

Mandibular Premolars with Deviant Root Canal Morphology: An Endodontic Challenge

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Abstract:

Background: Mandibular premolars have been reported with complex anatomical aberrations, making them one of the most difficult teeth to manage endodontically. A thorough knowledge of root canal anatomy is crucial for the successful endodontic treatment this case series illustrates endodontic management of rare cases with extra canals in the premolars. Emphasising the crucial diagnosis and treatment planning

Case presentation: In the first case a mandibular premolar is present with two roots and two canals, in the second case, there were two roots and three canals and third case had a single root with two canals. All of these cases were successfully managed by nonsurgical endodontic treatment

Conclusion: Mandibular premolars typically exhibit morphological and anatomical abnormalities, the careful interpretation of radiographs adequate debridement, activated irrigation and three-dimensional obturation are important for successful endodontic outcome.

Key Word: Root Canal Therapy, Anatomic Variation, premolars.

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I. Introduction

Successful endodontic treatment depends on a thorough knowledge of tooth morphology, careful radiographic interpretation, proper access cavity preparation, and exploration of the internal anatomy of the tooth. A clear understanding of the anatomy of teeth not only helps in the diagnosis and treatment planning but also ensures adequate biomechanical preparation thus controlling etiological factors related to apical periodontitis.

Mandibular premolars have been considered an enigma to the endodontist due to their unpredictable anatomy, coupled with difficulty in visualizing, accessing and negotiating canals creating challenges in dealing with such teeth. Owing to these reasons, a study by the University of Washington showed mandibular first premolars to have the highest failure rate of 11.4%.

In a systematic review and meta-analysis by Jojo Kottoor et al., 23.55% of mandibular first premolars had two canals and the incidence of three or more canals in mandibular first premolars was (0%–5%). The mandibular first premolars showed more bifurcation of canals terminating in multiple apical foramina (23%–30%) as compared to the second premolars (15%–20%). Mandibular second bicuspid presented with a higher incidence of single root (99.28%) and Vertucci's Type I canal anatomy (86.9%) [1].

The purpose of this clinical case series is to describe an anatomic abnormality that was detected during routine root canal treatment in mandibular premolars and their endodontic management.

II. CASE REPORTS

Case report I

A 47-year-old male patient presented with a chief complaint of pain and swelling in his lower right back tooth. Clinical examination showed a temporary restoration in the mandibular left first premolar (tooth #44), with tenderness to percussion. The preoperative diagnostic radiograph (figure 1 B) revealed radiolucency involving the pulp outline providing a clue that endodontic therapy has been attempted. Root morphology in the IOPA radiograph showed a fast break in the continuity of the canal at the middle third, the root outline was

wider suggesting the presence of additional roots and canals. There was diffuse radiolucency involving both roots present depending on clinical symptoms and radiographic examination the diagnosis of Previously Initiated Therapy with symptomatic apical periodontitis was made.

Treatment plan:

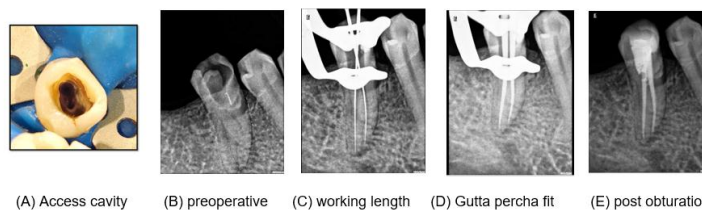
Informed consent was obtained from the patient before the treatment. The inferior alveolar nerve block was given using 2% lignocaine hydrochloride with 1:200,000 units of adrenaline (Lignox, Indoco Remedies Ltd., India), access was gained with the help of a small round bur (Dentsply-Sirona, USA) under rubber dam isolation. To enhance the magnification, a Loupe of 3X magnification (CarlZeiss, Germany) was used in the exploration the main canal had split into two different canals at the mid-level and separated into two roots.

