

Case Report
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Management of C-Shaped Canal Morphology in First Mandibular Molar: A Case Report

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ABSTRACT

One of the commonest anatomical variations of the root canal morphology includes the C-shaped canal configuration, frequently observed in second mandibular molars, but may be detected in other tooth morphotypes also. Very frequently, the first mandibular molars necessitate an endodontic therapy as they are often caries-prone and tends to be the first erupting permanent posteriors. The complexities of this root canal diversity might often make canal negotiation, debridement, and obturation cumbersome for the clinician. The detection and exploration of the fan-shaped regions and intricacy of the C-shaped morphology can be enhanced by radiographic and clinical diagnostics. Hand as well as rotary instruments, together with sonics/ultrasonics, could be used to adequately manage this unusual canal arrangement. The current case report describes the diagnosis and management of an unfamiliar C-shaped canal morphology in first mandibular molar and emphasizes the imperative role of CBCT, improved magnifying aids like microscope and good choice of an endodontic sealer for its efficient handling.

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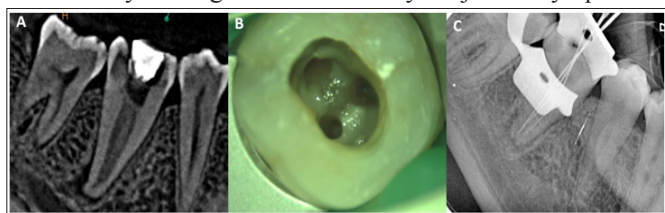
Case Report

A 23-year-old female patient reported to the Department of Conservative dentistry and Endodontics with the chief complaint of pain in the right lower posterior region. On obtaining history, the patient revealed pain of spontaneous nature with right first mandibular molar for past 2 days. The patient perceived an increased sensitivity to various thermal stimuli, and often presented with high intensity pain subjectively. The medical history of the patient was non-contributory. On clinical examination, the patient showed positive response/tenderness to percussion in 46. When performed cold test with Coltene vitality Control-Endo frost (sensitivity testing) in 46, the response was immediate and it kept lingering even after the removal of stimuli. Periodontal examination performed in 46 showed normal mobility within the physiological range, normal sulcular depth and bone morphology without any pockets. The Intraoral periapical radiograph taken pre-operatively in that region displayed the caries in 46 involving enamel, dentin and approximating the pulp with widening of periodontal ligament space close to the root apex. The angulated radiographs taken revealed the existence of fused roots. [Table/Fig 1A] The diagnosis of Symptomatic irreversible pulpitis with

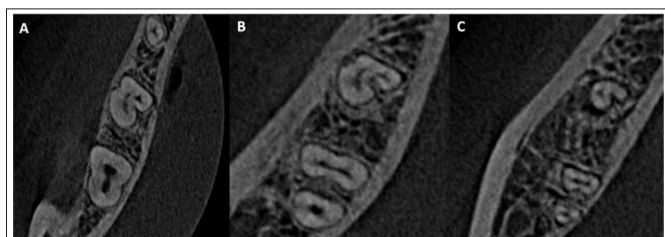
symptomatic apical periodontitis was made after correlating with the sensibility, clinical and radiographic examinations. The treatment plan was scheduled suitably after obtaining informed consent from the patient.

Local anaesthesia was administered using 2% of 2.5 ml lignocaine containing 1:2,00,000 epinephrine (CELON labs, Telangana, India) and rubber dam isolation (Hygiene – Coltene, Whale dent Ltd., USA) was performed. Caries excavation was done in 46 and a conventional access cavity preparation design was achieved with an Endo access bur (MANI, INC, Japan). On access opening, the pulpal extirpation was initiated and root canal orifices were visualised. [Table/Fig 1B] Owing to the variation in the canal morphology pattern while negotiation, the patient was advised for a CBCT (Carestream CS9300) as this would corroborate the extension of the C-shaped canal morphology and its possible diversities. The patient was recalled for second visit after placement of temporary restoration in 46. The exploratory CBCT again confirmed the fusion of two roots and revealed a C3 pattern at coronal-third, followed by a C2 and C4 morphological patterns in the middle and apical third respectively as per the Fan's classification [Table/Fig 2A-C]. Working length estimation was done with an apex locator and correlated with the radiograph as well. [Table/Fig 1C] Biomechanical preparation was initiated with

