Root canal treatment of Maxillary First Premolar with Three Roots: A case report

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Abstract

This case report is for a rare case of root canal treatment of the permanent maxillary right first premolar presented with three roots and three canals (Vertucci Type VIII). The patient is a 67-year-old male with hypertension and is allergic to milk and hydrocodone. The affected tooth was diagnosed with necrotic pulp with symptomatic apical periodontitis during examination.

Root canal treatment was carried out in this patient under rubber dam isolation, and cleaning and shaping were done with the help of ProTaper Gold rotary files. The obturation was done using a continuous wave compaction technique by the Calamus Dual Obturation System.

The unusual anatomy of this case can occur in only 0.95-1.6% of cases. The difficulty in treating such cases is identifying the extra canal. Cone Beam Computed Tomography is the gold standard in finding such a canal. However, in this case, two periapical radiographs were taken to identify the extra root due to the absence of CBCT in the clinic.

Using Cone Beam Computed Tomography, periapical radiographs with different angulations and magnification enhance visibility and improve the success rate in such cases. This comprehensive approach improves the accuracy of diagnosis and treatment outcomes in cases with complicated anatomy.

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Introduction

It is well known that the premolar is one of the most complex teeth with various anatomy. The majority of maxillary first premolars have a single root (8.7–18.2%), then two roots (80.2-89.7%), and the least common are three roots (0.95–1.6%) [1-3]. The majority of maxillary first premolars have two canals (90.53–96.08%), then one canal (2.94–7.86%), and the least common are three canals (0.98–1.61%) [1-3].

According to Vertucci's classification, the most common classification was Type IV, followed by II, I, V, and VIII [1,2]. Other studies found that Type IV is the most common, followed by II, I, VIII, and V [4]. Overall, the ethnic group of the population may play an essential role in this variation.

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The variation in the number of roots and canals can make the treatment more challenging. Using a periapical radiograph in conjunction with CBCT, in addition to the expertise of the endodontist, can play an essential role in treating these cases[5].

This case report highlights the treatment strategy and technique of the maxillary first premolar with three roots and Vertucci classification Type VIII.

Case Report

A 67-year-old male Caucasian was referred from the post-doc to the clinic with the chief complaint," That tooth hurts a lot." He was pointing to the upper right side. Upon taking the patient history and examination, the patient had hypertension, was allergic to milk and hydrocodone, and was taking Lisinopril as medication. According to the history, the patient is ASA II. Periapical radiograph size 2 was taken for the tooth, and another one with distal shift showed three roots and three canals (Figures 1a, 1b). Upon the tooth examination, the tooth was normal on palpation, sensitive on percussion, and negative to cold. The definitive diagnosis of

the tooth is necrotic pulp with symptomatic apical periodontitis.

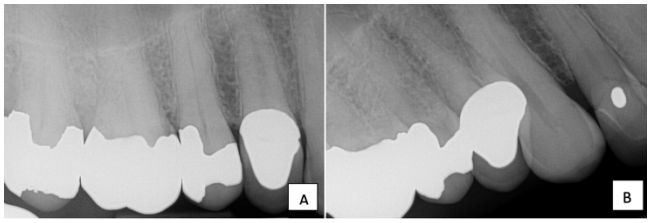

Figure 1. Periapical diagnostic radiograph of tooth #24, centered view (A), and distal shift (B) showed three roots in the permanent maxillary right first premolars.

The treatment plan was discussed with the patient: to keep the tooth as it is, root canal treatment, or extraction. The patient chose to undergo root canal treatment. The root canal treatment procedure was described to the patient; the risks and complications included pain, swelling, infection, tooth fracture, discoloration, and a file fracture in the canals. The patient approved of root canal treatment on the tooth and signed the consent form.

To anesthetize the tooth using the infiltration technique, one carpule of Lidocaine hydrochloride (2% solution, 1.8 ml, with epinephrine 1:100,000, Sigma-Aldrich, St. Louis, MO). Rubber dam isolation with a calm was positioned in the second premolar. A microscope was used to identify the canals after removing caries and the previous restoration. Upon locating the canals, the palatal and buccal canals were found; upon further exploration, the third canal was found around three millimeters palatal to the buccal canal. Working lengths were determined using an electronic apex locator Root ZX II (Morita Corp., Tokyo, Japan). Cleaning and shaping were done using K-hand files (M-Access, DENTSPLY Sirona, York, PA, USA) and ProTaper Gold rotary files (DENTSPLY Sirona, York, PA, USA). Irrigation was used during the procedure with 10 mL of 5.25% NaOCl in a syringe with a side-vented needle. The obturation was done using continuous wave compaction technique. Matching cone was appliedin the canal with AH Plus root canal sealer (DENTSPLY Sirona, York, PA, USA). The matching cone was trimmed with heat tip and around 4 mm left in the canal. The sealer was applied within the canal following by introducing heated gutta-percha by the Calamus dual obturation system (DENTSPLY Sirona, York, PA, USA) and then compcted by plugger. A post-operative radiograph was done, as shown in Figure 2. Ethical approval was received from the ethics committee of the College of Dentistry, Taibah University.

