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Report of Two Cases of Maxillary First Molar with Altered Root Canal Configuration Evaluated Using Cone-beam Computed Tomography Scanning.

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Abstract: *The success of the endodontic treatment depends on instrumentation and obturation of all the canals present in the involved tooth. We report two cases presented to the Government Dental College, Kozhikode, Kerala, India with pain in the left maxillary first molar. After diagnosis, root canal treatment was started. The access cavity was opened and the canals were negotiated under a Dental Operating Microscope (DOM). Mesiobuccal, Distobuccal and Palatal roots of maxillary first molar with three, two and single canals were found. This variation in the canal anatomy was confirmed with Cone-Beam Computed Tomography (CBCT) scanning. The root canals were instrumented and obturation was done with a permanent restoration. This case report discuss the importance of proper knowledge of the canal morphology, a diagnostic imaging with the three-dimensional image (CBCT) and the importance of magnification (DOM) in the management of maxillary molar with a varied root canal configuration.*

Keywords:*Cone-Beam Computed Tomography, Dental Operating Microscope, three dimensional image, root canal configuration.*

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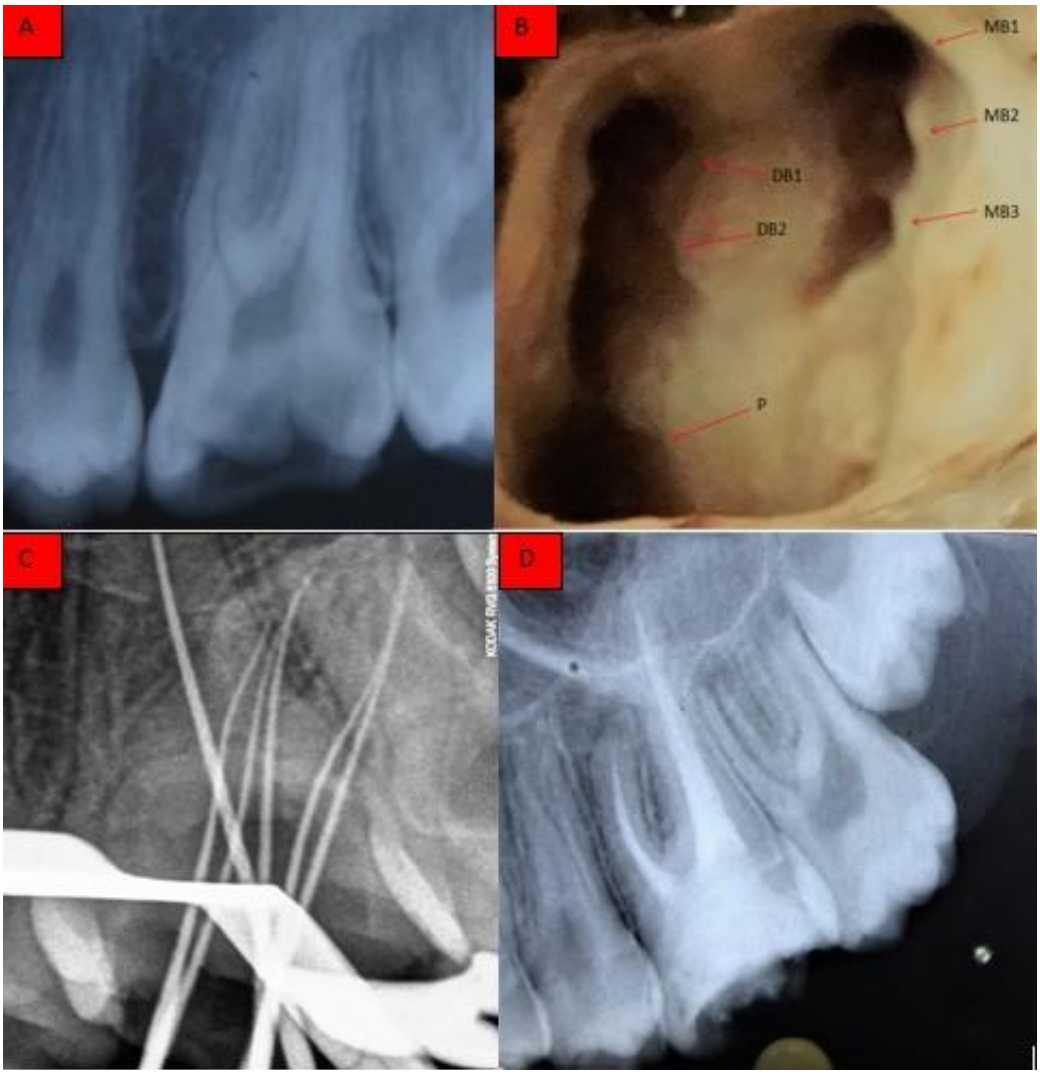
I. Introduction

