Cone Beam Computed Tomography As An Aid In Management Of A Rare Case Of Anatomical Variation In Maxillary Second Molar With Multiple Root Canals: A Case Study

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ABSTRACT

This case report describes an endodontic management of maxillary second molar with an atypical morphology of five canals using CBCT and Operating Microscope. Maxillary molars have one of the most complex root morphology and canal anatomies. The most common variation observed is the presence of two canals in the mesiobuccal root of maxillary molar. The incidence of two distobuccal canals is extremely rare. This case report presents the successful management of this unusual root morphology with the aid of Cone Beam Computed Tomography Scan as a latest adjunct in successfully diagnosing and treating this unusual canal anatomy.
INTRODUCTION:
In endodontic therapy, a thorough knowledge of internal dental morphology is of great importance. Most of the challenges faced during root canal therapy may be ascribed to an insufficient understanding of the canal morphology of teeth. Extra roots or root canals, if not detected, are the chief reason for endodontic failure. [1] Maxillary molars illustrate substantial anatomic variation and abnormalities with respect to the number of roots and canals. As per published results, most maxillary second molars commonly have 3 roots and 3 canals. [2, 3] Studies have reported the incidence of a second canal in the mesiobuccal root (MB2) to be ranging from 56.9-79.6%. [4, 5] Additional anatomic variations include distobuccal and palatal roots with more than 1 canal, amounting to 5 root canals or more. [6, 7] However, the presence of a second distobuccal canal (DB2) is extremely rare, and has been reported previously only by Kim et al. [6] A precise radiographic technique and correct interpretation are crucial for sound diagnosis and treatment. Preoperative radiographs at different angles help in detection and evaluation of root canal morphology and anatomy. However, this technique is non-reliable and produces only a 2D image of a 3D object leading to superimposition of images. CBCT is a valuable technique for evaluating and diagnosing the internal morphology of teeth. [8] This case report indicates the potential intricacy of maxillary second molar variations and is intended to reinforce clinicians’ knowledge in managing such cases of rare morphology with digital radiographic technology.

CASE STUDY
A 36-year-old male patient presented to the Department of Conservative Dentistry and Endodontics, Army College of Dental Sciences, Secunderabad, with the chief complaint of spontaneous toothache in his right upper back tooth region since 1 week. The pain intensified by hot food and on chewing. History revealed intermittent pain in the same tooth with hot and cold stimuli for the past 1 month. The patient’s medical history was noncontributory. On clinical examination, a curious maxillary right second molar (tooth #2) was observed, which was tender to percussion. The buccal and palatal aspect of the tooth did not reveal any tenderness on palpation. The tooth was not mobile and periodontal probing around the tooth was within physiological limits. Vitality testing with heated gutta-percha (Dentsply Maillefer, Ballaigues, Switzerland) and dry ice (R C Ice; Prime Dental Products Pvt Ltd, Mumbai, India) of the involved tooth caused an intense lingering pain, whereas electronic pulp stimulation revealed a premature response. A preoperative radiograph revealed disto-occlusal radiolucency, approaching the pulp space with periodontal ligament space widening in relation to the distobuccal root (Fig. 1A). Based on the clinical and radiographic findings, a diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis was made and endodontic treatment was suggested to the patient.

Clinical Treatment
1. First appointment
The involved tooth did not indicate any variation in the canal anatomy radiographically (Fig. 1A). The tooth was anesthetized with 1.8 mL (30 mg) 2% lignocaine containing 1:200,000 epinephrine followed by rubber dam isolation. An endodontic access cavity was established. Clinical examination with a DG-16 endodontic explorer (Hu-Friedy, Chicago, IL) revealed four canal openings; mesiobuccal (MB1, MB2), distobuccal and palatal orifices in their regular locations, at the angles in the floor-wall junction. During examination with a dental operating microscope (Labomed Prima DNT Surgical Microscope, Unicorn Denmart Limited, Delhi, India), a second canal was located immediately buccal and in line with the orifice of the palatal canal on the distal surface. Further removal of dentinal shelf beginning from the orifice of the distobuccal canal and moving toward the orifice of the palatal canal with START-X ultrasonic tip 2 and 3 (Dentsply Maillefer, Weybridge, Surrey, United Kingdom) clearly unveiled the orifice of the additional canal. Though the orifices of the
palatal, additional, and distobuccal canal were in the same line, the orifice of the canal was far closer in proximity to the distobuccal orifice rather than to the palatal orifice and thus it was recognized as DB2 orifice. Since the two orifices of distobuccal canal were in an extremely close proximity and the diagnostic radiograph was not conclusive regarding the number of root canals, suggesting some type of morphological variation, a CBCT was advised to confirm the canal configuration. Coronal enlargement was done to improve the straight-line access using a Nickel-Titanium ProTaper series orifice shaper (Dentsply Maillefer, Ballaigues, Switzerland) (Fig. 1B). The working length was determined with the help of an apex locator (Root ZX; Morita, Tokyo, Japan) and later confirmed using a radiograph (Fig. 1C). Access cavity was sealed with IRM cement (Dentsply De Trey GmbH, Konstanz, Germany).

