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ENDODONTIC TREATMENT OF MAXILLARY LATERAL INCISOR WITH SUSPECTED RADICULAR CYST AND EXTERNAL APICAL ROOT RESORPTION: A CASE REPORT

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ABSTRACT

Introduction and objective: Radicular cysts are the most common inflammatory cysts and arise from the epithelial residues in the periodontal ligament as a result of inflammation, following necrosis of the pulp. Cysts arising in this way are found most commonly at the apices of the involved teeth, but may also be found on the lateral aspects of the roots in relation to lateral accessory root canals. Periapical lesion such as cyst can cause apical root resorption.

Case report and conclusion: The case of a radicular cyst combined with external apical root resorption associated to the right maxillary lateral incisor is reported. Nonsurgical root canal therapy was performed, a dressing of calcium hydroxide was applied and replaced two times over a period of 1 month, the open apex was managed by placing an apical plug using mineral trioxide aggregate, and lesion healing was confirmed radiographically after 4 months.

Key Words: endodontic therapy, radicular cyst, apical plug, external periapical resorption

INTRODUCTION

By definition, cyst is a pathologic cavity, lined by epithelium that contains a liquid or semisolid material. Radicular cyst is an inflammatory cyst of the periodontium of a tooth with infected and necrotic pulp. Radicular cysts are the most common cysts of the jaw and comprise about 52% to 68% of all the cysts affecting the human jaws. The prevalence of radicular cysts is highest among patients in their thirties, higher among males, and more frequent in maxillary anterior region.

Radicular cyst is caused by dental caries (bacterial infection) and traumatic injuries. Radicular cyst develops from a preexisting periapical granuloma but not every periapical granuloma will develop into radicular cyst. Radicular cysts are usually asymptomatic and often are discovered during dental radiographic examination but some cases may develop...
signs and symptoms such as swelling and tooth mobility.4

Radicular cyst can be managed by root canal treatment and/or surgical treatment such as enucleation, marsupialization, and decompression.4 The choice of treatment depends on site and size of cyst, possibility of damaging adjacent anatomic structures, clinical characteristics of the lesion, cooperation, and systemic condition of the patient.4

The exact healing mechanism of radicular cyst is not clearly understood.5 According to Simon (1980) and Nair et al. (1996) radicular cyst such as pocky cyst is open to the root canal, therefore it is likely to heal after conventional root canal treatment due to the removal of intracanal irritants.1,6 The pressure from the expanding radicular cyst causes resorption of the surrounding bone and may lead to apical root resorption.7

Root resorption is associated with an additional clinical problem through the development of an open apex.8 The absence of apical stop may lead to extrusion of root filling materials into the periapical region.9 According to Nair et al. (1990) and Sjögren et al. (1995) this may in turn initiate a foreign body reaction and possibly induce further root resorption.8

Prior to root canal obturation, a treatment must be employed due to the presence of an open apex. According to Seltzer (1988) the conventional approach to induce apexification is by using calcium hydroxide following disinfection of the root canals.9 Therefore root canal obturation is delayed until root-end closure has been completed through apexification.9 The speed of barrier formation varies from 3 to 24 months.9 The long exposure of root dentin to calcium hydroxide can decrease dentin's ability to withstand fracture (Andreasen, 2006). According to Walia et al. (2005) the structure of the formed calcified bridge following apexification was porous.9

Given the complexity of apexification using calcium hydroxide, clinicians have frequently sought an alternative treatment protocol.9 Recently bioactive material such as mineral trioxide aggregate (MTA) has emerged as a reliable material due to its biocompatibility, sealing ability, and it induces regeneration of periapical tissues such as periodontal ligament bone and cementum.10 Hence, this paper will discuss the nonsurgical management of suspect radicular cyst and the management of external apical root resorption.

Case

A 33-year-old male patient reported with a chief complain of cavity in his upper front tooth. Patient confirmed history of restoration on the same tooth 19 years ago and spontaneous pain but he cannot remember the exact year and the tooth has been accessed endodontically 1 month prior to dental visit.

