CASE REPORT

Management of single C-shaped canal in mandibular second molar: A case report

Vandana Gade¹, Yugandhara Ikhar², Jaykumar R. Gade³, Reema Asani⁴

¹Department of Conservative Dentistry and Endodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India,
²Consulting Endodontist in Khare Dental Clinic, Nagpur, Maharashtra, India,
³Prosthetic Dentistry and Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India,
⁴Department of Conservative Dentistry, Swargiya Dadasaheb Kalmegh Smruti Dental College And Hospital, Nagpur, Maharashtra, India

Abstract

Variation in root canal morphology presents a continuous challenge to endodontic diagnosis and treatment. A number of cases have been reported with extra roots and canals, and also those with lesser number of roots and canals than normal. Hence, a clinician must also be aware regarding lesser number of root and canals as existing morphologic variation since varied canal anatomy poses a challenge to the clinician’s expertise. This case report presents a case with the management of an unusual C-shaped canal in mandibular second molar with two buccal roots fused. To confirm the extension of the unusual anatomy, cone-beam computed tomography was employed.

Keywords: Cone-beam computed tomography, C-shaped canal, root canal variation

Introduction

To achieve appropriate cleaning and shaping of the root canal system and ensure success of endodontic treatment, clinician must have a thorough knowledge of root canal system. Two well defined roots: A mesial root with two canals and a distal root with one or two canals is normal morphologic root canal anatomy in mandibular second molar. However, endodontic literature reveals extensive variations in the form, configuration, and number of root canals in mandibular molars in the form, configuration, and number of root canals in mandibular molars.¹

Varied canal configuration among the teeth is seen to a large extent; out of which, mandibular molar is of particular interest. First documentation of C-shaped canal in the literature was done by “Cooke and Cox” in 1979 and is commonly observed in mandibular 2nd molar. Although mandibular premolars, maxillary first molars have also shown the presence of C-shaped canal. The explanation behind the formation of C-shaped canal is the failure of fusion of hertwigs epithelial root sheath. Formation of conical/prism shaped root is the result of failure to fuse on both buccal and lingual side. This type of configuration shows ethnic predilection with high prevalence among Asians.²

The most practical method to predict root canal anatomy in clinical scenario is radiograph, while treating C-shaped configuration, difficulty on cleaning, debridement, and obturation are encountered. Hence, recognition of this before treatment will facilitate successful management of such cases.

The purpose of this case is to describe the management of a mandibular first molar with two fused roots and single C-shaped canal.

Case Report

A 39-year-old male patient reported to the department of conservative dentistry and endodontics with the chief complaint of spontaneous pain in the lower right posterior region. History revealed intermittent pain with the right mandibular first molar for the past 2 months, which had increased in intensity for the past 3 days. Subjective symptoms included sensitivity to thermal stimuli and an increase in intensity of pain. The patient’s medical history was non-contributory. Dental history included extraction of the left mandibular molar 3-4 years ago due to caries. On clinical examination, deep occlusal caries was seen, which was sensitive to percussion. Sensibility testing with RC Ice (Prime Dental Products Pvt Ltd, Mumbai, India) was done which caused an intense lingering pain; whereas exaggerated response was seen with electric pulp
testing (Parkell Electronics Division, Farmingdale, NY) showed. Pre-operative radiographs revealed a deep occlusal radiolucency approaching the pulp space with a widened periodontal ligament space adjacent to the root apex. A diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis was made from the sensibility tests and clinical and radiographic examination, and routine nonsurgical endodontic treatment was planned. Consent was obtained after explaining the entire treatment plan to the patient. The treatment was initiated by inducing 1.8 ml 2% lidocaine with 1:200,000 epinephrine (Xylocaine, AstraZeneca Pharma India Ltd, Bangalore, India). After placement of Rubber Dam, conventional endodontic access opening was established with an Endo Access Bur (Dentsply Tulsa, Tulsa, OK). On access opening, in the center of the pulp chamber, a single large C-shaped canal was located [Figure 1]. After clinical examination, it was found that the tooth had two root canals which were fused buccally and had single C-shaped canal. It was decided to confirm the extension of the C-shaped canal with a cone-beam computed tomography (CBCT) scan [Figure 2]. Thus, the fusion of the two buccal roots, and a single C-shaped canal was clearly visible in the coronal section which extended all the way till the apex. Working length determination was done using an apex locator (Root ZX II, Morita, and Tokyo, Japan) and confirmed with radiographs till 21 mm. [Figure 3]. Circumferential filing technique was done using with ISO 2% taper files up to size 25 (Mani Inc. Tochigi-Ken, Japan) for Cleaning and shaping. Further, cleaning and shaping done with proper gold rotary files (Denstply) till F3 5.25% sodium hypochlorite (Vishal Dental Products, Mumbai, India) was used as irrigant in between instrumentation. Final irrigation was done by normal saline (Nirma Pvt. limited, Gujarat, India), followed by 5.25% sodium hypochlorite and lastly by 17% EDTA (EDTA; Prime Dental Products Pvt. Ltd, Mumbai, India). Final rinsing of the canal was performed using normal saline. Using absorbent points, the canal was dried (DentsplyMaillefer, Ballaigues, Switzerland) and obturation was performed using sectional method for the apical third [Figure 3], followed by backfill with thermo plasticized gutta-percha using Calamus Obturating system and AH Plus resin sealer (MailleferDentsply, Konstanz, Germany) [Figure 4].

