

Immediate restoration of one-piece zirconia implants

Enhancing natural soft-tissue aesthetics

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One of the most challenging situations that the dental implant clinician faces, even with recent advancements in implant surgical protocols, is achieving natural soft-tissue contours around dental implants placed in the maxillary aesthetic zone.¹⁻⁵ Discoloration and recession of the marginal tissues around titanium dental implants placed, not only in the aesthetic zone, but at other sites requiring tooth replacement as well, have been complications associated with that classification of implant material for years, and their occurrence has been well documented in the dental literature.⁶⁻⁸ Bone loss around the affected implant generally is associated with these soft-tissue complications.⁶⁻⁸ Incorporating state of the art, minimally invasive, immediate restoration protocols, can drastically reduce these potential complications associated with titanium dental implants, especially in the maxillary aesthetic zone, however, the risk potential for tissue complications remains significant.⁹⁻¹¹

Utilising conventional two-piece implant designs introduces a connection between the implant and abutment complex. It has been well documented in the dental literature that a micro-gap area exists and can be an introductory point for bacterial invasion into the peri-implant environment, becoming an impetus for crestal bone loss and the initial event for peri-implantitis formation.¹²⁻¹⁵ Comparisons of zirconia custom abutments vs stock/custom titanium abutments has demonstrated a

reduced occurrence of bacterial plaque adhesion and biofilm formation present on zirconia abutments compared to titanium.¹⁶⁻¹⁹ Removing the micro-gap connection by utilising a one-piece implant design, can help reduce this concept, however adds a more complex surgical technique in regards to initial implant stability, and the trajectory of implant placement in both angulation and spatial arrangement for optimal implant restorative and biological success.²⁰

Incorporating a one-piece implant can reduce some of these issues, however presents additional challenges.^{20,21} One of these challenges is the positioning, trajectory and depth of placement of the coronal portion of the one-piece implant and the facial aspect of the scalloped abutment design. Without understanding the correct thread-time of the placement of the implant into the osteotomy, the incorrect position of the facial aspect of the scalloped buccal portion of the abutment can easily be in an inappropriate position leading to compromised interdental bone and soft-tissue contours. This can then lead to aesthetic complications, both in soft tissue and the final ceramic restoration aesthetics as well. One-piece zirconia implants offer a definitive solution to the micro-gap issue observed with two-piece implant designs, plus the benefits of zirconia as a dental implant material.^{20,21} Additionally, with various implant design features that offer aggressive thread patterns in the apical portion of the implant itself, achieving initial stability in extraction sites is more predictable.

The positioning of the platform aspect of the abutment portion of the one-piece zirconia implant, in close proximity to the critical soft-tissue area in respect to the emergence profile and facial gingival margin of the pre-existing gingival tissues offers benefits over the titanium one-piece implant designs.^{20,21} Obviously the warmth of zirconia in relation to thin and/or thick biotype of tissue is a definite benefit for soft-tissue aesthetics when compared to titanium.²² Additionally, depending on the one-piece implant selected, the ability to prepare the abutment/collar or on the implant portion of the one-piece implant allows a level of flexibility to manage placement



Fig. 1

Case 1—Fig. 1: Pre-op smile.



