

Endodontic Management of a Maxillary First Molar with Three Canals and Acute Curvature in Mesio-Buccal Root – A Rare Case Report

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ABSTRACT

Anatomic variations in root canal morphology have become easier to detect with the rapid advancements in clinical and diagnostic aids. Also an increased awareness of unusual anatomic morphology and a better understanding of the root canal system guide the clinician in diagnosis and treatment of such variations in order to achieve a successful endodontic outcome. Mesio-buccal root of first maxillary molar teeth have been considered to be one of the most complex and challenging root canal systems. This case report presents a successful management of a third canal and acute curvature in the mesio-buccal root of permanent maxillary first molar using dental operating microscope along with a modified access preparation

Keywords: Maxillary molar, three mesio-buccal canals, anatomical variation, microscope.

INTRODUCTION

Permanent first molar teeth are one of the first teeth to erupt into the oral cavity and therefore possibly the most root canal indicated tooth for the endodontist. The most common cause of treatment failures in permanent maxillary first molars have been attributed to failure in detecting additional canals especially in the mesiobuccal root and therefore has resulted in more research and clinical investigation than any other root.

In 1969 Weine et al¹ provided the first clinical classification of more than one canal system in a single root and used the mesiobuccal root of the maxillary first molar as the type specimen. Studies specifically addressing the mesiobuccal root have reported that the incidence of extra root canals in vitro is greater than in vivo. Apart from this, a wide variation of root and canal configurations of the maxillary first molars have been documented in the dental literature. Most of the in vitro studies addressing the mesiobuccal root canal anatomy^{2,3} have not reported the presence of a third canal in the mesiobuccal root. Two such studies have reported their incidence to be between 1.1% and 10%^{4,5}. However its presence has been documented in only a few case reports^{6,7}.

A case report is presented that illustrates multiple root canal systems that occur in the mesiobuccal root of maxillary first molar and its successful nonsurgical root canal treatment using modified access cavity preparation.

CASE REPORT

A 26 year old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in upper right posterior region of mouth for the past one week. The patient revealed a history of mild intermittent pain for the past 2 months, which had increased in intensity during the past one week. The patient reported subjective symptoms of prolonged sensitivity to hot and cold food and drinks. The pain was spontaneous and aggravated particularly at night, and the patient required to consume analgesic to get relief from pain. The general examinations contained no abnormal data. Clinical examination revealed a deep carious lesions on the right maxillary first (tooth 16). Palpation of the buccal and palatal aspects of the involved teeth did not reveal any tenderness. However, the tooth 16 was tender to vertical percussion. The tooth was not mobile and periodontal probing around the teeth was within the physiological limits. Thermal testing of

the involved tooth with heated gutta-percha (DentsplyMaillefer, Ballaigues, Switzerland) and cold spray (Roeko Endo-Frost spray, Coltene-Whaledent, Langenau, Germany) caused an intense lingering pain, whereas electronic pulp stimulation (Parkell Electronics Division, Farmingdale, NY, USA) showed pulpal vitality on both teeth. The preoperative radiograph revealed the carious lesions closely approximating the pulp with a widened periodontal ligament adjacent to the mesiobuccal root with respect to tooth 16. Based on sensitivity tests and radiographic findings, a diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis with respect to tooth 16 was made and endodontic treatment was initiated.

After a local anesthetic was administered by use of 2% Lidocaine with 1:100,000 epinephrine, a rubber dam was applied and the access cavity was prepared. The access opening was completed and the mesiobuccal (MB1), distobuccal (DB) and palatal root canals were easily found (fig. 1A). The careful examination of the floor of the pulp chamber with surgical loupes (EyeMag® with $\times 2.5$ magnification, Dental Microscopes and Dental Loupes by Carl Zeiss Meditec) and DG-16 Endodontic explorer used to locate the extracanal orifice showed 2nd mesiobuccal root canals (MB2). Ultrasonic tips (DentsplyMaillefer, Ballaigues, Switzerland) were used to remove the dentin. Again, careful examination of the floor of the pulp chamber showed an additional root canal orifice near the MB2 canal orifice. It was located approximately 1 mm palatally from the MB2 canal orifice, and away from the MB1 canal orifice. This canal is considered as the 3rd mesiobuccal canal (MB3) (fig. 1D&1E). The working lengths were determined with an apex locator (Propex II, DentsplyMaillefer, Switzerland) and controlled radiographically. The radiograph demonstrated that MB1, MB2 and MB3 were fused in the apical third root canals. Steep curvature was found in the apical third of the mesiobuccal canal.

