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Endodontic Management of Maxillary First Molar with Three Roots and Six Root Canals: A Case Report

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Abstract
Endodontic success largely depends on the thorough knowledge of the root canal anatomy, its variations, the presence of additional roots and root canals and unusual root canal morphology. This case report is about the successful endodontic management of right maxillary first molar in a young male with three roots and six root canals that were identified under the magnification of Dental Operating Microscope and confirmed with Cone Beam Computed Tomography.

Keywords: - *Maxillary first molar, six root canals, cone beam computed tomography*

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I. Introduction

Successful endodontic treatment is dictated by thorough knowledge of the root canal anatomy, its variations, the presence of additional roots and root canals, and unusual root canal morphology[1]. For the long-term success of root canal treatment, it is essential to properly access, clean, shape and fill all of the canal spaces. However, the anatomic complexities and variations are constant challenges for successful endodontic therapy[2]. The morphology of the maxillary first molar has been extensively studied and reported in the literature. Besides the traditional root canal morphologywith three roots and three canals,the occurrence of a fourth canal ranges from 50.4% to 95%[3-5], a fifth canal 2.25%[6], and a few authors have also reported cases with 6 canals[7,8]. The occurrence of 2 canals in distobuccal root has been less frequent and has been reported in 3.6% of maxillary molars[4,8,9]. Palatine root canal variations were classified by Christie et al.[6,10] as types I, II, and III, according to root degree of divergence. Others reported cases of maxillary first molar with two canals in each of the three roots[7,8]. The following case report describes the successful management of maxillary first molars with three roots and six canals. The clinical findings were confirmed with the help of operating microscope and cone beam computed tomography (CBCT).

II. Case Report

A 23 year old male patientwas referred to the Department of Conservative Dentistry and Endodontics of the Dental College and Hospitalpresented with the chief complaint of pain in the right upper back region.

The recently developed pain was continuous and referred in nature, whichaggravated on heat intake and required analgesics for relief. Patient also complained of pain at night. The patient's medical history was non-contributory. Clinical examination revealed a tooth with a large carious lesion with respect to tooth #16, which exhibited percussion and palpation sensitivity. Periodontal probing and mobility were within normal limits.The tooth did notrespond to both cold (Roeko, Endofrost, Coltene, Germany) and Electric Pulp Test (EPT) (Confident Dental Equipments, India). The pre-operative IOPAR showed constricted pulp chamber which was otherwise exposed to caries and radiolucency around the apex of MB and Palatalroots (Fig:- 1A).After the clinical and radiological examination, the tooth was diagnosed with symptomatic irreversible pulpitis with apical periodontitis and endodontic treatment was suggested to the patient.

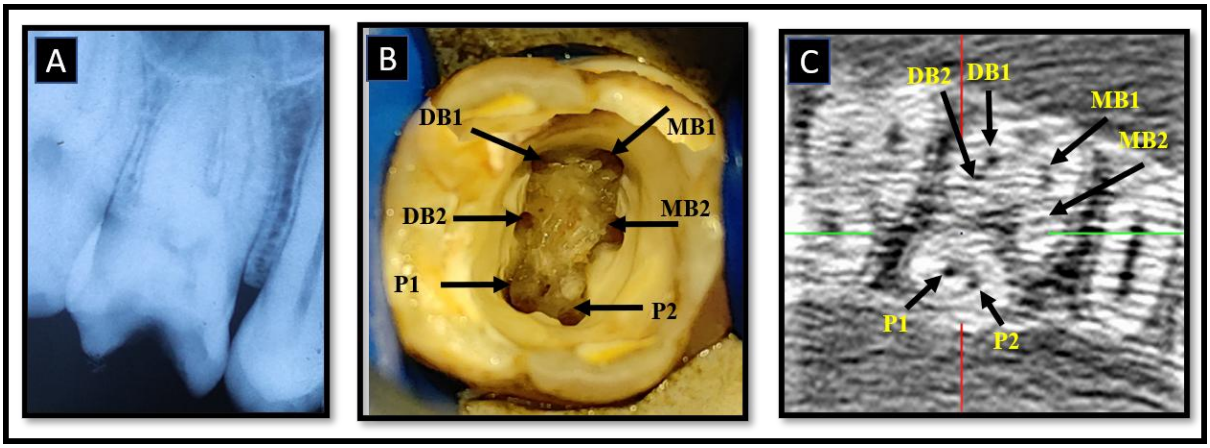

FIGURE 1:- A. Pre-operative radiograph showing cariously exposed #16 with constricted pulp chamber and radiolucency around MB and P roots. **B.**Access opening showing six canal orifices. **C.** Axial section of CBCT showing six canal orifices.

