

Treatment of anatomic canal variations in premolar teeth: Five case reports

Emre Bodrumlu¹, Esmâ Dinger¹

¹ Zonguldak Bülent Ecevit University, Faculty of Dentistry, Department of Endodontics, Zonguldak, Turkey

Correspondence:

Dr. Esmâ DİNGER

Zonguldak Bülent Ecevit University,
Faculty of Dentistry, Department of
Endodontics, Zonguldak, Turkey.

E-mail: esmadingerr@gmail.com

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Abstract

Aim: The aim of this case report is to present a series of anatomical variations and endodontic treatments in four two-canal mandibular premolar teeth and three rooted three-canal maxillary second premolar teeth with root canal treatment indications identified via clinical and radiographic examinations. The success of root canal treatment is achieved with a thoroughly examined root canal morphology that has been accurately determined radiographically and clinically before adequate shaping, irrigation, and hermetic filling procedures. Root canals that are not found or not adequately disinfected can cause root canal treatment failure and complications, such as pain, swelling, also known as flare-up, or persistent fistula, after treatment. Canal variations in the teeth were detected via periapical radiographs during the root canal instrumentation stage.

Methodology: The endodontic treatments of four two-canal mandibular premolar teeth and one triple-rooted three-canal maxillary second premolar with root canal treatment indications were described.

Conclusion: To achieve full success in root canal treatment, anatomical variations should be examined in detail before and during treatment, and treatment should be completed with appropriate techniques.

Keywords: mandibular first premolar, mandibular second premolar, maxillary second premolar, anatomical variation

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Introduction

It is important to know the anatomy of the root canal system and its potential variations to perform successful endodontic treatments. In the literature, it has been shown that there are many additional lateral and accessory canals and branches in the teeth. Different existing anatomical formations can be overlooked due to insufficient access to the cavity width and incorrectly interpreted radiographs. Errors can be prevented with accurate radiographic examination using different horizontal angles, sufficient access to the cavity width, and a detailed

examination of the pulp chamber with illumination and magnification (1, 2).

Root canals that are not found or adequately disinfected may cause root canal treatment failure and complications, such as post-treatment pain, swelling, and non-passing fistula (3).

Root canal morphology and possible anatomical variations of premolar teeth have been examined by many researchers. It has been reported that the maxillary and mandibular premolars show the most variation between teeth in terms of the canal configuration (4-6).

Usually there are two canals in the maxillary first premolars, whereas a single canal is seen in the maxillary second premolars. Although the presence of

three roots and three canals is a very rare anatomical variation for both tooth groups, it can be found in 1.2-5% of first premolar teeth and 0-1% of second premolar teeth (7, 8). On the other hand, mandibular premolar teeth are usually single root/single canal, and it has been shown that the probability of encountering more than one canal is higher than the second premolar teeth (9, 10). Two canals are found in 2.7-17.9% and 1.2-11.7% of mandibular first and second premolar teeth, respectively (5, 11, 12).

This paper describes the endodontic treatment of four two-canal mandibular premolar teeth with root-canal treatment indications and three rooted three-canal maxillary premolar teeth.

Case Reports

Case 1

A 45-year-old patient reported to the Endodontics Department of the Faculty of Dentistry at Zonguldak Bülent Ecevit University complaining of severe pain in the left mandibular first premolar.

The patient had no systemic disease. During the clinical examination, the presence of a deep carious lesion in the mandibular first premolar was detected. Whereas severe pain was observed during a percussion examination, no swelling or fistula was observed in the gingival tissue. The radiographic examination revealed that the tooth had two canals opened from the middle trio and the presence of a periapical lesion. As a result of the patient's complaints as well as clinical and radiographic examination, the patient was diagnosed with acute apical periodontitis.

Informed consent was then given by the patient, and root canal treatment was initiated under local anesthesia (Ultracaine DS bulb, Aventis Pharma Industry and Limited Company, Istanbul/Turkey) by inserting a rubber dam. Following the opening of the access cavity, #10 K and H hand files were placed in the canals, and a working length was determined via periapical X-ray. Preparation and irrigation processes were conducted up to X2 (25/.06) with 5.25% NaOCl using the ProTaper Next Ni-Ti rotary file system (Dentsply, Johnson, Switzerland). Then the canals were filled with the single-cone tapered gutta-percha and root-canal sealer (Dia-Proseal, DiaDent, Almere, Netherlands) (Fig. 1).

