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Case Report

Four Year Follow-up of a Mandibular Second Premolar Tooth with Three Canals and Large Periapical Lesion After Retreatment: A Case Report

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CLINICAL SIGNIFICANCE

It is crucial to ensure that the root canal system is thoroughly cleaned. In cases where the tooth has already undergone root canal treatment and has a large periapical lesion, non-surgical endodontic treatment should be the first course of action.

ABSTRACT

90% of mandibular second premolars typically have a single root canal from the orifice to the apical foramen. However, there may be rare cases where different canal numbers are present. In this instance, a four-year follow-up of a three-canal mandibular second premolar tooth with a rare anatomical variation and a large periapical lesion that had previously undergone root canal treatment was presented. The retreatment was performed using ProTaper Universal D1, D2, and D3 retreatment files and irrigated using 2.5% sodium hypochlorite, 17% ethylenediaminetetraacetic acid, and saline. During the patient's 7th-month follow-up, significant bone formation was observed in the periapical region, and at the 48th-month follow-up, the lesion size had substantially reduced. Radiographic examination revealed changes in densities within the lesion, reconstruction of the trabecular structure, formation of lamina dura in the apical region, asymptomatic formation of the teeth during clinical examination, and healthy soft tissues, all indicating a successful treatment. It is essential to note the significance of the Cone Beam Tomography imaging system in identifying canal variations, which should be used appropriately to increase treatment success. As demonstrated in this case, the first approach for a root canal-treated tooth with a large periapical lesion should be non-surgical endodontic treatment.

1. Introduction

To ensure a successful endodontic treatment, it is important to have a clear understanding of the anatomy of the root canal system. Clinicians may encounter various root canals with different sizes, shapes, and numbers. Failure to identify anatomical variations can result in inadequate instrumentation and obturation, leading to treatment failure.[1] Lesion size has been associated with a richer intra-radicular microbiota in terms of bacterial counts and species.[2] Arguably, this could pose a bigger challenge to adequate disinfection. Less than adequate root canal disinfection would negatively impact healing of apical periodontitis. Form a clinical standpoint, decreased success rates of non-surgical root canal treatment when lesion exceeds 5 mm in size [3] and negative correlation between apical lesion size and treatment success [1,4] are evidence for the lower treatment outcome expectations when large lesions are to be treated non-surgically. Despite the fact that a recent meta-analysis investigating the size of the periapical lesion on the success rate of different endodontic treatment modalities has reported significantly lower success rates of non-surgical root canal treatment in large lesions, it concludes that no endodontic treatment modality is superior than the others when treating large lesions.[5] Also, there is ample clinical evidence of complete radiographic healing of large-sized apical lesions.[6-8] Thus, from a clinical decision-making point of view, non-surgical root canal treatment is considered justifiable as the first treatment choice for large-sized apical lesions.

The root and canal morphology of some mandibular second premolars (Mn2P) can be extremely complex and requires careful consideration. The canal type seen in 90% of Mn2P is a single root canal from the orifice to the apical foramen.[9] The prevalence of Mn2P with two canals was reported as 1.2% [10] for the Mongoloid population and 22.8% [11] for the Jordanian population. The prevalence of Mn2P with three canals was reported only as 0.4%.[12] Genetic and racial variations are factors that can affect root canal morphology.[13] Besides, the design of the study, the method used for root canal system identification, and the sample size are some of the other factors that contribute to the results of prevalence studies.

Many different methods such as plastic resin injection [14], conventional radiographs [10], sectioning [15], scanning electron microscope [16], irrigation and colouring of tooth roots [17] and cone beam computed tomography (CBCT) [18] have been used to study root canal morphology. Since conventional radiographs can only obtain images in the buccolingual direction, they may not always be sufficient for an accurate morphological assessment. In some clinical cases, CBCT is used to provide further information on root canal morphology. In cases where there are large periapical lesions, it is strongly advised to perform a cone beam computed tomography (CBCT) examination.[19]

The primary objective of this research endeavor is to present the four-year follow-up findings of a retreatment procedure performed on an Mn2P with three canals that featured a large periapical lesion and indicated symptoms such as sensitivity to both palpation and percussion after a root canal treatment.