A successful endodontic treatment depends on the location of all the canals in the tooth with proper instrumentation and obturation. The maxillary molar is said to have the most variation in the root canal anatomy, with a common variation of having a second mesiobuccal canal (18% to 96%)[1,2]. There are also some rare variation which includes a single root canal in a single root [3], two root canals[4], five root canals[5], six root canals[6], C-shaped canals[7], and an additional palatal root[8], seven root canals[9,10], eight root canals[11]. The root canal treatment of most of the above mentioned case reports with the variation has been done under a Dental Operating Microscope (DOM) and confirmed with a Cone Beam Computerized Tomography (CBCT) scanning[11,9,10]. The present case reports discuss the successful endodontic management of a maxillary first molar presenting with three roots and six root canals. This unusual morphology was detected with Dental Operating Microscope (DOM) and confirmed with the help of Cone Beam Computerized Tomography (CBCT) scans.

II.Case reports

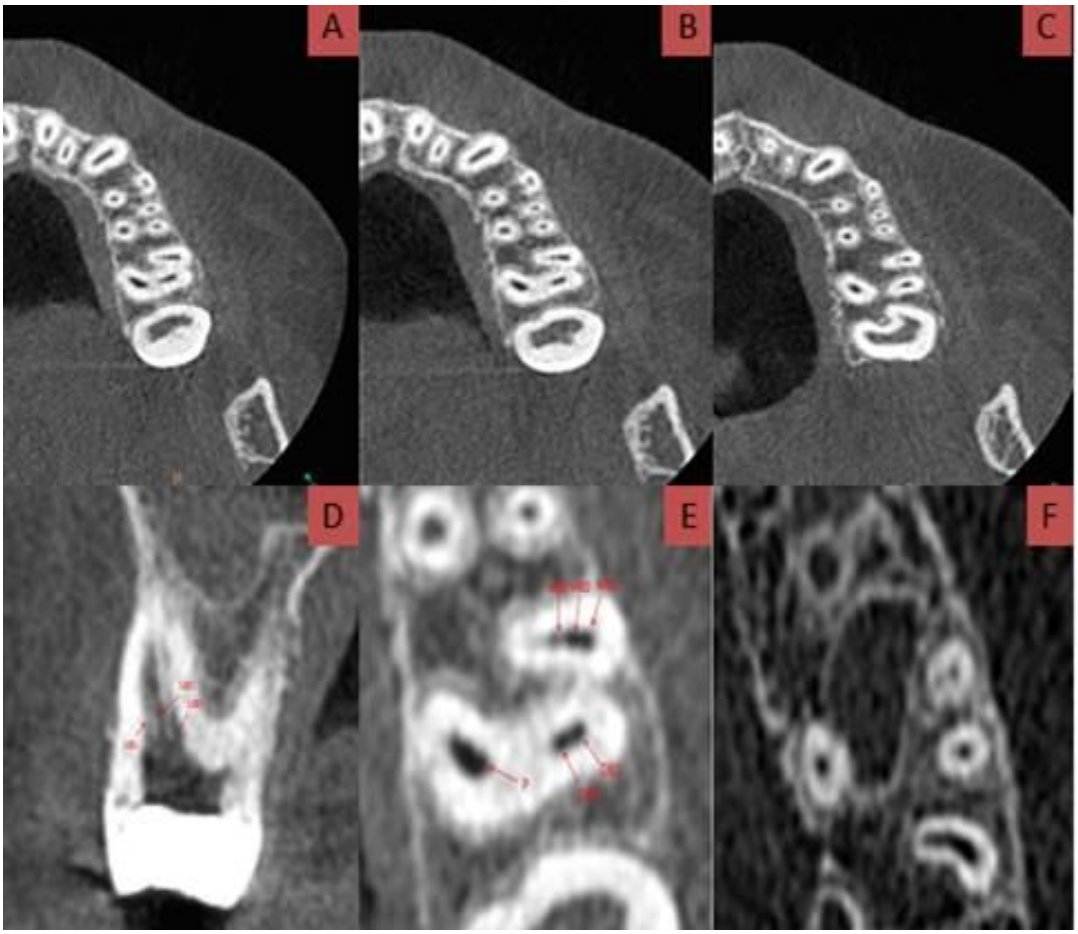
Case 1:A 14-year old boy reported to the Department of Conservative Dentistry and Endodontics, Government Dental College, Kozhikode, Kerala, India with the chief complaint of "a severe toothache in his left upper back tooth for past four days". History revealed that toothache was mild, and it intensified when the involved tooth is in contact with the cold stimuli and during mastication for the past two weeks. Clinical examination of the involved tooth (#14) revealed tender to percussion. A carious lesion was seen in the occlusal region of the involved tooth. The diagnostic tests were carried out and a periapical radiograph of the involved tooth was taken, it revealed an occlusal radiolucency, approaching the pulp chamber. The provisional diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made and the endodontic treatment was started.

