ENDODONTIC MANAGEMENT OF A MANDIBULAR SECOND MOLAR WITH C-SHAPED CANAL CONFIGURATION- A CASE REPORT

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ABSTRACT

BACKGROUND

Successful root canal therapy requires a thorough knowledge of root and root canal morphology. Coupled with information gleaned from preoperative dental radiography, the clinician can assess to a great extent the anatomic challenges in each tooth. One of the most important anatomic variations is the "C" shape configuration of the canal system. C shape canal presents an extensive complex system and is mostly seen in mandibular second molars. This case report aimed to present a case of a mandibular second molar with a C-shaped canal configuration, which was successfully treated endodontically. A 35-year-old female patient was referred to clinic at Department of Conservative Dentistry, Faculty of Dentistry, University of Sumatera Utara. She felt the discomfort in his mandibular right second molar after the amalgam restoration had failed. Clinical evaluation revealed that she had tenderness to percussion and palpation. In clinical visualisation following access opening, the tooth showed type III C-shaped canal configuration. Radiographic evidence showed the type I of the radicular and apical anatomy. Root canal obturation with warm gutta percha technique was performed with proper final restoration. Careful assessment of preoperative radiograph is a key step for its subsequent management and this assessment might impact greatly on the treatment outcomes. The C-shape configuration presents a challenge to debridement and obturation. According to the endodontic literature, the C-shaped root canal is most frequently seen in the mandibular second molar. The successful treatment of this case demonstrates that C-shaped canal is a challenge for practitioner and hence should be treated thoroughly.

KEYWORDS

C-Shaped, Mandibular Second Molar, Endodontic Management.

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BACKGROUND

The main objective of root canal treatment is the thorough mechanical and chemical cleansing of the entire pulp space followed by complete obturation with inert filling material. Therefore, it is imperative aberrant anatomy is identified prior to and during root canal treatment of such teeth. Root canal morphology is limitless in its variability and that clinicians must be aware that anatomic variations constitute an impressive challenge to endodontic success. Undetected extra roots or root canals are the major reason for failure of root canal treatment.[1,2]

A clear understanding of root morphology and canal anatomy is an essential prerequisite in order to achieve clean, disinfected and three dimensional filled root canal systems. Many of the challenges appear during root canal treatment may be directly attributed to an inadequate understanding of the tooth morphology. Human molars show considerable anatomic variation and abnormalities with respect to number of roots and root canals.[3,4]

The mandibular second molar is typically compared to the first mandibular molar. The differences are instructive. First, they are similar coronally than the first mandibular molar. Second, they are more symmetrical than the first molar. C-shaped root system is an anatomical variation of second molars. They can be seen with a fin or web connecting the root systems. Lateral canals, anastomoses and apical deltas are very common. Furthermore, the second molar roots have a tendency to be close together and may be fused single rooted (22%) and may have 3 roots also (2%).[5,6]

The C-shaped canal, which was first documented in endodontic literature by Cooke and Cox in 1979, is so named for the cross-sectional morphology of the root and root canal. Instead of having several discrete orifices, the pulp chamber of the C-shaped canal is a single ribbon-shaped orifice with a 180° arc (or more), which in mandibular molars starts at the mesiolingual line angle and sweeps around the buccal to the end at the distal aspect of the pulp chamber. This anatomical variation is mostly seen in mandibular second molars.[7,8]

The main anatomical feature of C-shaped canals is the presence of a fin or web connecting the individual canals. The coronal orifice of these canals is usually located apically to the CEJ level and may appear as a single, ribbon-shaped opening with a 180º arc linking all the main canals or a ribbon-shaped canal that includes the mesiobuccal and distal canals.[9,10]

Typically, this configuration is found in second mandibular molars with fused roots and its prevalence differs across races with prevalence as high as 52% in native Chinese population. C-shaped canal anatomy has also been found in mandibular first premolars, mandibular first molars, third molars, maxillary first molars and maxillary second molars.[9] The study of root and canal anatomy has endodontic and anthropologic significance. In fact, it is important to be familiar with variations in tooth anatomy and characteristic features in various racial groups, because such knowledge can aid

