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Clinical Approach for Identification of Radix Entomolaris and Modifications in Endodontic Treatment: A Case Report

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Abstract: ***Aim: To present a case of mandibular first molar with additional distolingual root (Radix Entomolaris). Summary: Endodontic therapy should result in complete debridement of root canal & provision of hermetic seal, to prevent re - infection. Mandibular 1st molars mostly present with two roots, mesial & distal. Anatomical variations may result in presence of an extra root, if present distolingually, k/a radix entomolaris (RE) or present mesiobuccally, k/a radix paramolaris. The first & foremost crucial step is careful interpretation of pre - operative radiograph. Multiple angled radiographs would result in detection of extra root/root canal, which would otherwise be missed due to superimposition. This case report describes endodontic management of mandibular molar with RE. Key Learning Points: 1) Detailed studying of pre - operative radiograph, taken at different angulations has to be done prior commencing the root canal therapy. 2) Modification in access cavity distolingually should be done to gain straight line access to the apex in case of RE. This will aid in unimpeded instrumentation. 3) Clinicians should be fully aware of the anatomical variations that might be present in mandibular 1st molars. 4) Extra canal is having curvatures & it's mostly narrower in dimensions. therefore, pre - curving of initial file, establishing glide path play a crucial role in successful management of RE.***

Keywords: Radix Entomolaris (RE), Distolingual (DL) root, Mandibular Molars, Endodontic Management, Anatomical Variation

1. Introduction

The main objective of the endodontic procedure/root canal therapy is to completely eliminate the microorganisms from the root canal system and prevention of further reinfection, which is achieved by biomechanical cleaning & shaping of the pulp space followed by hermetic sealing with obturating material (Arora et al., 2018) . Majority of mandibular 1st molars have one mesial & one distal root. An additional 3rd root, 1st described by Carabelli is found in some cases, known as radix entomolaris (RE).

The prevalence of RE appears to - be less than 3% in African populations, not to exceed 4.2% in Caucasians, to be less than 5% in Eurasian and Asian populations, and to be higher than 5% (even up to 40%) in populations with Mongolian traits (De Moor et al., 2004) . In races of Mongoloid origin (Chinese, Taiwanese, Korean, Inuits and Native American Indians), extra DL roots in mandibular first molars are considered a normal morphologic variant. The most common root canal configuration in three - rooted molars is type I for the distal root and type IV for the mesial root (Abella et al., 2012) .

Clinicians should be well aware of these unusual root morphologies in the mandibular molars. It is essential that the initial diagnosis of a radix entomolaris or paramolaris before root canal treatment is done to facilitate the endodontic procedure, and to avoid 'missed' canals. (Movassagh et al., 2016) . One of the critical reasons for the failure of endodontic therapy & retreatment is inadequate knowledge of anatomic variations resulting in missed canals (Arun et al., 2015) . Pre - treatment radiograph should be thoroughly inspected & interpretation of certain characteristics, such as an unclear view of the distal root/canal has to be done, that could aid in identifying the presence of distolingual roots (Abrami, 2016) . Radiographs exposed at two different horizontal angles and their careful interpretation facilitate the search of additional root canals. The use of magnification and additional lighting. i. e. loupes & DOM are recommended for the clinical examination of the pulpal floor (Rödig and Hülsmann, 2003).

CBCT is a competent tool for the detection of additional distolingual canals/roots and second mesio buccal canals, and it is a valuable aid for dentists providing root canal treatment (Pekiner et al., 2017) . An accurate detection of supernumerary roots, such as RE, can avoid complications during and after root canal treatment (Abella et al., 2011) . Carlsen and Alexanderson classified RE based on the location of its cervical part into four types (Shikha Gupta, 2015) (Carlsen and Alexandersen, 1990). **Type A**–Distally located cervical part with two normal distal root components. **Type B**–Same as Type A; however, only one normal distal root component. **Type C–**Mesially located cervical part. **Type AC**–Central location between mesial and distal root components.

