Case Series

Radix entomolaris: Endodontic challenges and management in a mandibular first molar: A case series

Muskan Jain[1], Pragya Pandey[2], Rakesh Kumar Yadav[2], Promila Verma[3], Ramesh Bharti[2]

From [1]Junior Resident, [2]Professor, [3]Professor and Head, Department of Conservative Dentistry and Endodontics, Faculty of Dental Sciences, King George Medical University, Lucknow, Uttar Pradesh, India

ABSTRACT

Radix entomolaris (RE) is a rare anatomical variation in mandibular molars characterized by the presence of an additional distolingual root. Its detection and management present unique endodontic challenges, particularly in retreatment cases. This series presents four clinical cases involving mandibular first molars with RE. In the first case, the RE was discovered during access cavity preparation of a symptomatic tooth. In the second case, a missed radix canal resulted in post-treatment complications. In the third and fourth cases, a re-root canal treatment was carried out on a radix case to promote healing of a periapical lesion. The use of angled radiographs, magnification, and cone-beam computed tomography enabled accurate diagnosis and treatment. These cases underscore the importance of anatomical awareness and the use of advanced tools in achieving successful endodontic outcomes.

Key words: Canal anatomy, Endodontics, Extra root, Mandibular first molar, Radix entomolaris

Radix entomolaris (RE) is an anatomical variation involving an additional distolingual root in mandibular molars. Its prevalence varies across ethnicities and regions, making its detection and management clinically significant. A normal mandibular first molar usually has a broad mesial root with two canals (mesiobuccal and mesiolingual) and a narrower distal root with one or sometimes two canals. In a typical mandibular first molar, there are two roots, one mesial and one distal, with three root canals. In contrast, the presence of a RE introduces an additional third root, which can complicate endodontic treatment due to its unusual curvature and morphology [1]. Globally, the prevalence of RE is reported to be around 5.6% [2]. Ethnic variations show a higher incidence in Asian populations (5–40%), a lower prevalence in African populations (3.6%), and a rare occurrence in Caucasians (typically <10%). In India, North Indian populations report RE prevalence as high as 24%, while South Indian populations show a rate of 13.3%/tooth examined [2].

Understanding variations in radix is crucial as they significantly influence the outcome of endodontic treatments, especially in primary and retreatment scenarios [3]. Preserving natural teeth is essential for maintaining proper function, esthetics, and overall oral health. Root canal treatment allows for the retention of teeth that would otherwise require extraction by eliminating infection and restoring their function [4]. Failure to identify and properly treat these canals may result in persistent periapical pathology and treatment failure [5].

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Case 1

A 35-year-old male presented with a complaint of intermittent pain in the lower right posterior region. Clinical examination revealed tenderness on percussion along with pain (Fig. 1a), suggestive of apical periodontitis. The buccal vestibule was slightly inflamed, and the tooth did not respond to vitality tests. A periapical radiograph demonstrated a radiolucency associated with the distal root (Fig. 1d). Based on clinical and radiographic findings, a diagnosis of apical periodontitis along with RE was made.

The existing access cavity was refined and modified into a trapezoidal shape to enhance visualization and access (Fig. 1b). Under 3.5× magnification using dental loupes, the pulpal floor was carefully examined, revealing a fourth orifice in the distolingual corner. A periapical radiograph was performed, confirming the presence of a separate distolingual root consistent

Correspondence to: Dr. Pragya Pandey, Professor, Department of Conservative Dentistry and Endodontics, Faculty of Dental Sciences, King George Medical University, Lucknow, Uttar Pradesh, India. E-mail: w.pragya78@gmail.com

