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4 Mesial Canals in Lower 2nd Mandibular Molar: A Rare Variation

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ABSTRACT:

Title: 4 Mesial Canals In Lower 2nd Mandibular Molar : A Rare Variation

Background: Variations in root canal anatomy of mandibular molars present significant challenges in endodontic therapy. The presence of additional canals, particularly in the mesial root, is uncommon and may lead to treatment failure if undetected.

Aim: To report a rare case of a mandibular second molar with four canals in the mesial root and one distal canal.

Materials and Methods: A 34-year-old male patient presented with symptomatic irreversible pulpitis in tooth #37. Endodontic treatment was performed under rubber dam using a dental operating microscope. Canal identification was aided by DG16 exploration, angulated radiographs, and CBCT imaging. Cleaning and shaping were done using hand and rotary instruments, followed by intracanal medicament placement and obturation with gutta-percha and resin sealer.

Results: Four mesial canals and one distal canal were successfully identified, negotiated, and treated.

Conclusion: The presence of four canals in the mesial root represents an extremely rare anatomical variation. Thorough knowledge of root canal morphology, along with magnification and advanced imaging, is essential for accurate diagnosis and successful endodontic management.

Keywords: mandibular molars, Endodontic, root canal morphology, mesial canals, additional canals

I. INTRODUCTION

Mandibular molars requiring endodontic therapy are often encountered in dental practice. Complexity of the root canal morphology is one of the challenges that clinician face. Favourable endodontic prognosis can be accomplished by complete debridement of bacterial by products and microorganisms from the root canal, thus an in-depth understanding of pulp anatomy is essential.

Usually mandibular molars have two roots, one mesial and one distal. Typically, the mesial root contains two canals- mesiobuccal (MB) and mesiolingual (ML), while distal root presents with a single canal. However, variations from these have been reported in various studies.[1]

Barker et al. and Vertucci and Williams were the primary researchers to demonstrate the presence of an extra and independent canal in the region of the mesial root of mandibular molar known as the "Middle mesial canal".[2]

According to Pomeranz etal., middle mesial canal (MMC) can be classified into three categories: Fin, confluent, or independents Fin is when an instrument can pass freely amid the MB or ML canal and the MMC. Confluent is when the MMC initiates as a distinct orifice but apically joins with the MB or ML canal, and independent is when the MMC initiates as a separate orifice and terminates as a separate foramen.[3] Mandibular molars have high incidences of intercanal and intracanal connections reaching about 83% under CBCT (Cone Beam Computed Tomography) but the accomplishment of accessing and hgnegotiating the middle mesial canal is very low about 1 to 25%.[4]

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Additional canals have been identified in approximately 4% of cases. In mandibular second molars, the mesial root commonly exhibits two canals in approximately 86.1% of cases, while the distal root typically presents with a single canal in about 77.7% of instances. The predominant root morphology involves two roots in 85.3% of cases, whereas the presence of three roots is observed in only 2.6%. In terms of canal configuration, three canals are most frequently seen (87.7%), followed by two canals (12.1%) and four canals (2.6%).

Anatomical variations such as C-shaped canals were identified in 7.5% of these teeth.[5]

The mesial root exhibits significant anatomical complexity, with the incidence of MMC reported up to 53.8% in certain populations. Therefore, knowledge of such variations is critical for successful endodontic therapy.[3]

The presence of an additional canal or root necessitates modifications to the treatment plan and requires increased clinical caution. When an extra canal is identified, the clinician must carefully evaluate its anatomical configuration and prepare it accordingly. Unlike the main (or parent) canals, the accessory canal may exhibit variations in curvature, diameter, and orientation, which demand individualized attention during cleaning, shaping, and obturation.Thorough preclinical evaluation, combined with detailed radiographic assessment, careful inspection of the pulpal floor under magnification are the fundamentals to achieving success in endodontic treatment.

II. CASE REPORT

A 34-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of mild, intermittent pain in the lower left posterior region for 10 days. The patient's medical history was non-contributory.

Clinical examination revealed occlusal caries in tooth #37, which was tender on percussion. The crown exhibited increased buccolingual dimensions, suggesting a possible anatomical variation.A preoperative intraoral periapical radiograph was obtained. Based on clinical and radiographic findings, a diagnosis of **symptomatic irreversible pulpitis with symptomatic apical periodontitis** was established according to the AAE (March 2020) classification. Root canal treatment followed by full coverage restoration was planned, and informed consent was obtained.

