IEJ
Iranian Endodontic Journal

Endodontic Treatment of Bilateral Mandibular First Premolars with Three Root Canals: A Report of Two Cases

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ARTICLE INFO

Article Type: Case Report

Received: 05 Jun 2021
Revised: 28 Aug 2021
Accepted: 18 Sep 2021
Doi: *10.22037/iej.v16i4.34781*

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ABSTRACT

Correct diagnosis of root canal anatomy is very important to ensure successful root canal treatment. Mandibular first premolars with three separate root canals are very rare. Consequently, they often require specific shaping and obturating techniques. This report describes the diagnosis and non-surgical treatment(s) of bilateral mandibular first premolars with three separate root canals.

Keywords: Anatomic Variation; Cone-beam Computed Tomography; Root Canal Treatment; Tooth Abnormalities

Introduction

High rates of success in endodontic treatment require sufficient knowledge of the root canal anatomy and morphology. Furthermore, the key to successful endodontic treatment is complete cleaning and shaping of the root canal system [1-3]. Lack of detection of root canal anatomic variations can lead to endodontic treatment failure [4]. According to Hoen and Pink [5], the incidence of missed roots and/or canals in the teeth that needed retreatment was 42%. In addition, they concluded that a thorough knowledge of root canal anatomy and its clinical application, as well as meticulous attention to treatment details, can minimize the treatment failure and possible need for subsequent endodontic retreatment [5].

Slowey [6] has claimed that mandibular premolars are the most difficult teeth for root canal treatment due to variations in root canal anatomy [6]. Consequently, their endodontic treatment has a high rate of failure and flare-ups. In addition, several studies have investigated the root canal morphology of mandibular premolars as well as the differences between the mandibular first and second premolars [7, 8].

Some studies have reported more than one canal in the mandibular first premolars [8-14]. Several studies have reported the prevalence of 15.1%-34% for 2 canals [9-12] and 0.5%-4.3% for 3 canals in mandibular premolars [8, 10, 13, 14]. However, it has been shown that mandibular premolars with three separate root canals are highly rare, with a prevalence of ~0.2% [7]. It seems that there is racial predisposition for (i) mandibular premolars with multiple canals [15] and (ii) the bilateral occurrence of the phenomenon [16]. There are cases in which some canals are missed because they cannot be found by the operating clinicians, especially in teeth with anatomical variations [17]. Therefore, clinicians should be fully aware of the internal anatomical configurations of teeth before any root canal treatment [18].

This rare case report presents the successful non-surgical root canal treatment of bilateral mandibular first premolars with three separate root canals using the cone-beam computed tomography (CBCT) as a confirmatory diagnostic tool.

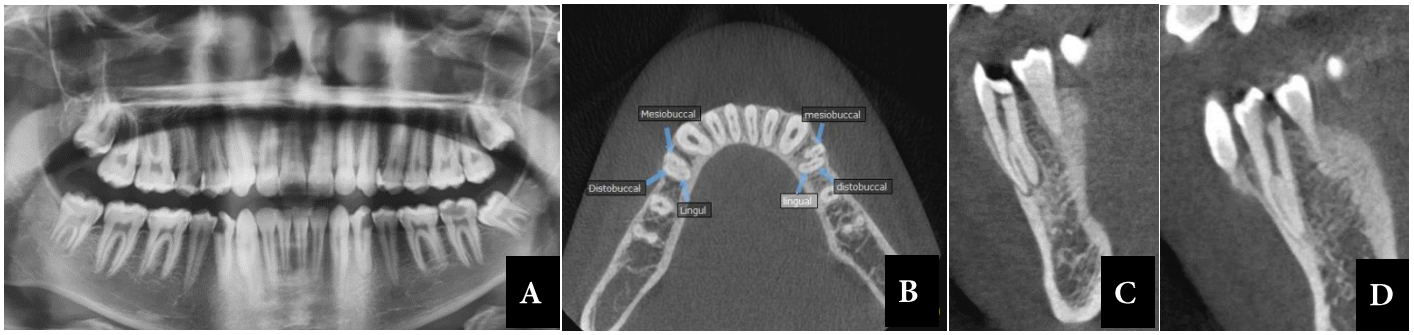

Figure 1. *A)* Panoramic view shows teeth #21 and #28 with a possibility of more than one canal; *B)* Axial image of CBCT presenting bilateral mandibular first premolars with three-root canals; *C, D)* Sagittal images show wide pulp chambers with more than one canal in teeth #21, #28

