



# Endodontic Treatment of a Mandibular Second Premolar With Three Canals and Atypical Orifices: A Case Report

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## Abstract

**Introduction:** Accurate diagnosis of root canal morphology and anatomy is essential for thorough shaping and cleaning of the entire root canal system and consequent successful root canal treatment. In a mandibular second premolar, it is rare to find extra roots and canals. The anatomy of the pulp chamber floor in premolars with more than one canal usually reveals one lingual and two buccal orifices at the same level.

**Case Presentation:** This case report explains nonsurgical endodontic treatment of a mandibular second premolar with three separate canals and three separate mesiobuccal, mesiolingual, and distolingual orifices.

**Discussion:** Mandibular premolars have always proven to be an enigma to endodontist, as they exhibit a high degree of variability in their root canal morphology when compared to any other tooth in the oral cavity. Flat roots are much more likely to contain multiple canals and intercanal ramifications. In such cases, to obtain predictable results, high quality preoperative radiographs should be available at different horizontal angulations and carefully evaluated to detect the presence of extra root canals.

**Keywords:** Endodontics, Root Canal Therapy, Anatomic Variation, Premolar

## 1. Introduction

A thorough knowledge of the basic root canal anatomy and its possible variations is essential for achieving successful nonsurgical endodontic treatment. Investigators have reported multiple foramina, fins, deltas, loops, furcations, and accessory canals in most teeth (1,2). Case reports of mandibular second premolars with three root canals have been presented by some investigators (3-6). Normal root and root canal anatomy of mandibular premolars are well documented in numerous textbooks, but there is a great deal of variation in the reporting of the incidence of anomalies (7). Vertucci reported that the second premolars had only one root canal at the apex in 97.5% of the teeth under study and two canals were only found in 2.5% of cases; the incidence of three root canals was extremely rare (8,9). Anatomically lower second premolars are described as teeth with single roots and single root canals (10). However, they can be the most challenging to treat due to failure to identify the complex variations in their root canal morphologies. The anatomy of the pulp chamber floor in premolars with three canals usually reveals one lingual and two buccal orifices at the same level. This case report explains nonsurgical endodontic treatment of a mandibular

second premolar with three separate canals and three separate mesiobuccal, mesiolingual, and distolingual orifices.

## 2. Case Presentation

The patient was a 19-year-old female with no history of any systemic diseases. The patient had referred to the department of endodontics, Hamadan faculty of dentistry, with a chief complaint of intermittent pain in the posterior area of the right lower arch, whereby exposure to extreme temperatures, especially cold, elicited intense pain, even after the source of the stimulus was removed. Clinical evaluation revealed a white discoloration in the disto-occlusal surface of mandibular second premolar. Pulp vitality test showed sensitivity to heat, cold and electric pulp tests and confirmed the history of pain. Sensitivity to percussion was in the normal range. Radiographic evaluation revealed normal periodontium and presence of two roots (Figure 1A).

The pulp was diagnosed with irreversible pulpitis with normal periradicular tissues. Isolation was achieved by rubber dam after local anesthesia with 2% lidocaine and 1:100,000 epinephrine. The conventional access opening

was prepared using a tapered diamond bur. During canal searching, finding the mesiobuccal canal was difficult and also this canal was narrow and calcified; to gain sufficient access to this canal, the access opening was modified in a way that it was wider mesially, using Gates-Glidden drill (Dentsply Maillefer, Ballaigues, Switzerland) 2 and 3 set on a slow hand piece with brushing motion to enlarge the main orifice to the level of the furcation in the middle of the root (like taurodont teeth).

The working length was determined with an apex locator (root ZX, J Morita Inc., USA) and confirmed by radiography (Figure 1B). Debridement and shaping of the canals were carried out by K-files (Mani, Utsunomiya, Tochigi, Japan) using the force-balanced technique up to size 0.02/25 and for the final ProTaper (F2) (Dentsply Maillefer, Ballaigues, Switzerland) was used by applying single-length technique. The canals were irrigated with 2.5% sodium hypochlorite and 17% ethylene diamine tetraacetic acid (EDTA) during instrumentation. After final irrigation with normal saline solution, the canals were dried with paper points and obturated with gutta-percha and AH26 (Dentsply, De Trey, Konstanz, Germany) sealer using lateral compaction technique.

Since the rubber dam frame was radio-opaque, during instrumentation, the X-ray angulation was mesially to avoid from superimposition of frame. Accidentally, during obturation of two mesial canals, the third canal was found and a modified parallel periapical radiograph with another direction (7, 11) confirmed it (Figure 1C and 1D). Optimum opening of the access cavity was absolutely necessary into distal direction to achieve straight line access, and then the canal was prepared and obturated the same as others (Figure 1E).

