Original Article

# The Six In Six: Management Of A Mandibular First Molar With 4 Distal And 2 Mesial Canals

**Dr. Mehak Batra[1], Dr. Sandhya Kapoor Punia[2*], Dr. Rahul Bhargava[3], Dr. Yogender Kumar[4], Dr. Shilpi, Kushwaha[5]**

[1]PG Student, Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan.
[2*]Professor and Head, Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan.
[3]Professor, Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan.
[4]Reader, Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan.
[5]Senior Lecturer, Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan.

***Corresponding author: -** Dr. Sandhya Kapoor Punia

*Professor and Head, Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan. Email: - drsanvikpunia@gmail.com
**DOI:** 10.47750/pnr.2023.14.03.23

## Abstract

Locating all the root canals, cleaning and shaping them and then sealing them completely with a root canal filling material is very important for the root canal therapy to be successful. Missed canals lead to failure of the root canal treatment rendering the patient in pain. A dentist should be well-versed with the variations in the root canal system. The given case report presents a case of lower first molar with six canals, 4 distal and 2 mesial. All the canals were located using the champagne bubble test and the bleeding points were identified and the area was scouted to locate the canals. The clinician should evaluate all the cases clinically as well as radiographically for the presence of anomalies. Usually, the clinicians try to locate only the predominant canals and do not scout the chamber for any abnormal variations. This failure to locate a canal will lead to remnants of pulp in the tooth which is the major reason for re-infection and failure of the treatment. Also, in some cases it can be a reason for persistent pain for the patient. So, it's important to locate all the canals and clean them for a successful root canal treatment.

**Key words:** Mandibular first molar, Six canals, Champagne Bubble test, Protaper Gold Rotary file, Aberrant anatomy, Dentinal map.

## INTRODUCTION

Mandibular first molar is the first posterior tooth to erupt in the oral cavity and literature shows that it is the most common tooth which requires root canal therapy. Most commonly, it has 2 roots (1-mesial and 1- distal) with usually 2 canals in the mesial root and 1 canal in the distal root. [1] However, a lot of variations are observed with the advancement in radiographic techniques and improved knowledge of the clinician and magnification. The internal complexities or variations in the anatomy are usually controlled by genetics and some variations may also be prevalent to a specific population. It has also been reported that with increasing age, secondary dentin deposits into the root canal system resulting in multiple canals and transverse connecting systems. [2]

A dental practioner, should be well versed with the internal anatomy as well as the possible variations of the root canal system. It is of utmost importance to locate all the canals, clean and shape them and then seal them with an inert root canal filling material, for the root canal therapy to be successful.[1]

Kottor et al. [3] and Ahmed et al. [4] in their study calculated the prevalence rate of 4% for 3 canals in mesial root and 3% for 3 canals in distal root. Therefore, their occurrence in a single tooth is extremely rare.[2] No case till date has been reported with 4 canals in the distal root.

It has been reported that there is an isthmus present in between the 2 mesial canals present in the mesial root. An accessory mesial canal may be present in this system with a prevalence rate of 0% to 17%. [2,5] Cases have reported with mandibular molars to have three roots. Mesial roots and distal roots with 3 canals each have also been reported. Literature has reports with 5 or 6 or more canals in the mandibular molar.[1]

Presence of 3 canals in the distal root is a rare entity with the incidence of 0.2-3%. The third canal is referred to as the middle distal (MD) canal, it is located in middle of the distolingual and distobuccal canals. [5]

It has been postulated that secondary dentine apposition during tooth maturation will form a dentinal vertical partition inside the canal cavity, thus creating the root canals. The third root canal may be created inside the root cavity of the mandibular molar by this process.[6] The larger mesio distal dimension of the single distal root, compared to that of the single mesial root, may account for the rare incidence of the third canal created by dentine apposition in a single distal root.[7] Other possible reasons for the presence of extra root canals include role of external factors during odontogenesis, penetrance of an atavistic gene and more importantly racial genetic factors.[8]

Six or more canals present in a mandibular molar is exceptionally rare and such teeth are reported in a very small number of case reports with their incidence being unknown. No case with 4 distal canals has been reported so the incidence and prevalence remains unknown.

## CASE REPORT

A 23 year old female reported to the department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Udaipur, Rajasthan with the chief complaint of decayed teeth in lower left back tooth region for 3 months. The patient reported no pain or sensitivity with the associated tooth. Patient didn't report any history of pain or any other symptoms associated with the tooth.

The patient gave no relevant medical history.

The patient had got RCT in the lower right back tooth region about one month back. The procedure was uneventful and the patient was comfortable.

