Zirconia abutment for the single tooth implant

Tony Aherne and Stuart Aherne present three case reports involving immediate implants with final zirconia abutments prepared extra-orally on fixture mounts and then attached to the implants

Treatment protocols have changed and improved with the advent of new technology. One such material that is the subject of much interest is zirconium oxide (ZrO2). It is a highly biocompatible ceramic material providing fracture strength properties that allow application in all areas of the oral cavity (Piconi C, Maccauro G, 1999; Kucey BK, Fraser DC, 2000). It also enables light transmission through the critical marginal area, preventing grey discolouration of the surrounding tissue.

Recent studies, both in vivo and in vitro, have demonstrated that zirconia ceramic surfaces accumulate fewer bacteria than commercially pure titanium (Gamborena I, Blatz MB, 2006; Rimondini L et al, 2002). In addition it has been reported that the soft and hard tissue response to Zr has been favourable (Saadoun AP, Touati B, 2007a).

Immediate implant placement after extraction is now seen as standard procedure. Biologic considerations play a major part in treatment planning of such cases. Preservation of the existing topography of hard and soft tissues is critical for aesthetic success. There is a growing emphasis towards minimally invasive surgery, with optimally designed implants and abutments (Van Dooren E, 2007). Frequent screwing and unscrewing of abutments leads to tissue loss and should be avoided whenever possible (Saadoun AP, Touati B, 2007b). Considerations of risk factors related to thin biotypes have to be borne in mind.

In the following case reports immediate implants have been placed after careful

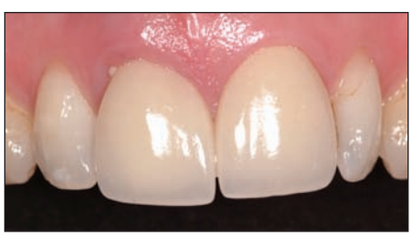

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Figure 2b

Figure 3

Figure 4

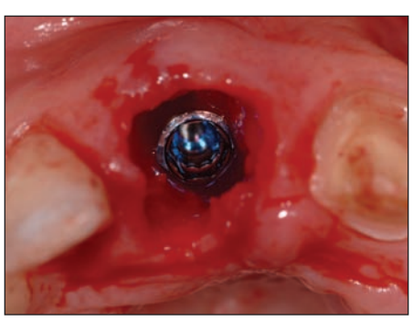


Figure 5

Figure 6a

Figure 6b

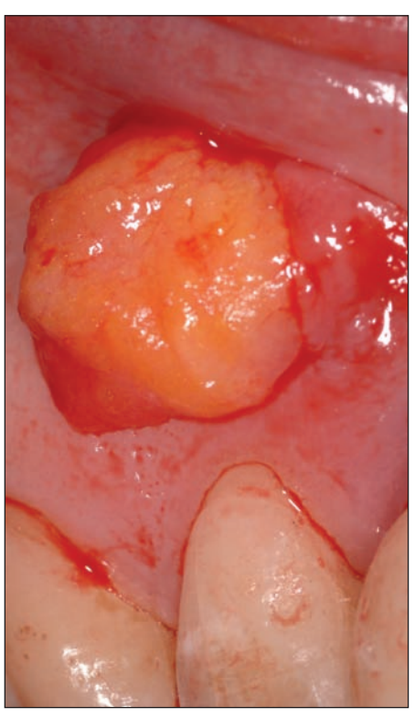


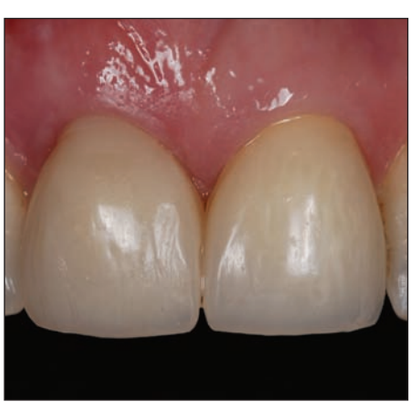
Figure7

extraction and minimally invasive techniques. Final zirconia abutments have been prepared extra-orally on fixture mounts and then attached to the implants. The abutments and implants have not been early loaded. The desire for new concepts in abutment design is timely, allowing the placement of the final transmucosal element of Zr abutments at the time of surgery in order to encourage a hyperplasic tissue response.

