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Non-surgical Endodontic Retreatment of a Large Periapical Lesion With External Apical Resorption Using Calcium Silicate-Based Materials: A Case Report

Harikaran Jayakkodi [1], Farzana Thasni CT [2], Nandhini K [1]

1. Department of Conservative Dentistry and Endodontics, Vinayaka Missions University, Salem, IND 2. Department of Conservative Dentistry and Endodontics, Educare Institute of Dental Sciences, Malappuram, IND

Corresponding author: Harikaran Jayakkodi, drjhari@yahoo.com

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Abstract

Large periapical lesions associated with previously treated teeth and external apical resorption can present a clinical challenge during endodontic retreatment. Although surgical intervention may be considered in selected cases, orthograde retreatment can provide a conservative treatment option when adequate disinfection and apical sealing can be achieved. A 30-year-old male patient presented with a chief complaint of pain in the maxillary left anterior region for the past one month, associated with a previously root canal-treated maxillary left central incisor (tooth 21), which exhibited an inadequately obturated canal, a large periapical radiolucency measuring approximately 12 × 10 mm, a pre-existing lateral root perforation, and external apical resorption. Non-surgical endodontic retreatment was performed following the removal of the previous root filling and chemomechanical preparation. The working length was established at 21 mm, and the canal was prepared to a final apical size corresponding to ProTaper Gold F4 (Dentsply Sirona, Ballaigues, Switzerland). Sodium hypochlorite, ethylenediaminetetraacetic acid, ultrasonic activation, and calcium hydroxide medication were used to facilitate canal disinfection. Because of the enlarged and resorbed apical region, a 4-mm mineral trioxide aggregate apical plug was placed to establish an apical barrier. The remaining canal was obturated using thermoplasticized gutta-percha backfill with CeraSeal calcium silicate-based bioceramic sealer (Meta Biomed Co., Ltd., Cheongju-si, Republic of Korea). At the three-month follow-up, the patient was asymptomatic, and radiographic examination revealed an approximately 2-mm reduction in the dimensions of the periapical radiolucency, with the lesion measuring approximately 10 × 8 mm. Further clinical and radiographic follow-up at six, 12, and 24 months is planned to evaluate the progression and stability of periapical healing. This case suggests that orthograde retreatment with appropriate disinfection and establishment of an apical barrier may be considered a conservative treatment option in selected previously treated teeth associated with large periapical lesions and external apical resorption.

Categories: Dentistry
Keywords: apical plug, calcium silicate-based sealer, endodontic retreatment, external apical root resorption, large periapical lesion, mineral trioxide aggregate (mta)

Introduction

Persistent apical periodontitis is commonly associated with microorganisms that remain within the root canal system following endodontic treatment. Inadequate instrumentation, incomplete disinfection, and inadequate root canal filling may contribute to persistent infection and treatment failure [1]. Large periapical radiolucencies associated with previously treated teeth may pose a diagnostic and therapeutic challenge. However, lesion size alone does not establish a histopathological diagnosis of a radicular cyst [2].

Following the establishment of an apical barrier, the remaining canal space can be obturated using thermoplasticized gutta-percha in conjunction with calcium silicate-based bioceramic sealers. These sealers have gained clinical use because of their favorable flow characteristics and physicochemical properties [3].

External apical resorption presents a significant challenge during endodontic obturation because the loss of apical root structure can result in an enlarged and irregular apical terminus. This altered anatomy may compromise the apical seal and increase the risk of extrusion of obturation materials into the periapical tissues. In such situations, placement of an artificial apical barrier using mineral trioxide aggregate (MTA) can provide a controlled endpoint for subsequent obturation [4]. In the present case, a 4-mm MTA apical plug was placed in the apical third to establish an apical barrier. The remaining canal space was subsequently obturated using thermoplasticized gutta-percha backfill in conjunction with CeraSeal, a calcium silicate-based bioceramic sealer (Meta Biomed Co., Ltd., Cheongju-si, Republic of Korea).

The clinical relevance of this case lies in the coexistence of a pre-existing lateral root perforation, external apical resorption, and a large periapical lesion in a previously treated tooth. Such cases present challenges

in retreatment, particularly in achieving adequate disinfection and establishing a predictable apical endpoint for obturation. Previous clinical evidence supports non-surgical endodontic treatment as a potential approach for managing selected teeth associated with large periapical lesions [5]. This case illustrates the considerations involved in adopting a conservative non-surgical retreatment approach in the presence of these complications. Although the techniques employed are established endodontic procedures, their application in this clinical scenario provides a useful clinical learning point.

