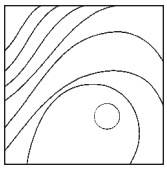
Interdisciplinary Approach for Treating a Large Through-and-Through Periapical Defect Using Guided Tissue Regeneration: A Case Report



Guo-Hao Lin, DDS[1]
Lien-Yu Chang, DDS, PhD[2]
Wen-Chun Lin, DDS[1]
Shyh-Yuan Lee, DDS, DScD[3]
Yu-Lin Lai, DDS, MS[4]

A number of diagnostic and management challenges exist for achieving complete regeneration of large through-and-through periapical lesions. An unfavorable endodontic outcome may occur as a result of uncontrolled infection or unpredictable bone healing. This article presents a case with a 15 × 15-mm through-and-through periapical lesion and persistent gingival swelling. Endodontic microsurgery and guided tissue regeneration were performed using a resorbable membrane and osseous substitute. A 2-year postoperative radiograph revealed complete resolution of the periapical radiolucency. Seven-year clinical and radiographic follow-up showed that the tooth was asymptomatic and a long-term successful outcome had been maintained.
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[1]Private Practice, Hsinchu, Taiwan.
[2]Assistant Professor, School of Dentistry, National Yang-Ming University; Senior Instructor, Department of Stomatology, Taipei Veterans General Hospital, Taipei, Taiwan.
[3]Professor and Dean, School of Dentistry, National Yang-Ming University, Taipei, Taiwan.
[4]Chairman, Division of Periodontology, Department of Stomatology, Taipei Veterans General Hospital; Professor, School of Dentistry, National Yang-Ming University, Taipei, Taiwan.

Correspondence to: Dr Yu-Lin Lai, Department of Stomatology, Taipei Veterans General Hospital, 201 Shih-Pai Road, Sec 2, Shih-Pai, Taipei 11217, Taiwan; fax: 886-2-28742375; email: yllai@vghtpe.gov.tw.

Most large periradicular defects occur in patients with sustained periapical inflammation[1] combined with periodontal-endodontic lesions,[2,3] a trauma history,[4,5] developmental anomalies such as dens invaginatus,[6-8] or cystic lesions.[4,9]

To manage large periapical lesions, conventional nonsurgical endodontic treatments or further surgical interventions are generally considered. However, the prognosis for treating large periapical lesions might not be as good as that of small lesions. With large endodontic lesions, there is often the chance for an enhanced inflammatory reaction and prolonged infection. Unreliable tissue repair following conventional root canal therapy may occur.[4,10] With nonsurgical endodontic treatment, Weiger et al[11] and Matsumoto et al[12] demonstrated an elevated risk of failure when apical lesions were > 5 mm. Caliskan[4] also reported that teeth with larger periapical lesions showed a lower rate of complete healing and a higher incidence of failure. In cases treated with conventional periapical surgery, Hirsch et al[13] showed that teeth with apical destruction of > 5 mm had a

Fig 1 *Initial radiograph showing a large periapical radiolucency of the maxillary left lateral incisor that had been restored with an ill-fitting crown.*

healing frequency of 39%, while teeth with destruction of ≤ 5 mm exhibited a healing frequency of 55%. Furthermore, if the apical lesion had neither buccal nor lingual walls, complete healing was significantly reduced to 25%. They concluded that more extensive periapical destruction had a tendency toward less predictable healing.

The use of a membrane technique in guided tissue regeneration (GTR) is widely applied in periodontology and implant dentistry. The GTR principle involves the use of a physiologic barrier over the bone defect to preclude the oral epithelium or gingival connective tissue from growing into the bone space so that cells with osteogenic potential can repopulate the defective area.[14,15] Based on favorable outcomes with periodontal applications, the GTR principle is currently applied as an adjunct to enhance bone healing for various advanced endodontic lesions, such as furcation perforations,[16,17] soft tissue fenestration defects,[18] and combined periodontal-endodontic lesions such as communication of a dehiscent bony defect with periapical lesions,[2,19] large periapical bony defects,[20,21] and through-and-through periapical lesions.[22]

Reports in the literature on the clinical efficacy of GTR used for through-and-through periapical lesions are limited. Taschieri et al[22] claimed an 88% success rate using periapical surgery with a barrier membrane and osseous graft to treat cases of through-and-through lesions in a 1-year prospective clinical study. However, there are limited reports in the literature on long-term evaluations of the GTR technique for such lesions. The purpose of this article was to present a case of a large through-and-through periapical lesion treated with GTR that showed promising long-term results.

