Case Report

APPLICATION OF CONE-BEAM COMPUTED TOMOGRAPHY IN DIAGNOSIS AND TREATMENT OF MULTIPLE CANALS– A CASE REPORT

Gyanendra Pratap Singh[1], Shruthi H Attavar[2], Sivaji Kavuri[3]*

[1]Conservative Dentistry and Endodontics, Private Practioner, Ghaziabad, India.
[2]Conservative Dentistry and Endodontics, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Mangalore, India. drshruthiattavar@yahoo.in
[3]Conservative Dentistry and Endodontics, Anil Neerukonda Institute of Dental Sciences, Andhra Pradesh, India.

https://doi.org/10.51847/vgeNZYRIRH

ABSTRACT

The most important objective of root canal treatment is to identify all the canals, thorough debridement and three dimenstional obturation of the canal space. The awareness of the anatomy within the canal apparatus is an important component in the treatment of dental procedures. Anatomically mandibular first molars have two roots with either three or four canals, nevertheless, the presence of extra canals has been reported by various authors, most commonly being the middle mesial root canal. The present case illustrates the application of CBCT in the diagnosis and treatment of mandibular first molar with seven root canals. A dental operating microscope was used clinically to detect the seven canals and substantiated using a CBCT scan. In conclusion, the presence of extra canals and the possibility of atypical morphology should be taken into reflection by the clinician during endodontic procedures. Therefore the operator must make an appropriate diagnosis regarding the presence of additional canals for the long-term success of the endodontic procedure.

Key words: CBCT, Root canal morphology, Dental operating microscope, Mandibular first molar.

Introduction

Endodontic treatment and its success are dependent on comprehensive root canal system debridement [1]. The preliminary goal of root canal therapy is to completely debride all pulp voids before filling them with an inert filler substance. Failure to traverse, clean, and three-dimensionally obturate the canal system is one of the preliminary causes of unsatisfactory treatment [2]. Although diagnosis and treatment planning is vital, a thorough understanding of the architecture and changes inside the root canal is also required for treatment effectiveness [3].

Over the years mandibular first molars have notably the most complicated canal morphology which has been reported by several studies. mandibular first molar has two roots with two mesial canals and one or two distal canals although in 1-15 percent of cases the existence of a middle mesial canal is the most prevalent difference in the internal architecture [4]. The supplemental changes in the canal architecture of mandibular first molars include an isolated root canal in a single root [5], four roots, radix paramolaris , radix entomolaris , middle distal canal, and C-shape canal [6]. According to various studies, the frequency of mandibular first molar with seven canals is highly uncommon [7]. The present case report focuses on the application of CBCT and surgical microscope in holistic management of mandibular molar with seven root canals

Materials and Methods

Case presentation

An adult male aged 35 having no pertinent medical condition visited the dental hospital with discomfort in the bottom left tooth area that had persisted for a week. Despite having had a root canal three days previously, the patient was still in tremendous agony. Root canal treatment was initiated after clinical examination, and a temporary restoration was missing within the access cavity, as well as discomfort on vertical percussion with tooth #36. On radiographic examination first, a mandibular molar with a prepared access cavity and expansion of the prepared periodontal ligament around the mesial root was discovered **(Figure 1a)**. A conventional root canal treatment was scheduled after clinical and radiographic tests indicated symptomatic apical periodontitis [8].

