Case Report

Root Canal Treatment of a Mandibular Second Premolar with Three Roots and Canals – An Anatomic Variation

Bhavana Gandhi[1]✉, Anand C Patil[2]

[1]Postgraduate Student, Department of Conservative Dentistry and Endodontics, KLE VK Institute of Dental Sciences, Nehru Nagar, Belgaum
[2]Pofessor and Head, Department of Conservative Dentistry and Endodontics, KLE VK Institute of Dental Sciences, Nehru Nagar, Belgaum

Abstract

Dental anatomical variations play a significant role in the diagnosis and a successful treatment outcome in endodontics. It is essential for the clinician to have a clear picture and understanding of the pulpal anatomy and its variations. In a mandibular second premolar, it is rare to find extra roots and canals. The aim of the present article is to report a case about the successful diagnosis, and clinical management of a three-rooted mandibular second premolar with three independent roots and canals.

Key Words: Anatomic Variation; Mandibular Second bicuspids; Three Rooted Bicuspids

Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2013; Vol. 10, No.6)

✉ Corresponding author:
B. Gandhi, Department of Conservative Dentistry and Endodontics,KLE VK Institute of Dental Sciences, Nehru Nagar, Belgaum

bhavanagandhi@gmail.com

Received: 24 April 2013
Accepted: 2 October 2013

INTRODUCTION

Successful root canal therapy is achieved by thorough shaping and cleaning of the root canal space followed by three-dimensional obturation of the root canal [1]. Thorough knowledge of the root canal morphology with an awareness of the number, shape and size of root canals thereby becomes a prerequisite for the clinician [1, 2]. The root and canal morphology can be variable and complex. The variations may be due to factors such as age, gender, ethnicity and trauma [2].

Variations in root canal morphology and missed canals are suggested as the most likely reasons for the high frequency of endodontic flare-ups and failures [3].

Mandibular premolars have always proven to be an enigma to the endodontist as they exhibit a high degree of variability in their root canal morphology when compared to any other tooth in the oral cavity [4].

A mandibular second premolar has a single root and root canal in the majority of the population [5]. The second premolars have only one root canal at the apex in 97.5% of the teeth and two canals in only 2.5% [6, 7]. Over the years, studies have reported the root canal morphology of mandibular premolars with a

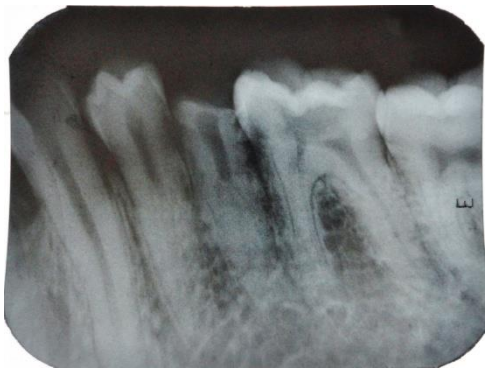

Fig 1. Preoperative radiograph shows a wide pulp canal space till the middle third of the canal followed by a sudden thinning.

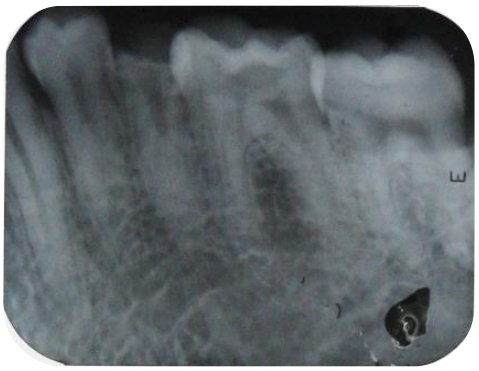

Fig 2. An angled pre-operative radiograph

high incidence of these teeth having more than one canal. According to Zillich and Dowson (1973), the incidence of three roots and canals is 0.4%. [6]. This case report presents a successful, nonsurgical endodontic management of a mandibular right second premolar with three separate roots and three distinct root canals.

CASE REPORT

A 34-year-old, healthy male patient was referred to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in the lower right back tooth from two weeks before.