Case report

A 24-year-old woman with a noncontributory medical history presented to the Division of Endodontics, Taipei Veterans General Hospital, Taiwan, with a complaint of long-term gingival swelling of the maxillary left lateral incisor. Her dental history revealed that her lateral incisor had a crown fracture from accidentally chewing on hard food, and she had undergone root canal therapy followed by porcelain-fused-to-metal (PFM) crown fabrication at a local dental clinic 5 years previously. However, gingival swelling had occurred off and on after the crown restoration.

A clinical examination showed that the lateral incisor had secondary caries at the crown margin. A sinus tract with pus discharge at the labial surface and gingival swelling at the palatal surface of the tooth were noted. This tooth had mobility and was sensitive to percussion and apical palpation, while its probing depths were all within 3 mm. Radiographs showed that the PFM crown margin of the tooth was ill-fitting, and a large 15 × 15-mm periapical radiolucent area was evident. Apical root resorption of the maxillary left central incisor and lateral root resorption at the mesial surface of the left canine were observed (Fig 1). However, both of these teeth were responsive to the electronic pulp tester.

Fig 2 *Six months after nonsurgical endodontic retreatment. Note the persistent sinus tract at the labial surface* (left) *and gingival swelling* (right) *at the palatal surface of the maxillary left lateral incisor.*

Fig 3 *Six months after nonsurgical endodontic retreatment, no improvement of the apical radiolucency was found.*

Following removal of the post and crown, the maxillary left lateral incisor was retreated under a microscope by an endodontist. However, the clinical symptoms persisted, and the periapical radiolucency remained unaltered after 6 months of calcium hydroxide root canal dressing (Figs 2 and 3). The patient was therefore referred to the Divisions of Periodontology and Prosthodontics to assess the possibility of combined periodontal-endodontic surgery and evaluation of the long-term prognosis of this tooth. Through interdisciplinary consultations, combined endodontic microsurgery and periodontal regenerative procedures followed by a crown restoration for the tooth were planned.

Surgery was performed 7 months after root canal retreatment. Following appropriate local anesthesia in the maxillary anterior area, a sulcular incision was made from the maxillary right central incisor to the left first premolar. In addition, mesial and distal vertical incisions were extended in the buccal and palatal sites for the purpose of flap relief. The mucoperiosteal flap was sufficiently elevated apically to visualize the periapical region. Immediately after flap elevation, pus and exudates were discharged. A dehiscence bony defect at the labial surface and a granuloma-like lesion surrounding the apical third of the left maxillary lateral incisor were noted. Following careful removal of the granuloma-like tissue, a large through-and-through bony defect, approximately 15 × 15 mm in the

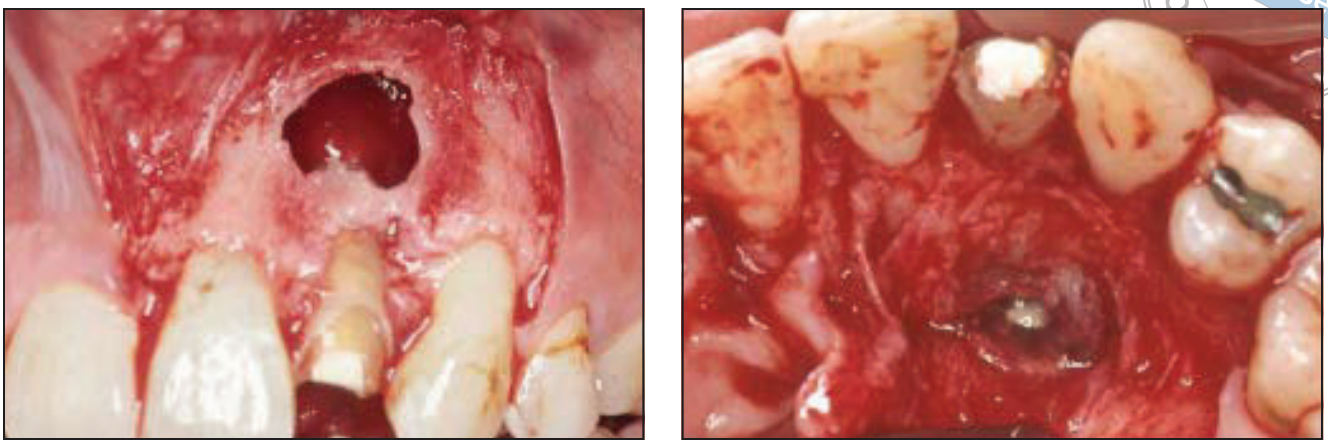


Fig 4 *The periapical lesion. Note a through-and-through periapical defect of the maxillary left lateral incisor* (left). *Pus discharge from the palatal bony defect was noted* (right).

