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Radix entomolaris: A case series

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Abstract

The objective of this case report is to present a review on the clinical approach for identification and endodontic management of RE and a case series on detection and root canal treatment of mandibular first molar with radix entomolaris. Dentists should be aware of the variations in the anatomy of permanent mandibular first molars. The knowledge about prevalence, diagnosis, morphology, canal configuration of an RE, and the right clinical approach to it is a very important requirement along with angulated radiographs for a successful endodontic treatment. A careful and adapted radiographic as well as a clinical approach is required for an RE, failure of which may lead to procedural errors and a failed treatment outcome in the future.

Keywords: radix entomolaris (RE), molar, prevalence, canal

1. Introduction

The primary goal of endodontic treatment is to eliminate or reduce the microbes from canal space by chemomechanical preparation and to stop re-infection and promote periapical healing by hermetically sealing the root canal space [1].

Radix entomolaris (RE) is one of the anatomical variants found in a permanent mandibular molar and was first described by Carabelli. It is characterized by the presence of a further or extra third root, which is usually found distolingually. RE is often found within the first, second, and third mandibular molar occurring least frequently within the second molar [2]. Studies have shown that this supernumerary root can be separate from or partially fused to other roots. It is often typically smaller than the mesial and distobuccal roots and is typically curved, requiring special attention when endodontic intervention is taken into account [4].

An additional extra root at the mesiobuccal side is called the radix paramolaris. The identification and morphology of those root complexes, containing a lingual or buccal supernumerary root are described by Carlsen and Alexandersen [5]. The prevalence of RE in mandibular first molars has been reported to be as low as 0.68% in Caucasians, 3% in African populations, and as high as 40% in Mongoloid populations. Various studies have shown that the population of Asians has a prevalence of RE of 5.8% to more than 30% [6].

Radix entomolaris isn't quite common in African, Eurasian, Caucasian, and Indian populations and it's said to be dysmorphic root morphology in them. However, RE consideration as an Asiatic trait with a high prevalence and a eumorphic root morphology in certain races like Chinese, Taiwanese, and Koreans, the incidence of RE among the Indian population was found to be very low only 0.2%. Despite this, a couple of studies have reported a better prevalence of RE, with a variety from 2.19-13.3% among the Indian population. The relationship between the finding of RE and various other factors such as gender, right versus left side distribution, and bilateral occurrence is said to be contradictory. Regarding gender predilection for RE, no significant difference was found in the side of occurrence, despite some studies reporting it to be more on the right side while other studies finding it more on the left side [2]. Currently, several techniques have been used to investigate the root canal configuration such as transparent specimen technique, conventional radiographs, radiopaque contrast media, cross-sectional cutting, scanning electron microscope (SEM), micro-computed tomography, and cone-beam computed tomography (CBCT). Recently, CBCT has emerged as

a useful tool to aid in the diagnosis of teeth with complex root anatomies. It is an imaging method employing tomography to generate a three-dimensional reconstruction of the entire tooth at different levels from a single imaging procedure [9]. The objective of this case report is to present a review on the clinical approach for identification and endodontic management of RE and a case series on detection and root canal treatment of a mandibular first molar with RE.

2. Case Reports

Case 1

A 28-year-old male patient presented with pain in the mandibular right back teeth region for one week. Clinical examination revealed deep proximal caries on the mesial side in the mandibular right first molar (tooth 46). The tooth didn't respond to percussion and palpation. On radiographic examination, apart from the deep proximal caries on the mesial side, there were no periapical changes seen. There was a presence of a further distal root outline seen. The tooth gave a delayed response to electric pulp testing. Following pulp testing, a diagnosis of irreversible pulpitis with asymptomatic apical periodontitis was made. The patient was suggested to

