

Successful endodontic management of three rooted mandibular 1st molars: Radix Entomolaris - A Case Series

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Abstract

Radix entomolaris (RE) is considered to be an Asiatic trait. However, its prevalence in Indian population is found to be lower than in other Asian races. Hence, its awareness and identification is pivotal to achieve success in endodontics. This article presents a review on clinical approach and a case series on the detection and endodontic management of RE in mandibular first molars. Radix entomolaris was detected by identifying the presence of a double or extra root outline in the preoperative radiograph, modifying the access opening and closely inspecting the pulp chamber and was endodontically treated following cleaning, shaping, and obturation of the canals. Achieving the endodontic success in the presence of an RE requires adequate knowledge about its existence, diagnosis, morphology, canal configuration, and clinical approach.

Introduction

Knowledge of root canal anatomy is essential for successful root canal treatment. Post-treatment disease occurs because of persistent infection caused by unidentified or missed root canals, which in turn results in failure to remove all the pulp tissue and microorganisms from the root canal system (Bystrom et al. 1987, Sjogren et al. 1997). Thus, an awareness and understanding of root canal anatomy is essential for improving the predictability

of root canal treatment. Mandibular first molar teeth display several anatomical variations. (1)The major variant in this tooth type is the occurrence of a supernumerary disto-lingual [DL]) root. This was first mentioned in the literature by Carabelli (1844) and was later termed radix entomolaris (RE) (Bolk 1915). (2) A mandibular first molar with three distal canals was first reported by Berthiaume (1983); however, the three distal canals ended in two apical foramina. Examples of mandibular first molars with three distal canals, all ending in separate apical foramina, have also been described (Stroner *et al.* 1984, Beatty & Interian 1985, Friedman *et al.* 1986). (3) 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 . (4). Various studies have shown that populations of Asians have a prevalence of RE of 5.8% to more than 30% . The prevalence of RE is reported to differ significantly with races and ranges from 0-33.1%. The prevalence of RE is said to be highest among the population of Mongolian origin such as Chinese, Taiwanese, and Koreans which considered to be a eumorphic root morphology among them. Radix entomolaris is not very common in African, Eurasian, Caucasian and Indian population and it is said to be a dysmorphic root morphology in them.

The association between locating RE and other factors such as gender, right vs left side distribution and bilateral occurrence is said to be contradictory. Although few studies found male predilection for RE, no significant difference was found in the prevalence of RE according to gender.(5)(6) Similarly, no significant difference was found in the side occurrence, despite some studies reporting it to be more on the right side while other studies finding it more on the left side. The bilateral occurrence of RE is reported to vary from 37.14 to 67%. However, since some studies have reported only unilateral occurrence of RE, further studies are required to clarify this aspect.

The purpose of this article is to present a review on 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.

Case 1

An 18-year-old woman was referred to the Department of Conservative Dentistry and Endodontics, Manav Rachna Dental College with a chief complaint of tooth decay in her lower right back teeth for 2 months. History revealed intermittent pain in the same tooth during mastication. The patient's medical history was noncontributory. Clinical examination revealed a grossly decayed right mandibular first molar (tooth #30). Tooth mobility was within physiological limits, and the gingival attachment apparatus was normal. The tooth was tender to vertical percussion. Thermal and electric pulp testing elicited a negative response. The preoperative radiograph showed widening of the periapical periodontal ligament space in relation to the mesial root apex. Also, the radiograph showed the presence of an extra distal root outline.(figure 1a) Radiographs with mesial and distal angulations was taken to confirm the same. From the clinical and radiographic findings a diagnosis of pulpal necrosis with symptomatic chronic apical periodontitis was made and

endodontic treatment was decided as the treatment of choice, for which the patient gave consent and a root canal treatment was initiated.

