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Endodontic Management of Maxillary First Molars with Six Canals - A Report of Two Cases.

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ABSTRACT: The complex root canal anatomy and variations in maxillary molars poses great challenge to dentists performing root canal treatment. Lack of knowledge about root canal complexities and variations could lead to failure of endodontic treatment. It is necessary to understand the morphology of the root canal system before carrying out an endodontic treatment. The use of operating microscope and cone beam computed tomography was crucial in detecting the canals. This report discusses and describes the variation in root canal system of maxillary first molar and its endodontic management.

Key words: Cone Beam computed tomography, Maxillary first molar, Two palatal canals, Operating microscope.

INTRODUCTION

The success of an endodontic treatment mainly depends on knowledge of root canal anatomy and variations which poses a great challenge to clinicians ¹. A major cause for failure of endodontic treatment is lack of knowledge and skill. It is therefore necessary to access, clean and fill all of the canal spaces without leaving any remnant tissue to achieve long term success in root canal treatment ². Technological advancements such as operating microscope and computed tomography have been introduced to facilitate detection and assessment of anatomical variations of root canal system. Studies have shown that the usage of magnification increases the chance of detecting additional canals ³. In general maxillary first molars are regarded as teeth with three roots and four canals mostly. Neelakantan et al found that the prevalence of MB2 canal to be 44.1% in maxillary first molars ⁴. The presence of two distobuccal canals was found to be rare and also was reported in 3.6% of maxillary molar ⁵. Christie et al reported that there were variations in palatine roots of maxillary first molar ⁶. Baratto Filho et al found the prevalence of two palatal canals to be 0.62% (clinical), 2.05% (ex vivo) and 4.55% (CBCT) ⁷. Kottoor et al reported about management of maxillary first molars with seven and eight canals ^{8,9}. The present case study reports the detection and successful management of maxillary first molars with six canals with the help of operating microscope and cone beam computed tomography (CBCT).

CASE REPORT I

A 48-year-old male patient presented with the chief complaint of pain in left upper back tooth. The pain was continuous and aggravated on consuming hot and cold food. The patient's medical history was non-contributory. Patient had undergone treatment in a clinic where caries was removed, temporary filling was placed and was referred to hospital for further treatment. Clinical examination revealed pain on percussion of the tooth. Electric pulp testing gave a premature response indicating inflammation of pulp. On radiographic examination, the radiopaque material extending to the pulp was found (Figure- 1A). After clinical and radiographic examination, the left maxillary first molar was diagnosed with irreversible pulpitis with symptomatic apical periodontitis. The tooth was anesthetized using 1ml 2% lidocaine containing 1 : 80,000 epinephrine. The temporary dressing was removed and a conventional endodontic access cavity was prepared under rubber dam isolation. On Clinical evaluation of the internal anatomy 3 principal root canal systems were found: mesiobuccal (MB), distobuccal (DB), each revealing one canal orifice and 2 canal orifices were detected in palatal root. In order to improve access to the palatal canals, conventional triangular access cavity design was modified into a trapezoidal shape. Small hemorrhagic pin point spots were found between palatal and mesiobuccal canals after exploring with a DG 16 endodontic explorer under operating microscope. On evaluation MB2 and MB3 were detected (Figure- 1B). The working length was determined in all identified canals using an apex locator and was confirmed with a periapical radiograph (Figure- 1D). Pulp was extirpated from all canals, sterile cotton was placed and access cavity was then sealed with IRM cement. A CBCT imaging of the tooth was advised for further evaluation of this unusual morphology. After obtaining informed consent from the patient, a multi-slice CBCT scan of the maxillary left side was performed. The CBCT scan images confirmed the presence of six root canals (Figure- 1C). The scans showed three mesiobuccal, a single distobuccal and two palatal canal systems. The MB canal system showed Gulabivala type (3-1) and Sert and Bayirli type XVIII; DB canal system showed Vertucci type I and palatal canal system showed Vertucci type II where

the mesiopalatal (P1) and distopalatal canals (P2) merged in the middle third of the root to follow as a single canal. The cleaning and shaping were performed using NeoEndo and heroshaper nickel-titanium rotary instruments with copious irrigation of 2.5% sodium hypochlorite solution and 17% EDTA. Mesial canals were enlarged upto 25 size with 4% taper, distal canal upto size 25 with 6% taper and palatal canals were enlarged to size 30 with 6% taper. The master cone radiograph was taken (Figure- 1E). The canals were dried and obturation was performed using cold lateral compaction of gutta-percha (Dentsply Mallifer) and a resin-based sealer (AH Plus, Maillefer, Dentsply, Konstanz, Germany) (Figure- 1F). The tooth was then restored with a posterior glass ionomer cement core. The patient was advised a full-coverage crown and was asymptomatic during the follow-up period.

