Case Report

Maxillary First Molar with Three Canals in Mesio-buccal Root: A Case Report

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Abstract

Usually, maxillary first molar has three canals in the three roots. The incidence of four canals ranges from 50.4% to 95% and the fifth canal is 2.25%; few authors have reported cases with six and seven canals too. With unpredictable number of canals and canal configurations, endodontic treatment of the maxillary first molars is always a challenge. In this article we are going to describe a case report of a maxillary first molar with the unusual anatomy of three canals in mesio-buccal root and its endodontic management. Dental surgeon performing endodontic treatment in maxillary first molars should always assume a greater number of canals and complex canal systems unless proven otherwise. Adequate knowledge and experience and the use of suitable diagnostic adjuncts help in enhancing the success of endodontic treatment of maxillary first molars.

Key words: Maxillary first molar, three canals in mesio-buccal root.

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Introduction

Principal objective of an endodontic treatment is the proper cleaning of the entire pulp cavity followed by perfect obturation with an inert substantial material. The most common causes of endodontic failure are missing root canals and infected spaces like lateral canals, isthmuses and deltas.[1] To overcome these problems, clinicians must have through knowledge of the external and internal anatomy of the tooth with its variation and should have advanced well equipment.[2]

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Variations in the number and configuration of the roots and their canals have been reported in the literature over the years.[3] The ability of the clinician to understand and navigate through the highly variable root canal system plays a prominent role.[4] Failure to detect and thus disinfect a canal especially in teeth with aberrant canal morphology is one of the main causes for failure of endodontic therapy.[5]

Maxillary first molar usually exhibits a radicular anatomy of three roots and three or four canals. However, different anatomic variations like abnormal number of roots and canals are possible. Many literatures could be found showing the several types of variations of root canals of maxillary molar teeth. Christie WH reported a maxillary molar with two palatal roots[6] and Zmener O showed maxillary molar with three buccal roots.[7] First recognized publication of maxillary first molar with three canals in mesio-buccal canal was reported by Richard G.Beatty in 1984.[8] Ferguson DB also showed a maxillary molar tooth with three canals in mesio-buccal root.[9]

This case report presents the unusual maxillary first molar anatomic configurations with three canals in mesio-buccal root and the successful management of it with one & half year follow up.

Case Report

In this case report a 32 years old male patient reported to our Endodontic Center (IMA Dental Care and Root Canal Center, Uttara, Dhaka, Bangladesh) with pain and swelling in upper left posterior segment for few days. On clinical examination- a faulty temporary restoration, swelling in attached gingival and discharging sinus track were found in the buccal mucosa of maxillay left first molar tooth. Patient had history of root canal treatment on that tooth. Intraoral peri-apical radiographs (IOPR) were taken (with Vatech-RVG sensor and Runyes Dental X-ray Unit, China) and short obturation with missed canal in mesio-buccal root was seen. Clinical diagnosis was secondary symptomatic apical periodontitis. Re-root canal treatment was planned for the management of this case.

The operative field was properly isolated with rubber-dam (Kuraray Co. Ltd. Japan). Access cavity was created with round diamond bur. Ultrasonic tip was used to remove the dentine overhang to explore the missing canals. After proper exploration we found single palatal and distal canal, three mesio-buccal canals. Combination of Apex locator (E-pex by Eighteeth, Changzhou Sifary Medical Technology Co.,Ltd.) and IOPR technique (with Vatech-RVG sensor and Runyes Dental X-ray Unit, China) were used to determined the working length. Measured working length were: Palatal canal-19mm (coronal reference point was palatal cusp), Disto-buccal canal-18mm(coronal reference point was Disto-buccal cusp), Mesio-buccal-1(MB1) canal-17mm(coronal reference point was Mesio-buccal cusp), Mesio-buccal-2(MB2) canal-17mm(coronal reference point was Mesio-buccal cusp), Mesio-buccal-3(MB3) canal -17.5mm(coronal reference point was Palatal cusp).

Gutta-perchas were removed with the aid of H-files and negotiations of the canals were done with number 10 k-files. Canal configuration of MB1, MB2 & MB3 was-separate canal orifice and separate apical foramen (3-3). Cleaning and shaping of root canals were done by crown down technique. Final apical file were; Palatal-30/4, Disto-buccal-25/4, MB1-20/4, MB2-20/4,MB3-20/4. As irrigants EDTA, Sodium hypochlorite(5.25%) and Chlorhexidine 2% with side vented needle were used; normal saline was used as an adjunct to irrigation solution. Ultrasonic activation of Sodium hypochlorite was done with Ultra X(Eighteeth). In obturation- warm vertical compaction by Fast Pack (Eighteeth, Changzhou Sifary Medical Technology Co., Ltd.) was applied. Guttapercha was used as filler and Sealapex by Kerr dental was used as calcium hydroxide based sealer. Post endodontic restoration was done with CLEARFIL AP-X composite restoration (By Kurary America, Inc). No endodontic mishap occurred in this case. After one and half year follow up, no abnormal clinic-pathological or IOPR findings were seen.

