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Case report

Endodontic management of type I maxillary first molar with two palatal roots using cone-beam computed tomography

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ABSTRACT

Background: *Understanding the anatomical variations in the root canal system is vital for the successful outcome of endodontic treatment. Anatomical variation with respect to palatal roots is rare compared with other roots of maxillary molars.* ***Purpose:*** *This case report describes a rare case of cone-beam computed tomography (CBCT)-guided endodontic treatment of a maxillary first molar with two palatal roots.* ***Case:*** *A 35-year-old Saudi woman complained of continuous pain in the right maxillary first molar. Past dental history revealed root canal treatment of the same tooth four weeks prior. Master cone radiographs recovered from her general dentist revealed a missing second palatal canal.* ***Case Management:*** *A CBCT image was taken to confirm if there were any aberrations in root canal morphology. Clinical exploration presented four distinct orifices: two palatal and two buccal. All the root canals were prepared and irrigated with 2.5% NaOCl and normal saline during instrumentation. All the canals were obturated with gutta-percha and AH 26 sealer using the continuous wave obturation technique.* ***Conclusion:*** *Clinical exploration of the pulpal floor, along with multiple angled radiographs, is needed to confirm any anatomic aberration.*

Keywords: *CBCT; endodontic management; maxillary first molar; two palatal roots*
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INTRODUCTION

Successful endodontic management requires knowledge of the anatomy and anatomical variations of the root and root canal system.[1] Recognizing the aberrant anatomy of the root canal system prior to treatment is essential. Failure to recognize such anatomical variations may complicate endodontic treatment, leading to unsuccessful treatment outcomes.[2] Normally, maxillary first molars show three roots: mesio-buccal, disto-buccal, and palatal. The mesio-buccal and palatal roots show the highest and lowest anatomical variations, respectively. A single palatal root with a single canal is observed in 99% of cases. Hence, very few cases of root canal treatment of a maxillary first molar with two palatal roots are reported in the literature. According to Christie et al.,[3] maxillary molars with two palatal roots are classified based on the shape and degree of root fusion viewed in the coronal third as type I (two widely divergent palatal roots), type II (four short, separate, parallel roots), and type III (molars are constricted with the mesio-buccal, mesio-palatal, and disto-palatal root dentin showing a web form). Baratto-Filho et al.[4] later added type IV to this classification, wherein the mesio-buccal and palatal roots are fused in the coronal two-thirds. This case report describes the cone-beam computed tomography (CBCT)-guided nonsurgical endodontic management of a type I maxillary first molar with two palatal roots.

CASE

This case report was presented to the institutional ethical review board to obtain ethical clearance (IRB/KKUCOD/ETH/2022-23/060). A 35-year-old Saudi woman was referred to the Department of Endodontics, King Khalid University Dental Clinics, Abha, Aseer Province, Kingdom of Saudi Arabia, by a general dental practitioner for continuous pain in the right maxillary first molar (tooth #3), despite pulp extirpation four weeks prior. The patient had presented to her dentist with a history of toothache

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in the right maxillary region, for which the dentist had initiated the endodontic treatment of tooth #3. The patient's medical history was non-contributory. Clinical examination revealed a dislodged temporary restoration in tooth #3, which was tender to percussion. Previous master cone radiographs retrieved from the patient's dentist revealed a missing second palatal canal (Figure 1). A CBCT image was taken to confirm whether any aberration in root canal morphology was present. ProMax® 3D Classic (Planmeca OY, Helsinki, Finland) was used for three-dimensional imaging with a field of view of Ø4 x 5 cm, voxel size of 150 µm, and effective patient dose of 14.4 µSv. Careful evaluation of the axial section of the CBCT image at the cervical third revealed the presence of two separate palatal roots along with two root canals (Figure 2).

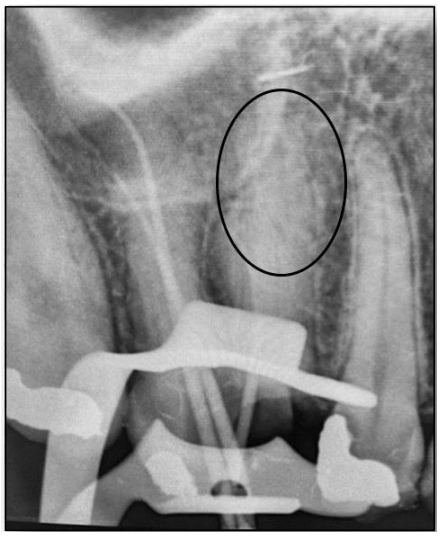

Figure 1. Previous master cone radiographs revealed a missing second palatal root (encircled).

