Contemporary endodontic management of four rooted maxillary second molar using waveOne

AJINKYA M PAWAR, SHARAD R KOKATE

Abstract

Knowledge of root canal morphology and variations is an essential factor to successful endodontic treatment. Presence of extra roots, canals, lateral canals, deltas etc., is commonly encountered. Maxillary second molar with two palatal roots or root canals is a rare dental anatomy. The purpose of this case report is to describe the successful endodontic management of a maxillary second molar with four root canals using a single reciprocating file system. The morphology is a typical characterized by two palatal roots with widely separated two orifices and canals. The tooth presented an individual mesiobuccal, distobuccal and two separate palatal roots.

Keywords: Maxillary second molar, palatal canals, root canal morphology, root variation, waveOne

Introduction

The main objectives of an endodontic treatment are the elimination of microorganisms from the root canal system and prevention of subsequent re-infection of the system. Inability to find, completely obliterate the canal and achieve a fluid tight sealed three dimensional obturation may cause failure. The complexity of the root canal morphology may present a challenge to clinicians for entire root canal debridement. Complete knowledge of root canal morphology and probable variations are essential factors to predict the success of any endodontic intervention.[1]

The maxillary molars may present variations in number of roots and canal configurations. Variations in the root and root canal morphology associated with the maxillary second molars have been investigated and reported in the literature. In a review and radiographic study by Libfeld and Rotstein out of 1200 maxillary second molars tested, five teeth were found to have four roots.[2] Case reports of maxillary second molars with three buccal roots have been reported in the literature.[3] Fava et al.[4] published the presence of just one canal and one root in the second maxillary molars while Alani[5] encountered bilateral presence of four roots in the second maxillary molars of the same patient. Baratto-Filho et al.[6] carried out an in vitro study of two maxillary second molars with four canals and two different palatal roots. Barbizam et al.[7] in their study have reported similar study of second maxillary molar with four canals in four distinct roots. Christie observed that two palatal roots may be encountered once every 3 years.[8] Variations in maxillary second molar with four separate roots and four separate canals including two palatal roots were the least frequent with an occurrence rate of 0.4-1.4% respectively.[8,9]

The aim of the present case report is to describe the contemporary root canal treatment of a four rooted maxillary second molar, mesiobuccal root with single canal, two individual palatal roots (mesiopalatal and distopalatal) with its own separate canal and distobuccal root with a single canal.

Case Report

This was a case of a 28-year-old-female patient who was referred to the Department of Conservative Dentistry and Endodontics with spontaneous pain in the maxillary left area since 2 days. The patient gave no relevant medical history. Clinical examination revealed that tooth mesio-occlusally had deep caries with respect to the maxillary left second molar tooth no 27. Radiographic examination [Figure 1] revealed carious lesion on mesial aspect of the suspected tooth involving the pulp. The diagnosis was made as irreversible pulpitis and the endodontic treatment was planned for the tooth no 27.

The tooth was anesthetized and isolated with a rubber-dam (Hygienic Corp., USA) and an ideal triangular...
access cavity was prepared locating three canals mesiobuccal, distobuccal and palatal. On the basis of the palatal canal being placed more mesially than at the center and the dentinal map presenting a continuation distally, the decision was made to explore the cavity more distally to chalk out any chances of missed canals. The access cavity outline was extended distally and changed from triangular to a more trapezoidal form and the fourth canal orifice was located [Figure 2]. The canal patency was checked for all the four canals by #10 K-files and the working length was determined using an electronic foramen locator (Root ZX, J. Morita USA, Inc). The working length was confirmed with a radiograph [Figure 3].

The canal orifices of all the canals were enlarged using gates glidden drills #1, #2 and #3 followed by shaping the canal by waveOne primary files using Xsmart Plus (DENTSPLY Tulsa Dental Specialties and DENTSPLY Maillefer) reciprocating endomotor. The file was withdrawn from the canal on meeting restriction, cleaned, the canal was irrigated, the patency was re-established using #15 K-File and then the reciprocating file was introduced again. The irrigation was done using 5.25% sodium hypochlorite. Ethylenediaminetetraacetic acid (EDTA) gel (RC-Helper, Prime Dental Products Pvt. Ltd, India) was used as a lubricant for the files. The shaping and cleaning procedure was continued until the reciprocating file reached the working length.

