NON-SURGICAL ENDODONTIC SUCCESS IN ACUTE APICAL ABSCESS WITH LARGE PERIAPICAL LESION: IS SURGERY ALWAYS NECESSARY?

Konjhodžić Alma[1], Pašić Mirna*[1], Džanković Aida[1], Begović Adna[1], Halilović Mehinović Madžida[1], Prcić Iman[2]

[1] Department of Dental Pathology with Endodontics, Faculty of Dentistry with Dental Clinical Center, University of Sarajevo, Bosnia and Herzegovina

[2] Independent Researcher

*Corresponding author

Mirna Pašić, DMD
Department of Dental Pathology with Endodontics
Faculty of Dentistry with Dental Clinical Center
University of Sarajevo
Bolnička 4a, 71000 Sarajevo
Bosnia and Herzegovina
Phone: +38761161714
E-mail: mirnapasic@sf.unsa.ba

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ABSTRACT

Background: The Acute Apical Abscess (AAA) represents a common endodontic emergency. The aim of this case report was to present successful root canal treatment, despite poor and uncertain prognosis. Case presentation: Despite the severity of the findings, which required a modification from standard therapeutic approach, the patient underwent immediate root canal treatment. The modified protocol involved the repeated, long-term application of aqueous calcium hydroxide paste, enhanced with methylcellulose. This formulation achieved a rapid pH increase and effective endotoxin neutralization, initiating bone healing.

Conclusion: This case highlights the clinical significance of long-term calcium hydroxide dressing in the conservative management of AAA with extensive periapical bone resorption. The extended medication protocol induced bone healing, enabling the completion of the root canal treatment and resulting in a favorable long-term therapeutic outcome, contrary to the initial prognosis.

Keywords: acute apical abscess, calcium hydroxide, non-surgical treatment, endotoxin

Introduction

Acute Apical Abscess (AAA) is an acute, purulent inflammation of periapical tissues, caused by bacterial infection in the root canal system [1]. It is defined as a localized purulent collection adjacent to the tooth apex formed by tissue liquefaction [2]. Bacteria from the root canal system invade periapical tissues via apical foramen, lateral foramina or other root perforations and therefore cause acute or chronic inflammatory response [3]. The microbiota responsible for AAA development is highly diverse and complex. It dominantly consists of strict anaerobic species inhabiting in the environment of necrotic pulp and associated periapical tissues [4]. The application of molecular methods to identify root canal microorganisms has significantly improved the knowledge of AAA etiology. These techniques enabled the discovery of previously uncultivable species [5].

Clinically, the patient is presented with pain and swelling usually located intraorally but it has the potential to spread rapidly into surrounding maxillofacial structures and lead to systemic complications. Severe clinical cases may manifest symptoms such as fever, fatigue, general malaise, lymphadenopathy, nausea. Most often, due to the vigorous reaction to the dissemination of infection from the endodontic space, resorption of the surrounding bone does not occur, so the disease is radiographically undetectable. However, in the situations where radiographic evidence of surrounding bone resorption is evident, the AAA is described as an acute flare up of a pre-existing chronic infection [2]. The first step in AAA treatment is to eliminate the purulent collection by effective drainage. Antibiotic therapy is necessary only for patients with systemic symptoms [6].

This case report describes non-surgical endodontic treatment of a maxillary lateral incisor with AAA and extensive resorption of the surrounding bone.

Case report

A 58-year-old male patient presented at the Department of Dental Pathology with Endodontics at the Faculty of Dentistry with Dental Clinical Center, complaining of mild pain and swelling in the maxillary incisor region. The patient's medical history was unremarkable.

Clinical inspection revealed an intraoral swelling positioned labially relative to the apex of the tooth #22. Digital palpation confirmed a soft consistency of the edema, which clinically suggested a significant cortical bone loss in that region in addition to Grade 1 tooth mobility. Clinical evidence led to the Acute Apical Abscess diagnosis.

Case management

Emergency endodontic treatment of the tooth #22 was performed under aseptic conditions. An access cavity was prepared and root canal orifice was widened and shaped using a Gates-Glidden bur. Subsequently, root canal patency was achieved with a size #10 hand K-file (Denco Medical Co., Shenzhen, China). Trans canal drainage was established for decompression and exudate release, which is essential for symptom relief. Copious irrigation with 2.5% sodium hypochlorite (NaOCl) and 2% chlorhexidine (CHX) was performed, including mandatory saline solution irrigation in between. An electronic apex locator (Woodpecker Guilin, China) was used to determine working length. Root canal instrumentation was performed using Mtwo® rotary files (VDW, Munich, Germany) with apical enlargement up to size 24/04. Intracanal dressing of UltraCal XS calcium hydroxide (Ultradent, South Jordan, Utah, USA) was applied for seven days. The access cavity was sealed by temporary restorative glass ionomer cement. Due to the severity of the symptoms and the need for immediate pain relief, urgent intervention was prioritized and the periapical

Figure 1. Periapical radiograph of the tooth #22 revealed extensive surrounding bone resorption after first calcium hydroxide application

Figure 2. The seven day follow-up control periapical radiograph revealed significant healing of pre-existing lesion.

