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Management of C-shaped root canal configuration with three different obturation techniques:-3 Case Reports

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Abstract : *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. Inability to detect and debride C-shaped canal anatomy can lead to endodontic failure. This case report highlights the management of three different cases of C- shaped canal configurations using different obturation technique.*

Keywords: *C-shaped canals, Lateral Condensation, Obtura III, Endoseal MTA*

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I. Introduction

Thorough knowledge of a tooth's internal anatomy in addition to proper diagnosis and treatment planning is paramount for achieving endodontic treatment success. Root canal anatomy, normal or aberrant, should be thoroughly identified to enable absolute debridement and obturation of the entire canal system, thus facilitating a three dimensional seal and preventing any ingress of organisms or toxins into the canal[1]. 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[2]. The prevalence of C-shaped root canal reported to ranges from 2.7% to 44.5% in mandibular second molars. Failure of Hertwigs epithelial root sheath to fuse on to the buccal or lingual root surface may be the main cause of this configuration[3]. 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. 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[4]. 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[5]. 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[6-7]. This report presents the management of C-shaped mandibular molar teeth with three different obturation techniques.

II. Case Report

Case 1

A 25 year old male patient reported to our department of conservative dentistry and endodontics with a chief complain of pain in lower right back tooth region**.** The medical history was Non-contributory. 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 (Figure1. A). 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 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.

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 1. C) .A temporary restoration was placed. The patient was recalled after 1 week for a post endodontic restoration.

Case 2

A 31 year old female reported to the department with a chief complaint of pain on eating food in lower right back tooth. Clinically, tooth 47 was carious and tender on percussion. Radiographically, occlusal radiolucency was evident involving the pulp. A single fused root with a wide canal suggestive of a C-shaped canal anatomy was seen. After rubber dam isolation and profound anesthesia, an access opening was prepared. Working length was determined after locating one single canal from crown to apex (Fan et al C1 type anatomy) in the pulp chamber floor (Figure 2. A). Canal were prepared with ProTaper rotary file system (Dentsply, Maillefer) upto F3 and radiograph was taken to confirm fit of the master cone.Obturation was done with thermoplasticised gutta-percha (Calamus, Dentsply Maillefer, Switzerland) (Figure 2. C). A single apical foramen is seen in apical third in the post obturation radiograph. Post endodontic composite restoration was carried out.

Case 3

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 (Figure 3. A). 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 EndoSeal MTA (Maruchi, Orange, CA, USA) a MTA based obturation system (Figure 3. C). The patient was recalled after 1-week and 6 months for review of endodontic treatment. The tooth was functioning normal, patient was free of pain and there were no radiographical abnormalities.

III. 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[8]. The C-shaped root may also be formed by coalescence because of deposition of the cementum with time. The basic feature of C-shaped canals is the presence of a fin or web connecting the individual canals[9]. 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.[In the first case, initial evaluation of the radiograph suggested the presence of single root with a wide centrally located canal space, suggesting that there may be a C-shaped configuration of the canal. After access preparation, only one canal with a round orifice was negotiated, which showed presence of a single root canal[10]. While in the second case, we found a single conical root with three canals centered on the tooth. On exploration of the chamber, 3 orifices were seen which were joining at the apical third of the root[11]. The morphological variant of single root and single canal is easily detected in routine radiographs[12]. 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[13-14].

In second and third case here, there was an absence of natural apical constriction. To establish an effective seal at the apex, Endoseal MTA was selected as it is known to serve as a suitable sealing material in Case 3. MTA possesses unique physiochemical and biological characteristics thus providing superior seal and excellent marginal adaptation . Also, because of its antibacterial and bioinductive properties, it is known to induce biologic repair mechanisms more consistently compared to *Gutta percha*[15-16],
Proving to be a suitable alternative material. Long term placement of MTA further increases fracture resistance and overall fracture strength of the tooth

Figures

1. A 1. B 1.C

Fig 1.A: Preoperative IOPA radiograph with 37, 1.B: Master cone radiograph of 37, 1.C: Obturation radiograph of 37

2. A 2. B 2. C

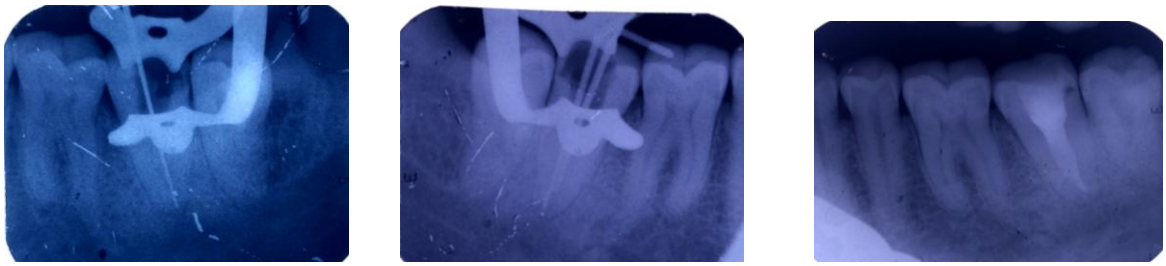


Fig 2. A: Working length determination radiograph of 47, 2.B: Master cone radiograph of 47, 2.C: Obturation radiograph of 47

3. A 3. B

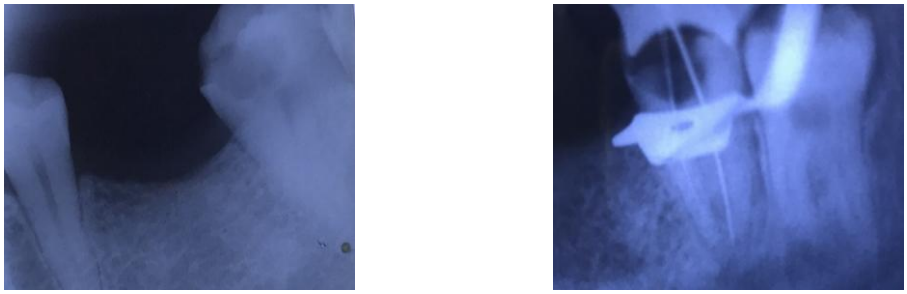
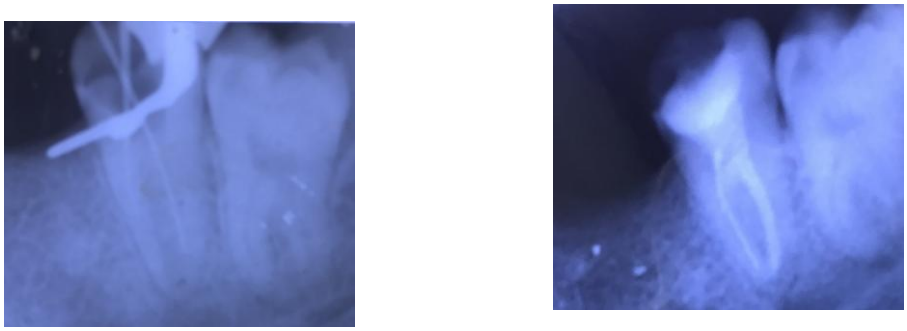


Fig 3.A: Preoperative IOPA radiograph with 37, 3.B: Working length determination radiograph of 37.

3. C 3. D



3.C: Master cone radiograph of 37 , 3.D: Obturation radiograph of 37

IV. Conclusion

Within the condition of the current case report, the following can be concluded:
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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