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Endodontic treatment of the molars with varying root canal anatomy: A report of 2 cases

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Abstract

Introduction The purpose of this article is to show the importance of the knowledge of the anatomy of root canals. Unusual root and root canal morphologies are associated both with maxillary and mandibular molars. Their endodontic treatment can often cause difficulties. Awareness and understanding of such unusual roots, and canal morphology, are factors that can affect the outcome of root canal treatment.

Methods In these case reports, two cases are presented involving the root canal treatment of maxillary second molar and mandibular first molar with unusual morphologic configurations of the root canals.

Results: During root canal treatment, the maxillary second molar had two buccal roots and two palatal roots. Second maxillary molar with two palatal roots is not frequent. In the second case, mandibular first molar was diagnosed with an additional disto lingual root which is called as radix entomolaris and in Indian population its incidence is less than 5%. After mechanical instrumentation, the canals were obturated. Radiologic and clinical re-evaluation showed no signs of inflammation

Conclusions: These reports describes and discusses the possibility of different root and canal variations of the molars from a clinical point of view. Anatomic variations can occur in any tooth. Therefore, careful examination of radiographs and internal anatomy of teeth is essential.

Keywords: Radix Entomolaris(RE)

Introduction

The main objective of root canal treatment is the thorough mechanical and chemical cleansing of the entire pulp cavity and its complete obturation with an

inert material and a coronal filling preventing ingress of microorganisms. Setting up sufficient access for cleaning and shaping is a basic and essential part of this process. Gaining these goals, the clinician is supposed to have integral knowledge of the root canal anatomy, and its anatomic varieties, including additional roots, extra canals, webs, fins, and isthmuses that may complicate the endodontic procedure. The clinician must also be prepared to identify those teeth that tend to vary greatly from the norm. Hoen and Pink found that in teeth that needed re-treatment the incidence of missed roots or canals was 42%. The hard tissue repository of human dental pulp takes on numerous configurations and shapes. Human permanent molars exhibit a varied anatomy. Thus, a clear understanding of the root canal anatomy of the human dentition and its variations is a prerequisite for successful endodontic procedures. The presence of two palatal roots in the maxillary molars, particularly in the second molars, is a rare phenomenon. Al Shalabi et al. Green , and Vertucci did not notice any maxillary second molars with two palatal root canals in their respective studies. Libfeld and Rotstein reported a 0.4% incidence of four rooted maxillary second molars among 1200 teeth studied. Also, anatomical variations are an acknowledged characteristic of mandibular permanent molars. Permanent mandibular first molars usually have 2 roots placed mesially and distally and 3 root canals, but variations in the number of roots and in canal morphology are not uncommon. The presence of a third root in the permanent first molar is the major variant in this group. Radix entomolaris (RE), first described by Carabelli, is an anatomical variant found in the permanent mandibular first molar. Radix entomolaris (RE) is characterized by the presence of additional third root (i.e. the supernumerary root or extra distal root), which is typically distributed lingually. This extra distolingual root is generally smaller than the distobuccal root and is usually curved. RE has not been reported for the mandibular second molar, but it is found (rarely) in the mandibular third molar.[9,10] The prevalence of a supernumerary root in mandibular molars varies based on race. The maximum frequency occurs in African populations and is 3%, however, in Eurasian and Indian populations it is less than 5%. Based on studies in populations with Mongoloid traits (such as the Chinese, Eskimo and American Indian), radix entomolaris occurs with a frequency that ranges from 5% to more than 30%. Although both macrostructures are rare conditions, the knowledge on its occurrence is important. This paper describes the endodontic management of two cases, the first case report is about the unusual variation in root and canal morphology of four-rooted maxillary second molar with two buccal and two palatal canals and the second case report is about the detection and management of radix entomolaris (RE) in a mandibular first molar during its root canal treatment.

Case report 1

A 32-year-old male patient was referred to the department Conservative Dentistry and Endodontics of Himachal Dental College and Hospital, Sundernagar with pain in maxillary right second molar i.e. 17, since a week. The pain aggravated on taking cold and hot food items. His medical history was non-contributory. Clinical examination of 17 revealed deep occlusal carious lesion(figure 1A). The periodontal examination of 17 was within the normal limits. Thermal and electric pulp test on 17 showed intense and prolonged response. Intraoral periapical radiographic examination of 17 revealed deep caries approximating the pulp space and slight widening of the periodontal ligament space.

The tooth was diagnosed with irreversible pulpitis. The root canal therapy was planned and the patient consent was taken.

