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CASE REPORT

ENDODONTIC CHALLENGES IN A MAXILLARY SECOND MOLAR WITH TWO PALATAL ROOTS: A CASE REPORT

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ABSTRACT

The success of endodontic treatment relies heavily on a thorough understanding of the internal anatomy of human teeth, particularly when anatomical variations occur. Clinicians must meticulously examine the pulpal floor and adjust radiographic angles to identify these variations and avoid missing canals. While it is typical for a maxillary second molar to possess three roots and four canals, the presence of four distinct roots is rare. This case report details the endodontic treatment of a maxillary second molar exhibiting four separate canals within four distinct roots.

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INTRODUCTION

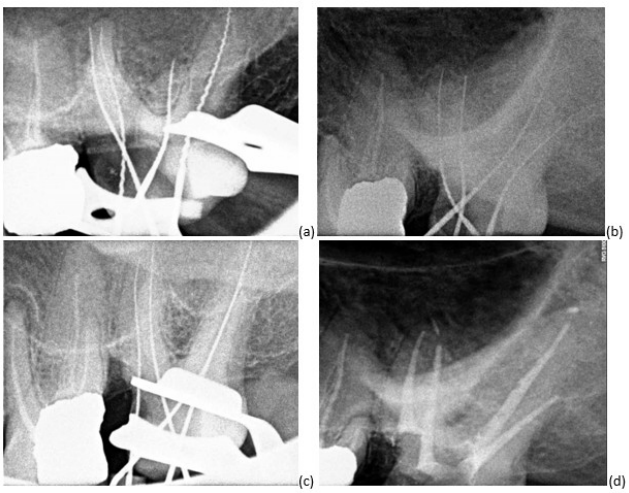
Anatomical variations are a notable aspect of dental morphology, particularly in maxillary second molars, which are often characterized by their three-rooted structure and three distinct canals. However, these teeth can exhibit a range of morphological differences that may impact the approach to endodontic therapy[1]. Recognizing these variations is crucial for dental practitioners, as it directly correlates with the efficacy and success rate of root canal treatments[2]. Maxillary molars are notable for their complex root anatomy, with more than 95% of these teeth exhibiting three distinct roots: mesiobuccal, distobuccal, and palatal. Among these, the mesiobuccal root stands out due to its significant anatomical variability. Research indicates that in approximately 56.8% of cases, this root contains two or more canals, making it a critical area of interest for dental practitioners.[3] The variability in canal morphology can pose challenges during endodontic treatments, necessitating a thorough understanding of this root's anatomy.

In stark contrast, the palatal root demonstrates remarkable consistency, typically presenting with a single canal in 99% of cases. Furthermore, it features a single apical foramen in 98.8% of instances, which simplifies the treatment process[4]. Despite this predictability, there are rare occurrences of maxillary molars exhibiting two palatal roots. Stone and Stroner reported very few cases of this anomaly, highlighting the unusual nature of such occurrences in clinical practice.[5] The exploration of maxillary molar anatomy has led to significant advancements in endodontic procedures. In 1991, Christie *et al.*[6] introduced a classification system for maxillary molars that possess two palatal roots, categorizing them based on root shape and the extent of fusion. This classification aids clinicians in anticipating potential complications during root canal therapy and underscores the importance of individualized treatment planning based on anatomical variations. Understanding these complexities is essential for successful dental interventions and improved patient outcomes. The classification of maxillary molars is essential for understanding their anatomical variations and implications for dental treatment. Type I maxillary molars are characterized by two widely divergent palatal roots, which can influence the approach to endodontic procedures. In contrast, type II molars present with four separate roots that are notably short and

parallel, presenting unique challenges for dental professionals. Type III molars, on the other hand, exhibit constricted root structures, where the mesiobuccal, mesiopalatal, and distopalatal root dentin form a web-like configuration, complicating access and treatment. Building on the foundational work of Christie, Baratto-Filho *et al.*[7] introduced a type IV classification, highlighting cases where the mesiobuccal and palatal roots may be fused in the coronal two-thirds. This addition acknowledges the complexity and diversity of maxillary molar anatomy, which can significantly affect clinical outcomes. Despite the advancements in classification, there remains a scarcity of comprehensive data regarding the incidence and types of anatomical variations, particularly in maxillary molars. This paper presents a detailed clinical case report that highlights the successful management of a maxillary second molar exhibiting unique root and canal configurations, underscoring the importance of thorough anatomical assessment in achieving favorable treatment outcomes.

