Case Report

# An Unusual Morphological Variation: A Rare Case Report of Anomalous Maxillary First Premolar with Multiple Roots and Rotated Second Premolar

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## Abstract

In endodontics, anatomical variations in tooth morphology present many challenges in diagnosis and treatment planning. The anatomical anomalies require a comprehensive understanding and meticulous approach to ensure successful outcomes. Premolars often exhibit diverse morphology, including extra root, accessory canals, and rotational anomalies. Such morphological variations in premolars demand careful clinical and radiographic evaluation. An extra canal in the maxillary first premolars is uncommon, additionally, a twisted second premolar exacerbates the case. A precise diagnosis and careful management are necessary for such situations to have effective outcomes. Significant diagnostic and therapeutic issues arise from anatomical variations. This case study highlights an uncommon presentation of three canals in the maxillary 1st premolar and a twisted second premolar. This case also highlights the importance of individualized treatment strategies in managing atypical anatomical variations.

**Keywords:** Anatomic variation, Bicuspid, Dental morphology, Endodontic treatment, Tooth rotation.

## Introduction

Maxillary premolars exhibit significant anatomical and morphological variations, posing challenges in root canal treatment. Their intricate root canal anatomy increases the risk of procedural errors such as missed canals. Successful endodontic therapy requires a thorough understanding of these variations for proper access, canal location, cleaning, shaping, and obturation. Radiographic evaluation is crucial in identifying additional canals. The maxillary first premolar typically has 2 canals (64–88%), though a single canal (9–36%) or 3 distinct canals (0.5–1%) may be present. Premolars with three roots, sometimes called "ridiculous molars," resemble maxillary molars in the root structure.[1] Advanced imaging such as cone-beam computed tomography (CBCT), magnification, and illumination aids in accurate canal identification.[2] Tooth rotation, a prevalent dental defect, is characterized by twisting a tooth along its axis due to factors, such as abnormal eruption paths, malocclusion, crowding, or trauma. It is more common in anterior teeth, with molars exhibiting the least rotation (0.8°–7.4°).[3] Rotation in anterior teeth affects esthetics and psychological well-being, whereas in posterior teeth, it impacts mastication, occlusion, and wear. In cases of rotated premolars, endodontic treatment becomes challenging due to altered access angles, necessitating precise access openings and specialized instrumentation.

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## Case Description

A 26-year-old Indian male presented with a chief complaint of pain in the upper right posterior region for 10 days, worsening when lying down. His medical history was non-contributory. Clinical examination revealed rotation of the maxillary second premolar, and pulp sensibility tests were negative. CBCT revealed that the maxillary first premolar had three roots and three canals (Figure 1a). Radiographic imaging showed extensive caries approximating the pulp with periapical pathosis. Symptomatic apical periodontitis was diagnosed concerning teeth 14, 15, and 16, and endodontic treatment was planned (Figure 1b). After obtaining informed consent, local

