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Management of Mandibular Premolar with Two Roots: Two Case Reports

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Abstract: *Thorough knowledge about the anatomy and morphology of root canal system is the prerequisites for the successful outcome of endodontic treatment. False assumptions about the root canal anatomy of teeth may lead to misdiagnosis, missed canals, improper debridement and breakage of root canal instruments during root canal treatment.[1] The complexity of root canal morphology presents a challenge to any clinician. Tooth often shows a change in their anatomy of the pulp chamber and root canal system. Careful interpretation of the radiograph and inspecting the pulp chamber in depth may provide details about the anatomic variations present in the tooth and may help for the better treatment outcome .This article reports two cases of mandibular premolars with two roots which were successfully treated by root canal therapy.*

Keywords: *mandibular premolars, root canal configuration*

I. Introduction

The root canal morphology of teeth is often extremely more complex and highly variable. Successful root canal therapy requires an in-depth knowledge of root canal morphology. Any attempt to perform root canal therapy must be preceded with a thorough understanding of the anatomy of both the pulp chamber and the root canal system. Recognition of variations in root canal anatomy is an essential prerequisite for successful endodontic diagnosis and treatment. The complexities of internal anatomy are often masked by the external surfaces, which have a relatively simple and uniform anatomy.[2] A wide range of variations in the root canal system was reported in the literature .Successful endodontic therapy is dependent on the cleaning ,shaping and obturation of the entire root canal system .The presence of accessory root canals and the ability to cleanse and seal these canals can also have an impact on prognosis.

Mandibular premolars have on multiple occasions been stated to be the most challenging teeth to be treated endodontically, especially when they present with multiple roots or canals. A University of Washington study assessed the failure rate of nonsurgical RCT in all teeth. It was highest for the mandibular first premolar at 11.45%.[3] Their propensities for anomalous variations, narrow mesiodistal dimensions and the ensuing narrow access to canals, lack of visibility, and apical third trifurcations and deltas are factors that further compound the difficulty for clinicians.[4]

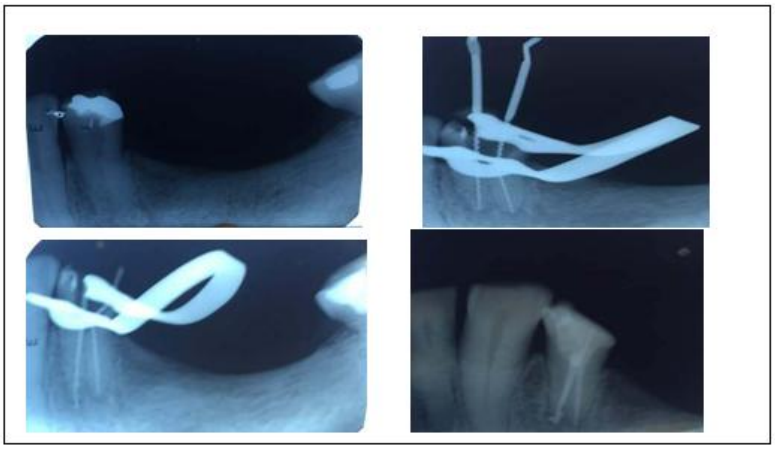
The failure rate of nonsurgical root canal treatment for mandibular first premolar is higher(11.45%)[3].The reason may be due to the morphologic variations,one such variation is two rooted premolar.[5] Mandibular first premolar is typically described in literature as single-rooted tooth. Two-rooted, three-rooted and four-rooted varieties have also been reported, but are rare.[6] This article describes two case reports of mandibular first and second premolars with two roots.

Case Report I

A 50 year old male patient reported to the department of Conservative Dentistry and Endodontics at Govt Dental College kozhikode , with the chief complaint of pain in the posterior left mandibular tooth for the past 2 weeks. Patient's medical history was non contributory. Clinical examination revealed a class ii amalgam filling and occlusally attrited left mandibular first premolar. The tooth was tender on percussion. Pre operative radiograph was taken which showed an unusual anatomy of two roots, and also there was widening of the apical periodontium, indicating periapical pathology and the necessity for root canal treatment [Figure 1]