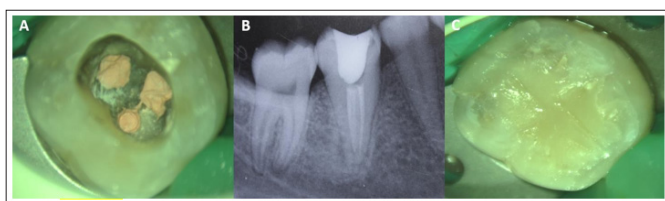
ISO 2% hand files (MANI, INC, Japan) up to a size of 20 in a circumferential filing motion followed by rotary instrumentation with protaper gold files (Dentsply Tulsa Protaper Gold 21 mm). Canal irrigation was primarily performed with 5.25% sodium hypochlorite solution (Chloraxid 5.25 cerkamed, Poland) and normal saline (Nirma Pvt limites, Gujarat, India) followed by final flush of 17% ethylene diamine tetra acetic acid (Meta Biomed Md Cleanser 17% EDTA Solution, South Korea). Passive ultrasonic activation (Eighteenth Medical Ultra X- Ultrasonic Activator, China) was performed after every sequential enlargement of canal. The canals received a final rinsing with normal saline and was dried with absorbent paper points (Dentsply Maillefer, Ballaigues, Switzerland). The obturation of apical third was done using sectional method, after which backfill using thermoplasticized gutta percha (Super Endo, Beta Obturation gun, Italy) with bioroot RCS (Septodont, India) sealer was done [Table/Fig 3A&B] under dental operating microscope. The access cavity preparation was further restored [Table/Fig 3C] using composite resin (3M ESPE Dental products, St Paul, MN) and the periodical follow-up reveals a satisfactory healing of 46 without any subjective symptoms.



Table/Figure 1: A. Pre-operative CBCT image of 46 showing root fusion, B. Clinical photograph of canal orifice viewed under operating microscope at 2.4 x magnification. C. IOPA radiograph in 46 taken during working length estimation.



Table/Figure 2A-C: Coronal, Middle and Apical-thirds CBCT section depicting C3, C2 and C4 Fan's morphological patterns respectively.



Table/ Figure 3: A and B. Post-obturation clinical and radiographic image of 46, C. Clinical photograph after definitive restoration with composite restoration in 46.

Discussion

The C-shaped root canal architecture is most always unique, and might usually possess great challenge during therapy due to higher possibilities of canal irregularities. Prior to the initiation of treatment, a definitive diagnosis as well as characterization based on classification systems is required. Anticipating the anatomical C-shaped diversities can aid in rendering efficient root canal

therapy. In general, a majority of permanent first mandibular molars are commonly seen with two fully defined roots, two canals in mesial root and one wide oval/ two round canals in distal root [1]. In addition to the commonest above-mentioned presentations, a great variety of variations of the root along with its canals have been identified in the literature [2,3].

The C-shaped root canal arrangement is a form of taurodontism that is widely observed in the second mandibular molar, with frequency varying from 2.7 percent to 45.5 percent in various populations [4]. Pertaining to mandibular first molar, from a study evaluated the morphological variations from the Indian population, it was concluded that only one of 125 samples had single canal and a single root [5]. The incidence of single root with single root canal and two roots with two root canals have been investigated in the literature by Sooriaprakas et al., and Krithikadatta et al [6,7].

To appreciate the varied spatial relationship of C-shaped canal, several different classifications were framed. Besides, Manning's and Melton's, several other classifications were proposed in the past by Fan et al., Gao et al., Min et al., and Al Fouzan et al [8].

In 1991, Melton et al. had offered a classification depending on the cross-sectional shape of the c-shaped canals. Fan et al. further modified the classification given by Melton in 2004 and proposed as following [9-11].

- C1:** The shape was an interrupted "C" with no separation or division.
- C2:** The shape of canal resembled a semicolon (;) resulting from a discontinuation of the 'C' outline.
- C3:** (Highest incidence): 2 or 3 separate canals.
- C4:** Only one round or oval canal in that cross-section.
- C5:** (Usually seen near the apex only): No canal lumen could be observed.

In order to label a root canal system to have a C-shaped morphological configuration, Fan et al stated that it must contain all the mentioned three characteristics: Presence of buccal and/or lingual longitudinal groove, the canal cross-sectional configuration should at least belong to any one of the three-C1, C2 or C3 pattern, and the presence of fused roots [10].

The usage of additive diagnostic aids like cone-beam CT utilises three-dimensional imaging technology that would further increase and facilitate the perception behind the complex morphologies of root canals. The employment of CBCT for assessing root canal anatomy in instances with aberrations has been recommended by Kottoor et al., and La et al., in this situation, CBCT was recommended to establish the root canal architecture as well as the continuation of the C-shaped canal to the apex. Also, the advent of dental operating microscope in endodontics has led to the increased visualization of root canals from both retro- and orthograde perspectives, all of which have ultimately resulted in ease of therapeutic performance in clinically complex scenarios [12-14].

The current case report describes the diagnosis and management of an unfamiliar C-shaped canal morphology in first mandibular molar and emphasizes the imperative role of CBCT, improved magnifying aids like microscope and good choice of an endodontic sealer for its efficient handling.

Conclusion

The current case report documents the unfamiliar morphology of first mandibular molar with two fused roots and differing canal patterns at the three levels. Prudent exploration of the molars under a dental operating microscope, meticulous irrigation activation procedures along with an unerring obturation technique can aid attain success in such varied morphological aberrancies.

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