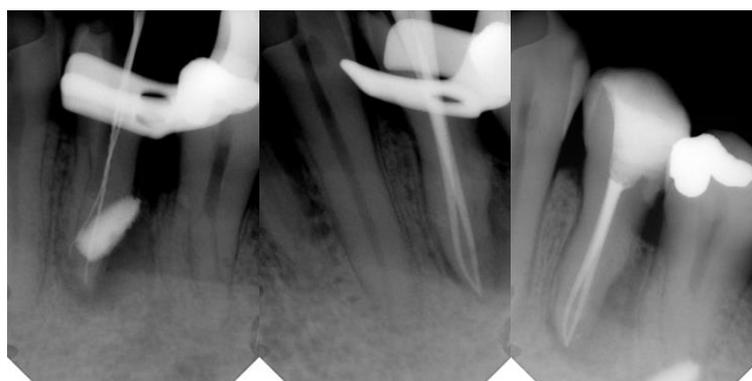


Figure 1. Root canal treatment

Case 2

In the Oral and Maxillofacial Surgery Department of the Faculty of Dentistry at Zonguldak Bülent Ecevit University, an apical resection and cyst operation were planned for the patient in the left mandibular first molar and the second premolar region as a result of radiographic and clinical examination. Afterward, the patient was directed to the endodontics clinic for root canal treatment in the left mandibular first molar and second premolar teeth.

The 45-year-old patient had no history of systemic disease. The clinical examination revealed previous root canal treatment in the left mandibular first molar and the presence of superficial caries in the left mandibular second premolar. No pain was observed during the percussion examination. In addition, no swelling and no fistula were observed in the gums. Root canal treatment was planned for the mandibular left second premolar in the first session. The radiographic

examination revealed that the tooth had two roots with two canals opened from the middle trio, and the borders of the lesion reached the apical region of the tooth and caused resorption. Informed consent was obtained from the patient. Under local anesthesia (Ultracaine DS bulb, Aventis Pharma Industry and Limited Company, Istanbul/Turkey), a root canal was performed. Following the opening of the access cavity, #10 K and #15 K hand files were placed in the canals, and the working length was determined via periapical X-ray. 10 # K type hand file was broken in the branching area during preparation.

Afterwards, the broken instrument was removed by plenty irrigation with H-type hand files. Irrigation and preparation processes were completed using the ProTaper Next Ni-Ti rotary file system (Dentsply, Johnson, Switzerland) with 5.25% NaOCl. The canals were filled with a tapered single cone gutta-percha and root canal sealer (Dia-Proseal, DiaDent, Almere, Netherlands) (Fig. 2).

