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Case Report

Management of C-shaped canal

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ABSRACT:
A C-shaped canal with varying configuration is commonly observed in single-rooted mandibular second molars. Cooke and Cox (1979) first documented the C-shaped canal in endodontic literature. The presence of high incidence of transverse anastomoses, lateral canals, and apical deltas makes it difficult to clean and seal the root canal system in these teeth. The main reason for failure in endodontic treatment of mandibular second molars is the inability to detect the presence of C-shaped canals prior to an endodontic therapy. This case report presents successful management of C-shaped canal configurations in lower right second mandibular molar.

Key words: C-shaped canals, mandibular second molar, single canal

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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[1]. The C-shaped root canal configuration is ananatomical variation of root fusion and a type oftaurodontism commonly seen in the mandibularsecond molar. Inthis configuration,the root canals are connected by slit orweb with varying anatomy along the root lengthwhich makes thorough debridement obstacle forthe clinician. C-shaped canal anatomy was first documented by Cooke and Cox[2] in mandibular second molar.Canal configuration has a high prevalence in mandibular second molars (2.7% - 45.5%)[1]

ETIOLOGY

Manning[3] conjectured that the C-shaped anatomy with separate canals could be the result of age changes due to deposition of dentin on the walls of the canal. However, this theory was refuted as separate canals in roots with C-shaped anatomy were observed even in patients under 40 years of age. The failure of fusion of Hertwig's epithelial sheath is the most lucid explanation for the formation of the C-shaped canal configuration[4]

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. Hence, this fusion is not uniform and a thin interradicular ribbon connects the two roots together. Failure of the sheath to fuse on both the buccal and lingual sides will result in the formation of a conical or prism-shaped root. Fusion is most likely to occur if the distance between the root canals is small. Earlier, the irregular fusion of the Hertwig's epithelial sheath was attributed to trauma, such as radiation or chemical interference.[5]

CLASSIFICATION

According to Melton[6]- classification of C-shaped canals based on their cross-sectional shape:

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 (i.e., C2 in Figure 1)
3. Category III: Refers to those with two or more discrete and separate canals:

Subdivision Seo*et al*.,[9] the most prevalent configuration types were Melton's type I (coronal region) and type III (apical region).

FAN MODIFIED[7] 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 should be no less than 60°.
3. Category III (C3): 2 or 3 separate canals and both angles, 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).

ACCORDING TO FAN C-SHAPED ROOTS WERE CLASSIFIED 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 atthe 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 rootinto 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

A 26-year-old male patient reported to the Department of Conservative Dentistry with a chief complaint of pain in the lower right back tooth region.

There was a presence of prolonged sensitivity to hot and cold.

Clinically, there was a presence of deep occlusal carious lesion with 47.

Radiographically, occlusal radiolucency was seen with 47 involving pulp chamberwithout any periradicular changes.

The patient was diagnosed with irreversible pulpitis with 47.

The radiograph also showed a single conical root with three radiolucent canal outline, which were joining at the apical third of the root, suggesting presence of C-shaped canal pattern [Figure 1]

Figure 1

- After proper isolation and profound anesthesia, an access cavity was prepared(Figure 2)

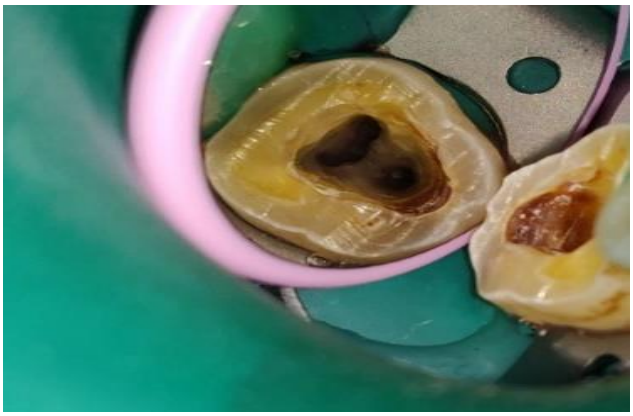

Figure 2: Access opening

- On exploration of pulp chamber, three orifices were recognized, which were then negotiated till apex with the use of multiple small K files (Prime Dent, India) and 3% NaOCl.
- After proper working length determination, an IOPA was taken [Figure 3] and it showed that all the canals were joined at the apical third of the root.

Figure 3: Working length radiograph,

- Then, cleaning, shaping [Figure 4], and obturation [Figure 5] was done.The patient is currently asymptomatic and under follow-up.

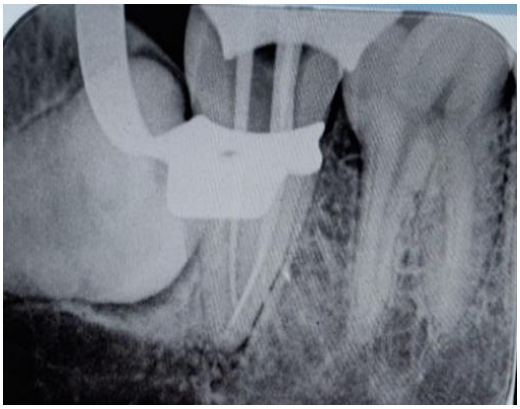

Figure 4: Master cone radiograph

Figure 5: Obturation radiograph

DISCUSSION

The definition of a C-shaped canal is not yet clear. Some authors consider C-shaped canals as all those with a general outline of a "C" and present in a C-shaped root, regardless of whether a separate canal or orifice was observed[8]

Clinical recognition of C-shaped canals is based on thedefinite 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). 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 entireC-shaped canal system.[1]

The basic feature of C-shaped canals is the presence of a fin or web connecting the individual canals.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. The morphological variant of single root and single canal is easily detected in routine radiographs. However, care should be taken to assess the correct anatomy on the preoperative radiograph to rule out the clinical condition of two roots, one buccal and one palatal that could be superimposed on the diagnostic radiograph

A study byWeine*et al*[9] reported that 1.3% of mandibular secondmolars had single canal configuration. 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 cleansibility in fan-shaped areas of the C-shaped canal. It should be emphasized that, in C-shaped mandibular molars, the mesiolingual canal is separate and distinct from the apex, although it may be significantly shorter than the mesiobuccal and distal canals [4]These canals are easily overinstrumented in C-shaped molars with a single apex.

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 canal irregularities.

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.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.[10]

CONCLUSION

The C-shaped root canal configuration has an ethnic predilection and a high prevalence rate in mandibular second molars. Understanding the anatomical presentations of this variation will enable the clinician to manage these cases effectively.

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