

INTEGRATED ENDODONTIC–SURGICAL MANAGEMENT OF A LATERAL PERIODONTAL CYST USING APICOECTOMY AND STRONTIUM SILICATE-BASED BIOACTIVE ROOT-END FILLING: A CASE REPORT

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ABSTRACT:

Background: Lateral periodontal cyst (LPC) is a rare developmental odontogenic cyst usually associated with vital teeth. Its occurrence with pulpal necrosis may mimic inflammatory periapical lesions, making diagnosis challenging.

Case Presentation: A 34-year-old female presented with a radiolucent lesion between the maxillary right lateral incisor and canine. Root canal treatment was performed, followed by surgical enucleation, apicoectomy, and retrograde filling with the strontium silicate-based bioactive material C-Root BP. Histopathological examination confirmed the diagnosis of LPC.

Results: Healing was uneventful, and the three-month follow-up showed reduction in lesion size with the patient remaining asymptomatic.

Conclusion: Combined endodontic and surgical management using C-Root BP resulted in favourable early clinical and radiographic outcomes. Histopathological examination remains essential for definitive diagnosis of atypical LPC cases

KEYWORDS: C-Root BP, Strontium-silicate, Lateral Periodontal Cyst, Retrograde filling, Apicoectomy, Apicectomy, Endosurgery

INTRODUCTION

The lateral periodontal cyst (LPC) is a non-inflammatory, intra-osseous cyst that arises in proximity of the roots of vital teeth. The World Health Organization's (WHO) classification of odontogenic tumors and cysts (4th Edition, 2017) classifies LPC as an odontogenic cyst of developmental origin. It makes up only 0.4% of all odontogenic cysts, making it a very uncommon odontogenic lesion. 1

Lateral periodontal cysts (LPCs) are typically asymptomatic and are most often detected incidentally during routine radiographic examinations. They occur predominantly in the alveolar bone of the mandibular canine–premolar region, with the anterior maxillary alveolar process being the second most common site. Clinically, some patients may present with a painless gingival swelling on the facial or lingual aspect between adjacent teeth. Although uncommon, symptoms such as pain, tenderness, and cortical bone expansion have also been reported in the literature. 1

On radiographic examination LPC typically appears as a well-defined, round or ovoid radiolucent lesion surrounded by a thin sclerotic border, with most lesions measuring less than 1 cm in diameter. 1

The associated teeth are typically vital unless affected by periodontal disease, dental caries, or other factors leading to pulpal necrosis.2,3 In cases where pulpal necrosis and associated periapical pathology coexist, management requires a combined endodontic and surgical approach. Successful treatment depends on meticulous disinfection and complete elimination of intracanal infection during the endodontic phase, followed by surgical enucleation of the pathological lesion and effective sealing of the root apex to facilitate optimal periapical healing.4,5

In recent years, bioactive root-end filling materials have significantly improved the predictability of surgical endodontic procedures. Among these, C-Root BP (Beijing C- Root Dental Medical Devices Co. Ltd., Beijing, China), a novel premixed, ready-to-use strontium silicate-based bioceramic material, has emerged as a promising alternative for various endodontic applications, including root repair, root-end filling, apexification, and vital pulp therapy. The material is insoluble, radiopaque, aluminium-free, and moisture-activated, allowing it to set in the presence of tissue fluids. Its

formulation comprises strontium silicate and calcium phosphate, which enhances its bioactivity and mineralization potential, while tantalum oxide provides radiopacity, making it a suitable material for root-end sealing during endodontic microsurgery.⁶

Case Report

A 34-year-old female presented to the Department of Conservative Dentistry and Endodontics with a chief complaint of a mild swelling in the upper right anterior region that had been present for two months. Her medical history was non-contributory, and no history of trauma or systemic illness was reported. Clinical examination revealed a mild, non-tender swelling in the region of the maxillary right lateral incisor and canine (teeth 12 and 13). No sinus tract formation or abnormal tooth mobility was observed. Pulp vitality testing demonstrated that both the involved teeth were non-responsive, indicating pulpal necrosis and warranting further radiographic evaluation.