Clinical examination of the involved region revealed a carious lesion involving the occlusal surface of the crown of the mandibular right second premolar, the tooth was tender to percussion, with no periodontal pockets and was in the physiologic range of mobility. Pulp vitality testing with an electric pulp tester revealed an exaggerated response compared to the clinically normal adjacent and contralateral teeth. Cold and heat testing of the tooth also showed a positive response. The pre-operative radiograph of the tooth (Figure 1) confirmed the occlusal carious lesion approaching the pulp and there was discontinuation of the apical lamina dura.

The wide pulp canal space till the middle third of the canal showed a sudden thinning that led to the suspicion that there was a variation in the morphology. An angled radiograph showed that the mandibular first premolar also showed a similar morphology. (Figure 2) The radiograph of the contralateral side also showed a similar morphology. (Figure 3)

Based on the clinical, radiologic and electric pulp testing findings, a diagnosis of acute irreversible pulpitis with acute apical periodontitis was made and a nonsurgical endodontic treatment was planned. The treatment plan was explained to the patient and his consent was obtained. The tooth was anesthetized with 2% lidocaine solution with adrenaline through inferior alveolar nerve block injection of the right side and a standard access cavity was prepared after rubber dam isolation on the mandibular right second premolar. The oval access cavity preparation revealed two canal orifices that was then modified to a triangular shape to reveal the third orifice (Figure 3).

The pulp was extirpated from all the three canals and the working length was determined using an electronic apex locator (Root ZX, J. Morita, USA) and it was confirmed using a radiograph (Figure 5).

The canals were explored and a glide path was established using #10 and #15 K files (Mani Inc. Japan). The cleaning and shaping was then carried out with a crown down technique using ProTaper Universal (Dentsply, USA) NiTi rotary files with copious irrigation using

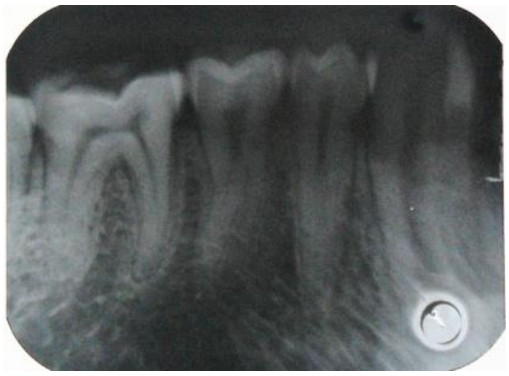

Fig 3. Radiograph of the contralateral side showing similar morphology

Fig 4. Access cavity preparation showing three canal orifices

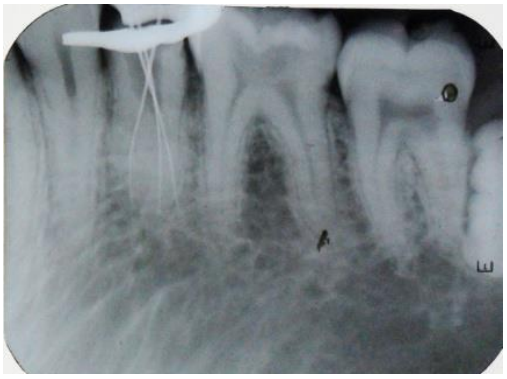

Fig 5. Working length radiograph

3% sodium hypochlorite and normal saline solution. The canals were filled with an intracanal medicament (Apexcal, Ivoclar Vivadent, Canada) for ten days for disinfection of the root canal followed by obturation with gutta percha cones and AH Plus (Dentsply, USA) root canal sealer. A post-obturation radiograph was obtained and the coronal access cavity was temporarily restored with Cavit™ G (3M ESPE, USA).

The tooth was permanently restored with a dual-cure hard fluoride releasing core build up material by HardCore (Pulpdent, USA) following a week **(**Figure 6). The patient was recalled after one week, one month and 6 months later and he was symptom-free with no tenderness on percussion; the follow-up radiographs showed a continuous lamina dura with no periapical changes (Figure 7).