Case Presentation

Patient information and chief complaint

A 30-year-old male patient presented with a chief complaint of pain in the maxillary left anterior region for one month, associated with a previously root canal-treated maxillary left central incisor (tooth 21).

Clinical and radiographic examination

On clinical examination, tooth 21 was tender to both vertical percussion and palpation. There was no evidence of tooth mobility, soft-tissue swelling, or sinus tract formation. Periodontal probing depths were assessed, and sensibility testing was performed on the adjacent teeth for comparison.

The crown margins and coronal seal were clinically evaluated and found to be satisfactory.

Periapical radiographic examination revealed inadequate obturation of the previous root canal treatment, a large periapical radiolucency, and external apical root resorption (Figure *1*).

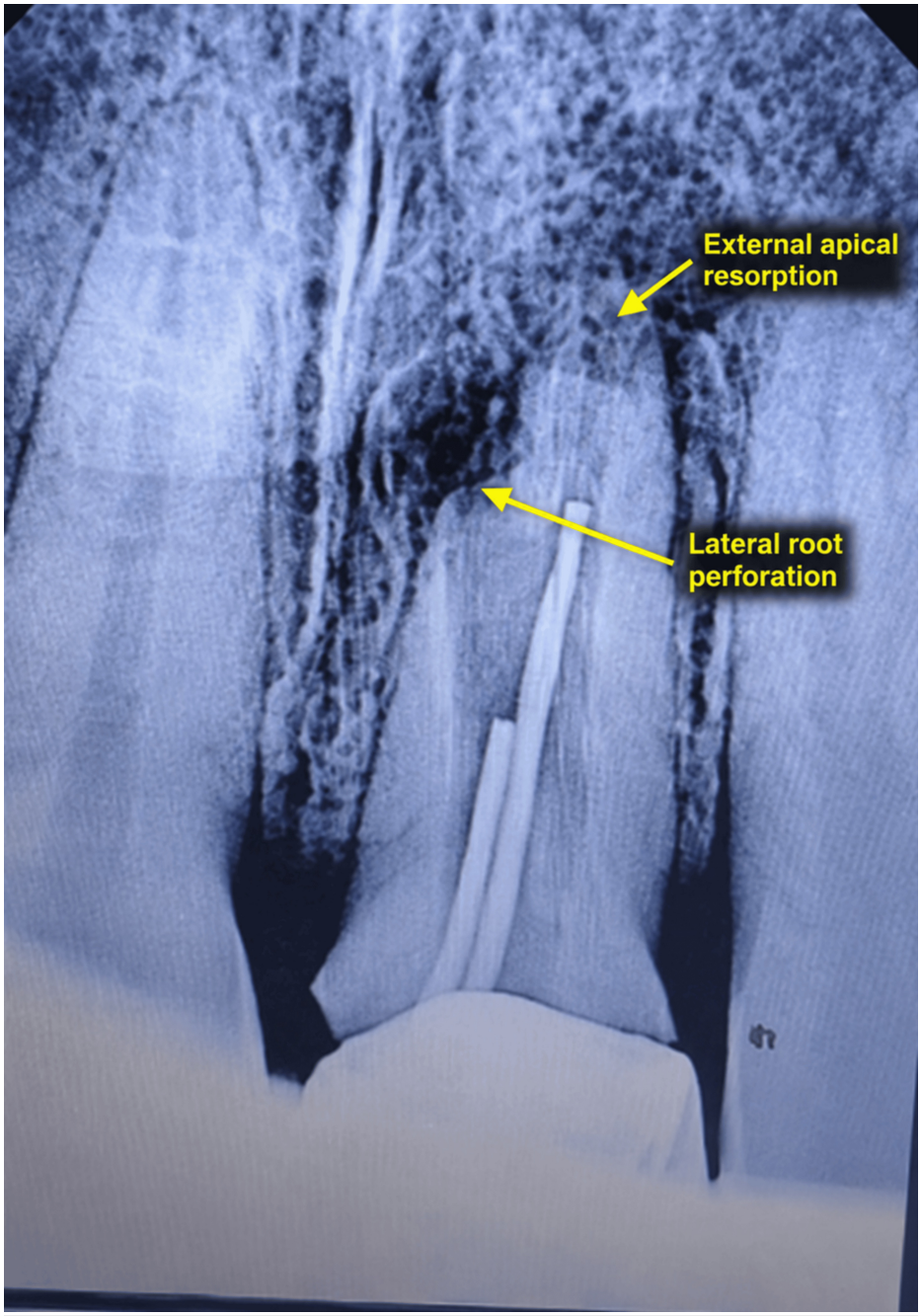

