

The Essential Guide to Managing Morphological Oddity of Two-rooted Mandibular Premolar: A case report with review of 10 years incidence

Abstract:

Introduction: The root canal morphology of teeth is often extremely complex and highly variable. One such morphological oddity is the presence of two roots, with a reported incidence of 1.8%.

Case: A 16-year-old female patient complains of pain in the posterior left mandibular tooth for the past 2 weeks. After clinical, radiographic examination, and vitality testing, we diagnosed the patient with Acute apical periodontitis of tooth #34. It was decided to treat the left mandibular first premolar with two roots endodontically. The patient was reviewed after 1 month, 3 months, 6 months,

Conclusion: This case report details the endodontic management of a sparse case of mandibular first premolar with two roots and two canals, which ended with a favorable outcome due to the satisfactory execution of the preferred constituents.

Key-words: Accessory root, Mandibular premolar, Root canal therapy.

Introduction:

Teeth frequently have incredibly intricate and varied root canal anatomy. Comprehending the anatomy of the root canal completely is necessary for long-term, effective endodontic therapy. Root canal treatment failure can be attributed chiefly to missing canals.[1] The root canal treatment aims to shape the system, clean it mechanically, and disinfect it chemically before completing the three-dimensional obturation.

According to Slowey[2], mandibular first premolars—often referred to as the "Endodontist's enigma"—might be the tooth for which successful endodontic therapy is most difficult to achieve out of all of the teeth. This is because they are anatomically surprising and often display a wide spectrum of morphological peculiarities. The occurrence of two roots is one such morphological peculiarity, with a reported prevalence of 1.8%.[3] Rare reports of four-rooted (0.1%) and three-rooted (0.2%) variants have also been made.[4]

It has been said on several occasions that mandibular premolars are the teeth that give the most significant challenge to endodontic treatment, mainly when multiple roots or canals

are present. The difficulties for clinicians are further compounded by the propensities for abnormal variations, narrow mesiodistal dimensions and the resulting restricted access to canals, lack of vision, and apical third trifurcations and deltas.⁵ When analyzing non-surgical root canal treatment, mandibular first premolars had the greatest failure rate (11.4%), according to a University of Washington research.[6]

For endodontic diagnosis and treatment to be successful, it is crucial to recognize variances in root canal anatomy. The exterior surfaces have a relatively basic and homogeneous anatomy, which frequently masks the intricacies of the underlying anatomy. In light of this, the case report aims to

¹RASLEEN DUA, ²ANSHUL GANGWAR, ³SRIPARNA DE

¹⁻³Department of pediatric and Preventive Dentistry, Institute of Dental Sciences, Bareilly

Address for Correspondence: Dr. Rasleen Dua
PG Student, Department of pediatric and Preventive Dentistry, Institute of Dental Sciences, Bareilly
Email : rasleendua14@gmail.com

Received : 19 July 2024, **Published :** 31 July, 2024

Access this article online	
Website: www.ujds.in	Quick Response Code 
DOI: https://doi.org/10.21276/ujds.2024.10.2.25	

How to cite this article: Dua, R., Gangwar, A., & De, S. (2024). The Essential Guide to Managing morphological oddity of Two-rooted Mandibular Premolar: A case report with review of 10 years incidence. UNIVERSITY JOURNAL OF DENTAL SCIENCES, 10(2).

inform dental professionals about the unusual occurrence of additional roots in the mandibular first premolar.

Case Report :

A 16-year-old female patient reported to the Department of Pediatric and Preventive Dentistry, **chief complaint**-The patient has reported experiencing pain for the last two weeks in the left posterior mandibular tooth.

Medical/ Dental History:

The patient's dental and medical history was noncontributory.

Intraoral examination-

The patient maintained good dental care; all teeth were healthy except for tooth #34, which had extensive proximal and occlusal caries that penetrated the pulp chamber. The tooth was tender on percussion.

Pulp Vitality:

The tooth was not responded to vitality testing.

Imaging Interpretation:

IOPA radiographs shows ill-defined radiolucency involving enamel, dentine, pulp, and two roots, with a widening of the periodontal ligament and broken lamina dura, but it produces only a two-dimensional image.(fig 1a)Hence, to ascertain this rare and complex root canal anatomy of the tooth in a three dimensional manner, dental imaging with the help of a **CBCT** was planned(fig 1b)

Based on a clinical,imaging, and vitality test evaluation, the patient was diagnosed with acute apical periodontitis of tooth #34.The decision was made to proceed with endodontic therapy.