The internal and external morphological configurations of roots and root canals are quite complex. Therefore, several classifications have been put forth by researchers to appropriately understand the distinguishable features of root and root canal systems of multirooted teeth (Pawar and Singh, 2020) . (De Moor et al., 2004) (Shikha Gupta, 2015) classified RE-based on the curvature in buccolingual orientation into three types. **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 the middle to apical third.

This paper highlights the clinical approach for identification of RE and modifications in endodontic treatment for their management.

2. Materials and Method

A 27 - year - old man was referred to our clinic for endodontic treatment of right mandibular first molar. The medical history was non - contributory. Clinical examination of tooth 46 showed deep carious lesion, involving enamel & dentin, approaching the pulp. Figure 1 showing the presence of an extra distolingual root. Percussion test was negative and at the periapical X - ray there was no periapical lesion.

An inferior alveolar nerve block followed by buccal infiltration was performed with 3.6mL of 2% lidocaine/epinephrine 1: 80, 000. After isolation of the operative field with dental dam, the decayed tissue was removed. Access cavity preparation was created using a round diamond Endo - Access bur and an Endo - Z bur (Maillefer, Ballaigues, Switzerland). A trapezoidal opening cavity was performed. Four root canals were found (MB, ML, DB and DL). A distolingual extension of the contour of the pulp chamber was necessary in order to localize the orifice of the distolingual root and to have optimal access. The lengths of these canals were measured electronically. A pre - curved stainless - steel K - File ISO number 10 (Dentsply Maillefer) also confirmed patency up to the apical foramen. Periapical X - ray for working length confirmation was taken (shown in Figure 2). The four root canals were disinfected with sodium hypochlorite solution (5.25%) and EDTA. The pre - flaring, the glide path and the root canal preparation were performed using nickel - titanium rotating files systems (Neo endo rotary files, apical size of 4% taper #25 no.). Throughout the procedure, the canals were irrigated with abundant 5.25% sodium hypochlorite solution. The final irrigation was done with normal saline. Calcium hydroxide (Prevest Denpro) dressing was given and the patient was appointed for next visit.

After one week patient returned, and was found to be asymptomatic. The canals were dried with paper points of 4% conicity. Master cone selection was done (Figure 3). Obturation was done with single cone obturation technique (25.4%), followed by sealing of the canals with ionosit baseliner (DMG) (Figure 4). Post - endodontic restoration and crown preparation was done (Figure 5), followed by crown cementation (shown in Figure 6).

Figure 1: Preoperative radiograph

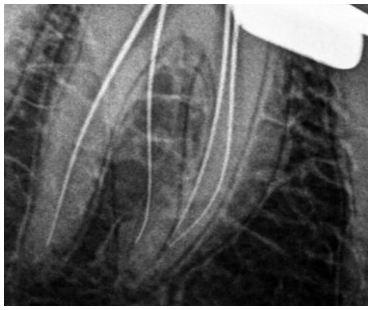

Figure 2: Working length radiograph (extra distolingual root)

Figure 3: Master cone selection radiograph

Figure 4: Radiograph showing obturation

Figure 5: Radiograph showing post endodontic restoration and crown preparation

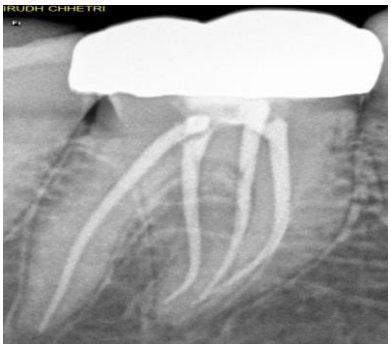

Figure 6: Radiograph showing crown cementation

3. Discussion

Radix entomolaris is characterized by the presence of an extra root located distolingually. It's present in mandibular 1st, 2nd & 3rd molars, with the lowest prevalence in mandibular 2nd molars. How the RE is formed is still not known. Because the extra root is dysmorphic, its formation could be due to external elements during odontogenesis or the influence of an atavistic gene or polygenetic system. In the Indian population the prevalence of RE is less (2.16%) than what was cited for any other Asian populations and had a greater occurrence on the right side of the jaw and in women. Bilateral occurrence of RE was found to be around 60%. High frequency of a third root in lower first molars make it mandatory to carefully examine radiographs, to have knowledge about the anatomy, modify the access opening and find missed canals.