Local anesthesia was administered using 1.8 mL of 2% lidocaine with 1:80,000 epinephrine via inferior alveolar nerve block. Under rubber dam isolation, caries excavation was performed and access cavity preparation was carried out using an endo access bur under a dental operating microscope (8×–16× magnification). Refinement of the access cavity was completed using an Endo-Z bur.

Initially, three canals were located—two mesial and one distal. On careful exploration of the pulpal floor using a DG16 explorer, catches were detected between the MB and ML canals. A #10 K-file was introduced into the additional orifice, and radiographs at different angulations confirmed the presence of an additional canal.

Coronal flaring was performed to achieve straight-line access. Canal patency was confirmed using a #10 K-file, and working length was determined with an apex locator. Cleaning and shaping were performed using hand files followed by rotary instrumentation (Endostar Azure) up to size 25/4% in mesial canals and 25/6% in the distal canal.

Irrigation was carried out using 5.25% sodium hypochlorite, 17% EDTA, and saline. The canals were dried using sterile paper points. Calcium hydroxide was placed as an intracanal medicament for 7 days. CBCT imaging was performed to further evaluate canal anatomy.

At the subsequent visit, the medicament was removed, and master cone fit was verified radiographically. Obturation was completed using gutta-percha and resin-based sealer. The tooth was restored with composite resin.

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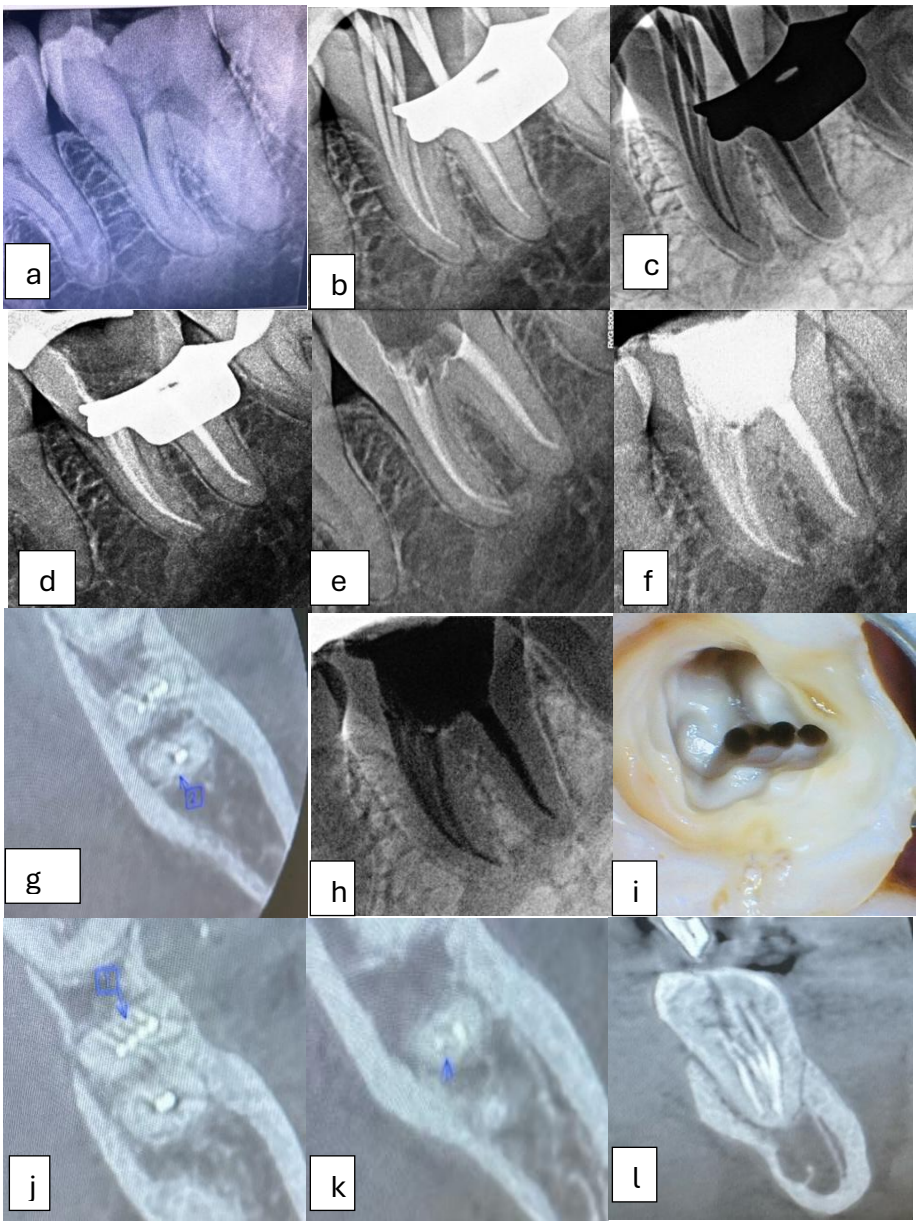