Acute apical periodontitis of the left mandibular second premolar was diagnosed after clinical, radiographic examination and vitality testing . Endodontic therapy was decided. The tooth was anaesthetized by inferior alveolar nerve block using a 2% solution of lignocaine hydrochloride containing 1:80000 adrenaline (Lignox 2% A, Warren, Indoco). The tooth was isolated with a rubber dam. Endodontic access cavity preparation was made with a round diamond bur in a high speed airotor handpiece. The pulp chamber was inspected with the help of a magnifying loupe (Seiler loupes) and a sharp DG 16 explorer was used to locate the canal orifice. After obtaining the canal patency, a #10 K file (Dentsply, Maillefer) was inserted to confirm the root canal configuration. A working length radiograph confirmed the presence of a two separate canals . The

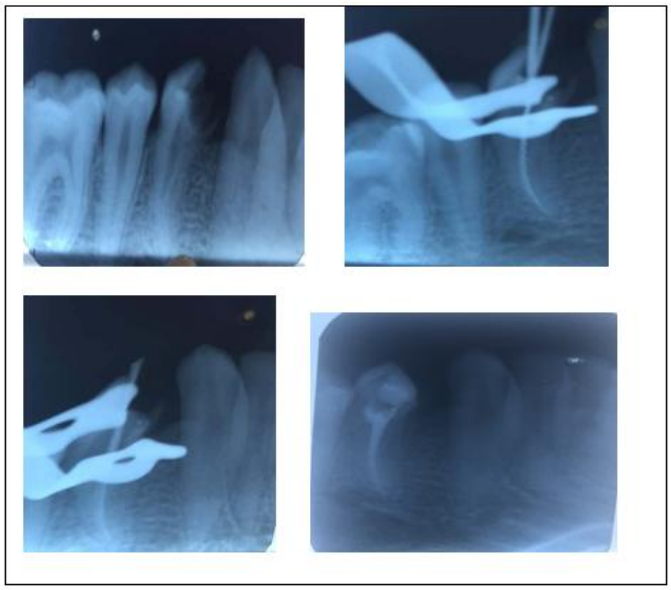
two canals exited in separate apical foramina located in the respective roots [Figure 2,3]. Cleaning and shaping of the canals was performed using crown-down technique under copious irrigation with 5.25% sodium hypochlorite solution. The canals were dried and the tooth was temporized. After 1week , the canals were obturated with cold, lateral condensation of gutta percha cones (Dentsply) and zinc oxide eugenol sealer. A post obturation radiograph was taken . [Figure4].



Case Report II

A 25 year old female patient reported to the department of Conservative Dentistry and Endodontics at Govt Dental College kozhikode , with the chief complaint of pain in the posterior right mandibular tooth for the past 1 week. Patient's medical history was non contributory. Clinical examination revealed pulp exposure of right mandibular first premolar. The tooth was tender on percussion. Pre operative radiograph was taken which showed caries involving pulp and an unusual anatomy of two roots, and there was widening of the apical periodontium, indicating periapical pathology and the necessity for root canal treatment [Figure 5]

After clinical and radiographic examination endodontic retreatment was decided .The tooth was anaesthetized by inferior alveolar nerve block using a 2% solution of lignocaine hydrochloride containing 1:80000 adrenaline (Lignox 2% A, Warren, Indoco). The tooth was isolated with a rubber dam. Endodontic access cavity preparation was made with a round diamond bur in a high speed airotor handpiece. The two canals were negotiated with K-flex files (Dentsply Maillefer, Ballaigues, Switzerland). Working length was established with the use of K files and periapical radiographs using Ingle's method [Figure 6,7]. Canal disinfection was performed using copious amount of 2.5% sodium hypochlorite, 17% ethylene diamine tetra acetic acid (EDTA), and saline. The canals were cleaned and shaped using crown-down technique. After drying the canals with sterile paper points (Dentsply, Maillefer, Ballaiques, Switzerland), the canals were obturated by cold lateral compaction of gutta percha using zinc oxide and eugenol sealer (Dentsply, Kalsogen Plus). A post obturation radiograph was taken. [Figure 8].



II. Discussion

Knowledge of both basic root and root canal morphology as well as possible variation in anatomy of the root canal system is important in achieving successful nonsurgical root canal treatment. This is followed by negotiation, cleaning and shaping, and obturation of the entire canal system in three dimensions. Variation in root canal morphology was suggested as the most likely reason for the high frequency of endodontic flare-ups and failures[7].A study at the University of Washington assessed the failure rate of non surgical root canal therapy in all teeth. The mandibular first premolar had the highest failure rate in the study at 11.45%. The root morphology of mandibular first premolar can be highly complex and extra root(s) can be found. Scott and Turner describe the accessory root of mandibular first premolar as Tome's root[8].

