

C- Shaped Root Canal In Mandibular Second Molar Diagnosed Using Cone Beam Computed Tomography– Two Case Reports.

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Abstract: C-shaped canal is one of the most difficult situations with which the dentist is confronted during endodontic treatment of teeth. Recognition of unusual variation in the canal configuration is critical because it has been established that the root with a single tapering canal and apical foramen is the exception rather than rule. The early recognition of these configurations facilitates cleaning, shaping, and obturation of the root canal system. "C" configuration, which is an important anatomic variation, presents a thin fin connecting the root canals. In this case reports successful management of C-shaped canals in mandibular second molars are presented by using cone-beam computed tomography and operating microscope for diagnosis, sonic irrigation and Calamus dual obturating device.

Key words: C-shaped canal, Melton's Classification, Endoactivator, Calamus Dual.

I. Introduction:

A thorough knowledge of the normal as well as unusual configuration of root canal anatomy is essential for successful debridement and obturation of root canal system. Variation in the root endodontic system has great clinical significance, since they are difficult to diagnose and create problems during endodontic treatment. One of the most important variations is the 'C' shaped configuration of the root canal system, which was first described by Cooke and Cox in mandibular molars (1). C shaped molars are so named because of the cross sectional morphology of their root and root canals. Main cause of C-shaped root canal is failure of Hertwig's epithelial root sheath to fuse on lingual or buccal root surface.

There is significant variation in the C shaped molars. Prevalence of C shaped canals reported are 2.7-8% in Americans, 31.5% in Chinese, 19.1% in Lebanese, 10.6% in Saudi Arabia, 32.7% in Korean population (2). This anatomy is more common in Asians than in whites (3). Once recognized, the C-shaped canal provides a challenge regarding debridement and obturation, especially because it is unclear whether the C-shaped orifice found on the floor of the pulp chamber is continuous up to the apical third of the root (4). Owing to their inherent limitations, conventional radiographs are of limited value in determining the complexity of C-shaped root canal patterns (4). Multiple IOPA with various angulations helped in identification of canal anatomy. Introduction of CBCT images has resulted in better understanding of root canal system (4,5). Various clinical studies have highlighted the role of cone-beam computerized tomography (CBCT) as an objective analytical tool to ascertain complex root canal morphology (5,6). This case reports describes the endodontic management of a mandibular second molar with Melton type I and Melton type II root canal. This aberrant root and canal morphology was identified using a dental operating microscope and confirmed by using CBCT and successfully treated by using Endoactivator (Dentsply, USA), a sonic irrigation device and Calamus Dual (Dentsply USA) obturating unit.

CASE REPORT - 1

A 23 year old female patient reported to Department of Conservative Dentistry and Endodontics, SDKS Dental College & Hospital, Nagpur, with a chief complaint of spontaneous pain in lower right back region of jaw since 3 days. The patient's medical history was not contributory. Intra oral examination revealed deep occlusal caries with right mandibular second molar (i.e. 37) with lack of swelling. History revealed intermittent pain in the same tooth to cold and hot stimuli for past 1 month. The tooth was tender to vertical

percussion. Radiographic examination revealed single conical root with deep occlusal radiolucency extending to the pulp with absence of peri-radicular changes radiographically (fig 1). Vitality testing of the involved tooth with dry ice (RC Ice Prime Dental Products, Mumbai, India) and with heated gutta percha caused an intense lingering pain. Electric pulp tester (Parkel Electronics Division, USA) showed premature response. Diagnosis was made as irreversible pulpitis. Patient was informed regarding endodontic treatment and written consent was taken.

Tooth was anesthetized by using 2% lignocaine containing 1: 20,000 epinephrine (LIGNOX 2% A). The endodontic access cavity was prepared under rubber dam isolation. The pulp chamber was irrigated with 2.5% sodium hypochlorite to debride the chamber fully and to identify the nature of the canal system under dental operating microscope (SEILER) (fig 2). The pulpal floor showed one mesial orifice & a broad C-shaped distal orifice resembling semi-colon type morphology. To confirm this unusual root canal morphology and to rule out the presence of any additional roots/canals, a diagnostic CBCT imaging of the tooth was done. The access cavity was sealed with temporary restoration (MD-Temp META BIOMED Korea). Informed consent was obtained from patient and a multi-slice CBCT of the mandible was performed (Kodak 9000 Cone Beam 3D). Axial slices of the mandible were obtained at different levels to determine the canal morphology (fig 3). The tooth root showed a distal C-shaped canal that extended from the cervical third up to the apex with separate mesio-lingual canal extending from middle to apical third of root, thus categorizing the root canal system as a Melton type II C-shaped anatomy.

