Management of Cyst-like Periapical Lesions by Orthograde Decompression and Long-term Calcium Hydroxide/Chlorhexidine Intracanal Dressing: A Case Series

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Abstract

Cyst-like periapical lesions should be treated initially with conservative nonsurgical procedures. In this case series, we describe the clinical and radiographic outcomes of large cyst-like lesions that were treated by orthograde decompression and long-term intracanal use of calcium hydroxide [Ca(OH)₂] mixed with 2% chlorhexidine digluconate. Ten cases of cyst-like periapical lesions involving 15 teeth from 10 patients were selected. Maximal radiographic diameters of the lesions ranged from 11 to 28 mm. Nonsurgical procedures were performed, including apical patency, orthograde puncture of cyst-like exudates, chemomechanical preparation, and placement of intracanal Ca(OH)₂/CHX dressings, which were periodically replaced during 6–10 months. The root canals were then filled with gutta-percha and sealer. The follow-up periods ranged from 6 to 24 months, and the outcome was classified as healed, healing, or failure. Nine lesions drained copious exudates after canal patency. One lesion only drained bloody serous exudate after periradicular instrumentation. In 9 patients, intracanal exudation ceased in the first follow-up visit. At the 24-month follow-up, 6 lesions (60.0%) had healed, and 3 lesions (30.0%) were healing, with the corresponding patients being without clinical signs or symptoms. The case of treatment failure was submitted to surgical treatment. Microscopically, the lesion appeared to be an apical cyst with exuberant extraradicular bacterial biofilms attached to the sectioned root apex. This case series supports the use of nonsurgical methods to resolve larger cyst-like periapical lesions. (J Endod 2016;42:1135–1141)

Key Words

Calcium hydroxide, large cyst-like periapical lesions, nonsurgical endodontic treatment, periapical healing, regression of apical cysts

Significance

The control of root canal infection and periapical exudation has pivotal importance in nonsurgical management of large cyst-like periapical lesions. The apical patency or periapical overinstrumentation followed by intracanal puncture promotes periapical decompression. In addition, the use of chlorhexidine/calcium hydroxide intracanal dressing after chemomechanical preparation provides supplementary antisepsis associated at stimulation of periapical repair. In this case series the periodic renewal of this intracanal dressing did provide progressive clinical and radiographic resolution of large cyst-like periapical lesions.
persistent intracanal exudation (3, 4), which is often caused by resistance infections (1, 19). Thus, intracanal use of Ca(OH)$_2$/CHX could be advantageous in these cases.

Nevertheless, limited clinical information is available regarding the use of intracanal Ca(OH)$_2$/CHX as an adjunct to nonsurgical treatment of cyst-like lesions. In this case series study, we describe the clinical and radiographic outcomes of large cyst-like periapical lesions treated by orthograde decompression and long-term Ca(OH)$_2$/CHX intracanal dressings.

**Materials and Methods**

**Patient Selection**

This study was approved (protocol #036/155) by the Ethics Research Committee of the Federal University of Waley de Jequitinhonha and Mucuri, Brazil. Treatments were performed between February 2009 and December 2013. We selected 10 cases of periapical lesions showing clinical and radiographic features compatible with large cyst-like lesions (5). Selected cases involved 15 teeth from 10 patients (6 women, 4 men; mean patient age, 23.4 ± 6.6 years) who had been referred to the endodontic clinic of our university. All patients gave their written informed consent before participating. Patients’ medical and family histories were noncontributory. All teeth presented negative responses to cold (Endo-Ice; The Hygenic Corp, Akron, OH) and electric (Vitality Vitality Scanner; Analytic Technology, Glendora, CA) pulp sensibility tests.

Preoperative and postoperative radiographs were taken by using the paralleling cone technique with an intraoral radiographic film holder (Maquira Ind/ustria de Produtos Odontológicos Ltda, Maringá, PR, Brazil) and ultra-speed film (Eastman Kodak Co, Rochester, NY). Films were processed by the time-temperature method. The diameter of the apical radiolucency was measured on each preoperative radiograph with a digital caliper (Mitutoyo Corp, Tokyo, Japan) by using a light-box with variable illumination. Maximal radiographic diameters of the lesions ranged from 11 to 28 mm. Detailed clinical and radiographic data are summarized in Table 1.

