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Management of Supernumerary Roots in Mandibular Molars: A Call From Radix Paramolaris – ACase Series

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ABSTRACT

Abstract

A comprehensive knowledge of the anatomy of the root canal is a basic prerequisite for the success of endodontic treatment. Permanent mandibular first molars usually have two roots, one mesial and one distal. However, permanent mandibular molars may have an additional lingual root located distally (radix entomolaris) or an additional buccal root located mesially (radix paramolaris). Literature suggests the

presence of radix paramolaris is very rare and occurs less frequently than the radix entomolaris. Clinicians should be aware of these unusual morphological variation of the roots in terms of root inclination and canal curvature which demand careful, adapted diagnostic and clinical approach to avoid or overcome procedural errors during root canal therapy. This case series discusses the management strategies for permanent mandibular molars with radix paramolaris.

Keywords Additional roots, mandibular first molar, radix paramolaris, root canal therapy.

Introduction

Molars are frequently affected by caries at an early age which may require endodontic treatment for their long-term retention in the oral cavity[1]. The objective of a successful endodontic treatment is the prevention or healing of endodontic pathology which in turn depends on a thorough chemo-mechanical cleansing and shaping of the root canals followed by a dense root canal filling with a hermetic seal. An awareness and understanding of the presence of unusual root canal morphology can thus contribute to the successful outcome of root canal treatment[2]. Mandibular molars usually have two roots, one mesial and one distal, which typically have either one or two canals each. A frequent anatomical variation in the mandibular first molar is the presence of a third root located in a distolingual position which is known as radix entomolaris (RE)[3]. In contrast, the most frequent anatomical variation of the mandibular second molar is fusion of its roots[4] and a C-configuration of root canal system[5,6]. Reports of presence of accessory roots on a mandibular second molar are rare[3]. In 1844, Carabelli was the first to describe the presence of a third root (located lingually) on a mandibular molar[7] which was termed as radix entomolaris (RE) by Bolk in 1915[8]. When it is located buccally instead of lingually, it is called radix paramolaris (RP), as was termed by Bolk in 1914[9]. The prevalence of RP is much lower than that of RE[2].

The purpose of this case series is to describe the endodontic treatment of permanent mandibular first and second molars with radix paramolaris.

Case Report 1

A 29-year-old female patient with a non contributory medical history reported to our Out Patient Department of Conservative Dentistry and Endodontics of Haldia Institute of Dental Sciences and Research complaining of pain on the lower right back teeth region since 2 weeks. She gave a history of sharp and intermittent pain in the same region for the past three months. Intraoral clinical and radiographic examination revealed deep occlusal caries involving pulp in the right mandibular first molar. A close inspection of the radiograph also revealed the presence of an additional periodontal ligament space crossing over the mesial root leading to an impression of double periodontal ligament space on the mesial aspect. This led to the suspicion of an additional mesial root (Fig. 1).

Fig. 1: Pre-operative radiograph of #46

The tooth had exaggerated response to electric pulp tester and the diagnosis ofsymptomatic irreversible pulpitis was made. Routine non-surgical endodontictreatment was planned.

After obtaining the informed consent for the root canal treatment and infiltration with local anesthesia (2% lidocaine with 1:100000 epinephrine), the tooth was isolated with a rubber dam (Hygenic, Coltene Whaledent, Switzerland). A conventional endodontic access was prepared with an Endo Access Bur (Dentsply, Maillefer, Switzerland) and an Endo Z bur (Dentsply, Maillefer, Switzerland). Four canal orifices wereidentified (two mesial and two distal) with a DG 16 explorer (Hu-Friedy, USA) and thetriangular access cavity was modified with a buccal extension (Fig. 2).

Fig. 2: Clinical picture showing four orifices (two mesial and two distal) of #46

determined; MB = 19 mm, ML = 17 mm, DB = 21 mm and DL = 19.5 mm using an apex locator (Canal Pro Coltene, Whaledent, Switzerland). Working length radiographs were taken to confirm the fourseparate root canals (Fig. 3).