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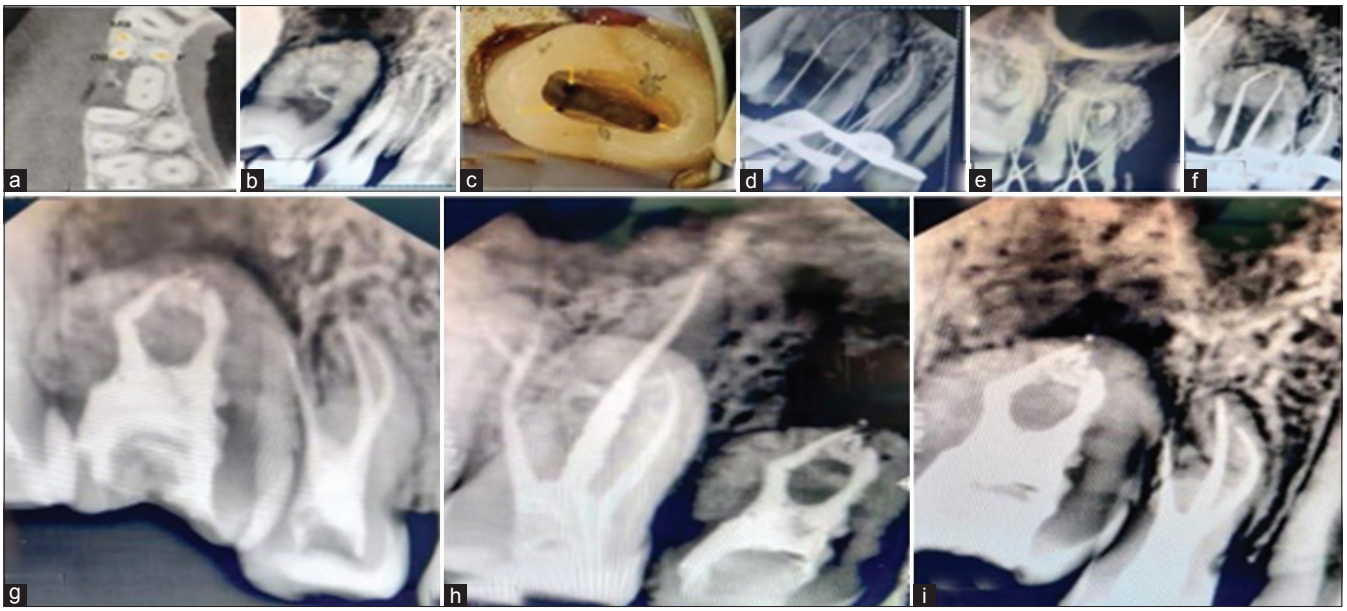


**Figure 1:** (a) Cone-beam computed tomography image of three-rooted first premolar, a rotated second premolar, and a maxillary first molar (b) pre-operative radiograph (c) access opening shows three separate canals (d) working length determination of 14, 15 (e) working length determination for 16 (f) radiograph shows master cone (g and h) radiograph after obturation of the first, second maxillary premolar, and first molar (i) Radiograph shows post-obturation