After caries excavation, the tooth was anesthetized by using 1.8 mL (30 mg) of 2% lidocaine containing 1:200,000 epinephrine (Xylocaine; AstraZeneca Pharma Ind Ltd, Bangalore, India). A rubber dam was placed, and a conventional endodontic access opening was established using the Endo Access kit (Dentsply Maillefer, Ballaigues, Switzerland) . The pulp chamber floor was shown to have 4 canals connected by the developmental root fusion line. (figure 1b) Coronal enlargement was done with a nickel-titanium (NiTi) ProTaper SX rotary file (Dentsply Maillefer, Ballaigues, Switzerland) to improve the straight-line access. Working length was determined with the help of an apex locator (Root ZX; Morita, Tokyo, Japan) and later confirmed by using a radiograph.(figure 1c) Multiple working length radiographs were taken at different angulations to identify the second distal root. Cleaning and shaping were performed under rubber dam isolation by using ProTaper Next NiTi rotary instruments (Dentsply Maillefer), with a crown-down technique upto size X2. Irrigation was performed by using normal saline, 3% sodium hypochlorite solution and 17% ethylenediaminetetraacetic acid. The access and instrumentation upto this point was carried out using a dental operating microscope. After completion of cleaning and shaping, the root canals were dried with absorbent points (Dentsply Maillefer). Calcium hydroxide (Calcicur; VOCO, Cuxhaven, Germany) was placed as an intracanal medicament with a lentulo spiral (Dentsply Maillefer), and the access cavity was sealed with Cavit (3M ESPE Dental Products, St Paul, MN).

At the next appointment after 2 weeks, the patient was asymptomatic. Final rinsing of the canals was performed by using 2% chlorhexidine digluconate with simultaneous

ultrasonic agitation. The canals were dried with absorbent points (Dentsply Maillefer), and obturation was done by using cold lateral compaction of gutta-percha (Dentsply Maillefer) and AH Plus resin sealer (Dentsply Tulsa, Tulsa, OK). (figure e) Access cavity was sealed with intermediate restorative material (IRM; Dentsply De Trey GmbH, Konstanz, Germany). The patient refused to get a permanent crown on the tooth. The patient was recalled after 6 months and an intraoral radiograph was taken . (figure 1g).

