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Radix Entomolaris : The Hidden Root - A Review and Case Report

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Abstract

The morphology of the hard tissues of teeth shows extreme diversity. A thorough knowledge and understanding of these variations, their identification with advanced imaging techniques and management with the aid of magnification helps result in more predictable outcomes with success in primary endodontic therapy. The radix entomolaris is an additional root present in the distolingual aspect of mandibular molars with a prevalence rate of <5% (in the Indian population). This article describes in detail the etiology, classification, methods of identification and endodontic management of teeth with radix entomolaris and presents a case report of a patient with this anomaly, the identification, treatment plan, complications encountered during therapy and case management.

Keywords: Radix Entomolaris, Classification, Review, Case Report, Seperated Instrument, CBCT.

Introduction

The success of endodontic treatment can be attributed to the complete tissue debridement, thorough disinfection and a three dimensional obturation of the root canal space.[1] Endodontic treatment may fail due to various reasons, a few being – insufficient tissue debridement, irrigation or obturation, missed canals, incomplete coronal and apical seal and secondary root caries.[1,2] Of these, a very major contributing factor to the pool is missed canals. With the advent of magnification in endodontics, this challenge is slowly shifting the curve towards a lower incidence, but is still very common.[3,19] Mandibular molars usually have two roots, a mesial and distal with a canal configuration of mesiobuccal, mesiolingual and distal. An additional distobuccal canal may also be present.[4] Sometimes, an additional root may be present. This additional root is called a "radix" (latin word derived from) and may be defined as an additional root present in mandibular molars. An additional root present in the distolingiual aspect is termed as "radix entomolaris" and a root present on the mesiolingual aspect is called "radix paramolaris". Carabelli was the first to report radix entomolaris in 1884 and Bolk was the first to coin the term "radix entomolaris" (RE).[5,6] This root anomaly is mostly seen in mandibular first molars. The incidence of RE varies with the race with 3.4-4.2% in the European population, 3% in European population, less that 5% in Indian population but is very high in Mongolian and native American populations of 5-30%.[7]

The meticulous diagnosis and clinical approach to treating these anomalies helps predict the success of endodontic treatment. Despite the emergence of new technologies in magnification and radiographic imaging, the failure to diagnose these anomalies still persists today. This case report describes a case of radix entomolaris, the diagnosis, treatment plan and treatment of it through endodontic therapy.

Case report

A 23 year old female patient reported to the Department of Conservative Dentistry and Endodontics, D.A.P.M. R V Dental College, Bangalore with a chief complaint of pain in the lower right back tooth region for the past 2 weeks which had increased in severity over the past 3 days. The history further revealed that she had a sharp shooting pain, which was intermittent, elicited when triggered by chewing and consumption of cold food and increased in intensity during the nights. The patient had no significant medical history and was of satisfactory good health. She had no history of any prior dental treatment for the same tooth.

After taking appropriate history, a routine clinical and radiographic examination was scheduled. On examination it was noted that, tooth number 46(first permanent right mandibular molar) was carious with suspected pulpal involvement. The carious lesion involved the central aspect of all cusps and extensively involved the distal marginal ridge(Fig1). The tooth showed no response to both heat and electric pulp testing suggesting that it was a non-vital tooth. The intra oral periapical radiograph revealed a distinct outline of a root in between the mesial and distal roots and hence a radix was suspected(Fig2). To further confirm the findings, a CBCT was advised. The CBCT revealed the presence of a radix entomolaris on the distolingual aspect of the tooth(Fig3 and Fig4). It measured 11 cm in length from the coronal reference point. There was widening of the periodontal space in the distal root as well as the radix entomolaris. Thus a diagnosis was made of chronic irreversible pulpitis with apical periodontitis and the tooth was scheduled for root canal treatment.

