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THE ROOT TOOK AN EXTRA ROUTE: CASE REPORTS

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Abstract

The literature extensively documents root anomalies in human permanent premolars and molars, presenting a challenge for successful endodontic treatment. The variations in mandibular first molars specifically involve the number of roots, root canals, and morphology. The additional roots, radix entomolaris, and radix paramolaris, are located lingually and buccally, respectively. The presence of an extra root can alter the route of treatment, especially when endodontic treatment is necessary, and requires knowledge of common anatomical characteristics and their possible variations. An early understanding of tooth morphology is essential for meticulous handling. Although the permanent mandibular first molar typically has two roots, mesial and distal, the presence of an extra root canal could cause infection and endodontic failure if left undiagnosed or improperly prepared during root canal preparation, leading to abscess formation. Identification of an extra root is challenging with periapical radiographic methods due to the superimposition of two roots. However, the significance of this endodontic concern has been highlighted through two documented cases that required endodontic treatment. Therefore, an accurate diagnosis, identification, and treatment of these variations require adequate knowledge of root and root canal anatomy and configurations to improve outcomes. Additionally, due to missed canals, mandibular first molars have a lower success rate following root canal treatment. Awareness of extra roots facilitates diagnosis and improves the overall prognosis for endodontic retreatment of an extra root can minimize complications related to exodontia, such as root breakage.

Key words: Radix entomolaris, Radix Paramolaris, endodontic therapy, root morphology, canal configurations

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INTRODUCTION:

• In 1844, Carabelli made the initial observation of a major anatomical variation in the mandibular first molar, specifically an additional root known as the Radix Entomolaris (RE) located distolingually. Another anatomical variation in this tooth is the presence of a root located buccally, which was named the Radix Paramolaris by Blok.

• Supernumerary roots or canals can occur in all types of teeth, but the frequency of canal configurations is notably higher in premolars and molars. Variations in the number of roots in mandibular first permanent molars have been observed among different races and often include anomalies and variations. One variation in this tooth is the presence of an additional third root either located mesiobuccally and referred to as the radix paramolaris (RP), or located distolingually and called the radix entomolaris (RE).

INCIDENCE AND PREVALENCE

Radix Entomolaris: (additional root located lingually):

According to Tratman, the incidence of radix entomoaris (RE) in the Indian population is 5%.

Furthermore, the presence of RE has also been observed in the first, second, and third molars, although it is less common in the second molar compared to the other two.

Classification: Carlsen and Alexandersen 1990 proposed a classification system for the radix entomolaris (RE) based on the location of the cervical part. The system includes four different types:

1. Type A: the RE is located lingually to the distal root complex which has two cone-shaped macrostructures.

2. Type B: the RE is located lingually to the distal root complex with one cone-shaped macrostructure.

3. Type C: the RE is located lingually to the mesial root complex.

4. Type AC: the RE is located lingually between the mesial and distal root complexes.

De Moor et al. (2004) classified radix entomolaris based on the curvature of the root or root canal:

1. Type 1: a straight root or root canal.

2. Type 2: a curved coronal third which becomes straighter in the middle and apical third.

3. Type 3: an initial curve in the coronal third with a second buccally oriented curve which begins in the middle or apical third.

Song JS et al. (2010) further added two more newly defined variants of RE:

1. Small type: length shorter than half of the length of the distobuccal root.

2. Conical type: smaller than the small type and having no root canal within it.

Wang et al (2011) have proposed an alternative classification based on radiographic assessment of the degree of overlap between the distolingual (DL) and distobuccal (DB) root. This classification comprises three types.

Type 1: Slight overlapped image

Type 2: Moderate overlapped image

Type 3: Severe overlapped image

Morphology:

The radix entomolaris (RE) is typically located distolingually and can vary in size, ranging from a short, conical extension to a normal mature root length. The coronal third of the RE is usually partially or fully attached to the distal root. Generally, the RE is smaller in size compared to the mesio- and distobuccal roots, may contain pulpal tissue. Externally, the furcation between the distal root and the RE is situated slightly lower (approximately 1mm) compared to the furcation between the mesial and distal roots.. Clinically, teeth with an additional distolingual root

may exhibit a more bulbous crown outline, an extra cusp, a prominent distolingual lobe, or cervical prominence. These characteristics can serve as indications for the presence of an additional root in the tooth.

Radix Paramolaris (additional root located buccally)

Bolk documented the occurrence of radix paramolaris, which is a relatively uncommon anatomical variation and is less prevalent than radix entomolaris. According to Visser, the prevalence of radix paramolaris is extremely low, with an incidence of only 0.2% for mandibular first molars, 0.5% for second molars, and 2% for third molars.

Classification: Carlsen & Alexandersen (1991) classified radix paramolaris (RP) into two different types:

1. Type A: cervical part is located on the mesial root complex.
2. Type B: cervical part is located centrally, between the mesial and distal root complexes.

Morphology:

The radix paramolaris (RP) is situated mesiobuccally and may vary in size and shape, ranging from a short conical extension to a fully mature root, which can either be separate or fused with a mesiobuccal root. Based on various studies, it has been observed that an increase in the number of cusps does not always correspond with an increase in the number of roots; however, the presence of an additional root is consistently associated with an increase in the number of cusps and root canals.