Fig. 2

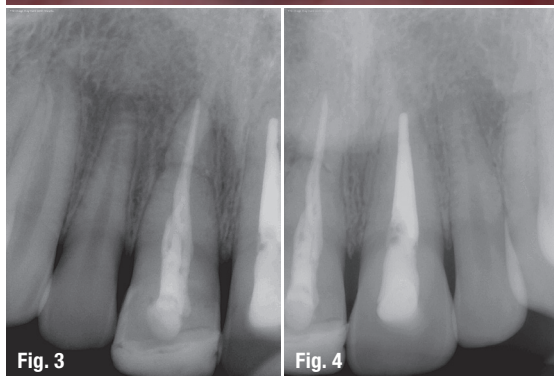


Fig. 3

Fig. 4

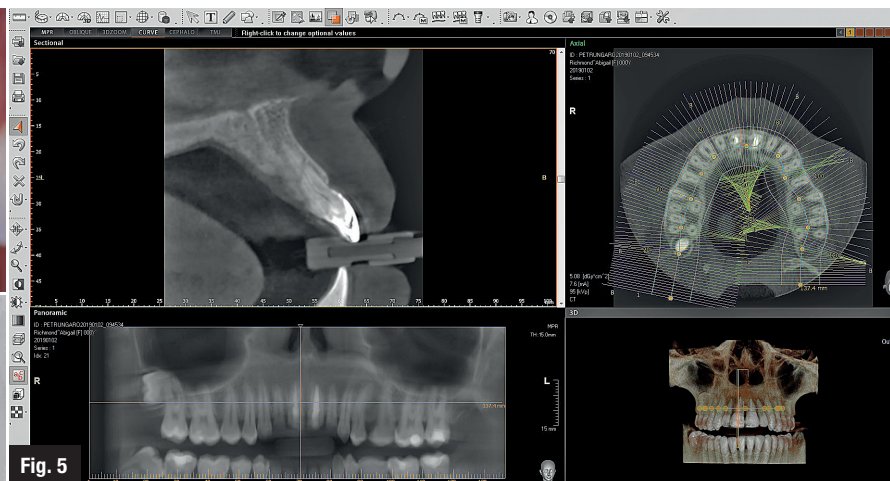


Fig. 5

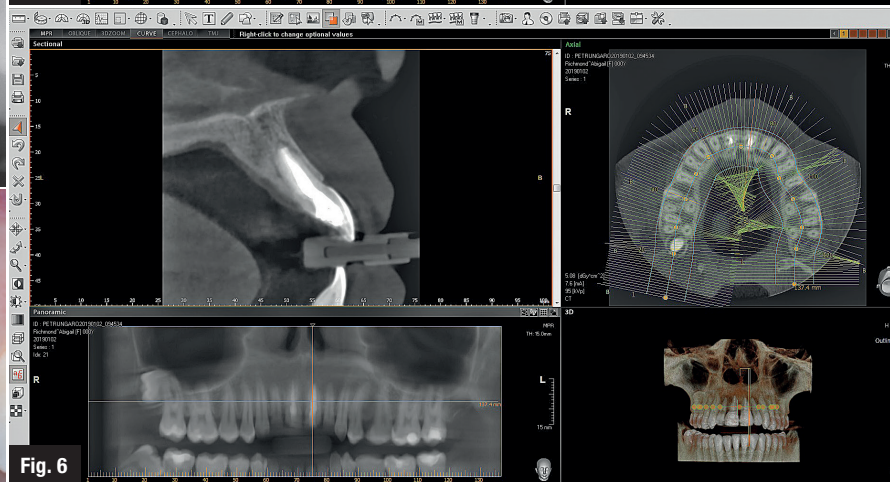


Fig. 6



Fig. 7

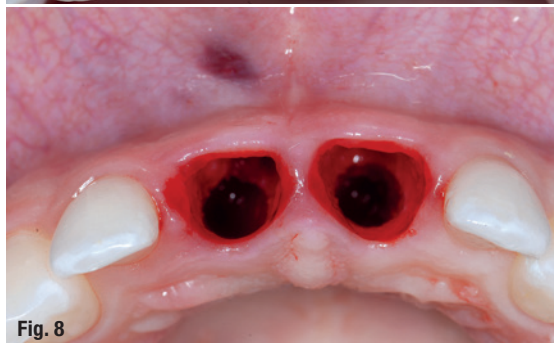


Fig. 8

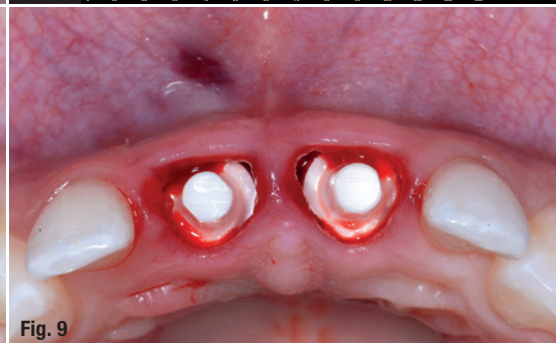


Fig. 9

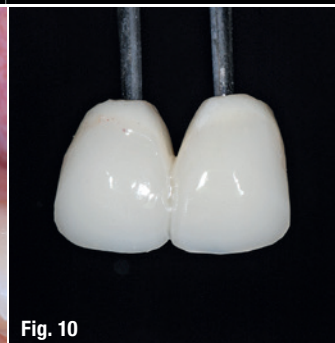


Fig. 10

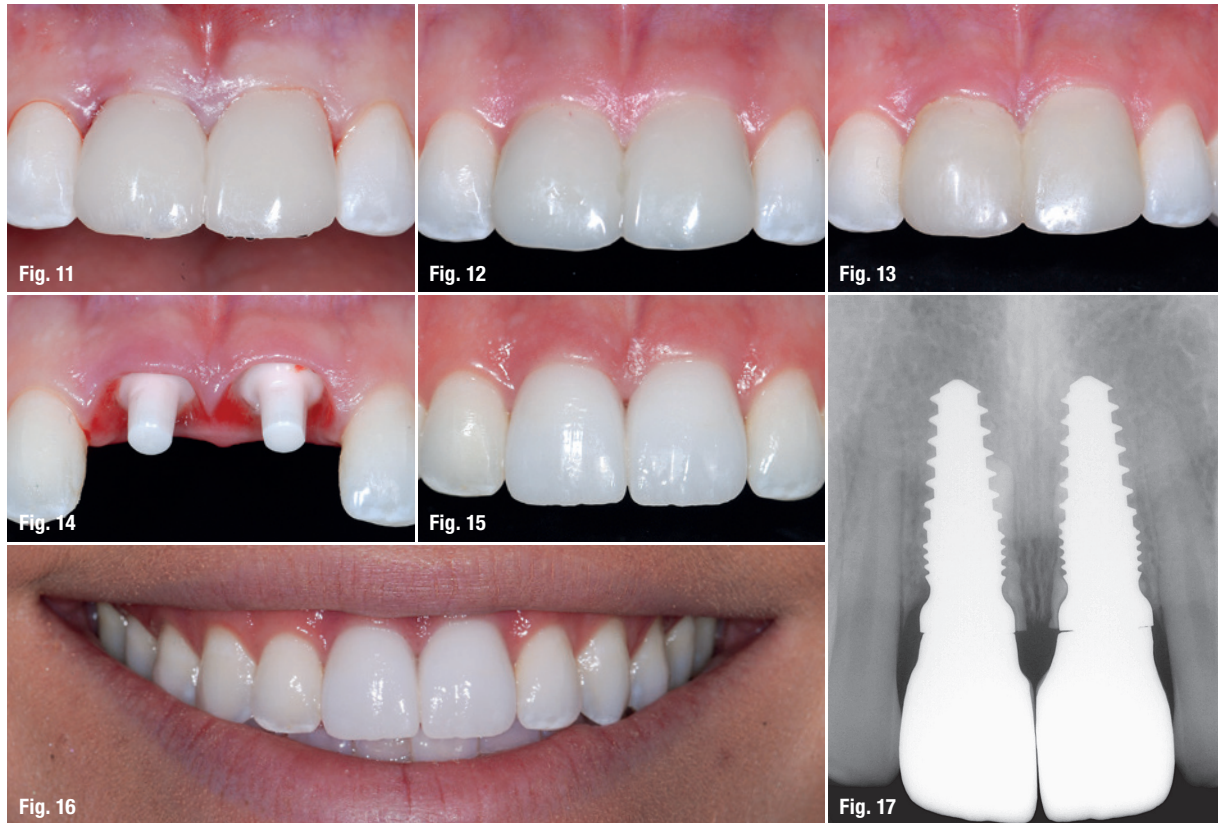
Case 1—Fig. 2: Pre-op clinical view of maxillary right and left central incisors. **Fig. 3:** Pre-op periapical radiograph, right central incisor. **Fig. 4:** Pre-op periapical radiograph, left central incisor. **Fig. 5:** Pre-op CT scan, right central incisor. **Fig. 6:** Pre-op CT scan, left central incisor. **Fig. 7:** Atraumatic tooth removal, maxillary right and left central incisors. **Fig. 8:** Atraumatic site preparation, maxillary central incisors. **Fig. 9:** Minimally invasive placement, Z-Systems one-piece tapered screw implants. **Fig. 10:** Immediate provisional restoration.

