

Case Report

C-Shaped Configuration of the Root Canal System of Mandibular Second Molar: Two case reports

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ABSTRACT

C-shaped canal configuration results from the failure of the Hertwig's epithelial sheath to fuse or its inadequate development during the root embryologic stage. Failure of the Hertwig's epithelial sheath to fuse on the buccal side will result in the formation of a lingual groove, and failure to fuse on the lingual would result in a buccal groove. Failure of the sheath to fuse on both the buccal and lingual sides will result in the formation of a conical root. Hence; we are presenting two case-reports of C- shaped configuration of root canal system of mandibular second molars.

Key words: C- shaped, Mandibular, Molars

Received: 12 May 2018

Revised: 17 June 2018

Accepted: 18 June 2018

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This article may be cited as: Cheema J, VK Ashwath, Salil. C-Shaped Configuration of the Root Canal System of Mandibular Second Molar: Two case reports. *Int J Res Health Allied Sci* 2018; 4(4):5-8.

INTRODUCTION

Thorough knowledge on root canal anatomy and its variations is a key factor for successful root canal treatment. One of the most important anatomic variations is the 'C' configuration of the canal system. The C-shaped canal was first documented in endodontic literature by Cooke and Cox in 1979. It 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.¹⁻³

Canal configuration has a high prevalence in mandibular second molars (2.7% - 45.5%). The C-shaped canal configuration has racial predilection. Higher incidence reported in countries belonging to the Asian continent like Chinese (31.5%) and Koreans (44.5%). It has been found

that there is no correlation of C-shaped canal configuration with gender and age. This C- shaped canal is an anatomical variation of a root fusion and a type of taurodontism.^{4,5}

C-shaped canal configuration results from the failure of the Hertwig's epithelial sheath to fuse or its inadequate development during the root embryologic stage. Failure of the Hertwig's epithelial sheath to fuse on the buccal side will result in the formation of a lingual groove, and failure to fuse on the lingual would result in a buccal groove. Failure of the sheath to fuse on both the buccal and lingual sides will result in the formation of a conical root. The C-shaped root may also be formed by coalescence because of deposition of the cementum with time.⁶ Melton et al. in 1991 proposed the following classification of C-shaped canals based on their cross-sectional shape:

CLASSIFICATION OF C-SHAPED CANAL^{3,4}

1. Category I: continuous C-shaped canal running from the pulp chamber to the apex defines a C-shaped outline without any separation
2. Category II: the semicolon-shaped orifice in which dentine separates a main C-shaped canal from one mesial distinct canal
3. Category III: refers to those with two or more discrete and separate canals:-
 - subdivision I, C-shaped orifice in the coronal third that divides into two or more discrete and separate canals that join apically;
 - subdivision II, C-shaped orifice in the coronal third that divides into two or more discrete and separate canals in the midroot to the apex; and
 - subdivision III, C-shaped orifice that divides into two or more discrete and separate canals in the coronal third to the apex

FAN'S CLASSIFICATION (ANATOMIC CLASSIFICATION)^{3,4}

Fan et al. in 2004 modified Melton's method into the following categories:

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, but either angle or should be no less than 60°.
3. Category III (C3): 2 or 3 separate canals and both angles, and , were less than 60°.
4. Category IV (C4): only one round or oval canal in that crosssection.
5. Category V (C5): no canal lumen could be observed (which is usually seen near the apex only).

FAN'S CLASSIFICATION (RADIOGRAPHIC CLASSIFICATION)^{3,4}

Fan et al. classified C-shaped roots according to their radiographic appearance into three types:

1. Type I: conical or square root with a vague, radiolucent longitudinal line separating the root into distal and mesial parts. There was a mesial and a distal canal that merged into one before exiting at the apical foramen (foramina).
2. Type II: conical or square root with a vague, radiolucent longitudinal line separating the root

into distal and mesial parts. There was a mesial and a distal canal, and the two canals appeared to continue on their own pathway to the apex.

3. Type III: conical or square root with a vague, radiolucent longitudinal line separating the root into distal and mesial parts. There was a mesial and a distal canal, one canal curved to and superimposed on this radiolucent line when running toward the apex, and the other canal appeared to continue on its own pathway to the apex.