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location and negotiation of canals as well as their subsequent management.[1,5]

These C-shaped canals present a challenge to the clinician, both at the diagnostic and treatment level. These unique anatomical features are not easily recognised on a traditional two-dimensional periapical radiograph; thus, the operator may first become aware of the anatomy of this root-canal system only when encountering the unfamiliar shape of the pulp chamber and its floor. With the increased use of CBCT for endodontic treatment planning, the clinician may be able to better detect and diagnose C-shaped canals prior to endodontic treatment.[7] This case report was aimed to report endodontic management of a mandibular second molar with C-shaped canal configuration.

Case History

A 35-year-old female patient was referred to clinic at Department of Conservative Dentistry, Faculty of Dentistry University of Sumatera Utara. She felt discomfort in his mandibular right second molar after the amalgam restoration had failed. Clinical evaluation revealed that she had tenderness to percussion and palpation. EPT showed negative response of the pulp vitality. In clinical visualisation and exploration following access opening, the tooth showed type III C-shaped canal configuration. Meanwhile, radiographic evidence showed the type I of the radicular and apical anatomy (Figure 1 and 2). The tooth was planned for root canal treatment and the procedure was explained to the patient. The consent was obtained from the patient.

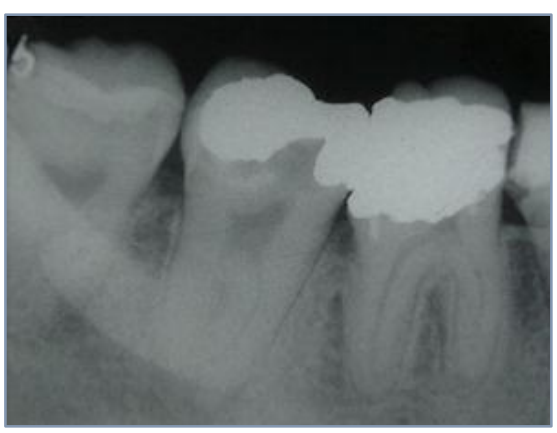

Figure 1. Pre-Operative Radiograph

Figure 2. Pre-Operative Clinical View

In the first visit, after the access cavity was established, the pulpal floor revealed type of canal orifice extending from distal canal to mesiobuccal canal and the other orifice of mesiolingual canal separately with four distinct canals, suggestive of type III of C-shape canal anatomy. Canal system identification was confirmed by taking working length intra-oral periapical radiograph. The procedure was performed under proper rubber dam isolation. All of the broken amalgam restoration was replaced with new composite resin restoration (Figure 3).

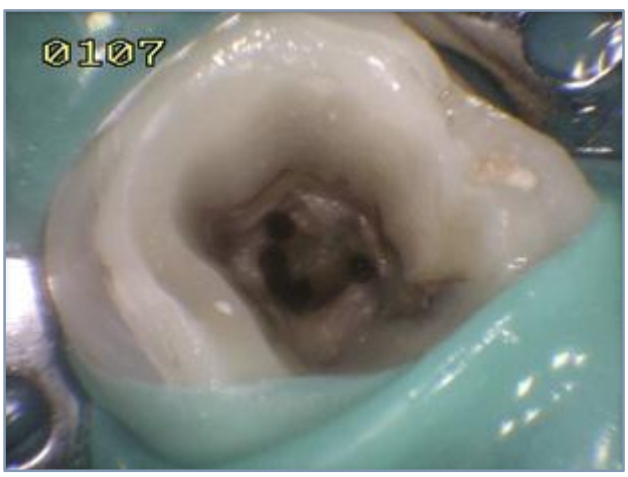

Figure 3. C-Shaped Canal

Figure 4. Working Length Confirmation

The negotiation of canals began with no. 15 ISO file. On closer inspection with 2.5 times magnification prismatic loupes (Zeiss Eyemag Pro S; Carl Zeiss, Italy) the pulp chamber floor was carefully examined. The working lengths of all root canals were estimated using an electronic apex locator (Raypex 6, VDW Endodontic Synergy, Germany) and then confirmed radiographically with initial files (Figure 4). Distal, mesiobuccal and mesiolingual canal spaces were prepared normally and the isthmus area was initially cleaned using smaller K-files not more than ISO no. 30. Then it was followed by cleaning with ultrasonic files; 2.5% Sodium hypochlorite and 17% EDTA were used as irrigants alternatively. Cleaning and Shaping were completed using rotary Mtwo instruments (VDW Endodontic Synergy, Germany) in a single length technique.

