Spiral Computed Tomographic Evaluation and Endodontic Management of Middle Mesial Canal in Mandibular First Molar- A Case Report

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Citation

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Abstract

The treatment of the entire root canal system is essential to maximize the possibility of obtaining success in endodontic therapy. Therefore, it is imperative that aberrant anatomy is identified prior to and during root canal treatment of such teeth. The presence of a third canal in the mesial root of the mandibular first molar has been reported to have an incidence rate of 1 to15%. The use of Spiral Computed Tomography in this case greatly contributed towards making a confirmatory diagnosis and successful nonsurgical endodontic treatment thereafter.The present report describes endodontic treatment in a mandibular first molar containing a middle mesial canal and the use of spiral computed tomography as a diagnostic method.

INTRODUCTION

From early work by Hess and Zurcher in 1925 to the more recent studies demonstrating the complex morphological variations of the root canal system, researchers have shown multiple orifices, fins, deltas, loops, accessory canals and other variations in most teeth [12]. Although all teeth are anatomically complex, first lower molars are the first permanent posterior teeth to erupt and are those that most often suffer from caries, so they are highly likely to require endodontic treatment [34]. These molars normally have two roots, one mesial and one distal, and their usual canal distribution is two in the mesial root and one or two in the distal root.

Unusual canal anatomy associated with the mandibular first molar has been reported in several studies. In a radiographic study of extracted teeth Goel et al. [5] reported that mandibular first molars had three mesial canals in 13.3% of specimens, four mesial canals in 3.3% of specimens, and three distal canals in 1.7% of specimens. The occurrence of three independent canals in the mesial root was reported by Pomeranz et al [6]. Beatty and Krell [7] described a mandibular first and second molar with three independent canals in the mesial root.

The present report describes endodontic treatment in a mandibular first molar containing a middle mesial canal and the use of spiral computed tomography which greatly contributed towards making a confirmatory diagnosis and successful nonsurgical endodontic management thereafter.

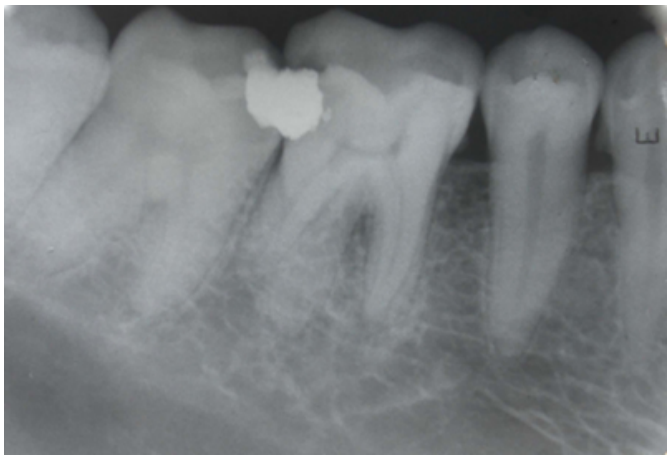
CASE DESCRIPTION

A 35-year old male patient reported to the Department of Conservative Dentistry and Endodontics with complaint of pain on the lower left posterior teeth region for three days prior to his appointment. The patient's medical history was non-contributory. Dental history revealed that he had undergone a temporary filling in the same tooth one month earlier by a general dentist, but the pain still persisted and had increased in intensity since the past three days. There was spontaneous pain on exposure to cold drinks. On clinical examination, a fractured temporary restoration with secondary caries on the left mandibular first molar was found. There was no evidence of swelling or sinus tract in relation to it. The involved tooth was tender on percussion and no periodontal pockets were present.

Radiographic evaluation of the involved tooth (Fig.1) revealed the vague outlines of three roots (one mesial and two distal) with a radiopaque coronal restoration with radiolucent margins suggestive of secondary caries around the restoration.

Figure 1

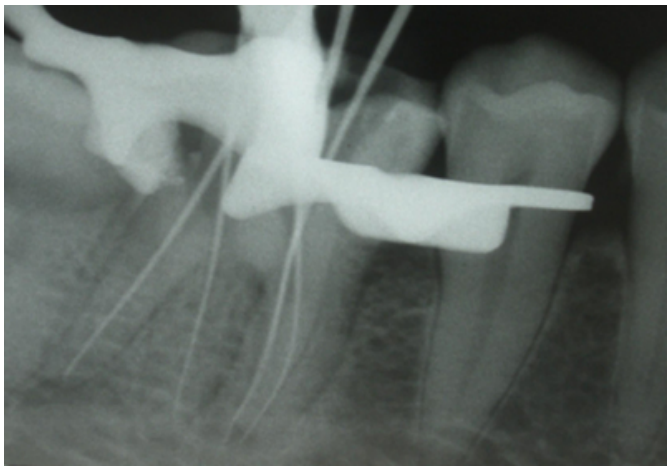
Fig.1 Preoperative radiograph



Based on clinical and radiographic findings, a diagnosis of chronic irreversible pulpitis of the left mandibular first molar was made. Endodontic treatment was planned for the tooth. Under rubber dam isolation, the access cavity was prepared and canals were located. Four canals (two mesial and two distal) were located in the first appointment. Working length was determined (Ingles method) and the canals were instrumented (Fig.2). The access cavity was sealed with a cotton pellet and temporary restoration placed (Coltosol F-Coltene Whaledent, Switzerland).

