Case Report

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# Endodontic management of radix entomolaris in mandibular first molar teeth: a case series

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## ABSTRACT

The success of endodontic treatment depends on a correct understanding of root canal anatomy, identification of anatomical variations, and correct canal positioning. Mandibular molars, which usually have two roots, may harbor an additional root, such as the radix entomolaris (RE), incompatible with this expected anatomy. The location of this variant root, especially close to the distolingual root, can complicate the endodontic procedure. This case series provides important insights into the clinical management of RE variation based on three cases with RE. The clinical evaluation, diagnosis, and root canal treatment procedures are presented. The teeth were asymptomatic at follow-up examinations, and radiographic examinations revealed normal/healthy periapical status. Endodontic specialists and endodontic treating physicians must take a careful and conscious approach to the presence of additional roots in mandibular molars during root canal treatment processes. Proper understanding and handling anatomical variations such as RE is a critical factor in the success of root canal treatment.

**Keywords:** Radix entomolaris, distolingual root, mandibular molar, anatomical root variation

## INTRODUCTION

Knowing and correctly understanding the basic anatomical structure of the teeth, anatomical variations, and possible localization of the canals is the first step in ensuring endodontic treatment success. Attention to this step prevents potential errors and opens the door to successful endodontic treatment and follow-up.[1,2] Studies on the anatomy of multi-rooted teeth have revealed deviations from the expected morphological structure and root canal variations.[3-6] Usually, mandibular molars have two roots (one mesial and one distal), while a third root is an important feature that makes these teeth anatomically more complex.[2,7] These additional root structures are usually located in the distolingual or mesiolingual regions and are defined as the radix entomolaris (RE) and radix paramolaris (RP). In addition, these roots have specialized canals.[8,9] Among these anatomical variations, the RE is the most common and can be observed as an independent root or partially fused with the main roots. Although RE can occur in all mandibular molars, it has been reported least frequently in second molars.[8] The prevalence rate varies among different populations. It has been reported to be approximately 4% in the Caucasian population and over 30% in the Mongolian population.[2,7-9]

Detecting these anatomical root variations poses a significant challenge because they are located in the same buccolingual plane as the distolingual root.[8] This positional proximity can lead to superposition on right-angled periapical radiographs, making it simple to miss this anatomical variation. Failure to detect and treat an additional root canal during root canal treatment is highly associated with the development of post-treatment apical periodontitis.[10]

Considering the clinical consequences of overlooking these anatomical variations, physicians must be alert and knowledgeable about the potential presence of additional roots in mandibular molars during root canal treatment. In this context, this study aims to present three cases involving RE, providing awareness and insights into the clinical management of these variations and their follow-up.

## CASES

### Case 1

A 19-year-old female patient was admitted to our clinic with a complaint of pain in the mandibular right first molar tooth. In her anamnesis, it was learned that she had no systemic disease, complained of spontaneous, long-lasting pain in the mandibular right first molar tooth, and could not chew with the related tooth. Intraoral examination revealed the presence of an occlusal amalgam filling. The tooth was percussed and palpated. There was no mobility. No fistula was found in soft tissues. Pulp sensitivity tests, including the cold test (Super Spray, Seçkin Dental, İstanbul, Turkiye) and EPT (C-Pulse Pulp Tester, Coxo, Foshan, China), confirmed that the tooth was devitalized. A radiographic examination revealed that

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the tooth had an extra root (**Figure 1a**). It was determined that there was no periapical pathology in the tooth's roots, but there was a gap in the periapical ligament. The patient was diagnosed with acute apical periodontitis, and root canal treatment was decided. Isolation of the tooth was provided with a rubber dam.

While opening the endodontic access cavity considering the apical radiograph, it was observed with the dental loop that the distolingual canal was positioned more lingual than it should be, and the presence of a RE with a distolingual canal entrance was confirmed. Using an apex locator and radiography, root canal lengths were determined with a #15 K-type file (Dentsply Maillefer, Ballaigues, Switzerland). The canals were prepared by the crown-down technique using nickel-titanium T-endo MUST files (Dentac, İstanbul, Turkiye). After each file change, the root canals were irrigated with 2 ml of 5.25% sodium hypochlorite (NaOCl). As the final irrigation, 10 ml of 5.25% NaOCl, 10 ml of 17% EDTA, and 10 ml of saline were used. NaOCl and EDTA were activated in each canal sequentially for 1 minute and 30 seconds, respectively, using the sonic activation device EndoActivator (Dentsply Tulsa Dental, Tulsa, OK, USA) according to the manufacturer's instructions. The root canals were dried with paper cones and filled with AH Plus (Dentsply Sirona, Konstanz, Germany) root canal paste using the lateral condensation method (**Figure 1b**). In the clinical and radiological follow-up of the patient at the 9$^{th}$ and 12$^{th}$ months, tooth 46 did not show any symptoms and was found to be periapically healthy (**Figure 1c, 1d**).

