Bull Tokyo Dent Coll (2016) 57(4): 253–258

Case Report

doi:10.2209/tdcpublication.2015-0027

Radix Entomolaris: A Report of Two Cases

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Received 10 September, 2015/Accepted for publication 26 February, 2016

Abstract

A comprehensive knowledge of the anatomy of the root canal is a basic prerequisite for the success of endodontic treatment. Mandibular molars may have an additional root located lingually (radix entomolaris) or buccally (radix paramolaris). An awareness of the potential for and understanding of unusual external and internal root canal morphology contributes to the successful outcome of root canal treatment. Here, we report two cases of radix entomolaris to increase awareness and understanding of this unusual morphology so that procedural errors during endodontic therapy might better be avoided.

Key words: Anatomical variation — Mandibular molar — Radix entomolaris

Introduction

A thorough knowledge of dental anatomy and an in-depth understanding of the potential for variation from the norm are required to achieve success in endodontic therapy. Missed canals, incomplete instrumentation and cleaning of the root canal space, and faulty obturation are the main reasons for failure of endodontic treatment[4].

Supernumerary roots and/or canals occur in all types of teeth, but the possibility of finding such aberrant canal configurations is much higher in premolars and molars. The first mandibular molar usually has two perfectly differentiated roots, one mesial and the other distal, but in rare cases may also have a third distolingual root[5]. This third root may emerge from a division of the apical third of the mesial or, less frequently, distal root. This macrostructure, which was first mentioned in the literature by Carabelli (1844), is known as a radix entomolaris (RE)[2], unless it presents mesiobucally, in which case it is called a radix paramolaris[2].

The RE occurs in less than 5% of Eurasian and Indian populations[3,10], and the incidence in the Indian population alone is very low, at only 0.2%[1,7].

A three-rooted molar has a high degree of

genetic penetrance and its dominance is reflected in the similar prevalence of the trait in pure Eskimo and Eskimo/Caucasian mixes[6]. Apart from its role as a genetic marker, however, the RE is also a significant entity in clinical dentistry[2].

Awareness and identification of RE are vital in ensuring the success of endodontic treatment. This means that the dentist must be knowledgeable about its prevalence, diagnosis, morphology, canal configuration, and the clinical approach required in such cases. Here, we report the prevalence, morphology, canal configuration, and clinical approach to the diagnosis and endodontic treatment of two cases of RE. We believe that these cases provide important information on the nature and management of this condition.

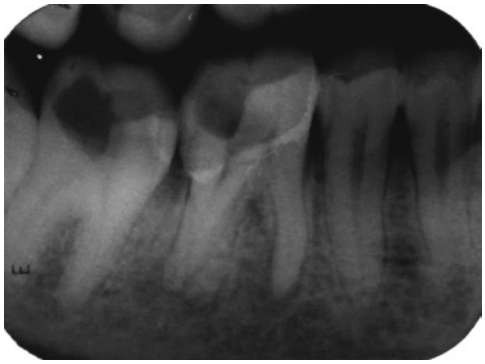

Fig. 1 Preoperative intraoral periapical radiograph of #46 showing distal coronal deficit with radiolucency involving distal pulp horn and periapical radiolucencies with respect to roots

Also, 3 roots can be identified here.

Case Reports

1. Case 1

A 24-year-old man presented at a private dental clinic (Moradabad, India) with the chief complaint of pain in the right lower molar region over a period of one month. He was prescribed analgesics and then referred to an endodontist at Kothiwal Dental College, Moradabad. There, the patient described a history of intermittent pain which was aggravated by hot food, and sometimes persisted, even after the removal of the stimulus. A preoperative intraoral periapical radiograph of #46 revealed a distal coronal deficit with radiolucency involving the distal pulp horn and periapical radiolucencies with respect to the roots. Three roots were also revealed in this intraoral periapical radiograph (Fig. 1). The tooth was not mobile and periodontal probing around the tooth was within physiological limits. Vitality testing with heated guttapercha (Dentsply Maillefer, Ballaigues, Switzerland) and dry ice (RC Ice, Prime Dental Products Pvt. Ltd., Mumbai, India) caused an intense lingering pain, whereas electronic pulp stimulation (Parkel Electronics Division, Farmingdale, NY, USA) elicited a premature response. Based on the results of clinical and radiographic examination, a diagnosis of chronic apical periodontitis was made and root canal treatment recommended.

