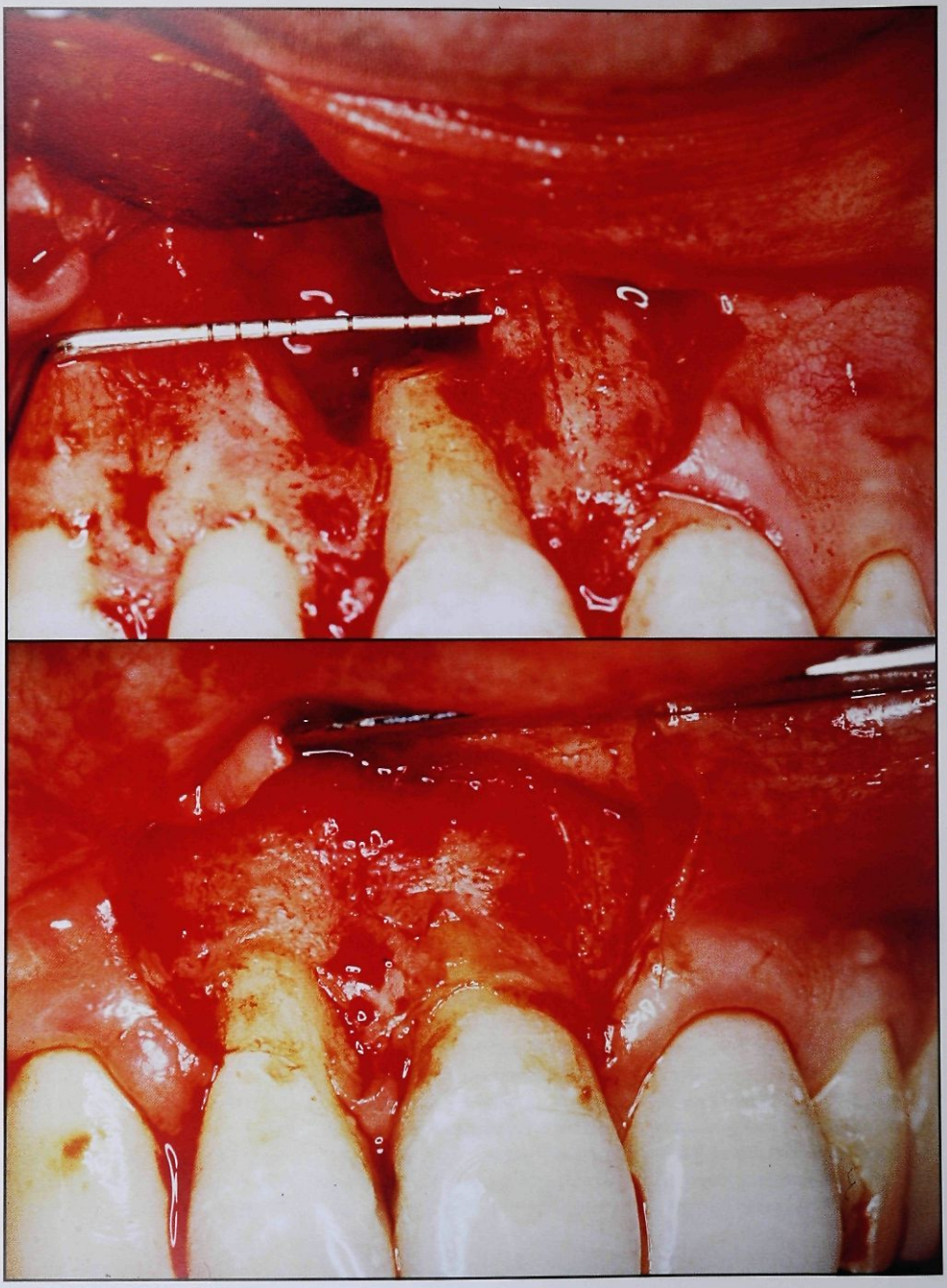

Treatment of a Large Periapical Lesion with Loss of Labial Cortical Plate Using GTR: A Case Report

*Federico Brugnami, DDS**
*James T. Mellonig, DDS, MS***

Following endodontic treatment, a large periapical lesion (9.0 mm × 9.0 mm) at a maxillary central incisor was treated with demineralized freeze-dried bone allograft (DFDBA) using the principles of guided tissue regeneration. The physical barrier was removed 6 months postsurgical. The cortical alveolar plate was observed to be completely reconstructed. Histologic evaluation demonstrated lamellar bone surrounding DFDBA particles. Radiographic follow-up 1 year posttreatment demonstrated complete resolution of the periapical radiolucency. (Int J Periodontics Restorative Dent 1999;19:243–249.)