Local anesthesia was achieved with 2% lidocaine and 1:80,000 epinephrine (Lignox 2%, Indoco Remedies Ltd., Mumbai, India). Tooth was isolated with rubber dam (Hygenic Dental Dam, ColteneWhaledent, Germany). Endodontic access cavity was prepared using a round diamond and Endo-Z high-speed burs(Dentsply Maillefer, Ballaigues, Switzerland).3 principal root canal systems i.e.mesiobuccal (MB), distobuccal (DB), andpalatal were located on clinical evaluation of the internal anatomy. After probing with a DG 16 endodontic explorer,small hemorrhagic points were noticed 2 mm palatal to the main MB canal and DB canals named MB2 and DB2 respectively. As the palatal canal orifice seemed off centered, so the dentinoccluding the orifice of the palatal canal was carefully removed with the help of ultrasonics (Pro-ultra #2, Dentsply) and a second palatal canal was identified.

This was further evaluated and verified with Dental Operating Microscope (Moller-Wedel, Germany). 2 distinct orifices were seen in all the roots under the microscope(Fig:- 1B). To confirm this complex anatomy and to ascertain the pattern of the canals in a 3-dimensional manner, CBCT imaging of the tooth was advised. An informed consent was obtained from the patient. Access cavity was sealed by sterile cotton pellet and an interim restoration of Cavit (3M Espe, Seefeld, Germany) and a multislice CBCT scan of the maxillary right first molar was performed (Sky View CBCT scanner, My Ray).

The CBCT scans confirmed the presence of six canals i.e. two Mesiobuccal, two Distobuccal and two Palatal canals(Fig:- 1C). Mesiobuccal, distobuccal and Palatal canals followed **Vertucci's type II** (two separate canals starting from the pulp chamber and joining as one, just short of the root apex). Mesiobuccal canals merged at apical third, distobuccal canals merged as middle third and two palatal canals merged at the apical foramen.

The working lengths of each canal were estimated by an electronic apex locator (Dentsply Propex Pixi) and confirmed with a radiograph(Fig:-2Ai&ii). The cleaning and shaping were performed using Hyflex CM nickel-titanium rotary instruments (ColteneWhaledent, Germany). Canals were recapitulated using small #15 K file and irrigated between each instrument using 2.5% sodium hypochlorite solution (Prime Dental Products, India) and 17% EDTA (Desmear, Anabond, India). After the completion of biomechanical preparation, the canals were dried with paper points and a paste of calcium hydroxide (Ultracal XS of Ultradent, USA) was inserted into the canals as intracanal medicament. Cavit was used as interim restorative material between the appointments

