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Unravelling the Mystics of Diagnosis and Management of Maxillary Molars: A Case Series

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Abstract

Aim: To present and describe the management of anatomical variations in maxillary first molars, one of the cases had unusual distal canal anatomy showing two distobuccal canals while other two cases exhibited 2 separate palatal canals.

Summary: Thorough knowledge of root canal anatomy is essential for successful endodontic therapy. There are both external and internal anatomic variations in maxillary molars, which could affect treatment outcome. This paper presents the endodontic management of a maxillary first molar with two palatal canals in one root (Vertucci type IV) and maxillary molar with 2 distobuccal canals (Vertucci type IV) in distobuccal root. It presents a rare case of maxillary third molar with 2 palatal canals (Vertucci type II) in palatal root. This case report is intended to reinforce clinician's awareness of the variable morphology of root canal system in maxillary molars.

Keywords: *Maxillary Molar; Unusual Root Anatomy; Variations; Vertucci's Configuration*

Introduction

The complexity of root canal morphology, especially in multirooted teeth can deter the success of endodontic therapy. It is a prerequisite to have knowledge of the most common anatomic characteristics and their possible variations otherwise failure of endodontic treatment is imperative. Thus, success of endodontic therapy is strictly dependent on thorough cleaning, complete debridement and three dimensional obturation of root canal system. Anatomic characteristics of permanent maxillary molars are generally described as a group of teeth with three roots, one palatal and two buccal, each root with one root canal. The occurrence of a second mesiobuccal canal when there are four canals also is common. The anatomic variability percentile with mesio-buccal root varies according to various authors, but they all agree on one fact: they may be present in more than half of cases [1,2]. The distobuccal and palatal roots usually have one canal each, although rare variation may be a second canal or two separate roots.

The prevalence of maxillary first molar with 2 distobuccal canals is 1.64 - 9.5% [3]. The frequency of a maxillary molar with two roots or two palatal canals is very low, 3.9 and 1% respectively [4].

Baratto-Filho., *et al*. (2009) assessed internal morphology of maxillary first molars by 3 different methods [5]. They found that second palatal canal prevalence in ex vivo assessment, 2.05%, in clinical assessment, 0.65%, and by cone-beam computed tomography, 4.55%.

This case report describes the diagnosis and successful endodontic management of 3 cases of three-rooted maxillary molar presenting with four root canals: two cases were documented with two palatal canals in one palatal root canal while another case with two separate distobuccal canals in one distobuccal root.

Case Report

Case 1

A 40-year-old female patient was referred to our clinic for endodontic treatment of right maxillary first molar, with a chief complaint of "food impaction in the upper right back tooth with history of pain". Her medical history was not contributory. Clinically the tooth had a deep carious lesion on the proximal surface. The tooth was tender to percussion. Pulp vitality testing of the involved teeth with cold showed delayed response, indicative of symptomatic pulpitis. The periapical radiograph revealed widening of the periodontal ligament and wide palatal canal anatomy (Figure 1). Clinical and radiographic features lead to a diagnosis of acute irreversible pulpitis, indicating the need for endodontic treatment.

Figure 1: *Intraoral periapical radiograph.*

After anesthesia, access opening was done under rubber dam. The pulpal floor exhibited four distinct canal orifices, two in the buccal and two in the palatal. The chamber was troughed well for MB2 under magnification (12.8X Seiler, Germany) The palatal canal showed two distinct palatal canals with vertucci's type IV configuration. Canals were cleaned and shaped till 25,6% in mb and db canals and 30, 6% in palatal canals. Cleaning was effectively done using 5% sodium hypochlorite solution (Prime Dental Product) and activation was done by intracanal heating of irrigant and ultrasonic activation (Cricendo, Mumbai). Obturation was done using warm vertical condensation technique using EQ V (Micro-Mega). Vertucci's type IV configuration was seen in palatal root of 16. Tooth was temporized (Figure 2) and recalled after 7 days for final post endodontic restoration.