2. Case Presentation

A 21-year-old Turkish man visited the Department of Endodontics at Recep Tayyip Erdogan University's Faculty of Dentistry with a complaint about his right Mn2P tooth. The patient had been experiencing recurring but not severe pain. During a clinical examination, it was discovered that the tooth was sensitive to both palpation and percussion. The radiological examination revealed that the tooth had previously received poor treatment, resulting in a large periapical lesion (Fig. 1A).

During the dental procedure, a rubber dam was placed to isolate the affected tooth and the coronal restoration material was removed. The dentist then employed the ProTaper Universal D1, D2, and D3 retreatment files with a speed and torque controlled motor (VDW Silver; VDW, Munich, Germany) to remove the canal filling. Then, a periapical radiograph was taken with manuel K-type files (Fig. 1B). To accurately determine the size of the lesion and estimate the canal variation, a CBCT scan was taken. CBCT images were attained by the Planmeca Promax 3D Classic (Planmeca, Helsinki, Finland) device and 90 kVp, 4-10 mA, and 200 µm high-sized parameters. CBCT images were formed on Planmeca Romexis software (Planmeca Romexis 4.6.2.R, Planmeca, Helsinki, Finland). To accurately assess the configuration of the root and root canal system, axial slices (coronal, mid-, and apical third) were evaluated in every third slice, along with sagittal and coronal slices. From the CBCT slices, it was found that the mandibular second premolar had three roots and a root canal in each root (Fig. 2).

To determine the working length in the mesiobuccal, distobuccal, and lingual canals, an apex locator (Root ZX Mini Apex Locator, J. Morita, USA) was used and later verified with a radiograph. The root canals were prepared with the ProTaper Universal system (Dentsply-Maillefer, Ballaigues, Switzerland) to instrument all canals up to F1. A solution of 2.5% sodium hypochlorite (NaOCl) that was constantly refreshed to ensure efficiency (Total 10 ml) was used.[20] To completely eliminate the smear layer, a thorough 17% ethylenediaminetetraacetic acid (EDTA) wash (2 ml for each canal), which was followed by another wash with NaOCl (2 ml) was employed. In between the NaOCl-EDTA washes, distilled water was used to ensure proper cleansing. The activation of the solution was accomplished manually with the aid of gutta-percha points, which ensured precision and accuracy in the process. A 27 gauge irrigator needle (Ultradent Endo Eze, Ultradent, Turkey) was used for irrigation. Once the preparation phase was complete, the canals were dried with paper points and filled with calcium hydroxide (Kalsin; Spot Dis Deposu AS, Izmir, Turkey). A temporary coronal restoration was placed with Cavit (ESPE, Seefeld, Germany), and the patient was scheduled for a follow-up appointment a week later.

After one week, the patient showed no symptoms and the calcium hydroxide medicament was removed by using master apical file instrument in combination with 17% EDTA solution.[21] ProTaper F2 (Dentsply-Maillefer, Ballaigues, Switzerland) was used for the final preparations of the canals with the irrigation protocols mentioned above. The procedure was terminated once the criteria of no outflow of canal filling debris during irrigation, absence of filling material on files or paper cones, and visible clean canal walls were met. Then, a radiograph was taken with master apical cones (Fig. 1C). After verifying the working length with cones, the canals were dried with paper points and root canal obturation was completed with a resin-containing root canal sealant (AH Plus,