CASE REPORT

Figure 1. Canal Orfices; MB: Mesiobuccal, DB: Distobuccal, MP: Mesiopalatal, DB: Distopalata L



(a) And (b) Working length radiograph (c) Mastercone radiograph (d) Obturation radiograph

A 34-year-old male presented to the clinic with concerns regarding food lodgement in the left upper back region, accompanied by occasional pain during chewing. His medical history was unremarkable, which prompted a focused clinical evaluation. The symptoms indicated a possible dental issue, leading to a thorough examination and radiographic assessment to identify any underlying problems. During the clinical examination, a carious left maxillary second molar was identified as the source of the patient's discomfort. The tooth exhibited tenderness to percussion, suggesting inflammation or infection in the surrounding tissues. This finding was critical in correlating the patient's symptoms with the observed dental condition, highlighting the need for appropriate intervention.

Chronic irreversible pulpitis is a dental condition that can lead to significant discomfort and complications if left untreated. In the case of the left maxillary second molar (tooth #27), radiographic examination revealed radiolucency affecting the enamel and dentin, extending toward the pulp. This finding indicated a serious issue requiring prompt intervention. The patient was informed about the nature of the condition and the necessity for endodontic treatment to alleviate pain and preserve the tooth. Upon the patient's acceptance of the proposed treatment, local anesthesia was administered to ensure comfort during the procedure. An access cavity was created to allow for a thorough examination of the pulp chamber. This step is crucial, as it enables the dentist to identify the number and configuration of the root canals, which play a vital role in the success of the endodontic therapy. In this case, the examination revealed three distinct canals: the mesiobuccal (MB), distobuccal (DB), and palatal (P) canals, each requiring careful cleaning and shaping. In the realm of endodontics, the precise identification of the canal system is crucial for successful treatment outcomes. After thorough examination and negotiation of the canal, the working length was established through the use of apical radiographs. This imaging technique allows practitioners to visualize the root canal anatomy accurately, ensuring that the subsequent steps of the procedure are based on reliable data. Proper determination of the working length is essential, as it influences the effectiveness of mechanical instrumentation and irrigation.

Following the identification of the working length, mechanical instrumentation commenced using Profile NiTi rotary files. These advanced files are designed to navigate the complexities of the canal system while maintaining the integrity of the tooth structure. The goal was to achieve a size of 25.04 at the working length, which facilitates adequate shaping of the canal for effective cleaning and disinfection. The use of rotary files enhances efficiency and reduces the risk of procedural complications compared to traditional hand files. To ensure optimal cleaning and disinfection, copious irrigation was performed throughout the procedure. Saline solution was used initially to flush debris, followed by the application of 5.25% sodium hypochlorite, a potent antimicrobial agent. This step is critical in eliminating bacteria and organic tissue from the canal system, significantly reducing the risk of post-treatment complications. The combination of precise instrumentation and effective irrigation techniques lays the foundation for a successful endodontic treatment, ultimately leading to improved patient outcomes. In a recent examination of the pulp chamber floor, an additional canal orifice was identified, highlighting the intricate anatomy often present in endodontic cases. This discovery was made possible with the use of a #2 ProUltra ultrasonic tip, which facilitated the opening of the

Table 1. Variations in no. of roots of maxillary second molar in previous studies

Authors	No. of samples	1 root	2 roots	3 roots	4 roots
Rweuyonyi *et al.*[13]	221			86%	
Zhang *et al.*[14]	210	10%	8%	81%	
Ng *et al*[15]	77			100%	
Gu Y *et al*[16]	1226				0.98%
Rouhani *et al.*[17]	125				1.6%
Georgia *et al*[18]	402	5.4%	8.25%	85.07%	1.2%
Silva *et al*[19]	306			45.09%	
Libfeld *et al*[20]	1200	3%, 0.5%	6%, 12%	90.6%, 87%	0.4%
Kim *et al.*[21]	821	4.63%			
Perez-Heredia *et al.*[22]	142	16.9%	4.2%	78.9%	
Afzal *et al.*[23]	70			85.7%	
Ghoncheh *et al.*[24]	423	11.3%		86%	
Martins JN *et al.*[25]	240, 802	10%, 13.3%	11.3%, 13.2%	77.1%, 72.9%	1.7%, 0.5%
Xia Y. *et al.*[26]	400	9.75%	12.25%	78.0%	
Ghobashy *et al.*[27]	610	1.6%	10.7%	87.7%	
Neelakantan *et al*[28]	205	0.9%	5.8%	93.1%	
Nikoloudaki GE[29]	402	5.47%	8.21%	85.07%	1.24%
Ratanajirasut *et al*[30]	457	3.5%	9.2%	87.1%	0.2%
H.M. Alamri *et al*[31]	351	0.3%	6.6%	92%	1.1%

