Morphologic aberration of mandibular molar – "C" shape canal: case report

Running title: Mandibular molar with "C" shaped root canals

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ABSTRACT

The mandibular molars are more prone to aberrations of canals. They include bifurcation and trifurcation of canals, fusion of roots, extreme canal curvatures and c shaped canals which makes it difficult to diagnose and manage. The failure to treat them leads to re-infection and persistence of infection in the tooth. Hence, it is of utmost importance for the clinician to know the morphologic variations. The present case report is aimed to give a clinical insight of such aberrations. The two cases presents with mandibular second molar with "c" shaped root canal system, which was diagnosed with CBCT. Both the cases were treated endodontically and successfully managed.

Keywords: mandibular second molar, "c" shaped root canals, two root canals, cone-beam computed tomography, molars.

MAIN TEXT CASE REPORT

INTRODUCTION

A characteristic anatomical variant of the root canal system with a connection of the root canals by a fin or web-like structure forming a C shape at the canal orifice is called a C-shaped root canal system [(1)]. It was first termed by Cooke and Cox in 1979 to describe the cross-sectional morphology of roots that resembled letter C [(2)]. During the stage of root development the Hertwig's epithelial sheath determines the shape and the number of roots. It bends in a horizontal plane below the cement enamel junction and fuses in the center leaving openings for roots. Failure of fusion on the lingual or buccal root surface is the main cause of C-shaped root which has C shaped canal. But a C-shaped root can also be formed by deposition of the cementum over time and has normal canal configuration [(3)]. The prevalence of c shaped canals in Indian population was observed in a study by Neelakantan et. al., found to be 7.5% of the teeth examined of which 54.84% of the teeth had two apical foramina, and one specimen (3.8%) of the C-shaped roots showed three apical foramina [(4)]. An analysis by

CBCT evaluation showed that 9.7% of second molars and 8% of third molars had C-shaped canals and a prominent buccal groove was seen in these teeth [5].

C shaped root canal system is often difficult to evaluate with pre-operative radiographs. Though it has a typical pulp chamber which is large in the occlusoapical dimension with a low bifurcation, the semicolon-type C-shaped root canals are hard to analyse due to proximity of two roots or a large distal root canal or a narrow mesial root canal and a blurred image of a third canal in-between [5]. CBCT plays a vital role in such cases and gives an insight into the canal configuration with the help of 3D imaging. Following root canal diagnosis, the access cavity is often critical to the success of a root canal procedure. The use of an operating microscope results in more effective treatment due to clear visualization of canal orifice thereby aid in effective cleaning and shaping [6]. Awareness of the complexity of the root canal system will enhance the capability of identification of the variation. The occurrence of "C" shaped root canal is relatively rare and so the purpose of this report is to provide an insight on clinical management of such cases.

CASE REPORT 1

A 34-year-old female patient reported with a chief complaint of pain in the lower right back tooth since 3 months. The nature of pain was spontaneous and aggravated on chewing and lying down. On intraoral examination, the access cavity of tooth 47 was filled with a temporary restoration and the tooth was tender to percussion. The radiographic examination of tooth 47 revealed a coronal restoration and fusion of roots in the apical part with enlargement of the periodontal ligament (PDL) in the periapical area (figure 1A). A diagnosis was made as symptomatic apical periodontitis following previously initiated root canal treatment. A CBCT was advised to evaluate the canal pattern and root canal treatment was planned (figure 1B). The patient was administered local anesthesia and tooth was isolated using rubber dam. Access preparation was made in the right mandibular second molar and C shaped canal orifices were located (mesial and distal) with the help of operating microscope and careful manual exploration (figure 1C). The canal configuration is observed to be fan type C2. With 10 K file negotiation was done and working length was measured with electronic apex locator and confirmed with radiograph (figure 1D). Both the canals were prepared using hand K-file till no 20 followed by NeoEndo file (Orikam, India) till 25, 0.06 (figure 1E). During preparation, the canals were lubricated and irrigated with EDTA and 2.5% NaOCl. Calcium hydroxide dressing was placed in the canals and temporary restoration was done. After two weeks, the canals were coated with AH plus sealer and obturated in the lateral Compaction technique and the tooth was restored with composite resin (figure 1F).

CASE REPORT 2

A 30 year old female patient came with the chief complaint of intermittent pain since two months in lower right back teeth region. Patient also complained of episodes of sensitivity to cool drinks in the involved tooth. Past medical and dental history was non-contributory. Deep disto-occlusal carious lesion was observed in tooth #47 and was tender to percussion. Based on clinical and radiographic evidences (figure 2A) a diagnosis of

symptomatic irreversible pulpitis with symptomatic apical periodontitis was made and nonsurgical root canal treatment was planned. Cone beam computerized tomography was performed to understand the root morphology which shows three canals namely mesio buccal, mesio lingual and distal canals (figure 2B). The canal configuration is observed to be fan type C3. Access preparation was made in the right mandibular second molar. With the help of operating microscope and careful manual exploration was done to locate 3 orifices in c shape arrangement (figure 2C). With 10 K file negotiation was done and working length was measured with electronic apex locator and confirmed with radiograph (figure 2D). The three canals were prepared using hand K file till no. 20 in step back method and NeoEndo file (Orikam, India) 25, 0.04% (figure 2E). During preparation, the canals were lubricated with Endoprep- RC and irrigated with 2.5% NaOCl. The calcium hydroxide dressing was placed in the canals and temporary restoration was done. After two weeks, the canals were coated with AH plus sealer and obturated in the lateral Compaction technique and the tooth was restored with composite resin (figure 2F).

