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RESEARCH ARTICLE

RADIX ENTOMOLARIS: AN UNUSUAL ANATOMY WITH MANDIBULAR 1ST, 2ND AND 3RD MOLAR A REPORT OF THREE CASES

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ABSTRACT

Thorough knowledge of internal and external root canal morphology contribute to the successful root canal treatment. A mandibular molar having Radix Entomolaris (Additional lingual root) and Radix Paramolaris (Additional Buccal root) with two distal roots is an interesting example of anatomic variation. This paper describes 3 cases of each of mandibular 1st, 2nd and 3d molar with radix entomolaris.

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INTRODUCTION

Good knowledge of tooth anatomy is fundamental to the success of root canal treatment. Incomplete instrumentation, inadequate cleaning and shaping, and the subsequent incomplete obturation of the root canal system are the main causes of endodontic treatment failure (Hartwell, 1982). A successful endodontic treatment includes locating the root canal orifice, chemo-mechanical shaping and cleaning of the root canals before a 3 dimensional root canal filling (Al Nazhan, 1999). Anatomical variations have been described in the mandibular first molar such as the number of roots and root canals may also vary. An additional third root, which was first mentioned in the literature by Carabelli, is called the radix entomolaris (RE).

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This supernumerary root is located distolingually in mandibular molars, predominantly in first molars. An additional root at the mesiobuccal side is called the radix paramolaris (RP) (Calberson, 2007). Carlsen and Alexanderson have classified the RE into four types according to its cervical part: type A and type B, distally located cervical part of RE with two normal mesial and one normal distal component, respectively; type C, mesially located cervical part; and type AC, central location, between distal and mesial root components (Carlsen, 1990). De Moor el al[5]classified the RE into three types according to buccolingual variations: type I, straight root/root canal; type II, initially curved entrance that continues as a straight root/root canal; type III, initial curve in the coronal third and a second curve beginning in the middle and continuing to the apical third. The occurrence of a separate RE in the first mandibular molar is associated with certain ethnic groups and is as follows: Africans, 3%; Eurasians/Indians, <5%; East Asians, South East Asians and people of the Arctic region of North America, 5 to 30%; Caucasians, 4.2% and among German dental school patient

populations the occurrence of three-rooted mandibular first molars was found to be rare with an overall incidence of 1.35% (Loh, 1990). In a study using periapical radiographic methods, Tu *et al*[7] investigated the occurrence of three-rooted mandibular first molars in a Taiwanese population and found that21.09% of the patients examined had an extra distolingual root that could affect endodontic procedures.[8]The present case report discusses the endodontic retreatment of a type I RE (according to De Moor) in a mandibular first, second as well as third molar.

Case No 1: A 32-year-old female patient reported with pain in right mandibular first molar i.e. 46, since a week. The pain aggravated on taking cold and hot food items and upon mastication. Her medical history was non-contributory. Clinical examination of 46 revealed deep occlusal carious lesion and it was tender to percussion. The periodontal examination of 46 was within the normal limits. Thermal and electric pulp test on 46 showed intense and prolonged response. Intraoral periapical radiographic examination of 46 revealed deep caries approximating the pulp space and slight widening of the periodontal ligament space around the apical area of the mesial root. 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 (Fig 2a). 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. Root canal treatment in 46 was initiated under rubber dam, following local anaesthesia and access opening in it. Careful exploration of the pulp chamber floor revealed five canal orifices (2 mesial & 3 distal) as seen in (Fig 2b), confirming the presence of additional distal canal. The pulpal tissue remnants were extirpated from the canals using K file no.10 & no.15 (DentsplyMaillefer, Switzerland).

Coronal flaring was accomplished with Gates Glidden drills (DentsplyMaillefer, Switzerland). Working length was determined using an apex locator (Root ZX, Morita, Tokyo, Japan). The radiograph was taken with a mesial angulation to verify the working length confirmed the presence of extra distolingual root (Fig 2c). All the canals of 46 were cleaned and shaped using rotary Nickle Titanium Protaper files (DentsplyMaillefer, Switzerland) in a crown down manner and irrigated using 3% sodium hypochlorite and2% chlorhexidine solutions. Calcium hydroxide (Dentokem, India) was used as an intracanal medicament and access opening was sealed with Zinc oxide- eugenol cement (DPI, India). Two weeks later, when the tooth was asymptomatic, the obturation was carried out by selecting 4% master cones (Fig 2d), AH Plus sealer (Dentsply De Trey, Konstanz, Germany) and lateral compaction method. Following the obturation, the access opening was filled with dental amalgam and patient was scheduled for follow-up visits (Fig 2e). Patient reported for follow up after 1year and radiograph was taken (Fig 2f)

Case No 2: A 18 years old female patient reported with chief complain of pain in mandibular right back region of jaw. Clinical examination showed, deep caries with tooth no 47. Radiograph revealed occlusal caries involving pulp without any periapical changes (Fig3a). Diagnosis of symptomatic irreversible pulpitis was done and endodontic treatment was initiated.

