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Maxillary Premolars with Three Root Canals: A Case Report

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ABSTRACT

The numerous difficulties found during root canal treatments are due to anatomical variations in the radicular morphology. Maxillary premolars have highly varied root canal systems and shapes. This case report addresses two endodontic treatment cases of the maxillary first and second premolars with three canals and a summary of their anatomical forms. The article describes the diagnosis and clinical management of these teeth.

Keywords: Anatomic Variations; Endodontics; Maxillary Premolars

Introduction

The success of root canal therapy depends on the complete debridement of the radicular system. Therefore, a clear understanding of tooth anatomy is a prerequisite to achieving proper access cavity preparation, thorough cleaning, careful disinfection and appropriate obturation of the root canal space [1, 2]. Consequently, one of the major reasons for the failure of endodontic therapy is the inadequate knowledge of the pulp space anatomy in root canals [3].

The current concept of root canal morphology of the maxillary premolars is based on the work by Kartal [4], whose examination of the root canal systems was based on Vertucci's classification [5]. In maxillary first premolars, the incidence of type I canals (one canal) was 8.66%, whereas 89.64% of the total samples demonstrated two canals (from type II to type VII). Only 1.66% of the maxillary first premolars were type VIII or type IX (three canals). In maxillary second premolars, the incidence of type I (one canal) was 48.66%, whereas it was 50.64% for type II to type VII (two canals). Type VIII (three canals) was found in 0.66% of the total sample. Vertucci [6] reported an incidence of 1% of maxillary second premolars with three canals.

There are reports of unusual canal anatomy in relation to all teeth, and maxillary premolars are not excluded [7-9]. Chauhan [10] reported the root canal treatment of a three-rooted maxillary second premolar in a patient with bilateral occurrence of three-rooted maxillary second premolars. In another study, Sulaiman *et al.* [11] showed a case of three canals in a maxillary first premolar with radiographically non-well defined root outline.

This paper reports the root canal treatment of maxillary premolars with an atypical root canal system, a rare presence of two teeth with similar anomalies next to each other, and different techniques used for canal obturation according to the existing conditions.

Case Report

A 23-year-old male patient with no history of any systemic diseases was referred to the Department of Endodontics, Mashhad Dental Faculty, Iran, with severe cold-sensitivity in upper right quadrant. Radiographic examination (Figure 1A) revealed deep carious lesions in teeth #4 and #5. Moreover, widening of periodontal ligament space and periapical radiolucency were observed in tooth #5. It was also observed that the mesio-distal width of the midroot was equal to or greater than that of the crown,

