

Nonsurgical Root Canal Therapy of Large Cystic Periapical Lesions Using Simple Aspiration and LSTR (Lesion Sterilization and Tissue Repair) Technique: Case Reports and Review

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Abstract

Introduction: This review and case report presents the treatment of two large cystic periapical lesions using simple aspiration technique for decompression and triple antibiotic paste for disinfection of the root canal system.

Methods: A non-surgical approach was followed for the two large cystic periapical lesions. Simple aspiration irrigation technique along with lesion sterilization therapy with triple antibiotic paste was used without any surgical intervention.

Results: Complete periapical healing of both the cyst like periapical lesions occurred without any surgical intervention. A 1 year follow-up radiograph showed complete healing of the lesion.

Conclusion: Pathogenesis, histology, and molecular cell biology of inflammatory apical true cysts are not different from pocket cysts. Therefore, inflammatory apical true cysts might regress after nonsurgical root canal therapy by the mechanism of apoptosis or programmed cell death, similar to inflammatory pocket cysts. Non-surgical approach using a combination of Simple Aspiration technique and LSTR (lesion sterilization and tissue repair) technique was successful in healing large cyst-like periradicular lesions.

Keywords: Large cyst-like periapical lesions; Non-surgical root canal therapy; Aspiration technique; Triple antibiotic paste; Apical cyst

Introduction

An apical cyst is a pathological cavity completely lined by non-keratinized stratified squamous epithelium of variable thickness in a three-dimensional structure in an apical periodontitis lesion. Inflammatory apical cysts are associated with endodontically involved teeth and formed by proliferation of the epithelial cell rests of Malassez in inflamed periradicular tissues [1-3]. Most periapical lesions (>90%) can be classified as dental granuloma, radicular cyst or abscess [4-6]. Periapical cysts described as pocket cysts and true cysts. The pocket cyst has its cavity open to the root canal. Apical true cyst is enclosed by lining epithelium and may be attached to the root apex by a cord of epithelium [7,8]. The reported incidence of apical cysts among periapical lesions varies considerably from 6% to 55%. Nair et al. examined 256 periapical lesions and found that 9% of them were apical true cysts and 6% were apical pocket cysts [7]. It is generally accepted that periradicular lesions cannot be differentially diagnosed as either radicular cysts or apical granulomas based on radiographic evidence alone [4,6] contrarily Natkin et al. analysed data and stated that with a radiographic lesion size of 200 mm² or larger, the incidence of cysts was almost 100% [9]. If the lesion is separate from the apex and with an intact epithelial lining (apical true cyst), it may have developed into a self-perpetuating entity that may not heal when treated non-surgically. On other occasions, a large periradicular lesion may have a direct communication with the root canal system (apical pocket cyst) and respond favourably to nonsurgical treatment. There has also been a prolonged debate about the management of large cystic lesions, with some maintaining that true cysts cannot successfully treat by surgical means [8,9]. However, clinicians believe that a large majority of cysts will heal after nonsurgical root canal treatment [4,10]. Case reports have shown that apical cysts (pocket and true) in apical periodontitis lesions could regress after a decompression and aspiration procedures to avoid periapical surgery, which might devitalize neighbouring tooth/teeth or damage adjacent vital structures [11,12] and cause unnecessary trauma and discomfort to the patient. Hoen et al. suggested aspiration

of the cystic fluid from the periapical lesion using a buccal palatal approach [13]. The disadvantage of this technique was the creation of buccal and palatal wounds that may cause discomfort to the patient. To overcome this, a simple technique [14] of aspiration through the root canal has been described. Inter appointment medicaments have been widely advocated to help eliminate remaining bacteria within the root canal system, reduce periapical inflammation and pain, and induce healing. Cariology Research Unit of Niigata University developed the concept of lesion sterilization and tissue repair therapy, which employs the use of a combination of antibiotics (metronidazole, ciprofloxacin, and minocycline) for disinfection of oral infectious lesions, including dentinal, pulpal, and periradicular lesions. The following case reports describe the successful endodontic treatment of a two large cyst-like periradicular lesion using a combination simple Aspiration technique and Triple antibiotic paste as an intracanal medicament.