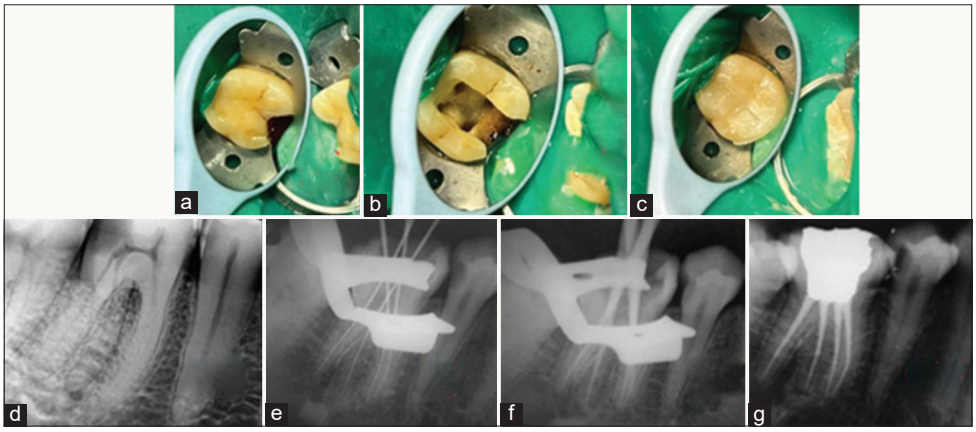

Figure 1: (a) Pre-operative; (b) access cavity preparation; (c) post-endo restoration; (d) pre-operative radiograph; (e) working length determination; (f) master apical cone radiograph; (g) obturation (case 1)

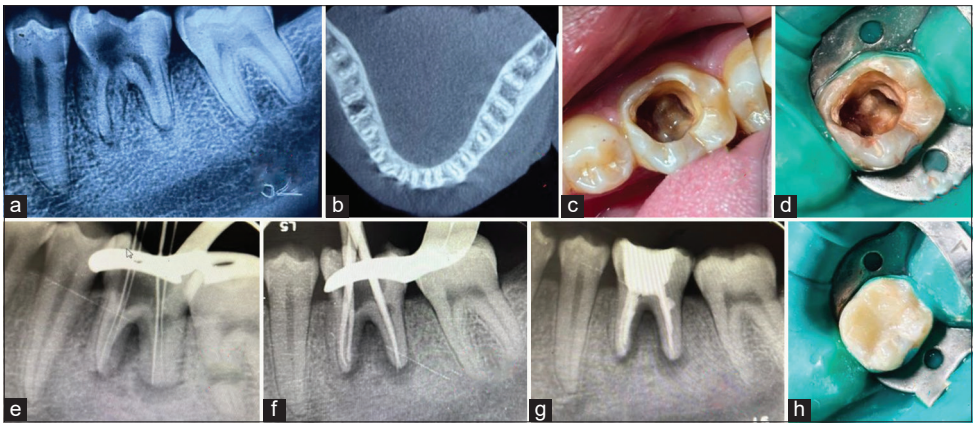

Figure 2: (a) Pre-operative radiograph; (b) cone-beam computed tomography showing extra buccal root; (c) pre-operative clinical picture; (d) rubber dam isolation; (e) working length determination; (f) master cone radiograph; (g) obturation; (h) post endodontic restoration (case 2)

with a RE, having a Vertucci type I canal configuration. Working lengths were established using an apex locator and confirmed radiographically. Biomechanical preparation was completed using rotary NiTi files under irrigation with 3% sodium hypochlorite and 17% ethylenediaminetetraacetic acid (EDTA). The canals were dried and obturated using single-cone obturation with gutta-percha and epoxy Resin based AH plus sealer plus resin-based sealer (Fig. 1c). Post-operative radiographs confirmed complete filling of all four canals, including the radix canal (Fig. 1e-g).

Case 2

A 32-year-old male patient reported to the dental clinic with a chief complaint of pain in the lower right back tooth region for the past 1 week. Clinical examination revealed deep caries in the mandibular first molar (tooth #46) (Fig. 2a) with tenderness on percussion. Radiographic evaluation showed an unusual root morphology suggestive of an additional root on the buccal aspect. Cone-beam computed tomography (CBCT) (Fig. 2b) confirmed the presence of a supernumerary root located mesiobuccally, consistent with radix paramolaris.

Endodontic treatment was initiated under rubber dam isolation. Rubber dam isolation was done, and access cavity preparation was modified to locate the canal orifice associated with the radix paramolaris (Fig. 2c and d). The extra root canal was identified mesiobuccally, separated from the main mesiobuccal canal. Working length was determined using an apex locator and confirmed radiographically. Cleaning and shaping were performed using a rotary NiTi system with copious irrigation using 2.5% sodium hypochlorite and 17% EDTA to ensure effective debridement. The canals were then dried and obturated with gutta-percha (Fig. 2e-h).

Case 3

A 29-year-old female reported discomfort and occasional swelling in the lower left posterior region despite recent root canal treatment on the mandibular first molar (#36) (Fig. 3a). Radiographic evaluation revealed a persistent periapical lesion with signs of incomplete obturation in the distal root (Fig. 3d). Angled radiographs confirmed the presence of a previously undetected distal unfilled canal (Fig. 3e). Accordingly, an endodontic retreatment was planned due to missed canal.

