IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 25, Issue 3 Ser. 4 (March. 2026), PP 68-74
www.iosrjournals.org

Double Trouble – An Endodontic Surprise: Endodontic Management Of A Maxillary First Molar With Two Root Canals – A Case Series

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Abstract
In order to eradicate the majority of the pathogenic bacteria that are present in the canals, root canal treatment intends to clean, shape, and fill the endodontic space in three dimensions. Inconsistencies in the shape of the root canal are a consequence of many of the challenges encountered during therapy. The continual existence of infection due to a missing canal or insufficient removal of bacteria and necrotic pulp remains during instrumentation may be linked to endodontic failure. It is crucial that one fully comprehends the internal structure and all of its factors because of this. Since the internal anatomy and morphology of permanent maxillary first molars vary between individuals, this tooth has been meticulously studied. Studies that describe tooth and root canal anatomy have seldom mentioned the possible existence of two canals in a maxillary first molar with two roots, the incidence of which is less than 1.3%. Teeth with two roots and two root canals that were root canal treated are presented in this case series.

Keywords: *2 rooted maxillary 1st molar, Root canal therapy, CBCT.*

Date of Submission: 16-03-2026 Date of Acceptance: 26-03-2026

I. Introduction

Successful endodontic therapy depends upon comprehensive debridement, disinfection, and obturation of the entire root canal system. An accurate understanding of internal root canal morphology is indispensable for achieving these objectives. Among posterior teeth, the maxillary first molar is considered one of the most morphologically complex teeth, typically characterized by three roots and three or four canals [1]. The mesiobuccal (MB) root, in particular, is known to exhibit considerable variation, often presenting a second canal (MB2) that can be difficult to locate.

However, while the presence of additional canals is relatively common, the occurrence of fewer canals than expected is exceedingly rare. Reports describing maxillary first molars with only two canals are uncommon and therefore constitute an endodontic surprise during treatment [2]. Such anatomical deviations pose significant diagnostic and procedural challenges to clinicians. Recognizing such an anomaly is vital to avoid procedural errors and to ensure complete cleaning and shaping of the existing canals without unnecessary dentin removal in search of non-existent ones [4].

The use of magnification devices like operating microscopes and loupes, along with advanced imaging modalities such as cone-beam computed tomography (CBCT), has enhanced the clinician's ability to identify these variations [5,6].

This case series documents the clinical management of three maxillary first molars exhibiting two-canal configurations, managed successfully with ProTaper Gold rotary files and Safe Endo Bioactive RCS sealer. The discussion elaborates on the anatomical, clinical, and procedural aspects relevant to such cases, supported by current literature.

II. Case Presentation

Case 1 – Maxillary first molar (16)

A 57-year-old female reported to the Department of Conservative Dentistry and Endodontics, Sri Rajiv Gandhi College of dental sciences, Bangalore, with pain on mastication and sensitivity to hot and cold stimuli in the upper right posterior region since a week. The pain was dull, intermittent**,** non-radiating in nature and exacerbated by biting and thermal changes, particularly hot foods.

Clinical examination revealed a deep mesio-occlusal carious lesion on tooth 16. The tooth was tender to percussion, with no swelling or sinus tract. Pulp vitality testing (cold test) elicited a lingering painful response, suggestive of irreversible pulpitis.

Preoperative radiographic examination revealed a large carious lesion approximating the pulp chamber and widening of periapical ligament space. Notably, only two root outlines were distinguishable—one buccal and one palatal—raising suspicion of an anatomical variation (Figure 1). The radiographic findings, in correlation with the clinical signs and symptoms, led to a diagnosis of Irreversible Pulpitis with Symptomatic Apical Periodontitis in relation to tooth 16 and nonsurgical root canal therapy was planned.

Figure 1: Preoperative image and IOPAR i.r.t 16

Under local anaesthesia and rubber dam isolation, access cavity was prepared. After the removal of caries, the roof of the chamber was removed completely. Dentinal map connecting two orifices only was seen after deroofing. One orifice was present in the buccal aspect, and other orifice was present in the palatal aspect (Figure 2). CBCT was done to confirm the morphology of the tooth.

Figure 2: Dentinal map connecting two orifices only was seen after deroofing

CBCT revealed the presence of two roots – one buccal root and one palatal root and presence of single canal in each root. This finding was present bilaterally (Figure 3).

