



ENDODONTIC MANAGEMENT OF MANDIBULAR PREMOLAR WITH BIFURCATED ROOT USING CONE BEAM COMPUTED TOMOGRAPHY

Krishna Popat., Deepak Kumar Sharma., Manu Bansal and Marikinda Manzoor

Department of Conservative Dentistry & Endodontics, Jaipur Dental College, Jaipur, Rajasthan, India

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ABSTRACT

Mandibular premolars ordinarily have single root with its one respective root canal system. However multiple studies on the anatomic variations of mandibular premolar have been reported. It's proved unquestionably that root canal system is highly complex, intricate and variable. For the successful endodontic treatment, the clinician must have the knowledge of the pulp system configuration. The incidence of two roots in these teeth is not so common. This report presents the clinical endodontic management of mandibular second premolar having bifurcated roots at the midroot level and with 2 distinguished root canals.

Key words:

Anatomic variation, mandibular premolar, root canal configuration

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INTRODUCTION

Thorough knowledge of internal anatomy of root canal system is mandatory for successful endodontic therapy.¹⁻³ Mandibular premolars are popular enough for having the most atypical anatomy.^{4,5} Literature showcased a fair percentage of teeth to have more than one canal.⁶⁻⁸ A series of studies imparted on extracted human teeth reported 2.5% incidence of a second canal.^{9,10} The clinician must be aware of the diverging complexity of the root canal configuration and also be capable of identifying these variations.

In endodontics, conventional intraoral periapical (IOPA) radiographs play an important diagnostic aid to assess the canal configuration but is not completely reliable due to its inherent limitations of producing 2D image of a 3D object.¹¹ This case report describes the endodontic management of mandibular second premolar having two roots and two canals thus, with the aid of cone beam computed tomography (CBCT).

Case Report

A 35-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the lower right back tooth since 20 days. History revealed that patient had earlier experienced sensitivity to cold drinks and then pain started after some time. Pain was spontaneous in nature which was aggravated on chewing and lying down.

The medical history was noncontributory. On intraoral clinical examination, there was a carious exposure of the pulp and the tooth 45 was tender to percussion. The provisional diagnosis was made of acute irreversible pulpitis with apical periodontitis.

Radiographic evaluation of the involved tooth #45 revealed an unusual, complex root canal anatomy and vague outlines of two roots with two known – mesial & distal canals (Fig.1). Various doubts existed about the presence of an extra canal in the involved tooth, because of the unusual anatomic makeup of its root canal system. Additional radiographs recorded at different angulations discovered the presence of at least two distinct roots, but the number of roots or root canals could not be confirmed with the help of IOPA radiographs as it reproduces only a two-dimensional image. Hence, to ensure this rare and complex root canal anatomy of the tooth in a three dimensional manner, dental imaging with the help of a CBCT was planned. To understand the root morphology better, Cone beam computed tomography was performed. The CBCT images revealed that tooth 45 had two separate roots bifurcating mesially and distally and two distinct root canals, without any evidence of fusion of the root canals at any level (Fig.2 & 3).

After the confirmatory diagnosis was made, treatment plan was done for the involved tooth. Following administration of local anesthesia (2% lignocaine with 1:1,00,000 epinephrine), and rubber dam isolation, access preparation was made in the right mandibular second premolar. To gain sufficient access to the canals, the conventional access opening was modified to be wider and buccolingually oriented. On careful exploration of

*Corresponding author: **Krishna Popat**

Department of Conservative Dentistry & Endodontics, Jaipur Dental College, Jaipur, Rajasthan, India

the pulp chamber floor with an endodontic explorer DG-16 [Dentsply Maillefer, Ballaigues (VD), Switzerland], it was observed under loupes that separation of the root started at the middle third of the root. After thorough inspection, two canal orifices one from the mesial side and the other from the distal side were located and patency was obtained using a size 10 k-file. Then working length was determined by using radiographs (Fig. 4) with the same files inserted into the two root canals.



Fig 1 RVG showing 2 roots and 2 canals in tooth 45.

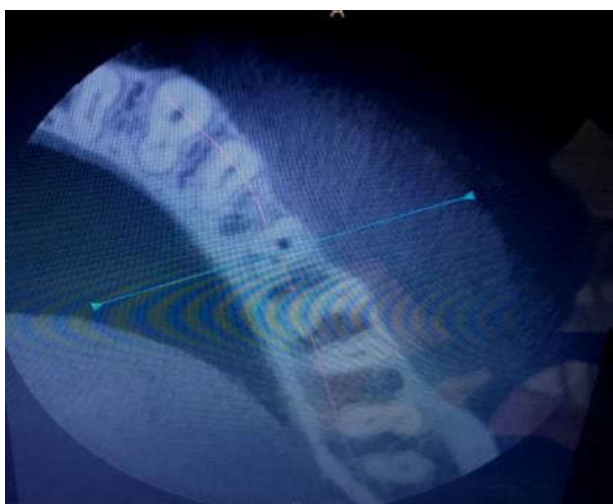


Fig 2 Axial View of CBCT showing a mesial and a distal canal



Fig 3 Sagittal section of CBCT showing 2 roots and 2 root canals bifurcated at mid root level