The coronal flaring was done for the ease of instrumentation, DG 16 probe was inserted to catch the orifice. The refinement of the access cavity was done in a bucco-lingual direction as the catch was felt in a buccal direction. A pre-curved 6 no k file (Mani, Inc; Tochigi, Japan) was inserted at the level of split keeping one file in a position where another pre-curved 6 no k file was inserted and confirmed radiographically. Canal orifices were enlarged and coronal interferences at the level of the split were removed.

Negotiation of canals till apex with hand files no 6, 8, 10, 15 k files with gentle watch winding motion and in between irrigation using 3% sodium hypochlorite and liquid ethylenediaminetetraacetic acid (Desmear, Anabond Stedman Pharma Research, India). Instrumentation was done using EdgeEndo rotary files. Apical preparation was done up to 25 sizes (4% taper) the canals were dried and dressed with Ca (OH) 2 and sealed coronally with a sterile cotton plug and temporary cement (Cavit). On follow up the patient was asymptomatic after the first appointment. Every 4th day, dressings were changed and Ca (OH)2 was placed as an intracanal medicament for 2 weeks. Hybrid obturation with modified downpack till the level of split followed by backfilling with thermoplastic GP and sealer till CEJ.

▶ Figure 1: Case report 1: Mandibular first premolar (34) with two roots and two root canals.

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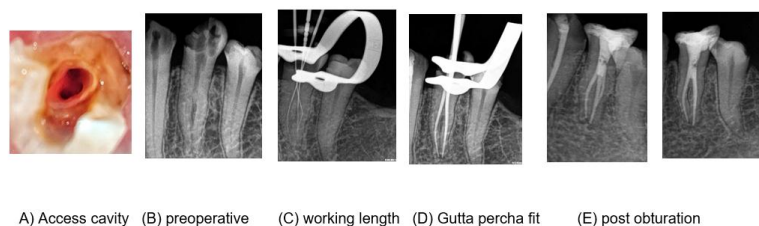


Case report II

A 39-year-old female patient complained of discomfort on her left mandibular premolar tooth number #34, Clinical examination revealed a carious left mandibular first premolar with caries involving pulp which was non-reactive to thermal and electric pulp testing and tenderness on percussion. Radiographically the mandibular left first premolar showed a complex root canal system with at least two roots and canals (Figure 2 B) Based on clinical features a diagnosis of necrotic pulp with symptomatic apical periodontitis was made. The treatment plan decided was nonsurgical endodontic treatment. Access cavity was prepared using a round bur a canal was identified in each of the two roots in a mesiodistal direction, using a precurved size 6 K-file.

After obtaining the working length radiograph (figure: 2 C) an extra canal confluent with the distal canal was seen. Followed by the use of a 6 no k file to locate the third orifice. The access cavity was refined and the orifice opener was used for relocating during further procedures. Negotiation of canals till apex with hand files with gentle watch winding motion followed by rotary files. Obturation using a hybrid technique using downpack and backfill was done.

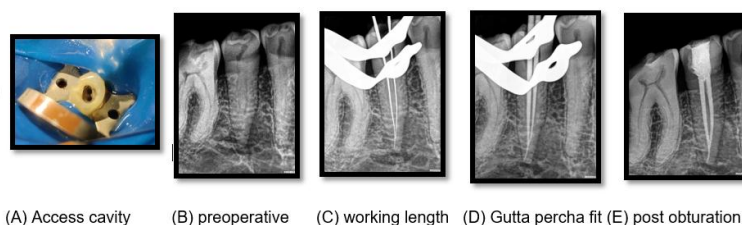
Figure 2: Case report 2: Mandibular first premolar (34) with two roots and three root canal



Case Report III

A 45-year-old male patient presented with the chief complaint of pain in the lower right back tooth region, on clinical examination a deep cervical abrasion was present. On radiographic examination (figure 3 B) of the root canal periapical radiolucency was present and the root outline revealed the presence of a single root and two radiolucent lines emerging from the pulp chamber to the middle third and joining to form a single apical foramen. Nonsurgical endodontic treatment was initiated on access cavity preparation a single canal was located and after careful exploration with DG 16 another canal orifice was located, and the working length radiograph was taken. A careful chemomechanical preparation followed by obturation using a single cone technique.