**Nonsurgical Treatment Protocols**

During endodontic treatment, strict antiseptic conditions were observed. Tooth, clamp, and surrounding parts of the rubber dam were cleaned with 30% hydrogen peroxide, swabbed with 5% iodine tincture, and later swabbed with 5% sodium thiosulfate solution. After proper coronal access, the pulp chamber and root canals were irrigated with 5.25% sodium hypochlorite (NaOCl) solution (Lenza Farmacéutica Ltda, Belo Horizonte, MG, Brazil) through a syringe with 30-gauge needle (NaviTip; Ultradent, South Jordan, UT). Preflaring was performed by using #15 to #40 K-files followed by #2 to #5 Gates-Glidden drills (Dentsply Maillefer, Ballaigues, Switzerland).

After apical patency with small K-file sizes, lesion decompression was completed through intracanal puncture under gentle aspiration with a Luer-Lock syringe and a 30/06 needle blocking the access cavity with a wet cotton pellet. Periapical overinstrumentation with #20 K-file was performed beyond the radiographic apex in a maximum extension of 5 mm when no drainage was observed after canal patency. Once the exudation was controlled, the apical canal third was chemomechanically prepared by the step-back technique by using K files and 5.25% NaOCl. Master apical file sizes for maxillary incisors (#45 to #55), mandibular incisors (#35 to #45), and the mandibular molar (#30 to #40) were set at sizes larger than the first file binding at the working length. The smear layer was removed with 17% EDTA solution (Lenza Farmacéutica) for 3 minutes, and the root canal was dried with absorbent paper points.

Ca(OH)$_2$ was mixed with 2% CHX digluconate solution (FGM Produtos Odontológicos, Joinville, SC, Brazil) at a ratio of 0.9 g/mL to obtain a toothpaste-like consistency (4, 13, 15). Intracanal dressings were placed by using a lentulo spiral. The access cavity was sealed with a temporary restorative material (IRM; Dentsply, Petrolpolis, RJ, Brazil). Ca(OH)$_2$ pastes were replaced every 2–4 weeks (17) for the next 3–10 months (mean time interval, 6.2 months). Instrumentation by using the master apical and patency K-files with copious irrigation of 5.25% NaOCl was performed to remove intracanal dressings. The tooth to be root-filled should be asymptomatic and without intra- canal exudation. Thus, a 17% EDTA solution was used for 3 minutes, followed by 5.25% NaOCl. Root canals were dried with absorbent paper points. They were filled by thermomechanical compaction by using gutta-percha cones (Dentsply) and a zinc oxide–eugenol–based sealer (Pulp Canal Sealer; Kerr Sybron Dental Specialties, Glendora, CA). Afterward, the coronal restoration was placed with a permanent material.

**TABLE 1. Clinical/Radiographic Aspects and Treatment Outcomes of Large Cyst-like Periapical Lesions**

<table>
<thead>
<tr>
<th>Case/ patient</th>
<th>Tooth</th>
<th>Clinical and radiographic aspects</th>
<th>Maximal diameter of periapical radiolucency (mm)</th>
<th>Follow-up periods (mo) Intracanal dressing After root filling Outcome</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>9</td>
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<td>10</td>
<td>9, 10</td>
<td>‡‡</td>
<td>28</td>
<td>4</td>
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</table>

*Slight facial asymmetry.
†Tooth crowding.
‡Accentuated swelling of the cortical alveolar bone.
§Significant periapical bone loss.
#Exudation after apical patency.
**Exudation after periradicular overinstrumentation.
††Supplementary surgery.
‡‡After surgery.
Outcome Assessment

The follow-up period ranged from 6 to 24 months. Two experienced endodontists used clinical and radiographic criteria to categorize each tooth as healed (absence of periapical radiolucency and absence of signs/symptoms), healing (advanced reduction of periapical radiolucency size and absence of signs/symptoms), or treatment failure (presence of pain, swelling, a sinus tract, persistent intracanal exudation, and unchanged periapical radiolucency) (3, 20). Once identified as a case failure, further surgical treatments including marsupialization, cystectomy, and apicoectomy were performed.

Results

Anterior teeth comprised 93.3% of sample teeth. Traumatic injuries (70%) were the predominant etiologic factor of cyst-like lesions, followed by caries (20%) and restoration loss (10%). Nine lesions drained large amounts of yellow serous exudates after canal patency, with 1–6 mL of exudates being recovered through orthograde puncture. In 1 case, the intracanal drainage of yellow or bloody serous exudate only occurred after periapical overinstrumentation.

In 9 patients, exudation ceased in the first follow-up visit. Among these 9 lesions, 6 (60.0%) were categorized as healed and 3 (30.0%) as healing (Table 1). These 9 patients were without clinical signs/symptoms at 24-month follow-up. Figures 1 and 2 (healed teeth) and Figure 3 (healing tooth) show some representative cases.

