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Endodontic Management of Radix - A Case Series

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Abstract: ***Usually, mandibular first molars have two roots (mesial and distal) and three root canals (mesiobuccal, mesio-lingual and distal), but variations in the number of roots and canals are not uncommon. Permanent mandibular molars can have an additional root, which may be located lingually as the radix entomolaris or buccally as the radix paramolaris. The successful endodontic outcome in such cases can be achieved by comprehensive diagnosis, Knowledge of such unusual root canal morphology & internal anatomy, three-dimensional cleaning, shaping, and obturation. This case series discusses endodontic management of three mandibular molars with two radix entomolaris and one paramolaris, which are rare findings in the Indian population. The prevalence, the external morphological variations, and inherent challenges in detection diagnosis and management of Radix Entomolaris and Paramolaris are discussed and deliberate upon.***

Keywords: Radix entomolaris, Radix Paramolaris

1. Introduction

Usually, mandibular first molars have two roots (mesial and distal) and three root canals (mesiobuccal, mesio-lingual and distal), but variations in the number of roots and canals are not uncommon. (1,2)In the year 1844 Carbelli reported a case with a variation in root canal morphology where an additional root was present lingual to the distal root of mandibular molar and he termed it as Radix Entomolaris.(3)After almost six-decade later, Bolk in 1910 reported a case where an additional root was present buccally to existing mandibular molar root and termed it as Radix Paramolaris. (4) The presence of an additional root, if remain undiagnosed and untreated may cause post-endodontic failure. The successful endodontic outcome in such cases can be achieved by comprehensive diagnosis, Knowledge of such unusual root canal morphology & internal anatomy, three-dimensional cleaning, shaping, and obturation.This case series discusses endodontic management of three mandibular molars with two radix entomolaris and one paramolaris, which are rare findings in the Indian population. The prevalence, the external morphological variations, and inherent challenges in detection diagnosis and management of Radix Entomolaris and Paramolaris are discussed and deliberate upon.

2. Case Report

Case 1

A 23-year-old male patient reported to the department of conservative dentistry & endodontics with the chief complaint of pain in the lower right back tooth since last two days. The pain was sharp, localized, continuous, aggravated by hot and cold substances and did not subside on taking medication. Having a history of silver amalgam restoration in 46 two years ago. Medical history was non-contributory. On clinical examination, there was class-I amalgam restoration along with isolated disto-occlusal caries in 46 which responded early on performing electric pulp test. 46 was non-tender on percussion and there was no mobility.

Intraoral periapical radiograph with parallel technique showed disto-occlusal radiolucency approaching distal pulp horn and two distal roots could be seen. (Figure 1)

Diagnosis of radix entomolaris with symptomatic irreversible pulpitis with 46 was made. After giving local anesthesia, the operating field was isolated with the help of rubber damp. All carious lesion and old restoration removed. An access opening is done with an endo-access bur.

As there were two distal roots so the extension of the access cavity was done more disto-lingually to make a trapezoidal form (Figure 2). DG -16 endodontic explorer and endodontic ultrasonic tips under a dental operating microscope were used for canal orifice location.

As there was no definite dentinal mapping, to rule out any missed canal and to find out canal orientation CBCT was taken, where 4 separate canals (MB, ML, DB & DL), one mesial root and two distal roots could be seen. DL moved more lingually while moving corono-apically in axial section of CBCT represented divergent DL root. (Figure 3)

Working length measurement is done with electronic root length measuring device and confirmed with the radiographic method. (Figure 4)

After getting a glide path with the help of ISO #8,10,15 file, canal preparation was done in the crown down technique (Figure 5). Recapitulation was done with no 15 file K file before moving to another file along with copious irrigation with 5.2% sodium hypochlorite, EDTA gel was used for lubricating the canals.

Corresponding to the last apical file used (35-06% Hyflex) master cone selection was done which confirmed with a radiograph (Figure 6). Obturation was done with cold lateral compaction technique and definite restoration was given (Figure 7).

