

CASE REPORT

Endodontic Management of Mandibular Premolars with Three Roots and Three Canals

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ABSTRACT

Proper knowledge of the internal anatomy of tooth is essential for the long-term success of endodontic treatment. Mandibular premolars exhibit a greater variation in their internal morphology due to the occurrence of additional roots and root canals. This article showcases two case reports of successful endodontic management of mandibular premolars with three roots and three canals. A detailed diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made through clinical and radiographic examinations. Endodontic management was carried out successfully and the patient was evaluated.

Keywords: Anatomical variations of teeth, Endodontic management, Mandibular premolar, Root canal anatomy.

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INTRODUCTION

Success of endodontic therapy depends on the complete disinfection and debridement of the entire root canal system followed by a three-dimensional obturation. The outcome of the therapy also relies on the adequate knowledge of the anatomical variations in the root canal configuration. One of the reasons for acute flare-up could be attributed to the failure in locating the presence of additional canals.¹

Mandibular premolars have shown greater variabilities in their morphology, with the presence of more than one canal. They are the most difficult teeth to treat endodonti-

cally with the possibility of a high failure rate.² Various cases that have been reported showed mandibular first premolars with the presence of two or more canals.

It has been assessed that the failure rate of nonsurgical root canal treatment is the highest for the mandibular first premolars.^{2,3} Hoen and Pink⁴ found a 42% incidence of missed roots or canals in their analysis of teeth requiring retreatment. The presence of two or more canals at the apex was found to be at 24.2%.⁵ Mandibular first premolars with three canals and three separate roots were found to be from 0.5 to 5.7%.⁶⁻⁹ Tzanetakis et al¹⁰ reported the incidence of two or more canals in the mandibular second premolar that ranged from 1.2 to 34%. The occurrence of three canals in the mandibular second premolars has been reported to be 0.0 to 0.4%.¹¹⁻¹⁵ This article is a case report of the successful endodontic treatment performed in two different mandibular second premolars with three canals and three different apical foramina.

CASE REPORTS

Case 1

A patient aged 35 years came to the Department of Conservative Dentistry and Endodontics for restoration of decayed teeth. Intraoral examination revealed multiple caries teeth and an orthopantomogram was advised, which showed deep caries for tooth 44 and 45. Pulp sensibility tests were done using electric pulp tester and both the teeth showed negative response. Access cavity was done under rubber dam isolation for tooth 44. Pulp chamber was initially entered using number 2 round diamond bur (Dentsply Maillefer, Ballaigues, Switzerland), and the dentin that covers the pulp chamber was unroofed with Endo Z burs (SybronEndo, Orange, CA).

Access was extended further lingually and distally to avoid missed canals. Careful examination of the pulpal floor revealed three canal orifices, two buccal and one lingual, and they were located with a DG-16 endodontic explorer. In order to obtain a glide path, No. 10 K file (Dentsply Maillefer) was lubricated and used in watch winding motion and three separate canals were located (Fig. 1). Working lengths of all the three canals were initially determined radiographically and later confirmed with an apex locator (J. Morita). All the three canals were initially hand filed with 20 size K file (Flexofiles, Dentsply Maillefer) until the working length. They were later cleaned

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and shaped with nickel titanium rotary instruments (HERO SHAPER Micro-Mega, Besancon, France) up to a size of 25, taper 4% along with frequent irrigation using 5.25% sodium hypochlorite and 2% chlorhexidine solutions. The canals were lubricated with Glyde (Dentsply) during instrumentation. Calcium hydroxide-containing iodoform was placed inside the canal as an intracanal medicament during the interappointment period, and access cavity was sealed using cavif (3M ESPE). Simultaneously, access cavity was prepared for tooth no. 45, single canal negotiated (Fig. 2), and working length was established. The canal was enlarged by hand instrumentation up to size 40 using K file (Mani files) by stepback method, intracanal medicament was placed, and access cavity was sealed. The patient was asymptomatic during the interappointment period. After 3 weeks, the tooth 44 was reopened, the intracanal medicament was removed, and the length of the master cone was checked with a radiograph (Fig. 3). All the three canals were finally obturated with

4% gutta-percha (Dentsply Maillefer) using AH Plus as a sealer and the coronal access was sealed with cavif. Tooth 45 was obturated with gutta-percha (Dentsply Maillefer) using lateral condensation method (Fig. 4).

Case 2

A 36-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, with the chief complaint of pain in the region of left lower posterior teeth for a period of 2 months. The pain was intermittent in nature that intensified by thermal stimuli and on mastication. The patient’s medical history was noncontributory.

