

Immediate zirconia implant placement

Connective tissue grafting in the aesthetic zone: A case-based narrative review

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Introduction

The replacement of compromised anterior teeth in young patients with a high smile line presents a unique combination of functional, biological and aesthetic challenges. Thin gingival biotypes, a history of chronic infection and high aesthetic demands often complicate treatment planning and require protocols that minimise tissue trauma while maximising long-term peri-implant stability. Immediate implant placement and provisionalisation have become increasingly accepted for managing tooth loss, offering benefits such as reduced treatment time, fewer surgeries and early restoration of aesthetics.¹⁻³ Zirconia implants, in particular monolithic one-piece designs, have gained attention for their favourable soft-tissue response, low plaque affinity and potential osteoimmunological advantages.⁴⁻⁸

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This article presents the treatment of a young female patient with a high smile line and a chronically infected, heavily discoloured, previously root-treated and resected tooth 22 exhibiting pain and mobility (Figs. 1+2). The case illustrates how a single-session workflow—comprising atraumatic extraction, immediate zirconia implant placement, simultaneous connective tissue grafting and same-day provisionalisation—can provide biological stabil-

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ity, aesthetic soft-tissue augmentation and immediate patient satisfaction. A narrative review contextualises the biological rationale behind zirconia implantology, osteoimmunology, monoblock designs and the role of soft-tissue augmentation.

Clinical background

The patient, in her mid-20s, presented with significant aesthetic concerns and chronic discomfort related to tooth 22. The tooth showed advanced discoloration, repeated endodontic interventions and persistent periapical pathology. Given the patient's high smile line, soft-tissue translucency and the risk of recession, traditional delayed implant approaches were considered less favourable. The patient expressed strong preference for a single-session solution to avoid aesthetic compromise and psychological stress associated with a visible gap or removable temporaries in the anterior maxilla.

Immediate zirconia implantation with connective tissue grafting was selected as the most predictable approach to achieve simultaneous infection control, socket preservation, soft-tissue thickening, and rapid aesthetic restoration.

Soft-tissue augmentation and aesthetic integration

Patients with a thin biotype and a high smile line are at increased risk for midfacial recession, mucosal translucency and peri-implant disharmony. A connective tissue graft (CTG) harvested from the palate in single-incision technique was transplanted to the buccal side of the implant to thicken the soft tissue and reinforce the peri-implant mucosal seal. This approach enhances long-term aesthetic predictability, improves colour masking and reduces the risk of peri-implant mucosal recession, particularly around zirconia implants where soft-tissue integration is strong, but volume stability still depends on biological thickness.^{9–11}

The graft was positioned to maximise its effect in the visible aesthetic zone, allowing a more natural emergence profile (Figs. 4+5). The primary objective was the forma-



tion of a robust keratinised mucosa capable of providing what has been described as a natural barrier against microbial penetration and inflammation.^{12–14}

Immediate extraction and implant placement

Atraumatic extraction was performed using periostomes and conscientious preservation of the buccal bone (Fig. 3). The socket was debrided and the apical region prepared to accommodate a one-piece zirconia implant (Figs. 6+7). Achieving primary stability is critical in immediate placement protocols, especially when immediate provisionalisation is planned. Modern ceramic implant designs with aggressive thread geometries facilitate torque stability in extraction sockets and create "healing chambers" between thread peaks—microenvironments that promote rapid bone formation and sufficient osseointegration.

Zirconia offers osteoimmunological advantages and stability comparable to titanium while eliminating galvanic and tribocorrosive processes associated with metal implants.^{8,15–17} The absence of microgaps, screws or internal interfaces in monoblock designs reduces bacterial colonisation risk and prevents microleakage at the bone crest—