Table 1. The Number of Roots and Canals in the Mandibular First and Second Premolars Reported in the Literature

References (Choronological Order)	Number of Roots	Number of Root Canals
Bram & Fleisher (1991)	1	4
Holtzman (1998)	1	4
Macri & Zmener (2000)	1	5
Rhodes (2001)	1	4
Al-Fouzan (2001)	2	4
R**ödig T (2003)**	1	3
Tzanetakis GN (2007)	1	4
Sachdeva (2008)	4	4
Aguiar C (2010), Poorni (2010)	2	3
Borna Z (2011)	1	3

Fig 6. Post-obturation radiograph

Fig 7. Six-month follow-up radiograph

DISCUSSION

Mandibular premolars have always been talked of having an unusual anatomy.

Numerous studies have been published in the literature regarding the number of roots and canals in the mandibular first and second premolars with the majority being those with two roots and three canals (Table 1) [8-16].

Numerous case reports have been published in the literature reporting extra roots and canals (Table 2) [12-22]. Scott and Turner described the accessory root of a mandibular first premolar as Tome's root [23].

This case report was similar to the one reported by Lotfi et al. [3] (2008). Three canal orifices were identified; namely, the distobuccal, mesiolingual and distolingual.

A number of analyzed mandibular second premolars showed one orifice in the lingual aspect and two in the buccal aspect [3, 8, 24]. The root canals can take up any configuration and variability is common [24].

Therefore, it is mandatory for the clinician to assess every tooth requiring a root canal treatment three dimensionally to avoid missing a canal.

Table 2. Case Reports Mentioning Extra Roots and Canals

References (Choronological Order)	1 Root	2 Roots	3 Roots
Barret (1925)	100%	-	-
Visser (1984)	99.85%	0.05%	0.1%
Zillich and Dowson (1973)	96.6%	-	0.4%
Vertucci (1978)	100%	-	-
Geider et al (1989)	97.6%	0.4%	-
Caliskan et al (1995)	100%	-	-
Zaatar et al (1997)	95.6%	4.7%	-
Sert and Bayirti (2004)	100%	-	-
Rahimi et al (2007)	98%	2%	-

Various diagnostic aids are available for this purpose such as high quality pre-operative radiographs taken in different horizontal angulations, probing the floor of the pulp chamber with a sharp explorer, using ultrasonic tips, staining with 1% methylene blue dye, using the dental operating microscope and the sodium hypochlorite 'champagne bubble' test [25]. A tooth has a greater probability of having three roots if the mesiodistal width of the mid-root image in the radiograph is equal to or greater than the mesiodistal width of the crown. The presence of an eccentric orifice during an access cavity preparation gives suspicion of a third orifice [26].

In a study by Gulabivala in 2001, it was reported that teeth that have broad, flat roots are much more likely to contain extra canals and ramifications [27]. One of the reasons cited for endodontic failure is a missed canal and such a tooth would require a nonsurgical or surgical intervention.

The problem of nonsurgical retreatment is that the anatomic landmarks might have been damaged or altered during access cavity preparation. So in such cases, morphologic landmarks cannot be relied as a guide to identify the position of root canals.

Advanced imaging could not be performed for the present case because it was expensive and unavailable. The use of advanced imaging techniques such as spiral computed tomography and cone-beam computed tomography may be beneficial [28].

CONCLUSION

The present case shows the unusual anatomy of a mandibular bicuspid, reminding us to keep in mind that during endodontic treatment these variations can be encountered and the treatment would vary accordingly.

REFERENCES

1- Fava LR. Root canal treatment in an unusual maxillary first molar: a case report. Int Endod J. 2001 Dec;34(8):649-53.

2- Cleghorn BM, Christie WH, Dong CC. Root and root canal morphology of the human permanent maxillary first molar: a literature review. J Endod. 2006 Sep;32(9):813-21.

3- Cantatore G, Berutti E, Castellucci A. Missed anatomy: frequency and clinical impact. Endodontic Topics. 2006;15:3-31.

4- Lotfi M, Vosoughhosseini S, Zand V, Fatemi A, Shyezadeh V, Ranjkesh B. A mandibular second premolar with three canals and atypical orifices. J Oral Sci. 2008 Sep;50(3):363-6.

