Aberrant Canal Configuration of the Maxillary First Molar: A Case Report

Rajiv Bali[1], Anshuman Kharbanda[1], Harkanwal Preet Singh[2]

[1]Department of Conservative Dentistry & Endodontics, LuxmiBai Institute of Dental Sciences & Hospital, Patiala, Punjab. [2]Department of Oral Pathology, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab

Abstract

Aberrations in the root canal anatomy are a commonly occurring phenomenon. A thorough knowledge of the basic root canal anatomy and its variations is necessary for successful completion of the endodontic treatment. Maxillary first molars usually have three roots and three or four canals (two mesiobuccal canals, one distobuccal and one palatal canal). The incidence of two palatal canals in a palatal root is quite rare. This case provides an evidence of variations in the root canals in palatal root of maxillary first molar. Clinicians should thoroughly examine the pulpal floor and radiographs for the possibility of additional canals. The clinician must know not only the normal root canal anatomy but also variation from the normal. It is also paramount for the clinician to seek out every possible aberration of root canal anatomy for all teeth undergoing treatment.

Key Words: Maxillary molar, Two palatal canals, Aberrant canal

Introduction

Knowledge of both the normal and abnormal anatomies of the root canal system dictates the parameters for the execution of root canal therapy and this can directly affect the outcome of the endodontic therapy [1]. Many unusual canal configurations and anomalies in the maxillary first molars have been documented in case reports and several studies. There are numerous variations in the canal number and configuration in maxillary molars [2]. In maxillary first molars, mesiobuccal roots tend to have more variations in the canal system followed by the distobuccal root, whereas the palatal root has the least.

The maxillary first molar most commonly has three or four canals, with one canal in both the palatal and distobuccal roots and one or two in the mesiobuccal root [1]. Most of the clinical literature on the fourth canal in maxillary molars reports an additional mesiobuccal canal (MB2). In addition to these studies, the literature cites the variation in the palatal root of the maxillary molars as a single root with 2 separate orifices, 2 separate canals, and 2 separate foramina; 2 separate roots, each with 1 orifice, 1 canal, and 1 foramen; and a single root with 1 orifice, a bifurcated canal, and 2 separate foramen, with a trifurcation at the apical third in the palatal canal. The incidence of two root canals in the palatal root of maxillary molars has been reported to be 2- 5.1%.

This case report intensifies the complexity of maxillary molar variation and is intended to reinforce the clinician's awareness of the rare morphology of root canals. It presents endodontic therapy of a permanent maxillary, first molar with 2 canals in a single palatal root.

Case History

A 23-year-old male presented to the Department of Conservative Dentistry and Endodontics, with the chief complaint of pain on chewing associated with the left maxillary first molar. On clinical examination revealed a deep carious lesion in the same tooth. The tooth was painful on percussion and gave exaggerated response to thermal and the electric pulp tests. The preoperative radiographic evaluation of the involved tooth indicated caries, which approximated the pulp with the normal root canal anatomy and the widening of the periodontal ligament space *(Figure 1)*. After thorough clinical and radiographic examination, a diagnosis of chronic irreversible pulpitis with apical periodontitis was made and the patient was prepared for endodontic treatment. The patient's medical history was found to be non-contributory. The tooth was anaesthetized by using 2% lidocaine with 1:100,000 adrenaline. After isolation by using a rubber dam, a conventional endodontic access opening was made.

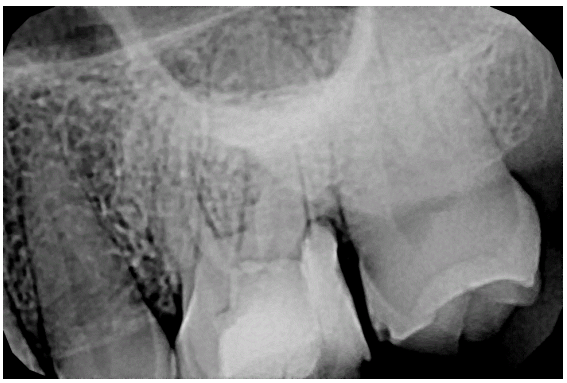

Figure 1. Preoperative Radiograph.