Case no.1

A 19 year's old female patient was referred by a private general practitioner to the Endodontic Speciality of the Shree Bankey Bihari Dental college and research centre, India for the treatment of maxillary right central incisor. Patient complained of swelling and pain in the upper front region of the mouth. Her medical status was non-contributory. Extra oral examination revealed a diffuse swelling

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of the upper lip. Intraoral examination revealed tooth no 11 was discovered (Figure 1A). Tooth was tender to percussion and palpation. Electronic pulp testing and cold application gave negative results. On radiographic examination, periapical radiograph (Figure 1B) revealed a large radiolucent lesion approximately Size 15×15 mm in diameter apparently involving the apex of teeth 11. Based on these findings, the patient was diagnosed as having a cyst-like periradicular lesion. After informed consent was obtained, access cavity prepared under rubber dam isolation. Upon access a clear, straw-coloured fluid was exuded from the canal. Working length determined radiographically(Figure 1C). The apical foramen widened till 60 # size ISO K file. A 26-gauge needle was attached to a 5-mL syringe and was inserted through the root canal past the apical foramen (Figure 1D). Approximately, 3 ml of straw colour fluid was aspirated with slight digital pressure on the labial sulcus. Drainage was performed until discharge through the canal ceased. During the instrumentation, the canal was irrigated copiously with 3% sodium hypochlorite solution after each instrument. The access cavity was sealed with Cavit G. On microscopic examination of the aspirated fluid showed the presence of cholesterol crystals. On the next appointment after one week the pus discharge did not cease completely and the swelling recurred, the canal was again irrigated with 3% Naocl and 17% EDTA, After drying with sterile paper points, a mixture of ciprofloxacin, metronidazole, and minocycline paste [30] was prepared into a creamy consistency and filled in root canal with the help of messing root canal gun up to the level of the CEJ. The paste was condensed using sterile cotton pellets before sealing the coronal access with Cavit G. The patient recalled after four weeks the teeth showed no pain on percussion, the soft tissues were found to be healthy, and the canals were dry on examination. The canals were irrigated with 3% sodium hypochlorite, Master cone selected (Figure 1E) and obturated with gutta-percha and MTA based root canal sealer (MTA Filapex, VDW) using the lateral compaction technique (Figure 1F). Access cavity was sealed with composite resin. A six month postoperative radiograph of the patients revealed complete healing of the lesion with healthy adjacent gingival tissue (Figure 1G). A Porcelain fused to metal crown was given (Figure 1H, I) after complete resolution of lesion.

Case no.2

A 20 year old male patient reported to Endodontic Speciality in Shree Bankey Bihari Dental college and research centre with complains of pain and swelling in the upper right front region of the mouth. Patient's medical history was non-contributory. A history of trauma due to fall was reported 8 years back. Extra oral examination shows a diffuse swelling on the upper lip and right side of the cheek. Intraoral examination showed a presence of sinus in relation to 11 and diffuses labial swelling extending from central incisor to distal of right first premolar. Hard tissue examination revealed Ellie's class 2 fractures and discoloration in relation to 11 and 12 and a previously done composite restoration (Figure 2A). Tooth # 11 and 12 were indeed found to be non-vital (no response to cold or electrical stimulation), whereas all other maxillary anterior teeth were normal in all regards. Radiographic examination showed a large periapical cyst like radiolucency approximately Size 25×25 mm in diameter in relation to 11 and 12 (Figure 2B). After consultation with the patient a root canal treatment of tooth # 11 and 12 was planned, Rubber dam was applied and access cavities were prepared. On opening, copious drainage of very thin viscosity was noted, which persisted for some time despite repeated drying with paper points. Working length was determined (Figure 2C) and shaping done up to size 60 # ISO file ,alternating irrigating with 3% sodium hypochlorite and 17% EDTA. Aspiration of the fluid was done as described above using a 26 gauge, 5 ml syringe. Patient was recalled after one week. But the pus discharge does not cease completely and recurrence of swelling was seen after each dressing, it was decided to use triple antibiotic paste as an intracanal medicament for the disinfection of the lesion. The canals were again irrigated with 3 % sodium hypochlorite and 17% EDTA, after drying with sterile paper points, a mixture of ciprofloxacin, metronidazole, and minocycline paste was placed with the help of messing root canal gun, and the teeth were temporized with Cavit G. The patient was recalled after 4 weeks revealed tooth had no symptoms, with no discharge from the canal. At this appointment the tooth was reopened, after thorough irrigation with 3% NaOCl the triple antibiotic paste was changed. After



