Case Report

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Combined therapy with mineral trioxide aggregate, and guided tissue regeneration for a large radicular cyst: a 13-year follow-up

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Abstract

Biomaterials such as membrane barriers and/or bone grafts are often used to enhance periapical new bone formation. A combination of apical surgery and these biomaterials is one of the latest treatment options for avoiding tooth extraction. In case of periapical lesions, guided tissue regeneration (GTR) is attempted to improve the self-regenerative healing process by excluding undesired proliferation of the gingival connective tissue or migration of the oral epithelial cells into osseous defects. In many cases, GTR is necessary for achieving periodontal tissue healing. This report describes the healing process after surgery in a challenging case with a long-term follow-up. In this case report, endodontic surgery was followed by retrograde sealing with mineral trioxide aggregate (MTA) in the maxillary right central incisor and left lateral incisor. Apicectomy was performed in the maxillary left central incisor and a 1-mm filling was removed. The bone defect was filled with an anorganic bone graft and covered with a decalcified cortical osseous membrane. No intraoperative or postoperative complications were observed. After 13 years of follow-up, the patient showed no clinical signs or symptoms associated with the lesion and radiographic examination showed progressive resolution of radiolucency. In conclusion, the combination of apical surgery and regenerative techniques can successfully help the treatment of periapical lesions of endodontic origin and is suitable for the management of challenging cases.

Keywords: guided tissue regeneration, apical surgery, MTA.

Introduction

Radicular cysts are common inflammatory cystic lesions that develop in the apical tissues as consequence of an infected and necrotic pulp[1]. Although in most cases small cystic lesions heal after endodontic therapy, in case of larger lesions, additional treatment may be needed[2]. Apical surgery for radicular cysts generally involves apical root resection and sealing with endodontic material[3].

Currently, the preferred root-end filling material is mineral trioxide aggregate (MTA) because it has some biological properties, such as induction of calcification that enables biological sealing[4-6]. The physiochemical and biological properties of MTA have been reported in numerous papers[4-7]. However, the ideal scenario would be to improve the benefits offered by the MTA with the aid of other techniques that promote tissue regeneration.

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Retrospective studies have shown that the success rate of apical surgery is not as high as expected[8-9]. Apical surgery was considered unsuccessful in about 1 out of every 4 cases in 1960-1979[10]. From the 1980s, the success rates increased to 50%, and the sizes of the lesions reduced in more than 25% of the cases[11]. However, the success rate of surgery remains low in cases of endoperiodontal lesions[8]. The high failure rate of apical surgery is directly related to the variety of factors that can influence the healing process in the periapical region[7,9]. Adequate results were obtained in studies related to the healing process and the regeneration of tissues, especially in the ones pertaining to the support and protection of the periapex[12-13]. These results were obtained by developing regenerative and reparative techniques that helped to reestablish the periodontal structures and to preserve the biological width of the involved tissues[14].

Use of guided tissue regeneration (GTR) in apical surgery can increase the success rate of this procedure[15]. The technique helps creating ideal conditions for the restoration of original structures and normal functioning of the tissues that were lost because of infectious and inflammatory processes[16]. The basic principle of GTR is cellular selectivity. The technique aims at enhancing the quality and quantity of new bone and accelerating bone growth around the bone cavity[17]. The barrier is put on the bone defect and may frequently be associated with osseous grafting materials. This avoids the penetration of cells from both the epithelial tissue and gingival connective tissue. The use of the barrier membrane affords the time needed for the differentiation, proliferation and migration of the cells from the ligament, and from periodontal and alveolar bones to the bone cavity, favoring the healing process. Furthermore, the space created by the membrane enables undifferentiated mesenchymal cells to migrate to this area and differentiate, thus promoting osteogenesis without the interference of other types of competitor cells[12-13].

The aim of the present case report was to describe a clinical situation in which combined therapy with MTA and GTR was performed to treat a large radicular cyst.