An informed consent was obtained from the patient, and a multi-slice CBCT scan of the maxilla was performed (The Secunderabad Diagnostic and Research Centre, Secunderabad, India). The transverse, axial, and sagittal sections were obtained in a thickness of 0.5-mm. CBCT scan slices revealed five canals (two mesiobuccal, one palatal, and two distobuccal) in the right maxillary second molar (Fig. 2A-C). Both the mesiobuccal canals (MB1, MB2) and distobuccal canals (DB1, DB2) exhibited separate canal orifices with a single apical foramen (Vertucci’s 2-1 configuration). CBCT images confirmed the presence of five canals that were not clearly seen in the conventional radiograph.
2. Second appointment

The patient was asymptomatic. After administering 1.8 mL (36 mg) 2% lignocaine with 1:200,000 epinephrine, cleaning and shaping was performed under rubber dam isolation using ProTaper nickel-titanium rotary instruments (Dentsply Maillefer) with a crown-down technique. Irrigation was performed using normal saline, 2.5% sodium hypochlorite solution, and 17% EDTA. The canals were dried with absorbent points (Dentsply Maillefer) and obturation was performed using gutta-percha (Dentsply Maillefer) with AH Plus resin sealer (Maillefer, Dentsply, Konstanz, Germany) (Fig. 1 D,E,F). The tooth was then restored with a posterior composite resin core (Spectrum, Dentsply, Konstanz, Germany). The patient was advised a full-coverage porcelain crown and was asymptomatic during the follow-up period of 12 months.

**DISCUSSION**

Anatomical variations can occur in any teeth. Therefore, an in depth knowledge of root-canal morphology is an imperative step in achieving a successful endodontic therapy. Missed canals can lead to endodontic failures. Hence, it is vital to locate and treat the entire root canal system, especially when facing maxillary molars where various aberrations may occur. In general, maxillary second molars have three roots: one palatal and two buccal. However, occasionally fusion of roots or variation in canal configuration/number may occur. Studies have reported a high incidence of MB2 canal in maxillary first molars, \(^{4,9}\) while its incidence in maxillary second molars is comparatively low, generally <50%. \(^{4}\) Literature search, reported a solitary case of 2 distobuccal canals with one root in maxillary second molar by Kim Y et al. As per his study, the prevalence of DB2 in second molars was found to be as low as
The present case report highlights the presence of a three rooted right maxillary second molar with MB2 and DB2 canals, which exhibit a type II canal configuration (two canals merging into a single canal at the apex). As per Vertucci, if the separation of orifices is less than 3 mm, canals usually merge with each other and if the distance is greater than 3 mm, canals remain separated throughout the entire length. This unusual morphology was confirmed with the help of cone-fit procedure, in which the master cone of MB2/DB2 could not reach its full length if the one for MB1/DB1 was placed to its full working length. Treatment prognosis for molars with 4 canals and 2 buccal roots should be considered the same as that for any maxillary molar. Failure to treat a missed canal is an obvious reason for treatment failure. At times interpretation of morphologic variations on radiograph is difficult, so careful examination of the pulp chamber floor, use of dental operating microscope and electronic apex locator is of great significance for a successful treatment.

Surgical Operating Microscope (SOM) is an important aid for locating root canals. It brings infinitesimal details into comprehensible view by enhancing the illumination and magnification. Studies have verified that magnification and illumination by the SOM amplified the detection of additional canals enormously. Use of cone beam computed tomography in diagnosis of anatomic variations as an adjunctive diagnostic tool is important. It has short scanning times (10–70 seconds) and the radiation dosage is 15 times lower than that of conventional CT scans. Use of this aid facilitates easy detection of variations in canal morphologies when compared to traditional techniques.

CONCLUSION
The present case report discusses the endodontic management of an unusual case of a maxillary second molar with three roots and five canals and also highlights the role of dental operating microscope and CBCT scanning as an adjunctive to traditional radiographs in determining root canal morphology.

REFERENCES


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