Figure 2

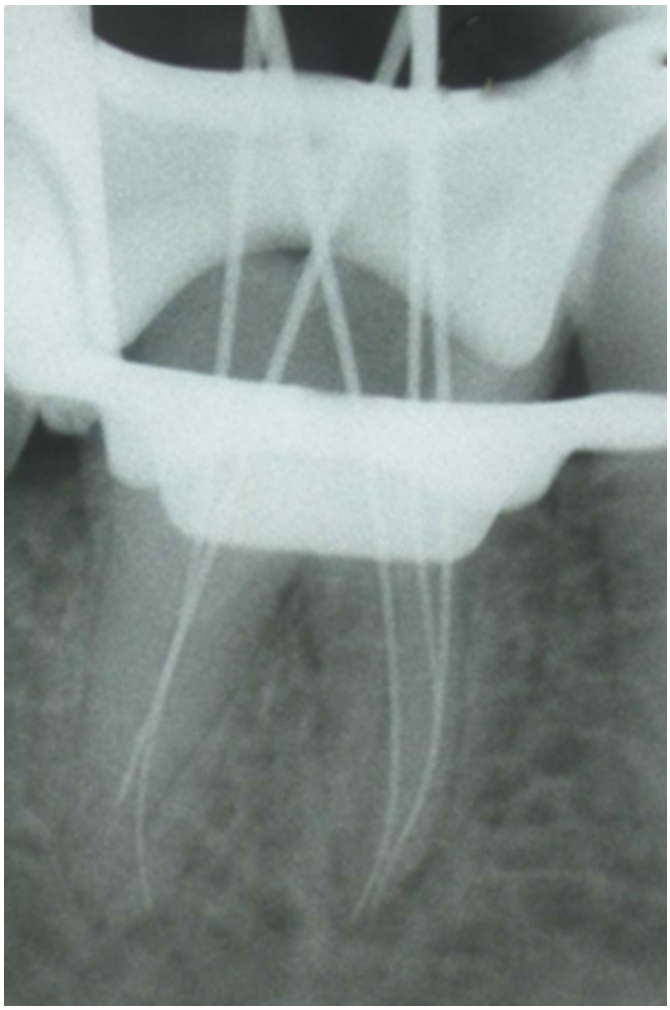
Fig.2 Working length determination



In the second appointment, a small orifice was noticed between the two mesial canals. In order to confirm that the orifice was an additional canal, a radiograph was exposed with endodontic files in all five canals (Fig 3).

Figure 3

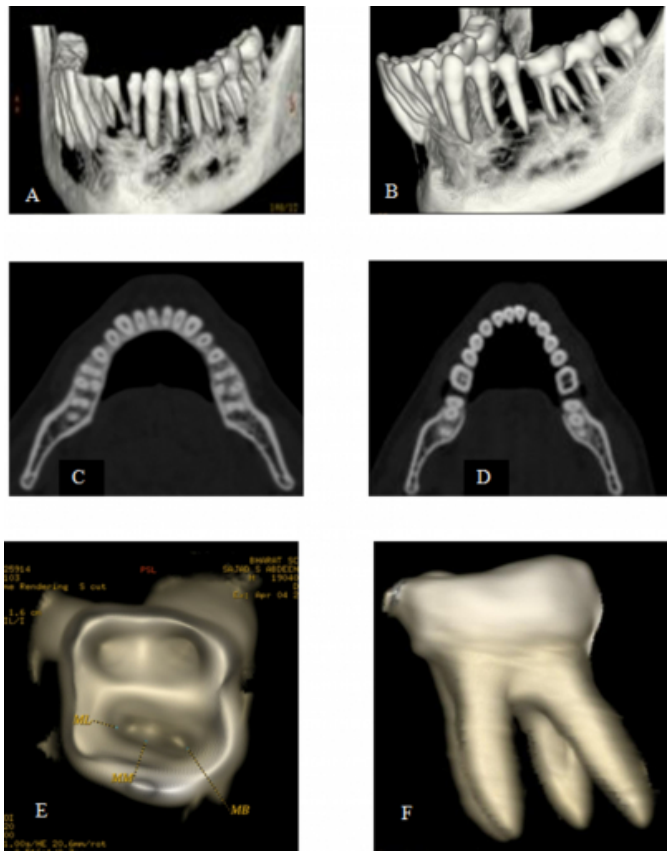
Fig.3 Radiograph with five files in position.



To ascertain this complex root canal anatomy of the tooth in a three-dimensional manner, dental imaging with the help of SCT was planned. Informed consent was obtained from the patient and a multisclice helical or SCT imaging of the mandible was performed by using the dental software Dentascan (GE Healthcare, Milwaukee, USA). The involved tooth was focused, and the morphology was obtained in transverse, axial and sagittal sections of 0.5 mm thickness, along with three-dimensional reconstructed images. The SCT images revealed that the lower mandibular first molar had three separated roots and five distinct root canals-distolingual, mesiolingual, mesiobuccal, distobuccal and a middle mesial canal (Fig 4).

