

IDENTIFICATION OF MIDDLE MESIAL CANAL IN MANDIBULAR SECOND MOLAR USING CONE-BEAM COMPUTED TOMOGRAPHY IMAGING –A CASE REPORT

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ABSTRACT

Introduction: The root canal treatment of a mandibular molar with aberrant canal configuration can be diagnostically and technically challenging.

Methods: This case report presents the clinical management of a mandibular second molar with three separate mesial canals including middle mesial canal, which was confirmed by cone beam computed tomography (CBCT) images.

Results: Post-treatment images revealed three root canals in the mesial root obturated efficiently to the accepted lengths in all three canals.

Conclusion: This case report highlights the usefulness of CBCT imaging for accurate diagnosis and management of the unusual canal morphology.

Keywords: Middle mesial canal, Cone beam computed tomography, intraoral periapical radiograph

INTRODUCTION

Thorough mechanical and chemical debridement of entire pulp canal space followed by complete obturation to provide hermetic seal is the main objective of root canal therapy (RCT). Thus, it is imperative to identify aberrant anatomy before and during RCT of a tooth.

Intraoral periapical radiographic (IOPA) examination is important for the evaluation of the number of roots and canal configuration. However, it has inherent limitation to assess the root canal system completely as it provides only two dimensional image. Conventional multidetector computed tomography (CT) imaging has been widely used in medicine since the 1970s and was introduced in the endodontic field in 1990 (1). Recently, as an alternative to multidetector CT imaging, cone beam CT (CBCT) imaging has been shown to provide three dimensional images at reduced dose as it is possible to take small field (FOV) view images (2). Cotton et al (3) reported various useful applications of CBCT imaging in endodontics including identification of complex root canal system (4).

Anatomic variations of mandibular molars such as the radix entomolaris and C-shaped root/canal

anatomy are well recognized by endodontic clinicians. Comparatively, data on the incidence/prevalence of MM canals are limited. Clinical studies on the incidence of negotiable MM canals are limited to those performed in the 1980s without using magnification (5)(6) The incidence of multiple canals in the mesial root of mandibular molars have been reported in the literature as 2.07% to 13.3% (7)(8). Pomeranz *et al* (5) reported the highest incidence of middle mesial canal (12%) and he described the anatomy of MM canals as follows: (1) Fin: The file passes freely between the main mesial canal (ML or MB) and the MM canal (transverse anatomies), (2) Confluent: The MM canal originates as a separate orifice but apically joins the MB or ML canal, and (3) Independent: The MM canal originates as a separate orifice and terminates as a separate apical foramen. Reuben *et al.* (9) evaluated root canal morphology of 125 extracted mandibular first molars in an Indian population by using spiral computed tomography (SCT) and they did not find mandibular molar mesial roots with three canals. A study in Sudanese population using a clearing technique found that the prevalence of three mesial canals was 4% in mandibular first molars and 10% in mandibular second molars. (10) In this report, we present clinical detection and management of middle mesial canal in mandibular second molar by using CBCT imaging.

CASE REPORT

A 19 year old female patient with non-

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[`http://dx.doi.org/10.20530/IJTA_31_1-4](http://dx.doi.org/10.20530/IJTA_31_1-4)

ISSN 2320-138X © 2016

contributory medical history reported to the post graduate department of Conservative Dentistry and Endodontics with a chief complaint of 'acute pain in her right lower back teeth'. On clinical examination, there was gross subgingival decay in the mandibular right first permanent molar (tooth 46) and deep class II caries in mandibular right first permanent molar (tooth 47), which was tender to percussion. Due to poor post endodontic prognosis, extraction was advised for tooth 46. Pulp sensibility testing of the tooth 47 with heated gutta-percha (DentsplyMaillefer, Ballaigues, Switzerland) and ice cube caused an intense lingering pain whilst an electric pulp stimulation (Parkel Electronics Division, Farmingdale, NY, USA) caused a delayed response with respect to 47. The preoperative diagnostic radiograph revealed proximal radiolucency, approaching the pulp space with periodontal ligament space widening and loss of lamina dura in relation to the mesial and distal root apex (figure 1a). From the clinical and radiographic findings, a diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis was made for tooth 47, and root canal treatment was scheduled.

Radiographic evaluation of the tooth indicated a normal root canal anatomy. After administering local anaesthesia with 2% lignocaine containing 1:200 000 adrenaline (Lox 2%, Neon laboratories limited, Andheri (East), Mumbai, India), tooth was isolated with rubber dam and endodontic access cavity was prepared. On examination with a DG-16 endodontic explorer (Hu-Friedy, Chicago, IL, USA), the pulp chamber had four canals (mesiobuccal, mesiolingual, distobuccal and distolingual). Further examination of access cavity and by exploring the fissure located on the lingual aspect of the MB canal orifice with a sharp endodontic explorer, a "stick" was encountered.