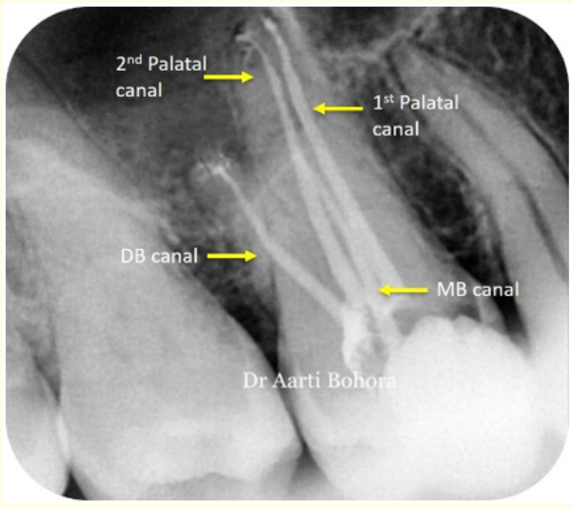

Figure 2: *Post obturation radiograph.*

Case 2

A 35 year old patient was referred to our clinic for endodontic treatment with 28. The patient complained that she felt a localized intermittent pain on chewing. However, the tooth was sensitive to percussion and there was no mobility. The vitality tests (electric pulp tester) showed delayed response. The radiograph revealed widening of periodontal ligament. The clinical and radiographic findings indicated of symptomatic apical periodontitis. An endodontic treatment was planned, posterior superior alveolar nerve block and infiltration was administered and the tooth was isolated with rubber dam. Access to the pulp chamber was made; three canal orifices (mesio-buccal, disto-buccal and palatal) were immediately detected using DG16 explorer. As palatal canal seemed off-centre, thorough probing adjacent to the palatal canal showed a sticky spot that seemed like an extra canal, slight troughing thus revealed an additional fourth canal (Figure 5).

Observation of the pulp chamber under magnification 2.5X with the aid of magnifying loupes (Seiler) was done and all the four canals and extra canal if any was confirmed. An Apex locater propex II (Dentsply USA) was used to verify working lengths. Pulp extirpation was done, and all the four canals were cleaned and shaped till 25,6% and 30,6%. During instrumentation, copious irrigation was performed with 3% sodium hypochlorite. Intracanal heating of irrigants was done followed by ultrasonic activation and root canals were dried with

sterile paper points. Obturation was performed using continuous wave condensation technique using non-standardised GP (Sure endo) and EQ V(Micro-Mega, France). Post-operative verification was done and the access cavity was filled with temporary filling (MD Temp) (Figure 3). Classic Vertucci's type II (2-1) canal configuration was seen in palatal root of 28.

Figure 3: *Post-operative radiograph.*

Case 3

A 25-year-old male patient was referred to our clinic for endodontic treatment of right maxillary first molar from a colleague dentist. The patient had initially reported with a chief complaint of continuous severe pain on hot and cold substances. He had no significant medical history. He was referred to us because despite of initiation of root canal therapy and complete cleaning and shaping, the pain was not relieved (Figure 4). After anesthesia, access opening was modified under rubber dam. The pulpal floor exhibited three distinct canal orifices, two in the buccal and one in the palatal. The chamber was troughed well for MB2 under magnification (12.8X Seiler, Germany), MB2 was located and checked for patency. There was another soft spot located near the distobuccal canal. On probing with DG16 (Hu friedy) second distobuccal canal was located.