After administration of local anesthesia using 2% lidocaine with 1:80,000 epinephrine and rubber dam isolation, tooth # 17 was accessed. Three distinct canal orifices were located ie. mesiobuccal, distobuccal and a palatal canal using magnification loupes. While doing the access opening a pin point haemorrhagic point was seen just adjacent to the main palatal canal orifice, which was the orifice of extra palatal root canal. The canals were then negotiated by using a K-Flex file ISO 15 (Dentsply Malliefer). The working length was determined by a Root ZX apex locator and later confirmed by parallel periapical radiograph(figure 1B).

After debriding pulp tissues, Gates Glidden drills (Dentsply, Maillefer) were used in a crown down fashion to enlarge the orifices with a brushing motion, and the canals were shaped with ProTaper Nickel-titanium rotary instruments (Dentsply, Maillefer) under copious irrigation with 2.5% sodium hypochlorite and lubrication with RC-Prep. After drying the canals with paper points, the master gutta percha points were fitted within the canals and a confirmation radiograph was taken(figure 1C). The root canal system was obturated with cold lateral compaction of guttapercha with accessory points and AH26 sealer(figure 1D). The access cavity was filled with composite resorative material. After a recall period of 2 weeks, the patient was asymptomaic.

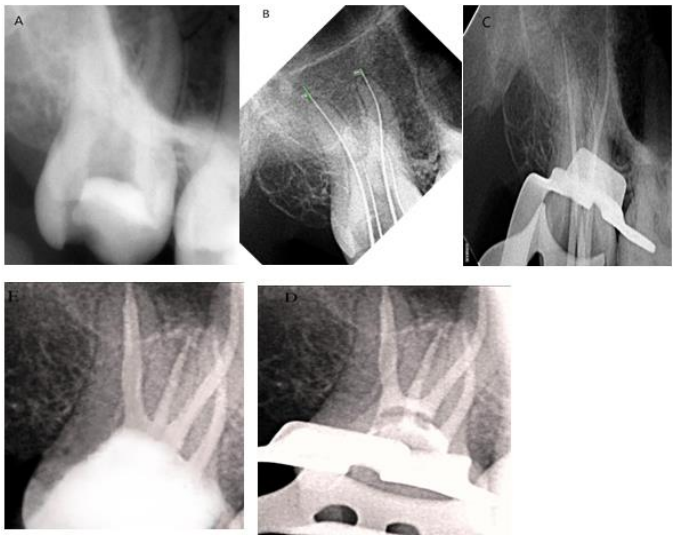

Figure 1: (A) preoperative radiograph of #17 showing carious involvement of pulp. (B) working length determination (C) Emphasizing working length by gutta percha cone. (D)final obturation**.** (E) follow up radiograph

Case report 2

A 27-year-old female patient reported to the Department of Conservative Dentistry and Endodontics of Himachal Dental College and Hospital, Sundernagar with a chief complaint of severe pain in the right lower back tooth region since last five days. The pain was intermittent in nature and aggravated on taking hot food and beverages, and lasted for 2–3 hours. Her medical history was non contributory. Clinical examination of 46 revealed deep occlusal carious lesion(figure 2A) and it was tender to both percussion and apical palpation. The periodontal examination of 46 was within the normal limits. Thermal and electric pulp test on 46 showed intense and prolonged response.

Apart from this, close inspection of the radiograph also revealed the presence of an additional periodontal ligament space crossing over the distal root leading to an impression of double periodontal ligament space on the distal aspect. This led to the suspicion of additional or

extra root entity. Another radiograph was taken at 30^0 mesial and distal angulation to confirm the same. Based on the clinical and radiographic examination, a diagnosis of symptomatic irreversible pulpitis with acute apical periodontitis in 46 was made and the patient was suggested to undergo root canal treatment.

Isolation with rubber dam was done. Access cavity preparation was done under local anesthesia with an endo access bur (Dentsply, Switzerland). The first distal canal was located towards the buccal side indicating the presence of one additional canal on the lingual side.

The shape of the access cavity was modified from triangular to a trapezoidal form to locate the fourth canal. DG-16 endodontic explorer was used to locate the root canal orifices and 15 # K-file (Mani, Japan) was used to establish patency of the canals. Working length was determined using apex locator (Root ZX, J. Morita) and reconfirmed radiographically(figure 2B). Biomechanical preparation was done with rotary ProTaper Next (Dentsply, Switzerland) file system. During instrumentation, 2.5% sodium hypochlorite was used as an irrigant and 17% EDTA was used as final flush. The master cone radiograph was taken(figure 3C). Obturation was performed with gutta-percha points using cold lateral condensation technique using AH plus sealer. Restoration of access cavity was done with composite resin (tetric-N-ceram, ivoclar vivadent) and a post-obturation radiograph was taken(figure 2D) . At 6-month follow-up, the patient was asymptomatic and radiographic evaluation showed no evidence of pathology(figure 2E).