Treatment planning (PRICE GUIDELINES 2020)-(Flowchart-1):

After obtaining consent from the parent.The tooth was anesthetized by an inferior alveolar nerve block with 2% local anaesthesia containing 1:80000 adrenaline. Cavity preparation for endodontic access was finished using a round diamond bur in a high-speed airtorhandpiece under rubber dam isolation. The DG 16 explorer was used to detect the canal entrance, and a magnifying loupe (Seiler loupes) was used to examine the pulp chamber. One largebuccal orifice is easily recognized, and the file was inserted into that orifice first. After altering the angulation under magnification loupes, we observed a little aperture mesiolingually, which radiovisiography corroborated.

Once the big buccal canal was determined to be patent, a #10 K file (Dentsply, Maillefer) was put into the canal bifurcation in a mesiolingual direction to reach the second root. A working length radiograph verified that only one coronal canal split off and coincided with the two roots' separation (Vertucci class V) just below the middle one-third. The two canals left the corresponding roots through distinct apical foramina. (Fig 2)

In a subsequent visit, Biomechanical preparation of the canals was performed using Safe Endo Smart Rotary (#25/ 0.04 taper) under copious irrigation with a total of 15 ml of 5.25% sodium hypochlorite and 15% ethylenediaminetetraacetic acid (EDTA) solution and final irrigation done with saline to neutralize the irrigation effect. After root canal desiccation, calcium hydroxide(PrevestDenPro) was filled in and temporarily sealed by Intermediate Restorative Material (Dentsply Sirona). The patient was recalled after 2 weeks.

The tooth was asymptomatic 2 weeks later; the canals were dried with absorbent points(Dentsply), and were obturated with 0.04 taper gutta-perchas(Dentsply) and MTA-Fillapex Sealer. A post-obturation radiograph was obtained to assess the quality of obturation. (fig 3)Composite(3M ESPE Dental Products) was used to finish the final post-endodontic restoration.(fig4 a)

Follow-up & Outcome:

At subsequent visit, the patient was asymptomatic and PFM crown was delivered to patient after 3months.The patient was followed up at six months, and one year to ensure that the healing was satisfactory on radiographs as well as clinically. (fig4b,c)

Literature Search Strategy:

A literature search was organized to review the past ten years publications about Morphology variations in the mandibular first premolar (incidence by number of roots and canals) with focus on cases reported in Medline, Scopus, and Google Scholar databases. The search strategy involved Mesh search keywords including “MANDIBULAR” “FIRST” “PREMOLAR,” “MORPHOLOGICAL VARIATION,” “ROOT”, “ROOT CANAL,” Boolean enquiry- AND/OR. Narrowing down to articles published in English language only. Finally based on the reporting criteria, management strategy of the mandibular first premolar with unusual rootmorphology, and the presence ofmultiple roots, 10 case studies were selected (Table 1).Out of them six of the selected

articles were single case reports whereas one of the studies had reported two cases and three of the studies had reported case series.

Discussion:

It is unquestionably an endodontic difficulty to diagnose and treat additional roots or root canals in the mandibular first premolar. For successful and predictable endodontic therapy, meticulous radiographic assessment and a thorough understanding of biology, anatomy and root canal architecture must determine the number of roots and root canals. The knowledge of tooth anatomy is crucial as it can aid in identifying the number of root canals. There are several methods for locating hidden canals and their associated root system, including magnification and illumination, radiographic diagnosis, CBCT, and various tests like the Champagne bubble test, use of dyes, Redline test, White line test, etc.[5]

The root morphology of mandibular first premolar can be highly complex and extra root(s) can be found. The mandibular first premolar's accessory root is referred to as Tome's root by Scott and Turner⁷. They noted that the form of roots varied throughout ethnic groups and that people from Australia and sub-Saharan Africa had the highest occurrence of accessory roots (>25%). Additionally, sex variations in canal morphology were documented by Sert and Bayrili [8], who found that females had a greater occurrence of supplementary roots and canals (44%) than males (34%).

According to published endodontic literature, most mandibular premolars in adult patients have multiple canals.[Table 1].[3,9-18], the present case was the youngest among reviewed cases.

In 1989, Wilcox[19] found that 12% of mandibular second premolars and 25% of mandibular first premolars had two roots. When Blaine et al. (2013) examined eight case studies, they discovered that 97.9% of mandibular first premolars had a single root, 1.8% had two roots, 0.2% had three roots, and 0.1% (very seldom) had four roots.[4]

The root canal system of premolars with two roots and three root canals is typically characterised by one large lingual canal and two smaller mesiobuccal and distobuccal canals in the buccal root. Tzanetakiset al.[20] suggested using the Krasner and Rankow[21] symmetry laws, particularly when unexpected or unusual anatomy is present. However, the mandibular premolar root canal system's dimensions are

broader buccolingually than mesiodistally in this situation.