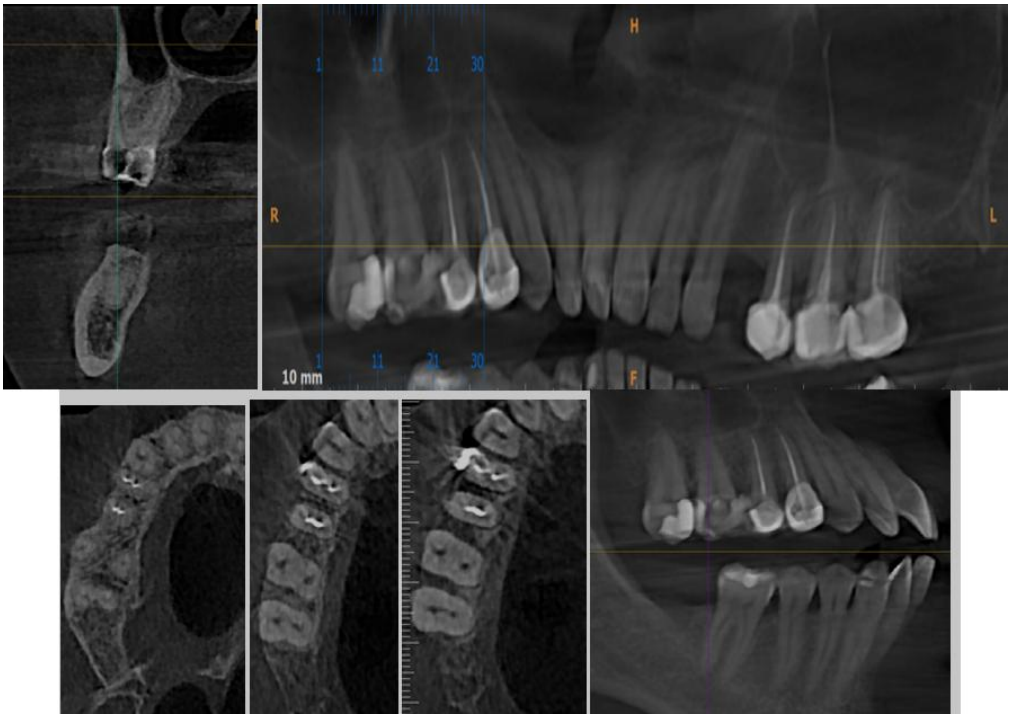

Figure 3: Cone-beam computed tomography coronal section; axial section at cervical third, middle third level, apical third level and sagittal section

The working length (buccal and palatal =19 mm) was established using an apex locator (Coltene CanalPro CL2i endomotor) and confirmed radiographically (Figure 4).

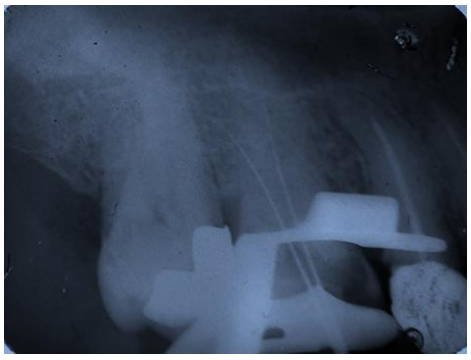

Figure 4: Working length determination

Cleaning and shaping were performed using the ProTaper Gold rotary system up to size F2. Irrigation was performed with 3% sodium hypochlorite, 17% EDTA, and saline as a final rinse. The canals were dried and obturated with Bioceramic root canal sealer using the lateral condensation technique (Figure 5). Post-endodontic restoration was completed with a composite resin and a crown (zirconia) was placed in further visits (Figure 6).

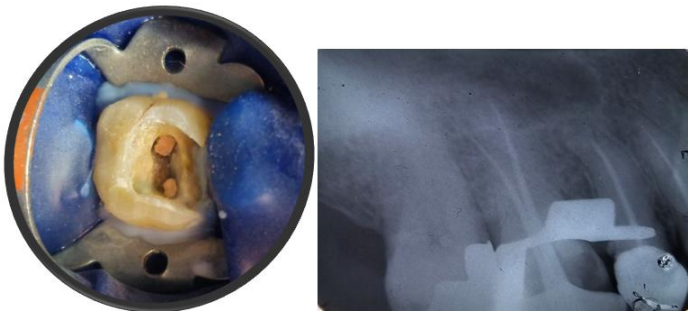

Figure 5: Post Obturation

Figure 6 : Post crown cementation

Case 2 and 3– Maxillary first molar (16, 26)

