

A rare morphological variant of the first maxillary premolar: a case report

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Abstract

Anatomical variations of the dental root morphology may lead to endodontic treatment failure. Knowledge of root morphology and possible anatomical variations may ensure proper endodontic treatment and long-term success. The present study describes the case of a three-rooted maxillary right first premolar with two buccal roots and one palatal root, each of them having one canal, diagnosed with symptomatic irreversible pulpitis. The treatment was applied according to traditional procedures, and the post-therapeutic evolution was favorable without any further complications.

Keywords: maxillary first premolar, root morphology, canal system morphology.

Introduction

The endodontic space includes the pulp chamber in the crown portion of a tooth and the root canal system. The ultimate goal of the root canal treatment is to provide a three-dimensional seal of the endodontic space. An accurate diagnosis followed by proper cleaning, shaping and filling of the root canal system are major factors for success.

The practitioner must have a thorough knowledge of root canal morphology and of its variations from the norm [1]. Anatomical variations within the root canal system may lead to failure of endodontic therapy; therefore, their knowledge becomes important for both physician and patient. These morphological changes can occur in any tooth and in all patients [2, 3] and this is the reason why many *ex vivo* studies were performed in order to describe dental roots anatomy. Morphologic irregularities consist of number of roots and number of canals in relation to the roots (separate roots with their own canal, fused roots with interconnections, or fused roots with separate canals) [4]. Unidentified root canals represent a major cause of endodontic treatment failure.

The objective of this case report was to describe the clinical management of a maxillary first premolar with mixed internal and external root morphology abnormalities. Usually, the maxillary first premolar is a two rooted tooth, one buccal and one palatal, each with its own canal.

Patient, Methods and Results

A 22-year-old female presented to the dental office with severe, continuous pain on the maxillary right quadrant. The medical history was noncontributory. Facial inspection did not reveal any pathologic signs. An extensive coronal lesion of the maxillary right first premolar was evident through teeth evaluation. The tooth

presented spontaneous, continuous, sharp pain referred to the right hemimaxilla, orbit and nasal region, and exacerbated by temperature changes, especially cold. The patient described bite sensitivity. Vertical percussion elicited pain and vitality tests were strongly positive. The diagnosis of a symptomatic irreversible pulpitis was sustained.

Complete removal of the pulp was performed under para-apical supraperiosteal anesthesia after the tooth was isolated with rubber dam system. Access to the pulp chamber was made directly after removal of altered dental hard tissues. Locating caries lesion enabled easier access to inflamed dental pulp. The ceiling of the pulp chamber was totally removed in order to get a direct access to root canals and to have good visibility. Coronal pulp was then removed with a mouth excavator, hemostasis was performed and the coronal cavity was irrigated with sodium hypochlorite 3%.

After pulp chamber floor was inspected, we tried to achieve root canals patency using 15 and 20 Kerr files. To our surprise, we quickly discovered access to three different directions and we assumed that there were three roots and three canals, two buccal and one palatal. Between the two buccal canals was quite a distance, so we assumed that the tooth had two buccal roots, besides the palatal root.

In a next step, the working length was established with the help of an electronic apex locator. Direct, straight-line accesses were obtained on all three canals. Radicular pulp was then removed and the crown-down root canal preparation technique was used, with manual Protaper system (Maillefer). Cleaning and shaping were accompanied by EDTA paste application and 3% sodium hypochlorite irrigation. Endodontic microscope was not used for this specific clinical case.

After drying the root canal, the lateral condensation

of gutta-percha technique was used for root canals filling and the crown was then sealed with a temporary filling material. The control periapical radiography confirmed our assumptions, the tooth presenting a rare morphological variation, with three roots and three canals. It also showed us the three-dimensional sealing of the root canal system (Figure 1).

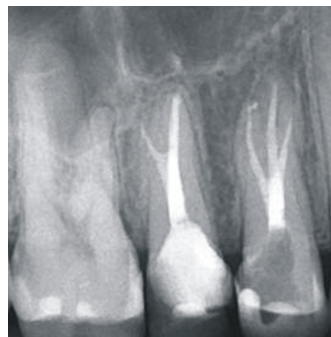


Figure 1 – Postoperative radiograph. The tooth 14 shows three roots and three canals.

