ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 07, pp.34309-34311, July, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

CASE STUDY

MANAGEMENT OF C SHAPED CANAL IN MANDIBULAR THIRD MOLAR USING CONE BEAM COMPUTED TOMOGRAPHY- A NEWER APPROACH

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ARTICLE INFO

Article History:
Received 25th April, 2016
Received in revised form
17th May, 2016
Accepted 17th June, 2016
Published online 16th July, 2016

Key words:

C – Shaped Canal,
Mandibular Third Molar,
Cone Beam Computed Tomography,
Root Canal Morphology.

ABSTRACT

For successful endodontic therapy, the clinician must have the thorough knowledge of root canal morphology. But variations in the root canal morphology makes the endodontic treatment challenging. One of the most challenging anatomic variations is the "C" shape configuration of the canal system. C shape canal presents an extensive complex system which is difficult to diagnose by preoperative Intra oral periapical radiograph as it is two- dimensional image of a tooth. However, with the help of Cone Beam Computed Tomography (CBCT) which is a non-invasive three-dimensional (3D) imaging technique, clinician will get more precise detailing of canal morphology which in turn helps in successful diagnosis and treatment of tooth which has "C" shaped canal morphology. Here, in this paper we are discussing a case of C shape canal in the mandibular third molar which was successfully diagnosed and treated with the help of CBCT.

Citation: Harshit Srivastava, Aastha Arora Srivastava, Ashwini.B.Prasad and Deepak Raisingani, 2016. "Management of c shaped canal in Mandibular third molar using cone beam computed tomography- A newer approach", *International Journal of Current Research*, 8, (07), 34309-34311.

INTRODUCTION

For successful endodontic therapy it is essential to have complete 3-Dimensional obturation of root canal system with fluid tight seal. Unfilled or untreated canals are one of the reasons for failure of endodontic treatment. So proper diagnosis coupled with treatment planning, knowledge of the canal morphology and its frequent variations are necessary for endodontic success. (Vertucci, 2005) One of the challenging root canal morphology variations is C shape canal. It is known as C Shape because of the C- shaped anatomical configuration of root and root canal (Rahimi *et al*., 2008). The C shaped canal was first described in literature by Cooke and Cox., 1979. While Weine *et al*., 1998, reported that several clinicians had suggested its presence in lectures earlier. C – shaped canal results from the failure of Hertwing's epithelial sheath to develop or fuse in the furcation area in the developing stage of the teeth which result in the formation of a conical or prism shaped root.(Manning, 1990). C shape canal are more common in asians than in white and is most commonly seen in mandibular second molar (Jafarzadeh and Wu, 2007). The incidence of C-shaped canal in mandibular third molar is low i.e 3.5% (Kuzekanani *et al*., 2012). And also it is difficult to diagnose and treat due to poor accessibility in third molar region. Melton *et al*., proposed the following classification of C-shaped canals based on their cross-sectional shape: (Jafarzadeh and Wu, 2007).

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

Fan *et al*., modified Melton's method into the following categories: (Jafarzadeh and Wu, 2007).

1. Category I (C1): The shape was an interrupted "C" with no separation or division.

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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 c and d 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.

Fan *et al*. classified C-shaped roots according to their radiographic appearance into three types: (Jafarzadeh and Wu, 2007).

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.

Matherene *et al*., 2008 in their study have reported the superiority of CBCT over other diagnostic methods in determining the variations in root canal morphology and in diagnosis of C shaped canal. The aim of this case report is to enlighten the clinician about the importance of CBCT in successful diagnosis and treatment of C shaped canals.

Case report

A 25-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. Clinically, there was a presence of deep class I caries in relation to 48. Radiographically, radiolucency was seen involving pulp without any peri-radicular changes. The radiograph also showed a single conical root with outline of single root canal, suggesting presence of C-shaped canal. To, confirm the diagnosis and to know the variations in root canal morphology precisely, we decided to go for CBCT. After CBCT reporting, the diagnosis of C-shaped canal was confirmed (Figure 1) and treatment plan was decided

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 5% sodium hypochlorite. Working length was determined using apex locator (Root ZX, J. Morita CO, Tustin, CA) and radiographs. Cleaning and shaping was done with manual K – files (Dentsply Maillefer, Ballaigues, Switzerland) using step back technique. Calcium hydroxide (RC-Cal, India), 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 with AH-Plus endodontic sealer (Dentsply Maillefer Company, USA) (Figure 2). A temporary restoration was placed. The patient was recalled after 1 week for a post endodontic restoration.

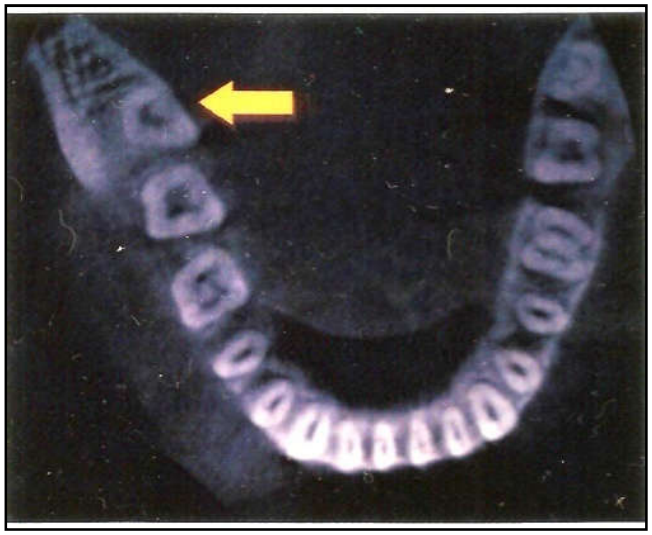

Figure 1. CBCT imaging showing the C – shape canal in mandibular third molar

Fig. 2. Obturated mandibular third molar

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 (Al-Fouzan,

2002). Fan *et al*., 2004, analyzed the C-shaped canal system using micro-computed tomography (CT) and modified the classification of the C-shaped canal system. They considered that this type of canal system had to exhibit all of the following three features: (i) Fused roots, (ii) a longitudinal groove on the lingual or buccal surface of the root, and (iii) at least one cross-section of the canal belonging to the C1, C2, or C3 configuration. Clinically, when a C-shaped canal system is observed, one cannot assume that such a shape continues throughout its length. The diagnosis and prognosis of such complex canal anatomies can be improved by using advanced technique like CBCT. This approach offers a non-invasive reproducible technique for 3D assessment of root canal system and aids the clinician to visualize the internal anatomy precisely. However, CBCT makes use of ionizing radiation. Therefore, it is advised to keep the patient's exposure to radiation as low as reasonably achievable (Sanjay Chhabra *et al*., 2014). However, in my case there is single root and single canal configuration. But to rule out the clinical condition of two roots, one buccal and one palatal that could be superimposed on the preoperative conventional radiograph and to know the root canal configuration more precisely we decided to get CBCT done. After the accurate diagnosis of canal configuration with the help CBCT we decided the treatment protocol. 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%). (Yin *et al*., 2010). In view of the above, canal preparation with manual K-file was done. 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 (Melton *et al*., 1991). Thermoplasticized gutta-percha technique is the recommended technique for canal irregularities (Collins *et al*., 2006). 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

The successful endodontic management needs proper knowledge about aberrant root canal systems. Appropriate mode of the treatment can be selected depending upon this morphology. So, it is important for the clinician to use the advanced technique like CBCT to know the exact morphology of the root canal which in turn increases the long term prognosis of such tooth.

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