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Research Article

ENDODONTIC MANAGEMENT OF MANDIBULAR FIRST PERMANENT MOLAR WITH FOUR ROOTS- A DISTINCTIVE DIFFERENTIA

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A B S T R A C T

A comprehensive knowledge and understanding of root canal anatomical variations are essential for the best clinical outcome following root canal treatment. The presence of an extra root/ roots in mandibular first molars is an important and challenging morphological variation, which the clinician should be able to recognize, identify and treat accordingly. A mandibular first molar with four roots represents a rare anatomical variant. Its incidence is reported to be between 0.2% and 20%. With the advent of cone beam computed tomography (CBCT) as an adjunctive diagnostic aid, the determination of root canal anatomy in teeth with complex canal configurations has become more precise and accurate. The present case report attempts to discuss effective nonsurgical endodontic management of mandibular first molar tooth with four roots employing CBCT as a supplemental diagnostic tool to the conventional intra oral periapical radiographs.

INTRODUCTION

The main criteria for the success of any non surgical endodontic treatment is complete debridement of the root canal system by thorough shaping and cleaning of the same followed by three dimensional fluid tight seal with a biocompatible inert filling material. Comprehensive knowledge of the root canal anatomy of each tooth is crucial in order to effectively reach this goal. Endodontic failure may be associated with the persistent infection due to missed canal or inefficient removal of microorganisms and necrotic pulpal and tissue remnants during chemo-mechanical instrumentation. [1] Success rate of endodontically treated teeth has been reported to be 87.79% and is still lower for mandibular first molars reaching around 81.48%. Various reasons have been described in the literature for failure of endodontic treatment. One of the most frequent cause being inability to locate and identify extra roots or canals. It has been reported that the incidence of missed roots or canals among the teeth requiring retreatment was as high as 42%. [2] Mandibular permanent first molar often pose clinical challenges due to its unpredictable anatomic variation regarding the number of roots and root canals. In case of mandibular permanent first molar, 86% of missed canals are found in the distal root and 14% in the mesial root.[3] The most common root canal morphology of mandibular first molars typically have two roots one mesial and one distal with three canals. But various studies have revealed that sometimes they have one or two additional root or roots.

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An additional third root, first mentioned in the literature by Carabelli is denominated as radix entomolaris. This supernumerary root is located distolingually in mandibular molars, mainly first molars. Additional root at the mesio‑buccal side is denominated as radix paramolaris. But sometimes even four rooted mandibular molar is also encountered in the clinical practice which is hardly mentioned in the literature due to its rare occurrence.[4]

Various studies indicate that the occurrence of accessory mesial roots in mandibular molar teeth, commonly in the 1st molar, ranges from about 0.2% to over 20%. So It is important that aberrant anatomy is identified prior to or at least during root canal treatment for predictable treatment result. [5]

Conventional intraoral periapical radiograph is an important diagnostic imaging technique in endodontic field which aids in the assessment of the root canal morphology. They are used for preoperative, intra-operative, postoperative assessment and follow-up. The angled radiographs, 20° from mesial and 20° from distal, may reveal the basic information on the tooth's external and internal anatomy that is required for endodontic treatment. But it has got its own limitations as conventional IOPA depicts three dimensional object two dimensionally. So, there are chances of superimposition of the important anatomical structures which limits its use as diagnostic tool. This restricts its significance in cases with complex root canal morphology.[6,7]

The revolutionary introduction of Cone Beam Computed Tomography (CBCT) in all fields of dentistry is unprecedented as it has created a true paradigm shift from a conventional 2D approach to a 3D understanding. Cone ‑beam computed

tomography (CBCT) can be used to aid in the confirmatory diagnosis of root canal morphology as it provides three dimensional representation and true spatial relationship with the adjacent anatomical structures. According to Matherne *et al*, CBCT allows better identification of supernumerary root canal systems than digital images.[7]

Till date, there are very few case reports available which provides detailed endodontic management of mandibular first molar with four roots which are diagnosed and confirmed with cone beam computed tomography [CBCT]. So, the purpose of this paper is to report the successful nonsurgical endodontic treatment of a four rooted permanent mandibular first molar, which is a rare anatomic configuration with each root containing its own independent root canal.

Case Report

A male patient, aged 13 years reported to the Department of Pedodontics and Preventive Dentistry, with a chief complaint of pain in the lower left posterior teeth region since two months. Family and medical history were non contributory. Dental history revealed patient had pain on having hot food substances that was relieved on having cold water and the pain was aggravated on lying down. Patient also said that root canal treatment was initiated at the lower back posterior teeth region few days back. At the time of reporting patient was asymptomatic.