After relieving the occlusion, canals were dried with sterile paper points. Calcium hydroxide was used as intracanal dressing and the tooth was temporised with temporary cement for two weeks.

Figure 5. Trial of Master Cone

In the second visit, the intracanal dressing was removed from the canals and all canals were cleaned using root canal irrigants. Upon clinical examination, the clinical symptoms disappeared and there were no tenderness and sensitivity on percussion and palpation. The master cone fit was checked and the root canals were dried with absorbing paper points. (Figure 5) Root canals were obturated using combination of cold lateral condensation technique and compaction technique of warm gutta percha with MTA based sealer (Fillapex, Angelus Brazil). After obturation, resin-modified glass ionomer cement was used to seal coronal portion (Figure 6). The tooth was then restored with composite resin onlay (Figure 7).

Figure 6. Post Obturation Radiograph

Figure 7. Onlay Direct Composite Resin

Followup was done after one year. There was totally no clinical symptom observed. Tooth could function properly and radiograph showed complete periradicular healing (Figure 8).

Figure 8. Followup Period at One Year

DISCUSSION

Before root canal treatment is performed, the clinician should ideally have adequate knowledge of the pulp chamber and internal anatomy of the teeth. All root canals should be accessed, cleaned and shaped to achieve a hermetic of the entire root canal space. There is an abundant amount of reports related to the anatomic variations of mandibular molars. This should induce the clinician to accurately observe the pulp chamber floor to locate possibly orifices. This will increase the long-term prognosis of endodontic therapy. Therefore, when root canal treatment is to be performed, the clinician should be aware that root canal anatomy may be abnormal.[1,5]

"C" configuration is mostly seen in mandibular second molar followed by other mandibular molars and maxillary molars respectively. It appears to be genetically determined and may be used in tracing the ethnic origin of the subject.

Prevalence of C-shaped canal in mandibular second molar has been reported to be 2.7% in the American population, 10% in the Thai population and 31.5% in the Chinese population. When present, over 70% of individuals have this canal configuration bilaterally in mandibular second molar.[11,12]

Failure of Hertwig's epithelial root sheath to fuse on buccal or lingual root surface is the main cause for occurrence of C-shaped roots, which always contain a C-shaped canal. However, C-shaped root may form by coalescence because of deposition of cementum with time.[8,13,14]

Melton et al in 1991 proposed the following classification of C-shaped canals based on their cross-sectional shape.[12] As in this classification, there has been no clear description of the difference between category II and III, Fan et al in 2004 modified Melton's method into following categories.[3]

1. **Category I-** The shape is an uninterrupted "C" with no separation (C1).
2. **Category II-** The canal shape resembles a semicolon resulting from a discontinuation of the "C" outline, but either angle α or β should be no less than 60° (C2).
3. **Category III-** Two or three separate canals are present and both angles α or β are less than 60° (C3).
4. **Category IV-** Only one round or oval canal is found (C4).
5. **Category V-** No canal lumen can be observed, usually seen near the apex (C5).

Fan et al (2004) stated that for mandibular second molar to qualify as having a C-shaped canal system, it has to exhibit all the following three features[4]:

a. Fused roots.
b. A longitudinal groove on lingual or buccal surface of the root.
c. At least one cross-section of the canal should belong to the C1, C2 or C3 configuration.

