Case Report
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Management of Two Rooted Mandibular Second Premolars: A Case Series

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Abstract

Mandibular premolars have been reported to have the most unusual canal aberrancies in the literature. Even though abnormal canal morphologies in mandibular premolars in the Asian population is less frequent, it continues to exist. When such rarities are encountered, supplemental diagnostic aids play a crucial role in determining the prognosis of the root canal procedure. The aim of this paper is to report a series of cases with unusual canal morphologies in which cone beam computed tomography was used as a diagnostic aid to visualize canal morphologies.

Keywords: C-Shaped Canal, Cone-Beam Computed Tomography, Mandibular Second Premolar, Two Roots

1. Introduction

One of the most complex anatomies can be attributed to the root canals, as the variations are more unpredictable and the presence of a single canal with a single portal of exit is an exception rather than the rule[1]. According to Slowey[2] it is extremely challenging to treat mandibular premolars due to the variations in the canal anatomy. The highest incidence (47%) of accessory foramina was observed in mandibular second premolars by Green. Rahimi *et al.*[3] also reported high incidence of lateral canals (38.7%) and apical delta (4.38%) in mandibular second premolars. Vertucci *et al.*[4] reported that the mandibular second premolar had one root canal at the apex in 97.5% and two canals with only 2.5% of the teeth; however, three root canals were scarce. Zillich and Dowson[5] in a study of 906 teeth encountered no two rooted mandibular second premolars and 0.4% of three rooted in mandibular second premolars, which emphasizes the occurrence of multi-rooted mandibular second premolars as being scarce, the same study found the incidence of two or more canals to be 12.5%[6]. Various data on the anatomical aberrancies encountered in mandibular second premolars are summarized in the (Table 1). Conventional intraoral periapical radiographs are the routine and basic investigations used to visualize the root canal anatomy, but it has its own shortcomings. Cone beam computed tomography was introduced in the early 1980s as a three-dimensional diagnostic imaging modality that revolutionised the imaging techniques in dentistry. However, the appropriate application of the modality continues to rest in the hands of the clinician. This paper presents three case reports of unusual morphology in which assessment of the canal morphology in two of the cases were supplemented by CBCT. This case series emphasizes the fact that an appropriate diagnosis is the foundation to proper treatment plan which dictates the success and prognosis of root canal treatment.

Case 1

A 29-year-old male patient reported to the Department of Endodontics with the chief complaint of pain in the right lower back tooth for the past 1 week. History of the presenting illness revealed that pain was severe, continuous and aggravates in the nighttime. Intraoral examination revealed dental caries in 45 with pain on

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probing and pain on percussion in 45. Radiographic examination revealed dental caries approximating the pulp space in 45, disappearance of the root canal space in the middle third of 45 which reappears in the apical third. Angulated radiographs revealed the presence of an additional root, but the number of root canals could not be detected on a radiograph (Figure 1).



Figure 1. **1.** Pre-operative radiograph of 45. **2.** Working length determination in 45. **3.** CBCT coronal section demonstrating 2 roots and 2 canals. **4.** CBCT Sagittal section. **5.** CBCT transverse section demonstrating the C shaped canal in the buccal root. **6.** Three dimensional CBCT image with enhanced translucency to visualise the bifurcation of roots in 45. **7.** Post-operative radiograph of 45.

Treatment procedure

Under Local anaesthesia (2% Lignocaine with 1:100000 Adrenaline), access opening was done in 45. Buccal and palatal canals were located and negotiated. The working length was measured as 18.5 mm in the buccal canal and 19 mm in the palatal canal using electronic apex locator and confirmed with a diagnostic radiograph (Figure 2). There was persistent bleeding from the buccal canal and patient was symptomatic during negotiation of the canal. Direct visualization of the canal orifice revealed a C-shaped orifice in the buccal canal of 45. This raised the need for a three dimensional imaging technique. A limited FOV CBCT was taken with CS 9300 (Carestream, Rochester, New York, USA) with small field of view (FOV) of 5×5 cm, high resolution of 90µm, 75kV, 4 mA, 20 seconds exposure time, 350 mGycm^2. CBCT revealed the presence of buccal and palatal root in 45 with bifurcation seen at the junction of middle and apical third and C-shaped canal configuration identified as C2[7] in buccal canal of 45 (Figures 3-6). After confirming the root canal morphology of 45, cleaning and shaping was done in 45 with Protaper F2 NiTi rotary instrument using 3% NaOCl and normal saline as irrigants. The palatal canal was obturated with F2 Protaper gutta percha and the C-shaped buccal canal was obturated using thermoplasticized gutta percha technique (Figure 7).