On oral examination, a mesio-occlusal carious lesion was seen i.r.t. # 36. the tooth was non-tender on percussion. Patient reported no sensitivity with the associated tooth. Early response was seen when electrical pulp testing was done. The patient had a good oral hygiene and an appreciable periodontal health.

On radiographic examination, a deep mesio-occlusal carious lesion (mesio-occlusal) was seen i.r.t. #36. The carious lesion was almost approaching the pulp chamber. The pulp chamber seemed to be calcified on the radiograph. PDL widening was seen i.r.t. mesial root of #36.

A diagnosis of asymptomatic irreversible pulpitis with asymptomatic apical periodontitis was made. A treatment plan of root canal therapy was established. The risks and benefits of the treatment were explained to the patient and a written consent was obtained before commencing with the treatment.

In the first appointment, treatment was initiated with the administration of local anaesthesia (2.2 mL 2% lidocaine with 1:100 000 epinephrine). Caries removal was done using a slow speed carbide bur. Pre-endodontic build up was done followed by Access opening using an endo access bur (#2 Endo Access Bur, Dentsply) and defined using an Endo Z Bur. The chamber was calcified and pin-point bleeding was seen in the distal side where canals were located. Canals were scouted using a #10 K file (Dentsply) and were negotiated uptil the working length. At that time only 5 canals were negotiated (2-mesial and 3-distal).

Orifice enlargement was done using the SX file (Protaper, Dentsply) and canal preparation was done using Protaper Universal uptil #F2 with EDTA Gel (Glyde, Dentsply) Copious irrigation was done using Sodium Hypochlorite and normal saline during the entire preparation. Final irrigation was done with chlorhexidiene and the tooth was restored with temporary restorative material (Cavitemp, Ammdent, India). The patient was recalled after 2 days.

In the next appointment, the patient reported slight pain in the tooth. The tooth had become tender on percussion. The temporary restoration was removed. On examination slight bleeding was observed from the disto-lingual orifice.

The canal was scouted using a #6 K-file (Dentsply) using tactile sensation and another canal was found with the configuration of 1-2-1 with the previously negotiated Disto-lingual canal. Canal preparation was done using the same protocol under copious irrigation. Intracanal calcium hydroxide dressing was given for 1 week and the patient was recalled.

After one week, the patient reported no symptoms. Master cone was selected using #F2 GP cones (Dentsply). Obturation was done using Resin based sealer (AH Plus) and lateral compaction technique. Post- obturation restoration was done.
A full-coverage all-ceramic crown was placed over the tooth. The patient reported no pain or discomfort after 6 months. Healing was noted in the peri-apical region.

## DISCUSSION

The main objective of root canal treatment is the thorough mechanical and chemical cleansing of the entire pulp cavity and its complete obturation with an inert filling material [2]. Failure of the endodontic therapy is most often attributed to missed or unfilled canals[9]. They offer a path of least resistance for the micro-leakage of the bacteria and its toxic by-

products to the apical area and leading to the reinfection of the root canal space. The pulp remnants and the persistent bacteria with their toxins act as a nidus for the apical infection. This leads to failure of the RCT leading to the need of a surgical/non-surgical retreatment and in worst cases even the extraction of tooth[10]. The recent developments in the science of diagnosis and instrumentation in the field of endodontics is mainly focused on improving the quality of treatment. The introduction of operating microscopes, digital radiographs, and CBCT to the field has attributed to an increased ability to detect and identify these anatomic variations. The introduction of apex locators, and NiTi instruments help in better cleaning and shaping of the root canal system.

The use of modern diagnostic tools can prevent an inadvertent search for extra canals that can lead to excessive removal of tooth structure and perforations. [11] These advanced diagnosis and treatment modalities are not available with ever dental practioners in a developing country like ours, India. Nor can the patient afford the high cost associated with the high-end treatment protocols. Therefore, a dental practitioner must have the skill and a sufficient knowledge to the science of giving best quality treatment with the limited resources. The presented case was not done using an operating microscope which had its own disadvantages, but despite that the middle distal canal and the 2 distolingual canals were found by careful observation of the dentinal map and the isthmus between the root canals. The canals were identified using the traditional indicators i.e., champagne bubbles test, the bleeding points and the dentinal map. [1]

The Distolingual canal 1 and Distolingual canal 2 in the present case report were intertwined and had a configuration of 2-1-2-1. The canal negotiation was cumbersome but was done using tactile sense and angled radiographs.

