

CASE REPORT

IDENTIFICATION AND ENDODONTIC TREATMENT OF THREE-CANALLED MAXILLARY FIRST PREMOLAR

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Maxillary premolars exhibit variable root canal morphology, but it is quite rare to find three canals in their root system. The aim of this case report is to present the diagnosis and clinical management of a patient with anatomical variation of having three root canals in the maxillary first premolar. Three-canalled maxillary premolars are quite an endodontic challenge. A discussion is provided here to facilitate the early recognition of these canals, access cavity modifications for better intra-canal preparation and obturation procedures. Clinicians are required to be aware of the anatomical variations they may encounter when dealing with maxillary premolars and should be trained to apply this knowledge in the clinical scenario.

Keywords: Maxillary First Premolar; Anatomical Variations; Root Anatomy; Endodontics

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INTRODUCTION

In order to perform endodontic therapy successfully, it is imperative that the clinicians should have an in-depth knowledge of external and internal tooth anatomy. The lack of sufficient knowledge results in the misdiagnosis, error in identification and localization of the root canal systems present and incomplete or erroneous preparation and canal filling. It is recommended that before initiating any endodontic treatment, the clinician obtains 2 or 3 radiographs from different angles to show and confirm the exact anatomical form and variation.¹

Maxillary first premolars have a very complex internal anatomy due to their inherent variation in root numbers and canal configuration (Figure-1).^{2,3} For the first maxillary premolars, the incidence of three canals is very low (~3-5%).⁴⁻⁶ Whereas, this three-canalled observation is about 1% for maxillary second premolars.⁷ In a study performed by Vertucci and Gegauff⁸ it was observed that 5% of the 400 maxillary first premolars observed had three canals with 0.5% of these three canals existing in a single root, 0.5% presented as two canals in one root and one canal in second root, and 4% were seen to exist as one canal in each of the three roots. The three-canalled maxillary premolars are difficult to visualize on preoperative radiographs. The general consensus is that the earlier these root canal configurations of very complex nature can be identified, the more likely it is that the clinician can successfully perform the intracanal preparation and obturation.

The most common root canal configuration observed for the three-canalled maxillary first premolar is the three separate roots, each consisting of a single canal classified as the mesiobuccal, distobuccal and the palatal canals.⁹ These three root

canals result in an anatomy of maxillary premolars that resembles the adjacent molars and are therefore sometimes called 'radiculous' (small molars).¹⁰ It is very helpful to examine radiographs obtained from contralateral teeth to compare and identify when suspecting a complex root configuration. The three rooted configuration of maxillary first premolars can often be visualized on preoperative radiographs.^{9,11} When employing straight-on radiographs the general rule and guide for identification of the three-rooted tooth is that if the mesial-distal width of the mid-root image appears greater or equal to the mesial-distal width of the crown image, then three roots are most likely to be present. Though this guideline provides a good visual cue, it is not definitive. The closer examination of extracted maxillary first premolars with three roots in comparison with maxillary first premolars with two roots (two canals in buccal root, one in palatal) demonstrates how this guideline is only valid for three-rooted premolars.⁹ The main aim of this case report is to present the identification and endodontic management of a three-canalled maxillary first premolar.

CASE REPORT

A 19 year old male patient was presented to the clinic referred by another general dental practitioner with spontaneous pain in tooth # 14. The past and present medical history was unremarkable. Clinically, it was observed that the pulp was exposed by a carious lesion in tooth #14. The tooth was sensitive to cold or electronic pulp testing with the response indicating towards irreversible pulp damage. A preoperative periapical radiograph confirmed the presence of a carious lesion on the distal surface of tooth #14 (radiograph not available).

The evaluation of the periapical radiograph together with the position of the buccal canal orifice

suggested the possibility of the presence of a third canal. Buccal canals in three-rooted premolars are usually observed to lay close to each other and are often covered and hidden by a projection of cervical dentine.^{9,12} An Endo Access bur 3 A0164 (Dentsply Maillefer, Ballaigues, Switzerland) was utilized to modify the access opening edges to create a triangular outline in the buccal direction. After removing the coronal pulp, the floor was explored. The buccal canals were explored with size 8 and 10 files and the palatal with a size 15 K file (Mani inc, Japan). A periapical radiograph was taken (Figure-2) to confirm the presence of three separate roots and three separate canals (two buccal and one palatal).

