Case Report

The Radix Entomolaris and Paramolaris: Clinical Approach in Endodontics

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Abstract:
Mandibular molars can have an additional root located lingually (the radix entomolaris) or buccally (the radix paramolaris). If present, awareness, and understanding of this unusual root and its root canal morphology can contribute to the successful outcome of root canal treatment. This report discusses the endodontic treatment of mandibular molars with a radix entomolaris or paramolaris, both of which are rare macrostructures in the Caucasian population. The prevalence, the external morphological variations, and the internal anatomy of the radix entomolaris and paramolaris are described.

Keywords: Anatomical variations, endodontic treatment, mandibular molar, radix entomolaris, radix paramolaris.

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INTRODUCTION

Knowledge of the internal anatomy and possible variations in the morphology of the root canal system is essential for performing successful endodontic therapy. Professionals must be prepared to identify and perform endodontic treatment of teeth that exhibit unusual configurations, to ensure that the entire root canal system will be debrided and filled. Among the dental groups that may have variations are the permanent mandibular molars; however, in Caucasian populations, these teeth are generally two-rooted (one mesial root with two mesial root canals and one distal root with one distal root canal) [Vertucci et al. 1984]. The presence of a supernumerary root in the distal-lingual region of the first permanent mandibular molars was first described by Carabelli, who called it the radix entomolaris (RE). The prevalence of RE differs significantly depending on the ethnic group, ranging from 0 to 33.33% [Garg et al. 2010, Tu, 2009]. The high prevalence in Asian populations such as Chinese, Korean and Taiwanese individuals, with an occurrence ranging from 24.5% to 33.3% [Tu et al. 2009, Kim, 2018], has led to this morphology being considered normal (eumorphic root morphology) [Kim et al. 2018]. In African, Eurasian, Caucasian, and Indian populations, this is considered dysmorphic root morphology, with a low prevalence of less than 5% (Culberson et al. 2007).

Regarding the clinical management of these root canals, the literature reports the importance of resources such as computed tomography for diagnosis [Abella et al. 2011, Rodrigues,2016], microscopic magnification [Calberson et al. 2007], and the use of ultrasonic inserts [López-Rosales et al. 2015] to help with localization. In addition, preparation with automated NiTi systems is indicated, mainly due to the curvatures that may be present in these root canals [Abella et al., 2011, López Rosales, 2015]

Radix entomolaris can be found in first, second, and third mandibular molar teeth [Song et al. 2010, Ferraz, 1993]; however, the literature has reported a higher number of occurrences in case reports of first

molars [Calberson et al. 2007, Rozito,2014, Abella, 2011]

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Because of this, it is crucial for clinicians need to be able to diagnose and perform endodontic treatment in a safely and predictably. Therefore, this report aimed to present the diagnosis and endodontic management of a clinical case of permanent mandibular first molars with radix entomolaris with the use of contemporary technical resources.

CASE REPORT

A 28-year-old Indian male patient reported with a chief complaint of pain in the lower- right posterior tooth region of the jaw for a few days. Clinically, the lower right first molar tooth had deep occlusal caries and was tender on vertical percussion. Mobility of the tooth was within physiologic limits. Radiographically, periapical radiolucency was seen with both mesial and distal roots (Figure 1a). The presence of third additional root was also revealed on the distal side. The extra root was relatively straight and originated from the distolingual aspect of the tooth. The tooth was unresponsive on electric pulp testing. A diagnosis of chronic apical periodontitis in relation to the lower right first molar was made because of pulpal necrosis. The tooth was anesthetized. An access opening was made, and two mesial canal orifices (mesiobuccal, mesiolingual) and one distal canal orifice (distobuccal) were initially located. Another orifice was located on the distolingual part of the pulpal floor on further exploration. The root canals orifices were enlarged using gates glidden drills (Mani Inc., Japan) for straight line access, and shape of the access cavity was modified from a triangular form to a more trapezoidal form to locate distolingual root better. The root canals were explored with a K-file ISO number 10 and 15, and the radiographic length of the root canals was determined (Figure 1b). Biomechanical preparation was carried out using the Neo endo flex rotary files (Orikam) in all the canals with intermittent irrigation using 3% sodium hypochlorite. Obturation of the root canals was performed using the gutta-percha points (Sure endo) (figure 1c) and AH plus sealer (Dentsply, Switzerland). The access open cavity was then sealed with temporary restoration (Cavit) (Figure 1d).