Case one

A 38-year-old patient attended with a fractured right central incisor (Figure 1). The |1 was in need of a replacement crown. A shell temporary bridge was manufactured with a pontic facing (Figures 2a and 2b). The existing crown in the |1 was removed (Figure 3). The 1| was removed carefully and flapless implant placement was carried out (Figure 4). The implant was placed on the palatel wall of the socket 3mm below the margin (Figure 5). A ZiReal (3i) ZR abutment was also placed immediately. There was a tear in the delicate marginal gingivae, which was associated with the root fracture (Figure 6a). At stage two recovery there was a gingival hyperplasia associated with the ZiReal abutment

Figure 8



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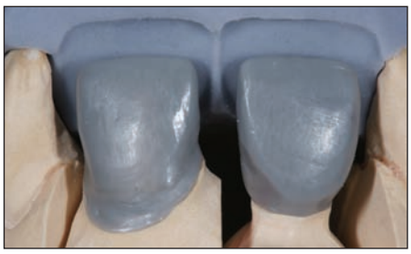

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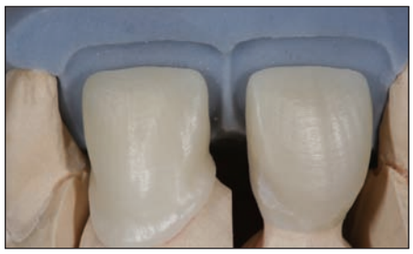

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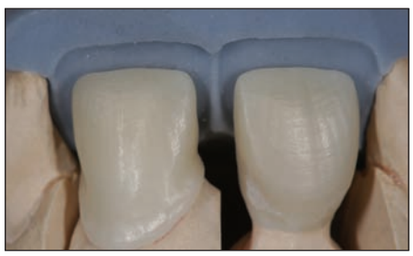

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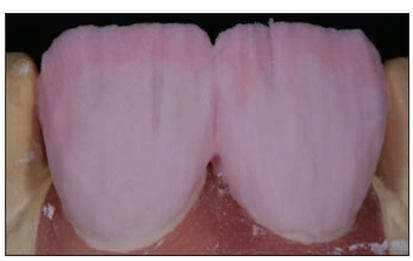
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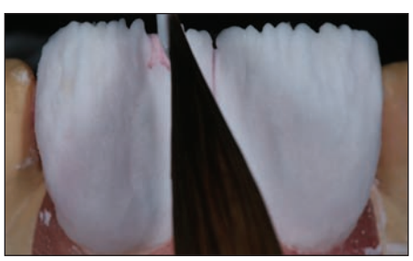
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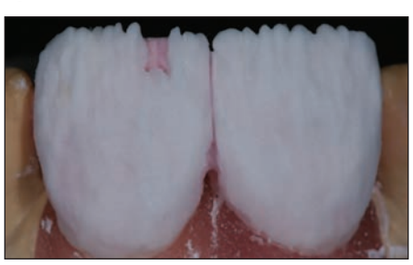
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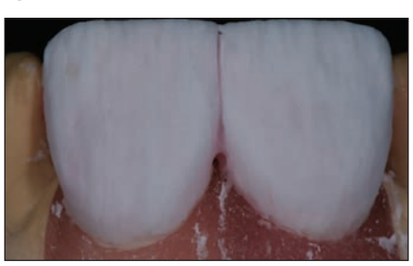
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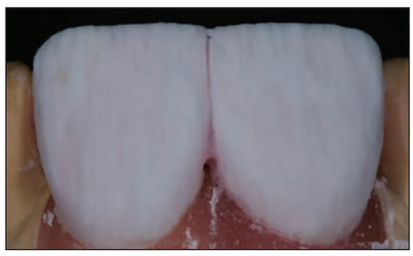
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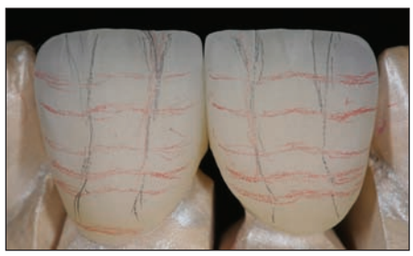
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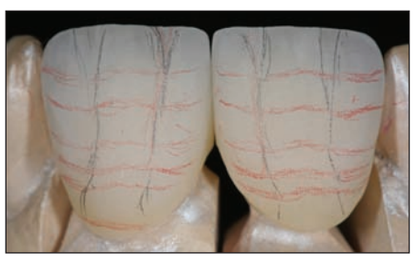
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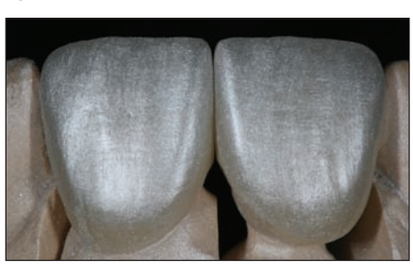
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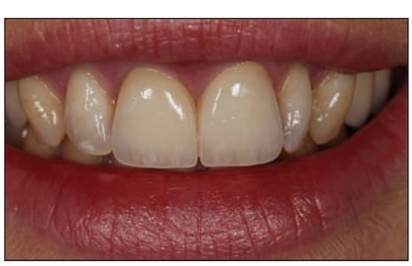
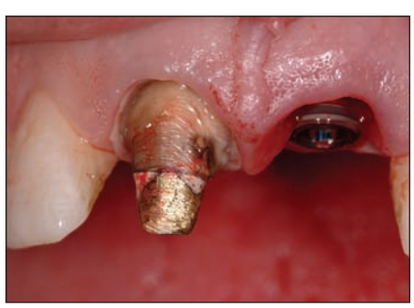