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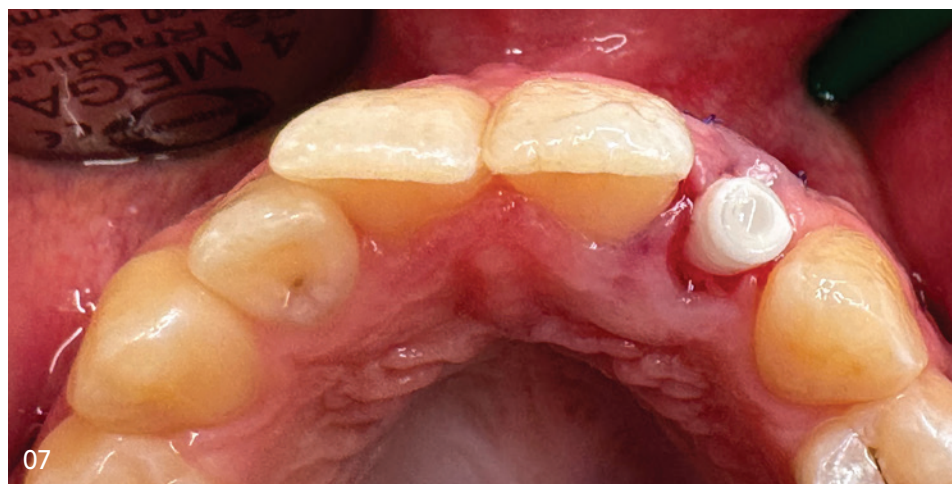
an important factor for long-term bone stability and osteoimmune and microbiome homeostasis.^{15–17}

Immediate provisionalisation, patient acceptance, and definitive prosthetic rehabilitation

A chairside provisional crown was fabricated and cemented with strict non-occlusal loading. Immediate provisionalisation avoids the aesthetic and psychological burden of a missing anterior tooth, particularly valuable in young patients. Studies consistently demonstrate higher patient satisfaction and improved quality of life with immediate provisionalisation protocols.^{18,19} Interestingly, even the provisional crown already provided an aesthetic improvement compared to the preoperative situation, ending a long history of salvage attempts that repeatedly resulted in pain and disappointment (Fig. 8). After three months, once complete osseointegration, a positive resonance frequency analysis, and full soft-tissue integration had been confirmed, the implant was restored with a custom-made, full-ceramic definitive crown (Figs. 9a+b). The patient was highly satisfied with both the aesthetic outcome and the overall treatment experience (Figs. 10–12).

Osteoimmunological considerations

Osteoimmunology emphasises that bone healing around implants is not purely mechanical but profoundly influ-