**Table 1: Incidence and Prevalence of Maxillary First Premolars with Three Roots and Canals (2000 – Present)**

| Year | Authors | Source | Population studied | Incidence | Methodology |
|---|---|---|---|---|---|
| 2004 | Dehua *et al*. | Weng XL, Yu SB, Zhao SL, Wang HG, Mu T, Tang RY, Zhou XD. Root canal morphology of permanent maxillary teeth in the Han nationality in Chinese Guanzhong area: a new modified root canal staining technique. Journal of endodontics. 2009 May 1;35 (5):651-6. | Chinese | 0.6 | In vitro study of 326 extracted teeth using radiographic analysis |
| 2008 | Awawdeh *et al*. | Awawdeh L, Abdullah H, Al-Qudah A. Root form and canal morphology of Jordanian maxillary first premolars. Journal of Endodontics. 2008 Aug 1;34 (8):956-61. | Jordanian | 1.5 | In vitro study of 600 extracted teeth using radiographic analysis |
| 2012 | Tian *et al*. | Tian YY, Guo B, Zhang R, Yu X, Wang H, Hu T, Dummer PM. Root and canal morphology of maxillary first premolars in a Chinese subpopulation evaluated using cone-beam computed tomography. International endodontic journal. 2012 Nov; 45 (11):996-1003 | Chinese | 1.0 | In vivo study of 300 patients using CBCT. |
| 2014 | Ok *et al*[6] | Ok E, Altunsoy M, Nur BG, Aglarci OS, Çolak M, Güngör E. A cone-beam computed tomography study of root canal morphology of maxillary and mandibular premolars in a Turkish population. Acta Odontologica Scandinavica. 2014 Nov 1;72 (8):701-6. | Turkish | 1.01 | In vivo study of 1,379 patients using CBCT. |
| 2015 | Abella *et al*. | 1. Abella F, Teixidó LM, Patel S, Sosa F, Duran-Sindreu F, Roig M. Cone-beam computed tomography analysis of the root canal morphology of maxillary first and second premolars in a Spanish population. Journal of endodontics. 2015 Aug 1;41 (8):1241-7. | Spanish | 2.6 | In vivo study of 430 patients using CBCT. |
| 2016 | Celikten *et al*. | Celikten B, Orhan K, Aksoy U, Tufenkci P, Kalender A, Basmaci F, Dabaj P. Cone-beam CT evaluation of root canal morphology of maxillary and mandibular premolars in a Turkish Cypriot population. BDJ open. 2016 Jan 29;2 (1):1-5 | Turkish cypriot | 0.9 | In vivo study of 437 patients using CBCT. |
| 2017 | Martins *et al*. | Martins JN, Ensinas P, Chan F, Babayeva N, von Zuben M, Berti L, Lam EW, Antúnez M, Pei F, de la Espriella CM, Vargas W. Worldwide Assessment of the Root and Root Canal characteristics of Maxillary Premolars–A Multi-center Cone-Beam Computed Tomography cross-sectional study with Meta-analysis. Journal of Endodontics. 2024 Jan 1;50 (1):31-54. | Caucasian | 0.7 | In vivo study of 690 patients using CBCT. |
| 2017 | Burklein *et al*. | Bürklein S, Heck R, Schäfer E. Evaluation of the root canal anatomy of maxillary and mandibular premolars in a selected German population using cone-beam computed tomographic data. Journal of endodontics. 2017 Sep 1;43 (9):1448-52 | German | 2.0 | in vivo study of 644 patients using CBCT |

anesthesia (2% xylocaine with 1:200,000 adrenaline) was administered, and rubber dam isolation was applied. Access cavity preparation for tooth 14 was done using an endo access bur and endo Z bur, modifying the cavity edges into a triangular shape similar to a maxillary molar (Figure 1c). The coronal pulp was extirpated, and canals were explored using a DG16 probe and ISO #8 stainless steel K-file for patency. Working length was determined using an apex locator and confirmed by radiovisiography (RVG) (Figure 1d and e) respectively. Hand instrumentation was performed up to ISO #20 K-file, followed by rotary shaping with 25/4% files (NeoEndo, Orikam Healthcare). Irrigation was done with 3% sodium hypochlorite and saline, with 17% ethylenediaminetetraacetic acid (EDTA) used for smear layer removal. The canals were dried with paper points, and calcium hydroxide dressing was placed as an interappointment medication. After a week, the dressing was removed, master cones confirmed (Figure 1f), and obturation was completed using the single-cone technique (Figure 1g). Post-obturation restoration was done with resin-modified glass ionomer cement. The maxillary second premolar (tooth 15) posed additional challenges due to its rotation. Its altered crown and root orientation complicated access, increasing the risk of perforations or missed canals. The traditional oval-shaped access had to be strategically modified to align with the actual pulp orientation. After obtaining informed consent, local anesthesia and rubber dam isolation were applied. Access preparation was done using an endo access bur and endo Z bur. The canal orifice was located with a DG16 probe, and patency was established with an ISO #10 K-file. Working length was determined using an apex locator and confirmed by RVG. Instrumentation was done up to ISO #20 K-file, followed by coronal flaring. The canals were prepared up to 30/4, whereas the palatal root of tooth 16 was prepared up to 25/6. Irrigation with sodium hypochlorite and saline was followed by final irrigation with EDTA. The master cones were confirmed radiographically, canals dried, and obturation was performed using the warm vertical compaction technique for tooth 15 and the single-cone technique for tooth 16. A post-obturation radiograph was taken to verify the integrity of the obturation (Figure 1h and i).