Figure 1

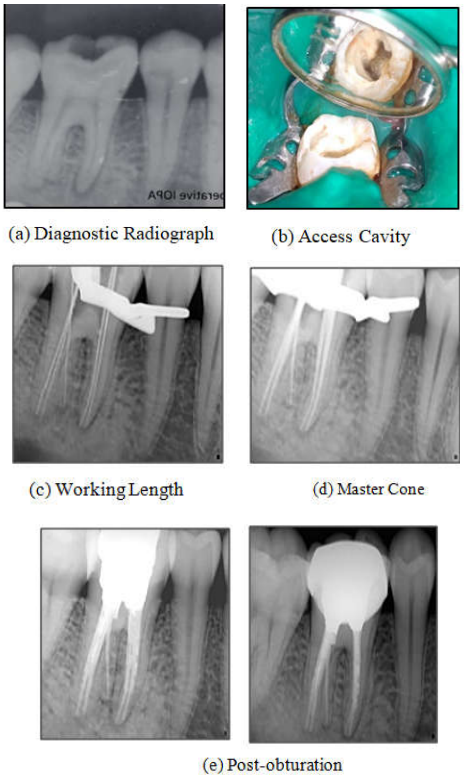
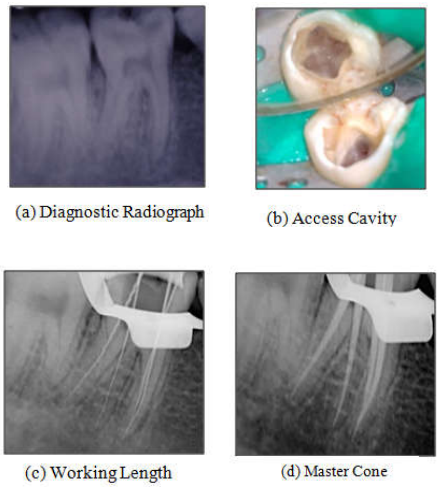
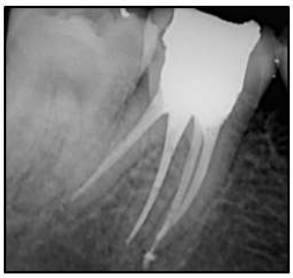


Figure 2

After anaesthetizing the tooth, under rubber dam isolation access preparation was done with endo-access bur and four canal orifices were located with DG 16 endodontic explorer (Fig 3b). The canal lengths were determined radio graphically with K file ISO 15 size (Fig 3 c) and electronically with Root ZX. They were cleaned with 2.5% sodium hypochlorite along with EDTA and shaped with protaper gold rotary system till a size of F-2. Master cone radiograph revealed proper fitting of cones (Fig 3d). Canals were dried with paper point and obturation done by single cone obturation technique and pulp chamber was restored with dental amalgam (Fig 3e)



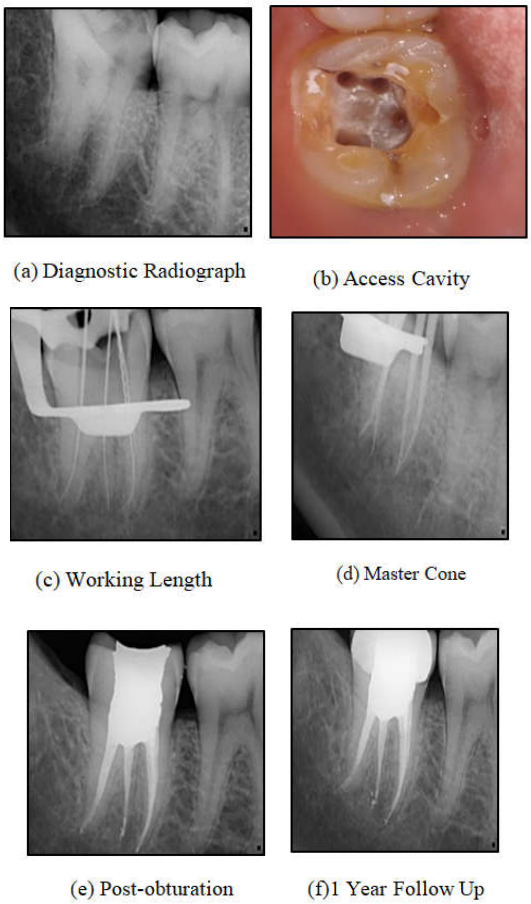


(e) Post-obturation

Figure 3

Case No 3

A 28 year-old male patient was reported to department of conservative dentistry and endodontics with chief complain of pain in lower right posterior most region of jaw. History revealed severe, continuous pain in that region since 3 days. Radiographical examination showed deep occlusal caries with tooth no 48 and there were two distal root and no signs ofapical periodontitis was encountered (Fig 4a). Access cavity four distinct canal orifices (Fig 4b) were found and were coronally enlarged with Gates Glidden drills. Initial negotiation of the root canals was performed with a K-file #10. The lengths of these canals were measured radiographically (Fig 4c) and verified using apex locator (Root ZX). The canals were cleaned with 2.5 % sodium hypochlorite solution and Glyde (DentsplyMaillefer), and shaped with ISO instruments with protaper gold rotary instrumentation system till size of F2 using crown down technique. After master cone confirmation by protaper F2 master cone (Fig 4d), obturation was done and tooth was restored with composite resin restoration (Fig 4e). Patient followed back 1 year post treatment (Fig 4f)