CASE 2

A 28-year-old female patient reported to the department of conservative dentistry & endodontics with the chief complaint of pain and food lodgement in the lower right back tooth since the last two days. The pain was sharp, localized, intermittent, aggravated by hot and cold substances, and subsided only on taking medication. Having a history of endodontic treatment in 45 and 47 two years before, underwent extraction of grossly decayed 36 one year back. Medical history was non-contributory. On clinical examination, there was mesio-occlusal caries in 46 which responded early on performing electric pulp test. 46 was non-tender on percussion and there was no mobility.

Intraoral periapical radiograph with parallel technique showed mesio-occlusal radiolucency approaching mesial pulp horn and shadow of an additional root along with mesial root could be seen, to confirm this another intraoral periapical radiograph from mesial cone shift technique was taken in which additional root shifted more distally that indicated additional root was present buccally to mesial root. Diagnosis of this Radix paramolaris with symptomatic irreversible pulpitis in 46 was made.

After giving local anesthesia, the operating field was isolated with the help of rubber damp. All carious lesion and old restoration removed. Access opening was done with an endo-access bur. Access cavity design was more of rhomboidal in shape (Figure 10). DG -16 endodontic explorer and endodontic ultrasonic tips under a dental operating microscope were used for canal orifice location.

The working length measurement was done with electronic root length measuring device and confirmed with the radiographic method. (Figure 11)

After getting a glide path with the help of ISO #8,10,15 file, canal preparation done in the crown down technique. Recapitulation was done with no 15 file K file before moving to another file along with copious irrigation with 5.2% sodium hypochlorite, EDTA gel was used for lubricating the canals.

Corresponding to the last apical file used (30-04% Hyflex) master cone selection was done which confirmed with a radiograph (Figure 13)

Case 3

A 35-year-old male patient reported to the department of conservative dentistry & endodontics with the chief complaint of pain in the lower right back tooth from last three days. The pain was dull, localized, aggravated, aggravated while chewing and subsided only on taking medication. Having a history of endodontic treatment in 46 one year before. Medical history was non-contributory. On clinical examination, there was fractured restoration in 46. The tooth was tender on percussion and there was no mobility.

Pre-operative Intraoral periapical radiograph of 46 with parallel technique showed marginal discontinuity in coronal restoration, incompletely obturated root canals, periapical radiolucency with relation to mesial root, one additional root along with distal root could be seen. (Figure 15)

Diagnosis of Radix Entomolaris with post-treatment symptomatic apical periodontitis in 46 was made.

Re endodontic treatment was planned in 46. Old restoration and obturating material were removed with the help of the Gutta-percha solvent. (Figure 16)

The working length measurement was done with the radiographic method. (Figure 17)

After getting a glide path with the help of ISO #8,10,15 file, canal preparation was done in the crown down technique (Figure 18). Recapitulation was done with no 15 file K file before moving to another file along with copious irrigation with 5.2% sodium hypochlorite, EDTA gel was used for lubricating the canals.

Corresponding to the last apical file used (35-04% Hyflex) master cone selection was done which confirmed with a radiograph (Figure 19). Obturation was done with cold lateral compaction technique and definite restoration was given (Figure 19).

3. Discussion

Prevalence of Radix Entomolaris and Radix Paramolaris

The presence of Radix Entomolaris in the mandibular first molar is associated with certain ethnic groups. In the Eurasian and Indian population, its frequency is less than 5%,(5) in the African population it's 3%(6). In Mongoloid traits, Radix Entomolaris occurs in the range from 5% to more than 30%. Because of such high frequency in these populations, the radix entomolaris considered to be a normal anatomical variant (Eumorphic root morphology). (7-12) In Caucasians, radix entomolaris is not common with a frequency of 3.4% to 4.2% and is considered as dystrophic or unusual root morphology. (13, 14)

The etiology behind the formation of the Radix entomolaris is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or penetrance of an atavistic gene or polygenetic system. In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in the more pronounced

phenotypic manifestation (15). 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. (16)

