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Management of a Maxillary Second Molar with Two Palatal Canals: A Case Report

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Abstract

Anatomical variations in root canal systems present significant challenges in endodontic treatment and may compromise outcomes if not properly identified and managed. Maxillary second molars typically present with three canals; however, the presence of two palatal canals is a rare variation that may be easily overlooked.

This case report describes the diagnosis and management of a maxillary second molar with two palatal canals in a 62-year-old male patient. The tooth was diagnosed with pulp necrosis and normal apical tissues based on clinical and radiographic examination. Primary endodontic treatment was performed using a minimally invasive approach. Initially, three canals were identified and prepared. Intraoperative radiographic assessment raised suspicion of additional canal anatomy, leading to further exploration and identification of a second palatal canal.

All four canals were instrumented using nickel-titanium rotary instruments and irrigated with standard protocols. The canals were obturated using a bioceramic sealer in combination with gutta-percha. Postoperative radiographic evaluation confirmed adequate filling of all canals. The patient remained asymptomatic at follow-up.

This case highlights the importance of thorough knowledge of root canal anatomy and careful intraoperative assessment in detecting rare anatomical variations. The use of magnification, modern instrumentation, and minimally invasive techniques contributes to successful management of complex canal systems. Failure to identify additional canals may result in persistent infection and treatment failure.

Recognition and proper management of such variations are essential for achieving predictable endodontic outcomes.

Keywords: maxillary molar, palatal canal, endodontics, root canal anatomy, bioceramics

Introduction

Successful endodontic treatment depends on thorough knowledge of root canal anatomy and its variations. The maxillary second molar typically presents with three roots and three or four canals;

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however, anatomical deviations are not uncommon and may significantly influence treatment outcomes (1,2). One such rare variation is the presence of two palatal canals, which can be easily overlooked during conventional treatment (3).

Failure to detect and adequately treat additional canals is a major cause of endodontic failure (4). Studies have reported that untreated canals may harbor persistent infection, leading to post-treatment disease (5). The incidence of two palatal canals in maxillary molars is considered low, with reported prevalence ranging between 1% and 5%, depending on the population and diagnostic method used (6,7).

Modern endodontic approaches, including enhanced magnification, cone-beam computed tomography (CBCT), and minimally invasive techniques, have improved the detection and management of complex canal systems (8,9).

The present case report describes the diagnosis and successful management of a maxillary second molar (tooth 27) with two palatal canals using a minimally invasive endodontic approach.

Case Description

A 62-year-old male patient presented with discomfort in the upper left posterior region. The patient reported intermittent, mild, non-spontaneous pain localized to the area, without irradiation to adjacent regions. The discomfort was primarily elicited during mastication, and no episodes of spontaneous or nocturnal pain were noted. The patient did not report any sensation of tooth mobility.

Clinical examination revealed a heavily restored maxillary second molar (tooth 27). The tooth was non-responsive to vitality testing, while percussion and palpation tests were negative, and no abnormal mobility was detected.

Radiographic examination demonstrated normal apical tissues with no signs of periapical pathology. Based on clinical and radiographic findings, a diagnosis of pulp necrosis with normal apical tissues was established.

After obtaining informed consent, primary endodontic treatment was initiated. Local anesthesia and rubber dam isolation were applied. An access cavity was prepared following minimally invasive principles.

Initially, three canals were identified and negotiated: mesiobuccal (MB), distobuccal (DB), and palatal (P). Working length was established using an apex locator and confirmed radiographically. Mechanical preparation was performed using rotary nickel-titanium instruments with the following protocol:

- MB and DB canals prepared to size 25/.04
- Palatal canal initially prepared to size 30/.04

Root canal disinfection was performed using a standardized irrigation protocol. A 5.25% sodium hypochlorite solution was used throughout instrumentation, followed by 17% EDTA for smear layer removal. Irrigant activation was achieved using an ultrasonic U-file, with three activation cycles of 20 seconds per canal for each of the solutions. Final irrigation was completed with sterile saline.

The canals were obturated using a combination of bioceramic sealer and gutta-percha – hydraulic condensation (fig. 1)

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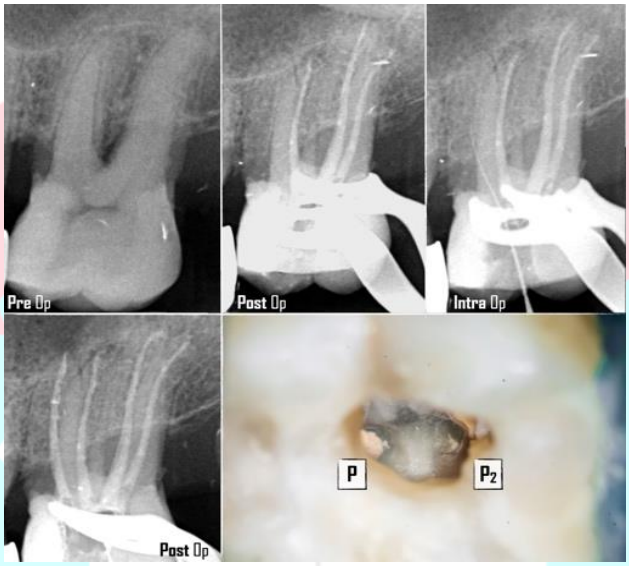

