

Anatomical Variation of Middle Mesial Canals in Mandibular 1st Molar: A Case Series

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ABSTRACT

Background: Success in root canal treatment is achieved by meticulous mechanical and chemical cleansing of the pulp space and three dimensional obturation of root canal system. Pulp tissue remnants present in missed canals and spaces may compromise the treatment outcome. Therefore, it is imperative for the clinician to diagnose the peculiar anatomy of such teeth during root canal treatment. The prognosis for endodontic treatment in teeth with abnormal morphology is unfavourable if the clinician fails to recognize extra root canals. This case series describes the diagnosis and successful endodontic management of an unusual mandibular first molar with five and six canals with different canal configurations.

Keywords: Middle mesial canal, six canals, mandibular first molar.

INTRODUCTION

The mandibular first molars usually have two roots (mesial and distal) that accommodate two mesial canals and 1–2 distal canals, respectively. Rarely extra canals are found in mesial and distal roots called middle mesial (MM) and middle distal (MD) canals. These canals exist in the developmental groove, which is present between the mesiolingual (ML) and mesiobuccal (MB) canals. The incidence of a MM canal was ranged 0% to 37.5%.^{1,2,3} On the other hand, the percentage of middle distal canal in-between the two distal root canals was 0.2–8%.^{4,5,6} Barker et al.⁷ and Vertucci and Williams⁸ were the first researchers to demonstrate the presence of an extra and independent canal in mesial root of mandibular molars. Later, Martinez-Berna and Badanelli⁹ reported a middle canal in the distal root also.

CASE REPORT

20yrs male presented with severe pain in mandibular left first molar (#36) with caries involving pulp, tooth was diagnosed with

symptomatic irreversible pulpitis with chronic apical periodontitis (Fig1a). Root canal treatment was started under local anaesthesia (lidocaine 2% with epinephrine 1:80,000) and rubber dam isolation, access opening with the aid of magnification and start x tip (#2) showed presence of MM and MD canal. MM canal was nearer to MB canal and MD canal was equidistance from DB & DL canal. MM canal was completely independent from MB & ML canal and all 3 canals exited separately. MD canal though joined with DB canal and ML canal had separate exit as is evident in post obturation x-rays. All 6 canals were prepared with Neo endo Flex files, till #30 (4%), following irrigation with 5.25% NaOCl after each file, and final removal of smear layer with 17% liquid EDTA. Canals were dried with paper points and obturated with Gutta percha using Warm vertical compaction (Fig 1c). Access was restored with Filtek Z 350XT composite.

CASE REPORT 2

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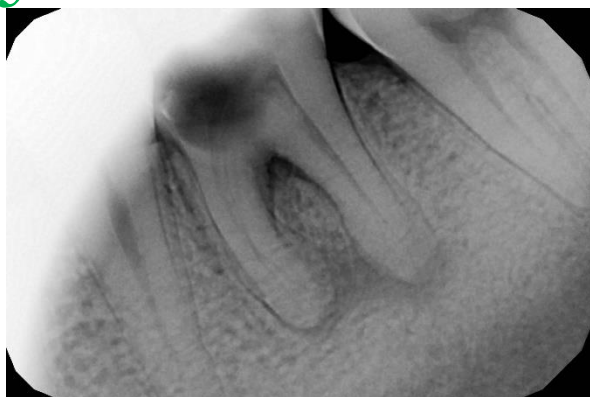


Fig 1: Pre operative photograph.



Fig 2: Access opening.



Fig 3: Master cone radiograph.



Fig 4: Obturation done.

Case 2:



Fig 5: Access opening done.



Fig 6: Obturation Complete.

Case 3:



Fig 7: Preoperative radiograph.

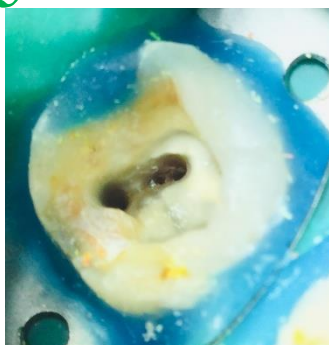


Fig 8: Re access opening done.



Fig 9: Obturation done.

16 yr old female presented with pain in mandibular right first molar (#46), tooth was diagnosed with symptomatic irreversible pulpitis. Root canal treatment was started under local anaesthesia (lidocaine 2% with epinephrine 1:200,000) and rubber dam isolation, caries was excavated and an adequate coronal access was made. Clinical inspection of the pulp chamber floor revealed orifices corresponding to the MB, ML, DB and DL. Thorough observation with magnification (2.5x loupes, Carl Zeiss, Germany) and troughing the developmental groove between the ML & MB canals with Start X tip (#2) indicated the presence of middle mesial (MM) canal which was equidistance from MB & ML canal, similarly Middle distal canal (MD) was identified (fig 2a) and negotiated to full length with #8 and #10 K-hand files MM canal was patent throughout the working length and was completely separate from MB & ML canal throughout the length of canal, where as in distal root, MD and DL canal merged with DB approximately 4mm above the root apex and exited as single canal.

