

Case Report

Unusual root canal morphology of mandibular first premolar and its management: A rare case report

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Abstract

Clinicians proceed the canal exploration according to the literature so far reported. At times, there are apparent variations in the teeth. These discrepancies should be thoroughly surveyed and piled up to date. One such rare complexity of canal morphology was discussed in the present case. A 48-year-old female patient referred to the endodontic clinic for full-mouth rehabilitation. On intraoral hard-tissue examination, decay was noted in multiple teeth which were confirmed by an orthopantomogram and endodontic treatment plan was suggested. The patient was prepared for the access opening of right mandibular first premolar (tooth #44) before which endodontic treatment of first and second quadrants was completed. The cone-beam computed tomography (CBCT) images revealed that tooth # 44 had two separate roots and four distinct root canals (mesiobuccal, mesiolingual, distobuccal, and distolingual). Root canal treatment was completed in two visits. Postoperative CBCT was advised to confirm the obturation of all the canals.

Keywords: Cone-beam computed tomography; root canal anatomy; variations; Vertucci

INTRODUCTION

Knowledge of root canal anatomy and morphology is imperative to locate, clean, and shape root canal systems and seal them. While any single factor cannot be related to clinically better outcomes, all these factors seem to work in close relation to each other.^[1]

The complexities of the root canal systems of human teeth have been published by several authors.^[2,3] Although some variations have been reported to be very rare, an astute clinician must be able to recognize such a variation when encountered clinically. One tooth which is often considered simple, while in reality houses a very complex anatomy is the mandibular premolar. High flare-up and failure rates have been reported with root canal treatment in these

group of teeth.^[4] One possible explanation could be the extreme variations in root canal morphology in these teeth.^[5]

To the best knowledge of the authors, the occurrence of two canals with four orifices and four apical foramina in a mandibular first premolar has not been reported thus far. This case report presents the nonsurgical endodontic management of a mandibular right first premolar with two roots and four distinct root canals which were diagnosed using cone-beam computed tomography (CBCT).

CASE REPORT

A 48-year-old female patient was referred to the department for full-mouth rehabilitation due to multiple carious lesions and spontaneous pain in the right lower back teeth region. Clinical and radiographic examination revealed dental caries involving the pulp in teeth #11, #12, #13, 14, #21, #22, #23, #24, #44, #45 [Figure 1a]. Teeth #11, #44, and #45 were tender on percussion. Pulp

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sensibility test with an electric pulp tester (API Pulp Tester, India) showed negative response in teeth #11, #12, #13, #14, #21, #22, #23, and an exaggerated response with lingering pain in #44 and #45. Based on the clinical and radiographic findings, teeth #44 and #45 were diagnosed as symptomatic irreversible pulpitis with symptomatic apical periodontitis while #12, #13, #14, #21, #22, and #23 were diagnosed as pulp necrosis and #11 as pulp necrosis with symptomatic apical periodontitis. Root canal treatment was advised for the aforementioned teeth.

Following local anesthesia (Lignox), under rubber dam isolation (Coltene, Whalident), access cavity was prepared in #44 and #45. During access cavity preparation in #44, vague outlines of three canals were seen (mesiobuccal, mesiolingual, and distal). The trunk of the pulp chamber seemed to trifurcate giving rise to three separate canals. Working length (WL) was determined using an electronic apical locator (Propex pixi, Dentsply) and an intraoral periapical radiograph was also taken for confirmation of the presence of three canals [Figure 1b]. The endometric radiograph revealed an extra canal that was distally placed [Figure 1c]. However, the canal could not be confirmed clinically and hence not explored. The mesiobuccal, mesiolingual, and distal canals were first negotiated with a size 10 K file (Dentsply) and prepared up to an apical size of 25 in a step-back approach. During root canal preparation, 3% sodium hypochlorite (NaOCl) and 17% ethylenediaminetetraacetic acid (EDTA) (SmearClear, Kerr) was used as the irrigant. The access cavity was filled with intracanal medicament and temporarily restored with Cavit (3M, ESPE).

To confirm the diagnosis of the presence of a fourth canal and identify its location, a CBCT scan was advocated following an informed consent. A three-dimensional image of the mandibular first premolar was obtained at a setting of 70 KV of tube voltage and a tube current of 10 mA for 10.8 s. The CBCT images revealed that tooth #44 had two separate roots and four distinct root canals (mesiobuccal, mesiolingual, distobuccal, and distolingual) [Figure 1g and h].