The clinical evaluation of the internal anatomy of the pulp chamber revealed 3 principal root canal orifices (the Mesio-Buccal the Disto-Buccal and the Palatal). The pulp chamber was frequently flushed with 5.25% sodium hypochlorite to remove the tissue debris. Examination of the floor of the pulp chamber with an endodontic explorer revealed 4 canal orifices, one mesiobuccal canal, one distobuccal canal and two palatal orifices On probing with DG-16 endodontic explorer, a stick was noted at the same orifice level, approximately 2 mm distally from the orifice of the main palatal canal. The access cavity was further modified. Inspection of the pulp chamber revealed four distinct orifices, two buccal and two palatal. K-type files were used to clean and shape the canal system. Frequent irrigation with 5.25% sodium hypochlorite was also carried out (Figure 2-5).

Corresponding author: Dr. Harkanwal Preet Singh, MDS, Department of Oral Pathology, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab, Tel: 9501544877; e-mail: Hkps0320@gmail.com

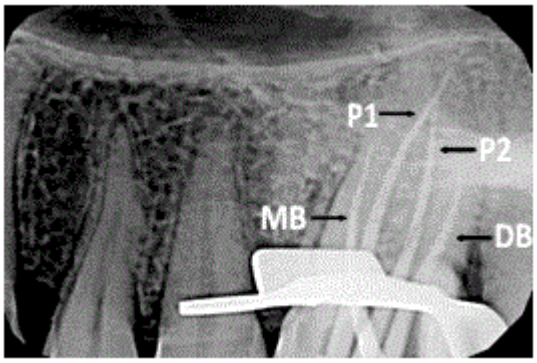

Figure 2. Master Cone Radiograph, MB: Mesiobuccal, DB: Distobuccal. P1: Palatal first, P2: Palatal second.

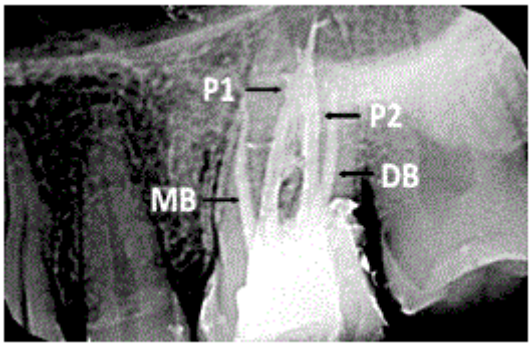

Figure 3. Post-obturation Radiograph. MB:Mesiobuccal , DB: Distobuccal. P1: Palatal first, P2: Palatal second.

A working length radiograph confirmed the presence of two canals (Vertucci's Type II) in the palatal root. All the canals were instrumented by the crown down technique by using protaper nickel- titanium rotary instruments (Maillefer Dentsply, Baillaigues, Switzerland) with 5.25% sodium hypochlorite solution and EDTA (Glyde, Maillefer, Dentsply). *Figure 5* shows the photograph of the chamber floor after instrumentation. Master cone radiograph was taken *(Figure 3)*. Final irrigation was done with sodium hypochlorite followed by a rinse with normal saline. The canals were dried with paper points and obturated with gutta-percha (Mailllefer, Dentsply, Tulsa, OK) with an AH plus resin sealer (Dentsply, DeTrey Konstanz, Germany). The access was then sealed with IRM cement. The post obturation radiograph revealed a Vertucci's Type II root canal morphology in the palatal root *(Figure 4)*.

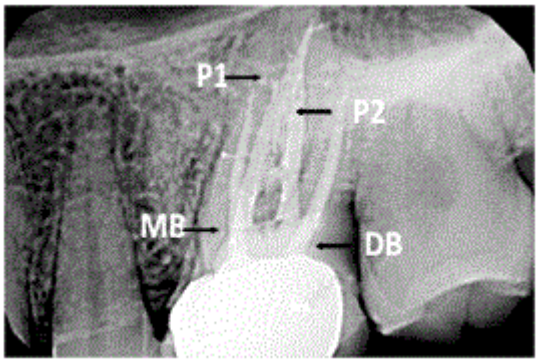

Figure 4. After Crown Cementation. MB:Mesiobuccal , DB: Distobuccal, P1: Palatal first, P2: Palatal second.

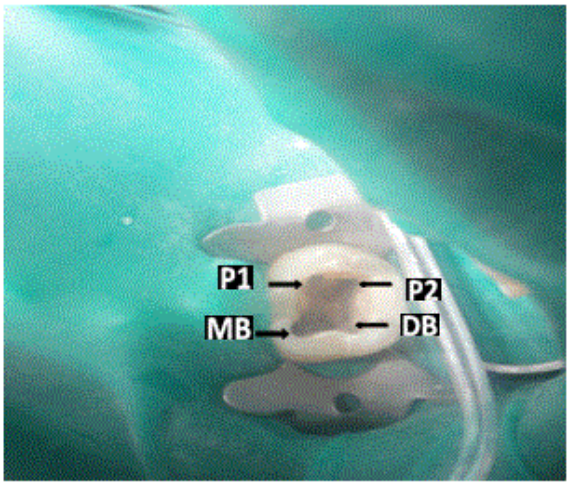

Figure 5. Clinical View. Post- instrumentation Photograph of chamber Floor. MB: Mesiobuccal , DB: Distobuccal. P1: Palatal first, P2: Palatal second.