ETIOLOGY:

The causative factors responsible for the formation of an additional third root in mandibular molars are still not clearly understood. In cases of dysmorphic supernumerary roots, the formation could be attributed to external factors during odontogenesis or the reactivation of an atavistic gene or polygenetic system. Atavism refers to the re-emergence of a trait after it has been absent for several generations. On the other hand, in cases of eumorphic roots, it has been suggested that racial genetic factors could be responsible for a more pronounced phenotypic expression of a particular gene, resulting in the formation of an additional root.

CASE REPORT 1:

A 32-year-old male patient presented to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in the lower right back tooth region for a few days. Upon further examination, it was found that tooth 46 was grossly carious and tender on vertical percussion. The pain was spontaneous, moderate in intensity, and throbbing in nature, aggravated by hot drinks and sweets. A heat test resulted in severe lingering pain. A periapical radiograph revealed radiolucency involving the distal pulp horn with the widening of the periodontal ligament space.

After adequate anesthesia and isolation with a rubber dam, an access cavity was prepared, and the working length was determined using a #10 k-file. The canals were shaped and cleaned till #25/0.06 in all canals. The canals were irrigated with 2.5% sodium hypochlorite and 17% EDTA after the use of each file. In the subsequent appointment, the canals were dried using paper points, and obturation was done using AH Plus sealer. Finally, the access cavity was sealed with composite.

Fig 1: working length

Fig 2: master cone

Fig 3: obturation

CASE REPORT: 2

A 24-year-old female patient presented to the Department of Conservative Dentistry and Endodontics with a chief complaint of mild, continuous pain in the lower right back tooth region for the past 10-15 days. The pain was non-radiating and worsened upon biting. Clinical examination showed deep caries and tenderness to percussion in relation to tooth 46. An intraoral periapical radiograph revealed radiolucency on the distal aspect involving the pulp with the widening of the periodontal ligament space and the presence of an additional root in tooth 46. Based on clinical and radiographic findings, the diagnosis of symptomatic irreversible pulpitis with acute apical periodontitis in relation to tooth 46 was established. After adequate anesthesia and isolation with a rubber dam, an access cavity was prepared, and the working length was determined using a #10 k file. The canals were shaped and cleaned till #25/0.06 in all canals. The canals were irrigated with 2.5% sodium hypochlorite and 17% EDTA after each file was used. In the subsequent appointment, the canals were dried with paper points and obturation was done with AH plus sealer. Finally, the access cavity was sealed with composite.

Fig 1: pre operatory

Fig 2: working length

Fig 3: master cone

Fig 4: obturation

DISCUSSION:

The identification of supernumerary roots, such as Radix Entomolaris (RE) and Radix Paramolaris (RP), can greatly impact endodontic treatment. Accurately diagnosing the presence of these roots can prevent complications or the failure to identify an extra canal during root canal therapy. On clinical examination, signs such as an additional cusp, a prominent distolingual lobe, a bulbous crown, a cervical convexity, and a complex external contour of the furcation can indicate the presence of RE and RP. Radiographically the double periodontal ligament image or an obscured view of the distal root/canal can also suggest their presence. Taking a preoperative radiograph using the tube shift technique can assist in identifying the supernumerary root and its location.

The Entomolaris root is characterized by moderate to sharp curvature, particularly in the buccolingual direction. This can cause technical difficulties during cleaning and shaping, with an increased risk of instrument separation, furcal or strip perforation, vertical root fracture, canal straightening, ledge formation, loss of working length, and transportation. To prevent procedural errors, special care should be taken during orifice enlargement, cleaning, and shaping. During initial canal negotiation, the use of #10 k-file or a smaller file is preferred. Flexible nickel-titanium rotary instruments with less taper should be used during chemo-mechanical preparation.

Various methods can be used to locate additional canals, such as the law of symmetry, law of orifice location, visualizing the dentinal map, canal bleeding points, and the use of tactile sensation using hand instruments like endodontic explorer, pathfinder, DG 16 probe, and Micro openers. The champagne bubble test can also be used, whereby sodium hypochlorite is placed in the pulp chamber to produce effervescent bubbles from the remaining pulpal tissue in the canal, indicating the location of the canal orifice. Advanced imaging techniques, such as digital radiography, fiber optic illumination, dental endoscopy and orascopy, surgical loupes, operating microscope, micro-computed tomography (CT), visualization endograph using Ruddle's solution, and magnetic resonance microscopy, can help locate and confirm additional canals, particularly in multirooted teeth.

In some cases, the Radix canal orifice can be occluded by secondary or calcified dentine, which increases the risk of perforating the tooth during access preparation. Secondary dentine is generally whitish or opaque, whereas the floor

chamber is darker and grey in appearance. Therefore, visual access and superior control during access procedures are essential tools in these cases.

CONCLUSION:

Dentists and other oral health care professionals should be aware of variations in the anatomy of permanent mandibular first molars. Accurate diagnosis is crucial to ensure successful endodontic treatment and avoid treatment failures. Proper interpretation of radiographs taken at different horizontal angles can aid in identifying the number of roots and their morphology. upon diagnosis of an additional root in the mandibular first molar, it is recommended to modify the conventional triangular cavity to a trapezoidal shape that extends distolingually. This modification will help in locating the orifice of the extra root during the endodontic procedure. During treatment procedures, adjunctive aids, such as dental loupes, dental operating microscopes, and intraoral cameras, can be useful in identifying canal orifices. By possessing knowledge of the location of additional roots and their root canal orifices and utilizing an adapted clinical approach, procedural errors during endodontic therapy can be avoided or overcome, and the incidence of retreatment can be reduced.

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