CASE REPORT

Endodontic management of maxillary first molar with three mesiobuccal root canals using cone beam computerized tomography

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ABSTRACT

Endodontic treatment of maxillary first molar with three canals in mesiobuccal root using cone beam computerized tomography (CBCT). This case report presents a maxillary first molar with three mesiobuccal canals. Missing a canal during root canal therapy is one of the main causes of endodontic failure. The frequency of detection of extra canals has increased with better techniques in instrumentation, magnification and illumination. The present case shows three canals in the mesiobuccal root, which is an aberrant and rare anatomical presentation. CBCT proved to be an important tool in confirming the presence and location of the extra canals.

Key words
3 mesiobuccal canals, cone beam computerized tomography, maxillary first molar

INTRODUCTION

Straight-line access to the apical foramina of a tooth is the foremost step towards clinically successful endodontic treatment. This mantra to success is often difficult to follow due to the inability of the endodontist to diagnose abnormal canal configurations, which dissuades acceptable completion of root canal therapy.

A correct diagnosis is often the most important step towards clinical success in treatment of any pathology pertaining to the human body, and the root canal is no exception to this age-old understanding. The discovery of X-rays by Roentgen in 1895 allowed visualization of root canal spaces and their treatment and hence that many teeth condemned to extraction were retained in the oral cavity. Over the years, as newer and better diagnostic tools have been applied to endodontics, increasingly greater clinical success has been achieved. Radiovisiography and cone-beam computerized tomography (CBCT) are the latest in the array of diagnostic tools available for detection of normal and variant root canal morphology.

The following paper is a case report of a maxillary first molar with three mesiobuccal canals, which was successfully treated using CBCT as an adjunct in the diagnosis.

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CASE REPORT

A 27-year-old female was referred to the Department of Endodontics with deep distal caries in her upper left first molar (#26). The tooth was tender on percussion and gave a lingering positive response to the electric pulp tester. There was no swelling and no periodontal pockets associated with the tooth; no involvement of lymph nodes and mobility was in physiologic limits. An intraoral radiograph revealed the presence of radiolucency encroaching on the pulp horn with an apparently normal periapex. Based on the clinical and radiographic findings, a diagnosis of irreversible pulpitis was agreed on, and the patient was advised to undergo root canal therapy for the tooth.

Local anesthesia was administered using 2% lignocaine with 1:80,000 adrenaline (1.8 ml) (Ligno × 2% A, Indoco Remedies, India) and subsequently rubber dam isolation was achieved. Conventional coronal access was made with high-speed turbine hand piece using endo access bur (Dentsply Tulsa Dental, Tulsa, OK, USA). With the help magnifying Loupes (2.5X, ST250, STAC Dental Instruments Inc., Brampton, Canada), caries was removed from the distal aspect using a spoon excavator. A DG 16 endodontic explorer (Hu-Friedy, USA) and Sodium hypochlorite (Novo Dental Products, Mumbai, India) were the adjuncts used to locate the canals. The pulp chamber was completely deroofed, pulp tissue from the chamber was removed and canal orifice location was done using #10 K files (MANI INC, Japan).

It was observed that there were three orifices in the mesiobuccal root [Figure 1], which was unusual. While negotiating the canals individually in the mesiobuccal root, there was no hindrance to the movement of the #10 K file in any of the three canals. The above finding raised an element of doubt regarding the configuration of the three different horizontal angulations. However, all of the radiographs (RVG images) suffered from overlapping of the endodontic files radiopacity[Figure 2].

The access cavity was sealed using Cavit (3M™ ESPE™, USA) and the patient was referred to Department of Oral Medicine and Radiology for three-dimensional imaging of the tooth using CBCT to confirm the unusual morphology. The CBCT (Cscan-70 kV, 8 mA, 76 micron voxel) scan revealed three distinct orifices in the mesiobuccal root and one each in the distal and palatal roots [Figure 3].

In the second sitting, the working length was measured using apex locator (J Morita Japan) and confirmed with a radiograph. A reproducible glide path was prepared using #15 K file and cleaning and shaping was performed using Protaper Universal (Dentsply Tulsa Dental, Tulsa, OK, USA) abiding by the manufacturer's instructions under copious irrigation of 3% Sodium hypochlorite and saline after each file use. RC Prep (Premier Products Co.) was used as a lubricant. Patency was checked at each step. Biomechanical preparation was done up to F2 in palatal canal and F1 in all others.