undergo a root canal treatment. Local anesthesia was administered and rubber dam isolation was done. After the access cavity preparation, the close inspection of the pulp chamber revealed two mesial and two distal canal orifices. The presence of the canal orifices was confirmed using an endodontic explorer [DG 16, Hu Friedy, Chicago]. The canals were explored and negotiated with the #08K file [Dentsply, Mallieffer, Switzerland]. The working length of the canals was determined electronically using an apex locator [Eighteenth Medical E-Pex Pro Apex Locator] and confirmed radiographically. Canals were cleaned and shaped using rotary Niti files [Protaper, Dentsply, Mallieffer] using the crown down technique. Canals were irrigated using 3% sodium hypochlorite solution and flushed with 17% EDTA solution to remove the smear layer. Calcium hydroxide was placed as an intracanal medicament for canal disinfection. In the follow-up visits, when the patient was found asymptomatic, gutta-percha master cones [Protaper, Dentsply, Mallieffer] were selected. Obturation was carried out with master cones and resin sealer. The access opening was restored using composite resin and the patient was scheduled for a post endodontic treatment.

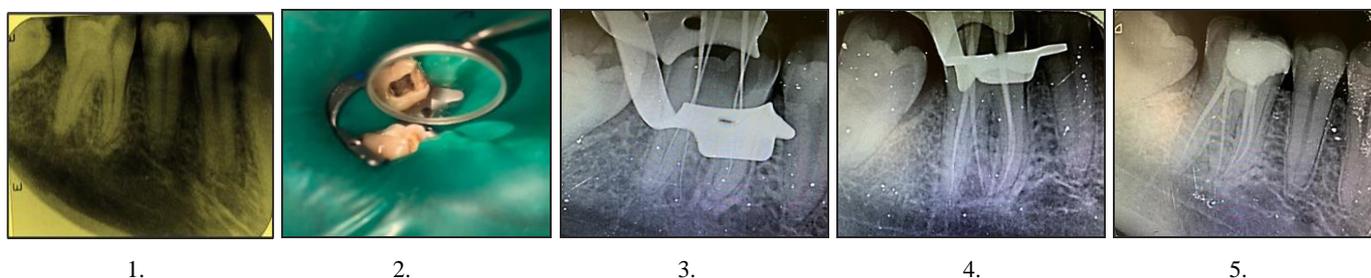


Fig 1: 1. Preoperative radiograph of tooth 46 2. Access opening 3. Working length determination 4. Master cone 5. Completion of root canal treatment and permanent access restoration

Case 2

An 18-year-old female patient presented with a mild intermittent pain that had increased in intensity during a time of two weeks in the mandibular right back teeth region (tooth 46). The tooth had a deep occlusal carious lesion and was sensitive to percussion. Radiographic examination of tooth 46 revealed the pulp extent of caries along with a periapical radiolucency around the mesial and distal roots and widening of the periodontal ligament around the mesial and distal roots. It showed a double distal root outline indicating the presence of RE. Tooth 46 showed no response to electric pulp testing. Following the pulp test, a diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made and root canal treatment was started under local anesthesia followed by rubber dam isolation. Access opening was done and exploration of the floor of the pulp chamber revealed an extra canal orifice situated distolingually and confirmed the presence of RE. The presence of the canal orifices was

confirmed using an endodontic explorer [DG 16, Hu Friedy, Chicago]. The canals were explored and negotiated with the #08K file [Dentsply, Mallieffer, Switzerland]. The working length of the canals was determined electronically using an apex locator [Eighteenth Medical E-Pex Pro Apex Locator] and confirmed radiographically. Canals were cleaned and shaped using rotary Niti files [Protaper, Dentsply, Mallieffer] using the crown down technique. Canals were irrigated using 3% sodium hypochlorite solution and flushed with 17% EDTA solution to remove the smear layer. Calcium hydroxide was placed as an intracanal medicament for canal disinfection. In the follow-up visits, when the patient was found asymptomatic, gutta-percha master cones [Protaper, Dentsply, Mallieffer] were selected. Obturation was carried out with master cones and resin sealer. The access opening was restored using composite resin and the patient was scheduled for a post endodontic treatment.