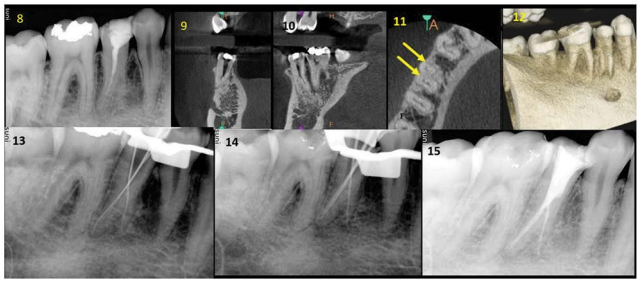


Figure 2. **8.** Pre-operative radiograph showing missed root and root canal in 45. **9.** CBCT Coronal view of 45. 10. CBCT Sagittal section of 45 demonstrating the two roots. **11.** Transverse section of 45 showing 2 roots and 3 root canals. **12.** Three dimensional CBCT image with enhanced translucency to visualise the bifurcation of roots in 45. **13.** Working length determination of 45. **14.** Master cone radiograph of 45. **15.** Post-operative radiograph of 45.

Case 2

A 27-year-old male patient reported with the chief complaint of pain in the right lower back tooth for the past 1 week and a recent history of root canal treatment in 45. History of presenting illness revealed that pain was severe, spontaneous and aggravates in the night time. Past dental history revealed that 45 was root canal treated 2 months back. Intra oral examination revealed a Zinc Oxide Eugenol temporary restoration in 45 with tenderness on percussion. Intra oral periapical radiograph revealed a poorly obturated 45 and a missed root (Figure 8). Exploration of the access cavity revealed the presence of a ribbon shaped canal orifice which appeared to bifurcate beyond the middle third of the root. As the canal morphology was apparently bizarre, a limited FOV CBCT was taken with CS 9300 as per specifications followed in case 1. CBCT revealed the presence of mesial and distal roots in 45 with one root canal in the mesial root and two root canals (distobuccal and distolingual) in the distal root which was bifurcating at the middle third of the root (Figures 9–12). Based on the clinical, radiographic and CBCT findings a confirmed diagnosis of previously root canal treated 45 with symptomatic apical periodontitis was made.

Treatment procedure

Under LA with Adrenaline (2% Lignocaine with 1:100000 Adrenaline), access opening was done in 45. Mesial, distobuccal and distolingual canals were located and negotiated. The working length was measured as 17.5mm in mesial, 19mm in distobuccal and 18mm distolingual canals using electronic apex locator and confirmed with a diagnostic radiograph (Figure 13). Cleaning and shaping was done in 45 upto K file no # 30 in all the canals using 3% NaOCl and normal saline as irrigants and obturated with # 30 gutta percha and Zinc Oxide Eugenol sealer using cold lateral condensation technique (Figure 14,15).

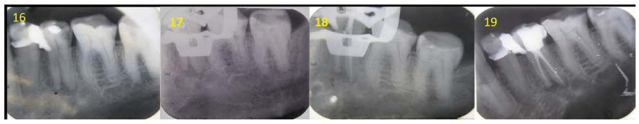


Figure 3. **16.** Pre-operative radiograph of 35 showing the mesial and distal root. **17.** Working length determination in 35. **18.** Master cone radiograph of 35. **19.** Post-operative radiograph of 35.

Case 3

A 45-year-old male patient reported with the chief complaint of pain in the right lower back tooth for the past 1 week. History of the presenting illness revealed that pain was moderate, intermittent and aggravates while chewing and biting. Intra oral examination revealed that 35 was restored with silver amalgam and was tender to percussion. Intra oral periapical radiograph revealed radiopacity approximating the pulp space in 35 and radiolucency beneath the radioapacity suggestive of secondary caries. Two roots (mesial and distal) were evident in the radiograph with haziness of lamina dura around the apical third of 35 (Figure 16). Correlating the clinical and radiographic findings the case was diagnosed as dental caries in 35 with symptomatic apical periodontitis.

Treatment procedure

Under LA with Adrenaline (2% Lignocaine with 1:100000 Adrenaline), access opening was done in 35. Mesial and distal canals were located and negotiated. Working length was determined using electronic apex locator and confirmed with a diagnostic radiograph (Figure 17). The working length was measured as 18.5mm in the mesial canal and 19mm in the distal canal. Cleaning and shaping was done manually in 35 up to K file no 40 instrument in all the canals using 3% NaOCl and normal saline as irrigants and obturation was done with no 40 size master cone gutta percha (Figure 18) and cold lateral condensation techniques using Zinc Oxide Eugenol sealer (Figure 19).

2. Discussion

Considering that mandibular second premolars stand a good chance of demonstrating unusual canal morphologies, it would be wise to expect and anticipate extra roots and canals. In the first case, the patient continued to be symptomatic even after instituting root canal treatment and there was persistent bleeding from the canal. This raised suspicion concerning a complex root canal morphology like bifurcations or apical ramifications etc., which can be visualized only using three-dimensional imaging. This urged us to explore the canal anatomy using CBCT. C-shaped canals in mandibular second premolars are extremely rare and case reports demonstrating this type of configuration is sparse. Chemomechanical debridement is the ideal method to treat C shaped canals[7]. The anatomic classification of this C shaped configuration according to Fan *et al.*[8] could be designated as type C2 where the canal had a semicolon shaped due to discontinuation of the C outline. Also, the two orifices had a common portal of exit. Thus, the straighter part of the C shaped configuration was treated as the principal canal and obturation was done using thermoplasticized gutta percha technique where condensation of the gutta percha is performed under hydraulic forces[9].