Fig. 1. Endodontic treatment of upper molar with two palatal canals – preoperative, intraoperative, postoperative x-ray and clinical view

During intraoperative radiographic assessment, suspicion of an additional palatal canal arose due to unusual canal morphology. Careful re-exploration of the pulpal floor under magnification revealed a second palatal canal (fig. 2).

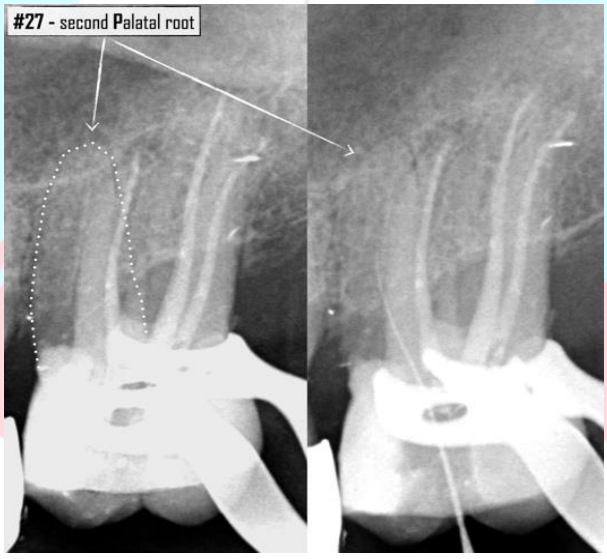

Fig. 2. Radiographic assessment showing second palatal root and canal

Cone-beam computed tomography (CBCT) was not performed, as the diagnosis and treatment planning were adequately achieved using clinical examination and careful interpretation of conventional periapical radiographs. Although an additional palatal root and canal were identified during treatment, this anatomical variation was successfully detected with the aid of a dental operating microscope and managed without the need for three-dimensional imaging.

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In accordance with the ALARA (As Low As Reasonably Achievable) principle, CBCT was avoided due to its higher radiation dose compared to conventional radiography. Given that the additional imaging was unlikely to significantly influence the treatment approach or outcome, the potential risks associated with increased radiation exposure outweighed the expected diagnostic benefit.
The additional canal was negotiated, instrumented to size 30/.04, and irrigated thoroughly using 5,25 % sodium hypochlorite and 17% EDTA protocols as mentioned above (fig. 3). It was obturated using a combination of bioceramic sealer and gutta-percha – hydraulic condensation. Post-operative radiography confirmed dense and homogeneous filling of all canal (fig.4).

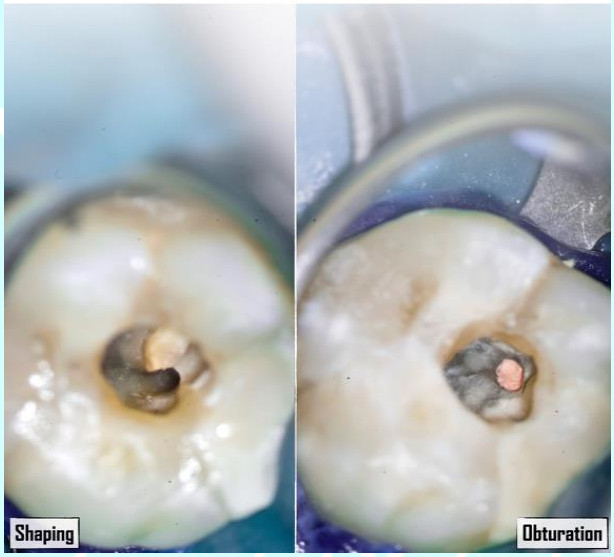

Fig. 3. Clinical view under microscope –second palatal canal shaped and obturated.

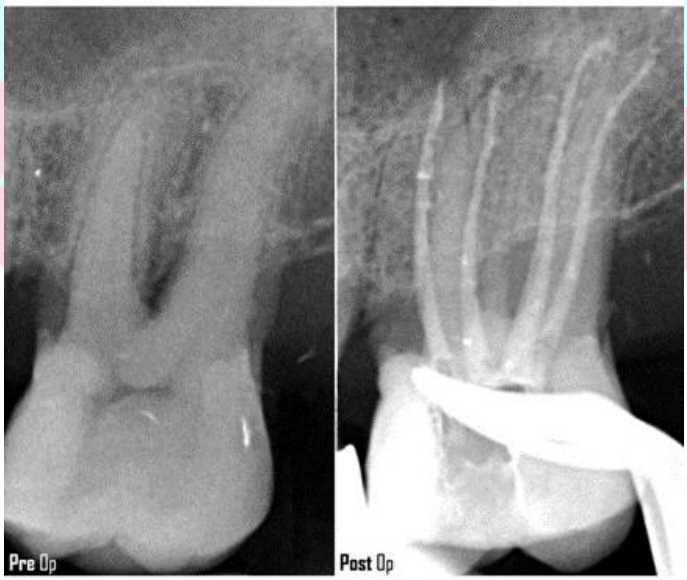

Fig. 4. Pre and postoperative X-ray assessment

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The patient was asymptomatic at follow-up, and no complications were observed.