*Clinical Instructor, Department of Periodontology, Tufts University School of Dental Medicine, Boston, Massachusetts; and Private Practice, Rome, Italy.
**Professor, Department of Periodontics, University of Texas Health Science Center at San Antonio, Texas.

Reprint requests: Dr James T. Mellonig, Department of Periodontics, University of Texas Health Science Center Dental School, 7703 Floyd Curl Drive, San Antonio, Texas 78248-7894.

Advanced periodontal breakdown may be associated with endodontic lesions. Endodontic therapy, both orthograde and retrograde, has been shown to be successful in many cases.[1] Guided tissue regeneration (GTR) has been used to successfully regenerate periodontal defects.[2] The principle of GTR is dependent on the use of cell-occlusive barriers to isolate periodontal defects from gingival epithelium and connective tissue.[3] This technique isolates the space around the osseous defect and allows cells from the periodontal ligament and bone to selectively repopulate the root surface and bone defect, resulting in new attachment.[2,3] The use of demineralized freeze-dried bone allograft (DFDBA) has been shown to be effective in enhancing GTR in treating periodontal defects,[4] maintaining and augmenting ridges,[5,6] repairing extraction socket defects,[7,8] and treating bone defects around dental implants.[9–12] Recently, several

Fig 1 *Large radiolucency is evident at the apex of the maxillary left central incisor.*

authors also described the use of GTR to enhance healing of advanced endodontic lesions.[10,11] A physical barrier with a bone graft may be indicated to prevent barrier collapse into large osseous lesions.[13] The creation and maintenance of adequate space under a cell-occlusive barrier is crucial for achieving adequate bone fill.[14] The purpose of this article was to present a case of a large periapical osseous defect filled with DFDBA and treated by the principles of GTR using a titanium-reinforced barrier.

Case report and surgical technique

A 30-year-old African American man with no medical contraindication to dental treatment presented for endodontic treatment. Upon radiographic evaluation, a large periapical radiolucency was observed at the maxillary left central incisor (Fig 1). Two interproximal composite restorations were noted. The left central incisor was nonresponsive to sensitivity testing and was acutely sensitive to percussion and apical palpation. All surrounding teeth reacted normally to similar testing.

Informed consent and anesthesia were obtained. A sulcular incision was made on the facial aspect with vertical releasing incisions at the mesial line angle of the maxillary right central incisor and distal line angles of the left first premolar. A full-thickness mucoperiosteal flap was reflected, exposing the endodontic lesion and the tooth that was a candidate for apicoectomy. Complete lack of a labial cortical plate and a facial dehiscence on the maxillary left central incisor were observed. The level of interproximal bone was normal. At the apical extent, the lesion measured 9.0 mm in width and 9.0 mm in depth, extending coronally toward the nasal fossa (Figs 2 to 4). The height of the defect measured 13.0 mm from the apex of the tooth to the roof of the lesion. The apicoectomy was performed under copious irrigation and an amalgam retrograde seal was placed. The defect was thoroughly debrided and residual granulation tissue was completely removed. Adequate bleeding points were established by intramarrow penetration prior to placement of the graft material. Commercially available DFDBA (LifeNet Transplant Service), 250 to 710 µm particle size, was rehydrated

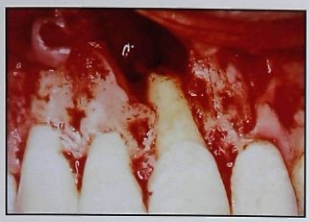

Fig 2 *Lack of labial cortical plate upon flap reflection.*

Fig 3 *Mesiodistal dimension of the lesion at the apical level.*

Fig 4 *Buccolingual dimension of the lesion at the apical level.*

Fig 5 *DFDBA is placed.*

Fig 6 *Barrier removal 6 months after regenerative procedure.*

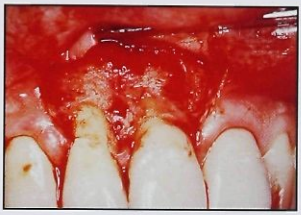

Fig 7 *Labial cortical plate is completely regenerated.*

with sterile saline 30 minutes prior to the procedure. The bone was placed into a tipless sterile syringe and packed in incremental steps into the defect.

