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Demystifying C shaped canals

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Abstract

Introduction: Knowledge of root canal anatomy is essential in order to achieve a successful root canal treatment. C shaped canal anatomy is most commonly seen in mandibular second molars and to some extent mandibular premolars. Such canals are difficult to negotiate, debride/disinfect and obturate due to its high incidence of fins, webs, lateral canals and anastomoses. Inability to identify and debride such canal anatomy may lead to endodontic failure.

Case Report: These case series highlights on two different c shaped canals with two different obturation techniques.

Conclusion: Complexity of C shaped canal morphology can be managed successfully with proper irrigation and obturation techniques.

Keywords: C shaped canals, mandibular second molars, mandibular premolars, thermo plasticized gutta-percha, warm vertical compaction, lateral compaction technique

Introduction

A proper knowledge of the tooth's anatomy and its morphological variations is of utmost importance to a clinician. This will facilitate thorough debridement, cleaning, shaping and obturation of the canal aberrations and intricacies leading to success of the treatment^[1].

Failure of Hertwig's epithelial sheath to fuse during the embryologic stage of root development results in C-shaped canals. This is a frequent finding in mandibular 2nd molars. However, mandibular second premolars with a c-shaped configuration is not unlikely and the prevalence may be around 7.9%^[2].

Attention to radiographic/CBCT details can aid in proper diagnosis and management of such canals. Use of rotary as well as hand instrumentation assisted with sonic irrigation and newer obturating techniques may be helpful. If such teeth require post placement, instead of the usual prefabricated stick posts, PTFE fibres, everstick fibres, pin posts which conform to the canal anatomy can be used alternatively^[3]. The present case series illustrates successful management of two such c-shaped canals.

Case report 1

A 49 years old female patient reported to the department with the chief complaint of pain in her lower right back teeth since 2 weeks that relieved on taking medications. Pain was sharp, intermittent, aggravated on mastications. Intraoral examination revealed deep dentinal caries on 45 and 46 with tender to percussion. IOPA revealed radiolucency involving enamel, dentine extending to pulp with loss of lamina dura and widening of periodontal ligament space. (Figure 1)

Sensitivity tests elicited sharp lingering pain even after removal of stimulus.

Further CBCT, revealed c shaped canal configuration wrt 45 and a deep lingual groove. A single canal bifurcating into lingual and buccal was noticed at the middle third-Fan's anatomic category C2 and Radiographic Type 2 category- conical or square root with mesial and distal canals till the apex (fig 2a-2c).

Teeth were diagnosed as symptomatic irreversible pulpitis with symptomatic apical periodontitis. After proper inferior alveolar nerve block (IANB) and rubber dam isolation, access cavities were prepared on 45, 46 under dental operating microscope and canals negotiated with #10 K files.

The orifices of the canals were enlarged using orifice opener and working length determined using # 15 k-files. The canals was prepared with NeoEndo rotary files (Orikam) via sequential filing followed by circumferential filing with hand H-files (Dentsply Maillefer, Switzerland) using 3% sodium hypochlorite (NaOCl) and 17% EDTA. Endo activator (Dentsply, Maillefer, Switzerland) was used to ensure thorough disinfection of the entire root canal space. Intracanal medicament i.e. Calcium hydroxide (RC Cal Prime Dental Products, Thane, India) was placed for a period of 1 week, followed by obturation using warm vertical compaction technique. GP was removed 2mm below cemento enamel junction (CEJ) and the access cavity was restored with fibre reinforced composite (GC ever X posterior) followed by full

coverage crown. (fig 3a-3g)



