Report of Occurrence and Endodontic Management of Three-rooted Maxillary First and Second Premolars in the Same Individual

Abstract
Anatomical variations should be kept in mind in clinical and carefully looked for in radiographic evaluation during endodontic treatment of maxillary premolars. These teeth have highly variable root canal morphology. Although three separate roots in the maxillary first premolars have been reported, it is a rarity to find both the first and second premolars possessing three separate roots. This case report describes the diagnosis and endodontic management of maxillary first and second premolars with three canals and three separate roots. Access cavity refinements were required for stress-free entry to the complex anatomy.

Keywords: Radicular anatomical variations, root morphology, three-rooted maxillary premolars

Introduction
The success of endodontic treatment depends on the thorough debridement and obturation of the root canal system. This goal is difficult to achieve in teeth with abnormal anatomical variations.[1] Extra roots are an additional challenge, which begins at case assessment and during all operative stages, including access cavity design, canal access, cleaning and shaping, and obturation of the root canals present in these extra roots.[2] In the case of maxillary first premolars, three root canals were found at a frequency of 0.5%–6%, generally with one canal in each of the three roots.[3] In the case of the maxillary second premolars, laboratory studies have revealed a lower incidence of three root canals between 0.3% and 2%. Vertucci et al. found 2 of 200 maxillary second premolars to contain three canals.[4] Bellizzi and Hartwell[5] found that only 1.1% of teeth with three canals in 630 maxillary premolars and did not report any with three roots. There were only a few case reports of maxillary second premolars with three canals and three independent roots.[2,6] Three-rooted forms of maxillary premolars were reported to be a rare variation in the Asian population.[7] The occurrence of three-rooted maxillary first and second premolars in the same individual was reported to be very rare. The anatomy of maxillary premolars with three root canals, mesiobuccal (MB), distobuccal (DB), and palatal, is similar to that of adjacent maxillary molars, and they are therefore sometimes called small molars.[8] This is a case report of endodontic management of maxillary right first and second premolars with three separate roots and three root canals. Triangular-shaped access cavity modification was performed for straight-line access to all three root canals. Further, two cleaning devices such as Nano-Brush and EndoActivator System were used separately for thorough debridement of the complex root canal system.

Case Report
A 24-year-old Indian male patient was referred to the Department of Endodontics with the chief complaint of spontaneous throbbing pain in the maxillary right premolars (teeth #14 and #15). The patient’s medical history was noncontributory. The dental history revealed that he had undergone root canal treatment for the maxillary right first and second premolars 2 weeks earlier which was incomplete. Clinically, palpation of the buccal and palatal aspects of the teeth #14 and #15 did not reveal any tenderness; however, the teeth were tender to vertical percussion. Periodontal probing around the teeth and mobility were within physiological limits. The access cavity of teeth #14 and #15

Kothandaraman Sathyanarayanan, Manali Ramakrishnan Srinivasan1, Sundaresan Balagopal2, Lingeswaran Poornima3

1Department of Conservative Dentistry and Endodontics, Sathyabama University Dental College and Hospital, 2Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, 3Department of Conservative Dentistry and Endodontics, Tagore Dental College and Hospital, Private Practitioner, Chennai, Tamil Nadu, India

Address for correspondence: Dr. Kothandaraman Sathyanarayanan, No. 17/30, Kingsway Tulips, 5th Cross Street, Trustpuram, Kodambakkam, Chennai - 600 024, Tamil Nadu, India.
E-mail: drsathyas_od@yahoo.com

How to cite this article: Sathyanarayanan K, Srinivasan MR, Balagopal S, Poornima L. Report of occurrence and endodontic management of three-rooted maxillary first and second premolars in the same individual. Indian J Dent Res 2017;28:337-40.
had been sealed with zinc oxide eugenol cement. The preoperative periapical radiograph revealed an abrupt loss of radiolucency in the pulp cavity. The external root morphology shows a greater mesiodistal root diameter in the middle third with three separate roots [Figure 1]. From the clinical and radiographic examination, a diagnosis of symptomatic apical periodontitis of the maxillary right first and second premolars was made, and nonsurgical endodontic treatment was recommended.