Once in place, the graft was compressed with a saline gauze to avoid excessive dead spaces between the particles (Fig 5). A nonresorbable expanded polytetrafluoroethylene (e-PTFE), titanium-reinforced barrier (Gore-Tex Periodontal Material, 3i/WL Gore) of suitable size was selected and trimmed to the desired dimensions. It was shaped and secured on the buccal aspect of the maxillary left central incisor at the level of the cementoenamel junction, extending over the lesion at least 2 to 3 mm in all directions onto sound bone. Interproximally, care was taken to avoid contact with the adjacent teeth. An e-PTFE suture (Gore-Tex Suture Material, 3i/WL Gore) was used to approximate the flap margins. Complete wound closure was obtained. A mild analgesic was prescribed for postoperative pain. Antibiotic coverage, doxycycline 100 mg

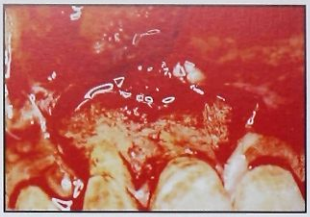

Fig 8 *Harvesting of sample for histologic evaluation.*

Fig 9 *Harvested bone sample for histologic evaluation.*

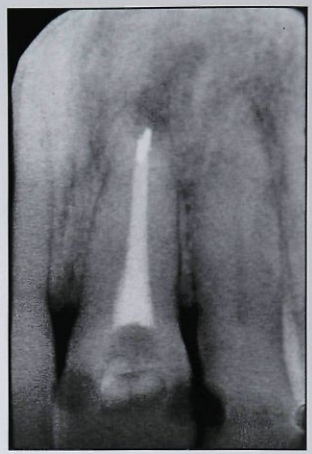

Fig 10 (right) *Radiographic follow-up at 1 year shows complete resolution of the lesion.*

daily, was used for 2 weeks postsurgical.

The patient was seen weekly during the first month and monthly thereafter until barrier removal. These follow-up visits included plaque debridement and light polishing in the treated area when necessary. Peridex (Proctor & Gamble) was used to enhance plaque control until the time of barrier removal. The e-PTFE sutures were removed 3 weeks postsurgical.

Six months postsurgical, the e-PTFE barrier was removed (Fig 6). After administering an appropriate local anesthetic a sulcular incision was made, mimicking the original incision. Vertical incisions were placed when necessary to completely dissect the e-PTFE barrier from the underlying bony tissue. During the clinical examination the area was evaluated as completely healed (Fig 7). With the aid of a rongeur, a biopsy was harvested from the graft site (Figs 8 and 9). The bone sample was fixed in formalin 10% and processed for histologic evaluation. The flap was reapproximated and sutured with Vicryl (Ethicon). The Vicryl sutures were removed after 1 week. Peridex was used to enhance plaque control. The healing was uneventful. Radiographic follow-up at 1 year showed complete regression of the periapical radiolucency (Fig 10).

Histologic evaluation

Core samples were decalcified by means of 3¾ hours of

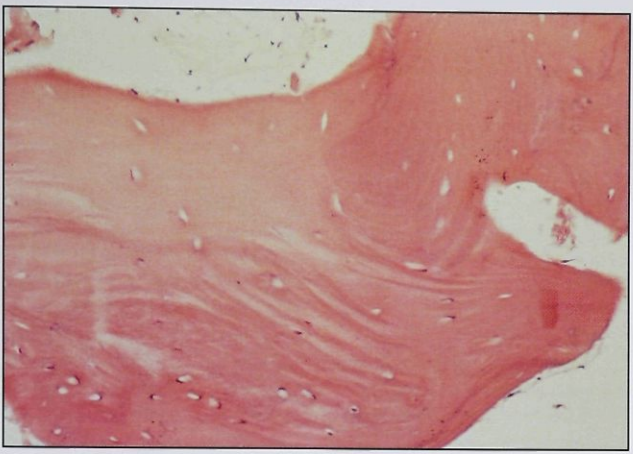

Fig 11 *Histology of graft site demonstrates lamellar bone surrounding nonvital graft particles. (Original magnification × 100; hematoxylin-eosin stain.)*

incubation in 100 mL of decalcifying fluid, which consisted of a standard solution of ethylenediaminetetraacetic acid (EDTA) disodium, potassium sodium tartrate, and diluted hydrochloric acid in distilled water, pH < 1 (RDO solution, DuPage Kinetic Laboratories). The sections were cut to a thickness of 6 µm and stained with hematoxylin-eosin. Sections were examined using light microscopy. The decalcified sections showed foci of DFDBA completely incorporated into woven and lamellar bone (Fig 11). The allograft exhibited a notable lack of fibrous encapsulation. The new bone marrow demonstrated a mild degree of fibrosis without inflammatory reaction.