Following the shaping procedure the mastercone were selected to the corresponding waveOne file and placed in the canals and a radiograph was taken to confirm the extent of the cones [Figure 4]. After confirming the mastercone selection the canals were flooded with 17% aqueous EDTA (Dent Wash, Prime Dental Products Pvt. Ltd, India) for a min to assure removal of the smear layer prior obturation. A final rinse with 5 ml of 5.25% sodium hypochlorite was done.

Figure 1: Pre-operative radiograph

Figure 2: Modified access cavity showing two palatal orifices

Figure 3: Working length X-ray

Figure 4: Mastercone X-ray
The root canals were then dried using the paper points and the obturation was completed with cold lateral condensation using AH-Plus (De Trey-Dentsply, Konstanz, Germany) as the sealer. A post obturation radiograph was taken to confirm the quality of obturation [Figure 5].

Discussion

The maxillary second molar usually has two buccal roots and a palatal root. Four rooted maxillary second molar is a rare condition. Alavi et al.\(^1^0\) as well as Lee\(^1^1\) couldn’t find any maxillary molars with two palatal roots in their studies. Hartwell and Bellizi\(^1^2\) have reported that 9.6% of maxillary molars, they examined, had four canals, but had not mentioned about any case with four roots. Presence of extra canals or roots in the mesiobuccal portion of these teeth is more common.

Peikoff et al. in an article in 1996\(^1^3\) carried out retrospective study and classified the anatomical root and canal variants for maxillary second molar into six categories. (1) Three separate roots and three separate canals (56.9%). (2) Three separate roots and four canals (two in mesiobuccal root) (22.7%). (3) Three roots and canals whose mesiobuccal and distobuccal canals combine to form a common buccal with a separate palatal (9%). (4) Two separate roots with a single canal in each (6.9%). (5) One main root and canal (3.1%) (6) Four separate roots and four separate canals including two palatal (1.4%).\(^1^5\) Christie et al. in 1991 have proposed a classification system describing three types (I-III) of four rooted maxillary second molar abnormalities, based on root separation level and their divergences. Type I with long tortuous divergent separate palatal roots, Type II with short blunt and parallel roots and type III those with three convergent roots and distinctly divergent fourth distobuccal root.\(^1^6\) According to this system the case presented falls in type I.

The clinician should therefore give special attention to the evidence of the occurrence of anatomical variations throughout the procedure. The belief that a tooth has only a fixed number of roots and root canals is now obscure and it is very important that careful attention is paid to locate and treat the extra canals. Canals are often missed as the clinician fails to locate them successfully. Difficulties during endodontic treatment of maxillary second molar are due to its posterior position, superposition of anatomical structures in radiograms (such as zygomatic arch) leads to failure of diagnosing unusual anatomy.

A reciprocating motion decreases the impact of cyclic fatigue on nickel-titanium (NiTi) rotary instrument’s life when compared with rotational motion.\(^1^4\) The waveOne NiTi file system is a single-use, single-file system to shape the root canal completely from start to finish. It is Single NiTi instrument resulting in decreased shaping time, allowing the clinician to spend more time cleaning the root-canal system with enhanced irrigation techniques. No risk of cross contamination as it is single use file, which also eliminates procedural errors by using a single instrument rather than using multiple files.\(^1^3\)

Radiographic examination is an essential component of the management of endodontic problems. The amount of information gained from conventional radiographs and digitally captured periapical radiographs is limited by the fact that the three dimensional anatomy of the area being radiographed is compressed into a two-dimensional image.\(^1^4\) Radiographic interpretation of the second maxillary molar root anatomy presents complications because of superimposition of roots on each other or adjacent bony structures. Thorough knowledge of anatomical variations and frequent anomalies in the region besides multiple radiographs with different angles or cone-beam computed tomography (CBCT) could be helpful, the advantage over the conventional radiograph it being the three-dimensional image and also allows the operator to look at multiple slices of tooth roots and their root canal systems.\(^1^6\) CBCT images always result in the identification of the greater number of root canal systems than digital images.\(^1^7\)

Meticulous exploration of the developmental groove in the pulp chamber floor is suggested in order to locate canal orifices; moreover, any dentin projection, which could cover existing orifice, should be removed carefully.\(^1^8\)

Conclusion

In the present case, the extra palatal root could not be detected on a pre-operative radiograph but was found on modifying the access cavity. Hence a good knowledge of internal anatomy, possible normal variations, use of multiple angulated radiographs are necessary as missed extra canals or roots could lead to root canal treatment failure. The additional uses of newer diagnostic aids like CBCT may also help in diagnosing and locating extra canals.
Hence not knowing the internal anatomy of the tooth we are treating is like setting out on an unknown journey without a road map.

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