Case Report 2

A 28-year-old male patient presented with the chief complaint of pain in the left upper back tooth. The pain was continuous and aggravated on mastication. The patient also gave a history of nocturnal pain. The patient's medical history was noncontributory. Based on clinical and radiographic examination (Figure- 2A) a diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made and endodontic treatment was suggested to the patient. The tooth was anaesthetized with 1ml of 2% lidocaine containing 1:80,000 epinephrine. Under rubber dam isolation, a conventional endodontic access cavity was prepared. Clinical evaluation of the internal anatomy after exploring with DG 16 revealed 3 principal root canal systems: mesiobuccal (MB), distobuccal (DB), and palatal with two canal orifices each (Figure- 2B). In order to improve access to the palatal canals, conventional triangular access cavity design was modified into a trapezoidal shape. The canals MB1&MB2, DB1&DB2 and P1&P2 were found. These were evaluated and verified by a Surgical Operating Microscope. The access cavity was then sealed with IRM. A CBCT imaging of the tooth was advised for further evaluation and understanding this unusual morphology. After obtaining an informed consent from the patient, a multi-slice CBCT scan of the maxillary left side was performed. The CBCT scan images confirmed the presence of six root canals (Figure- 2C). The scans showed two mesiobuccal, two distobuccal and two palatal canal systems. All three roots showed Vertucci type II canal configuration where the two canals in each root merged in the middle third to follow as a single canal. Working lengths of each canal were determined using an electronic apex locator and confirmed with a radiograph (Figure- 2D) at the next visit. The cleaning and shaping were performed using NeoEndo and Heroshaper nickel-titanium rotary instruments with copious irrigation of 2.5% sodium hypochlorite solution and 17% EDTA. Mesial and distal canals were enlarged upto 25 size with 4% taper and palatal canals were enlarged to size 30 with 6% taper. The master cone radiograph was taken (Figure- 2E). The canals were dried and obturation was performed using cold lateral compaction of gutta-percha (Dentsply Mallifer) and a resin-based sealer (AH Plus, Maillefer, Dentsply, Konstanz, Germany) (Figure- 2F). The tooth was then restored with a posterior Glass Ionomer cement core and a week later a full-coverage crown was cemented.

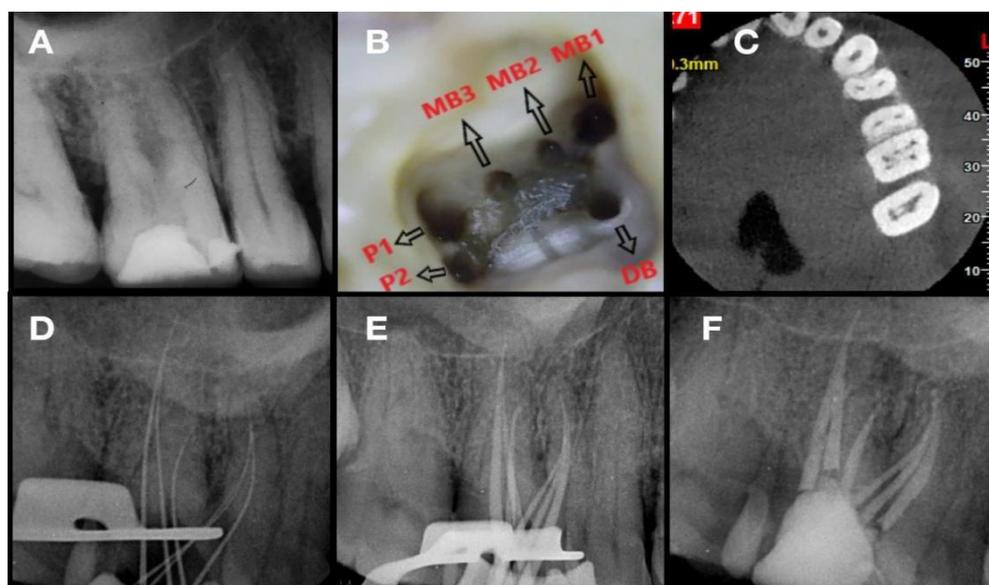


Figure 1 : A- Preoperative radiograph; B- Access opening showing three mesiobuccal (MB1, MB2 and MB3), two palatal (P1 and P2) and one distobuccal (DB) canal orifices; C- CBCT image; D- Working Length radiograph; E- Master cone radiograph; F- Obturation radiograph

