A rare case of three mesial and two distal independent canals in mandibular first molar

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Abstract

The primary objective of endodontic therapy is to achieve a three dimensional obturation of root canal space after removing the tissue debris, microorganism and their byproducts. Anatomical variations have been encountered in endodontic practice and have to be adequately managed by the dentist. The knowledge of variations in root canal morphology is critical for a successful endodontic treatment outcome.

Mandibular molars demonstrate considerable variations with respect to number of roots as well as root canals. The possibility of additional root canals should always be considered even in teeth with a low frequency of abnormal root canal anatomy. This interesting and rare case report discusses the endodontic management of the rare anatomical complexity middle mesial canals in mandibular first molar which is quite uncommon.

Key Words: Elusive canal, Mandibular first molar, Middle mesial canal, Root canal anatomy

Introduction

The primary objective of root canal therapy is to obtain hermetic seal of the root canal space. Therefore the sum of successful endodontic therapy is to thoroughly debride the canal of organic substrate, infected pulp tissue, microorganisms and then seal the canal.

Knowledge of both normal and abnormal anatomy of the root canal system dictates the parameters for execution of root canal therapy and can directly affect the outcome of the endodontic therapy. Missed extra roots and root canals during diagnosis and procedure are one of the major reasons for the failure of root canal treatment[1]. All categories of teeth may have additional roots and/or canals, with an increased likelihood of finding aberrant canal configuration in premolars and molars. The lower first mandibular molars are the first permanent teeth to erupt and most often require endodontic treatment[3]. The mandibular first molar normally has two roots, one mesial and one distal with two canals in the mesial and one or two in distal. The anatomical variation of lower first molars include C shaped canals, five canals, six canals and seven canals. Variation in roots include three rooted mandibular molar.[2,4–9].

Till date very few clinical reports have described more than two canals in the mesial root of mandibular molars. Among these, the occurrence of middle mesial canal in the lower mandibular molar is (1–15%); this canal is also called "intermediary mesial canal" or "medial mesial canal" since it is situated centrally between the main buccal and lingual root canals[10–17]. The diameter of these middle mesial canals is smaller than other two[10].

It is of prime importance for the dentist to identify the entire topographic location of any additional canal orifices and also extremely important that dentist use all the armamentaria at their disposal to locate and treat the entire root canal system[18]. Well-angulated periapical films should be taken with cone-directed straight-on, mesio-oblique, and disto-oblique; this technique often reveals and clarifies the three dimensional morphology of the tooth. The use of the magnifying loupes, dental operating microscope, and adjunctive diagnostic aids like cone beam CT and so forth can also be used[19,20].

This paper reviews the endodontic management of a mandibular first molar containing three independent canals in its mesial roots.

Case Report

A 22-year-old Male patient reported to dental wing of Mittal Nursing Home Sonipat with the chief complaint of intermittent pain in the lower right posterior teeth for the past three months, which used to be aggravated on lying down and was associated with decayed tooth. The tooth exhibited no mobility, was mildly tender to percussion. On examination tooth produced a negative response to heat test and mild reaction to electric pulp tester. His past medical history was taken and patient was found free from systemic diseases. The clinical and radiographic findings led to a diagnosis of chronic irreversible pulpitis of the right mandibular first molar no. 46, necessitating endodontic therapy. Radiographic evaluation of the involved tooth indicated a deep, carious lesion approximating the pulp

and a normal canal configuration of two canals in the mesial root and one canal in the distal root shown in figure.

The right inferior alveolar nerve was used for local anesthesia by using 2% Lignocaine with 1: 80,000 adrenaline after checking for sensitivity. The tooth was isolated by application of rubber dam, and then endodontic access cavity was gradually and gently established. Investigation of the root canal system was initially performed with the help of an endodontic explorer, and the canals were explored with a no. 10 K-file of 21mm of length. Two mesial canals and a single distal canal were located initially. On examining the fissure connecting the two mesial canals revealed an additional orifice in between the two mesial canals (mesio buccal, middle mesial, and mesiolingual). The additional canal was explored with a no. 10 K-file of 21 mm of length.