Figure 1



Figure : a



Figure : b

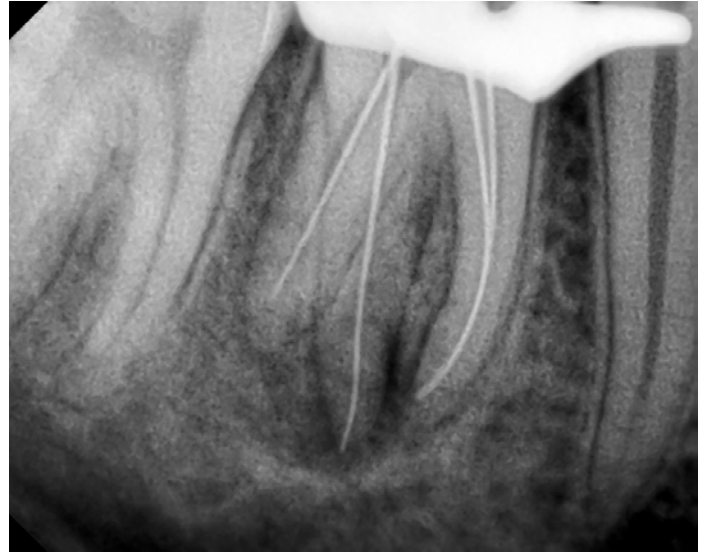


Figure : c



Figure : d

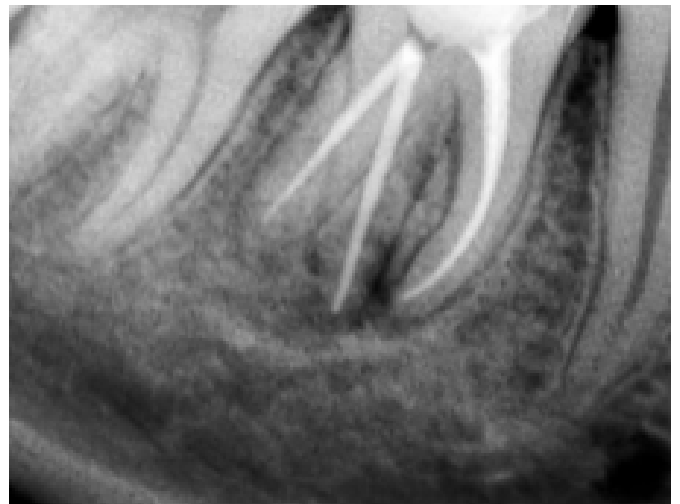


Figure : e

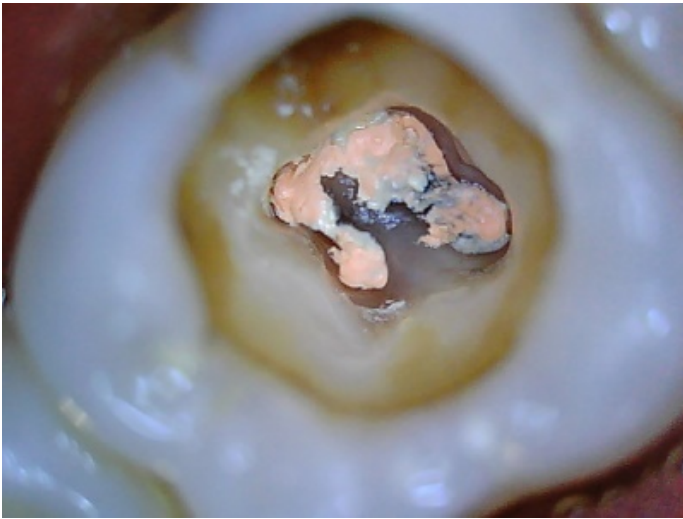


Figure : f



Figure : g

(a) Preoperative radiograph of mandibular right first molar revealed the extent of caries and the presence of an RE. (b) Four orifices located on access opening (c) working length determination (d) master cone xray (e) obturation xray (f) intraoral image of the obturated canals (g) 6 months follow up IOPA

Case 2

A 30 year old male patient reported to the department of conservative dentistry and endodontics, with a chief complaint of decayed tooth in the lower left back tooth region since the past 2 months. The patient was asymptomatic and his medical history was noncontributory. Clinical examination revealed a grossly

decayed right mandibular first molar (tooth #19). There was no associated intraoral swelling with the tooth. There was no tenderness on palpation; tooth mobility was within physiological limits, and the gingival attachment apparatus was normal. Thermal and electric pulp testing elicited a negative response. The preoperative radiograph showed a deep occlusal carious lesion approaching the pulp. Also, the radiograph showed the presence of an extra distal root outline. Radiographs with mesial and distal angulations was taken to confirm the same. Endodontic treatment was decided for which the patient gave consent and a root canal treatment was initiated.

After caries excavation, the tooth was anesthetized. A rubber dam was placed and endodontic access opening was established using the Endo Access kit (Dentsply Maillefer, Ballaigues, Switzerland). The presence of four canal orifices was confirmed with DG-16 explorer. (Hu-Friedy, Chicago). Working length was determined with the help of an apex locator (Root ZX; Morita, Tokyo, Japan) and later confirmed by using a radiograph. (Figure 2b) Multiple working length radiographs were taken at different angulations to identify the second distal root. Cleaning and shaping were performed under rubber dam isolation by using Neo Endo file system upto 25/0.06 (Orikam), with a crown-down technique. Irrigation was performed by using normal saline, 3% sodium hypochlorite solution, and 17% ethylenediaminetetraacetic acid. After completion of cleaning and shaping, the root canals were dried with absorbent points (Dentsply Maillefer). Calcium hydroxide (CalciCur; VOCO, Cuxhaven, Germany) was placed as an intracanal medicament with a lentulo spiral (Dentsply Maillefer), and the access cavity was sealed with Cavit (3M ESPE Dental Products, St Paul, MN).

At the next appointment after 10 days, the patient was asymptomatic. Final rinsing of the canals was performed

by using 2% chlorhexidine digluconate coupled with ultrasonic agitation. The canals were dried with absorbent points (Dentsply Maillefer), and master cone radiograph was taken (Figure 2 c). Obturation was done by using cold lateral compaction of gutta-percha (Neo Endo) and AH Plus resin sealer (Dentsply Tulsa, Tulsa, OK). Access cavity was sealed with intermediate restorative material (IRM; Dentsply De Trey GmbH, Konstanz, Germany).