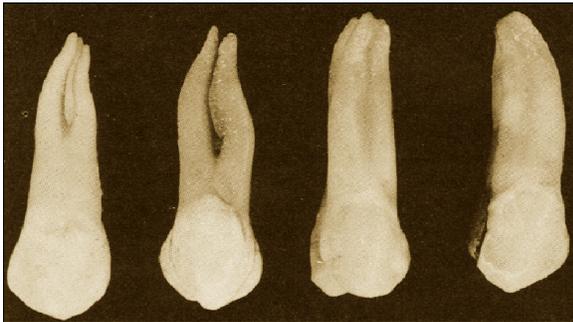


Figure-1: The comparison between root morphology of extracted maxillary premolars with three root canals



Figure-2: Radiographic confirmation of the independent trajectory of the three root canals and their respective roots in tooth #14



Figure-3: Radiograph following the obturation of the three root canals in tooth #14

The working length was confirmed using an apex locator. The buccal roots were prepared manually using 8, 10 and 15 K files (Mani inc, Japan). Sizes 1, 2 and 3 Orifice shapers of the Profile system (Dentsply, Maillefer) were used to achieve the counter-curve reduction of the cervical and middle thirds. The apical third preparation was accomplished with sizes 1-6 taper 0.04 instruments of the Profile (Dentsply, Maellefer) series with copious irrigation with 1% sodium hypochlorite. The buccal root canals were shaped to a size 4 taper 0.04 instrument and the palatal canal to a size 5 taper 0.04 instrument. After cleaning and shaping, the canals were dried with paper points (Roeko, Coltene/ Waledent-Germany) and filled with gutta percha (Roeko, Coltene/Waledent-Germany) and AH26 sealer (Dentsply Dentry GmbH, Germany) by cold lateral condensation (Figure-3). The access cavity was sealed with composite (Filtek™ Supreme 3M ESPE). Postoperative instructions and analgesic were given and the patient was referred to a periodontist for crown lengthening to prevent biologic width violation before crown preparation would be carried out.

DISCUSSION

The maxillary first premolars are among the most challenging teeth to be managed via endodontic therapy. The various reasons for this are: the varying number of roots, number of canals, variations in pulp cavity configuration, the longitudinal and directional depressions present on the roots and limitation and difficulty of visualization of apical limit on radiographs.¹ The acquisition of sufficient knowledge of tooth, root canal and pulp morphology can lead to improvement in endodontic therapy results. Traditionally in the past many clinicians have treated maxillary first premolars assuming that they have 2 canals. This concept has and should change now since we know that although the incidence is low, between 0.5–7.5% of these teeth possess 3 canals.^{1,6,13,14} We know that the root curvature towards the buccal or lingual cannot be detected in radiographs. This can result in perforations during instrumentation. It has been shown that lingual root is straight in about 24% and curve towards the buccal side in 26% of the 2 rooted teeth.¹ Also, the buccal root being longer by almost 1 mm than the lingual root has been seen.^{1,15} The recognition of variations in length and curvatures of roots allows the clinician to adjust his technique and instrumentation to avoid iatrogenic perforations.

The foundation of successful endodontic treatment is always dependent on achieving good access.^{16,17} A cavity modification into a “T” shape access cavity is required for the three-canalled

maxillary first premolar.^{9,18} This access cavity goes from mesial to distal extending the buccal aspect of the usual outline form.⁹ This modification results in adequate access to the two buccal canals. Sometimes the two buccal canals arise from a narrow common canal that originates from the pulp chamber and this creates an “S” shaped configuration that restricts instrumentation as it is difficult to maintain that shape.^{19,20} This situation can be negotiated by creating and extending a trough 1–2 mm apically over and between the buccal canals.^{9,20} This is similar to pre-flaring during intra-canal preparation and eliminates the “S” shaped canal rendering apical canal instrumentation more manageable.⁹ Once the access cavity has been prepared, intra-canal preparation can be completed. Narrow buccal canals should not be over-enlarged (to avoid “strip” perforation) and should be negotiated with a #10 endodontic file till the full working length.⁹ Once the intra-canal preparation is accomplished using step back flaring, reverse flaring and/or reverse filing to satisfaction, the obturation can be initiated and completed.^{21,22}

CONCLUSION

It is very important for clinicians to have a clear knowledge of the anatomical variations in maxillary premolars they may encounter. This knowledge has to be applied towards successful radiographic and clinical interpretation. Due to the complex anatomy that may prevail, access cavity refinements are usually required to achieve stress-free and uncomplicated straight line access to the canals. The saying that ‘what you don’t know doesn’t hurt you’ does not apply to dentistry and the field of endodontics particularly. The lack of identification which leads to missing the present extra canal often leads to persistent pain encountered by the patients after root canal therapy. The complex premolar anatomical presentations require management following accurate identification and negotiation.

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