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Case Report

Endodontic management of a three-rooted maxillary premolar: A case report

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الملخص

تُظهر ضواحك الفك العلوي اختلافات تشريحية في أعداد الجذور والقنوات، ويشكل ذلك تحديا خلال علاج قناة الجذر. في تقرير الحالة هذا، نصف معالجة ضاحك الفك العلوي ذي ثلاثة جذور. أُحيل مريض يمني عمره ٤٧ عاما إلى كلية طب الأسنان بجامعة طيبة للمعالجة اللبية للضاحك العلوي الأول الأيمن (#١٤). لم يقدم التصوير الشعاعي التشخيصي الذروي نتائج كافية فيما يتعلق بتشكل نظام قناة الجذر وعدد الجذور. بعد ذلك، تم التقاط صورة مقطعية مخروطية ثلاثية الأبعاد أظهرت أن ضاحك الفك العلوي يحتوي على ثلاث جذور. أُجريت معالجة قناة الجذر تحت التكبير باستخدام مجهر جراحي للأسنان، وباستعمال نظام "ريسبروك بلو" ونظام تسليك نيكل — تيتانيوم، وتم الحشو الثلاثي الأبعاد للقنوات الجذرية بجهاز "كلاموس".

ينبغي على الأطباء أن يكونوا قادرين على توقع الاختلافات التشريحية في الضواحك الفكية، كما ينبغي أن يكون لديهم المعرفة والمهارات الكافية للتعامل مع مثل هذه الحالات.

الكلمات المفتاحية: الاختلافات التشريحية؛ المعالجة اللبية؛ الضواحك العلوية؛ القناة الجذرية؛ ثلاثي الجذور

Abstract

Maxillary premolars exhibit anatomical variations in the numbers of roots and canals, which pose a challenge during root canal therapy. In the present case report, we describe the endodontic management of a three-rooted maxillary premolar. A 47-year-old Yamani man was referred to the College of Dentistry, Taibah University for endodontic treatment of his right maxillary first premolar (#14). Periapical diagnostic radiography did not provide adequate information about the morphology of the root canal system and number of roots. Subsequently, a 3D cone-beam computed tomographic (CBCT) image was obtained, which revealed three roots in the aforementioned premolar. Root canal treatment was performed under magnification using a dental operating microscope, R25 RECIPROC blue NiTi single file system, and the Calamus dual 3-D obturation system. Clinicians should be able to predict the anatomical variations in maxillary premolars and have adequate knowledge and skills for managing such situations.

Keywords: Anatomical variations; Endodontics; Maxillary premolars; Root canal; Three-rooted

Introduction

The anatomy of the root canal system is unique and complex, which provides a suitable environment for the microbial flora.[1,2]

Therefore, success of root canal treatment depends on several factors such as evaluation of the configuration and anatomical variations of the root canal system,[3] thorough cleaning and shaping of the canals, and obtaining a three-dimensional hermetic seal.[4]

Inadequate knowledge of the morphology and configuration may lead to improper identification of the root canals, which can cause failure of the treatment.[5] Failure of root canal therapy is encountered in numerous cases owing to

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missed canals.[5] Therefore, clinicians should be aware of the morphological variations in the root canal system of all teeth.

In routine dental practice, the determination of root canal anatomy and configuration is based on diagnostic preoperative radiographs,[6] which have potential drawbacks such as superimposition of structures and image distortion.[6]

Recently, cone-beam computed tomography (CBCT) has been used for the diagnosis of controversial cases in endodontics. CBCT images provide a three-dimensional evaluation of the root canal system, teeth, hard tissues, and the adjacent structures.[7,8]

Maxillary premolars exhibit anatomical variations in the numbers of roots and canals, which pose a challenge during endodontic therapy of these teeth.[9] Several studies have reported anatomical variations in the root canal system of maxillary premolars,[10,11] and the internal root canal anatomy may show several configurations.[12–14] The prevalence of three roots in maxillary first premolars is 0–6%, and in general, each root contains one canal.[11,14]

In the present case report, we describe the endodontic management of a three-rooted first maxillary premolar.