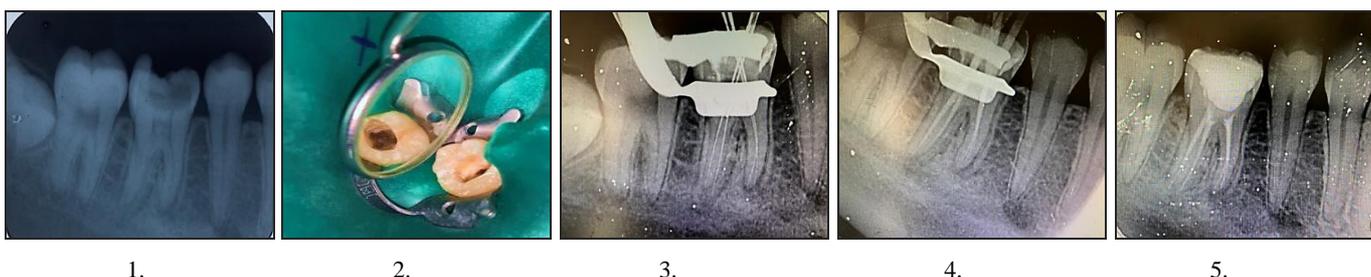


Fig 2: 1. Preoperative x-ray of tooth 46 2. Access opening 3. Working length determination 4. Master cone 5. Completion of root canal treatment and permanent access restoration

Case 3

A 41-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with pain within the lower-left posterior region for two weeks. Clinical examination revealed deep proximal caries on the distal side of the left mandibular first molar (36). The tooth was tender on percussion, on radiographic examination it revealed distoproximal caries involving the pulp with periapical changes seen involving both the distal roots. Electric pulp testing revealed a delayed response. Following pulp testing, a diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made. The patient was informed about the root canal therapy regarding tooth 36. Local Anaesthetic (LOX*2) was administered to the patient and rubber dam isolation was done followed by quadrangular access cavity preparation, on de-roofing the pulpal floor it revealed 2 distinct separate mesial and distal canal orifices. All orifices

confirmation was done by probing with (DG-16 explorer, Hu friedy, Chicago). The canals were explored and negotiated with #10 K files (Dentsply Sirona, USA). The working length was measured using an apex locator (Eighteenth Medical E-Pex Pro Apex Locator) and confirmed radiographically. Canals were instrumented with #15-25K NiTi files (Dentsply NITI flex K-File) for glide path preparation, then canals were shaped with NiTi Protaper Universal Hand files (Dentsply Sirona, USA) using crown down technique. Canals were irrigated using 3% sodium hypochlorite solution and flushed with 17% EDTA solution to remove the smear layer. Calcium hydroxide was placed as an intracanal medicament for one week. In the follow-up visits, the patient was found to be asymptomatic, corresponding gutta-percha points were selected as master cones and obturation was done using AH plus sealer. The access opening was restored with composites and the patient was scheduled for crown placement.

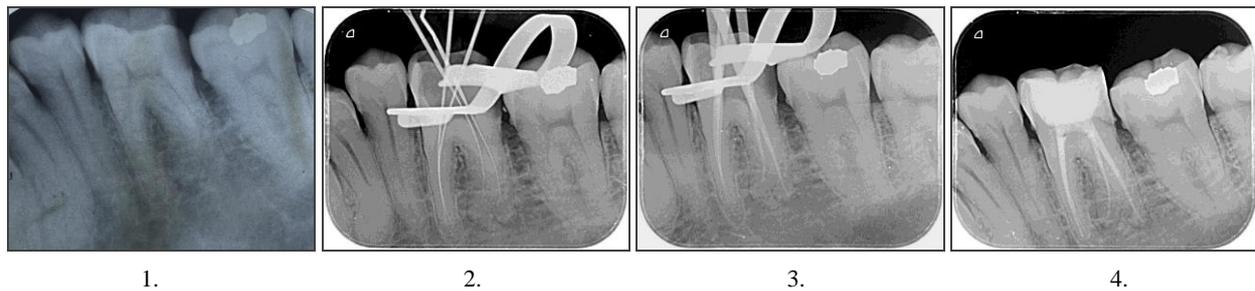


Fig 3: 1. Preoperative radiograph 2. Working length of 36 3. Master cone 4. Completion of root canal treatment and permanent access restoration