Figure 1: A: Preoperative photograph of the tooth # 11; B: Preoperative radiograph of the tooth # 11; C: Working Length determination radiograph; D: Aspiration of fluid done using 26 gauge needle; E: Mastercone selection radiograph; F: Radiograph after successful obturation of the tooth; G: Follow up radiograph of the tooth after 6 months; H: Photograph after Prosthetic rehabilitation of tooth with PFM crown; I: Radiograph of the tooth after placement of crown.

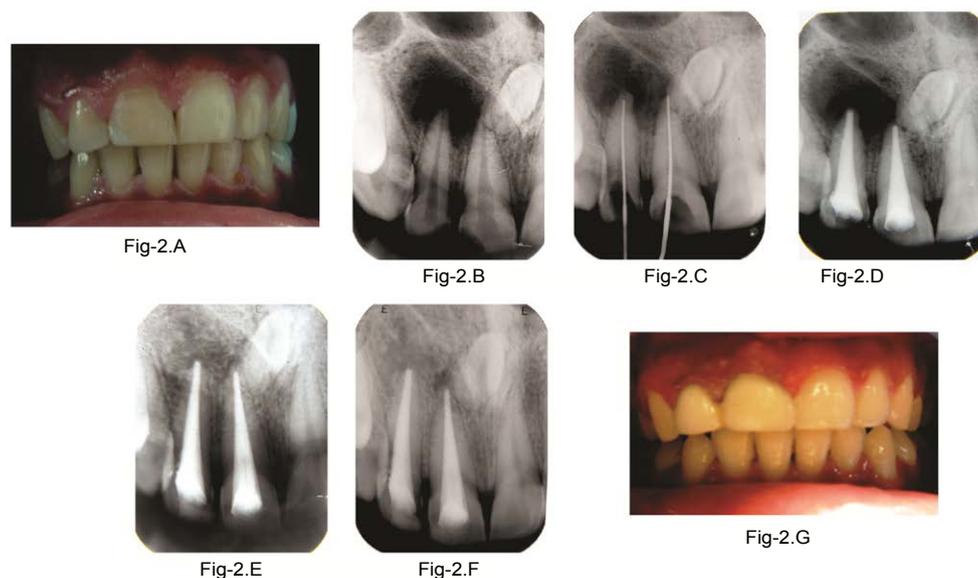


Figure 1: A: Preoperative photograph of the tooth # 11 and 12; B: Preoperative radiograph of the tooth # 11 and 12; C: Working Length determination radiograph; D: Radiograph after successful obturation of the tooth; E: Follow up radiograph of the teeth after 6 months; F: Follow up radiograph of the teeth after 12 months; G: Photograph after Prosthetic rehabilitation of tooth with PFM crowns.

4 weeks the patient was recalled root canal irrigated with 3% sodium hypochlorite, and obturated with gutta-perch and MTA based root canal sealer (MTA Fillapex, VDW) using the lateral condensation technique (Figure 2D) and access cavity was sealed with composite resin. After 6 months (Figure 2E) the intraoral periapical radiograph showed complete bony healing with well-defined bony trabecular pattern. A 12 month follow up radiograph showed complete healing of the lesion (Figure 2F). Porcelain fused to metal crown was given (Figure 2G) after the resolution of the lesion.