Case report

A 47-year-old Yamani man was referred by his general dentist to the endodontic specialty clinic at the College of Dentistry, Taibah University (KSA) for endodontic treatment of his right maxillary first premolar (#14). The general practitioner had started the root canal treatment; however, he/she was not able to complete the same owing to inadequate radiographic information and the suspicion of a complex root canal system anatomy.

The patient was fully informed about the treatment steps, and a written informed consent form was obtained before starting the treatment.

The medical history of the patient was non-contributory. No remarkable findings were noted during the extra- and intra-oral examinations. The diagnostic periapical radiograph of the right maxillary first premolar did not clearly reveal the root morphology; however, no periradicular lesion or widening of the periodontal ligament space was noted (Figure 1). Subsequently, cone-beam computed tomographic (CBCT) images (Figure 2) were acquired using the Kodak 9000c 3-D system. The extraoral imaging machine and 3-D Kodak Dental Imaging software version 1.3 were used following the manufacturer's guidelines. The imaging parameters were as follows: voltage, 80 kV; exposure time, 30 s; current, 5.0 mA. A 14-bit grey scale voxel (76 × 76 × 76-μm) was used. The CBCT data were analyzed using an imaging software (CS 3D; Care stream Health, Inc., 2011) (Figure 2).

Figure 1: Periapical diagnostic radiograph.

The patient was diagnosed with a case of previously initiated endodontic therapy with normal periapical tissues.

Local anaesthesia was administered with 36 mg lidocaine and 0.018 mg epinephrine, following which the tooth was isolated using a rubber dam. The access cavity was re-evaluated and modified. The canal orifices were identified using an endodontic explorer (DG16), and cleared and flared using ultrasonic tips under magnification (25x) with a Leica M320 dental microscope (Leica Microsystems, Wetzlar, Germany). The working length was determined using a Root ZX II apex locator (MORITA CORP), and was confirmed

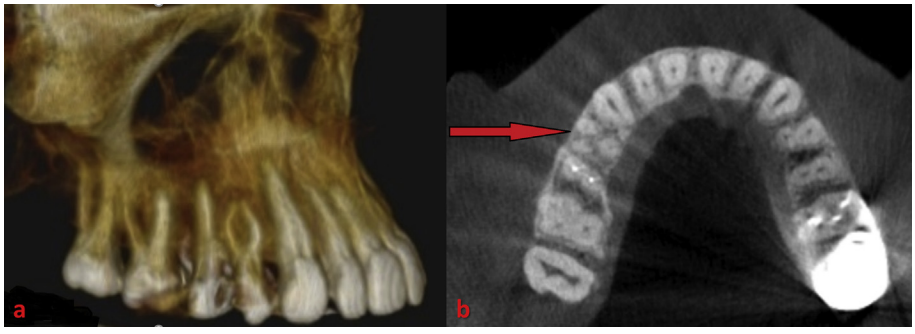

Figure 2: a. Three-dimensional cone-beam computed tomographic (CBCT) image of tooth #14 showing two buccal roots b. Axial view of the CBCT images of tooth #14 showing three roots.