Case Report

A 45-year-old woman who had previously undergone endodontic treatment for apical lesions associated with the maxillary left central incisor sought treatment at the Apical Surgery Center at the Araçatuba School of Dentistry at the UNESP. The patient presented poorly adapted prostheses in the maxillary right central incisor and left lateral incisor, as well as a large resin restoration in the maxillary left central incisor (Figure 1A). Radiographic examination revealed extensive apical lesions associated with the maxillary right and left central incisors and the left lateral incisor, in which root canal treatment had failed (Figure 1B).

The first suggested treatment option was the removal of

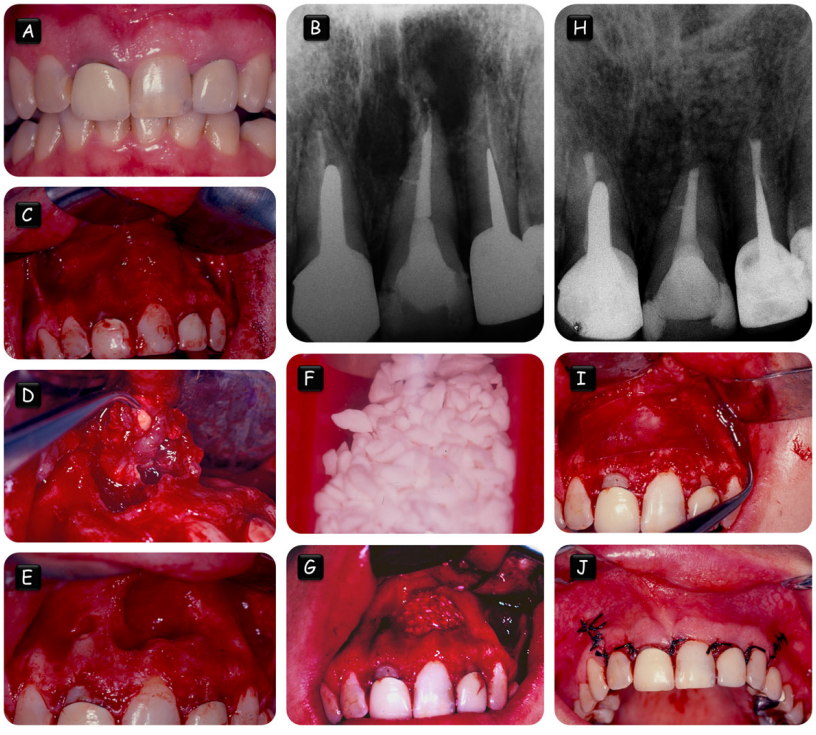

Fig. 1. (*A*) Clinical aspects of poorly adapted prostheses in the maxillary right central incisor and left lateral incisor; large resin restoration in maxillary left central incisor. (*B*) Preoperative radiographs of the central maxillary right, left central and left lateral incisors. Radiography revealed extensive periapical lesions for which root canal treatments had failed. (*C*) Exposed surgical area with root-end surgery in the maxillary right central, left central and left lateral incisors. (*D*) Excision for periapical lesions. (*E*) In the maxillary right central and left lateral incisors, retrograde endodontic treatment was performed and teeth were sealed with mineral trioxide aggregate (MTA). In the maxillary left central incisor, apicectomy and removal of the filling (1 mm) was performed. (*F*) Anorganic bovine-bone particles (Gen-Ox; Genius). (*G*) The bone cavity was filled with anorganic bone graft particles and had a blood clot. (*H*) Radiographic aspect after apicetomy, root-end filling and bone filling with anorganic bovine bone. (*I*) The bone cavity and the bone graft were covered by a decalcified cortical osseous membrane (Gen-Derm; Genius). (*J*) The flap was repositioned and secured by interrupted 4.0 sutures.

the crowns/posts and retreatment of the maxillary right central incisor and left lateral incisor. However, the patient refused the proposed treatment due to the risks involved and opted for apical surgery. Complementary laboratory exams showed that the patient had no systemic alteration. Prophylactic antibiotics were prescribed 1 h prior to the surgery.

