

Radix Entomolaris and Its Anatomical Variations - A Review¹Dr. Abhijeet Haridas,²Dr. Aparna Palekar,³Dr. Basawaraj Biradar,⁴Dr. Ankita Dalvi,⁵Dr. Piyush Gupta

Department of Conservative and Endodontics. Rural Dental College Loni, Dist. Ahmednagar, Pin. 413736

Corresponding Author: Dr. Abhijeet Haridas, Department of Conservative and Endodontics. Rural Dental College Loni, Dist. Ahmednagar, Pin. 413736**Type of Publication:** Review Paper**Conflicts of Interest:** Nil**Abstract**

The basic prerequisites for successful endodontic treatment are firstly a comprehensive knowledge on the root canal anatomy and proper identification of all the canals, meticulous chemo-mechanical preparation followed by three dimensional obturation with hermetic seal. Failure of any of these steps may occur due to unusual tooth morphology. Usually mandibular first molars have two roots with three canals (mesiobuccal, mesiolingual & distal) but in few cases, the number of roots and canals vary. The variation of mandibular permanent 1st molar with additional distolingual root is called Radix Entomolaris (RE). This article presents such a case report. Also mentioned are the modifications in the access opening, canal preparation, problems encountered during the treatment, common iatrogenic errors which occur during the treatment and factors which affect the prognosis.

Key words: Radix entomolaris, anatomical variations, three rooted mandibular molar, extra root, supernumerary root.

Introduction

Treatment of entire root canal system is required for getting successful results and to prevent reinfection.^{1, 2} The reasons for failure of establishment of hermetic seal is not only reaching complete working length but also lack

of knowledge of anatomic structures and its variations. According to Barrett, of all the phases of anatomic study in human system, one of the most complex is that of pulp cavity morphology. The hard tissue reservoir of the human dental pulp takes on multifarious configurations and shapes. Therefore a complete knowledge of tooth morphology, careful interpretations of fine radiographs at different levels, good access preparation, detailed cleaning and shaping of the canals and tri-dimensional obturation with hermetic seal are essential prerequisites of successful treatment outcome³ because the non-treatment of one canal may lead to endodontic treatment failure.⁴ Therefore successful treatment is very important since first molars play an important role in mastication, maintains vertical dimension of face, maintains continuity of dental arched and also maintains teeth and tongue position.⁵

Human permanent molars exhibit a varied anatomy. The anatomical variations have been described in the mandibular first molar. Fabra Campos⁶ reported the presence of three mesial canals and Stroner⁷ observed the occurrence of three distal canals. The number of roots may also vary in mandibular molars. Permanent mandibular first molars usually have two roots mesial and distal and three root canals, but variations in the number of roots and in canal morphology are not uncommon.³ The additional third root, (i.e. the supernumerary root) in permanent

mandibular first molar variants that have three roots is typically distributed lingually. This was first described by Carabelli in 1844⁸ and was termed radix entomolaris (RE) by Bolk in 1915.⁹ Similarly an additional root at the mesiobuccal side of the distal root of the mandibular molar is called the radix paramolaris (RP). Radix paramolaris is more infrequent than RE.¹⁰ The identification and external morphology of this anomaly containing a supernumerary lingual or buccal root are described by Carlsen and Alexandersen.¹¹

This clinical case represents a mandibular first molar with four canals and three roots: one mesiobuccal, one mesiolingual, one distobuccal, and one distolingual (RE).

Prevalence

A RE can be found on the first, second and third mandibular molar, occurring least frequently on the second molar. Each ethnic groups varies in prevalence of RE.

