MANAGEMENT OF C-SHAPED CANALS: 3 CASE REPORTS

A Case Report

Kinha Thakkar*, Disha Mehta, Rupal Vaidya***, Shraddha Chokshi******

ABSTRACT

Introduction: Thorough knowledge of the root canal morphology is essential for a successful endodontic therapy. Unusual root canal anatomy always presents a challenge for the clinicans. Identification of such variation is important for the success of the root canal treatment outcome. The C-shaped root canal configuration is one of the aberrant morphology of molar teeth, commonly the mandibular second molar. In this configuration, the canals are connected by slit or web. The presence of such fins, slits and web are an obstacle for the clinician to negotiate, debride and obturate because of the high incidence of anastomoses, lateral canals, and apical deltas. Inability to detect and debride C-shaped canal anatomy thoroughly can lead to endodontic failure.

Case Report: This article highlights the management of three case reports of three different types of C- shaped canal configurations using thermoplasticised gutta-percha technique.

Conclusion: Complex intricacies and diverse morphology of C shaped canals can be managed with advanced irrigation and obturation techniques.

Keywords: C-shaped canal, mandibular second molar, root canal configuration, thermoplasticised gutta-percha.

Received: 09-04-2016; **Review Completed:** 24-08-2016; **Accepted:** 21-01-2017

INTRODUCTION

A thorough knowledge of the root canal anatomy and its variations is required for achieving success in root canal therapy, along with diagnosis, treatment planning and clinical expertise.[1], One such variation of the root canal system is the C-shaped canal configuration. It is termed so because of the C-shaped cross-sectional anatomical configuration of the root and root canal.[2] This condition was described for the first time in literature by Cooke and Cox in 1979.[3] This canal configuration has a high prevalence in mandibular second molars (2.7% - 45.5%).[4]

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. [5]

The presence of thin fin, slit and web create difficulty in the canal shaping, through debridement and obturation. It is uncertain whether a C-shaped orifice found on the floor of the pulp chamber may continue to the apical third of the root. Irregular areas in a C-shaped canal that may house soft-tissue remnants or infected debris may escape thorough cleaning or filling and may be a source of bleeding and severe pain. Due to the presence of canal irregularities, it is important to select the proper obturation system. Thermoplasticised obturation technique is successful enough to fill the canal irregularities so, it is mandatory to use that in such cases.

CASE REPORTS

Case 1

A 28-year old female reported to the Department of Conservative Dentistry and Endodontics, with a chief complaint of pain on eating food in lower left back tooth region. The patient was asymptomatic before 6 months. The pain was of dull and continuous type and aggravated on taking food and relieved on medication. The medical history was non-contributory. Past dental history suggested a tooth-coloured restoration done in respect to the lower left back tooth region. Extra-oral examination and intra-oral soft tissue examination revealed no detectable abnormalities. Clinically, tooth no. 37 was examined to have secondary caries and peripherally open margins of the previously done Class II GIC restoration. The patient gave a positive response to vertical percussion. The tooth was not responsive to the cold test performed with

*Post graduate student, **Post graduate student, ***Professor, **** Professor and Head of Department

DEPARTMENT OF CONSERVATIVE DENTISTRY & ENDODONTICS
AHMEDABAD DENTAL COLLEGE AND HOSPITAL, TA. KALOL, DIST: GANDHINAGAR, GUJARAT, INDIA.

ADDRESS FOR AUTHOR CORROSPONDENCE : DR. KINHA THAKKAR, TEL: +91 9428047260

an ice-stick or the electric pulp test (EPT) performed with a vitalometer. (Digitest Pulp Vitality Tester, Parkell, U.S.A.). So, the tooth was diagnosed as a non-vital tooth. Radiographically, it was seen that the previously done restoration approached the pulp and radiolucency in the periapical region. A single fused root with a wide canal suggestive of a C-shaped canal anatomy was predicted. (Figure 1 a). Endodontic treatment was planned for tooth no. 37 and explained to the patient. After profound anesthesia and rubber dam isolation, the previous restoration was removed and a pre-endodontic composite build-up was done on the distal margin of the tooth. An access opening was then made with the help of an Endo-Z bur (Dentsply, Maillefer, Switzerland). Two separate canals were located in the pulp chamber floor (Melton et al C2 type anatomy) (Figure 1b). The canals were negotiated with 10 No. K files (Mani, Japan). Working length was determined with an apex locator (Root Zx II, J. Morita, U.S.A.) using 15 No. K files (Mani, Japan) and then confirmed with an IOPA. (Figure 1c). Cleaning & shaping was carried out using Protaper hand file system (Dentsply, Maillefer, Switzerland) and K files (Mani, Japan) along with copious irrigation of 17% EDTA (RC Prep, Prime Dental Products, India) and 5.25% Sodium Hypochlorite (Vishal Dentcare, India), which was activated with Endo activator (Dentsply Maillefer, Switzerland). Canals were prepared upto ProTaper file F2. Calcium hydroxide (RC Cal Prime Dental Products, India) was placed as an intracanal medicament in both the canals and temporary restoration (Kalzinol) was placed. After 1 week, the temporary restoration and the intracanal medicament was removed and the size of the master cones was checked with radiographs taken at various angulations to confirm the apical fit of the master cones (Figure 1d). Obturation was done using vertical compaction technique with a thermoplasticised gutta-percha system. (Calamus, Dentsply Maillefer, Switzerland). Canals were seen joining in the apical third in the post obturation radiograph. Post endodontic composite restoration was carried out then (Figure 1e).

