

Uncommon Root Canal Morphology in a Mandibular Second Premolar: Diagnostic and Clinical Insights

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ABSTRACT:

Excellent success rate of endodontic treatment is achieved by thorough knowledge of anatomical and morphological variations of the root canal system. Endodontist must be able to recognize teeth that differ from standard morphology, because these variations can complicate the treatment process. Ensuring thorough cleaning and sealing of these teeth is crucial, because it leads to the negative outcomes. Mandibular premolars, are known to have unique and irregular anatomical characteristics. Presence of separate three canals with distinct apical foramina of mandibular premolars is a rare occurrence. While mandibular first premolars may exhibit three canals up to 23% cases, this is much less common in second premolars, with an incidence of 0.4%. Furthermore, mandibular second premolar with three roots is found in just 0.2% cases. Following case report discusses the endodontic management of a mandibular second premolar which has unique variations in canal anatomy.

Keywords: *Ah plus sealer, Hero Gold Niti rotary, Mandibular second premolar.*

INTRODUCTION:

A strong understanding of basic anatomy of the roots and its possible diversities is crucial for achieving successful outcomes in endodontic therapy. Failing to identify or treat these variations of canals can be a significant cause of endodontic treatment failure. [^{1,2}] Root canals often left without treatment due to clinician's inability to detect their presence, especially in teeth with anatomical variations. Mandibular premolars are particularly challenging to treat, likely because of irregularities in their canal structure. [³] Frequency of roots and canals in mandibular premolars in anatomical studies varies significantly across the literature. [^{4,5}] Mandibular premolars, displays high diversity and complexity in root canal anatomy. According to studies incidence of two canals along with separate foramina in mandibular second premolar is 5.3%, and incidence of two canals with only one foramen is about 44%. and only 0.4-5% displays three canals with three different foramina. [⁶] This article aims to report and to discuss diagnosis and challenges arising during treatment protocol.

Case Reports:

Case Report 1.

A 28-year-old female patient with no significant systemic or medical history was referred to the department. Her primary complaint was pain in the lower left posterior region of the jaw. Clinical examination stated caries involving enamel, dentin and pulp in 35. Vitality tests were performed on mandibular second premolar revealing a painful reaction to heat, and electric pulp test (EPT), while the tenderness on percussion was absent. Radiograph showed periapical radiolucency and multiple canals with associated tooth (Figure-1a).

The final diagnosis was irreversible pulpitis with acute periapical abscess. Two to three visits were planned for nonsurgical endodontic management of tooth. After administration of local anesthetic that is (2% lignocaine with 1: 80,000 adrenaline), isolation of tooth was done and access cavity was prepared (Figure-1b).

Working length was determined using Root ZX mini, J. Morita Inc., USA apex locator and the same was confirmed radiographically (Figure-1c). The canals of

teeth were shaped and cleaned with hand K-files till #20 (mani) and further canal cleaned and shaped using NiTi rotary instrument (Micro Mega Hero gold) in step down technique till canal size of 20 number 4% and master cone radiograph was taken (Figure-1d). Irrigation of the canals was done with 5.2% sodium hypochlorite during the instrumentation process and with 17% liquid EDTA after completing instrumentation.

Final irrigation was done using normal saline. Paper points were used to dry the root canals and obturation was done with gutta-percha and Dentsply AH Plus root canal sealer using single cone obturation technique (Figure-1e). Tooth was asymptomatic and showed normal periapical area after taking radiograph on 1-month recall (Figure-1f).