We decided to perform multisliced scans of the mandible with informed consent from the patient. The first molar was focused, and the morphology was obtained in transverse, axial, and sagittal sections of 0.075mm thickness using Endomode of the small field of view (F.O.V.) CBCT scan (Planmeca Pro-Max 3d Mid, Romexis 3.25 Software). The transverse images revealed that the mesial root had three root canals (figure 1b). According to Pomeranz's classification, the middle mesial canal (MM) canal was classified as "dependent." The MM canal had a separate orifice but merging with ML and MB at apical foramen. After scouting the root canals, flaring of the coronal thirds was performed with a ProTaper SX rotary file (DentsplyMaillefer) (figure 1c). The working length was determined using an electronic

apex locator (Propex II, DentsplyMaillefer) and confirmed radiographically (figure 1d). The root canals were prepared in a by crown-down method using ProTaper Ni-Ti rotary instrumentation (DentsplyMaillefer). Irrigation between each instrument was performed using saline, 0.5% sodium hypochlorite and 17% EDTA (Prime Dental Product Pvt Ltd, Mumbai, India). The canals were dried with absorbent points (Dentsply Tulsa, Tulsa, OK, USA). The access cavity was sealed temporarily.

At the next appointment, 1 week later, the tooth was asymptomatic. The final irrigation was performed with 2% chlorhexidine. The canals were dried with absorbent points (Dentsply Tulsa) and filled using cold lateral compaction of Gutta-percha and AH-Plus sealer (Dentsply Tulsa). Posttreatment CT images revealed three root canals in the mesial root obturated efficiently with gutta-percha to the accepted lengths in all three canals (figure 1e,f). The patient experienced no posttreatment discomfort and was subsequently referred for appropriate coronal restoration.

DISCUSSION

The common cause of failure of root canal treatment is presence of residual bacterial biofilm in root canal system. One of the cause of residual

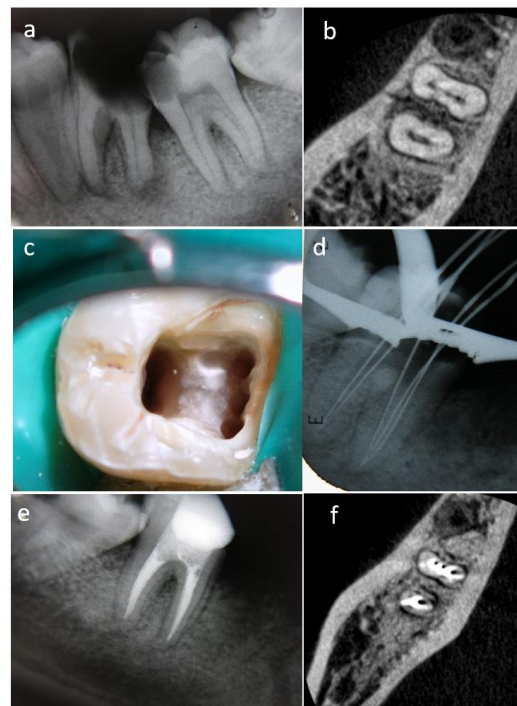


Figure 1: a) preoperative intraoral periapical radiograph, b) CBCT image showing presence of five canals (axial view) c) clinical photograph showing five canals, d) working length determination radiograph, e) post-obturation intraoral periapical radiograph, f) post-obturation CBCT image (axial

bacterial biofilm is a missed canal or an unclear root canal system due to anatomic variation. Literature shows deviations from the norm, in that tooth morphology is not uncommon and mandibular second molar is not an exception.

The detection of additional root canals requires a careful clinical and radiographic inspection. Diagnostic tools such as multiple radiographs, careful examination of the pulpal floor with a sharp explorer, and better visualization using an operating microscope are all important aids in the detection of additional root canals. The operator should accurately observe the pulp chamber floor to locate possible canal orifices. Pulp chamber floor and wall anatomy provide a guide to determine the root canal morphology. Krasner and Rankow(11)(12)(13)(14) made a rational approach to study the relationship of the pulp chamber to the clinical crown and the pulp chamber floor. Their observations, presented in the form of laws, are valuable aids to the clinician searching for elusive canals. Failure to identify extra canals and to recognize any unusual canal configuration is implicated as one of the most common reasons for the failure of endodontic therapy.(15)(16)(17) A round bur or an ultrasonic tip can be used for removal of any protuberance from the mesial axial wall, which would prevent direct access to the developmental groove between mesiobuccal and mesiolingual orifices. This developmental groove should be carefully checked with the sharp tip of an endodontic explorer. If depression or orifices are located, the groove can be troughed with ultrasonic tips at its mesial aspect until a small file can negotiate this intermediate canal.(9)(18)(19)

CBCT has been successfully used in endodontics for better understanding of the root canal anatomy (20), evaluation of root canal preparation/obturation, detection of bone lesions(21), and vertical root fractures (2). Recently, CT imaging is used for the confirmatory diagnosis of morphologic aberrations in the endodontic field.

In the present case considering the age of the patient and incidence of middle mesial canal in young age, we explored the fissure located on the lingual aspect of the MB canal orifice with a sharp endodontic explorer, and we encountered stick. Furthermore, to confirm the presence of middle mesial canal and to prevent iatrogenic perforation, we have taken a CBCT image. Small FOV CBCT image was taken in the present case which generally yields considerably lower effective doses than conventional full FOV image.(22). In this case CBCT helped to confirm the presence of three

mesial canals that were confluent and also to confirm that the canals were obturated well.

CONCLUSION

Treating additional aberrant canals can be challenging, but the inability to find root canals may cause failures. The evaluation of CBCT images can result in better understanding of root canal anatomy, which enables the clinician to investigate the root canal system and to clean, shape, and obturate it more efficiently.

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