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Navigating Complexity: Two Case Reports on the Management of the Mesiobuccal 2 (MB2) Canal in Maxillary Molars

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Abstract

Maxillary molars, particularly the first and second molars, represent some of the most anatomically complex teeth encountered in endodontic practice. The mesiobuccal (MB) root of these teeth is well-documented for harboring a second mesiobuccal canal (MB2), which, if undetected and untreated, significantly compromises treatment prognosis. This paper presents two distinct clinical case reports involving the successful endodontic management of maxillary molars with MB2 canal configurations. Case 1 describes a 35-year-old male who presented with an incompletely treated maxillary right first molar (tooth #16) where MB2 had been missed during prior treatment at a private clinic. Case 2 presents a 54-year-old female requiring intentional root canal treatment of the maxillary right second molar (tooth #17) as part of prosthetic rehabilitation. In both cases, magnification-aided access modification, systematic exploration, and rotary nickel-titanium (Ni-Ti) instrumentation facilitated identification and successful treatment of the MB2 canal. These cases underscore the clinical importance of thorough anatomical awareness, advanced visualization, and meticulous technique in achieving endodontic success.

Keywords: MB2 canal, maxillary first molar, maxillary second molar, root canal treatment, mesiobuccal root, endodontics, intentional root canal treatment, magnification

Introduction

A thorough understanding of root and canal morphology is indispensable for effective endodontic therapy [1]. The primary goal of root canal treatment is the complete debridement, shaping, and three-dimensional obturation of all canal spaces, necessitating the identification of every root canal present [2]. The maxillary first and second molars are among the most frequently treated teeth in endodontic practice and are notable for their complex root canal anatomy. The maxillary first molar typically presents with three roots and three to four canals, while the second molar demonstrates similar, though often more variable, anatomy [3].

The mesiobuccal (MB) root of maxillary molars is particularly renowned for housing a second canal—the MB2—which courses palatal to the main mesiobuccal canal. Prevalence studies in the Indian population have reported MB2 canal incidence of 44.1% to 47.1% in maxillary first molars using cone beam computed tomography (CBCT) [7,8]. Despite this high prevalence, MB2 canals remain among the most frequently missed canals in clinical endodontics, with the risk being especially elevated in retreatment scenarios [9]. Undetected MB2 canals lead to persistent periapical pathology, treatment failure, and adversely affect the long-term prognosis of the tooth [12].

Various factors contribute to the difficulty in locating MB2 canals: calcified orifices, inadequate access preparation, anatomical variability, and limited magnification [4]. Advances in diagnostic imaging, particularly CBCT, and enhanced intraoperative visualization through dental loupes and operating microscopes have substantially improved detection rates [5,6]. Stropko demonstrated that with optimal magnification, instrumentation, and systematic search strategies, MB2 canal identification rates in maxillary first molars can approach 93% [16].

Intentional root canal treatment (IRCT) represents a planned endodontic procedure performed on a tooth with a healthy or minimally symptomatic pulp, typically in preparation for prosthetic rehabilitation or to serve as a strategic abutment. IRCT for the maxillary second molar is occasionally indicated when prosthetic demands require alteration of tooth anatomy or when the tooth is to be used as a fixed partial denture abutment requiring significant crown reduction that may risk pulpal exposure [18]. In such situations, identification and treatment of all canals, including MB2, is critical.

This report presents two clinical cases managed at the Department of Conservative Dentistry and Endodontics, highlighting the challenges and successful management of MB2 canals in the maxillary first and second molars, respectively.

Case Reports

Case Report 1: Retreatment of Maxillary Right First Molar (Tooth #16) with Missed MB2 Canal

A 35-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, with a chief complaint of persistent pain in the upper right posterior region. The patient reported that root canal treatment had been initiated on the upper right first molar (tooth #16) at a private dental clinic approximately three weeks prior, following which he continued to experience discomfort.

