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Research Article

THE RADIX ENTOMOLARIS: CLINICAL APPROACH IN ENDODONTICS

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ABSTRACT

The prevention or healing of endodontic pathology depends on a thorough chemomechanical cleaning and shaping of the root canals before a dense root canal filling with a fluid tight seal. An awareness and understanding of the presence of unusual root canal morphology can thus contribute to the successful outcome of root canal treatment. It is known that the mandibular first molar can display several anatomical variations. An additional third root, first mentioned in the literature by Carabelli is called Radix Entomolaris. This supernumerary root is located distolingually in mandibular molars, mainly the first molars. The prevalence of Radix Entomolaris has been reported to be as low as 0.2% in Indian population. Several refinements during radiographic interpretation, access cavity preparation and cleaning and shaping are required in order to avoid procedural errors during the successful endodontic management of Radix Entomolaris. This report discusses endodontic treatment of two mandibular molars with radix entomolaris, which are rare macro structures in the Indian population.

INTRODUCTION

The main objective of root canal treatment is the thorough mechanical and chemical cleansing of the entire pulp cavity and its complete obturation with an inert material and a coronal preventing ingress of microorganisms (Endodontics 6, Ingle J.I., 2008). One of the main reasons for failure of root canal treatment in molars is failure to remove all the pulp tissue and microorganisms from the root canal system (Endodontics 6, Ingle J.I., 2008). Hence it is of utmost importance that the operator should be familiar with root and root canal anatomy. The common morphology that first molars exhibit is two-rooted with two mesial and one distal canal (Endodontics 6, Ingle J.I., 2008). But mandibular first molars are teeth that show variations in its external and internal morphology to the extreme (Endodontics 6, Ingle J.I., 2008). The major variant in this tooth is the presence of an additional third root; a supernumerary root which can be found lingually also called as "Radix Entomolaris" (Endodontics 6, Ingle J.I., 2008). This report discusses endodontic treatment of two mandibular molars with a radix entomolaris, which are rare macro structures in the Indian population.

Case 1

A 16 years old male patient reported to the department of conservative dentistry and endodontics, with a chief complaint of pain in lower right back tooth region of jaw.

Clinical examination revealed that there was deep occlusal caries in right mandibular first molar (46). Electric (Gentle Test Dental PulpTester, Pac-Dent International, Inc.,) and thermal (heat test- heated ball burnisher) pulp tests were performed with 46 which elicited lingering pain which was persistent even after the stimulus was removed. However, tenderness on vertical percussion was not elicited.

After taking pre-operative radiograph (Fig.1a), periapical radiographic examination revealed severe caries involving the enamel, dentin and pulp and widening of PDL space with the mesial and distal roots. Also presence of an extra root mesial to the distal root was observed. The clinical diagnosis of Chronic Irreversible Pulpitis with 46 was formulated and root canal treatment followed by coronal coverage was recommended.

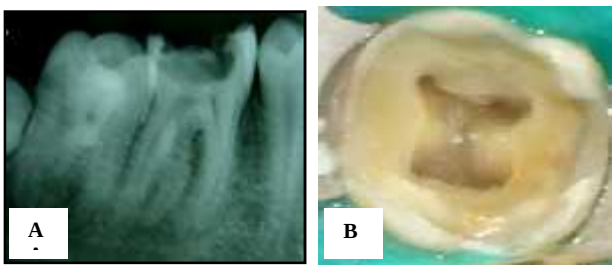

Fig. 1 (a) Pre-operative radiograph (b) Intraoral photograph revealing 4 canals

Inferior alveolar nerve block was administered using 2% Lignocaine (Lignox 2% Indoco Remedies Ltd.) with 1:80,000 epinephrine followed by isolation of the tooth using rubber dam (Hygienic Dental Dam, Coltene, Whaledent, Germany). Endodontic access cavity was prepared using an endo access bur (Dentsply, Maillefer, Ballaigues, Switzerland). The pulp

chamber was repeatedly flushed with 3% sodium hypochlorite (Sigma-Aldrich Corporation, Bangalore, India) to remove necrotic tissue and microorganisms. Careful inspection of the pulpal floor was done and canal orifices were located using endodontic explorer (DG 16 Hu Friedy, Chicago, IL) which revealed four canal orifices (mesiobuccal, mesiolingual, distobucal and distolingual)(Fig.1b).