Local anesthesia was induced using 2% lidocaine with 1:200,000 epinephrine (Xylocaine, AstraZeneca Pharma India Ltd, Bengaluru, Karnataka, India). The teeth were isolated under rubber dam, the access preparation was modified with an Endo Access Bur and Endo-Z Bur (Dentsply Tulsa, Tulsa, USA), to make a triangular shape at the base, in the buccal direction. Examination of the pulp chamber floor with a DG-16 Endodontic Explorer (Hu-Friedy, Chicago, IL, USA) revealed three separate root canal orifices, one MB, one DB, and one palatal (P). The two buccal canals in the three-rooted premolars were close to each other and covered by a projection of cervical dentin. The pulp chamber floor was positioned more apically, which made it difficult to locate and obtain access to the root canals. The two buccal canals were explored with sizes 8- and 10-K files and the palatal canal with a size 15-K file, resulting in clinical and radiographic confirmation of three canals and three independent roots [Figure 2]. The working lengths were confirmed with the help of an apex locator (Root ZX; Morita, Tokyo, Japan) and radiographic method [Figures 3 and 4]. Coronal enlargement was performed with a nickel–titanium ProTaper SX rotary file (Dentsply Maillefer, Ballaigues, Switzerland) to improve the straight-line access to root canals. Cleaning and shaping were performed using ProTaper nickel–titanium rotary instruments (Dentsply Maillefer) with a crown-down technique. The MB and DB canals were enlarged to ProTaper F2, whereas the palatal canal was enlarged until ProTaper F3. During root canal preparation, irrigation was performed using 2.5% sodium hypochlorite solution and 17% ethylenediaminetetraacetic acid. Final rinsing of the canals was performed using 2% chlorhexidine digluconate. Further Nano-Brush (Denbur Inc., USA) and EndoActivator System (Dentsply Tulsa Dental Specialties, Tulsa, USA), an irrigation facilitator was used separately for thorough debridement of root canal anatomy. After completion of cleaning and shaping, the root canals were dried with absorbent points (Dentsply Maillefer). Calcium hydroxide (Calcicur, Voco, Cuxhaven, Germany) was placed as an intracanal medicament with a lentulo spiral (Dentsply Maillefer), and the access cavity was sealed with Cavit (3M ESPE Dental Products, St. Paul, MN, USA).

At the next appointment scheduled after 2 weeks, the patient was asymptomatic. The root canals were dried and obturation was performed using cold lateral compaction of gutta-percha (Dentsply Maillefer) and AH Plus resin sealer (Dentsply Maillefer, Konstanz, Germany). A final radiograph was taken to establish the quality of the obturation [Figures 5 and 6]. After completion of root canal treatment, the teeth were restored with a composite resin core (Z-100; 3M ESPE Dental Products, St. Paul, MN, USA). The patient was reviewed for 1-year follow-up, and the 1-year postoperative radiograph [Figure 6] reveals no evidence of periapical pathology or symptoms of failure. The patient was subsequently referred for appropriate coronal restoration.

**Discussion**

This article has presented a case report of a patient possessing three-rooted maxillary first and second premolars. Usually, the roots of the premolars are tapered and flattened mesiodistally. This provides more room for the trifurcated roots of the maxillary molars. This also provides sufficient bone formation separating the maxillary antrum from the roots of the premolars. Occasionally, maxillary first or second premolar may have anomalous
three roots but not combined together. The presence of three-rooted maxillary first and second premolars occurring in the same individual from South Indian population is a very rare occurrence, and our literature search did not show any previous report of such occurrence.

The possible anatomic configurations of maxillary premolars are well documented in the literature, except for the reports of maxillary premolars with three roots and three canals.\[2\] Visualization of three-rooted maxillary premolars on the preoperative radiographs can often be difficult due to its lower incidence of occurrence. Whenever there is an indication of different anatomies, additional periapical radiographs should be exposed at mesial or distal horizontal angles.\[2\] Cone beam computed tomography has been used successfully in endodontics for the diagnosis of endodontic pathosis and root canal morphology, assessment of pathosis of nonendodontic origin, evaluation of root fractures and trauma, analysis of external and internal root resorption, invasive cervical resorption, and presurgical planning.