The surgical area was disinfected with iodine solution and 0.12% chlorhexidine gluconate. Prilocaine hydrochloride (3%) with octapressin (Dentsply, Petrópolis, RJ, Brazil) was used for local anesthesia. The flap design consisted of 2 releasing incisions connected by a sulcular incision (Figure 1C). The apical lesion was removed with size 85 Lucas surgical curettes (Hu-Friedy, Chicago, IL, USA) and size 35 and 36 curettes (Dentsply Maillefer, Tulsa, OK, USA) (Figure 1D). Apical roots were sectioned (3-mm sections) perpendicular to the long axis of the root with a Zekrya bur (Dentsply Maillefer) with a high-speed handpiece (Figure 1E). Different treatment approaches were performed for each tooth.

For the maxillary central right incisor, retrograde endodontic treatment was performed using pre-bent files with a 4 mm length and filled with Pro-Root MTA® (Dentsply Maillefer). Apicectomy and removal of the apical filling (1 mm) was performed in the maxillary central left incisor because it was properly treated. For the maxillary lateral left incisor, retrograde endodontic treatment was performed using 6 mm pre-bent files and Pro-Root MTA® as the root-end filing material. Pro-Root MTA® was prepared according to the manufacturer's instructions and inserted using the MAP System device (Produits Dentaires, Vevey, Switzerland).

After the surgical procedures, radiographs were taken to verify the quality of the root-end treatments. The bone defect was filled with an anorganic bone graft (Gen-Ox; Genius, São José dos Campos, SP, Brazil) (Figure 1F-H) and covered with a decalcified cortical osseous membrane (Gen-Derm; Genius, São José dos Campos, SP, Brazil) (Figure 1I). Finally, the flap was sutured with a simple interrupted suture using 4.0 silk (Ethicon, São José dos Campos, SP, Brazil) (Figure 1J). After the surgery, the patient received antibiotics and medication to control pain.

A full histological study of the cystic capsule was performed to confirm the previous diagnostic hypothesis (Figure 2*A*). After 7 days, the sutures were removed and the patient was examined. The patient experienced no pain and showed no swelling. No intraoperative or postoperative complications were observed. At the 32-month follow-up, the tooth had no clinical signs or symptoms and radiographic examination showed progressive resolution of radiolucency (Figure 2*B, C*).

A follow-up evaluation performed after 13 years confirmed clinical silence and normal apical radiographic aspects (Figure 2D-F). It was also verified that the patient had not changed the prosthetic crowns, preserving the posts, following the recommendations after surgery.

Discussion

Radicular cysts are also known as periapical cysts, dental cysts or apical periodontal cysts. A radicular cyst is generally asymptomatic, grows slowly and rarely grows large enough to erode extensively the adjacent bone structures. Enucleating