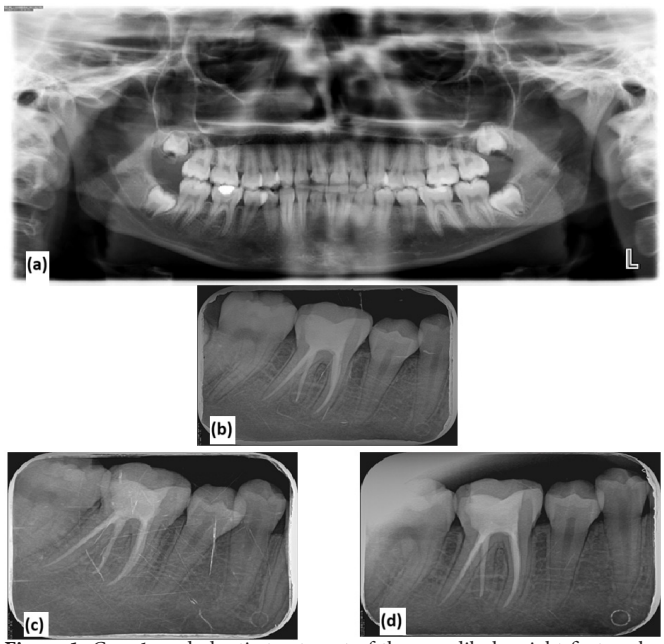


**Figure 1.** Case 1: endodontic treatment of the mandibular right first molar. a) Panoramic radiograph of the patient before treatment. b) Periapical radiograph of the patient immediately after the procedure. c) Periapical radiograph of the patient at the 9$^{th}$ month. d) Periapical radiograph of the patient at the 12$^{th}$ month

## Case 2

A 20-year-old female patient was admitted to our clinic with a complaint of pain in the mandibular left first molar. In the anamnesis, it was learned that the patient had no systemic disease and had long-lasting pain in the mandibular right first molar that started spontaneously. Clinical examination revealed a deep carious cavity in the tooth. Percussion and palpation tests revealed pain and no tooth mobility. EPT revealed that the tooth responded earlier than the symmetrical tooth and was vital. No swelling was found in soft tissues. A radiographic examination revealed the presence of an extra root distal to the tooth (**Figure 2a**). It was determined that there was no periapical pathology in the tooth's roots, and the lamina dura was normal. The patient was diagnosed with pulpitis, and root canal treatment was decided. The tooth was isolated with a rubber dam. After the endodontic access cavity was opened, root canal preparation was performed according to the sequence in case 1. After the root canals were dried with paper cones, they were filled with the single cone method using Bioserra (Imicryl, Konya, Turkiye) root canal paste with bioceramic content and gutta-percha (**Figure 2b**). At the sixth month of clinical and radiological follow-up of the patient, the mandibular left first molar did not show any symptoms and was periapically healthy (**Figure 2c**).

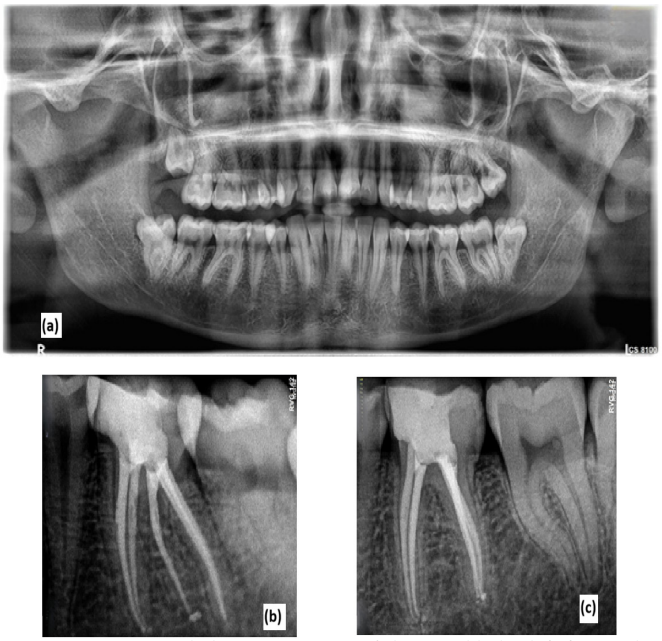


**Figure 2.** Case 2: endodontic treatment of the mandibular left first molar. a) Panoramic radiograph of the patient before treatment. b) Periapical radiograph of the patient immediately after the procedure. c) Periapical radiograph of the patient at the 6$^{th}$ month