Case 4

A 37-year-old female patient reported to the department of conservative dentistry and endodontics with pain in the lower right back tooth region for five days. Clinical examination revealed deep proximal caries on the distal side of the right mandibular first molar (46). The tooth was tender on percussion, on radiographic examination it revealed distoproximal caries involving the pulp with no periapical changes. Electric pulp testing revealed an early response. Following the pulp testing diagnosis of irreversible pulpitis was given. The patient was informed about the root canal therapy regarding tooth 46. Local Anaesthetic (LOX*2) was administered to the patient and rubber dam isolation was done followed by quadrangular access cavity preparation, on de-roofing the pulpal floor it revealed two distinct separate mesial and distal canal orifices. All orifices confirmation was done by probing with (DG-16 explorer, Hu friedy, Chicago).

The canals were explored and negotiated with #10 K files (Dentsply Sirona, USA). The working length was measured using an apex locator (Eighteenth Medical E-Pex Pro Apex Locator) and confirmed radiographically. Canals were instrumented with #15-25K NiTi files (Dentsply NITI flex K-File) for glide path preparation, then canals were shaped with NiTi Protaper Universal Hand files (Dentsply Sirona, USA) using crown down technique. Canals were irrigated using 3% sodium hypochlorite solution and flushed with 17% EDTA solution to remove the smear layer. Calcium hydroxide was placed as an intracanal medicament for one week. In the follow-up visits, the patient was found to be asymptomatic, corresponding gutta-percha points were selected as master cones and obturation was done using AH plus sealer. The access opening was restored with composites and the patient was scheduled for crown placement.

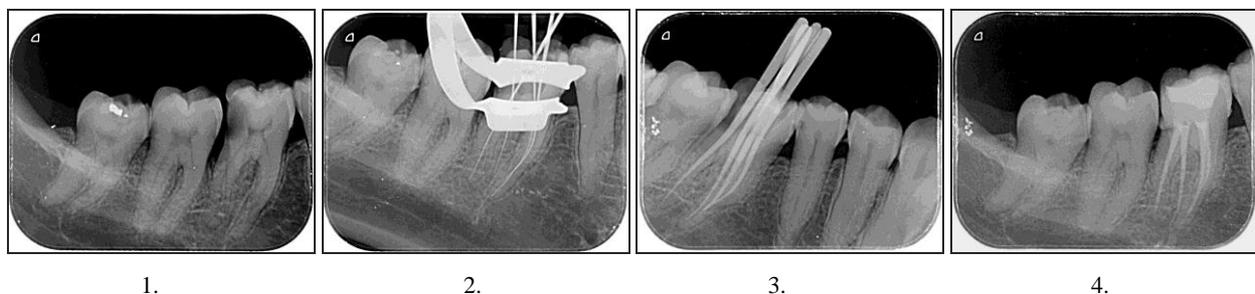


Fig 4: 1. Preoperative radiograph of 46 2. Working length determination 3. Master cone 4. Completion of root canal treatment and permanent access restoration

3. Discussion

Anatomical variations are an acknowledged characteristic of the mandibular permanent molars. Although a majority of the mandibular molars are two rooted with a mesial and distal

root, an extra distolingual root may occasionally be a genetic trait rather than a developmental anomaly. The study of root canal anatomy is important for dental practice and has immense anthropological significance. The presence of