Figure 1a

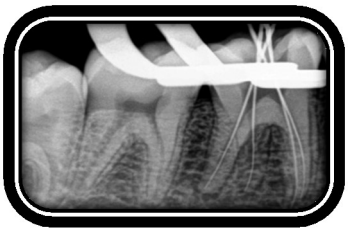

Figure 1b

Figure 1c

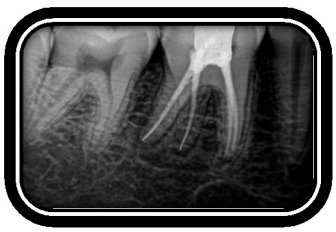

Figure 1d

DISCUSSION

Radix Entomolaris (additional root located lingually)

Prevalence:

Anatomic variations in permanent mandibular first molars are documented in the literature. The majority of mandibular first molars are two rooted; mesial and distal. Sometimes, an extra distobuccal or distolingual root may be encountered. The etiology for radix entomolaris is still unknown; it can be because of external factors during tooth formation or can attributed to the atavic gene or polygenic system. It has also been suggested that "three-rooted molar" traits have a high degree of genetic predisposition as in Eskimos and in a mixture of Eskimos with Caucasians. The presence of radix entomolaris has been associated with ethical groups of mongoloid origin (>30%), relatively low prevalence in white Caucasian, African, Eurasian and Indian populations. The radix entomolaris may also be present in the first, second and third molar, being less prevalent in the second molar. A bilateral occurrence of radix entomolaris has also been reported. The relationship between radix entomolaris (RE), gender predilection, and side distribution are unclear. Few studies have reported more male predilection for RE, while others reported no significant difference between gender and RE. Similarly, no significant difference was reported for side distribution, despite few studies reporting it to be more on the left side while others on the right side. Bilateral occurrences for RE has been reported to range from 37.14 – 67 %.

Classification:

Carlsen & Alexandersen (1990) classified radix entomolaris (RE) into four different types based on the location of its cervical part]: 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 that becomes straighter in the middle and apical third. 3. Type 3: an initial curve in the coronal third with a second buccally oriented curve that 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.

Morphology:

The radix entomolaris is located distolingually, ranging from short, conical extension to averge mature root length with its coronal third partially entirely fixed to the distal root. Generally, the radix entomolaris is smaller than mesio- and distobuccal roots and may contain pulpal tissue [22]. Externally, the distal furcation is slightly lower (1 mm) than the furcation between mesial and distal roots. Clinically, a tooth with an additional distolingual root may present a more bulbous crown outline, an additional cusp, a prominent distolingual lobe, or cervical prominence. These features can indicate the presence of additional root. Radiographically, third root is visible.in 90% of cases. Occasionally it may be missed because of its slender dimension or overlapping with distal root. Radiographs should be carefully inspected to reveal the presence of hidden radix entomolaris which might present as unclear outline of distal root or root canal. Additional radiographs taken from different horizontal projections, 20 degree from mesial and 20 degree from distal reveals the basic information about the anatomy of additional third root. In addition to this, magnifying loupes, dental microscope or intraoral camera may also be useful. Recently, cone-beam computed tomography (CBCT) has emerged as a useful tool to aid in the diagnosis of teeth with complex root anatomies. However, cost and accessibility are the main limiting factors till now.

Radix paramolaris (additional root located buccally)

Prevalence:

Bolk reported the occurrence of radix paramolaris. Radix paramolaris is very rare and occurs less frequently than radix entomolaris [12]. Visser reported the prevalence of radix paramolaris to be

0% 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 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, i.e. 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 radix entomolaris has clinical implications in root canal treatment. Accurate clinical and radiographic diagnosis can avoid failure of root canal treatment because of missed canal in distolingual root. Most important basic principle for successful root canal treatment is the principle of 'straight-line access'. Ultimate objective is to provide access to the apical foramen. As the orifice of radix entomolaris is distolingually located, the shape of access cavity should be modified from classical triangular form to trapezoidal or rectangular form in order to better locate the orifice of distolingual root. The root canal orifices follow the laws of symmetry which help in locating the radix entomolaris. 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 centre. Straight line access is essential as 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.

CONCLUSION

The high frequency of a fourth canal in mandibular first molars makes it essential to anticipate and find all canals during molar root canal treatment. The possibility of an extra root should also be considered and looked for carefully. Proper angulation and interpretation of radiographs help to identify chamber and root anatomy. In the case of an RE the conventional triangular opening cavity must be modified to a trapezoidal form in order to better locate and access the distolingually located orifice of the additional root. Straight-line access, in this respect, has to be emphasized as the majority of the radices entomolaris are curved.

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