ABSTRACT: Successful root canal therapy requires a thorough knowledge of root and root canal morphology. It is generally accepted that the most common form of the permanent maxillary first molar has three roots and four canals. The main reasons for endodontic failure are apical percolation and the presence of microorganisms caused by incomplete instrumentation, inadequate cleaning, insufficient canal obturation, and the presence of untreated canals.

KEYWORDS: Maxillary First Molar, Palatal Canals, Spiral CT.

INTRODUCTION: The chief objective of a successful root canal therapy is the meticulous cleaning and obturation of the entire root canal system. In order to achieve this, a detailed comprehension of additional or unconventional root morphology is a primary requisite. The common anatomical characteristics of a maxillary first molar is generally described as 3 roots; 1 palatal and 2 buccal, with each root having 1 canal. Variations often occur in the mesiobuccal canal followed by mesiopalatal canal, however, the occurrence of maxillary first molar with unusual numbers of palatal roots and canals has been limitedly reported in the literature with an overall incidence of less than 1%. Similarly, studies conducted by Pineda and Kuttler and findings by Thomas and others have concluded that maximum subjects had one canal in the palatal root.

While considering an endodontic therapy for a maxillary first molar one must be prepared for its aberrant morphology. A simple diagnostic tool such as conventional radiograph often strains the dentist to comprehend its morphology completely. Thus advanced diagnostic tool such as spiral computed tomography (SCT) comes as a relief to ease the pursuits of a dentist.

The present case reports the endodontic management of an anatomically variant palatal root with 2 canals (Vertucci type II) in a maxillary first molar, which was confirmed with the help of SCT.

CASE REPORT: A 24-years-old male patient presented with the chief complaint of intermittent pain in the upper left back tooth for the past 3 months. His medical history was non-contributory.

On taking detailed history patient revealed he visited dentist 10 days back for the same complaint, however pain persisted as he discontinued his treatment. Clinical examination revealed a symptomatic right maxillary first molar which was temporarily temporized with open access cavity and accumulation of food debris. Moreover, the tooth exhibited tenderness on percussion. Intraoral periapical (IOPA) radiograph revealed a prepared access cavity with normal root canal anatomy and widening of periodontal ligament space of the involved tooth (Figure 1).

The clinical and radiographic findings lead to a provisional diagnosis of chronic irreversible pulpitis of the right maxillary first molar. Thus the proposed tooth was marked for nonsurgical endodontic therapy and required consent was obtained.
Prior to isolation with a rubber dam, the tooth was anesthetized using 2% lidocaine with 1:80,000 adrenaline (Lignox, Indoco Remedies Ltd, Mumbai, India). 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. On probing with a DG-16 endodontic explorer (Hu-Friedy, Chicago, IL), a small hemorrhagic point was noted at the same orifice level approximately 1mm distally from the orifice of the main palatal canal.

The access cavity was further modified to get better access to the additional canal. Inspection of the pulp chamber with magnifying loupes (Seiler loupes, 3× magnification) revealed 4 distinct orifices, 2 buccally and 2 palatally. The additional canal patency was checked with #10 K-file (Mani ILC, Tochigi, Japan). 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 De Trey GmbH, Konstanz, Germany).

To confirm the presence and the morphology of the additional palatal canal, SCT was scheduled. A precise 3-dimensional (3D) relationship of the tooth structure was acquired using a CT image (General Electric, Siemens, 64slice, 120 kV, 90 mA). This 3D reconstructed image, at an interval of 0.6mm, confirmed the presence of 2 distinct orifices (2.5mm interorifice distance) separated by a thin dentinal separation till the apical third in relation to tooth#16 and a single exit (Vertucci type II) indicating 2 separate canals in the palatal root (Figures-3[i, ii, iii]). The canals were further prepared with Protaper- rotary files (Dentsply) with 0.04 taper using the crown-down technique. During root canal preparation, irrigation was performed using normal saline, 2.5% sodium hypochlorite solution, and 17% EDTA. The canals were dried with absorbent paper points (Dentsply, Maillefer) (Figure-4) and obturated using lateral condensation with gutta-percha (Dentsply) and AH26 resin sealer (Dentsply) (Figure-5). Access cavity was then sealed with a temporary restorative material. Post restoration crowns were given (Figure-6[i, ii, iii, iv]).

**DISCUSSION:** In 1969 Weine et al. provided the first clinical classification of more than one canal system in a single root.5 Later, Stone and Stroner described numerous systems in which a single palatal root contains two separate orifices, canals or foramina.6 They have also detected two separate roots, each with a separate canal or a single palatal root with one orifice, a bifurcated canal, and two foramina.6

Usually, the interpretation of the radiograph along with a careful inspection of the pulp chamber floor enables the operator to understand the root canal configuration. In the present case, though IOPA did not reveal the presence of 2 palatal canals, after a clinical modification of the access cavity, an additional palatal orifice was suspected. Thus, the inherent limitations of radiographs lead to confirm the presence of 2 palatal canals via newer modality like SCT. A thorough literature study affirmed the use of SCT in identifying and understanding the anatomic variation of the maxillary first molar.

SCT is a new technology that obtain images in sagittal, coronal and axial slices and emits up to 60% less carbon emission, thus reducing the radiation exposure to the patient. It also result in faster scan time and helps in stacking up images that aids to reconstruct 3D visualizing images. Thus precise information of the canal configuration of tooth #16 was obtained, which confirmed the presence of 2 palatal canals (Vertucci type II) along with the MB and DB.
Accuracy of an access cavity preparation which is the initial step in canal preparation, helps to eliminate potential problems during canal preparation and obturation. Furthermore, the clinician should be observant of any clinical signs that depict anatomic variations during access cavity preparation. As in the present case, a bleeding spot in the pulp chamber floor was noticed, suggesting the presence of an additional palatal canal. Other implications are the eccentric location of an endodontic file during working length determination with the help of a radiograph, inconsistent apex locator readings, a sinus tract that traces laterally away from the main canal, or the perception of a “catch” on the canal wall during instrumentation of a wide and unobstructed main canal. If mainly 1 orifice is noticed which is not in the centre of the tooth, then there is high probability of another canal being present. Inability to treat a missed canal is indisputably the prime cause for root canal treatment failure.

**CONCLUSION:** With accurate anatomic and morphological basis along with the use of advanced diagnostic supplementary aids one can achieve precise diagnosis and hence an expected treatment outcome. This article shares an understanding of a rare case with an unusual number of palatal canals with help of spiral CT. It also ascertains that even though the statistics of similar findings are very low and has been rarely described this anomaly is of important consideration during the endodontic treatment for successful results.

**REFERENCES:**

CASE REPORT

Fig. 1: Pre-operative intra-oral periapical radiograph

Fig. 2: Working length intra-oral periapical radiograph

Fig. 3: Spiral Computed Tomography (SCT) Images

Fig. 4: Master apical file intra-oral periapical radiograph

Fig. 5: Post oburation intra-oral periapical radiograph
Fig. 6: (i, ii, iii, iv) Post Root Canal Restoration (Clinical Images)

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