ORIGINAL RESEARCH PAPER

Dental Science

ENDODONTIC MANAGEMENT OF "C" SHAPE CANAL CONFIGURATION – CASE SERIES

KEY WORDS: C-shaped canals, mandibular second molar, thermoplasticised gutta-percha.

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ABSTRACT

A thorough knowledge of the root canal morphology is required for successful endodontic therapy. C-shaped canals are anatomic features that present the clinician with both diagnostic and operational challenges. They present as an extensive complex system and is mostly seen in mandibular second molars. Careful assessment of preoperative radiograph is a key step for its subsequent management, and this assessment might impact greatly on the treatment outcomes1. This case series presents successful management of 3 different C-shaped canal configurations in mandibular molars.

INTRODUCTION:

The C-shaped root canal configuration is one of the most important anatomical variations commonly encountered in mandibular second molars. It was first documented by Cooke and Cox in 1979 and is named so for the cross-sectional morphology of the root canal. The prevalence of C-shaped root canal reported to ranges from 2.7% to 44.5% in mandibular second molars with single large root although it can even be present in mandibular premolars, maxillary molars and mandibular third molars. Failure of Hertwig's epithelial root sheath to fuse on to the buccal or lingual root surface may be the main cause of this configuration. The success of any root canal treatment depends on the thorough cleaning shaping and obturation of canal space which is dependent on the knowledge of root canal anatomy and adaptation of necessary treatment modifications where required. C shaped canal configuration may have clinical presentation with variations in number as well as course in the tooth which definitely proves to be a challenge during every step of root canal treatment The presence of thin fin, slit and web create difficulty in the canal shaping, through debridement and obturation. If such canals can be recognised before the initiation of treatment many mishaps including irreparable damage to tooth like perforation can be avoided thus increasing the likelihood of success in such cases. Many authors recommended themoplasticised systems as it completely fill the canal irregularities. Here we report a case series of management of 3 different C-shaped canal variants in mandibular molar teeth.

Case report 1:

A 32-year-old male reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in his left back tooth region since 1 week. On examination tooth #37 was carious and non-tender on percussion, tooth gave prolonged response to thermal testing. Intra oral periapical radiograph revealed the presence of single C-shaped canal in relation to carious tooth #37 (Fig 1a). Diagnosis of irreversible pulpitis was made which required root canal treatment. Under the administration of local anesthesia and rubber dam isolation access opening in tooth #37 was done. One single orifice was located in the center of the pulp chamber (Fig 1b)(Melton's class I). The working length (Fig 1c) was determined using 15 no k file (mani files). The cleaning and shaping was performed with protaper universal file system 0.6%. Calcium hydroxide was placed inside the canal as an intracanal medicament. Copious irrigation was carried out with 3.0% Sodium hypochlorite and normal saline. Thermoplasticised gutta percha technique was used to obturate the canal(Fig 1e) followed by placement of metal crown in relation to 37(Fig 1f) after few weeks once the tooth becomes asymptomatic

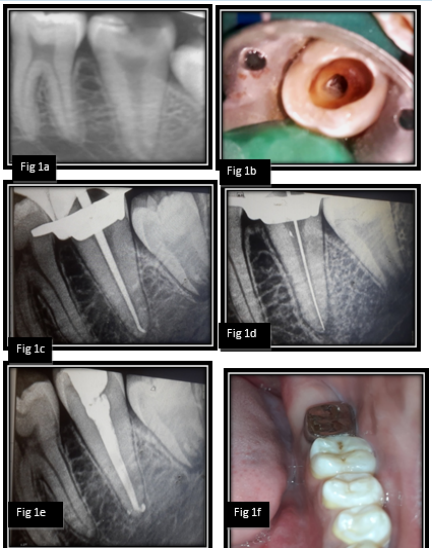
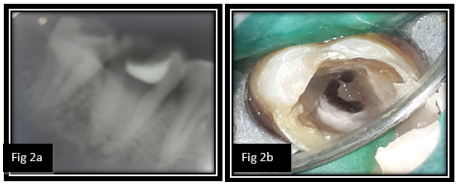


Figure 1a- preoperative radiograph, Fig 1b-access cavity preparation showing melton's classification I, Fig 1c-working length determination, Fig 1d-Master cone selection, Fig 1e-obturation, Fig 1f- Crown placement