FIGURE 1 a) Pre-operative radiograph; (b) Master cone radiograph; (c) Master cone Inverse;(d) Obturation; (e) Two separate mesial canals apically; (f) Post- obturation radiograph;(g) Post- obturation Inverse; (h) Clinical Picture; (i-k) Location of root canal orifices and CBCT images of axial slices at coronal, middle and apical third respectively; (l) CBCT image of sagittal section

III. DISCUSSION

The root canal anatomy of mandibular molars is highly variable, a careful assessment of the literature shows deviations from the norm in that tooth morphology is not infrequent. and clinicians must be aware of possible deviations from the conventional morphology.[6]

The root canal anatomy of mandibular second molars has been described by a number of investigators (Hess 1925, Pederson 1949, Tratman 1950, Ainamo & Loe 1968, Pineda & Kuttler 1972, Green 1973, Tamse&KafFe 1981, Vertucci 1984, Kotoku 1985, Yingetal. 1988, Walker 1988, Weine et al. 1988).[7]

Understanding these morphological variations is crucial for effective endodontic treatment, as unrecognized extra canals can contribute to treatment failure. In certain circumstances, the root canals can be left untreated during the endodontic therapy, if the clinician is

unable to detect their presence.[8] Anatomy of the mandibular second molar has racial variations. Weine FS et al. showed that mandibular second molar seems to have more anatomical variations than any other molar. Maggiore C et al. said that the second mandibular molar roots could range from one to three. Among these anatomic variances, the presence of MMC in mandibular molars has been reported in the literature with the prevalence ranging from 0.26% to 53.8% in various populations, according to a recent systematic review.

In the present case, the identification of **four mesial canals along with one distal canal** highlights the complexity of the root canal system. However, the presence of **fivecanals in a mandibular molar, particularly fourcanals within the mesial root**, is considered a **rare anatomical finding**making their detection clinically challenging but extremely important.

Instead of the conventional triangular access, a broader, trapezoidal access was taken for better visibility and straight-line entry to the mesial root region.**Magnification using a dental operating microscope** enabled visualization of the developmental groove where the additional canal was located.

During access cavity preparation under magnification, initially three canals were identified—two mesial and one distal. On careful exploration of the developmental groove between the mesiobuccal and mesiolingual canals using a DG16 explorer, additional 2 catches were detected.

Additional anatomic information about the root canals was confirmed by angulated radiography, R.V.G, and CBCT. The evaluation of CBCT images results in better understanding of root canal anatomy, which enables the clinician to examine the root canal system and to clean, shape, and obturate it more competently. CBCT imaging is an excellent tool in identifying complex root canal system configurations.[9]

In consideration of the complex anatomy of the mesial roots in mandibular molars, it is necessary to meticulously instrument and thoroughly irrigate root canals during root canal preparation, to improve the chances of any irrigants going into the isthmi.

Irrigation was carried out using 5.25% sodium hypochlorite, 17% EDTA, and saline.

At the subsequent visit, master cone tugback was checked and confirmed radiographically. Obturation was done with corresponding gutta-percha points using AH Plus sealer.

Nagahara et al. (2020) highlighted that the prevalence of the middle mesial canal in mandibular molars is significantly influenced by the patient's age. Their study emphasized that younger patients exhibit a higher prevalence of the MMC due to reduced pulp calcification. As individual grow older, continuous dentin deposition leads to a progressive reduction in pulp space, making the canals more confluent thin and narrow, leading to difficulty in identification and negotiation.[10]

Cantatore et al., through several epidemiological and retrospective studies, highlighted that failure to identify and treat all the canals significantly increases the rate of apical periodontitis in teeth that have undergone endodontic therapy. Anatomical variations that go unnoticed are a primary factor in root canal treatment failure, as the complexity of the root canal system is closely linked to the occurrence of apical periodontitis.[11]

IV. CONCLUSION:

The presence of five canals in mandibular molar, particularly four canals in the mesial root, represents a rare anatomical variation. It requires meticulous exploration, advanced diagnostic aids, and careful clinical management for successful endodontic outcomes.

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