RE within the mandibular first molar is related to certain ethnic groups. In the African population, a maximum of 3% is found, whereas in the Eurasian and Indian populations the frequency is less than 5%. In populations with mongoloid traits, the frequency of occurrence is 5-40%. During the past 100 years, there have been excellent studies of pulp morphology. Upon comparing the findings of those studies with those of this investigation, one finds that the results reported by Okumura, who used transparent specimens, and Pineda and Kuttler, who employed a radiographic evaluative technique, come closest to the findings reported. It appears that the use of an intact root of a specimen rendered transparent by decalcification and radiographic examination enabled the investigator to view more clearly all of the ramifications of the root canal system.^[8]

The most important fundamentals for a successful root canal treatment is that the principle of "straight-line access." because the orifice of RE is distolingually located, the form of the access cavity should be modified from classic triangular form to trapezoidal or rectangular form to better locate the orifice of the distolingual root. The root canal orifices follow the laws of symmetry which help in locating the RE. Canal orifices are equidistant from a line drawn in a mesiodistal direction to the pulpal floor and lie perpendicular to this mesiodistal line across the center.^[10]

Clinically, aside from the notice about the possible existence and racial prevalence of RE, factors like an additional cusp, prominent distolingual lobe, cervical convexity, complex external contour of the furcation can indicate the presence of an RE.^[4] Radiographic examination is regarded as a suitable procedure for pre-operative identification and assessment of RE. Although. The radiographic image is just a two-dimensional representation of a three-dimensional object, alteration of beam angulation might provide additional information not readily available from the orthoradial image. It is mentioned that the radiographs were successful in over 90% of the cases while identifying additional roots but superimposition of the distal roots can be a limiting factor. An angled radiograph (25°-30°) can be more useful in this regard, and it is said that a mesial angled radiograph is better than the distal angled for RE detection^[4, 6].

Radiographs taken at a different angulation/CBCT (cone beam computed tomography) and CT (computed tomography) should be taken and studied carefully to estimate the root length and curvature^[4, 5]. The major advantages of using digital radiography for assessment in endodontics are that the images are obtained instantly and the radiation exposure is 50%-90% less compared to conventional film-based radiography^[7].

3.1 There are various classifications given for RE

3.1.1. Classification by Carl and Alexandersen describes four different types of RE according to the location of the cervical part of RE-

- Type A and B- Distally located cervical part of RE with two normal and one normal distal root component, respectively.
- Type C- Mesially located cervical part
- Type AC- Central location, between the distal and mesial root components.

3.1.2. De Moore *et al.* (2004) classified RE based on the curvature of root or root canal

- Type1- A straight root or root canal.
- Type2- A curved coronal third that becomes straighter in

the middle and apical third.

- Type3- An initial curve in the coronal third with a second buccally oriented curve that begins in the middle or apical third.

3.1.3. Song *et al.* (2010) further added two more defined variants of RE-

- Small type- Length shorter than half of the length of the distobuccal root.
- Conical type- Smaller than the small type and having no root canal within it^[5, 10]

A severe root inclination or root curvature, particularly within the apical third (type 3 RE) can cause shaping aberrations like straightening of canal or ledge, with root canal transportation and loss of working length. The use of flexible nickel-titanium rotary files allows a more centered preparation shape with a restricted enlargement of the coronal third and orifice relocation. After relocation and enlargement of the orifice, initial canal exploration with small files (size 10 or less) alongside radiographical passage length and curvature determination, and the creation of a glide path before preparation, is a step-by-step action that should be taken to avoid procedural errors^[1, 4, 10].

4. Conclusion

Dentists should be aware of the variations in the anatomy of permanent mandibular first molars. The knowledge about prevalence, diagnosis, morphology, canal configuration of an RE, and the right clinical approach to it is a very important requirement along with angulated radiographs for a successful endodontic treatment.

A careful and adapted radiographic as well as a clinical approach is required for an RE, failure of which may lead to procedural errors and a failed treatment outcome in the future.

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