Clinical examination revealed tooth 12 was temporary restored and has been
restored with a tooth-colored restoration on mesial, buccal, and distal and tender to vertical percussion.

Periapical radiograph examination of tooth 12 revealed a well-defined radiolucency approximately 6 mm in diameter involving the periapical region of tooth 12, well-defined sclerotic border was present around the radiolucency, and apical root resorption.

(a) (b) (c)

Fig 1. (a) and (b) Preoperative photograph showing tooth 12. (c) Radiograph showing radiolucency involving apex of 12.

Based upon clinical and radiographic findings diagnosis of suspect radicular cyst of tooth 12 was made. Treatment plan comprised of root canal treatment and MTA plug.

Case Management

The distal wall of tooth 12 was built with GIC and the proximal contact of tooth 12 was adjusted. The existing access cavity was enlarged and working length of the tooth was determined with the help of periapical radiograph.

(a) (b) (c)

Fig 2. (a) Access cavity of tooth 12. (b) Adjusted proximal contact and distal artificial wall build-up of tooth 12. (c) Radiograph showing verification of working length with initial file.

Canals were cleaned and shaped with circumferential filing technique with-file ISO #55, irrigating with copious amount of 2.5% sodium hypochlorite followed by irrigation with sterile saline solution to remove any remnants of sodium hypochlorite. Canals were also irrigated with EDTA 17% solution. The canal was dried with absorbent paper point and calcium hydroxide was inserted into the root canal space as intracanal medicament followed by temporary restoration for 2 weeks.

(a) (b) (c)

Fig 3. (a) Radiograph showing periapical evaluation and the condition of calcium hydroxide at the second visit. (b) MTA apical plug. (c) Radiograph showing 1 week follow-up post application of MTA plug.
After 2 weeks, radiograph revealed no reduction in the size of periapical radiolucency.

Temporary restorations were removed, canal were irrigated with 2.5% sodium hypochlorite followed by irrigation with sterile saline solution and 17% EDTA solution. Afterwards the canal was dried with absorbent paper point. Calcium hydroxide was inserted into the root canal space and the access cavity was sealed with GIC.

On the third visit (3 weeks after the second visit) clinical examination revealed no tenderness to percussion and no subjective complaints. Radiographic examination revealed the reduction of lesion size. The root canal was cleaned and dried. MTA (MTA Angelus) was manipulated according to manufacture instructions. MTA was placed on the apical root with MTA carrier (MAP System) and was condensed vertically with hand plugger. Afterwards radiographic examination showed dense apical plug 4mm in thickness. Afterwards the orifice was sealed with cotton pellet and temporary restoration.

Follow-up was scheduled for 1 week, 1 month, and 4 months post application of MTA plug. One month follow up showed signs of periapical healing such as the reduction of lesion size and periapical radiolucency. Four months follow-up showed further reduction in periapical radiolucency and lesion size. Furthermore prefabricated fiber post was inserted inside root canal and composite resin core build-up material was applied. The patient was scheduled for porcelain crown restoration.

**Fig 4** (a) Pre-operative radiograph, (b) Radiograph showing 1 month follow-up post post application of MTA plug. (c) Radiograph showing 4 months follow-up post application of MTA plug.

**Fig 5** (a) Tooth preparation for porcelain crown. (b) Temporary crown for tooth 12 and 11.

**DISCUSSION**

In this case, bacterial endotoxins released from the necrotic pulp may initiate the inflammation and immune response and may directly cause epithelial proliferation. Afterwards the cyst cavity may form within a proliferating epithelial mass in an apical granuloma by degeneration and death of cells in the centre. Hence, the radicular cyst may be a direct sequel to apical granuloma. The third phase of pathogenesis is osmosis that may contribute in the increasing size of cysts. Lytic products of the epithelial and inflammatory cells in the cyst cavity provided greater numbers of smaller
molecules which raised the osmotic pressure of the cyst fluid. As a result, the osmotic pressure of the cyst fluid rises to a level higher than the tissue fluid. The increased intracyst pressure may lead to bone resorption and expansion of the cyst and the pressure from the expanding cyst may contribute to apical root resorption.

