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Single-Visit Root Canal Treatment on a Mandibular First Premolar with Three Root Canals

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Abstract

Background: In root canal treatment, accurate diagnosis of root canal morphology is crucial for treatment success. Vertucci reported that in mandibular premolars, 74% have one canal, 25.5% have two canals, and 0.5% have three canals. Therefore, pre-treatment radiography, careful examination, and appropriate techniques are essential to identify root canal orifices, especially in cases with canal variations. The purpose of this case report is to demonstrate the importance of knowledge about the morphology of the root canal system and how to manage root canal care in the first premolar tooth of the lower jaw with three root canals. Case: A 57-year-old female patient with a complaint of a large cavity of the left lower jaw premolar tooth, no pain and wants to be treated. The radiographic results showed that the tooth pulp was open and the morphology of the root canal showed that there were three root canals. Management: Access opening and search of three root canals is carried out using ultrasonic tips and magnification assistance with a dental microscope. The root canal is prepared with rotary NiTi fileby irrigation using 5.25% sodium hypochlorite, 17% EDTA. Obturation using thermal fill and the use of dental crowns as final restoration will be done at the next visit. Conclusion: An understanding of the morphology of the root canal system and the proper use of tools and materials will influence success in the treatment of complex root canals in premolar teeth with three root canals.

INTRODUCTION

Root canal treatment is one of the important procedures in the field of endodontics that aims to maintain teeth that have suffered damage to pulp or periapical tissue. The success of endodontic treatment is greatly influenced by a good understanding of the anatomy and morphology of the root canal system in each tooth. Variations in tooth anatomy are often a clinical challenge because each tooth can have a different number of roots and root canal configurations. One of the teeth that has a fairly complex morphological variation is the first premolar tooth of the mandible (Al-Zubaidi et al., 2022; Arayasantiparb & Banomyong, 2021; Karobari et al., 2023; Thanaruengrong et al., 2021; Wolf et al., 2021). In general the first premolar teeth of the mandible are often thought to have one root and one root canal, but various studies suggest that anatomical variations can occur. A classic study conducted by (Cleghorn et al., 2017)reported that about 98% of the first premolar teeth of the mandible had one root, 1.8% had two roots, and about 0.2% had three roots.

In addition, the first premolar tooth of the mandible with four roots is a very rare condition with a prevalence of less than 0.1% of all samples studied. (Chang et al., 2021) also reported several cases of the first premolar teeth of the mandible having three roots and three root canals, indicating significant morphological variations. Vertucci reported that about 74% of the first premolar teeth of the mandible had one root canal, 25.5% had two root canals, and

about 0.5% had three root canals. This variation suggests that the root canal system in the first premolar tooth of the mandible is not always simple and therefore requires special attention in endodontic care (Patel, 2016; Hargreaves & Berman, 2021). Understanding the morphological variations of the root canal is very important because failure to identify the entire root canal can lead to failure of endodontic treatment. Additional undetected root canals can become persistent sites for microorganisms causing recurrent infections of periapical tissue. Therefore, dentists must have comprehensive knowledge of the possible anatomical variations in each tooth to be treated (Ahmed & Dummer, 2018; Almeida et al., 2023; Karobari et al., 2024; Martins et al., 2020, 2025).

Understanding the morphological variations of the root canal is very important because failure to identify the entire root canal can lead to failure of endodontic treatment. Additional undetected root canals can become persistent sites for microorganisms causing recurrent infections of periapical tissue (Alsofi et al., 2025; Hameed et al., 2024). Therefore, dentists must have comprehensive knowledge of the possible anatomical variations in each tooth to be treated. Recent research using cone-beam computed tomography (CBCT) technology shows that root canal variations in mandibular premolar teeth are more common than previously thought. CBCT studies in Thai populations show that most of the mandibular premolars have a single root, however the root canal configuration can vary according to the Vertucci, (Vertucci, 2015) classification with a prevalence of type I of about 63% in the first premolars of the mandible (Prapayasatok et al., 2021). Other studies also report that about 85% of the first premolars of the mandible have a single root, while the rest can have two or more roots (Elsherif et al., 2024). Recent systematic studies show that about 74.34% of the first premolars of the mandible have a type I root canal configuration according to the Vertucci classification (Ahmed et al., 2023). Nonetheless, more complex root channel configurations such as two or three root channels can still be found in a certain percentage. These variations can be influenced by genetic, ethnic, and anatomical development factors. Therefore, careful radiographic evaluation as well as the use of modern imaging technologies are essential in accurately determining the morphology of the root canal before performing endodontic treatment (Hargreaves & Berman, 2021; Patel et al., 2016).

