

Endodontic Treatment of a Maxillary First Molar with Seven Root Canals Confirmed with Cone Beam Computer Tomography – Case Report

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ABSTRACT

The most common configuration of the maxillary first molar is the presence of three roots and four root canals, although the presence of several other configurations have already been reported. The objective of this work is to present a rare anatomic configuration with seven root canals diagnosed during an endodontic therapy. Endodontic treatment was performed using a dental operating microscope. Exploring the grooves surrounding the main canals with ultrasonic troughing was able to expose unexpected root canals. Instrumentation with files of smaller sizes and tapers was performed to prevent root physical weakness. The anatomic configuration was confirmed with a Cone Beam Computer Tomography image analysis which was able to clearly show the presence of seven root canals. An electronic database search was conducted to identify all the published similar cases and the best techniques to approach them are discussed.

Keywords: Anatomy, Cone beam computer tomography, Molar, Root canal therapy

CASE REPORT

A 30-year-old Indian male was referred to an endodontic appointment reporting a main complaint of a sharp and increasing pain to temperature variations in the upper right side. Clinical examination revealed a large resin filling on the occlusal surface of the maxillary right first molar, no periodontal pockets were present and the tooth mobility was within physiological limits. No swelling was associated or pain on lying down. The preoperative panoramic radiograph confirmed a deep filling with a possible secondary caries lesion on the distal aspect of the tooth. The periodontal ligament space was uniform surrounding the three usual roots [Table/Fig-1]. The reaction to the ice sensibility test was intense pain that lingered for several minutes. The diagnosis was irreversible pulpitis on maxillary right first molar (tooth #16). The clinical condition was explained, the endodontic treatment was proposed and accepted by the patient.

Buccal and palatal infiltration anaesthesia was performed using 1.8ml of 4% articaine with 1:200,000 epinephrine (Artinibsa, Inibsa, Spain) and isolation with rubber dam was obtained. The resin filling was removed and a proper access cavity was achieved. The examination of the pulp chamber floor utilizing a dental operating microscope (Opmi Pico, Carl Zeiss Surgical, Germany) was able to identify three canals [mesiobuccal (MB1), distobuccal (DB1) and palatal (P)] in the extremities of the dark developmental lines of the dentinal map. After canal identification and negotiation, the working length was determined by apical radiographs and confirmed with electronic apex locator (Root Zx II, Morita, USA) and the mechanical instrumentation was performed with the Profile NiTi rotary files (Profile, Dentsply Maillefer, Switzerland) until a 25.04 could reach the working length in the buccal canals and 35.06 in the palatal. All the instrumentation was performed with a continuous irrigation with 5.25% sodium hypochlorite. A closer look of the pulp chamber floor was able to detect two grooves, one starting in the MB1 with direction towards the palatal and a second groove surrounding the DB1. The two grooves were opened with #2 ProUltra ultrasonic tip (ProUltra, Dentsply Maillefer, USA) troughing and four extra canals were detected (MB2, MB3, MB4 and DB2) [Table/Fig-2]. These root canals were prepared as the other three. Profile 20.04 was the last apical file in the three new mesial canals to avoid over instrumentation and physical weakness in a root with so many canals. Due to time

limitations the therapy was accomplished in two appointments. Calcium hydroxide, as intracanal medication, and Cavit (Cavit W, 3M ESPE, Germany), as provisional restoration, were used between visits. To perform a better anatomic diagnosis and confirm this rare condition so that the rest of the treatment could be better planned a CBCT (Planmeca ProMax, Planmeca, Finland) was performed between appointments, with patient authorization, and the images analyzed on proper computer visualization software (Planmeca Romexis, Planmeca, Finland). Several axial slices were observed to understand the anatomy of tooth 16 [Table/Fig-3]. At the second appointment, recapitulation was performed and a final irrigation protocol which included 17% EDTA irrigation followed by a final rinse with sodium hypochlorite was performed. The obturation technique chosen was the continuous wave of condensation technique. AH plus (AH Plus, Dentsply, Germany) was used as sealer [Table/Fig-4-6]. The pulp chamber was restored with Cavit filling. The tooth was scheduled for permanent restoration with the primary dentist and full crown coverage was done. The 8-months follow up shows no clinical or radiographic finding [Table/Fig-7].

DISCUSSION

With the constant evolution of techniques and technology employed in Endodontic, it becomes mandatory to have a deep knowledge of the tooth internal anatomy so that an increase of the effectiveness of the endodontic treatment can be achieved. Anatomy studies using Cone beam computer tomography (CBCT) [1,2] and Micro-computed tomography (μ -CT) [3,4] technology has given new information about the internal morphology of the root canal system.



