

# Management of C-shaped root canal configuration with three different obturation systems

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## ABSTRACT

Unusual root canal anatomy always poses a diagnostic and treatment challenge. 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 fin, slit and web makes through debridement obstacle for the clinician. This case reports present successful management of C-shaped mandibular molars with three different obturation systems.

## Key words

C-shaped canals, Obtura III, RealSeal, resilon-epiphany

## INTRODUCTION

The C-shaped configuration of root canal is one of the most important anatomical variations of the canal. It was first documented by Cooke and Cox in 1979. The prevalence of C-shaped root canal reported to ranges from 2.7% to 44.5% in mandibular second 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.<sup>[1]</sup> This type canal configuration consists a single ribbon shaped orifice instead of several discrete orifices and the orifice looks like 180° arc starts from mesio lingual line angle to and sweeps around the buccal to the end at the distal aspect of the pulp chamber. Two main basic form of C-shaped canal are single ribbon shaped canal from orifice to apex and multiple canals may present below the C-shaped orifice.<sup>[2]</sup> C-shaped canal poses diagnostic difficulty radiographically because of the two-dimensional view of the radiograph. 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.<sup>[3]</sup> Due to the presence of canal irregularities, it is important to select the proper obturation system. Many authors recommended themoplasticised systems as it completely fill the canal irregularities. This report presents the management of C-shaped mandibular molar teeth with different obturation systems.

## CASE REPORTS

### Case 1

A 36-year-old male patient reported to our Department of Conservative Dentistry and Endodontics with a complaint of pain of his lower left back tooth. The medical history was noncontributory. Intra oral examination revealed dental caries on tooth 37 with necrotic pulp and slight pain on percussion. The tooth was not responsive to the electric pulp test (EPT). Radiographically the tooth was conical in shape with fused mesial and distal root with a thin radiolucent line between them, with a suspected of C-shaped canal. The tooth was diagnosed with necrotic pulp. Root canal treatment (RCT) was planned and explained to the patient.

The access cavity was prepared under local anesthesia (LA) and a single semicircle shape orifice was found. Cleaning

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and shaping of the canal was done with hand K files and ProTaper rotary files (Dentsply Maillefer, Ballaigues, Switzerland) up to F3. The anti-curvature filing method was performed to avoid the strip perforation. Copious amount of 5% sodium hypochlorite was used for irrigation and calcium hydroxide dressing was given as an intracanal medicament. The patient was recalled after 1-week and was sign and symptom free. The obturation was performed using The Obtura III Max system (Obtura Spartan, Fenton, MO, USA) and Endoflas FS (Sanlor, Colombia). The patient was recalled after a week and 6 months for evaluation of treatment [Figure 1a-c]. The metal ceramic crown restoration was given after 2 weeks. The tooth was functioning normal, patient was free of pain and there were no radiographic abnormalities.

### Case 2

A 27-year-old male patient came to our Department of Conservative Dentistry and Endodontics with a chief complaint of pain of his lower back tooth. The medical history was no significant. Intra oral examination revealed carious 37 with pain on percussion. Intra oral periapical radiograph (IOPA) showed pulpal involvement with fused mesial and distal roots. The presence of conical shaped root outline and radiolucent line in middle of the roots suggested C-shaped root canal morphology. Cold test using ice pencil and EPT gave negative response. Tooth diagnosed with necrotic tooth with acute apical periodontitis. RCT was planned and explained to the patient.

Access cavity was prepared after achieving profound LA. The cleaning and shaping was performed with hand K files and Hero Shaper rotary files (Micro-Mega, Besançon, France). The anti-curvature filing method was used. Five percentage sodium hypochlorite was used for irrigation and calcium hydroxide was applied as an intracanal medicament and recalled after 1-week. The obturation was done using 6% resilon cone and RealSeal sealer (SybronEndo, Orange, CA, USA) a resin based obturation system. The patient was recalled after 1-week and 6 months for review of endodontic treatment [Figure 1d-f]. The metal ceramic crown restoration was given after 3 weeks. The tooth was functioning normal, patient was free of pain and there were no radiographical abnormalities.