Local anesthesia (2% lignocaine with 1: 100,000 epinephrine) was administered and the tooth isolated under a rubber dam. Access was established with an endo access bur no.1 (Dentsply Maillefer). The first distal canal was located slightly off-center buccally, indicating that the other canal would be on the lingual side. Therefore, the access cavity was given a trapezoidal rather than a triangular shape and the fourth canal located. Close inspection of the pulp chamber revealed two mesial and two distal canal orifices (Fig. 1). The presence of all the orifices was confirmed using an endodontic explorer (DG16, Dentsply, Gloucester, United Kingdom) and a surgical microscope (Global, Ambala, Haryana, India). The patency of the canals was established with a No.10 K-File (Dentsply Maillefer).

The working length was determined radiographically and confirmed using an apex locator (Root ZX, Morita, Tokyo, Japan). Cleaning and shaping were performed using rotary Nickel-Titanium ProTaper files (Dentsply Maillefer) in a crown-down manner and irrigation with 5.25% sodium hypochlorite (Prime Dental Products Pvt. Ltd.)

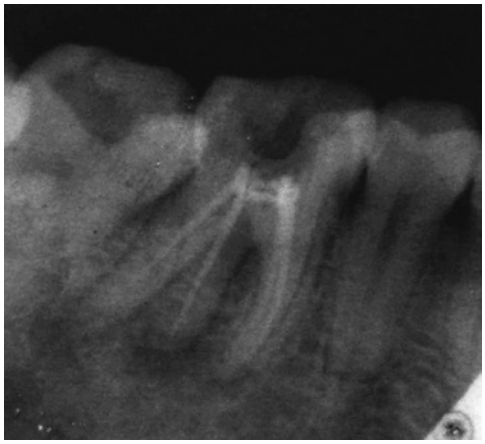

Fig. 2 Intraoral periapical radiograph of #46 after obturation

Fig. 3 Preoperative intraoral periapical radiograph of radix entomolaris at #46 showing traces of radiopacities in pulp chamber and radiolucency toward pulp

Three roots can be observed, with periodontal ligament widening with respect to roots.

and 17% EDTA (Dent Wash, Prime Dental Products Pvt. Ltd.). Canal disinfection was carried out using calcium hydroxide (Calcicur, VOCO, Niedersachsen Germany). The finding of a separate disto-lingual canal orifice and the outline of the roots in subsequent radiographs indicated the presence of an RE. At follow-up visits, the patient was found to be asymptomatic, and gutta-percha master cones (ProTaper, Dentsply Maillefer) were selected. The canals were thoroughly dried and obturation (Fig. 2) performed using F2 ProTaper Gutta-percha and AH Plus sealer (Dentsply Maillefer). A post-obturation radiograph was taken. The access cavity was restored with silver amalgam (DPI Alloy Fine Grain Silver Tin Dental Amalgam Alloy, Deepdent Products, Delhi, India). At a follow-up visit one month later the patient was found to be asymptomatic.

2. Case 2

This patient reported to the Outpatient Department of Conservative Dentistry and Endodontics at Kothiwal Dental College and Research Centre (Moradabad, India). The patient was a 32-year-old woman who presented with the chief complaint of pain in the lower right molar region over a 2-week period. Clinical examination revealed a fractured temporary restoration at #46. A preoperative intraoral periapical radiograph of #46 showed traces of radiopacities in the pulp chamber and radiolucency towards the pulp. Three roots were also revealed, with the periodontal ligament widening with respect to the roots.

