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Unusual root morphology in a Maxillary first molar with four roots: A case report

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Abstract
Background: Maxillary First molars are usually three rooted with three to maximum seven canals, making them among the most variable teeth with presence of canals. The occurrence of a four-rooted maxillary molar with addition of palatal root is an extremely rare anatomical variation, reported to be 0.047% of cases in Asian populations. Such variations can complicate diagnosis and endodontic treatment if not identified early and leads to Re Root Canal Treatment.
Cas Presentation: This report describes the endodontic management of a Maxillary First molar with four roots and additional present with palatal root. The patient reported with pain in left upper back tooth region and sensisbility tests with heat and cold showed no response. Initial periapical radiographs suggested unusual root morphology. Angled radiographs confirmed the presence of four roots and access cavity was modified. Endodontic treatment was performed under magnification, with careful biomechanical preparation and obturation of all four root canals.
Discussion: Anatomical variations in maxillary first molars are frequent, with a single palatal root most common, while two palatal roots are rare. Kim *et al*. found one palatal root with one canal in 150 cases. Christie *et al*. classified double palatal root molars into three types: Type I with long, divergent palatal roots and "cow horn" buccal roots; Type II with short, parallel roots; and Type III with grouped MB, MP, DP roots and a separate DB root. Baratto Filho *et al.* added Type IV, with fusion of the accessory palatal root to MB. Careful clinical observation, DOM, and DG16 probe enabled identification of an extra palatal canal without calcification, avoiding CBCT.
Conclusion: Understanding variations in root canal anatomy is vital for successful endodontic therapy. Accurate diagnosis with careful clinical and radiographic evaluation helps detects additional canals. Recognizing such complexities ensures precise management, ultimately improving prognosis and long-term treatment success.

Keywords: Unusual root morphology in a maxillary first molar with four roots

Introduction

The major aim of root canal therapy is to perform adequate cleaning, shaping, disinfection and to three-dimensional sealing of the entire root canal system. Therefore, it is important that aberrant anatomy is identified prior to and during root canal treatment. Careful evaluation with multiple angulations of radiograph prior to treatment is necessary however, the deviations from the norm in tooth morphology are not uncommon. This anatomical variability necessitates the need for clinicians to understand these anatomical structural characteristics in-depth for effective endodontic treatment.

Christie *et al*. explored endodontically treated or extracted maxillary molars, identifying three unique radicular configurations based on root shape and separation. To treat maxillary molars, especially those with double palatal roots, depends on accurately identifying and managing all root canals. The challenge is not number of roots but also number of canals, curvatures, and bifurcation, trifurcations that complicates treatment.

A comprehensive understanding of the root canal system in these teeth is, therefore, essential for effective treatment planning and execution. Recent advances in diagnostic imaging, particularly cone-beam computed tomography (CBCT), it provides a three-dimensional view of the tooth, offering critical insights into number of root canals, location, and canal curvature. Moreover, the development of Dental Operating Microscope (DOM) and NiTi rotary instruments has greatly enhanced endodontic treatments' precision and success rates. [1]

The aim of this case report was to illustrate the endodontic management of a maxillary second molar with two palatal roots under DOM.

Case Report

1. A 31-year-old female patient was referred from department of conservative and endodontics. Past dental history showed no significant findings. On clinical examination there was tender on percussion present with 26 (According to FDI tooth numbering systems) with normal oral mucosa and no any signs of sinus tract were present. Radiographic examination from multiple angulations revealed four roots of the maxillary first molar. (Figure 1)
2. Local anesthesia (2% lidocaine hydrochloride with 1:80,000 epinephrine) (Lignospan Special, Septodont,