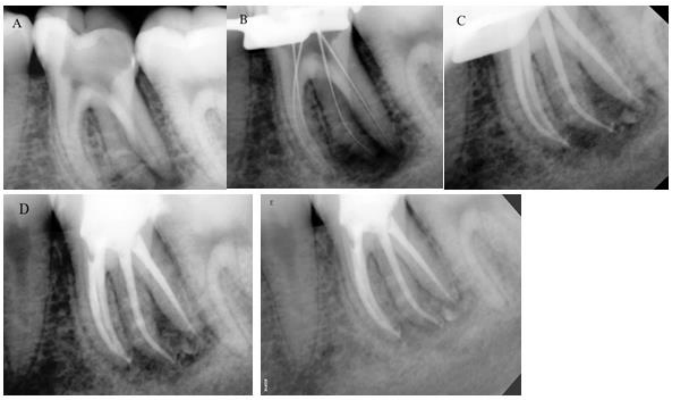

Figure 2 : (A) Preoperative radiograph of 46 depicting the additional distal root and possibility of RE. (B) Working length radiograph of 46 revealing the existence of RE. (C) Master cone radiograph of 46. (D) Post obturation radiograph of 46 showing the RE. (E) 6 month follow up radiograph.

Discussion

Clinical triad of diagnosis, adequate chemomechanical preparation, and three-dimensional obturation determine the success of root canal therapy. The first stage of endodontic triad, i.e., correct diagnosis is one of the most important steps towards the success of the endodontic procedure. One of the main reasons for the failure of root canal treatment is negligence in removing pulpal tissue and microbes from all the pulp canals. Hence, appropriate radiographic diagnosis play a crucial role in the successful outcome of endodontic therapy. So, radiographs are taken at different angulations to minimize the chances of “missed canals”. Radix entomolaris has a prevalence rate of less than 5% in the Indian population and such cases are not commonly observed during dental treatment. The etiology behind the formation of the RE is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of

absence). In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in the more pronounced phenotypic manifestation. Curzon suggested that the 'three-rooted molar' trait has a high degree of genetic penetrance as its dominance was reflected in the fact that the prevalence of the trait was similar in both pure Eskimo and Eskimo/Caucasian mixes. Bilateral occurrence of the RE has also been reported from 50 to 67%. According to the classification of De Moor et al based on the curvature of the separate RE variants in buccolingual orientation, three types can be identified.

TYPE I	A straight root/root canal
TYPE II	An initially curved entrance which continues as a straight root/root canal
TYPE III	An initial curve in the coronal third of the root canal and a second curve beginning in the middle and continuing to the apical third.

The number of roots in maxillary molars can also vary. Libfeld and Rotstein examined 1200 molars and found a 0.4% incidence of maxillary molars with four roots. Christie et al reported 14 maxillary second molars with two palatal roots found during 40 years of daily clinical practice. They classified maxillary molars according to the shape and root separation as types I, II and III.

TYPE I	Maxillary molars have two widely diverge palatal roots, which often long and tortuous.
TYPE II	There are four separate roots, but the roots often are shorter, run parallel, have buccal and lingual root morphology, and have blunt root apices
TYPE III	Type III are constricted in root morphology with the mesiobuccal, mesiopalatal, and distopalatal canals engaged in a web of root dentin. The distobuccal root in these cases seems to stand alone and may even diverge to the distobuccal.

Initial radiographic interpretation of the second maxillary molar root anatomy may be more complicated because of superimposition of roots on each other or adjacent bony structures. Clinicians encounter a dilemma when additional abnormality presents in the area. Thorough knowledge of anatomical variations and frequent anomalies in the region besides multiple radiographs with different angles or cone-beam computed tomography (CBCT) can be helpful. , Meticulous exploration of the developmental groove in the pulp chamber floor is suggested in order to locate canals' orifices; moreover, any dentin projection which could cover existing orifice should be removed carefully . Also, a more mesiodistally extended access may be considered in order to find canal orifices.

Conclusion

Radix entomolaris and maxillary molars with two palatal roots has been reported to occur with a frequency of 0.2–32% and 0.4% respectively in different populations. It is crucial to ascertain the exact nature/characteristic of such root canal anatomies in terms of curvature and conformation to carry out a proper treatment. Therefore, such cases require judicial application of diagnostic tools and endodontic skills for their management. Careful interpretation of the radiograph, using different horizontal cone projections and advanced tools such as CBCT, may facilitate their

recognition. Once diagnosed, management of the extra canal and root can be done using equipments such as magnification aids, orifice locators and flexible files.

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