Radiographic examination revealed that root canal treatment had been attempted but not completed (Fig. 3). The tooth was not mobile and periodontal probing around the tooth was within physiological limits. Vitality testing by electronic pulp stimulation (Parkel Electronics Division) elicited no response. Based on the results of clinical and radiographic examination, chronic apical periodontitis (non-vital) was diagnosed and root canal treatment recommended.

The tooth was isolated under a rubber dam and access established with an endo access bur no.1 (Dentsply Maillefer). The first distal canal was located slightly off-center buccally, indicating that the other canal would be on the lingual side. Therefore, the access cavity was given a trapezoidal rather than a triangular shape and the fourth canal located (Fig. 4). Close inspection of the pulp chamber revealed two mesial and two distal canal orifices. The presence of all these orifices was confirmed using an endodontic explorer

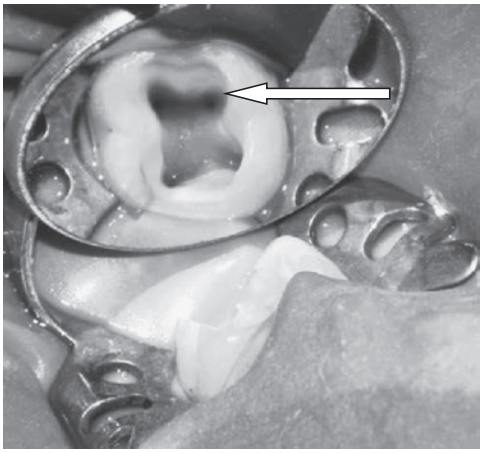

Fig. 4 Clinical photograph of #46 revealing 4 root canal orifices and additional distolingual canal orifice (arrow)

Fig. 5 Intraoral periapical radiograph of #46 after post-obturation restoration

(DG16, Dentsply) and a surgical microscope (Global). The distolingual orifice was very distinct, indicating the presence of an RE. The patency of canals was established with a No. 10 K-File (Dentsply Maillefer).

The working length was determined radiographically and confirmed using an apex locator (Root ZX). Cleaning and shaping were performed using rotary Nickel-Titanium ProTaper files (Dentsply Maillefer) in a crown-down manner and irrigation with 5.25% sodium hypochlorite (Prime Dental Products Pvt. Ltd.) and 17% EDTA (Dent Wash). Canal disinfection was carried out using calcium hydroxide (Calcicur, VOCO). The finding of a separate distolingual canal orifice and the outline of roots in subsequent radiographs indicated the presence of an RE. At follow-up visits, the patient was found to be asymptomatic and gutta-percha master cones (ProTaper, Dentsply Maillefer) were selected. The canals were thoroughly dried and obturation performed using F2 ProTaper Gutta-percha and AH Plus sealer (Dentsply Maillefer). A post-obturation radiograph was taken. The access cavity was restored with silver amalgam (DPI Alloy Fine Grain Silver Tin Dental Amalgam Alloy, Deepdent Products). At a follow-up visit one month later, the patient was found to be asymptomatic (Fig. 5).

Discussion

The etiology of the RE is still unclear. In dysmorphic, supernumerary roots, its formation may be related to external factors during odontogenesis or the penetrance of an atavistic gene or polygenetic system; in eumorphic roots, racial genetic factors influence the more profound expression of a particular gene, resulting in the more pronounced phenotypic manifestation[1,6].

In general, an RE is smaller than the distobuccal or mesial root, with which it may be either separate or partially fused. Carlsen and Alexandersen[2] categorized REs into 4 types according to the location of the cervical portion: A, B, C, and AC. In types A and B, the cervical portion is located distally, and there are 2 and 1 normal distal root components, respectively; in type C, the cervical portion is located mesially, while in type AC it is located centrally, between the distal and mesial root components. De Moor *et al.*[3], on the other hand, categorized REs into only 3 types: type I, with a straight root/root canal; type II, with an initially curved entrance which continues as a straight root/root canal; and type III, with 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.