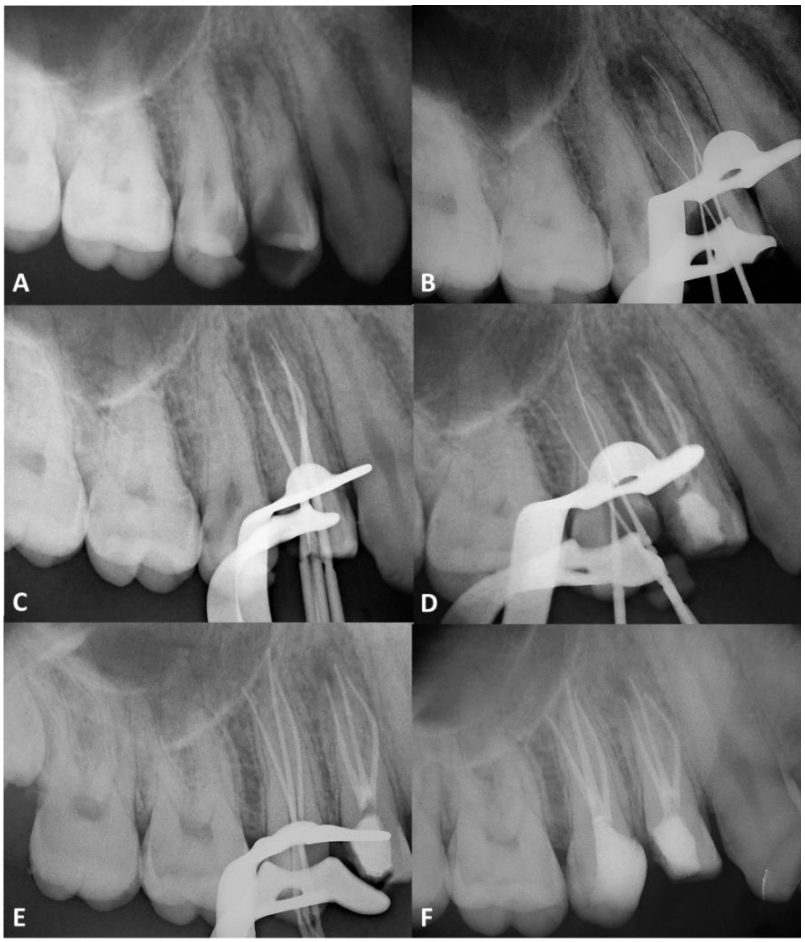

Figure 1. Periapical radiographs of teeth #4 and #5; *A)* Diagnostic radiograph shows three-roots beside carious lesions in both teeth, and periapical radiolucency in tooth #5; *B)* Endodontic files in teeth #5; *C)* Master cones confirmation radiograph in tooth #5; *D)* Endodontic files in teeth #4; *E)* Master cones confirmation radiograph in tooth #4; *F)* Three separate canals in both teeth in the final radiograph

increasing the possibility of having three roots. The periodontal status was normal (probing depth< 3 mm) with physiologic mobility in teeth #4 and #5. Responses of sensibility/sensitivity tests (thermal and electric pulp tests [EPT]) revealed irreversible pulpitis for tooth #4 (long-lasting severe pain while thermal testing) and necrosis for tooth #5 (no response to each test). The periapical tissues of tooth #4 seemed normal (not sensitive to percussion), but tooth #5 was moderately tender on vertical percussion, which indicated chronic apical periodontitis, thus, non-surgical root canal therapy was scheduled. The treatment plan was explained to the patient, and informed consent was obtained for endodontic treatment of the involved teeth.

After receiving infiltration with local anesthesia using 2% lidocaine and 1:100,000 epinephrine (Darupakhsh, Tehran, Iran), the tooth was isolated with rubber dam, caries was removed and endodontic access cavity was prepared. Canal orifices were identified using DG16 endodontic explorer and magnification with a dental microscope (Figure 2A). After finding the orifices of canals, working length (WL) was determined with a #8 K-type file (Dentsply Maillefer, Ballaigues, Switzerland) coupled with Root ZX II apex locator (J. Morita, Irvine, CA, USA). WL was then confirmed by radiographic examination after establishing a glide path in each canal with #10 and #15 K-type files (Dentsply Maillefer, Ballaigues, Switzerland) (Figure 1B and D).

Canals in tooth #4 were instrumented with HERO Shaper® (MicroMega, Besançon, France) rotary files to size 25/0.04 and HERO 642® (Micro- Mega, Besançon, France) rotary files to size 30/0.02, using a crown-down technique. The crown-down technique was also used to prepare canals in tooth #5 with HERO Shaper® (MicroMega, Besançon, France) rotary files to size 25/0.04. Afterward, master cone confirmation radiographs were taken (Figure 1C and E).

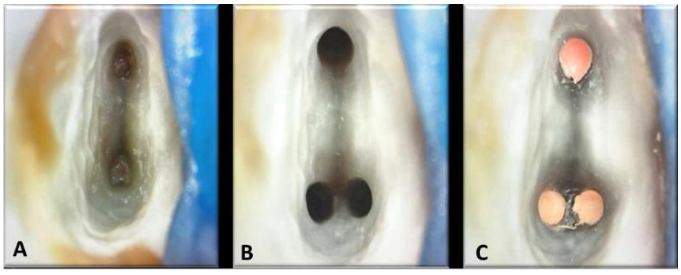

Figure 2. Dental microscope photographs from tooth #4; *A*) Canal orifices identification; *B*) Canal orifices after preparation; *C*) The final photograph