Discussion

This case report describes the treatment of a two mandibular second molars with a C-shaped root canal system. C-shaped canal configuration is a unique root canal configuration, mostly found in mandibular second molars with a prevalence that ranges between 2.7%–52% in different populations [(7)]. The highest prevalence of c shaped canal was 44% observed in China and the lowest in Brazil with 6.8% showing a huge variability based on region [(8)]. C-shaped canal systems have many configurations and may also vary along the length of the root which proves that C-shaped canals have a complex canal anatomy [(9)]. The main characteristics seen in a c-shaped canal are either the instruments appear to converge at the apex or to exit at the furcation resembling a perforation of the furcation [(9)]. The working length radiographs are more useful in identifying the morphology as compared to the preoperative radiographs which are the not very effective in diagnosing the C-shaped cases [(10)].

After the orifice location, Gates-Glidden burs should not be used to prepare the mesiobuccal and buccal isthmus areas as it can cause over-preparation and perforation [(3)]. A continuous circumferential filing along the periphery of the C canal is advocated during canal preparation. But it is important to note that the C-shaped canals are not centrally located. In most of the cases the mesiolingual area is thinner than the other side of the root impeding a ‘danger zone’ and filing should be done away from this area to prevent strip perforations [(11)]. The canals should be irrigated with copious amounts of 5.25% NaOCl and Hedstrom files are especially effective for efficient tissue removal. At the apical part of the canal, the cold lateral compaction and cold injectable filling techniques were observed to be more successful compared with the warm gutta-percha filling techniques in C shaped root canal configuration [(12)].

Increased risk of root perforation is observed in C-shaped canals during shaping and post space preparation procedures because the buccal and lingual canal walls are very narrow at mesial locations [(13)]. Hence, placement of posts or antirotational pins in the mesiolingual and mesiobuccal areas of C-shaped root canal can cause perforation. If a post is indicated, the post width should be minimized. We must also be aware of the impact this anatomy has when

surgical endodontics is indicated. The intercanal communications or fins present along the root length makes it difficult for the retropreparation and eventual retrofilling. If endodontic surgical intervention is indicated it is better to consider alternative options like extraction, retrofilling, and intentional replantation [(2)]. C-shaped root canal configuration was found to have no significant effect on the healing rate of the endodontic therapy in mandibular molars [(14)]. But a proper pulpal diagnosis and final restoration will greatly influence the healing outcomes of C-shaped and non-C-shaped canals, respectively [(15)].

CONCLUSION

This case report describes a C-shaped canal in a mandibular second molar managed with the aid of CBCT. Its usage during dental treatment of suspected cases may provide the clinician with a better tool to diagnose this complex anatomy and choose appropriate instrumentation and obturation techniques.

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CONFLICT OF INTEREST: Nil

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FIGURES

Figure 1: CASE 1: (A): pre-operative radiograph, (B): CBCT imaging, (C): orifice location (mesial and distal), (D) working length determination, (E) master cone, (F) obturation and post endo restoration

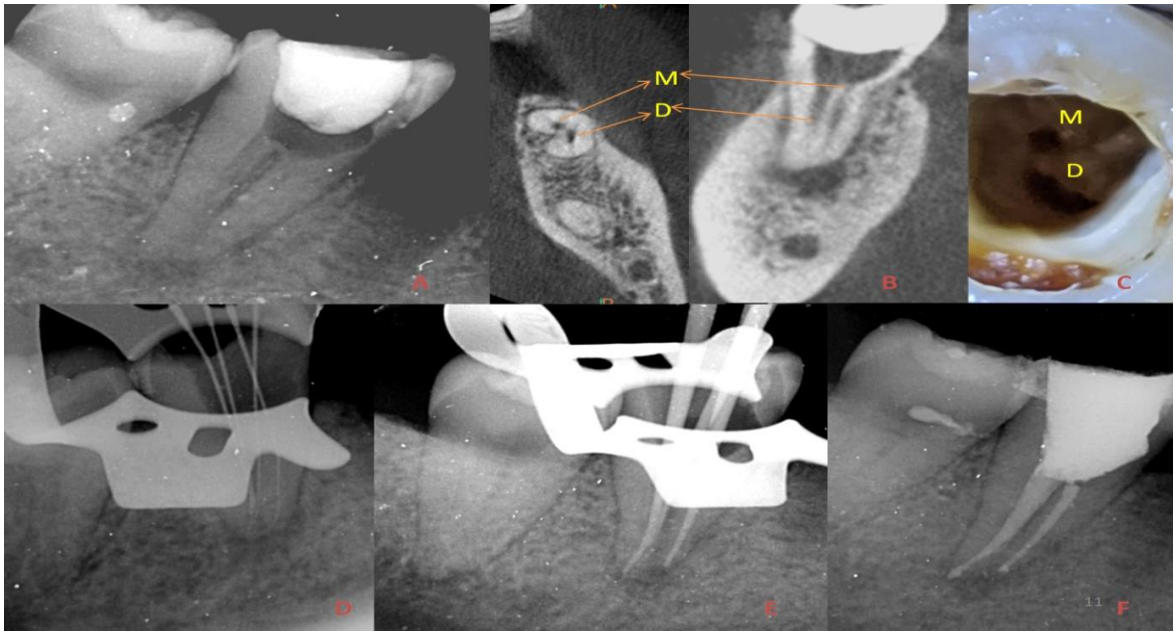

Figure 2: CASE 2: (A): pre-operative radiograph, (B): CBCT imaging, (C): orifice location (mesiobuccal, mesiolingual and distal), (D) working length determination, (E) master cone, (F) obturation and post endo restoration