Case Report
Journal of Pierre Fauchard Academy (India Section), *Vol 36(4), DOI: 10.18311/jpfa/2022/31155, December 2022 p. 142-146*
ISSN (Print) : 0970-2199
ISSN (Online) : 2405-772X

CBCT Imaging of a Rare Case of Radix Entomolaris in Mandibular Second Molar

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Abstract

The presence of an additional supernumerary distolingual root in the mandibular molar is termed Radix Entomolaris (RE). It is common in the mandibular first molar, but its occurrence in the mandibular second molar is scarcely reported in the literature. Two-dimensional imaging can diagnose anatomical root canal variations when taken with different horizontal angulations. With the recent innovations in three-dimensional diagnostic imaging, cone beam computed tomography (CBCT) can aid in unfolding the complexities of the root canal system. Accurate diagnosis by CBCT leads to the success of endodontic treatment. A rare case of radix entomolaris in the mandibular second molar in an Indian female is reported here with three of its CBCT findings. Imaging in all three dimensions, oblique sections and volume rendering by CBCT proved to be of additional help to understand the complex anatomy and root canal morphology of the tooth.

Keywords: Additional Root, Cone Beam Computed Tomography, Distolingual Root, Mandibular Second Molar, Radix Entomolaris, Radix

1. Introduction

Variations of root canal anatomy involving extra roots and canals make root canal treatment complicated. Multiple anatomic variations like the presence of extra canals or canals, C-shaped canal configuration, dens in dente and abnormal morphology of the tooth and root can occur. The prospects of a successful endodontic outcome increase with the knowledge of root canal anatomy. In recent times, Cone Beam Computed Tomography (CBCT) has been a blessing in acquiring an in-depth knowledge of complex root canal morphology.

The presence of a distolingual supernumerary extra root is called Radix Entomolaris (RE)[1]. It is one of the most common variations of the mandibular first molar with the presence of a distolingual root, first discovered by Carabelli in the year 1844 and termed by Bolk in 1915[1,2]. According to Manning, only 2% of mandibular second molars have three roots[3]. RE is common in the mandibular first molar but its occurrence in the mandibular second molar is an exception and is rarely reported in the literature. The present study reports the diagnosis of an unusual case of RE in the mandibular second molar with three roots and four canals with three-dimensional imaging findings by CBCT.

2. Case Report

A 56 -year-old female patient came with a complaint of pain in the lower left posterior tooth for one week. Clinical examination revealed that the mandibular left second molar was restored (tooth #37). The tooth was tender on percussion. A provisional diagnosis of acute irreversible pulpitis with apical periodontitis was made and the patient was sent for radiographic investigation.

The intraoral periapical radiograph showed a radio-opaque restoration in proximity to the pulp with the widening of the periodontal ligament space and the

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shadow of an additional root between the mesial and distal roots. (Figure 1A-B). The presence of an additional root was suggestive of Radix Entomolaris (RE) which was confirmed by CBCT.

After obtaining the informed consent of the patient, a CBCT of the left mandibular posterior region was performed with Kodak 9500 (tube voltage: 90 kV, current: 10 mA, Carestream Health Inc., Rochester, NY, USA). The transverse, axial and sagittal CBCT sections of the involved tooth were assessed and all images were analyzed with the help of CS three-dimensional (3D) imaging software (Carestream Dental LLC). The CBCT scan slices confirmed the presence of radix entomolaris. Axial images were obtained at 180 µm thickness and were studied at the cervical, middle, and apical third of the roots to determine the canal morphology (Figure 1C). The images revealed that the left mandibular second molar had three roots and four root canals (mesiobuccal, mesiolingual, distobuccal and distolingual). The accessory distal root was present centrally and lingually in between the mesial and distal roots. The distolingual root was slightly curved in the cervical area and curved buccally at the apex.

3. Discussion

The aetiology of RE is not known. Genetic factors have been strongly implicated in its aetiology. The penetrance of an atavistic gene or polygenetic system or due to external factors during odontogenesis has been attributed to RE[4,5]. The presence of RE has been attributed to certain ethnic groups as described in Table 1[6–8].

