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The Radix Entomolaris and Paramolaris: A Case Report

Shailendra Gupta* Deepak Raisingani Rishidev Yadav*****

*M.D.S, Professor & Head, **M.D.S, Associate Professor, ***M.D.S, Senior Lecturer, Department of Conservative Dentistry & Endodontics, Mahatma Gandhi Dental College & Hospital, Jaipur, Rajasthan, India.
Contact: draisingani@gmail.com

Abstract:

An awareness and thorough knowledge of internal and external root canal morphology contribute to the successful root canal treatment. A mandibular first molar Radix Entomolaris (Additional lingual root) and Radix Paramolaris (Additional Buccal root) with two distal roots is an interesting example of anatomic variation. This paper describes 2 case reports of mandibular first molar with three roots (one mesial and two distal) and four canals (two in mesial and one in each distobuccal and distolingual root).

Keywords: Endodontic treatment, mandibular molar, anatomical variations, radix entomolaris, radix paramolaris.

Introduction:

A clinician should have complete knowledge of anatomic variation of macrostructure and internal and external root canal anatomy. A successful endodontic treatment includes locating the root canal orifice, chemomechanical cleaning and shaping of the root canals before a dense root canal filling with a hermetic seal. First molars has two-root with two mesial and one distal canal. In most cases the mesial root has two root canals, ending in two distinct apical foramina and sometimes, these merge together at the root tip to end in one foramen. The distal root typically has one kidney-shaped root canal.[2,3,5,6]

Anatomical variations have been described in the mandibular first molar like the number of root canals, the number of roots may also vary. 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. An additional root at the mesiobuccal side is called the radix paramolaris (RP).[9] The identification and external morphology of these root complexes, containing a lingual or buccal supernumerary root, are described by *Carlsen* and *lexandersen*. When present, complete diagnosis and treatment plan is necessary and clinician should take it as a additional canal to fill.[7,9,10]

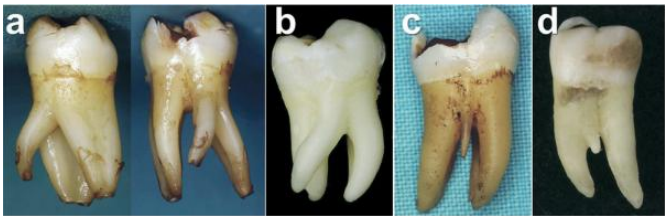

Fig 1: Clinical images of extracted mandibular molars with a radix entomolaris or paramolaris. (*A*) first molar with a radix entomolaris [distolingual view (left), lingual view (right)]. (*B*) radix entomolaris on a third molar (lingual view). (*C*) first molar with a separate radix paramolaris (buccal view). (*D*) first molar with a fused radix paramolaris (buccal view).
[Courtesy JOE (2007);33;59]

Case 1:

An 18 years old female came for endodontic treatment of mandibular right first molar. On clinical examination the tooth was deeply carious and was suffering from irreversible pulpitis. Radiograph of mandibular right first molar was normal without any periapical changes(Fig 2a).

After anaesthetizing the tooth, access preparation was done with endo-access bur and canal orifices were located with DG 16 endodontic explorer. Initial negotiation of the root canals was conformed with K-file 10. The fourth disto-lingual canal orifice was present far from distal root canal orifices(Fig 2d).

The canal lengths were determined radio graphically with K file ISO 15 size and electronically with Root ZX (Fig 2c). They were cleaned with 2.5% sodium hypochlorite along with EDTA and shaped with protaper rotary system till a size of F-2 and patient was recalled after 3 days . At next appointment patient was asymptomatic. Master cone radiograph revealed proper fitting of cones .Canals were dried with paper point and obturation done by using zinc oxide eugenol sealer(Fig 2f).

Fig 2a:Diagnostic radiograph

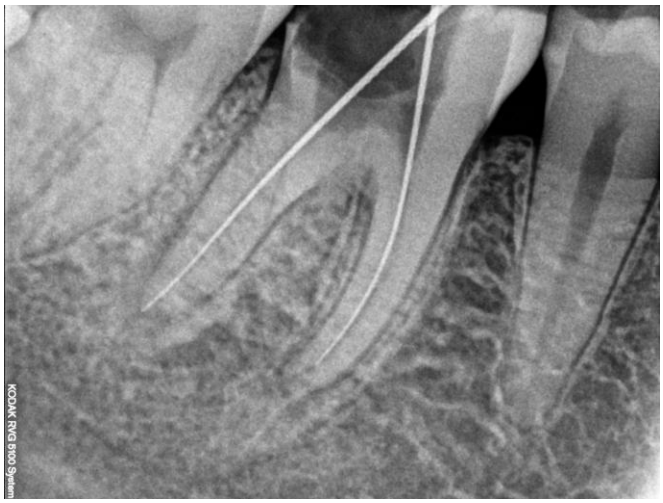

Fig2b:working length radiograph

Case 2

A 28 year-old male was referred for endodontic treatment of the mandibular right first molar with irreversible pulpitis. Radiographical examination showed two distal root and no signs of apical periodontitis (Fig 3a). Access cavity four distinct canal orifices were found and were

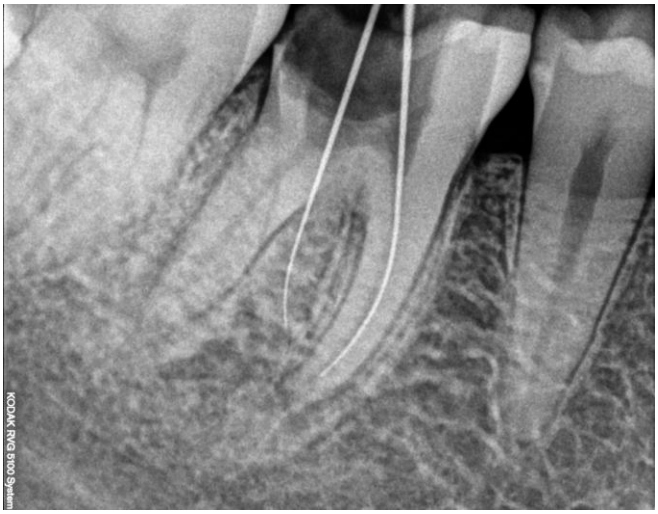

Fig2c: Third root working length

Fig2d: Occlusal view of pulp chamber

Fig 2e: Master cone radiograph

coronally enlarged with Gates Glidden drills. Initial negotiation of the root canals was performed with a K-file #10. The lengths of these canals were measured radiographically and verified using apex locator (Root ZX Triauto ZX) (Fig 3b). The canals were cleaned with 2.5 % sodium hypochlorite solution and Glyde (Dentsply Maillefer)), and shaped with ISO instruments with crown down technique. All canals were filled with gutta-percha and ZOE sealer (Fig 3c).

Fig2f: Post obturation radiograph

Discussion:

The etiology behind the formation of the radix entomolaris (RE) is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to 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]

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 less than 5%. In populations with Mongoloid traits (such as the Chinese, Eskimo and American Indians) reports have noted that the RE occurs with a frequency

Fig 3a: Diagnostic radiograph

Fig3b: Working length radiograph

that ranges from 5% to more than 30%. Because of its high frequency in these populations, the RE is considered to be a normal morphological variant (Eumorphic root morphology). In Caucasians the

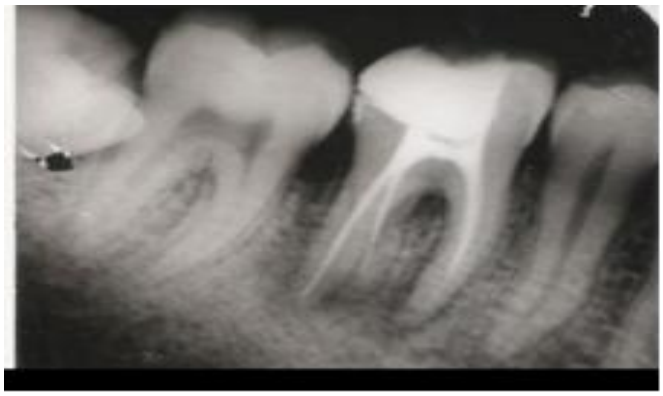

Fig:3 c Post Obturation Radiograph

RE is not very common and, with a maximum frequency of 3.4 to 4.2%, is considered to be an unusual or dysmorphic root morphology.[9,12,14]