Case report 2

A 35 year old male patient presented to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in relation to 47 since15 days. Intra oral examination revealed fractured restoration with secondary caries in relation to 47 with pain on percussion and vitality test revealed delayed response. The radiograph showed pulpal involvement with fused mesial and distal roots (fig 2a). Tooth diagnosed with acute apical periodontitis. Access was prepared after adequate anesthesia with rubber dam and one mesial orifice & A broad C- shaped distal orifice was seen (Melton's class II) (fig 2b).The working length(fig 2c) determined with no.15k file(Mani files). The cleaning and shaping was performed with Protaper universal rotary files. Copious irrigation was carried out with 3% Sodium hypochlorite and normal saline. The obturation was carried out by thermoplasticised gutta percha technique(fig 2e) and porcelain fused metal crown was placed in relation to 47(fig 2f).



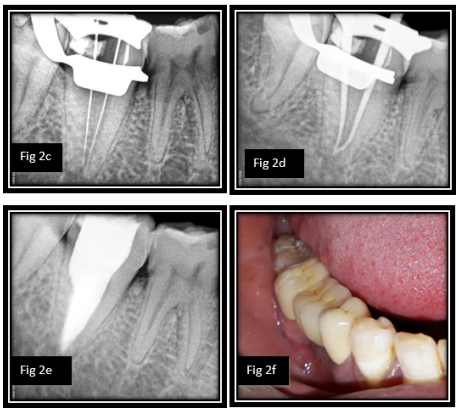


Figure 2a- preoperative radiograph, Fig 2b-access cavity preparation showing melton's classification II, Fig 2c-working length determination, Fig 2d-Master cone selection, Fig 2e- obturation, Fig 2f- Crown placement

Case report 3

A 40 years old female patient reported with the chief complaint of pain in her lower left back tooth region since 1 month. On intraoral examination 37 was grossly decayed, with tenderness on vertical percussion. The diagnostic radiograph showed radiolucency involving pulp (Fig3a) and diagnosed as symptomatic apical periodontitis which required root canal treatment. After giving profound anaesthesia rubber dam was applied and access cavity was prepared. After proper orifice enlargement of the root canal C shaped canal configuration was visualised with 3 different orifices (melton's class III) (fig 3b). Working length (Fig 3c) was determined by using no. 15 k files. Biomechanical preparation of canals was done using careful circumferential filing method up to 35 no. k file in the presence of sodium hypochlorite irrigating solution and Ethylene diamine tetra acetic acid (EDTA). calcium hydroxide dressing was kept along with temporary restoration for 1week. During next appointment the master cone selection was done (Fig 3d). The canals were then obturated (Fig 3e) using standard gutta percha points and AH plus sealer followed by placement of metal crown with 37 after few weeks(fig 3f)

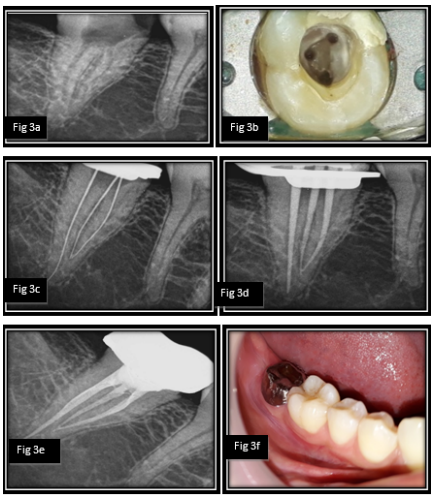


Figure 3a- preoperative radiograph, Fig 3b-access cavity preparation showing melton's classification III, Fig 3c-working length determination, Fig 3d-Master cone selection, Fig 3e- obturation, Fig 3f- Crown placement

DISCUSSION

C-shaped canal configuration has the highest prevalence in mandibular second molars (10-31.5%). Typically this is found in teeth with fusion of roots either on buccal or lingual aspect. C-shaped canal configuration can assume many variations. Melton (1991) proposed the following classification based on the different configurations of the orifices :

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

Class II: 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: two or more separate canals are present, as in a typical lower molar, with three canal orifices.

Fan et al in 2004 gave a modified classification as:

Category I (C1): the shape is an uninterrupted "C" with no separation or division (Fig. 4a).

Category II (C2): canal shape resembles a semicolon resulting from a discontinuation of the "C" outline (Fig. 4b), but either angle or (Fig. 5) should be no less than 60°.