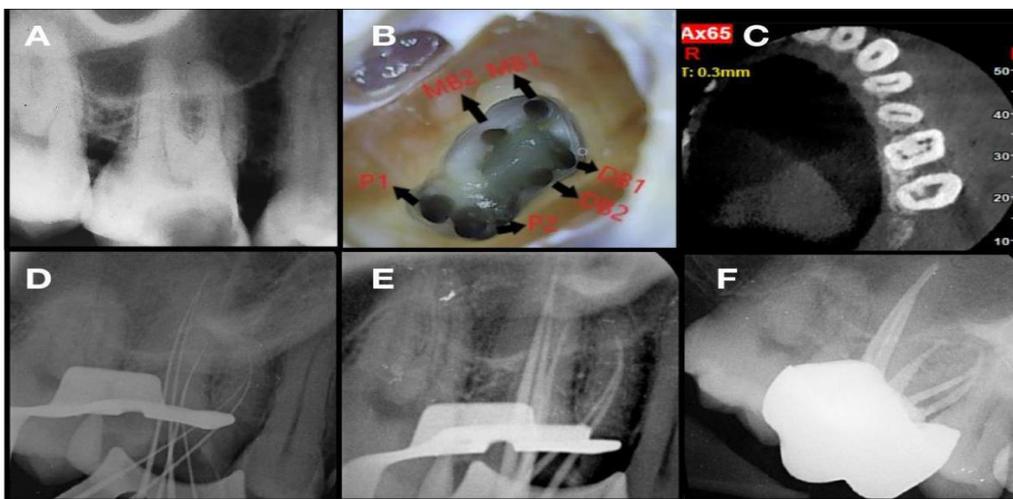


Figure 2: A- Preoperative radiograph; B- Access opening showing two mesiobuccal (MB1 and MB2), two palatal (P1 and P2) and two distobuccal (DB1 and DB2) canal orifices; C- CBCT image ; D- Working Length radiograph; E- Master cone radiograph; F- Obturation radiograph

DISCUSSION

This case report emphasizes the significance adequate access, use of microscope and cone beam computed tomography to improve the likelihood of detecting additional canals. The conservation of tooth structure should always be kept in mind during an endodontic access for successful restoration of the tooth after root canal treatment¹⁰. Surgical microscope brings minute details into clear view by enhancing lighting and visibility. Studies have proved that magnification and illumination has increased the detection of additional canals¹¹. Other diagnostic measures such as multiple preoperative radiographs at different angulations, examination of the pulp floor with a DGI6 explorer, use of ultrasonic tips to trough the grooves, staining the chamber floor with 1% methylene blue dye, performing champagne bubble test using sodium hypochlorite and visualizing canal bleeding points are other important aids in locating root canal orifices¹². Initially, examination of the pulp floor, following the root developmental fusion lines and exploration of hemorrhagic spots using a DGI6 aided in detecting presence of extra orifices and canals in the presented cases. CBCT is a valuable method for initial detection and evaluation of intricate anatomical morphologies of teeth. Hence, a CBCT scanning was performed for a better understanding of the complex root anatomies in the present cases. The newer CBCT scans requires less time due to its ability to acquire whole three dimensional volume of data in a single rotation. The major advantages of CBCT are its intricate details, rapid scan time and effective radiation dose when compared to conventional CT¹³. The presence of additional canals in mesiobuccal root of maxillary molars has been described in many studies. JC Kulid, DD Peters¹³ and Buhrlay LJ et al¹⁴ have concluded the occurrence of second mesiobuccal canal can be between 56.8% and 96.1%. According to Verma P et al¹⁵ and Degerness et al¹⁶, the presence of three mesiobuccal canals can vary between 1.1 and 10%. In case 1, we found three mesiobuccal canals which had Sert and Bayirli type XVIII and CBCT of contra-lateral tooth revealed similar root canal morphology. Additional canals in mesiobuccal root were commonly found in the age group of 20 to 40 years¹⁷. Surprisingly the age of the patient where three mesiobuccal canals found was 48 years. As the age advances, the root canal becomes simpler due to calcification¹⁸. Failure in maxillary first molars is majorly due to missed canal in mesiobuccal root¹⁹. Hence clinicians should be very much aware and pay attention in searching additional canals. The presence of two distobuccal canals was found to be less frequent and has been reported to be between 1.12 and 9.5% which mostly exit as single canal^{20,21}. Our second case showed two distobuccal canals which followed vertucci type II configuration. Shahi et al²² and Zheng et al²³ found the prevalence of two palatal canals in maxillary first molar to be 0.73% and 1.17% respectively. CBCT of both the cases showed six canals, where two palatal canals were found to occur in contra-lateral tooth as well. The incidence of additional canals in bilateral maxillary first molars was higher 58.78% than that of unilateral maxillary first molars which was 52.40%²³. Evaluation of post-obturation radiograph immediately is mandatory to analyze condensation and apical seal of root canal filling materials. Multiple angulations allow us to appreciate the seal of all gutta percha points in relation to apex of each root.

CONCLUSION

Clinicians should be aware of root canal variations in maxillary first molars and never underestimate it while performing endodontic treatment. The present report highlights the use of microscope and cone beam computed tomography in detecting additional canals. Thorough knowledge, diagnostic aids, location of canals without missing any and operators skill are the keys to achieve success in such complicated endodontic cases.

CONFLICT OF INTEREST

Conflict of interest declared none.

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