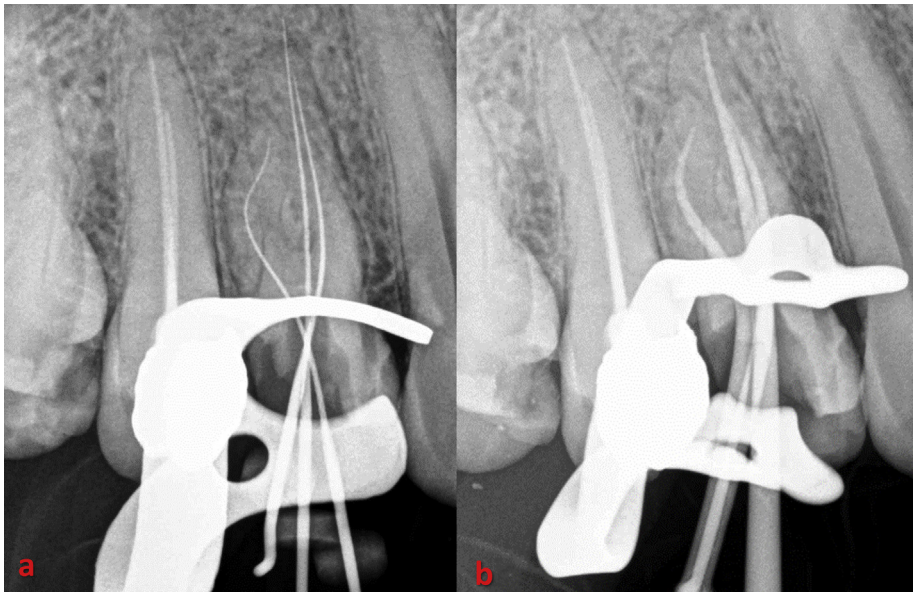

Figure 3: a. Working length determination by radiography; b. Master cone confirmation by radiography.

Figure 4: Root canal obturation.

by radiography (Figure 3). A glide path was established carefully using K files (size 8, 10, and 15) (Dentsply Maillefer, Ballaigues, Switzerland). The root canals were subsequently cleaned and shaped using the R25 RECIPROC blue single instrument with a NiTi reciprocating system (VDW GmbH, Munich, Germany). Sodium hypochlorite (3%) and 17% ethylenediaminetetraacetic acid were used as irrigants for removal of the smear layer. The canal was filled using the Calamus dual 3-D obturation system (DENTSPLY International, Inc., Tulsa, OK, USA) (Figure 4—a). The access cavity was sealed with glass ionomer cement, and the patient was referred to his dentist for final restoration (Figure 4—b).

Discussion

Thorough knowledge of the anatomy of the root canal and accurate diagnostic radiographs are mandatory before initiation of root canal therapy. In the case presented herein, periapical radiography, which provides a 2D view of a 3D object, did not provide adequate diagnostic information; thus, CBCT images were obtained before starting root canal therapy. CBCT imaging provides a 3-dimensional view of the teeth and supporting structures. In addition, CBCT can be used to identify the internal anatomy of the root canal system in permanent dentition.[8—10]

The internal canal configuration of maxillary premolars is diverse, and varies depending on the geographical region and

race.[14] In the current case, the first maxillary premolar had three roots with a 50° curvature in the distobuccal root, as assessed according to the method described by Schneider.[15] The degree of curvature observed in this case is considered severe; thus, the glide path was carefully prepared using manual stainless steel files (size 8, 10, and 15) and subsequently, root canal preparation was completed using the Reciproc Blue NiTi single instrument system, which has high cyclic fatigue resistance and superelasticity.[16,17] The Reciproc Blue system is subjected to a creative thermal processing, which leads to formation of a blue layer of titanium oxide,[17] and creates a predetermined shape memory.[18]

The root canal obturation was performed using the Calamus dual 3-D obturation system, which has flexible silver cannulas that make it suitable for use in curved root canals.[19] Calamus is a warm gutta-percha obturation technique that exhibits favourable results, which can be attributed to the maximum inert core material, minimum sealer, and higher homogeneity.[20,21]

In the present case, the procedure was performed under magnification using a dental operating microscope, which enhanced the visibility of the canal orifices, thus improving the outcome of the root canal treatment.[22]

In conclusion, complex anatomy of the root canal is common in premolar teeth. Therefore, clinicians should have a comprehensive knowledge of the internal anatomy and configurations of the root canal, and the ability to apply the same in clinical practice by careful evaluation of radiographs. Recent advances in endodontics will facilitate root canal therapy and improve the quality of treatment.

Source of funding

Nil.

Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

This case report was approved by the research ethics committee of the College of Dentistry – Taibah University (Protocol no.TUCDREC/20190416/HMGhabbani) in agreement with the guidelines of the Helsinki Declaration as revised in 1975.

Authors' contributions

M AlRahabi conceived and designed the study, performed this case, provided the material for the case report, collected and organized data, and wrote the initial and final drafts of the article.

H Ghabbani analyzed, interpreted, discussed the data, and provided logistic support.

All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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