FIGURE 1: Preoperative intraoral periapical radiograph of tooth 21 showing the previously treated root canal, inadequate previous obturation, large periapical radiolucency, external apical resorption, and pre-existing lateral root perforation in the mesial aspect.

Cone-beam computed tomography (CBCT) evaluation of tooth 21 revealed a lateral root perforation measuring approximately 1.3 mm, located 3 mm coronal to the root apex along the mesial aspect of the root. The previous root canal filling material terminated approximately 4 mm short of the radiographic apex. Additional findings included localized periradicular osteolysis, internal root canal resorption, and external apical root resorption. The associated inflammatory periapical lesion measured approximately 7.8 × 9.5 × 5.3 mm. The radiographic working length was approximately 20.9 mm (Figures *2*-*4*).

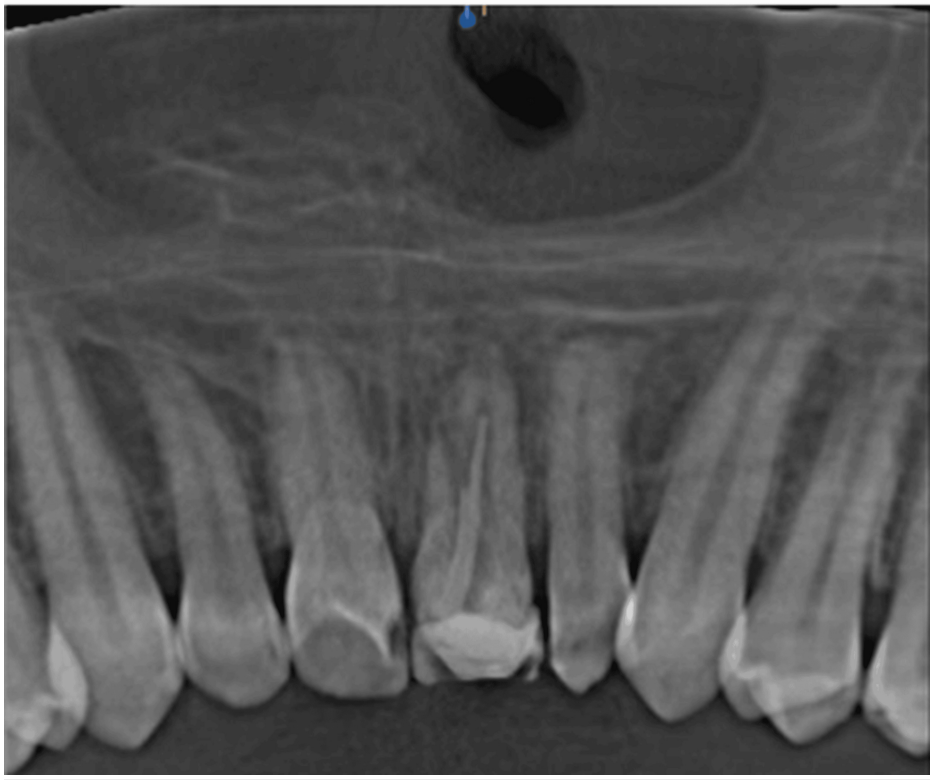

FIGURE 2: Reconstructed panoramic image demonstrating the anterior maxillary region and the periapical pathology associated with tooth 21.