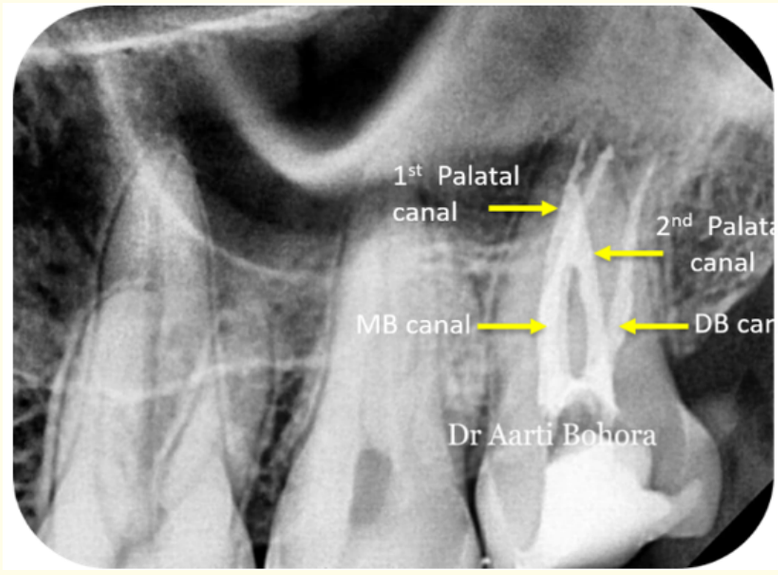

Figure 4: *Intraoral periapical radiograph.*

Canals were cleaned and shaped till 25,6% in mb and db1, db2 canals and 30, 6% in palatal canal. Cleaning was effectively done using 5% sodium hypochlorite solution (Prime dental product) and activation was done by intracanal heating of irrigant and ultrasonic activation (Cricendo, Mumbai) (Figure 5). Obturation was done using warm vertical condensation technique using EQ V (Micro-Mega). Tooth was temporized (Figure 2) and referred back to the previous dentist. The post-operative radiograph (Figure 6) shows Vertucci's type IV canal configuration of distobuccal canals in the distal root.

Figure 5: *Clinical picture showing all four canals and sodium hypochlorite bath.*

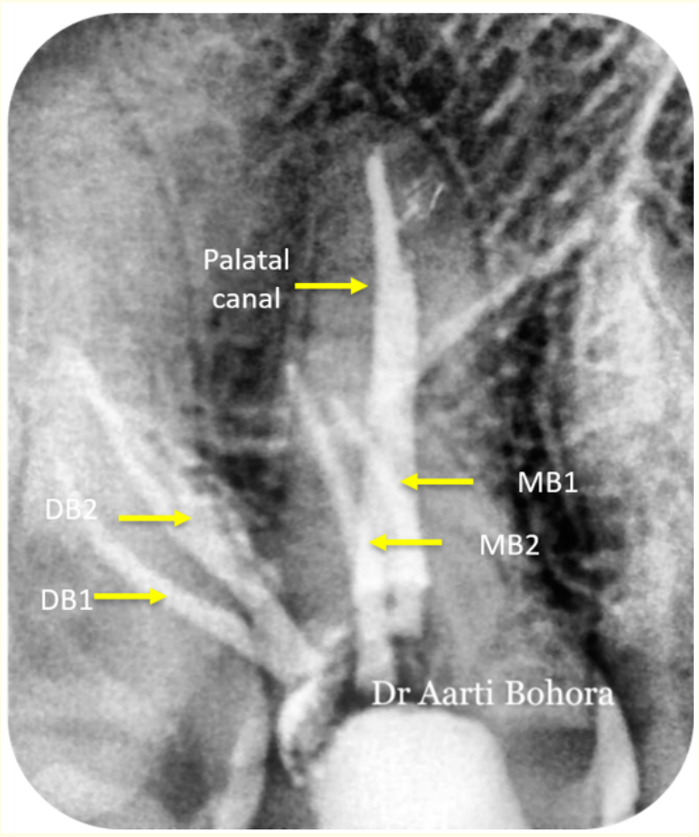

Figure 6: *Post-operative radiograph.*

Discussion

The present case report describes the nonsurgical endodontic management of maxillary molar with unusual anatomy. Incidence of two palatal canals in maxillary first molars is low (1%). There are some case-reports that have described two palatal canals in one palatal root in maxillary first molars (Table 1).

