

Mandibular first premolar with two roots : a morphological variation - two case reports

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Abstract

Anatomy of the root canal system, intercanal instrumentation, debridement and three dimensional obturation are some of the factors effecting endodontic treatment outcome. The root and root canal morphology of mandibular first premolar can be complex and requires careful evaluation prior to root canal therapy. The role of genetics and racial variation may result in differences of incidence of root numbers and canal number in human population. Thus, thorough knowledge of the root canal morphology, appropriate assessment of the pulp chamber floor, and critical interpretation of radiographs are a prerequisite for successful root canal therapy. Thus, It is crucial to be familiar with variations in root/canal anatomy and characteristic features since such knowledge aids in location and negotiation of canals, along with their subsequent management. This article reports on two cases of successful nonsurgical endodontic management of mandibular first premolar with two roots.

Key Words: : Abnormal morphology, mandibular first premolar, root canal anatomy, root canal therapy

Introduction

Over the years, it has been established that knowledge of common root canal morphology and its frequent variations is a basic requirement for endodontic success. While treating each tooth the clinician must assume that complex anatomy occurs often enough to be considered normal.

Major causes of endodontic treatment failure such as incomplete cleaning and shaping of root canal, incomplete obturation and untreated major canals, failure to negotiate an additional root canal may result in treatment failure and may cause acute flare ups during and after treatment.¹

Slowey has suggested that mandibular first premolars, often called as "Endodontist's enigma," may present the greatest difficulty of all teeth to perform successful endodontic treatment.² Studies³⁻⁷ citing the anatomy and morphology of mandibular premolars report that approximately 98% of the teeth in these studies were single rooted. The incidence of two roots was 1.8%. Three roots when reported were found in 0.2% of the teeth studied. Four roots were rare and were found in less than 0.1% of the teeth studied.

Mandibular first premolar has been associated with anomalies such as gemination, dense invagination, dense invagination, two roots, three roots, two canals in a single root, three canals with fused roots, three canals in a single root, three canals and two roots, three canals and three roots¹³.

The bifurcation of second canal may occur in the mesiodistal dimension or the buccolingual dimension and in different levels of the roots. Clinically, the sudden narrowing or disappearance of the root canal indicates the presence of bifurcation in the main canal in the buccolingual direction¹³.

Numerous factors contribute to variations found in the root and root canal studies reported.⁸ These factors include ethnicity, age, sex, unintentional bias in selection of clinical examples of teeth (specialty endodontic practice versus general dental practice) and study design (in vitro versus in vivo). Higher incidences of teeth with additional canals and roots have been reported in Chinese, Australian, and sub-Saharan African populations. Physical anthropology studies seem to show the lowest incidence in Western Eurasian Japanese and American Arctic populations.^{10,12}

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CASE REPORT-1

A 59 year old male patient was referred to the Post Graduate Department of Conservative Dentistry and Endodontics with the chief complaint of severe pain in relation to lower left posterior teeth. The pain was severe, lancinating and continuous in nature which aggravated on chewing.

On clinical examination, there was generalized attrition with severe attrition of 34 involving pulp. The tooth was tender on percussion but showed no evidence of swelling or sinus tract. Preoperative periapical radiographic examination revealed coronal attrition involving pulp, the presence of two roots with widening of the apical periodontium, indicating periapical pathology and the necessity for root canal treatment. Patient's medical history was non contributory.

Based on clinical and radiographic evidences a diagnosis of acute apical periodontitis was made.

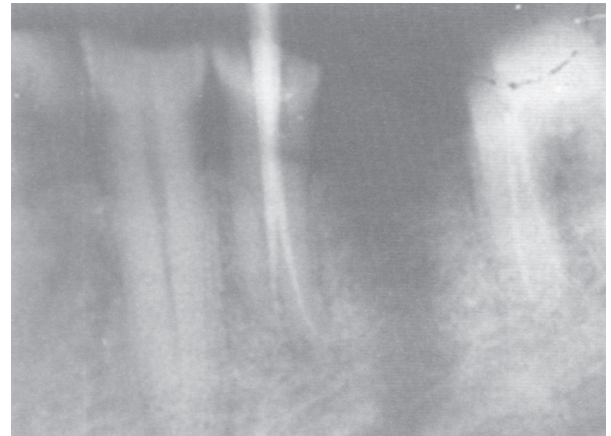
Access was gained to the pulp chamber after administration of local anesthesia (2% Lidocaine With 1:80,000 adrenaline). The two canal orifices were located with the aid of a magnifying loupe (Seiler loupes) and a sharp DG 16 explorer was used to locate the canal orifice and patency was ascertained with a small size 10 K-file (Dentsply, Maillefer, USA).

The working length radiograph was taken which confirmed the presence of a single coronal canal bifurcating in the coronal one third, and coinciding with the separation of the two roots. The two canals exited in separate apical foramina located in the respective roots (Fig 1).



