

ENDODONTIC MANAGEMENT OF A MAXILLARY FIRST MOLAR WITH THREE SEPARATE ROOT CANALS IN THE MESIOBUCCAL ROOT: A CASE REPORT

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ABSTRACT:

Root canal morphology is complex and aberrations are common. A thorough knowledge of the same is extremely important when performing endodontic therapy. This article describes the identification of three root canals in the mesiobuccal root of a maxillary first molar. These three canals existed in a Vertucci Type VIII canal configuration.

A 23-year-old male patient was referred to the Department of Endodontics for Root Canal therapy of tooth 26. After obtaining adequate coronal access, the mesiobuccal, distobuccal and palatal canals were located. Clinical examination, exploration and probing of the pulpal floor revealed two additional canal orifices in the mesiobuccal root. Radiographs confirmed the presence of three canals in the mesiobuccal root. This was further confirmed by three separate working length readings in the mesiobuccal root with the aid of an electronic apex locator and instrumentation and obturation were completed.

Radiographs and clinical examination confirmed the existence of a Vertucci type VIII canal configuration in the mesiobuccal root of tooth 26.

This report describes and discusses the variation in root canal morphology of the maxillary first molars. It also emphasizes the importance of manual exploration, keen observation and use of magnification over the radical use of newer invasive diagnostic modalities.

Key Words: Tooth anatomy, root canal configuration, root canal aberrations, three mesiobuccal root canals



INTRODUCTION:

The primary aim of endodontic therapy is the alleviation of oro-facial pain and swelling. To achieve this, a thorough understanding of the morphology of the root canal system is essential. It aids in the location of root canals which thus enables the complete chemomechanical debridement of microorganisms. An

inadequate knowledge of the pulp space anatomy is the most common cause for difficulties and complications encountered during endodontic therapy. It is thus indispensable to familiarize ourselves with the complexities and aberrations of the root canal system to achieve the highest standards of treatment.

The maxillary molars have been the most written about teeth because of the varied internal anatomy and morphology. The normal root canal anatomy of the maxillary first molar has been described as having three roots with three or four root canals. Of these, the mesiobuccal root of the first maxillary molar has had its own domain with a large amount of literature discussing the canal configuration of this root. The mesiobuccal canal space can vary from a simple, single canal to multiple canals with anastomoses or isthmus areas woven throughout the root length [1]. Evenot (1980) stated that it was the most difficult root to treat endodontically and also that some of the anatomic variations seen in this root defied any successful treatment available at that time [2]. Maxillary molars frequently present with variations and in these teeth, upto five roots [3] or even upto eight canals [4] have been reported.

The most common variation in the pulp anatomy of maxillary first molars is the presence of a second mesiobuccal canal (MB2), also known as the mesiolingual or the mesiopalatal canal. Numerous studies have reported the frequency of occurrence of a second canal in the mesiobuccal root of maxillary molars [5]. The occurrence of this canal has been reported to be as frequent as 96% [6]. It has been stated that failure to locate and obturate the second mesiobuccal root canal of the first maxillary molar could be the chief contributing factor for endodontic treatment failure of the maxillary molars [4].

Neaverth *et al* [12] stated that the incidence of 3 canals exiting as three separate foramina in the mesiobuccal root of the first maxillary molars is only 0.4%. Very few cases have been reported where three canals were located in the mesiobuccal root of maxillary first molar [4]. The present case report describes the successful endodontic management of a maxillary first molar which presented with three canals in the mesiobuccal root with a type VIII canal configuration as given by Vertucci [18].

CASE DETAIL:

A 23-year old male with a non-contributory medical history was referred to the Department of Conservative Dentistry and Endodontics of Pacific Dental College, Udaipur, India for treatment of the left maxillary first molar (26). The patient complained of spontaneous, intermittent pain which aggravated by thermal stimulation. Intraoral examination revealed mesioproximal caries in the left maxillary first molar which was sensitive to percussion and gave a delayed reaction to pulp vitality tests (electrical and thermal). Mobility and periodontal probing around the tooth were within physiologic limits. An intraoral periapical radiograph revealed a deep carious lesion in tooth 26 involving the mesial portion of the crown and extending upto the mesial pulp horn with the widening of the periodontal ligament space. The standard periapical radiograph showed the three roots with no indication of any extra root canals. A diagnosis of irreversible pulpitis with

symptomatic apical periodontitis in relation to tooth 26 was made and endodontic treatment was advised.

After obtaining adequate anaesthesia, coronal access was established under rubber dam isolation. Initially, the mesiobuccal, distobuccal and palatal canals were identified. Careful probing was carried out for exploration of the mesiolingual canal and it was located. At this point it was noted that the fissure between the mesiobuccal and the mesiolingual canal had a soft area and thus further exploration and probing were carried out. Using a DG16 endodontic explorer (EXDG16, Hu-Friedy, Chicago, IL) and a no. 6 K file (Mani Inc., Japan), the third canal was identified in the mesiobuccal root. An electronic apex locator (Raypex 5, VDW GmbH, Munich, Germany) was used to ensure that the third canal was not a perforation of the pulpal floor. The three mesiobuccal canal orifices could be clearly distinguished by the use of 2.5X dental loupes and a surgical operating microscope (Seiler, St. Louis, Missouri, United States). Exploration of the three mesiobuccal canals using no. 8 K files and subsequent radiographs in an eccentric distoradial position indicated that the three canals exited as three separate apical foramina (Type VIII). This was further confirmed by the fact that the electronic apex locator gave three different working length readings for the three canals. The coronal orifices of all five canals were enlarged (Figure 1A). An electronic apex locator and multiple working length radiographs at different angulations were used to