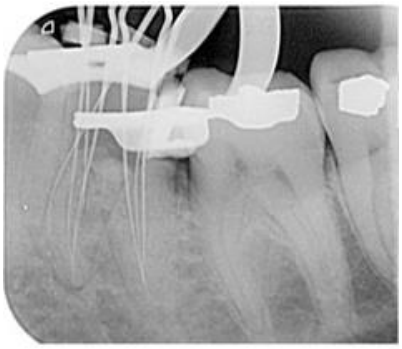
Treatment protocol

The tooth was anesthetized with a 2% lidocaine volume of 1.8ml with 1: 200,000 adrenaline (Xylocaine; Astra Zeneca). Endodontic access was performed under a rubber dam using endo access bur which was further modified with Endo Z bur (Dentsply Tulsa). Four canals were discovered during a clinical examination using the DG-16 endodontic explorer, two in the mesial and two in the distal (Hu-Friedy, Chicago, IL). An isthmus connected the distobuccally (DB) with distolingual (DL) canals, as well as the mesiolingual (ML) with mesiobuccal (MB) canals. Because of the presence of a vast space betwixt the two mesial and distal orifices, the existence of extra canals was suspected [9].

After examining the canals, a ProTaper SX rotary file was used to expand the coronary arteries (Dentsply Maillefer). Third generation apex locator (Root ZX; J. Morita,) was used to estimate the working length electronically and radiographically confirmed later. In an attempt to understand the better anatomy of the canal space numerous radiographs at diverse angles were taken **(Figure 1b)**. In an attempt to validate the tooth's distinctive pattern, CBCT imaging was scheduled. The endodontic cavity was sealed with IRM cement. A CBCT scan (Kodak 9000; Carestream) both coronal and axial revealed the presence of seven canals **(Figures 2a and 2c)**. The Axial CBCT images divulged discrete four canals in the coronal, and middle portions respectively, but in the apical axial image only two canals were evident of mesial canal space, indicating a Sert and Bayirli's Type XIV canal pattern, whereas in the distal canal axial images three different root canals in coronal and middle portions, and apical axial image only one canal were indicating a Sert and Bayirl Type XIV canal pattern [10].

In the second session, the tooth was anesthetized with 2% lignocaine. Using the crown-down method, Hyflex (VDW, Munich, Germany) rotary files were utilized to shape the teeth. The canal was prepared to a taper of 25% in the mesial canal, while that of the distal canal was enlarged to 30%. In between instrumentation, irrigants of saline, 5.25 percent sodium hypochlorite (Prime Dental Product), and 17 percent EDTA (Pulpdent Corporation) were used, with a final irrigant of 2 percent chlorhexidine (Endo-CHX). The canals were obturated with a single cone obturation technique using AH Plus sealer **(Figure 1c)**. The access restoration was subsequently built up with a composite resin core (P60; 3M Dental Products). On follow-up over the 24 months, the patient remained asymptomatic and received a full-coverage porcelain crown [11].

a)



b)

c)

Figure 1. a) Preoperative radiograph, b) working length radiograph, c) Post Obturation

Results and Discussion

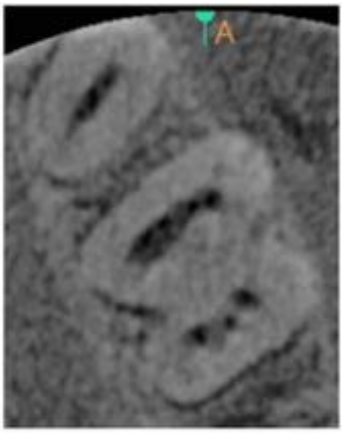
In mandibular first molars, clinicians have a difficult time detecting and treating extra roots or canals. Long term success of endodontic treatment can be achieved by understanding detailed knowledge regarding the most frequent root canal morphology and its variability. If the additional canals are not found and addressed, the treatment outcome may be affected [12].

The most important aspect in a clinical circumstance for the detection of the root canal morphology is using conventional intraoral periapical radiographs and digital radiographs. On the other hand, standard radiography techniques only provide a 2-D image of a 3-D entity. As a result, they're only beneficial in cases when the canals' anatomical arrangement is uncommon. New imaging techniques, like CBCT scanning, have been employed to analyze root canal architecture in three dimensions in recent years. CBCT scanning allows the practitioner to analyze many aspects of the internal anatomy of the roots and its canals at various planes [13] and helps discover a higher number of anatomical anomalies in the canal system when compared to traditional radiography.