CASE REPORT- 1

A 23 year old female patient reported to Department of Conservative Dentistry and Endodontics, with a chief complaint of spontaneous pain in lower right back region of jaw since 3 days. The patient's medical history was not contributory. Intra oral examination revealed deep occlusal caries with right mandibular second molar with lack of swelling. History revealed intermittent pain in the same tooth to cold and hot stimuli for past 1 month. The tooth was tender to vertical percussion. Radiographic examination revealed single conical root with deep occlusal radiolucency extending to the pulp with absence of peri-radicular changes radio-graphically. Vitality testing of the involved tooth with heated guttapercha caused an intense lingering pain. Electric pulp tester showed premature response. Diagnosis was made as symptomatic irreversible pulpitis. Patient was informed regarding endodontic treatment and written consent was taken.

CASE REPORT- 2

A 25 year old female patient reported to Department of with a chief complaint of pain in lower left back region of jaw since 1 week. The patient's medical history was not contributory. Intra oral examination revealed deep occlusal caries with left mandibular second molar. Tooth was tender on percussion. Radiographic examination revealed single conical root with deep occlusal radiolucency extending to the pulp with large apical foramen. Diagnosis was made as symptomatic irreversible pulpitis. Patient was informed regarding endodontic treatment and written consent was taken. The pulpal floor showed a C-shaped orifice extending till the apex. The tooth root showed 1 root canal orifice with C-shaped canal that extended from the cervical third up to the apex, thus categorizing the root canal system as a Melton type I C-shaped anatomy.

Cleaning and shaping

A #20 file was directed into the mesial corner and a #40 was placed into the most distal aspect of the canal in order to determine the apical extension and possible bifurcation of the C-shaped canal. A working length radiograph was then taken. The root canals were enlarged using H files with 3 % sodium hypochlorite as the irrigating solution. After proper isolation and anesthesia, an access cavity was prepared and Fan et al C1 type canal anatomy was found. Canal was prepared with ProTaper rotary files up to F3 followed by circumferential filing with hand H files. The final shaping of the canals was achieved with hand instruments. The root canals were once more irrigated with 3% sodium hypochlorite and dried with sterile paper points. Standardized gutta-percha cones of corresponding widths were selected.

MASTER CONES PLACEMENT

To ensure proper placement of the master cones within the C-shaped canal, a large diameter file was placed into the most distal portion of the canal. The master cone for the mesial portion was then coated with sealer and guided into place. The file was removed without dislodging the mesial master cone and the distal master cone was inserted. Additional accessory gutta-percha cones were coated with sealer and inserted into the middle portion of the C-shaped canal.

Warm Lateral Condensation

A heated instrument is introduced into a tooth already obturated by lateral condensation to soften the gutta-percha mass and enhance adaptation to the internal anatomy of the canal. This technique is useful to increase the adaptation and density of teeth obturated with lateral condensation, it is especially indicated for C-shaped canals. Then post endodontic restoration was done with composite.