Coronal pre-flaring was done with #2 gates glidden drill. Working length was determined using apex locator (Dentaport ZX, J. Morita Japan) and confirmed radiographically (fig 4). Cleaning and shaping was done with handProTaper system. Between instrumentation, canal was irrigated with 2.5% sodium hypochlorite and activated with sonic unit (Endoactivator Dentsply USA) for 1 minute for maximum debridement of the complex anatomy of the root. Intracanal calcium hydroxide medicament was placed until next appointments. After removal of smear layer using 17% of EDTA, final irrigation was done with 2.5% of sodium hypochlorite. The canals were dried with absorbent point. AH Plus sealer was placed and obturation was carried out using warm vertical compaction with Calamus dual (Dentsply, USA). Apical seal in mesio-lingual canal & C-shaped canal was obtained using GP no.30 (6%) & no.40 (6%), respectively. Rest of the C-shaped canal was back filled with thermoplasticized gutta-percha technique (Calamus Dual, DENSPLY USA) (fig 5). The tooth was then restored with a posterior composite core (Z 100; 3M Dental products). The patient was advised to accept a full coverage crown and tooth was asymptomatic during the subsequent follow-up period.

Case I:



Fig 1: Preoperative Radiograph showing deep occlusal caries extending into pulp.



Fig 2: Access cavity preparation showing C shaped canal



Fig 3: CBCT Images at cervical, middle and apical region confirms melton type ii



Fig 4: Diagnostic radiograph



Fig 5: Post operative radiograph

Case II:

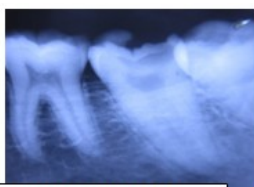


Fig 6: Preoperative Radiograph showing deep occlusal caries with 37



Fig 7 .access cavity shoes c shaped canal morphology of 37

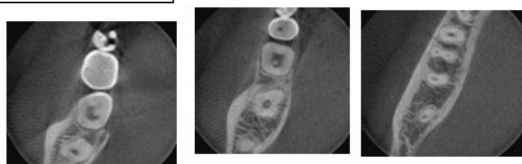


Fig 8. CBCT Images showing Cshaped canal morphology



Fig 9: post obturation IOPA of 37

CASE REPORT - 2

A 23 year old female patient reported to Department of with a chief complaint of pain in lower left back region of jaw since 1 week. The patient's medical history was not contributory. Intra oral examination revealed deep occlusal caries with left mandibular second molar. Tooth was tender on percussion. Radiographic examination revealed single conical root with deep occlusal radiolucency extending to the pulp with large apical foramen. Diagnosis was made as irreversible pulpitis. Patient was informed regarding endodontic treatment and written consent was taken.

Endodontic therapy was performed similar to case report 1 (fig 6 to fig 9). The pulpal floor showed a C-shaped orifice extending till the apex. To confirm this unusual root canal morphology and to rule out the presence of any additional roots/canals, it was proposed to perform CBCT imaging of the tooth. The tooth root showed 1 root canal orifice with C-shaped canal that extended from the cervical third up to the apex, thus categorizing the root canal system as a Melton type I C-shaped anatomy.

The canal was dried with sterile paper points. Apical seal was obtained with MTA as tooth was having large apical foramen. Obturation of the root canal system was performed with warm vertical condensation (Calamus dual) and resin based sealer (Resinoseal). Post endodontic restoration was done with composite (Para core).

The operating microscope was employed throughout the procedure to enable sufficient illumination and magnification.

II. Discussion

The variability of root canal system of multirouted teeth represents a challenge to diagnosis and treatment (7).C shaped canal is one of the most difficult situation in endodontics which was first described by Keith (1908),and later by Keith and Knowles (1913), Pederson (1949),Tratman (1950) and Cook and Cox (1979)(8). This is C shaped canal is so named for the cross sectional morphology of root and root canal.Instead of having several discrete orifices, the pulp chamber of the C shaped canal is 180 degree arc (or more).This variation may occur in mandibular first molar(9),maxillary molars,(10,11)mandibular first premolars(12) and even in maxillary lateral incisors(13), but it is most commonly found in mandibular second molar(14) Yang et al showed the presence of C- shaped canal in lower second molar in 31.5% of Chinese population and 13% of mixed Asian population (15).C-shaped canal may be found in contra lateral tooth in over 70% of individuals(16).

The C shaped canal system can assume many variations in its configuration. So a comprehensive classification can help in diagnosis and management.

Melton in 1991 (17) divided the C-shaped canals into three types.

Type I: The continuous C-shaped canal.