Medical history was non-contributory. Intraoral examination demonstrated a temporary restoration on tooth #16 with tenderness on percussion. No sinus tract, swelling, or pus discharge was noted. Radiographic examination revealed evidence of incomplete instrumentation and a radiolucent shadow suggestive of an untreated MB2 canal (Figure 1). Pulp sensibility tests were not applicable given the prior access preparation. A diagnosis of previously initiated root canal treatment with symptomatic apical periodontitis was established for tooth #16.

Figure 1: Preoperative periapical radiograph of tooth #16 showing prior access preparation and suspected untreated MB2 canal.

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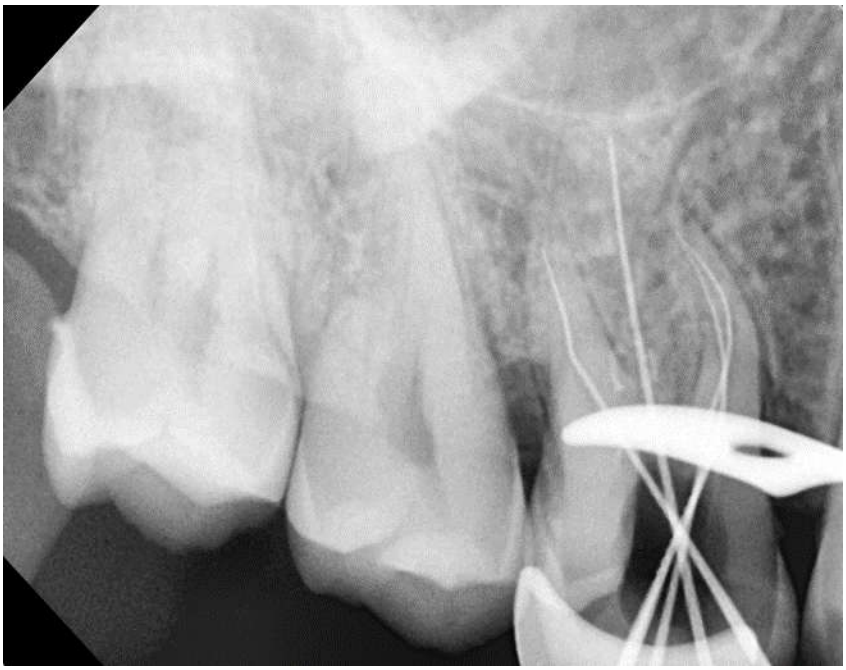
Following administration of posterior superior alveolar nerve block using 2% lignocaine with 1:80,000 adrenaline and rubber dam isolation, the temporary restoration was removed. A 3.5x dental loupe was employed for magnification and enhanced illumination throughout the procedure. The existing access cavity was evaluated; three orifices—palatal (P), mesiobuccal (MB1), and distobuccal (DB)—were identified at their conventional positions. The pulp chamber floor was systematically explored using a DG-16 explorer, specifically directing attention to the developmental groove extending mesiopalatally from the MB1 orifice.

The MB2 orifice was identified approximately 2 mm palatally and slightly mesially to the MB1 orifice, consistent with the literature [17]. The access cavity was modified from the conventional triangular outline to a trapezoidal form to accommodate instrumentation of both MB1 and MB2 canals simultaneously and facilitate straight-line access [16].

Working length was determined using Root ZX mini electronic apex locator and confirmed radiographically with an angled projection (Figure 2A). Cleaning and Shaping was performed using rotary Ni-Ti files. MB1,MB2 and DB canal was instrumented to size 25/.04 and the P canal to 30/.06. Irrigation was performed using alternating 3% sodium hypochlorite (NaOCl) and 0.9% normal saline throughout instrumentation. Calcium hydroxide intracanal medicament was placed and the tooth temporized. The patient was recalled after 7 days.

Figure 2A: Working length radiograph for tooth #16



At the second appointment, the patient was completely asymptomatic. The temporary restoration and calcium hydroxide dressing were removed. Final irrigation was performed using 3% NaOCl activated with the EndoActivator sonic device, followed by 17% EDTA for smear layer removal, and a final rinse with 0.9% saline. Master apical cones were selected and fit verified radiographically (Figure 2B). Obturation was performed using a cold lateral compaction technique with gutta-percha master cones and epoxy resin-based sealer . Obturation quality was confirmed radiographically (Figure 2C).