At the second visit using the CBCT images as the guidance, the fourth (distobuccal) canal was located under $\times 3.5$ following refinement of the access cavity using tapered, diamond-coated ultrasonic tips (Tün Endo Ultrasonics, USA). WL was established [Figure 1d]. The fourth canal was instrumented with size 06, 08, and 10 K-Flexo hand files. Cleaning and shaping was completed in all canals using Hero Shaper (Micro Mega) rotary instruments, up to an apical size 30/0.04. Canals were filled with 5.25% NaOCl and sonic activation for 30 s at 10,000 rpm (EndoActivator, Dentsply). Obturation was done using backfill technique (Obtura II) and restored with composite [Figure 1e]. Postoperative CBCT was taken to confirm the quality of treatment procedure [Figure 1i and j]. Under

asymptomatic conditions, porcelain fused to metal crown was placed after 15 days [Figure 1f].

DISCUSSION

The endodontic literature so far revealed a high percent of cases with more than one canal in mandibular premolars [Table 1].^[6-9] In a review of Blaine *et al.* (2013) which included eight studies found the majority of the mandibular first premolar had a single root in (97.9%). Two roots were found in 1.8% of the teeth studied. Three-rooted (0.2%) and four-rooted (0.1%) varieties were quite rare.^[6] Therefore, it infers a racial predisposition for the presence of two or more canals in mandibular first premolar.

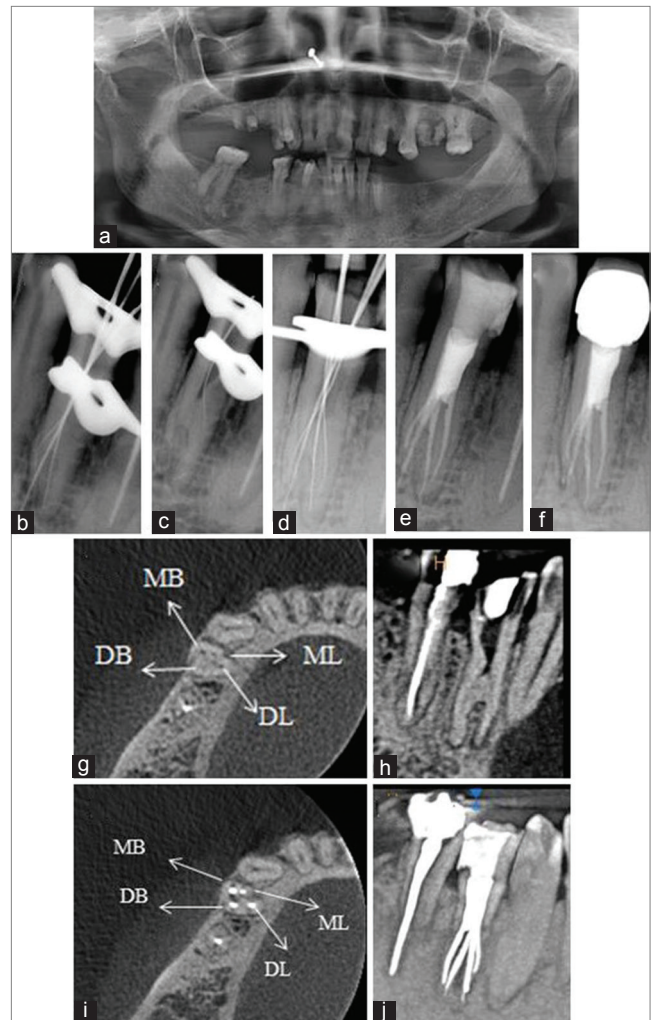


Figure 1: Mandibular right first premolar (#44): (a) Preoperative orthopantomograph. (b) Working length intraoral periapical radiograph, (c) Intraoral periapical radiograph reveals to have an extra fourth canal, (d) Working length intraoral periapical radiograph, (e) Postoperative intraoral periapical radiograph. (f) Postoperative intraoral periapical radiograph with crown, (g and h) Preoperative cone-beam computed tomography scan axial view and sagittal view, (i and j) Postoperative cone-beam computed tomography scan axial view and sagittal view