Discussion

It has been suggested that the tissue dynamics of an apical true cyst is “self-sustaining” by virtue of its independence of the presence or absence of root canal infection [15]. Therefore, sometimes apical true cysts are less likely to heal by nonsurgical root canal therapy, and surgical intervention is necessary. Although there are no direct evidences to show that large cyst-like periapical lesions and radicular cysts can or cannot heal or regress after nonsurgical root canal therapy. These lesions cannot be diagnosed before treatment [16,17] and can only be diagnosed after surgical biopsy of the lesions. Accurate histopathological diagnosis of radicular cyst is possible only through the methods like serial sectioning or step serial sectioning of the lesion removes in too. The photomicrographs shown in many studies like Bhaskar et al. [18] and lalonde and leubke [6] mainly represents the magnified view of a selective section of epithelium and not supported by the pictures at lower magnification of sections different axial planes. So this discrepancy in method of reporting by histopathological examination may be the reason behind disparity in incidence of periapical cyst. Above assumptions have been well supported by studies [8]. Contrary to this the clinical diagnosis of a periradicular cyst is reasonable if all of the following conditions exist: (a) the periradicular lesion involves one or more teeth with necrotic pulps; (b) the lesion is greater than 200 mm² in size; (c) a straw-coloured fluid is produced upon aspiration or on drainage through an access; and (d) the fluid contains cholesterol crystals. Studies strongly suggest that the incidence of cysts rises as lesion size increases. This, in turn, suggests that as the

size of lesions increases, the reliability of radiographic differentiation may be significantly improved [9]. Lesion sizes of 200 mm² or more, the incidence of cysts is at or close to 100%. Clearly, at this lesion size the probability of correctly identifying a cyst like lesion as a cyst would also be at or close to 100% [6,10]. The majority of the cytological specimens obtained from cyst and cyst like lesions of the jaws reveals characteristic cellular pattern. A prompt provisional diagnosis can be rendered with the help of diagnostic cytological examination which might help the clinician in diagnosis [19]. Cholesterol crystals are encountered in 29 to 43% of dental cysts [20]. Cholesterol crystals are more frequently encountered in radicular cysts than in apical granulomata and are identifiable under a microscope. There are many Potential deleterious effects of enucleating radicular cysts surgically. These surgical pitfalls include (1) injury to the blood vessels and nerves of adjacent teeth, thereby compromising their vitality; (2) seriously jeopardizing the osseous support of adjacent teeth; (3) damage to anatomic structures such as the mental foramen, inferior alveolar nerve and/or artery, nasal cavity, and maxillary sinus; (4) occurrence of a surgical defect or scar after healing has taken place (5) considerable pain or discomfort experienced by the patient during or after the procedure; and (6) some patients (the very young, the very old, the very apprehensive) not tolerating the procedure well. How is the epithelial tissue removed? Following endodontic manipulation, an acute inflammation occurs and the polymorphonuclear leukocytes digest the epithelial tissue [4]. This theory can be questioned, however, polymorphonuclear leukocytes do not digest cells. Bender et al suggested an interesting hypothesis. They believe that as healing takes place, the collagen deposition squeezes the capillaries, which shut off the blood supply to the epithelial cells. These cells undergo degeneration and the macrophages remove the disintegrated epithelial cells [21]. Therefore, intracanal bacteria and bacterial toxins and metabolic by-products are not able to affect an apical true cyst. However, inflammatory cell infiltration is always present in a cyst's lining epithelium and/or fibrous connective tissue capsule of apical true cysts [15,16] if the periapical cystic lesions were self-sustaining then they would be a neoplasm as any disease that persist after cessation of aetiology can be considered as neoplasm [22]