Orifices were enlarged by using Gates glidden drill (Mani Inc., Japan) and initial negotiation of canals was done using K files (No. 15, 25 mm) (Mani Inc., Japan). Working length determination was done using Electronic apex locator Root ZX (J Moritta, Japan) and then it was confirmed by placing K files (No. 15, 25 mm) (Mani Inc., Japan) in each canal and exposing radiograph by placing the X ray cone at 30 degrees from mesial (Fig.3a).

To confirm the unusual canal anatomy and to understand its configuration, Cone Beam Computed Tomography (CBCT) (Sirona Galileos) imaging of the tooth was performed after the tooth was temporized with temporary filling material (Orafil G, Prevest Denpro, Heidelberg, Germany). After obtaining an informed consent from the patient, CBCT of the mandible was performed with focus on the right mandibular first molar. Axial, coronal, and sagital CBCT slices revealed four canals (two each in the distal and mesial roots) in the referred tooth (Fig.2a,b,c). The presence of four canals was confirmed and root canal therapy was started.

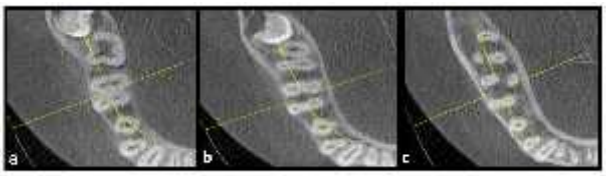

Fig.2 CBCT images at (a)coronal, (b)middle and (c) apical third of 46 respectively

Following working length determination, biomechanical preparation was completed using Hero Shaper (MicroMega, France) rotary endodontic instrumentation in a crown down manner till their respective working length with an apical size of #20/0.06. Irrigation was performed using 5mL of 2.5% sodium hypochlorite solution and 17% EDTA (Glyde File Prep, Dentsply, Maillefer, Switzerland) during instrumentation and finally with normal saline. The canals were then dried with sterile paper points (Dentsply, Maillefer, Tulsa, USA) and master cone selected, radiograph was taken (Fig.3b). and obturated with single cone obturation technique using gutta-percha (#20/0.06) (Dentsply, Maillefer, Tulsa, USA) and AH Plus sealer (Dentsply, Maillefer, Tulsa, USA). For evaluating the obturation, a post obturation radiograph was taken (Fig.3c). and subsequently the patient was referred for crown restoration after post endodontic restoration was done with light cure composite (Filtek Z 350, 3M ESPE, Minnesota, USA).

Fig. 3 (a)Working Length Radiograph (b) Master Cone Radiograph (c) Post Obturation Radiograph

Case 2

A 21 years old male patient reported to the department of conservative dentistry and endodontics, with a chief complaint of pain in lower left back tooth region of jaw.

Clinical examination revealed that there was deep occlusal caries in left mandibular first molar (36). Electric (Gentle Test Dental PulpTester, Pac-Dent International, Inc.,) and thermal (heat test- heated ball burnisher) pulp tests were performed with 36 which elicited lingering pain which was persistent even after the stimulus was removed. However, tenderness on vertical percussion was not elicited.

After taking pre-operative radiograph (Fig.4a), periapical radiographic examination revealed severe caries involving the enamel, dentin and pulp and widening of PDL space with the mesial and disto lingual root and rarefaction in periapical region of disto buccal root. Also presence of an extra root mesial to the distal root was observed. The clinical diagnosis of Chronic Irreversible Pulpitis with 36 was formulated and root canal treatment followed by coronal coverage was recommended.

Root canal treatment was performed in the same manner as discussed in the first case (Fig.4b, 5a-c, 6a-c).