A careful clinical examination revealed a carious mandibular left second premolar tooth. The tooth 35 was not mobile and periodontal probing was within physiological limits. Electric pulp testing and cold test revealed a lingering response, and the tooth was tender on percussion. A preoperative radiograph revealed coronal radiolucency involving the pulp space and the presence of three roots

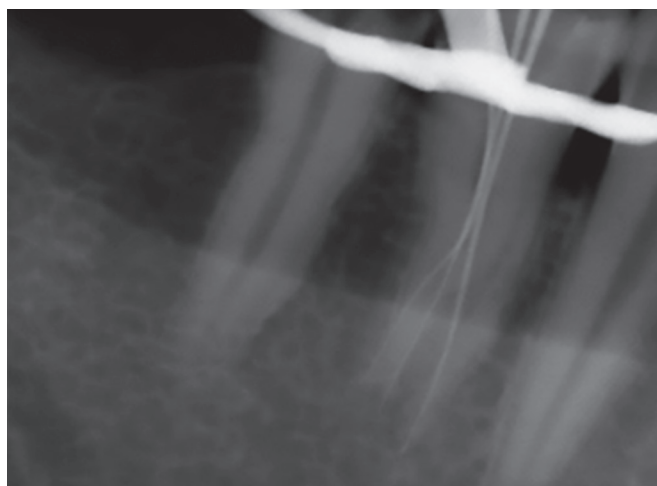


Fig. 1: Working length radiograph of tooth #44 showing three canals

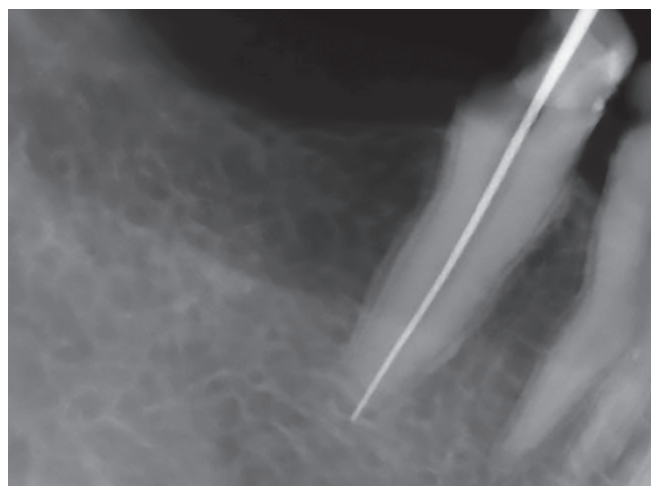


Fig. 2: Working length radiograph of tooth #45 with single canal

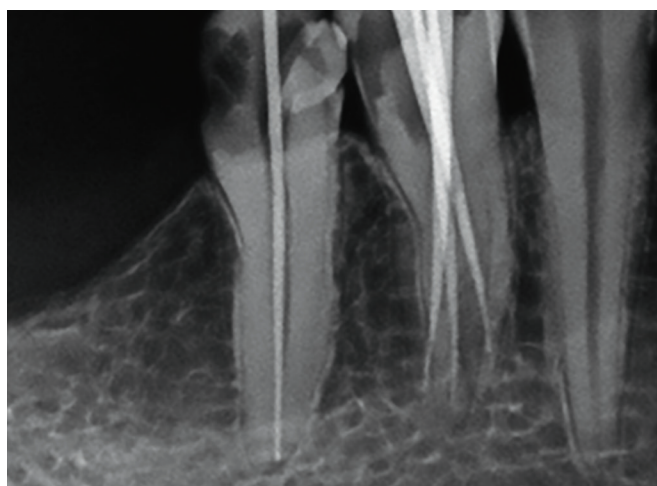


Fig. 3: Master cone radiograph

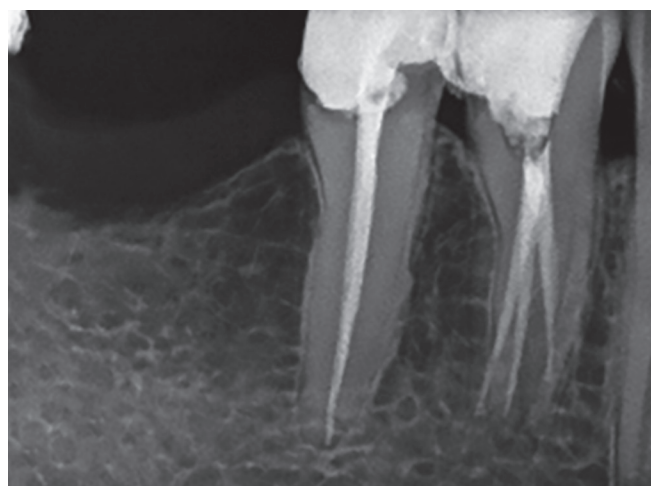


Fig. 4: Post obturation radiograph

with a widening of periodontal ligament space at the apex of mesial and distal root (Fig. 5). Based on the clinical and radiographic findings, a diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made and endodontic treatment was initiated.