### Case 3

A 20-year-old female patient reported to our Department of Conservative Dentistry and Endodontics with the complaint of pain of her lower back tooth. Intra oral examination revealed carious tooth 37 with pulp involvement. The patient had slight pain on percussion and EPT gave negative response. IOPA revealed presence of conical and fused with thin radiolucent line in-between, suggested C-shaped root canal. The tooth was diagnosed with necrotic tooth and RCT was initiated after had discussion with patient. Access cavity was prepared after LA given. Cleaning and shaping was done using hand K file and ProTaper rotary files (Dentsply Maillefer, Ballaigues, Switzerland) up to F3. Copious amount of 5% sodium hypochlorite was used as an irrigant.



**Figure 1:** Management of C-shaped canal Case 1, 2 and 3. (a-c) Case 1 – Preoperative, working length and obturation. (d-f) Case 2 – Preoperative, working length and obturation. (g-i) Case 3 – Preoperative, working length and obturation

Intracanal dressing with calcium hydroxide was done and patient was recalled after 1-week. The obturation was done using lateral condensation method with ProTaper F3 Gutta-percha master cone and Endoflas FS (Sanlor, Colombia). The patient was recalled after a week and 6 months for treatment evaluation [Figure 1g-i]. The metal ceramic crown restoration was given after 2 weeks. The patient was pain free in relation to that tooth, IOPA revealed there were no abnormalities.

## DISCUSSION

The reason for C-shaped morphology is failure of the Hertwig's epithelial root sheath to fuse on the lingual or buccal root surface is the main cause of C-shaped roots, which always contain a C-shaped canal. The C-shaped root may also be formed by coalescence because of deposition of the cementum with time.<sup>[4]</sup>

The prevalence of C-shaped configuration is highest in mandibular second molar and the bilateral occurrence was over 70%.<sup>[5]</sup> According to Fan *et al.* indicated that a majority of teeth with C-shaped canal system showed an orifice with an uninterrupted "C" configuration.<sup>[6]</sup> 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.

Preoperative radiographs show close fused roots or images of two distinct roots. Additional 20° mesial or the distal angulation will be useful to deduct this configuration. Furcal perforation is a differential diagnosis for C-shaped canal, an electronic apex locator can be used to rule out this. Clinically, when a C-shaped canal orifice is observed under the operating microscope, however one cannot assume that such a shape continues throughout its length.

### Problems encountered in C-shaped canal and management

Sometimes deep penetration is needed to get a proper access to canal. During cleaning and shaping, normal preparation can be done in mesial and distal canals. Nevertheless the isthmus should not be prepared with larger than number 25 files; otherwise, strip perforation is likely. The anti-curvature filing method will be useful in these circumstances. Gates-Glidden burs should not be used to prepare the mesiobuccal and buccal isthmus areas. Copious amount of 5% should be used in order to get a maximum disinfection in the inaccessible areas, use of ultrasonics will be more effective.<sup>[2]</sup> Irrigation is an crucial part of root canal disinfection because it attains cleaning beyond what might be achieved by root canal instrumentation alone.<sup>[7]</sup> Due to the irregular canal

morphology the use of thermoplasticised Gutta-percha will be useful for effective obturation. Furthermore, proper placement of sealers also plays a critical role in obturation.

The Case 1 represents type I C-shaped canal according to Fan *et al.*<sup>[8]</sup> radiographic classification of C-shaped canal. There was a mesial and a distal canal that merged into one before exiting at the apical foramen. This type of tooth usually possess conical or square root with a vague, radiolucent longitudinal line separating the root into distal and mesial parts. Due to the accessibility up to the apical third' this case was managed with Obtura III, which is an injectable thermoplasticised gutta-percha system. The Case 2 represents type II configuration in which the tooth poses 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. This case was managed with RealSeal sealer and resilon cone which is a resin based obturation system. This was selected due to its flow and monobloc effects. The Case 3 represents type III configuration in which the tooth poses 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. This case was managed with Endoflas FS (Sanlor, Colombia) sealer, which is a zinc oxide based sealer with iodoform. Iodoform gives antibacterial effects, which is more important in C-shaped canals because during mechanical debridement some parts of canal remain untouched. All the cases reviewed after 1-week and 6 months to evaluate the RCT by intra oral examination and IOPA. The patients were free of pain and there were no radiographic abnormalities.

The proper diagnosis plays a key role for the management of C-shaped canals. Depending upon the morphology the management mode can be selected. Nevertheless the three-dimensional seal of root canal is most important.

## CONCLUSION

The successful endodontic management needs proper knowledge about aberrant root canal systems. Appropriate mode can be selected depending upon this morphology. The considerable care should be taken during biomechanical preparation and obturation of C-shaped canals for good long term prognosis.

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