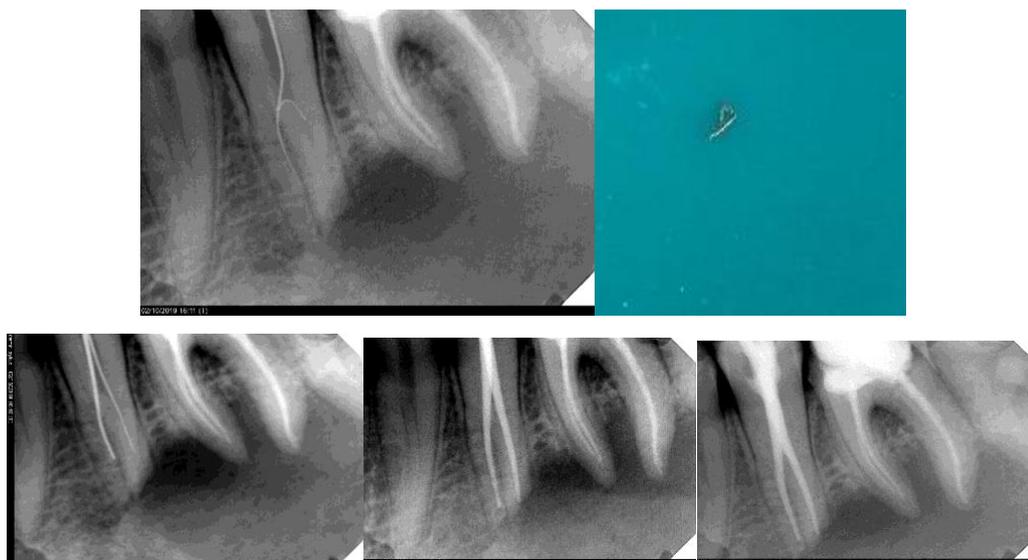


Figure 2. Broken file removed and root canal treatment

Case 3

A healthy 63-year-old patient was directed to the Department of Endodontics in the Faculty of Dentistry of Zonguldak Bülent Ecevit University for treatment of the right mandibular first premolar. The patient's main complaint was the spontaneous, severe pain on right mandibular first premolar. Clinical and radiographic examination revealed a deep distoocclusal caries in right first premolar. While severe pain was observed in the percussion examination, no swelling or fistula was observed in the gingiva. Radiographic examination revealed that the tooth had two canals opened from the middle trio and the beginning of the periapical lesion. As a result of the patient's complaints and clinical, radiographic examination, the patient was diagnosed with acute apical periodontitis.

Then, the consent form was signed, and root canal treatment was initiated under local anesthesia (Ultracaine DS bulb, Aventis Pharma Industry and Limited Company, Istanbul/Turkey) and by inserting a rubber dam. Following the opening of the access cavity, 8 and 10 # K type hand files were placed in the canals and the working length was determined by periapical x-ray. Preparation and irrigation procedures were carried out with 5.25% NaOCl by using the ProTaper Next Ni-Ti rotary file system (Dentsply, Johnson, Switzerland) up to X2 (25 / .06). Then the canals were filled with a single cone angle gutta-percha and root canal sealer (Dia-Proseal, DiaDent, Almere, Netherlands) (Fig. 3).



Figure 3. Root canal treatment

Case 4

The 48-year-old patient who has no systemic disease was reported to the Department of Endodontics, Faculty of Dentistry, Zonguldak Bülent Ecevit University with the complaint of deep caries and cold-hot pain in the mandibular right first premolar tooth. The presence of deep caries was detected in the mandibular right first premolar tooth in clinical examination. No pain in percussion examination, no swelling and no fistula in the gums were observed. Radiographic examination revealed that the tooth had two canals opened from the middle trio and there was no periapical lesion. As a result of the patient's complaints and clinical, radiographic examination, the

patient was diagnosed with pulpitis. The consent form was signed, and root canal treatment was initiated under local anesthesia (Ultracaine DS bulb, Aventis Pharma Industry and Limited Company, Istanbul/Turkey). Following the opening of the access cavity, 8 and 10 # K type hand files were placed in the canals and the working length was determined by periapical x-ray. Preparation and irrigation procedures were performed with 5.25% NaOCl by using ProTaper Next Ni-Ti rotary file system (Dentsply, Johnson, Switzerland) up to X2 (25 / .06). Later, the canals were filled with a single cone and lateral condensation technique (Fig. 4).

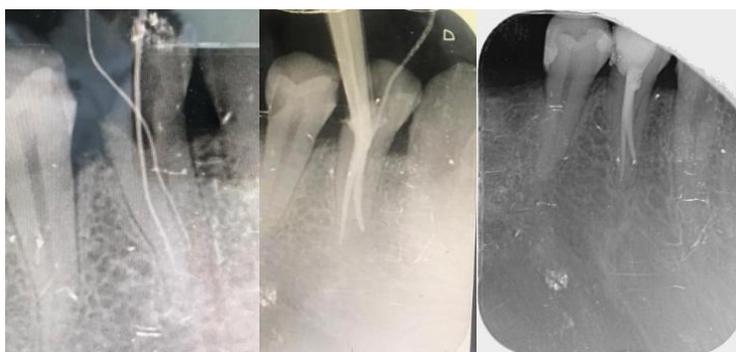


Figure 4. Root canal treatment

Case 5

The 32-year-old patient who has no systemic disease was reported to the Department of Endodontics, Faculty of Dentistry, Zonguldak Bülent Ecevit University with the complaint of a fistula which does not pass in the area of the maxillary right secondary premolar of buccal gingiva. The presence of post-core, prosthesis and buccal mucosa fistula in the maxillary right second premolar tooth were detected in clinical examination. Pain and gingival swelling were not observed during percussion and palpation examinations. As a result of clinical and radiographic examination, retreatment treatment was planned for the patient after removal of the prosthesis. Significant periapical lesion was not detected on radiographic examination. As a result of the patient's

