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MANAGEMENT OF C-SHAPED ROOT CANAL CONFIGURATION IN MANDIBULAR SECOND MOLAR: A CASE REPORT

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Subija K NarayananKutty
MDS, Former Junior Resident, Dept. of Conservative Dentistry and Endodontics, Government Dental College, Thiruvananthapuram.

Anulekh Babu
MDS, Assistant Professor, Dept. of Conservative Dentistry and Endodontics, Government Dental College, Thiruvananthapuram.

Aparna Mohan E
BDS, Junior Resident, Dept. of Conservative Dentistry and Endodontics, Government Dental College, Thiruvananthapuram.

Mohammed Akber KM
BDS, Junior Resident, Dept. of Conservative Dentistry and Endodontics, Government Dental College, Thiruvananthapuram.

Joms K George
BDS, Junior Resident, Dept. of Conservative Dentistry and Endodontics, Government Dental College, Thiruvananthapuram.

ABSTRACT Adequate knowledge of the root canal anatomy is required for success of endodontic therapy. Variations in the root canal system pose a diagnostic and treatment challenge. One of the most important variations is the C-shaped canal configuration. Proper diagnosis and modification of instrumentation and obturation techniques is essential for management of such cases. This paper reports the successful endodontic management of a mandibular second molar with C-shaped canal.

Introduction

Proper knowledge of internal anatomy of the tooth and its variations is necessary for successful diagnosis as well as management of root canal infections[1-4]. Morphological variations in root canal anatomy may not always be present as an extra canal or root, it may be a reduction in number of roots or canals, manifested as fused root or C-shaped canal configurations. One of the most important anatomic variations in mandibular molars is the C-configuration of canal system which may pose challenge in negotiation, debridement and obturation.

Cooke and Cox in 1979 first documented C-shaped canal configuration and named so for the cross sectional morphology of root and root canal[5]. He reported it as a single ribbon shaped orifice with 180° arc which starts at the mesiolingual line angle and sweeps around the buccal to end at the distal aspect of the pulp chamber[6].
The major challenge for endodontic treatment of such cases is the inability to access all fins and webs thereby making debridement and obturation a difficult task. Mostly this configuration is noticed in fused roots and in such cases floor of the pulp chamber is unusually deep and shows unusual anatomic appearance[7]. This article highlights successful management of a C-shaped root canal in a mandibular second molar.

Case report

A 20 year old male patient reported to our department with complaint of pain in relation to lower left back tooth since one month. He had occasional night pain. His medical history was non-contributory and had extraction of left mandibular first molar due to caries one month back.

Clinical examination revealed deep dental caries involving pulp of #18 with no evidence of mobility, sinus tract or swelling. Periodontal probing depth was normal and tooth was tender on percussion. Intraoral periapical radiograph revealed coronal radiolucency of #18 extending to pulp chamber & periapical radiolucency indicative of apical periodontitis (Fig. 1). Floor of pulp chamber appeared to be situated deep and roots were fused.

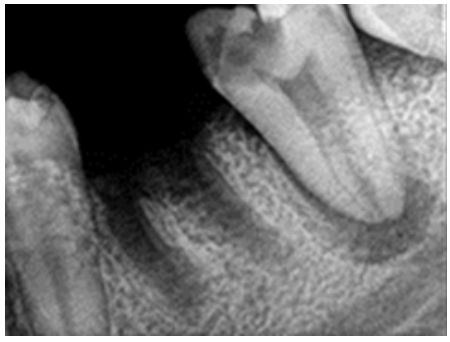

Fig 1: Pre-operative radiograph

Based on clinical and radiographic findings, a diagnosis of symptomatic chronic apical periodontitis was made. Patient was informed of necessity of endodontic treatment and variation in morphology of tooth.

Local anesthesia (2% lignocaine with 1:200000 adrenaline, Kwality pharmaceuticals Pvt. ltd, India) was administered. Tooth was isolated with rubber dam and endodontic access cavity was prepared under magnification using dental operating microscope (Seiler, USA). The pulp chamber was unusually large in the occlusoapical dimension with a low bifurcation.

Under dental operating microscope the canal system appeared as dark area. Deep orifice preparation and meticulous probing with small K-files characterized it as Melton's class II C-shaped category[2] in which mesiobuccal and distal canals were fused and separated from one distinct mesiolingual canal by a dentine bridge at middle third of root. Orifice was enlarged with Sx ProTaper Universal (Dentsply, Switzerland) and canals were enlarged upto #25 K files initially. Ultrasonic agitation (Start X, Dentsply Maillefer) with 5.25% sodium hypochlorite was done for thorough debridement as the narrow isthmus areas were inaccessible otherwise. Calcium hydroxide dressing was given and patient was recalled after two weeks. Patient didn't report for the next appointment due to personal

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reasons and returned after four weeks. On radiographic examination the periapical lesion was healed almost completely.