The cleaning and shaping of the canals were done by Protaper Gold Ni-Ti rotary files (DentsplyMaillefer, Ballaigues, Switzerland). Root canal filling done with appropriately sized gutta-percha points (DentsplyMaillefer and SybronEndo, respectively) and Sealapex sealer (Kerr Co., Romulus, MI, USA). On completion of the root canal therapy, the tooth was restored with composite resin materials. A final radiograph showed the presence of three mesiobuccal root canals (fig. 1B & 1C).

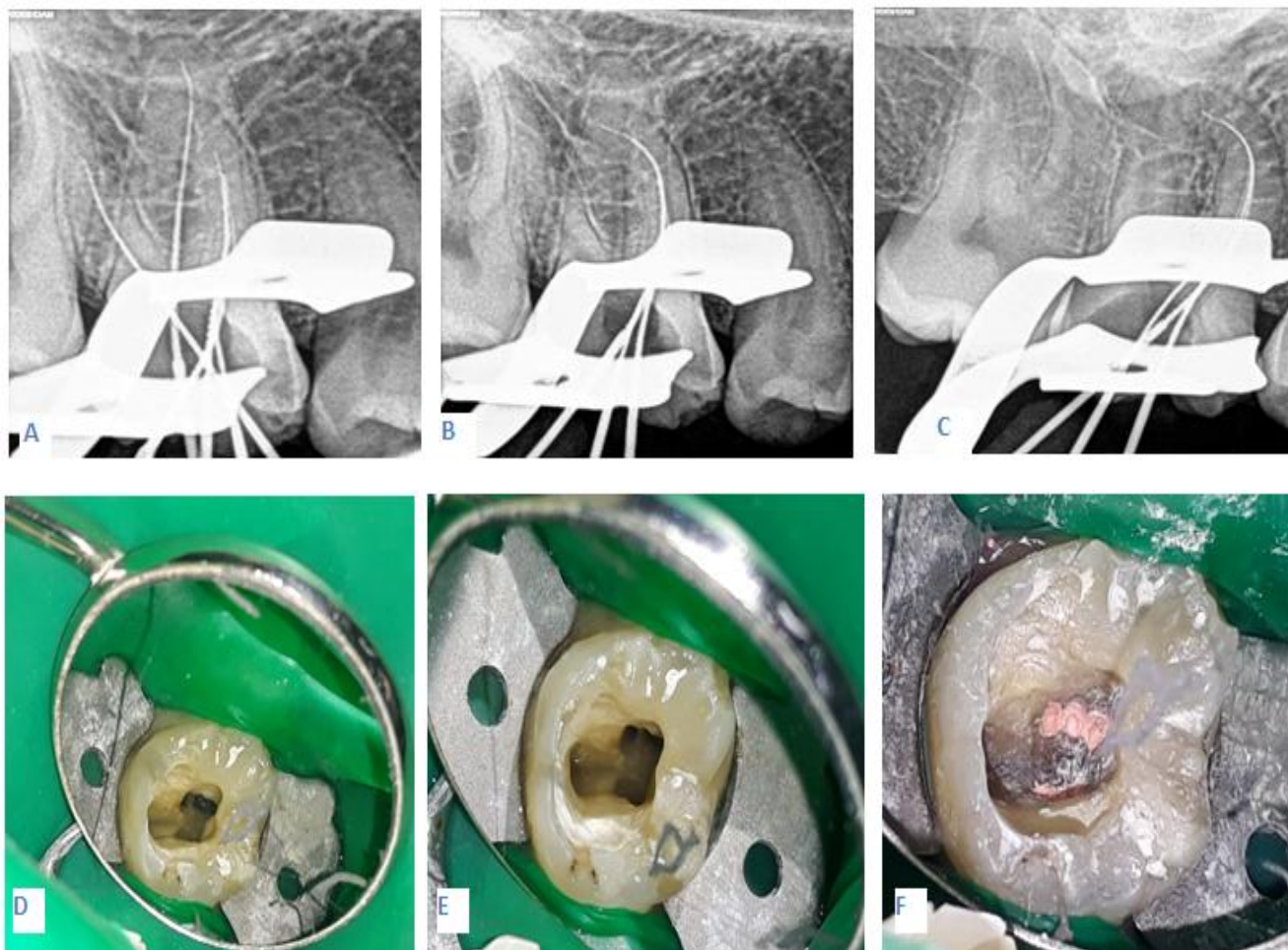




Figure 1: A-working length, B & C- working length for mesial root only reaching up to the apex, D- photograph showing 3 mesial canal, E- photograph showing all 5 canal, F- obturation of 3 mesial canals, G- obturation of all 5 canals, H & I- postoperative straight and angulated x-rays.

DISCUSSION

Traditionally, many treatment failures in maxillary molars were related to not locating additional canals in the mesiobuccal root. Despite the current high success rate achieved by root canal therapy, the permanent maxillary first molars is still associated with a considerable number of failures mainly in the mesiobuccal root due to the difficulty in locating and filling the second and/or third mesiobuccal canals^{8,9}. The causes of missed canals could be attributed to the limited knowledge of the root canal system, incomplete access preparations and clinician's dependency on two dimensional radiographs, to name a few.

These obstacles can be overcome by updating our knowledge on the complexities of the root canal system and realizing the importance of modified access preparations in such cases so as to facilitate in the detection and location of additional canals. The use of conventional radiographs for interpretation of complex root canal anatomy in the mesiobuccal roots of maxillary first molar could fall short due to superimposition of maxillary sinus, zygomatic buttress or overlapping between the roots. Detection of a third mesiobuccal root canal could be hindered radiographically because the locations of additional canals in the mesiobuccal root occur on the same plane. Hence, additional periapical radiographs should be taken by varying the horizontal angle followed by detailed examination of the radiographs.

The working length radiograph is the most informative radiograph for locating extra canals. If the endodontic files are not well centered in the canal on the radiograph, the possibility of additional canals should always be considered. Also the extra mesiobuccal canal will often show up as a dark line running nearly parallel to the file in the coronal third of the root¹⁰. The establishment of adequate access to the entire pulp chamber is the most important step in successfully locating the additional canals in the mesiobuccal root.

