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Case Report

Endodontic Management of an Anatomically Variant Palatal Root with Two Canals in a Maxillary First Molar with the Aid of Spiral Computed Tomography

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ABSTRACT

A case report is presented of an endodontically managed maxillary first molar with an unusual morphology of 2 distinct palatal canals with single root. An accurate assessment of this morphology was made with the help of spiral computerized tomography. Aberrations in root canal anatomy are commonly occurring phenomena. Radiographs produce only a 2D image of a 3D object, resulting in superimposition of images. Therefore, they are of rather limited value in cases with complex root canal anatomy. This case report highlights the role of surgical operating microscope and Spiral CT as an objective analytic tool to ascertain root canal morphology.

Key words: spiral computed tomography, palatal canals with single root, maxillary first molar, variant palatal canals.

INTRODUCTION

Endodontic treatment requires thorough knowledge regarding, root canal system of any tooth and probability of extra canals should be considered. Additional canals which contain tissue, microbiota and irritants, if remain undiagnosed can inevitably contribute to failure of endodontic treatment. Presence of additional canal in palatal root of first maxillary molar canals is not frequent and its incidence reported in literatures is about 2–5.1%.[(1)] Previous case reports , reporting extra canals were based on the radiographic examinations of the teeth, both pre-operatively and post-operatively.[(2)] Ideal method of precise determination of the root canal morphology of a tooth is serial sectioning of the tooth, which is impractical in clinical situations.[(3)] Therefore, other diagnostic methods like spiral computed tomography (CT),[(3-8)] cone-beam CT, peripheral quantitative CT, 3D accuitomo XYZ slice view tomography are useful in such conditions, to analyze the root canal morphology.[(4,5)] The present case emphasizes the use of advanced valuable

diagnostic tool, Spiral CT in successfully diagnosing additional canals in permanent maxillary first molar with two palatal root canals and managing by nonsurgical endodontic therapy

CASE PRESENTATION

A 29-year-old male patient reported with a complaint of food lodgement in left upper back tooth region. He gave the history of pain in the same tooth from past 3 months for which emergency endodontic treatment was rendered. His medical history was non-contributory. Clinically the tooth was tender to percussion. There was no mobility and periodontal probing was within normal limits. The initial periapical radiograph revealed widening of the apical periodontium (figure 1).

These findings lead to a provisional diagnosis - chronic apical periodontitis with respect to (w.r.t) left maxillary first molar (tooth 26), necessitating non surgical endodontic therapy.

Investigation:

Figure 1 – Pre-operative radiograph

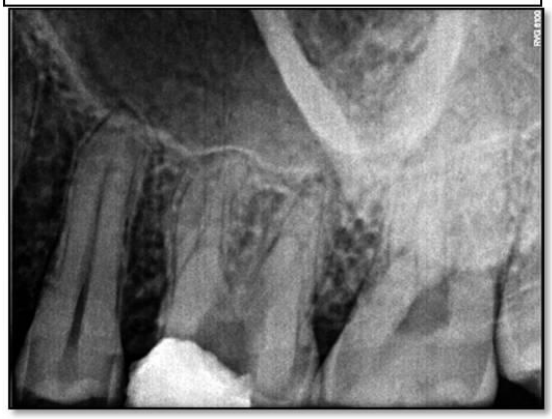


Figure 2 – Working length

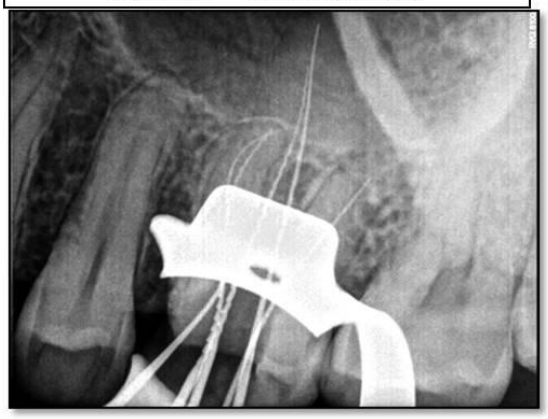
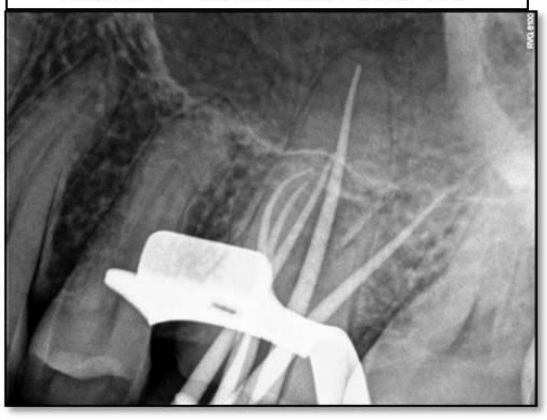


Figure 3a & 3b – Horizontal Section of CT scan at different levels

Figure 4 – Master cone selection



Intraoral Periapical Radiograph: Radiographic evaluation of tooth 26 showed access opening (figure 1).Widening of apical periodontium seen at the apex of root.