Access was gained with No. 2 round bur (Dentsply Maillefer, Ballaigues, Switzerland) to the pulp chamber after administration of local anesthesia (2% lidocaine with 1:80,000 adrenaline) under rubber dam isolation. The conventional access opening was modified into one that was wider mesiodistally to gain sufficient access to the canals. Clinical examination with a DG-16 endodontic explorer (Hu-Friedy, Chicago, IL) revealed the presence of three root canals: mesiobuccal, distobuccal, and lingual (Fig. 6).

After radiographic determination, the working length was confirmed using an apex locator. Canals were thoroughly irrigated with 2.5% sodium hypochlorite solution, 17% ethylenediaminetetraacetic acid and 2% chlorhexidine digluconate with intermittent use of normal saline.

Canals were enlarged using stepback technique with master apical file size 35 (Mani files). Calcium hydroxide medicament was placed and the access was temporized for 2 weeks. During the second visit, the lingual coronal tooth structure was found to be fractured at the level of gingiva and the tooth was found to be symptomatic. The canals were thoroughly irrigated and the medicament was replaced. After endodontic management, crown lengthening followed by cast post and core was planned. During the subsequent visit, since the symptoms were found to be subsided, obturation was performed using lateral compaction of gutta-percha (Dentsply Maillefer) and zinc oxide eugenol as the sealer (Figs 7 and 8). Crown lengthening was performed followed by post space preparation in the distal root up to peeso reamer size 2 (Dentsply Maillefer) on the next visit, and an impression was made using rubber-based impression material. Cast post was cemented and the tooth rehabilitated with porcelain-fused metal crown (Fig. 9).