Non-surgical retreatment was initiated. The access cavity was modified (Fig. 3b), and careful inspection of the pulpal floor under a dental operating microscope revealed the missed canal orifice in the distal area. The canal was negotiated and cleaned using rotary instrumentation. Irrigation was enhanced with ultrasonic

activation to debride the previously untreated canal. The canal was obturated, and the tooth was restored) (Fig. 3c-g). The patient was further kept on follow-up to evaluate for the healing.

Case 4

A 32-year-old male presented with a recurrent dull ache in the lower right molar region. Clinical examination and radiographic findings revealed a previously treated mandibular first molar (#46) with periapical radiolucency (Fig. 4a). An intraoral periapical radiograph indicated the presence of a RE (Fig. 4d). Based on this, a diagnosis of previously treated tooth with chronic apical periodontitis associated with RE was established.

Endodontic retreatment was initiated. The previous obturation was removed, and the access cavity was refined under magnification (Fig. 4b). After successful negotiation of the canal, working length was established using an apex locator. Cleaning and shaping were completed using rotary NiTi instruments with copious irrigation of sodium hypochlorite and EDTA. Calcium hydroxide was placed as an intracanal medicament for 1 week. At the subsequent appointment, the canal system was obturated (Fig. 4e and f). A follow-up radiograph taken 6 months post-treatment showed signs of periapical healing.

DISCUSSION

RE presents both diagnostic and technical challenges in endodontic practice. The presence of an additional distolingual root may go undetected in routine straight radiographs due to the superimposition of root structures [6]. Radix Paramolaris is a rare anatomical variation in mandibular molars characterized by the presence of an additional root located buccally, typically on the mesial side. Unlike RE, which is found distolingually, Radix Paramolaris is less common and can pose diagnostic and treatment challenges during endodontic procedures due to its atypical location and morphology [6].

Several classifications have been proposed in the literature to describe the morphological variations of RE (Table 1 and Fig. 5) [7-9]. Understanding such variations is crucial as they significantly influence the outcome of endodontic treatments, especially in primary and retreatment scenarios. Failure to identify and properly treat these canals may result in persistent periapical pathology and treatment failure [10,11].

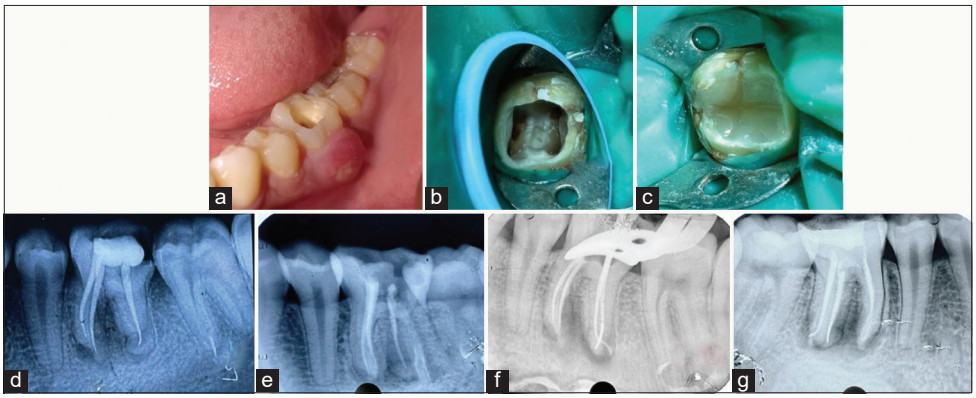

Figure 3: (a) Clinical picture showing gingival swelling; (b) access cavity showing an extra canal; (c) post endodontic restoration; (d) pre-operative radiograph; (e) radiograph taken from the mesial angulation showed missed distal canal; (f) master cone radiograph; (g) obturation (case 3)