Therefore, the purpose of this study is to describe and analyze the management of single-visit root canal treatment in a mandibular first premolar with three root canals, emphasizing the importance of accurate diagnosis and appropriate clinical techniques. The expected benefits of this study are both theoretical and practical. Theoretically, this study contributes to the development of endodontic knowledge, particularly regarding anatomical variations and their clinical implications. Practically, this case report provides guidance for clinicians in identifying and managing complex root canal systems, thereby improving the success rate of endodontic treatment in teeth with rare anatomical variations.

RESEARCH METHOD

This study used a case report design with a clinical descriptive approach. This approach is used to systematically describe the process of diagnosis, planning, and management of root canal treatment in the first premolar tooth of the mandibular with three root canals. The design of the case report was chosen because the study focused on one specific clinical case that had a rare anatomical complexity of the root canal.

Research Subject

The subject in this study was a 57-year-old female patient who came with a complaint of a large perforated left mandibular first premolar tooth without pain. Patients were selected based on clinical indications of pulp abnormalities and radiographic findings showing morphological variations in the root canal in the form of three root canals.

Research Procedure

The research procedure is carried out through several stages, namely:

1. Clinical examination and diagnosis

The examination was performed subjectively, objectively, and sustainively using periapical radiography to establish the diagnosis of pulp necrosis with chronic periapical abscesses as well as identify the number and configuration of root canals.

2. Action Preparation

The patient is given an explanation related to the diagnosis, treatment plan, and possible risks. After that, an informed consent was signed as a form of approval for medical measures.

3. Root Canal Treatment Stage

Isolation using rubber dams to maintain aseptic conditions, Creation of cavitite access using Endo Access bur, Exploration of root canals with the help of ultrasonic tips and dental microscopes, Determination of working length using apex locator and radiographic confirmation, Preparation of root canals using rotary NiTi files, Irrigation using sodium hypochlorite (NaOCl) solution 5.25%, EDTA 17%, and saline, Activation of irrigation using ultrasonic

4. Obturasion and Restoration Stage

Gutta-percha trial (try-in), Obturasion using modified single cone technique with a combination of thermal fill, Installation of fiber pegs, Temporary restoration using composite resin

5. Evaluation and Follow-up

The patient is scheduled for follow-up control for clinical and radiographic evaluation before a definitive restoration of the indirect crown.

Data Collection Techniques

Data is collected through:

1. Direct clinical observation
2. Periapical radiographic examination
3. Clinical photo and radiography documentation during the treatment process

Data Analysis Techniques

Data analysis was carried out in a qualitative descriptive manner, namely by systematically describing all stages of treatment and relating them to the scientific literature related to root canal morphology and the success of endodontic treatment.

RESULTS AND DISCUSSION

Case

A 57-year-old female patient came in with a complaint of a single left lower jaw premolar tooth with a large hole, no pain, and wanted to be treated. Clinical photographs show a large cavity in the lower left premolar tooth of the distal side that extends to almost half of the crown of the tooth. The base of the cavity of the distal part of tooth 34 is parallel to the sulcus gingiva (*equi gingiva)* and an open pulp chamber is obtained. In the objective examination, the results of the percussion test were positive, the bite test was negative, the palpation was positive, and the EPT test showed the number 80 which showed negative vitality. On periapical radiography examination, it was found that caries profunda perforation in the distal tooth 34 reached the pulp and appeared morphology of 3 root canals. On the periaphal, there is a radioluscent image of the periapical abscess. So that from subjective, objective, and periapical supporting examinations, a diagnosis of pulp necrosis accompanied by chronic periapical abscess of teeth 34 was obtained.

Figure 1. Clinical photograph of tooth 34 showing a large distal cavity
Source: Clinical documentation by the author, 2026

Figure 2. Periapical radiograph showing three root canals and periapical lesion
Source: Radiographic documentation by the author, 2026

Case Management

The clinical management stages in this case are carried out systematically to ensure the success of root canal treatment. Before starting the procedure, the patient is given an explanation of the diagnosis, treatment plan, procedure to be performed, as well as possible risks and prognosis of treatment. After the patient understands all the information provided, the patient signs an informed consent as a form of consent to the action to be taken. Furthermore, the work area is isolated using rubber dams to maintain aseptic working conditions and prevent saliva contamination during the treatment procedure (Figure 3).