[Figure-1]; (a) Pre-operative intra oral periapical radiograph of tooth #14. (b) DOM examination of thesix root canal orifices. (c) Working length of the tooth #14 in an eccentrical angulation (d)Postobturation radiograph of tooth #14.



After getting the informed consent from the patient the root canal treatment of the involved tooth was started by administering local anaesthesia with 1.8 mL (30 mg) of 2% lignocaine containing 1:200,000 epinephrine (Xylocaine, AstraZeneca Pharma Ind Ltd). After obtaining adequate anaesthesia, under rubber dam isolation the root canal procedure was started. The preoperative radiograph showed a narrow canal in both mesiobuccal and distobuccal roots. While negotiating the canals with DG-16 endodontic explorer (Hu-Friedy, Chicago, and TL), two mesiobuccal, one distobuccal and one palatal canal was found. When the tooth was examined with the DOM for any variation, a third mesiobuccal and second distobuccal canal was found. With the apex locator (Raypex 6, VDW, Munich, Germany) the working length of the root canals was determined and final confirmation was done radiographically (Fig-1A). After the detection of six canals under DOM, to confirm and to check whether any extra canals are present, a CBCT imaging of the quadrant was taken with a tube voltage of 60-90KV and a tube current of 2-5mA and the images were analysed. CBCT images confirmed this unusual canal morphology (Fig-2).

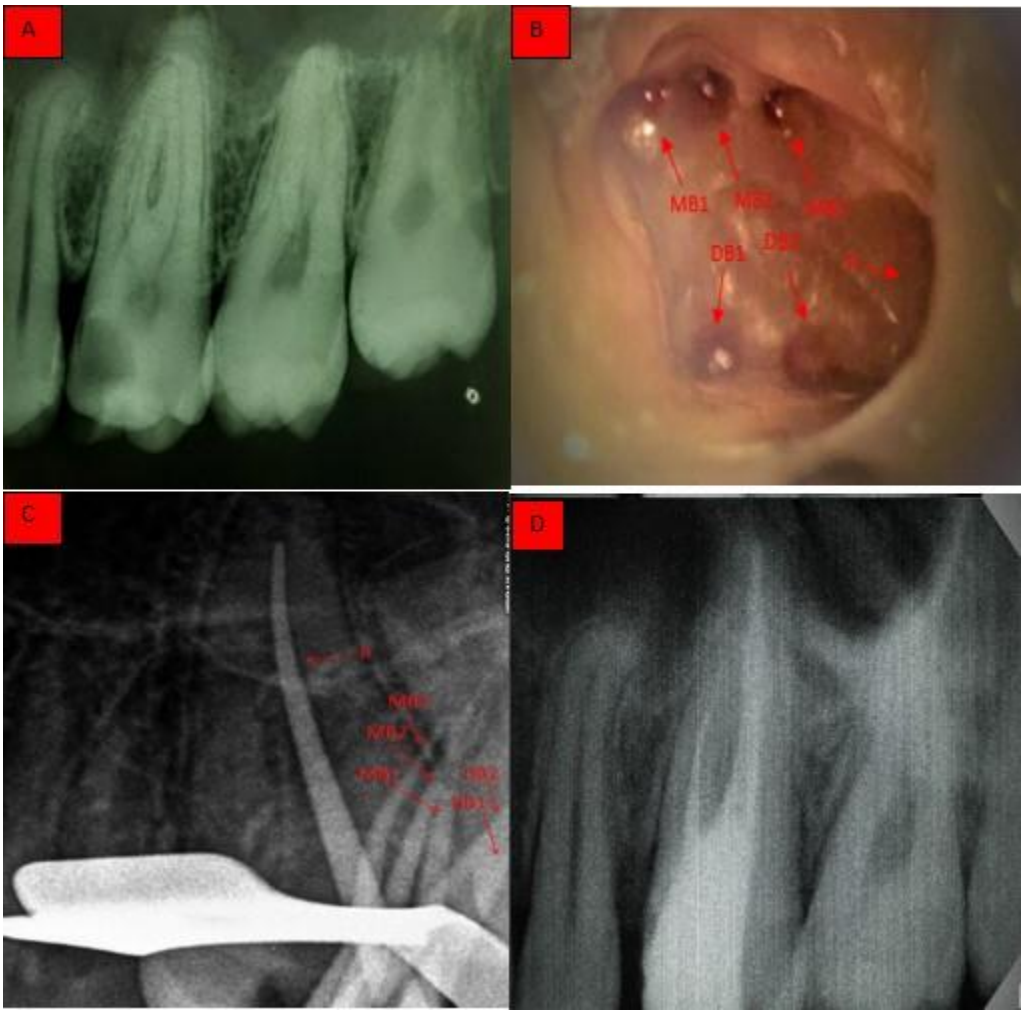
[Figure-2]; (a-c) CBCT images of the left maxillary arch showing axial sections at the (a) Cervical,(b) Middle and (c) Apical level. (d) Coronal section of mesiobuccal root of the tooth #14 showingSert and bayirli type XV canal (e-f) Enlarged axial section CBCT images of the tooth #14 at the(e) Middle level showing three MB, two DB and one P canal and (f) Apical level showing twoseparate apical foramens in mesiobuccal root, one apical foramen in distobuccal root andpalatal root.