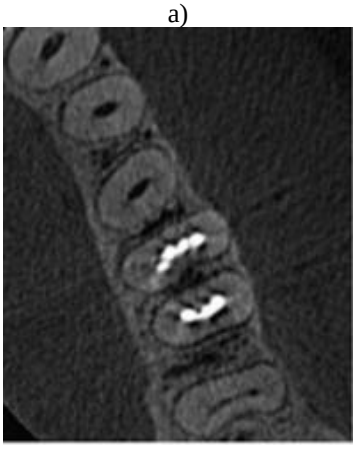
CBCT scanning was employed in this example to provide a better knowledge of the intricate root canal architecture. The mandibular molar with the occurrence of two roots and seven canals in the left mandibular molar was confirmed by

a dental operating microscope and CBCT scan; three canaled distal roots and four canaled mesial roots. Albuquerque and colleagues suggested a taxonomy which is a structurally built appellation that considers the exact position and the root-to-root-canal configurations in the lower molars [14].

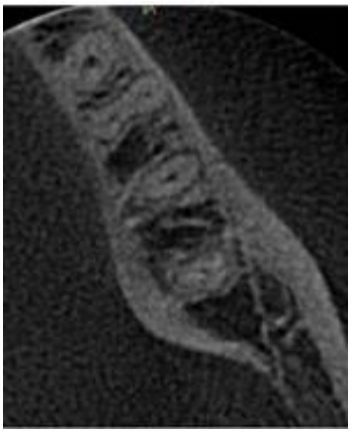
Such complex morphology, according to Peiris [15] is the consequence of secondary dentin deposition, which produces many partitions and culminates in a reticular structure with several vertical canals. According to Mortman and Ahn [16] additional channels in the mesial root are the consequence of instrumentation between the mesiobuccally and mesiolingual canals. According to Navarro [17], canal preparation in the isthmus is acceptable to split the isthmus and allow disinfectants to permeate locations that are difficult to reach with a file if it may result in cleaning and reshaping it without affecting the root structure. Depending on the angulation of the x-ray beam and the tooth location, even a poorly obturated canal can be believed to be satisfactory [18]. As a result, in this case, a post-obturation CBCT scan of coronal and axial was performed to help in the assessment of the root canal filling's integrity **(Figures 2b and 2d)**.



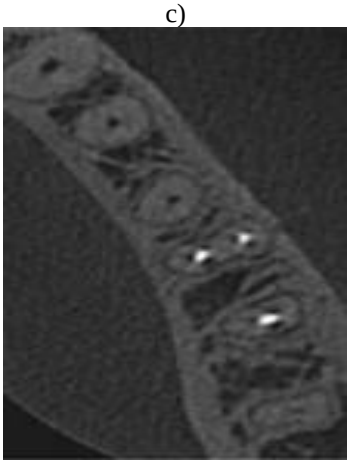
a)



b)



c)



d)

Figure 2. a) Pre-operative Coronal CBCT image showing the presence of seven canals, b) Post-operative Coronal CBCT image showing the presence of seven canals, c) Pre-operative axial CBCT image showing the presence of seven canals, d) Postoperative axial CBCT image showing the presence of seven canal

Conclusion

While performing endodontic therapy, doctors must have a complete awareness of the anatomic variations of the canal system, according to the present case study. Canal multiplicity in mandibular molars is a rare condition. Their recording, on the other hand, may make it simpler to recognize and handle similar conditions in the future if endodontic treatment is required. It also highlights the need for modern diagnostic methods like CBCT imaging and a dental operating microscope in detecting abnormal morphology and assuring endodontic therapy success.

Acknowledgments: The authors are indebted to department of conservative dentistry and endodontics, Krishnadevaraya college of dental sciences for providing with the facilities.

