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RADIX ENTAMOLARIS AND PARAMOLARIS: A REVIEW

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ABSTRACT: A thorough knowledge of root canal anatomy and its variations is very important for successful endodontic therapy and it depends upon the locations of all the canals, debridement and proper sealing. At times the clinicians are challenged with variations in morphology of root canal, one of such variations are observed in mandibular first molars. It is well known that both primary and permanent mandibular first molars usually have two roots, one mesial and distal and rarely an additional third root (supernumerary root) , when it is located distolingually to the main distal root is called “radix entomolaris (RE)” and when it is placed mesiobuccaly to the mesial root is called “radix paramolaris (RP) .” This review article attempts to make the dental fraternity aware of this morpho-anatomical variation, prevalence and endodontic management of these teeth thereby making their endodontic treatment successful.

KEYWORDS: Radix entamolaris (RE) , Radix paramolaris (RP) , Prevalence, Classification, Identification, Management

INTRODUCTION

The primary objective of the endodontic treatment relies on the identification and complete cleaning of the root canal system [1]. Establishing adequate access for cleaning and shaping is an integral part of this procedure. In order to achieve these endodontic goals, the clinician must have an in-depth knowledge of root canal anatomy and be aware of its anatomic diversities such as extra roots, extra canals, webs, fins, and isthmuses that may complicate the endodontic procedure. Additional roots and root canals if not detected could lead to endodontic failure.

. The additional third root in mandibular first molars was first mentioned in the literature by Carabelli in 1844 [2] and is described by various terms, such as “extra third root” or “distolingual root” or “extra distolingual root or Radix entamolaris. Radix paramolaris (RP) on the other hand is known as the “mesiobuccal root” and was first described by Bolk [3]. The purpose of this study was to perform a review of literature related to variations in roots and root canal morphology of permanent mandibular first molar along with identification and their management.

Prevalence

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% .Tratman and others surveyed the Indian population in 1938 and found its frequency <5% [5 -8]. However, few studies have reported higher prevalence of RE, with a range from 2.19-13.3%, among the Indian population. Presence of RE in the first mandibular molar is most commonly seen in the Mongoloid population[9 –12].

Bolk reported the occurrence of a buccally located additional root, the Radix paramolaris(RP). This macrostructure is very rare and occurs less frequently than the RE. The prevalence of RP as observed by Visser [15], was found to be 0% for the first mandibular molar, 0.5% for the second and 2% for the third molar. Other studies have, however, reported RP in first mandibular molars [13-14].

Reports have been presented by Pomeranz et al. and Goel et al. on the incidence of RP in mandibular molars, with an occurrence ranging from 1% to 15% in vivo [24 - 25].

Etiology

Factors during Odontogenesis or presence of an atavistic gene could affect the formation of supernumerary roots. De Moor proposed that particular racial genetic factors might affect the more profound expression of a specific gene leading to the more pronounced phenotypic eumorphic manifestation in roots[17].

CLASSIFICATION

I. **Radix entamolaris (RE)**

RE can be classified into four different types depending on the location of its cervical part[18] :

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

Type B: The RE is located lingually to the distal root complex which has one cone-shaped macrostructures.

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

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

Each type has a sub-classification to allow for the identification of separate or non-separate Radix entamolaris.

Based on the study by Ribeiro., *et al.* another classification of RE was given by De Moor *et al.* elaborating the curvature of the root or the root canal in to three types[17] .

Type 1: A straight root or root canal.

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

Type 3: 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 variants of RE[19]

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.

Canal configuration wise, despite these morphological variations, RE is reported to be typically rounder in shape with Vertucci type I configuration which can be considered to be the simplest canal anatomy of all types[20 -23].

II. Radix Paramolaris (RP)

Carlsen and Alexandersen described two different types of RP [26]:

Type A: RP in which the cervical part is located on the mesial root complex

Type B: RP in which the cervical part is located centrally, between the mesial and distal root complexes, an additional cusp was present on the buccal side.

Identification

Knowing the variations in root canal morphology is helpful in predicting the presence of an extra canal and/or root. These variations in root anatomy may be identified through careful reading of angled radiographs and/or other diagnostic images ,these will help clinician in detecting the variations present in both root and root canal anatomy. According to Clark's rule (Also known as SLOB rule or Waltons projection), an object that moves in the same direction as the cone is located toward the lingual. Conversely, an object that moves in the opposite direction from the cone is located towards the buccal. Therefore, the RE image that moves distally is superimposed on the distobuccalroot image that moves towards the mesial, when taking radiographs with small distal angulations It has been recommended that two diagnostic radiograph be taken, one ortho radial radiograph and the other taken either 30^0 mesially or distally depending upon the location of the tooth that is being examined. A careful examination of the pre-operative radiograph along with knowledge of anatomic aberrations, such as root position, root shape and relative root outline will help to know variations in root anatomy[27 -28]. However in cases where radiographs are not clear or direct visualization of the internal anatomy is not possible or impaired, the use of magnification devices or and enhancement of color contrast by means of dye is recommended [32].

But according to Wang *et al.* (2011), radiographic images taken with eccentric beam angulations have the potential to improve diagnosis. However, they are inherently less distinct and they lose normal sharpness that is expected because anatomical structures could overlay roots and affect visibility and identification of roots and canals [31]. Cone-Beam Computed Tomography (CBCT) provides dentistry with a practical tool for non-invasive and 3-dimensional (3D) reconstruction imaging for the use in endodontic applications and morphologic analyses. CBCT imaging allows for visualizing a new dimension, eliminate superimpositions, provide additional information for diagnosis and therefore enables a more predictable management of complex endodontic conditions compared with intraoral radiographs alone. CBCT imaging allows ascertaining the identification, exact location, curvature and angulation of the RE in order to prevent iatrogenic events that might occur in relation to canal curvature like instrument separation, perforation and ledge formation[29 -30].

Management

Principle for successful root canal treatment is the principle of 'straight-line access' [4]. 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[4, 33- 34] . An initial relocation of the orifice to the lingual without excessive removal of dentin helps to achieve straight-line access and avoid perforations. Manual preflaring is recommended to prevent instrument separation. It is said that RE exhibits the greatest degrees of curvature among the other roots of a mandibular molar with its canal having relatively longer length and smaller radius of curvature. As the risk of instrument fracture significantly increases with the decrease in the radius of curvature, canal preflaring with manual use of stainless steel files is suggested to overcome instrument fracture. Initial root canal exploration with small files (size 10 or less), creation of a glide path along with the proper determination of the canal curvature and working length would reduce the procedural errors such as ledging and transportation [35].

Further, following a dark line on the floor of the pulp chamber may act as a visual aid to indicate the position of an RE canal orifice. Examination of the pulp chamber floor with a sharp explorer, troughing of the grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the sodium hypochlorite "champagne bubble test," and visualizing canal bleeding points are all important aids in locating the root canal orifices. The search for an extra orifice is also aided by the use of microscopes, magnifying loupes and fiber-optic trans-illumination to locate the developmental line between the mesiobuccal and mesiolingual orifices[36 -37].

Finally, use of nickel-titanium rotary files having a taper of not more than 0.04 taper and crown down technique is said to allow a more centered, rounder and conservative canal preparation [35].

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