

Accessory Roots and Root Canals in Maxillary First Premolars: Case Reports

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Abstract: Adequate knowledge of both external and internal radicular anatomy is a fundamental prerequisite for successful endodontic therapy. Maxillary premolar teeth present an endodontic challenge due to their increased prevalence for root and root canal aberrations. These case reports aim to discuss the occurrence of accessory roots and root canals in maxillary first premolars and the variations in their morphology which require special attention and sufficient knowledge of their complex anatomy. Good pre-operative radiographs, correct access cavity preparation, enhanced visibility and adequate armamentarium are required to prevent the undesirable event of leaving a root canal untreated.

Keywords: accessory root, accessory root canal, maxillary first premolar, root canal aberrations

1. Introduction

The ability to locate, shape and 3-dimensionally obturate the complex root canal system is an essential prerequisite for successful endodontic treatment and prevention from periodontal disease [10, 39]. Through elimination of bacteria and their byproducts and hermetic seal of the canals prevention from reinfection and healing of periodontal tissues is achieved in case of apical periodontitis [15, 30].

Thorough knowledge of both normal anatomic forms and unusual variations in dental morphology is essential for endodontic practice. Although possible aberrations of canal anatomy should be considered for all teeth, their incidence in some teeth is greater, one of them being the maxillary premolars [10, 39]. According to traditional beliefs and morphological findings, maxillary first and second premolars are either single rooted, containing one or two root canals, or double rooted, with one canal in each root [17, 24]. However, the presence of accessory roots and/or root canals is well documented, as well [7, 25, 35]. The results of a literature review show that prevalence of maxillary premolar teeth with three roots or root canals varies widely, from 0 to above 25% [5, 21, 27, 29, 31, 33, 38, 41]. It seems that frequency of a third canal, usually presented in a third root in maxillary premolars, is different for people of different ethnic origin. Therefore, ethnicity should be considered during the preoperative evaluation prior to root canal therapy [12, 39].

A perceptible heterogeneity in the root canal systems of three-rooted maxillary premolar teeth was registered when their internal anatomy has been examined by using high-resolution computed tomography (μ CT) [40]. A unified classification of the wide anatomical variations of three-rooted maxillary first premolars is not currently existing. Bellizzi and Hartwell [7] and Carlsen [11] classified them on the basis of external morphological features (also named as ridiculous premolars, small molars, mini-molars and miniature three-canal maxillary molars [6, 25, 35] into three categories. Vertucci's classification for root canal

morphology [37] and its subsequent supplemental configurations [18, 34] recognize most root canal configurations but do not address the number of roots present in premolar teeth and the root canals contained therein. This is especially true for Class VIII configuration (3 separate, distinct root canals extending from the pulp chamber to the apex) as no information is given on whether these canals are encased in single, double or three-rooted premolars. A new classification is proposed by Ahmed and Cheung [2] in which all possible accessory root and root canal configurations in relation to maxillary premolars are included based on the understanding that their root canal system will vary when located in single, double and three-rooted teeth.

The following cases present three-rooted maxillary first premolars, one of them endodontically treated, the others – analyzed after being extracted.

2. Case reports

Case 1

A 34-yr-old healthy male patient presented to the dental practice with complaints of a sharp, severe, pulling and irradiating pain with short remissions from a tooth in the maxillary right region. The patient was unable to point out the painful tooth and analgesics did not relieve pain. The examination of the maxillary right jaw revealed a deep carious lesion on the mesial proximal surface of the first maxillary premolar. The grey-colored carious tissue was soft and moist and probing provoked acute dentin reaction, without communicating with the pulp chamber. Tooth vertical percussion was painful.

The diagnostic radiograph showed presence of a big mesial carious lesion and a premolar with two relatively straight root canals.

Vital extirpation of this irreversibly inflamed pulp was performed. After proper isolation and cleaning of all carious tissues, an oval-shaped access cavity was prepared. The pulp

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chamber roof and all interferences to the root canal orifices were completely removed. The palatal orifice was easily located but the buccal one was not found on its expected position - it was detected mesially from the line connecting the two cusps. The outline form was then modified and extended distally where a second buccal canal was located.