Fig 1: OPG revealing radiolucency wrt 45 46

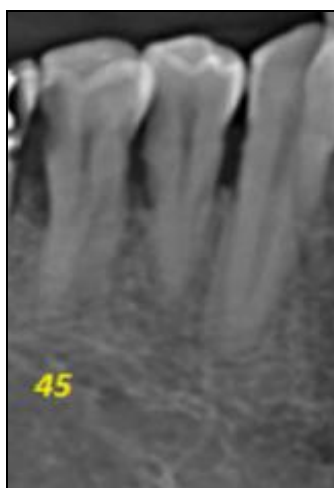


Fig 2a: Radiograph showing two roots and presence of deep lingual groove irt 45

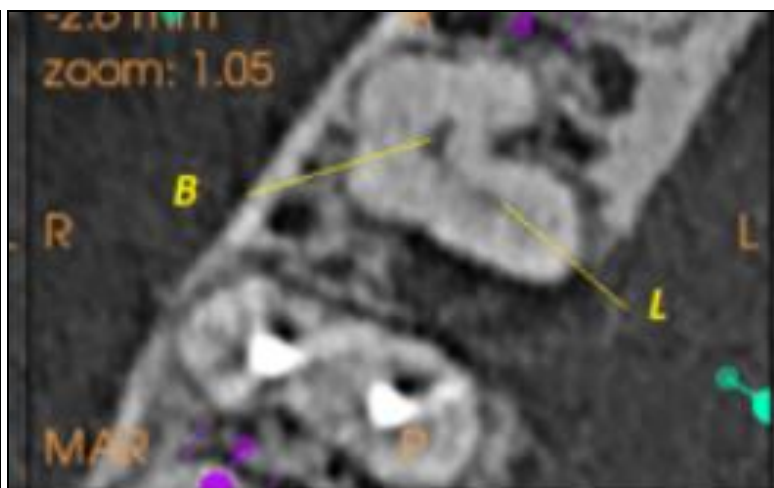


Fig 2b: CBCT axial section of tooth 45 at middle third shows c shape configuration