A 34-year-old female reported to the Department of Conservative Dentistry and Endodontics, Sri Rajiv Gandhi College of dental sciences, Bangalore, with pain on mastication and sensitivity to hot and cold stimuli in the upper right and left posterior region since 2 weeks. The pain was dull, continuous, throbbing**,** non-radiating in nature and exacerbated by biting and thermal changes, particularly hot foods. Over the preceding few days, the discomfort had intensified, especially during chewing. There was no history of swelling, pus discharge, or sinus tract formation**.**

Clinical examination revealed a deep mesio-occlusal carious lesion on tooth 16 and 26. The tooth was tender to percussion, with no swelling or sinus tract. Pulp vitality testing (cold test) elicited a lingering painful response, suggestive of irreversible pulpitis.

Preoperative radiographic examination revealed a large carious lesion approximating the pulp chamber and widening of periapical ligament space. Notably, only two root outlines were distinguishable—one buccal and one palatal—raising suspicion of an anatomical variation (Figure 7). The radiographic findings, in correlation with the clinical signs and symptoms, led to a diagnosis of Irreversible Pulpitis with Symptomatic Apical Periodontitis in relation to tooth 16 and 26, and nonsurgical root canal therapy was planned.

Under local anesthesia and rubber dam isolation, access cavity was prepared. After the removal of caries, the roof of the chamber was removed completely. Dentinal map connecting two orifices only was seen after deroofing. One orifice was present in the buccal aspect, and other orifice was present in the palatal aspect.

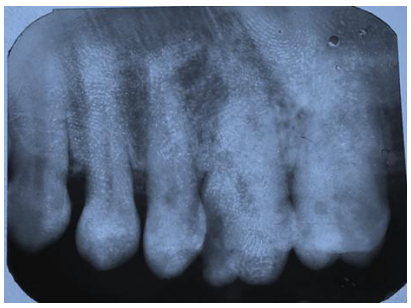

Figure 7: Preoperative IOPAR i.r.t 26

CBCT was done to confirm the morphology of the tooth.

CBCT revealed the presence of two roots – one buccal root and one palatal root and presence of single canal in each root. This finding was present bilaterally (Figure 8).

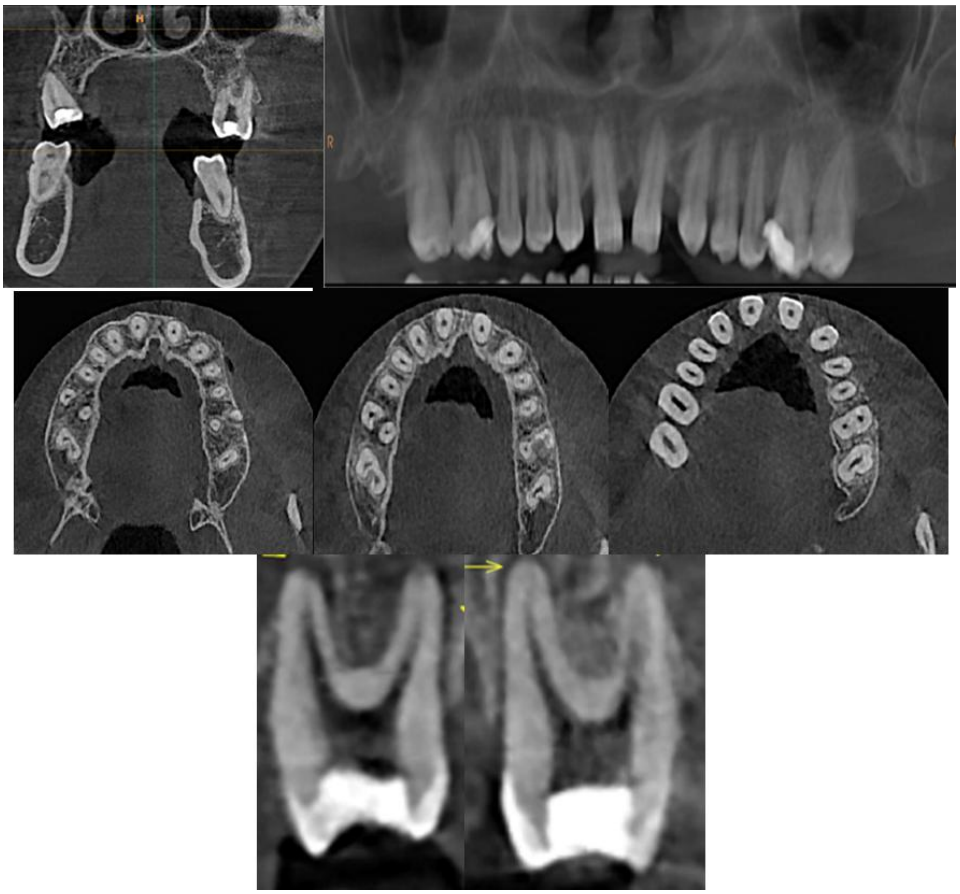

Figure 8: Cone-beam computed tomography coronal section; axial section at cervical third, middle third level, apical third level and sagittal section

