Endodontic management of mandibular molars with middle mesial canal under magnification: A case series

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Abstract:

It is not uncommon to encounter various deviations from the routine anatomy during endodontic management of various teeth and mandibular molars. This variation presents a range of variations, such as additional canals, roots, challenging curvatures. Three clinical reports of mandibular molars are presented in which three canals in the mesial root were treated endodontically. The third canal in the mandibular molars are often difficult to identify and might serve as a reason for treatment failure.

Keywords: Isthmuses, middle mesial canal, orifice location

I. Introduction

The mandibular first molar is the earliest permanent posterior tooth to erupt. It is the most common source of endodontic treatment. It usually has two roots, but occasionally three, with a supernumerary distolingual root. The probability of a mandibular first molar having a fifth canal is 1-15%. The purpose of this paper is to present clinical reports of three canals in the mesial root of mandibular molars in the Indian population.

It is important to visualize and have knowledge of internal anatomic relationships before undertaking endodontic therapy. The main objective of root canal therapy is thorough shaping and cleaning of all pulp spaces and its complete obturation with an inert filling material. The presence of an untreated canal may be a reason for failure. The root canal system is complex and canals may branch, divide and rejoin. Weine categorized the root canal systems in any root into four basic types. Middle mesial canal in mandibular first molar presents itself as a rare anatomical variant. According to Mortman, the third mesial canal is not an extra canal but rather the sequelae of instrumenting the isthmus between the mesiobuccal and mesiolingual canals.

According to Von Arx, isthmuses in the mesial root of mandibular first molars may be classified into 5 types:

1. Type I is two separate canals with no isthmus.
2. Type II is two separate canals joined by an isthmus.
3. Type III is three canals joined by an isthmus.
4. Type IV is two elongated canals that join in the centre.
5. Type V is a single, very broad and elongated canal.

The mesial root of the mandibular first molar is most frequently of Type IV or V.

II. Case report

Case 1:

A 27-year-old male patient was referred for endodontic treatments of the right first mandibular molar (tooth 46). His medical history was non-contributory. The patient’s chief complaint was severe spontaneous pain located in the periapical area of the first molar as well as aggravation during night. Percussion and palpation of the corresponding mucosal area elicited painful responses, whereas sensitivity tests generated no response from the first molar. The preoperative radiograph revealed a coronal radiolucency involving enamel dentin and pulp. A clinical diagnosis of acute irreversible pulpitis was established for the first molar, and root canal treatment was initiated. After administering local anesthesia, rubber dam isolation, previous restoration, and all carious tissue were removed, and an adequate endodontic access was made. The initial inspection of the pulp chamber floor under 4.5 X magnification of the DOM (Seiler, St. Louis USA) revealed two mesial and one distal canal orifices corresponding to 3 root canals: mesiobuccal, mesiolingual, and distal. Working lengths were estimated by using an electronic apex locator (Apex id – Sybron endo, Kerr corporation - USA) and then confirmed with a radiograph. All canals were cleaned and shaped with Protaper rotary instruments (Dentsply-Maillefer, Ballaigues, Switzerland) under copious irrigation with 5.25% sodium hypochlorite. After preparation,
the root canals were inserted with gutta-percha cones (Diadent, Seoul, Korea) to reconfirm working lengths. Probing of the groove connecting the mesiobuccal and mesiolingual root canals with an endodontic explorer (DG16; Hu-Friedy, Chicago, IL, USA) gave the feeling of a ‘sticky’ point. Under 12X magnification, the depression between the two mesial canals was initially probed with a size 08 K-file (Dentsply Maillefer). By exploring the fissure located on the lingual aspect of the ML canal orifice with a sharp endodontic explorer, a ‘catch’ was encountered. A number 6 k file was used to negotiate the middle mesial canal and the canal was cleaned and shaped in the above-mentioned method and obturated.