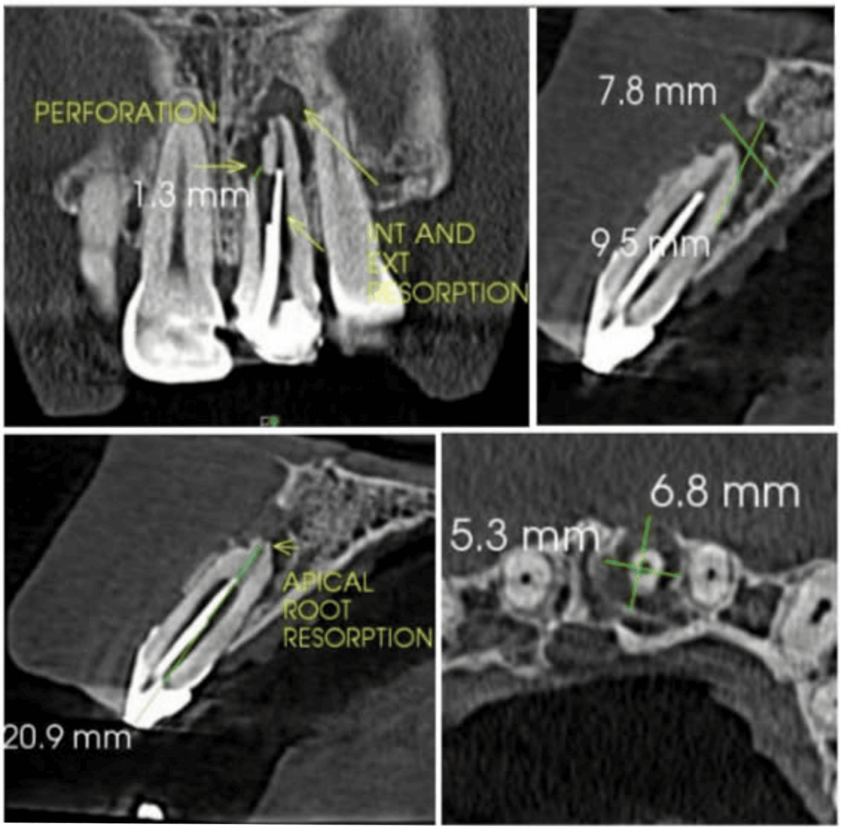

FIGURE 3: Preoperative cone-beam computed tomography images demonstrating the periapical lesion, external apical resorption, and pre-existing lateral root perforation associated with tooth 21.

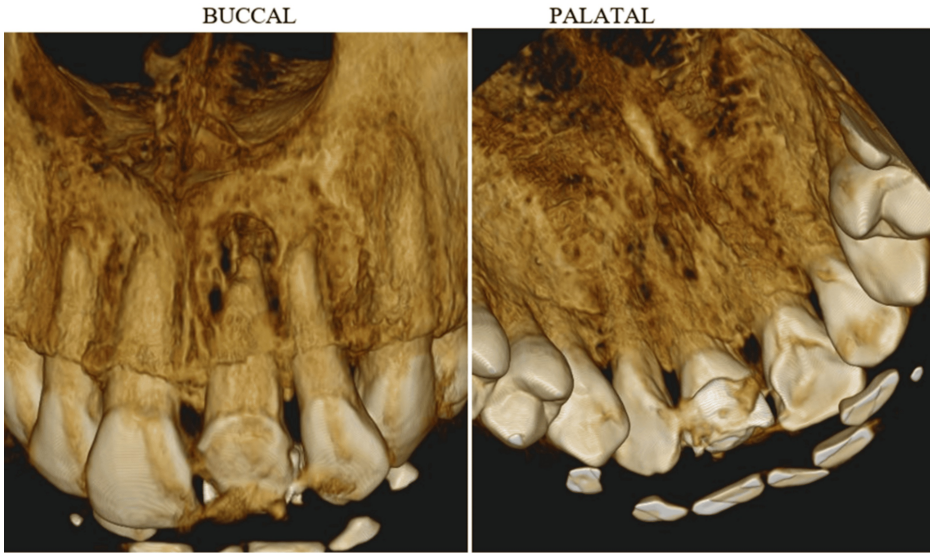

FIGURE 4: Three-dimensional reconstructed images demonstrating the buccal and palatal aspects of the anterior maxilla and the region associated with tooth 21.

Diagnosis and treatment planning

Based on the clinical and radiographic findings, the tooth was diagnosed with symptomatic post-treatment apical periodontitis associated with inadequate previous root canal obturation, external apical root resorption, internal root canal resorption, and a pre-existing lateral root perforation.