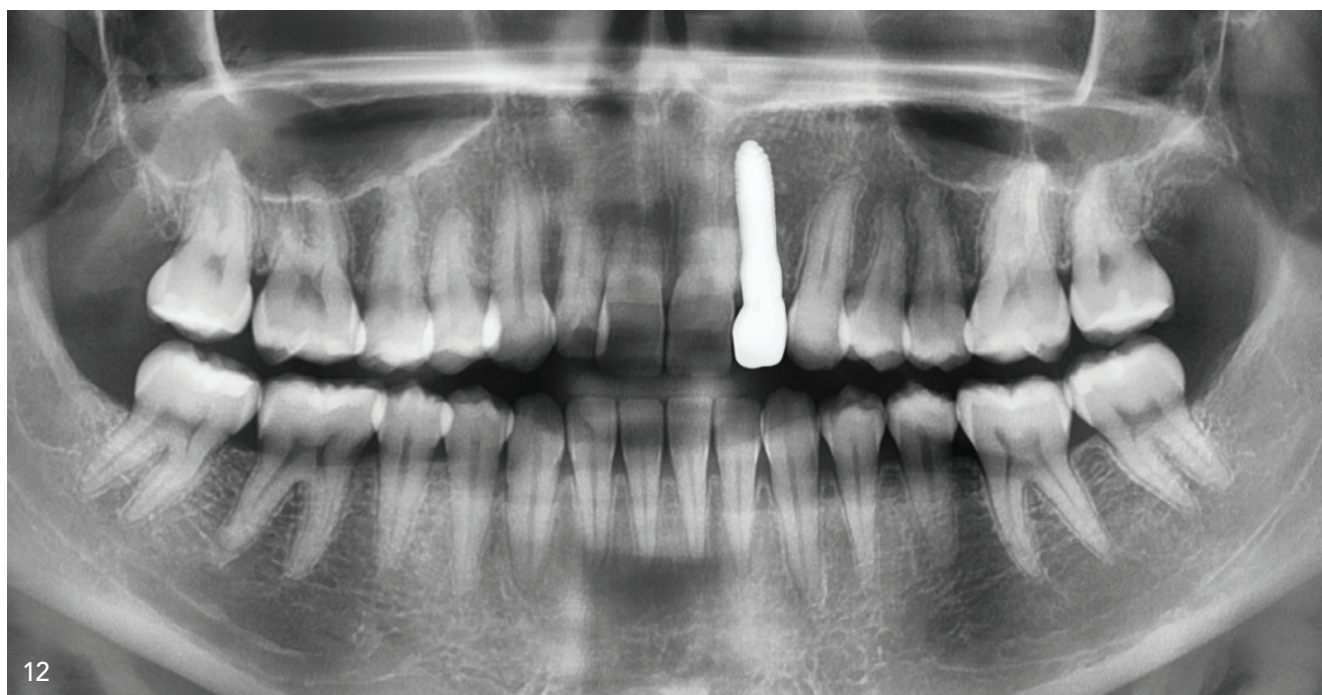




enced by immune-modulatory interactions. Zirconia may show reduced inflammatory cytokine expression, lower macrophage activation and decreased release of pro-inflammatory mediators such as $\text{TNF-}\alpha$ and $\text{IL-1}\beta$ compared with titanium when metallic wear particles or tribocorrosion occur.^{8,15,20-22}

Recent work has shown that ceramic implant materials may be associated with more stable soft-tissue interfaces and reduced risk of peri-implant inflammation, particularly when combined with thick keratinised mucosa.¹²⁻¹⁴ The monoblock nature of one-piece and tissue level zirconia implants eliminates internal voids that could serve as reservoirs for bacterial leakage^{23,24} and endotoxins, thereby supporting a stable and sustainable peri-implant immune environment.

Beyond material-specific immune responses, the osteo-immunological assessment of peri-implant bone quality and density is gaining importance—particularly through transalveolar ultrasound diagnostics, which allow non-invasive evaluation of bone integrity.^{25,26} This is clinically relevant in areas of incomplete bone regeneration²⁷, including former surgical sites, extraction sockets, peri-implant bone regions, as well as zones affected by post-endodontic inflammatory stress. Chronic immunological activation in these zones can alter osteoblastic and osteoclastic dynamics, potentially leading to fatty-degenerative osteolytic changes (FDOJ/Cavitations). These low-grade osteolyses are characterised by persistent overexpression of inflammatory cytokines—notably RANTES/CCL5 and other chemokines—contributing to a state of silent inflammation with possible systemic implications.²⁸⁻³⁰ Incorporating ultrasound-based bone density profiling into implant planning may therefore enhance early detec-



tion of immunologically stressed or compromised bone compartments, supporting more predictable regenerative and implantologic outcomes.

Discussion

This case highlights several advantages of an immediate zirconia implant approach in the aesthetic zone. Reducing the number of surgical sessions decreases total morbidity and enhances patient comfort. Avoiding temporisation gaps is especially important in patients with high smile lines, where aesthetics are continuously exposed during social interaction.

Soft-tissue augmentation at the time of implant placement is essential in thin biotypes. It supports long-term stability and significantly reduces recession risk—one of the most common complications in immediate implant dentistry. Zirconia's immunologically favourable profile, strong soft-tissue adhesion and resistance to biofilm accumulation further contribute to long-term success.

Conclusion

Immediate zirconia implant placement with connective tissue grafting and same-day provisionalisation represents a powerful treatment modality especially for young, aesthetically demanding patients. The biological and osteoimmunological advantages of zirconia, combined with precise soft-tissue management and monoblock implant design, support predictable outcomes with high patient satisfaction and sustainability of both hard and soft tissues.

“[...] the osteoimmunological assessment of peri-implant bone quality and density is gaining importance [...]”

Literature



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