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Figure 2B: Master apical cone fitting radiograph for tooth #16 demonstrating cone placement in all four canals including MB2.

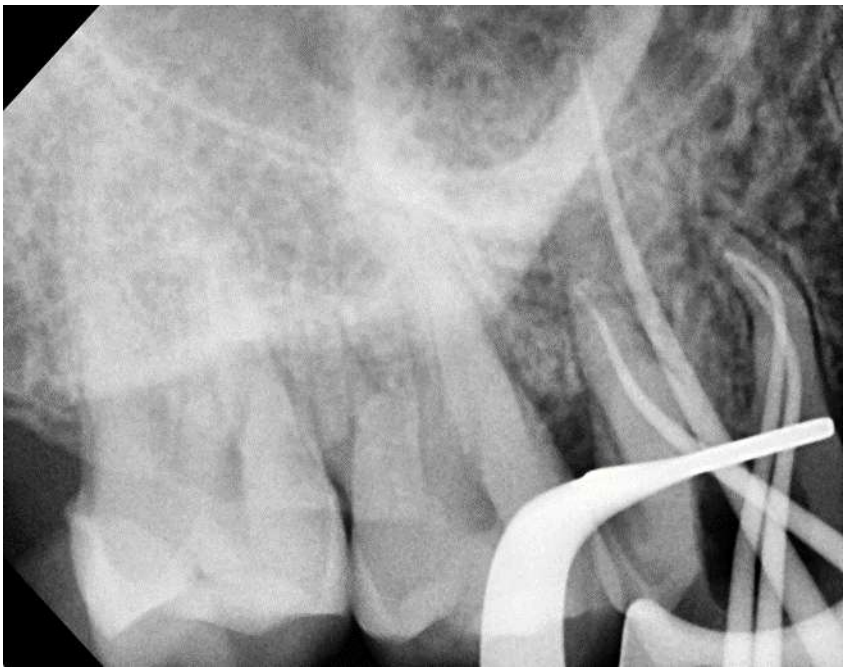

Figure 2C: Post-obturation radiograph of tooth #16 confirming three-dimensional obturation of all four canals including the MB2 canal.

Post-endodontic restoration was subsequently placed. A postoperative radiograph demonstrated satisfactory obturation of all four canals (Figure 3). The patient was advised to undergo crown restoration as definitive coronal protection.

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Figure 3: Final post-obturation periapical radiograph of tooth #16 demonstrating well-condensed obturation of all canals including MB2, with post-endodontic restoration in place.

2.2. Case Report 2: Intentional Root Canal Treatment of Maxillary Right Second Molar (Tooth #17) for Prosthetic Rehabilitation

A 54-year-old female patient was referred to the Department of Conservative Dentistry and Endodontics, for intentional root canal treatment (IRCT) of the maxillary right second molar (tooth #17). The referral was made by the Department of Prosthodontics in preparation for a fixed partial denture (FPD) that required tooth #17 to serve as a terminal abutment. The planned prosthetic rehabilitation necessitated significant crown preparation that would likely result in pulpal exposure, making prophylactic endodontic treatment necessary prior to final prosthetic procedures [18].

Medical history was significant for controlled hypertension managed with antihypertensives. Blood pressure was recorded as 130/80 mmHg at the time of treatment; medical clearance was obtained from her physician prior to proceeding. Intraoral examination of tooth #17 revealed a clinically intact tooth with no caries, fractures, or restorations. Periodontal examination was within normal limits. Radiographic evaluation of tooth #17 demonstrated an intact root canal system with no evidence of periapical pathology. The mesiobuccal root showed a broad buccolingual dimension, raising clinical suspicion for the presence of an MB2 canal . Pulp sensibility testing (cold test and electric pulp test) confirmed vital pulp. The clinical diagnosis was normal pulp with a treatment plan of intentional root canal treatment in preparation for prosthodontic rehabilitation.