complaints and clinical, radiographic examination, the patient was diagnosed with chronic apical abscess. In the second session, following the removal of the prosthesis, the consent form was signed, and retreatment treatment was initiated. After the opening of the access cavity, the former canal fillings and post were removed. The canal that was not previously filled was found in the buccal. Preparation and irrigation procedures were carried out up to X3 (25 / .06) using a ProTaper Next Ni-Ti rotary file system (Dentsply, Johnson, Switzerland) with 5.25% NaOCl. Ca(OH)₂ treatment was applied until the fistula healed. Root canal treatment and metal post placement were completed two weeks later, the tooth was closed with temporary filling material and the patient was directed to the prosthesis clinic (Fig. 5).



Figure 5. Retreatment and root canal treatment

Discussion

Clinically, the failure to determine the exact number of internal structure, root canal form, and root canals of the teeth can be a problem with endodontic treatment. Each endodontic treatment is unique because of the high variability of the root canal system (13). In the literature, it was reported that differences in root canals related genetic factors and occurred in the odontogenesis phase (14, 15).

In order to achieve success in root canal treatment, it is necessary to identify all existing root canals, apply an adequate chemomechanical preparation process to the canals and finally, hermetically fill them with a biocompatible root canal filling material (16). During root canal treatment, when the pulp chamber does not appear to the expected size during the access cavity opening stage, in the presence of a large crown and root, if the canal is seen in the mesial or distal than the midline during radiography examination, there are probably more canals than expected (17).

Allen et al. reported in their study that untreated canals were responsible for failure at a rate of 8,8% (18). Hoen and Pink, stated that unnoticed canals cause the renewal of endodontic treatment in 42% of their cases (19).

In a study conducted at the University of Washington, the failure rate was observed with the highest rate of 11.45% in mandibular premolars due to untreated additional canals in the endodontic treatment classification (16). Sermanand and Hasselgren, stated that 15.7% of the patients had a split root or canal in the mandibular premolar teeth (20). Because of the wide variations in internal and external root morphology, mandibular premolars are considered difficult to treat endodontically. In addition, the division of the roots and / or root canals in these teeth occurs mostly in the middle and apical thirds. This condition makes anatomical variations difficult to detect (17).

It was reported that the root canals in mandibular first premolars are generally quite round and conical, but the wide buccolingual canals narrow to two small canals by bifurcation in one third of the root (21). Mueller (22), Green (23), Vertucci (4) et al. reported that the probability of encountering more than one canal in mandibular first premolars was 2-17.9%, whereas probability of encountering more than one canal in mandibular second premolars was reported by Çalışkan et al. (8) 6.38%, Trope et al. (24) 1.5%, Kartal and Yanıkoğlu (25) 9.62%. in their studies.

In maxillary premolar teeth, if the pulp chamber seems to deviate from the normal configuration, if it is too large, triangular or T-shaped in the mesiodistal plane, it should be suspected more than one root canal (26). The three-rooted maxillary premolars make difficult to detect and prepare the canal because the premolar teeth of buccal canal orifices are positioned close to each other (13).

Ok et al. (7) stated that, the probability of having three roots was low in maxillary premolars in the Turkish population. They reported that triple root maxillary

first premolar teeth are rare (0.5-6%), while the second premolar teeth have a lower incidence of three root canals (0.3-2%) (4,27). In the studies, Pineda and Kuttler (12), Green (23) and Çalışkan (8) et al. that they did not detect a three-canal maxillary second premolar. Kartal et al. (25) and Belizzi and Hardwell (28) stated that there was a second premolar with three canals at a rate of 0.66% (28). Sert and Bayırlı explained rate of three rooted first maxillary premolars (2-4%) and rate of second premolars (2-1%) in their root canal configuration study (29).

Conclusions

It should not be forgotten that extra canals may exist in mandibular and maxillary premolar teeth with anatomical root canal variations as shown in this case series.

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