A number of investigators concluded that the preparation of a rhomboidal shaped access cavity rather than a traditional triangular outline form would permit straight line visualization, allowing for complete debridement of the pulp chamber and aid in localization of additional canals in the mesiobuccal root of the maxillary molars. In approximately 30% of cases, the additional use of probing with sharp explorers or cutting instruments such as a round slow speed bur to trough along the subpulpal groove starting from the main mesiobuccal canal within the pulp chamber floor is necessary to locate any additional canals in this root¹¹.

In this case, the third canal was located by modifying the access cavity from the traditional triangular outline form to a rhomboidal shape which permitted straight line visualization, allowing for complete debridement of the pulp chamber and aided in localization of the MB 3 canal in the mesiobuccal root of the maxillary first molar. The young age of the patient involved in this case may have contributed to the relative ease of identification of the third canal without the use of a SOM. This fact corroborates the findings of Iqbal and Filmore who found a correlation between caries, treatment regimens and patient age in the ultimate detection of the number of canals by the clinician in maxillary molars¹².

In this case, the modified access preparation allowed for a clear view of the pulp chamber floor that showed the presence of three bleeding points in the mesiobuccal root. Other diagnostic aids for canal location are staining the pulpal floor with ophthalmic dyes, trans-illumination or performing the champagne or bubble test with warmed 2.6% NaOCl as suggested by

Ruddle¹³. Studies with modern techniques supported by magnification and adequate illumination have reported higher rates of detection of a second canal in the mesiobuccal root of maxillary molars¹⁴. Even so, more emphasis should be placed on the importance of using magnification in locating MB 3 canal and not on which type of magnification is used. In our case SOM helped in complete negotiation and root canal therapy of all three canals successfully.

CONCLUSION

Thorough knowledge of complexity of the root canal system and its variations increased operator experience and increased time per appointment with adequate illumination help in identification and treatment of these extra canals.

ACKNOWLEDGEMENTS

The author denied any conflict of interests.

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