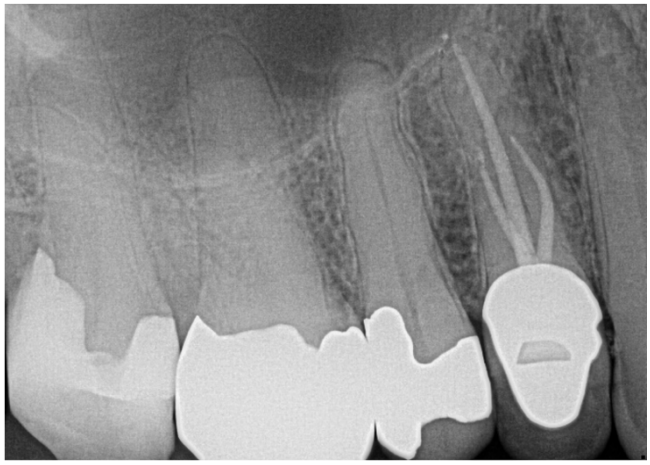

Figure 2. A post-operative periapical radiograph of tooth #24 showed filling in all three root canals of the permanent maxillary right first premolars.

Discussion

The presence of a third canal in maxillary first premolar cases is a rare occurrence, with reports indicating a prevalence of only 0.98-1.61% [4,6,7]. This rarity and the unique anatomy of these teeth can complicate endodontic treatments. Identifying and accessing all canals are crucial steps; however, the complexity of these steps may lead to missed canals, adversely affecting treatment outcomes [8,9].

Managing this case with necrotic pulp with symptomatic apical periodontitis presents various challenges, including patient-specific factors such as allergies to painkillers and milk, hypertension, and the technical demands of thoroughly cleaning and shaping each canal from the orifice to the apex. Extra roots and canals pose additional challenges beyond these issues, impacting the success of endodontic procedures. Hypertension is of particular concern in dental practices due to its systemic cardiovascular implications, necessitating careful management during treatment to avoid adversely affecting overall health [10]. Strategies include cautious use of local anesthetics containing epinephrine, reducing patient stress and anxiety, avoiding lengthy treatment sessions, making gradual changes to patient positioning, and careful prescription of medications to prevent drug

interactions [11,12]. In cases of well-controlled hypertension or moderate systemic illness (classified as ASA II), the use of epinephrine is not contraindicated, but dosages should be kept below 0.04 mg [13].

Accurate medical history collection is vital to circumvent issues related to allergies. It was disclosed that the patient had allergies to hydrocodone and milk. In endodontics, certain materials or anesthetics may contain dairy products, but commonly used dental anesthetics like lidocaine and articaine do not [14,15]. Hydrocodone, an opioid pain medication, can cause side effects such as drowsiness, constipation, and potentially addiction [16-18]. Alternative medications, like paracetamol and ibuprofen, can be considered for pain management [19].

Diagnostic imaging plays a crucial role in formulating a diagnosis and treatment plan. Traditional periapical radiographs offer basic anatomical insights, while shifted periapical radiographs can help reveal additional roots or canals and complex tooth structures, crucial for minimizing treatment failure [20]. In this case, radiographic evaluation was instrumental in identifying a third root, essential for a successful endodontic outcome [21].

Cone Beam Computed Tomography (CBCT) is becoming more widely used for its ability to provide 3D images of teeth, significantly improving the detection of additional canals compared to standard radiographs [22,23]. Research using CBCT found that 46.5% of endodontically treated maxillary premolars overlooked the third canal [24]. However, the higher cost of CBCT may limit its widespread adoption [25].

Magnification tools, like loupes or microscopes, not only enhance visibility but also increase the success rate of treatment, especially in complex cases [26-28]. One in-vitro study demonstrated a 100% detection rate of the MB2 canal in the maxillary first molar using magnification [29]. In this case, the use of a microscope facilitated the detection of additional root canals, situated three millimeters palatal to the buccal canal.

While there is no consensus on the optimal obturation technique, AH Plus sealer combined with continuous wave compaction is frequently used due to its advantages, such as enhanced sealer penetration and reduced microleakage, promoting better sealing and a three-dimensional fill of the root canal system [30].

As the above discussion outlines, employing appropriate diagnostic tools and magnification aids is recommended, particularly for teeth with complex anatomies, to improve the likelihood of treatment success and enable the detection and management of intricate canal systems.

Conclusions

The case report highlighted the importance of recognizing anatomical variation in clinical practice. The importance of using Cone Beam Computed Tomography and periapical radiographs with multiple angulations and magnifications is essential in diagnosing and treating such cases. This can improve the outcome and enhance the diagnosis and treatment planning accuracy.

Declaration of interest

The author declares that there no conflict of interest and the article was not funded or supported by any research grant.

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