determine the working lengths of all the five canals (Figure 1B). The canals were instrumented using manual NiTi instruments (ProTaper, Dentsply Maillefer, Ballaigues, Switzerland) using the crown down technique. Calcium hydroxide intracanal dressing was placed followed by a temporary restoration (IRM, Dentsply Caulk, Milford, DE). At the next appointment, the patient was asymptomatic and thus all the five canals were obturated using cold lateral compaction of gutta percha (ProTaper, Dentsply Maillefer, Ballaigues, Switzerland) (Figure 2A) and AH plus sealer (Dentsply De Trey GmbH, Konstanz, Germany). Post obturation radiograph (Figure 2B) was taken to ascertain the adequacy of the root canal obturation and a composite post endodontic permanent restoration was placed.

DISCUSSION:

The root canal morphology is frequently very complex and highly variable. The maxillary first molar is a typical example. Root canal aberrations present not only with extra canals or lesser number of canals, but may also be encountered as apical ramifications, apical deltas and lateral canals. One such case report [7] presented a patient with all maxillary and mandibular molars and premolars having single roots with single root canals. Missed canals often results in failure of the endodontic treatment. It is thus essential that every attempt be made to locate all root canals so that further instrumentation and obturation can be satisfactorily achieved.

Radiographs are essential for endodontic diagnosis as well as treatment. A three dimensional picture of the expected number of canals and their locations must be developed so as to interpret them thoroughly. Use of periapical radiographs is essential to identify and monitor anatomical details, canal length, quality of obturation and tooth and bone pathology [8]. Unfortunately, images created by the standard angulations can result in superimposition of adjacent anatomical landmarks or pathological features leading to difficulties during interpretation. The buccolingual dimension is missed [9]. To assess this third dimension onto these radiographs, a deliberate and controlled alteration of radiation geometry can be beneficial [8]. The use of Clark's [10] Buccal object rule and the triangular scanning technique as suggested by Bramante [11] may aid in the three dimensional interpretation of radiographs. Corroborating the clinical findings with radiographs before and during access preparation, aids in locating aberrations in the root canal system. In the present case, radiographs taken from various angulations helped in the confirmation of the canal configuration in the mesiobuccal root.

The present case report discusses the presence of three canals in the mesiobuccal root of a maxillary first molar which can be classified as Vertucci type VIII. The canals extended all the way upto the root apex as separate entities and exited at separate apical foramina as confirmed by three separate apex locator working length readings and also by

radiographs. The distobuccal and palatal roots showed a type I canal configuration with single canals which is the most predominant form [12].

Though there have been a few similar clinical reports (Table 1), most of these present cases where these three canals exist in a type XV canal configuration as given by Sert and Bayirli [13] and exit at two apical foramina. The only case of a maxillary first molar with three mesiobuccal canals which exit as three separate foramina has been reported by Beatty [19]. (Table 1)

Today, magnification is considered to be an indispensable aid in endodontics [14]. Hence, dental loupes with a 2.5X magnification and surgical operating microscope were used for the location of the root canals. It has been conclusively proven that additional canals are more frequently located with the use of an operating microscope [15,16]. Though Sempira et al [17] stated that the number of second mesiobuccal canals located was not significantly increased with the use of a surgical microscope, the authors are of the opinion that surgical microscopes aid in location and confirmation of these canals due to their enhanced illumination and vision. It is justified to use surgical microscopes for canal location as they are relatively docile, safe and non-invasive compared to the more complex radiographic imaging modalities (SCT & CBCT). In the present case, the relatively easy identification of the three mesiobuccal canals with the use of

magnification could probably be attributed to the young age of the patient.

Spiral Computed Tomography (SCT) and Cone Beam Computed Tomography (CBCT) are frequently employed nowadays in cases where extra canals are suspected. The authors were also tempted to justify the presence of three mesiobuccal canals by the use of CBCT but felt it unnecessary due to the relative ease of location of the root canals. Also it would be unjust to expose the patient to unnecessary radiation when conventional radiography and magnification were sufficient enough to confirm the aberration and thus it was deemed inappropriate to adopt any further diagnostic or confirmatory measures. The authors would also like to state that the recent diagnostic trend to use CT and CBCT should be appropriately reviewed

and weighed against the concerns of radiation and the high cost of the equipment. The need for high end diagnostic imaging should be restricted to difficult cases where the abovementioned diagnostic modalities do not suffice.

CONCLUSION:

We would thus like to conclude that this report is clinically significant as it is the first report of a maxillary first molar with a type VIII canal configuration in the mesiobuccal root which could be confirmed by the use of an electronic apex locator and magnification apart from routine radiography. This paper thus highlights the importance of bearing detailed knowledge of pulp space morphology, a keen observation and patience for endodontic exploration.

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TABLE:

Table 1: Summary of Case Reports of Maxillary First Molars Presenting with three root canals in the mesiobuccal root

Total no of canals	Canal configuration of MB root	Reference
Six (2 cases)	*	Martínez-Berná et al
Five	¥	Beatty RG
Five	*	Ferguson et al
Five	*	Favieri et al
Six	*	Adanir N
Six	*	Ibrahim S
Seven	*	Kottoor et al
Five	*	Garg et al
Five	*	Lin et al
Eight	*	Kottoor et al
Five	*	Chourasia et al
Five	*	Ayranci et al
Five	¥	Present case

* Sert and Bayirli's type XV, ¥ Vertuci's type VIII.

FIGURES:

