

The Radix Entomolaris and Paramolaris: A Review and Case Reports with Clinical Implications

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Abstract

Normally, the permanent mandibular first molar has two roots, mesial and distal. However, mandibular molars may have an additional root located either buccally (radix paramolaris) or lingually (radix entomolaris [RE]). Understanding of the presence of an additional root and its root canal, anatomy is essential for successful treatment outcome. The aim of this paper is to review the prevalence and morphology of RE and to present two cases of permanent mandibular first molars with an additional third root (RE) in the Indian population. In this study, we did a clinical investigation of two cases; one case of successful endodontic management of permanent mandibular first molar characterized as RE, whereas the second one is a presentation of a case of severe bone loss around permanent first molar with an additional third root. The presence of an additional third root in permanent mandibular first molars may affect the prognosis of the tooth if it is misdiagnosed. Thus, an accurate diagnosis and thorough understanding of variation in root canal anatomy are essential for treatment success.

Key words: Additional third root, Permanent mandibular first molar, Radix entomolaris, Root canal anatomy

INTRODUCTION

The prevention or healing of endodontic pathology depends on a thorough chemomechanical cleansing and shaping of the root canals before a dense root canal filling with a hermetic seal. An awareness and understanding of the presence of unusual root canal morphology can thus contribute to the successful outcome of root canal treatment.^[1] In a mandibular first molar, an additional third root, first mentioned in the literature by Carabelli is called the radix entomolaris (RE). This supernumerary root is located distolingually in mandibular molars, mainly first molars.^[2] The presence of a separate RE in the first mandibular molar is associated with certain ethnic groups. Mandibular first molar which has three roots has a frequency of <5% in white Caucasian (UK, Dutch, Finnish,

German), African (Bantu Bushmen), Eurasian, and Indian populations.^[3] In those with Mongoloid traits, such as the Chinese, Eskimos, and Native American populations, it occurs with a frequency of five to more than 30%.^[4,5] RE has an occurrence of <5% in the Indian population and such cases are not routinely observed during dental procedures.^[6-12] Knowledge of such anatomic variation of root and root canals is essential during the treatment of the patients presenting with morphological diversities in their root canal anatomy. A case report on morphology, clinical approach to diagnosis and management of RE has been presented here.

CASE REPORT

An 18-year-old female came for endodontic treatment of mandibular right first molar. On clinical examination, the tooth was deeply carious and was diagnosed with irreversible pulpitis. The radiograph of the mandibular right first molar was normal without any periapical changes. After anesthetizing the tooth, access preparation was done with an endo-access bur and canal orifices were located with DG 16 endodontic explorer. Initial negotiation of

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the root canals was conformed with K-file 10. The fourth distolingual canal orifice was present far from distal root canal orifices. The canal lengths were determined radiographically with K file ISO 15 size. They were cleaned with 2.5% sodium hypochlorite along with EDTA and shaped and the patient was recalled after 3 days. At the next appointment, obturation done [Figures 1-5 and Table 1].

Case 2

A 28-year-old female was referred for endodontic treatment of the mandibular right first molar with pain and swelling from past 2-month clinical presentation-patient is gone to root canal treatment 6 months back, on radiographic examination shows incomplete obturation with a missed canal in relation to 46 and periapical lesion in distal root and one missed canal treatment plan – retrieval of obturating material access cavity four distinct canal orifices were found and were coronally enlarged with gates glidden drills. Initial negotiation of the root canals was performed [Table 1 and Figures 1-5].

DISCUSSION

The etiology behind the formation of the RE is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to the penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of absence).

In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in the more pronounced phenotypic manifestation.^[8] Curzon suggested that the “three rooted molar” trait has a high degree of genetic penetrance as its dominance was reflected in the fact that the prevalence of the trait was similar in both pure Eskimo and Eskimo/Caucasian mixes.^[13,14]

The presence of a separate RE in the first mandibular molar is associated with certain ethnic groups. In African populations, a maximum frequency of 3% is found, while in Eurasian and Indian populations, the frequency is <5%. In populations with Mongoloid traits (such as the Chinese, Eskimo, and American Indians), reports have noted that the RE occurs with a frequency.

The RE is located distolingually, with its coronal third completely or partially fixed to the distal root. The dimensions of the RE can vary from a short conical extension to a “mature” root with normal length and root canal. In most cases, the pulpal extension is radiographically visible. In general, the RE is smaller than the distobuccal

and mesial roots and can be separate from, or partially fused with, the other roots.^[12]

A Classification by Carlsen and Alexandersen Describes Four Different Types of RE According to the Location of the Cervical Part of the RE

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

This classification allows for the identification of separate and non-separate RE.

Table 1: Incidence of two canals in distal root of mandibular first molar

Author/year	incidence (%)	population group
Skidmore (1971)	28.9	Caucasians
Gulabivala <i>et al.</i> (2002)	33.4	Thai
Sen <i>et al.</i> (2004)	46	Turkish
Gulabivala <i>et al.</i> (2001)	10.1	Burmese



Figure 1: Clinical images of extracted mandibular molars with a radix entomolaris or paramolaris. (a) First molar with a radix entomolaris (distolingual view [left] and lingual view [right]). (b) Radix entomolaris on a third molar (lingual view). (c) First molar with a separate radix paramolaris (buccal view). (d) First molar with a fused radix paramolaris (buccal view). (Courtesy JOE [2007];33;59)



Figure 2: Pre-operative radiographic



Figure 3: Working length determination



Figure 4: Master cone

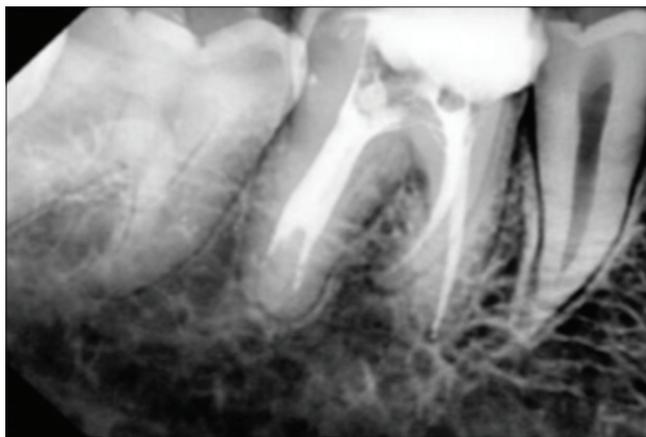


Figure 5: Obturation

De Moor *et al.* (2004) classified RE based on the curvature of the root or root canal.^[7]

1. Type 1: A straight root or root canal^[2]
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 *et al.* (2010) further added two more newly defined variants of RE.^[8]

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.

Radix Paramolaris (RP) (Additional Root Located Buccally) Prevalence

Bolk reported the occurrence of RP.^[12] RP is very rare and occurs less frequently than RE.^[12] Visser reported the prevalence of RP to be 0% for mandibular first molars, 0.5% for second molars, and 2% for third molars.^[15]

Classification

Carlsen and Alexandersen (1991) classified 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 RP is located mesiobuccally. The dimensions of RP may vary from short conical extension to a mature root which can be separate or fuse. Few observations can be made from various studies, that is, an increased number of cusps is not necessarily related to an increased number of roots; however, an additional root is always associated with an increased number of cusps and with an increased number of root canals.

Clinical Implications

Endodontic procedures

The presence of RE has clinical implications in root canal treatment. Accurate clinical and radiographic diagnosis can avoid failure of root canal treatment because of a missed canal in distolingual root. The most important basic principle for successful root canal treatment is the principle of “straight-line access.”^[13] Ultimate objective is to provide access to the apical foramen. As the orifice of RE is distolingually located, the shape of access cavity should be modified from classical triangular form to trapezoidal or rectangular form to better locate the orifice of 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 through the pulpal floor and lie perpendicular to this mesiodistal line across the center.^[16-18] Straight-line access is essential as the majority of radices entomolaris are curved. Care must be taken to avoid excessive removal of dentin or gauging during access cavity preparation, as this may weaken the tooth structure. A thorough inspection of the pre-operative radiograph and interpretation of

particular marks or characteristics, such as an unclear view or outline of the distal root contour or the root canal, can indicate the presence of a “hidden” RE. To reveal the RE, a second radiograph should be taken from a more mesial or distal angle (300).^[19,20]

Clinical inspection of the tooth crown and analysis of the cervical morphology of the roots by means of – periodontal probing can facilitate the identification of an additional root. Using various instruments such as endodontic explorer, pathfinder, DG 16 probe, and micro-opener champagne effect – bubbles produced by remaining pulp tissue in the canal, while using sodium hypochlorite in pulp chamber. An extra cusp (tuberculum paramolare) or more prominent occlusal distal or distolingual lobe, in combination with a cervical prominence or convexity.

An extension of the triangular opening cavity to the (disto) lingual results in a more rectangular or trapezoidal outline form. Visual aids such as a loupe, intraoral camera, or dental microscope can, in this respect, be useful. A dark line on the pulp chamber floor can indicate the precise location of the RE canal orifice. A severe root inclination or canal curvature, particularly in the apical third of the root (as in a Type III RE), can cause shaping aberrations such as straightening of the root canal or a ledge, with root canal transportation and loss of working length resulting. The use of flexible nickel-titanium rotary files allows a more centered preparation shape with restricted enlargement of the coronal canal third and orifice relocation. After relocation and enlargement of the orifice of the RE, initial root canal exploration with small files (size 10 or less) together with radiographical root canal length and curvature determination, and the creation of a glide path before preparation, is step-by-step actions that should be taken to avoid procedural errors.

CONCLUSION

The oral health-care professionals should be aware of this variation in the anatomy of permanent mandibular first molars. The initial diagnosis is of utmost importance to facilitate the endodontic procedure and to avoid treatment failures. Proper interpretation of radiographs taken at different horizontal angulations may help to identify a

number of roots and their morphology. Once diagnosed, the conventional triangular cavity should be modified to a trapezoidal form distolingually to locate the orifice of the additional root.

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