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Endodontic Management of Radix Entomolaris in Permanent Mandibular First Molars: A Case Series

[1]Aswathi K, Assistant Professor, Department of Conservative Dentistry and Endodontics, AJ Institute of Dental Sciences, Rajiv Gandhi University of Health Sciences, Karnataka, India

Corresponding Author: Aswathi K, Assistant Professor, Department of Conservative Dentistry and Endodontics, AJ Institute of Dental Sciences, Rajiv Gandhi University of Health Sciences, Karnataka, India

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Abstract

The permanent mandibular first molars are generally two rooted teeth, one mesial and one distal root with two mesial and one distal root canals. But some of the mandibular first molars may have an additional root located either buccally (radix paramolaris) or lingually (radix entomolaris).For understanding the presence of extra root and its root canal anatomy an appropriate diagnosis is mandatory before starting with the root canal procedure in order to ensure successful treatment outcome. In the present case reports describes the diagnosis and endodontic management of the additional lingual root of mandibular first molars.

Keywords: Radix entomolaris, Endodontic treatment, mandibular first molar, root canal anatomy

Introduction

For the success of endodontic therapy, it is essential to have the knowledge of normal and usual configuration of the pulp cavity and its variations from the normal. The main objective of endodontic treatment is to prevent or eliminate infection within the root canal, which is achieved by cleaning and shaping of root canals and pulp space followed by obturation. Before starting the root canal treatment after correct diagnosis and treatment planning, one must have thorough knowledge of the unusual root canal morphology that can contribute to the success of the endodontic procedure. Most of the mandibular first molars have one mesial and one distal root with two mesial canals and one distal canal.

The two mesial root canals forms two distinct apical foramina or they can join together at the root apex into one apical foramen [1].In 1974, Vertucci and William described the presence of independent middle mesial canals in the mesial root of lower first molars. In 2004, a literature review by Baugh and Wallance reported the prevalence of a third mid-mesial root canal in mandibular first molars is between 1-15% [2].The number of roots for the mandibular first molar teeth may also vary.

A major variant is the presence of three roots in mandibular first molar. In white Caucasian (UK, Dutch, Finnish, German), African (Bantu Bushmen), Eurasian

and Indian populations, the frequency of three roots in mandibular molars as less than5% and in those with Mongoloid traits (Chinese, Eskimos, and native American populations), it occurs with a frequency of 5 to more than 30% [3,4,5]

The presence of an additional root in mandibular first molar was first mentioned by Carabelli in 1844 and is called as radix entomolaris (RE) [6]. This additional third root is commonly found distolingual in the mandibular first permanent molars. Radix entomolaris can be seen in the first, second and third mandibular molars, occurring least frequently in the second molar. An additional root is present on the mesiobuccal side, called as radix paramolaris.

A careful preoperative radiographic diagnosis plays a vital role inorder to complete a successful endodontic therapy of all canals of the tooth. Radiographs taken at different angulations reveal the basic knowledge regarding the internal anatomy of a tooth and thus helps in detecting additional canals or roots.[10] The major limitation of conventional radiographic images is to compress 3- dimensional anatomy into a 2-dimensional image and an attempt to overcome this drawback of conventional radiography inorder to detect the presence of additional canals or roots, it is helpful to take additional exposures changing the angulations of the main x ray beam. Clark's rule (SLOB rule or Waltons projection) helps in the detection of extra canals or roots in the teeth and have the potential to improve diagnosis. Advanced radiographic techniques like Cone Beam Computed Tomography (CBCT) imaging provides three dimensional (3-D) imaging and greatly reduces the error normally found interpreting standard two dimensional (2-D) images, leading to higher accuracy in the diagnosis.

CBCT imaging allows ascertaining the identification, exact location, curvature and angulation of the Radix Entomolaris in order to prevent iatrogenic errors like instrument separation, perforation and ledge formation that might occur in canal curvature. [7]This article describes the identification and endodontic management of permanent mandibular first molars of two patients with Radix Entomolaris.

Case Report 1

A 24 year old female patient reported with a chief complaint of pain in lower right back tooth region since last five days. The pain was intermittent in nature and aggrevated while taking hot and cold foods and lasted for 1-2 hours. The patient had undergone initiation of endodontic treatment since 2 days. On clinical examination, tenderness on percussion was positive for the tooth, mobility of the tooth was within physiologic limits and no intraoral swelling was revealed with tooth in relation to 46.The medical history of the patient was non contributory.

On radiographic examination, an intraoral periapical radiograph was taken and revealed the initiation of access cavity preparation, without periapical radiolucency. The presence of an additional distal root (Radix Entomolaris) was also revealed in the radiograph. The additional root was straight and was originated from the distolingual aspect of the tooth. The tooth of interest was diagnosed as chronic apical periodontitis as the pulp was necrosed.

