Maxillary second premolar with two roots and three canals: A case report

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Abstract
The success of a root canal treatment depends upon the accurate diagnosis of the anatomy of the root canal. Upper second premolars generally have a single root and one or two canals. Upper premolar teeth with three canals, with two or three roots in maxillary second premolars is quite rare. One can locate the root canal orifices through careful observation of preoperative radiographs and examination of the pulp chamber floor under magnification. This case report presents an unusual anatomy that was detected in a maxillary second premolar.

Key words: Anatomic variations, endodontic treatment, maxillary second premolar, root canal treatment

Introduction
The success of a root canal therapy depends upon a thorough chemo-mechanical cleansing and shaping of the entire root canal system and its three-dimensional filling with a hermetic seal. Tooth anatomy and root canal morphology may be quite variable within the norm. Apart from normal variations, anomalous root and root canal anatomy can also occur and its incidence can be quite variable. So, thorough knowledge about these variations is necessary.

Normal variations usually occur in presence of number of roots, canals in each root, shape of root canals and also fusion of roots or canals at various levels. Maxillary second premolar also shows these variations. Most common form is single rooted with 90.7% of incidence. The incidence of two rooted form ranges from 5.5%\(^1\) to 20.4\(^2\) and the three-rooted form showed an incidence of 0\(^3\)\(^4\) to 1\(^2\). Like the root form, canal system also varies. It has one canal in 50% of the teeth examined, and two canals in 46.5% of teeth. Presence of three canals was a rare finding with 1.2% of incidence.\(^5\)\(^6\) Apart from these normal variations, some anomalous variations like taurodontism\(^9\), dens invaginatus\(^10\) and deep distal root concavity also occur in maxillary second premolars. The presence of three roots and three canals\(^12\)\(^13\) and also two roots and three canals\(^14\)
are rare findings in maxillary second premolar. In this report, a case of two roots and three canals is presented.

**Case report**

A 23-year-old male patient reported to the department complaining of pain in the upper right back tooth for a few days. There was a history of pain to cold and hot food, and also a history of pain at night. Examination of the tooth (tooth 15) revealed a large carious lesion involving occlusal and distal surface with pain on probing. The tooth was mildly tender to percussion. Pulp sensibility tests using cold test (Roeko Endo-Frost; Coltene Whaledent, Langenau, Germany) and electric pulp test (Digitest II Pulp Vitality Tester; Parkell Inc, Edgewood, NY) showed excruciating response. Radiographic examination (tooth 15) revealed carious lesion involving the pulp. No relevant medical history was elicited.

A diagnosis of irreversible pulpitis was made for tooth #15, and root canal treatment was planned. After taking informed consent, root canal treatment was initiated in the undergraduate clinic.

Local anaesthesia (Lignocaine 2%, Adrenaline 1:200000; Aculife Healthcare Pvt Ltd, Gujarat, India) was administered. The pulp chamber was accessed and two canals were located on the buccal aspect. This lead to the suspicion of a perforation or the presence of three canals. A radiographic examination was followed by placing #15 K files through the orifices (Figure 1). Radiographic examination was not conclusive about the presence of a perforation. But, it revealed the presence of a missed root. So, another radiograph was taken with a distal horizontal angulation, which was also not conclusive about the perforation, but it revealed the missed root as the palatal one (Figure 2). The case was referred to the postgraduate clinic.

In the post-graduate clinic, the tooth was isolated using rubber dam (Hygienic; Coltene Whaledent AG, Alstatten, Switzerland) and pre-endo build up was done with resin based composite (3M ESPE, St. Paul, MN). Access cavity was extended palatally using an Endo-Z bur (Dentsply Maillefer, Tulsa, Oklahoma) and the palatal canal was found (Figure 3). To rule out perforation, surgical operating microscope (Seiler, St. Louis, MO) and electronic apex locator (Root ZX Mini; J Morita, Kyoto, Japan) were used. Electronic apex locator gave a gradual rise in electrical resistance in all the canals which proved the canals are intact.

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**Figure 1:** Radiograph of tooth 15 to rule out perforation

**Figure 2:** Radiograph of 15 with a distal horizontal angulation

**Figure 3:** Access cavity showing all the three canals
Working length of the canals was determined using apex locator and confirmed with radiograph (Figure 4). This was followed by shaping and cleaning of the canals. ProTaper rotary system (Dentsply Maillefer, Bellaigues, Switzerland) was used sequentially after preparing the canals up to ISO #15 K-file (Dentsply Maillefer, Bellaigues, Switzerland). Canals were enlarged up to F2. During instrumentation, adequate irrigation was performed with normal saline (Pentagon Labs Ltd., Indore, India), 5% sodium hypochlorite (Pyrex Exports, Roorkee, India) and lubricated using Endoprep-RC (Anabond Stedman, Chennai, India). Final rinsing was done with 2% chlorhexidine digluconate (Asep-RC; Stedman Pharmaceuticals Pvt Ltd., Tamil Nadu, India). After drying the canals with paper points (DiaDent, Burnaby, Canada), obturation was performed with corresponding ProTaper gutta percha points and AH plus sealer (Dentsply Maillefer, Bellaigues, Switzerland) (Figure 5). Root canal orifices were sealed with resin modified glass ionomer cement (GC Fuji II LC; GC Corp, Tokyo, Japan) and coronal restoration was done with composite (Figure 6). Entire treatment was completed in one visit.

Discussion
Persistent or reintroduced microorganisms are the common cause for endodontic failure. A missed canal harbours microorganisms which can lead to posttreatment disease, which makes it necessary to clean and shape entire root canal system in a tooth. For proper cleaning and shaping of the entire system, thorough knowledge about the variations in pulp space morphology is essential.
Clinically, radiographs are the most useful tool in detecting extra roots and canals in a tooth. Tube-shift technique using a change in 20 degrees - 40 degrees horizontal angulation is suitable for detecting number of canals in one root.

The use of apex locators to find out perforations were initially described by Nahmias et al. in 1983. In the present case report, since the radiographs were inconclusive about the perforation, apex locator was used for a definitive diagnosis. Surgical operating microscope was also used for modification of the access preparation, finding the missed canal and also to rule out perforation.

Conclusion

The present case report emphasizes the importance of radiographs and magnification during endodontic treatment, and also the use of apex locators in identifying anatomical variations from suspected perforation. Moreover, a thorough understanding of root canal anatomy with all its variations is of utmost importance to achieve the best possible prognosis.

References