After completion of root canal treatment, using resin composite (3M ESPE Dental Products, St Paul, MN), the access cavity was restored.

**Discussion**

Eruption age for the mandibular second molars is 7–8 years and apical closure is usually completed by 8–9 years. About 3–6 years
after root completion the canal differentiation commences. Variations in canal anatomy results due to disturbances in this differentiation. Existence of such anatomical variations in all the maxillary and mandibular second molars had been identified by Fava et al.[4] Most of the permanent second mandibular molars typically presents with two well-defined roots, a distal root with a wide oval canal or two round canals and a mesial root with two canals. Reuben et al. had documented this type of morphological variation in an in vitro study. Out of 125 samples of mandibular first molars from an Indian population, only one molar showed a single root and single canal (0.8%). Further, only one sample showed C-shaped canal.[5] Demirbuga et al. evaluated the root and canal morphology of first and second mandibular molars in Turkish population and reported an incidence of 0.85% for C-shaped canals in mandibular and 0.12% for single root and canal[6] and. Sooriaprakas et al. have reported the incidence of a single root and single canal in mandibular first molar.[7]

In endodontic treatment, radiographic examination is considered as an essential component. An additional radiographic view from a 20-degree mesial or distal projection. Chances of detecting unusual root canal morphology increase with the use of multiple pre-operative radiographs or an additional radiographic view from a 20-degree mesial or distal projection.[8] To determine the morphology of root canal in cases with aberrations, Kottoor et al. and La et al. have suggested the use of CBCT. CBCT was advised in this case to find out the root canal morphology and also to determine the extension of C-shaped canal towards the apex. CBCT helped to interpret that this tooth had a single C-shaped canal beginning from the pulp chamber to apex without any furcation.[9]

Melton et al., in 1991, had proposed a classification of C-shaped canals based on their cross-sectional shape.[8] Fan et al., in 2004, modified Melton’s classification into the following categories:[10]

1. Category I (C1): The shape was an interrupted “C” with no separation or division.
2. Category II (C2): The canal shape resembled a semicolon resulting from a discontinuation of the “C” outline.
3. Category III (C3): Two or three separate canals (highest incidence).
4. Category IV (C4): Only one round or oval canal in that cross-section.
5. Category V (C5): No canal lumen could be observed (which is usually seen near the apex only).

In this case, according to this classification, the C-shaped canal will fall under C1 (Category I). The anatomic feature of C1 shows the presence of a fin or web which connects the individual canals. Instrumented C-shaped canals show a large amount of debris which could lead to endodontic failure.[11] The use of hand or rotary endodontic files alone would not result in proper cleaning of such canal systems. The constant irrigant flow is an added advantage. In this case, the enlargement was done initially using ISO taper files and finished with the Protaper Rotary files.

Due to the oval C-shaped canal outline thermo plasticized, obturation was choice of technique here. In combination with vertical compaction, this technique allows thorough filling of the canal anatomy. C-shaped canal are rare morphologic variation, root canal treatment of such tooth is often challenging. This case report discusses the treatment plan for such variation to achieve a successful treatment outcome.

**References**

1. Krithikadatta J, Kottoor J, Karumaran CS, Rajan G. Mandibular first molar having unusual mesial root canal morphology with contradictory cone-beam computed tomography findings: A case report. J Endod 2010;36:1712-6.
2. Fava LR, Weinfeld I, Fabri FP, Pais CR. Four second molars with single roots and single canals in the same patient. Int Endod J 2000;33:138-42.
3. Reuben J, Velmurugan J, Kandaswamy D. The evaluation of root canal morphology of the mandibular first molar in an Indian population using spiral computed tomography scan: An in vitro study. J Endod 2008;34:212-5.
4. Demirbuga S, Sekerci AE, Dincar AN, Cayabatmaz M, Zorba YO. Use of cone beam computed tomography to evaluate root and canal morphology of mandibular first and second molars in Turkish individuals. Med Oral Patol Oral Cir Bucal 2013;18:e737-44.
5. Sooriaprakas C, Ballal S, Velmurugan N. Mandibular first molar with a single root and single canal. Case Rep Dent 2014;2014:159846.
6. Fava LG, Dummer PM. Periapical radiographic techniques during endodontic diagnosis and treatment. Int Endod J 1997;30:250-61.
7. Kottoor J, Velmurugan S, Surendran S. Endodontic management of a maxillary first molar with eight root canal systems evaluated using cone-beam computed tomography scanning: A case report. J Endod 2011;37:715-9.
8. La SH, Jung H, Kim EC, Min KS. Identification of independent middle mesial canal in mandibular first molar using cone-beam computed tomography imaging. J Endod 2010;36:542-5.
9. Melton DC, Krell KV, Fuller MW. Anatomical and histological features of C-shaped canals in mandibular second molars. J Endod 1991;17:384-8.
10. 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.