Raigad, India) was administered and rubber dam isolation was done with ivory clamp 14A. Access opening was done under DOM with Endo Z bur and round bur No.4. Glide path was established, and K-files (Dentsply Tulsa Dental, Oklahoma City, USA) were used to negotiate all the root canals. Access cavity was modified from triangular to trapezoidal arrangement were observed on the pulp floor, with the two palatal root canal orifices notably distant (Figure 2). The root canal working lengths were measured with an electronic apex locator (J Morita Corp, Tokyo, Japan), and a periapical radiograph was taken to confirm the working length (Figure 3). The Protaper gold NiTi rotary system (Proaper gold, Dentsply Tulsa Dental, Oklahoma City, USA) was used for cleaning and shaping the canals, alternating irrigation with 3% sodium hypochlorite (NaOCl) solution and 17% ethylenediaminetetraacetic acid (EDTA) solution as final irrigating solution. The canals were thoroughly rinsed with saline and dried using paper points. Obturation was done with gutta percha point and AH plus sealer, Post obturation restoration was performed with composite restoration (Figures 4 and 5)

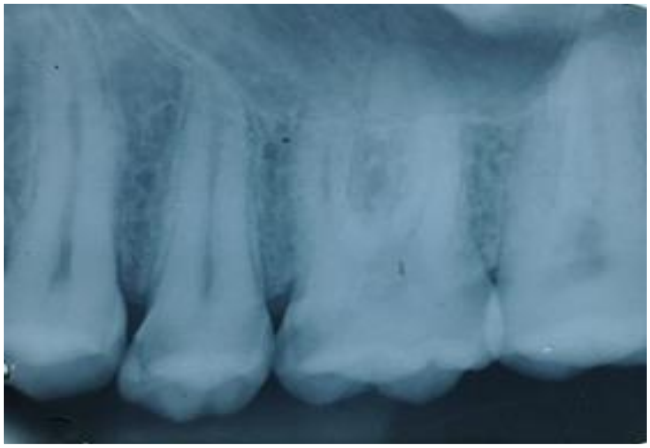

Fig 1: Intraoral periapical Radiograph with 26

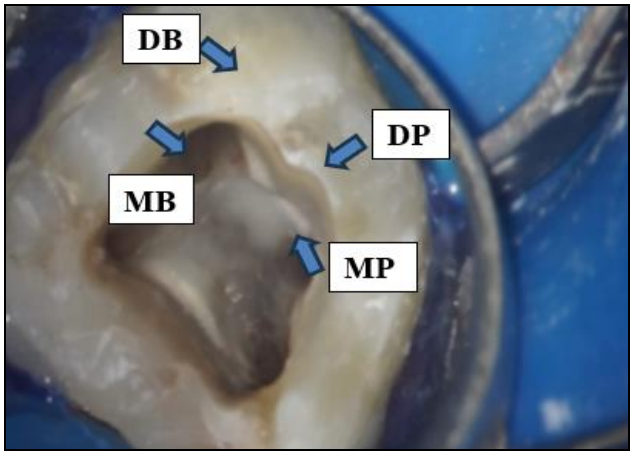

Fig 2: Access opening under DOM with Trapezoidal design modification (DB- Disto Buccal, MB- Mesio Buccal, DP- Disto Palatal, MP- Mesio Palatal)

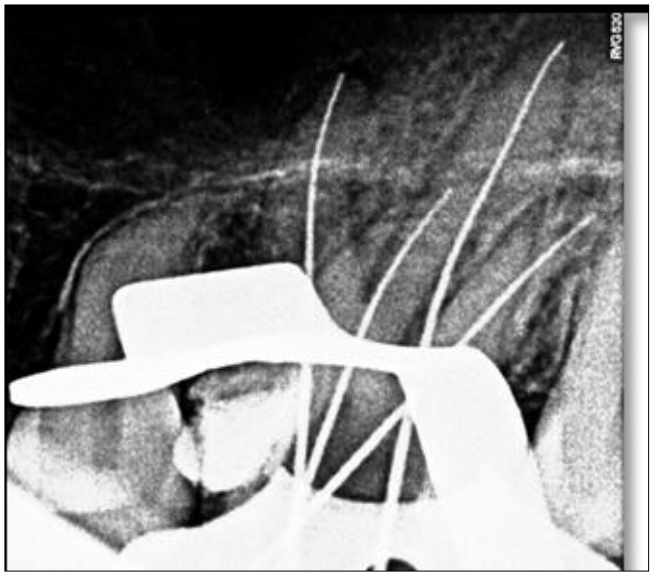

Fig 3: Working length determined by Apex Locator and confirmed Radiographically with 26