### 3. Discussion

The main objective of root canal treatment is thorough shaping and cleaning of the entire root canal system followed by its complete obturation with an inert filling material and a final restoration (12). Mandibular premolars have always proven to be an enigma to the endodontist as they exhibit a high degree of variability in their root canal morphology when compared to any other tooth in the oral cavity (13). Gulabivala et al. concluded that broad, flat roots are much more likely to contain multiple canals and intercanal ramifications. In such cases, to obtain predictable results, high-quality preoperative radiographs should be available at different horizontal angulations and carefully evaluated to detect the presence of extra root canals (14). Conventional intraoral periapical radiographs are routinely employed to evaluate the root

canal anatomy, but it inherently represents only a three-dimensional anatomy on a two-dimensional image (15). Martinez-Lozano et al. reported that a change of 40° in the horizontal X-ray tube angulation can contribute to the identification of an extra canal in mandibular second premolars (11). Careful interpretation of the periodontal ligament space may suggest the presence of an extra root or canal (16). The use of magnification and fiber optic illumination offers wonderful advantages in locating and treading these extra canals. In addition, dental operating microscope has been helpful (17). Cone-beam computed tomography technology provides some information concerning extra canals, apical deltas, canal morphology, accurate measurement potential in all aspect of root canal system, and a three-dimensional image of root canal(s) anatomy (18). During root canal treatment of taurodont teeth, the clinician should appreciate the complexity of the root canal system, canal obliteration and configuration, and the potential for extra roots and canals. Careful exploration of the grooves between all the orifices, particularly with magnification, use of ultrasonic irrigation, and a modified filling technique are particularly important (19). While locating the root or the canals, it should be considered that the more apically the root canal divides, the more difficult it is to access and obturate efficiently. Hence, smaller K files are initially used as they can deviate buccally or lingually as the main canal divides. Therefore, a good tactile sense is important and the files have to be precurved appropriately before negotiating the canals. During obturation, canal patency was maintained through the apically compacted gutta percha with a file or with a spreader of suitable taper while each canal was being obturated. Failure to recognize these extra canals and to obturate them with care can lead to acute flare-ups during treatment and subsequent failure in endodontic therapy (20, 21).

#### 3.1. Conclusions

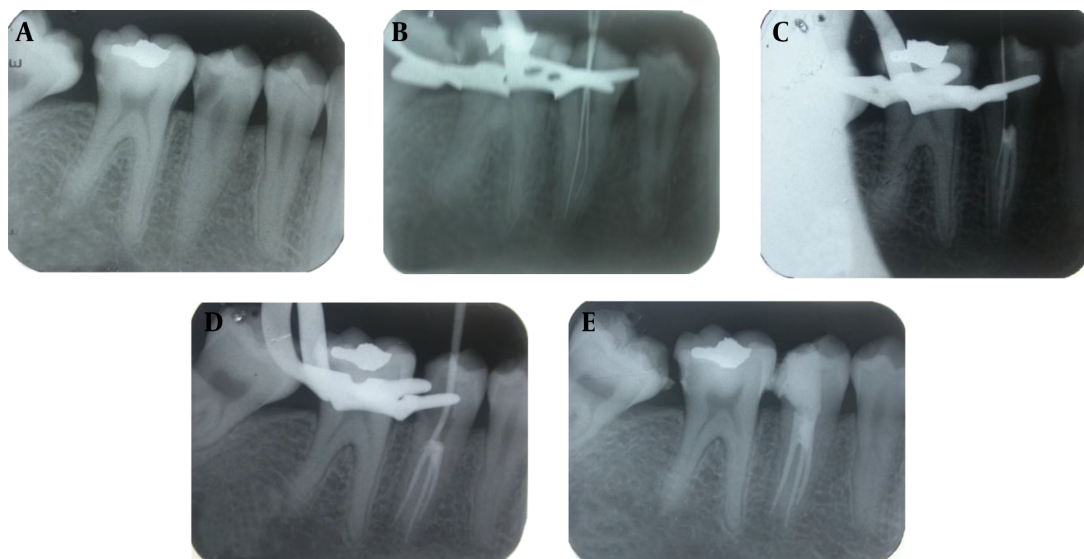
Achieving successful outcomes in endodontic treatments requires an understanding of root canal anatomy and morphology. Clinician should have a thorough knowledge of root canal anatomy to identify the presence of anatomic variations and extra canals.

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#### Footnotes

**Authors' Contribution:** Acquisition of data and drafting of the manuscript: Saeedeh Ghaneie; study supervision: El-

**Figure 1.** Radiographic Evaluation

A, preoperative radiograph of three-rooted second mandibular premolar; B, determination of working lengths by radiography; C, D, third canal determination; E, three-month follow-up.