Careful interpretation of the radiograph reveals external and internal anatomic details that suggest the presence of extra canals or roots. If a radiograph shows a sudden narrowing or even a disappearing pulp space, an extra canal should be suspected that could be in the same root or in separate roots. In straight-on radiographs of maxillary premolars, Sieraski et al.\[9\] found that whenever the mesiodistal width of the mid-root image was equal to or greater than the mesiodistal width of the crown, the tooth most likely had three roots.

The access cavity for maxillary premolars is usually oval in the bucco-palatal direction. In this case report, the access cavity was modified. A third root canal should be suspected clinically when the pulp chamber does not appear to be aligned in its expected bucco-palatal relationship or when an eccentric canal orifice was found. If the pulp chamber appears to be either triangular in shape or too large in a mesiodistal plane, more than one root canal should be suspected. The completed access cavity preparation was triangular in outline, resembling the access cavity for maxillary first molar, but smaller in size.
Traditional approach for debridement and irrigation of the root canals was done using syringes and needles of different size and tip designs. However, this approach results in ineffective irrigation, particularly in areas such as anastomoses between canals, fins, and the most apical part of the main root canal. Therefore, several mechanical devices have been developed to improve the penetration and effectiveness of irrigation.

Nano-Brush is an elongated form of microapplicator brush which comes in different sizes/colors. It goes deep inside the root canal and cleans it mechanically from inside the complex root canal system. Further, EndoActivator System uses safe, noncutting polymer tips in an easy-to-use sonic handpiece to quickly and vigorously agitate irrigant solutions during endodontic therapy. EndoActivator had a minimal amount of irrigant extruded out of the root apex when delivering the sonic activation of the irrigant into the pulp chamber and root canals.[10]

Any attempt to perform endodontic therapy must be preceded with a thorough understanding of the anatomy of both the pulp chamber and the root canal system. The use of magnification (surgical loupes and dental operating microscope) and additional lighting (fiber-optic illumination) is recommended for successful management of complex root canal system.

Conclusion

An accurate knowledge of root canal morphology with its anatomical variations was required for successful root canal treatment. Access cavity refinements may be required for the identification and negotiation of the complex root canal anatomy of three-rooted maxillary premolars. Further, endodontic cleaning instruments such as Nano-Brush and EndoActivator System helped in thorough debridement of the complex root canal anatomy.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Gondim E Jr., Setzer F, Zingg P, Karabucak B. A maxillary central incisor with three root canals: A case report. J Endod 2009;35:1445-7.
2. Soares JA, Leonardo RT. Root canal treatment of three-rooted maxillary first and second premolars – A case report. Int Endod J 2003;36:705-10.
3. Vertucci FJ, Gegauff A. Root canal morphology of the maxillary first premolar. J Am Dent Assoc 1979;99:194-8.
4. Vertucci F, Seelig A, Gillis R. Root canal morphology of the human maxillary second premolar. Oral Surg Oral Med Oral Pathol 1974;38:456-64.
5. Bellizzi R, Hartwell G. Radiographic evaluation of root canal anatomy of in vivo endodontically treated maxillary premolars. J Endod 1985;11:37-9.
6. Ferreira CM, de Moraes IG, Bernardineli N. Three-rooted maxillary second premolar. J Endod 2000;26:105-6.
7. Evans M. Combined endodontic and surgical treatment of a three-rooted maxillary first premolar. Aust Endod J 2004;30:53-5.
8. Maibaum WW. Endodontic treatment of a “ridiculous” maxillary premolar: A case report. Gen Dent 1989;37:340-1.
9. Sieraski SM, Taylor GN, Kohn RA. Identification and endodontic management of three-canalled maxillary premolars. J Endod 1989;15:29-32.
10. Desai P, Himel V. Comparative safety of various intracanal irrigation systems. J Endod 2009;35:545-9.