Radix entomolaris is usually present disto-lingually and mainly in mandibular first molars. The presence of an additional root on the mesiobuccal aspect may occur rarely and is described as Radix Paramolaris (RP)[9]. Radix entomolaris and radix paramolaris can be found on the first, second and third mandibular molar, but their presence has been reported with the least frequency in the second molar. The RE may be a short conical extension or a mature root. It is found to be more common in males and on the right side than in females. It is mostly reported among Mongoloids, Thais and Japanese and is a rare occurrence among Indians[6]. The presence of RE noted in our patient was an infrequent finding as it was present in an Indian female in the mandibular second molar on the left side.

Various classifications have been used to categorise RE as follows:

Table 1. Prevalence of radix entomolaris in different ethnic groups

Ethnic Groups	Percentage of Occurrence
Mongoloids	40%
Eskimos	27%
Taiwanese [Chinese]	21.1%-33.33%
Thai	13%
Indians and Eurasians	<5%
Europeans	3.4-4.2%
Africans	3%
Turkish	1.9 (1st MOLAR) 0.6 (2nd MOLAR)

Table 2. Carlsen and Alexanderson have classified RE as follows

Type A	Distal part of the root has three cone-shaped macrostructures; lingual, medial and facial, which may be non-separate or lingual structure is separate while the medial and facial structures are non-separate.
Type B	Distal part of the root has two cone-shaped macrostructures, lingual and facial of nearly the same size.
Type C	Cervical part is located mesially
TypeAC	Cervical part is centrally located, between mesial and distal root components.

Table 3. De Moor's classification of RE

Type I	Straight root/root canal
Type II	Initially curved entrance which continues as a straight root/root canal
Type III	Initial curve in the coronal third of the root canal and a second curve beginning in the middle third and continuing to the apical third

Table 4. Wang's classification of RE

Type i	Easily identified on a radiograph
Type ii	A large beam angulation mesially or distally is necessary for its identification.
Type iii	Identification of RE is extremely difficult, because of the overlap of the adjacent distobuccal root.