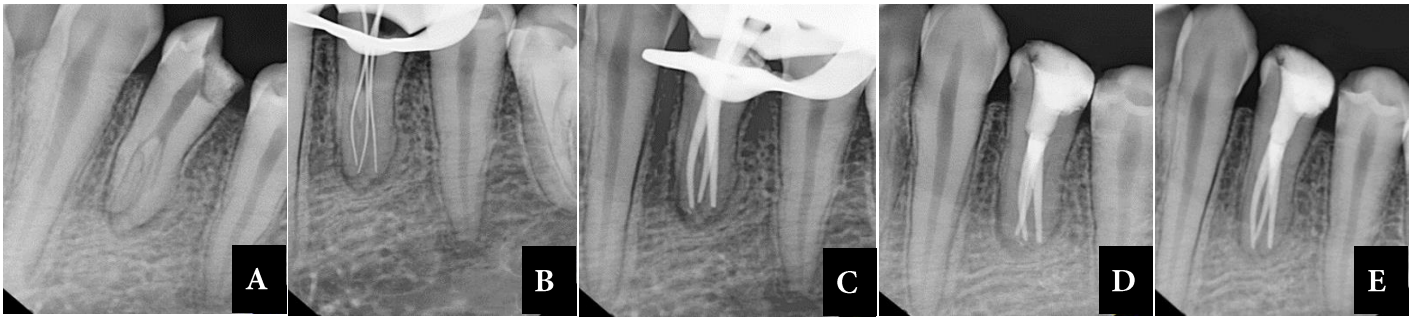

Figure 2. *A)* Diagnostic preoperative radiograph showing three roots in the mandibular left first premolar with a deep carious lesion in the distal surface of tooth, wide pulp chamber and periapical lesion; *B)* Radiograph taken after determining the working length; *C)* Radiograph taken for the evaluation of master cone; *D)* Periapical radiograph taken after the completion of root canal obturation, showing obturation of all three root canals of the mandibular left first premolar and coronal seal with resin composite restoration; *E)* Follow-up radiograph after 1 year, showing complete healing of the periapical lesion

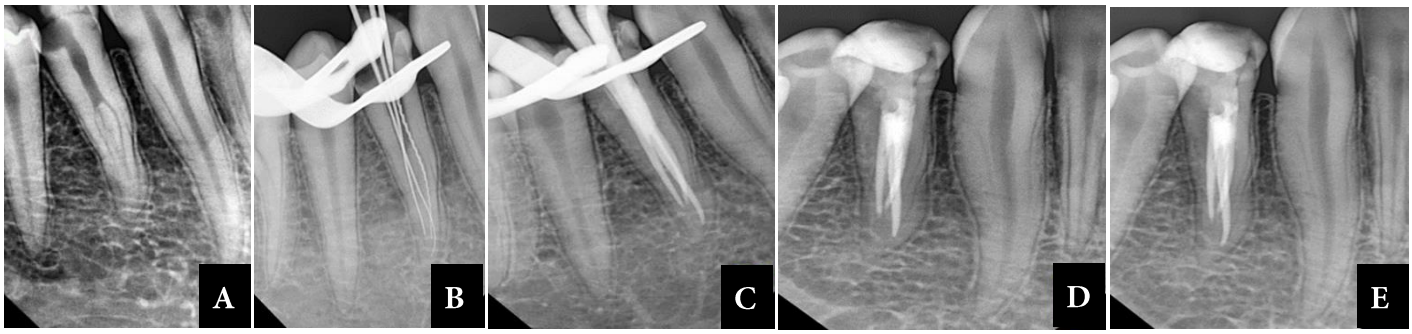

Figure 3. *A)* Preoperative periapical radiograph showing three roots in mandibular right first premolar with a deep carious lesion in the distal surface of tooth and wide pulp chamber; *B)* Radiograph taken after determining the working length; *C)* Radiograph taken for evaluation of master cone; *D)* Post-obturation radiograph and coronal seal with resin composite restoration; *E)* Follow-up radiograph after 1 year

Case Report

A 19-year-old male patient with a non-contributory medical history was referred to the Dental School, Zahedan University of Medial Sciences, by his general dentist for the endodontic treatment(s) of bilateral mandibular first premolars. Intraoral clinical examination revealed deep caries in both teeth. Pulp sensibility tests showed response to cold test (Hygenic Endo-Ice; Coltene /Whaledent, Mahwah, NJ, USA) and to the electrical pulp test (EPT) (Parkell Electronic Division, Farmingdale, NY, USA). The involved tooth was tender to percussion and palpation.

Moreover, the panoramic/periapical radiographic interpretation/evaluation revealed the presence of complex root canal anatomy and possible existence of more than 2 canals in each tooth (Figures 1A, 2A, 3A). CBCT was prescribed for the patient, and performed using an Acteon CBCT system (Acteon Group, Norwich, United Kingdom) with kVp: 85, mA: 8, field of view: 80×80, voxel size: 2 mm and exposure time of 10 sec, as the exposure settings. CBCT imaging showed a wide pulp chamber in the sagittal view and 3 separate root canals in the axial section of teeth #21 and #28 (Figure 1B to 1D). Based on the above-mentioned findings, the diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis was made.