Discussion

A comprehensive understanding of root canal anatomy and its variations remains fundamental to successful endodontic therapy. Maxillary molars, particularly second molars, exhibit considerable anatomical variability, which may complicate diagnosis and treatment (10,11,12).

The presence of two palatal canals is considered a rare anatomical variation, with reported prevalence ranging between 1% and 5%, depending on the population studied and the diagnostic methods employed (6,7). However, the true incidence may be underestimated, as conventional radiographic techniques often fail to reveal complex internal morphology (13,14). Studies utilizing CBCT have demonstrated a significantly higher detection rate of additional canals compared to two-dimensional imaging (6,14).

Equally important is the documented frequency of missed canals during endodontic treatment. Literature suggests that missed canals are present in up to 42% of teeth requiring retreatment (4,13). In maxillary molars, untreated canals—most commonly the second mesiobuccal canal (MB2), but also additional palatal canals—are a frequent cause of persistent disease (13).

Failure to detect and treat an additional palatal canal may have significant biological and clinical consequences. Residual necrotic tissue and microorganisms within an untreated canal can serve as a persistent source of infection (5). This may lead to:

- development or persistence of apical periodontitis
- post-treatment pain or discomfort
- failure of the root canal therapy
- need for retreatment or surgical intervention

Microbiologically, untreated canals provide an ideal environment for bacterial survival and biofilm formation, which are resistant to host defenses and antimicrobial agents (5). Over time, this can compromise the long-term prognosis of the tooth.

From a clinical perspective, the detection of additional canals requires a systematic and meticulous approach. Traditional methods such as careful inspection of the pulp chamber floor and evaluation of anatomical landmarks remain essential (8). However, modern endodontics increasingly relies on advanced technologies to improve diagnostic accuracy.

The use of dental operating microscopes has been shown to significantly increase the detection rate of additional canals (15). Magnification and enhanced illumination allow for better visualization of subtle anatomical features, including additional canal orifices that may otherwise remain undetected.

Ultrasonic instruments play a crucial role in refining access cavities and troughing grooves to locate hidden canals. Their precision allows for conservative dentin removal while minimizing the risk of procedural errors such as perforation. This aligns well with the principles of minimally invasive endodontics, which aim to preserve tooth structure without compromising treatment efficacy.

Nickel-titanium (NiTi) rotary instruments have further improved the management of complex canal systems. Their flexibility and resistance to cyclic fatigue enable safe and efficient preparation of curved and narrow canals, including accessory palatal canals. In the present case, the use of NiTi

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instruments with controlled taper (25/.04 and 30/.04) allowed adequate cleaning while preserving structural integrity.

In addition, irrigation protocols remain critical in cases with complex anatomy. The combination of sodium hypochlorite and EDTA enhances both organic tissue dissolution and smear layer removal, improving disinfection of otherwise inaccessible areas.

The use of bioceramic sealers further enhances treatment outcomes due to their excellent sealing ability, biocompatibility, and antimicrobial properties, particularly in anatomically complex canal systems (16).

Minimally invasive endodontic strategies, as applied in this case, aim to balance effective debridement with conservation of dentin. While smaller preparation sizes may raise concerns regarding disinfection, evidence suggests that proper irrigation and activation techniques can compensate for reduced mechanical enlargement.

This case highlights the importance of continuous intraoperative assessment. The identification of the second palatal canal was made possible through critical evaluation of radiographic findings and re-exploration of the pulp chamber. Such vigilance is essential, as anatomical variations may not be evident at the initial stages of treatment.

In summary, the successful management of maxillary molars with unusual anatomy depends on a combination of anatomical knowledge, clinical experience, and the use of modern endodontic technologies. Failure to recognize and treat additional canals remains a major risk factor for endodontic failure, underscoring the need for a systematic and technology-assisted approach.

Conclusion

This case report emphasizes the importance of recognizing anatomical variations in maxillary molars, particularly the presence of two palatal canals.

Clinicians should maintain a high level of suspicion when treating maxillary molars and employ appropriate diagnostic and clinical strategies to identify additional canals.

Minimally invasive endodontic techniques combined with modern materials such as bioceramic sealers can lead to successful outcomes even in complex anatomical cases.

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