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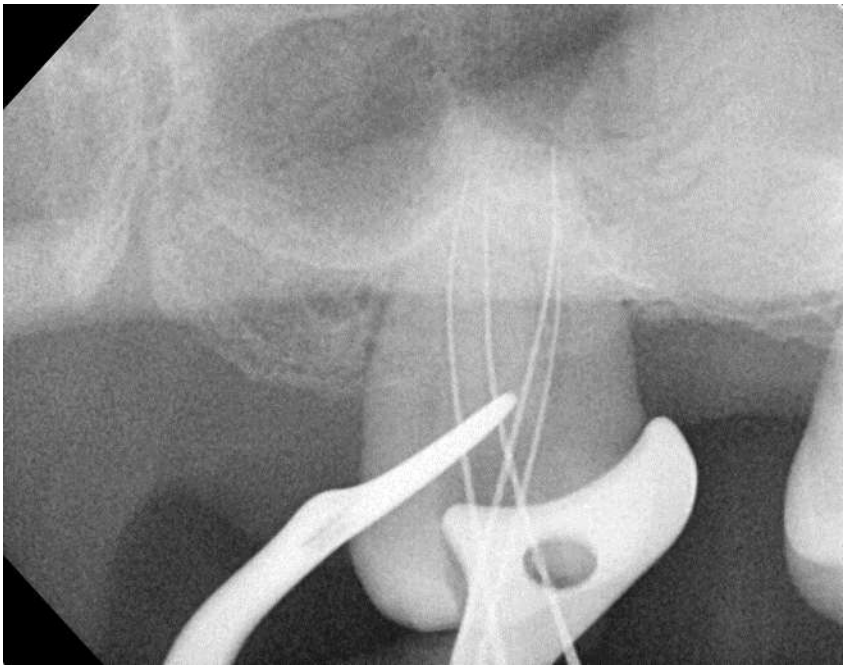
Figure 4 (Case 2 – Working Length Radiograph): Periapical radiograph of tooth #17 showing intact root morphology with broad mesiobuccal root; working length files in position confirming access to all canals including MB2.



Local anesthesia was administered using 2% lignocaine with and rubber dam isolation was secured. A 3.5x dental loupe was used for magnification and illumination. The occlusal access cavity was prepared using a round bur and safe-end bur. Three orifices were initially identified: P, MB1, and DB at their expected positions. Exploration of the mesial pulp chamber floor with a DG-16 explorer, specifically along the MB groove in the mesiopalatal direction, revealed a fourth orifice consistent with MB2, located approximately 1.8–2.0 mm palatal and slightly mesial to MB1 [14,15]. The access outline was modified to a trapezoidal form.

Working length was established electronically and confirmed radiographically (Figure 4). Rotary Ni-Ti instrumentation was performed: MB2, MB1 and DB to 25/.04, and P canal to 25/.06. Irrigation was carried out with 3% NaOCl and 0.9% saline alternately. Calcium hydroxide medicament was placed, the tooth temporized, and the patient recalled after 7 days.

At the second appointment, the tooth remained asymptomatic. Final irrigation with 3% NaOCl, 17% EDTA, and 0.9% saline was performed. Master apical cones were selected (Figure 5) and obturation completed using cold lateral compaction with gutta-percha and epoxy resin-based sealer .Post-obturation radiograph confirmed satisfactory obturation of all canals including MB2 (Figure 6).

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Figure 5 Master apical cone radiograph for tooth #17 confirming appropriate cone length in all canals including MB2 prior to obturation.