irregularities in regards to depth of placement, and spatial arrangement in regards to trajectory and angle of emergence of the one-piece implant.²⁰

Case 1

A 30-year-old, non-smoking female, presented for removal of failing maxillary central incisors (Figs. 1 & 2). The past history included trauma to the maxillary anterior, root canal treatment at both central incisors, and

presently, a horizontal fracture at the right central incisor (Fig. 3). Figures 3 and 4 demonstrate the pre-treatment digital peri-apical views while Figures 5 and 6 demonstrate the pre-treatment CT scan views of the maxillary right and left central incisors, respectively. The patient was interested in zirconia implants, and the final aesthetic result was of paramount importance to her, in addition to a sound biologic foundation present for long term success. Pre-treatment planning consisted of study models, diagnostic waxing of the central incisors and



Case 1—Fig. 11: Immediate postoperative clinical view. **Fig. 12:** Seven-day postoperative view. **Fig. 13:** Four months post-op. **Fig. 14:** Aesthetic soft-tissue emergence profile contours. **Fig. 15:** Case complete clinical view, maxillary central incisors. **Fig. 16:** Case complete smile. **Fig. 17:** Case complete periapical radiograph.

surgical stent fabrication. After evaluation of the patient's intra-oral tissues, CT scans and periapical radiographs, the decision to proceed with a minimally invasive surgical approach with immediate provisional restoration, and a one-piece zirconia implant design offered the best opportunity to ensure the foundations for natural aesthetics in this critical area.

After a pre-surgical administration of an appropriate antibiotic (Augmentin 875mg, started the day prior to surgery), the patient presented for the immediate tooth replacement procedure. Administration of an appropriate local anaesthetic was given, and the maxillary right and left central incisors were removed atraumatically (Fig. 7) and both sites thoroughly debrided by mechanical curettage and rotary instrumentation. Placement of the surgical guide, TempStent II surgical guide system, precedes initial site preparation.^{23,24} From our pre-treatment planning, and due to the width of the central incisors, the decision was to prepare the sites to receive 5.0 diameter one-piece implants. Final site preparations can be observed in Figure 8. Placement of two, 5.0 x 12mm, Z-Systems one-piece tapered screw implants, was performed by minimally invasive surgical protocol, achieving an initial torque of 45Ncm at both central incisor sites (Fig. 9). The defects on the facial aspect of

the implants to pre-existing buccal plate defects were managed by a combination of autologous platelet-rich fibrin and Osseolive grafting material (curasan).

Conversion of the TempStent II surgical guide system allows for the fabrication of the immediate provisional restoration (Fig. 10). Cementation with a strong temporary cement, and thorough removal of any excess material was then completed. The immediate postoperative clinical view can be seen in Figure 11. A seven-day postoperative clinical view can be seen in Figure 12. Please note the natural soft-tissue emergence profile and papillary contours present at this postoperative time frame. Figure 13 demonstrates the four-month postoperative clinical view, and prior to final abutment level impressions. Figure 14 demonstrates the natural soft-tissue emergence profiles obtained from the minimally invasive, immediate placement and provisionalisation procedure. The case complete clinical view can be seen in Figure 15. Please note the natural soft-tissue contours, maintained throughout the entire procedure. Additionally, please note the gingival health facial to the zirconia implants at both central incisors.

The case complete smile view can be seen in Figure 16, please note the patient is undergoing at home bleaching

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procedures to lighten her natural tooth colour. Following prescribed procedures adhered to in the author's clinical practice, all implant restorations are seated with provisional cement for 3–6 months, preceding final cementation. Figure 17 demonstrates the case complete digital periapical radiograph, prior to final cementation. Please note the interdental bone contours maintained throughout the entire procedure.