Figure 1: Classification of C Shaped canal

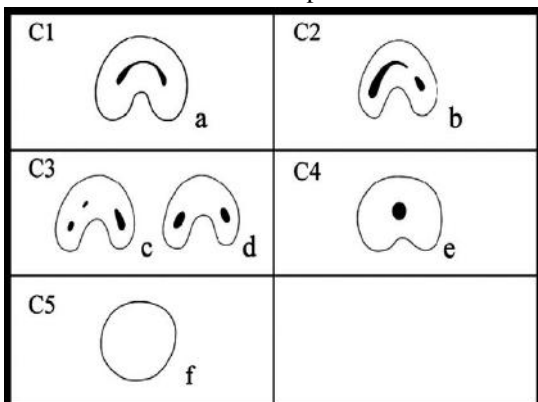


Figure 2: Radiographic classification of C Shaped canal

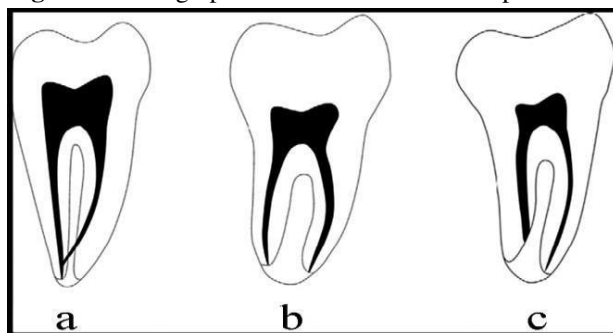


Figure 3: Case report 1

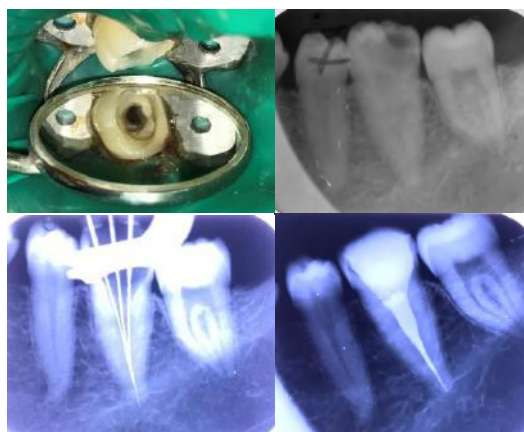
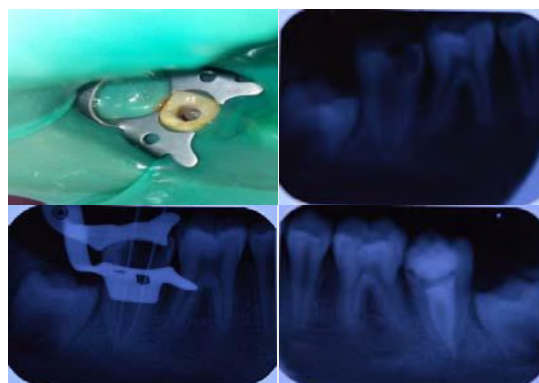


Figure 4: Case report 2



DISCUSSION

Various classifications of C-shaped canals have been proposed to make the diagnosis and treatment planning easier. Treatment of the C-shaped canals should be accompanied by additional measures for complete debridement and thorough cleansing of the complex root canal anatomy. Access cavity design modification may be required to locate and negotiate the entire root canal system. Magnifying loupes, microscope and CBCT aids in better understanding the canal system in the pulpal floor. Self -

adjusting file system is found to be efficacious in cleaning and shaping C-shaped canals.⁴⁻⁶

Circumferential filing should be done to ensure maximum tissue removal and care should be taken to avoid strip perforation. Calcifications in the pulp chamber should be negotiated with ultrasonic tips to reveal the canal anatomy completely. Copious irrigation with 5.25 % NaOCl should be done to debride the intricacies of the C-shaped canal. Irrigant should be activated using ultrasonics or sonics. It is challenging to obtain a three dimensional obturation of the C-shaped canals due to its complex configuration. Thermoplasticized gutta-percha technique is the recommended technique for C- shaped canals.^{7,8}

Recent studies done on mandibular molars with C- shaped roots, NiTi rotary instrumentation was associated with a higher percentage (59.6%) of uninstrumented canal areas than the manual K- file group (41.6%) with more dentine removed from the convex aspect of the C- shaped canal. The C- shaped canal system thus represents a challenge to its proper debridement and obturation.⁵⁻⁷

Mandibular second molars qualified as having a Cshaped canal system had to exhibit all the following three features:

- (a) fused roots;
- (b) a longitudinal groove on lingual or buccal surface of the root;
- (c) at least one cross-section of the canal belongs to the C1, C2, or C3 configuration.^{8,9}

CONCLUSION

Management of C shaped canal represents a great challenge with respect to diagnosis and treatment. Magnification and illumination can help to identify these hard to detect c shaped configuration. Proper access cavity preparation, meticulous mechanical and chemical preparation and three dimensional obturation should be carried out to successfully manage C- shaped root canal.

REFERENCES

1. Fernandes M, de Ataide I, Wagle R. C-shaped root canal configuration: A review of literature. *J Conserv Dent* 2014; 17:312-9
2. Vieira MVB, Vieira MM, Pileggi R. "C-shaped canal": an anatomical variation. *RBO*. 1998; 55(4):204-08.
3. Manning SA. Root canal anatomy of mandibular second molars. Part I: *IntEndod J*. 1990; 23:34-9.
4. Fan B, Cheung GS, Fan M, Gutmann JL, Bian Z. Cshaped canal second system in mandibular molars: Part I anatomical features. *J. of Endodon*, 2004; 30(12):899-903
5. Gulabivala K, Opananon A, Ng YL, Alavi A. Root and canal morphology of Thai mandibular molars. *IntEndod J* 2002; 35:56-62.
6. Jin GC, Lee SJ, Roh BD. Anatomical study of C-shaped canals in mandibular second molars by analysis of computed tomography. *J Endod* 2006; 32:10-3.
7. Chai WL, Thong YL. Cross sectional morphology and minimum canal wall widths in C-shaped roots of mandibular molars. *J. of Endod*. 2004; 30(7):509-12.
8. Fan B, Ye W, Xie E, Wu H, Gutmann JL. Threedimensional morphological analysis of C-shaped canals in mandibular first premolars in a Chinese population. *IntEndod J*. 2012; 45:1035-41.
9. Sikri VK, Sikri P. Mandibular premolars: aberrations in pulp space morphology. *Indian J. Dent. Res*. 1994; 5(1):9-14.