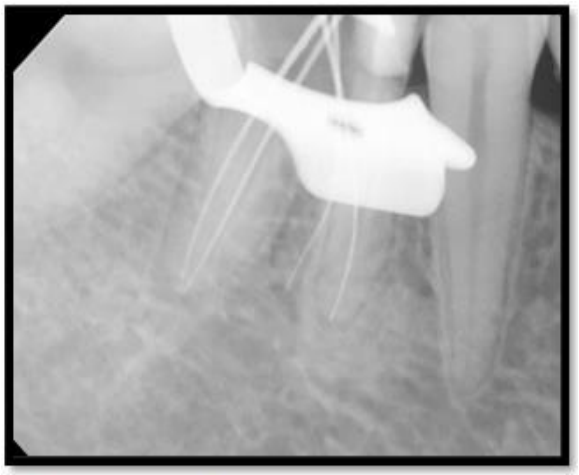

Fig. 3: Working length radiograph of #46

NiTi Rotary instruments (Neo Endo Flex, Orikam) with a taper of 4% and 6% were used to prepare the mesial canals and the distal canals respectively using a torquecontrolled endomotor (Canal Pro 2, ColteneWhaledent, Switzerland). Copious amount of 5% sodium hypochlorite solution (Parcan, Septodont) was used for irrigation during instrumentation and a final rinse wasdone using 17% EDTA (RC Help, Prime Dental) for 1 minute. Master cone was confirmed (Fig. 4) and the canals were dried with paper points (Orikam).

Obturation was done using calcium hydroxide based sealer (Apexit Plus, Ivoclar). The postoperative radiograph andclinical photograph showed satisfactory obturation (Fig. 5A. & 5B.). Post endodontic restoration was done with composite (Te-EconomPlus Composite, Ivoclar) (Fig. 6).

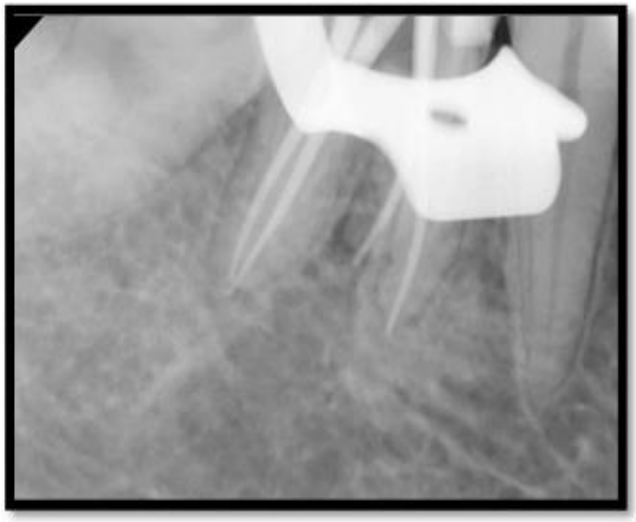

Fig. 4: Radiograph showing master cone verification of #46

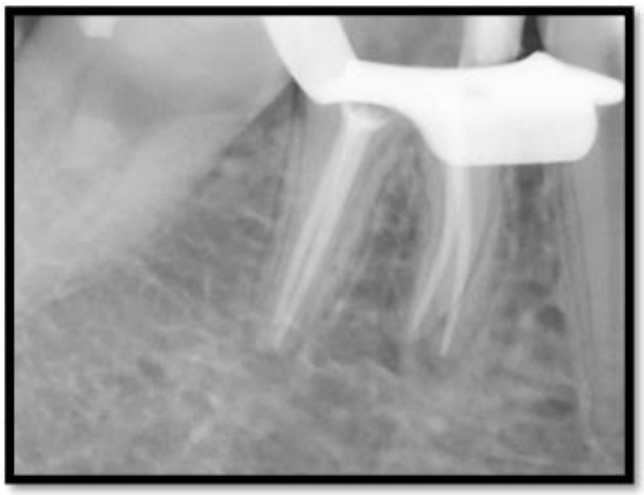

Fig. 5A: Radiograph showing obturation of #46

Fig. 5B: Clinical picture showing obturation of #46

Fig. 6: Radiograph showing post endodontic restoration of #46

The patient was recalled after a week for follow-up and was found to be asymptomatic following which he was referred to the Department of Prosthodontics and Crown and Bridge for extracoronal restoration. The patient was asymptomatic during the follow-up period of 6 months (Fig. 7).