canal. The newly identified canal, referred to as MP, was subsequently prepared to a Profile 25.04, aligning it with the treatment protocols established for the other three canals previously identified in the same tooth. The identification of the fourth root canal was a two-step process, beginning with a clinical examination that suggested its presence. Following this initial observation, a series of radiographs were taken at various angles to confirm the existence of the canal. This methodical approach is crucial in endodontics, as it allows for a comprehensive understanding of the root canal system, which can often be complex and variable among different teeth. Calcium hydroxide (RC Cal Prime Dental Products, India), as intracanal medication, and Cavit, as provisional restoration, were used between visits. To perform a better anatomic diagnosis and confirm this rare condition so that the rest of the treatment could be better planned, various RVG X-rays were recorded with different angulations to confirm the findings of the canal and the additional root as well. Recapitulation was performed, and after the final irrigation protocol, obturation was done using the lateral condensation technique. The pulp chamber was restored with a permanent restoration, and full crown coverage was completed.

DISCUSSION

The presence of second maxillary molars exhibiting two palatal roots or canals is a rare anatomical variation observed in dental practice. Research indicates that this occurrence is reported in only 0.4% to 2% of cases, making it an uncommon finding among dental professionals. Understanding this variation is crucial for endodontic treatment as it can significantly influence the approach to root canal therapy.[8 9]

Slowey was the first to document the occurrence of two distinct palatal roots in the second maxillary molar, marking a significant milestone in endodontic treatment.[10] This finding challenged the conventional understanding of maxillary molar anatomy, which typically recognized only one palatal root. The implications of this discovery are profound, as they suggest a need for a more thorough examination of root canal systems during endodontic procedures. Further research by Baratto-Filho *et al*[11]. in 2002 reinforced Slowey's findings by reporting two palatal roots in two separate cases of maxillary second molars. This study contributed to the growing body of evidence that highlights anatomical variations in dental structures, emphasizing the importance of individualized treatment plans in endodontics. Such variations can significantly impact the success of root canal treatments and necessitate a comprehensive understanding of each patient's unique dental anatomy. As dental professionals continue to explore the intricacies of maxillary molar anatomy, it becomes increasingly clear that thorough diagnostic imaging and careful assessment are crucial. The recognition of multiple palatal roots can lead to improved treatment outcomes and reduced rates of endodontic failure.[12] By staying informed about these anatomical variations, dentists can enhance their clinical practices and provide better care for their patients, ultimately advancing the field of endodontics. Research has shown that anatomical variations in maxillary second molars are notably more common than in first molars. These variations can include unusual root formations, such as additional or malformed roots, which may complicate endodontic procedures. Studies have highlighted a significant number of cases involving palatal root abnormalities, which raises questions about their underlying causes and frequency. (Table 1) This discrepancy in anatomical features between the two types of molars suggests a need for more comprehensive research to better understand these variations.

The presence of palatal root abnormalities can pose challenges for dental practitioners during diagnosis and treatment. Such variations may lead to difficulties in accessing the root canal system, increasing the risk of procedural complications. Furthermore, if these anomalies are not recognized, they can result in incomplete treatment and subsequent failures. Therefore, it is essential for dental professionals to be aware of these potential variations and incorporate them into their clinical assessments. As the field of dentistry continues to evolve, the importance of understanding the clinical significance of anatomical variations cannot be overstated. Enhanced knowledge of maxillary second molar anatomy will lead to improved diagnostic accuracy and treatment outcomes. Continued investigation into these variations will not only benefit practitioners but also enhance patient care by ensuring that treatment plans are tailored to the unique anatomical realities of each individual. Ultimately, recognizing and addressing these anatomical differences will contribute to the overall effectiveness of dental procedures.

CONCLUSION

In the realm of dentistry, understanding the complexities of tooth anatomy is crucial for effective treatment. This case report delves into the anomalies associated with the palatal roots and root canal systems of maxillary second molars. While such variations are infrequent, they can significantly impact endodontic procedures and outcomes. Clinicians must maintain a high level of awareness regarding these potential anomalies to ensure comprehensive care for their patients. The palatal root of the maxillary second molar is typically characterized by its single canal structure. However, this report highlights instances where anatomical deviations occur, such as additional canals or unusual root configurations. These variations can complicate the treatment process, leading to challenges in achieving complete cleaning and shaping of the canal system. As such, thorough preoperative assessments, including imaging, are essential for identifying these anomalies. In conclusion, while anatomical variations in the palatal root of maxillary first molars are rare, their existence cannot be overlooked. Clinicians should be vigilant and prepared to adapt their treatment strategies accordingly. By fostering a deeper understanding of these potential variations, dental professionals can enhance their ability to manage complex cases effectively, ultimately improving patient outcomes.

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