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CASE STUDY

THE RADIX ENTOMOLARIS: ENDOEXPERIENCE OF A RARE ENTITY

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ABSTRACT

A comprehensive knowledge of the root canal anatomy is essential for successful endodontic treatment. However, presence of anatomic malformation in the tooth can be diagnostically and technically challenging and hence may pose difficulties during endodontic therapy. One such anatomical variation is the presence of extra root distolingually in permanent mandibular first molars. This additional root is called Radix entomolaris. Awareness and understanding of this unusual root and its canal morphology are factors that can affect the outcome of root canal treatment. This article presents a case of Radix entomolaris in a mandibular left first molar and knowledge about its prevalence, possible aetiology, external and internal morphology, radiographic and clinical approach to diagnosis, endodontic management and common iatrogenic errors which may occur during the treatment.

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INTRODUCTION

The success of root canal treatment depends on eradication of endodontic pathology through a thorough chemo-mechanical preparation of the canal system before a tri-dimensional root canal filling with a hermetic seal. Therefore, the clinicians should have an integral knowledge of the root canal anatomy as well as its variations (Davini, 2012). Anatomical variations in terms of an accessory canal or a supernumerary root may contribute to endodontic failure because of a "missed" canal or incomplete root canal preparation and obturation (Segura-Egea, 2002). In this respect, mandibular first molars have a significantly lower success rate compared with other teeth, according to Swartz, Skidmore and Griffen (Swartz, 1983). Permanent mandibular first molars are usually two-rooted with two mesial and one distal canal. However, in 1971, Skidmore and Bjorndal reported that 71.1% of distal roots of mandibular first molar teeth have only one canal, 28.9% can have two canals and in rare cases it can have three root canals (Skidmore, 1971). The number of roots for the mandibular first molar teeth may also vary. First mentioned in the literature by Carabelli (1844) (Carabelli, 1844), presence of an additional third root or a supernumerary root located disto-lingually is known as Radix entomolaris which is a major anatomical variant found in mandibular molars, mainly mandibular first molars. This article presents a case report which illustrates about the radiographic identification and endodontic management of Radix entomolaris in a mandibular left first molar.

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Case Report

A 32 years old female patient was referred to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the left lower back tooth region since 10 days. The patient reported a history of intermittent pain, which aggravated on chewing food. Her medical history was non-contributory. Intraoral examination revealed a deep carious lesion on the disto-occlusal aspect of the crown irt 36 and the tooth was tender on vertical percussion. Electric pulp test was negative irt 36. Intraoral periapical radiographic examination (Figure 1) revealed an ill-defined distal radiolucency approaching the pulp space coronally and periapically there was an ill-defined radiolucency surrounded by diffuse radiopacity irt distal root of 36. Apart from this, close inspection of the radiograph also revealed the presence of an additional periodontal ligament space crossing over the distal root leading to an impression of double periodontal ligament space on the distal aspect.

Figure 1. Pre-operative radiograph

Figure 2. Access cavity

This led to the suspicion of additional root entity. The buccal object rule confirmed this additional root as a distolingual root (Radix entomolaris). Based on the clinical and radiographic findings, the tooth was diagnosed with condensing osteitis and hence, endodontic management was planned. In the first visit, local anaesthesia was administered using 2% lidocaine (LOX 2%, Neon Laboratories Ltd. Mumbai, India) for inferior alveolar nerve block and the tooth was isolated under rubber dam. Access preparation (Figure 2) was done with an endo access bur no.1 (Dentsply, Maillefer, Ballaigues, Switzerland) and mesiobuccal, mesiolingual and distal (distobuccal) orifices were located. The distal canal orifice was found slightly away from the centre (buccally), indicating possible presence of another canal lingually. On inspection of the pulp chamber floor with operating loupes, a dark line was observed between the distal canal orifice and the distolingual corner of the pulp chamber floor.