Figure 1: Clinical view of orifices of mesiobuccal 1 (MB1), MB2 and MB3 in #26

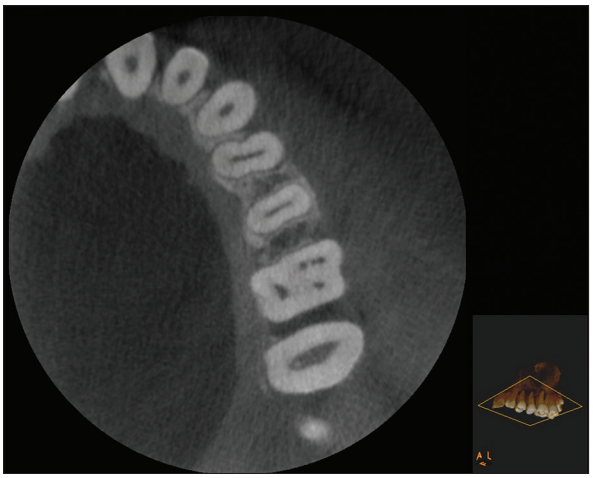

Figure 2: Orifices of all canals in #26 seen on CBCT

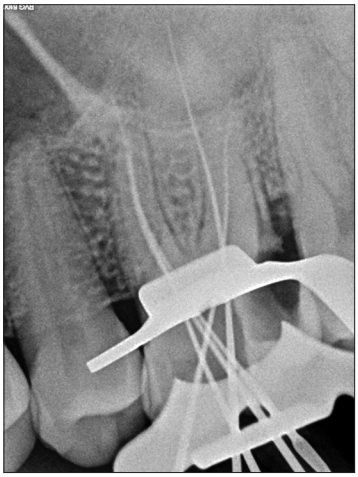

Figure 3: . Working length RVG of #26

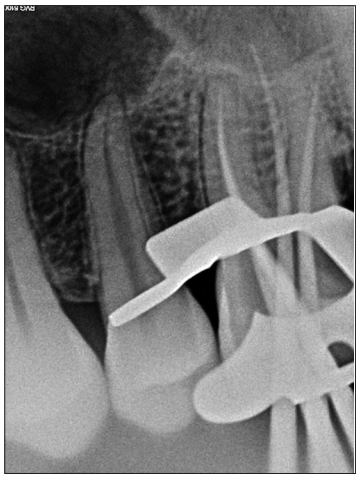

Figure 4: Master cone RVG of #26

The mesiobuccal root, after enlargement, still showed three distinct orifices. A mastercone (Protaper, Dentsply Mailefer) radiograph was taken [Figure 4].

Irrigation was done with 17% EDTA (Desmear, Anabond, India) to remove the smear layer which was followed by saline wash and final irrigation with 2% chlorhexidine Digluconate (Neelkanth Enterprises, India). The canals were dried using paper points and coated with a zinc oxide-eugenol sealer. The mastercones were coated with a zinc oxide-eugenol sealer and inserted in the canals. Obturation was carried out using cold lateral condensation technique [Figure 5]. The cavity was sealed with cavit and the patient was referred to the Department of Oral Medicine and Radiology for posy-obturation CBCT imaging.

Cone beam volumetric imaging revealed three completely filled canals in the mesiobuccal root, one in distal root and one in the palatal root [Figures 6 and 7]. The scan confirmed the previous observations made at the time of the preoperative scan. The lateral scan showed two mesiobuccal canals exited in one apical foramen while the third exited through a separate apical foramen.

The patient was appointed for final restoration and full coverage crown subsequently. He was asymptomatic during follow-up up to a period of 6 months.

DISCUSSION

Several researchers have attempted and proposed new techniques to provide a broader description of the anatomy of permanent teeth. The first study is describing the internal dental anatomy dates back to the 19th century.[1] In the beginning of the 20th century, Okumura[2] 1927 published his revolutionary study about the transformation of teeth into transparent blocks, revealing complex wefts that were part of root canals. Weine *et al.*[3] 1969 observed that failures related to the mesiobuccal root of maxillary molars jeopardized the success of the endodontic treatment and found that teeth with a fourth canal occurred more frequently than those with three canals (51.5% vs. 48.5%). Since then, several studies have investigated the endodontic significance of canal configuration in the mesiobuccal root of maxillary first molars using different methods and found similar results to those of Weine *et al.*[3] 1969. Hession[4] 1977 compared the canal morphology before and after instrumentation and concluded that the number of canals usually equals the number of roots and Vertucci[5] 1984, in his classic paper, gave the most widely accepted classification of the root canal system. The greatest variations observed were the presence of two canals in the mesiobuccal root of maxillary molars, canals in the furcation area and presence of lateral and accessory canals.[6]

