

CASE REPORT

*Management of C-shaped canal configuration: Three case reports*Akshita Chaudhary¹, Karishma Pathak¹, Leeza Bharati¹, Diksha Yadav¹.**Abstract**

C-shaped canal configuration is a variation that has a racial predilection and is commonly seen in mandibular second molars. The intricacies present in this variation of canal morphology can pose a challenge to the clinician during negotiation, debridement and obturation. Inability to detect and debride C-shaped canal anatomy can lead to endodontic failure.

Keywords: C- shaped canal, obturation.

Introduction

The main objective of root canal therapy is thorough shaping and cleaning of all pulp spaces and its complete obturation with an inert filling material. The presence of an untreated canal may be a reason for failure. Together with diagnosis and treatment planning, knowledge of the canal morphology and its frequent variations is a basic requirement for endodontic success.

One of the most important anatomic variations is the "C" configuration of the canal system. Cooke and Cox (1979) first documented the C-shaped canal in endodontic literature and named it for the cross-sectional morphology of the root and canal¹. Failure of Hertwig's epithelial root sheath to fuse on to the buccal or lingual root surface may be the main cause of this configuration². MELTON (1991) proposed the following classification based on the different configurations of the orifices in C-shaped canal systems³.

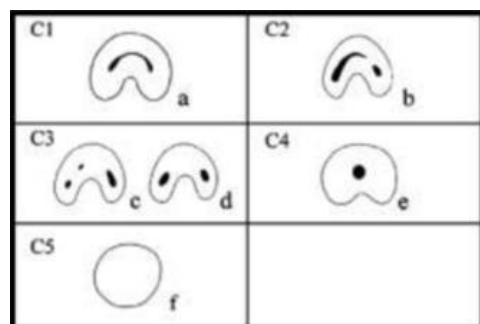
- Class I: a continuous C-shaped canal, with no separation of the canals.

- Class II: the canal orifices resemble a semicolon (;), where a C-shaped canal is present buccally or lingually, separated from another distinct canal by a dentine wall.
- Class III: Refers to those with 2 or more discrete and separate canals.

Fan *et al.*³, modified Melton's method into

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 α or β should be no less than 60° .
3. Category III (C3): 2 or 3 separate canals and both angles, α and β , less than 60° .
4. Category IV (C4): Only one round or oval canal in the cross-section.
5. Category V (C5): No canal lumen could be observed (which is usually seen near the apex only)

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Fan et al.³, classified C-shaped roots according to their radiographic appearance into three types:

1. Type I: Conical or square root with vague radiolucent 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 way to apex.



Case Report

Case 1

A 20 year old female patient visited Department of Conservative Dentistry with the complaint of pain in the lower right back region of the jaw. Medical history of the patient was noncontributory. Clinical examination showed that mandibular right second molar had deep caries and was tender on percussion.



Obturation

After gaining profound anesthesia and rubber dam application, an access cavity was prepared. After pulp extirpation, a single round orifice, located in the middle portion of the floor of the pulp chamber was seen. The pulp chamber was irrigated with 2.5% sodium hypochlorite. Working length was determined using radiographs. Cleaning and shaping was done with ProTaper Gold rotary files and circumferential filing was done to minimize the uninstrumented portion of the canals. Calcium hydroxide, an intracanal medicament was used and the patient was recalled after 1 week. In the next appointment, Master cone was fitted to the working length and radiograph was taken, and the canal was obturated with selected master gutta-percha cone along with accessory cones. A temporary restoration was placed. The patient was recalled after 1 week for a post endodontic restoration.

Case 2

A 38-year-old female patient reported to the Department of Conservative Dentistry with a chief complaint of pain in the lower right back tooth region. Medical history of the patient was noncontributory. Clinically, there was a presence of deep occlusal carious lesion with 47 approaching pulp with the presence of periapical radiolucency. Radiographically, radiolucency in the crown and the floor of the pulp chamber was seen. Two fused roots indicating a C-shaped canal anatomy was observed.

After proper isolation and profound anesthesia, an access cavity was prepared. On exploration of pulp chamber, two orifices were recognized, which were then negotiated till apex with the use of multiple small K files with the help of RC-Help (Prime Dent, India) and 2.5% NaOCl. After proper

working length determination, an IOPA was taken. Then, cleaning, shaping and obturation was done as mentioned in Case 1. A temporary restoration was placed. The patient was recalled after 1 week for a post endodontic restoration.



Pre- op Xray

Working length determination



Mastercone Xray

Obturation

Case 3

A 26-year-old male patient reported to the Department of Conservative Dentistry with a chief complaint of pain in the lower left back tooth region. Medical history of the patient was noncontributory. There was a presence of prolonged sensitivity to hot and cold. Clinically, there was a presence of deep occlusal carious lesion with 47 approaching pulp. The patient was diagnosed with irreversible pulpitis with 47. Tooth was conical in shape with fused mesial and distal roots, suggesting presence of C-shaped canal pattern.

After proper isolation and profound anesthesia, an access cavity was prepared. On exploration of pulp chamber, two orifices were recognized, which were then negotiated till apex with the use of multiple small K files with the help of RC-Help (Prime Dent, India) and 2.5% NaOCl. After proper

working length determination, an IOPA was taken and it showed that all the canals were joined at the apical third of the root. Then, cleaning, shaping and obturation was done as mentioned in Case 1. A temporary restoration was placed. The patient was recalled after 1 week for a post endodontic restoration.



Pre- op Xray

Working length determination



Mastercone Xray

Obturation

Discussion

The high variability in the root canal anatomy of C shaped molar creates a big challenge to practitioners with respect to cleaning and obturation. Studies have shown that percentage of uninstrumented areas of C shaped canals to be 59% and 66%^{4,5} when rotary instruments are used and 41% when hand instruments used^{5,6}. The basic feature of C-shaped canals is the presence of a fin or web connecting the individual canals³. The convergence of root canal instruments at the apex or being centered and exiting the furcation were used as the criteria for identifying C-shaped canals.⁷ C-Canal configuration has been shown to have a high prevalence in mandibular second molars with a percentage ranging between 2.7%-45.5%.^{8,9}

Clinical recognition of C-shaped canals is based on the definite observable criteria (i.e., the anatomy of

the floor of the pulp chamber and the persistence of hemorrhage or pain when separate canal orifices were found).⁸ When a deep groove is present on lingual or buccal surfaces of the root, a C-shaped canal is to be expected. New methods should be developed to diagnose not only the existence but also the configuration of the entire C-shaped canal system.⁹

The use of ultrasonics along with conventional therapy would be more effective. An increased volume of irrigant and deeper penetration with small instruments using sonics or ultrasonics may allow for more cleansability in fan-shaped areas of the C-shaped canal.¹⁰ Thermoplasticized gutta-percha technique is the recommended technique for canal irregularities¹¹ like Obtura II, Inject R fill. Since most of dental practitioners use only lateral condensation technique, we used the same and found excellent results with gutta-percha and AH Plus sealer into the complex anatomy of the canal.

Conclusion

It is evident that, for endodontic treatment of teeth with C-shaped canal systems to be successful, there must be modification of procedures at all stages of the treatment, and new resources must be used. The magnification provided by the Dental Operating Microscope is a great aid in the interpretation of the anatomy of the floor of the pulp chamber, and thus facilitating effective access to the canal system.

Declaration of patient consent:

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest:

There are no conflicts of interest.

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