Second case was a symptomatic root canal treated 45 in which the mesial root was left untreated. During re-treatment procedure, the distal canal orifice was ribbon shaped and appeared to bifurcate. As the exact point of bifurcation, if present and the portals of exit could not be assessed clinically, CBCT was taken for this case. The roots were slender and to avoid procedural mishap like perforation, cleaning and shaping was accomplished with 2% stainless steel K files (Mani Inc.).

Third case possessed 2 roots: Mesial and distal which were evident in the radiograph and the orifice locations were obvious apparently not posing an anatomical complexity. As the case was evidently uncomplicated, there was no indication for a 3D imaging.

Table 1. The prevalence of root canal types in mandibular second premolars in South Indian population (Shetty et al., 2014)[13]

Vertucci's type	1	2	3	4	5	6	7	8	C shaped	Gulabivala type 1
Number	761	12	2	0	32	0	0	1	6	0
Percentage	93.48	1.4	0.2	0	3.9	0	0	0.1	0.7	0

3. Conclusion

Mandibular premolars are the most difficult teeth to treat endodontically due to variations in canal anatomy, variations in internal morphology, extra root canals, apical deltas and lateral canals[2,10–12]. Advanced imaging techniques like CBCT has made it possible to diagnose the complex root canal morphologies and treat them accordingly. However, these techniques should be used only when indicated considering the radiation exposure associated with CBCT. Our paper reported two cases where CBCT complimented root canal procedure and one case where the treatment was performed without the aid of CBCT. Thus, the prudent use of the available technologies will aid in rendering a proper treatment and improve the overall success rate of the tooth in the long term basis.

4. Conflict of Interest

"No potential conflict of interest relevant to this article was reported".

5. References

1. Hargreaves KM, Cohen S, Berman LH. Cohen's pathways of the pulp. Pulpal reactions to caries and dental procedures 2011 10th ed. St Louis, Mo, Mosby Elsevier; 2011. p. 504. https://doi.org/10.1016/B978-0-323-06489-7.00013-8
2. Slowey RR. Root canal anatomy. Road map to successful endodontics. *Dent Clin North Am*. 1979; 23(4):555–573
3. Green D. Stereomicroscopic study of 700 roots apices of maxillary and mandibular posterior teeth. *Oral Surg Oral Med Oral Pathol*. 1960; 13:728–733. https://doi.org/10.1016/0030-4220(60)90373-X
4. Rahimi S, Shahi S, Yavari HR, Reyhani MF, Ebrahimi ME, Rajabi E. A stereomicroscopy study of root apices of human maxillary central incisors and mandibular second premolars in an Iranian population. *J Oral Sci*. 2009; 51:411–415. https://doi.org/10.2334/josnusd.51.411. PMid:19776508
5. Vertucci FJ, Seling A, Gillis R. Root canal morphology of the human maxillary second premolar. *Oral Surg Oral Med Oral Pathol*. 1974; 38:456–464. https://doi.org/10.1016/0030-4220(74)90374-0
6. Zillich R, Dowson J. Root canal morphology of mandibular first and second premolars. *Oral Surg Oral Med Oral Pathol*. 1973; 36:738–744. https://doi.org/10.1016/0030-4220(73)90147-3
7. Jin GC, Lee SJ, Roh BD. Anatomical study of C-shaped canals in mandibular second molars by analysis of computed tomography. *J Endod*. 2006; 32:10–13. https://doi.org/10.1016/j.joen.2005.10.007. PMid:16410060
8. Fan B, Cheung GS, Fan M, Gutmann JL, Bian Z. C-shaped canal system in mandibular second molars: Part I: Anatomical features. *J Endod*. 2004; 30:899–903. https://doi.org/10.1097/01.don.0000136206.73115.93. PMid:15564874
9. Ruddle JC. Three-dimensional obturation of the root canal system. *Dent Today*. 1992; 11:28, 30–33, 39.
10. Awawdeh LA, Al-Qudah AA. Root form and canal morphology of mandibular premolars in a Jordanian population. *Int Endod J*. 2008; 41:240–248. https://doi.org/10.1111/j.1365-2591.2007.01348.x. PMid:18081806
11. De Moor RJ, Calberson FL. Root canal treatment in a mandibular second premolar with three root canals. *J Endod*. 2005; 31:310–313. https://doi.org/10.1097/01.don.0000140578.36109.c0 PMid:15793392
12. Nallapati S. Three canal mandibular first and second premolars: a treatment approach. *J Endod*. 2005; 31:474–476. https://doi.org/10.1097/01.don.0000157986.69173.a6. PMid:15917692
13. Shetty A, Hegde MN, Tahiliani D, Shetty H, Bhat GT, Shetty S. Three-Dimensional Study of Variations in Root Canal Morphology Using Cone-Beam Computed Tomography of Mandibular Premolars in a South Indian Population. *J Clin Diag Res*. 2014 Aug; 8(8): ZC22-ZC24A.