International Journal of Research and Review
DOI: https://doi.org/10.52403/ijrr.20210619
Vol.8; Issue: 6; June 2021
Website: www.ijrrjournal.com
Case Report *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Role of Comprehensive Diagnostic, Imaging and Treatment Strategies in Endodontic Retreatment of a Maxillary Molar with Unusual Anatomy: A Case Report

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ABSTRACT

An appreciation of the anatomic complexity of the root canal system is essential at every step of endodontic treatment. Endodontic treatment of teeth with unusual root canal anatomy presents a unique challenge. This clinical case report presents the application of cone beam computed tomography as a useful imaging technique in endodontics for the management of teeth with aberrant anatomy. Failure to detect an extra canal may lead to treatment failure. The current report presents the management of a previously endodontically treated maxillary first molar with missed additional mesiobuccal and distobuccal canals.

Keywords: CBCT, Canal Morphology, Maxillary molar, Missed canal, Retreatment

INTRODUCTION

Wide range of variation within the literature has been reported with reference to frequency of occurrence of the number of canals, number of roots and incidence of fusion of canals as well as roots.[1] Morphology of root canal systems varies significantly in different races and in different individuals within the same population.[2]The anatomical complexities of the root canal system have always been considered as one of the challenges for endodontists and researchers. Despite following all procedural protocols, missing a canal or an extra root may lead to treatment failure.[3] Various studies have demonstrated considerable variation in human permanent maxillary molar anatomy. The most common form of the permanent maxillary first molar has three roots and four canals with majority of the mesiobuccal roots having two canals while distobuccal and palatal roots having a single canal.[4] The mesiobuccal root of the first maxillary molar has generated more research and clinical investigation than any other root. In a review, Cleghorn *et al.* found that incidence of two or more canals in distobuccal root was1.7%.[5] The clinician's experience along with the use of technological enhancements such as the dental operating microscope and cone-beam computed tomographic (CBCT) imaging are helpful in avoiding missed canals.[6]

The current report presents the management of a previously endodontically treated maxillary first molar with missed additional mesiobuccal and distobuccal canals.

CASE REPORT

A 23-year-old male patient complained of dislodged restoration and pain on chewing with respect to one of the maxillary molars. Clinical examination in the concerned region revealed dislodged

restoration wrt tooth 26 while being tender to percussion. Pulp sensibility test revealed negative response. Preoperative IOPA radiograph suggested root canal opacity indicating previous endodontic treatment. However, the diagnostic radiograph pointed towards the presence of variant anatomy in the form of untreated additional canals thus leading to apical periodontitis [Fig 1(A,B)]. The patient was informed and non-surgical retreatment was planned for treatment of secondary apical periodontitis wrt 26.