Although the definitive diagnosis have to be made by histological examination, however, a preliminary clinical diagnosis of radicular cyst can be made if the lesion at the apex of the nonvital tooth is more than 5 mm in diameter.

Radicular cyst can be treated by surgical and/or nonsurgical methods. Ideally, a nonsurgical method should be initiated, especially in cases where lesions are in close proximity to important anatomical structures. According to endodontic literature a great majority of cysts heal after nonsurgical root canal therapy. "success rates" of 85% to 90% have been reported. The success of nonsurgical endodontic treatment method is based on appropriate cleaning, shaping, apicectomy and fision of the root canal. The aim of nonsurgical root canal therapy is the elimination of infection from the root canal (necrosis pulp tissue and bacteria).

In this case, 2.5% sodium hypochlorite was used because of its antibacterial effect and the ability to dissolve necrotic tissue, and the organic components of dentin and biofilm.

17% EDTA solution to eliminate the mineralized material of the smear layer, EDTA extracts bacterial surface proteins by combining with metal ions from the cell envelope, which can eventually lead to bacterial death, and calcium hydroxide was used as intracanal medication. Calcium hydroxide has antibacterial action, antiinflammatory activity, neutralizes acid products, activates alkaline phosphatase, and creates favorable conditions for periapical repair and stimulates hard tissue formation.

The absence of natural apical constriction increased the risk of extrusion of the root filling materials. Therefore mineral trioxide aggregate (MTA) was used to create artificial apical barrier to prevent root canal overfilling and increase the fracture resistance of immature teeth. MTA has the ability to induce cementum-like hard tissue when in contact with periradicular tissue and the sealing ability wasn't affected by the presence of moisture. In this case, 4 months follow-up radiographic examination showed the formation of hard tissue structure adjacent to the apical plug.

The exact healing mechanism of radicular cysts heal is not clearly understood. It is suggested that if the calcium hydroxide is confined to the root canal, it is possible that the inflammation created by the diffusion of the calcium hydroxide through the apical foramen may be sufficient to cause break-up of the cystic epithelial lining, thereby allowing a connective tissue invasion into the lesion with ultimate healing.
In the healing of radicular cyst such as pocket cyst, the cyst will undergo regression. Based on the previously described studies, regression of epithelial strands in periapical granulomas and the lining epithelium of radicular cysts are most likely caused by programmed cell death. After endodontic therapy, the restricted-potential basal stem cells in the epithelial strands or lining epithelium of cyst will stop proliferating because of a reduction in inflammatory mediators, proinflammatory cytokines, and growth factors. Furthermore, the terminally differentiated squamous cells in the epithelial strands and the lining epithelium of a cyst will die of programmed cell death. Eventually, most basal cells will regress or become atrophic through programmed cell death because of deprivation of survival factors or receiving death signals during progressive wound healing of periapical lesions. It is also possible that epithelial cells in epithelial strands and in apical cysts may be biologically similar to autoreactive T lymphocytes and are deleted by programmed cell death.

At the absence inflammation caused by bacterial infection, the space that has gone through bone resorption because of the expanding lesion are filled with delicate cancellous bone in their apical two thirds at 10 weeks, and they are completely filled with bone at 15 weeks. Increased radiopacity is demonstrated as soon as 38 days and radiopacity similar to that of the surrounding bone at 105 days. Following 1 month post MTA plug application, the radiograph revealed the reduction of periapical radiolucency. Furthermore, following 4 months post MTA plug application, the radiograph showed even further reduction of periapical radiolucency and lesion size. Therefore it shows signs of alveolar bone healing.

CONCLUSION

Suspect radicular cyst and external apical root resorption on tooth 12 managed by root canal treatment and application of MTA apical plug. Signs of success based on radiographic examination of 1 and 4 months follow up that revealed reduction in periapical radiolucency and lesion diameter, the appearance of hard tissue barrier adjacent to the MTA apical plug. Clinical examination revealed negative to percussion and palpation and the absence of subjective.

REFERENCES


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