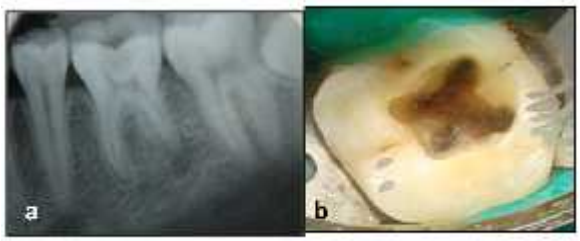

Fig.4 (a) Pre-operative radiograph (b) Intraoral photograph revealing 4 canals

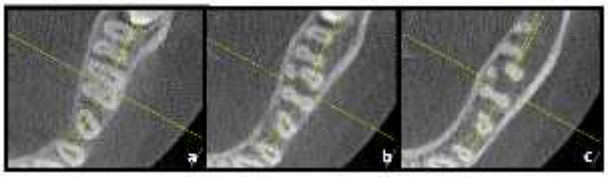

Fig.5 CBCT images at (a)coronal, (b)middle and (c) apical third of 36 respectively

Fig. 6 (a) Working Length Radiograph (b) Master Cone Radiograph (c) Post Obturation Radiograph

DISCUSSION

Radix Entomolaris

The Radix Entomolaris (RE) is a super- numerary root located distolingually in mandibular molars with its coronal third completely or partially fixed to the distal root (Fig.7a,b). This macrostructure, was mentioned in the literature by Carabelli in 1844 and called as radix entomolaris (RE) (The Radix Entomolaris and Paramolaris: Clinical Approach in Endodontics, Calberson *et al*, JOE 2007). The dimensions of the RE can vary from a short conical extension to a 'mature' root with normal length and root canal.

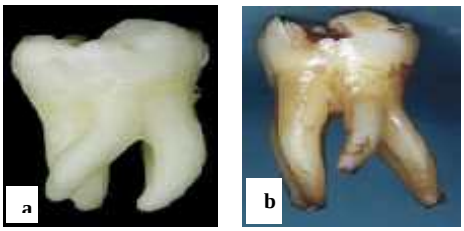

Fig. 7 Clinical images of extracted right mandibular molars with radix entomolaris (a) radix entomolaris on a third molar (lingual view) (b) first molar with a radix entomolaris (lingual view)

In general, the RE is smaller than the distobuccal and mesial roots and can be separate from, or partially fused with, the other roots. The orifice of the RE is located disto to mesiolingually from the main canal or canals of the distal root (Fig.8).

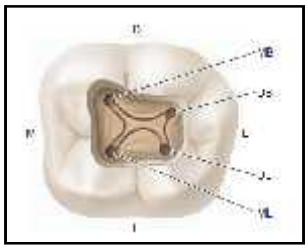

Fig. 8 Mandibular First Molar Showing Canal Orifices of Four Canals

M – Mesial, B – Buccal, D – Distal, L – Lingual, MB – Mesiobuccal canal orifice, DB – Distobuccal canal orifice, DL – Distolingual canal orifice, ML – Mesiolingual canal orifice

A dark line or groove from the main root canal on the pulp chamber floor leads to these orifices(The Radix Entomolaris and Paramolaris: Clinical Approach in Endodontics, Calberson *et al*, JOE 2007). The canal can be straight, have a coronal curvature, or can have separate coronal and apical curvatures. These anatomic variations present definite challenges to therapy because of their orifice inclination and root canal curvature(The radix entomolaris in mandibular molars: an endodontic challenge, De Moor *et al*, IEJ, 2004).

Prevalence

Radix Entomolaris can be found on the first, second and third mandibular molar, occurring least frequently on the second molar. Bilateral occurrence of the RE ranges from 50% to 67% (The Radix Entomolaris and Paramolaris: Clinical Approach in Endodontics, Calberson *et al*, JOE, 2007). Although this is a rare occurrence in white populations it is more common in Asian populations. It is found either distally or mesially in Eurasian and Indian populations in the less than 5% of cases (The Radix Entomolaris and Paramolaris: Clinical Approach in Endodontics, Calberson *et al*, JOE, 2007)

Classification

A classification by **Carlsen and Alexandersen** describes four different types of radix entomolaris according to the location of the cervical part of the RE:-

- **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
- **Type AC** refers to a central location, between the distal and mesial root components.

This classification allows for the identification of separate and non-separate RE.