Figure 45

(Figure 6b). A connective tissue graft was carried out at stage two using the tunnel technique to augment the soft tissue (Figure 7). At this stage the tissues were custom guided with temporary crowns (Figures 8 and 9). The technical aspects of the case are illustrated in Figures 10 to 43. The final all-ceramic crowns were fitted with Fugicem and showed good integration with the tissues (Figures 44 and 45).


Figure 46


Figure 47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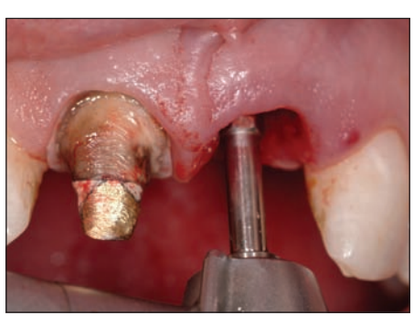
Figure 49

Case two

A 32-year-old female smoker presented with a fractured root under a left central incisor post crown (Figure 46). The prognosis for the tooth was hopeless and a replacement with an osseointegrated implant was decided on. The right central incisor had a post crown present in need of replacement (Figure 47). A shell temporary bridge was made up with a

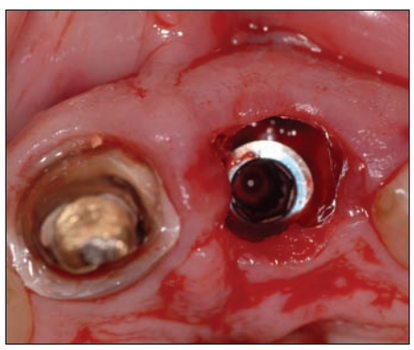
Figure 50


Figure 51


Figure 52


Figure 53

retainer on the 1| and a pontic facing on the |1. Flapless implant surgery was performed. After performing an osteotomy a 3i Certain PREVAIL implant with a platform switch was placed. The implant was placed 3mm under the margin and in the palatal aspect of the socket (Figures 48, 49 and 50). A 3i ZiReal ZR abutment was tried in and then adjusted extra-orally on a fixture mount (Figure 51).