Figure 2



Figure : a

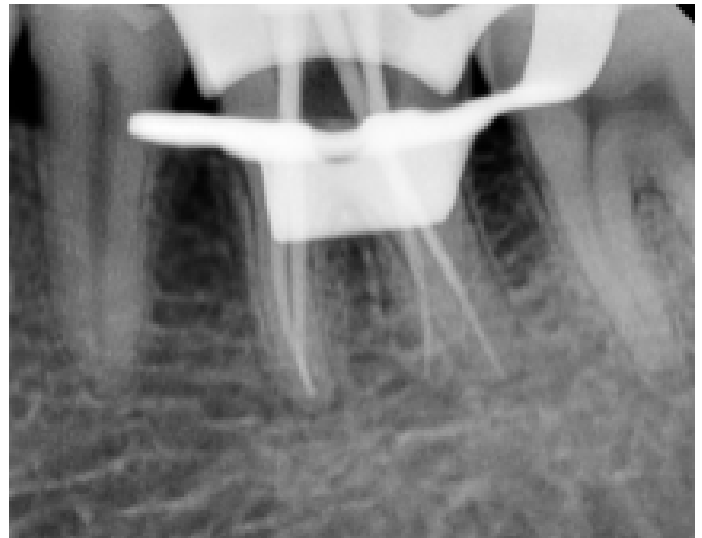


Figure :c



Figure : d



Figure :e

Figure : b

Case 3

A 20 year old female patient reported to the department of Conservative Dentistry and Endodontics, Manav Rachna Dental College, with a chief complaint of pain in the lower left and right posterior tooth region since the past one month. The pain was dull throbbing and intermittent in nature which aggravated on mastication. Clinical examination revealed deep occlusal caries in mandibular left and right first molar (tooth #19 and #30). The tooth was very sensitive to percussion and apical palpation. On radiographic examination of the teeth, apart from deep occlusal caries, periapical radiolucency was seen around the roots. Further, the presence of an additional distal root outline was noticed on the radiograph of both the 3rd and 4th quadrant, suggestive of bilateral occurrence of radix entomolaris.

The patient was advised to undergo root canal treatment and an emergency access opening was made in relation to #19 first as requested by the patient. Following the initiation of root canal treatment, the close inspection of the pulp chamber revealed the presence of two mesial and two distal canal orifices. The access cavity was refined using an Endo Z bur. Calcium hydroxide dressing was given in between visits. The working length of the canals was determined electronically using an apex locator [J Morita] and confirmed radiographically. (figure 3b) Canals were cleaned and shaped using rotary Ni-Ti files ProTaper Next (Dentsply-Maillefer] and crown-down technique. Irrigation was done using 3% NaOCl solution and flushed with 17% EDTA solution to remove smear layer. Canal disinfection was carried out using calcium hydroxide [Calcicur, VOCO, Germany]. In the follow up visits, when the patient was found asymptomatic, gutta-percha master cones [ProTaper next, Dentsply Maillefer] were selected [Figure 3c]. Obturation was carried out with master cones and AH plus sealer [De Trey Dentsply,

Konstanz, Germany]. (figure3d). Similarly, when the patient was comfortable, treatment of the 4th quadrant was initiated. (figure 4)

Figure 3



Figure : a

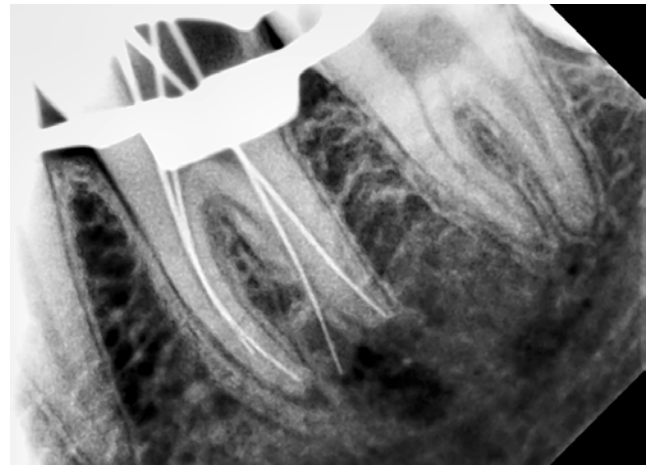


Figure : b

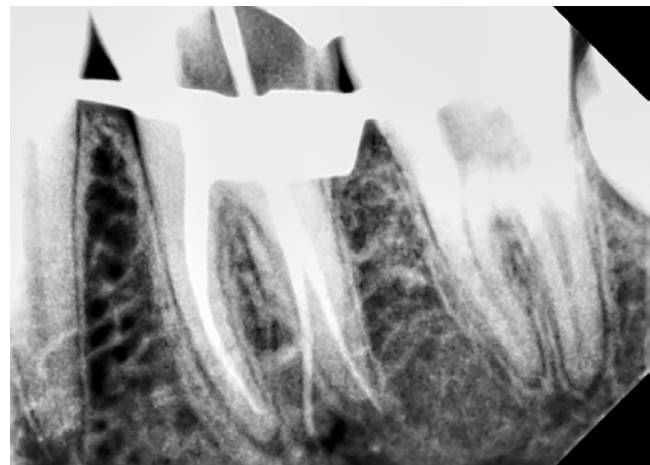


Figure : c



Figure : d
Figure 4



Figure : c



Figure : a



Figure : d



Figure : b

(a) Preoperative radiograph of mandibular left first molar showing RE. (b) working length determination (c) master cone xray (d) Obturation

