

# CRUCIAL RADIOGRAPHIC APPRAISAL OF ROOTS - A KEY TO ENDODONTIC SUCCESS

## ABSTRACT

Missing canal is the most common cause which contribute endodontic failures. Proper radiographic diagnosis should be there to identify extra root or extra canal. Radix Entomolaris is the clinical situation where an extra root is present disto-lingually. Clinicians must identify the presence of extra root which will lead to successful endodontic treatment.

**KeyWords:** Radix Entomolaris, Third Root.

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## INTRODUCTION

For more than 50 years there has been universal agreement that the endodontic success depends on the triad that consists of shaping canals, cleaning in 3 dimensions, and three-dimensional hermetically sealed obturation of the canal systems.<sup>1</sup> The main and most important objective of root canal therapy is thorough shaping and cleaning of all pulp spaces and its complete 3 dimensional obturation with an inert filling material. Canal preparation is the most important and challenging part of the triad due to the complex morphology of the root canal system. The main reason for failure of root canal treatment is presence of an untreated canal. Therefore it is essential to have a thorough knowledge about internal and external morphologies of the teeth and together with diagnosis and treatment planning, it is a basic requirement for endodontic success.<sup>2</sup>

Following are the main factors behind the failure of root canal treatment:

- 1) incomplete removal of pulp,
- 2) lack of tight apical and coronal seal and
- 3) last but not least missed canals.<sup>3</sup>

Thus, the clinician should be aware of the various internal and external morphologies of permanent tooth and the possible variations which may be encountered during the root canal treatment of permanent tooth.<sup>4</sup>

The first posterior tooth to erupt in the oral cavity is the mandibular first molar and hence it is the tooth that most often requires root canal treatment. The mandibular first molar typically has two well-defined roots, mesial root and distal root. Mesial root has flattened mesiodistal surface and widened buccolingual surface and distal root is straight with a wide oval canal or two round canals.<sup>5</sup> Mostly, the mesial root has two root canals ending in two distinct apical foramina, whereas in some cases these merge together at the root tip to end in a single foramen. The canals of the mesial root take a more curved course with a mesial orientation immediately below the orifice and then distal in the rest of the root canal.<sup>6</sup> The distal root typically has one kidney-shaped root canal and the orifice is particularly narrow and round sometimes a second distal canal may also be present.<sup>7</sup>

Following are the various anatomical

variations that have been described in the mandibular first molar:

- 1) the presence of three mesial canals was reported by Fabra-Campos<sup>7,8</sup> and Bond<sup>9</sup>.
- 2) the presence of three distal canals was noted by Stroner<sup>10</sup>.

Like the number of root canals, the number of roots may also vary in some tooth. Carabell, first mentioned in the literature an additional third root<sup>11</sup>, and Bolk termed it as radix entomolaris (RE) in 1915<sup>12</sup>. This additional or supernumerary root is located distolingually in mandibular molars, mainly first molars. When an additional root is present at the mesiobuccal side it is called the radix paramolaris (RP). Carlsen and Andersen described the identification and external morphology of these root complexes, containing a lingual or buccal supernumerary root<sup>13,14</sup>.

## CASE REPORT

A male patient 22-year-old reported to the Department of Conservative Dentistry & Endodontics, SDS, KIMSDU with a chief complaint of pain in lower-right posterior teeth from a few days. Intra-oral examination of the lower arch, revealed deep occlusal caries with respect to the first molar of right quadrant [Figure 1] and the teeth was tender to percussion. The mobility of the teeth were within physiologic limits and vitality testing revealed the teeth to be non-vital. The medical history of the patient was noncontributory.



Figure 1 – Intra oral Clinical Image

Radiographically, there was radiolucency involving enamel, dentin and pulp. Periapical radiograph taken from the mesial angulation, revealed the presence of an additional distolingual root, which was of slightly curved and of the same length to that of the distal root. [Figure 2]



Figure 2 - Pre-operative Radiograph

### Treatment

The tooth was anesthetized and Caries excavation was done, followed by access opening with 46, under rubber dam isolation. Pulp chamber was de-roofed. Three canals orifices were initially identified. On further exploration, a second distal canal was found which was located more lingually. [Figure 3]



Figure 3. Clinical Image Of Access Opening

To have proper location of orifice, and straight line access of this third root, access cavity was modified from conventional triangular to trapezoidal form with more extension to lingual side.

Initial negotiation of the root canals was performed with Mani stainless steel K file size

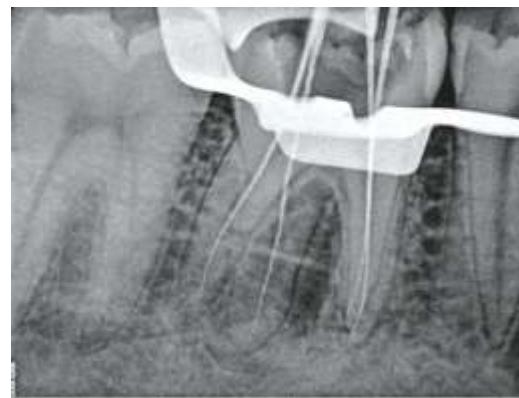


Figure 4 – Working Length Radiograph

ISO 10. The working length of the canals was determined electronically using an apex locator Root ZX Mini [J morita] and confirmed radio graphically. [Figure 4]

Canals were cleaned and shaped using hybrid technique with C-Pilot [SybronEndo] hand NiTi files ISO 15, 20 & 25 with .02 taper which is followed by Hero Shaper [Micro Mega] rotary Ni-Ti files of ISO size 20/04, 20/06 & 25/06 using EDTA gel as a lubricant.

