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Case Report

Radix Entomolaris in Indian Population: A Review and Case Series

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Abstract:

Radix entomolaris (RE) is a variation sometimes present in mandibular molars, wherein the tooth has an extra root attached to its lingual aspect. An awareness and understanding of this unusual root and its root canal morphology can contribute to the successful outcome of root canal therapy. This paper reviews prevalence of such cases in Indian population and discusses endodontic management of four cases with RE using different file systems. Irrespective of the type of file system used, an accurate diagnosis and careful application of clinical endodontic skill, improves the prognosis of mandibular molars with this root canal morphology.

Key Words: Anatomical variation, cone-beam computed tomography, radix entomolaris, three rooted mandibular molar

Introduction

The prevention or healing of endodontic pathology depends on thorough chemomechanical cleansing and shaping of the root canals before placing a dense root canal filling with a hermetic seal. An awareness and understanding of the presence of unusual canal anatomy can thus contribute to the successful outcome of root canal therapy.

The earliest permanent tooth to erupt, the mandibular first molar seems to be the tooth that most often requires root canal treatment.[1] Most of the population exhibit two roots: One mesial and one distal.[2,3] Mesial root has two canals ending in two different canal orifices or sometimes only one. The distal root typically has one kidney shaped root canal, although a second distal canal may be present.[4]

Like the number of canals, the number of roots may also vary. An additional third root, first mentioned in the literature by Carabelli,[5] is called the radix entomolaris (RE).[6] It is usually located distolingually. If the additional root is present mesiobuccally, it is called the radix paramolaris (RP).[7]

Tratman and others surveyed the Indian population in 1938 and found its frequency <5%.[8-10] Presence of RE in the first mandibular molar is most commonly seen in the Mongoloid population.

Radiographs taken at different angulations can help to detect RE or RP.[7] Recently, cone-beam computed tomography (CBCT) is emerging as a useful tool to aid in diagnosis of such morphologies.[11-13]

RE can be shaped with different file systems. This report describes diagnosis and management of four such cases with various file systems. This study was approved by the Ethics Committee of Maharana Pratap College of Dentistry and Research Centre. All the patients were informed about the study being conducted and written consent to participate in the study was taken.

Case Reports

Case 1

A 22-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Maharana Pratap College of Dentistry and Research Centre, Gwalior with a chief complaint of pain in lower right back tooth region since 3 days. Tooth was tender on percussion. Periodontal probing and mobility were normal. Intraoral periapical radiograph revealed a deep carious lesion approaching the pulp along with periodontal ligament widening in mesial and distal root. An additional distolingual root was also found (Figure 1a). A diagnosis of acute irreversible pulpitis with apical periodontitis was made. Endodontic treatment was planned and the procedure was explained to the patient with the possible outcomes and complications.

After taking consent from the patient local anesthesia was administered and tooth was isolated under rubber dam. The pulp chamber was accessed and two mesial and one distal canal orifice were located using an endodontic explorer (DG-16 endodontic explorer, Dentsply, United Kingdom). In addition, a dark line guided toward an extra orifice located toward distolingual part of pulpal floor. Root canal orifices

were enlarged using GG drills (Mani Inc., Japan) and then explored with K-File ISO #15. Working length measurement was performed using apex locator which was confirmed radiographically (Figure 1b). Root canals were instrumented using ProTaper Hand Files (Dentsply Maillefer, Ballaigues, Switzerland) in all canals. Adequate irrigation was performed using 5.25% sodium hypochlorite and lubricated using Glyde (Dentsply Maillefer, Ballaigues, Switzerland) in all canals. Obturation was performed using AH Plus sealer (Dentsply Maillefer, Ballaigues, Switzerland) and corresponding gutta-percha points (Figure 1c and d). Access cavity was sealed and patient was referred for corresponding full crown prosthesis.

Case 2

A 28-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, Maharana Pratap college of Dentistry and Research Centre, Gwalior with a chief complaint of severe pain in right lower back tooth region since 5 days. Medical history of the patient was non-contributory. On clinical examination, tooth #46 was found to be carious and tender on percussion. Periodontal probing and mobility were within physiologic limits. Tooth was sensitive to cold. Intraoral periapical radiograph revealed a deep carious lesion in close proximity to pulp along with periodontal ligament widening. An additional root was also seen (Figure 2a). Based on the above findings, a diagnosis of acute irreversible pulpitis with apical periodontitis was made and endodontic treatment of the tooth was planned.

After application of rubber dam and administration of anesthesia the pulp chamber was accessed and two mesial and one distal canal were found. Another orifice was located toward the distolingual part of the pulpal floor. On radiographic length measurement, a separate lingual root was identified as RE (Figure 2b). All canals were disinfected with 5.25% sodium hypochlorite solution. Shaping was done with 2% files (SybronEndo, Orange, CA). Instrument separation was observed in RE. An attempt at instrument bypass was made which proved unsuccessful. Therefore, obturation was done using AH Plus sealer (Dentsply Maillefer, Ballaigues, Switzerland) by lateral condensation method (Figure 2c and d). Access cavity was sealed and patient referred for full coverage crown.