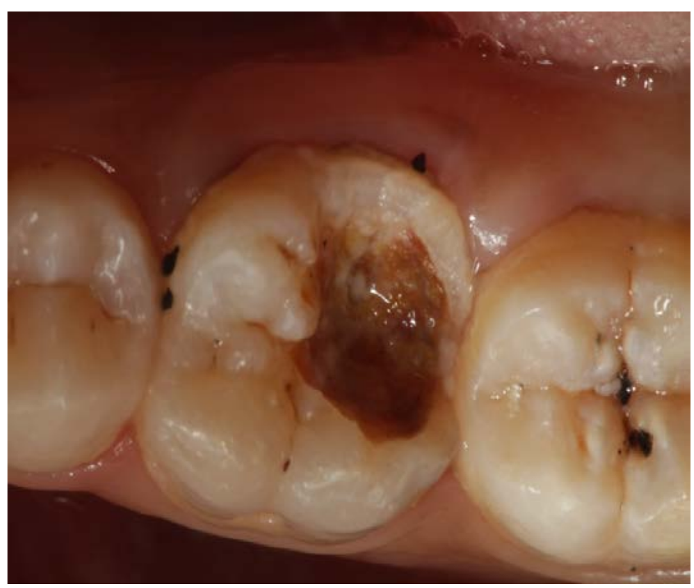

Fig 1: Pre-Operative Photograph of tooth 46

Fig. 2**:** Pre-Operative IOPAR of tooth 46

Fig. 3: CBCT of 46 [axial section] revealing additional root in the distolingual aspect

Fig. 4: CBCT of 46 [coronal section] revealing additional root in the distolingual aspect

The root canal treatment was started with the administration of local anaesthesia(inferior alveolar nerve block; 2mL of 2% lignocaine with 1:80,000 adrenaline). After sufficient anesthesia was achieved, the pre-endodontic build up was done using packable composite(Ivoclar Tetric N ceram Packable Composite) and using Teflon tape to protect the exposed pulp space(Fig5). After this, access opening was done (using the Dentsply Access Opening bur size 2) to locate 3 orifices. When the access cavity was viewed under magnification(Keeler loupes 2X), a dark line was noted extending from the distal canal distolingially revealing the location of orifice of the radix. The access preparation was modified and extended distolingually to include the additional orifice(Fig6). The pulp was extripated and irrigation with local anesthetic solution followed by saline and 3% sodium hypochlorite was done.

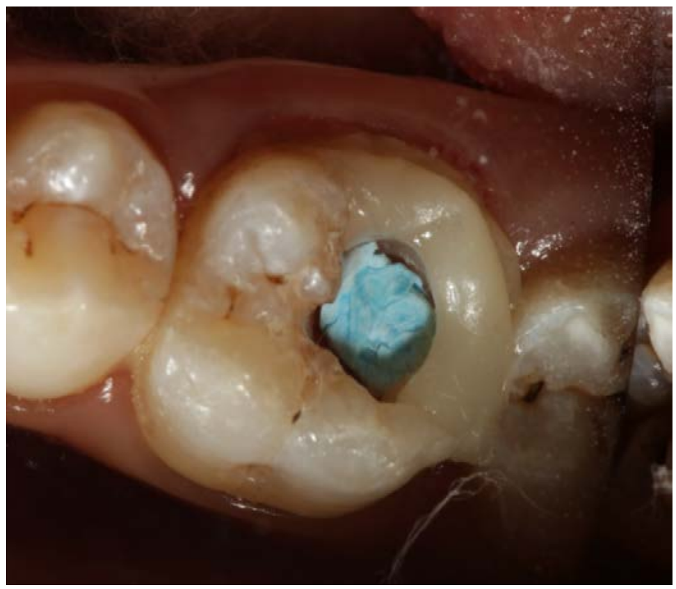

Fig. 5: Pre-endodontic buildup of tooth 46 with isolation of pulp space using sterile Teflon tape

Fig. 6: Access opening done after pre-endodontic build up and location of four canal orifices(mesiobuccal, mesiolingual, distal and radix)