An RE can be found on the first, second and third mandibular molar, occurring least frequently on the second molar. Some studies report a bilateral occurrence of the RE from 50 to 67%. *Bolk* reported the occurrence of a buccally located additional root: the RP. This macrostructure is very rare and occurs less frequently than the RE. The prevalence of RP, as observed by *Visser*, was found to be 0% for the first mandibular molar, 0.5% for the second and 2% for the third molar.

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

Author/Year	Incidence (%)	Population group
Skidmore and Bjorndal (1971)	28.9	Caucasians
Vertucci and Williams(1974)	30	Caucasians
Yew and Chan (1993)	31.5	Chinese
Zaatar et al (1997)	29.9	Middle East
Gulabivala et al (2001)	20	Burmese
Gulabivala et al (2002)	33.4	Thai
Sen et al (2004)	46	Turkish

Table 2: Prevalence of three rooted mandibular first molars- survey of available studies

Author/year	Prevalence (%)	Population group
Taylor (1899)	3.4	United Kingdom
Tratman (1938)	5.8	Chinese
Tratman (1938)	0.2	Indians
Skidmore and Bjorndal (1972)	2.2	Caucasians
Yones et al (1990)	2.92	Saudi
Loh (1990)	7.9	Chinese (Singapore)
Yew and Chan (1993)	21.5	Chinese
Sperber and Moreau (1998)	3.0	Senegalese
Gulabivala et al (2001)	10.1	Burmese

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 radix entomolaris (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 nonseparate radix entomolaris.

In the apical two thirds of the RE, a moderate to severe mesially or distally orientated inclination can be present. According to the classification of *De Moor et al*, based on the curvature of the separate RE variants in bucco-lingual orientation, three types can be identified.[8]

Type I - refers to a straight root/root canal,

Type II refers to an initially curved entrance which continues as a straight root/root canal.

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.

The radix paramolaris (RP) is located buccally. As with the RE, the dimensions of the RP can vary from a 'mature' root with a root canal, to a short conical extension. This additional root can be separate or nonseparate *Carlsen* and *Alexandersen* describe two different types: types A and B. Type A - An RP in which the cervical part is located on the mesial root complex, Type B - An RP in which the cervical part is located centrally, between the mesial and distal root complexes.

An increased number of cusps is not necessarily related to an increased number of roots; however, an additional root is nearly always

associated with an increased number of cusps, and with an increased number of root canals.

The presence of an RE or an RP has clinical implications in endodontic treatment. An accurate diagnosis of these supernumerary roots can avoid complications or a 'missed canal' during root canal treatment. Because the (separate) RE is mostly situated in the same buccolingual plane as the distobuccal root, a superimposition of both roots can appear on the preoperative radiograph, resulting in an inaccurate diagnosis.

A thorough inspection of the preoperative 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 (30^0).

Clinical inspection of the tooth crown and analysis of the cervical morphology of the roots by means of -

- Periodontal probing can facilitate identification of an additional root.
- Using various instruments like endodontic explorer, path finder, 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, intra-oral 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, are step-by-step actions that should be taken to avoid procedural errors.[8,12,16]

Conclusion:

Clinicians should be aware of these unusual root morphological variations of the RE in terms of root inclination and root canal curvature. A careful and adapted diagnostic and clinical approach to avoid or overcome procedural errors during endodontic therapy.

The initial diagnosis of a radix entomolaris or paramolaris before root canal treatment is important to facilitate the endodontic procedure, and to avoid 'missed'canals. Preoperative periapical radiographs exposed at two different horizontal angles and clinical diagnosis are required to identify these additional roots.

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