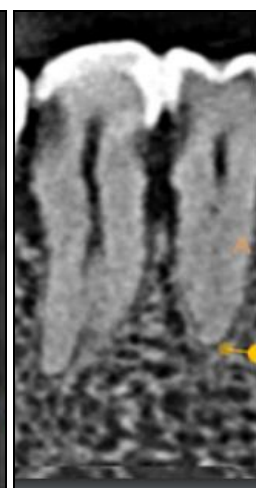


Fig 2c: CBCT #45 shows Vertucci's Type V canal

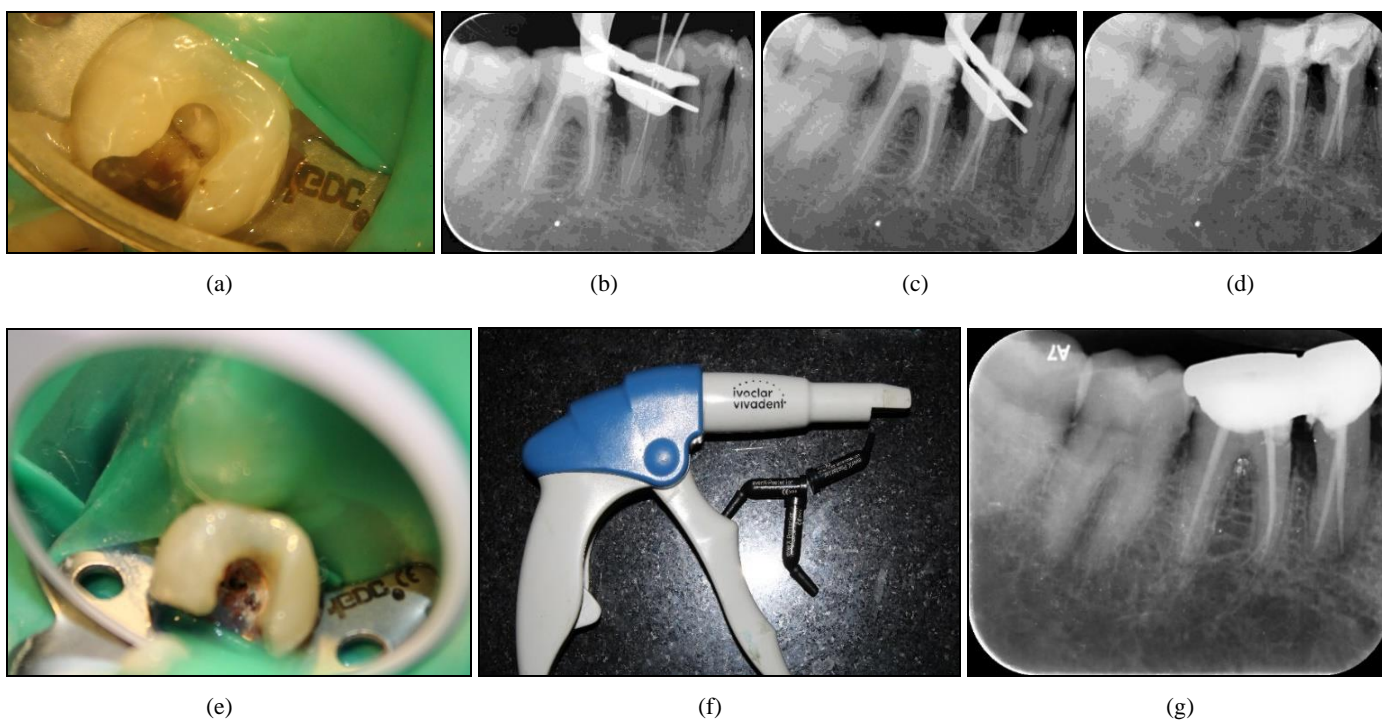


Fig 3: a) Access cavity was prepared under magnification. b) Working length determined. c) Master cone selected. d) obturation done using warm vertical compaction technique. e) 2mm intraradicular gutta-percha was removed. f) Ever X posterior access restoration g) crowns were provided to 45 46

Case report 2

Male patient aged 17 years complained of pain in lower left root canal-initiated tooth since a week. Intra oral examination

revealed temporary restoration on #37 which was tender on percussion. IOPA revealed access restoration without any obturation and widening of lamina dura. #37 was diagnosed to

be a flare-up seen in previously root canal-initiated tooth with symptomatic apical periodontitis. Temporary restoration was removed and cavity was modified and was found to belong to Fans anatomic category C1 and radiographic type 2 c-shaped canal configuration. C1-uninterrupted c with no separation or division.

Type 2-conical or square root with a vague, radiolucent longitudinal line separating into mesial and distal canals. Rotary files were used for cleaning and shaping, followed by obturation using cold lateral compaction technique and access restoration was done with composite resin. (Figure 4a-4e)