Continuation of access cavity preparation was done under rubberdam followed by modifying of the access cavity from triangular to a trapezoidal shape inorder to locate the fourth canal of the extra root. DG- 16 endodontic explorer was used for locating the root canal orifices and the apical patency was achieved using 15# K file. Four canals were located (Mesio-buccal, Mesio-

lingual, Disto- buccal and Disto-lingual). Pulp extirpation was done, working length was determined using apex locator(Root ZX, J. Morita) and reconfirmed with the radiograph. Cleaning and shaping of the canals were done using 3% sodium hypochlorite,17% EDTA and saline .The canals were enlarged coronally upto 45 # K file and 30 # K file apically for all the canals. Obturation was performed with gutta percha points using lateral condensation technique. Permanent access restoration was done using composite resin (3M Filtek Z350 XT) and postoperative radiograph was taken. A six month follow up was taken, where the patient was totally asymptomatic and there was no evidence of periapical pathologies.

Figure 1: (a) Preoperative radiograph of tooth in relation to 46

Figure 1: (b) Access opening

Figure 1: (c) Working length determination

Figure 1: (d) Master cone placement

Figure 1: (e) Obturation

Figure 1: (f) permanent access restoration

Case Report 2

A 29 year old male patient reported complaining of pain and intraoral swelling in the lower right back tooth region since one week. The pain was intermittent in nature and aggrevated while taking hot and cold foods and lasted for 1hour. The patient complaints of pus discharge from the buccal vestibule since 2 days. On clinical examination, deep dentinal caries seen in relation to distal aspect, tenderness on percussion was positive for the tooth, mobility of the tooth with respect to 46 was within physiologic limits. The medical history of the patient was non contributory.

On radiographic examination, an intraoral periapical radiograph was taken and IOPAR with respect to tooth

46 shows radiolucency involving enamel, dentin and pulp, without any periapical changes. Caries was seen deep in the distal aspect extending subgingivally. The presence of an extra distal root in the lingual aspect was revealed in the radiograph and confirmed the presence of Radix Entomolaris. The additional root was seen as a straight root. The tooth of interest was diagnosed as pulpal necrosis.

On the same appointment, incision was given for the intraoral swelling region and the pus was drained followed by access opening was done under rubberdam isolation .Caries was removed completely and access cavity was modified such that the root canal in the extra distal root was located. DG- 16 endodotic explorer was used inorder to locate the root canal orifices and the apical patency was achieved using 15# K file. Mesio-buccal, Mesio-lingual, Disto- buccal and Disto-lingual canals were located. Pulp was removed completely, working length was determined using apex locator (Root ZX, J. Morita) and reconfirmed with the radiograph. Cleaning and shaping of the canals were done and canals were enlarged upto 30# K file. All the four canals were irrigated using 3% sodium hypochlorite, 17% EDTA solution and normal saline. Access cavity was closed using cotton pellet, open dressing was given after flushing the canals with normal saline as the final step of irrigation. Patient was recalled after four days for the continuation of the biomechanical preparation.

On second visit of root canal treatment, intraoral swelling in the buccal vestibule was subsided, cotton pellet in the access cavity was removed and then continued the irrigation procedure. The canals were enlarged coronally till 45#K file and master apical cone was placed. Obturation done using lateral compaction technique. zincoxide eugenol temporary restoration was done. patient was adviced to come after a week for the permanent restoration. Permanent access restoration was done with composite resin (3M Filtek Z350 XT) in the coming week and the healing of intraoral swelling was satisfactory and post operative radiograph was taken. A six month follow up was taken, patient was asymptomatic and there was no periapical pathology.

Figure 2: (a) Preoperative clinical view, intraoral swelling in the buccal vestibule of tooth in relation to 46

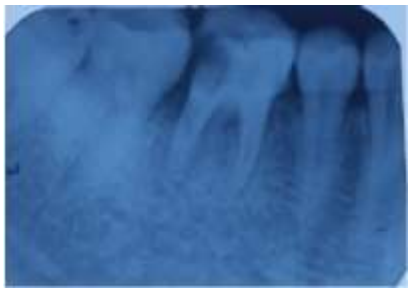

Figure 2: (b) Preoperative radiograph of tooth

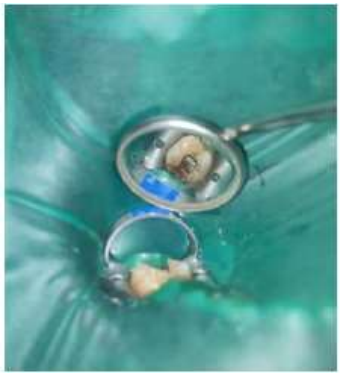

Figure 2: (c) Access opening

Figure 2: (d) Working length determination

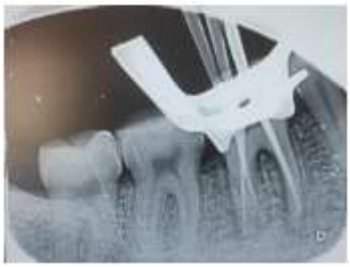

Figure 2: (e) Master cone placement

Figure 2: (f) Obturation

Discussion

The Radix Entomolaris is an important and challenging anatomic variation of mandibular first permanent molars which was first described by Carabelli, characterized by an extra root located disto-lingually. Radix entomolaris was considered as a genetic trait rather than a developmental anomaly and has been suggested that "three-rooted molar" traits had a high degree of genetic penetration as reflected in Eskimo/Caucasian mixed-race individuals which had a similar prevalence of the trait. It may be regarded as a normal morphological variant in ethnic groups of mongoloid origin (>30%) and in Indian population it has rather low prevalence (<5%).[8,9]