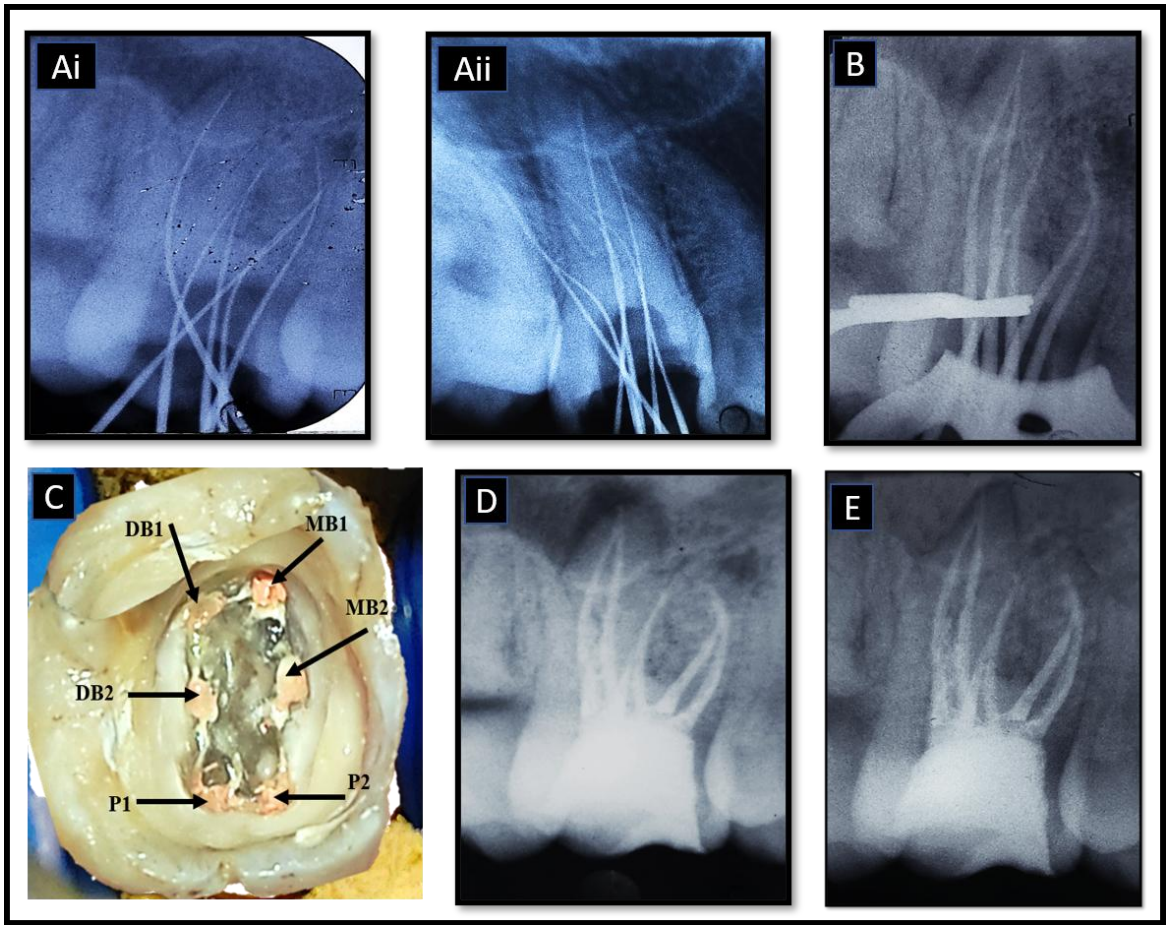

FIGURE 2:-Ai&ii. Working length determination using mesial and distal angulation respectively. **B.** Master cone radiograph. **C.** Access cavity showing six canal orifices after obturating with gutta percha. **D.** Immediate post-op radiograph. **E**. Six months follow-up showing significant reduction in periapical radiolucency.

On second appointment scheduled 14 days after the first appointment, the patient was asymptomatic with no pain. Under rubber dam isolation, Cavit and calcium hydroxide were removed and the canals were irrigated with 2.5% NaOCl and 17% EDTAusing Endo Activator system (Dentsply Tulsa Dental Specialties, Tulsa). The canals were dried with paper points followed by obturation of canals using coldlateral compaction of gutta-percha (ColteneWhaledent, Germany) anda resin-based sealer (AH Plus, Maillefer, Dentsply, Konstanz,Germany)(Fig:-2B&C). The tooth was then restored with acomposite resin restoration(IvoclarVivadent, Switzerland)(Fig:-2D) and a full-coverage porcelain crownwas advised to the patient.After six months, patient was asymptomatic and IOPAR showed marked reduction in the periapical radiolucency(Fig:-2E).

III. Discussion

Thorough knowledge of root canal morphology and configuration of maxillary molar teeth plays an important role in the success of endodontic therapy. Prevalence of additional root canals has been discussed and reported in various studies. Anatomical variations are commonly observed in maxillary first molar ranging from one to seven canals[4]. General acceptance is three roots and three canals with a fourth canal (MB2) seen in 50.4–91% of cases[3-5]. The incidence of having two canals in the DB and palatal root have been reported to be between 1.6%-9.5%[11,12] and 33.3%[11]respectivelyThe occurrence of double canal system in all roots of a maxillary first molar is an uncommon finding.

Reassessing and modifying the shape of the access cavity to identify and negotiate unusual anatomy of root canal is the key requirement in endodontic success[13]. In the present case report, the conventional triangular access was modified to somewhat trapezoidal to improve access to the additional canals.

Diagnostic measures that aids in locating root orifices are:multiple preoperative radiographs, examination of the pulp floor with a sharp explorer, troughing of grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the hypochlorite champagne bubble test,visualising canal bleeding points under dental operating microscope (DOM)[14]. In the present case report, additional canal orifices were located by complete examination of the pulpal floor to follow the dentinal map, exploration of haemorrhagic points with the DG-16 explorer, troughing of dentin shelf over the orifices and finally by visualizing the final access cavity under the DOM. Studies have demonstrated that magnification and illumination by DOM has tremendously increased the identification of additional canals[3].

Radiographs are an essential tool in management of endodontic problems. But they produce only a 2D image of a 3D object resulting in superimposition of images.CBCT is considered as a valuable tool for both initial diagnostic purposes and also for the effective evaluation of internal morphology of tooth[3,15]. In the present case report, CBCT scanning was used for a better and defined understanding of the complex root anatomy.

IV. Conclusion

Variations in root morphology although a rareoccurrence, their importance should not be underestimated.Clinicians should be aware of the complex root canal anatomy and should carefully examine the radiographs taken pre-operatively as well as during the treatment, have proper access preparation and detailed exploration of the interior of the tooth, ideally under magnification, for a successful treatment outcome.

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