Radix Entomolaris with a Bilateral Occurrence; A Case Series
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Citation

Abstract
Most mandibular first molars have two roots. The presence of third root in the permanent mandibular first molar is the major variant, a supernumerary root which can be found either distolingually (RADIX ENTOMOLARIS) or distobucally (RADIX PARAMOLARIS), both of which are rare macrostructures in the Caucasian population. Endodontic treatment of these molars may be challenging compared with two-rooted molars owing to the unusual coronal and root canal morphology and a need to modify the access cavity. There is not much data about the bilateral occurrence of such type of mandibular first molars. This report describes the endodontic therapy on three rooted mandibular first molars with a bilateral occurrence.

INTRODUCTION
The basic objective of root canal treatment is thorough mechanical and chemical cleansing of the entire pulp cavity and its complete Obturation with an inert filling material. Endodontic therapy requires a thorough knowledge of root canal morphology to adequately shape and clean the canal system. Proper care and attention should be directed in identifying and negotiating extra roots and canals.

Mandibular first molar can display several anatomical variations. The majority of Caucasian Permanent mandibular first molars usually have 2 roots placed mesially and distally and 3 root canals (1,2), but variations in the number of roots and in canal morphology are not uncommon (3). The additional third root (a supernumerary root) in those permanent mandibular first molar variants that have 3 roots is typically distributed distolingually. This additional root was first described in the literature by Carabelli (4), is called the radix entomolaris [RE] (5). This extra root is typically smaller than the distobuccal root and is usually curved, requiring special attention during cleaning and shaping procedures (6).

There have been several morphometric analyses of extracted permanent mandibular first molars that were based on microcomputed tomography (7-9), but it is impossible to compare the results of these studies related to gender and the bilateral occurrence of such permanent three-rooted mandibular first molars. The recent introduction of cone-beam computed tomography (CBCT) potentially provides dentistry with a practical tool for non-invasive and 3-dimensional (3D) reconstruction imaging for use in endodontic applications and morphologic analyses (10, 11-13). The application of CBCT can determine the exact position of the distolingual root of the permanent mandibular first molars.

There has not yet been any studies/case reports of this morphological variant in Kashmiri population which has a majority of non-mongoloid Caucasian population. Because of the lack of research on this macrostructure in Kashmiri population thorough knowledge of its occurrence and location are important. In this case report endodontic management of three such cases is presented.

CASE# 1
A 20- year- old female patient reported to the department of conservative dentistry and endodontics, govt dental college, Srinagar, India with a chief complaint of pain and swelling in her lower right back teeth for one week. On clinical oral examination of the patient her mandibular right first molar had a deep carious lesion. The tooth was tender on percussion. Digital radiograph (Schick technologies, NY, USA) of the mandibular right fist molar showed a broad coronal radiolucent area involving the pulp. Radiograph also revealed the presence of an extra distal root with accompanying apical radiolucency. Buccal object rule (SLOB technique) confirmed the additional root as distolingual root (RADIX ENTOMOLARIS) (Fig 1a). Radiograph of the opposite side mandibular fist molar also revealed the presence of an extra distal root (Fig 1b).
Endodontic treatment of the involved tooth was decided and access cavity preparation was done using access opening bur kit (Dentsply Mailiefer) under proper rubber dam isolation and one distal & and two mesial canal orifices were located using an endodontic explorer at the first instant. The access cavity was then slightly modified and extended more distolingually to search for the presence of the extra distal canal orifice and a fourth canal orifice was located (Fig 1c).

The root canals were explored with a k-flex file ISO20 (Dentsply Mailiefer) except distolinguai canal which was explored with a k-flex file ISO15 (Dentsply Mailiefer) & radiographic working length determination was performed Elements diagnostic apex locater (Sybronendo, USA, USA) and confirmed radiographically (Schick technologies, NY, USA) (Fig 1d).

The root canals were shaped with ProTaper rotary instruments (Dentsply Mailiefer). During canal preparation Glyde (Dentsply Mailiefer) was used as a lubricant & the root canals were disinfected with 5.25% sodium hypochlorite (Prime Dental Product, Mumbai, India). The root canals were properly dried with absorbent paper points and obturated with gutta-percha and resin based sealer (AH plus, Dentsply De Trey, Konstanz, Germany) (Figs 1e, 1f). The access cavity was then sealed with temporary restorative...
material. The patient was recalled for the permanent restoration.

**Figure 5**
Fig 1e, master cone selection radiograph

**Figure 6**
Fig 1f, post-operative obturation radiograph

**CASE# 2**
A 30- year- old female patient was referred to the department of conservative dentistry and endodontics, govt dental college, Srinagar, India for endodontic treatment of mandibular right first molar. The patient had a chief complaint of pain in the lower right back teeth since 5 days. She had taken analgesics and antibiotics for the pain prescribed by a local dentist after which she was referred to our department by that dentist. On clinical oral examination mandibular right first molar of the patient had a deep carious lesion. Digital radiograph (Schick technologies, NY, USA) of mandibular right first molar showed a broad coronal radiolucency involving the pulp. Radiograph also revealed the presence of an extra distal root with accompanying apical periodontitis (Fig 2a).

**Figure 7**
Fig 2a, pre-operative diagnostic radiograph

Buccal object rule (SLOB technique) confirmed the additional root as distolingual root (RADIX ENTOMOLARIS). Radiograph of the opposite side mandibular first molar revealed the presence of an extra distal root (Fig 2b).