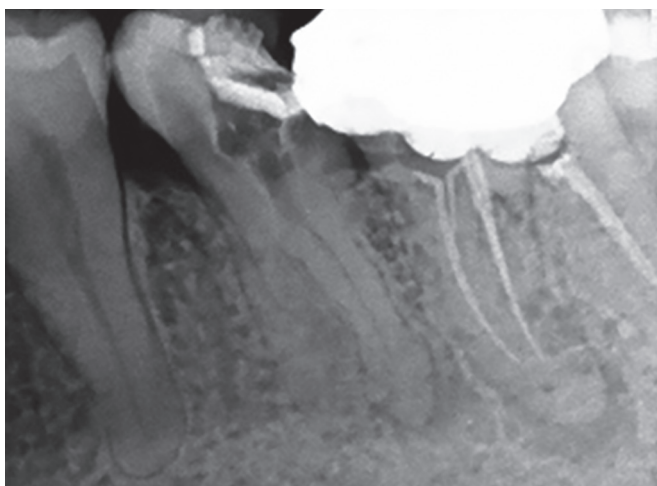


Fig. 5: Preoperative diagnostic radiograph of tooth #35

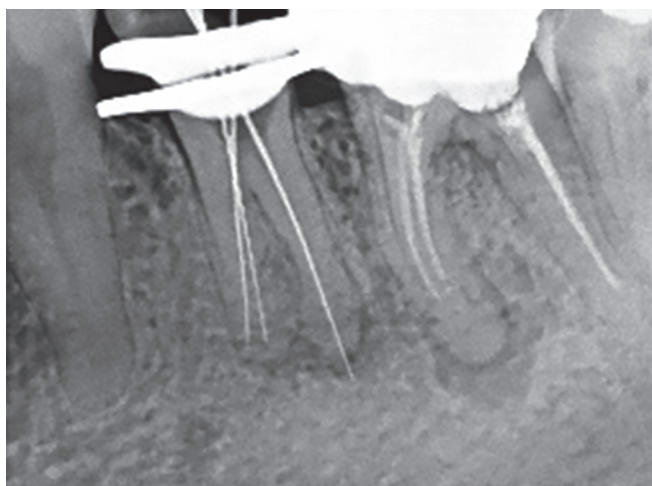


Fig. 6: Working length radiograph of #35 showing three canals

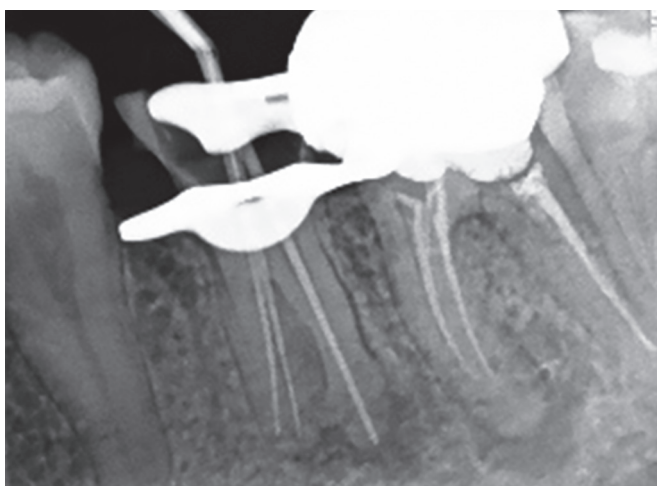


Fig. 7: Master cone radiograph of #35

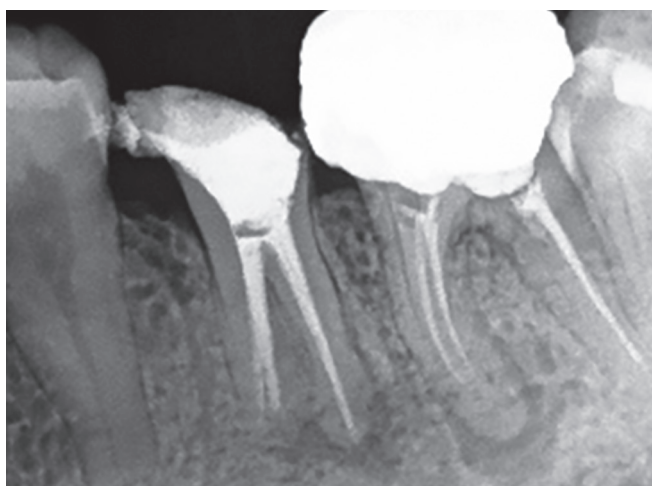


Fig. 8: Post obturation radiograph of #35

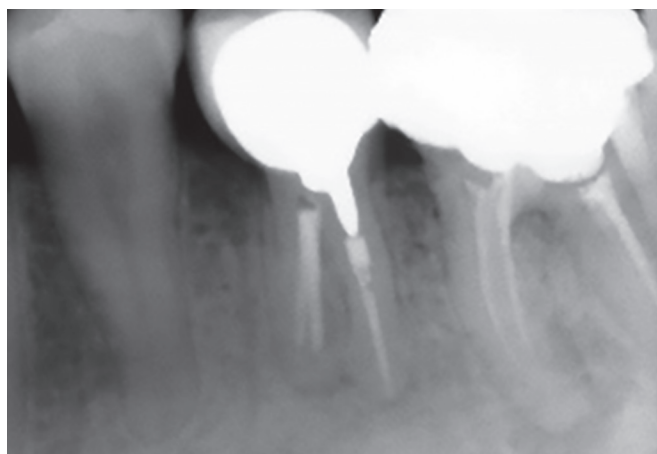


Fig. 9: Radiograph after post placement on #35

DISCUSSION

Complexities in the internal anatomy of mandibular premolars are well documented in the literature. Considering the number of root canal, apical deltas, and lateral canals, they are supposed to be the most difficult teeth to manage.¹⁶⁻¹⁸ Reports with the existence of 3, 4, or even 5 root canals for mandibular premolars have been documented, which suggests a possibility of missing an extra root or canal.¹⁹⁻²¹

Proper diagnostic imaging along with an adequate knowledge of the root canal anatomy and its possible variations is necessary for successful endodontic treatment.

Preoperative radiographs taken at different angulations are found to be of great use in determining the presence of additional canals.²²⁻²⁴ The periodontal ligament space may show a sudden narrowing of the root canal space on its division into two or more canals.^{12,17,21} Dentin map analysis on the floor of the pulp chamber also helps in the location of all the root canals.¹⁷

Access preparation was modified with preflaring of coronal portion for thorough visualization of the root canal as well as ease of placement of initial apical file and shaping and cleaning of the apical third of the root canal system.²⁵⁻²⁷ Many authors have reported one orifice in the lingual side and two in the buccal for mandibular premolars with three canals.^{18,28,29} Both the case reports were also in accordance with their findings. Working lengths of each root have been confirmed with electronic apex locator, which reduced the chances of flare-ups. The use of calcium hydroxide as an intracanal medicament aided in providing antimicrobial action. All the three canals were obturated using lateral compaction technique followed by adequate coronal restoration, which prevents the chances of endodontic failure. Since the tooth 35 in case report 2 was found to be fractured during the subsequent visit, cast post followed by prosthetic rehabilitation was planned, which provided a complete coronal seal.

CONCLUSION

The anatomy of the mandibular premolar has complex variations. Adequate knowledge of root canal anatomy and its variations, careful interpretation of periapical radiographs, proper modification of access opening, and close clinical inspection of the floor of the pulp chamber result in successful treatment outcomes.

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