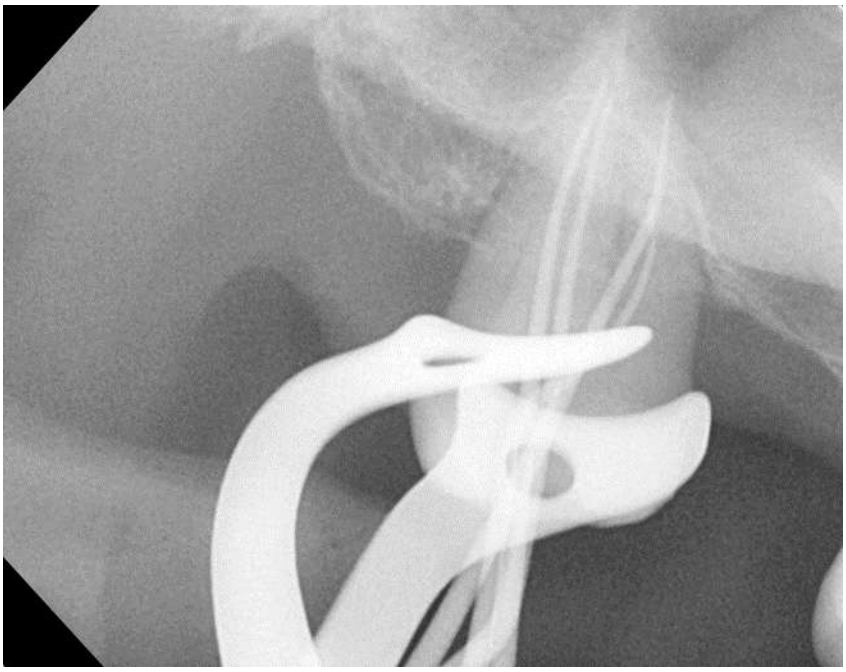
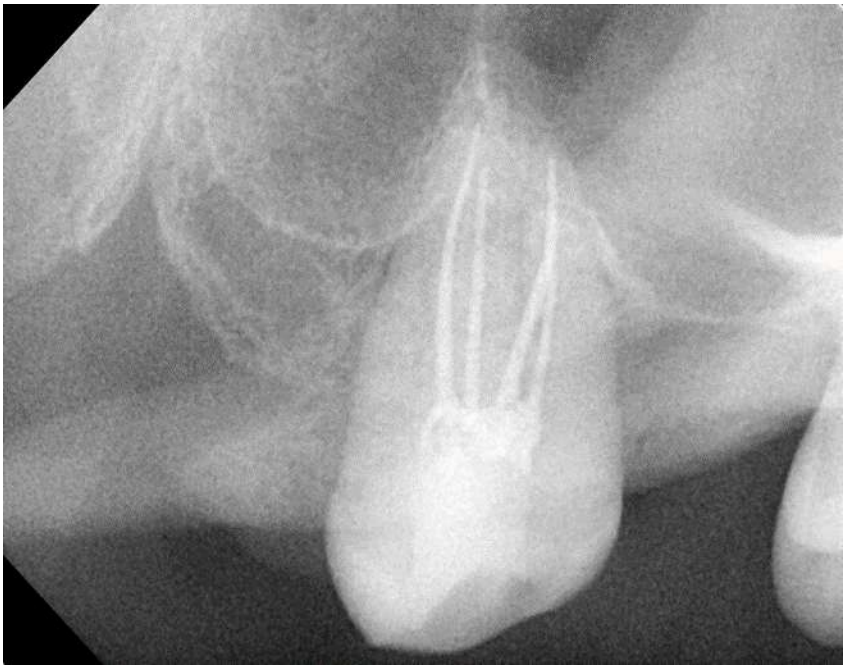


Figure 6: Post-obturation periapical radiograph of tooth #17 demonstrating well-condensed, three-dimensional obturation of all root canals including MB2. The tooth was subsequently referred for prosthetic crown fabrication.



Discussion

The two cases presented herein highlight distinct yet clinically significant scenarios in which the identification and management of MB2 canals were pivotal to successful endodontic outcomes. Case 1 exemplifies the not-uncommon clinical situation of retreatment necessitated by a missed MB2 canal

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during initial treatment, while Case 2 demonstrates the complexity of IRCT in a second molar with suspected MB2 anatomy, performed in preparation for prosthetic rehabilitation.

The morphological classification of root canal systems by Weine et al. remains the most clinically applicable framework for understanding the variability of canal configurations encountered in the maxillary molar [10]. The mesiobuccal root of the maxillary first and second molars is particularly known for Type II (two separate canals joining into one) and Type IV (two separate canals with separate foramina) configurations, accounting for the majority of MB2 presentations [10]. Cone beam computed tomography (CBCT) studies have consistently reported MB2 prevalence in the 50–90% range, with clinical detection rates considerably lower, highlighting the diagnostic and technical challenge this anatomy presents [5,7,8].