According to some studies the occurrence of bilateral radix entomolaris is 50%-67% of total radix entomolaris cases. (10,17)

Radix paramolaris is very rare and occurs less frequently than radix entomolaris. Bolk reported the occurrence of a buccally located additional root, the radix paramolaris. (18) Visser reported the prevalence of radix paramolaris as 0% for a first mandibular molar, 0.5% for the second, and 2% for the third molar. (19)

External Morphological variations of the Radix Entomolaris and Radix Paramolaris

Carlsen and Alexandersen classified Radix Entomolaris according to the location of the cervical part of radix entomolaris: types A, B, C, and AC. Types A and B refer to a distally located cervical part of the Radix Entomolaris 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. This classification allows for the identification of separate and nonseparated RE. (20)

De Moor et al classified Radix Entomolaris in three types, based on the curvature of the separate Radix Entomolaris variants in buccolingual orientation. Type I refers to a straight root/root canal, while 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. (21)

Carlsen and Alexandersen describe two different types of Radix Paramolaris: types A and B. Type A refers to a Radix Paramolaris in which the cervical part is located on the mesial root complex; type B refers to a Radix Paramolaris in which the cervical part is located centrally, between the mesial and distal root complexes.(22)

Inherent challenges in detection diagnosis and management of Radix Entomolaris and Paramolaris

The presence of a Radix Entomolaris or a Radix Paramolaris has clinical implications in endodontic treatment. An accurate and comprehensive diagnosis of these supernumerary roots can avoid complications or a 'missed canal' during root canal treatment. Because the (separate) Radix Entomolaris is mostly situated in the same buccolingual plane as the distobuccal root, a super imposition 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, shadow of a root can indicate the presence of a 'hidden' Radix Entomolaris. To reveal the Radix Entomolaris, a second radiograph should be taken from a more mesial or distal angle (30 degrees) with a cone shift technique (SLOB Rule). This way an accurate diagnosis can be made in the majority of cases.

Cone-beam computed tomography (CBCT) can be used for the detection of accurate positioning, orientation, curvature in root, and presence of calcification or obliteration in Radix Entomolaris or Radix Paramolaris.

Apart from a radiographical diagnosis, a clinical inspection of the tooth crown and analysis of the cervical morphology of the roots using periodontal probing can facilitate the identification of an additional root.

An extra cusp (tuberculum paramolare) or more prominent occlusal distal or distolingual lobe, in combination with a cervical prominence or convexity, can indicate the presence of an additional root.

After confirming the presence of an extra root buccally or lingually, we can extend our access cavity design accordingly. Usually, access cavity design for mandibular molars are triangular or rhomboidal in shape but in the case of Radix Entomolaris the extension of access cavity design is more distolingually that makes it a more trapezoidal or rectangular shape.

The presence of dark line on the pulp chamber floor can indicate the location of canal orifices. Endodontic explorers, endodontic ultrasonic tips, orifice detecting dyes, champagne test with sodium hypochlorite can also be used for canal orifice location.

Visual enhancement aids like loops, dental operating microscopes, orascope, endoscope, and intraoral camera can be used for precise endodontic treatment.

Because of severe curvature and narrow root canals, perforation and ledge formation are more likely to happen during the preparation of Radix Entomolaris or Radix paramolaris. Therefore, after location and enlargement of the orifice of the Radix Entomolaris or Radix Paramolaris, 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.

4. Conclusion

The initial diagnosis of a radix entomolaris or paramolaris before endodontic treatment is important to achieve the predictable endodontic outcome and to avoid 'missed' canals. Preoperative periapical radiographs exposed at two different horizontal angles (Cone shift technique/ SLOB rule) or CBCT are required to identify these additional roots. Knowledge of the location of the additional root and its root canal orifice will result in a modified opening cavity with extension. The morphological variations of the Radix Entomolaris or Radix Paramolaris in terms of root inclination and root canal curvature demand a comprehensive and accurate diagnosis, careful and adapted clinical approach to avoid or overcome procedural errors during endodontic therapy.