but that has not been found true in case of periapical cysts. This indicates that there are irritants somewhere either in the root canal system or in the lumen of cysts to attract inflammatory cells to the cysts. So aspiration of the fluid from the lesion and disinfection of the canal might play greater role in successful resolution of the lesion these cases. Aspiration of cystic fluid through the root canal by passing the aspirating needle through the apical foramen eliminates the creation of buccal and palatal wound, as in traditional aspiration irrigation technique. But it is advisable not to use these techniques in case of severely curved canals [8] and adjacent tissues where the sinus, cavities are present in our case the apical enlargement was done up to ISO Size 60 to facilitate the aspiration through the needle beyond the apical foramen. It's been considered that over enlargement of the apical foramen have significant drawbacks. In endodontic therapy, it's been suggested that whenever an apical radiolucent lesion is present, instrumentation should be carried to about 1 mm beyond the apical foramen. This need not be done with every instrument. Extension beyond the apex two or three times with one of the smallest files or reamers should be sufficient to produce the desired effect. It must be borne in mind that excessive traumatization of apical tissues would cause unnecessarily excessive acute inflammation and severe discomfort. In addition to the microscopic findings which favour the above concept, there is the clinical observation that whenever apical lesions undergo spontaneous change to a dento-alveolar abscess, conservative endodontic therapy is almost always successful (when performed after drainage and the disappearance of acute symptoms). The ability of neutrophils to destroy tissue is inherent in their proteolytic enzymes, and thus their ability to destroy the epithelial lining [4]. Instrumentation of mandibular canines/bicuspid to size #80 [15,23] and the mesial roots of mandibular molars to a size #60 and demonstrated an 81 to 100% reduction in remaining bacteria. Rollison et al. showed larger file sizes to a #50 produced greater reduction in remaining bacteria than those instrumented with a #35 file [24]. Tan et al. compared hand versus rotary files using specific criteria for apical enlargement [25]. Their results also conclude that no technique was totally effective in cleaning the apical canal space. They concluded that larger instrumentation was beneficial in reducing the debris in the apical third of the canal. Recently, Usman et al. also showed that larger instrumentation files cleaned the apical third of the canal better than smaller instrument size [26]. Contrary to the above studies, Coldero et al. reported that there was no difference in intracanal bacterial reduction with and without apical enlargement [27]. Chemo mechanical preparation of the coronal aspect allowed NaOCl to reach the apical part of the canal and thus aid in eliminating *E. faecalis* without apical enlargement. However, in their study, there was minimal difference in the apical instrumentation sizes between groups. Taken together, virtually all of the above studies provide a strong consensus that larger apical preparation sizes produces a greater reduction in remaining bacteria and dentinal debris as compared to smaller apical preparation sizes in cyst like periradicular lesions. Animal experiment studies confirm [28] that cysts similar to apical cysts are formed from abscess lesions induced by bacterial infection. Any disease caused by infection, including apical cysts (pocket and true), should be able to heal if the causative irritants are removed or eliminated, unless the irritants are neoplasm-inducing agents or carcinogens. Hoshino et al. and Sato et al. [29,30] in two separate in vitro studies used a mixture of metronidazole, ciprofloxacin, and minocycline effectively against endodontic pathogens that disinfected even the deep layers of dentin in infected teeth, and revealed that using triple antibiotic dressing in infected canals for 2 weeks resulted in bacteria-free culture in 70% of cases. Triple antibiotic paste has been successfully used for disinfection

of oral infectious lesions, including dentinal, pulpal, and periradicular lesions and repair of the damaged tissue is expected [31] after thorough disinfection of the lesion. Commercially available drug can be mixed in the ratio 1:3:3 or 1:1:1 with equal amounts of macrogol ointment and propylene glycol as a vehicle. The paste was delivered into the root canals with Messing root canal gun. Although small amount of drug used in the therapy but care should be taken to check if patient is sensitive to these antibiotics. Primary disadvantage of Triple antibiotic paste is [32] the discoloration induced by minocycline that have been seen in some cases. On the basis of pathogenesis, histology, and molecular cell biology, inflammatory apical true cysts are not different from pocket cysts. Therefore, inflammatory apical true cysts might regress after nonsurgical root canal therapy by the mechanism of apoptosis or programmed cell death, similar to inflammatory pocket cysts. Inflammatory apical true cyst is not a neoplastic or developmental disease and not always requires surgical removal. Because apical periodontitis lesions, regardless of whether they are granulomas, abscesses, or cysts, are primarily caused by root canal infection, we should use a treatment protocol that will eliminate their aetiology in the root canal system rather than their product, apical true cyst. Studies [32,33] have shown that failure of apical periodontitis lesions to heal, including apical true cysts, after nonsurgical root canal therapy is primarily caused by bacterial infection in the root canal system. Based on the meticulous serial section studies have shown that the incidence of true radicular cyst is less than 10% of all cystic lesions [8]. This implies that most of the cases in which periapical surgery has been performed based on radiographic diagnosis of cyst might have resolved by conventional root canal therapy and proper disinfection protocol.

Conclusion

Inflammatory apical true cysts might regress after nonsurgical root canal therapy by the mechanism of apoptosis or programmed cell death, similar to inflammatory pocket cysts.

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