Anticurvature filing method was used in mesiolingual and canals were enlarged upto size 4% 40 using Hyflex CM files (Coltene Whaledent). Canals were coated with sealer (AH Plus, Dentsply) and master cones were placed in each canal. Technique of obturation used in this case was similar to that advocated by Walid[8]. Gutta percha was seared off using Touch N Heat (Sybron Endo) in the mesiobuccal canal and down packing of thermoplasticised gutta percha was done using plugger with master cone in place in the distal canal. Similarly obturation was done in distal canal also and backfilling was done with thermoplasticised gutta percha which helped in the passage of obturating material into narrow isthmus and root canal aberrations. Mesiolingual canal was obturated similarly (Fig. 2). The tooth was restored with composite resin and patient was referred for prosthetic rehabilitation.

Fig. 2: Post-operative radiograph

Discussion

C-shaped canal configuration has the highest prevalence in mandibular second molars (10-31.5%)[9]. Typically this is found in teeth with fusion of roots either on buccal or lingual aspect. C-shaped canal configuration can assume many variations. Melton (1991) proposed the following classification based on the different configurations of the orifices[2]:

Class I: a continuous C-shaped canal, with no separation of the canals.

Class II: canal orifices resemble a semicolon (;), where a C-shaped canal is present buccally or lingually, separated from another distinct canal by a dentine wall.

Class III: two or more separate canals are present, as in a typical lower molar, with three canal orifices.

Fan et al in 2004 gave a modified classification as:[7]
Category I (C1): the shape is an uninterrupted "C" with no separation or division (Fig. 3a).

Category II (C2): canal shape resembles a semicolon resulting from a discontinuation of the "C" outline (Fig. 3b), but either angle α or β (Fig. 4) should be no less than 60°.

Category III (C3): two or three separate canals (Figs. 3c,d) and both angles α or β, are less than 60°.

Category IV (C4): only one round or oval canal in that cross section (Fig. 3e).

Category V (C5): no canal lumen observed (which is usually seen near the apex only) (Fig. 3f).

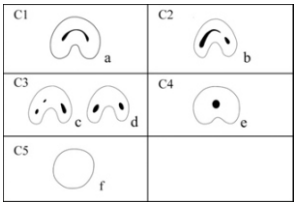

Fig. 3: Classification by Fan et al

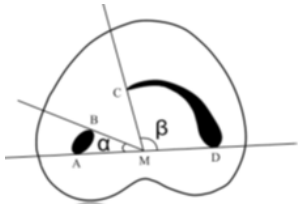

Fig. 4: α and β angles

Diagnosis of this variant anatomy poses a major challenge. The following three features should be used to diagnose a tooth with C-shaped configuration: fused roots, longitudinal groove on buccal and lingual surface of root and at least one cross section of canal belonging to C1, C2 or C3 configuration[7]. Clinically, unusual appearance of pulp chamber and persistence of hemorrhage or pain contributes to its diagnosis[10]. Radiographically, radicular fusion, large distal canal, narrow mesial canal and a blurred image of a third canal in between may be found[11]; but diagnosis based on radiographic appearance is difficult and requires additional 20° mesial or distal projections and a clinical exploration of pulp chamber for confirmation[12]. Cone Beam Computed Tomography (CBCT) is a clinically useful tool for diagnosis and treatment planning of such cases[13].

Increased visibility offered by surgical operating microscope[14] can aid in identification of pulp chamber morphology to an extent but a deeply seated pulp chamber floor and possibility of division into additional canals at any level of roots limits its use. Deep orifice preparation and cautious use of small hand files upto #25, copious irrigation with 5.25% sodium hypochlorite along with ultrasonic activation may allow proper cleaning in fan shaped areas of C-shaped canals[15,2]. Anticurvature filing can prevent perforation that is most likely due to aggressive instrumentation[15].

Various modifications in obturation techniques have been introduced. Lateral condensation alone cannot completely seal isthmus, narrow canals or fins. Use of thermoplasticised gutta percha is advocated as a more appropriate method. Novel approaches include 'zap and tap' technique and Walid's technique. Martin developed Endotec II which uses zap & tap technique[16]. In this, the Endotec plugger is preheated for 4 to 5 seconds before insertion (zap) and hot instrument is moved in and out in short continuous strokes (taps) 10 to 15 times. The plugger is removed while still hot, which is followed by a cold spreader with insertion of additional accessory points[17]. Walid described the use of two pluggers simultaneously to down pack the main canals in a C-shaped canal[8] which was used in this case.

Conclusion

Successful endodontics depends on proper knowledge, respect and appreciation of root canal anatomy and meticulous cleaning and shaping. C-shaped configuration presents a complex aberration, the fins and webs harbour soft tissue remnants which may be difficult to debride completely. Diagnosing a C-shaped morphology itself is a challenging task, but proper evaluation and thorough debridement with modern sophisticated instruments such as ultrasonics might make the task a bit lighter. In this case, healing of periapical lesion was noticed after initial appointment which emphasizes the importance of proper cleaning and shaping.

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