Case 2

A 49-year-old non-smoking female patient presented for treatment of a maxillary arch terminal dentition (Fig. 18). A past history of multiple teeth treated with root canals, post and core build-ups and crown and bridge resulted in fractured teeth, poor aesthetics and marginal periodontal disease. The patient elected to undergo tooth removal, placement of dental implants simultaneously, and wanted natural tooth replacement. Additionally, the patient had

concerns regarding the dark hue at the gingival margins of the maxillary restorations, and requested this to not be present in the final implant restorations (Figs. 19 & 20). The pre-treatment CT scan can be seen in Figure 21. Please note the serial view of the right lateral incisor, with the total loss of the buccal plate, and fractured root. The pre-treatment plan was to remove all maxillary teeth, excluding the natural pre-existing right canine, which exhibited health periodontally and structurally. One-piece zirconia implants were planned to be placed at selective sites throughout the maxillary arch by minimally invasive means, with minimally invasive bone grafting procedures and immediate provisionalisation of the zirconia implants at placement.

Preoperative administration of oral antibiotics precedes the initial surgical visit. Fabrication of a diagnostic waxing of the TempStent II surgical guide/provisionalisation system was completed for the maxillary arch.^{23,24}



Fig. 18



Fig. 19



Fig. 20



Fig. 22

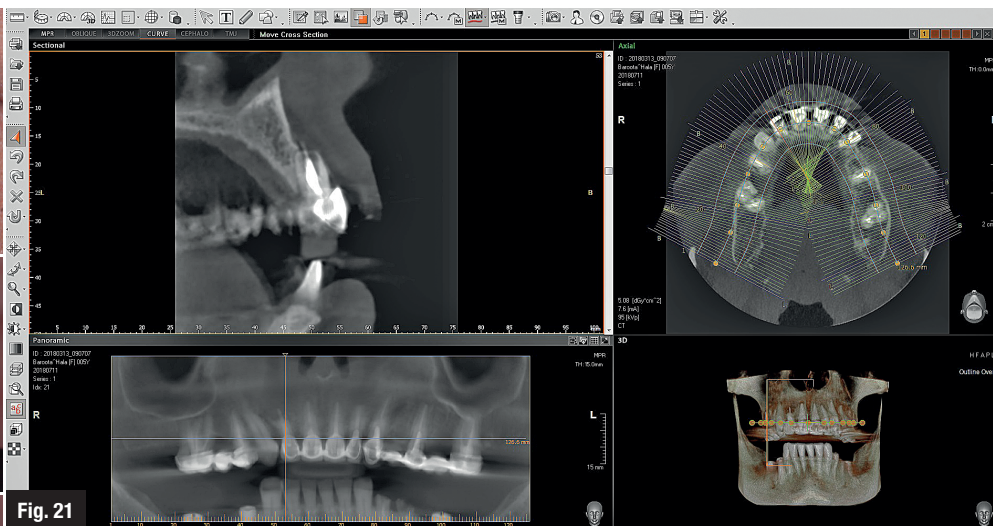


Fig. 21

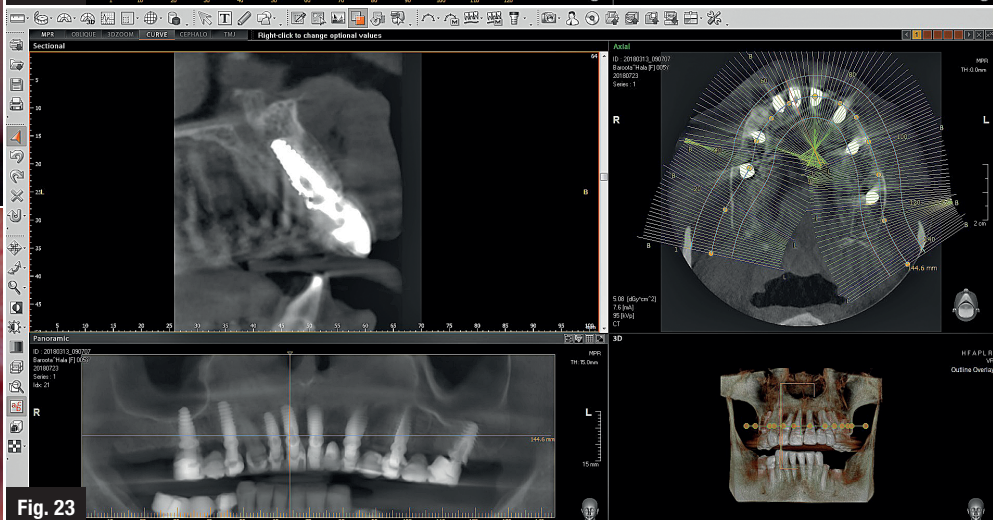


Fig. 23

Case 2—Fig. 18: Pre-treatment smile view. **Fig. 19:** Pre-treatment clinical view, maxillary anterior. **Fig. 20:** Pre-treatment clinical view, maxillary right lateral view. **Fig. 21:** Pre-treatment CT scan. **Fig. 22:** Minimally invasive implant placement maxillary arch, Z-Systems one-piece tapered screw implant design. **Fig. 23:** Immediate post-op CT scan.



Case 2—Fig. 24: Natural emergence profiles obtained, right lateral incisor. **Fig. 25:** Case complete clinical view, maxillary arch. **Fig. 26:** Case complete smile view.

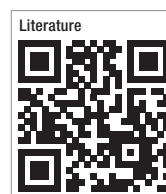
After administration of an appropriate local anaesthetic, all remaining maxillary teeth, with the exception of the maxillary right canine, were removed by atraumatic techniques, and the sites thoroughly debrided by mechanical and rotary instrumentation ensuring all remnants of periodontal ligament and granulation tissue were removed. Insertion of the TempStent II surgical guide system allowed for efficient site preparation. Following a soft bone drilling sequence, eight one-piece zirconia tapered screw implants (Z-Systems' ceramic implant system) were inserted achieving initial torque values between 40–45 Ncm. The implants consisted of 4–5 mm diameter, 10–12 mm in length at the sites in the maxillary arch (Fig. 22).