Radiographic examination revealed a well-defined, unilocular radiolucent lesion located between the roots of the maxillary right lateral incisor and canine (teeth 12 and 13) (Fig 1). The lesion exhibited well-circumscribed borders without evidence of significant root resorption of the adjacent teeth. Based on the clinical and radiographic findings, a provisional diagnosis of a radicular cyst associated with pulpal necrosis was considered.

Therapeutic Intervention

Following clinical and radiographic evaluation, nonsurgical root canal treatment of teeth 12 and 13 was initiated as the first phase of treatment to eliminate intracanal infection and minimize the risk of reinfection before surgical intervention. Under rubber dam isolation, access cavities were prepared, and the working lengths were established using an electronic apex locator and confirmed radiographically (Fig 2a). Biomechanical preparation was performed using nickel–titanium rotary instruments to a master apical file size of #35/.06, with copious irrigation using 5.25% sodium hypochlorite throughout instrumentation. A final rinse with 17%EDTA was used for smear layer removal, and the irrigants were activated with an ultrasonic activator to enhance canal disinfection. Calcium hydroxide was placed as an intracanal medicament for seven days for 2 consecutive visits. At the subsequent visit, following complete removal of the medicament, the canals were dried and obturated using the single-cone technique with BioRoot RCS sealer (Fig 2b). Adequate orthograde root canal disinfection and obturation were considered essential to eliminate residual microorganisms and establish an effective corono-apical seal prior to surgical management.

Subsequently, surgical enucleation of the lesion was performed under local anesthesia. A full thickness mucoperiosteal flap was reflected to expose the periapical lesion, following which complete cyst enucleation was carried out while preserving the surrounding alveolar bone. The excised specimen was submitted for histopathological examination. Apicoectomy was then performed by resecting approximately 3 mm of the apical portion of teeth 12 and 13 perpendicular to the long axis of the roots to eliminate the apical ramifications and lateral canals. Root-end cavities, approximately 3 mm in depth, were prepared using ultrasonic retrograde tips, ensuring centered and well-defined cavity preparations.

The prepared retrograde cavities were filled with C-Root BP, a premixed strontium silicate-based bioactive root-end filling material. Owing to its excellent sealing ability, superior biocompatibility, bioactivity, and favorable handling characteristics, the material was selected to promote periapical healing. In addition to providing an effective apical seal, the release of strontium ions is known to stimulate osteoblastic activity, inhibit osteoclastic bone resorption, and enhance bone regeneration. Furthermore, its alkaline environment imparts antibacterial properties, while its relatively shorter setting time compared with mineral trioxide aggregate (MTA) facilitates clinical application.

Histopathological examination of the excised lesion revealed a thin non-keratinized epithelial lining with focal epithelial plaques supported by a fibrous connective tissue capsule, confirming the diagnosis of a lateral periodontal cyst.

Postoperative healing was uneventful, with satisfactory soft tissue healing observed at the one-week follow-up. Radiographic evaluation at three months demonstrated a reduction in the size of the radiolucent lesion (Fig 4). The patient remained asymptomatic, and the treated teeth were functional throughout the follow-up period.



Figure 1 Preoperative radiograph showing a well-defined, unilocular radiolucent lesion located between the roots of the maxillary right lateral incisor and canine (teeth 12 and 13).

