated with reduced bacterial adhesion and inflammatory response compared to titanium.[2,6] These properties contribute to favourable peri-implant soft-tissue outcomes, as observed in this case. Additionally, the intrinsic colour of zirconia minimises the risk of peri-implant discolouration, particularly in patients with thin soft-tissue biotypes.[7]

The use of carbon fibre-reinforced PEEK screws allows for a completely metal-free restorative complex while maintaining adequate mechanical stability.[4] Furthermore, alumina-toughened zirconia (ATZ), utilised in contemporary ceramic implants, exhibits enhanced flexural strength, fracture toughness, and resistance to crack propagation. This improves structural reliability under functional loading conditions.[8–10]

The adjunctive use of PRF may have further supported soft-tissue healing and early osseointegration, consistent with previous reports demonstrating improved angiogenesis and wound healing with autologous platelet concentrates.[11]

Overall, this case demonstrates that ceramic implants provide a predictable metal-free alternative with favourable biological and prosthetic outcomes.

Conclusion

Zeramex XT ceramic implants represent a viable and predictable metal-free alternative to titanium implant systems. In this case, successful rehabilitation of a posterior mandibular edentulous segment was achieved, demonstrating excellent soft-tissue integration, stable peri-implant conditions, and favourable functional outcomes.

The two-piece, screw-retained design enhances prosthetic flexibility, retrievability, and long-term maintenance. Further long-term studies are required to validate the durability and clinical success of these systems in broader patient populations.

References

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