The evolution was favorable with light bite-pressure tooth sensitivity, amenable to common pain relievers and anti-inflammatory medication. After 10 days, the tooth was directly restored with a resin based composite material (Figure 2).



Figure 2 – Final restoration.

Discussion

This clinical case describes a rare root morphological variant of the maxillary first premolar.

As data obtained from the specialized literature indicate, this tooth most commonly has two separate roots and two canals [4, 5]. A high incidence of two separate canals and apex foramina (71.3%) regardless of the numbers of roots is reported [5]. The presence of a longitudinal sulcus on the buccal surface of the buccal root determines the morphologic variant of three canals (two buccal and one palatal) in cases of two-rooted maxillary first premolars [6].

The incidence of the single-rooted canal morphological variant is quite large: 49.4% as reported by Loh HS [7], 60% as determined by Walker RT [8], both in Asian population studies, 55.8% as found by Pécora JD *et al.* [9] on South American population. A smaller percentage (15.5 %) is indicated by Lipski M *et al.* [10] for one root type in first maxillary premolars extracted from Polish patients. Most often, the single-rooted first maxillary premolar has two canals, which suggests that a fusion of two roots has occurred [8].

The frequency of the three-rooted maxillary first premolar ranges from 0 to 6% [5]. In Asian population it is very rare [5] and there are researches that do not mention this morphologic variant [7, 8]. Studies indicate that this form is also quite rare in European population –

3.3% [11]. The highest incidence (6%) was determined by Carns EJ and Skidmore AE on 100 plastic casts of the root canals of maxillary first premolars [12].

Most frequent, the three roots anatomy presents two buccal roots (one distobuccal and one mesiobuccal) and one palatal root. The bilateral incidence of this morphology is reduced (less than 1% of the cases) [13]. Regarding the three roots and three canals maxillary first premolars, Pécora JD *et al.* showed that they may have separate roots like a maxillary first molar, or fused roots [9].

Anatomical studies show that the three-rooted first maxillary premolar always presents three canals (one for each root) [5].

The frequency of the three canals morphological variant as reported in the literature is low: 1.4% [5] and 2.5% [9]. The incidence of the three canals pattern as reported by Belizzi R and Hartwell G was similar – 3% [14], while Rózyło TK *et al.* determined a higher value – 9% of the cases [15]. Even rare, gemination of the maxillary first premolar is also reported [16].

Incidence of the one root canal morphological variant is quite large: 61.9% in Asian population *versus* 31.2% in non-Asian population [5].

According to many references in the literature, even if there is no consensus, it can be seen that the three roots and three canals version in maxillary first premolar is very rare. When present, this particular morphology can determine the dentist to make mistakes. As Pécora JD *et al.* mentioned, “Despite the low incidence of three canals, it cannot be overlooked” [9]. The same authors also consider that maxillary first premolar is one of the most difficult teeth to be endodontically treated, due to the number of roots and number of canals, the direction and frequent longitudinal depressions of the roots and the difficulties in visualizing the apical limit and the root curvatures toward the buccal and lingual by radiographs [9]. More than that, Kerekes K and Tronstad L emphasized the difficulties in instrumenting the maxillary first premolars, as a consequence of the apical morphology of these teeth [17].

Differences between studies with regard the occurrence of the number of roots, the number and the shape of canals in each root exist. These differences are mainly related to ethnic background [5]. However, the frequency of genetically determined variations in root and canal system morphology has not been established [8]. Also, differences are due to the study method: canal staining and clearing technique (diaphanization), periapical radiography, cone-beam computed tomography, etc. [18].

The possibility that a tooth has additional roots and multiple canals should be carefully analyzed. Clinical and radiographic examinations of the maxillary first premolar are needed to early detect abnormalities of the number of roots and root canals. The role of cone-beam computed tomography in complicated root canal morphology identification is well documented nowadays [19]. The use of advanced microscopy technology is recommended for successful root canal treatment [20].

Correct evaluation of the clinical situation can eliminate the possible errors. Thus, the follow-up complications and retreatments will be avoided, which, unfortunately,

are quite common even in situations where a normal root morphology is considered.

☒ Conclusions

Clinicians should be aware of root canal system variations when perform endodontic treatment. The particular root and canal morphology of a maxillary first premolar was successfully negotiated in the clinical case described.

Contribution Note

The authors contributed equally to this paper.

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