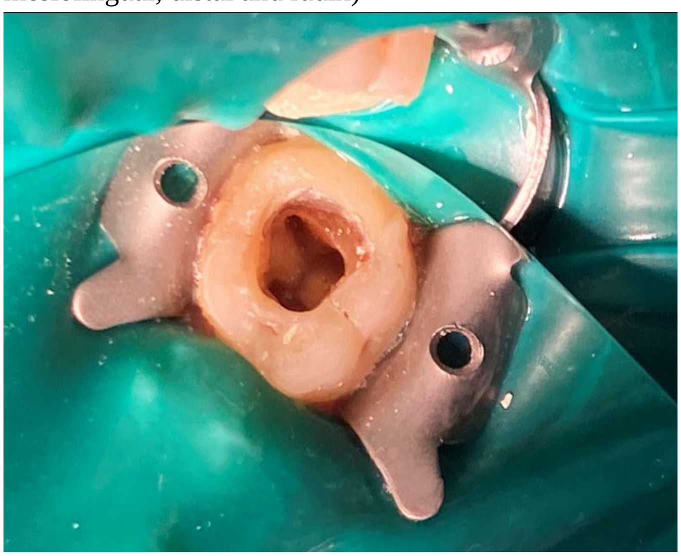

Fig. 7: Single tooth rubber dam isolation

Working length was determined by inserting 4 15 number K files into all four canals and taking an IOPAR(Fig8). The working length was further confirmed using the preoperative CBCT images and an apex locater (Dentsply Maillefer Detect Apex Locator). Cleaning and shaping was done under single tooth rubber dam isolation using Dentsply Maillefer Protaper Gold 21mm rotary files. The orifices were enlarged using the orifice opener (SX) and irrigation was done using and alteration between 3% sodium hypochlorite and EDTA. This was followed by Shaper 1 and Shaper 2 after which the apical third of the canals were enlarged using Finisher 1 and Finisher 2.

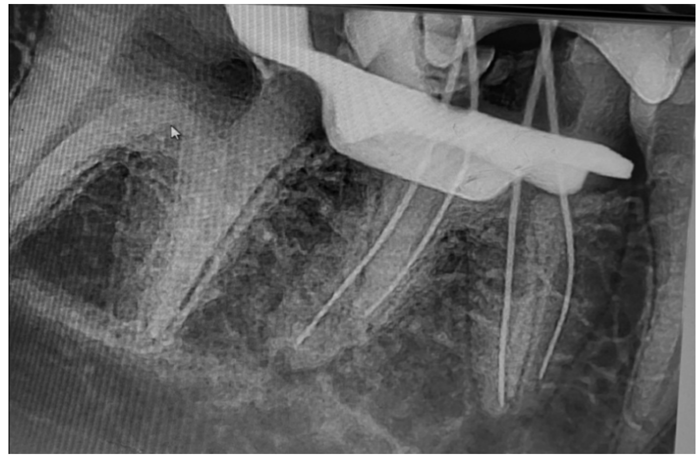

Fig. 8: Working length X-ray of 46

Fig. 9: Seperated instrument [Dentsply Mallifer Protaper Gold F2]