One of the most important steps towards the success of the endodontic procedure is the correct diagnosis and the main reasons for the failure of endodontic treatment is the negligence in extirpating the pulpal tissue completely and microbes from all the canals. However, radiographic diagnosis play an important role in the successful outcome of endodontic therapy.[10] The radiographs were taken at different angulations inorder to minimize the chances of missed canals.[11]

Radix Entomolaris (RE) was classified into four different types by Carlsen & Alexandersen (1990) based on the location of its cervical part [11]

Type A: the RE is located lingually to the distal root complex which has two cone-shaped macrostructures.

Type B: the RE is located lingually to the distal root complex which has one cone-shaped macrostructures.

Type C: the RE is located lingually to the mesial root complex.

Type AC: the RE is located lingually between the mesial and distal root complexes.

De Moor et al. (2004) classified radix entomolaris based on the curvature of the root or root canal [12]

Type 1: a straight root or root canal.

Type 2: a curved coronal third which becomes straighter in the middle and apical third.

Type 3: an initial curve in the coronal third with a second buccally oriented curve which begins in the middle or apical third.

The newly defined variants of Radix Entomolaris was described by Song JS et al(2010)[13]

Small type: length shorter than half of the length of the distobuccal root.

Conical type: smaller than the small type and having no root canal within it.

The radix entomolaris is located distolingually ranging from short, conical extension to normal mature root length with its coronal third partially or completely fixed to distal root. Generally, the radix entomolaris is smaller

than mesio- and distobuccal roots [14]. Externally, the distal furcation is slightly lower (1 mm.) than the furcation between mesial and distal roots [15]. A careful clinical and radiographic inspection of the mandibular first permanent molar can reveal the presence of a "hidden" Radix Entomolaris. On clinical examination of the mandibular first permanent molar can reveal a more bulbous outline of the crown, an extra cusp (tuberculum paramolare), and a more prominent occlusodistal or distolingual lobe along with a cervical prominence or convexity can indicate the presence of an extra root. Use of magnifying loupes, an intraoral camera, or a dental microscope aids in the clinical examination of Radix entomolaris. On Radiographic examination, a third root should normally be readily evident in about 90% of cases [16]. RE may be missed as it has a slender dimension or the overlapping with the distal root. So inoder to detected the additional root of mandibular first permanent molar, an additional exposure of the tooth from different horizontal projections, the standard buccal-to-lingual projection, 20 degrees from the mesial and 20 degrees from the distal reveals all the anatomy of the tooth [17,18]. According to Clark's rule (Also known as SLOB rule or Waltons projection), an object that moves in the same direction as the cone is located toward the lingual [19] helps in the detection of RE in the mandibular first permanent molars. As an advanced radiographic techniques, cone-beam computed tomography (CBCT) has emerged as an useful tool to aid in the diagnosis of teeth with complex root anatomies. However, the cost and accessibility of CBCT imaging are the main limiting factors till now. [20,21]

The location, curvature and direction of the root canals can be correctly noticed and treated with the help of radiographs. In the above mentioned case series, once the diagnosis was reached, the access cavity has to be prepared, care should be taken to establish a "straightline" access. The access cavity was modified from the classical triangular access cavity to a trapezoidal form to locate and access the root canal of the disto-lingual root, the Radix Entomolaris. The laws of orifice location may aid in the location of extra orifices.[22]

In some of the mandibular first molars there may have severe root inclination or root curvature, starting from the middle of the root or in the apical third (type 3 RE) which can cause shaping aberrations like straightening of canal or ledge, with root canal transportation and loss of working length. Hence the use of precurved files, to establish a smooth glide path to the apical segment and flexible Nickel-titanium rotary files allows a more centered preparation shape with a restricted enlargement of the coronal third and orifice relocation.[23] Inorder to avoid procedural errors ,after relocation and enlargement of the canal orifice, initial canal exploration was done with small files (size 10 or less) alongside radiographical passage length and curvature determination, and the creation of a glide path before preparation, is a step-by-step action that has be to emphasized.[24,25]

Conclusion

The success of Enododontic treatment depends on the proper diagnosis and management of the tooth inorder to avoid treatment failures. The clinicians should have a thorough knowledge and understanding of the prevalence of Radix Entomolaris, its anatomical variations as well as the clinical and radiographic diagnosis along with the correct treatment plan while performing the root canal treatment for the mandibular first permanent molars. In addition to this use of magnification aids, different horizontal cone projections and advanced tools such as CBCT will provide the

clinician with a better understanding of its complexity in order to ensure successful treatment outcomes.

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