Peri-implant defects at the facial aspects of the implants placed by minimally invasive protocols were grafted with autologous platelet-rich fibrin and 1–2 mm particle size allogeneic mineralised cancellous bone graft material. Conversion of the TempStent II surgical guide system into the immediate provisional restoration, and the emergence profiles, and contact point relationships were customised in the provisional restoration. The provisional restoration was then cemented with a strong provisional cement. The immediate postoperative CT scan can be seen in Figure 23. The provisional restoration was utilised for five months. Final all zirconia restorations were then fabricated by abutment level impressions. Figure 24 demonstrates the natural soft-tissue emergence profiles realised from the minimally invasive, immediate restoration procedure. Figure 25 demonstrates the final restorations across the maxillary arch, initially cemented with provisional cement. Figure 26 demonstrates the case complete smile view.

Discussion

The incorporation of zirconia dental implants into the armamentarium of tooth replacement procedures, especially in the aesthetic zone, offers a superior soft-tissue response, less plaque and biofilm affinity and superior soft-tissue gingival aesthetics when compared titanium. One-piece implant designs can effectively remove the micro-gap issue between the implant and abutment

complex. Utilising a zirconia material that allows for modification to the abutment, the platform of the abutment and/or implant itself offers additional flexibility to solve angulation and/or spatial positioning irregularities. The author recommends additional clinical studies to further substantiate the effectiveness of zirconia as an alternative to titanium in dental implant procedure.



about the authors



Dr Paul Petrunaro is a USA-based expert in Implantology, as well as the treatment of failed implants, and zygomatic implants. He graduated from Loyola University Dental School in 1986. He is a fellow of the International and American College of Dentists, and a Diplomat of the International Congress of Oral Implantologists. Dr Petrunaro

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