## Case 3

A 32-year-old male patient was admitted to our clinic with complaints of pain in the mandibular left first molar. In the anamnesis, it was learned that he did not have any systemic disease. He had long-lasting pain and night pain in the mandibular left first molar, which started spontaneously 1 month ago, but he was asymptomatic at the moment. Clinical examination revealed an occlusal amalgam filling in the relevant tooth. The presence of percussion and palpation was observed and no mobility was found. Pulp vitality tests, including the cold test (Super Spray, Seçkin Dental, İstanbul, Turkiye) and EPT (C-pulse Pulp Tester, Coxo, Foshan, China), revealed that the tooth was devitalized. A radiographic examination revealed that the tooth had an extra root (**Figure 3a**). It was determined that there was no periapical pathology in the tooth's roots, but there was enlargement of the periapical ligament. The patient was diagnosed with

acute apical periodontitis, and root canal treatment was decided. Isolation of the tooth was provided with a rubber dam. When opening the access cavity, a dental microscope (Semorr 3000 E-4 K, Bondent, China) was used to locate the canal opening of the distolingual root. Thus, less material was removed from the tooth, and the risk of complications was minimized. The root canal disinfection procedure in Case 1 was followed. Since the root canals could not be dried with paper cones, calcium hydroxide was placed in the canal for 10 days. In the second session, calcium hydroxide was removed with abundant irrigation and activation, as in the first session. After the final flushing procedure, the canals were filled with AH Plus (Dentsply Sirona, Konstanz, Germany) root canal paste using lateral condensation (**Figure 3b**). At the sixth month of clinical and radiological follow-up, the mandibular left first molar showed no symptoms and was periapically healthy (**Figure 3c**).

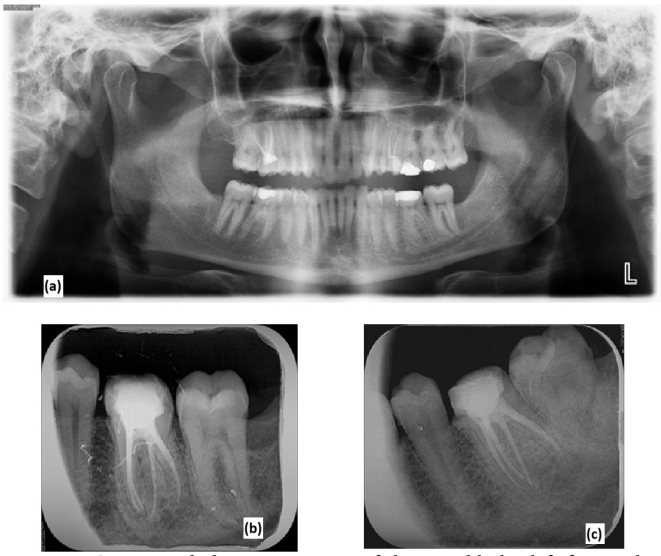


**Figure 3.** Case 3: endodontic treatment of the mandibular left first molar. a) Panoramic radiograph of the patient before treatment. b) Periapical radiograph of the patient immediately after the procedure. c) Periapical radiograph of the patient at the 6th month

## DISCUSSION

These case reports emphasize the importance of detailed clinical and radiographic evaluations and an in-depth understanding of tooth anatomy in diagnosing and treating teeth containing RE. These anatomical variations in mandibular molars involve extra canals; overlooking or inadequate cleaning of these canals can significantly adversely affect the prognosis of endodontic treatment.[2,10,11] These successful treatment results, achieved during a follow-up period of at least 6 months, are based on correctly identifying the extra root, accurate diagnosis, and effective management of these anatomical variations.