Fig. 7: Radiograph showing follows up of #46 after 6 months

CASE REPORT 2

A 44-year-old male patient with a non- contributory medical history reported to our Out Patient Department of Conservative Dentistry and Endodontics of Haldia Institute of Dental Sciences and Research complaining of pain on the lower right backteeth region since 1 week. He gave a historyof sharp and severe lingering pain in the same region since 1 month. The pain increased on consumption of hot and cold food. Intraoral clinical and radiographic examination revealed deep mesio-occlusal caries involving pulp in the right mandibular first molar with unusual mesialroot morphology (Fig. 8).

Fig. 8: Pre-operative radiograph of #46

CBCT imaging was done to confirm the presence of an additional buccal root in themesial direction (Fig. 9)

The tooth had exaggerated response to electric pulp tester and the diagnosis ofsymptomatic irreversible pulpitis was made. Routine non-surgical endodontictreatment was planned.

Fig. 9: CBCT imaging (axial section) confirming the two separate mesial roots

After obtaining the informed consent for the root canal treatment, the tooth was isolated with a rubber dam (Hygenic, Coltene Whaledent, Switzerland) followinginfiltration with local anesthesia (2% lidocaine with 1:100000 epinephrine). Aconventional endodontic access was prepared with an Endo Access Bur (Dentsply, Maillefer, Switzerland) and an Endo Z bur (Dentsply, Maillefer, Switzerland). Four canal orifices wereidentified (two mesial and two distal) with a DG 16 explorer (Hu-Friedy, USA) and theconventional triangular access cavity was buccally extended (Fig. 10).

Fig. 10: Clinical picture showing four orifices (two mesial and two distal) of #46

After checking the patency of the canals with #10K file (Dentsply-Maillefer), theworking lengths of the canals were determined; MB = ML = DL = 19 mm and DB = 20 mm using an apex locator (Canal Pro Coltene, Whaledent, Switzerland).

Working length radiographs were taken to confirm the four separate root canals (Fig. 11).

Fig. 11: Working length radiograph of #46

NiTi Rotary instruments (Neo Endo Flex, Orikam) with a taper of 4% were used using a torque controlled endomotor (Canal Pro 2, Coltene Whaledent, Switzerland). Copious amount of 5% sodium hypochlorite solution (Parcan, Septodont) was used for irrigation during instrumentation and a final rinse was done using 17% EDTA (RC Help, Prime Dental) for 1 minute. Master cone was Fig. 10: Clinical picture showing four orifices (two mesial and two distal) of #46 Fig. 9: CBCT imaging (axial section) confirming the two separate mesial roots Fig. 11: Working length radiograph of #46 confirmed (Fig. 12) and the canals were dried with paper points (Orikam).

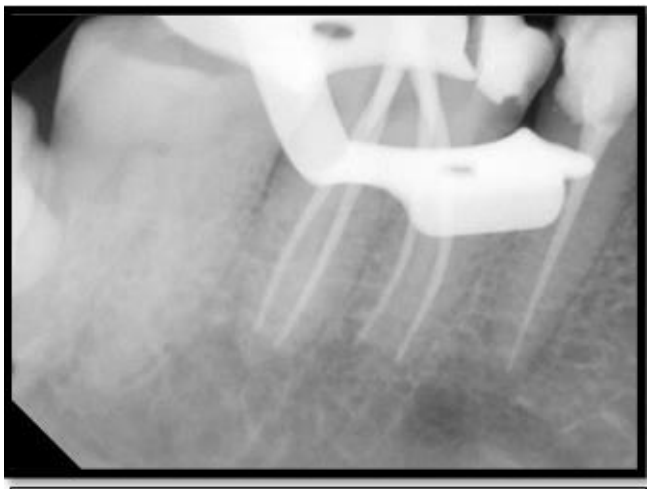

Fig. 12: Radiograph showing master cone verification of #46

Obturation was done using calcium hydroxide based sealer (Apexit Plus, Ivoclar). The postoperative radiograph and clinical photograph showed satisfactory obturation (Fig. 13A. & 13B.).