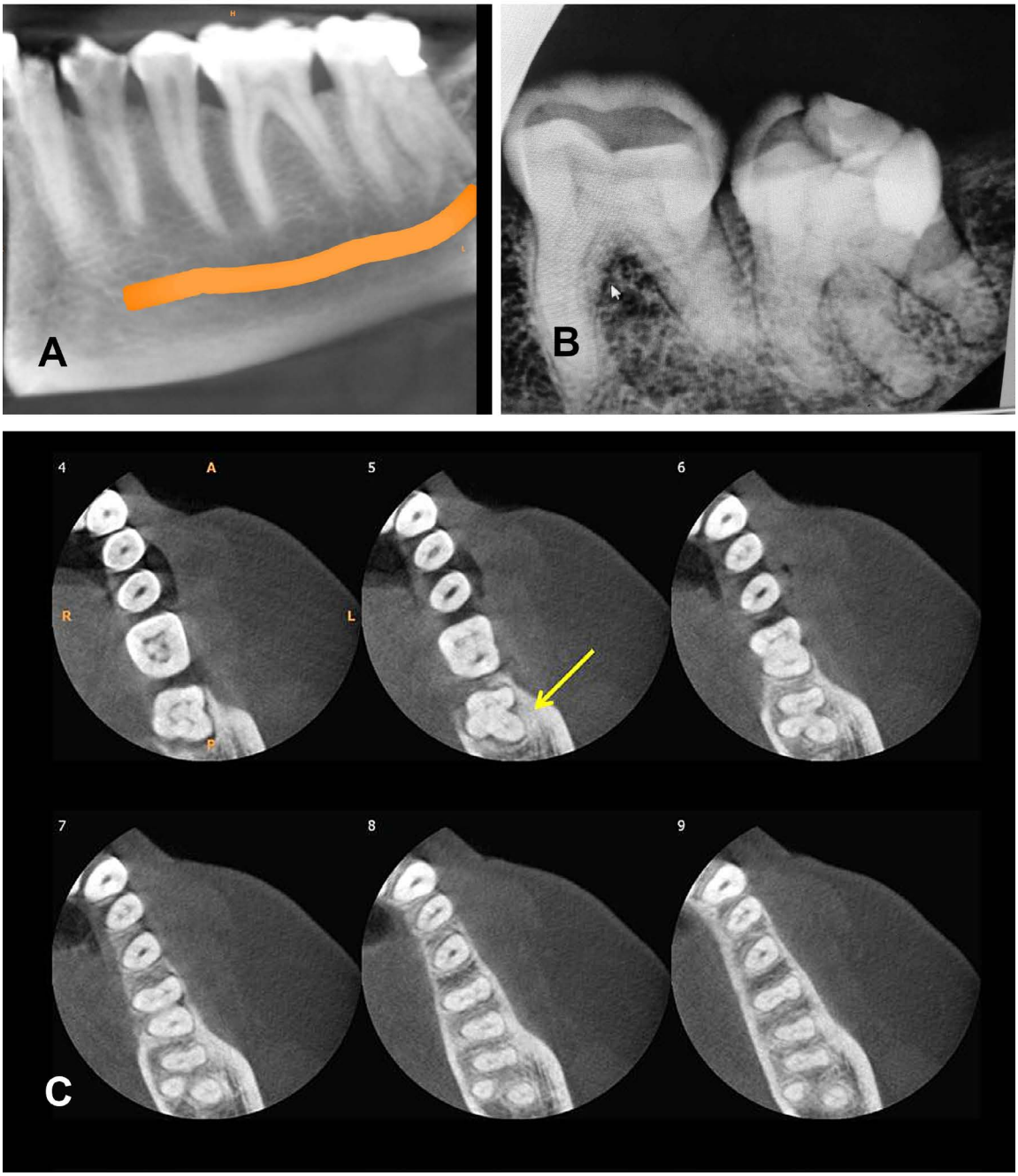


Figure 1. (A) OPG; B) Intra-oral peri-apical view; C) axial section of mandible on CBCT depicts shadow of an additional root between the mesial and distal roots of tooth #37.

1. Carlsen and Alexanderson[10] have classified RE on the basis of the morphology of the cervical third of RE. (Table 2)
2. De Moor *et al.*[11] have described, three types of RE based on the curvature of the extra root in the buccolingual direction: (Table 3)
3. Wang[12] has also classified RE depending on its identification on the periapical radiograph (Table 4)

In our case report, CBCT helped us to confirm and classify the presence of radix entomolaris in the mandibular left second molar. In the present case, CBCT images confirmed the presence of Type III curvature

according to De Moor classification. (Figure 2). According to Wang, it was classified as type (i) since it was evident clearly on the intraoral periapical radiograph. According to Carlson & Alexanderson's classification, the RE was classified as type B, in which the distal part of the root has two cone-shaped macrostructures of nearly the same size. (Figure 3).

4. Diagnosis

Clinical diagnostic methods, root canal morphology and thorough examination of the pulp chamber and conventional IOPA have been suggested for the diagnosis of RE. It has been reported that additional roots and canals can also be found in teeth with additional cusp/tubercle (tuberculum paramolare)[13]. A thorough clinical examination may reveal the presence of an extra tubercle/lobe in combination with cervical prominence and may point towards an extra root. An additional tubercle was found in 23% of the teeth with radix entomolaris in a study by Duman *et al.*[6]

An accessory root is clearly visible on an intraoral periapical radiograph in most cases, however it may sometimes be obscured. The presence of an ill-defined outline of the distal root contour or canal may indicate the presence of RE. An intraoral periapical radiograph may be supplemented with an additional radiograph with different horizontal angulation (Clark's rule/SLOB rule)[14]. Advanced imaging with CBCT provides images of the area of interest in all three dimensions. This technology helps in the identification of the location and pattern of canal morphology, the number of canals, missed canals and calcifications along with lateral canals. In our case, it was very difficult to predict the root canal anatomy on the basis of a preoperative radiograph alone. Endodontic application in CBCT utilizes a small field of view with high resolution and minimal radiation exposure.

Literature reveals that the majority of RE may have one or more curvatures starting in the middle third or apical third of the root. CBCT images always result in the identification of a greater number and anatomy of root canal systems since it allows detailed examination in all three planes.

5. Conclusion

RE is extremely rare in the mandibular second molar. Initial identification of this entity on an intraoral radiograph and further treatment planning by a CBCT is vital for the success of endodontic treatment. CBCT aids in an in-depth understanding of the true morphology of curved root/roots and canals. This is a case report of RE of a mandibular second molar with three roots and four canals confirmed with the help of CBCT.

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