The working length (buccal and palatal =17mm) was established using an apex locator (Coltene CanalPro CL2i endomotor) and confirmed radiographically (Figure 9). Cleaning and shaping were performed using the ProTaper Gold rotary system up to size F2. Irrigation was performed with 3% sodium hypochlorite, 17% EDTA, and saline as a final rinse. The canals were dried and obturated with Bioceramic root canal sealer using the lateral condensation technique. Post-endodontic restoration was completed with a composite resin (Figure 10).

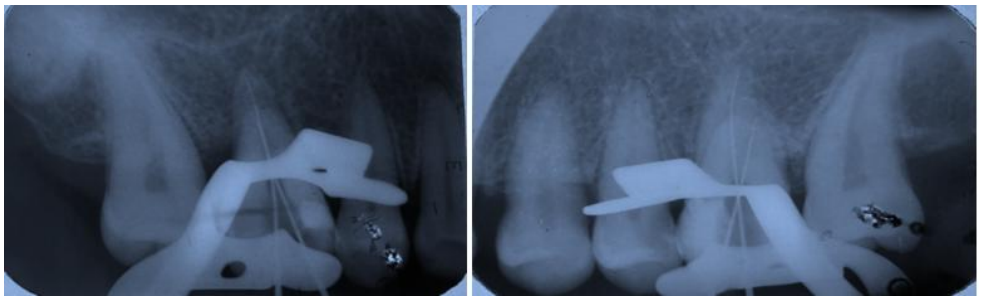

Figure 9: Working length determination i.r.t 16, 26

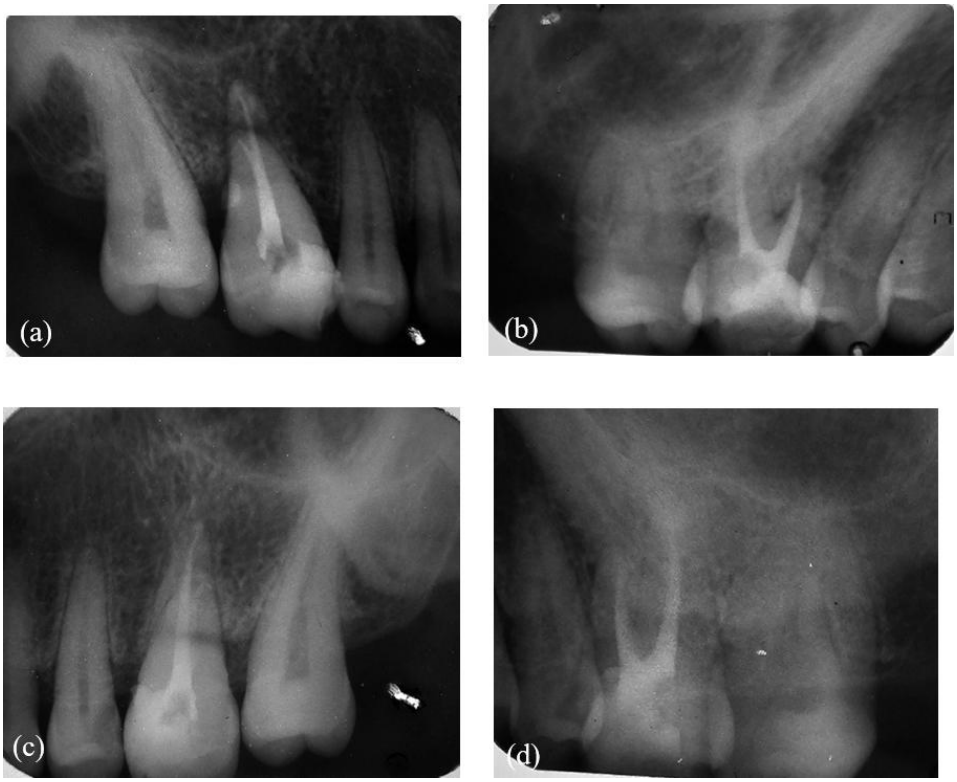

Figure 10: (a)Obturation i.r.t 16, (b) Post endodontic restoration i.r.t 16, (c) Obturation i.r.t 26, (d) Post endodontic restoration i.r.t 26