In order to easily locate these intermediate canals these four steps are suggested by Fabra-Campos[12]

- Once the access cavity is made the dentinal protuberance which separates the entrance to the mesiobuccal and mesiolingual canals are removed with either ultrasonic tips or round bur
- An explorer is used to explore through the groove connecting the mesiobuccal and mesiolingual canal to search for any possible intermediate depression. Also, in teeth with vital pulp a bleeding spot can be observed which may indicate middle mesial canal.
- Catheterize the third canal by using a thin file (#08 or 10) in an alternating 45-deg rotating motion
- Once the canal is located enlarge canal entrance. Most of the time this intermediate canal will join at the apical or middle third with either the mesiolingual or mesiobuccal canal, ending in one foramen. This intermediate canal joins more frequently with the mesiobuccal canal. Various authors[1,11] have suggested that younger patients had intermediate canals which were more easily found.

Fabro-Campos[13] in his case report suggested that the intermediate canal should not be enlarged as much as the main canal because of the danger of perforation. This in turn makes obturation of the canal more difficult as spreaders cannot be introduced to the correct level during lateral condensation techniques.

Finally diagnostic measures such as multiple preoperative radiographs, examination of pulp chamber floor with a sharp explorer, troughing of the grooves with ultrasonic tips, staining the pulp chamber floor, visualization of bleeding points and with use of magnification, the middle mesial canal can be detected and treated for the success of the root canal treatment.

Radiographs and other imaging techniques such as CBCT and micro-CT serves as the most appropriate method for the practitioner to detect the variations in the root canal anatomy. However, only by correct clinical examination and interpretation of these images can the clinician detect variations and be aware of them before and during endodontic procedures. Also, “the eyes can only see what the mind knows”; therefore, the endodontist or the practitioner should be well-versed with the anatomic variations before and during performing the root canal therapy. [2]

Over the period of years, certain techniques have been devised to identify aberrant anatomy and locating extra canals. These can be summed up as:

1. Multiple radiographs: Well angulated radiographs should be taken. (Mesio-angular, disto-angular, straight) when evaluating an endodontic failure.
2. Digital radiography: This offers a variety of software features, significantly enhancing radiographic diagnostics in identifying hidden, calcified or untreated canals.
3. Visual enhancers: Magnifying glasses, head-lamps, transilluminating devices, dental operating microscopes are used to improve visualization.
4. Coronal flaring: This should be done for better visualization of canal orifice.
5. White line test: Shelf of dentin meets the pulpal floor and forms a groove. It forms a visible roadmap that can be followed and explored to find canal orifice.
6. Red line test: In vital cases, blood flows into the orifices, fins and isthmus areas thus serving as a road map for identification of canal orifices.
7. Surgical length burs: They enhance direct vision by moving the head of the hand-peice further away from the occlusal table and improving the line of sight along the shaft of the bur.
8. Piezoelectric ultrasonic. Troughing of grooves with-ultrasonic tips (CPR tips)

9. Examination of the pulp chamber floor with a sharp explorer ( DG 16)
10. Dyes: 1% methylene blue dye is irrigated into the pulp chamber and subsequently rinsed thoroughly with water, dried and visualized to see where the dye has been absorbed. Frequently the dyes will be absorbed into the orifices, fins and isthmus areas
11. Champagne bubble test using Sodium Hypochlorite: After cleaning and shaping procedures, the access cavity is flooded with NaOCl and the solution is observed to see if bubbles are emanating toward the occlusal table from canal orifice. A positive bubble reaction signifies that NaOCl is -reacting with residual tissue within the instrumented or the missed canal or with the residual chelator present within the prepared canal.
12. Ruddle‘s solution: This irrigant is a "cocktail" containing 5% sodium hypochlorite (NaOCl), Hypaque and 17% EDTA. Hypaque is a water-soluble, radiopaque, contrast solution which can be utilized to visualize root canal system anatomy, monitor the remaining wall thickness during preparation procedures, detect pathological defects and manage iatrogenic mishaps. The composition of the Ruddle Solution simultaneously provides the "solvent action" of full-strength NaOCl, "visualization" as its radiopacity closely matches that of gutta-percha and improved "penetration" as the tension-active agent lowers the surface tension.[14,15]

The most striking feature of this case was the presence of 4 distal canals which have not been reported till now. It should also be noted that the disto-buccal canal orifice was located in the mesial half of the tooth which was something which is not encountered in the day-to-day practice.

## CONCLUSION

This case report presented the Root Canal Treatment of a mandibular first molar with 6 canals. 6 canals in a mandibular first molar have been rarely reported. The clinician should evaluate all the cases clinically as well as radiographically for the presence of anomalies.

The accessory canals in mandibular molars should be detected and negotiated to provide access for irrigation and filling materials into otherwise inaccessible isthmus.