## Discussion

Anatomical and morphological variations in maxillary premolars significantly influence endodontic treatment outcomes. Missed canals due to anatomic complexity can lead to treatment failure and persistent infection. Studies show that three-rooted maxillary first premolars are rare. Kartal *et al*.[4] found that 89.64% of maxillary first premolars had two canals, whereas only 1.66% had three canals. For maxillary second premolars, 48.66% had a single canal, whereas 50.64% had two canals. Bulut *et al*.[5] reported a 1% prevalence of three-rooted maxillary first premolars, whereas Ok *et al*.[6] found a slightly higher incidence of 1.2%, and Pécora *et al*.[7] reported 2.5%. Vertucci[8] classified maxillary first premolar canal configurations into eight types, with type VIII (three canals) being the most challenging to manage. In the Asian population, the prevalence of three-rooted maxillary first premolars is below 0.5% (Table 1). Advanced imaging and magnification are essential for identifying anatomical variations. High-quality pre-operative radiographs taken from different angles, CBCT, and dental loupes improve canal detection. NiTi rotary instruments offer superior flexibility and resistance to cyclic fatigue, aiding in the management of complex canal systems and improving treatment prognosis. Reports on maxillary premolar variations remain scarce in the literature despite their clinical significance. Tooth rotation has an unclear etiology but may result from developmental disturbances, occlusal factors, or genetic predisposition. Vani *et al*.[9] reported a 7.9% prevalence of maxillary first premolar rotation, with higher occurrence in males (22.8%) than females (17.6%). The degree of rotation ranges from mild (below 45°) to severe (above 90°). Gupta *et al*.[10] categorized rotations into three groups: <45° (31%), 45°–90° (58%), and >90° (11%), with 180° rotations being the rarest (Table 2). Rotation in anterior teeth mainly affects esthetics, whereas in posterior teeth, it causes occlusal disturbances and mastication issues. Rotated teeth are also prone to caries due to food lodgment. Endodontic therapy in rotated premolars presents challenges due to altered pulp chamber orientation, requiring precise access modifications. Kim *et al*.[11] studied the influence of local factors on lower premolar rotation and noted the role of prolonged deciduous tooth retention in rotation development. Morgan[12] suggested that retention of primary teeth could rotate premolars due to eruptive pressures. Such cases require careful instrumentation and modification of standard access cavity designs. CBCT is invaluable in endodontics for identifying additional canals, particularly in rotated or atypical teeth. It provides detailed visualization of the middle and apical thirds, which may not be visible under a dental operating microscope. The integration of CBCT in endodontic diagnostics enhances treatment outcomes by improving morphological assessments and structural evaluations of root canal systems.

**Table 2: Degree of Rotation in Maxillary Second Premolar (2010 – Present)**

| Year | Degree of rotation | Laterality | Source |
|---|---|---|---|
| 2013 | 180° | Unilateral | NayaK G, Singh I. A variation in tooth position-180 rotated maxillary second premolar. Journal of Clinical and Diagnostic Research: JCDR. 2013 Aug; 7 (8):1806. |
| 2018 | 180° | Unilateral | Pauly NG. Morphometric Analysis of the Mental Foramen and Mandibular Canal Using OPG and CBCT: A Comparative Radiographic Study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)). |
| 2023 | 90° | Bilateral | Adeyemi Te, Ewansiha Go, Adekoya Mn, Iya Mm. Bilateral 90° rotation of maxillary second premolar: a rare case report in Nigeria and review of the literature. Journal of Paediatric Dental Research and Practice. 2023 Dec 30;4 (2):65-9. |

## Conclusion

This case report highlights the importance of recognizing anatomical and morphological variations in maxillary premolars for successful endodontic outcomes. Three-rooted first premolars are rare but require meticulous evaluation using advanced imaging and magnification. Rotated teeth pose additional challenges, demanding precise access modifications and careful instrumentation. CBCT plays a critical role in diagnosing complex canal configurations, enhancing the predictability and success of endodontic treatment. Understanding and managing these variations are key to improving prognosis and preventing treatment failures.

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