At this corner, overlying dentin was removed with a diamond bur with a noncutting tip (Diamendo, Dentsply, Maillefer) and a second distal canal orifice was detected. Coronal enlargement of the canals were performed with the nickel-titanium ProTaper orifice shaper (Dentsply, Maillefer). The canals were then negotiated with K-file ISO 10 (Mani, Japan) to create initial glide path and length determination was done with an electronic apex locator (Canal Pro, Coltene Whaledent) and confirmed radiographically (Figure 3). Root canal instrumentation was performed with ProTaper Gold Ni-Ti rotary files (Dentsply, Maillefer) in a crown-down technique up to F1 size for the mesial canals and F2 size for the distal canals, using Glyde (10% carbamide peroxide & 15% EDTA, Dentsply, Maillefer) as lubricant. After each instrumentation, the root canals were adequately irrigated with 2.5% sodium hypochlorite solution. Final irrigation was done using 2% chlorhexidine (RC-Chlor, Deor, Azure laboratories, Kochi, India). Calcium hydroxide intracanal medicament was placed and access cavity was restored with zinc oxide eugenol cement. In the follow-up visit after one week, when the tooth was asymptomatic, master cone radiograph (Figure 4) was taken. The canals were dried using paper points and obturated with corresponding ProTapergutta-percha points (Dentsply, Maillefer) using AH plus resin sealer (Dentsply, Maillefer). A postoperative intraoral periapical radiograph (Figure 5) was taken and subsequently the access cavity was sealed with permanent coronal composite resin restoration.

Figure 3. Working length radiograph

Figure 4. Master cone radiograph

Figure 5. Post-obturation radiograph

DISCUSSION

An aberration in root canal systems of tooth is a commonly occurring phenomenon. The presence of an extra root distolingually in permanent mandibular first molars, known as Radix entomolaris is one such developmental variation which may pose difficulties in dental treatment. Hence, it is imperative to have an integral knowledge about its prevalence, possible aetiology, external and internal morphology, radiographic and clinical approach to diagnosis, endodontic management and common iatrogenic errors which may occur during the treatment.

Prevalence: The presence of Radix entomolaris in mandibular first molar is associated with certain ethnic groups. It is commonly present in races of Mongoloid traits such as the Chinese, Eskimos and Native Americans with a frequency of 5-30 %. However, in Indian population, frequency is less than 5% and hence is considered to be an unusual or dysmorphic root morphology (Tratman, 1938; Curzon, 1971 and Turner, 1971). Radix entomolaris can be found on first, second and third mandibular molar teeth, occurring least frequently on second molars (Visser, 1948). The bilateral frequency distribution in Indian population has been reported to be 3.72% for the first molar. However, the relationship between radix entomolaris and gender predilection as well as side distribution is not clear (Karale, 2013).

Aetiology: Though exact aetiology is unknown, Radix entomolaris being dysmorphic, its formation could be related to external factors during odontogenesis or the influence of an atavistic gene or polygenetic system. However, racial genetic factors can also influence profound expression of a particular gene that can result in the more pronounced phenotypic manifestation (Calberson, 2007).

Morphology: Morphologically, Radix entomolaris is commonly smaller than the distobuccal and mesial roots and can be separate, or partly fused with the other roots. A classification by Carlsen and Alexandersen (Carlsen, 1990), describes four different types of Radix entomolaris according to the location of its cervical part, which allows for the identification of separate and non-separate types.

- Type A – Distally located cervical part with two normal distal root components
- Type B – Distally located cervical part with only one normal distal component
- Type C – Mesially located cervical part
- Type AC – Central location between mesial and distal root components

In addition to this inclination, the root can be straight or curved to the lingual. Based on the curvature in a bucco-lingual orientation, the separate RE variants can be classified into three types according to De Moor *et al* (De Moor, 2004).

- Type I – Refers to a straight root/root 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 buccally oriented curve starting from middle to apical third.

