

Management of C Shaped Canals in Mandibular Molars: Two Case Reports

¹ Rakhee Ramdas, ² Ramesh Kumar, ³ Jayasree S, ⁴ Praveen K

^{1,2,3} Dept of conservative dentistry and endodontics, Govt dental college Calicut, India

⁴ Dept of orthodontics, Govt dental college Calicut, India

Abstract: Each tooth in oral cavity shows different possible alteration in their internal anatomy. Hence knowledge of these variations is very important for success of endodontic therapy. The C shaped canal configuration is one among them; commonly observed in mandibular 2nd molar. It was first documented in literature by Cooke and Cox in 1979. This configuration demands a big challenge to clinician with regard to cleaning, debridement and obturation. This is a case report presenting the management of two cases of C shaped canal configuration in mandibular 2nd molars.

Keywords: C shaped canals, mandibular second molars, melton category III, root canal configuration

I. Introduction

A thorough knowledge of root canal anatomy and its variations is an essential pre requisite for the success of endodontic treatment. A large variation in canal configuration is seen among teeth; of particular interest being that of mandibular second molar. The C shaped canal was first documented in literature by Cooke and Cox in 1979¹ and is commonly observed in mandibular 2nd molar, although it can also be seen in mandibular premolars², maxillary first molars³. The failure of fusion of Hertwig's epithelial root sheath is the explanation for the formation of C shaped canal. Failure to fuse on both buccal and lingual side result in formation of conical/prism shaped root⁴. This configuration shows ethnic predilection showing high prevalence among Asians^{5,6}.

Melton et al in 1991 was the first to propose the classification of C shaped canals based on their cross sectional shape¹.

Category I : Continuous C shaped canal running from pulp chamber to the apex defines a C shaped outline without any separation. (c1 in fig 1)

Category II: The semicolon shaped (;) orifice in which dentin separates a main C shaped canal from one mesial distinct canal. (c2 in fig 1)

Category III: Refers to those with 2 or more discrete and separate canals.

Fan et al^{7,8} in 2004 modified Melton's classification into the following categories:

Category I (C1) : The shape was an uninterrupted C with no separation or division (fig 1a)

Category II (C2): The canal shape resembled a semicolon resulting from the discontinuation of the C outline (fig 1b)

Category III (C3) : 2 or 3 separate canals. (highest incidence) (fig 1c,d)

Category IV (C4): Only one round or oval canal. (fig 1e)

Category V (C5): No canal lumen observed. (seen near apex only) (fig 1f)

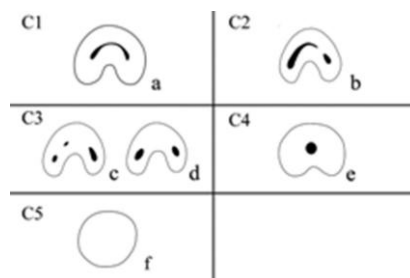


Figure 1: Classification of C-shaped canal configuration

Teeth with C shaped canal presents with

- Isthmus connecting M and D canals
- Deep pulp chamber floor
- Fused roots with longitudinal groove^{4,9}

Radiographic characteristics that allow prediction of the existence of this condition are

- a. Radicular fusion
- b. Radicular proximity
- c. Large distal canal
- d. Blurred image of 3rd canal in between^{10, 11}

Radiograph is the most practical method to predict root canal anatomy in clinical scenario. C shaped configuration creates difficulty in cleaning, debridement and obturation⁴. Hence recognition of this before treatment will facilitate successful management of such cases. Here we will discuss the successful management of two cases of C shaped canal configuration in mandibular 2nd molar.

II. Case Report I

49 year old female patient reported to the department of endodontics with chief complaint of pain in relation to lower right molar for past 1 week. Patient gives history of night pain, sensitivity to thermal stimuli. Medical history of the patient was noncontributory. Clinical examination revealed the presence of large mesioocclusal carious lesion in relation to lower second molar. Vitality testing was conducted with electric pulp tester and showed exaggerated response. Preoperative radiograph revealed a mesio occlusal radilolucency approaching pulp space. From the clinical and radiographic examination and result of vitality testing, a diagnosis of systematic irreversible pulpitis was made and root canal treatment was planned. After attaining anaesthesia and rubber dam placement, an access cavity was prepared. After extirpation of pulp tissue from the chamber, the canal system appeared C shaped with 2 orifices. working length was determined using apex locator (rayapex 6,VDW)and confirmed using radiograph. The working length periapical radiograph revealed canal as Melton Category III. Cleaning and shaping was done with rotary protaper files. 5.25% sodium hypochlorite was used in large quantity.Sealer was applied using lentulospiral and obturation was done by thermoplasticized technique.