Inability to detect this extra root results in inadequate debridement of the canal space, and hence endodontic treatment failure, resulting in retreatment. The existence of 'invisible' RE can be illustrated by the entire examination of the preoperative radiograph, explanation of specific features, such as unclear view or outline of the distal root shape or the root spiracle

In conventional radiographs, the 3D image is suppressed to 2D. An inaccurate diagnosis may occur on the radiograph due to superimposition of the distobuccal root over the radix as they are mostly located in the same plane. Thus, one is not able to locate it. Therefore, it's suggested to take radiographs at different angulations i. e., 20 degree mesial & 20 degree distal. SLOB rule (i. e., same lingual opposite buccal) can also be applied to detect this root. An additional root appears as a thin line or shadow in the radiograph.

Thorough clinical examination of the tooth crown and inspection of the cervical morphology of the roots can give us a hint of an additional root. Other diagnostic aids are: presence of dark line on the pulp chamber floor, champagne bubble test, use of DG 16 explorer, periodontal probing, pathfinder, JW - 17explorer, endodontic explorers, micro - openers, visualizing the dentinal map, ultrasonic tips, CBCT, staining the chamber floor with 1% methylene blue dye, transillumination. Sometimes an additional cusp (tuberculin paramolaris) may hint an extra root. Visual aids such as a loupe, intraoral camera or dental microscope can also be useful.

If the extra root is located, then the access cavity should be modified from triangular to trapezoidal form. If it's located prior, then modified access cavity has to be prepared. The extra root (RE) is usually shorter than other roots and mostly curved at the apex, hence it's advisable to pre curve the initial file, establish glide path & patency, followed by use of NiTi hand instruments for further cleaning & shaping of the canal to prevent procedural errors such as ledge formation, zip, separation of instrument.
In the present case, the variations in distal root anatomy were identified through careful reading of angled IOPA radiographs. With the advent of rotary instruments, access burs such as Endo Z, SS white access burs, access can be modified to get a straight - line access. Use of copious amount of saline & full concentration of sodium hypochlorite is recommended during biomechanical preparation.

Canal preparation was done up to apical size of 4% taper #25 no. file. This was to ensure that there are no chances of procedural errors, at the same time promising adequate cleaning and shaping of all the canals, including the extra canals of RE. Obturation was done with single cone technique for the proper fit of the cone & after tug back was obtained. This was followed by post endodontic restoration. According to (Helfer et al., 1972) , endodontically treated teeth are more brittle & vulnerable to fracture, due to structural loss of root canal treated teeth (which have already been weakened by caries). Therefore, the tooth was restored with full coverage crown to ensure maximum life of the tooth, by providing strength & bringing back the tooth in function, occlusion & mastication.

4. Conclusion

The complexity of the root canal system often poses a challenge to the clinician. Failure of endodontic therapy & retreatment can be prevented by careful & detailed studying of pre - operative radiographs, which can be exposed at different horizontal angulations, either mesially or distally, or both. Extension of access cavity distolingually has to be done if RE is suspected in order to gain straight line access to the apex. This will aid in unobstructed instrumentation. Negotiation of extra root has to be done with small instruments, as they are more flexible. Furthermore, accessory root being narrower, it should be prepared to as minimum working width as possible, along with abundant use of irrigants, & frequent recapitulation with smaller number instruments (#10, #15), promoting its complete decontamination & at the same time preventing errors such as instrument separation, apical transportation, ledge formation, canal blockage. This will follow Schilder's principle of maintaining the canal in its original shape. All these steps, when followed effectively & efficiently, will result in successful management of radix entomolaris.

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Figure Legends

Figure 1. Preoperative radiograph
Figure 2. Working length radiograph (extra distolingual root)
Figure 3. Master cone selection radiograph
Figure 4. Radiograph showing obturation
Figure 5. Radiograph showing post endodontic restoration and crown preparation
Figure 6. Radiograph showing crown cementation