**Figure 8**
Fig 2b, radiograph of the opposite side mandibular first molar

Endodontic treatment of the involved tooth was decided and access cavity preparation was done using access opening bur kit (Dentsply Malliefer) under proper rubber dam isolation. On adjusting the access cavity four distinct canal orifices were located. Initial negotiation of the canals was done using k-flex file ISO 15(Dentsply Malliefer). Working length
determination was done using Elements diagnostic apex locater (Sybronendo, USA) and confirmed radiographically (Schick technologies, NY, USA) (2c).

**Figure 9**
Fig 2c, working length determination radiograph

Root canal shaping was done with the help of ProTaper rotary instruments (Dentsply Mailiefer) using copious Glyde (Dentsply Malliefer) as a lubricant during the preparation. Canal disinfection was done using 5.25% sodium hypochlorite (Prime Dental Product, Mumbai, India). After root canal cleaning & shaping the canals were properly dried with absorbent paper points and obturated with Gutta percha and resin based sealer (AH plus, Dentsply De Trey, Konstanz, Germany) (Figs 2d, 2e). The access cavity was sealed with a temporary restorative material. The patient was recalled for the permanent restoration.

**Figure 10**
Fig 2d, master cone selection radiograph

**CASE#3**
A 24-year-old female patient visited the department of conservative dentistry and endodontics, govt dental college, Srinagar, India with a complaint of pain in the mandibular right first molar. On clinical oral examination mandibular right first molar of the patient had a deep carious lesion. Digital radiograph (Schick technologies, NY, USA) of mandibular right first molar revealed the presence of an extra distal root with accompanying apical periodontitis (Fig 3a).

**Figure 11**
Fig 2e, post-operative obturation radiograph

Buccal object rule (SLOB technique) confirmed the additional root as distolingual root (RADIX ENTOMOLARIS). Radiograph of the opposite side mandibular first molar revealed the presence of an extra distal root (Fig 3b).
Endodontic treatment of the involved tooth was decided and access cavity preparation was done using access opening bur kit (Dentsply Malliefer) under proper rubber dam isolation. Four distinct canal orifices were located and negotiated using k-flex file ISO 15 (Dentsply Malliefer). Working length measurement was done using Elements diagnostic apex locator (Sybronendo, USA) and it was confirmed by a digital radiograph (Schick technologies, NY, USA) (Fig 3c).

DISCUSSION
The presence of a third root (RE) in mandibular first molar is associated with certain ethnic groups. The maximum frequency of RE in African population is 3% (7). While in Eurasian and Indian populations the frequency is less than 5% (8). In populations with mongoloid traits (such as the Chinese, Eskimos and American Indians) reports have noted that RE occurs with a frequency that ranges from 5% to more than 30% (8-14). In Caucasians, RE is not very common and occurs with a frequency of 3.4 to 4.2% (15, 16), and is considered to be unusual or dysmorphic root morphology.

The mechanism of 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 polygenic system (atavism...
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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 (13, 17). Curzon (1974) suggested that the “three-rooted molar” trait has a high degree of genetic penetrance as its dominance was reflected in the fact that the prevalence of the trait was similar in both pure Eskimos and Eskimos/Caucasian mixes (18).

Radix Entomolaris can be found on the first, second and third mandibular molar, occurring least frequently on the second molar (19). Some studies report a bilateral occurrence of the RE from 50 to 67% (12, 20).

Radix Entomolaris may present the clinician with a lot of difficulties during endodontic treatment. An accurate diagnosis of these extra roots can avoid a lot of procedural errors or a missed canal during root canal treatment. RE is mostly situated in the same bucco-lingual plane as the distobuccal root; a superimposition of both roots can appear on the preoperative radiograph, resulting in an inaccurate diagnosis. To reveal the RE, a second radiograph should be taken from a more mesial/distal angle (30 degree). This way an accurate diagnosis can be made in the majority of cases.

The presence of RE has a lot of clinical implications when an access cavity preparation is done. The root canal orifice of RE is situated disto to mesiolingually from the main canal or canals in the distal root. An extension of the triangular opening cavity to the (disto) lingual side results in a more rectangular or trapezoidal outline form (21). A thorough inspection of the pulp chamber floor and wall, especially in the distolingual region should be done to search for the root canal orifice of RE. Sophisticated visual aids such as magnification loupes, intra oral camera or dental operating microscope can be valuable tool for finding these extra root canal orifices.

The calcification which is often situated above the orifice of an RE has to be removed for a better view and access to the RE. However, to avoid procedural errors in the coronal third of a severe curved root care should be taken not to remove excessive amount of dentin on the lingual side of the cavity and orifice of the RE (21). The use of flexible nickel-titanium rotary files allows a more centred preparation shape with restricted enlargement of the coronal third and orifice relocation. Nevertheless, unexpected complications such as instrument separation do occur, & are more likely to happen in an RE with severe curvatures or narrow root canals. Therefore, after relocation and enlargement of the orifice of the RE, initial root canal exploration with small files (size 10 or less) together with radiological 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.

CONCLUSION
Clinicians should have a thorough knowledge of several anatomical variations seen in cases of mandibular first molars. An accurate diagnosis of a Radix Entomolaris before root canal treatment is important to facilitate the endodontic procedure, and to avoid missed canals. Preoperative periapical radiographs, exposed at two different horizontal angles (mesial/distal) are required to identify these additional roots. A thorough knowledge about the anatomy and location of this additional root and its root canal orifice will result in a modified access cavity preparation with a distolingual extension. There should be proper understanding about the morphological variations seen in case of mandibular first molars and an adapted clinical approach to avoid/overcome procedural errors during endodontic treatment.

References
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