Following pulpal extirpation, the working length was measured with an apex locator. Step-back technique and K-files were used for shaping of all canals. AMF for the two buccal canals was ISO 25 and for the palatal – ISO 30. During mechanical instrumentation each file was coated with a lubricant (Glyde, Dentsply Maillefer) and a copious irrigation with 3% NaOCl was carried out. Obturation of all root canals was accomplished with lateral condensation. The postoperative radiograph confirmed the presence of three separate root canals located in three separate roots. (Fig.1)



Figure 1: Postoperative radiograph of a three-rooted maxillary first premolar

Case 2

A 17-yr-old female patient visited the dental practice for extraction of the two maxillary first premolars for orthodontic reasons. The clinical examination revealed teeth with intact crowns with wider mesiodistal dimension compared to its buccolingual one. Both premolars appeared to be with three well distinguished separate roots after the extraction. (Fig. 2)

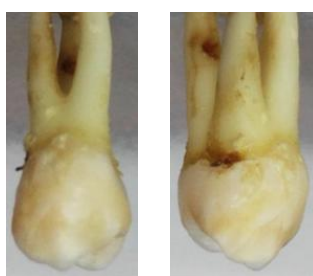


Figure 2: Bilateral three-rooted maxillary first premolars

Case 3

A 51-yr-old man with a 3rd degree mobility of an upper right maxillary first premolar visited the office for extraction. The extracted tooth was with three roots, very close to one another but yet separate. (Fig. 3)



Figure 3: A three-rooted maxillary first premolar

3. Discussion

Nonsurgical endodontic treatment may present as a challenge, especially in cases with aberrant canal configurations, accessory canals, bifurcations, isthmuses, and anastomoses which are often difficult to be identified. The missed anatomy, leading to inadequate cleaning and treatment of all the canals, is generally accepted as a major cause of the failure of the root canal therapy [10, 19, 39]. Therefore, clinicians should be familiar with the common root and root canal morphology and its possible variations in the different groups of teeth before commencing endodontic treatment [15].

Although the exact reason for accessory root formation remains uncertain, different ethnic groups, local traumatic injuries to Hertwig's epithelial root sheath during root formation, genetic factors and some diseases are considered to be the main causes [9, 12, 22, 23, 26]. Armitage [4] defines occurrence of three-rooted maxillary premolars as a rare recessive trait and relates it with a gene mutation. Barros et al. [6] assumed the possibility of inheritance of this deviation of tooth morphology. Midtbø and Halse [26] reported an association with Turner syndrome, which is a sex chromosomal disorder associated with a female phenotype.

Age has been suggested to be a contributing factor for the complexity of the root canal system [14, 28], especially between the ages of 20 and 40 years.

According to data in literature [1] the maxillary first premolars are predominantly 2-rooted teeth with 2 root canals and the presence of 3 roots with 3 root canals is one of the most common anatomic variation in these teeth. Such morphological aberration was found in the above described cases, as well.

Like the endodontic treatment of the premolar in the first case careful clinical and radiographic examination are the first steps to be made. The registered wider mesiodistal dimension of the crown compared with its buccolingual dimension may be an indicator for presence of extra roots or root canals [7, 35]. An accessory root canal may not be detected on the initial X-ray therefore angulated periapical radiographs and 3D imaging techniques are recommended to confirm the presence of extra roots or root canals.

The critical step in detecting the presence of accessory roots and/or root canals is the access cavity preparation. The internal morphological features, the number and location of the roots are revealed after a complete removal of the pulp

chamber roof and all interferences to the root canal orifices [10]. When two canals are present they are often joined by a shallow groove on the pulp chamber floor which is parallel to a line connecting the two cusps. If buccal orifice is discovered mesially or distally of this line, three root canals should be suspected, as was the finding in our endodontic treatment. In this case the oval shaped access cavity should be modified into a triangular outline form with a base on its buccal side [35]. Magnification and co-axial illumination enhance visibility of the internal root anatomy and precision of endodontic treatment [10].

Bilateral occurrence of three-rooted maxillary first premolars is registered in many reports [3, 4, 6, 20, 31, 32] and these findings coincide with the one in our second case. In addition, the concurrent existence of three-rooted first and second maxillary premolar teeth has been pointed out [8, 10, 35, 36].

The bilateral occurrence of root canal aberrations is common, and it has been noted that the rarer the aberration, the more likely it is to occur bilaterally [31]. Accordingly, root canal treatment of such maxillary premolar teeth with complex internal root anatomy may serve as a suitable reference for the corresponding contralateral teeth currently being considered for endodontic therapy.

Operator's experience in locating additional canals is a factor that should not be underestimated, as well. Corcoran et al. [13] proved that experience gives dental practitioners more confidence in locating and negotiating difficult and/or additional canals.

In conclusion, variations in morphology of maxillary first premolars require special attention and sufficient knowledge of teeth complex anatomy. Good pre-operative radiographs, correct access cavity preparation, enhanced visibility and adequate armamentarium are required to prevent the undesirable event of leaving a root canal untreated.

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