Despite the associated complications, tooth 21 was considered restorable. Therefore, a conservative non-surgical endodontic retreatment approach was selected as the initial treatment strategy.

Considering the satisfactory condition of the existing crown margins and coronal seal, immediate removal and replacement of the crown was not considered necessary. Furthermore, considering the anterior location and associated esthetic considerations, the existing crown was retained during retreatment. Crown replacement was planned for consideration during subsequent follow-up if clinically indicated.

Treatment procedure

Following the administration of local anesthesia, rubber dam isolation was achieved. Access was performed through the existing crown using transmetal burs, allowing the preservation of the existing prosthetic restoration.

The previous root filling material was removed using ProTaper Universal Retreatment files D1, D2, and D3 (Dentsply Sirona, Ballaigues, Switzerland). The working length was established at 21 mm. Cleaning and shaping were subsequently performed using ProTaper Gold rotary instruments (Dentsply Sirona, Ballaigues, Switzerland), with final apical enlargement to F4.

Irrigation was performed using 3% sodium hypochlorite (NaOCl; 20 mL), followed by 17% ethylenediaminetetraacetic acid (EDTA; 5 mL) and subsequent saline irrigation. Passive ultrasonic irrigation was performed using a Woodpecker ultrasonic unit fitted with an E1 endodontic holder and a non-cutting ultrasonic U-file (#25/.02). The irrigant was activated in three cycles of 20 seconds each, with replenishment between cycles. The ultrasonic file was positioned approximately 2 mm short of the working length and maintained passively without binding against the canal walls. Considering the presence of external apical resorption, care was taken to minimize the risk of apical extrusion.

Calcium hydroxide was placed as an intracanal medicament for 14 days as an adjunct to chemomechanical preparation. However, its use should not be interpreted as ensuring complete microbial elimination, particularly against resistant microorganisms such as *Enterococcus faecalis*.

At the subsequent appointment, the patient was asymptomatic. The calcium hydroxide intracanal medicament was removed using gentle instrumentation and irrigation with 3% NaOCl. Passive ultrasonic activation was performed to facilitate the removal of residual medicament. The canal was subsequently irrigated with 17% EDTA, followed by saline, and dried using sterile paper points.

Because of the enlarged and irregular apical anatomy resulting from external apical resorption, a 4-mm MTA apical plug was placed in the apical third using an MTA carrier and hand pluggers to establish an artificial apical barrier.

The remaining canal space was obturated using a down-pack and thermoplasticized gutta-percha backfill technique. CeraSeal calcium silicate-based bioceramic sealer was used in conjunction with thermoplasticized gutta-percha. The Fi-P and Fi-G obturation system (Guilin Woodpecker Medical Instrument Co., Ltd., Guilin, China) was used for the down-pack and backfill procedure. The postoperative radiograph demonstrated a dense root canal filling (Figure *5*).