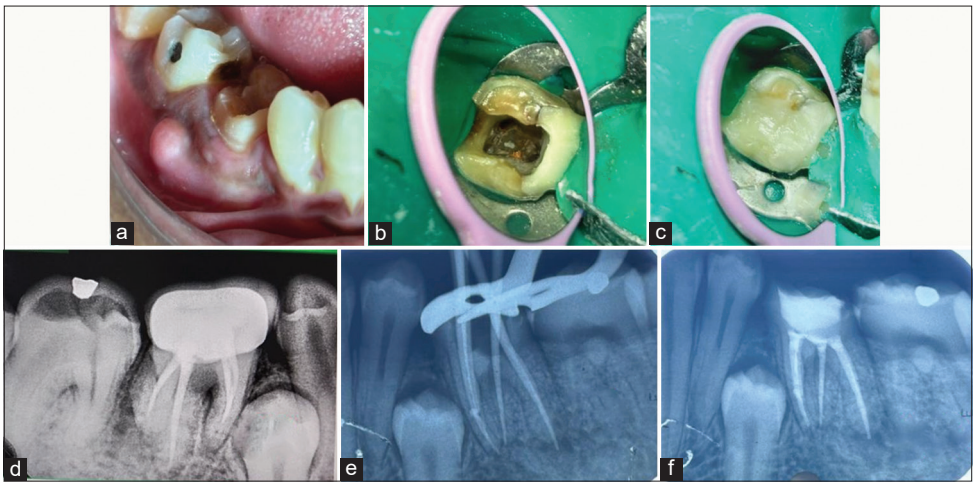

Figure 4: (a) Clinical picture showing gingival swelling; (b) access cavity; (c) post endodontic restoration; (d) pre-operative radiograph; (e) master cone radiograph; (f) obturation (case 4)

Table 1: Classifications to describe the morphological variations of radix entomolaris

Classification	Author/year	Types/description
Cervical location	Calberson *et al*. (2007) [7]	- Type A: Distal cervical part, two normal distal roots - Type B: Distal cervical part, one normal distal root - Type C: Mesial location - Type AC: Central between mesial/distal
Buccolingual curvature (extracted teeth)	De Moor *et al*. (2004) [8]	- Type I: Straight root/canal - Type II: Coronal curve+straight apical - Type III: Double curve (coronal+middle-apical)
Comprehensive morphology	Song *et al*. (2010) [9]	- Type I: No curve - Type II: Coronal curve+straight - Type III: Coronal+buccal middle-apical curve - Small: <½ distobuccal root length - Conical: Cone-shaped, no canal

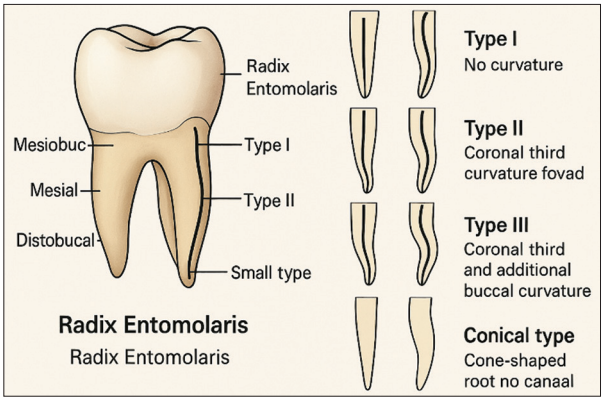

Figure 5: Types of radix entomolaris [9]

In these cases, the use of angled radiographs was indispensable in accurately identifying the root morphology [7-9,12]. Periapical radiographs play a crucial role in detecting root variations such as RE or Radix Paramolaris. They provide a detailed visualization of the tooth's root morphology and canal configuration, helping clinicians identify extra roots that may not be apparent clinically. Accurate radiographic interpretation is essential for proper diagnosis, treatment planning, and successful endodontic outcomes. Advanced imaging, particularly CBCT, provides three-dimensional insight into canal anatomy, allowing for precise diagnosis and treatment planning [12,13].

The access cavity design is also critical. A standard triangular access might hinder the detection of RE; hence, a modified trapezoidal shape is recommended, especially in suspected cases [14]. During access preparation, the developmental root fusion line serves as an important visual cue, often appearing in "X" or "Y" shapes and leading toward an additional orifice [15]. The use of magnification and proper illumination significantly improves the detection of hidden canals, especially in complex anatomy such as RE [9,16]. Tactile feedback while scouting canals also aids in identifying unusual canal orientations [8].

Calberson's and De Moor's classifications provide clinicians with a framework to anticipate potential complexities in morphology. Identifying the type of RE assists in predicting canal curvature and root length, which are essential for effective biomechanical preparation [7,8]. Song's classification further refines this understanding by incorporating multiple morphological criteria, thus aiding in accurate canal navigation and shaping [9]. These cases exemplify the consequences of missed canals, where incomplete treatment led to persistent periapical pathology. This underlines the importance of thorough diagnostic evaluation, especially when initial treatment fails. Modern tools, CBCT, microscopes, and ultrasonic tips are now indispensable for high-standard endodontic care [12,13]. Early identification of such anatomical variants not only prevents retreatment but also improves prognosis and patient satisfaction.

CONCLUSION

The presence of RE can compromise endodontic outcomes if not identified and treated adequately. Clinicians should maintain a high index of suspicion, use angled radiographs, and consider CBCT and magnification tools for successful management.

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