Discussion

The result of this case report indicates that GTR in combination with a bone graft can be successfully used to reconstruct a large periapical lesion of endodontic origin. The use of a physical barrier prevents contact of the connective tissue with the osseous walls of the defect, protects the underlying blood clot, and stabilizes the wound.[15] The addition of a bone graft provides support for the physical barrier, which might otherwise collapse into the defect and prevent regeneration. Furthermore, the bone graft may assist wound healing through osseoinduction, osteoconduction, or both.[16,17]

Boyne et al[18] demonstrated healing with complete

regeneration of the labial cortex within 5 months after soft tissue debridement in 9 adult patients with 21 periapical bone defects measuring 5.0 to 8.0 mm. Defects measuring 9.0 to 12.0 mm in diameter exhibited limited labial cortex formation 8 months after surgery, except when implanted with a bone graft. Grafted sites demonstrated complete labial cortex formation.

The DFDBA was chosen as the graft material because of its long history of safety and effectiveness.[16,19] It is also available in suitable quantities to fill multiple or large osseous defects. Autogenous bone is generally preferred to allogeneic bone. In the case presented here, grafting of such a large defect would require an extensive amount of autogenous bone. Since only limited quantities of autogenous bone are available from intraoral sites, an extraoral site would be necessary. Autogenous bone could have been obtained from the chin, tibia, or iliac crest. The additional expense, time, morbidity, and evidence for a favorable comparison of DFDBA to autogenous bone contraindicated the use of a bone autograft in this case.[20]

The results of this article are supported by previous publications, which also demonstrated successful results in similar types of lesions. Abramowitz et al[21] presented 2 cases of large apical lesions with complete loss of the cortical plate on the involved teeth. The use of GTR in combination with DFDBA resulted in reestablishment of the cortical plate as determined at the time of barrier removal, 4 to 12 weeks after the procedure. Pinto et al[22] reported on a large, 19 mm × 24 mm, periapical osseous defect that was associated with an endodontically involved maxillary lateral incisor and perforated both labial and palatal cortical plates. Treatment by GTR with DFDBA resulted in complete reconstruction of the alveolar bone. A biopsy demonstrated healing with mature bone and hematopoietic marrow. Likewise, Kellert et al[23] presented several successful cases of teeth with periapical pathology treated by GTR and DFDBA. The successful combined endodontic and periodontal treatment of a large, endodontically induced periradicular defect and soft tissue fenestration was also described by Tseng et al.[24] Following retrograde amalgam placement, soft tissue debridement, and root planing, the osseous defect was filled with DFDBA and covered with a physical barrier. At 6 months posttreatment the barrier was removed. Bone regeneration and complete closure of the fenestration had occurred.

A common finding in the current report, as well as in those cited above, is the absence of labial cortical plate over the involved tooth and periradicular osseous defect with the presence of a nearly normal height of interproximal alveolar bone. Intact interproximal bone acts like a tent pole to support and stabilize the soft tissue flap; this limits gingival recession and eventual exposure of the physical barrier. Premature exposure of the physical barrier may be associated with a lesser degree of success than barriers that retain soft tissue closure.[25]

Conclusion

The use of a barrier membrane and DFDBA with the principles of GTR has been shown to be successful in many different treatment modalities. This case report demonstrated that the technique can also be effective in enhancing the treatment of extensive periapical lesions of endodontic origin. The success of this procedure has been proven by the clinical and radiologic 1-year posttreatment follow-up. The results have also been confirmed at the histologic level, where DFDBA particles in situ appear to be surrounded by newly regenerated woven and lamellar bone in the absence of inflammation and fibroencapsulation.