Discussion

The success of root canal treatment depends majorly on accurate diagnosis, anatomy or morphology, canal configuration and clinical approach undertaken by the practitioner, followed by thorough mechanical and chemical debridement of the entire pulp cavity and complete obturation with an inert filling material. To achieve this goal, it is mandatory that the clinician has a complete knowledge and adequate preoperative

assessment of the root canal morphology of each individual tooth being treated in the oral cavity. In the permanent dentition, the mandibular first molar has been considered to bear maximum biting force. It is one of the earliest erupting succedaneous teeth, as well as the one frequently suffering from pulpal disease and apical periodontitis (4). Also, mandibular first molars have been reported to have varied root and canal morphology, and many studies have been carried out to assess their anatomical characteristics.(4) It is now universally accepted that a major anatomical variant of the two-rooted mandibular first molar is a tooth with a lingually located supernumerary root.(4) This variant was first mentioned in the literature by Carabelli in 1844 and termed radix entomolaris (RE) (6); it refers to a distolingual extra root, as opposed to radix paramolaris when present buccally. It is characterized by the presence of an additional or extra third root, which is typically found disto-lingually. Radix entomolaris can be found in the first, second, and third mandibular molars, occurring the least frequently in the second molar.(6) This extra root is usually smaller than the disto-buccal (DB) root and is normally curved, instrumentation and filling of this additional root can pose challenges (Gu et al. 2011). (5)(7)

Endodontic success depends on. For RE, an accurate diagnosis can avoid complications like missed canal which is a common reason for endodontic failure. Clinically, apart from the awareness about the possible occurrence and the racial prevalence of RE, factors such as an extra cusp,(paramolar tubercle) prominent distolingual lobe, cervical convexity, complex external contour of the furcation can indicate the presence of an RE. Radiographically, an unclear outline of the distal root or the root canal can point to the presence of an RE. However, this requires a thorough inspection of the preoperative radiograph. An angled radiograph (25-30°)

can be extremely helpful in this regard and it is said that a mesially angled radiograph is better than a distally angled radiograph for RE detection. Another study suggested a 30° mesial horizontal beam to provide additional details of the root canal anatomical configuration of mandibular first molars in clinical and in vitro evaluations. (8) Nevertheless, according to Walker and Quackenbush, the accuracy of a correct diagnosis of 3-rooted mandibular molars is about 90%, even when using only panoramic radiographs. (3)

Three-dimensional imaging techniques based on computed tomography (CT) and cone beam computed tomography (CBCT) are very useful aids in visualizing and understanding the true anatomic morphology of an RE in a noninvasive manner using less radiation. However, cost and access to them are the limiting factors. In the present case series, radiographs alone, including preoperative ones, clearly showed the presence of RE in all the cases signifying the importance of radiographs in the detection of RE and, from patient's point of view, prevented the need for expensive investigations such as CBCT. Thus thorough reading of the pre operative radiographs plays a very importance role prior to the initiation of treatment.

Carlsen and Alexandersen described 4 different types of RE, whereas DeMoor et al.(2) suggested a classification with 3 different types of RE: type I refers to a straight root, type II refers to an initially curved entrance that continues as a straight root, and type III refers to 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.A classification given by Song et al (2010) described the various root morphologies of 3 rooted mandibular 1st molars. The DL root is located disto-lingually, with its coronal third completely or partially attached to the main distal root. Based on the original classification of De Moor

et al. (2004), Song et al. (2010) also reported a variant of this classification and used the three types of morphologic features together with two newly defined types: (1) a small type, the length of which was shorter than half of the length of the DB root and (2) an even smaller conical type in which the root canal was absent. (9)

In the present case series, radiographs alone, including preoperative ones, clearly showed the presence of RE in all the cases signifying the importance of radiographs in the detection of RE and avoided the need for expensive investigations such as CBCT. Changes in the conventional triangular access to obtain rectangular or trapezoidal outline form assists in locating the orifice of RE. Since canal orifices are equidistant from a line drawn in a mesio distal (MD) direction through the pulp chamber floor and lie on a line perpendicular to this MD line across the center of the floor of the pulp chamber, following the laws of symmetry, straight line access is essential and it helps in both detecting and locating an RE. Further, following the dentinal map on the floor of the pulp chamber may also act as a visual aid to indicate the position of an RE canal orifice. (10)

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