Case 2

Figure 1 a: Pre-operative radiograph
1 b: Access cavity.
1 c: Working length radiograph

Figure 1 d: Master cone radiograph.
1 e: Post-obturation radiograph.

A 31-year old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in lower right back tooth region. The pain was sharp, shooting, continuous in nature, which got aggravated on eating hot and cold food. The medical history was non-contributory. Past dental history revealed silver filling in the lower right back tooth region. Extra-oral examination and intra-oral soft tissue examination revealed no detectable abnormalities. Intraoral hard-tissue examination showed extensive defective silver amalgam restoration with proximal caries on the distal side along with a distal pocket with the impingement of 48. There was a slight tenderness to vertical percussion in tooth no 47. Cold test with the help of an ice stick revealed prolonged sensitivity even after removal of stimulus. Heat test with the help of hot burnisher revealed sharp pain on application of stimulus. Electric pulp testing revealed early response, however that was due to presence of extensive metallic restoration giving false positive result. Radiographically, a defective restoration was seen with disto-proximal caries. The mesial inclination of the partially impacted 48 suggested of traumatic resorption on the distal side of 47. There was an evident PDL widening in tooth no. 47 and radiolucency in the periapical area. The IOPA radiograph also showed a single conical root and predictive presence of a C-shaped canal. (Figure 2a, b). Local anaesthesia was administered and proper isolation was maintained with rubber dam. The old defective restoration was removed along with the caries on the distal side with the help of a large round bur no.6 (S. S. White, U. S.A.). The access cavity was then made with the help of an Endo-Z bur and Melton et al C3 type canal anatomy was found on the pulpal floor. The canals were negotiated with 10 No. K files. Working length determination using 15 No. K file was done with the help of an apex locator and different angulation radiographs (Figure 2c). The canals were shaped with ProTaper rotary files (Dentsply Maillefer, Switzerland) and cleaned with copious irrigation of 5.25% Sodium hypochlorite & 17% EDTA. The circumferential filing was carried out with hand K files (Figure 1b). 5.25% sodium hypochlorite was activated with Endo activator for thorough cleaning. The sizes of the master cones were checked (Figure 2 d) by again taking radiographs from different angulations. Obturation was completed with vertical compaction technique using thermoplasticised gutta-percha system (Figure 2e, f).

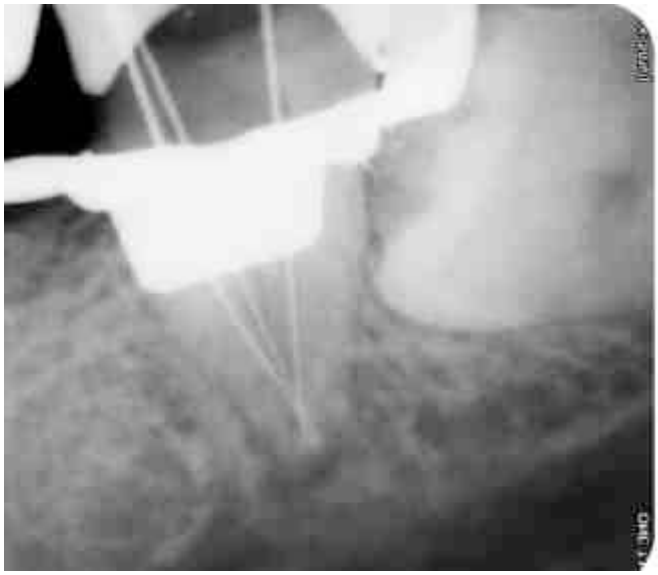

Figure 2 a: Pre-operative radiograph.
2 b: Access cavity.
2 c: Working length radiograph