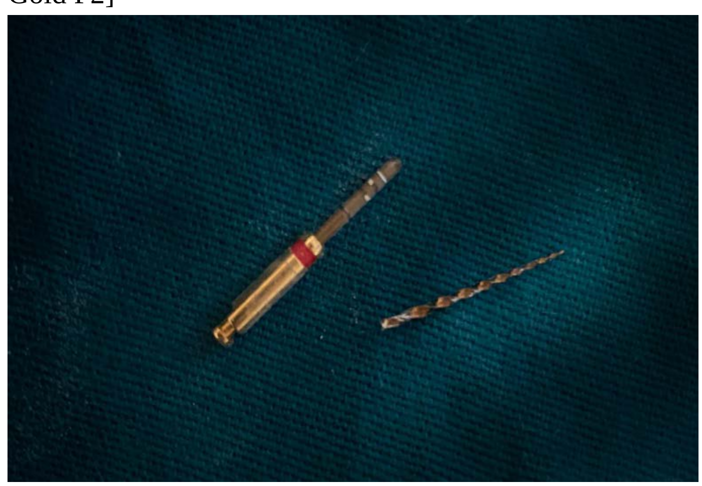

Fig. 10: Retrieved separated file

Unfortunately, during this process, the F2 file was separated in the mesiobuccal canal(Fig9). The separated file was 10mm in length and was accessible through the orifice. Troughing of the root canal dentin was done adjacent to the coronal third of the separated instrument. Rigorous irrigation using sodium hypochlorite was done and an ultrasonic tip was used to dislodge the separated instrument from the canal(Fig10). After successful removal of the separated instrument, disinfection of the root canal space was carried out using 3% sodium hypochlorite solution and recapitulation of the canals. The irrigant solution was activated using ultrasonics. Master cone selection was done based on the size of the master apical file and working length was confirmed using an iopar(Fig11). After confirmation of length, the canals were finally rinsed with saline and dried using paper points. The obturation was done using Kerr Endodontics Sealapex sealer and Dentsply Gutta percha corresponding cones. The excess gutta-percha was seared off using a heated hand instrument and a temporary access restoration was placed(Fig12).

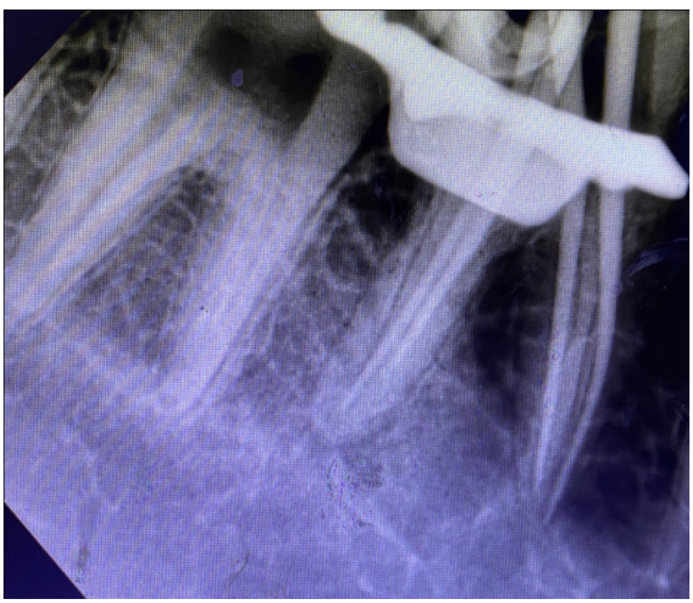

Fig. 11: Master cone X-ray

Fig. 12: Obturation X-ray

The patient was prescribed analgesics for suspected post operative pain(100mg aceclofenac + 500mg paracetamol combination oral tablets). The patient was recalled after one week for the permanent access restoration and preparation of the tooth for a all ceramic crown. The patient was asymptomatic after one week, and the restorative procedure was carried out followed by the placement of a crown.

Discussion

The incidence of radix entomolaris is around 5% in the Indian population making it a common anomaly.[3,7] This anomaly however often goes undiagnosed and may lead to a cause of failure of endodontic treatment. It is thus of utmost importance to diagnose these anomalies and to treat them. It has been suggested that these “three rooted” mandibular molars have high association with genetic predisposition.[8] It also has been found that there has been a significant higher incidence rate of a radix of one side if it present on the contralateral side(50-60%).

Carlsen and Anderson (Fig13) in 1990 classified radix entomolaris into four types based on the location of the cervical portion of the root:[9,10,13]

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

Fig. 13: Carlsen and Andersen's classification of RE. [(a). Type A - RE located lingually to the distal root complex which has two cone-shaped macrostructures. (b). Type B - RE is located lingually to the distal root complex which has one cone-shaped macrostructures. (c). Type C - The RE is located lingually to the mesial root complex. (d). Type AC - RE is located lingually between the mesial and distal root complexes]

De Moor et al. (2004) (Fig14)classified radix entomolaris based on the curvature of the root or root canal:[9,10]

Type 1: A straight root or root canal

Type 2**:** A curved coronal third which becomes straighter in the middle and apical third

Type 3: An initial curve in the coronal third with a second buccally oriented curve which begins in the middle or apical third.