The distance between MB1 and MB2 orifices is a critical anatomical parameter; studies have reported a mean distance of 2.31 mm (Kulild and Peters) and 1.82 mm (Gilles and Reader) [14,15]. In the cases reported here, MB2 orifices were located approximately 1.8–2.0 mm palatal and mesial to MB1, consistent with published data. Closer proximity between orifices increases the probability of the two canals joining apically, which may simplify obturation but complicates negotiation [13].

A critical factor in the management of both cases was the systematic modification of access cavity design. Conventional triangular access preparation, while adequate for three-canal maxillary molars, is frequently insufficient for exposing the MB2 orifice. Conversion to a trapezoidal or rhomboidal outline, as advocated in the literature, allows unobstructed visualization and instrumentation of both MB1 and MB2 canals and was employed in both cases presented [16].

The use of 3.5x magnification loupes in both cases provided enhanced visualization of the pulp chamber floor, enabling differentiation between canal orifices and identification of subtle anatomical landmarks. Magnification tools reduce the risk of procedural errors including perforation and ledging, which are heightened risks when modifying access cavity design near the furcation area [4]. Stropko's landmark study demonstrated that detection rates for MB2 approaching 93% are achievable with optimal magnification and systematic technique [16].

In Case 2, the decision to perform IRCT was made collaboratively with the prosthetic team. IRCT is indicated when anticipated prosthodontic procedures would result in pulpal exposure, when the tooth is a critical bridge abutment necessitating substantial crown reduction, or when root resection for prosthetic purposes is planned [18,19]. The maxillary second molar, serving as a terminal abutment, often undergoes aggressive preparation that may compromise pulpal vitality; prophylactic endodontic intervention prevents future complications such as acute pulpitis or postoperative pain beneath a fixed prosthesis [18]. In our case, the broader mesiobuccal root of tooth #17 prompted high clinical suspicion for MB2, which was confirmed during access preparation. MB2 canal detection: champagne bubble test, DG-16 explorer, methylene blue dye staining, ultrasonic troughing under magnification/ DOM.

Irrigation using 3% NaOCl and 17% EDTA facilitated chemomechanical debridement and smear layer removal, particularly important in the narrow MB2 canal. The use of epoxy resin-based sealer (Diaproseal) with cold lateral compaction is a well-established protocol for achieving a hermetic obturation in challenging canal morphologies [2]. Post-endodontic restoration provided immediate coronal seal, reducing the risk of microleakage between appointments and prior to definitive crown placement.

The cases illustrate that a systematic, methodical approach—incorporating appropriate access design, magnification, electronic apex location, rotary instrumentation, and thorough irrigation—is the cornerstone of managing MB2 canals. Clinicians should maintain a high index of suspicion for MB2, particularly in maxillary first molars (higher prevalence) and second molars with broad mesiobuccal roots. CBCT evaluation, when available, remains the gold standard for preoperative assessment of canal morphology and should be considered in complex or retreatment cases [5,6].

Conclusions

These two case reports affirm the persistent clinical challenge posed by MB2 canals in maxillary molars and demonstrate that successful identification and

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management is achievable with systematic technique, adequate magnification, and thorough understanding of root canal anatomy. In Case 1, identification and retreatment of the missed MB2 canal in tooth #16 resolved persistent periapical pathology and restored the tooth to health. In Case 2, proactive detection and treatment of MB2 in tooth #17 during intentional root canal therapy facilitated seamless prosthetic rehabilitation without subsequent endodontic complications.

Clinicians must be vigilant in seeking MB2 canals in every maxillary molar case. The use of enhanced magnification, modified trapezoidal access design and electronic apex locators significantly improves MB2 detection rates and treatment outcomes. Advances in imaging, including CBCT, further support preoperative identification of this anatomical variant. Systematic training and adoption of these strategies are essential for minimizing treatment failures attributable to missed canals in maxillary molar endodontics.

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