Figure 3. Post-operative obturation control.

Figure 4. Three year follow-up.

radiograph was performed postoperatively. Radiographic analysis revealed significant bone resorption which involved apically two-thirds of the root length #22 **(Figure 1)**. Due to the severity of bone resorption and uncertain treatment outcome, the patient was advised to undergo an apicoectomy with bone grafting. Patient declined, insisting on a conservative approach. A mandatory follow-up visit was scheduled in seven days.

At the follow-up examination, pain and swelling were significantly reduced. Control periapical radiograph demonstrated significant healing of the previously diagnosed lesion **(Figure 2)**. The same treatment protocol was repeated, including instrumentation, irrigation, intracanal calcium hydroxide medication with temporary glass ionomer restoration.

Since this occurred during the COVID-19 pandemic, dental visits were limited, the subsequent visit took place after a six-month interval. Given the prolonged interval between appointments, the previous treatment steps were repeated.

The patient returned after two years, stating the COVID-19 pandemic as the reason for the non-attendance. Since the access cavity had been sealed with glass ionomer cement, clinical inspection revealed that the restoration remained intact with

preserved marginal integrity. Root canal was obturated using the monocone technique with the Mtwo®-matched gutta-percha and MTA-based bio ceramic sealer Bioseal (Itena Clinical, Paris, France). A postoperative periapical radiograph was taken and revealed significant bone healing **(Figure 3)**. After two days, the definitive coronal restoration of the tooth was performed. The recall appointment occurred three years after obturation and confirmed adequate root canal filling and complete periapical healing **(Figure 4)**.

Discussion

The primary goal of AAA management is to establish adequate drainage and evacuation of purulent exudate. Based on the clinical findings, drainage can be achieved via several methods: trans canal approach, incision and drainage in cases of fluctuating swelling, or in the most severe cases via tooth extraction [2]. trans canal drainage, thorough irrigation and instrumentation of the root canal system is the most preferred method. Subsequent to achieving adequate drainage, intracanal medication is necessary to prevent the proliferation of residual microorganisms [7].

Calcium hydroxide is considered the gold standard for root canal medication. [8] It has a dual mechanism of action: antimicrobial activity related to high alkalinity and bio inductive effect by promoting bone healing [9, 10]. Calcium hydroxide dissociates into calcium ions (Ca^{2+}) and highly reactive hydroxyl ions (OH^-) in contact with periapical tissue fluids. The alkaline environment (pH 12.5-12.8) is highly effective against most microorganisms by inducing cytoplasmic membrane disruption, protein denaturation and DNA destruction within bacterial cells. Furthermore, calcium hydroxide is a potent anti-endotoxin agent responsible for bacterial lipopolysaccharide (LPS) neutralization. LPS, also known as endotoxins, are the key virulence factors of Gram-negative bacteria that induce acute inflammation. Endotoxin concentration is directly correlated with the extent of surrounding bone destruction [11]. LPS present in the root canal system and periapical area are powerful immunostimulatory. They trigger a strong host immune response, leading to proinflammatory cytokines release that are involved in apical periodontitis pathogenesis. Consequently, as an anti-endotoxin agent, calcium hydroxide significantly facilitates and accelerates the healing of periapical tissues [11]. Marinho AC et al. [11] demonstrated that intracanal medication in a 30-day period effectively reduces endotoxin levels, even in chronic apical periodontitis.

The role of the vehicle (carrier) is crucial for the calcium hydroxide kinetics. The specific type of vehicle directly influences the rate and concentration of the calcium and hydroxyl ion dissociation [12]. Vehicles are classified as aqueous (water-based) or viscous (oil-based). The aqueous vehicles are characterized by rapid dissociation but limited longevity, while the viscous vehicles provide sustained ion release, maintaining elevated pH levels [13,14]. In the presented case, UltraCal XS calcium hydroxide was used: a pre-mixed paste of calcium hydroxide in an aqueous vehicle with a methylcellulose suspension. This modified vehicle provides increased viscosity and easier application into the root canal, and ensures uniform distribution of calcium hydroxide particles. Furthermore, methylcellulose acts as a slow-dissolving matrix, thereby prolonging the biological activity of the calcium hydroxide. Although oil-based pastes were traditionally favored for large periapical lesions, aqueous-based calcium hydroxide paste was intentionally selected based on previously described benefits. In this case report, the elimination of infection through drainage, instrumentation and irrigation, combined with the repeated calcium hydroxide application created the necessary environment for the medicament's full therapeutic potential.