Fig 4: Post obturation access figure

Fig 5: Radiographical Post obturation restoration

Discusssion

The anatomical variation in maxillary first molars is significantly seen, with a single palatal root being more common, occurrence of two palatal roots is rare. Kim *et al*., demonstrated that the palatal roots had one root with one canal among 150 maxillary first molars. [4]

Christie *et al.* have categorized maxillary molars with double palatal roots into three types. In this case, the affected tooth closely resembles Type I of their classification, where the two palatal roots are long and widely spaced, and the two buccal roots are closer together, resembling cow horns shaped root canals. [1]

Christie *et al* classification, [5]

Type I	Maxillary molar with 4 separate roots; the palatal roots are widely divergent and are often long and tortuous. The buccal roots are less divergent and have a 'cow-horn' shape
Type II	Maxillary molar with 4 separate and parallel roots; the roots are short and have blunt apices
Type III	Maxillary molar with 4 roots; the MB, MP, and DP roots are grouped together while the DB root is separate and may diverge distobuccally

Baratto-Filho *et al*., [6]

Type IV: Maxillary molar with 4 roots; the accessory palatal root is fused with the MB root in the coronal two-thirds

Carlsen and Alexandersen classification

Radix mesiolingualis: The accessory root has affinity to the pronounced MP part of the crown

Radix distolingualis: The accessory root has affinity to the pronounced DP part of the crown

Radix mesiolingualis ⁄ distolingualis: Both MP and DP roots have affinity to the pronounced MP and DP parts of the crown, respectively

Clinically careful observation and examination of the tooth's crown and cervical morphology are essential. Molars with extra roots often exhibit a bulbous crown appearance, additional cusps, and axial surface protrusions, with the tooth's cervical outline being palpable with a periodontal probe.

Some of the cases requires pre-operative diagnosis, intraoperative navigation, and postoperative assessment might require CBCT. Nevertheless, for patients with limited income or those who decline CBCT scans, capturing X-rays from various angles continues to be a cost-effective and realistic primary option. Clinically, to locate the second canal in the mesiobuccal root, the typical access opening for maxillary first molars is a mesially-tilted quadrilateral.

For maxillary first molars with double palatal roots, especially those corresponding to Christie's Type I, the mesiodistal diameter is wider than the lingual tip, necessitating a larger than usual access opening to expose the extra root canal orifices. In cases where the tooth's pulp chamber is calcified or secondary dentin blocks the root canal orifice, the blockage needs to be removed under a dental operating microscope using ultrasonic tips, combined with methods like the champagne bubble test, methylene blue dye, and fiber optic transillumination for locating the root canal orifice.

This approach allows for more precise operations, minimizing damage to the tooth structure and preventing perforation of the pulp chamber floor or root canal. However, the "as low as reasonably achievable (ALARA)" principle should always be considered to ensure patient safety. [1]

In this case due to thorough use of DOM, DG 16 probe extra palatal canal was identified and no calcification was seen. Hence, CBCT was not recommended in this case.

Conclusion

Understanding the possible variations in the internal anatomy of human teeth is crucial for achieving successful endodontic treatment. Accurate diagnosis, combined with thorough clinical and radiographic examination, plays a vital role in identifying teeth that present with a greater number of canals than typically expected. Recognizing these anatomical complexities is essential to ensure favorable treatment outcomes.

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