It was decided to perform the treatment in multiple sessions. The treatment steps were explained to the patient, and an informed consent was taken.

The tooth was anaesthetised *via* inferior alveolar nerve block using 2% lidocaine with 1:80,000 epinephrine (Persocaine; DarouPakhsh, Tehran, Iran) and isolated with rubber dam. After the removal of existing deep caries, endodontic access cavity was prepared.

To have sufficient access to root canals, the access cavity was mesiodistally widened. The distobuccal canal was initially found followed by the mesiobuccal canal using a dental operating microscope (OPMI Pico; Zeiss Co., Jena, Germany). Mesio/distobuccal canals were negotiated using #10 K-file (Kerr, Karlsruhe, Germany). Since the lingual canal was hidden under a dentinal shelf, it was difficult to find. Therefore, the access cavity was again widened in the lingual orientation and the lingual canal was explored using a pre-curved #10 K-file (Kerr, Karlsruhe, Germany). The working length (WL) was determined using an electronic apex locator (Root ZX; Morita, Irvine, CA, USA) and confirmed using radiography (Figure 2B). The canals were prepared using ProTaper rotary system up to size F3 (Dentsply Maillefer, Ballaigous, Switzerland) and then washed with 2.5% sodium hypochlorite solution (Chloraxid; Cerkamed, Poland). After canal instrumentation, 17% EDTA (Asia Chimi Teb, Tehran, Iran) was used for 1 min to remove the smear layer. After master cone radiography (Figure 2C), the canals were obturated using the lateral condensation technique and AH-26 sealer (Dentsply DeTrey, Konstanz, Germany). The tooth was restored with resin-based dental composite filling material (Figure 2D).

Similarly, after the application of cold test (Hygenic Endo-Ice; Coltene/Whaledent, Mahwah, NJ, USA), EPT (Parkell Electronic Division, Farmingdale, NY, USA), palpation and percussion on tooth #28 as well as radiographic investigation, the diagnosis of symptomatic irreversible pulpitis with normal periradicular tissue was made (Figure 3A). In the next session, the treatment steps were re-explained to the patient, and informed consent was taken. After local anaesthesia and tooth isolation using rubber dam, caries were removed and the access cavity was prepared. Mesio/distobuccal canals were initially found and then, the lingual canal was located with difficulty. The canals were negotiated using #10 K-file. Next, the working length was determined using the aforementioned apex locator and confirmed by radiography (Figure 3B). Similar to tooth #21, the canals were cleaned and shaped. Afterwards, a master cone radiograph was taken (Figure 3C). Obturation was performed using the lateral condensation technique and AH-26 sealer (Dentsply DeTrey, Konstanz, Germany). The tooth was restored with resin-based dental composite filling material.

The post-restoration radiograph demonstrated three separate canals (Figure 3D). Following 12 months, teeth #21 and #28 were asymptomatic (Figure 2E, 3E).

Discussion

In mandibular premolars with 3 separate canals, the cervical half of the root is generally wider than when there is no or slight tapering. Endodontic treatment of such mandibular premolars can be extremely difficult, with the highest rate of failure [1].

Various studies have reported anatomical variations in the mandibular first premolars as well as extremely low prevalence of the mentioned teeth with 3 root canals [9-12]. Moreover, it has been shown that the phenomenon has dissimilar prevalence in different races [1]. Zillich and Dowson [9] and Vertucci [10] reported the prevalence of 0.4% and 0.5% of the mandibular first premolars with 3 root canals, respectively. Moreover, Rahimi *et al.* [8] reported the prevalence of 1.2% in the Iranian population. According to Sabala *et al.* [16] the rarer the anomaly is, the higher the probability of its bilaterality would be. They reported that anomalies with the prevalence of <1% had a 90% chance of bilaterality [16].

High-quality radiography is extremely important in identifying the internal and external root canal morphology. However, radiographs only produce a 2-dimensional image of a 3-dimensional object, resulting in superimposed structures in the images. Therefore, they have limited value in cases with complicated root canal anatomy. In this case, panoramic radiography showed the bilaterality of the anatomic variation [19].

It is worth noting that CBCT, dental operating microscope and dental loupe introduction, as well as advances in the root canal system instrumentation and obturation, have made the treatment of challenging and complex teeth easier. The dental operating microscope can help dentists better identify canal orifices and is greatly useful for the extra root or canal detection [20]. CBCT has overcome the limitations of 2-dimensional radiographs, making it more predictable to be applied for the treatment of complex endodontic cases compared to intraoral radiographies [21]. Also CBCT is very helpful and provides beneficial information about the root canal morphology of mandibular premolars [22]. This technique has been used in many studies to investigate the root canal configurations of the first mandibular premolars [23].