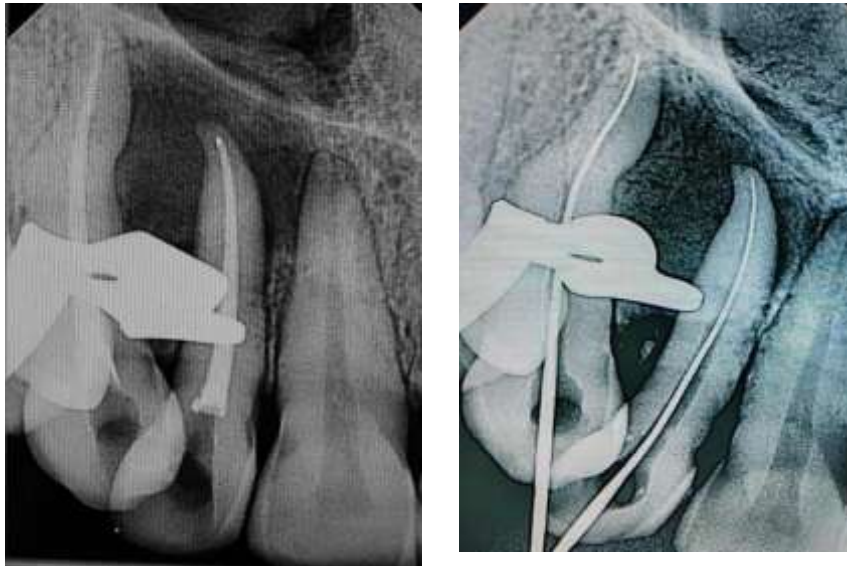


Figure 2 (a) Radiograph confirming Working length (b) Radiograph Showing Obturation with Single cone obturation technique in teeth 12 and 13.



Figure 3 Postoperative radiograph



Figure 4 Radiograph at three months demonstrating a reduction in the size of the radiolucent lesion

DISCUSSION

Lateral periodontal cyst (LPC) is a rare, non-inflammatory developmental odontogenic cyst that typically occurs adjacent to the lateral surface of the root of a vital tooth. It represents one of the least common developmental odontogenic cysts and is usually asymptomatic, with most cases being detected incidentally during routine radiographic examination. Radiographically, LPC characteristically presents as a small, well-defined, round or ovoid unilocular radiolucency surrounded by a corticated or sclerotic border, with the majority of lesions measuring less than 1 cm in diameter.^{2,3} Histopathologically, LPC is characterized by a thin, non-keratinized epithelial lining, generally one to five cell layers thick, resembling the reduced enamel epithelium. The epithelial lining frequently demonstrates focal plaque-like thickenings containing glycogen-rich clear cells, while the underlying connective tissue often exhibits areas of hyalinization.^{3,7} Owing to its overlapping clinical and radiographic features, LPC should be differentiated from lesions of endodontic and periodontal origin as well as other developmental odontogenic cysts.^{3,8} Furthermore, its histogenetic relationship with the gingival cyst of the adult, botryoid odontogenic cyst, and glandular odontogenic cyst has been suggested, indicating a possible common developmental origin.^{3,7}

The present case is unusual because lateral periodontal cysts are classically associated with vital teeth, whereas the involved teeth in this case were non-vital and failed to respond to pulp vitality testing.^{2,9,10} This atypical presentation created a diagnostic challenge, as the lesion closely resembled an inflammatory periapical lesion, such as a radicular cyst or lateral radicular cyst, on both clinical and radiographic examination.^{2,9} Consequently, establishing a definitive diagnosis based solely on clinical and radiographic findings was difficult. Histopathological evaluation following surgical enucleation was therefore essential to confirm the diagnosis of a lateral periodontal cyst.^{9,10} Similar diagnostic dilemmas have been reported in the literature, where LPCs associated with non-vital teeth have been mistaken for endodontic lesions because of their overlapping clinical and radiographic characteristics.⁹ The coexistence of pulpal necrosis with an LPC in the present case necessitated a combined endodontic and surgical approach to address both the intracanal infection and the developmental cyst, thereby ensuring complete resolution of the pathology.^{4,12}