With less than 5% in Indians/Eurasians and 3-4% in Europeans.¹² In Caucasians the prevalence of RE is 4.2%. In American Indian population and in Asian population it occurs very frequently with prevalence ranging from 5% - 40%.¹³⁻¹⁵

In Africans frequency of RE was reported less than 3%.¹² ¹⁶ Incidence of RE was about 1.35% in German population as reported by Schafer et al.¹⁷ In Taiwanese population Tu et al investigated the occurrence of three rooted mandibular 1st molar and found that 21.09% of the patients examined had distolingual root that could affect the endodontic treatment if diagnosed incorrectly.¹⁸

In Turner's syndrome patients root length; the crown height and root morphology was studied in intraoral and panoramic radiographs by Midtbo and Halse and reported the occurrence of Radix Entomolaris in several mandibular 1st molars. Hence they concluded that changes

in the root morphology were associated with X-Chromosome deficiency.¹⁹

Radix entomolaris is considered as Eumorphic root morphology i.e. normal morphology in people of Arctic region of North America, East Asians and South East Asians since the occurrence is very frequent in these regions. In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in a more pronounced phenotypic manifestation. However, it is considered as dysmorphic root morphology in Caucasians since its frequency is very less. In dysmorphic supernumerary roots, their formation is related to external factors during odontogenesis, or due to penetration of an atavistic gene or polygenic system.²⁰

Regarding gender predilection, although few studies found male predilection for RE, no significant difference was found in the prevalence of RE according to gender.²¹

Traits such as three rooted mandibular first Molar were genetically dominant as was reflected in the fact that pure Inuit population had similar prevalence of the trait as shown in the study by Curzon.²²

Similarly, no significant difference was found in the side occurrence, despite some studies reporting it to be more on the right side while other studies finding it more on the left side.²¹ Bilateral occurrence of RE cases was reported in some studies in a range of 50%-67%.^{23, 24}

De Moor et al ²⁵ classified the RE into three types according to buccolingual variations: type I, straight root/root canal; type II, initially curved entrance that continues as a straight root/root canal; type III, initial curve in the coronal third and a second curve beginning in the middle and continuing to the apical third.

Carlsen and Alexanderson ²⁶ have classified the RE into four types according to its cervical part: type A and type B, distally located cervical part of RE with two normal mesial and one normal distal component, respectively;

type C, mesially located cervical part; and type AC, central location, between distal and mesial root components.

Ribeiro and Consolaro²⁷ proposed a classification for radix entomolaris as follows: Type I refers to a straight root/root canal; Type II to an initially curved entrance and the continuation as a straight root/root canals; 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.

A 30 year old patient was reported to The Department of Conservative Dentistry and Endodontics, Rural dental college Ioni, India in the year 2017 complaining of pain in the lower left back region of jaw. The patient gave history of pain since 10 to 15 days. Medical history was not contributory. According to the history provided by the patient the tooth had undergone root canal treatment two months earlier. Since then she noticed increase in pain and increase in discomfort on mastication. On intraoral examination the tooth was restored and tender on percussion.

The diagnostic radiograph showed periodontal space widening in the apical one third region, with discontinuous lamina dura in the apical one third region. An additional root between mesial and distal roots was observed. Two radiographs with different horizontal angulations i.e. mesial and distal angulations were made which confirmed that the additional root was located distolingual to the mesial root. It was also observed that the disto-buccal canal was not obturated and the distolingual root was over obturated. A diagnosis of radix entomolaris with apical periodontitis was made. The patient was informed in detail about the treatment planning for non surgical endodontic treatment for 36. The Patient refused other alternative treatment like extraction of tooth 36.

On account of tender on percussion of the tooth 36, local anesthesia was administered and then isolated with a rubber dam. The access cavity preparation was enlarged on the distobuccal side. The distobuccal orifice was located using a endodontic explorer.

The obturated distolingual canal was retreated by removal of gutta-percha with the help of solvent (rcsolv) and headstrom files of size 15# and 20#. The disto-lingual and disto-buccal canals were prepared upto size F2 using the Pro Taper System (Dentsply, Konstanz, Germany) and then was obturated with corresponding gutta-percha master cone points using AH+ Sealer (Dentsply).



Fig 1: (a) Diagnostic Radiograph of 36 (b) Working length Radiograph of 36. (c) Master Cone Radiograph. (d) Post Obturation Radiograph.

After one week, tooth was restored and a full cast crown was advised for long term success. The patient remained asymptomatic when she last reported 1 month after the treatment and is under continuous active follow up.

Discussion

Thorough mechanical and chemical debridement of the entire root canal system and its obturation with an inert material with Hermetic seal is the main objective of endodontic treatment.

