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Endodontic Management of a Maxillary First Molar with Taurodontia and Two Palatal Canals: A Case Report

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ABSTRACT

The present case report describes an endodontic treatment of a three-rooted maxillary first molar with taurodontia and a palatal root with two separate canals. Maxillary first molar with two palatal canals is rare since extra canals are found most in the mesiobuccal root as the second mesiobuccal canal. Clinicians should have a thorough knowledge of the root canal system and internal anatomy and be alert about the possible existence of any variation in the canal morphology because it determines the successful outcome of an endodontic treatment.

Keywords: Anatomic Variation; Maxillary First Molar; Taurodontism

Introduction

The primary objective of endodontic treatment is to prevent and intercept pulpal/periradicular pathosis to preserve the natural dentition when affected by pathosis [1]. One of the main causes of endodontic treatment failure is the inability to negotiate, clean, or obturate all the existing root canals [2, 3]. Deep knowledge of root canal morphology is a very important aspect of the success in root canal treatment.

The permanent maxillary molars have one of the most challenging anatomies for endodontists, and their morphology has been extensively revised [4]. The most common anatomy of the maxillary first molar is three roots with three canals (one mesiobuccal, one distobuccal, and one palatal) and an incidence of about 55% to 70% of four root canals, two of which are usually present in the mesiobuccal root [5, 6].

One of the most important abnormalities of the morphology of the maxillary molars teeth is taurodontism. Taurodontism is a developmental disturbance of a tooth that lacks constriction at the level of the cementoenamel junction (CEJ) and is characterized by vertically elongated pulp chambers as well as apical displacement of the pulpal floor [7]. The term "taurodontism" was coined from the Latin term tauros, which means bull, and the Greek term odus, which means tooth (or) bull tooth [8]. It is thought to be caused by the failure of the invagination of Hertwig's epithelial sheath diaphragm at the proper horizontal level, resulting in a tooth with short root, the enlarged pulp chamber, and normal dentin [9]. Taurodontism has been graded according to its severity as least pronounced (hypotaurodontism), moderate (mesotaurodontism), and most severe (hypertaurodontism), in which the bifurcation or trifurcation occurs near the root apices [10].

The frequency of maxillary molar tooth with two palatal roots is low; however, in the literature, few cases were reported on this topic. Slowey [11] reported a maxillary second molar with two palatal roots for the first time, Shahi *et al.* [12] reported 0.73% of the first molars with two palatal canals, and Zheng *et al.* [13] reported a prevalence rate of 1.17% for the presence of an extra canal in the palatal roots. Stone and Stroner [14] examined approximately 500 extracted maxillary molar teeth, and found a prevalence rate of less than 2% for the presence of additional canals in the palatal roots of maxillary molars; moreover, they reported the variations of the palatal root of maxillary molars; these include a single root with two

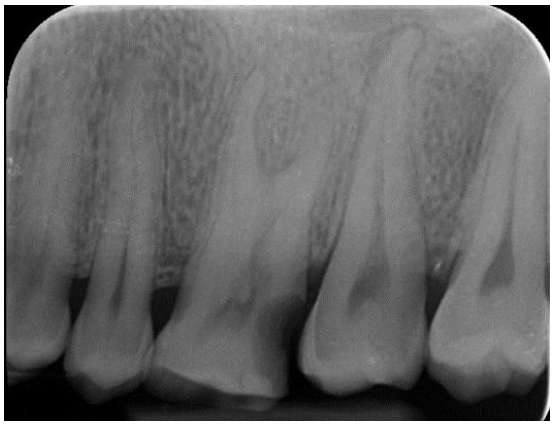


Figure 1. Pretreatment periapical radiograph of upper left first taurodontic molar shows deep disto-occlusal caries

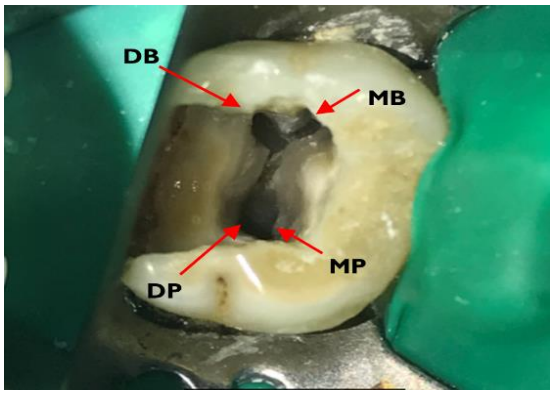


Figure 2. Clinical photograph showing isolated maxillary first molar with mesiobuccal (MB) distobuccal (DB), mesiopalatal (MP) and distopalatal (DP) canals

separate orifices, two separate canals, and two separate foramina; or two separate roots, each with one orifice, one canal and one foramen; or single root with one orifice, a bifurcated canal, and two separate foramina.