In these situations, a successful endodontic result depends on meticulously applying all available diagnostic tools to identify and address the root canal system. A good treatment outcome requires careful interpretation of angled radiographs, appropriate preparation of the access site, and a thorough tooth examination.

Table 1: Morphology variations in the mandibular first premolar (incidence by number of roots and canals)

Reference (chronologic order)	Number of roots	Number of canals	Vertucci ¹⁸ And its modified version	Technological advances used to locate the canals	Age/sex of the patients
Solete P, et al., (2023) ⁹	1	3	Type IX	The canals were identified using a size 10 K hand file and magnification loupes	29yrs/Male
Salvankar S, et al., (2023) ¹⁰	2	2	Type V	Canals were detected by making a severe pre-curve at the end of #15 K-file	40yrs/male
Zhang M, et al., (2020) ¹¹	1	5	Type XI	Four canals were found under a dental operating microscope and fifth canal was found later during preparation	25yrs /Male
Izaz S, et al., (2018) ¹²	2	4	Type XI	Mesiobuccal, mesiolingual, and distal canals were first negotiated with a size 10 K file and distobuccal, and distolingual was confirmed by CBCT	48yrs/Female
Ramdas R, et al., (2017) ¹³	2	2	Type IV	Clinical exploration with DG-16 & magnifying loupe was used to locate the canal orifice.	50yrs/Male
Haddadi A, et al., (2017) ¹⁴	1	3	Type VIII	Canals were detected by making a severe pre-curve at the end of #15 K-file	27yrs/Male
Haddadi A, et al., (2017) ¹⁴	1	3	Type VIII	Canals were detected by making a severe pre-curve at the end of #15 K-file	27yrs/Male
Ganeshwar F, et al., (2015) ¹⁵	1	3	Type IX	Canals were detected by making a severe pre-curve at the end of #15 K-file	32yrs/Female
Vaghela DJ, et al., (2013) ¹⁶	4	4	Type XX	Mesiobuccal, distobuccal, mesiolingual, and distolingual canals were ascertained using a small size K-file	24yrs/Male
Kararia N, et al., (2012) ¹⁷	2	2	Type V	Clinical exploration with DG-16& magnifying loupe was used to locate the canal orifice.	32yrs/Male
Kakkar P, et al., (2012) ¹⁷	3	3	Type IX	The three canal orifices were located under magnification using an operating microscope and spiral CT scan using dental software Dentascan after obturation	19yrs/Female
Present Case (2023)	2	2	Type V	Buccal and lingual orifice were identified with DG-16 & magnifying loupe confirmed with the axial CBCT images.	16yrs/Female