Recently Song *et al*. have suggested a new classification based on morphological characteristics: Type I, Type II, Type III, Small type and Conical type. Types I, II and III are same as that of De Moor *et al*. Small type refers to root length less than half that of the distobuccal root and Conical type suggests cone-shaped extension with no root canal (Nagaven, 2012). Tratman suggested that the additional root is not simply a division of the distal root, but rather is a true extra root with a separate orifice and apex (Tratman, 1938). The present case has reported a Type A-III Radix entomolaris which was of same length as that of the distobuccal root.

Radiographic diagnosis: Intra-oralperiapical radiographs may be helpful in identifying Radix entomolaris. Radiographic features like double periodontal ligament images or unclear outline of the distal root contour indicate the possibility of its presence. If Radix entomolaris is suspected then buccal object rule may be useful to confirm the anatomic variation in most cases (Carlsen, 1990). In this regard, Wang *et al*. demonstrated that 25-degree mesially directed second radiograph was significantly better for optimum diagnosis (Wang, 2011). In recent years, advanced imaging modalities such as Cone Beam Computed Tomography (CBCT) has emerged as a promising tool to aid in the diagnosis of complex root morphology. CBCT imaging allows ascertaining the identification, exact location, curvature and angulation of the supernumerary root eliminating superimpositions and therefore enables a more predictable management of complex endodontic conditions compared with intraoral radiographs alone (Mahendra, 2013). In the present case, buccal object rule had successfully identified the Radix entomolaris which eliminated the need for a CBCT examination.

Clinical diagnosis: Clinical inspection of the tooth crown and analysis of the cervical morphology of the roots by periodontal probing can aid in 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 its presence. After access preparation, a thorough inspection of the floor and wall of pulp chamber, especially in the distolingual region, is important. In this respect, visual aids such as a dental loupe, intra-oral camera or operating microscope can be useful. Clues such as narrow and round distal root orifice may suggest presence of Radix entomolaris or a dark line on the pulp chamber floor can indicate the accurate location of this accessory canal orifice (Calberson, 2007). Other methods like staining the chamber floor with 1% methylene blue dye or performing the sodium hypochlorite "champagne bubble test" may be helpful (Jaiswal, 2015). In the present case, buccally

located distobuccal canal orifice has raised the suspicion and the dark line on the pulp chamber floor which was visible with proper illumination and use of dental loupes had guided the diagnosis of Radix entomolaris.

Clinical guidelines to management

- Modification of access cavity preparation from a triangular to a rectangular/ trapezoidal shape to ensure a straight line access to the apical one-third of the canal.
- According to Tu *et al*, the mean inter-orifice distances from the disto-lingual canal to the distobuccal, mesio-buccal and mesio-lingual canals of the permanent three-rooted mandibular molars were 2.7, 4.4 and 3.5 mm respectively, knowledge of which might help in orifice localisation.
- The root length of RE being inconsistent, verification of the root length with apex locator is therefore essential prior to radiographic working length determination.
- Initial root canal exploration with small files (size 10 or less) and creation of a glide path before preparation should be done. Flexible nickel-titanium rotary files should be preferentially used, which allow a more centred preparation shape with restricted enlargement of the coronal canal third and orifice relocation and prevent the flexural failure of the instrument.
- Vertical compaction technique is recommended for obturation (Calberson, 2007 and Thomas, 2016).

Complications: The common complications encountered during the endodontic treatment of Radix entomolaris include difficulty in radiographic interpretation, problems with accessory canal localisation, modification in access cavity preparation leading to inadvertent removal of dentin on the lingual side of the cavity and confusion in working length determination. Apart from these difficulties, clinicians are prone to commit some iatrogenic errors such as straightening of a root canal resulting in loss of working length, ledge formation, zipping, canal transportation or even perforation (Bolla, 2010).

Conclusion

'The eyes see only what the mind knows'- The clinicians should be aware of such unusual anatomical variation in mandibular first molars in order to minimize the chances of missed canal. For this purpose, the initial diagnosis of radix entomolaris before the beginning of the endodontic treatment is essential. Knowledge of its presence will herald modifications in the treatment procedure which in turn will ensure a successful treatment outcome.

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