Figure 1: Initial IOPR

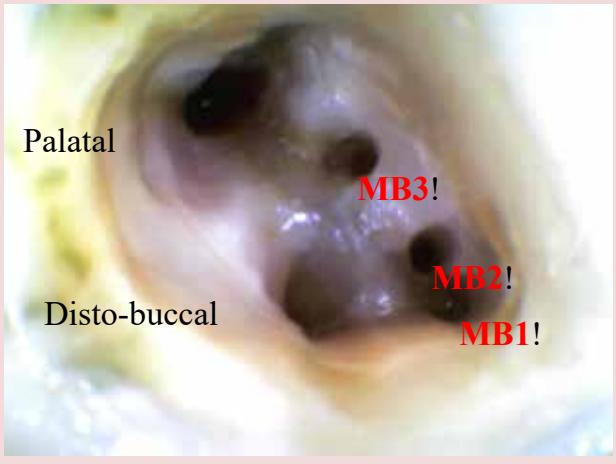

Figure 2: Location of all canals in pulp chamber

Figure 3: Radiographic working length measuring

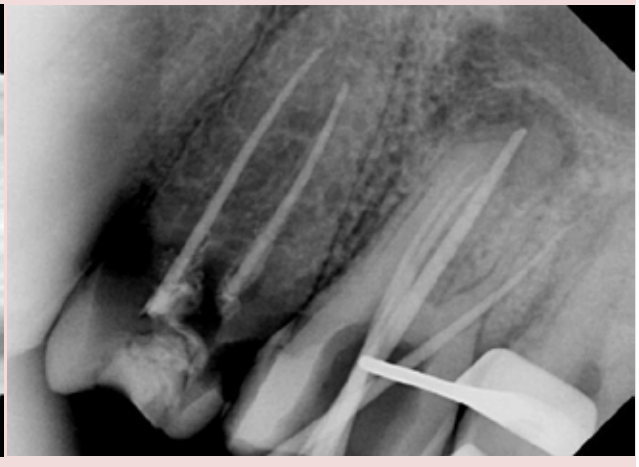

Figure 4: Pre-seal radiograph

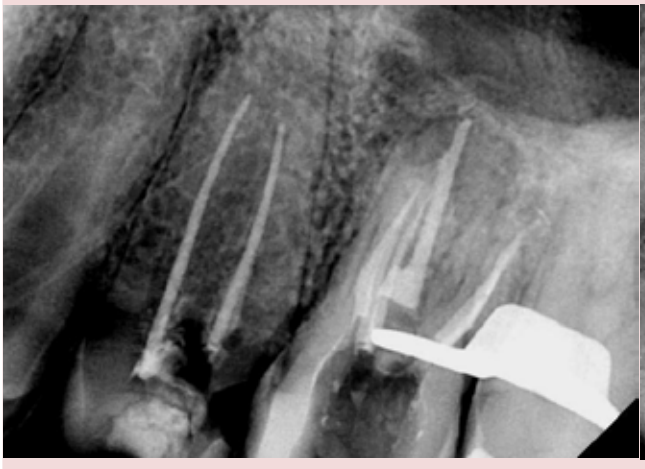

Figure 5: After obturation

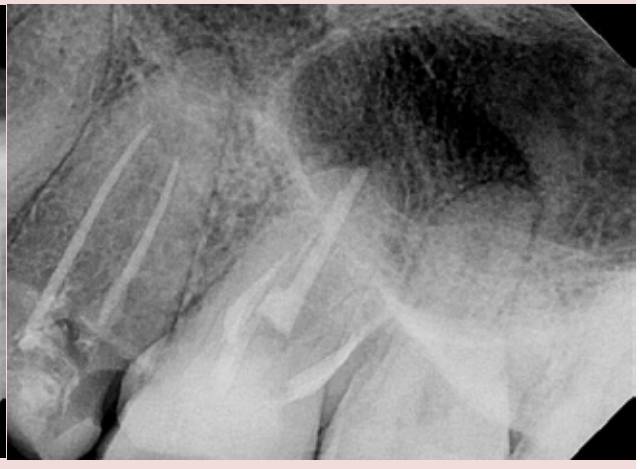

Figure 6: Follow up IOPR

(After one and half year) on 25.06.2022

Discussion

The reported third canal in this study was located without the aid of the surgical (endodontic) microscope.