All 6 canals were prepared with Neo endo Flex files, till #30 (4%), following irrigation with 5.25% NaOCl

after each file, and final removal of smear layer with 17% liquid EDTA. Canals were dried with paper points and obturated with Gutta percha using Warm vertical compaction (Fig 2b). Access was restored with Filtek Z 350XT composite.

CASE REPORT 3

20 yr male patient presented with swelling in buccal gingival aspect of mandibular right 1st molar (#46). Access restoration was seen in #46 with history of endodontic treatment 3yrs back somewhere else, radiographic evaluation revealed short obturation with both mesial and distal root canals with periapical lesion with both roots (Fig3a).

Root canal treatment was started under local anaesthesia (lidocaine 2% with epinephrine 1:200,000) and rubber dam isolation, access was modified and using Protaper retreatment files (D1-D2-D3) in sequential manner gutta percha was removed from previously obturated MB, ML and DB canals. Using Start X ultrasonic tip (#2) access was modified and MM canal and disto lingual canals were located which were previously missed (Fig3b).

All the 5 canals i.e MB, MM, ML, DB & DL canals were negotiated till working using apex locator (Root Zx mini, MORITA). This case with MM canal was different from both the above cases as the MM canal was very close to ML canal as compared to other 2 cases where MM canal were almost equidistance from MB and ML canal. In this case MM merged with ML canal. BMP was carried out till 30 (4%) with 5.25% NaOCl irrigation in between and finally smear layer removal by 17% liquid EDTA, obturation was carried out by warm vertical compaction (Fig3c).

DISCUSSION

Sometimes, the "extra" canal is found in the mesial root which is termed as middle mesial canal (MMC) and was first reported by Vertucci and Williams in 1974. The incidence rate of MMC varies from 1% to 15%.

It has been postulated that secondary dentine apposition during tooth maturation will form a dentinal vertical partition in the canal cavity, thus creating extra root canals. Other possible reasons for the presence of extra roots and canals include role of external factors during odontogenesis,

presence of an atavistic gene and racial genetic factors. Pomeranz et al. have classified the MM canal into three types: Fin, confluent, and independent. Fin type does not have a separate orifice and it is usually small linear extension of MB or ML canal of very small length allowing free movement of the file between the main canal and fin. The confluent type has separate orifice but it merges either with the MB or the ML canal. Independent type has a separate orifice and separate exit at the foramen.¹⁰

All 3 cases presented here have different canal configuration.

In case 1 and 2, MM can be classified as independent as all 3 canals had 3 separate orifices and separate exit but for distal canal in case 1 & 2 can be classified as confluent where MD merged with DB and DL had separate exit, in case 3 where MM merged with mesiolingual resulting in confluent canal configuration. Some research articles report the third canal to be located equidistant to both the main canals, while others report it to be closer to one of the main canals. Sherwani et al.¹¹ observed that, in 67% of cases from an Indian population, the MMC orifice was located in the middle of the MB and ML orifice and 20% had the orifice closer to the ML canal, while the remaining 12% had the orifices located closer to the MB canal. In contrast, Karapinar-Kazandag et al.¹² reported a higher number of canals closer to either the ML or the MB canal in their study which employed magnifying loupes. Nosrat et al.¹³ in a study on a population from the USA, demonstrated that the MMC was located closer to the ML canal in a majority of the cases, followed by in the middle of the MB and ML canals. In a study by de Toubes et al.¹⁴ more number of MMC was identified close to the MB (46%) than to the ML (31%) canal, while 23% were located at the centre.

Prevalence of confluent configuration has also been reported by other researchers to lie between 46.7% and 96%. Furri¹⁵ observed a greater prevalence of confluent canals in teeth with MMC than in those with DMMC in both first and second mandibular molars. de Toubes et al. reported that a higher number of MMC connected to the MB (54%) than to the ML (38%) canal. Confluence configuration in MDC has also been reported. In this case, the distobuccal and mid-distal canals joined at the middle third of the root and exited through a single

apical foramen while the distolingual canal had a separate orifice and foramen. A case of MMC and MDC confluence configuration in both mesial and distal roots of a mandibular first molar has also been reported. Gupta et al.¹⁶ reported that MMC and MDC were found confluent with their respective mesial/distal buccal canals at the junction of the middle and apical one-thirds, indicating the presence of three orifices and two apical foramina in each root. Versiani et al.¹⁷ reported the MMC to be more frequently confluent with the MB (16.7%) than the ML (8.3%) canal in their Brazilian population.

CONCLUSION

A thorough understanding of normal root canal configuration and its different variations is imperative in success of root canal procedure. Each case should be carefully evaluated clinically and radiographically to detect any anatomic anomalies. Possible variations in the internal anatomy of human teeth should be taken into account and treated accordingly.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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