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Short Communication

Endodontic management of two multi-rooted mandibular premolars: A Case Report

Engy Atallah [1, *]

[1]*Assistant lecturer, Department of Endodontics, Faculty of Oral and Dental Medicine, Egyptian Russian University, Badr City, Cairo-Suez Road, Cairo 11829, Egypt.*

*Corresponding author(s): Engy Atallah, E-mail: Engy-abdelnour@eru.edu.eg

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ABSTRACT

Successful endodontic treatment depends on a thorough knowledge of root canal anatomy. It is well established that undetected extra roots or root canals can hinder full disinfection of the whole root canal system, thus, leaving a chance for infection and increasing the likelihood of developing apical disease. Although it was previously thought that mandibular premolars typically show one root and one root canal, considerable variations in their morphology have been found in the literature. The incidence of double-rooted or three-rooted premolars is generally low but should always be suspected especially if the pre-operative radiograph suggests abnormal root outline such as bifurcation or trifurcation. It is crucial for the dentist or endodontist to have a thorough understanding of tooth anatomy. Proper pre-operative radiographic assessment and clinical examination are essential to diagnose and plan the treatment effectively. The current case report discusses the diagnosis and conventional root canal treatment of first and second mandibular premolars with 2 and 3 roots, respectively.

Keywords: Mandibular bicuspids, root canal treatment, extra roots

1. Introduction

The root canal morphology of mandibular premolars exhibits significant variations. Accurate assessment and management of these anatomical complexities are necessary for achieving favorable treatment outcomes. Advanced imaging technologies, along with meticulous clinical techniques, play a vital role in ensuring the thorough cleaning, shaping, and disinfection of the root canal system, ultimately improving the long-term prognosis of mandibular premolars. Root canal morphology of mandibular premolars varied greatly in the literature (1–5). This might present a higher chance of leaving untreated canals which will affect the tooth prognosis (3). The prevalence of multi-rooted mandibular premolars is very uncommon. According to two literature reviews studying root anatomy of mandibular premolars, the presence of two roots was reported to be 1.8 % in first premolars and 0.3 % in second premolars, while the prevalence of three roots in the first and second premolars were 0.2% and 0.1%, respectively. Moreover, the incidence of more than one root or one canal was higher in the first premolar than in the second premolar (6,7). However, these results may vary according to location and ethnicity. In Middle Eastern countries, the incidence of premolars with multiple canals ranged from 0.8 % to 4.5% with the majority of roots having Vertucci type I canal configuration (4,5,8).

2. Materials and Methods

A 23-year-old Egyptian male patient presented to the Department of Endodontics, Faculty of Dentistry, Cairo University, complaining of intermittent spontaneous pain related to the right side that is relieved with analgesics. Upon clinical examination, a carious lesion was observed on the first and second right mandibular premolars. Medical history was non-contributory. A pulp sensibility test was done using ethyl chloride spray (Walter Ritter GmbH & Co., Pharmaceutica, Germany) which showed a lingering response with both first and second premolars. The contra-lateral tooth was examined as a control. Radiographic examination revealed deep caries approximating the pulp, in addition to unusual root morphology suggesting the presence of two roots in the first premolar and three separate roots in the second premolar (Figure 1.). Teeth were anesthetized using Mepivacaine hydrochloride 2% with 1:100,000 epinephrine (Scandonest, Septodont, France) after which conventional root canal treatment was initiated. First, teeth were isolated using a dental dam and an access cavity was performed.

Access cavities were refined using an ultrasonic tip ED3D (Guilin Woodpecker Medical Instrument Co., Ltd.) to allow straight-line access to all canals. The access cavity of the first premolar was oval, one buccal and one lingual canal were detected. The second premolar had a triangularly shaped access cavity with two buccal canals (mesiobuccal and distobuccal) and one lingual canal. Working length was determined using Epex Pro (Eighteeth Medical Technology Co., Ltd., Changzhou, China). Canal shaping was done using ProTaper Next (Dentsply, Tulsa Dental Specialties, USA) X1 (17/.04), X2 (25/.06) and X3 (30/.07) instruments. Irrigation was performed with 5.25% sodium hypochlorite solution and 17% EDTA solution followed by saline as a final rinse. Canals were dried using absorbent paper points. Obturation was done using cold lateral condensation of gutta-percha points alongside the main gutta-percha cones size X3 (30/0.07) with a resin-based sealer (Adseal, MetaBiomed, Co., LTD., Chungbuuk, Korea). The access cavities were then sealed with a temporary restoration.

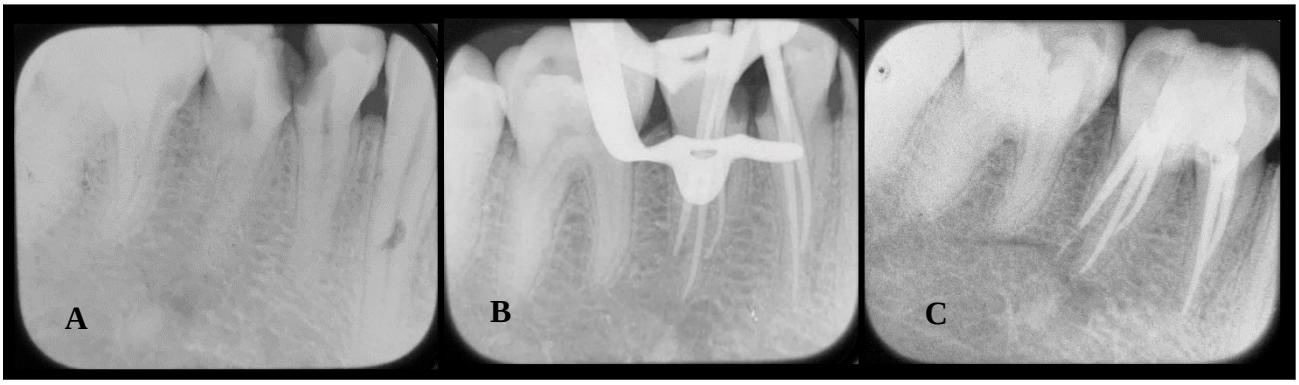

Figure 1. (**A**) Pre-operative periapical radiograph showing unusual root configuration; (**B**) Master cone radiograph **C)** Post-obturation radiograph.