Investigators	Study type	Key information
Johal 2001 [13]	Clinical RCT	2MB, 1DB, 2P
Holderrieth and Gernhardt 2009 [14]	Clinical RCT	2 cases: 2MB, 1DB, 2P
Aggrawal., *et al.* 2009 [15]	Spiral CT	1MB, 1DB, 2P
Deepalakshmi., *et al.* 2009 [16]	Spiral CT	2MB, 1DB, 2P

Table 1: *Review of case reports of two palatal canals in one palatal root in maxillary first molar. MB: Mesiobuccal; DB: Distobuccal; P: Palatal.*

Incidence of two distobuccal canals in distobuccal root in maxillary first molar is 1.64% - 9.5% [3]. Studies on maxillary first molar have reported the most common canal system morphology of the distobuccal root was a single canal (93.3%). Two canals were found 1.7% of the time of which a single apical foramen was present 98% of the time, hence showing 2nd distobuccal canal being a rare occurrence [4]. 2 or more distobuccal canals were reported in about 9.50% of the teeth studied of which 97% ended into a single apex [4]. In another study 1.64% of cases had 2 distobuccal canals of which 98.4% of the cases ended into single canal at the apex [6]. It can be concluded from these reports that the incidence of two distobuccal canals with two distinct apical foramina in maxillary first molar is less than 5% thus making it a rarity. Our case report shows a maxillary first molar with one distobuccal root and two distobuccal canals exiting in two distinct apical foramina.

Incidence of two palatal canals in maxillary third molar is not been reported. A thorough literature search in PubMed site revealed that the present case is the first reported case of endodontic management of a maxillary third molar with 2 palatal canals.

Anatomical variations in permanent maxillary molars are unusual and they have play a conclusive role in the success of endodontic therapy [7]. The present manuscript presents three distinct cases showing variations. Case one show post obturation radiograph having two palatal canals in maxillary first molar while case two shows post obturation radiograph with one palatal root and two palatal canals in maxillary third molar. Case 3 shows post obturation radiograph of maxillary first molar with 2 distobuccal canals in distobuccal root. From a clinical standpoint, radiographic or other images provide clinicians with the most appropriate method to detect variations in both root and canal anatomy [8]. Pecora., *et al*. [9] recommended the use of two diagnostic radiographs, of which one was ortho-radial and the other taken either 30° mesially or distally, according to the anatomical location of the tooth being examined. If a radiograph shows a sudden narrowing or even a disappearing pulp space, the canal diverges at that point into two parts that may either remain separate or merge before reaching the apex [10]. The presence of an additional canal should be suspected whenever an instrument demonstrates an eccentric direction on deeper penetration into the canal, termed directional control, as reported by Tagger., *et al.* [11] or if a length file appears off-centre on the radiograph.

There are following various methods besides normal procedural protocols to detect additional roots and canals:

1. Evaluation of multiple radiographs: Take two angled radiographs, one from mesial and other from distal.
2. Digital radiography: This is recommended due to the diversity of software, especially in the diagnosis of un-detected and untreated canals [12].
3. Coronal flaring: To improve visualisation of the canal orifices
4. Troughing: The pulp chamber floor should be examined with a sharp explorer
5. White line test: The pulpal floor meets the dentinal walls and creates a groove which can be followed to detect canal orifices.
6. Ultrasonics: The grooves should be followed with ultrasonic tips.
7. Enhanced vision: Loupes or dental operating microscope are helpful.
8. Additional imaging techniques: CBCT can help find all elusive canals.
9. Champagne bubble test and dyes.

Conclusion

This case report serves to remind the dental practitioners of the complexities in root canal morphologies that the maxillary molars can exhibit. A clinician should have a thorough knowledge of both external and internal anatomical variations from normal and should perform meticulous examination and treatment. As “eyes see only what the mind knows”, thus enhancing one’s expertise is a key to successful endodontic treatment.

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