5- Cleghorn BM, Christie WH, Dong CC. The Root and root canal morphology of the human mandibular second premolar: a literature review. J Endod. 2007 Sep;33(9):1031-7.

6- Zillich R, Dowson J. Root canal morphology of mandibular first and second premolars. Oral Surg Oral Med Oral Pathol. 1973 Nov;36(5):738-44.

7- Vertucci FJ. Root canal morphology of mandibular premolars. J Am Dent Assoc. 1978 Jul;97(1):47-50.

8- Chan K, Yew SC, Chao SY. Mandibular premolar with three root canals – two case reports. Int Endod J. 1992 Sep;25(5):261-4.

9- Rödig T, Hülsmann M. Diagnosis and root canal treatment of a mandibular second premolar with three root canals. Int Endod J. 2003 Dec;36(12):912-9.

10- ElDeeb ME. Three root canals in mandibular second premolars: literature review and a case report. J Endod. 1982 Aaug;8(8):376-7.

11- Poorni S, Karumaran CS, Indira R. Mandibular first premolar with two roots and three canals. Aust Endod J. 2010 Apr;36(1):32-4.

12- Bram SM, Fleisher R. Endodontic therapy in a mandibular second bicuspid with four canals. J Endod. 1991 Oct;17(10):513-5.

13- Holtzman L. Root canal treatment of mandibular second premolar with four root canals: a case report. Int Endod J. 1998 Sep;31(5):346-64.

14- Marci E, Zmener O. five canals in a mandbular second premolar. J Endod. 2000 May;26(5):304-5.

15- Rhodes JS. A case of unusual anatomy: a mandibular second premolar with four canals. Int Endod J. 2001 Dec;34(8):645-8.
16- Al-Fouzan KS. The microscopic diagnosis and treatment of a mandibular second premolar with four canals. Int Endod J. 2001 Jul;34(5):406-10.
17- Rödig T, Hülsmann M. Diagnosis and root canal treatment of a mandibular second premolar with three root canals. Int Endod J. 2003 Dec;36(12):912-9.
18- Tzanetakis GN, Lagoudakos TA, Kontakiotis EG. Endodontic treatment of a mandibular second premolar with four canals using operating microscope. J Endod. 2007 Mar;33(3):318-21.
19- Sachdeva GS, Ballal S, Gopikrishna V, Kandaswamy D. Endodontic management of a mandibular second premolar with four roots and four root canals with the aid of spiral computed tomography: a case report. J Endod. 2008 Jan;34(1):104-7.
20- Aguiar C, Mendes D, Câmara A, Figueiredo J. Endodontic treatment of a mandibular second premolar with three root canals. J Contemp Dent Pract. 2010 Mar;11(2):78-84.
21- Borna Z, Rahimi S, Shahi S, Zand V. Mandibular second premolars with three root canals: a review and 3 case reports. Iran En Endod J. 2011 Fall;6(4):179-82.
22- Rahimi S, Shahi S, Yavari RH, Manafi H, Eskandarzadeh N. Root canal configuration of mandibular first and second premolars in an Iranian population. J Dent Res Clin Dent Prospects. 2007 Summer;1(2):59-64.
23- Scott R, Turner II C. The anthropology of modern human teeth. Cambridge: Cambridge University Press; 2000.
24- Vertucci F. Root Canal Anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol. 1984 Nov;58(5):589-99.
25- Friedman S, Moshonov J, Stabholz A. Five root canals in a mandibular first molar. Endod Dent Traumatol. 1986 Oct;2(5):226-8.
26- Sieraski SM, Taylor GN, Kohn RA. Identification and endodontic management of three -canalled maxillary premolars. J Endod. 1989 Jan;15(1):29-32.
27- Gulabivala K, Aung TH, Alavi A, Ng YL. Root and canal morphology of Burmese mandibular molars. Int Endod J. 2001 Jul;34(5):359-72.
28- Robinson S, Czerny C, Gahleitner A, Bernhart T, Kainberger FM. Dental CT evaluation of mandibular first premolar root configuration and canal variations. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002 Mar;93(3):328-32.