Table 1: Cases reported by authors with varied canal morphologies

Number of roots	Root canals	Diagnostic method	Country	Authors
1 Root	2 Canals	R/G	USA	England <i>et al.</i> 1991
	3 Canals	R/G	Jamaica	Nallapati 2005
	3 Canals	R/G	Brazil	De Almeida-gomes <i>et al.</i> 2006
	2 Canals	R/G	India	Shenoy <i>et al.</i> 2013
	3 Canals	R/G	India	Daneshvar F <i>et al.</i> 2015
2 Roots	3 Canals	R/G	Iran	Vyapaka Pallavi <i>et al.</i> 2015
	3 Canals	R/G	India	Moayedhi and Lata 2002
	Nil	R/G	USA	Milano <i>et al.</i> 2002
	3 Canals	R/G	India	Poorni <i>et al.</i> 2010
	2 Canals	R/G	India	Kararia <i>et al.</i> 2012
3 Roots	3 Canals	3d CBCT	India	K Balakasireddy <i>et al.</i> 2015
	3 Canals	R/G	China	Chan <i>et al.</i> 1992
	3 Canals	Extraction	USA	Fischer and Evans 1992
	3 Canals	Micro	Britain	Cleghorn <i>et al.</i> 2008
	3 Canals	CT After Extraction	India	Kakkar and Singh 2012
N/L	3 Canals	R/G	Germany	Hulsmann, 1990
N/L	3 Canals	R/G	Australia	Australia Yang, 1994
N/L	R/G	R/G	China	Du Et <i>et al.</i> 2013
N/L	4 Canals	R/G	China	Liu XY <i>et al.</i> 2015
4 Roots	4 Canals	R/G	India	Vaghela and Sinha 2013

The present case with two roots and four distinct canals was not reported in the literature so far. It is highly possible that endodontic treatment results in failure if the third and fourth canal had not been recognized in this present case. During access cavity preparation, vague outlines of three canals were noticed (mesiobuccal, mesiolingual, and distal). It was in accordance with Rodig and Hulsmann, who stated that the presence of a triangle-shaped pulp chamber is the characteristic of mandibular premolars with three root canals, in which the distance from the distobuccal to the lingual orifices was at a peak.^[10]

While estimating the WL radiographically, a fourth canal was suspected. Outline of the orifice was modified to a “h” shape to locate the fourth canal which was recommended by Slowey who stated that is helpful to visualize this canal configuration as a lower case letter “h.”^[4]

In the case of the multiplicity of canals, means of magnification and illumination are of high value. This case was dealt under $\times 3.5$ to confirm the configuration of four canals which was not proportionate. Hence, the clinical photograph of the access cavity was not reproduced. As the division of the four canals was from the middle third, not coronally, the direct photograph using the camera was also obscured.

Exploring the canals is one of the important missions to be accomplished by an endodontist. Many advancements were put forward to effectuate the task, one of which was ultrasonics which has enhanced the quality of treatment

and represents an important adjunct in the treatment of difficult cases. It also aids in refining the access, locating the orifices and calcified canals, and removal of attached pulp stones. Summing up the microscopic visualization with ultrasonic instruments can be the safe and effective combination to achieve optimal results.^[11]

Radiographs reproduce two-dimensional image of a three-dimensional object resulting in overlapping of images. As they are of restricted value in cases with complex root canal anatomy, a preoperative CBCT was advocated. The CBCT images displayed two roots, mesial and distal (mesiobuccal, mesiolingual, distobuccal, and distolingual) with four distinct root canals. Hence, this case may be considered as Type 14 as per Gulabivala's classification.^[12] However, CBCT stand in need only where conventional imaging systems do not yield sufficient information that it helps in the appropriate canal definition. Endodontists should see to that ALARA (as low as reasonably achievable possible) principle is followed.^[13]

With all the methods established, the protest is still to penetrate, reach, and kill bacteria, which are well-known to protect themselves from the dentinal mud, their own secretions, and biofilms. Ample of irrigation and disinfection aids in the success of root canal therapy. In the present case, 5.25% (NaOCl) and 17% (EDTA) were active irrigants. Passive irrigation was done with EndoActivator. The EndoActivator system has been reported to provide inmost penetration of an irrigation solution to all areas of the endodontic space, and vigorously clean debris from lateral canals, remove the smear layer, and dislodge clumps of simulated biofilm.^[14]

Warm vertical compaction (system B) was done for obturation with backfilling technique (Obtura II) which had shown to provide an excellent apical plug with great adaptation of gutta-percha to root canal walls till the apex. The use of the Obtura II technique is beneficial in cases with irregular canals. The conversion of the softened gutta-percha to the canal walls had shown to be significantly better than lateral compaction by cold gutta-percha point.^[15]

CONCLUSION

The significant accomplishment of the root canal is influenced by the multiple factors such as through cognition about the anatomy, constructive diagnosis with the help of advanced diagnostic tools, and application of skillful equipment in the completion of an uneventful treatment. An endodontist should anticipate the phenomenal aberrations in the morphology of mandibular premolars. The use of CBCT facilitates the diagnosis of such complex variegations.

This case report details the endodontic management of sparse case of mandibular first premolar with two roots and four canals which was ended with a favorable outcome due to the satisfactory execution of the preferred constituents.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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