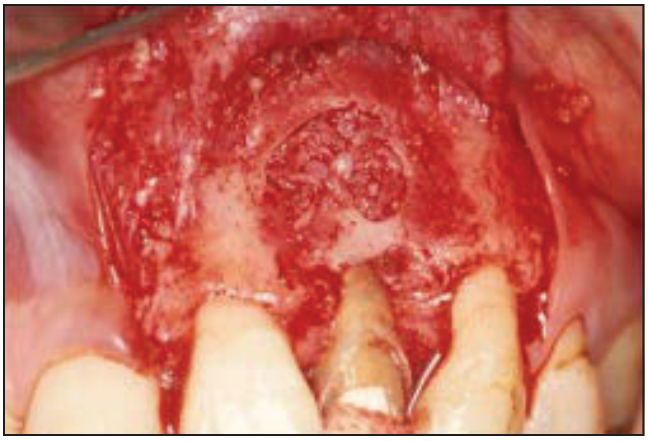


Fig 5 *An osseous graft was placed in the defect.*

apical area of the left maxillary lateral incisor, was observed (Fig 4). The root surface was scaled and planed with hand instruments. The root surface was examined under a microscope (OPMI pico, Carl Zeiss) by an endodontist, and the possibility of a vertical root fracture was excluded. Subsequently, the root apex was resected using a fissure bur. Root-end cavity preparation was done with an ultrasonic instrument (KiS-1, Obtura Spartan), and SuperEBA (Harry J. Bosworth) was put in place as retrograde filling material under microscopy. After thorough debridement, the bony defect was augmented with a mixture of osseous substitutes containing demineralized freeze-dried bone allograft (demineralized cortical powder, 500 to 1,000 µm, Pacific Coast Tissue Bank) and bioactive glass (Biogran, Biomet 3i) (Fig 5). The buccal and palatal defect openings were covered with resorbable polylactic acid membranes (EpiGuide, Kensey Nash) (Fig 6), and the flap was then repositioned and sutured. Antibiotics (500 mg amoxicillin 3 times daily), analgesics (25 mg diclofenac every 4 to 6 hours as needed for pain), and an oral rinse with 0.2% chlorhexidine gluconate were prescribed for 7 days postoperatively.

All sutures were removed 2 weeks after surgery, and healing was uneventful. The patient was

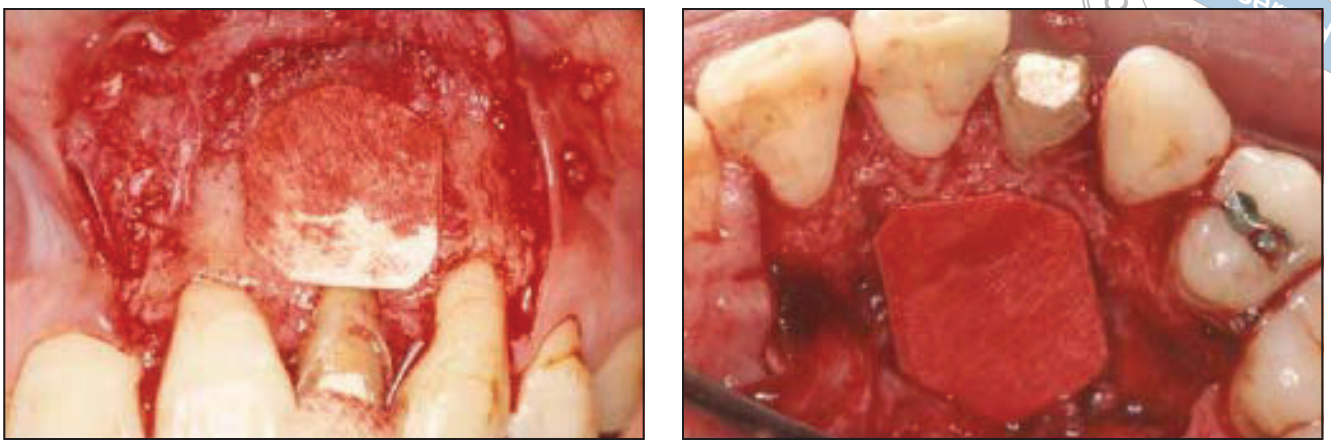
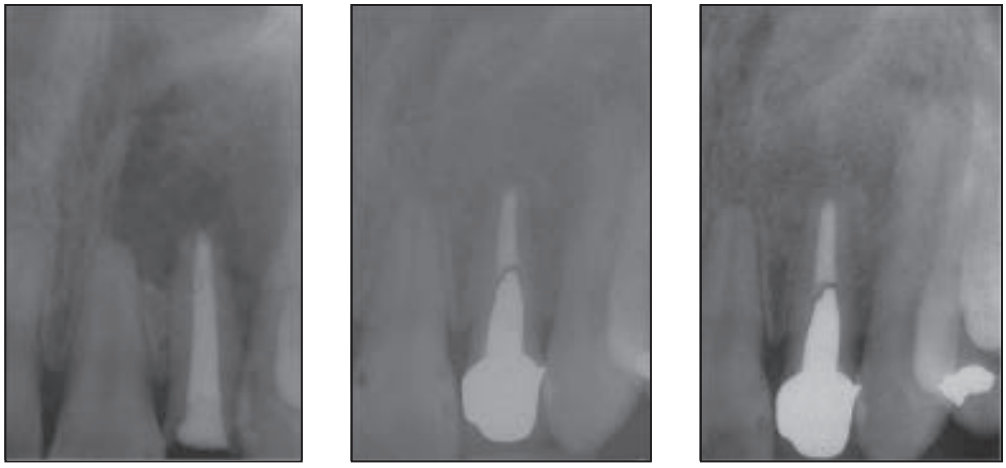


Fig 6 *Bioabsorbable membranes were placed on both the buccal* (left) *and palatal* (right) *sides.*

Fig 7 (left) *Radiograph at 2 weeks postsurgery. The increase in radiopacity in the apical area resulted from placement of the radiopaque graft material.*

Fig 8 (middle) *Radiograph at 2 years showing the restored tooth with a post and core, crown, and complete resolution of the periapical radiolucency.*

Fig 9 (right) *Radiograph at 4 years showing no deterioration.*

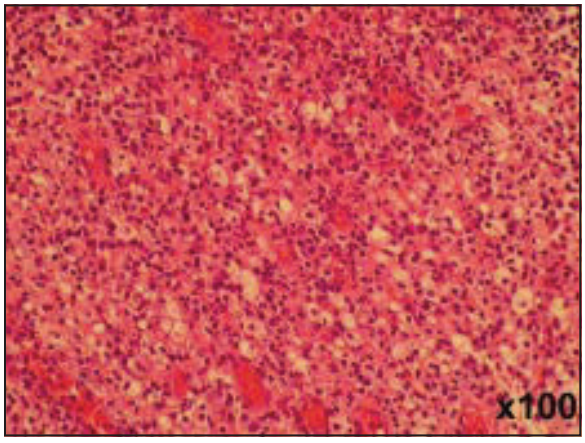


recalled periodically, and long-term radiographic follow-up showed gradual improvement of the periapical radiolucency (Figs 7 to 10). Eighteen months later, the tooth was restored with a casting post and core and PFM crown. The occlusal contacts of the crown were carefully adjusted in centric occlusion and eccentric movements to minimize occlusal overload. Complete regression of the apical lesion was evident 2 years postoperatively (Fig 8). Seven-year postoperative and 5-year postrestorative follow-up revealed no recurrent sinus tract or sensitivity to percussion or palpation of the maxillary left lateral incisor. All adjacent teeth remained vital and exhibited no further external root resorption. The gingival tissue of the teeth was healthy, and there was no radiographic pathology (Fig 10).

Pathologic evaluation

The pathology report revealed a periapical granuloma. The specimen consisted of fibrovascular connective tissues infiltrated with chronic and acute inflammatory cells and scattered foamy histiocytes. A cystic space with an epithelial lining was not found in the pathology sections (Fig 11).

Fig 10 *Seven-year follow-up. Note the healthy gingiva* (left). *The radiograph shows no periapical pathology* (right).



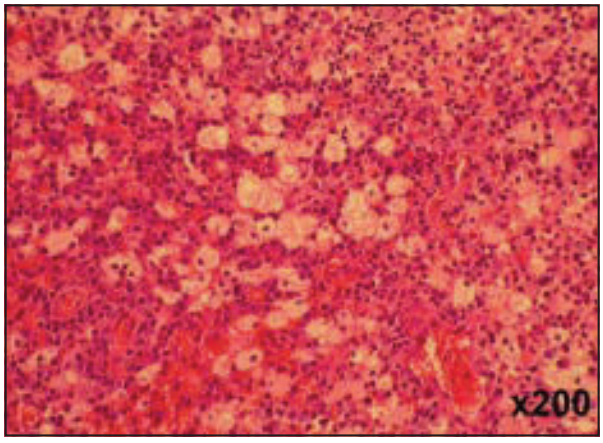


Fig 11 *Histology of periapical tissues showing fibrovascular connective tissue infiltrated with chronic, acute inflammatory cellular aggregate and scattered foamy histiocytes. A cystic space with epithelial cell lining was not found (hematoxylin-eosin; original magnification ×100 and ×200).*

Discussion

It is generally thought that endodontic lesions, even with large periapical radiolucencies, can heal or regress after complete removal of the intracanal irritants by conventional endodontic treatment alone.[4,10] However, additional surgery may be required if nonsurgical root canal therapy is unsuccessful in resolving the periradicular pathosis. In this case, the large apical lesion remained unimproved, and the sinus tract persisted after long-term calcium hydroxide root canal dressing. The patient was therefore scheduled for further periapical surgery that provides better access to clean the inflamed apical root canal and remove the periapical pathosis.

In this case, the bony defect was augmented with osseous substitutes, and the defect openings were covered with resorbable membranes. Although traditional endodontic surgery for large periapical lesions can be effective,[14] scar tissue formation during tissue repair is sometimes observed with through-and-through periapical lesions.[23,24] To achieve better tissue regeneration, GTR principles using a barrier membrane and/or an osseous graft were recently suggested as an adjunct to endodontic surgery for endodontic-related defects. Particularly, with through-and-through periapical defects, some animal and clinical studies demonstrated the effectiveness of

GTR techniques. In surgically created through-and-through bone defects in conjunction with an apicectomy of the lateral maxillary incisors in monkeys, all expanded polytetrafluoroethylene (e-PTFE) membrane-covered defects had healed with bone closure and only a minute portion exhibited connective tissue after a 3-month healing period. In contrast, defects that were not covered with membranes were filled with fibrous connective tissue.[25] In a clinical study conducted by Pecora et al,[21] the results revealed that the use of GTR principles enhanced the quality and quantity of bone regeneration in large periapical defects, especially in through-and-through lesions. Taschieri et al[22] also found that 1 year postoperatively, through-and-through periapical defects treated by GTR techniques had a greater chance of complete radiographic healing than lesions in which grafts or membranes were not placed. In the present case, regression of the apical lesion was obvious at the 9-month follow-up, and the lesion had almost completely healed by the 18-month follow-up. Thereafter, the final prosthetic plan for the tooth was determined, and a favorable outcome and long-term success were achieved.

A wide variety of membrane materials are applied in clinics. The most commonly used nonabsorbable membrane is the e-PTFE membrane, and widely used resorbable membranes include collagen, polylactic acid, polyglactin, and copolymers of glycolide and lactide.[26] Nonabsorbable membranes are more rigid and capable of maintaining space for bone healing. However nonabsorbable membranes must be removed in a second operation. Although the space-making effect of resorbable membranes is not as good as of that of nonabsorbable membranes, it is effective at promoting regeneration in apical defects.[27,28] In the present case, a 15 × 15-mm through-and-through defect existed. A resorbable membrane may not be rigid enough for space maintenance; therefore, an osseous substitute was combined as a scaffold for the GTR procedure. However, the benefits from the adjunctive use of an osseous graft in periapical surgery are controversial. Tobon et al[29] demonstrated that the combined use of bone grafting material in GTR procedures enhanced periapical tissue regeneration, whereas Britain et al[27] and von Arx et al[30] showed no additional effects. Further controlled clinical and histologic studies with large sample sizes are needed to confirm the biologic nature of new tissue formed after combining bone grafting materials and barrier membranes for through-and-through periapical lesions.

Early extraction of the infected tooth with a large bony lesion was not considered in this case because removing a tooth with an extensive periapical defect may be accompanied by severe alveolar bone loss in the anterior maxilla, which would compromise the esthetic outcome of future restorations. Through comprehensive multidisciplinary cooperation, the large periapical defect in the presented case had completely healed 2 years postoperatively. Five-year postrestorative follow-up revealed that the esthetics and function of the tooth remain promising. The long-term success of this case infers that large through-and-through apical defects can be regenerated through combined endodontic and periodontal treatment. Complete bone healing provides periodontal health and soft tissue esthetics of the restored tooth, while also creating bone mass that facilitates implant placement if the tooth cannot be restored.

Conclusions

This patient presented an affected tooth with a large apical lesion unresponsive to conventional endodontic therapy. The large through-and-through bony defect and persistent apical infection were successfully treated using combined endodontic microsurgery and periodontal regenerative procedures. The results of this case suggest that teeth with a questionable prognosis can be preserved through multidisciplinary cooperation in an effort to control etiologic factors and regenerate lost periapical tissue.

Acknowledgment

The authors reported no conflicts of interest related to this study.

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