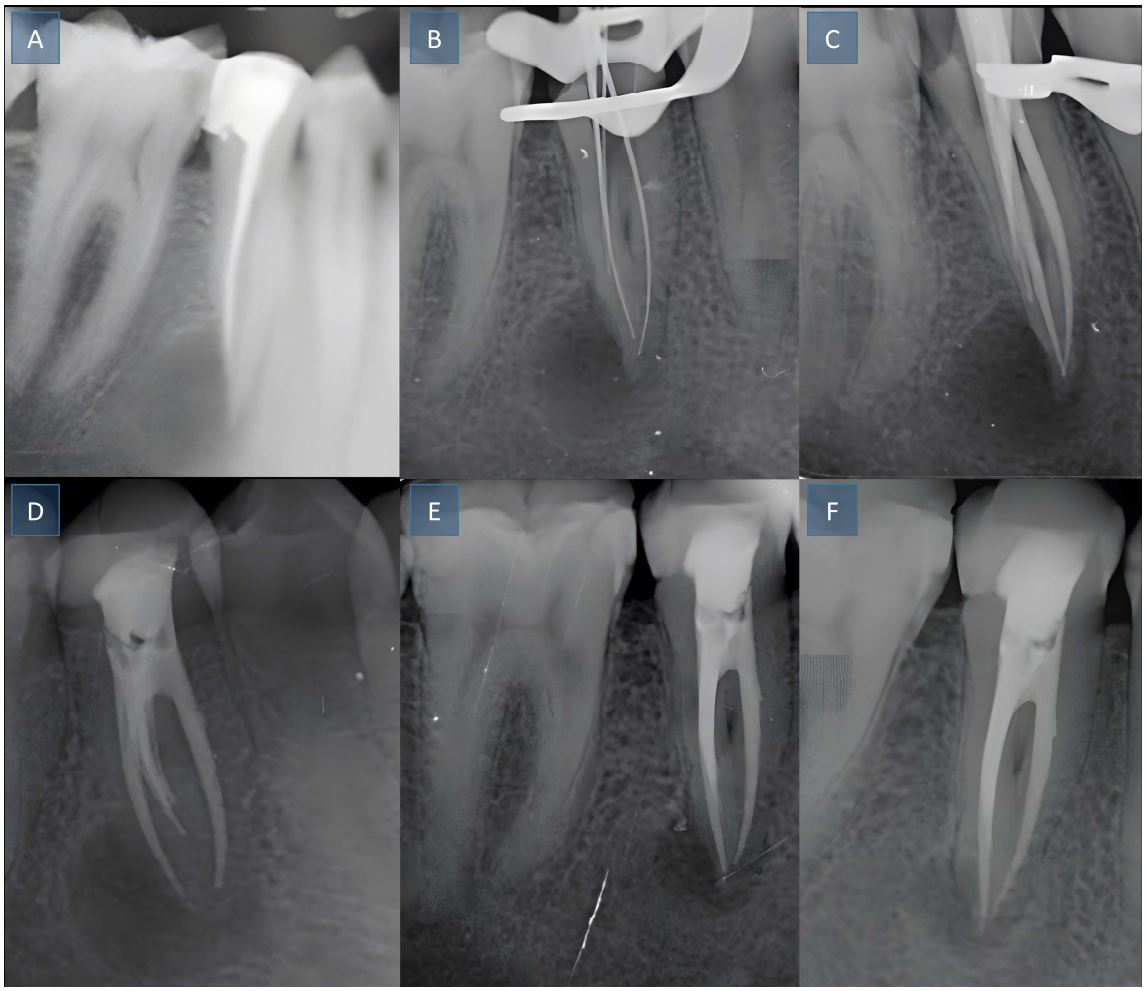

Fig. 1. Periapical radiograph of the right mandibular second premolar (A) before the retreatment, (B) with manuel K-type files, (C) with cones, (D) after completion of retreatment, (E) after 7th month, (F) after 48th month

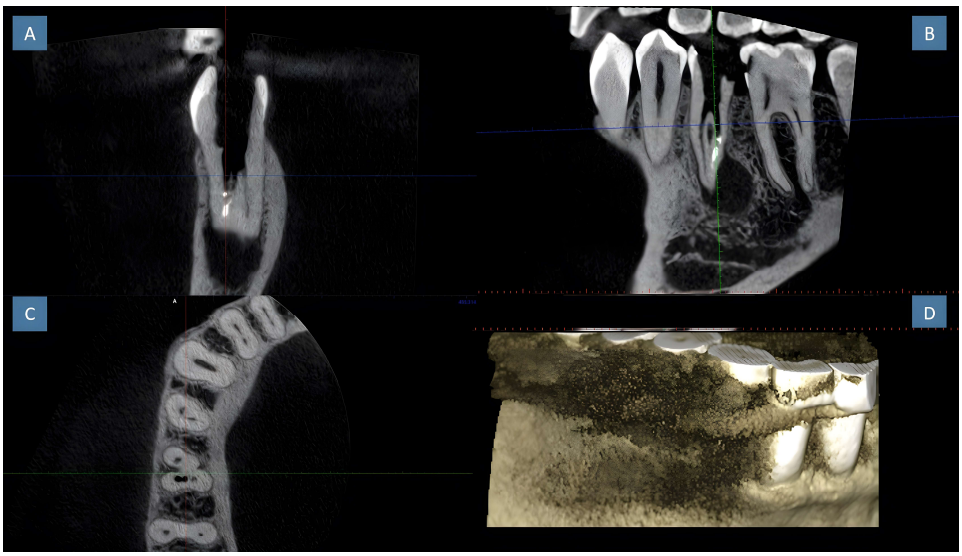

Fig. 2. The CBCT sections that are displayed in four different views: (A) Coronal, (B) Sagittal, (C) Axial, and (D) a three-dimensional image.

