CASE REPORT

Endodontic retreatment of a mandibular first molar with five root canal systems: an important clinical lesson

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SUMMARY

The objective of root canal treatment is to perform complete debridement of the root canals and subsequent obturation to facilitate healing of periapical pathosis. However, this process becomes complicated with the presence of additional root canal systems. The purpose of the present article is to report successful non-surgical retreatment of a mandibular first molar with five canals. This case report discusses the clinical management of a previously root filled mandibular first molar with two missed canal systems; distolingual and an additional mesial canal known as the middle mesial canal. The post-treatment radiographs show successful obturation to length in all canals. The middle mesial canal was found to be associated with mesiolingual canal and categorised as confluent. The configuration of canals in the mesial root was type XV, based on the classification given by Sert and Bayirli. This case report highlights the importance of knowledge and its application in the management of abnormal anatomic variants which play a crucial role in the success of endodontic retreatment.

BACKGROUND

The aim of root canal treatment is thorough chemo-mechanical preparation of the entire pulpal space and its obturation with an inert filling material.¹ Likewise, inadequate shaping and cleaning of root canal space leads to post-treatment disease.^{2,3} This can happen especially in cases where teeth have morphological deviations from their normal anatomy.

One such example is the mesial root of the permanent mandibular first molar which occasionally harbours an additional root canal system known as accessory mesial canal. This canal is located in the developmental groove present between the mesiobuccal and mesiolingual root canal systems.⁴ Studies have reported the range of occurrence of this canal from 1% to 15%.⁴⁻⁶ Vertucci and William⁷ were the first researchers to describe the presence of these canals; since then, there are many case reports in the literature that discuss the presence of these accessory canals.⁸⁻¹⁵

A classification of this accessory mesial canal (also known as middle mesial canal; MM) was developed by Pomeranz *et al.*¹⁶ Pomeranz *et al* evaluated 100 mandibular molars clinically and found 12 molars consisting of middle mesial canals. Based on the anatomical variations that he observed, he classified them into three types: (1)

Fin—when there was a communication between middle mesial canal with either mesiobuccal or mesiolingual canal and an instrument could pass freely between them. (2) Confluent—when the middle mesial canal originated as a separate orifice and later on its course joined the mesiobuccal or mesiolingual canal. (3) Independent—if the canal remained completely separate from mesiolingual and mesiobuccal canals throughout its course. It is noteworthy that in their study, only two canals could be classified as independent.¹⁶

There is a general consensus on the presence of multiple foramina in the mesial root of the mandibular first molars, however, the presence of three separate canals is still considered a very rare finding.¹⁷ With regard to the root canals, teeth demonstrate several anatomical variations and aberrations which pose a significant challenge to the clinician.¹⁸ In recent times, particularly with the advent of magnification, the numbers of reported cases of aberrant root canal morphologies have been increasing. Similarly, it is important to keep the researchers and clinicians up to date with the help of case reports regarding such variations in anatomy of teeth.

There are a number of tools and techniques available to detect accessory root canals, such as well angulated radiographs, magnification aids, modified access preparations, pulpal floor examination with explorer, dies, ultrasonics and use of bur—all essential aids for detection of accessory root canals.^{19,20} The purpose of the present article is to report successful non-surgical retreatment of a mandibular first molar with five root canals.

CASE PRESENTATION

A 53-year-old man from Balochistan presented to the dental clinic with a history of throbbing pain for past 3 days. The pain kept him awake at night and was arising from the lower right side of his face radiating to the right ear. Clinical evaluation revealed that the patient had fixed fused prosthesis extending from right mandibular second premolar to right mandibular first molar. On radiographic examination, a frank pathology was evident that was present apical to the roots of the right mandibular first molar. This tooth had been previously endodontically treated and the substandard obturation was considered as the reason for failure (figure 1). Therefore, a diagnosis of post-treatment disease secondary to bacterial leakage was made. The patient had also received extensive prosthetic work from his

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Figure 1 Panoramic view showing splinted fixed prosthesis on the right mandibular first molar and second premolar. Apical pathosis in the form of large radiolucency can be seen periapically to the roots of mandibular molar (white arrow).

city and most of the prosthesis were splinted with each other with poor marginal adaptation.

Medical, social and familial histories were unremarkable.

INVESTIGATIONS

Dental panoramic radiograph.

DIFFERENTIAL DIAGNOSIS

Vertical root fracture, missed canal, accessory canals.

TREATMENT

The emergency treatment began with administration of local anaesthesia and separating the fused prosthesis of right mandibular first molar from second premolar with high-speed hand-piece. Once the prosthesis on first molar was separated and sectioned, an access cavity was made without application of rubber dam in order to maintain access orientation. On access, three obturated canals were identified (mesiolingual, mesiobuccal and distolingual) along with an unprepared distobuccal canal (figure 2). After removing gutta percha, a combination of electronic apex locator (Root ZX, J. Morita Corp, Tustin, California, USA) and periapical radiographs were used to

Figure 2 On initial access, a missed distolingual canal can be readily seen (black arrow). Notice the off-axis position of mesiobuccal canal showing buccolingual width of mesial root.

Figure 3 Working length radiograph taken at the initial visit. Radiograph was taken with mesial angulation.

estimate working lengths (figure 3). The mesial canals were 22 mm in length, whereas the distal canals had a working length of 21.5 mm. The canals were then filled with non-setting CaOH (Calcipulp, Specialites Septodont, Saint-Maur, France) with the help of small hand files and the tooth was restored with a temporary filling material (Cavit, ESPE, Seefeld, Germany).