Figure 3. Isolation using rubber dam during root canal treatment
Source: Clinical documentation by the author, 2026

Root canal treatment begins with the creation of cavity access using an Endo Access bur (Dentsply) to open the pulp chamber. Furthermore, exploration and expansion of access were carried out using Gates Glidden Drill (GGD) (Dentsply) and Ultrasonic Endo Tip (Satelec ETBD) to facilitate orifice identification. The exploration process was carried out with the help of an EXDG16 (Osung) endodontic explorer and supported by magnification using a dental operating microscope to increase visibility during the procedure. After all the orifices were found, root channel negotiations were carried out using M3-C Plus size files No. 06, 08, and 10 (UDG) until the initial path of the root channel was reached.

The next stage is the determination of the length of work using the apex locator (Eighteeth), which is then reconfirmed through periapical radiographic examination to ensure the accuracy of the length of work (Figure 4). After the length of work is determined, the creation of a glide path is carried out using the M3-Path rotary file with sizes 13/02, 16/02, and 19/02. During the preparation process, root canal irrigation is carried out periodically using a solution of 5.25% sodium hypochlorite (NaOCl), 17% EDTA, and saline to help remove debris, necrotic tissue, and smear layer from the root canal wall.

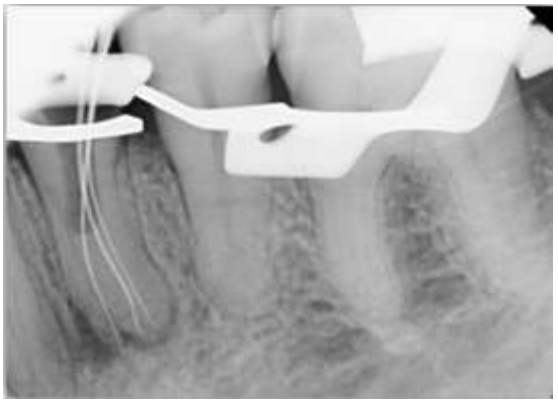

Figure 4. Working length determination using apex locator and radiographic confirmation

Source: Clinical documentation by the author, 2026

Biomechanical preparation is then continued using One Curve rotary file size 25/04 (MicroMega) until it reaches the predetermined working length. During the instrumentation process, an apical patency procedure is performed to prevent debris buildup in the apical part and to keep the working length stable. To increase the effectiveness of irrigation, the activation of the irrigation solution is carried out using an Ultra-X (Eighteeth) ultrasonic device so that the penetration of the solution into the root canal system becomes more optimal.

After the preparation and irrigation process is completed, a gutta-percha try-in stage is carried out to ensure the suitability of the length and adaptation of the obturate material to the root canal (Figure 5). Furthermore, root canal obtuation was carried out using the modified single cone technique combined with warm vertical compaction (thermal fill) to obtain an optimal apical seal (Figures 6 and 7). After the obtuation is complete, fiber pegs are installed to increase restoration retention in the treated teeth (Figure 8).

Figure 5. Gutta-percha try-in stage

Source: Clinical documentation by the author, 2026

Figure 6. Root canal obturation using thermal fill technique

Source: Clinical documentation by the author, 2026

Figure 7. Post-obturation radiograph showing adequate filling of three canals
Source: Clinical documentation by the author, 2026

Figure 8. Fiber post placement for reinforcement
Source: Clinical documentation by the author, 2026

The next stage is the creation of an artificial wall to replace the missing tooth wall structure and prepare the cavity shape for further restoration. Temporary restoration was then carried out using resin composite materials with direct composite techniques (Figures 9 and 10). After treatment is completed, the patient is scheduled for follow-up to evaluate clinical and radiographic conditions before a definitive restoration of the indirect crown.

Figure 9. Temporary restoration using composite resin
Source: Clinical documentation by the author, 2026

Figure 10. Final condition after temporary restoration
Source: Clinical documentation by the author, 2026

CONCLUSION

Non-surgical endodontic treatment of the first premolar tooth of the mandibular with three root canals can be successful if the entire root canal system can be identified and debridement thoroughly. Anatomical variations in the mandibular premolar teeth should always be considered, as the possibility of additional root canals may affect the success of treatment. Therefore, operators must have clinical vigilance to detect second, third, or even more root canals in order for the entire root canal system to be optimally treated. The use of tools such as radiography, ultrasonic tips, and magnification tools is also very helpful in improving the accuracy of diagnosis as well as the success of treatment in teeth with complex root canal anatomy.

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