In the present case, a combined orthograde endodontic and microsurgical approach was adopted to achieve complete elimination of infection and facilitate periapical healing. According to Kim and Kratchman, successful endodontic microsurgery depends on meticulous root-end management, including apicoectomy, ultrasonic retrograde cavity preparation, and placement of a biocompatible root-end filling material.⁴ Resection of approximately 3 mm of the root apex is recommended because this removes the majority of apical ramifications and lateral canals, which are potential reservoirs for persistent microorganisms and may contribute to treatment failure if left untreated.^{4,12} Ultrasonic retrograde preparation provides a conservative, centered cavity aligned with the long axis of the root, resulting in improved access, minimal removal of sound dentin, and enhanced retention of the retrograde filling material.^{4,13}

The selection of an appropriate root-end filling material is a critical determinant of the success of endodontic microsurgery, as it must provide a hermetic apical seal while promoting regeneration of the surrounding periapical tissues.⁴ In the present case, C-Root BP, a premixed strontium silicate-based bioactive root-end filling material, was used because of its favorable physicochemical and biological properties. This moisture-activated biomaterial exhibits excellent sealing ability, superior biocompatibility, bioactivity, and favorable handling characteristics, making it well suited for root-end filling procedures.¹⁴ In addition to establishing an effective apical seal, its composition of strontium silicate and calcium phosphate promotes hydroxyapatite formation and mineralization at the material–tissue interface.^{15,16} The sustained release of strontium ions has been reported to stimulate osteoblastic activity, inhibit osteoclast-mediated bone resorption, and enhance bone regeneration, thereby creating a favorable environment for periapical healing. Furthermore, the alkaline pH generated during setting contributes to its antibacterial properties, while its relatively shorter setting time compared with mineral trioxide aggregate (MTA) facilitates clinical application.¹⁴ Collectively, these characteristics position C-Root BP as a promising alternative to conventional calcium silicate-based materials for endodontic microsurgery.¹⁷

Histopathological examination remains the gold standard for the definitive diagnosis of lateral periodontal cyst (LPC), particularly in cases presenting with atypical clinical and radiographic features. In the present case, microscopic examination revealed a thin non-keratinized epithelial lining with focal epithelial plaques supported by a fibrous connective tissue capsule, findings that are characteristic of LPC. These histological features closely correspond to the diagnostic criteria described by Wysocki et al. and Altini and Shear, who reported that LPC is typically lined by a thin epithelium resembling reduced enamel epithelium with localized plaque-like epithelial thickenings containing glycogen-rich clear cells.^{3,7} The 2022 World Health Organization (WHO) Classification of Head and Neck Tumours also recognizes these microscopic features as diagnostic hallmarks of LPC.^{7,10} Histopathological confirmation was particularly important in the present case because the associated teeth were non-vital and the lesion closely resembled an inflammatory periapical lesion both clinically and radiographically. Therefore, definitive diagnosis could not be established on the basis of clinical and radiographic findings alone, emphasizing the indispensable role of histopathological evaluation in differentiating LPC from radicular cysts and other odontogenic lesions.²

CONCLUSION

This case highlights the importance of a comprehensive diagnostic approach in the management of lateral periodontal cysts presenting with atypical features. The presence of pulpal necrosis associated with an LPC can closely mimic inflammatory periapical lesions, making definitive diagnosis dependent on histopathological examination. A combined orthograde endodontic and surgical approach effectively addressed both the intracanal infection and the cystic pathology, resulting in favorable clinical and radiographic outcomes. Furthermore, the successful use of C-Root BP, a novel strontium silicate-based bioactive root-end filling material, demonstrated its potential to provide an effective apical seal while

promoting periapical healing and bone regeneration. The reduction in lesion size and satisfactory healing observed at the 3-month follow-up suggest that this treatment strategy is a promising and biologically favorable option for managing atypical cases of LPC associated with pulpal necrosis. However, longer-term follow-up and further clinical studies with larger sample sizes are required to evaluate the long-term success and clinical performance of C-Root BP in endodontic microsurgery.

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