### CONFLICT OF INTEREST

The author denies any conflicts of interest related to this case report.

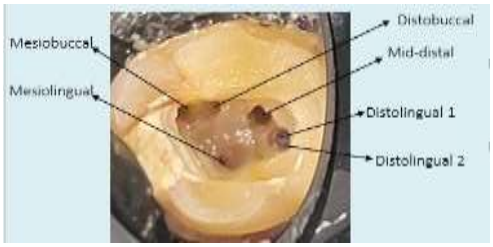
## REFERENCES


1. Ballullaya SV, Vemuri S, Kumar PR. Variable permanent mandibular first molar: Review of literature. Journal of Conservative Dentistry 2013; 16(2):99-110.
2. Claudio Maniglia-Ferreira, Fabio de Almeida Gomes, Bruno Carvalho Sousa. Management of Six Root Canals in Mandibular First Molar. Case Reports in Medicine 2015; Article ID 827070.
3. J. Kottor, K. K. Paul, J. Mathew, S. George, A. Roy. A permanent mandibular second molar with seven root canal systems. Quintessence International 2014; 45:381–383.
4. H. A. Ahmed, N. H. Abu-Bakr, N. A. Yahia, Y. E. Ibrahim. Root and canal morphology of permanent mandibular molars in a Sudanese population. International Endodontic Journal 2007; 40(10):766–771.
5. Hasan M, Rahman M, Saad N. Mandibular first molar with six root canals: a rare entity. BMJ Case Reports 2014; 31:bcr2014205253.
6. Bond JL, Hartwell GR, Donnelly JC, Portell FR. Clinical management of middle mesial root canals in mandibular molars. Journal of Endodontics 1988; 14:312–314.
7. Matinez-Berna A, Badanelli P. Mandibular first molar with six root canals. Journal of Endodontics 1985; 8:348–352.
8. BaughD, Wallace J. Middle mesial canal of the mandibular first molar: A case report and literature review. Journal of Endodontics 2004;30:185–186
9. J. F. Siqueira Jr., I. N. Rôças. Clinical Implications and microbiology of bacterial persistence after treatment procedures. Journal of Endodontics 2008; 34(11):1291-1301.
10. P. Neelakantan, C. Subbarao, C. V. Subbarao. Comparative evaluation of modified canal staining and clearing technique, cone-beam computed tomography, peripheral quantitative computed tomography, spiral computed tomography, and plain and contrast medium-enhanced digital radiography in studying root canal morphology. Journal of Endodontics 2010; 36(9):1547–1551.
11. Subramaniam Ramachandran V, Shankari V, Rathakrishnan M, Chandrasegaran V, Kumaraguru K. Management of Three Rooted Mandibular First Molar with Six Canals: A Case Report. Cureus 2019; 11(12):e6280.
12. Fabra-Campos H. Unusual root anatomy of mandibular first molars. Journal of Endodontics 1985; 11:568– 572.
13. Fabra-Campos H. Three canals in the mesial root of mandibular first permanent molars: A clinical study. International Endodontic Journal 1989; 22:39–43.
14. Siqueira JF Jr. Aetiology of root canal treatment failure: why well-treated teeth can fail. International Endodontic Journal 2001; 34(1):1-10.
15. Sandhya Punia, Meenakumari Chikkanna, Jayashree Hegde, Vikas Punia, Lakshman Rao. Techniques in detection of superfluous root morphology: A review and case report of a mandibular canine with two roots. Annals and Essences of Dentistry 2011; 3(1):85-88.

A. B.

**Figure 1:** A. Pre-operative photograph; B. Pre-operative Radiograph

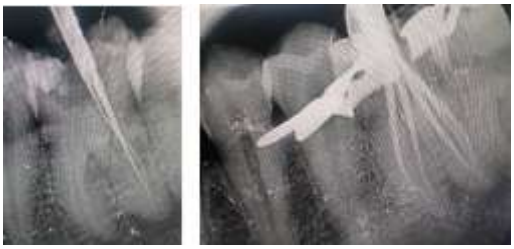
A. B.




C.

**Figure 2:** A. Access opening; B.Orifice enlargement; C. Orifice configuration in the pulp chamber

A. B.



C D.

**Figure 3 :** A. Working Length radiograph with straight angulation B. Working Length radiograph with mesial angulation C. Canal scouted from the Disto-Lingual orifice; D. Master cone selection

A. B. C.

C E.

**Figure 4:** A,B and C. Obturation with straight and mesial angualtion; D. Post-obturation radiograph; E. 6- months follow up