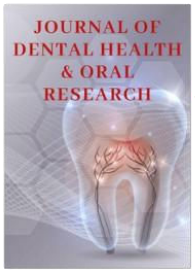

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Case Report

Endodontic Retreatment of a Maxillary Second Molar with Two Separate Palatal Canals Using Cone Beam Computed Tomography and Dental Operating Microscope: A Case Report

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Abstract

To present a rare case of a maxillary second molar with two separate palatal canals in a Saudi patient and discuss the significance of Cone Beam Computed Tomography (CBCT) and Dental Operating Microscope (DOM) in detecting such anatomical variations.

Case Report: A 40-year-old Saudi male presented with persistent discomfort in a previously treated maxillary second molar. Radiographs suggested inadequate obturation. During retreatment, a missed distopalatal canal and a second mesiobuccal canal were identified using Cone-Beam Computed Tomography (CBCT) and a Dental Operating Microscope (DOM). The canals were prepared and obturated successfully and the patient was referred for definitive crown placement.

Conclusion: This case underscores the clinical importance of incorporating advanced imaging and magnification tools for detecting rare canal configurations, particularly in anatomically diverse populations.

Keywords: Palatal Root; Extra-Root; Anatomical Variation; Cone Beam Computed Tomography

Introduction

Successful endodontic treatment fundamentally relies on a comprehensive understanding of root canal anatomy and the clinician's ability to locate, clean, shape and obturate the entire root canal system. Among posterior teeth, the maxillary second molar is considered one of the most anatomically variable, frequently exhibiting complex root and canal configurations that challenge even experienced practitioners [1-3]. While the typical anatomy of a maxillary second molar includes three roots mesiobuccal, distobuccal and palatal with three or four canals, numerous reports have documented anatomical anomalies such as the presence of a second palatal canal or even a second palatal root [5-9]. The clinical relevance of these variations is substantial, as undetected and untreated canals are a well-established cause of persistent periapical pathology and post-treatment disease [10,11]. Although conventional periapical radiographs are commonly employed in endodontic diagnostics, they are inherently limited due to their two-dimensional nature, which may obscure overlapping structures or atypical root configurations [4]. The advent of Cone-Beam Computed Tomography (CBCT) has significantly enhanced diagnostic accuracy by providing three-dimensional visualization of the root canal system, enabling the detection of aberrant and additional canals [3,4]. Similarly, the use of Dental Operating Microscopes (DOM) has markedly improved the clinician's ability to locate elusive or calcified canal orifices [10,12-14]. The occurrence of two separate palatal canals or roots in maxillary second molars is uncommon, with a reported prevalence ranging from 0.4% to 1.5% [6-9]. A particularly rare case of a maxillary second molar with two palatal roots in a Saudi patient was reported by Alenazy and Ahmad, highlighting the importance of regional anatomical awareness and its implications for clinical endodontic practice [12].

Case Report

A 40-year-old Saudi male was referred for evaluation before prosthetic restoration of tooth #27. Mild discomfort was reported. Radiographic assessment revealed inadequate obturation and a suspected untreated palatal root (Fig. 1). After rubber dam isolation and removal of the existing restoration, three gutta-percha-filled canals were noted (MB, DB, mesiopalatal). Two additional canals were located under DOM: A second Mesiobuccal (MB2) and a distopalatal canal. CBCT imaging confirmed these findings (Fig. 2). The canals were retreated, medicated with calcium hydroxide and obturated with gutta-percha and Amino-Hydantoin (AH) Plus sealer. The access cavity was restored and the patient was referred for final crown placement (Fig. 3).

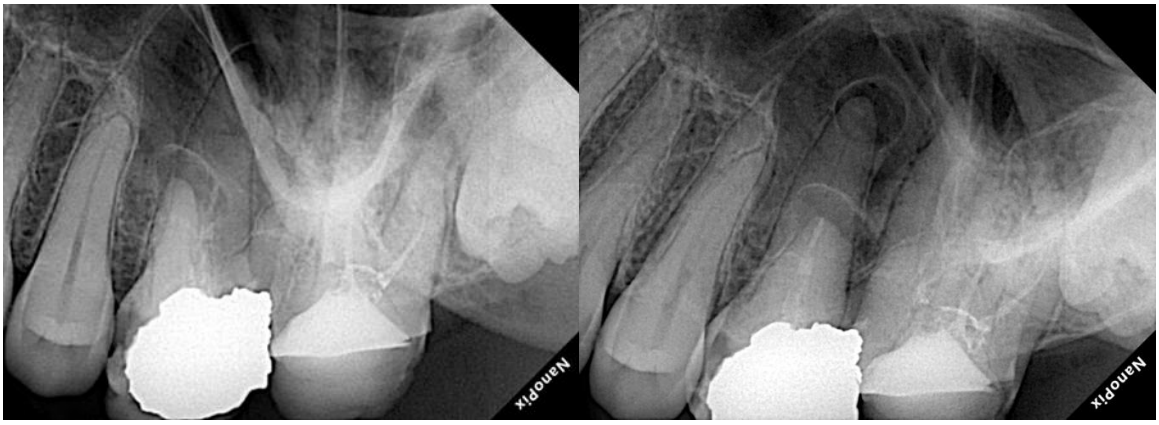

Figure 1: a: Panel corresponding to image 1; b: Panel corresponding to image 2.