Case 3

A 17-year-old male patient reported to our department with a chief complaint of pain and swelling in right lower back tooth region for 10 days. Clinical evaluation revealed gross decay in mandibular right first permanent molar #46. Intraoral sinus tract was present in buccal vestibule at the marginal gingiva in relation with tooth 46. Tooth was tender on palpation and percussion. Intraoral periapical radiograph revealed a deep carious lesion progressing toward pulp chamber. It also showed that the tooth had an additional root and widening of lamina dura was also observed (Figure 3a). Based on the clinical and

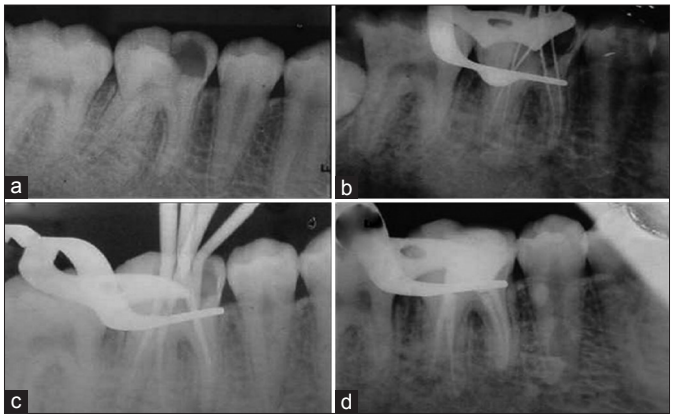

Figure 1: (a) Pre-operative radiograph, (b) working length determination, (c) gutta-percha cone fit, (d) post-operative radiograph.

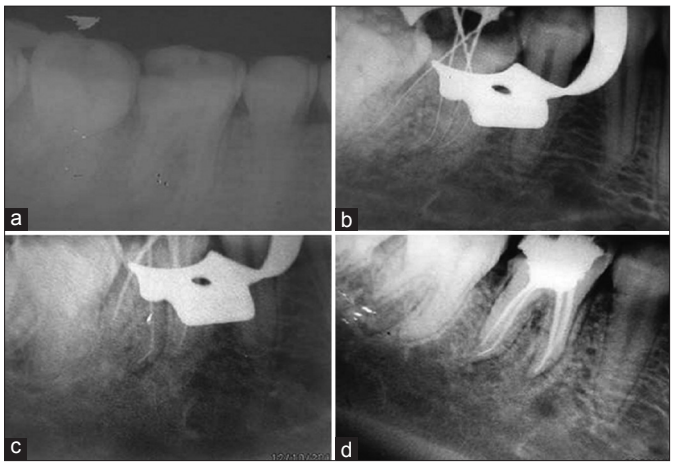

Figure 2: (a) Pre-operative radiograph, (b) determination of working length, (c) gutta percha master cone fit, (d) post-operative radiograph.

radiographic findings, diagnosis of pulpal necrosis with chronic apical periodontitis was made.

Following isolation with rubber dam and administration of anesthesia, conventional triangular access cavity was modified into a more trapezoidal cavity in order to locate, and open the orifice of the distolingually located radix entomolaris. Root canals were explored using K-file ISO 15 (Mani Inc., Japan) and working length calculated using an apex locator (Root ZX II, J Morita) which was confirmed radiographically (Figure 3b). Root canals were prepared in a crown down method using rotary ProTaper universal instruments (Dentsply Maillefer, Ballaigues, Switzerland). An interappointment calcium hydroxide and iodoform dressing (Metapex, Meta Dental Corp. Ltd., Elmburst, NY) was placed in the canals and temporized. After 2 weeks calcium hydroxide was removed and obturation was performed (Figure 3c and d).

Case 4

A 30-year-old female patient reported to our department with severe pain in right lower back tooth region for 3 days. On

Figure 3: (a) Pre-operative IOPA, (b) determination of working length, (c) gutta percha fit, (d) post-operative radiograph IOPA.

clinical examination, the mandibular right third molar #48 was carious and tender on percussion. Tooth was very sensitive to cold and showed positive response on vitality testing. A deep carious lesion in close proximity to the pulp with periodontal ligament widening was revealed on intraoral periapical radiograph. The radiograph also showed that the tooth had an additional distolingual root (Figure 4a). A diagnosis of acute irreversible pulpitis with apical periodontitis was made and endodontic treatment of the involved tooth was planned.

The tooth was isolated under rubber dam and access cavity was prepared with distolingual extension to provide proper access to distolingual canal. Canal orifices were located using an endodontic explorer, canals were explored, and working length determination was performed (Figure 4b). The distal, mesiobuccal, mesiolingual, and distolingual root canals were shaped with K3 rotary instruments (Sybron Endo, Orange, CA) in crown down manner using ethylenediaminetetraacetic acid as lubricant (Glyde, Dentsply Maillefer, Ballaigues, Switzerland) and 5.25% sodium hypochlorite solution. Obturation was performed with corresponding gutta-percha points and AH plus sealer (Dentsply Maillefer, Ballaigues, Switzerland) (Figure 4c and d).