Figure 2. CBCT image taken to evaluate any aberrations in root canal morphology (arrow pointing at two palatal roots).

CASE MANAGEMENT

The patient was advised of the radicular anatomical aberration and the necessity for a root canal re-treatment. Written informed consent that educates the patient about the risks, benefits, and alternatives of the intervention was signed by the patient. Under 2% lidocaine with 1:80000 epinephrine, re-treatment was initiated. A safe-ended tungsten carbide side-cutting bur (Endo-Z bur, Dentsply, Switzerland) was used to modify the conventional triangular access cavity to a trapezoidal shape to improve access. Clinical exploration with an endodontic probe revealed two palatal and two buccal orifices. Rubber dam isolation was performed once the four root canal orifices were located. An electronic apex locator (Root ZX, J. Morita MFG. Corporation, Kyoto, Japan) was used to determine the working length. Canal negotiation was achieved using #10 and #15 hand K-files (Dentsply, Switzerland). Chemo-mechanical preparation was done using the crown-down technique up to a final apical width of 30/0.04 (RaCe NiTi rotary files, FKG Dentaire, Switzerland). The irrigation protocol followed was the use of 2.5% NaOCl followed by a final rinse of normal saline. The canals were dried with paper points, the master cone gutta-percha (30/0.04) was adjusted, and obturation was completed using an epoxy resin-based sealer (AH 26, Dentsply, Switzerland) with the continuous wave obturation technique (Figure 3). Final restoration was completed using composite restoration.

DISCUSSION

This report presents a rare variation in the maxillary molar's usual anatomy that the dental practitioner seldom considers. Although two palatal roots in the maxillary molar are

Figure 3. Post-obturation radiograph showing all four canals filled.

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uncommon, it is important for clinicians to be aware of this unusual root morphology to avoid incomplete root canal treatment, thereby reducing endodontic treatment failures. The occurrence of two palatal canals in a maxillary first molar is extremely low (around 1%). An appropriate access cavity outline can help in diagnosing and negotiating the root canals.[5] Diagnosis of any aberrant tooth anatomy in the maxillary molar is a challenge due to anatomical noise as well as its location.[6] One common reason for endodontic treatment failure is a missed canal leading to incomplete debridement.[7] In such cases, CBCT can be used to effectively evaluate unusual root canal morphology before initiating an endodontic treatment. It precisely identifies the root canal angulations and anatomical aberrations through 3D imaging.[8,9] Complex root canal anatomy of the maxillary molars can be comprehended with the pre-operative use of CBCT to enable predictable endodontic treatment. Other methods recommended to trace additional canals in such cases include the assessment of radiographs at different angulations, white/red line examination, ultrasonics, the champagne bubble test, the use of dyes, and magnification.[10,11]

Generally, a single canal is located in the center of the access cavity. However, if a single orifice is located off-center, then its opposite side should be searched for additional canals.[12] The inter-orifice relationship is also noteworthy, as the root canals with nearer orifices tend to merge at some point throughout their extent. To improve accessibility, it is also recommended to change the outline form of the access cavity that exposes the location of the orifice. Here, the traditional triangular access cavity was revised into a trapezoidal form to provide better access to the second canal orifice. A careful reading of the pre-operative radiographs, along with an attentive exploration of the pulpal floor using an endodontic explorer, allows the clinician to trace the canal orifice. Use of magnification devices such as endodontic loupes and microscopes aids in proper visualization and identification of root canal morphology and its variations.[13–15] In this case, the patient did not get relief from her symptoms despite a complete pulpectomy. Hence, the master cone radiograph retrieved from the referring dentist was evaluated and a second palatal root was found to have been completely missed. The patient was completely asymptomatic once the missed palatal canal was debrided. Moreover, the role of intracanal medicaments and irrigants is critical in improving the endodontic treatment outcome.

In conclusion, searching for anatomical variations, even in a seemingly normal tooth, is vital. Clinicians should have a comprehensive knowledge of unusual anatomical variations and canal configurations. Proper radiographic examination and clinical exploration are indispensable for successful endodontic treatment outcomes. The palatal canal of the maxillary molar tends to show numerous anatomical variations, and therefore it is essential that clinicians be cognizant of the possible anatomical aberrations. CBCT can be a helpful tool in such cases. If a challenging endodontic outcome is anticipated, the option of referring to an endodontist should be given due consideration.

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