Endodontic management of mandibular first molar with seven root canals using dental CT scan as a diagnostic aid: a rare case report

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Abstract:
The accomplishment of a successful treatment outcome following endodontic therapy depends on a thorough chemo-mechanical preparation of the root canals followed by 3-dimensional obturation with a dense root canal inert filling material. An understanding of the presence of complex and unpredictable root canal morphology can positively affect the outcome of the therapy. Thus it is imperative that any aberrant root-canal configuration to be identified and treated accordingly. Therefore mandibular first molar with an intricate root canal anatomy can be clinically very challenging. This case report discusses endodontic treatment of mandibular first molar with seven root canals. This finding was confirmed using radiographs at different angulations and Dental CT scan during and after completion of the treatment.

Keywords: Mandibular first molar, Seven canals, Four distal canals, Dental CT scan, Extra canals.

Introduction
The main goal of endodontic treatment is to retain a pulpally involved tooth and in turn restore it to its physiologic form, function and esthetics. Root canal system is a highly complex system consisting of fine tributaries running along the entire length of the canal. To achieve predictable outcome of endodontic therapy, proper visualization and understanding of internal complex anatomy with its numerous variations and careful interpretation of clinical and radiographic findings are essential prerequisites. It is important to be familiar with the root canal morphology along with its variations for thorough negotiation and proper management.

Mandibular first molar typically presents with two well defined roots but occasionally it has three roots, with two or three canals in the mesial root and one, two or three canals in the distal root.¹² Investigators have commonly encountered bifurcated canals, fins, multiple foramina, apical deltas, cul-de-sacs, inter-canal links, C-shaped canals and accessory canals in these teeth.³⁶ A standardized method for categorizing known root canal anatomic variations has been proposed by “Vertucci”. It is well known that failure to negotiate all the canals may contribute to an unsuccessful endodontic treatment. In a recent study, 86% of missed canals were identified in the distal and 14% were identified in the mesial root.³ Hence these untreated extra canals form a basis for treatment failure. Various case reports have been published with findings of middle mesial and middle distal canals,⁴⁶ but finding of four distal canals, all ending in distinct apical foramina is rare.³ It has been documented in previous studies that if all the orifices are separate and the canals could be instrumented to a definite length it is legitimate to count all of them as separate canals.³ This case report presents endodontic management of mandibular first molar with seven root canals out of which three were mesial and four were distal. This finding was confirmed by a Dental CT scan taken during and after the completion of the treatment.

Case report
A 35 year old male patient reported with chief complaint of severe pain in right lower back jaw region since 1 week. Clinical examination revealed carious right mandibular first molar with tenderness on percussion. His medical history was noncontributory. Thorough clinical and radiographic evaluation led to the diagnosis of symptomatic irreversible pulpitis with apical periodontitis necessitating endodontic intervention.

Presence of more than one canal in both mesial and distal roots was clearly evident on the pre-operative radiograph (Fig.1). To commence with the treatment, profound anesthesia was achieved with inferior alveolar nerve block using 2% lignocaine. Following this the tooth was isolated under rubber dam and endodontic access cavity was prepared. On
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exploration, two mesial and two distal canals were clearly located. However, continued bleeding from the canal orifice and positive champagne test led to the suspicion of extra canals. On careful examination with an endodontic explorer (Hu-Friedy, USA) and with increased magnification under surgical operating microscope (OPMI Pico Dental Microscope, Zeiss, Oberkochen, Germany), a third mesial canal (middle mesial) and a third distal canal (middle distal) were located midway between the two orifices of the main mesial and distal canals respectively. On further exploration fourth canal orifice was located in the distal root between the middle distal and the distobuccal canal (Fig 2).

Accurate assessment of extra canals in routine radiographs became difficult due to superimposition of roots and anatomic noise, even at different angulations. To ascertain this rare and complex canal anatomy 3-dimensionally, dental imaging with the help of computed tomogram using the dental software Dentascan (GE HealthCare, Milwaukee, WI) was planned and informed consent was obtained from the patient for the same. The findings were confirmed by the Dental CT Scan in which seven orifices were clearly evident (Fig 3). Glide path was established using 10K-files (Dentsply Maillefer, Switzerland). Working length was determined with radiographs at different angulations and verified using apex locator (Root ZX; Morita, Tokyo, Japan). Cleaning and shaping of the canals was done using Hero 642 Ni-Ti rotary files (Micro mega, Besancon, France). Canals were prepared till 25.06T in mesial canals and 25.04T in distal canals along with copious irrigation using 2.5% sodium hypochlorite solution and 17% EDTA (ethylene diamine - tetraacetic acid) alternatively. An interappointment calcium hydroxide dressing was given and patient was recalled after 1 week. After 1 week, the dressing was removed from the canals using 10% citric acid and a master cone radiograph was taken (Fig 4). Then the canals were dried with paper points and obturated with HERO cones (Micro mega, Besancon, France) using AH Plus sealer (Dentsply, Maillefer) (Fig 5). The access cavity was temporarily restored. Post obturation radiographs even at different angulations could not confirm all the seven obturated canals due to superimposition. Therefore presence of seven obturated canal were verified by dental CT scan (Fig 6). Tooth was restored with a permanent restoration after a week.
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Discussion

One of the major reasons for failure of endodontic treatment is incomplete removal of pulp tissues and microbes from the highly complex and variable root canal systems. Thus identification of all the canal orifices followed by thorough cleaning, shaping and complete disinfection of the root canal system is vital for the success of endodontic procedure. The orifices could be simply located by following the basic rules of pulp chamber floor anatomy and laws of access cavity preparation.6,7,9

Routine diagnostic measures like multiple angled radiographs, examination with a sharp explorer, use of ultrasonic tips, location of canal bleeding points, use of 1% methylene blue dye and sodium hypochlorite “champagne bubble test” are very useful in locating canal orifices and extra canals.10,11 Furthermore, use of magnification such as dental operating microscopes and loupes has significantly broadened the operator’s domain to search for extra canals. Conventional dental imaging is easy and economical but lose the battle of perception as it is a 2-dimensional (2D) representation of a 3-dimensional (3D) object. Careful interpretation and critical evaluation of a 2D conventional radiograph may alert the clinician about presence of aberrant canal anatomy but would not be able to present a clear morphologic structure of root canals and their interrelations. The role of dental CT scan in providing a 3-dimensional assessment and establishment of a confirmatory diagnosis of variations in root canal morphology has been documented in various studies.11-15 Dentascan(GE HealthCare, Milwaukee, WI) is a reformatting software used along with spiral / helical CT and allows assessment in all three dimensions. It provides axial, panoramic, paraxial and 3rd volume rendering which helps in diagnosis.

Even modern diagnostic aids like charged couple device (CCD) and photo-stimulable phosphor plate (PSP) digital imaging techniques, provide a 2D image. In this case seven root canals were located and confirmed using dental CT scan during and after the treatment. The presence of multiple canals could be a consequence of deposition of secondary dentin forming vertical partitions resulting in multiple canals.10,11 Although a CT scan cannot be routinely prescribed as a part of endodontic diagnostic workup due to the high radiation exposure, its judicious use is advocated in cases where extra diagnostic accuracy or a 3D visualization is necessary for a successful endodontic treatment outcome.

To find and treat extra canals may be challenging and failure to do so could affect the outcome of the endodontic treatment. Therefore through this case report, we emphasize the importance of proper understanding of the root canal system along with judicious use of advanced diagnostic imaging techniques that enables the clinician to investigate and treat the complex root canal system efficiently.
References:
7. Reeh ES. Seven canals in a lower first molar. Journal of endodontics. 1998;24(7):497-