One case was categorized as treatment failure. This case evidenced large maxillary radiolucencies associated with teeth #9 and #10 (Fig. 4). Endodontic retreatment of tooth #9 was performed, followed by endodontic treatment of tooth #10, in which continuous purulent intracanal drainage persisted during a 4-month period. Therefore, surgical marsupialization was performed. After 6 months, the root canals of teeth #9 and #10 were filled, followed by cystectomy (Fig. 4B) and apicoectomy of tooth #10. Histopathologic findings (hematoxylin-eosin staining) of the lesion showed a continuous epithelial lining and fibrous capsule containing chronic inflammatory infiltrate (Fig. 4C), with disperse cholesterol crystals (Fig. 4D). Scanning electronic microscopic analysis of the 2-mm sectioned root apex revealed exuberant bacterial biofilms with cocci forms immersed in an amorphous material (Fig. 4E). Radiographically (Fig. 4F), the periapical tissues were completely healed at 24-month follow-up.

Discussion

Several decades ago, many pathologists and maxillofacial surgeons considered that apical cysts did not have a favorable response to conservative endodontic treatment alone and that they required periapical curettage (5, 21). Nowadays, the endodontic community strongly believes that large cyst-like periapical lesions and apical true cysts are most likely not able to heal through conservative root canal treatment alone (5, 6, 21).

For many years, periapical radiolucencies with a size greater than 10 mm were interpreted as probable cystic lesions (21), although the definitive diagnosis could only be confirmed by biopsy (6, 22). In 1 study, histopathologic analysis found that 6% of serially sectioned

Figure 1. Case classified as healed. (A) Clinical aspects of accentuated swelling of buccal cortical bone (arrow) and crowding of teeth #6, #7, and #8. (B) Large periapical radiolucency associated with tooth #7. (C) K-file placed on apical patency length. (D) Orthograde puncture of cyst-like lesion resulted in exudate (6 mL). (E) Healed periapical tissues at 12-month follow-up visit.
periapical lesions were apical pocket cysts and 9% were true cysts (6).
The relative discontinuity between a true cyst and the apical foramen
made the cyst self-sustaining (6, 24, 25), thereby impairing a positive
response to root canal disinfection procedures (6, 7, 24, 25).
However, apical pocket and true cysts are morphologically and
immunologically identical (26). Thus, if the intracanal infection was
to be controlled, the lesions might be able to heal (1, 3). This case
series confirms the potential utility of nonsurgical treatment
protocols for resolving large cyst-like periapical lesions.

In this study, the lesions drained yellow or blood serous exudates
during apical patency or periapical overinstrumentation, approaches
that have been recommended previously for cyst-like lesions (3, 4,
10, 22). Together with decompression, apical patency and periapical
overinstrumentation can be used to remove exudates, fluid, bacterial
colonies, and cholesterol crystals (1). Thus, intracanal puncture plays
a pivotal role in the orthograde treatment protocol and promotes
comfortable decompression of the lesion, in contrast to aspiration
through the mucosa (27) or surgical procedures such as marsupializa-
tion and enucleation (28). In addition, orthograde lesion decompres-
sion may be facilitated by using the EndoVac System (Kerr Dental,
Plymouth, MA) (11).

In most cases, teeth treated by intracanal puncture followed by
root canal preparation and intracanal dressings showed a progressive
reduction in the amount of exudates. This result may be attributed to the
antiseptic effect of the chemomechanical debridement, supplemented
by the extended use of an intracanal Ca(OH)₂-based paste (3, 4).

Figure 2. Case classified as healed. (A) Large periapical radiolucency associated with tooth #19. (B) K-files placed on apical patency length. (C) Orthograde puncture of lesion resulted in bloody serous exudate. (D) Healed periapical tissues at 24-month follow-up visit.

Figure 3. Case classified as healing. (A) Large periapical cyst-like radiolucency associated with tooth #7. (B) K-file on the patency length. (C) Orthograde puncture of lesion resulted in bloody serous exudate. (D) Healing process of periapical tissues at 6-month follow-up visit.
Figure 4. Case classified as treatment failure, which was subsequently surgically resolved. (A) Occlusal radiograph showing large maxillary radiolucency. (B) Enucleation of remaining lesion 6 months after marsupialization procedure. (C) Histopathologic analysis showing cystic cavity and intense chronic inflammatory infiltrate. (D) Cystic structure containing cholesterol crystals. (E) Numerous cocci forms immersed in exuberant periapical biofilm. (F) Healed maxillary radiolucency at 24-month follow-up visit (after surgery).
This treatment approach differs from the conventional short-term use of Ca(OH)$_2$ (29) for the endodontic management of apical periodontitis. Some studies found that the ex vivo long-term use of Ca(OH)$_2$ was associated with weakening of the root canal dentin and increased tooth fracture risk (30, 31). However, in this study, we did not observe any instance of fracture among our cases at the end of the follow-up period.