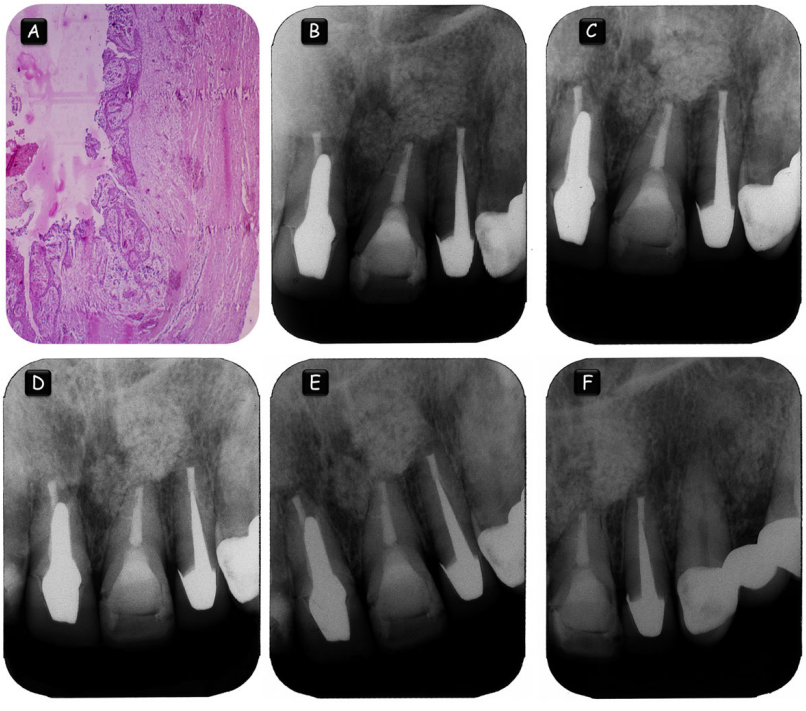

Fig. 2. (*A*) Histological specimens revealed a periapical cyst lined by non-keratinized stratified squamous epithelium. Note the moderate inflammatory response (H.E. staining, 40× magnification). (*B, C*) A follow-up radiograph obtained 32 months after surgical root canal therapy shows healing of periapical lesions. (*D-F*) Radiograph obtained at the 13-year follow-up visit.

the cyst is one of the recommended treatments[1], but surgical procedures alone are not sufficient for a successful treatment of radicular cysts. One of the main goals of conventional endodontic treatment is to prevent the invasion of bacteria and their byproducts from the root canal system into the periradicular tissues of teeth in cases of apical periodontitis[18].

The use of GTR techniques has been proposed as an adjunct to endodontic surgery to favor bone healing[19]. GTR has been accepted as a viable treatment for gingival recession[20], intrabone defects[21-22], vertical ridge augmentation[23], furcation defects[24], circumferential periodontal and dental implant-associated defects[25-26], and in apical microsurgery[12,18].

Membrane barriers and/or bone graft materials have also been used in periapical surgery to enhance new bone formation[3]. However, there are significant differences in the application of GTR between periodontal regenerative therapy and apical surgery. Regeneration represents replacement of damaged tissue by the cells of the same tissue. Repair occurs when the healing process results in the formation of new tissue with cells and structures that have the ability to behave differently from the original ones[18]. In apical surgery, the resected root end cannot be regenerated. Complete periapical wound healing after periapical surgery includes regeneration of the alveolar bone, periodontal ligament and cementum[27]. The application of a membrane barrier and/or bone graft during periapical surgery may not result in a complete regeneration of the apical tissues[3]. The adequate apical healing would be deposition of the cementum on the resected surface and root-end filling material[4-6] and re-establishment of the biological width and periodontal ligament[12-13].

In this case report, a large bone defect involving 3 teeth was detected and the use of GTR was justified. In a previous study it was observed that the use of biomaterials such as GenOx® combined with the GenDerm® membrane provided better results than blood clot for treating critical-size defects[28]. The distance between the margins of the bone cavity determined the type of cells that would first migrate to the defect site and consequently the tissue that would be formed[8]. Fibrous scar formation may occur in cases in which GTR is not used. The membranes used in apical surgeries, which may or may not be in contact with bone graft materials, have the special function of guiding the formation of the new bone in the apical defect and may enhance the healing process. The bone graft material used in this case was an anorganic bovine bone that participated in the development of the new bone tissue and can act as an osteoconductive material.

In the present case, a retrograde, not direct, endodontic retreatment was performed for the maxillary central right incisor and left lateral incisor because of the presence of the prostheses. On the other hand, for the maxillary left central incisor, which had been subjected to endodontic treatment recently, a curettage was performed followed by apicoectomy and remodeling of the filling 1 mm from the apex.

In this case, the lesions had a positive response to the combination of surgical treatment and biomaterials. The use of membrane barriers and other agents, such as bone graft materials or tissue growth factors, has been reported as a viable treatment option[1,3,27-28]. No intraoperative or postoperative complications were observed. At the 13-year follow-up, the patient showed no clinical signs or symptoms associated with the lesion and radiography showed progressive resolution of the radiolucency.

Compared to the traditional methods of endodontic surgery, GTR techniques have significantly improved the outcomes for periapical lesions[29]. A review of literature suggests that there is a lot of optimism about regenerative procedures. However, despite the success achieved with these procedures, as seen in this case report, they should be applied with caution. Biological studies in experimental models should be conducted to evaluate the need for GTR use with apical surgery.

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