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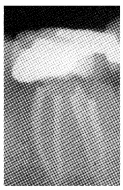

CASE REPORT

Ridge preservation in cases requiring tooth extraction during endodontic surgery: a case report

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Abstract

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Aim To provide a treatment option to endodontists performing surgery that will enhance ridge preservation when tooth extraction is required.

Summary A 47-year-old woman was referred to an endodontic practice for apical root-end resection of tooth 22 because of refractory periradicular disease. Radiographic examination revealed a large periradicular lesion, 5 mm in diameter and a root-end filling at the root apex. The treatment plan included exploratory surgery and apical root-end resection. A vertical root fracture was diagnosed and the decision was made to extract the tooth. The socket was grafted with a cancellous bovine bone and covered with a resorbable collagen membrane. Follow-up examination revealed favourable bone healing with formation of a new cortical plate and the preservation of soft tissue width and height in the aesthetic area.

Key learning points

- The principles of guided bone regeneration.
- Preserving or reconstructing the extraction socket.
- Enhances the ability to restore function and provide aesthetically pleasing restorations to patients without violating the predictability and function of the prostheses.

Keywords: endodontic lesion, ridge preservation, tooth extraction.

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Introduction

Surgical endodontic treatment is a recommended procedure for teeth with persistent periradicular disease in which nonsurgical root canal treatment is not feasible or

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contraindicated (Gutmann 1984, Gutmann & Harrison 1985). The development of new techniques, materials and instruments for surgical endodontic treatment has increased the success rate to over 90% (Tsesis *et al.* 2006). A dental operating microscope, minimal bevel of root resection, root-end canal preparation using ultrasonic tips to the depth of 3–4 mm and root-end filling with mineral trioxide aggregate are several main changes that have improved the outcome of contemporary endodontic surgery. However, in some instances, the tooth has to be extracted because of vertical fracture, perforation or other reasons that are noticed during surgery. After tooth extraction, 40–60% of bone resorption occurs in the first year, the buccal wall of the socket might completely resorb (Atwood & Coy 1971), resulting in ridge migration to a more palatal position in relation to adjacent teeth and the opposite jaw. Periapical infections, as well as prolonged and challenging surgical treatments (repeated root-end surgeries), might also result in further resorption of the cortical plates. This can lead to a severe aesthetic compromise particularly when a fixed partial denture is present or in cases in which a fixed implant-supported rehabilitation is indicated.

The clinician may face problems depending on the severity of bone resorption after tooth extraction. Regarding aesthetics, there could be a problem in fabricating an implant-supported restoration or a conventional prosthesis; placing an implant could be a challenge if not impossible and if the area is restored with a pontic, an aesthetic problem may arise (Lekovic *et al.* 1998, Irinakis 2006). However, ridge augmentation procedures performed at the time of extraction using graft materials with or without barrier membranes minimize these problems (Winkler 2002, Zubillaga *et al.* 2003). This type of guided bone regeneration (GBR) procedure has been reviewed extensively in the literature (McAllister & Haghighat 2007).

The purpose of this report was to provide a treatment option that will enhance ridge preservation when tooth extraction is required during endodontic surgery.

Case report

A 47-year-old female was referred to an endodontic practice for apical root-end resection of tooth 22 (FDI) because of refractory periradicular disease detected on pre-prosthetic examination. The patient reported previous endodontic surgery on the tooth 4 years earlier. Radiographic examination revealed a large periradicular lesion, 5 mm in diameter and a root-end filling at the root apex (Fig. 1). Periodontal examination revealed a mid-buccal 5 mm pocket with bleeding on probing and class II mobility (Miller 1950). Based on the clinical and radiographic findings, differential diagnosis included a vertical root fracture. The recommended treatment plan consisted of exploratory surgery and subsequent treatment according to the findings and definitive diagnosis.

Under local anaesthesia, a full-thickness flap was raised using intrasulcular incisions with vertical releasing incisions extending beyond the mucogingival line. The papillae were dissected and raised. After removal of the granulation tissue, a vertical root fracture was diagnosed. A decision was made to extract the tooth. Extraction was performed traumatically to preserve adjacent bone and the socket carefully curetted to remove granulation tissue. The blood-filled socket was grafted with a xenograft cancellous bovine bone (Navigraft; Tutogen Medical GmbH, Freiburg, Germany) (Fig. 2) and carefully covered with an adapted resorbable collagen membrane (Ossix, Implant Innovations, Inc., Barcelona, Spain) (Fig. 3) after raising the palatal flap to provide better membrane adaptation. The flap was repositioned coronally using periosteal releasing incisions to achieve primary closure over the membrane and sutured with 5–0 nylon (KiS 1-6D; Obtura Spartan, Fenton, MO, USA). The provisional prosthesis was cemented and all pressure points were removed from the soft tissue.

Figure 1 Preoperative radiograph of the left lateral incisor.

Postoperative medication included nonsteroidal anti-inflammatory drugs (NSAID) and chlorhexidine rinses. Sutures were removed after 10 days. At 6 months follow-up examination, healing of the treated site was uneventful and favourable bone healing was observed (Fig. 4). Clinical examination revealed preserved soft tissue width and height in the aesthetic area (Fig. 5).