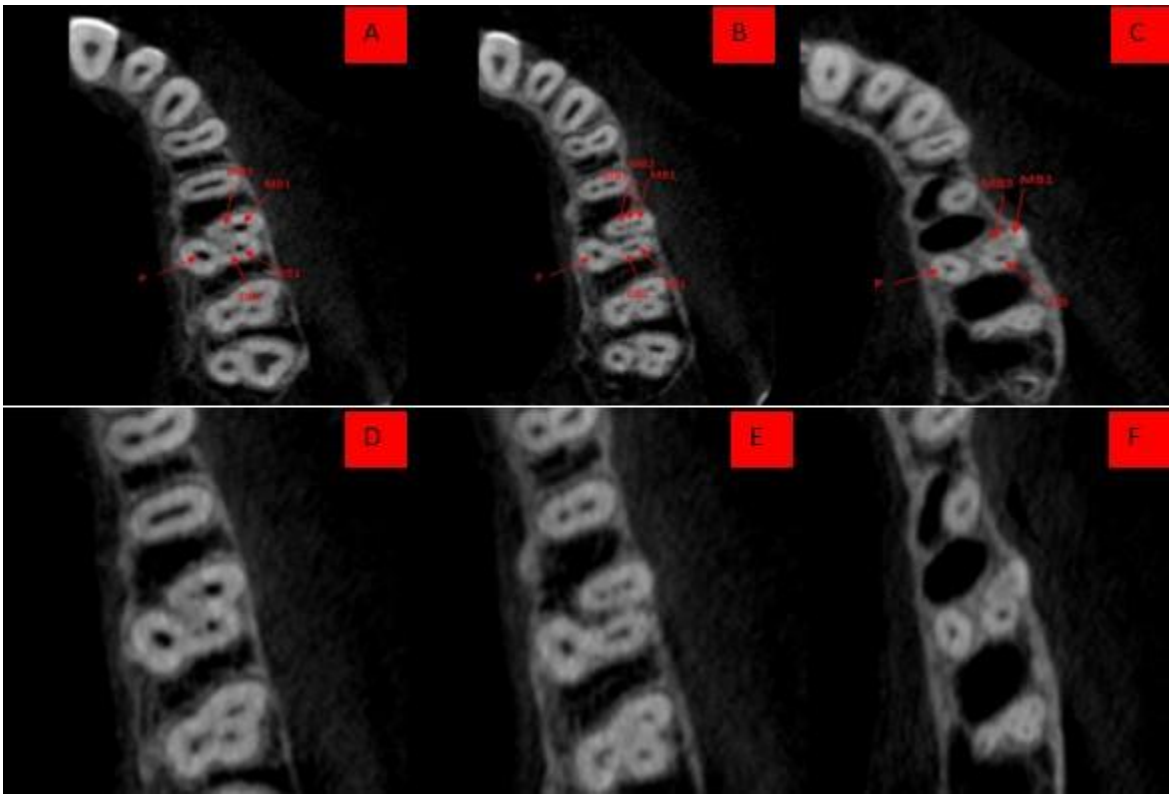
In the second appointment Bio-mechanical preparation of the root canals of the involved tooth was done with the protaper rotary files (Dentsply Maillefer, Ballaigues, Switzerland) in continuous rotation motion according to the manufacturer's instructions. The irrigant solution used was normal saline, 5% sodium hypochlorite, and 2% chlorhexidine. After manual irrigation with the 30 gauge single side vented needle an ultrasonic agitation was done. After the irrigation, the canals was dried with the absorbent paper points and the obturation was done with cold lateral compaction with AH Plus sealer (Dentsply, Tulsa) (Fig-1B). After the obturation, tooth was restored with a permanent restorative material and was reviewed for six months for any signs and symptoms of endodontic failure.