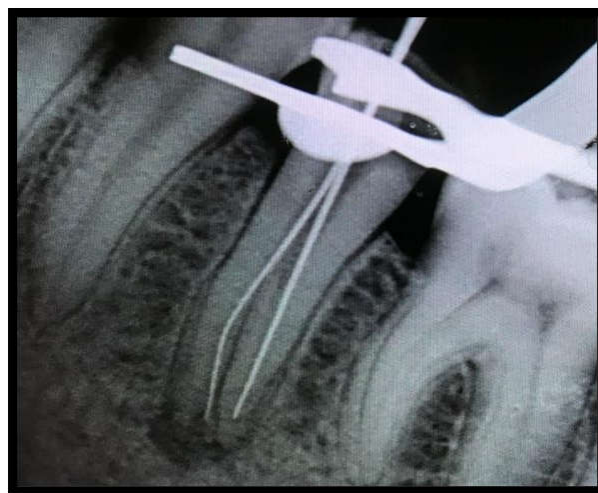


Fig 4 Working length determination of 2 root canals



Fig 5 Obturation of Bifurcated canals

To obtain straight line access to both the canals, Gates Glidden drills with a brushing motion were used in a crown down manner to enlarge the main orifice to the level of the bifurcation. Then the two canals were cleaned and shaped initially with hand K-files and then with nickel titanium rotary files- hyflex CM (Coltene Endo) up to 25/ 0.04 taper under copious irrigation with 5.25% sodium hypochlorite and 17% ethylenediaminetetraacetic acid (EDTA). Intracanal medicament, calcium hydroxide was placed within the canals and sealed with temporary restoration.

One week later, the tooth was asymptomatic. At the second visit, all canals were recapitulated, irrigated, dried and a radiograph was taken with master cones in both canals. Upon verification of master cone length, the canals were obturated by using gutta-percha and sealer (AH-plus, Dentsply Maillifer, Switzerland).

A postobturation radiograph was taken (Fig. 5) and the access was restored permanently with universal composite resin restorative material (3M ESPE, USA). The patient experienced no post-treatment pain or discomfort.

DISCUSSION

Recognition of the aberrant anatomy requires good clinician's knowledge of the root canal morphology, critical interpretation of the diagnostic tools, appropriate assessment of the pulp chamber floor and operative skills of the clinician. The case

report presented here describes the management of endodontic challenge of mandibular second premolar with two roots which are bifurcated at the midroot level.

It is undoubtedly an endodontic challenge to diagnose and manage extra roots or root canals in mandibular premolars. A wide range of opinions are notified in the literature regarding the number of root canals, but only some reports on the variations in the number of roots that occur in the mandibular second premolars.^{12,13} Slowey¹⁴ has shown that when the root canal shadow abruptly stops in the radicular region on radiograph, one should suspect bifurcation or trifurcation of the canal at that point. Also an additional root canal can be identified when the root outline is ill-defined or has an unusual contour, or is deviated from the normal appearance on radiograph.

Considering the fact that many aberrations exist in these teeth, it becomes mandatory that when a patient comes with pain or sensitivity to hot and cold after root canal treatment the clinician should suspect a chance of missed root canals. In such complex situations, judicious use of high-end diagnostic aids is recommended.

Radiographs result in superimposition of images as they can produce only a two-dimensional image of a three-dimensional object. Hence, they have rather limited value in cases with complex root canal anatomy. Tachibana and Matsumoto¹⁵ thus studied the applicability of computerized tomography to endodontics.

The CBCT images revealed that the tooth in the above case report had two separate roots with two distinct root canals. Both the root canals had separate portals of exit. Although the vague lines of the two roots could be observed on the radiograph, the confirmatory diagnosis of the exact number of roots and root canals could only be made with the help of CBCT.

The use of magnification was necessary for the management of branched canal configuration wherein the clinician confronts difficulty in locating and preparing the canal. Also a crucial step required in such canal was a modification in access preparation which required an adequate flaring of the canal coronal to the bifurcation for unobstructed passage of instruments into the second canal. Careful manual exploration of the bifurcated canal should be done with a pre curved 10K file that will provide a tactile sensation as the instrument moves in an eccentric direction on deeper penetration into the canal^{16,17} and also prevents the instrument separation.

Clearly, these findings are clinically important as in a study by Ingle JI in 2003 at the University of Washington assessing the results of endodontic therapy, the mandibular first and second premolars showed a failure rate of 11.45 and 4.54% of all types of the teeth. Possibly, these findings could be attributed to the complex root canal anatomy of a large number of these teeth. Omission to recognize the presence of extra root or canals can often lead to acute flare-ups during treatment and subsequent endodontic therapy failure.

CONCLUSION

Successful nonsurgical endodontic management of mandibular second premolars with bifurcated roots and root canals has been presented.

It is a well established fact that the presence of extra roots and root canals in this tooth may be far more than one can expect. In this case, radiographs alone could not confirm the exact root canal anatomy. Hence, the use of CBCT helped in making a confirmatory diagnosis. This case report provides a clinical significance on the importance of thorough knowledge of the internal morphology of the root canal and use of the modified techniques before and during treatment to prevent subsequent flare ups.

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