Systemic antibiotics were not prescribed. The decision was based on the absence of systemic symptoms and the spreading of the infection, coupled with adequate drainage and evacuation of the purulent exudate [15].

Conclusion

This case report demonstrates the significance of long-term calcium hydroxide dressing in AAA with large periapical bone resorption. Despite extensive bone loss, the extended medication protocol led to bone healing, enabling a successful root canal treatment. Bone healing is one of the reliable indicators to proceed with the root canal treatment, even with large periapical lesions.

Declaration of interest: Authors declare NO conflict of interest.

References

1. DynaMed. Acute Apical Dental Abscess. Ipswich (MA): EBSCO Information Services. [Updated May 15, 2025]. Available from: https://www.dynamed.com/condition/acute-apical-dental-abscess#GUID-14430C12-AE43-434F-AA45-9F3F0295D2E0 . [Accessed November 24, 2025].
2. Siqueira JF Jr, Rôças IN. Microbiology and treatment of acute apical abscesses. Clin Microbiol Rev. 2013 Apr;26(2):255-73.
3. Sasaki H, Stashenko P. Interrelationship of the pulp and apical periodontitis. In: Hargreaves KM, Goodis HE, Tay FR, editors. Seltzer and Bender's Dental Pulp. 2nd ed. Chicago: Quintessence Publishing; 2012. p. 277–99.
4. de Sousa ELR, et al. Bacteriological study of root canals associated with periapical abscesses. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003;96(3):332–9.
5. Konjhodzic A, Hasic Brankovic L, Tahmiscija I, Dzankovic A, Korac S, Pasic M, Begovic A, Halilovic Mehinovic M, Salihefendic L. Molecular Genetic Identification Methods of Microorganisms in Root Canals. Stomatological Review. 2023;12(2):60–7.
6. Matthews DC, Sutherland S, Basrani B. Emergency management of acute apical abscesses in the permanent dentition: a systematic review of the literature. J Can Dent Assoc. 2003 Nov;69(10):660.
7. Dixit S, Dixit A, Kumar P. Nonsurgical Treatment of Two Periapical Lesions with Calcium Hydroxide Using Two Different Vehicles. Case Rep Dent. 2014;2014:901497.
8. Ba-Hattab R, Al-Jamie M, Aldreib H, Alessa L, Alonazi M. Calcium Hydroxide in Endodontics: An Overview. Open J Stomatol. 2016;6(12).
9. Estrela C, Cintra LTA, Duarte MAH, Rossi-Fedele G, Gavini G, Sousa-Neto MD. Mechanism of action of Bioactive Endodontic Materials. Braz Dent J. 2023 Jan-Feb;34(1):1-11.
10. Paula-Silva FW, Ghosh A, Arzate H, Kapila S, da Silva LA, Kapila YL. Calcium hydroxide promotes cementogenesis and induces cementoblastic differentiation of mesenchymal periodontal ligament cells in a CEMP1- and ERK-dependent manner. Calcif Tissue Int. 2010 Aug;87(2):144-57.
11. Marinho ACS, Martinho FC, Zaia AA, Ferraz CCR, Gomes BPFA. Monitoring the effectiveness of root canal procedures on endotoxin levels found in teeth with chronic apical periodontitis. J Appl Oral Sci. 2014;22(6):490–5.
12. Nguyen V. The Purpose of Calcium Hydroxide in Root Canal Treatment. Int J Res Appl Sci Eng Technol. 2023;11:49446.
13. Safavi KE, Nakayama TA. Influence of Mixing Vehicle on Dissociation of Calcium Hydroxide in Solution. J Endod. 2000;26(11):649–51.
14. Eftekhar B, Moghimipour E, Eini E, Jafarzadeh M, Behrooz N. Evaluation of Hydroxyl Ion Diffusion in Dentin and Injectable Forms and a Simple Powder-Water Calcium Hydroxide Paste: An in Vitro Study. Jundishapur J Nat Pharm Prod. 2014;9(3):e14029.

Cope AL, Francis N, Wood F, Thompson W, Chestnutt IG. Systemic antibiotics for symptomatic apical periodontitis and acute apical abscess in adults. Cochrane Database Syst Rev. 2024;5:CD010136.