Mandibular premolars have earned the reputation for having the most aberrant anatomy. Numerous reports of root canal variations in these teeth have been reported in the literature. The dimensions of the mandibular premolar root canal system are wider buccolingually than mesiodistally. Two pulp horns are easily detected: a large, pointed buccal horn and a small, rounded lingual horn. At the cervix of the tooth, both the root and canal are oval; this shape tends to become flat or round where the canal approaches the middle of the root. If two canals exist, they are usually circular from the pulp cavity to their apical foramen. In this anatomic variation, a single, broad root canal may bifurcate into two separate root canals at the apex of the root. Direct access to the buccal canal is usually possible, whereas the lingual canal is often very difficult to locate and tends to deviate from the main canal at a sharp angle. In addition, the lingual inclination of the crown tends to direct files buccally, making the location of a lingual canal orifice highly challenging.[9]

In 1973, Zillich and Dowson reported 23.1% of mandibular first premolars had two or three root canals radiographically.[10] In 1978, Vertucci using a transparent method found 25.5% of 400 mandibular premolars had two apical openings and 0.5% of the teeth had three apical openings.[11] Wilcox in 1989 reported two roots in 25% of mandibular first premolars and 12% in mandibular second premolars.[12] A study by Kartal and Yanikoglu in 1992, using pooled data that included first and second premolars, reported a 27.8% incidence of mandibular premolars with more than one canal.[3] Vyoma et al. in 2016 assessed the root morphology and canal configuration of mandibular first premolars using cone-beam computed tomography imaging (CBCT). Of the 200 mandibular first premolars evaluated, 194 had one root (97%) and 6 had two roots (3%); 88.5% had one canal, 10% had two canals, 1.5% had three canals, and 0.5% had C shaped canals[13]. According to Ingle, mandibular second premolars have only 12% chance of a second canal, 0.4% of a third canal and Harty has reported 11% possibility of second canal. In most instances they have had one canal, but teeth with two or more canals have also been reported[14]. Tzanetakis et al.[15] suggested the use of symmetry laws proposed by Krasner and Rankow[16] especially when an unexpected or unusual anatomy is present. The root canal system of premolars with two roots and three root canals is usually characterized by one large lingual canal and two smaller mesiobuccal and distobuccal canals in the buccal root. A third canal should be suspected clinically when the pulp chamber does not appear to be aligned in its expected buccal-lingual relationship.[17]

The inability to locate, prepare, or obturate one or more of the root canals is a common cause of post-treatment disease or failure of endodontic treatment.[18,19] Therefore, clinicians should be familiar with the common root and root canal morphology and its possible variations in the different teeth groups before commencing endodontic treatment.[20] Often considered an enigma to the endodontist, the mandibular first premolar with canals dividing at various levels of the root can generate complex mechanical problems. Canal configurations in mandibular premolars may vary significantly with respect to ethnicity, race, and sex.[18]

Numerous methods have been adopted to study the internal anatomy of tooth. Although the canal staining and clearing technique is considered the gold standard method of studying root canal anatomy, the main disadvantage of this method is that it cannot be used *in vivo*.[21] The complex anatomy of the canal system in the mandibular premolars makes it difficult to assess their clinical morphology with conventional radiography.[22] Advanced modes of radiographic imaging and analysis have allowed for in-depth knowledge of pulp space anatomy in three dimensions and allowed for identification of rare aberrations. These methods include spiral computed tomography (SCT), micro-computed tomography (micro CT), and cone beam computed tomography (CBCT).[23]However in our case discussed above we have used only conventional radiographs as diagnostic tool.

III. Conclusion

Successful endodontic outcome in such cases is dependent upon careful use of all the available diagnostic aids to locate and treat the entire root canal system. Careful interpretation of angled radiographs, proper access preparation and a detailed exploration of the tooth are essential prerequisites for a successful treatment outcome. When uncertainty exists in the diagnosis of canal variations, or a change of shape/direction in the middle or apical third of the canal is detected, periapical radiography associated with CBCT can be used to determine or confirm the presence and location of canal

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