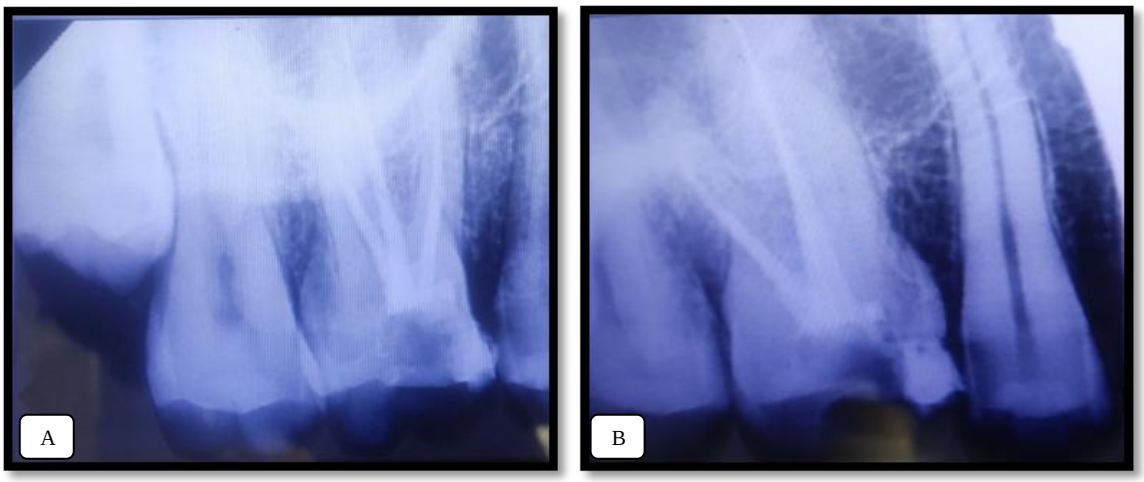

Fig 1(A,B): Preoperative IOPA with different angulation showing missed canal

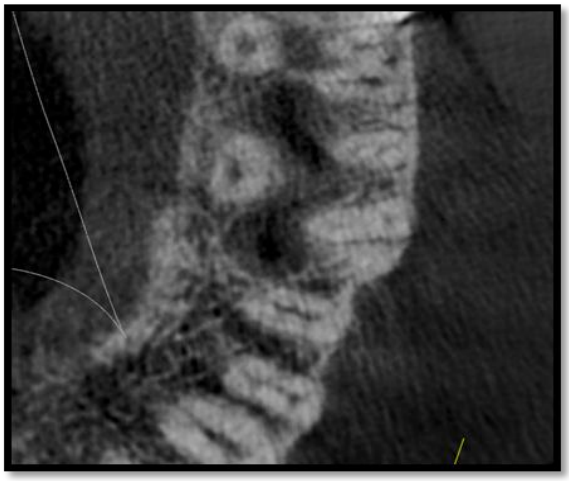

Fig 2: CBCT scan showing additional canals in mesiobuccal and distobuccal roots

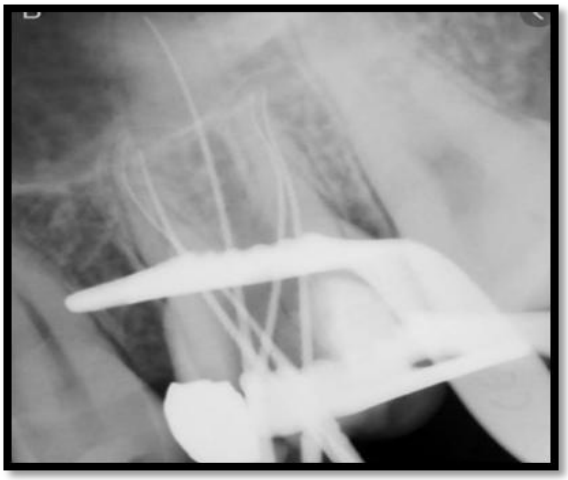

Fig 4: Working length determination

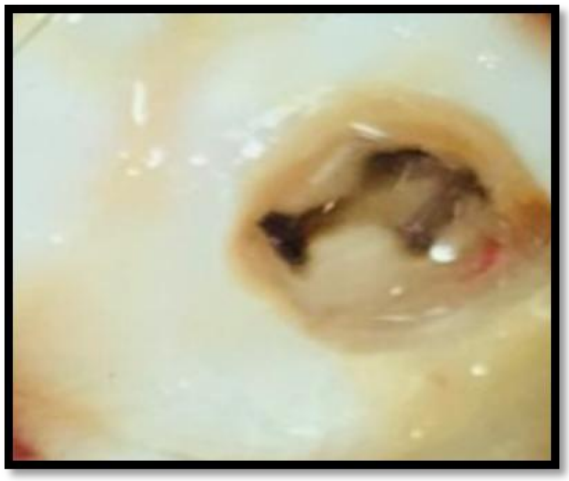

Fig 3: Modification of access cavity to locate additional canals

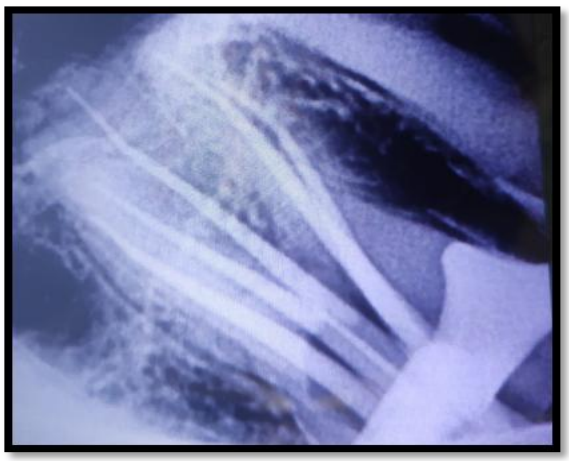

Fig 5: Master gutta percha conesin all five canals

Fig 6: Obturation and post endodontic restoration

The endodontic therapy was initiated after achieving regional anesthesia with 2% lidocaine with 1:100,000 epinephrine followed by rubber dam application. Old gutta-percha filling was removed using retreatment files (Mani, Inc., Japan) and a localized volume CBCT scan was done to aid in detailed understanding of pulp chamber anatomy, root canal orifice and anatomy. The axial sections revealed the presence of 2 mesiobuccal, 2 distobuccal and a palatal canal [Fig 2]. Based on tomographic evaluation the access cavity was ultrasonically modified under X3 magnification to search and locate previously missed additional mesiobuccal and distobuccal canals using DG16 explorer. The additional canals were patented and working length was confirmed using apex locator (Canal Pro AL, Coltene Whaledent) and radiographs [Fig 3, 4]. The canals were shaped and cleaned using ProTaper Gold rotary file system till size F1 inMB1, MB2, DB1, DB2 canals and F3 in palatal canal along with intermittent irrigation with 5.25% NaOCl and 17% EDTA followed by 2% chlorhexidine as final flush. The canals were dried with the help of absorbent paper points and then obturated with matched taper gutta percha cones of the corresponding size and AH Plus sealer [Fig 5]. The taper of palatal canal was wide and required accessory cones for complete obturation using lateral compaction technique. Post endodontic restoration was done using resin composite restorative material (Filtek Z350, 3M ESPE) [Fig 6]. On recall appointment, patient was asymptomatic and a follow up radiograph was taken.

DISCUSSION

Suspecting, detecting and locating unusual variant endodontic anatomy can be a difficult and time consuming task specially during retreatments but, failure to explore and instrument even one of the canals results in improper cleaning of root canal system and can lead to failure of endodontic treatment.[7] Sudden change in radiographic density and sudden narrowing of root canal space usually indicates an additional canal.[8] The of Krasner and Rankow highlight some useful general anatomical landmarks that may help for locating the orifices.[9] The presence of an eccentric orifice, other than in its normal location leads to the suspicion of the presence of an extra canal.[10] Precise inspection of root canal configuration can be done through discrete diagnostic methodologies such as magnifying loupes, dental microscope, judicious interpretation of angled radiographs and auxiliary diagnostic aids like CBCT.

Compared to 2-D radiographs, CBCT permits a more accurate diagnosis of the aberrant root canals with accurate identifications and measurements by slicing of images in multiple planes which otherwise may not be easily identifiable with conventional radiographs even if taken at different angulations. Also, the cone beam technique provides amultiplanar scan of the concerned area assuring that no anatomic detail is missed which is otherwise quite frequent with conventional radiographic technique.[11]