III. Discussion

Knowledge of root canal anatomy and its variations is fundamental for successful endodontic therapy. The maxillary first molar commonly possesses three roots and three or four canals; however, rare variations such as two roots with two canals have been reported in literature with a prevalence ranging from 0.4% to 1.2% [7, 8]. These variations can be attributed to developmental anomalies during Hertwig's epithelial root sheath formation [9]. Missed canals or incorrect identification of canal morphology is one of the major causes of endodontic failure [10]. Therefore, careful evaluation of preoperative radiographs and the use of magnification are indispensable in such cases.

In the literature, a wide range of variations with respect to the number of roots and root canals have been reported in the literature with respect to maxillary first molar. Because of the morphological characteristics of the maxillary molar, this fusion between roots may occur in several ways depending on which roots are involved. Fusion of roots may take place between mesiobuccal and distobuccal roots, mesiobuccal and palatal roots, or distobuccal and palatal roots. In the present case, two buccal roots were fused together resulting in a single buccal root with large single buccal canal.

Sabala et al. observed that unusual root morphology was bilateral approximately 60% of the time and stated that rarer the aberration, greater would be the probability of it being bilateral. In the present case, maxillary first molars with two roots and two canals were present bilaterally. The existence of similar configuration in the contralateral molar was confirmed with CBCT axial images [11].

As radiographs are two-dimensional image of a three-dimensional object, erroneous interpretations are very much possible due to the superimposition of multiple anatomic structures questioning its reliability.

In endodontic practice, CBCT is a diagnostic tool which offers a better understanding of root canal in axial, sagittal, and coronal planes. In the present case, the presence of only two roots and two canals was suspected from multiple angled radiographs and confirmed with CBCT. The integration of magnification tools such as operating microscopes or loupes greatly enhances canal detection [12, 13]. In all three cases in this series, Zumax TTL loupes provided enhanced illumination and visual clarity, allowing the clinician to confirm the presence of only two canals.

The cleaning and shaping of the canals were performed using ProTaper Gold rotary files, which offer improved flexibility and fatigue resistance due to their proprietary metallurgy [14]. Adequate irrigation is critical in such anatomically variant canals. The use of 3% sodium hypochlorite ensures effective organic tissue dissolution, while 17% EDTA aids in smear layer removal [15]. Final flushing with saline prevents residual chemical interactions within the canal system.

Obturation was performed using the lateral condensation technique with Safe Endo Bioactive RCS sealer, a calcium silicate-based bioactive material. This sealer exhibits excellent sealing ability, dimensional stability, and biocompatibility, promoting favourable periapical healing [16, 17]. Studies have demonstrated that bioactive sealers form hydroxyapatite upon setting, enhancing the adhesion between dentinal walls and gutta-percha [18]. This property contributes significantly to the long-term success of endodontic therapy, particularly in cases with atypical canal anatomy.

Magnification and illumination play a pivotal role in modern endodontics. Several studies have reported improved canal detection rates and treatment precision when magnification devices are utilized [19, 20]. The present case series reinforces the importance of magnification, enabling clinicians to recognize rare variations confidently and to perform meticulous canal debridement.

Follow-up evaluations in all three cases demonstrated absence of pain, tenderness, or periapical pathology, indicating favorable healing. This underscores the significance of accurate diagnosis, conservative access preparation, thorough biomechanical cleaning, and the use of bioceramic sealers in achieving predictable outcomes even in rare anatomical configurations [21, 22].

Clinical Significance

Understanding root canal variations and applying magnification-assisted endodontic techniques are crucial for avoiding missed anatomy and ensuring treatment success. The use of bioactive sealers such as Safe Endo Bioactive RCS enhances sealing ability and promotes biological healing, making them highly suitable for complex or atypical canal systems.

IV. Conclusion

This case series illustrates that even in anatomically rare configurations like a maxillary first molar with only two canals, successful endodontic outcomes can be achieved through careful diagnosis, magnification-assisted canal identification, appropriate rotary instrumentation, and the use of bioactive sealers. Clinicians should always be aware of possible variations and use all available diagnostic aids to ensure comprehensive canal debridement and obturation.

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