Discussion

Occasionally, during endodontic surgery, tooth extraction is necessary. When indicated, a ridge preservation procedure should be considered to prevent bone loss. The use of bone grafting materials in freshly extracted sockets is supported in the literature (Artzi *et al.* 2000, Iasella *et al.* 2003). Demineralized freeze-dried bone allograft (DFDBA) used in conjunction with a collagen membrane decreases the width of the alveolar ridge (9.2–8.0 mm) and the naturally healed socket sites (9.1–6.4 mm) (Iasella *et al.* 2003). Average bone height loss was 1 mm in the latter sites, but height was gained in the grafted sites. Socket fill of nearly 85% can be achieved even without a barrier membrane by placing porous bovine bone mineral into fresh extraction sites (Artzi *et al.* 2000). The types of bone substitutes and membranes available for bone grafting are shown in Tables 1 and 2.

The presented case showed that a ridge preservation procedure should be considered when extracting teeth during endodontic surgery to preserve the alveolar ridge for future implant placement.

Figure 2 Bone graft placed at extraction socket to augment alveolar bone deficiency.

Figure 3 Membrane placed over the graft material.

Figure 4 At 6 months follow-up, radiograph shows advanced bone healing.

Figure 5 Complete soft tissue healing of the surgical site with preserved tissue volume at 6 months follow-up.

Table 1 Bone graft materials used for ridge preservation

Graft category	Subtypes	Advantages	Disadvantages
Autogenous (same individual)	Extraoral-anterior iliac crest, calvarium, tibialntraoral-chin, ramus, tuberosity	Both osteoinductive and osteoconductive properties	Second surgical site-donor site morbidity
Allograft (two or more individuals allogeneic at one)	Frozen Freeze-dried Freeze-dried and demineralized	Available in unlimited quantities; no need for second surgical site; available as block or particulate	Potential of disease transmission
Xenografts (donor of one species grafted into a recipient of another species)	Bovine-derived, porcine-derived, etc.	Available in unlimited quantities; no need for second surgical site	No osteo-inductive properties
Alloplastic materials (resorbable/nonresorbable) (synthetic grafts)	Polymers Ceramics Calcium sulphate	Available in unlimited quantities; no need for second surgical site; osteoconductive	Residual graft particles

Table 2 Membrane material used for ridge preservation

Membrane category	Origin/type	Advantage	Disadvantage
Nonresorbable	Microtitanium mesh and foil e-PTFE	Long lasting structural integrity; good space maintaining	Requires second surgery for removal; technique sensitive-possible premature removal
Resorbable	Collagen derived (with or without cross-linking)	No need for removal; improved soft tissue healing; decreased patient morbidity; better cost-effectiveness	Various resorption times; lack of stiffness; need for membrane supporting material
	Synthetic aliphatic polyesters	No need for removal; improved soft tissue healing; decreased patient morbidity; better cost-effectiveness	Various resorption times; lack of stiffness; need for membrane supporting material
	Polyglactin 910	No need for removal; improved soft tissue healing; decreased patient morbidity; better cost-effectiveness	Various resorption times; lack of stiffness; need for membrane supporting material
	Polylactic and polyglycolic acid	No need for removal; improved soft tissue healing; decreased patient morbidity; better cost-effectiveness	Various resorption times; lack of stiffness; need for membrane supporting material

The anterior maxilla is the most traumatized region in the mouth (Andreasen & Andreasen 2000, Altay & Gungor 2001, Nik-Hussein 2001, Rocha & Cardoso 2001, Levin *et al.* 2003) and dental implants should be considered for post-traumatic anterior maxillary teeth with unfavourable prognosis. Tooth loss, as a result of dental or alveolar trauma, might be accompanied by continuous bone loss. Extensive maxillary alveolar bone loss can compromise future implant placement, resulting in impaired aesthetics.

Success of osseointegrated implants depends on sufficient volume of healthy bone at the recipient site at the time of implant placement. A site with a thin crestal ridge (*e.g.*, post-extraction ridge) could result in a significant buccal dehiscence. During extraction procedures, every effort should be made to prevent alveolar bone resorption and to preserve the ridge for future prosthetic rehabilitation.

Maintenance of an extraction socket does not exclude immediate implant placement, but knowledge and experience are necessary to determine the best treatment modality (Marcus *et al.* 1996). Post-extraction treatment options may include, but are not limited to, immediate implant placement, natural socket healing and delayed implant placement, natural healing and future osseous ridge augmentation (for implant or fixed partial denture), natural healing and future soft tissue ridge augmentation (for fixed partial denture), natural healing and removable partial denture (Irinakis 2006).

Regardless of the reasons for socket preservation, clinicians must be aware that sufficient alveolar bone volume and favourable architecture of the alveolar ridge are essential to achieve ideal functional and aesthetic prosthetic reconstruction following implant therapy (Schwartz-Arad & Levin 2004). According to the principles of guided bone regeneration, preserving or reconstructing the extraction socket enhances the ability to restore function and provide aesthetically pleasing restorations to patients without violating the predictability and function of the prostheses. In the present case, the objective of GBR was to preserve the apical portion of the buccal bone and to repair the coronal (already damaged) portion.

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