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Nonsurgical Retreatment of a Failed Root Canal–Treated Mandibular First Molar Using a Bioceramic Sealer: Early Periapical Healing – A Case Report

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ABSTRACT: This case report aims to present the early clinical and radiographic outcomes of nonsurgical endodontic retreatment performed using a bioceramic root canal sealer in a previously treated mandibular first molar (#46) exhibiting persistent symptoms. A 23-year-old systemically healthy female patient presented with a several-day history of spontaneous pain in the mandibular right first molar, which intensified at night. Clinical examination revealed tenderness to percussion. Periapical radiographic evaluation demonstrated inadequate and non-homogeneous root canal obturation associated with a periapical radiolucent lesion.

Nonsurgical retreatment was performed in two visits. Following removal of the previous root canal filling material and chemomechanical preparation, calcium hydroxide was placed as an intracanal medicament. At the second appointment, the root canals were obturated using a bioceramic sealer in combination with gutta-percha.

At the three-month follow-up, the patient was asymptomatic, and radiographic examination revealed a significant reduction in the size of the periapical radiolucency, indicating favorable early periapical healing.

KEYWORDS: retreatment; bioceramic sealer; calcium hydroxide; mandibular first molar; periapical healing

INTRODUCTION

The primary objective of root canal treatment is to eliminate infected pulpal tissue, disinfect the root canal system, and prevent reinfection through a hermetic three-dimensional obturation (1). Despite high reported success rates, endodontic failure may still occur. The most common causes of failure include inadequate chemomechanical preparation and irrigation, insufficient or short obturation, and the persistence of intraradicular microorganisms, all of which have been shown to negatively affect treatment outcomes. The presence of residual microorganisms may sustain inflammatory responses in the periapical tissues and contribute to the development or persistence of apical periodontitis (2).

In such cases, treatment options include nonsurgical retreatment, surgical endodontic intervention, or tooth extraction. When clinically feasible, nonsurgical retreatment is generally considered the first-line approach. The primary objectives of retreatment are the complete removal of the existing root canal filling material, re-instrumentation and reshaping of the root canal system, and effective disinfection to eliminate persistent infection (3).

Irrigation activation systems and intracanal medicaments play a crucial role in reducing the microbial load during retreatment procedures. Calcium hydroxide, owing to its high pH and well-documented antibacterial properties, is widely used as an intracanal medicament, particularly in cases involving persistent infection (4).

In recent years, calcium silicate–based bioceramic sealers have gained considerable attention due to their favorable physicochemical and biological properties. These materials exhibit excellent biocompatibility, the ability to create an alkaline environment, and calcium ion release, which may promote periapical tissue healing and enhance treatment outcomes (5).

The present case report describes the early clinical and radiographic findings of a two-visit nonsurgical retreatment performed using a bioceramic root canal sealer in a previously treated mandibular first molar presenting with persistent symptoms.

CASE REPORT

A 23-year-old systemically healthy female patient was referred to our clinic with a chief complaint of persistent pain in the mandibular right first molar (#46), which had previously undergone root canal treatment. The patient reported that the pain had been present for several days and was particularly exacerbated during function. According to the patient's dental history, root canal treatment had been performed on the same tooth; however, symptoms had not completely resolved.

Clinical examination revealed tenderness to percussion in the affected tooth. Periodontal probing depths were within normal limits, and no pathological periodontal pockets were detected. Periapical radiographic evaluation demonstrated inadequate and non-homogeneous root canal filling material within the canals, accompanied by a distinct periapical radiolucent lesion (Figure 1).

Based on the clinical and radiographic findings, the case was diagnosed as symptomatic apical periodontitis associated with a failed primary root canal treatment.

Nonsurgical endodontic retreatment was planned. Prior to the procedure, both verbal and written informed consent were obtained from the patient.

Figure 1. Periapical radiograph obtained at the time of presentation demonstrating inadequate and non-homogeneous root canal obturation associated with a distinct periapical radiolucent lesion in the mandibular right first molar (#46).