On intraoral examination it was noticed that root canal treatment was initiated in 36. On clinical examination, the tooth was mild tender on percussion.

The pre-operative intra-oral periapical radiograph revealed that carious lesion was involving the pulp with no periapical pathology and the clinical condition was diagnosed as asymptomatic irreversible pulpitis with symptomatic apical periodontitis and completion of root canal treatment in single appointment was advised.

The radiograph also revealed double periodontal ligament space on distal side and a bulky mesial root suggesting possibility of presence of extra roots [Figure:1].

Figure 1

For confirmation of the same the patient was advised for CBCT examination and analysis. CBCT images were obtained in transverse, sagittal and axial sections. Thus CBCT data and their three dimensional reconstruction images confirmed presence of four roots: two individual distal root and one bulky mesial root with bifurcation at the apical third indicating there are total four roots and each with one canal. The disto-lingual root was a short conical root with distal orientation. So, this root can be considered as a radix entomolaris. [Figure: 2 & Figure : 3]. CBCT scan slices revealed four individual canal orifices at coronal third as well as at apical third. [Figure : 4 & Figure : 5]

The patient was anesthetized by left inferior alveolar nerve block using 2% solution of lignocaine hydrochloride containing 1: 80,000 adrenaline [LIGNOX 2% A, Warren, Indoco Remedies LTD, Mumbai]

Access cavity preparation was modified using Endo-access bur no :1 and Endo Z bur. All the four canal orifices [mesiobuccal, mesiolingual, distobuccal and distolingual] were explored using a DG16 endodontic explorer and negotiated with 15 size K-file (Mani Inc, Tokoyo, Japan). Two mesial canal orifices were widely placed bucco-lingually indicating that they reside in two different roots. [Figure : 6] Working length was determined for all the canals using electronic apex locator (Root ZX, Morita company, Tokyo, Japan) and it was confirmed using intraoral periapical radiograph.

Root canal instrumentation was performed using a crown down technique with rotary ProTaper files [Dentsply Maillefer, Switzerland]. The canals were prepared to a master apical size of F2 in DB and DL canals and F1 in MB and ML canals.

Canal disinfection was performed using 2 ml of 2.5% sodium hypochlorite after each instrumentation. At the end of the completion of root canal preparation canal was rinsed with 17% EDTA followed by profuse irrigation with saline. The last irrigant used was 2% chlorhexidine. The canals were properly dried with absorbent paper points and obturated with gutta-percha and AH plus sealer (Dentsply-DeTrey, Switzerland). Access cavity restoration was done with high strength Glass Ionomer cement. Patient was asymptomatic during the subsequent follow-up period and full coverage stainless steel crown was given as post endodontic restoration [Figure : 7].

DISCUSSION

Endodontic triad consists of an ideal access cavity preparation which includes identification and location of all the root canals followed by their complete shaping, cleaning and subsequent obturation. Treatment of multi- rooted teeth is even more challenging due to the varied morphological presentations associated with their root canal system.

Knowledge of root canal anatomy and morphology has profound influence on the success rate of non-surgical endodontic treatment. The incidence of missed roots and root canals in endodontically treated teeth has been studied vividly and it was reported as high as 42%.[2] This high percentage indicates that the variability in intra- and extra-radicular anatomy is the rule rather than the exception. Due to these morphological complexities, it is of utmost importance for the clinician to study the root morphology of each case in specific and accurate manner. The clinician must have comprehensive knowledge of root canal anatomy, configuration and their common variations from the norm to treat any teeth effectively and successfully.

The root canal morphology in mandibular molars is variable and complex. The presence of extra roots in mandibular first molars has clinical implications in endodontic treatment. The identification of this additional root / roots avoids missing a canal, which could lead to future treatment failure and complications. The major variant in this type of tooth is the presence of an additional third root; a supernumerary distolingual root called radix entomolaris. Its prevalence varies in different populations ranging from 3% of the African population to more than 30% of the Mongoloid population. [9] An extremely rare variation is presence of an additional mesiobuccal root which is known as radix paramolaris. The morphology of the mesial root also in mandibular molars may pose a complex pattern by the presence of an accessory or supernumerary roots.[4]

Interestingly, some controversial opinions do exist with regard to the application of the term accessory or extra roots. In 1971, De Souza-Freitas *et al* [10] studied the anatomical variations of mandibular first molar roots in two ethnic groups, and commented that disto-lingual roots are the real supplementary roots, and they did not consider the mesial root bifurcation as a third root, even though many authors defined this mesial root bifurcation as extra root.