Figure 5: Postobturation RVG of #26

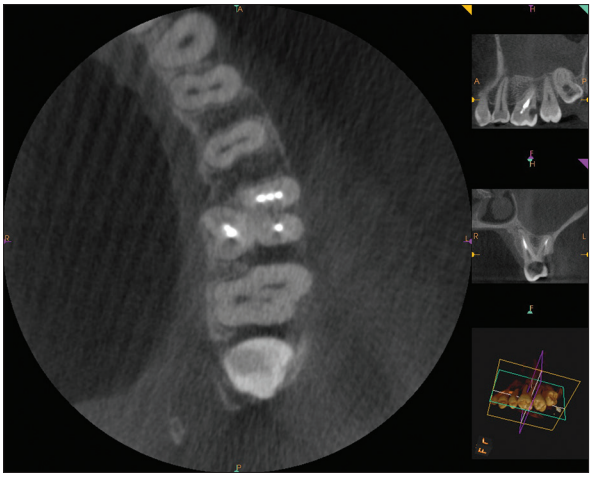

Figure 6: All canals of #26 obturated, seen on cone beam computerized tomography

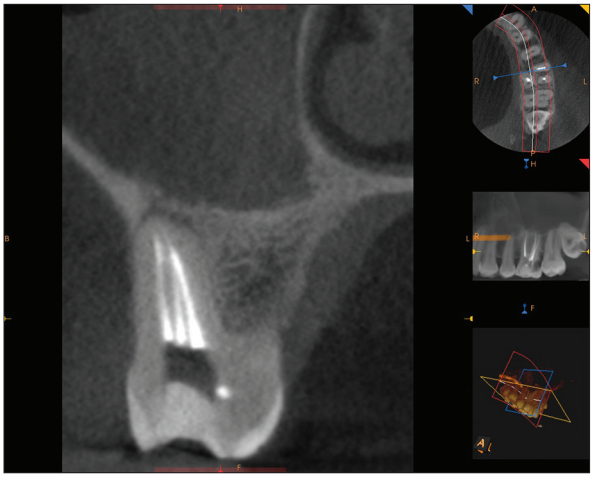

Figure 7: All canals of #26 obturated, lateral view seen on cone beam computerized tomography

Among very recent studies, Somma *et al.*[7] 2009 investigated *ex vivo*, the root canal morphology of the mesiobuccal (MB) root of maxillary first molar teeth by means of micro-computed tomography. They inferred

that the MB root canal anatomy was complex: A high incidence of MB2 root canals, isthmuses, accessory canals, apical delta and loops were found. The MB2 canal was present in 80% of specimens and was independent in 42% of these cases.

Prabu *et al.*[8] 2009 reported the presence of three canals in the mesiobuccal root of the maxillary first molar in their case report. The mesiobuccal root presented a moderate curvature with three separate canals. The mesiobuccal canal-1 had one opening and one exit (Vertucci's Type-I), whereas the mesiobuccal canal-2 and the mesiopalatal canal presented two openings and one exit (Vertucci's Type-II).

Pais *et al.*[9] 2012 reported the endodontic retreatment of the right maxillary first molar with unusual anatomical variation displaying three canals in the MB root, a root canal in the DB root (DV) and a root canal in the palatal root (P) using operating microscope.

Arora *et al.*[10] 2013 presented a case of a maxillary left second molar where three canals were located in its mesiobuccal root with the use of visual and diagnostic aids.

Chourasia *et al.*[11] 2011, in their case report, describe the identification and treatment of a maxillary first molar exhibiting three canals in the mesiobuccal root.

Horatti *et al.*[12] 2013 described the nonsurgical endodontic treatment of maxillary permanent first molar with three canals in the mesiobuccal root.

Ayranci *et al.*[13] 2011, in their case report, discussed the successful nonsurgical endodontic management of permanent maxillary first molar presenting with the anatomical variation of 3 roots and 5 canals (three mesiobuccal, one DB and one palatal canal).

In our case, we treated a maxillary first molar with three roots and five root canals with the mesiobuccal root showing three separate orifices, three separate canals, two of which exited in a common foramina and one exited in a separate foramen. The Vertucci classification for the palatal canal and the DB canals is Type I and for the mesiobuccal root is Vertucci's additional Type XVIII (3-2). The incidence of an MB3 canal is infrequent. Literature searches yield that for Type XVIII,[3] total prevalence in males and females is 0%, for both additional Types XVII (−3-1) and Type XVIII (3-1) the total prevalence in males was found 1% and 0% was reported in females.[14] There is no mention of prevalence of Type XVIII (3-2) in the literature.

Cone beam computerized tomography scanning is a relatively newer diagnostic imaging modality that has been used in endodontics for the effective evaluation of the root canal morphology.[15-18] CBCT technology aids in the diagnosis of endodontic pathosis, assessing root and alveolar fractures, analysis of resorptive lesions, identification of pathosis of nonendodontic origin, and presurgical assessment before root-end surgery.[15,17,18] The short scanning time (10-70 s) and radiation dosage is reportedly up to 15 times lower than that of conventional CT scans.[19] These systems are promising and eminently more suitable for endodontic application.

In our case, CBCT scanning was used for a better understanding of the complex root canal anatomy. CBCT axial images confirmed the presence of three roots and five root canals, namely MB1, MB2, MB3, DB and palatal (P). The MB2 is, usually, located palatally and mesially to the MB1,[1] but in this particular case additional MB3 was located [Figure 3] and this was confirmed in the CBCT axial images. Thus, CBCT scanning was pivotal in the diagnosis of this unusual root canal system and towards its successful endodontic management.

CONCLUSION

During the preliminary workup of the case, pretreatment radiographs should be carefully assessed with additional radiographs taken at different angulations as these often help in predicting unusual external and internal anatomic details. The fact that a third canal has been located in the mesiobuccal root of the maxillary permanent first molar highlights the need for a thorough evaluation of canal anatomy during endodontic procedures. Undeniably, endodontics should continue to assume the existence of additional canals until all measures towards their detection have been exhausted.

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