Fig. 1: Preoperative radiograph

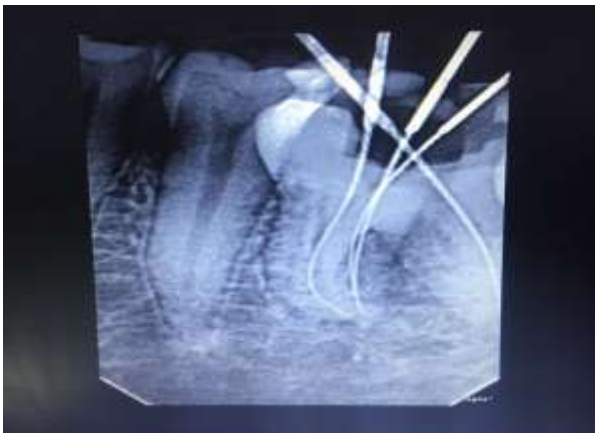

Fig. 2: Working length of mesial three canals

Fig. 3: Working length of two distal canal

Fig. 4: Obturation

Multiple working length radiographs were taken at different angulations with file placed in each of the three mesial and two distal orifices to confirm the independent presence of five distinct canals (Fig. 2 and 3) Individual canal instrumentation was performed using a crown down preparation with Protaper nickel-titanium rotary instruments. Copious chemical irrigation was performed with 5.25% sodium hypochlorite solution and 17% EDTA. The root canals were dried with paper points. Obturation was performed after two weeks with resin sealer and cold laterally condensed with gutta-percha and sealed with IRM cement. Post obturation radiograph was taken to confirm the completeness and the extension of the root filling, which revealed three distinct orifices with three separate apical terminations of mesial canals with thin dentinal separation between three canals till apical third and two distal canals. Then appropriate post endodontic restoration was performed in a subsequent appointments to ensure adequate coronal seal.

Discussion

The present paper reports the endodontic management of independent and confluent middle mesial canals in the mandibular first molar. Unusual canal anatomy associated with the mandibular first molar has been reported in several studies, Fabra et al.[5]

reported that 2.6% of molars had three canals in the mesial root, 1.7% of third canal joined the mesiobuccal canal in the apical third, and 1.6% converged with the mesiolingual canal and as an independent canal (0.13%). Goel et al.[9] reported that mandibular first molars had 13.3% three mesial canals, 3.3% four mesial canals, and 1.7% three distal canals. They also reported that one apical foramen was present in 30%, two in 60%, three in 6.7%, and four in 3.3% of the cases. The occurrence of three independent canals in the mesial root similar to first case in this paper is most uncommon manifestation and rarely encountered[2,5,13,14].

The mesial roots of mandibular first and second molars had mostly one large canal until 11 and 15 years of age; due to secondary dentine depositions at 30–40 years of age, the canal system in the apical and middle third of the root was completely established. There are also chances of extensive differentiation resulting in reticular form. The prevalence of inter canal communications were low at young and old ages, but high at intermediate ages. It is important to be familiar with these age-related variations in the root canal system to aid in the location and negotiation of canals as well as their subsequent management[17,21].

Prevention of missed canal anatomy starts with good preoperative radiographs, even though radiographs have limitations in assessing the number of canals radiographs taken from at least two different horizontal angles along with careful interpretation, which will aid in the detection of extra canals[22]. Without doubt, a proper access cavity preparation is of central importance in localizing the orifices of the root canals, examination of the pulp chamber floor with a sharp explorer, troughing of grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, and performing the sodium hypochlorite "champagne bubble" test, fibro optic transillumination, and visualizing canal bleeding points are important aids in locating root canal orifices. Clinically, the presence of additional canal indicates continuous bleeding in teeth with pulpitis or normal pulps despite complete instrumentation. Following are the important aids in locating the additional canal such as: the presence of apical rarefaction on the lateral side of the root with necrotic pulps, fast break guideline, eccentric location of an endodontic file during working length determination, inconsistent apex locator readings, a sinus tract that traces laterally away from the main canal, or the feeling of a "catch" on the canal wall during instrumentation[23].

In most of the cases, middle mesial canal is hidden by a dentinal projection in the mesial aspect of pulp chamber walls, and this dentinal growth is usually located between the two main canals (mesiobuccal-mesio-lingual). Ultrasonic systems provide a breakthrough for exploring and identifying the extra canals and also eliminate the bulky head of the conventional hand piece that frequently obstructs the vision. The working tips of the specific ultrasonic instruments are ten times smaller than the smallest round bur, and their abrasive coating aids in a controlled and delicate removal of calcifications and other interferences of the canal orifices[18].

The use of dental operating microscope provides enhanced lighting and visibility and identifies subtle color changes, better understanding of floor map, fine instrumentation, coaxial illumination, and magnification. In the present paper, the middle mesial canal was present at an equidistance between the two mesial canals (mesiobuccal and mesio-lingual).

Failure to recognise the anatomy of a root canal system and developmental anomalies can lead to inadequate debridement of the root canal system and thus contribute to unfavorable endodontic treatment outcome and the subsequent need for retreatment or surgical intervention[18]. The present paper necessitates for thorough investigation of root canal anatomy during treatment to clean and shape it more efficiently.

Conclusion

To summarize, treating additional canals may be challenging, but the inability to find and properly treat the root canals may cause failures. Identification of these extra canals and their instrumentation is one of the key factor in the prevention of unsuccessful outcomes. In addition to various diagnostic aids, operating experience has also been identified as a key factor in locating aberrant canals. All dentist should be aware about the knowledge and occurrences of such variations in the mandibular first molar and perform a preoperative radiograph assessment from different angles, proper access preparation and through examination of pulp chamber to locate and debride all the canals. An accurate clinical evaluation of root canal number and morphology of the teeth should be done using various diagnostic methodologies with magnification and illumination which would pave the way for long term success of endodontic therapy.

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