After a week, the patient returned to dental clinic for his endodontic visit without any discomfort. The temporary restoration was removed and the axial walls of the chamber were finished using high-speed diamond fissure bur. At $\times 4$ magnification (EyeMag Pro F, Carl Zeiss Meditec Ag, Germany), the area between the mesiolingual canal and the mesiobuccal canal was cautiously troughed with a fissure bur. Next, on careful inspection with a sharp explorer, a sticky point was found in proximity to the mesiolingual canal between the developmental line that connects mesiolingual and mesiobuccal canal orifices. A small hand file was initially placed and a periapical radiograph was

Figure 4 The prepared canals under field isolation showing mesial root canal systems. Image taken prior to obturation.

Figure 5 One month follow-up radiograph showing all five obturated canals and permanent restoration with a significant reduction in periapical pathosis.

obtained from a mesial angulation. It was determined that there is an accessory mesial canal merging with mesiolingual canal at its apical third (figure 4). The middle mesial canal was categorised as confluent.

All canals were then prepared with the Protaper nickel-titanium rotary instruments (Dentsply-Maillefer, Ballaigues, Switzerland) and RC-Prep (Hawe Neos Dental, Bioggio, Switzerland). Copious irrigation with 5% sodium hypochlorite was performed during shaping and cleaning procedure. The canals were dried with paper points, coated with Sealapex (Kerr Manufacturing Co.) and obturated using Obtura II system (Obtura Spartan, USA). Subsequently, the access cavity was filled with silver amalgam (Dental BMS Amalgam, Italy). A 1-month follow-up shows a significant reduction in the periapical pathosis of the retreated tooth (figure 5).

OUTCOME AND FOLLOW-UP

Outcome was successful non-surgical endodontic retreatment and resolution of patient's severe discomfort. The patient was advised to receive a full coverage restoration when he returned for his 1-month follow-up visit. As the patient is a resident of Balochistan, we do not know when he would be able to return for further visits to receive a definitive restoration, that is, porcelain fused to metal prosthesis.

DISCUSSION

Clinicians normally begin root canal procedures based on observation of external root canal anatomy as guided by radiographs. However, the presence of internal anatomic variances and anomalies is not uncommon. Among these internal deviations, the incidence of middle mesial canals ranges from 0.5% to 15% based on several case reports which make them difficult to locate.⁶⁻⁸⁻¹⁵⁻¹⁷ Moreover, these canals are known to have a high frequency of intercanal isthmuses which pose an additional barrier to shaping and cleaning procedures.²¹

In a study conducted by Fabra-Campos, a total of 760 mandibular molars were evaluated and it was found that 20 (2.6%) had three root canals within mesial root and 13 (65%) of the middle mesial canal joined the mesiobuccal canal in its apical third whereas, 6 (30%) of these middle mesial canals joined the mesiolingual canals in their apical thirds and had mutual exits. It was noted that only one canal out of these 20 molars was categorised as independent which had a separate orifice and a separate portal of exit.²² Goel *et al* in his study found that the mesial roots of the first mandibular

molars comprised of two foramina in 60% of evaluated cases and one foramen in 30% of cases. In addition to these findings, the presence of three foramina was found to be 6.7% and four foramina were located in only 3.3% of the cases. The middle mesial canal could be located 13.3% of the time in their study.⁴ In our study, the middle mesial canal was found to be associated with the mesiolingual canal in its apical third and had a common exit which is a rarer finding in middle mesial canal configurations.²² The mesiobuccal canal was independent and was located off-axis, positioned more towards the buccal aspect suggesting a wider than usual mesial root. Based on the configurations studied by Sert and Bayirli in 2004; the classification of mesial canals reported in this study is type XV that is, three canal orifices with two exits in the mesial root.²³

The author suggests finishing the axial walls of the access cavity with a surgical length diamond bur in high-speed handpiece. Once the access cavity is adequately flared and finished, it provides improved visualisation of the pulp cavity floor. It has been recommended to sequentially flush the pulp chamber floor with 17% aqueous solution of ethylene diamine tetra acetic acid (EDTA) and 95% ethanol to achieve adequate cleaning and drying before visual examination of the orifice/canal system.²⁴ The groove between the mesiolingual and mesiobuccal orifices should then be carefully inspected with a sharp explorer for potential sticky point that is suggestive of an additional canal. Once the middle mesial canal orifice is located, small hand files should be used to negotiate it up to its middle third. Intracanal lubricants such as EDTA may prove to be beneficial at this stage. Sequential flushing with sodium hypochlorite should be carried out to remove debris and used up chelator. Gates Glidden drills should be avoided as they may pack debris into the canal and block it. At initial stage, the working length of the mesiolingual or mesiobuccal canal can be taken as an estimate for the length of middle mesial canal. Once a glide path is obtained with hand file #15, regular sequence with rotary instruments can be followed.

Identifying this rare canal can be challenging and depends on many factors. In order to be successful in managing such atypical cases, clinicians should hold a philosophical belief and a strong familiarity with endodontic anatomy and its associated variances. Likewise, techniques/concepts such as multiple angulated radiographs, magnification, appropriately flared access cavity, careful examination of pulpal floor, use of ultrasonics, pursuing bleeding points and cone beam CT (CBCT) imaging can maximise the outcome for additional canal exploration.²⁵ Ideally, CBCT imaging should have been performed for this case. However, it is presently unavailable at our centre.

This article reports the successful management of a mandibular first molar with five root canals, three in mesial root and two in distal root. Furthermore, it also informs clinicians of the aberrant root canal anatomy which can occur with any case that may appear otherwise normal.

Learning points

- ▶ This case report informs clinicians of aberrant root canal anatomy which can occur with any tooth that may appear otherwise normal.
- ▶ Holding a philosophical belief for the presence of additional root canals is crucial for their recognition.
- ▶ It also informs clinicians about the high probability of root canal failure if such anatomic variants are not properly dealt with.

Competing interests None.

Patient consent Obtained.

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