Case 2: A 22-year-old male patient reported with the chief complaint of "a toothache in the left maxillary region" for the past three days. History revealed that toothache was intensified when in contact with hot stimuli. Clinical examination of the involved teeth revealed that the tooth was tender to percussion. A mesio-occlusal radiolucency of the tooth (#14) was seen in the diagnostic radiograph. Diagnostic tests were carried out and a diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made. After obtaining adequate anaesthesia, under rubber dam isolation the root canal procedure was started. The canals were negotiated with DG-16 endodontic explorer. One canal in each root was found, while examining the canals under DOM a second and third mesiobuccal canal and second distobuccal canal was found (Fig-3A). With the apex locator (Raypex 6, VDW, Munich, Germany) the working length of the root canals was determined and final confirmation was done radiographically (Fig-3B). The CBCT images confirmed the presence of this unusual canal morphology (Fig-4). After confirming this with CBCT, the canals were instrumented same as above mentioned and was obturated followed by a permanent restoration at the second appointment (Fig-3C). The patient was asymptomatic for the following six months.

[Figure-3]; (a) Preoperative intra oral periapical radiograph of tooth #14. (b) DOM examination of thesix root canal orifices. (c) Eccentrically angulated radiographs of tooth #14 to confirm the workinglength in the Mesiobuccal, Distobuccally and Palatal roots. (d) Postobturation radiograph of tooth #14.



[Figure-4]; (a-c) CBCT images of the left maxillary arch showing axial sections at the (a) Cervical,(b) Middle and (c) Apical level. (d-f) Enlarged axial section CBCT images of the tooth #14 at (d)cervical showing two MB, two DB and one P canals (e) Middle level showing three MB, two DB andone P canal and (f) Apical level showing two separate apical foramens in mesiobuccal root, one apicalforamen in distobuccal root and palatal root.



III. Discussion

The knowledge about the root canal anatomy and its variation is important before starting the root canal treatment. Weine et al[12] and Vertucci[13] provided the classification of variations in the root canal system. But there was some more variation other than the Weine and Vertucci classification which was then classified by some authors (Sert and Bayirli[14]). The endodontists have long relied on the two-dimensional imaging, which gives a two-dimensional image of a three-dimensional object, with this two-dimensional image the variation in the canal anatomy was very difficult to identify. But with the invention of the three-dimensional imaging (CBCT) in endodontics, the outcome of the treatment has become much better with the location of any extra canals and identification of varied canal anatomy.

In both, the cases after a thorough examination with the DOM six canals were located but for confirming this variation in the canal anatomy a CBCT scanning of the involved tooth were taken. The CBCT image of the tooth was obtained in several numbers of slices, the axial images of the tooth in both cases confirmed the presence of six root canals with three mesiobuccal (Sert and Bayirli[14] type XV), two distobuccal (Vertucci[13] type II) and one palatal canal (Vertucci[13] type I) (Fig- 2,4).

With the periapical radiograph (two-dimensional image) the buccolingual dimension is very difficult to visualize and only with the mesiodistal plane, the location of the extra canals are difficult. The mesiobuccal root of maxillary molar in both the patient had a Sert and Bayirli type XV canal configuration which is that the MB1 and MB2 will join at the middle third of the root and exit as a single canal and MB3 will have a separate canal orifice and a separate apical foramen. This canal configuration was identified mainly with the help of the CBCT scanning. The present case reports confirm the necessity for the meticulous examination of the pulpal floor at high magnification under sufficient illumination of the DOM and emphasize the importance of CBCT in intraoperative assessment. Thus the role of dental operating microscope and CBCT scanning was pivotal in the diagnosis of this unusual root canal system and towards its successful endodontic management.

IV. Conclusion

The intra-oral periapical radiograph was used by the endodontists for centuries. With CBCT, the assessment of variation of the canal anatomy was comparatively easier when compared with the periapical radiograph in endodontics. The endodontists have gained the ability to collect much more data with a single scan. So the CBCT

imaging should not be done only in cases with the variation of the canal or any complication, instead, it should be done as a supplemental procedure for a better knowledge of the root canal anatomy and for better treatment outcome.

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