



### Case Report

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## Anomalous Morphology of a Maxillary First Molar Featuring Two Roots and Two Canals: A Rare Case Report

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### Abstract

A comprehensive understanding of root canal morphology, alongside an informed anticipation of potential anatomical variations, is essential for minimizing iatrogenic errors and achieving successful treatment outcomes. The morphology of the permanent maxillary first molar has been extensively investigated, with significant emphasis on variations such as the presence of additional roots and root canals. However, reports documenting the occurrence of two canals in two-rooted maxillary first molars are scarce in the literature on tooth and root canal anatomy. This case report presents the successful endodontic management of a two-rooted maxillary first molar with two canals.

**Keywords:** Dental Pulp Cavity, Maxillary First Molar, Root Canal Therapy, Tooth Abnormalities.

### INTRODUCTION

The root canal system encompasses the entire area within the dentin that houses the pulp. This system is often complex, with its general shape reflecting the tooth's external contour. Natural variations in canal shape can influence changes needed during cleaning and shaping, the techniques used for instrumentation, and ultimately the treatment outcome. Understanding typical root canal anatomy and its common variations is essential for successful root canal treatments [1].

The permanent maxillary first molar typically contains three roots and three or four canals [2]. However, significant anatomical variations, such as differences in root numbers, canal distribution in each root, and root fusion, are noted in the literature. Although cases involving an increased number of roots and canals are relatively well-documented, instances of maxillary first molars with a reduced number of roots and canals are uncommon [3]. Specifically, reports of maxillary first molars with two roots and two canals are rare [4]. Approximately 0.4% of maxillary first molars and 2.2% of maxillary second molars have been reported to exhibit fused buccal roots, resulting in the formation of two-rooted maxillary molars [3].

The success of endodontic therapy is dependent upon effective biomechanical preparation and irrigation, followed by the placement of a suitable root canal filling. This process above all, requires a deep understanding of the potential anatomical variations of the root canal system [5]. This case report presents successful endodontic management of a maxillary molar exhibiting rare occurrence of two roots and root canals.

### CASE REPORT

An 18-year-old female patient presented with the chief complaint of pain in her left upper back region of the jaw for the last 3 days. Her medical history was insignificant. On clinical examination, the maxillary left first molar (26) was grossly decayed.

Pulp vitality tests were performed, and the tooth was sensitive with early response to cold test and exhibited tenderness to vertical percussion. An intraoral periapical radiograph concerning 26 revealed ill-defined radiolucency involving enamel, dentin, and close to the pulp. A diagnosis of irreversible pulpitis with apical periodontitis was established. The radicular pattern on the preoperative radiograph raised suspicion of the presence of only two roots, prompting the recommendation for cone-beam computed tomography (CBCT). However, she denied the investigation due to economic considerations and, also the limited resource setting made it impracticable. The intraoral radiograph of the contralateral maxillary first molar (16)

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similarly revealed two roots with two canals.

Under local anesthesia and proper isolation, an endodontic access cavity was prepared. After proper caries removal, deroofing of the pulp chamber was done using Endo Access and Endo Z burs. The dentinal map connecting two orifices was seen only after complete deroofing. A single orifice was identified on the buccal aspect, while another was located on the palatal aspect (Figure 1). The buccal orifice exhibited a larger diameter compared to the usual dimensions of mesiobuccal or distobuccal orifices typically observed in maxillary first molars.



**Figure 1:** Intraoral clinical picture showing one buccal and one palatal canal

Additionally, the access cavity displayed an ovoid configuration rather than the conventional triangular or rhomboidal shape. Working length was determined using a #15 K file (Dentsply Maillefer, Switzerland) with apex locator (WispeX, Fanta Dental Materials Co., Ltd, China) and confirmed radiographically (Figure 2-4). The buccal and palatal roots were respectively 17.5 and 18.5 mm long.



**Figure 2:** Working Length Radiograph

The root canals were shaped and prepared using rotary instruments from the ProTaper Gold file system (Dentsply Maillefer, Switzerland) up to size F3 to the working length. The root canals were irrigated with normal saline, 2.5% sodium hypochlorite, and 17% ethylenediaminetetraacetic acid (EDTA). They were then dried using absorbent paper points and obturated with F3-sized gutta-percha as the master cone, combined with a zinc oxide-eugenol-based sealer (RC Fill, Prime Dental Products, India), utilizing the cold lateral compaction technique. Glass ionomer cement (GC Gold Label II, GC Corporation, Tokyo) was used as a base followed by composite resin (Spectrum, Dentsply Sirona, USA) placement as a post-endodontic restoration.