Case 1 Fig 1: Working length radiograph of the mandibular left first premolar in the patient in the case study, showing the presence of a single coronal canal bifurcating in the coronal one third and coinciding with the separation of the two roots

The canals were cleaned and shaped sequentially with ProTaper files till F1 file because canal was narrow due to calcification of the canals in the aged patient (Dentsply, Maillefer, USA), irrigated using 3% sodium hypochlorite and a final rinse with saline. Master cone x-ray was taken (Fig. 2). Tooth was temporized till the next appointment. After three days, the canals were obturated with F1 ProTaper gutta-percha cones (Dentsply and zinc oxide eugenol sealer). A post obturation radiograph was taken to evaluate the quality of obturation. The access cavity was filled with silver amalgam (Fig 3).



Case 1 Fig 2: master cone x-ray



Case 1 Fig 3: post operative radiograph

CASE REPORT -2

A 66 year old female patient reported to the Post Graduate Department of Conservative Dentistry and Endodontics with the chief complaint of pain and sensitivity in lower right back tooth, since last one week. The pain was severe, continuous in nature and lancinating, which aggravated at night. The sensitivity in the involved tooth was episodic and severe especially with cold and hot food and water. Clinical examination revealed a carious lesion on the disto-occlusal surface of the crown of mandibular right first premolar. There was no evidence of swelling or sinus tract. There were evidences of generalized attrition. The tooth was tender

on vertical percussion and vitality tests with electrical pulp tester showed response at higher current level compared with contralateral and adjacent teeth. Pre operative periapical radiographic examination revealed disto occlusal caries lesion encroaching the pulp. The lamina dura was indistinct with slight widening of periodontal ligament and approximately 2mm bone loss from CEJ (Fig 1).

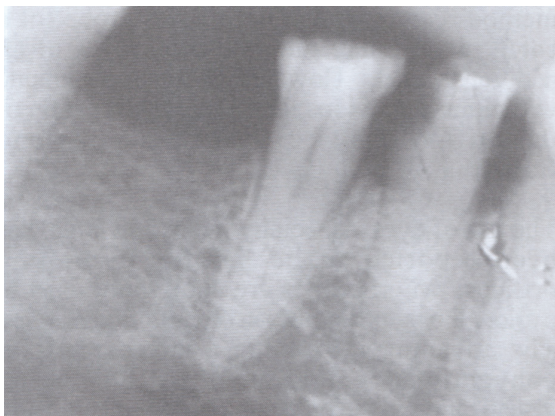


Fig 1: Pre operative Periapical radiograph of the mandibular right first premolar in the patient in the case study, showing the presence of disto occlusal caries lesion encroaching the pulp.

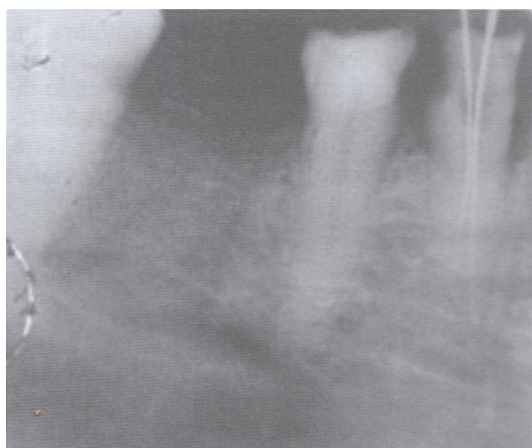


Fig 2: Periapical radiograph of the mandibular right first premolar, taken with slight distal angulation showed the presence of two roots and two canals.

Based on clinical and radiographic evidences, a diagnosis of irreversible pulpitis was made and root canal therapy was planned.

The treatment plan was discussed with the patient and after obtaining her consent, local anesthesia (2% Lidocaine solution with 1:80,000 adrenaline) by the way of right inferior alveolar nerve block was administered. Subsequently, endodontic access cavity was prepared with round diamond burs at high speed airtor hand piece. The canal orifices were located with the aid of a magnifying loupe (Seiler loupes). A sharp

DG 16 endodontic explorer was used to locate the canal orifice and patency was ascertained with a small size # 10 K-file (DENTSPLY, Maillefer, USA).

After extirpation of pulp tissues, a working length radiograph was taken with a small size #10 K- file (DENTSPLY, Maillefer, USA) which confirmed the presence of single coronal canal bifurcating in the middle third and exiting in separate apical foramina located in the respective roots. (Fig: 2).

Following the working length determination, the canals were prepared with crown down technique with proTaper files (DENTSPLY, Maillefer, USA), copiously irrigated using 5% sodium hypochlorite solution and a final rinse of saline. After completion of cleaning and shaping, the tooth was temporized till next appointment. After two days, the canals were obturated with FI ProTaper gutta-percha cones (DENTSPLY) using a resin-based sealer (AH plus, DENTSPLY). Before obturation, master cone x ray was taken (Fig: 3). A post obturation radiograph was obtained to evaluate the quality of obturation after restoring the access cavity with silver amalgam (Fig 4).