Canals were irrigated using 3% sodium hypochlorite solution to remove smear layer and flushed with normal saline. Master cone radiograph was taken. [Figure 5 ]Obturation of the root canals was performed using AH plus sealer [Dentsply] and corresponding guttapercha points of 25/.06, snugly fitting to the root apex. [ Figure 6 and 7] Endodontic access cavity was then sealed using composite resin.



Figure 5. Master Cone Radiograph



Figure 6. Obturation Radiograph



Figure 7. Obturation Clinical Image

## DISCUSSION

**Radix Entomolaris** (additional root located lingually): The presence of radix entomolaris has been associated with ethnic groups of mongoloid origin (>30%) and low prevalence (<5%) in white Caucasian, African, Eurasian and Indian populations.<sup>15</sup>

In north Indian population about 1.75% cases showed Bilateral occurrence for RE<sup>16</sup> whereas slightly higher rate was observed in south Indian population.

The relationship between radix entomolaris (RE) & gender predilection is not clearly stated. Few studies have reported more of male predilection for RE, While others reported no significant relationship between gender & RE.<sup>17</sup> Similarly, no significant relationship was reported for side distribution, while few studies reported it to be more on left side while others on right side<sup>17</sup>. The bilateral occurrence of RE is reported to vary from 37.14 to 67%. But, some studies have reported only unilateral occurrence of RE, hence further studies are required to clarify this aspect<sup>13,17,18,19</sup>.

In European populations it has been reported that a separate RE is present in the mandibular first molar with a maximum frequency of 3.4-4.2%.<sup>5,20,21,22</sup> In African populations a maximum of 3% is found.<sup>23</sup> In Eurasian and Indian populations the frequency is less than 5%.<sup>24</sup> In populations with Mongoloid traits, such as Chinese, Eskimo and American Indians, the RE occurs with a frequency of 5% to more than 40%.<sup>23,24,25,26,27,28</sup>

The RE is mostly located distolingually, with its coronal third completely or partially fixed to the distal root. The dimensions of the RE can vary. It can be in a form of a short conical extension or a 'mature' root with normal length and root canal. The distolingual root may be separate from other roots or may be partially fused with the other roots.<sup>29</sup>

On the basis of the curve of the root/root canal the RE could be classified in following three groups. This classification is based on a classification proposed by Ribeiro and Consolaro (1997) [Figure 8]



Figure 8 - Ribeiro and Consolaro Classification OF Radix Entomoalris

- 1) Type I refers to a straight root/ root canal,
- 2) Type II to an initially curved entrance and the continuation as a straight root/root canals,
- 3) Type III to an initial curve in the coronal third of the root canal and a second buccally orientated curve starting from the middle to apical third.<sup>30</sup>

According to the location of the cervical part of the RE Carlsen and Alexandersen classified RE in four different types.

- Type A
- Type B
- Type C
- Type AC

Types A and B refer to a distally located cervical part of the RE with two normal and one normal distal root components, respectively.

Type C refers to a mesially located cervical part while type AC refers to a central location between the distal and mesial root components.<sup>13</sup>

Morphologically, the radix entomolaris is located distolingually ranging from short, conical extension to normal mature root length. The coronal third part is partially or completely fixed to distal root. Generally, the radix entomolaris is smaller than mesio-buccal and disto-buccal roots and it may also contain pulpal tissue.<sup>31</sup> Externally, the distal furcation is slightly lower (1mm.) than the furcation between mesial and distal roots.<sup>32</sup>

On clinical examination, features which are observed on a tooth with additional distolingual root includes a more bulbous crown outline, an additional cusp and 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.<sup>33</sup> It may be present as unclear outline of distal root or root canal hence, occasionally it may be missed because of its slender dimension or overlapping with distal root therefore radiographs should be carefully inspected to reveal the presence of hidden radix entomolaris. Additional radiographs with different horizontal angulations should be taken for confirming the presence of supernumerary root. Additional radiographs taken from 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, using magnifying loupes, dental microscope or intraoral camera may also be helpful. OPG is also useful in determining the presence of complex root anatomies. Recently, to aid in the diagnosis of teeth with complex root anatomies cone-beam computed tomography (CBCT) technique has also emerged. However, cost and accessibility are the main limiting factors till now.<sup>34</sup>

With a good knowledge of law of symmetry and law of orifices, following are the various methods which are very useful.<sup>35</sup>

1. Adequate access modification for enhanced visualization
2. Careful observation of dentinal map
3. Fiberoptictransillumination to locate the developmental line between the canal orifices
4. Careful exploration with a sharp instrument (DG16) of floor of the chamber for canal orifices
5. Looking for bleeding points
6. Champagne bubble test with warmed 2.6% NaOCl and observed under magnification
7. Staining the chamber with 1% methylene blue
8. Straight and angled radiographs with instruments in canals.

Some of the common problems which we have encountered during the treatment of Radix Entomolaris are difficulty in Radiographic interpretation, inability to locate the fourth canal, modification in access cavity preparation, confusion in working length determination.

## CONCLUSION

Teeth are never alike. A number of variations occur which pose a challenge to a clinician. Failure to identify and treat an RE can significantly affect the outcome of an endodontic treatment. Proper mesial and distal angulation and interpretation of radiographs help to identify the root canal anatomy and any

variations that are present in it. In the case of a Radix Entomolaris, the conventional triangular access cavity opening must be modified to a trapezoidal form in order to properly locate the distolingually located canal orifice of the extra root.

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