Correctly identifying extra roots before endodontic treatment, making the correct diagnosis, and creating appropriate treatment plans are important steps in ensuring success. In addition, this process requires a careful examination of the chronal features that can provide predictions to the dentist. One of the important indicators in this respect is the presence of an extra tubercle, usually observed in conjunction with a prominent distolingual lobe and cervical convexity, which should raise suspicions of the presence of an additional root. An important indicator in this context is the presence of an additional tubercle, often observed with a prominent distolingual lobe and cervical convexity. Along with this, the significantly wider distance between the distobuccal and distolingual tubercle tips should raise suspicion of the presence of an additional root.[8,12,13] Furthermore, a meticulous review of periapical radiographs taken from different angles can reveal subtle but critical details indicating extra roots.[14] Studies have examined various angular projections to determine the optimal angle for the accurate visualization of RE. In periapical radiographs, images taken with a slight distal angle show the RE moving distally, overlapping the image of the distobuccal root moving mesially. The RE type can only be accurately assessed if the radiographic beam is directed at a larger angle from the distal direction. The study has revealed that mesial projections better detect extra roots than distal projections. Furthermore, the optimal angle for ensuring the best visualization of RE has been determined to be 25 degrees in mesial projections.[14] Specific radiographic findings should be considered When conventional periapical radiographs detect extra roots such as RE and RP. In this context, important indicators of the presence of an extra root include the intersection of a translucent line in the pulp cavity, the intersection of the periodontal ligament space, the lack of clarity or loss of distinct borders of the distal root contour or root canal, and the clear visibility of an extra root between the mesial and distal roots.[15] Although detecting an extra root with two-dimensional radiographs is possible, previous studies have shown that cone beam computed tomography (CBCT) is a superior method for evaluating dental structures.[16,17] Periapical radiographs have disadvantages, such as their inability to prevent superposition and the potential to trigger the gag reflex when used in posterior regions. CBCT is an excellent option for detecting anatomy and eliminating the disadvantages of periapical radiographs. Three-dimensional images created with axial, sagittal, and coronal sections help identify other features of RE, such as determining the spatial location of structural elements like the entrance of the RE orifice, thereby aiding in accurate diagnosis. CBCT not only confirms the presence of anatomical variations, such as extra roots and missed canals, but also provides a significant advantage in detecting the location and direction of these variations with extreme precision. This characteristic feature is a decisive factor, particularly in distinguishing between RE and RP. The canal localization in the extra root can also pose a challenge in treatment. In this context, the design of a suitable access cavity is critical. This is because it provides a clearer view of the pulp chamber floor and allows direct access to the canal orifices by creating a suitable pathway.[8,18] The canal orifices of extra roots are usually located in the lingual position, either mesial or distal to the distal root canal.[19] This specific location suggests that in teeth with this variation, the conventional access cavity may not adequately expose these orifices, and a wider access cavity is often required.[8,9] In cases where it becomes difficult to locate the canal orifice, it is paramount to carefully examine the pulp chamber floor and walls, especially in distolingual areas.1 In the cases presented, a critical step was to meticulously assess the pulp floor and

trace the dark lines with an endodontic explorer (DG16) to locate the canal. This method helped to expose the debris on the pulp roof that concealed the entrance to the root canal. A dental microscope has been very useful in identifying the canals more precisely. These optical instruments significantly improve examination accuracy, making it possible to study the complex structure of dental anatomy more detail and effectively.[20]

It has been reported in the literature that canals in extra roots usually have smaller diameters and show different curvatures in the coronal, middle, or apical triads. This increases the risk of shaping errors during endodontic treatment. These errors can lead to problems such as root canal straightening, step formation, canal migration, or endodontic file breakage.[8,9] Considering such difficulties, a careful approach is required during canal preparation. This should include the creation of a smooth glide path with a small K file up to size 15 before the rotary instruments are used. This initial preparation reduces the torque stress applied to the rotary tools, allowing for a more controlled and safe operation. Taking a conservative approach to shaping the grooves using files with fewer tapers can help to reduce the risk of over-preparation and potential errors. Minimizing the amount of canal expansion enables clinicians to preserve the natural anatomy of the tooth and reduces the likelihood of complications related to excessive dentin loss. These strategies and precautions are critical to overcome the challenges associated with extra roots and thus contribute to safer and more predictable treatment outcomes.[1,8,21]

## CONCLUSION

The current knowledge of the prevalence of potential anatomical variations and morphological features clearly emphasizes the importance of preoperative planning. Periapical radiography and CBCT for diagnosis, operating microscopy and dental loupe for magnification, and sonic/ultrasonic devices and NiTi instrument systems with advanced metal technology for treatment are extremely valuable tools in the management of mandibular first molars with RE. This case series presented the understanding of the anatomical variation of mandibular molars and the accurate identification of additional roots and their treatment with advanced treatment tools. It also demonstrated that successful treatment results could be achieved.

## ETHICAL DECLARATIONS

### Informed Consent

All patients signed and free and informed consent form.

### Referee Evaluation Process

Externally peer-reviewed.

### Conflict of Interest Statement

The authors have no conflicts of interest to declare.

### Financial Disclosure

The authors declared that this study has received no financial support.

### Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version.

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