De Moor (2004) (The radix entomolaris in mandibular molars: an endodontic challenge, De Moor *et al*, IEJ 2004) classified RE based on the curvature in bucco-lingual orientation into three types.(Fig. 9)

Fig. 9 De Moor's Classification

- **Type I** refers to straight root or canal.
- **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.

Etiology

The etiology behind the formation of RE is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of absence). In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in the more pronounced phenotypic manifestation. (The radix entomolaris in mandibular molars: an endodontic challenge, De Moor *et al*, IEJ 2004)

Clinical Approach

The presence of an RE has clinical implications in endodontic treatment. Because the (separate) RE is mostly situated in the same buccolingual plane as the distobuccal root, a superimposition of both roots can appear on the preoperative radiograph, resulting in an inaccurate diagnosis(Radix entomolaris in mandibular first molars - An endodontic challenge, Bansal R. *et al*, Indian Journal of Dentistry 2011). 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, can indicate the presence of a 'hidden' RE(Radix entomolaris in mandibular first molars—An endodontic challenge, Bansal R. *et al*, Indian Journal of Dentistry 2011). To reveal the RE, a second radiograph should be taken from a more mesial or distal angle (30 degrees) (Radix entomolaris in mandibular first molars—An endodontic challenge, Bansal R. *et al*, Indian Journal of Dentistry 2011). Apart from a radiographical diagnosis, clinical inspection of the tooth crown and analysis of the cervical morphology of the roots by

means of periodontal probing can facilitate identification of an additional root (Prevalence of Radix Entomolaris in an Indian Population, Bharti R. *et al*, Indian J Stomatol 2011). 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. (Prevalence of Radix Entomolaris in an Indian Population, Bharti R. *et al*, Indian J Stomatol 2011)

The location of the orifice of the root canal of an RE has implications for the root canal access opening. An extension of the triangular opening cavity to the (disto) lingual results in a more rectangular or trapezoidal outline form (Prevalence of Radix Entomolaris in an Indian Population, Bharti R. *et al*, Indian J Stomatol 2011). Visual aids such as a loupe, intra-oral camera or dental microscope can, in this respect, are useful (Insight To Three Dimensional Imaging In Endodontics, Dhobhal A. *et al*, Indian journal of dental sciences, 2011). The calcification, which is often situated above the orifice of the RE, has to be removed for a better view and access to the RE (Prevalence of Radix Entomolaris in an Indian Population, Bharti R. *et al*, Indian J Stomatol 2011). An initial relocation of the orifice to the lingual is indicated to achieve straight-line access (Prevalence of Radix Entomolaris in an Indian Population, Bharti R. *et al*, Indian J Stomatol 2011). However, to avoid perforation or stripping in the coronal third of a severe curved root, care should be taken not to remove an excessive amount of dentin on the lingual side of the cavity and orifice of the RE (Endodontic management of radix entomolaris - two case reports, Rambabu T, Annals and Essences of Dentistry, July – Sept 2011). A severe root inclination or canal curvature, particularly in the apical third of the root (as in a type III RE), can cause shaping aberrations such as straightening of the root canal or a ledge, with root canal transportation and loss of working length and even instrument separation.

(Endodontic management of radix entomolaris - two case reports, Rambabu T, Annals and Essences of Dentistry, July – Sept 2011) The use of flexible nickel-titanium rotary files allows a more centered preparation shape with restricted enlargement of the coronal canal third and orifice relocation. (Endodontic management of radix entomolaris - two case reports, Rambabu T, Annals and Essences of Dentistry, July – Sept 2011)Therefore, after relocation and enlargement of the orifice of the RE, 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. (Endodontic management of radix entomolaris - two case reports, Rambabu T, Annals and Essences of Dentistry, July – Sept 2011)

CONCLUSION

Clinicians should be aware of these unusual root morphological variations of the radix entomolaris in terms of root inclination and root canal curvature. A careful and adapted diagnostic and clinical approach should be adopted to avoid or overcome procedural errors during endodontic therapy. The initial diagnosis of a radix entomolaris before root canal treatment is important to facilitate endodontic procedure and to avoid 'missed' canals. Preoperative periapical radiographs exposed at two different horizontal angles, clinical diagnosis and use of CBCT are required to identify these additional roots.

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