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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 anatomyduring endodontic management of various teeth and mandibular molars stands out in this aspect presenting a range of variations such as additional canals, roots and challenging curvatures. Three clinical reports of mandibular molars are presented in which three canals in the mesial rootswere treated endodontically. The third canal in the mandibular molars are often difficult to identify and most of the time left untreated and might serve as a reason for treatment failure.

Keywords: ***Isthmuses, middle mesial canal, orifice location***

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I. Introduction

The mandibular first molar is the earliest permanent posterior tooth to erupt. It is mostfrequently in need of endodontic treatment.It usually has two roots, but occasionally three,usuallywith a supernumerary distolingualroot.The probability of a mandibular first molar having a fifth canal is 1-15%. [2,3,4] 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 to have knowledge of internal anatomic relationships before undertaking endodontic therapy. The main objective of root canal therapy is thoroughshaping 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. Weinecategorized 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,[6]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,[7]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 endodontictreatments of the right first mandibular molar (tooth 46). His medical history was non-contributory.The patient's chief complaints were severe spontaneous pain located in the periapical area of the firstmolar as well as aggravation during night. Percussion and palpation of thecorrespondingmucosal 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. 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' wasencountered.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.

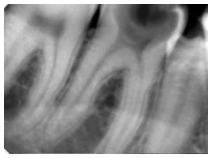

Figure 1a - Pre-operative radiograph

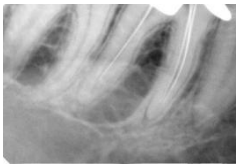

Figure 1b – Working length radiograph

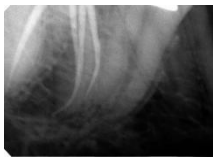

Figure 1c – Mastercone Radiograph

Figure 1d – Post obturation radiograph

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 spontaneouspain or pain during percussion and palpationof the corresponding mucosal area. The preoperativediagnostic radiograph revealed the existence of previousroot canal filling materials and a mild periapical radiolucency in the distal root (Fig 2a). A clinical diagnosis of root canal-filledtooth with asymptomatic apical periodontitis wasmade, and endodontic retreatment was scheduled.After local anaesthesia, rubber dam isolation anddisinfection of the field with 2.5% sodium hypochlorite, the restoration was removed and anadequate endodontic access was made. The initialinspection of the pulp chamber floor under 4.5 X magnification of the DOMrevealed two mesial and two distalcanal orifices covered with filling material. Removal of the root canal fillingwas performed with theProtaper retreatment files in the coronal and middle third areas of the root canals, and Hedströmfiles were used for the apical portion. Probing of the groove connectingthe mesiobuccal and mesiolingual root canals withan endodontic explorergave the feeling of a 'catchy' point. Under12X magnification, the depression between the twomesial canals was initially probed with a size 08 K-file. After hand pre-flaring of the cervicaland middle thirds of the middle mesial canal, theS1 and SX ProTaper instrumentswere used for enlargement of the respective canalportions and a middle mesial canal was observed (Fig 2b). The working lengths were established withan electronic apex locator and confirmed with a radiograph(Fig 2c). The chemomechanicaldebridement was performed with ProTaper rotary NiTiinstruments used according to themanufacturers' instructionsunder copious irrigation of 2.5% NaOCl.Apical preparation of the two mesial canals ended at30/0.07; for the distal canal at 50/0.05 (F5ProTaper). Following preparation of the two mesialcanals, the confluence of the middle mesial canal withthe mesiolingual canal was identified. Smear layer removal with 17% EDTAfollowed by a flush of 2.5% NaOCl completed thedisinfection protocol. The root canals were dried withsterile paper points and dressed with calcium hydroxidepaste (RC Cal,Prime Dental Products India). A dry cotton pellet was placed into thepulp chamber and the access cavity was sealed withtemporary filling material (Cavit; 3M ESPE, Seefeld,Germany). After1week, calcium hydroxide was removedwith alternating irrigation of NaOCl and 17% EDTA, which were activated with a size 15 ultrasonicfile (Satelec Acteon Group, Merignac Cede,France). A final flush with chlorhexidine (CHX) 2%followed and the root canals were subsequentlydried 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).

Fig 2a – Pre-operative radiograph

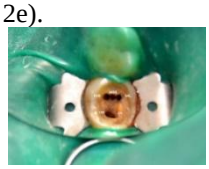

Fig 2b – Orifices of mesial canals

Fig 2c – Working lengthradiograph

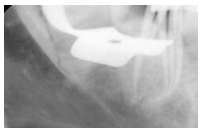

Fig 2d – Master cone radiograph.

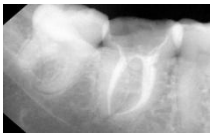

Fig 2e – Post obturation radiograph

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).

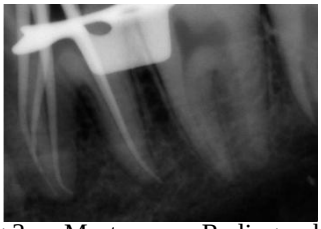

Fig 3a – Master cone Radiograph

Fig 3b – Post obturation radiograph

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.[8] The occurrence of three independent canals in the mesial root is rarely encountered and is the most uncommon manifestation.[9]

In this case series no mesial root with three distinct and independent canals was discovered which concurrs with other studies[10,11]. 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[9,12]

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.[13] 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.[14]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.[14]

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.[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.

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