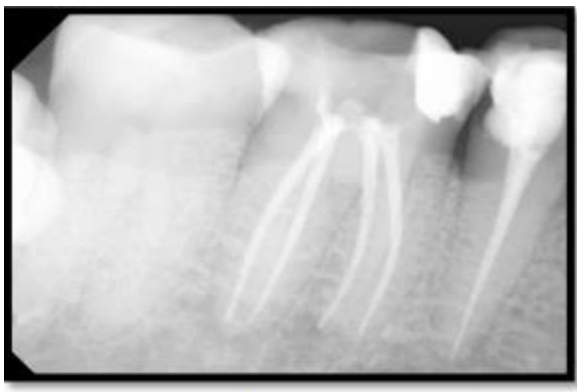

Fig. 13A: Radiograph showing obturation of #46

Post endodontic restoration was done with composite (Te-EconomPlus Composite, Ivoclar) (Fig. 14). The patient was recalled after a week for follow-up and was found to be asymptomatic following which he was referred to the Department of Prosthodontics and Crown and Bridge for extracoronal restoration.

Fig. 13B: Clinical picture showing obturation of #46

Fig. 14: Radiograph showing post endodontic restoration of #46

The patient was asymptomatic during the follow-up period of 6 months (Fig. 15)

Fig. 15: Radiograph showing follow up of #46 after 6 months

CASE REPORT 3 A 22-year-old male patient with a non contributory medical history reported to our Out Patient Department of Conservative Dentistry and Endodontics of Haldia Institute of Dental Sciences and Research complaining of pain on the lower left back teeth region since 2 months. He gave a history of sharp and severe lingering pain which increased on consumption of hot and cold beverages. Intraoral clinical and radiographic examination revealed deep mesio-occlusal secondary caries involving pulp underneath previous restoration in the left mandibular second molar with unusual mesial root morphology (Fig. 16).

Fig. 16: Pre-operative radiograph of #37

A close inspection of the radiograph revealed an additional periodontal ligament space crossing over the mesial root leading to an impression of double periodontal ligament space on the mesial aspect. This led to the suspicion of an additional mesial root (Fig. 16). The tooth had exaggerated response to electric pulp tester and the diagnosis of symptomatic irreversible pulpitis was made. Routine non-surgical endodontic treatment was planned. After obtaining the informed consent for the root canal treatment, the tooth was isolated with a rubber dam (Hygenic, Coltene

Whaledent, Switzerland) following infiltration with local anesthesia (2% lidocaine with 1:100000 epinephrine). A conventional endodontic access was prepared with an Endo Access Bur (Dentsply, Maillefer, Switzerland) and an Endo Z bur (Dentsply, Maillefer, Switzerland). Three canal orifices were identified (two mesial and one distal) with a DG 16 explorer (Hu-Friedy, USA) and the triangular access cavity was buccally extended (Fig. 17).

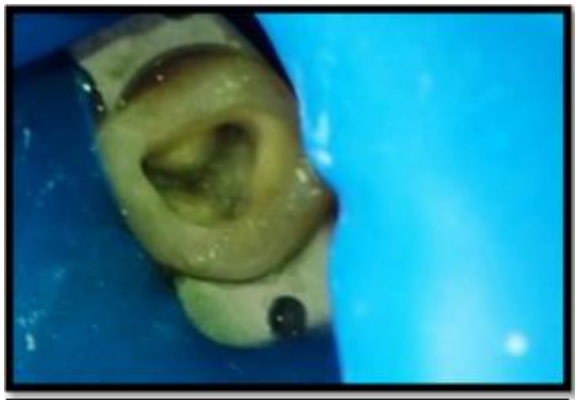

Fig. 17: Clinical picture showing three orifices (two mesial and one distal) of #37

After checking the patency of the canals with #10K file (Dentsply-Maillefer), the working lengths of the canals were determined; MB = 18 mm, ML = 17 mm and D = 18.5 mm using an apex locator (Canal Pro Coltene, Whaledent, Fig. 16: Pre-operative radiograph of #37 Fig. 17: Clinical picture showing three orifices (two mesial and one distal) of #37 Switzerland). Working length radiographs were taken to confirm the three separate root canals and two separate roots (Fig. 18). Biomechanical preparation was completed using ProTaper Gold (Dentsply, Maillefer, Switzerland) rotary NiTi files (till F2) using a torque controlled endomotor (Canal Pro 2, ColteneWhaledent, Switzerland) with copious amount of 5% sodium hypochlorite solution (Parcan, Septodont) as the irrigant.