References

1. Gutman J, Harrison J. Surgical Endodontics. Cambridge: Blackwell Scientific, 1991:353–357.
2. Gottlow J, Nyman S, Karring T, Wennstrom J. New attachment following surgical treatment of human periodontal disease. J Clin Periodontol 1986;13:604–616.
3. Melcher AH. On the repair potential of periodontal tissues. J Periodontol 1976;47:256–260.
4. Bowers GM, Chadroff B, Carnevale R, Mellonig J, Corio R, Emerson J, et al. Histologic evaluation of new attachment apparatus formation in humans. Part II. J Periodontol 1989; 60:675–682.
5. Nevins M, Mellonig JT. Enhancement of the damaged edentulous ridge to receive dental implants: A combination of allograft and the Gore-Tex membrane. Int J Periodontics Restorative Dent 1992;12:96–111.
6. Brugnami F, Then PR, Moroi H, Kabani S, Leone CW. GBR in human extraction sockets and ridge defects prior to implant placement: Clinical results and histologic evidence of osteoblastic and osteoclastic activities in DFDBA. Int J Periodontics Restorative Dent 1999;19:259–267.
7. Caudill RF, Meffert RM. Histologic analysis of the osseointegration of endosseous implants in simulated extraction sockets with and without e-PTFE barriers. Part 1. Preliminary findings. Int J Periodontics Restorative Dent 1991;11:207–215.
8. Brugnami F, Then PR, Moroi H, Leone CW. Histologic evaluation of human extraction sockets treated with demineralized freeze-dried bone allograft (DFDBA) and cell occlusive membrane. J Periodontol 1996;67: 821–825.
9. Landsberg CJ, Grosskopf A, Weinreb M. Clinical biologic observations of demineralized freeze-dried bone allografts in augmentation procedures around dental implants. Int J Oral Maxillofac Implants 1994;9: 586–592.
10. Gelb DA. Immediate implant surgery: Three-year retrospective evaluation of 50 consecutive cases. Int J Oral Maxillofac Implants 1993; 8:388–399.
11. Mellonig JT, Triplett RG. Guided tissue regeneration and endosseous dental implants. Int J Periodontics Restorative Dent 1993;13:108–119.
12. Shanaman RH. The use of guided tissue regeneration to facilitate ideal prosthetic placement of implants. Int J Periodontics Restorative Dent 1992;12:463–473.
13. Machtei E, Schallhorn R. Successful regeneration of mandibular Class II furcation defects. Int J Periodontics Restorative Dent 1995;15:146–167.
14. Dahlin C, Andersson L, Lindhe A. Bone augmentation at fenestrated implants by an osteopromotive membrane technique. A controlled clinical study. Clin Oral Implants Res 1991;2:159–165.
15. Haney JM, Nilveus RE, McMillan PJ, Wikesjo UME. Periodontal repair in dogs: Expanded polytetrafluoroethylene barrier membranes support wound stabilization and enhance bone regeneration. J Periodontol 1993;64:883–890.
16. Mellonig JT. Autogenous and allogeneic bone grafts in periodontal therapy. Crit Rev Oral Biol 1992;3: 333–352.
17. Harakas NK. Demineralized bone matrix-induced osteogenesis. Clin Orthop 1984;188:239–251.
18. Boyne PJ, Lyon HW, Miller CW. The effects of osseous implant materials on regeneration of alveolar cortex. Oral Surg 1961;14:369–378.
19. Mellonig JT. Donor selection, testing and inactivation of the HIV virus in freeze-dried bone allografts. Pract Periodontics Aesthet Dent 1995;7: 13–23.
20. Heiple KG, Chase SW, Herndon CH. A comparative study of the healing process following different types of bone transplantation. J Bone Joint Surg Am 1963;45:1,593–1,599.
21. Abramowitz PN, Rankow H, Trope M. Multidisciplinary approach to apical surgery in conjunction with the loss of buccal cortical plate. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1994;77:502–506.
22. Pinto VS, Zuolo ML, Mellonig JT. Guided bone regeneration in the treatment of a large periapical lesion: A case report. Pract Periodontics Aesthet Dent 1995;7: 76–81.
23. Kellert M, Chalfin H, Solomon C. Guided tissue regeneration: An adjunct to endodontic surgery. J Am Dent Assoc 1994;125:1,229–1,233.
24. Tseng CC, Chen YH, Huang CC, Bowers GM. Correction of a large periradicular lesion and mucosal defect using combined endodontic and periodontal therapy: A case report. Int J Periodontics Restorative Dent 1995;15:377–383.
25. Mellonig JT, Nevins M. Guided bone regeneration of bone defects associated with implants: An evidence-based outcome assessment. Int J Periodontics Restorative Dent 1995; 15:169–185.