3. Discussion

The diversity observed in the structure of root canals in permanent teeth is impacted by several factors, including the ethnic origins, age, and gender distribution of the population (9). A comprehensive analysis of the root canal structure in mandibular premolars has revealed that populations of Caucasian, Indian, and Middle Eastern descent exhibit a higher occurrence of multiple canals (14%–17%), (10). Zillich et al. studied the root morphology of 1393 mandibular first premolars and 938 second premolars using conventional radiographs and concluded that

69.3 % of first premolars had one canal, 22.7 % had two canals, and 0.4 % had three canals. 84.5 % of second premolars had one canal, 11.7 % had two canals, and 0.4 % had three canals (11).

A review article by Cleghorn et al. assessed the root morphology of first mandibular premolars across earlier studies. They showed that 98% were single-rooted, 1.8% had two roots and 0.2% had three roots (6). Cleghorn et al., in a separate review, investigated the morphology of second premolars. Their findings revealed that 99.6% of these premolars had a single root, while 0.3% had two roots, and only 0.1% exhibited three roots (7).

A recent study reviewing the mandibular premolar anatomy in a Thai population observed that the most frequent root canal pattern in mandibular premolars was Vertucci type I, found in 63.1% and 98% of the first and second premolars, respectively. Over 98% of mandibular premolars had only one root. Bifurcation occurred in 28.5% and 1.5% of the first and second lower premolars, respectively (12).

The presence of a third root/canal in Middle Eastern populations was found to be very rare. Alhadainy (13) investigated the root configuration of Egyptian 250 mandibular first premolars showed 96% single-rooted premolars and 3.2% double-rooted premolars with no three-rooted teeth. Awawdeh et al. (8)., examined the root canal anatomy of the Jordanian population and found that only 2.2% had 3 canals with 3 apical foramina. In another study of a Saudi subpopulation, Al-Zubaidi et al. observed that 95.5% of mandibular first premolars had a single root and 4.5% had two roots. While 99.2% of mandibular second premolars had one root and only 0.8% had two roots (5).

Missed canals are one of the major causes leading to endodontic failure. It was reported that 42% of unsuccessful treatments were caused by untreated canals (14). A thorough clinical examination is the first step in detecting extra canals. However, this is dependent on the operator’s experience and knowledge of the canal anatomy (15). Recently, several techniques have made finding extra anatomy easier for clinicians. The use of magnification devices, such as dental microscopes or loupes, enhances visualization during endodontic procedures. Higher magnification allows for better identification of extra canals, especially those located in challenging areas. Coupled with appropriate lighting, magnification aids in detecting extra canal

orifices that might otherwise be missed (16). This can be particularly useful in premolars with extra canals as they have small and narrow pulp chambers in the mesiodistal dimension.

Careful inspection of pre-operative radiographs of appropriate quality is necessary for the detection of additional roots or root canals. A sudden change in canal radiolucency usually suggests the branching of the main canal into smaller ones (17). More than one angled radiograph may be needed to further assess the root anatomy (18). Conventional periapical radiographs provide a two-dimensional view of the tooth and surrounding structures. While they are useful, they may not always reveal the presence of extra canals. However, modern radiographic techniques, such as digital radiography and cone-beam computed tomography (CBCT) offer more detailed information and improved visualization of complex root canal systems. CBCT is a noninvasive technique that allows healthcare professionals to examine the anatomy of the maxillofacial region in sagittal, axial, and coronal views. CBCT has become a valuable tool in identifying extra canals as it provides a three-dimensional view of the tooth and its intricate anatomy (16). CBCT was found to be the tool of most accuracy when compared with direct vision, use of loupes, and microscope (16).

Following access cavity preparation, the pulpal floor should be inspected for unusual shapes; a triangular shape or a wider chamber mesiodistally may suggest the presence of extra canals (19). Premolars having three root canals have been reported to have one large palatal or lingual canal, together with two smaller mesiobuccal and distobuccal ones (20). In addition, if the pulp chamber seems to not be in its usual location or if the detected orifice is eccentric, the presence of a second or third canal is expected (21). If extra canals are suspected the access cavity should be modified/extended accordingly to gain straight-line access to all canals. Ultrasonic tips can be employed in such cases to remove dentin more conservatively than traditional burs providing less vision obstruction and more controlled dentin removal (22).

4. Conclusion

Proper knowledge of mandibular premolar anatomy and its possible variations may help clinicians to more easily predict, detect, and manage extra anatomy and avoid unwanted mishaps. It is also important to note that the combination of multiple techniques is often necessary to accurately detect extra canals. Dentists should employ a systematic approach, utilizing both

clinical and imaging methods, to ensure a comprehensive evaluation of the tooth's root canal system.

- **Conflict of Interest**

The author declares no conflict of interest.

5. References

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