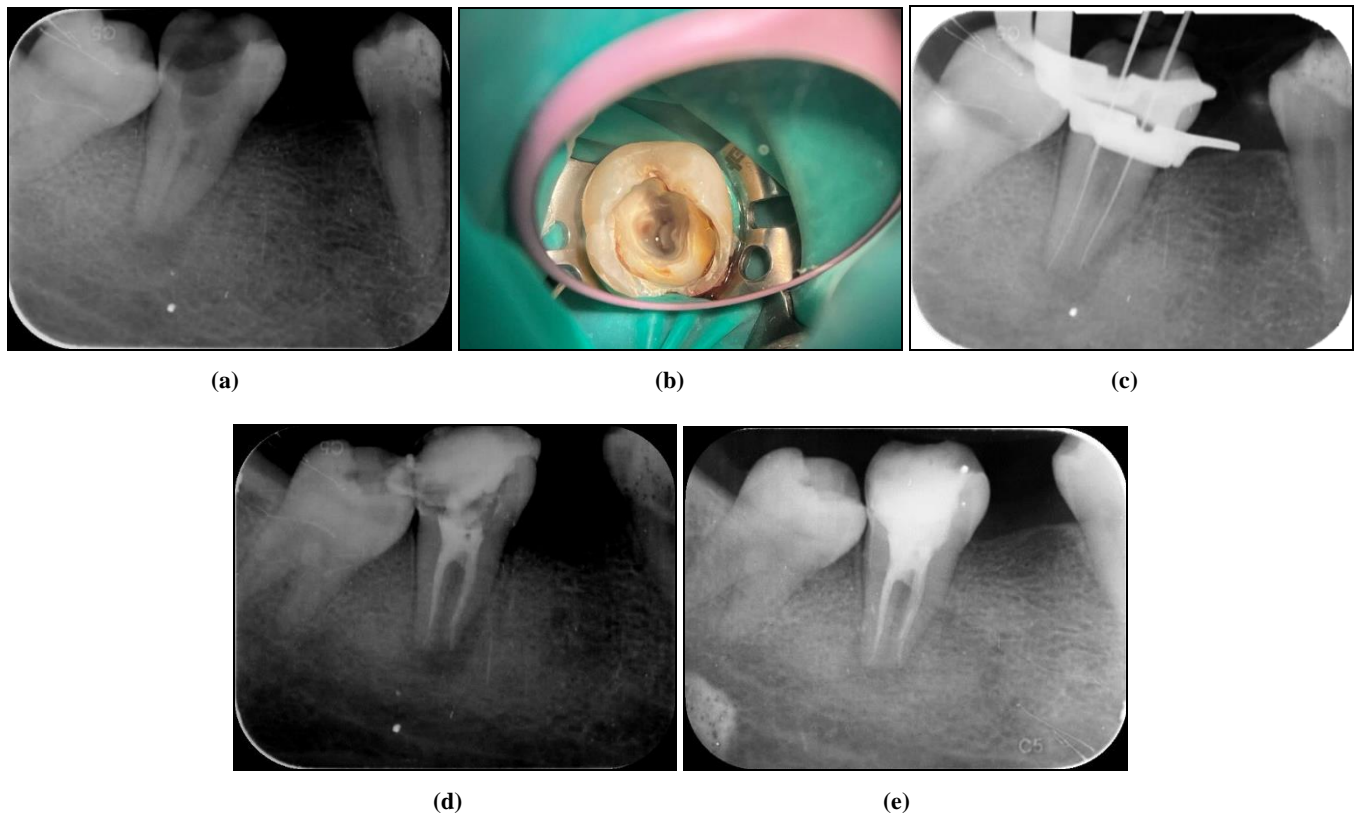


Fig 4: a. Pre-operative radiograph. b) Fan et al anatomic C-shape category 1. c) Working length determined. d) obturation done. e) Post-obturation radiograph (3 months follow up)

Discussion

C-shaped root canal can be illustrated as a root canal that is shaped like the letter C in transverse section. It was firstly documented in endodontic literature in the year 1979 by Cooke and Cox in mandibular second molar.

According to Bharadwaj *et al.*, failure of fusion of HERS on the buccal side will result in the formation of a lingual groove, and vice versa. Failure of fusion of Hertwigs epithelial root sheath on both the sides will result in the formation of a conical root [4].

The prevalence of c-shaped canals in Chinese may vary from 0.6%-41.27% [5], Koreans 31.3%-44.5%, Burmese population 22.4%, Indians 7.5% [6], Thai 6% and Sri Lankan population 1.9-2.9% [7].

It is difficult to diagnose C-shaped root canals based on two dimensional IOPAR radiographs. However, presence of poorly distinguished floor of the pulp chamber, fused root, working length radiograph with inserted instruments giving the impression of a perforation in the furcation area or instruments tending to converge at the root apex should raise a suspicion of the presence of an unusual canal anatomy. The final diagnosis in most of the cases is determined after gaining access to the pulp chamber and viewing an unusual ribbon shape of the canal under magnification. Clinically C-shaped canals can be identified by tracing the dentinal map following access opening or due to the presence of haemorrhage or red line between canal orifices.

Access cavity modification may be required to locate and

negotiate the entire root canal system. Magnifying loupes, dental operating microscope and CBCT aids in better understanding the canal system. The routinely used rotary files along with instrumentation using hand files by anti-curvature filing and circumferential filing may be required to avoid strip perforation. Chandrakant Velip *et al.* in his study concluded that use of Self-adjusting files would be better in such cases [8]. Chockattu stressed the importance of thorough debridement and disinfecting of the complex root canal anatomy for successful outcome. Irrigant activation devices can serve as adjuvant to increase the cleaning efficacy [9].

It is challenging to obtain a complete three-dimensional obturation of the C-shaped canals due to its complex configuration. The selected obturation procedure should ensure 3D obturation technique with gutta-percha and sealer into the root canal aberrations. However, Li peng *et al.* in his meta-analysis compared warm vertical compaction and cold lateral compaction stated that there is no significant difference between these two techniques [10].

Conclusion

Several classifications have been proposed to render the complexity of C-shaped root canal morphology. A thorough knowledge of canal configuration is essential to properly plan the treatment. Modifications in well-established treatment protocols may be required aided with magnification for better visualisation.

This case series has showcased the management of two

different C-shaped canals using different instrumentation and two different obturation techniques.

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