During the intracanal dressing period, we found an evident reduction in the radiolucency sizes of the cyst-like lesions in a mean time interval of approximately 6 months. This positive outcome was possibly due to the alkaline pH of the intracanal Ca(OH)$_2$ paste and the effect of the Ca$^{2+}$ and OH$^-$_ions on the periapical tissue and microorganisms (13). Prolonged Ca(OH)$_2$ exposure maintains a high concentration of OH$^-$ ions and inhibits bacterial enzymes, producing an antimicrobial effect. The Ca$^{2+}$ ions, in turn, activate tissue enzymes such as alkaline phosphatase, thereby inducing a mineralizing action (12, 13, 29).

In addition, Ca(OH)$_2$ has been used to aid in the drying of canal irrigant (36, 37). Replanted teeth whose root canals were dressed with CHX showed a significant reduction of inflammatory lesions of endodontic origin (19, 35), which are often present in persistent periapical infections (23), such as Enterococcus faecalis and Candida albicans (14, 34), which are often present in persistent periapical lesions (19, 35). In vitro studies recommended that CHX can be used at a 2% concentration when applied as a root canal irrigant (36, 37). Replanted teeth whose root canals were dressed with CHX showed a significant reduction of inflammatory resorption in the periodontal space by 4 weeks of treatment (38).

The broad antimicrobial activity of CHX is due to its cationic nature. CHX binds to negatively charged bacterial cell walls, leading to osmotic alterations that allow the molecule to permeate the bacteria, causing toxic effects and death (15, 16). Furthermore, CHX has substantivity, which favors its release and availability in the root canal dentin during an extended time (up to 90 days) (39, 40). The prolonged prevalence of CHX ensures a residual bactericidal effect (15, 40) and prevents microbial colonization on the dentin surface (15, 16). Moreover, the 2% CHX intracanal medication presents passive diffusion through the radicular dentin and reaches the outer surface, exerting antimicrobial action in vitro (41). This evident diffusion could eliminate biofilms attached to the radicular surface and indirectly control the periapical exudation. When CHX is combined with Ca(OH)$_2$, a precipitate of non-soluble CHX molecules is formed, which decreases the effectiveness of the CHX molecule (16). Conversely, CHX fragmentation produces different by-products with antioxidant or pro-oxidant properties, which have high antimicrobial activity (15, 42). Despite the theoretical risk that these potentially cytotoxic by-products could cause periodontal tissue damage (42, 43), no clinical evidence exists to support this adverse effect. In this study, Ca(OH)$_2$/CHX dressings confined to root canal space were helpful in managing the exudative inflammatory cyst-like lesions, as demonstrated by the reduction of clinical and radiographic pathologic signs in 90% of cases.

The refractory lesion (treatment failure case) continuously drained periapical inflammatory exudate, despite efforts to control the infection. Continuous exudation made the root canal debridement difficult. Possible causes for treatment failure could include a resistant intracanal infection (19, 33, 35) or extraradicular infection (23), such as bacterial biofilm formation (22, 44, 45). Scanning electronic microscopic images revealed an adhered and well-characterized extraradicular biofilm with predominance of cocci forms. This observation suggests that the bacterial microcolonies were related to the maintenance of the cyst-like lesion, as verified in previous reports (44, 45).

Poor patient compliance in terms of attending recall visits after root canal filling limited the follow-up of this study to 24 months. At this time, 60% of the cyst-like lesions had completely healed. Another 50% of lesions evidenced advanced reduction of the periapical radiolucency size, which is a predictive factor of successful endodontic outcomes up to a 1-year follow-up period (20). Thus, overall therapeutic outcomes for large periapical cyst-like lesions were similar to those of the conventional endodontic treatments performed in teeth with apical periodontitis (17, 18, 46).

**Conclusion**

Large cyst-like periapical lesions had favorable clinical and radiographic responses to nonsurgical endodontic treatment protocols. Although the treatment was extended for several months, the orthograde root canal procedures presented in this case series may be a viable clinical alternative for solving cyst-like periapical lesions.

**Acknowledgments**

The authors are very grateful to Professors Maria Helena Santos and Flavia Dornela Verli for carrying out the microscopic analysis of case classified as failure treatment. The authors deny any conflicts of interest related to this study.

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