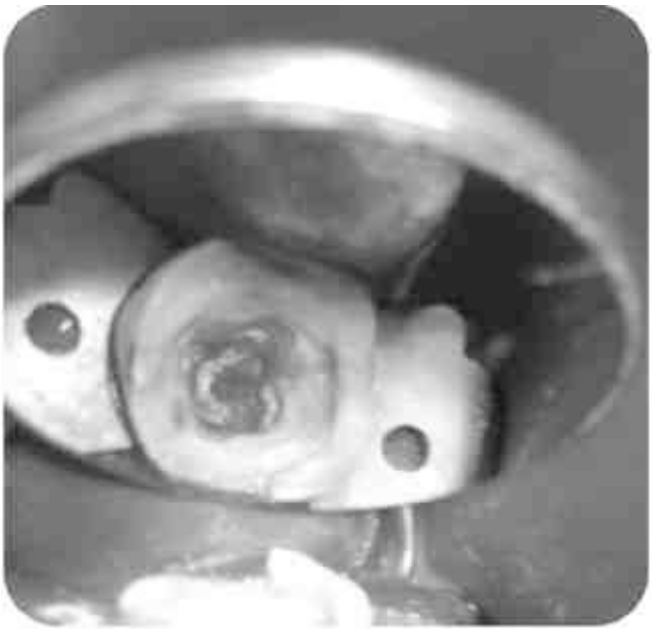

Figure 2 d: Master cone radiograph.
2 e, f: Post-obturation radiograph & clinical picture.

Case 3

A 36-year-old male patient reported to our Department of Conservative Dentistry and Endodontics with a chief complaint of pain of his lower left back tooth region. The pain was localized, intermittent, dull and aching in nature, which increased in intensity over a period of time. The pain was relieved by medications. The medical history was non-contributory. Intra oral examination revealed tooth no. 37 having deep dental caries. The tooth showed slight pain on vertical percussion. Cold test with the help of an ice stick revealed prolonged sensitivity on application of the stimulus.

Heat test with the help of hot ball burnisher revealed sharp pain on application of stimulus. Electric pulp vitality test revealed delayed response in comparison to the contralateral and adjacent teeth. The tooth was diagnosed of chronic irreversible pulpitis with symptomatic apical periodontitis. Radiographically, the tooth showed deep dental caries involving enamel, dentin and pulp. The tooth was conical in shape with fused mesial and distal root, suggestive of a C-shaped canal (Figure 3a). Endodontic treatment was planned for tooth no. 37 and explained to the patient. The access cavity was made under local anesthesia (LA) and a single semicircle shape orifice (Figure 3b), indicating Melton et al C1 configuration was found. The canal was negotiated with 15 No. K file. Working length was determined with 20 No. K file using an apex locator and confirmed with a radiograph (Figure 3c). The cleaning and shaping of the canal was carried out with hand K files and ProTaper rotary files up to F3. Copious amount of 5.25% sodium hypochlorite & 17% EDTA was used for irrigation along with Endo Activator for the activation of the irrigant solution. The obturation was performed with thermoplasticised gutta-percha using vertical compaction technique after checking the final master cone fit through various angulation radiographs. (Figure 3c, d). Post-endodontic restoration with composite was done (Figure 3 e).

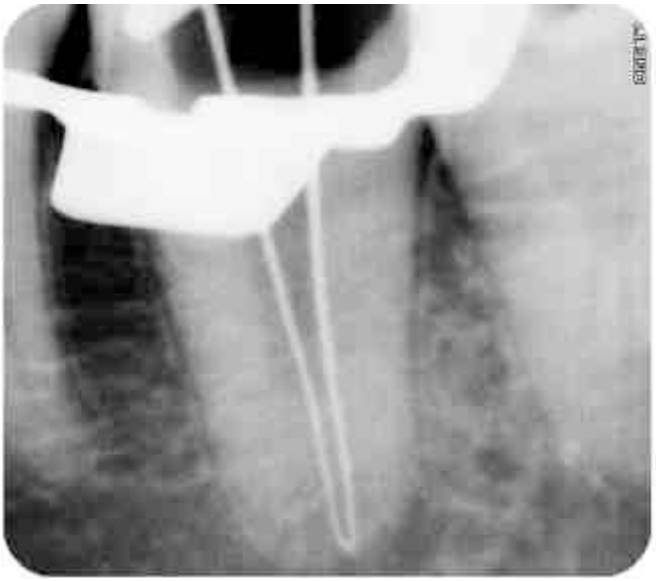

Figure 3 a: Pre-operative radiograph.
3 b: Access Cavity.
3 c: Working Length radiograph