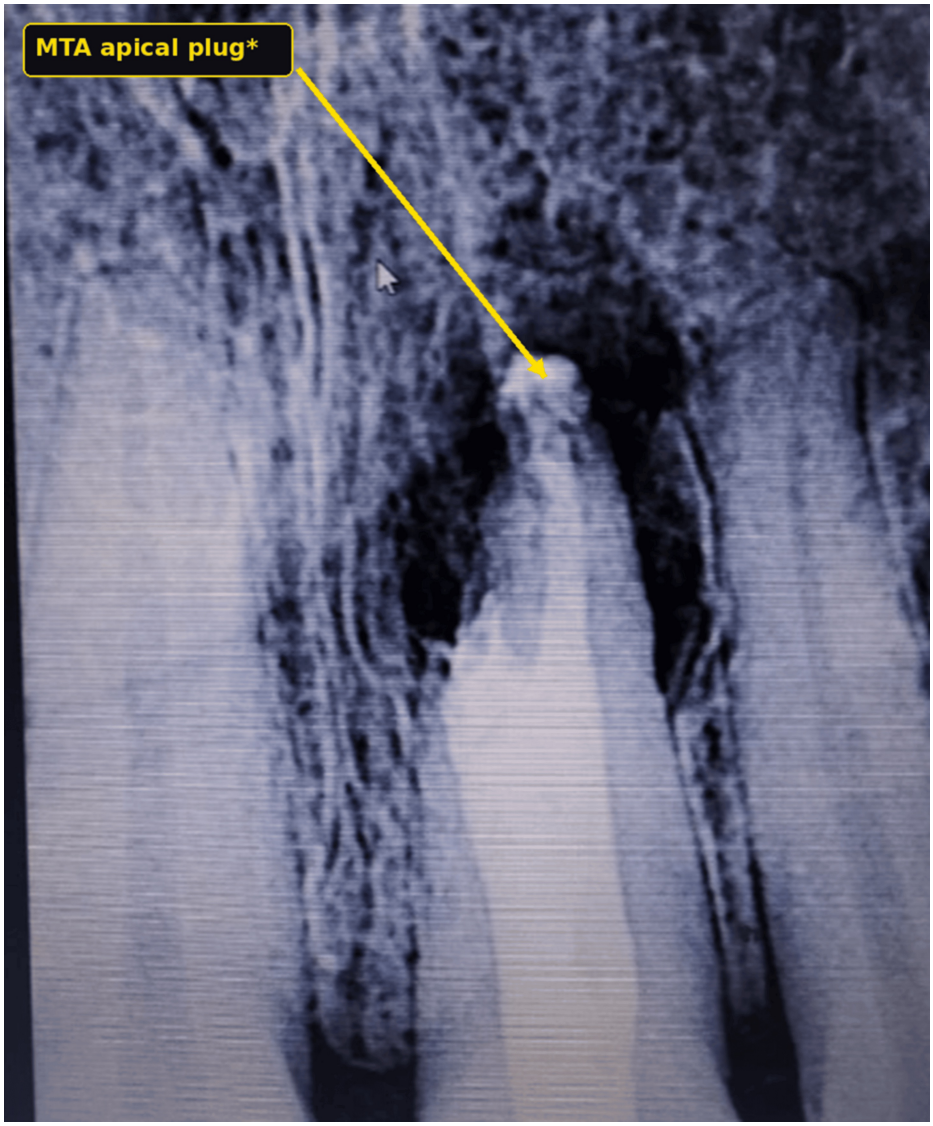

FIGURE 5: Postoperative intraoral periapical radiograph showing completed orthograde endodontic retreatment with a 4-mm MTA apical plug and thermoplasticized gutta-percha backfill.

MTA: mineral trioxide aggregate

The access cavity was subsequently sealed with composite resin (Figure *5*).

Follow-up

At the three-month follow-up, the patient was asymptomatic, and a reduction in the periapical radiolucency was observed on the follow-up periapical radiograph compared with the preoperative image. These findings indicate resolution of the presenting clinical symptoms and early radiographic improvement. However, a three-month observation period is insufficient to establish definitive periapical healing.

Discussion

Persistent apical periodontitis following root canal treatment is commonly associated with residual microorganisms within inadequately disinfected or filled root canal systems [1]. In the present case, the previous root canal treatment was inadequate, with incomplete obturation and associated periapical pathology. Because the tooth was restorable, non-surgical endodontic retreatment was selected as the initial treatment approach. Contemporary evidence supports non-surgical retreatment as a viable treatment option for teeth with persistent apical disease following previous endodontic treatment [6].

Large periapical lesions do not necessarily require immediate surgical intervention. Previous clinical

evidence has demonstrated that substantial healing of large periapical lesions may occur following appropriate non-surgical endodontic treatment [5]. Recent CBCT-based studies have also evaluated the outcomes and prognostic factors associated with the healing of large periapical lesions following primary endodontic treatment and retreatment [7]. Furthermore, radiographic lesion size alone cannot reliably establish the presence of a radicular cyst, and histopathological examination is required for definitive diagnosis [2]. Therefore, a conservative orthograde approach was considered appropriate in the present case.

Access was performed through the existing crown to facilitate retreatment while preserving the existing prosthetic restoration. Removal of the previous root filling allowed subsequent chemomechanical preparation of the canal. The working length was established at 21 mm, and preparation was completed to ProTaper Gold F4. NaOCl and EDTA were used sequentially, with ultrasonic activation to support chemical and mechanical debridement.

Calcium hydroxide was used as an intracanal medicament for 14 days as an adjunct to chemomechanical preparation. Its application was intended to support further microbial reduction between appointments. However, the antimicrobial effectiveness of calcium hydroxide is variable, and it cannot be assumed to achieve complete microbial elimination, particularly against resistant microorganisms such as *Enterococcus faecalis*. A recent systematic review evaluating calcium hydroxide in endodontic retreatment also highlights the need to interpret its clinical effectiveness cautiously [8]. Therefore, its use should be considered an adjunct rather than a substitute for effective chemomechanical preparation and irrigation.

External apical resorption presents an additional challenge because loss of the apical root structure can result in a wide and irregular apical terminus. In such situations, conventional obturation may be difficult and may increase the risk of extrusion of filling material into the periapical tissues. An MTA apical plug can provide an artificial apical barrier and facilitate controlled obturation of the remaining canal space [4]. In the present case, a 4-mm MTA plug was placed in the apical third before backfilling the remaining canal.

CeraSeal, a calcium silicate-based bioceramic sealer, was used in combination with thermoplasticized gutta-percha. Calcium silicate-based sealers possess favorable flow and physicochemical characteristics that may be advantageous when obturating complex or irregular canal spaces [3]. The combination of an apical MTA barrier with thermoplasticized gutta-percha backfill allowed the remaining canal space to be obturated.

An additional challenge in this case was the presence of a pre-existing lateral root perforation associated with the previous endodontic treatment. CBCT evaluation helped identify its location and extent before retreatment, allowing the defect to be considered during treatment planning. Recognition of this complication was important to avoid further mechanical damage to the root and to minimize the risk of irrigant or obturation material extrusion through the defect. The retreatment procedure was therefore performed with particular attention to controlled instrumentation, working length determination, and irrigation. The MTA plug was placed exclusively in the apical third to establish an apical barrier and was not intended to repair the lateral perforation. Recent literature discussing the diagnosis, prognostic factors, and management of root perforations further emphasizes the importance of accurate identification and appropriate treatment planning [9]. Identification and consideration of the perforation during treatment planning helped avoid additional procedural complications while allowing a conservative orthograde approach to be undertaken.

At the three-month follow-up, the patient was asymptomatic, and a reduction in the periapical radiolucency was observed on the follow-up periapical radiograph compared with the preoperative image. These findings indicate resolution of the presenting clinical symptoms and early radiographic improvement. However, a three-month observation period is insufficient to establish definitive periapical healing. Studies evaluating the healing of periapical lesions following non-surgical endodontic treatment and retreatment, including CBCT-based outcome assessments, highlight the importance of longer observation periods for evaluating treatment outcomes [7,10]. Therefore, further clinical and radiographic evaluations at six and 12 months are planned to assess the progression and stability of periapical healing.

This case illustrates that a conservative orthograde approach may be considered for selected restorable teeth with failed root canal treatment, large periapical lesions, external apical resorption, and associated pre-existing root perforations. Careful assessment of the root anatomy, effective chemomechanical preparation, controlled apical barrier placement, and appropriate obturation techniques are important considerations in managing such complex cases. Nevertheless, longer-term follow-up is essential before drawing conclusions regarding the definitive treatment outcome.

Conclusions

Large periapical lesions associated with previously treated teeth and external apical resorption do not necessarily require immediate surgical intervention. In a restorable tooth, careful orthograde retreatment with adequate chemomechanical disinfection and establishment of an apical barrier can provide a conservative treatment option.

In the present case, placement of a 4-mm MTA apical plug followed by thermoplasticized gutta-percha backfill using a calcium silicate-based sealer was associated with resolution of clinical symptoms and early radiographic reduction of the periapical lesion at the three-month follow-up.

Although these findings indicate favorable short-term clinical and radiographic improvement, the three-month follow-up period is insufficient to establish definitive periapical healing. Further clinical and radiographic evaluations at six and 12 months are required to determine the extent and stability of periapical healing.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Harikaran Jayakkodi, Farzana Thasni CT, Nandhini K

Acquisition, analysis, or interpretation of data: Harikaran Jayakkodi, Farzana Thasni CT, Nandhini K

Drafting of the manuscript: Harikaran Jayakkodi, Farzana Thasni CT, Nandhini K

Critical review of the manuscript for important intellectual content: Harikaran Jayakkodi, Farzana Thasni CT, Nandhini K

Supervision: Harikaran Jayakkodi, Farzana Thasni CT, Nandhini K

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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