This classification is further modified by adding two more newly defined variants of RE termed 'small type', where the length is half of that of the distobuccal root, and 'conical type', where it is even smaller than the small type and has no root canal[7,9,12].

In terms of canal configuration, regardless of these morphological variations, the RE is typically rounder and has a Vertucci type I configuration, the simplest canal anatomy of all types[7,11,12]. The radiographic evidence in the present cases is in line with these earlier findings, with the REs exhibiting a Vertucci type I canal configuration.

In addition to considering the possible presence of REs based on racial prevalence, the dentist should also be aware of other factors indicative of its presence, such as an extra cusp (tuberculum paramolare), cervical convexity, prominence of the distolingual lobe, and complicated external furcation contours[4]. Radiographically, a double periodontal ligament image or an unclear view or outline of the distal root contour or the root canal can also hint at the presence of an RE. However, this requires a thorough inspection of the preoperative radiograph. One earlier study found that radiographs were successful in identifying additional roots in over 90% of cases, although superimposition of distal roots was potentially a limiting factor. Moreover, an angled radiograph (25–30°) was found to be more useful in this regard, with mesial yielding better results than distal angulation[13]. In the present report, all the radiographs taken during the root canal procedure were clearly suggestive of an RE, obviating the need to resort to other imaging modalities such as cone-beam computed tomography (CBCT) or 3-dimensional reconstruction.

The orifice of the RE is located mesio-lingually from the main distal canal, and therefore requires a more rectangular or trapezoidal access cavity to achieve a straight line of access. A dark developmental line on the pulp chamber floor, carefully explored with an endodontic probe, can indicate the precise location of the RE canal orifice[1,4]. Values based on the mean inter-orifice distance between an extra distolingual canal and remaining canals may also serve as a useful guideline in locating and treating an RE[8]. An operating microscope or loupes can be very useful, especially in cases where the orifices are covered by any calcification that can be easily removed with ultrasonic tips or long-shank round burs[1,3]. Three-dimensional imaging techniques based on CT or CBCT are also useful in visualizing and studying the true morphology of an RE in a noninvasive manner and with minimum exposure to radiation. However, cost and access to these imaging modalities has been reported to be a limiting factor in their availability[10,12].

Radix entomolaris can pose multiple and significant endodontic problems due to morphological variation and variable furcation. This may take the form of furcal or strip perforation; weakening of the root; vertical root fracture; straightening of the root canal; ledge formation; loss of working length; root canal transportation and instrument separation, especially during coronal pre-flaring; canal cleaning and shaping; or post-space preparation, particularly in a type III RE which exhibits more curvature than other types[1,7]. Therefore, endodontic treatment of an RE should incorporate measures aimed at minimizing these complications. Initial lingual relocation of the orifice without excessive removal of dentin helps achieve straight-line access and avoid perforations. Manual preflaring is recommended to prevent instrument separation. Some studies have noted that REs have a greater degree of curvature than the other roots of the mandibular molars, and their canals are relatively longer and have a smaller radius of curvature. Therefore, manual canal preflaring with stainless steel files is recommended to overcome instrument fracture, together with initial root canal exploration with small files (size 10 or less), creation of a glide path, and proper determination of the canal curvature and working length. All these measures should help reduce procedural errors such as ledging and transportation. Use of nickel-titanium rotary files with a taper of not more than 0.04 and crown-down tech-

nique should allow a more centered, round, and conservative canal preparation than the use of stainless steel instruments[1,12].

Conclusion

Clinicians should be aware of the potential for unusual root morphologies in the mandibular first molars. An initial diagnosis of an RE before root canal treatment is important in facilitating endodontic procedures and avoiding missed canals. Care should be taken in interpreting preoperative periapical radiographs so that any additional roots might be identified. The opening cavity will have to be modified depending on the location of the additional root and its root canal orifice. The morphology of an RE will vary in terms of root inclination and canal curvature, which means that great care should be taken in choosing a clinical approach that will prevent or overcome procedural errors during endodontic therapy. This case report explains in detail how to diagnose and endodontically manage cases of RE.

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