Discussion

Morphology

Carlson and Alexanderson described the identification and external morphology of these root complexes according to the location of cervical part of RE.[14,15]

i. Type A: RE located lingually to the distal root complex which has two cone-shaped macrostructures
ii. Type B: RE located lingually to the distal root complex which has one cone-shaped macro structure
iii. Type C: RE located lingually to the mesial root complex
iv. Type AC: RE located lingually between mesial and distal root complexes.

Figure 4: (a) Pre-operative radiograph, (b) working length determination, (c) Gutta percha master cone fit, (d) post-operative.

De Moor *et al*. gave an alternate classification of RE based on its buccolingual orientation.[8]

i. Type 1: A straight root or root canal
ii. Type 2: An initially curved entrance which becomes straighter in middle and apical third
iii. Type 3: An initial curve in the coronal third with a second curve beginning in the middle and continuing in the apical third.

Recently Wang *et al*. gave another classification for RE depending on its radiographic appearance.[16]

i. Type 1: Presents the most identifiable radiographic imagei.
ii. Type 2: A large beam angulation is necessary mesially or distally for their identificationii.
iii. Type 3: Identification becomes extremely difficult because of the overlap of the adjacent distobuccal root.

Prevalence and etiology

Presence of a separate RE is an acknowledged characteristic of mandibular molars. A RE could be found on first, second or third mandibular molar, least commonly on the second.[17] A gender predilection for males has been seen.[18,19] However, another study reports similar occurrence in both the sexes.[20] Majority of the studies report a bilateral occurrence ranging from 50-67%[19-22] although sometimes unilateral occurrence has also been reported.[23]

In Indians its prevalence has been shown to be 5%,[8,9] more commonly observed in individuals from the eastern region of the country. RE is most prevalent in the Mongoloid population with a frequency ranging from 5% to 30%[24,25] and is therefore considered to be a normal morphological variant (eumorphic). Whereas, in Caucasians, RE is not very common with a maximum frequency of 3.4-4.2%[20,21] and is therefore considered as an uncommon (dysmorphic) root morphology.[26] In white Caucasians, Africans (Bantu Bushmen), and Eurasians, its occurrence is <5%.[8,9]

The etiology behind formation of RE is still unclear. In dysmorphic roots, its formation could be related to external factors during odontogenesis or penetrance of an atavistic gene, while in eumorphic, racial genetic factors influence the profound expression of a particular gene resulting in more pronounced phenotypic manifestation. Some authors also suggest RE to have a genetic predisposition.[27,28]

Management

Missed canals or inadequate cleaning and shaping of the canals can lead to failure of root canal treatment. Detection of RE or RP during the diagnosis stage, helps the operator to plan the treatment accordingly.

On clinical examination, a more bulbous outline of the crown, an extra cusp or a more prominent occlusodistal or distolingual lobe along with a cervical convexity can be suggestive of RE or RP. On radiographic examination, a third root is visible in almost 90% of the cases.[29] Sometimes however, superimposition of distobuccal root can make diagnosis of RE difficult. Also an unclear view or outline of the distal root contour or root canal can reveal the presence of the "hidden" RE. Taking multiple radiographs with the cone-shift technique helps in identifying these extra canals. Limitations of radiographs can be overcome by CBCT as it enables visualization of third dimension and also eliminates super-impositions. It also aids in-depth understanding of the true morphology of root canals.[30]

The orifice of the root canal of an RE is located disto- or mesiolingual from the main canal(s) in the distal root. Therefore the access cavity has a more rectangular or trapezoidal outline form. Complete deroofing of the pulp chamber should be done in order to locate the RE orifice. The dentinal map serves as a useful guide for orifice location. Visual aids such as loupes, intra-oral camera or dental microscope can also prove useful. Because of the curvature present, an initial relocation of the orifice to the lingual is indicated to achieve straight line access. However, care should be taken to avoid perforation or stripping in the coronal third of a severely curved root.

Majority of radices entomolaris are found to be curved. Initial root canal exploration with small precurved files (ISO 08 or 10) and subsequent use of flexible nickel-titanium rotary files should be done. Accurate root canal length and curvature determination, along with the creation of a smooth glide path helps in avoiding procedural mishaps.

Conclusion

RE has been observed relatively frequently in the Indian population and should be considered a normal trait among Indians. Knowledge about the basic root canal anatomy and its variations especially in the Mongoloid and Asian populations is essential in achieving a higher percentage of success in endodontics. Initial diagnosis of the RE or RP with the help of periapical radiographs or CBCT, followed by access cavity modification, orifice location and canal preparation using a careful and adapted clinical approach can avoid and overcome procedural errors during endodontic therapy. Irrespective of the type of file system used, an accurate diagnosis and careful application of clinical endodontic skill, improves the prognosis of mandibular molars with this root canal morphology.

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