The patient was advised for a crown placement after the restoration was performed. The patient was kept on periodic follow-ups which were uneventful.



**Figure 3:** Master Cone Radiograph



**Figure 4:** Post-obturation Radiograph

## DISCUSSION

The morphology of roots and root canals shows considerable variation, as documented in the literature. However, many studies fail to provide information on factors such as ethnic background, age, gender, or potential explanations for the observed variations [2]. The maxillary first molar is a well-known tooth to exhibit such anatomic variation in root and canal morphology [6]. Burns stated maxillary first molars are possibly the most treated yet least understood, posterior tooth [3]. For many years, the literature has extensively reported variations in the root canal morphology of maxillary first molars, extending beyond the typical three roots and three or four canals.

During root formation, the epithelial diaphragm divides the root trunk into two or more roots through differential growth, with the number of roots corresponding to the number of divisions. Rarely, disruptions in the genetic programming of the epithelial diaphragm may result in fewer or fused roots [7]. A literature review by Cleghorn et al., based on data from four anatomical studies with a sample of 416 teeth, found that 96.2% of maxillary molars had three roots, while two roots were present in 16 (3.8%) teeth. He noted that the two-rooted configuration is rarely observed and suggested it may arise from the fusion of the distobuccal root with either the palatal root or the mesiobuccal root [2]. Hence, root fusion can occur in various combinations, depending on the specific roots involved [3].

In our case, the two buccal roots fused into a single buccal root with a large single buccal canal, resulting in a two-rooted maxillary first molar. Sabala et al. reported that atypical root morphology occurred bilaterally in approximately 60% of cases and noted that the rarer the anomaly, the higher the likelihood of it being bilateral [6]. Malagnino mentioned that fusion of the two buccal roots is one of the most common aberrations of maxillary molars with a prevalence of 0.4% and 100% cases showing bilaterality [8]. Our case aligns with this observation, as both maxillary first molars exhibited two roots and two canals bilaterally. Similarly, Christie et al. reported the presence of two palatal roots in maxillary molars in their study and mentioned that such findings would be detected once every three years in an intense daily clinical practice [9].

Variations in root canals of the maxillary first molar include one, four, and five canals and an unusual morphology of root canal systems within the individual roots. Furthermore, cases with five and six root canals, or with a C-shaped canal configuration are also seen [10-12]. Slowey mentioned that the primary reason for endodontic treatment failure is the inability to detect extra roots or root canals. In our case, however, the issue was not the presence of extra canals, but the absence of one, with only two canals found instead of the typical three canals in the maxillary first molar roots.

A thorough understanding of root canal anatomy enables clinicians to effectively remove biofilm from the entire root canal system through comprehensive biomechanical preparation and irrigation, ensuring proper three-dimensional obturation and hence, successful treatment outcomes. Root canal morphology should be further assessed during treatment by analyzing radiographs taken from various horizontal angles. Utilizing preoperative radiographs along with supplementary radiographic views taken at 20-degree mesial or distal angulations are effective methods for evaluating root canal morphology and anatomy [13,14].

## CONCLUSION

Variations in canal morphology, including extra canals, apical ramifications, apical deltas, and lateral canals, are frequently encountered by clinicians and are well-documented. However, it is also important to be mindful that some cases may present with fewer roots or canals. While the occurrence of two roots and two canals is relatively rare, it is crucial to consider these variations during root canal treatment of maxillary molars to avoid iatrogenic errors and ensure a successful outcome. This report emphasizes the significance of recognizing such anatomical variations during the diagnosis and treatment of maxillary molars to achieve successful root canal therapy.

## Conflicts of Interest

The author reports no conflicts of interest.

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## Author Contribution

AK, MAH: Patient management, Manuscript write-up and proofreading. MK, BK, NS: Manuscript write-up, editing, and proofreading. RA, PS: Manuscript editing and proofreading.

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