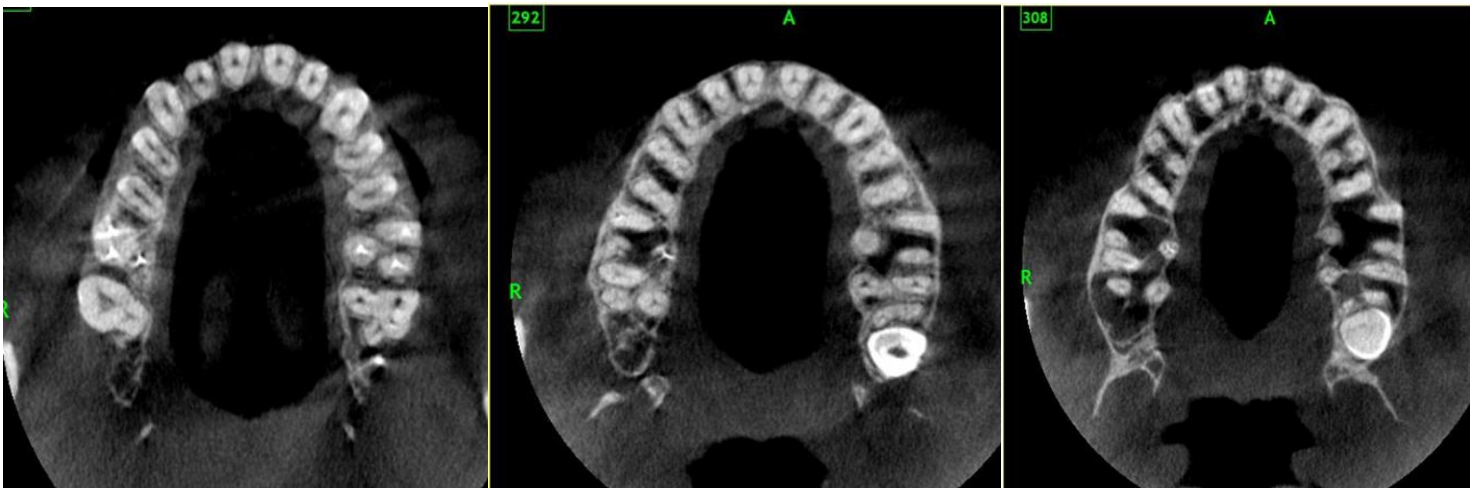

Figure 2: a: Panel corresponding to image 3; b: Panel corresponding to image 4; c: Panel corresponding to image 5.

Figure 3: a: Panel corresponding to image 6; b: Panel corresponding to image 7.

Discussion

The internal and external anatomy of maxillary second molars exhibits significant variability, often posing diagnostic and therapeutic challenges during root canal treatment. While the typical morphology comprises three roots and three or four canals, variations such as the presence of two palatal canals are rare but clinically relevant. The prevalence of a second palatal canal in maxillary second molars has been reported to range between 1.1% and 1.5% globally, with comparable findings observed in Middle Eastern populations through Cone-Beam Computed Tomography (CBCT) studies [1,12-15]. Many clinical reports exist in the literature across the world with different ethnic backgrounds such as Presence of Extra canals or even an extra root. illustrated in Table 1 (from number 1 to number 24). In the current case, the missed distopalatal canal likely contributed to the failure of initial root canal therapy, manifesting as persistent periapical pathology. Missed canals are a well-documented cause of endodontic failure. Nair demonstrated that untreated anatomical spaces may harbor residual microorganisms, leading to chronic apical periodontitis [30]. Similarly, Hoen and Pink, identified missed canals in approximately 42% of cases undergoing endodontic retreatment, highlighting the need for thorough canal system exploration [31]. Traditional periapical radiographs, while routinely used, are inherently limited by their two-dimensional projection, which may obscure complex internal anatomy. In contrast, CBCT provides high-resolution, three-dimensional imaging that enhances the detection of additional or aberrant root canals [6]. In the present case, CBCT imaging was crucial in visualizing the untreated palatal canal, allowing for successful nonsurgical retreatment. Equally important is the use of magnification. The Dental Operating Microscope (DOM) offers enhanced visualization of the chamber floor, helping to identify subtle developmental grooves, isthmuses or dentinal map lines suggestive of canal bifurcation. Several studies have demonstrated that the adjunctive use of CBCT and DOM improves the detection rate of additional canals in posterior teeth [6,7,20,21].