Case 2:
A 25-year-old male patient was referred to the dental office for endodontic treatment of the right first mandibular molar (tooth 47). His medical history was found to be non-contributory. The patient reported a slight tenderness infrequently evoked upon chewing, and did not exhibit spontaneous pain or pain during percussion and palpation of the corresponding mucosal area. The preoperative diagnostic radiograph revealed the existence of previous root canal filling materials and a mild periapical radiolucency in the distal root (Fig 2a). A clinical diagnosis of root canal-filled tooth with asymptomatic apical periodontitis was made, and endodontic retreatment was scheduled. After local anaesthesia, rubber dam isolation and disinfection of the field with 2.5% sodium hypochlorite, the restoration was removed and an adequate endodontic access was made. The initial inspection of the pulp chamber floor under 4.5 X magnification of the DOM revealed two mesial and two distal canal orifices covered with filling material. Removal of the root canal filling was performed with the Protaper retreatment files in the coronal and middle third areas of the root canals, and Hedström files were used for the apical portion. Probing of the groove connecting the mesiobuccal and mesiolingual root canals with an endodontic explorer revealed the feeling of a ‘catchy’ point. Under 12X magnification, the depression between the two mesial canals was initially probed with a size 08 K-file. After hand pre-flaring of the cervical and middle thirds of the middle mesial canal, the S1 and SX ProTaper instruments were used for enlargement of the respective canal portions and a middle mesial canal was observed (Fig 2b). The working lengths were established with an electronic apex locator and confirmed with a radiograph (Fig 2c). The chemomechanical debridement was performed with ProTaper rotary NiTi instruments used according to the manufacturers’ instructions under copious irrigation of 2.5% NaOCl. Apical preparation of the two mesial canals ended at 30/0.07; for the distal canal at 50/0.05 (F5ProTaper). Following preparation of the two mesial canals, the confluence of the middle mesial canal with the mesiolingual canal was identified. Smear layer removal with 17% EDTA followed by a flush of 2.5% NaOCl completed the disinfection protocol. The root canals were dried with sterile paper points and dressed with calcium hydroxide paste (RC Cal, Prime Dental Products India). A dry cotton pellet was placed into the pulp chamber and the access cavity was sealed with temporary filling material (Cavit; 3M ESPE, Seefeld, Germany). After 1 week, calcium hydroxide was removed with alternating irrigation of NaOCl and 17% EDTA, which were activated with a size 15 ultrasonic file (Satelec Acteon Group, Merignac Cede, France). A final flush with chlorhexidine (CHX) 2% followed and the root canals were subsequently dried with sterile paper points and master cone x-ray were taken (Fig 2d), then filled with cold lateral compaction. A postoperative radiograph was taken, which revealed confluence of all three mesial canals (Fig 2e).
Case 3:

A 34-year-old male patient was referred for endodontic treatments of the right first mandibular molar (tooth 36). His medical history was non-contributory. The patient’s chief complaints were severe spontaneous pain located in the periapical area of the first molar. Percussion and palpation of the corresponding mucosal area elicited painful responses, whereas sensibility tests generated no response from the first molar. The preoperative radiograph revealed a coronal radiolucency involving enamel dentin and pulp and a mild periapical radiolucency in the mesial root. A clinical diagnosis of symptomatic apical periodontitis was established for the first molar, and root canal treatment was initiated. After administering local anesthesia, rubber dam isolation, previous restoration, and all carious tissue were removed, and an adequate endodontic access was made. The initial inspection of the pulp chamber floor under 4.5 X magnification of the DOM revealed two mesial and one distal canal orifices corresponding to 3 root canals: mesiobuccal, mesiolingual and distal. Working lengths were estimated by using an electronic apex locator and then confirmed with a radiograph. All canals were cleaned and shaped with Protaper rotary instruments under copious irrigation with 5.25% sodium hypochlorite. After preparation, the root canals were inserted with gutta-percha cones to reconfirm working lengths. Probing of the groove connecting the mesiobuccal and mesiolingual root canals with an endodontic explorer gave the feeling of a ‘sticky’ point. Under 12X magnification, the depression between the two mesial canals was initially probed with a size 08 K-file. By exploring the fissure located on the lingual aspect of the ML canal orifice with a sharp endodontic explorer, a ‘stick’ was encountered. A number 6 k file was used to negotiate the middle mesial canal and the canal was cleaned and shaped and a master cone radiograph was taken which showed a confluence of the mesial canals (Fig- 3a). The canals were then obturated using cold lateral compaction (Fig – 3b).

III. Discussion:

It is imperative that the operator has a thorough knowledge of the root canal anatomy before commencing the endodontic procedure to obtain a good chemomechanical debridement and hermetic obturation. It is of paramount importance to be vigilant for any deviation from normal and manage them effectively. Fabra-Campos reported that the incidence of the MM canals is about 2.6% where 1.7% of the third canal joined the MB canal in the apical third, which is the most common; 1.6% converged with the ML canal and 0.13% as an independent canal. The occurrence of three independent canals in the mesial root is rarely encountered and is the most uncommon manifestation.

In this case series no mesial root with three distinct and independent canals was discovered which concurs with other studies. The incidence of the MM canals is more in the younger age patients compared to middle and old aged patients. Patients aged 20 years or younger showed the incidence of 32.1% of negotiable MM canals.

The role of magnification in endodontics is indispensable in both diagnosis and treatment. The clinical detection rate of root canal orifices without any magnification is less compared to microscopes. The use of dental operating microscope or loupes will offer an excellent magnification and illumination of the operating field that substantially improves the visualization of canal orifices. When using adequate illumination and magnification provided by the DOM, two main features are very important for canal location. The first is the presence of a groove in the pulpal floor, serving as a map for canal location. Second, is the colour difference between the dentin of the pulpal floor and that around the canal orifices.

Conventional radiographs although provide a valuable information have inherent disadvantages such as superimposition, distortion, foreshortening, elongation, interpretation variability, and lack of three-dimensional
representation. It may be more advantageous if advanced radiographic techniques such as cone beam computed tomography are utilized for the detection of middle mesial canals which provide more accurate information than the conventional radiographs.\textsuperscript{15,16}

IV. Conclusion

Even though a deviation from the original canal anatomy is not a common finding in routine clinical cases, the clinician should be vigilant enough to encounter any extra canal or root. Magnifying tools such as dental loupes and dental operating microscope are indispensable in an operator’s armamentarium and might serve as a tool to escalate one’s practice.

References


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