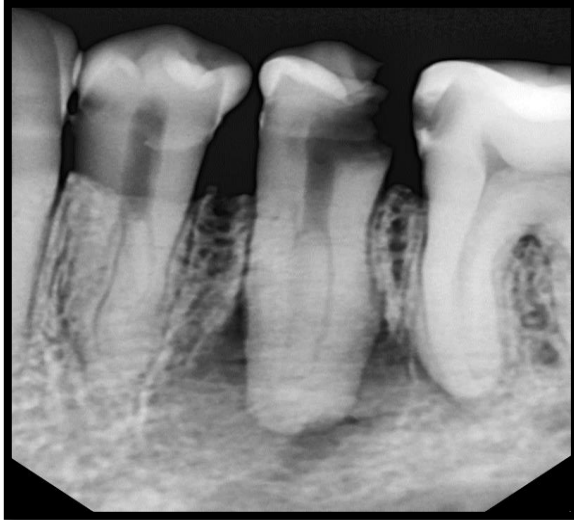


Figure-1a: Pre-Operative Radiograph



Figure-1b: Access Cavity Preparation

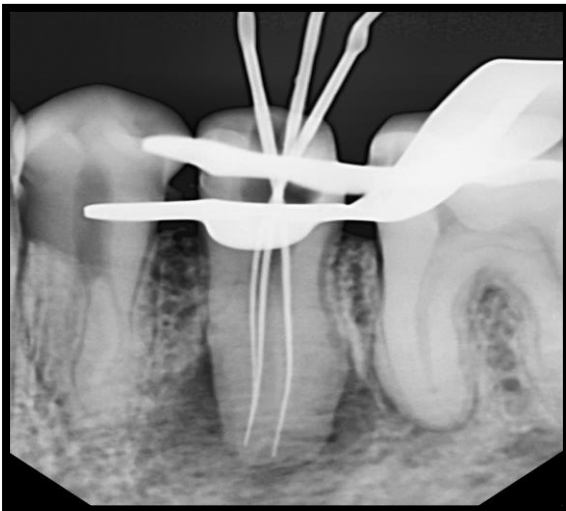


Figure-1c: Working Length Radiograph



Figure-1d: Master Cone Radiograph

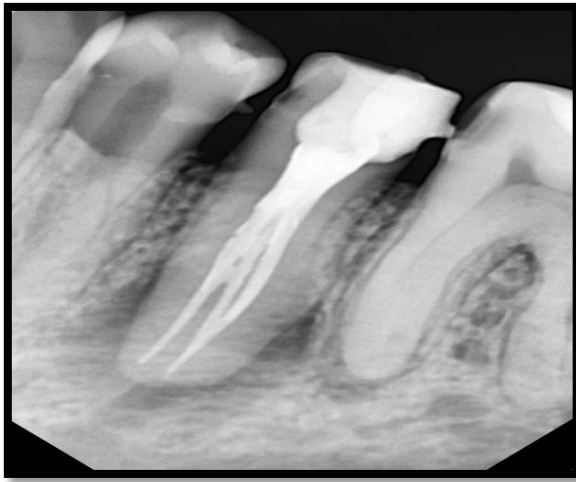


Figure-1e: Obturation and Post obturation restoration



Figure-1f: One Month Follow Up

Case Report-2.

A 16-year female patient without systemic background had visited to department. Chief complaint was pain in lower left back region of jaw. Intraoral examination showed caries with respect to 35. Vitality test revealed a painful reaction to electric pulp test (EPT) and heat, with a normal response on vertical percussion. Radiograph showed healthy periapical area, and there was a suspicion of multiple root canals in the tooth. (Figure-2a).

Pulpal diagnosis was determined to be irreversible pulpitis, while the periradicular diagnosis was considered normal. Endodontic treatment planned was

for two visits. After administration of local anesthetic agent (2% lignocaine with 1: 80,000 adrenaline), isolation of tooth was done and access cavity was prepared (Figure-2b).

Working length was determined using apex locator Root ZX mini, J. Morita Inc., and checked by taking radiograph (Figure-2c). Biomechanical preparation of canals was done till 25 number 4% NiTi rotary files. (Figure-2d).

Same irrigation protocol was followed as mentioned in above case.

Same obturation technique was used as mentioned earlier. (Figure-2e).