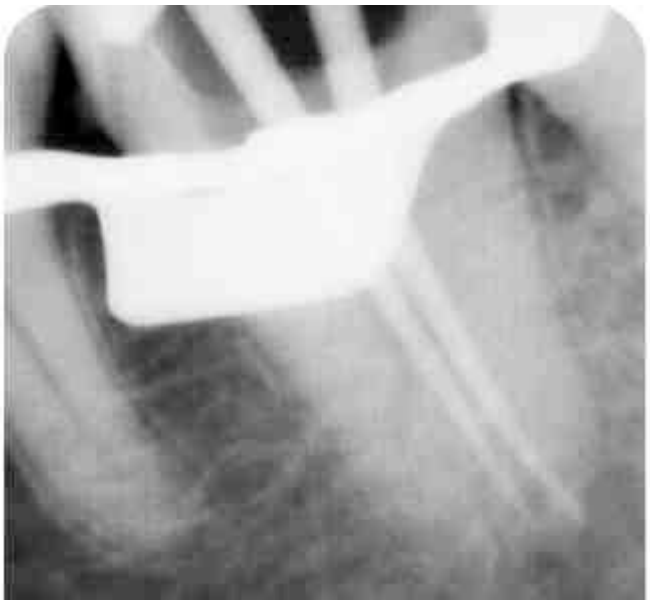

Figure 3 d: Master cone radiograph.

Figure 3 e: Post-obturation radiograph.

DISCUSSION

The reason for C-shaped morphology is the failure of the Hertwig's epithelial root sheath to fuse on the lingual or buccal root surface. The C-shaped root may also be formed by coalescence in course of deposition of the cementum with time. The prevalence of C-shaped configuration is highest in mandibular second molar and the bilateral occurrence was over 70%.[7] According to Fan et al. indicated that a majority of teeth with C-shaped canal system showed an orifice with an uninterrupted "C" configuration.[8] The teeth that qualified as having a C-shaped canal system had to exhibit all the following three features: Fused roots, a longitudinal groove on the lingual or buccal surfaces of the root, and at least one cross-section of the canal belongs to the C1, C2, or C3 configuration.[9]

Preoperative radiographs show close fused roots or images of two distinct roots. Additional 20° mesial or the distal angulation is useful to deduct this configuration.[10] Clinically, when a C-shaped canal orifice is observed under the operating microscope, one cannot assume that such a shape continues throughout its length.

Deep orifice preparation (isthmus) should not be done with files larger than no. 25; otherwise, strip perforation is likely. Also, Gates-Glidden or rotary orifice openers should not be used to prepare the orifices and isthmus areas. An increased volume of irrigant and deeper penetration with small instruments using sonics or ultrasonics may allow for better cleansibility in fan-shaped areas of the C-shaped canal.

Obturation of 'C' shaped canal requires technique modification. The usually used cold lateral compaction is ineffective in filling the canals as well as the isthmus or the fan shaped regions. Hence thermoplasticized gutta percha obturation seems to be capable of filling multiple foramina, other irregular configurations of the root canal system and ensures better homogeneity.

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. Ultrasonic instrumentation and devices for thermoplasticisation of guttapercha assist greatly with debridement and obturation respectively. This case report shows management of three different C - shaped canal anatomies performed successfully with the help of these advanced aids.

REFERENCES:

1. Manning SA. Root canal anatomy of mandibular second molars. Part I: Int Endod J. 1990;23:34–9.
2. Melton DC, Krell KV, Fuller MW. Anatomical and histological features of C-shaped canals in mandibular second molars. J Endod. 1991;17:384–8.
3. Cooke HG, 3rd, Cox FL. C-shaped canal configurations in mandibular molars. J Am Dent Assoc. 1979;99:836–9.
4. Weine FS. The C-shaped mandibular second molar: Incidence and other considerations. Members of the Arizona Endodontic Association. J Endod 1998;24:372–5.
5. Manning SA. Root canal anatomy of mandibular second molars. Part II: C shaped canals. Int Endod J. 1990;23:40–5.
6. Fan B, Min Y, Lu G, Yang J, Cheung GS, Gutmann JL. Negotiation of C-shaped canal systems in mandibular second molars. J Endod 2009;35:1003-8.
7. Sabala CL, Benenati FW, Neas BR. Bilateral root or root canal aberrations in a dental school patient population. J Endod 1994;20:38-42
8. Fan B, Cheung GS, Fan M, Gutmann JL, Bian Z. C-shaped canal system in mandibular second molars: Part I - Anatomical features. J Endod 2004;30:899-903.
9. Fernanades M, Ataide I, Wagle R. C shaped root canal configuration: A review of literature. J Conserv Dent. 2014;17:312-319.
10. Lambrianidis T, Lyroudia K, Pandelidou, Nicholas. Periapical evaluation of radiographs in the recognition of mandibular c-shaped second molars. Int. Endod. J., v.34, p.458-62, 2001.