Conflict of interest: None

Financial support: None

Ethics statement: None

References

1. Yang Y, Wu B, Zeng J, Chen M. Classification and morphology of middle mesial canals of mandibular first molars in a southern Chinese subpopulation: a cone-beam computed tomographic study. BMC Oral Health. 2020;20(358):1-10.
2. Madani ZS, Mehraban N, Moudi E, Bijani A. Root and Canal Morphology of Mandibular Molars in a Selected Iranian Population Using Cone-Beam Computed Tomography. Iran Endod J. 2017;12(2):143-8.
3. Pan JY, Parolia A, Chuah SR, Bhatia S, Mutalik S, Pau A. Root canal morphology of permanent teeth in a Malaysian subpopulation using cone-beam computed tomography. BMC Oral Health. 2019;19(14):1-10.
4. Arora A, Acharya SR, Sharma P. Endodontic treatment of a mandibular first molar with 8 canals: A case report. Restore Dent Endod. 2015;40(1):75-8.
5. Shaik I, Bolla N, Dasari B, Bhattacharjee AP. Endodontic management of various canal morphologies in maxillary first molars: a series of four case reports. Front Dent. 2019;16(3):231-8.
6. Sagale AA, Ramugade MM, Ganga R. Endodontic management of mandibular second premolar with type IX canal configuration using cone-beam computed tomography as a diagnostic aid: A rare case report. Contemp Clin Dent. 2018;9(Suppl 1):S180-4.
7. Arora R, Gupta T, Mirdha N, Omer M, Hamza B, Bhagyasree V, et al. A case report on aberrant root canal morphology of mandibular first premolar. Int J Appl Dent Sci. 2019;5(1):17-9.
8. Vineet A, Sonali K, Dhwani B. Rare case of a mandibular first molar with seven canals confirmed by cone-beam computed tomography and its endodontic management. Int J Health Sci. 2018;12(2):91-3.
9. Georgiev K, Pecheva A. Deviant Morphology of the Root Canal System in Mandibular Premolars: Clinical Cases. Folia Med. 2022;64(1):176-80.
10. Mashyakhy M, Hadi FA, Alhazmi HA, Alfaifi RA, Alabsi FS, Bajawi H, et al. Prevalence of missed canals and their association with apical periodontitis in posterior endodontically treated teeth: a CBCT study. Int J Dent. 2021;2021:1-6.
11. do Carmo WD, Verner FS, Aguiar LM, Visconti MA, Ferreira MD, Lacerda MF, et al. Missed canals in endodontically treated maxillary molars of a Brazilian subpopulation: prevalence and association with periapical lesion using cone-beam computed tomography. Clin Oral Investig. 2021;25(4):2317-23.
12. Kiarudi AH, Eghbal MJ, Safi Y, Aghdasi MM, Fazlyab M. The applications of cone-beam computed tomography in endodontics: a review of literature. Iran Endod J. 2015;10(1):16-25.
13. Jabali AH. Middle Mesial and Middle Distal Canals in Mandibular First Molar. J Contemp Dent Pract. 2018;19(2):233-6.
14. Bhargav K, Sirisha K, Jyothi M, Boddeda MR. Endodontic management of contralateral mandibular first molars with six root canals. J Conserv Dent. 2017;20(4):282-5.
15. Peiris HR, Pitakotuwage TN, Takahashi M, Sasaki K, Kanazawa E. Root canal morphology of mandibular permanent molars at different ages. Int Endod J. 2008;41(10):828-35.
16. Mortman RE, Ahn S. Mandibular first molars with three mesial canals. Gen Dent. 2003;51(6):549-51.
17. Navarro LF, Luzi A, Garcia AA, Garcia AH. Third canal in the mesial root of permanent mandibular first molars: Review of literature and presentation of three clinical reports and two in vitro studies. Med Oral Patol Oral Cir Bucal. 2007;12(8):605-9.
18. Bharadwaj VK. Additional root in the mandibular first molar - a rare case report. J Dent Health Oral Disord Ther. 2016;5(4):303-4.