Flowchart-1: PRICE GUIDELINES 2020

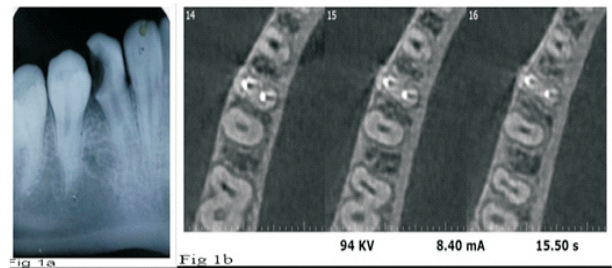
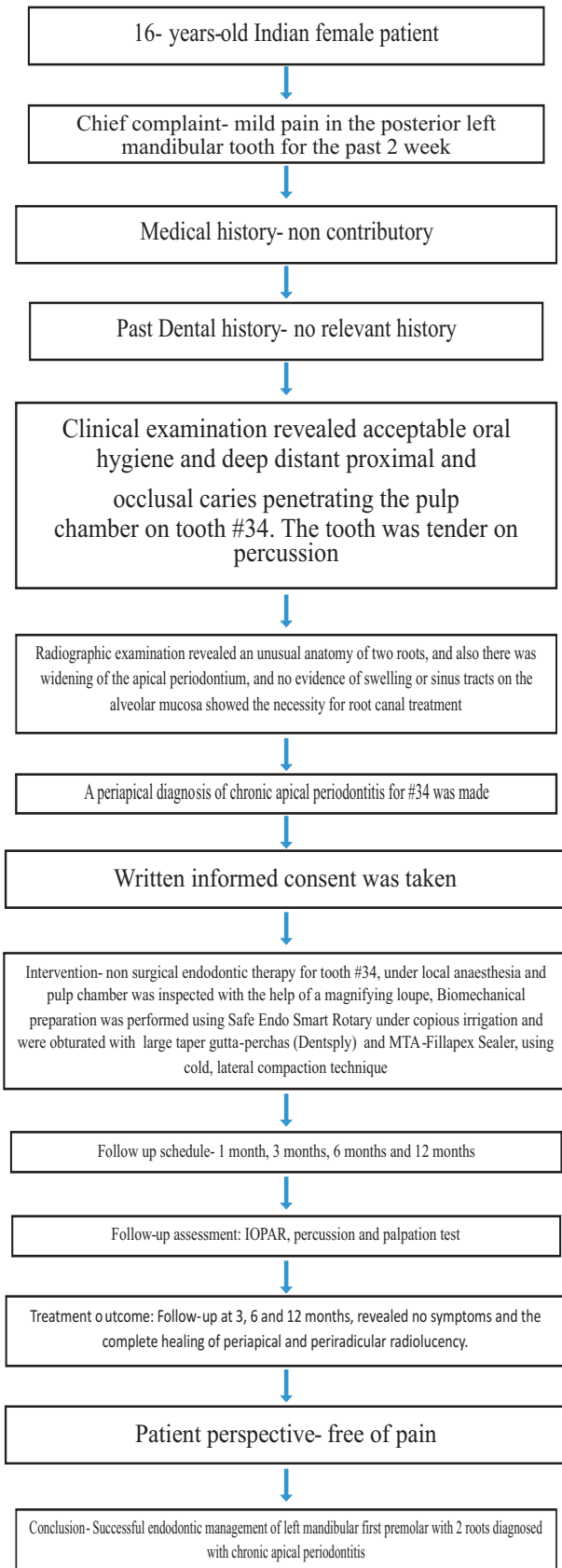


Fig 1: a) Intraoralperiapical radiograph; b) cone-beam computer tomography.



Fig 2:working length radiograph

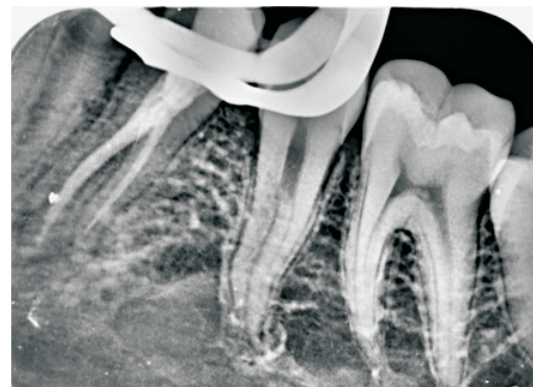


Fig 3: Post-obturation radiograph

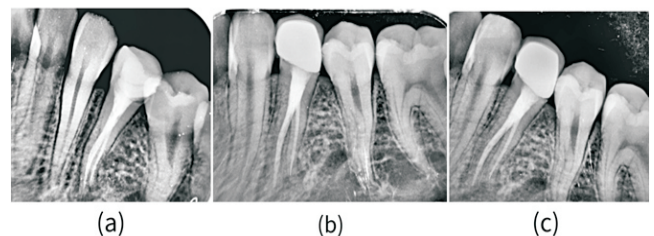


Fig 4: a) Final post-endodontic restoration; b) follow up at six months; c) follow up at one year

Conclusion:

Compared to the traditional description of one root, one canal found in dental anatomy manuals, reports in the literature differ widely about the mandibular first premolar's uncommon number of roots and aberrant root canal architecture. It is essential for clinicians to be aware of the anatomical variances with this tooth and to thoroughly assess each case using radiography and clinical examination to identify any accessory roots or canals.

Acknowledgment:

We thanked the patient for using their radiographs and case in manuscript preparation (CARE GUIDELINES)

References:

1. Singh A, Abraham D, Ahuja R, Jala S. Mandibular premolar with two roots - a case report. *J Den Sci* 2016; 4(1)4-6. https://www.researchgate.net/publication/354554963_mandibular_premolar_with_2_roots
2. Slowey RR. Root canal anatomy. Road map to successful endodontics. *Dent Clin North Am* 1979;23:555-73. [https://doi.org/10.1016/S0011-8532\(22\)03170-6](https://doi.org/10.1016/S0011-8532(22)03170-6).
3. Kararia N, Chaudhary A, Kararia V. Mandibular left first premolar with two roots: A morphological oddity. *Contemp Clin Dent* 2012;3:234-6. DOI: 10.4103/0976-237X.96840.
4. Cleghorn BM, Christie WH, Dong CC. The root and root canal morphology of the human mandibular first premolar: a literature review. *J Endod*. 2007;33(5):509-16. DOI: 10.1016/j.joen.2007.03.020
5. Gómez Sosa JF. Diagnosis and endodontic management of a mandibular second premolar with four root canals. *ENDO (Lond Engl)* 2008; 2(4):285-289. https://www.researchgate.net/publication/305730943_Diagnosis_and_endodontic_management_of_a_mandibular_second_premolar_with_four_root_canals
6. Ingle JI, Baumgartner JC. *Ingle's endodontics 6: PMPH - USA*; 2008.
7. Scott R, Turner C 2nd. *The anthropology of modern human teeth*. Cambridge: Cambridge University Press; 2000. DOI: <https://doi.org/10.1017/CBO9781316529843>
8. Sert S, Bayirili GS. Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. *J Endod* 2004;30:391-8. doi: 10.1097/00004770-200406000-00004.
9. Solete P, Priscilla Antony SD, Teja KV, Chandragupta MS, Sanju D, Suresh Babu NM. Endodontic management of aberrant canal morphology in mandibular premolar: A case series. *J Conserv Dent*. 2023 Mar-Apr; 26(2):236-240. doi: 10.4103/jcd.jcd_548_22.
10. Kalyankar S, Sharma AS, Jadhav A, Patil R, Gujarathi N, Bhagwat D. Mandibular Premolars, an Enigma to Endodontists : A Case Series. *Eur. Chem. Bull*. 2023; 12(4):12087-92. DOI: 10.48047/ecb/2023.12.si4.1085
11. Zhang M, Xie J, Wang YH, Feng Y. Mandibular first premolar with five root canals: a case report. *BMC Oral Health*. 2020 Sep 10;20(1):253. doi: 10.1186/s12903-020-01241-0.
12. Izaz, Shaik; Dasari, Bhargavi¹; Bolla, Nagesh; Neelakantan, Prasanna². Unusual root canal morphology of mandibular first premolar and its management: A rare case report. *Journal of Conservative Dentistry* 21(3):p 344-347, May - Jun 2018. | DOI: 10.4103/JCD.JCD_312_16
13. Ramdas R, Jayasree S, Kumar R, Rahman NK, Rajeesh MK, Raj G. Management of Mandibular Premolar with Two Roots: Two Case Reports. *IOSR J Dent Med Sci* 2017;16(5): 116-119. DOI: 10.9790/0853-160506116119.
- Hoshiyari N, Haddadi A. Endodontic Treatment of A Mandibular First Premolar with Three Root Canals: A Case Report. *J Res Dentomaxillofac Sci*. 2017;2(4):50-54.
14. Hoshiyari N, Haddadi A. Endodontic Treatment of A Mandibular First Premolar with Three Root Canals: A Case Report. *J Res Dentomaxillofac Sci*. 2017;2(4):50-54. DOI:10.29252/jrdms.2.4.50
15. Daneshvar F, Baziar H, Karkehabadi H, Jafarzadeh H, Bhandi S, Patil S. Mandibular first premolars with one root and three canals: A Case Series. *J Contemp Dent Pract* 2015;16(6):519-22. DOI:10.5005/jp-journals-10024-1715.
16. Vaghela DJ, Sinha AA. Endodontic management of four rooted mandibular first premolar. *J Conserv Dent*. 2013 Jan;16(1):87-9. doi: 10.4103/0972-0707.105307.
17. Kakkar P, Singh A. Mandibular First Premolar with Three Roots: A Case Report. *Ira Endo J* 2012;7(4):207-210. PMID: 23130081; PMCID: PMC3487526.
18. Bansal R, Hedge S, Astekar MS. Classification of Root Canal Configurations: A Review and a New Proposal of Nomenclature System for

- Root Canal Configuration. *J ClinDiag Res.* 2018 May, Vol-12(5): ZE01-ZE05.
19. Serman NJ, Hasselgren G. The radiographic incidence of multiple roots and canals in human mandibular premolars. *IntEndod J.* 1992;25(5):234–7. DOI: 10.1111/j.1365-2591.1992.tb01155.x
 20. Tzanetakis GN, Lagoudakos TA, Kontakiotis EG. Endodontic Treatment of a Mandibular Second Premolar with Four Canals Using Operating Microscope. *J Endod.* 2007;33(3):318–21. DOI:10.1016/J.JOEN.2006.08.006
 21. Krasner P, Rankow HJ. Anatomy of the Pulp-Chamber Floor. *J Endod.* 2004;30. DOI: 10.1097/00004770-200401000-00002