CT Scans: To confirm the presence of the additional canal and its morphology in the palatal root, spiral computed tomography (SCT) was scheduled. To ascertain more precisely the 3-dimensional (3D)

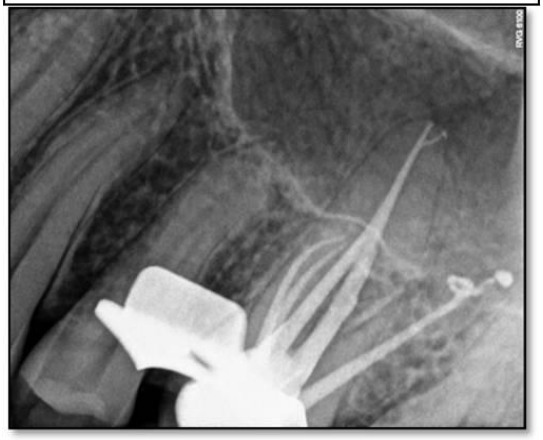
relationship of the tooth structure, CT imaging was performed using the 3D (General Electric, Siemens, 64 slice, 120 kV, 90 mA). From the 3D reconstruction (interval of 0.6 mm) image it was confirmed that the tooth 26 revealed 2 separate orifices and a single exit (Vertucci type II) indicating 2 separate canals in the palatal root (figure 3a) and (figure 3b). A thin dentinal separation between the two canals till the apical third was evident which join at apex.

Differential Diagnosis: Symptomatic apical periodontitis w.r.t 26

Treatment: Local anaesthesia of 2% lidocaine with 1:100,000 epinephrine was administered. After isolation with rubber dam, the access cavity was modified using a round bur (Dentsply-Maillefer, Ballaigues, Switzerland). Clinical evaluation of the internal anatomy of the pulp chamber revealed 3 principal root canal orifices: mesiobuccal, distobuccal, and palatal. The pulp chamber was frequently flushed with 5% sodium hypochlorite to remove pulp tissue remnants After probing with a Hu-Friedy (Chicago, IL) DG 16 endodontic explorer, a small amount of dentin that was occluding the orifice of the second palatal canal was removed with the help of Endo Access bur (Dentsply Maillefer, Ballaigues, Switzerland). Examination of the chamber floor with the explorer revealed 5 canal orifices. There seemed to be 2 distinct orifices in both the mesial and palatal root. Access was further modified. Inspection of the pulp chamber with magnifying loupes (Seiler loupes, 3× magnification) revealed 5 distinct orifices, 3 buccally and 2 palatally. The additional canal patency was checked with a #10 K-file (Mani ILC, Tochigi, Japan). Under surgical operating microscope of magnification 8×, a groove between the mesio-buccal canal 1(MB1) and palatal canals was located. The mesio-buccal canal 2 (MB2) canal was found along the mesial groove, also a small amount of dentin that was occluding the orifice of the second palatal canal was removed with the help of Ultrasonic diamond tip (ET40D tip, Satelec, Merignac, France, with Suprasson hand piece) and second palatal canal orifice was revealed.

Figure 5 – Five sealed canal orifices

Figure 6 – Obturated canals



Working length radiograph confirmed the presence of 2 canals in the palatal root (figure 2).The appointment was then concluded with the application of sterile cotton pellets and IRM cement

(Dentsply DeTrey GmbH, Konstanz, Germany).

To confirm the presence of the additional canal and its morphology in the palatal root, spiral computed tomography (SCT) was scheduled and it was confirmed that the tooth 26 revealed 2 separate orifices and a single exit (Vertucci type II) indicating 2 separate canals in the palatal root (figure 3a) and (figure 3b). After confirming the presence of 5 canals, conventional endodontic treatment was performed using rotary Protaper (Dentsply Maillefer) nickel-titanium files. Master cone selected (figure 4) and obturation was done using AH plus sealer (figure 5). Post obturation radiograph revealed Vertucci type II root canal morphology in the palatal root (figure 6)

Outcome and Follow-Up: Endodontic treatment was successful and patient is under annual follow up.