Figure 4

Fig.4 (A-F) CT scans and 3-dimensional reconstruction of left mandibular first molar.



Once the confirmatory diagnosis was made, instrumentation of the involved tooth was planned. During instrumentation, all the three mesial canals presented separately (Fig 5).

Figure 5

Fig.5 Three mesial canals

All the canals were prepared manually up to a no. 25 file using crown down technique and then instrumented with the ProTaper rotary system (Dentsply -Maillefer, Switzerland). A gutta-percha cone fit radiograph was made (Fig.6) and the canals were obturated (Fig.7) using cold lateral compaction of gutta- percha (Dentsply-Maillefer, Switzerland) and a resin sealer (AH Plus, Dentsply, Germany).

Figure 6

Fig.6 Mastercone radiograph

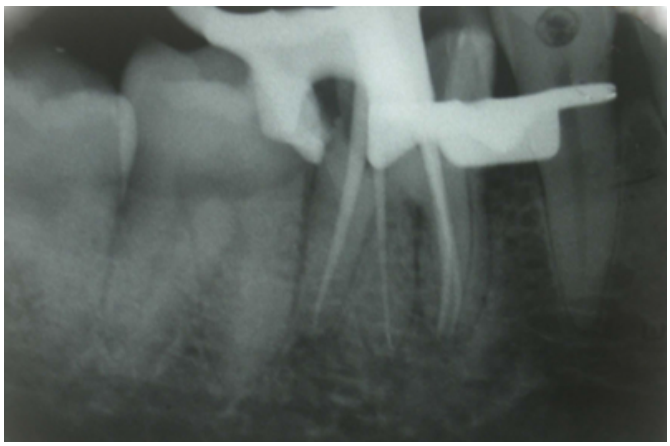
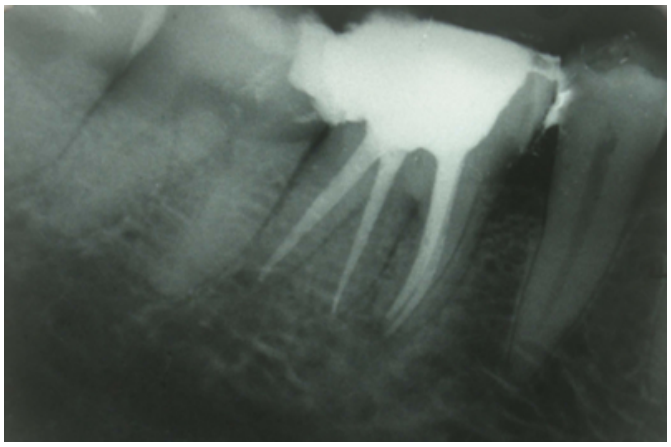


Figure 7

Fig.7 Post-treatment radiograph



The patient experienced no post-treatment consequences and the tooth would require a full coverage restoration.

DISCUSSION

Based on the literature and this clinical case, it is evident that the knowledge of the anatomical variations of mandibular molars is extremely important for the success of endodontic treatment. According to Cohen and Burns [8] , canals are often not treated because they are not located. Once endodontic treatment has been initiated, proper access cavity preparation is a basic prerequisite for the investigation and successful detection of all root canal orifices.

The root canal anatomy of the mandibular first molar can be aberrant. Clinicians must be aware of the finding that the presence of a third canal in the mesial root of the mandibular first molars has been reported to have an incidence rate of 1% to 15% [9] . In order to treat a mandibular first molar with five canals, it is necessary to check their clinical and radiographic anatomy.

Conventional dental radiography produces images in only two dimensions, usually in the mesiodistal direction . Hence, they are of rather limited value in cases with complex root anatomy. Interpretation and appraisal based on a two-dimensional radiograph may alert the clinician to the presence of aberrant anatomy but would not be able to present the variable morphological structure of root canals and their interrelations [10] . Based on previous studies by Reddy et al [11] , Ballal et al [12] and Gopikrishna et al [13] , where spiral CT was used for the confirmatory diagnosis of morphological aberrations in the root canal anatomy, SCT of the involved tooth was planned.

The SCT images revealed that the tooth had three roots with five canals. The confirmatory diagnosis of the middle mesial canal could only be made with the help of SCT. In this case, we found the middle mesial canal originated as a separate orifice but joined the mesiolingual root canal at the middle third. According to the classification of middle mesial canal by Pomeranz et al, this canal type can be classified as confluent.

CONCLUSION

Instrumentation is one of the key factors in determining the success of endodontic therapy; therefore, the clinician should be aware of the incidence of extra canals in the mandibular first molar. The clinician can then perform a thorough examination of the pulp chamber to ensure complete debridement of all canals. This case report highlights the role of SCT as an important diagnostic tool in endodontics, thereby enhancing overall success of endodontic therapy.

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