[Table/Fig-1]: Initial panoramic radiograph **[Table/Fig-2]:** Pulp chamber floor after full biomechanical instrumentation with seven root canal orifices



[Table/Fig-3]: Pulp chamber floor after root canal filling. **[Table/Fig-4]:** Final endodontic treatment radiograph **[Table/Fig-5]:** Final endodontic treatment radiograph taken from distal **[Table/Fig-6]:** Eight months follow-up



[Table/Fig-7]: A) CBCT axial view from the coronal third of the root of the maxillary right first molar, (B) CBCT coronal view of the mesiobuccal root, (C) CBCT coronal view of the distobuccal root

Name of authors	Country / Ethnicity	Gender	Age	Number canals	Diagram	Root configuration	Study type
Baratto-Filho (2009) [7]	Brazil / N/A	N/A	N/A	7		Both MBR and DBR with type XVIII (3-1) and PR with type I (1)	ex vivo
Kottoor (2010) [10]	India / Indian	Male	37	7		MBR with type XV (3-2) and both DBR and PR with a type II (2-1)	in vivo
Kottoor (2011) [11]	India / Indian	Male	30	8		Both MBR and DBR with type XV (3-2) and PR with a type II (2-1)	in vivo
Present work	Portugal / Indian	Male	30	7		MBR with type (4-1), DBR with type II (2-1) and PR with type I (1)	in vivo

[Table/Fig-8]: Characteristics review of the case reports with seven or more root canals available in the literature
 MBR: mesiobuccal root, DBR: distobuccal root, PR: palatal root

A new knowledge that reports complex multicanalar systems with anastomosis and isthmus connecting the main root canals that may merge and separate along their track in the tooth root and that may end in several apical foramina [3,4] is now available.

Several anatomic variations of the configuration of the maxillary first molar have been reported in the scientific literature. A study from Cleghorn et al., [5] makes an extensive review of the available literature. Regarding the mesiobuccal root, in a combine sample of 8399 roots from 34 laboratorial and clinical studies it was possible to identify one canal (MB1) in 43.1 % of the cases and two canals or more in 56.8 %. Two CBCT studies from Kim et al., [6] (n=814) and Lee et al., [1] (n=458), and a μ -CT study from Kim et al., [3] (n=154) reported an incidence of MB3 in 0.1 %, 1.3 % and 12 % respectively. The distobuccal root review by Cleghorn et al., [5]

had a combined sample of 2576 roots from 14 laboratorial and clinical studies. The incidence of a single canal was 98.3 % and the presence of two or more canals was found in 1.7 % of the cases. A four root canals orifice in the pulp chamber floor is the most common configuration for the maxillary first molar [5]. An incidence of 1.23 % has been reported for the presence of five root canals orifices [6]. Although the presence of six root canals is a rare condition, Zheng et al., [2] (n=775) and Baratto-Filho et al., [7] (n=291) were able to document an incidence of 0.31% and 0.34 % respectively. Very few case reports have been presented [8,9]. Baratto-Filho [7] (n=140) was able to report an incidence 0.72 % for seven root canals configuration. Only two in vivo case reports have been presented [10,11], both case reports belong to patients of Indian ethnicity, as does the case presented in this study [Table/

Fig-8]. These multicanal configurations may be a characteristic of this ethnic population.

The present study reports a configuration on the pulp chamber floor with the presence of seven root canals orifices. The detection of this configuration was only possible after a careful analysis of the pulp chamber under a dental operating microscope. A careful observation of the dark developmental lines and exploration of the grooves that may surround the root canals may show other unexpected root canals of a complex root canal system. Opening this grooves using an ultrasonic troughing technique has been described as helpful on locating extra canals [12], as have several studies report a significant difference on the number of located canals when comparing examinations of the pulp chamber with or without magnification [13,14]. The final apical file was a 25.04 or 20.04 file, which may be considered a small size and small taper when compared to other systems, the decision of finishing in these sizes and tapers was made taking into account that a physical weakness should be avoid in roots with so many root canals, and avoid also the apical over instrumentation that could lead to apical transportation since the four mesial root canals appear to have a single foramen apical. The obturation technique chosen to this case was the continuous wave of condensation. Although it has been stated that has similar success rates as the lateral condensation [15], it has also been proved to be able to provide a higher density condensation when compared to lateral technique [16] and is able to provide a good filling of groove and depressions in complex root canal systems [17]. When dealing with multicanal configurations, the radiographic controls may provide limited information because of anatomic structures overlapping [18]. In the present case report the CBCT scan was performed for a better understanding of the root canal configuration. The image analysis was able to show a Vertucci type II (2-1) configuration on the distobuccal root and a Vertucci type I [1] configuration on the palatal root. In the mesiobuccal root a Sert type XXI (4-1) was present.

CONCLUSION

Unexpected root canal configurations may always be possible to be present in the maxillary molar. The dental operating microscope and CBCT scans are important to a correct understanding of the root canal morphology. The grooves surrounding the root canals orifices may hide a multicanalar configuration.

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