FIRST VISIT

Following the administration of local anesthesia, the tooth was isolated under rubber dam to ensure adequate moisture control and aseptic conditions. The existing coronal restoration was removed, and the access cavity was refined to allow proper visualization and straight-line access to the root canals (Figure 2).

The previously placed root canal filling material was removed, and radiographic verification confirmed its complete elimination from the canal system (Figure 3).

Figure 2. Clinical view after removal of the existing restoration and refinement of the access cavity.

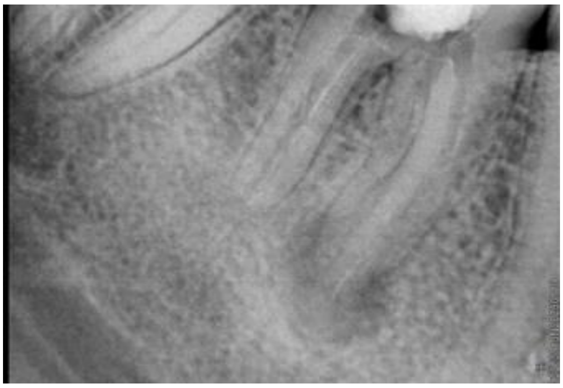

Figure 3. Radiographic image obtained after removal of the previous root canal filling material.

Working length was determined using an electronic apex locator (Woodpex 3 Apex Locator; Woodpecker Medical Instrument Co., Guilin, China) and subsequently confirmed with a periapical radiograph.

Root canal re-instrumentation and reshaping were performed using a rotary nickel–titanium file system (EndoArt Touch Blue; EndoArt, Istanbul, Türkiye). Chemomechanical preparation was carried out with copious irrigation using 5.25% sodium hypochlorite solution (NaOCl; Microvem, Istanbul, Türkiye). Irrigation activation was achieved using a sonic activation system (EDDY; VDW, Munich, Germany) to enhance the effectiveness of the irrigant. A flexible irrigation needle (Irriflex; Produits Dentaires, Vevey, Switzerland) was utilized during irrigation procedures to improve irrigant delivery within the canal system (Figure 4).

Figure 4. Flexible irrigation needle (Irriflex) used during the irrigation procedure.

Following completion of chemomechanical preparation, the canals were subjected to a final irrigation protocol consisting of 17% ethylenediaminetetraacetic acid (EDTA) to remove the smear layer, followed by saline solution and a final rinse with 5.25% sodium hypochlorite (NaOCl). The canals were then dried using sterile paper points (VDW GmbH, Munich, Germany).

Calcium hydroxide paste was placed as an intracanal medicament to further reduce the microbial load and promote disinfection between appointments. The access cavity was subsequently sealed with a temporary restorative material to ensure coronal sealing.

SECOND VISIT

At the second appointment, performed 10 days later, the patient was asymptomatic. After achieving rubber dam isolation, the temporary restoration was removed. The calcium hydroxide dressing was completely eliminated using a combination of irrigation with 17% ethylenediaminetetraacetic acid (EDTA), saline solution, and 5.25% sodium hypochlorite (NaOCl).

Following the final irrigation protocol, the canals were thoroughly dried with sterile paper points. Root canal obturation was performed using a calcium silicate–based bioceramic sealer (Bioserra; Meta Biomed, Korea) (Figure 5) in combination with gutta-percha cones (EndoArt Gutta Percha Points; EndoArt, Istanbul, Türkiye). The canals were filled using a single-cone technique an appropriate obturation technique to achieve a homogenous and well-adapted root canal filling.

A postoperative periapical radiograph was obtained to verify the adequacy, homogeneity, and working length accuracy of the obturation. The tooth was subsequently restored with a composite resin restoration to ensure coronal sealing.

Figure 5. Calcium silicate–based bioceramic root canal sealer (Bioserra; Meta Biomed, Korea) used for obturation.

FOLLOW-UP

Preoperative, post–filling removal, and post-obturation radiographic images were recorded and documented. At the three-month clinical and radiographic follow-up, the patient remained asymptomatic. No tenderness to percussion was detected upon clinical examination. Radiographic evaluation revealed a marked reduction in the size of the periapical radiolucency, indicating favorable early periapical healing (Figure 6).

Figure 6. Three-month follow-up periapical radiograph demonstrating a significant reduction in the periapical radiolucent lesion, consistent with early periapical healing.

DISCUSSION

In failed primary root canal treatments, persistent intraradicular infection, inadequate chemomechanical preparation, and insufficient coronal and apical sealing are among the most frequently reported causes of failure. In such cases, nonsurgical retreatment is generally considered the first-line treatment option, as it aims to eliminate the existing filling material, re-establish canal disinfection, and promote periapical healing (6,7). In the present case, the previous root canal filling was completely removed, and the canal system was thoroughly re-instrumented to improve debridement and facilitate effective irrigation.

Microbial elimination during retreatment is not solely dependent on mechanical instrumentation; the efficacy of irrigation protocols plays a decisive role in reducing the bacterial load. In this case, sodium hypochlorite irrigation was supported by sonic activation. Sonic activation has been reported to enhance irrigant penetration and improve biofilm disruption, particularly in anatomically complex areas such as isthmuses, lateral canals, and irregular canal extensions. Furthermore, the use of a flexible irrigation needle may contribute to safer and more homogeneous irrigant delivery, especially in the apical third, thereby increasing the effectiveness of disinfection while minimizing the risk of extrusion (8,9). Therefore, the combination of sonic activation and a flexible irrigation needle was preferred to optimize the irrigation protocol in the present case.

A two-visit treatment protocol was adopted, and calcium hydroxide was used as an intracanal medicament. Due to its high pH and well-documented antibacterial properties, calcium hydroxide remains one of the most widely used interappointment dressings in retreatment cases. It may be particularly beneficial in cases with suspected persistent infection, as it can reduce bacterial counts and create unfavorable conditions for resistant microorganisms (10). The use of calcium hydroxide between appointments in the present case was intended to further decrease the microbial load before definitive obturation.

For obturation, a calcium silicate–based bioceramic sealer was selected. Bioceramic sealers have gained widespread attention in recent years due to their favorable physicochemical and biological properties, including biocompatibility, high alkalinity, calcium ion release, dimensional stability, and potential for chemical bonding with dentin (11,12). These characteristics have been associated with improved sealing performance and may support periapical tissue healing. The bioactive properties of calcium silicate–based materials may also stimulate hard tissue formation and enhance the repair process in periapical tissues.

At the three-month follow-up, complete resolution of clinical symptoms and a marked reduction in the size of the periapical radiolucency were observed, indicating favorable early healing. However, periapical healing is a dynamic and time-dependent process, and long-term radiographic evaluation is essential to confirm complete resolution of apical pathology (13,14).

This case report has certain limitations. Cone-beam computed tomography (CBCT) was not utilized for three-dimensional assessment of the periapical lesion, and the follow-up period was relatively short. Therefore, longer-term monitoring and advanced imaging techniques could provide more comprehensive evaluation of treatment outcomes.

Within the limitations of this case, it can be concluded that thorough mechanical re-preparation, enhanced irrigation with activation systems, the use of intracanal calcium hydroxide, and obturation with a calcium silicate–based bioceramic sealer may contribute to favorable early clinical and radiographic outcomes in nonsurgical retreatment of failed root canal–treated teeth.

CONCLUSION

Nonsurgical retreatment represents an effective treatment option in cases presenting with symptoms related to failed primary root canal therapy. Complete removal of the existing filling material, effective irrigation supported by activation systems, the use of intracanal medicaments, and obturation with a bioceramic root canal sealer may contribute to favorable early clinical and radiographic healing.

Nevertheless, long-term follow-up is essential to confirm sustained periapical healing and overall treatment success.

ETHICAL STATEMENT

Written and verbal informed consent was obtained from the patient for the use of clinical and radiographic data for scientific publication. All identifying information has been kept confidential to protect patient privacy. As this study represents a single case report, institutional ethics committee approval was not required in accordance with local regulations.
The author declares no conflict of interest.

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