Modification of the access cavity design is also necessary in order to locate additional canals. Ultrasonic troughing around the potential location of canal loosen up the dentin overhang and opens up the orifice. Micro-openers, DG16 & JW-17 are some of the recommended tools which may

locate a potential catch suggesting of an orifice location. In addition, magnification via loupes or dental operating microscope definitely increases the frequency of locating additional canals and thus, the successful outcome of the root canal therapy.[11]

According to study by Prasad AC *et al.* advanced imaging techniques such as CBCT resulted in increased detection (68%) of MB2 canals. This is because of the ability of CBCT to produce multiple slices at a higher resolution in axial view. The orifice which might not be detected clinically during ultrasonic troughing and tactile probing would be visible in an axial section of CBCT.[12]

This case report presents and highlights the use of multiple diagnostic aides in endodontic retreatment of a previously treated maxillary first molar with five canals. In the present case type IV Vertucci canal configuration was observed in mesiobuccal and distobuccal roots while the palatal root presented with type V anatomy. According to a study by Neelkantan *et al*., the most common canal morphology in the mesiobuccal roots of three-rooted first and second molars in the Indian population was type I (51.8% and 62%, respectively), followed by type IV (38.6% and 50%, respectively). The distobuccal and palatal roots of first and second molars showed predominantly type I canal morphology.[13] Kim et al. studied maxillary first and second molars from Korean patients of Mongoloid origin by using in vivo CBCT methods and reported additional canals in 63.59% and 1.25% of the MB and DB roots of first molars, respectively.[14] Careful location and negotiation of the canals should be carried out for successful treatment. This case highlights the utmost importance of CBCT as an important imaging approach in negotiating the complex root canal anatomy of a maxillary molar during nonsurgical retreatment endodontic therapy.

CONCLUSION

Failure to detect and treat a missed canal is an important cause for failure of endodontic treatment. The knowledge, awareness and understanding of the presence of unusual canal morphology during diagnosis and treatment phase can contribute largely to a successful outcome of the treatment.[15]

Acknowledgement: None

Conflict of Interest: None

Source of Funding: None

Declaration of Patient Consent

Appropriate patient consent was taken prior to publication in the journal.

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How to cite this article: Ahuja K, Gupta S, Nikhil V et.al. Role of comprehensive diagnostic, imaging and treatment strategies in endodontic retreatment of a maxillary molar with unusual anatomy: a case report. *International Journal of Research and Review*. 2021; 8(6): 155-159. DOI: *https://doi.org/10.52403/ijrr.20210619*

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