Ingle listed apical percolation and subsequent diffusion into the root canals as the most frequent cause of endodontic failure. One of the main reasons for failure is a canal that is left untreated because a clinician fails to recognize it. Therefore, for understanding the principles and problems of cleaning and shaping, for the determination of apical limits and dimensions of canal preparation and for successful treatment outcomes a thorough understanding of the complexity of the root canal system is essential.

The Vertucci study of the internal and external anatomy of teeth has shown that anatomical variations can occur within each group of teeth, within each person and, in general, within each racial group.

It is important to understand the Clinical applications in treatment of radix entomolaris. Diagnostic problems may arise in such cases. In order to avoid any complications or missed canals it is important to diagnose the supernumerary root of RE clinically and radiographically.

Usually on a preoperative radiograph of a Radix Entomolaris the distolingual root lies in the same buccolingual plane as the distobuccal root, hence there is a superimposition of these two roots. So inappropriate distal curvature of the distal root on a radiograph may indicate presence of RE. Therefore, applying the Clark's rule or the buccal object rule where radiographs are taken from more mesial and distal angle helps in locating extra canals and roots which may appear superimposed in normal radiograph. Intraorally, an additional cusp (tuberculum paramolare) or a cervical convexity that is noticed by probing may indicate RE.

Sometimes location of the additional canal orifice may be difficult. If the orifice is missed the treatment leads to failure due to infected tissue or necrotic remnants. A modification of the classical triangular shaped access opening into a trapezoidal shape and a straight line access

is necessary in order to locate the disto-lingual orifice. If the orifice is not located even after the modified trapezoidal access opening a thorough inspection of the walls and the floor is necessary especially in the disto-lingual region.

Most RE's are curved and in some cases an additional curvature appears in the middle or apical third of the root according to Ribeiro and Consularo. Therefore, a straight access to these root canals is crucial for adequate shaping and cleaning (also mention about the rotary). In one of these case, although electronic determinations of the working length in this root canal had been reproduced, the root canal filling seems to be a little short of the apex therefore, a curved RE is assumed. This could be due to the fact that the apex of the RE could have a severe curvature, which is not visible on the radiograph. Canal curvature, particularly in the apical third of the root can cause shaping aberrations, such as straightening of the root canal, ledge formation, root canal transportation resulting in loss of working length.

Therefore, after the canal location, orifice enlargement, working length determination and glide path preparation till 15# K-files should be administered followed by completion of shaping and cleaning by flexible nickel-titanium rotary files. All of these steps help the file to attain a more centered preparation with restricted enlargement of the coronal third of the root canal.

An additional root may also be a contributing factor to localized periodontal destruction. Attachment loss and greater probing depths and at the disto-lingual aspect have been observed as a common finding for RE. In one of the above cases, an increased probing depth of 5 mm was recorded at the lingual aspect in the furcation area where the RE was located. After root canal treatment this probing depth reduced to 3mm. Thus, one of the

adjunctive methods to identify an additional root is probing at the distolingual aspect of mandibular molar. With a good knowledge of law of symmetry and law of orifices, various methods like, visualizing the dentinal map and canal bleeding points, using DG-16 explorer, micro opener, troughing of the grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, champagne bubble test, magnetic resonance microscopy, CBCT and microcomputed tomography will be useful to locate the canals. Careful clinical examination for any unusual morphology, in combination with Visual aids such as loupes, endoscopes and dental operating microscopes can help in the early diagnosis of these complicated macrostructures. Since 5% of the Indian population have RE, every effort must be taken in order to diagnose and treat RE successfully.

Conclusion

Different morphology of mandibular 1st molars makes it difficult for endodontic treatment if the knowledge of the operator is not precise. Basic diagnosis of tooth morphology plays a vital role in treatment outcome of the root canal therapy. Hence RE must be diagnosed correctly by taking eccentric radiographs in order to imply the modifications in access opening, biomechanical preparation and obturation for successful treatment. Not just diagnosis but the knowledge of prevalence, canal configuration and root morphology is also important. The access opening in RE must be modified into a trapezoidal shape for easy access of canals.

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