In a retrospective clinical study, Christie *et al.* [15] evaluated the endodontic treatment on 16 maxillary molars with two palatal roots performed for 15 patients and six extracted teeth and classified them into three types as follows:

Type I maxillary molar: two widely divergent palatal roots which are often long and tortuous. The buccal roots are often "cow-horn" shaped and less divergent and all roots can be seen on a radiograph.

Type II maxillary molar: four separate roots in which the palatal root is often shorter, run parallel, and the root apices are blunt. A radiograph with buccolingual superimposition may make this type of maxillary molar appear as having only a mesial and a distal root.

Type III maxillary molar: the roots are constricted in morphology with the mesiobuccal, mesiopalatal, and distopalatal canals engaged in a web of root dentin. The distobuccal root in these cases appears to stand alone and may even diverge to the distobuccal direction.

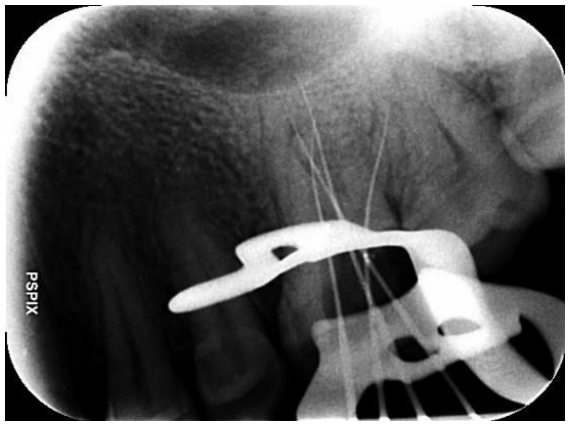


Figure 3. Working length determination was done by #15 K file

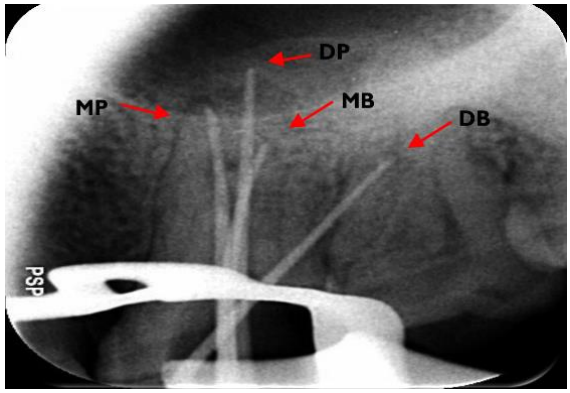
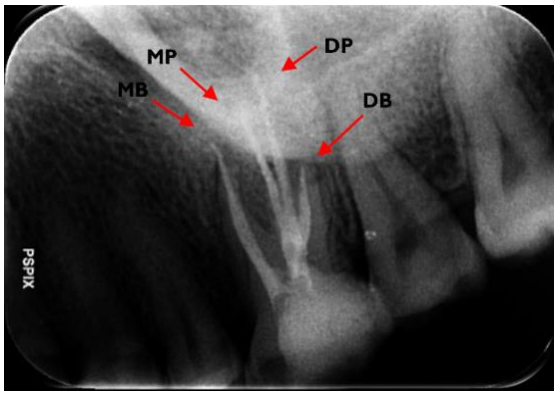


Figure 4. Master cone radiograph shows mesiobuccal (MB) distobuccal (DB), mesiopalatal (MP) and distopalatal (DP) canals

This case report presents a maxillary first taurodontic molar with three roots with four canals, including two separate palatal canals, one distobuccal, and one mesiobuccal canal.

Case report

A 35-year-old man presented to the Department of Endodontics, Dentistry College, Tehran University of Medical Sciences with a chief complaint of pain in the upper left back tooth region for more than four days which was elicited by drinking cold liquid and during mastication. The patient's medical history was non-contributory. On clinical examination, disto-occlusal decay was seen in the upper left first molar without any periapical abscess or sinus tract. Also, the periodontal examination was done with a graduated periodontal probe and revealed a normal probing depth. The tooth was tender to percussion, with a positive response to sensibility tests in the form of severe discomfort after cold testing with the Endo Ice (Maquira, Parana, Brazil). Radiographic examination revealed a deep disto-occlusal caries extending up to the pulp chamber with normal



periapical tissues (Figure 1).

Figure 5. Post-obturation periapical radiograph shoes separated four root canals

These findings led to the diagnosis of irreversible pulpitis with symptomatic apical periodontitis for which root canal therapy was deemed necessary.