Dentsply DeTrey GmbH, Konstanz, Germany) and compatible gutta-percha (Diadent, Seoul, South Korea). The permanent coronal restoration was done with composite resin (Filltek P60, 3M Dental Products, St. Paul, MN, USA) and a final periapical radiograph was taken to confirm the completion of the treatment (Fig. 1D). The patient was informed about the tooth's morphology and the size of the periapical lesion, and that follow-up appointments should be scheduled at certain intervals. The patient returned to the clinic 7 months later and a periapical radiograph showed significant healing of the lesion (Fig. 1E) with no clinical problems. A follow-up 4 years later showed smaller periapical lesion dimensions in the radiograph (Fig. 1F), and the patient was instructed to return for further control.

3. Discussion

It is important for proper treatment and a positive outcome to have a thorough understanding of the intricate anatomy of mandibular premolars.[10] Incomplete cleaning and filling of root canals, leading to unsuccessful endodontic treatment [22], can occur if there is insufficient knowledge of the anatomy. Clinicians must be mindful of any variations that may exist and be familiar with the normal root canal system's anatomical morphology.

During endodontic treatments, periapical radiographs are commonly used for anatomical evaluations of teeth. However, in cases where the canals have different root canal configurations, like in this situation, periapical radiographs may not provide sufficient information. To better visualize the canals, radiographs taken at different horizontal angles can be used. CBCT is considered a suitable technique for precise investigation of root canal systems and detailed determination of anatomy as the anatomy of a tooth can be observed three-dimensionally from different angles, allowing for both qualitative and quantitative evaluations of its characteristics.[18] CBCT has been used for identifying the root and root canal system configurations in cohorts with similar characteristics both at the demographic and tooth-level as the patient and tooth described in this case report, corroborating the rare anatomical variation treated.[23,24]

The treatment of mandibular premolars can be challenging due to their complex canal systems, making them one of the most difficult teeth to address in endodontics.[25] Nevertheless, advancements in imaging systems, loop and operating microscope magnification tools, and updated knowledge on the anatomy of these teeth have led to improved success rates in even the most demanding cases. There have been numerous studies in the literature regarding the anatomical variations of mandibular premolar teeth, specifically the second premolars.[9,25,26] Briseño-Marroquín, et al. [27] identified the root canal system configuration of these teeth as typically having a single root and canal. However, other studies have reported variations in the root canal morphology. In fact, the occurrence of a second canal in mandibular second premolars has been found to be relatively rare, with a prevalence of only 2% in Iran [28] and between 5.8–17.5% in Mexico [10]. It is important to consider genetic and racial differences when examining root canal anatomy and morphology.[25] In a study conducted in Turkey, Sert, et al. [29] found that 7% of Mn2P had two root canals. Another study conducted in Turkey by Çalişkan, et al. [26] reported that the occurrence of three canals in Mn2P was 0%.

Insufficient cleaning and filling of a root canal can lead to microbial infection, resulting in endodontic treatment failure.[30] If initial root canal treatment fails, retreatment should be considered as the first option. Adequate biomechanical cleaning of the root canal system is the most critical factor for healing in teeth with periapical lesions. Calcium hydroxide is commonly used as an intracanal endodontic material, as it has a high alkalinity tissue dissolving effect, induces hard tissue formation, and has a bactericidal effect.[21] In this case study, the patient was given calcium hydroxide, and significant bone formation was observed in the periapical region in the seventh month follow-up visit. After each root canal treatment, it is necessary to evaluate the periapical lesion to ensure proper healing. In this study, the size of the lesion was greatly reduced after 48 months of observation, indicating successful treatment.

4. Conclusion

It's important for all clinicians to understand that root canals can have a variety of canal morphologies and anatomy. If the canal system isn't completely cleaned before treatment, it's likely that the treatment will fail. That's why it's crucial to examine the tooth's anatomy before beginning endodontic treatment. Using a CBCT imaging system can help identify variations in the canal and improve the chances of success. In cases where there is a large periapical lesion, non-surgical endodontic treatment should be the first approach for a tooth that has already undergone root canal treatment.

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