Discussion

Success in root canal treatment is achieved after thorough cleaning and shaping followed by the complete obturation of the root canal system. So, thorough knowledge of both the external and internal anatomy of teeth is an important aspect of root canal treatment. Vertucci [1] proposed a standardized method for categorizing known root canal anatomic variations, and a more clinically relevant classification of the root canal anatomy was described by Weine [2]. However, in everyday endodontic practice, clinicians have to treat teeth with atypical configurations [3]. Extra roots or root canals if not detected are a major reason for failure [4].

In vitro and in vivo studies have demonstrated substantial variation in human maxillary molar anatomy regarding the number of roots and root canals. Most endodontic and dental anatomy texts describe the human maxillary first molar with three roots and three or four root canals [4,5]. Unusual canal anatomy associated with the maxillary molars has been investigated in several studies [6-9]. But the prevalence of

maxillary first molars with 2 palatal canals is rare. However, Christie et al. [9] have reported a variation in the number of roots and an unusual morphology of root canal systems in maxillary molars. Similarly, the present report highlights the unusual anatomy of a maxillary first molar with 2 separate palatal canals.

Thorough knowledge of root canal anatomy is the "single most important aspect for the successful treatment of endodontically treated teeth." Finding all of the root canals in an endodontic case is essential to long-term treatment success. In other words, the clinician cannot properly clean and shape, fill, and seal root canals that he does not find or if he does not know where to look for them or that he should look for them.

Even though anatomical variations in maxillary first molars are documented in the literature, variations in the anatomy of these teeth are not recognized by a great many dentists [10]. It is important to know when to be suspicious. When a preoperative radiograph reveals an atypical tooth shape and an unusual contour, further radiographs should be taken with different angulations to confirm any unusual anatomical feature. Buccolingual views, 20º from mesial and 20º from distal, reveal the basic information on the tooth's anatomy and root canal system required for endodontic treatment [11]. Patients are rarely happy to have more radiographs, but the new technologies for digital radiography (RVG) help to decrease the radiation exposure to our patients and improve acceptance of additional radiographs.

We should always search for more canals if files are not well centered in the canal on the radiograph or clinically as they protrude from the canal orifice. It helps to examine the placement of the file in the canal and how it relates to the root dimensions. Looking at the dentinal map on the floor of the pulp chamber helps improve the likelihood of finding additional canals. Even the use of magnification (loupes and dental operating microscopes) may be of some benefit in diagnosing additional canals.

Recent technique of Computerized Tomography allowed the observation of the morphology of the root canals and the roots and the appearance of the tooth in every direction. In CT, a series of 2-dimensional image data sets can be integrated mathematically to produce cross sections in any plane or 3-dimensional images. However, its drawbacks include high radiation, limited availability & significant capital investment. CBCT is another advanced technology which procures 3D images with much reduced exposure. The higher accuracy of CBCT has greatly facilitated three-dimensional imaging and visualization of unusual anatomy and/or additional root canals that can often be missed on routine radiographs [12-14]. CBCT compared to conventional CT scans is advancement in CT imaging that provides relatively high-spatial resolution of anatomic structures with much reduced patient radiation dose [15-16]. Additionally, CBCT scanners use simpler, less complicated, and therefore, less expensive hardware (X-ray source and detector) making it quite popular as an office diagnostic tool.

Treatment sequence and prognosis for molars with 2 palatal canals should be considered to be the same as those for any maxillary molar. With advancement in diagnostic imaging such as Spiral CT, enhanced magnification aids like loupes & surgical operating microscopes, advanced apex locator, rotary endodontics, newer irrigation regimen and obturation systems, treatment of such challenging cases can be more predictable and rewarding to both patient and endodontist.

Conclusion

When root canal treatment is to be performed the clinician should be aware that both external and internal anatomy may be abnormal. A clinician should open his/her mind to the various possible canal morphologies and should not stick only to a limited and standard number of canal patterns. Careful examination of radiographs and internal anatomy of teeth is essential. If left undetected extra roots or root canals are a major reason for the treatment failure. Hence the ability to locate all the canals in the root canal system is an important factor in determining the eventual success of a case.

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