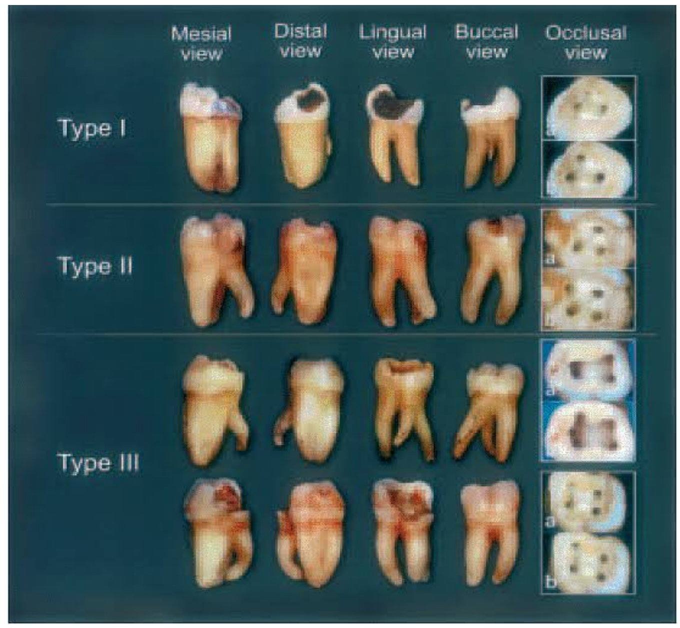

Fig. 14: De Moor et al. (2004) classification of RE

Type1**:** A straight root or root canal.

Type2: A curved coronal third which becomes straighter in the middle and apical third.

Type3**:** An initial curve in the coronal third with a second buccally oriented curve, which begins in the middle or apical third.

Song JS et al. in 2010 defined two more newly variants of RE:[10]

Small type**:** Length shorter than half of the length of the distobuccal root.

Conical type**:** Smaller than the small type and having no root canal within it.

The radix entomolaris is a small additional root present on the distolingual aspect of the mandibular molar. It may vary from being a small conical extension to a full length additional root.[11] The amount of pulp tissue present depends on the size of the radix. Clinically, the tooth may present with a varied coronal anatomy having a bulbous or prominent distolingual cusp. Radiographically, an outline of an additional root will be seen in between the mesial and distal roots.[12] These outlines may be missed as the radix can be slender and small. During access opening, attention must be given to the anatomy of the pulpal floor. Dark lines extending from the orifices of the distal canal can lead the clinician to the possible location of an additional orifice.[13,14,19]

The etiology of radix entomolaris is still unknown. However, it can possibly be attributed to:

A. Genetic Predisposition

Certain races like the Mongolian, native Americans and Eskimos have a much higher incidence rate (5-30%) when compared to other races (<5%)[15]

B. Developmental Disturbance

A disruption in the Hertwig's epithelial root sheath may result in the formation of an additional root.[16,17]

C. Atavism

The occurrence of radix may be attributed to a "reappearance of ancestral characters" where a suppressed genetic geneotype may suddenly get expressed as a phenotype. The evidence on this theory is however limited.1[8,19]

The anatomy of radix is very varied. Some authors have reported the occurrence of sharp curvatures in the apical third of the root making it very easy for zipping and ledging to occur.

Conclusion

Radix Entomolaris is a common tooth anomaly but is often missed by the endodontist. The meticulous clinical and radiographic examination of the tooth can help avoid these procedural errors. The use of aids in magnification such as loupes and microscopes help visualize the pulpal floor better to help locate additional orifices. Additional imaging techniques like CBCT along with angulated IOPARs help the clinician diagnose these anomalies. Having a high index of suspicion is the key for diagnosis and management of radix entomolaris. The early diagnosis of these anomalies is cardinal in successful primary endodontic treatment.

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