Onda *et al* studied shape and number of roots in mandibular molar teeth extracted from Indian skulls and suggested that all root bifurcations that have their own root canals defined as extra roots which can then be classified according to their level of bifurcation (apical, middle or cervical) and whether they are separated or fused. As such, the extracted tooth sample in that particular study was classified as three-rooted mandibular molar tooth with well separated, double mesial roots in which the level of bifurcation was at the apical third.[11.12]

The four-root configuration has an incidence of 0.04% in the mandibular first molar, with very few case reports available till now. A review on the literature indicates that the occasion of accessory mesial roots in mandibular molar teeth, commonly in the first molar, ranges from about 0.2% to over 20% depending on ethnicity. In addition, this anatomical variant has also been reported in patients with Turner syndrome.[11]

Development of an extra root usually occurs either by splitting of the Hertwig's epithelial root sheath (HERS) to form two similar or by folding of the HERS to form an independent root. The splitting or folding of the HERS results in the formation of a bifurcation or trifurcation area. [5]

Identifying the complex root canal anatomies and additional roots is critical for effective treatment outcome. Conventional intraoral periapical radiographs are routinely employed to evaluate the root canal anatomy. But due to the inherent limitations associated with this technique they are not very reliable in the assessment of complex root canal morphologies. Therefore it is always better to obtain additional information if any with the help of advanced imaging techniques like CBCT. CBCT is a contemporary, three-dimensional, diagnostic imaging system designed specifically for use on the maxillofacial region. . It uses a cone-shaped beam of radiation to acquire a volume in a single 360- degree rotation. CBCT can be used as an important aid to detect, locate, negotiate and treat the entire root canal system precisely and effectively. Root morphology can be visualized in three dimension depicting their exact spatial relationship.

CBCT scanning is a non-invasive method that provides for axial and cross-sectional observation of each tooth and makes it easier to diagnose additional roots. So in this case CBCT analysis was done to verify the presence of additional roots and the same was confirmed also by the images and data obtained by CBCT.

CBCT imaging provides additional information for diagnosis and therefore enables a more predictable management of complex endodontic conditions compared with intraoral radiographs alone. It also offers the advantage of obtaining a large amount of data within a short span of time and radiation exposure is less compared to spiral CT scan. [8]

This article highlights the diagnostic importance of CBCT and effective endodontic management of an uncommon four-rooted mandibular first molar with two mesial roots containing independent canal, a distobuccal root and one radix entomolaris.

CONCLUSION

This case report attempted to present the successful non surgical endodontic management of unusual root canal morphology of a four -rooted mandibular first molar with four canals confirmed by CBCT. Although it is a very rare condition still the presence of a supernumerary third and fourth root in mandibular first molars is an important anatomic variation, which pose challenging task to the clinicians. The use of CBCT enables accurate assessment of the canal anatomy thereby making endodontic diagnosis and treatment planning more predictable. So, it can be used as supplemental diagnostic aid to gain accurate information regarding the root canal system which is not possible to get from conventional techniques.

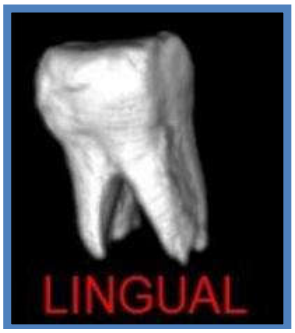

Figure 2

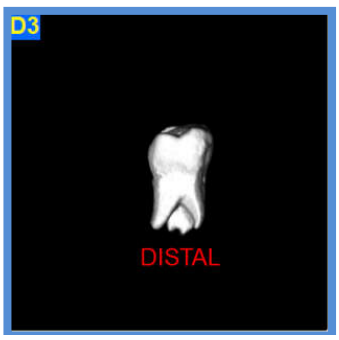

Figure 3

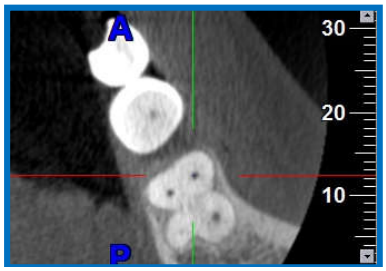

Figure 4

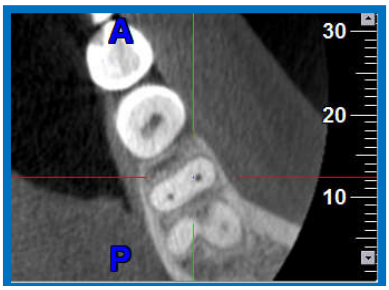

Figure 5

Figure 6

Figure 7

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