DISCUSSION

Variations in root canal anatomy can pose a considerable challenge to endodontic diagnosis and treatment. The maxillary first molar is the largest tooth in volume and has a complex root canal anatomy.[9] This report highlights the unusual anatomy of a maxillary first molar with 2 separate palatal canals in single root which join at the apical third. In the past, most of the literature concentrated on the morphology of mesiobuccal root, particularly on the MB2 canal. Very few literatures cites many anomalies associated with maxillary molars, such as single-rooted maxillary molars, 2 distobuccal root canals.[10] Anatomic variations involving the number of root canals or number of roots in the palatal root of permanent maxillary molar are unusual and rare. The incidence of two root canals in the palatal root of maxillary molars has been reported to be 2% to 5.1%.1. All the case reports mentioned above used radiographic examination. This article is probably the third case to be reported where a maxillary first molar with 2 canals in a single palatal root, which was confirmed and managed with the help of SCT.

To determine for presence of additional root there should be slight difference in clinical approach besides normal procedural protocol and the clinician should look for following signs which might indicate towards the presence of additional root.[11]

- Understand the complexity of the morphology of the tooth involved
- Cervical prominence – it could be detected through periodontal probing
- Extra cusp – which is present in combination with cervical prominence
- Take additional off-angle radiographs
- Ensure adequate “straight-line” access to improve visibility and accessibility
- Careful examination of the pulpal floor for identification of dentinal maps
- Remove all dentinal overhanging’s occluding the canal orifice. CT scan

The dentist should be suspicious of additional canals if endodontic files are not well centred in the canal on the radiograph or if endodontic files are not well centred in the canal clinically. It must be assumed that most maxillary first molars will have 4 canals. The second MB canal is usually found 0.5-5 mm palatal to the main MB canal, often hidden under a cervical ledge. Cutting around the first orifice, cutting a trough in a straight line toward the palatal canal, or both, will usually allow the dentist to find it.

In the present case IOPA didn’t not reveal the presence of 2 palatal canal. But clinically after modification of access cavity, an additional palatal orifice was suspected.

In the presented case, a large access was required to locate the 2 palatal canals. The access cavity on maxillary molars exhibiting 2 palatal canals should be wider than usual on the palatal aspect. The access outline will be trapezoidal rather than triangular. In the current case, the 2 palatal orifices were also found to be well-developed and large.[11] This case also emphasizes the importance of dental operating microscope (DOM) in identifying extra canals. The dental operating microscope (DOM) was recently introduced to endodontics. It is of interest to note that accurate location of canals depends on use of magnification, adequate lighting and modified access.[12] The studies utilizing microscopes have reported a significantly higher percentage of MB canal system occurrences than the studies using other means of determination.[1] Kulild and Peter[13] and Buhrley et al[14] reported that the use of DOM did help the identification of the extra canal.

Additional to the clinical skills, though Periapical radiographs are highly useful in assessing the canal configuration, it is not a completely reliable diagnostic tool in analysing complex root canal systems. We need to take radiographs in different angulations only to interpret 2D image three dimensionally.[15] Conventional images compress three-dimensional anatomy into a two-dimensional image or shadowgraph, greatly limiting diagnostic performance. To overcome the inherent disadvantages of conventional radiographic methods, i.e., magnification, distortion, and anatomic superimposition of 2-dimensional images and to assess root canal morphology more accurately we used Spiral CT as a prime analytical tool. Tachibana & Matsumoto (1990) studied the applicability of Computerised Tomography to endodontics. They concluded that this method allowed the observation of the morphology of the root canals, the roots and the appearance of the tooth in every direction. Moreover the image could be analysed, altered and reconstructed by the computer. 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.[16] However, its drawbacks include high radiation, limited availability & significant capital investment. The Endodontist must consider the judicious use of high-end diagnostic imaging techniques for successful management of complicated cases Compared with radiographs, CT permits a more accurate diagnosis of the aberrant root canals with accurate identifications and measurements in multiple planes[17,18] which may not be readily identifiable with IOPA radiographs even if taken at different angles. An extensive review of the literature showed that the SCT has been used to identify and understand the anatomic variation of the maxillary first molar morphology.[15,19-21] 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.[22]

CONCLUSION

Ability to locate all the canals in the root canal system is an important factor in determining the success of a case. The role of CT as an objective analytical tool to ascertain root canal morphology in unusual cases. With existence of anatomic variations, the advanced supplementary aids like loupes & surgical operating

microscopes can be used as valuable tool in rendering successful endodontic treatment.

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