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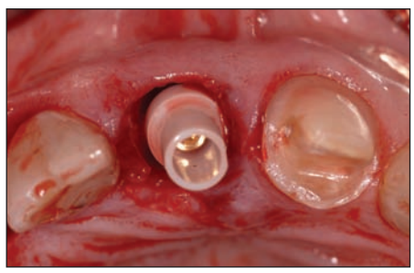

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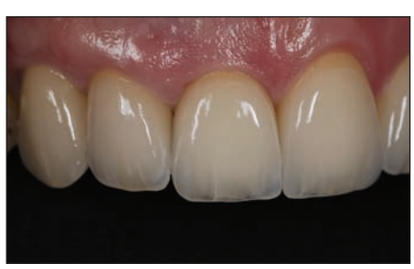

Figure 66

A temporary bridge was fitted and healing was allowed for 12 weeks. At stage two the temporary bridge was removed, revealing a hyperplasic gingival response to the Zr abutment (Figure 52). Final preparation was carried out on the Zr abutment and discoloured adjacent tooth (Figure 53). The discoloured tooth substrate was opaqued to help prevent shadowing. A Procera alumina coping was made up for the Zr abutment and a tissue impression was taken (Figure 54). Shade taking was also carried out. Two Procera crowns were made up (Figure 55) and fitted. Soft tissue integration was complete (Figure 56).

Case three

A middle-aged woman attended with a fractured right central incisor. An immediate implant was placed after extraction, together with a Zr abutment (Figures 57, 59, 60, 61, 62 and 63) and a temporary bridge fitted with a retainer on |1, plus a hollow pontic on the 1| overlaying but not loading the abutment (Figures 58 to 65). Healing was allowed for 12 weeks; at review there was a positive tissue response around the Zr abutment (Figure 64). At 12 weeks the abutment was loaded. A shell temporary bridge was relined. Final prosthesis shows good tissue integration (Figure 66).

Conclusion

The successful replacement of a single missing anterior tooth with an implant is a significant challenge, mainly due to the high aesthetic demands as well as biological and functional considerations. In a healing site after extraction there are varying degrees of resorption and soft tissue changes, often leading to hard and soft tissue loss.

The avoidance or reduction of soft tissue loss in moderate to thin biotypes is a major consideration, in particular using non-invasive techniques (Saadoun AP, Touati B, 2007b). Evidence suggests soft tissue stability and thickness are essential for adhesion and good long-term tissue response. This will result in an improved seal, which will protect bone from the external environment, resulting in a decrease in marginal bone resorption and long-term tissue stability (Van Dooren E, 2007).

Biocompatible materials are essential to attain good soft tissue adhesion. Titanium has been the main choice for many years. However, with the advent of improved technology with high strength ceramics, more favourable aesthetic results are being achieved, in particular around the critical marginal zone.

Much attention is currently focused on zirconium. High biocompatibility with reduced bacterial adhesion and high flexural strength make this material suitable for close contact with surrounding soft tissues (Holst S et al, 2006). This material is used in fabricating implants, abutments and as a core material for all-ceramic restorations. In vitro and in vivo studies have shown positive tissue responses to this material (Gamborena I, Blatz MB, 2006; Rimondini L et al, 2002).

In the cases presented, final Zr abutments were put on three immediately placed implants after extraction. The abutments were not immediately loaded. Temporary bridges were used as a provisional replacement of the missing teeth. In all three cases there was a hyperplasic tissue response, which has not been noted by the authors when using titanium abutments. One of the cases was that of a smoker. Hyperplasic tissue response has been reported by the use of hollow pontics on an edentulous ridge (Tal H et al, 2004). However, the pontic design used in cases one and two was a pontic facing that allowed access for oral hygiene procedures and were closely monitored.

The cases presented in this article allowed the placement of the final abutment without early loading because of a favourable combination of circumstances that permitted provisionalisation using temporary bridges, preventing the pontic touching the final abutment. In the vast majority of cases such favourable conditions do not exist. Despite this, an area suggested for future research may be the designing of systems that allow the final Zr transmucosal element of an abutment to be placed at the time of implant surgery as a routine procedure.

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Acknowledgements

The authors would like to thank Master Dental Technician Harald Heindl of Aesthetic Dental Creations, Mill Creek, Washington, USA, for cases one and three, as well as Nicky Cox of Precision Dental Studios, Rivermead, Berkshire, UK, for the second case.