In the present study, CBCT imaging revealed 3 separate roots and canals. The diverse anatomy and morphology of the

mandibular first premolars have made it difficult to clean and shape these teeth [3]. In the present case, modifications in access cavities and their further extension in the mesiodistal/buccolingual directions led to more direct access to the root canals, which could be effective in the successful endodontic treatment.

Conclusion

Given their complicated root canal system, the mandibular first premolars have one of the highest incidences of failure for endodontic treatment amongst all teeth. The use of CBCT, dental operating microscope and newer techniques for instrumentation and obturation can lead to a higher rate of success in endodontic treatment of the aforesaid teeth.

Conflict of Interest: 'None declared'.

References

1. Nallapati S. Three canal mandibular first and second premolars: a treatment approach. A case report. J Endod. 2005;31(6):474-6.
2. Khedmat S, Assadian H, Saravani AA. Root canal morphology of the mandibular first premolars in an Iranian population using cross-sections and radiography. J Endod. 2010;36(2):214-7.
3. Lu T-Y, Yang S-F, Pai S-F. Complicated root canal morphology of mandibular first premolar in a Chinese population using the cross section method. J Endod. 2006;32(10):932-6.
4. Poorni S, Karumaran CS, Indira R. Mandibular first premolar with two roots and three canals. Aust Endod J. 2010;36(1):32-4.
5. Hoen MM, Pink FE. Contemporary endodontic retreatments: an analysis based on clinical treatment findings. J Endod. 2002;28(12):834-6.
6. Slowey R. Root canal anatomy: road map to successful endodontics. Dent Clin North Am. 1979;23:555-73.
7. Cleghorn BM, Christie WH, Dong CC. The root and root canal morphology of the human mandibular first premolar: a literature review. J Endod. 2007;33(5):509-16.
8. Rahimi S, Shahi S, Yavari HR, Manafi H, Eskandarzadeh N. Root canal configuration of mandibular first and second premolars in an Iranian population. J Dent Res Dent Clin Dent Prospects. 2007;1(2):59.
9. Zillich R, Dowson J. Root canal morphology of mandibular first and second premolars. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1973;36(5):738-44.
10. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surgery, Oral Medicine, Oral Pathology. 1984;58(5):589-99.
11. Pineda F, Kuttler Y. Mesiodistal and buccolingual roentgenographic investigation of 7,275 root canals. Oral Surg, Oral Med, Oral Pathol. 1972;33(1):101-10.
12. Yoshioka T, Villegas JC, Kobayashi C, Suda H. Radiographic evaluation of root canal multiplicity in mandibular first premolars. J Endod. 2004;30(2):73-4.
13. Hülsmann M. Mandibular first premolar with three root canals. Dent Traumatol. 1990;6(4):189-91.
14. Moayedi S, Lata D. Mandibular first premolar with three canals. Endodontology. 2004;16:26-9.
15. Trope M, Elfenbein L, Tronstad L. Mandibular premolars with more than one root canal in different race groups. J Endod. 1986;12(8):343-5.
16. Sabala CL, Benenati FW, Neas BR. Bilateral root or root canal aberrations in a dental school patient population. J Endod. 1994;20(1):38-42.
17. Al-Fouzan K. The microscopic diagnosis and treatment of a mandibular second premolar with four canals. Int Endod J. 2001;34(5):406-10.
18. Diwan A, Sreedevi C, Nagaraj T, Raghava V, Sinha P, Moushmi C. Determination of internal anatomy of a permanent dentition: A review. Int J Contemp Dent Med Rev. 2015;2015:110115.
19. Kakkar P, Singh A. Mandibular first premolar with three roots: a case report. Iran Endod J. 2012;7(4):207.
20. Del Fabbro M, Taschieri S. Endodontic therapy using magnification devices: a systematic review. J Dent. 2010;38(4):269-75.
21. Patel S, Kanagasingam S, Mannocci F. Cone beam computed tomography (CBCT) in endodontics. Dent Update. 2010;37(6):373-9.
22. Mohammadi Z, Shalavi S, Giardino L, Asgary S. Endodontic considerations in three-canalled premolars: A practical update. Iran Endod J. 2016;11(2):134.
23. Hosseinpour S, Kharazifard MJ, Khayat A, Naseri M. Root canal morphology of permanent mandibular premolars in Iranian population: A systematic review. Iran Endod J. 2016;11(3):150.

Please cite this paper as: Dalaei Moghadam M, Farahi F. Endodontic Treatment of Bilateral Mandibular First Premolars with Three Root Canals: A Report of Two Cases. Iran Endod J. 2021;16(4): 261-4. *Doi: 10.22037/iej.v16i4.34781.*