Type II: The semicolon shaped canal.

Type III: Two discrete and separate canals.

Based on this classification, the present case no 1 would be categorized as type II and case no.2 would be type I.

Conventional 2–dimensional radiograph might not provide adequate diagnostic information for the clinicians to appreciate complicated morphology of root canal system. These problems might be overcome by using spiral computerized tomography (SCT) and cone beam computerized tomography (CBCT), which can provide 3- dimensional images of individual teeth, and the surrounding tissues (4,6). But, it is equally important that the radiation dose should be low (4).

In both cases, shape of access cavity was modified and canal morphology was confirmed under operating microscope. The connecting fins or isthmus is usually a thin area and its irregular areas contain soft tissue remnants or infected debris that may escape regular cleaning and shaping procedure. Because of that sonic irrigation was used to thoroughly debride the root canal system.

Gutmann and Rakusin suggested use of thermoplastized gutta percha for obturation of C–shaped canals (18). Accordingly, thermoplasticized gutta percha of Calamus dual were used to allow for a more complete obturation of the complex root canal system.

III. Conclusion

Management of C shaped canal represents a great challenge with respect to diagnosis and treatment. Magnification and illumination can help to identify these hard to detect c shaped configuration. Proper access cavity preparation, meticulous mechanical and chemical preparation and three dimensional obturation should be carried out to successfully manage C- shaped root canal.

References

- [1]. Cooke HG 3rd, Cox FL: C-shaped canal configuration in mandibular molars J Am Dent Assoc 1979;99:836-839
- [2]. Hamid Jafarzadeh, and You-Nong Wu: The C-shaped root canal configuration: A Review JOE-Volume 33, number 5, May 2007.
- [3]. COHEN S, Burns RC. Pathways of the pulp. 8th ed. St. Louis: Mosby, 2002; 196-229.
- [4]. Jojo Kottoor, Natanasabapathy Velmurugan, Suma Ballal, and Anna Roy Four rooted maxillary first molar having C-shaped palatal root morphology evaluated using cone-beam computerized tomography: a case report Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011; 111: e 41-e45
- [5]. Gao Y, Fan B, Cheung GS, Gutmann JL, Fan M. C-shaped canal system in mandibular molars part IV: 3-D morphological analysis and transverse measurement. J Endod 2006; 32: 1062-5
- [6]. Kottoor J, Hemamalathi S, Sudha R, Velmurugan N. Maxillary second molar with 5 roots and 5 canals evaluated using cone beam computerized tomography: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010; 109: e 162-5
- [7]. Ravichandra, Harikumar: C shaped canals in mandibular second molars IJDA, 2 (1), 2010, 156-158
- [8]. Bernard Jankovic, Ivica Anic, Ivana Miletic: Instrumentation of 'C' Shaped Endodontic Area 47. Acta Stomatol Croat, Vol. 34, br. 2, 2000, 223-225
- [9]. Bolger WL, Schindler WG: A mandibular first molar with a C-shaped root configuration. J Endod 1988; 14: 515-519
- [10]. Yilmaz Z, Tuncel B, Serper A, Calt S: C-shaped root canal in a maxillary molar: a case report. Int Endod J 2006; 39: 162-166.
- [11]. Danker E, Friedman S, Stabholz A: Bilateral C shape configuration in maxillary first molars. J Endod 1990; 16: 601-603.
- [12]. Lu TY, Yang SF, Pai SF: Complicated root canal morphology of mandibular first premolar in a Chinese population using the cross section method. J Endo 2006; 32: 932-936
- [13]. Boveda C, Fajr DOM, Millan B: Root canal treatment of an invaginated maxillary lateral incisor with C-shaped canal. Quintessence Int 1999; 30: 707-711
- [14]. Bing Fan, Yi Min, Guanfan Lu, Jun Yang, Gary S.P. Cheung, and James L. Gutmann: Negotiation of C shaped canal system in mandibular molars. J Endod 2009; 35: 1003-1008
- [15]. Yang ZP, Yang SF, Lin YC, Shay JC and Chi CY: C-shaped canals in mandibular second molar in a Chinese population. Endod Dent Traumatol. 1998; 4: 160-163
- [16]. Sabala CL, Benenati FW, Neas BR: Bilateral root or root canal aberrations in a dental school patient population. J Endod 1994; 20: 38-42.
- [17]. Melton DS, Krell KV and Fuller MW. Anatomical and histological features of C- shaped canals in mandibular second molars. J Endodon. 1991, 17: 384-8
- [18]. Gutmann JL, Rakusin H. Perspectives on root canal obturation with thermoplasticized injectable gutta-percha. Int Endod J 1987; 20: 261-70