Treatment

After a thorough discussion about the treatment and its outcome, root canal therapy was initiated with the patient's informed consent. Profound local anesthesia was achieved with one cartridge infiltration (2% Lidocaine with 1:80,000 epinephrine) and the absolute isolation with a rubber dam. All the caries were removed with the help of a round bur using a slow-speed handpiece, and the access cavity was made using endo-access bur. The main canals were located, which are the mesiobuccal, distobuccal, and palatal canals. A small hemorrhagic point was noted adjacent to the palatal orifice. The second palatal canal negotiation was done under magnifying loupes with 3.2× magnification (QuickWhite QuickLase,Germany) using DG16 to assess the second canal (Figure 2). Smaller K-file #10 (Dentsply Maillefer, Ballaigues, Switzerland) was used to check for canal patency, and the canal was negotiated and enlarged to K-file #15. The working length determination was done through Root ZX apex locator (J. Morita USA, Inc., Irvine, CA, USA) and confirmed by a radiograph (Figure 3).

Initial instrumentation was done up to #25 K-file (Dentsply Maillefer, Ballaigues, Switzerland) to full working length with copious sodium hypochlorite irrigation (2.5%) and normal saline (0.9%). Next, intracanal medicament (calcium hydroxide mixed with saline) was placed in the root canal and the access cavity was sealed with zinc oxide eugenol(Perfection Plus Ltd, United Kingdom). The second appointment was arranged for one week later.

At the second visit, the patient was asymptomatic. The clinician recommended that the root canal anatomy should be evaluated with three-dimensional cone-beam computed tomography (CBCT). The patient was informed about the unusual root canal anatomy of this tooth; however, the patient declined this and preferred to complete the treatment without CBCT evaluation. Then, final instrumentation was done using 25/0.06 Neoniti A1 (NEOLIX, Châtres-la-Forêt, France) with 17% ethylenediaminetetraacetic acid (DiaPre Pro, DiaDent, Korea) and copious irrigation of sodium hypochlorite (2.5%). Final irrigation was done with a copious amount of saline (0.9%). A Master cone radiograph was taken (Figure 4). The canals were dried with absorbent paper points (META BIOMED, Cheongju, South Korea) and obturated by lateral condensation technique with gutta-percha (META BIOMED, Cheongju, South Korea) and resin-based root canal sealer (ADSEAL, META BIOMED, Cheongju, South Korea). The tooth was provisionally sealed, and the patient was referred for restorative treatment (Figure 5).

Discussion

In this paper, we reported an anatomic variation of a taurodontic maxillary first molar with a palatal root with two separate canals and two buccal roots. The canal configuration found in our case in the palatal root can be classified as type IV according to Vertucci classification [16] that is one root with two canals having separate apical foramen.

The taurodontic tooth shows a wide variation in the size of the pulp chamber, varying degrees of canal configuration like apically displaced furcation with a shorter root length and a less marked cervical constriction. The reported rate of occurrence ranges from 0.57% to 4.37%[17]. Taurodontism appears most frequently as an isolated anomaly; it has also been associated with several syndromes and anomalies, including Klinefelter's, Down's, tricho-dento-osseous syndrome, and others [17]

The final outcome of endodontic treatment depends on the complete filling and sealing of the root canal system after proper chemo-mechanical debris removal and disinfection. However, one of the most important reasons for endodontic treatment failure is the presence of micro-organisms due to incomplete instrumentation, inadequate cleaning, insufficient obturation, and missed canals [18]. This contingency can occur particularly in teeth that have anatomical variations or additional root canals [19].

Anatomical variations frequently happen in maxillary molars, and the presence of two palatal canals/roots in the first maxillary molars is less common than the second maxillary molars; however, the evaluation of preoperative radiograph, especially in different angulation, is necessary to detect the anatomical variations of maxillary molars [20]. Moreover,

CBCT is a useful device for evaluating root canal anomalies and can also be used for intra- or post-operative assessment of treatment complications [21]. In the present case, the patient had been informed about the unusual anatomy of his tooth, so he was advised to take a CBCT image to be sure about the root canal anatomy, but the patient declined and preferred to complete the treatment without CBCT evaluation

Clinicians should be aware of the configuration of the tooth's pulp space that is to be treated and should have the skill and proficiency to locate even the additional canals and canals located in unusual locations using modern magnification tools, *e.g.* loupes or surgical operating microscopes [20].

Conclusion

This manuscript demonstrates the successful endodontic management of a left maxillary first taurodontic molar with two palatal canals. It also highlights the need for the clinician to have a thorough knowledge of unusual anatomical variations and canal configurations. Proper clinical examination and visualization through magnification devices like microscope as well as careful examination of radiographs and understanding the internal anatomy of teeth are essential for a successful endodontic treatment.

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