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Figures

Figure 1: Preoperative X-ray of 46

Figure 2: Trapezoidal access cavity design 46

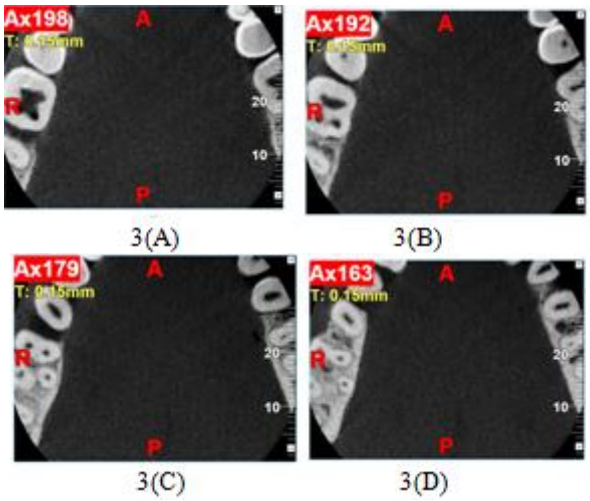


Figure 3: Axial sections while moving corono-apically (A) two separate canal orifice in distal root at the level of pulpal floor. (B) two separate canals below the level of the pulpal floor. (C) two separate roots at coronal 3rd of the distal root. (D) DL moved more lingually while moving more apically

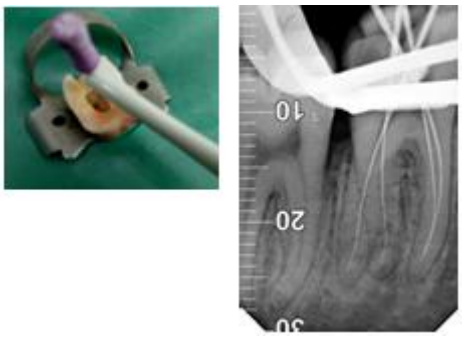


Figure 4: Working length determination with electronic root length measuring device (A) and confirmed with radiographic method (B)

Figure 5: The sequence of files used for canal preparation

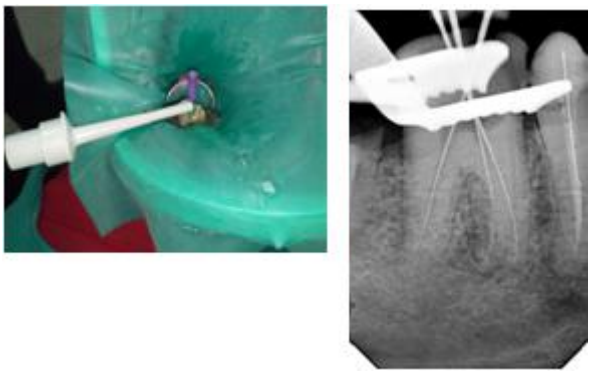
Figure 6: Master cone X-ray

Figure 7: Post obturation X-ray

Figure 8: Pre-operative intraoral periapical radiograph with parallel

Figure 9: Preoperative intraoral radiograph with mesial cone shift

Figure 10: Access opening showing three canal orifices (MB, ML, D)



11(A) 11(B)

Figure 11: Working length determination with electronic root length measuring device (A) and confirmed with the radiographic method (B)

Figure 12: Master cone selection

Figure 13: Obturation was done with cold lateral compaction technique and definite restoration was given

14(A) 14(B)

14(C)

Figure 14: Postoperative intraoperative radiographs (A) with parallel technique, (B) with mesial cone shift techniques, (C) with more mesial cone shift technique

Figure 15: Pre operative Intra oral radiograph

Figure 16: Intraoral periapical radiograph after removal of old restoration and obturating material

Figure 17: Working length determination with the radiographic method

Figure 18: Master cone selection intra oral peri apical radiograph

Figure 19: Postoperative intraoral radiograph

Author Profile

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