Fig. 18: Working length radiograph of #37

A final rinse was done using 17% EDTA (RC Help, Prime Dental) for 1 minute. Master cone was confirmed (Fig. 19) and the canals were dried with paper points (Orikam).

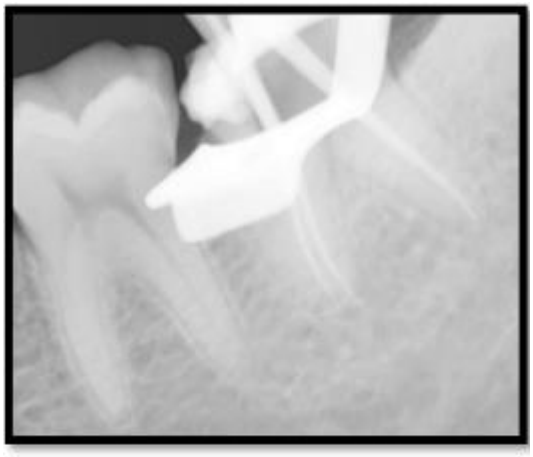

Fig. 19: Radiograph showing master cone verification of #37

Obturation was done using calcium hydroxide based sealer (Apexit Plus, Ivoclar). The postoperative radiograph and clinical photograph showed satisfactory obturation (Fig. 20A. & 20B.).

Fig. 20A: Radiograph showing obturation of #37

Fig. 20B: Clinical picture showing obturation of #37

Post endodontic restoration was done with composite (Te-EconomPlus Composite, Ivoclar) (Fig. 21). The patient was recalled after a week for follow-up and was found to be asymptomatic following which he was referred to the Department of Prosthodontics and Crown and Bridge for extracoronal restoration.

Fig. 21: Radiograph showing post endodontic restoration of #37

The patient was asymptomatic during the follow-up period of 6 months (Fig. 22)

Fig. 22: Radiograph showing follow up of #37 after 6 months

DISCUSSION

About 97.8% of mandibular first molars have two roots among which 64.4% have three canals; two canals are located in the mesial root and one canal in the distal root[10]. The single distal canal is usually large, central and more oval in cross-section than the mesial canals. Incidence of two distal canals has been reported in 28% of cases with small orifices that are located either buccally or lingually[10]. The presence of a separate radix paramolaris in the first and second mandibular molar is usually associated with certain ethnic groups. Radix paramolaris is observed in 1.5%-3% of the African population while the frequency of occurrence of the same is around 2% in the Indian population[11]. Literature shows that radix paramolaris is commonly present in 0.7% to 4.2% of the European population[12-16].

Reports by Pomeranz et al.[17] and Goel et al.[18] described the incidence of radix paramolaris in

mandibular molars to be ranging from 1%-15% in vivo. However, in vitro studies have not reported such a high occurence of three mesial canals, with most studies showing an incidence of either 0% or 1%[19,20].

According to Visser, the prevalence of radix paramolaris, was found to be 0% for the first mandibular molar, 0.5% for the second and 2% for the third molar[21]. Other studies have, however, reported radix paramolaris in first mandibular molars to be in only 0.5% of the cases[22].

Ahmed et al.[23], Al-Qudah et al.[24] and Loh et al.[25] studied the number of roots present on mandibular second molars but they did not find any third roots. On the contrary, Manning examined 149 mandibular second molars and found a third root in 2% of the cases but he did not specify their locations[26]. Gulavibala et al.[27] and Rocha et al.[28] found three Fig. 21: Radiograph showing post endodontic restoration of #37 Fig. 22: Radiograph showing follow up of #37 after 6 months roots in 1.2% and 1.5% of the cases, respectively.