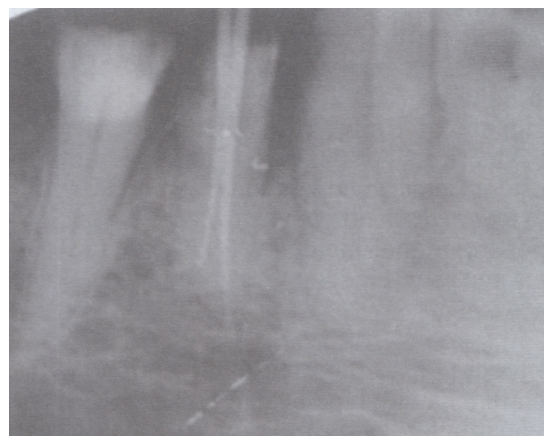


Fig 3: master cone X ray of mandibular right first premolar with two roots.

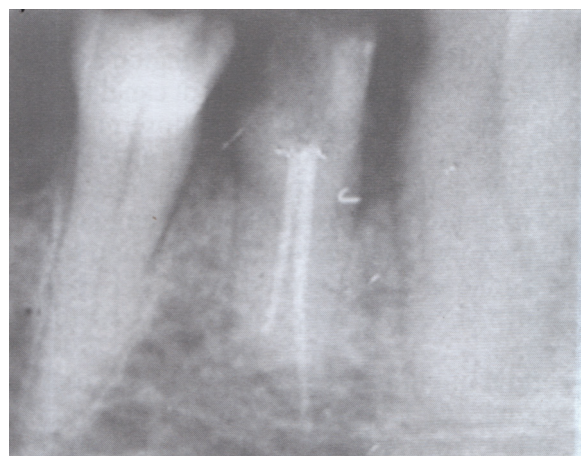


Fig 4: Post operative radiograph

Discussion:

Although it should come as no surprise, the high incidence of additional canals in molars, premolars, and mandibular incisors is significant. Hess, as early as 1925, pointed out that 54% of his 513 maxillary molar specimens had four canals. For years these facts were generally ignored¹³.

Ethnic variance may form a major part of the equation.¹² African Americans have more than twice as many two-canal mandibular premolars (32.8% versus 13.7%) than do Caucasian patients. The Chinese also have two canal lower incisors 27% of the time, but only 1% terminate in two foramina, compared to two foramina terminations 30% of the time in a US study. A Brazilian study reports two canals with two foramina in 1.2% of mandibular canines.¹³

Anatomical variations of mandibular premolars are well documented in literature both in terms of anatomic studies and clinically reported cases.⁹ The root morphology of mandibular first premolar can be highly complex and extra root(s) can be found.

Scott and Turner¹⁰ describe the accessory root of mandibular first premolar as Tome's root. They observed ethnic differences in the root morphology; and, reported the highest incidence (>25%) of accessory roots in the Australian and sub Saharan African populations. The lowest incidence of Tome's root (0-10%) occurred in the American, Arctic, New Guinea, Jomon and Western Eurasian populations. Sert and Bayrili¹¹ also reported sex differences in canal morphology, reporting higher incidence (44%) of accessory roots and canals in females as compared to males (34%).

Vertucci (1978) reported that mandibular first premolar having type I canal in 70% cases, type II canal in 4% cases and type III in 1.5% cases while type IV canal present in 24.0% of the cases. In type IV canal, root canal bifurcated in the apical third region and thus showed two foramina.

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%.¹² This may be due the extreme variations in root canal morphology of mandibular premolar teeth compared with the standard description of one root and one canal and therefore poses an endodontic challenge to the clinician. In certain circumstances, most of the extra root canals

may be left untreated during endodontic therapy. Although knowledge of anatomic aberrations, such as root position, root shape, and relative root outline, will help decrease the failure rate of root canal therapy, routine intraoral radiograph with different angulations are a major aid in determination of the presence of extra roots. However, diagnosis of extra canals with a normal number of roots may be difficult because of their superposition over other root canals or, sometimes, their relatively small size.¹⁴

Tactile examination of all the walls of the major canal with a small, precurved K-file tip is another method recommended in order to probe for a catch, which may indicate the orifice of an additional canal.¹⁵ However, using this technique without any previous idea about the location of the orifices may be time consuming and frustrating.

The use of dyes, especially methylene blue, has been reported to be helpful in finding orifices.¹⁵ Microscopes are commonly used to explore the pulp chamber in order to find orifices. The advantages of using a microscope for conventional endodontics include better visualization of the pulp chamber floor and walls, which prevents inadvertently missing orifices. Although we did not use a microscope, we do recommend it for better visualization.

Hence, it is recommended that clinicians should consider a thorough assessment of radiographs before treatment of mandibular premolars and have a true concept of the number of root(s) and canal(s). Special attention must be given to the preparation of a correct access cavity that is the key to finding all orifices and a successful treatment. The concept of mandibular premolars with one canal should not be considered as a rule.

Conclusion:

Anomalous and multiple canals are a worldwide problem, a fact that makes imperative a careful search in every tooth for additional canals. Knowledge of possible variations in internal anatomy of teeth and proper examination of clear radiographs taken from different angles and proper modification of the conventional access opening seem to be essential for recognition and adequate treatment of teeth with different anatomical variations. Root canal treatment is likely to fail if extra roots or root canals are not detected.

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