Nevertheless, even when recognised as a C-shaped canal, cleaning, shaping and obturation of such a root canal system present unique challenges to the clinician. This root canal system tends to have flat, wide-spreading fins which may present an even greater challenge if mesh-like connections between the fins are present.[5,6]

The rotary nickel-titanium files that are currently used are of great help when treating simple, curved canals with round cross-sections. However, these instruments are less effective when dealing with flat, oval canals. The assessment of the endodontic treatment may appear satisfactory when viewed on a periapical radiograph. Nevertheless, the extent to which the buccal and lingual recesses ("fins") or isthmuses were left unaffected by the endodontic procedure cannot be visualised. These untreated parts of the root canal system may serve as a potential habitat or passage for bacteria.[7,10]

In this clinical case, thorough cleaning and shaping were done with Mtwo file system in the first visit. Proper cleaning and shaping should be performed completely in order to remove all the necrotic pulp tissue and eradicate all microorganism in the root canal system. Calcium hydroxide used as intracanal dressing to disinfect the root canal system. Besides it has a role to promote healing and repair in inflamed pulp with periapical lesions. At one year followup period, the tooth could remain functioning properly and patient did not have any clinical symptoms. Intraoral radiography showed good healing of periapical tissue. By having proper understanding of C-shaped classification, a clinician will have better treatment result.

In conclusion, every attempt should be made to find and treat all root canals to ensure successful endodontic treatment. The importance of an accurate clinical evaluation of root canal number and morphology in mandibular second molar cannot be overemphasised. Anatomic variation in the number of roots and root canals can occur in any tooth. Examination of clear radiographs taken from different angles and careful evaluation of the internal anatomy of teeth is essential.[14] Although, the prevalence is less, when sound principals of chemomechanical preparation and obturation are followed, the long-term prognosis for the C-shaped root retention equals that of other molars.

REFERENCES

[1] Cooke HG, Cox FL. C-shaped canal configurations in mandibular molars. J Am Dent Assoc 1979;99(5):836–9.
[2] Fan B. The anatomy of C-shaped canal system in mandibular second molars. Contemporary Endodontics 2005;1-3.
[3] Melton DC, Krell KV, Fuller MW. Anatomical and histological features of C-shaped canals in mandibular second molars. J Endod 1991;17(8):384–8.
[4] Fan B, Cheung GS, Fan M, et al. C-shaped canal system in mandibular second molars: Part I–anatomical features. J Endod 2004;30(12):899–903.
[5] Fan B, Cheung GS, Fan M, et al. C-shaped canal system in mandibular second molars: part II–radiographic features. J Endod 2004;30(12):904–8.
[6] Fan W, Fan B, Gutmann JL, et al. Identification of a C-shaped canal system in Mandibular second molars-part III: anatomic features revealed by digital subtraction radiography. J Endod 2008;34(10):1187–90.
[7] Fan B, Min Y, Lu G, et al. Negotiation of C-shaped canal systems in mandibular second molars. J Endod 2009;35(7):1003-8.
[8] Cheung LH, Cheung GS. Evaluation of a rotary instrumentation method for C-shaped canals with micro-computed tomography. J Endod 2008;34(10):1233-8.
[9] Ingle JI, Newton CW, West JD, et al. Obturation of the radicular space. 6th edn. In: Ingle JI, Bakland LK. Endodontics. London: BC Decker Inc., 2008:625–64.
[10] Liewehr FR, Kulild JC, Primack PD. Obturation of a C-shaped canal using an improved method of warm lateral condensation. J Endod 1993;19(9):474–7.
[11] Jafarzadeb H, Wu YN. The C-shaped root canal configuration: a review. J Endod 2007;33(5):517-23.
[12] Walid N. The use of two pluggers for the obturation of an uncommon C-shaped canal. J Endod 2000; 26(7):422–4.
[13] Woelber JP, Bruder M, Tennert C, et al. Asssessment of endodontic treatment of C-shaped root canals. Swiss Dent J 2014;124(1):11-5.
[14] Grande NM, Plotino G, Gambarini G, et al. Present and future in the use of micro-CT scanner 3D analysis for the study of dental and root canal morphology. Ann 1st Super Sanita 2012;48(1):26-34.