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## References

- Vertucci FJ, Haddix JE, Britto LR. Tooth morphology and access cavity preparation. *Pathways Pulp*. 2006;**9**:148-232.
- Paul B, Dube K. Endodontic treatment of a mandibular second premolar with three roots and three canals. *Case Rep Dent*. 2014;**2014**:973410. doi: [10.1155/2014/973410](https://doi.org/10.1155/2014/973410). [PubMed: [25431692](https://pubmed.ncbi.nlm.nih.gov/25431692/)].
- Shokouhinejad N. Root canal re-treatment of a mandibular second premolar with three root canals: a case report. *Aust Endod J*. 2009;**35**(3):180-2. doi: [10.1111/j.1747-4477.2009.00172.x](https://doi.org/10.1111/j.1747-4477.2009.00172.x). [PubMed: [19961459](https://pubmed.ncbi.nlm.nih.gov/19961459/)].
- Chan K, Yew SC, Chao SY. Mandibular premolar with three root canals-two case reports. *Int Endod J*. 1992;**25**(5):261-4. [PubMed: [1291523](https://pubmed.ncbi.nlm.nih.gov/1291523/)].
- Rodrig T, Hulsmann M. Diagnosis and root canal treatment of a mandibular second premolar with three root canals. *Int Endod J*. 2003;**36**(12):912-9. [PubMed: [14689961](https://pubmed.ncbi.nlm.nih.gov/14689961/)].
- De Moor RJ, Calbertson FL. Root canal treatment in a mandibular second premolar with three root canals. *J Endod*. 2005;**31**(4):310-3. [PubMed: [15793392](https://pubmed.ncbi.nlm.nih.gov/15793392/)].
- Ingle JL. *Ingle's endodontics* 6. USA: PMPH; 2008.
- Honsy KF, Abiad RS. Mandibular second premolar with three root canals: a case report. *JLDA*. 2013;**48**(1).
- Cohen S, Burns RC. *Pathways of the pulp*. 4. Mosby; 1998.
- Ingle JL, Balkland LB. *Endodontics*. New York: Elsevier; 2002.
- Martinez-Lozano MA, Forner-Navarro L, Sanchez-Cortes JL. Analysis of radiologic factors in determining premolar root canal systems. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1999;**88**(6):719-22. [PubMed: [10625856](https://pubmed.ncbi.nlm.nih.gov/10625856/)].
- Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. *Endodontic Topics*. 2005;**10**(1):3-29.
- Lotfi M, Vosoughhosseini S, Zand V, Fatemi A, Shyezadeh V, Ranjkesh B. A mandibular second premolar with three canals and atypical orifices. *J Oral Sci*. 2008;**50**(3):363-6. [PubMed: [18818477](https://pubmed.ncbi.nlm.nih.gov/18818477/)].
- Gulabivala K, Aung TH, Alavi A, Ng YL. Root and canal morphology of Burmese mandibular molars. *Int Endod J*. 2001;**34**(5):359-70. [PubMed: [11482719](https://pubmed.ncbi.nlm.nih.gov/11482719/)].
- Yoshioka T, Villegas JC, Kobayashi C, Suda H. Radiographic evaluation of root canal multiplicity in mandibular first premolars. *J Endod*. 2004;**30**(2):73-4. doi: [10.1097/00004770-200402000-00002](https://doi.org/10.1097/00004770-200402000-00002). [PubMed: [14977299](https://pubmed.ncbi.nlm.nih.gov/14977299/)].
- Asgary S. Endodontic therapy in a three canal mandibular second premolar. *Iran Endod J*. 2006;**1**(1):43-4. [PubMed: [24494024](https://pubmed.ncbi.nlm.nih.gov/24494024/)].
- Saberi EA, Rasooli H, Movassagh Z. Retreatment of a mandibular second premolar with three roots: a case report. *Iran Endod J*. 2014;**9**(2):158-60. [PubMed: [24688588](https://pubmed.ncbi.nlm.nih.gov/24688588/)].
- Peters OA. Current challenges and concepts in the preparation of root canal systems: a review. *J Endod*. 2004;**30**(8):559-67. [PubMed: [15273636](https://pubmed.ncbi.nlm.nih.gov/15273636/)].
- Jafarzadeh H, Azarpazhooh A, Mayhall JT. Taurodontism: a review of the condition and endodontic treatment challenges. *Int Endod J*. 2008;**41**(5):375-88. doi: [10.1111/j.1365-2591.2008.01388.x](https://doi.org/10.1111/j.1365-2591.2008.01388.x). [PubMed: [18363703](https://pubmed.ncbi.nlm.nih.gov/18363703/)].
- Reddy SJ, Chandra PV, Santoshi L, Reddy GV. Endodontic management of two-rooted mandibular premolars using spiral computed tomography: a report of two cases. *J Contemp Dent Pract*. 2012;**13**(6):908-13. [PubMed: [23404026](https://pubmed.ncbi.nlm.nih.gov/23404026/)].
- Sachdeva GS, Ballal S, Gopikrishna V, Kandaswamy D. Endodontic management of a mandibular second premolar with four roots and four root canals with the aid of spiral computed tomography: a case report. *J Endod*. 2008;**34**(1):104-7. doi: [10.1016/j.joen.2007.10.004](https://doi.org/10.1016/j.joen.2007.10.004). [PubMed: [18155506](https://pubmed.ncbi.nlm.nih.gov/18155506/)].