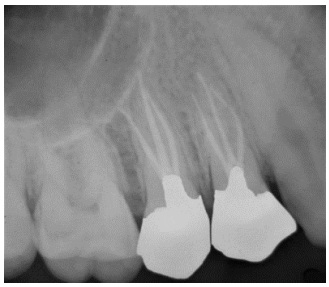

Figure 3. Periapical radiograph of teeth #4 and #5 after six months, showing formation of lamina dura and loss of radiolucency

The canals were irrigated with 5.25% sodium hypochlorite during treatment and finally with normal saline. Cold lateral condensation was considered as the method for obturation of three-canalled premolars [12]. The canals were dried with paper points (Figure 2B) and tooth #4 was obturated with laterally condensed gutta-percha and AH-26 sealer (De Trey, Dentsply, Switzerland) (Figure 2C). Canals of tooth #5 had thin walls and resorption was observed in the end of roots. As a result, less preparation was performed to prevent excessive pressure on the roots during lateral compression. The canals of tooth #5 were filled with single-cone obturation technique using gutta-percha point of 0.04 taper and Sure Seal Root sealer (Sure Dent Corp.,Gyeonggi-do, Korea) as a bioceramic sealing material. A final radiograph was taken to evaluate the quality of obturation (Figure 1F) and the patient was referred to an operative dentist for coronal restoration. The tooth was clinically and radiographically asymptomatic at recall appointment after six months (Figure 3).

Discussion

Complicated and diverse root canal systems pose a challenge to successful diagnosis and treatment. The most common root canal morphology of maxillary premolars is the presence of two canals (from type II to type VII). However, the possibility of maxillary second premolar with three roots is very small and only a few cases have been reported [13]. In addition to a study by Kartal [4] on the morphology of root canals of maxillary premolars, Carns [14] examined one hundred plastic casts of the root canals of human maxillary first premolars, and found that the incidence of maxillary first premolars with three roots, three canals, and three foramina was 6.0 per cent. Pecora *et al.* [15] reported that 55.8% of the teeth #5 had a single root, 41.7% had two roots and 2.5% had three roots.

Visualization of three canals in a maxillary premolar on pre-operative radiographs can often be difficult. The root canal configuration resembles that of a miniature three canalled maxillary molar [16]. Whenever the mesio-distal width of the mid- root image is equal to or greater than that of the crown, the tooth is highly likely to have three roots [17]. Moreover, multiple canals are common when a radiograph shows a file as eccentric in the roots [18]. Changes in access cavity are required to find the canal orifice in a complex anatomy. To locate root canal orifices in the maxillary premolars with three roots, a T-shaped access cavity is recommended [19].

A significant fallback in conventional radiography is the creation of a two-dimensional (2D) image of a three-dimensional (3D) object, resulting in the superimposition of the overlying structures. Therefore, radiographs can be of limited value in cases that have complex root canal anatomy. Consequently, CBCT is designed to provide non-invasive 3D information from root canal anatomy [20]. Recent advances in diagnostic radiographic techniques have provided new horizons in the detection and interpretation of root canal anatomy [21]. However, CBCT should be only considered when conventional periapical radiographs fail to provide adequate information and details of the structures to be identified [22], as CBCT views may also show misleading findings [23]. In this study, the use of 2D radiographic information seemed to be adequate to make accurate diagnosis, and thus CBCT was not deemed necessary.

A complete analysis of radiographs, exploration of the floor of pulp chamber, knowledge of anatomy and possible variations in the root canal system are necessary to achieve successful results [11].

Conclusion

Variations in pulp anatomy and morphology must be always considered before beginning treatment. Careful clinical and radiographical examinations are essential for successful endodontic treatment. Usually, a thorough and magnified examination of the pulp chamber can assist in finding additional canals. Complex premolar anatomy may be predictably managed following canal identification and negotiation.

Conflict of Interest: 'None declared'.

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