Figure2: clinical photograph

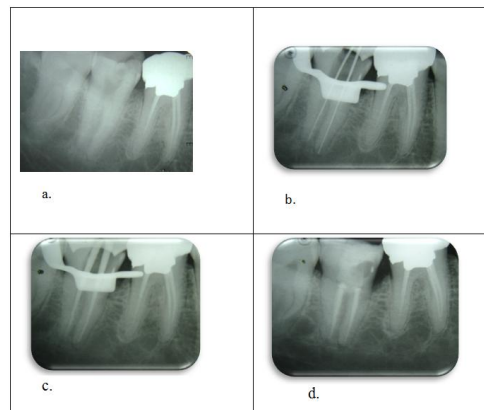


Figure 3: (a) Preoperative radiograph, (b) Working length radiograph, (c) Master cone radiograph, (d) Obturation radiograph

III. Case Report II

A 29 year old female patient reported to the department of endodontics with chief complaint of pain in relation to lower right back tooth region. Medical history of the patient was noncontributory. Patient gives history of sensitivity to thermal stimuli. Clinically there was presence of deep carious lesion in relation to 47 and it was nonresponsive to vitality test. Radiograph revealed radilolucency extending upto the pulp. The case was diagnosed with pulp necrosis. After profound anaesthesia and proper isolation, an access cavity was prepared. When the pulp chamber was explored, three orifices was recognized. Pulp tissue was extirpated and canals were cleaned and shaped using rotary hero files and irrigated using 5.25% sodium hypochlorite. working

length was determined by using apex locator(Rayapex 6,VDW) and finally IOPA was taken which revealed canal as Melton Category III. The canals were obturated using by thermoplasticized technique. Both the above cases were asymptomatic on follow up and metal ceramic crown was given.

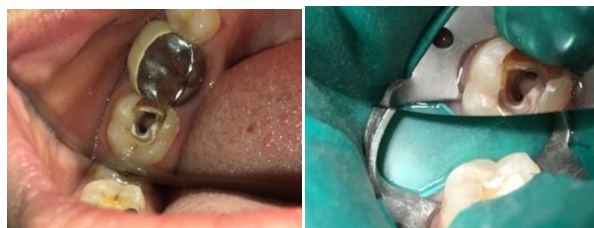


Figure 4: clinical photograph

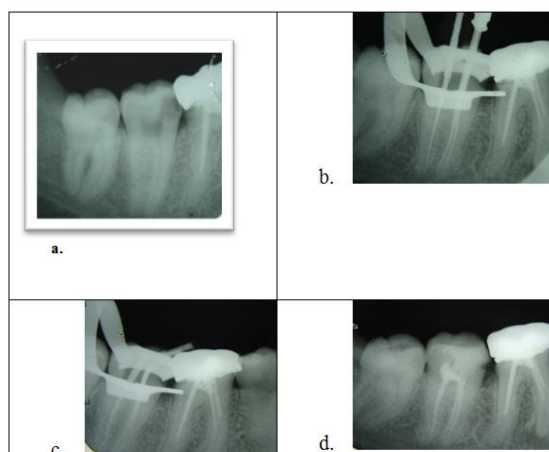


Figure 5: (a) Preoperative radiograph, (b) Working length radiograph, (c) Master cone radiograph, (d) Obturation radiograph

IV. Discussion

What do you mean by C shaped canal? The idea still remains unclear. 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%^{12, 13} when rotary instruments are used and 41% when hand instruments used^{13, 14}.

C shaped canals shows a frequency of 2.7 -8%¹. They also show significant ethnic variability. It is more common among Asians than Europeans^{5, 6}. When present on one side, it may be found on contralateral tooth in over 70% of the individuals¹. In this paper, we are dealing with the endodontic treatment of mandibular 2nd molar; Melton Category III which shows a prevalence of 17.4% according to study conducted by Jin et al¹⁵.

Although in C3 type configuration orifice may look like 2 or 3 separate orifices, an isthmus linking them is often discernible⁷. The presence of 2 or 3 independent root canals in the apical third has been previously reported in C-shaped molars. This variation is known as the C3 configuration⁹. The success of treatment lies in the recognition of this kind of variability in root canal morphology. Periapical radiograph is an essential tool for recognition and diagnosis of this sort of variability although these days new techniques for diagnosis has emerged; the most important one being the CT imaging to mention. Fan et al analysed C shaped canal system using micro-computed CT and modified the classification of C shaped canal⁷. According to him, this configuration exhibit fused roots, longitudinal groove on buccal and lingual surface of root; atleast one cross section of canal belonging to C1,C2 or C3 category.

The debridement of the narrow canal isthmus with small files in conjunction with 5.25% sodium hypochlorite is very important. Nowadays the combination of ultrasonics and 5.25% sodium hypochlorite is highly recommended as it has the power to dissolve tissues at isthmus level¹⁶. Obturation of the C shaped canal system may require modification as it is difficult to seal the isthmus by lateral condensation alone. In our case we have adapted thermoplasticized technique for obturation.

V. Conclusion

The C shaped canal system tends to vary considerably in their anatomical configuration. It is one of the important challenges a dentist confronts during treatment. Our traditional radiographic techniques provide information about some of the anatomic characteristics such as root convergence, root canal spaces. With the

advent of newer technology like micro-computed tomography(micro-CT) an accurate and detailed description of the root canal anatomy is now available to clinician. Despite the limitation of the study of not using advanced technology like CBCT, however the above provided data may help clinician to get a better idea and understanding of the root canal morphology of c shaped mandibular molar and its management. Hence a combination of proper diagnosis, proper technique of cleaning, debridement and obturation is inevitable for this kind of root canal anatomy and for attaining success in these cases.

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