Figure-2a: Pre-Operative Radiograph

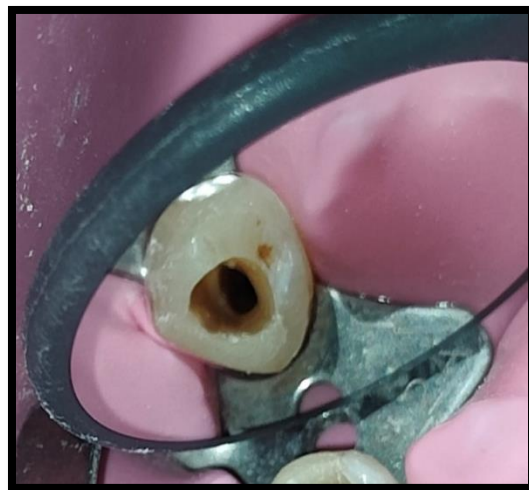


Figure-2b: Access Cavity Preparation

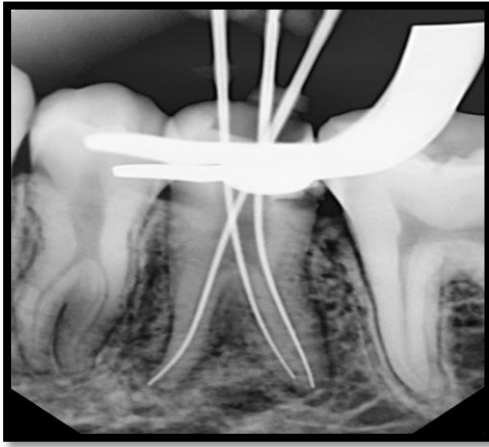


Figure-2c: Working Length Radiograph



Figure-2d: Master Cone Radiograph



Figure-2e: Obturation and Post obturation restoration

DISCUSSION:

Mandibular second premolar typically contains two root canals, a well-documented finding. Presence of three separate canals is rare, occurring in approximately 0.4% of cases. [5]

Vertucci found that 2.5% of mandibular second premolars possess two separate root canals. However, no instances of mandibular second premolars with three root canals were reported. Occurrence of three roots in these teeth is exceedingly uncommon, with an estimated incidence of only 0.1%. [7] Root and canal morphology of these teeth is often more complex than previously recognized.

Diagnostic tools and methods can offer valuable insights that assist clinicians in recognizing additional roots and canals. For correct assessment of how many roots and number of root canals in involved tooth (here mandibular second premolar), we should take radiographs at a particular angle that's is 15-20 degree once in mesial direction and once in distal direction. Studies showed that sudden narrowing of root canal system in a parallel radiograph is suggestive of

presence of more than one canals. [8] Martinez-Lozano et al. recommended using a 40-degree mesial angulation of the x-ray beam to help identify more than one canals. [9]

Successful and reliable endodontic treatment depends on a comprehensive understanding of biology, physiology, and root canal anatomy, as well as the correct use of instruments and the skill to apply them effectively. Teeth with additional roots or canals present particular challenges. Failing to identify and treat these extra canals can lead to treatment failure. Thorough examination of preoperative radiographs can help locate these additional roots or canals. Therefore, endodontic treatment for such teeth should involve use of X-rays from various angles, efficient explorers, larger access openings, proper illumination, and, when possible, magnification. To ensure success, special precautions should be taken, and instrumentation should be done with nickel-titanium files, which offers flexibility and reduces risk of ledge formation and perforations.

CONCLUSION:

The occurrence of multiple roots, multiple canals, and foramina is less common in mandibular second premolars compared to first premolars. Because of these complexities, mandibular premolars enforce challenge to endodontist to produce successful long-term prognosis after treatment. This case is shared to highlight our experience and raise awareness among clinicians about variations in the tooth morphology of mandibular premolars, ultimately resulting in more consistent treatment outcomes.

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