(a) Diagnostic Radiograph (b) Access Cavity

(c) Working Length (d) Master Cone

(e) Post-obturation (f)1 Year Follow Up

Figure 4

DISCUSSION

In the present case report, Radix entomolaris which is common anatomical variation in mandibular first molar but rare occurance in mandibular 2nd and 3rd molar is discussed. Presence of a separate RE in the first mandibular molar varies within various ethnic groups. A maximum frequency of 3% is found in African populations, while in Eurasian and Indian populations the frequency is less than 5%. In populations with Mongoloid traits such as the Chinese, Eskimo and American, Indians reports have noted that frequency of RE in such population ranges from 5% to more than 30% and hence, the RE is considered to be a normal morphological variant. Radix Paramolaris (RP) is commonly observed in 1.5-3% of African population whereas RP is less frequent in Indian population. Its frequency of existence is around 2% (Anurag Singhal, 2011). Ahmed *et al* reported that an evaluation of the number of roots and their morphologies revealed that 3% of mandibular first molars were three-rooted with the extra distal root on the lingual aspect (De Moor, 2004; Naoum, 2003). The nature of this additional root is also variable which ranges from a short conical extension to full length, with pulp extending into the root canal (Reichart, 1981). This additional root can occur unilaterally or bilaterally29 with a predilection for bilateral distribution in females and unilateral in males (Somogyi-Csizmazia, 1971). Incidence radix entomolaris in mandibular 2nd molar is most rare entity observed in litreture amongst mandibular molars. According to Manning, 22% of mandibular second molars have one root, 76% have 2 roots, and 2% have 3 roots (Manning, 1990).

This tooth showed both Mongoloid and Caucasian traits, with 8.98% of the teeth having three roots in Indian population (Neelakantan, 2010). Incidence radix entomolaris in mandibular 3rd molar is not well documented litreture. A retrospective study by Somasundaram P *et al* using Cone beam computed tomography concluded that 3 roots were observed in 2.8% of total samples in study.Sidow SJ *et al* reported that 5% of mandibular 3rd molar had three roots. In the study by Faramarzi F *et al* 2.89% of mandibular 3rd molar were three rooted (Somasundaram, 2017). For differentiation between separate and non-separate RE. According to the location of the cervical part of the RE, Carlsen and Alexandersen classified RE into four types which are Type A, B, C, and AC. In Type A, the distal part of the root has three cone-shaped macrostructures, a facial, a medial, and a lingual in which either the lingual structure is separate while the medial and facial structures are nonseparate, or all three macrostructures are non-separate.

In Type B, the distal part of the root has two cone-shaped macrostructures, lingual and facial ones of nearly the same size. These structures are either separate or non-separate. In Type C, the cervical part is located mesially. In Type AC, the cervical part is centrally located, between the mesial and distal root components (Carlsen, 1998). Preparation of the access cavity may need to be modified to identify three roots and four canals. With the distolingually located orifice of the radix entomolaris, a modification from the classical triangular access cavity to a trapezoidal form to better locate and access the root canal is crucial and straight line access must be established.[5]The outline shape should reflect the anatomy of the chamber when dealing with such teeth. Based on the previous findings it was found that the majority of the extra roots were curved.

This finding is important to the operator during shaping this type of curved canal to avoid chances of instrument separation (Weine, 1989; Sleiman, 2008). Apart from the knowledge & awareness about the possibility of existence and the racial prevalence of RE, it can be detected by thorough inspection of preoperative radiographs, especially those taken from different angles. It is suggested that the radiographs were successful in over 90% of the cases while identifying additional roots (Walker, 1985). Radiographic features like double periodontal ligament images or unclear view of distal root/canal suggest the possibility of RE (Chen *et al*., 2009). In the present case, all the radiographs taken during the root canal procedure were clearly suggestive of RE and hence there was no need for further investigations like cone-beam computed tomography and 3-dimensional reconstruction (Tu, 2009). Good illumination, use of magnifying loupes, microscopes are also helpful in locating and managing RE (James, 2008).

Conclusion

Dental clinician should be aware of the occurrence of RE as an anatomical variant not only in mandibular 1st molar but also in 2nd and 3rd molar, although of rare occurance. Operator should always use angulated radiograph or other imaging technique whenever neccesarry for identifying RE so that it could be cleaned, shaped and obturated in an attempt to increase prognosis or outcome of root canal treatment.

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