Category III (C3): two or three separate canals (Figs. 4c,d) and both angles or , are less than 60°.

Category IV (C4): only one round or oval canal in that cross section (Fig. 4e).

Category V (C5): no canal lumen observed (which is usually seen near the apex only) (Fig. 4f).

Fig. 4: Classification by Fan et al

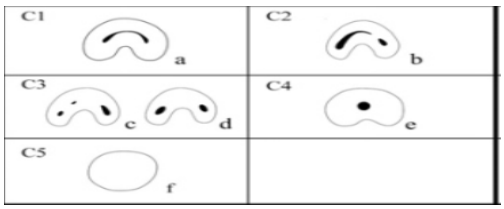
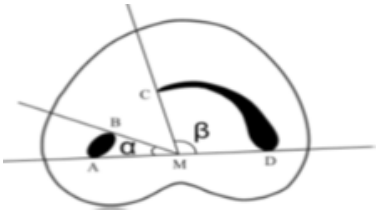


Fig. 5: α and β angles



Diagnosis:

Diagnosis of this variant anatomy poses a major challenge. The following three features should be used to diagnose a tooth with Cshaped configuration: fused roots, longitudinal groove on buccal and lingual surface of root and at least one cross section of canal belonging to C1, C2 or C3 configuration . Clinically, unusual appearance of pulp chamber and persistence of hemorrhage or pain contributes to its diagnosis . Radiographically, radicular fusion, large distal canal, narrow mesial canal and a blurred image of a third canal in between may be found ; but diagnosis based on radiographic appearance is difficult and requires additional 20° mesial or distal projections and a clinical exploration of pulp chamber for confirmation . Cone Beam Computed Tomography (CBCT) is a clinically useful tool for diagnosis and treatment planning of such cases.

Management : Increased visibility offered by surgical operating microscope can aid in identification of pulp chamber morphology to an extent but a deeply seated pulp chamber floor and possibility of division into additional canals at any level of roots limits its use. Deep orifice preparation and cautious use of small hand files upto #25, copious irrigation with 5.25% sodium hypochlorite along

with ultrasonic activation may allow proper cleaning in fan shaped areas of C-shaped canals . Anticurvature filing can prevent perforation that is most likely due to aggressive instrumentation[3]. However manual instrumentation leaves a large amount of debris and uninstrumented areas fins or isthmus area of a C-shaped canal, which might influence the outcome of root canal treatment. Therefore, endoactivator irrigation system can be used to increase the efficacy of irrigant. Mancini et al. reported that endoactivator aided in effectively removing the smear layer from root canals. Its design allows for the safe activation of various intracanal reagents and could produce vigorous intracanal fluid agitation. Additional disinfection by Lasers may be a useful treatment adjunct especially in cases of complex root canal anatomy[5]. Another alternative is the SAF system (self adjustable File) which has a hollow core with interlocking lattice design, accommodates itself according to the shape of the canal. It is ideally suited for large, oval, or C-shaped canals. The constant irrigant flow is an added advantage of SAF[6].

Various modifications in obturation techniques have been introduced. Lateral condensation alone cannot completely seal isthmus, narrow canals or fins. Use of thermoplasticised gutta percha is advocated as a more appropriate method. The compaction of softened gutta-percha and sealer throughout a well-prepared canal space should move gutta-percha and sealer into root canal aberration. But in C-shaped canals, conditions are different for two reasons:

(1) divergent areas that are frequently unshaped and may offer resistance to obturating material flow and (2) communications between the main canals of the C-shape, through which the entrapped filling materials that should be captured between the apical tug-back area and the level of condensation may pass from one canal to another(fig 2e)[7]. Novel approaches include 'zap and tap' technique and Walid's technique. Martin developed Endotec II which uses zap & tap technique[3]. Endoflas FS sealer, which is a zinc oxide based sealer with iodoform is preferred in c shape canals. It contains iodoform which has antibacterial effects, and is more important in C-shaped canals because during mechanical debridement some parts of canal remain untouched.[2]

CONCLUSION

The complex configuration of C-shaped canals make root canal treatment unusually difficult. Therefore careful location and negotiation of canals, meticulous mechanical and chemical debridement of the pulp chamber and three dimensional obturation should be carried out in order to successfully treat a C-shaped canal[4].

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