The reality is that as a third canal has been located in the mesio-buccal root of the maxillary permanent first molar this emphasizes the need for thorough evaluation of canal anatomy during endodontic procedures. Certainly, an Endodontist should assume that additional canals exist and satisfy only when all measures have been tried in locating them. The fact is that, this third canal was located without the use of a dental loupes or an endodontic microscope.

Several studies report a significant difference on the number of located canals when comparing examinations of the pulp chamber with or without magnification.[10-12] The use of CBCT has also been described as useful when trying to understand the root canal anatomy.[13] Different anatomic variations could be occurred on maxillary first molars. Blaine M. Cleghorn reported the incidence of one canal in the mesio-buccal root is 43% and of two canals is 56.8%[1] in a weighted average of 34 different studies. According to Frank J. Vertucci'sclassification,[15] root canal morphology are eight types that are described as follows- Type I (1-1): a single main canal is present starting from the pulp chamber to the root apex, Type II (2-1): two separate canals leave the pulp chamber but join to form one canal to the apex, Type III (1-2-1): one canal leaves the pulp chamber and divides into two smaller canals which later merge again to exit through one canal, Type IV (2-2): two separate as well as completely distinct canals run from the pulp chamber to the root apex, Type V (1-2): there is a single canal exiting the pulp chamber which divides into two canals with separate apical foramina, Type VI (2-1-2): two separate canals join at the middle of the root to form one canal which extends till the apex, just short of the apex, and again divides into two, Type VII (1-2-1-2): the canal starts as a single until the middle third of the root then divides into two separate canals that rejoin after some distance and then, near the apex, divides into two again, Type VIII (3-3): the pulp chamber near the coronal portion divides into three separate canals extending till the apex. In our case three canals in mesio-buccal root was Type VIII.

In recent years the percentage of extra canal has been alarmingly on the rise, mainly due to advanced diagnostic techniques with enhanced anatomical knowledge and the operator's keenness in detecting these variations.[3] Dental radiographic assessment is an essential tool for endodontic diagnosis. Conventional intraoral periapical radiographs are routinely used during endodontic diagnosis to examine the tooth, identify the pathology and plan the treatment. But a conventional radiograph is a 2D image of a 3D object and therefore has limitations. Several previous studies have demonstrated the effective use of CBCT in the assessment of complex endodontic cases.[13] With CBCT, it is possible to reconstruct overlapping structures at arbitrary intervals.

Gorduysuset. *et. al.* [16] concluded in his study that, without the aid of magnification extra mesio-buccalcanal could be located in 93.3% cases and among these cases canal negotiation could be possible in 69% cases. But with the assist of the endodontic microscope that could be negotiated up to 80% cases. Buhrleyet al.[17] found that those practitioners using the microscope could locate extra mesio-buccal canal 57.4% of the time, and those using dental loupes 55.3%. When no magnification was used, extra mesio-buccal canals were located only 18.2% of the time. Wolcott et al.[18] along with five endodontics examined 1873 conventionally treated and retreated maxillary molars over a 2 years period, they noted a significant difference in the incidence of extra mesio-buccal canals located during initial treatments and re-treatments. They concluded that failure to locate and treat mesio-buccal canals decreases the long-term prognosis of endodontic therapy in maxillary molars. The young age of the patient involved in this case could have played a role in the relatively easy identification of the third canal without the use of a surgical operating microscope.

Canal configuration of mesio-buccal three roots are varies from case to case,Ayranci LB et. al[19] reported vertucci's additional type XVIII (3-1); Kakkar P[20] and Favieri A[21] reported unique vertucci's type I (1-1) in MB1 canal and vertucci's type II (2-1) in MB2 & MB3 canals in a single root. Where Kottoor J[22] reported vertucci Type II (2-1) for MB1 & MB2 canals and vertucci's type I canal pattern in MB3. In our study we found vertucci's type VIII canal pattern in mesio-buccal root (three separate canals extending till the apex).

Conclusion

Dental surgeon performing endodontic treatment in maxillary first molars should always assume more number of canals and complex canal systems unless proven otherwise. The skill to differentiate between the closely located canals within a root has always been a matter of concern for the clinician. When indistinct images of the canals are presented in preoperative Xray images, the clinician must consider the possibility of two canals or extra canals. In such a situation the possibilities that the newer imaging solutions, which remove the subjectivity from the diagnostic process are very encouraging. It can thus be safely concluded that adequate knowledge and experience and the use of suitable diagnostic adjuncts helps in enhancing the success of endodontic treatment of maxillary first molars.

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