Figure 3: Case report 3: Mandibular second premolar (44) with single root and two root canals.



III. DISCUSSION

Anatomical variations of mandibular premolars are well documented in the literature. The complex internal anatomy of mandibular premolars of premolars can be attributed in part to genetic traits and evolutionary patterns of individuals [2]. All three cases of mandibular premolars discussed here demonstrated variable patterns of foraminal exits. In the first case, the root system was characterized by a complete mid-root separation of the two roots with their corresponding canals Vertucci type one configuration for two roots. In the second case, there were two roots and three canals, the mesial root had one canal type one Vertucci configuration; the distal root had two canals that merged at the middle third type two Vertucci configuration (2–1), the third case single root had two canals that merged at middle third type two Vertucci configuration (2–1). These complexities and variations in mandibular premolars about the roots, apical third anatomy and foraminal exits play a significant role in determining long-term endodontic success. Such variability of the root canal system also needs due consideration during endodontic surgery.

The pre-treatment intraoral periapical radiographs revealed unusual morphology and suggested the presence of extra roots and root canals. Mesially and distally angulated radiographs were taken to confirm their presence. In the above cases, the non-availability of CBCT was a limitation. CBCT would have offered maximum information regarding root canals and would have also guided the endodontic treatment. In mandibular premolar with a single canal, the access cavity is more circular and if two canals are suspected, a bucco-lingually directed oval access cavity is more appropriate (Figure 1A, 3A). If the pulp chamber is either triangular or too large in a mesiodistal plane, more than one root canal should be suspected [3] (figure 2 A).lingual inclination of the mandibular poses problems during access cavity and canal exploration, as preservation of the lingual cusp may lead to missing the canal orifice.

Tactile examination of all the walls of the major canal with the tip of a small, pre-curved scouting K-file is recommended, to get catch, which may indicate the orifice of an additional canal. Magnification is important for visualization and identification of extra orifices. Canal scouting was done using pre-curved 6 no k file DG 16 explorer followed by Negotiation of canals till apex with sequential use of k files no 6 to no. 20 with gentle watch winding motion. Rotary files EdgeEndo (EdgeEn-do; Albuquerque, New Mexico, United States), 4% taper Ni-Ti instruments were used for canal preparation. These files cause less friction and stress on the

instrument and allow for more controlled canal preparation. It enhances disinfection and extrudes less debris beyond the apex.

Obturing such root canal systems requires good clinical skill, a technique proposed by Hermann and Hülsmann is called "the "Squirt technique" [4, 5]. In this technique, both ends of the root canals are obturated simultaneously by injection of thermoplasticized gutta-percha, followed by backfilling. Alternately, two or three separate master cones are used with each cone being sheared apical to the bi- or trifurcation, allowing room for the next master cone to be seated. Once the individual canals in the apical third are filled, the coronal canal is backfilled. In the Second technique, each canal can be obturated separately by blocking other canals by files, all the teeth were restored using composite resin restorations and on Follow-up appointments of 1 week and 1 month, all teeth were asymptomatic.

Mandibular premolars, because of their complex canal systems, are often considered the most difficult of all teeth on which to perform successful endodontic treatment [2,6]. Failure rates for endodontic treatment in mandibular premolars are high. Various innovations in diagnostics, magnification, operative instruments, and techniques and updated knowledge about the anatomy of mandibular premolars could certainly improve the endodontic success rates of even the most challenging cases. Clinicians undertaking treatment of such complex anatomy cases need to be extremely patient as prolonged and multiple appointments are very much a certainty. The time involved in treating such complex cases of variable tooth anatomy is mainly dependent on the clinical skill, expertise, and proficiency of the endodontist and the armamentarium available to achieve optimum clinical outcomes.

IV. CONCLUSION

Endodontic management of teeth with anatomical variations poses different challenges to the endodontist henceforth a thorough knowledge of normal anatomy and variations, careful interpretation of radiographs adequate chemo mechanical preparation with activated irrigation and a three-dimensional obturation are important for achieving endodontic successful outcome.

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