This multimodal approach was integral to managing the complex anatomy encountered in this case. This case also complements a previously published report by Alenazy and Ahmad, who documented a maxillary second molar in a Saudi patient with two separate palatal roots, each containing a single canal [12]. These reports collectively highlight the morphological diversity found in the Saudi population and the clinical need to remain vigilant for anatomical deviations, especially in retreatment scenarios. Furthermore, population-based CBCT studies from Saudi Arabia have documented greater variability in canal configurations than traditionally described, particularly in maxillary molars [12-14]. Such findings reinforce the importance of incorporating ethnogeographic data into clinical risk assessment during diagnosis and treatment planning. From a clinical standpoint, the presence of an untreated palatal canal can serve as a persistent nidus of infection, particularly given the palatal root's larger cross-sectional area and potential for lateral canals. Failure to treat such anatomy not only compromises prognosis but may result in unnecessary retreatment or surgical intervention.

#	Reference	Country	Type of Study	Tooth	Patient	Roots Morphology
1	Nakagawa, et al., [1]	Japan	Macroscopic study	#27	NS	Type I
2	Barker [2]	Australia	Cleared tooth study	NS	NS	Type I
3	Slowey [3]	USA	Radiographic exam	#17	NS	Type I
4	Slowey [4]	USA	Radiographic exam	#27	NS	Type I
5	Stone and Stroner [5]	USA	Clinical RCT	#27	NS	Type I
6	Friedman, et al., [6]	USA	Clinical RCT	#17	44-y male	Type I/II/III
7	Libfeld and Rotstein [7]	USA	Clinical RCT	#27	27-y female	Type I/II/III
8	Jacobsen and Ni [8]	USA	Clinical RCT	#27	61-y male	Type I
9	Deveaux [9]	France	Clinical + radiographic	#17, #27	24-y female	Type I/II/III
10	Baratto-Filho, et al., [10]	Brazil	Macro/radiographic study	NS	Caucasian	Type I
11	Baratto-Filho, et al., [11]	Brazil	Macro/radiographic study	NS	Caucasian	Type IV
12	Alani [15]	UAE	Clinical RCT	#17	35-y female	Type IV
13	Kim, et al., [20]	South Korea	Clinical RCT	#17	31-y male	Type I/II/III
14	Qun, et al., [21]	China	Clinical RCT	#27	Female	Type I
15	Joshi [22]	India	Clinical RCT	#27	54-y male	Type I
16	Prashanth, et al., [23]	India	Clinical RCT	#17	32-y male	Type I
17	Scarparo, et al., [24]	Brazil	Clinical Re-RCT	#27	NS	Type I
18	Badole, et al., [25]	India	Clinical RCT	#17	33-y female	Type I
19	Fontana, et al., [26]	Brazil	Clinical RCT	#17	42-y female	Type I
20	Patel and Patel [27]	India	Clinical RCT	#17	37-y male	Type I/II/III

21	Patel and Patel [28]	India	Clinical RCT	#17	48-y male	Type I/II/III
22	Alenazy and Ahmad [12]	Saudi Arabia	Clinical RCT + DOM	#27	45-y female	2 separate palatal roots
23	Alaajam, et al., [13]	Saudi Arabia	Case series + CBCT	#17, #27	Saudi patients	2 separate palatal roots
24	Al-Qahtani and Abdulrab [14]	Saudi Arabia	Clinical retreatment + CBCT	#27	35-y male	2 separate palatal roots

Table 1: Summary of literature on two palatal canals/roots in maxillary second molars.

Conclusion

This case highlights the clinical significance of careful exploration of maxillary second molars, where rare anatomical variations such as two separate palatal canals may occur. The use of CBCT and DOM was pivotal in detecting and managing the missed canal, leading to a successful nonsurgical retreatment outcome. Clinicians should remain vigilant for such variations, particularly in populations with documented anatomical diversity and adopt advanced imaging and magnification as routine adjuncts in complex endodontic cases.

Conflict of Interest Statement

All authors declare that there are no conflicts of interest.

Informed Consent Statement

Informed consent was taken for this study.

Authors' Contributions

All authors contributed equally to this paper.

Financial Disclosure

The authors received no external financial support for this study.

Data Availability Statement

Not applicable.

Ethical Statement

Not applicable.

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