Carlsen and Alexanderson stated that the dimensions of the radix paramolaris can vary from a 'mature' root with a root canal to a short conical extension. This additional root can be separate or non-separate[2].

Carlsen and Alexanderson has described two different types of radix paramolaris: Type A – Refers to a RP in which the cervical part is located on the mesial root complex[2]. Type B – Refers to a RP in which the cervical part is located centrally, between the mesial and distal root complexes[2]. The presence of radix paramolaris has great clinical implications in clinical endodontics. The first stage of endodontic triad, i.e., correct diagnosis is one of the most important steps for success of any endodontic procedure. An accurate diagnosis of the supernumerary roots in mandibular molars can avoid complications or cases of 'missed canal' during root canal therapy[2].

Radix paramolaris is mostly situated in the same buccolingual plane with the mesiolingual root, so a superimposition of both roots can appear on the preoperative radiograph, resulting in an inaccurate diagnosis[1]. A thorough inspection of the preoperative radiograph and interpretation of particular characteristics, such as an unclear view or outline of the mesial root contour or the root canal, can indicate the presence of a "hidden" radix paramolaris[1]. For proper diagnosis, a second radiograph should be taken from a more mesial or distal angle (30°)[1]. A non invasive three-dimensional reconstruction image can be achieved using cone-beam CT (CBCT)[29].

Apart from a radiographical diagnosis, clinical inspection of the tooth and analysis of the cervical morphology of the roots by means of periodontal probing can facilitate identification of an additional root[1]. The presence of an extra root is sometimes associated with changes in occlusal anatomy[3]. Sperber and Moreau found that 20% of molars having an additional root also possess an extra cusp that is situated between the two lingual ones, indicating the presence of a distolingual root. In their observational study, 100% of the molars with an extra cusp had an additional root[30]. According to Calberson et al., an extra cusp i.e, the tuberculum paramolare or more prominent occlusal distal or distolingual lobe, in combination with a cervical prominence or convexity, can indicate the presence of an additional root[2].

After diagnosis, care should be taken to establish a "straight line" access during an access cavity preparation[31].

Straight-line access in this respect has to be emphasized, as the most of the radix roots are curved[11]. The laws of orifice location may aid in the location of extra orifices[32]. To avoid weakening of the tooth, perforation or stripping in the coronal third of a severe curved root, care should be taken not to remove an excessive amount of dentin on the buccal side of the cavity and orifice of the radix paramolaris[31]. With a good understanding of the law of symmetry, various methods like visualizing the dentinal map using magnification, use of micro-openers and DG 16 probes, properly designed access cavity, staining the chamber floor with 1% methylene blue dye, performing champagne bubble test, use of piezoelectric ultrasonics, red line and white line tests aid in accurate canal identifications[1, 33].

A dark line on the pulp chamber floor can indicate the precise location of the RP canal orifice[1]. The mesial and buccal pulp chamber wall can be explored with an angled probe to reveal overlying dentin or pulp roof remnants masking the root canal entrance[1].

Precurving the files to establish a smooth glide path to the apical segment and using Nickel-Titanium rotary files for cleaning and shaping, is the desired option for curved canals in cases of radix paramolaris[2].

Adequate coronal enlargement helps avoid obstructions in the coronal segment of the canals and easy passage of the endodontic file to the apical segment. This also allows larger volumes of root canal irrigants to pass on to the apical segments thus making treatment outcome more favourable[31].

CONCLUSION

Rare occurrence of anomalies requires that the clinician be vigilant in diagnosis and management of the same. It is crucial to ensure the nature and characteristics of radix paramolaris when it comes to canal curvatures and conformations to carry out a proper root canal therapy. Hence, these cases require judicial application of diagnostic tools and endodontic skills for their treatment. Careful interpretation of the radiograph, using different horizontal cone projections and advanced tools such as CBCT may facilitate their recognition. Once diagnosed, management of the extra root and the canal can be done using equipments such as magnification aids, orifice locators and flexible files.

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