A Case Report of Six Canals in a Maxillary First Molar

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Identifying the variations of root canal morphology is crucial prior to commencing any endodontic treatment. The advancement of current endodontic instrumentation and technology has greatly enhanced treatment outcomes, which are now more predictable. This clinical case report presents a case of a maxillary first molar showing six root canals and apical foramina, i.e. three mesiobuccal canals, two palatal canals and one distobuccal canal. The occurrence of bifurcation in the second mesiobuccal canal is also emphasised.

Key words: *maxillary first molar, mesiobuccal canal, six canals, ultrasonic*

The main objectives of endodontic treatment are to clean and shape the root canal system and seal it in three dimensions to prevent long-term re-infection. However, procedural errors are common for teeth with complex root canal morphology. This could be avoided by a correct preoperative diagnosis and careful technical handling of instruments during canal negotiation and preparation. A missed canal in an endodontic treatment could jeopardise the treatment outcome as remaining microorganisms will act as a source of infection for further apical periodontitis and post-treatment disease.

Maxillary first molars with six canals and with different variations in root canal configuration and morphology have been reported in the literature[1-4], but the occurrence of a 1–2 configuration, or bifurcation, with separate foramina in a second mesiobuccal canal (MB2), as described in the present case, is rare. The current report describes a case of non-surgical endodontic treatment of a maxillary first molar with six canals and separate apical foramina, with three canals in the mesiobuccal root (MB1, MB2-1, MB2-2), two canals in the palatal root and a single canal in the distobuccal root. A three-dimensional constructed image of the post-operative root canal filling is also presented.

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Case report

A 21-year-old Chinese female with a non-contributory medical history was referred to the Department of Operative Dentistry and Endodontics, Jinan Stomatological Hospital, Shandong Province, China, with a diagnosis of irreversible pulpitis of the left maxillary first molar, due to a deep caries lesion. The patient reported that the tooth had suffered a dislodged restoration about 3 months previously, with the onset of lingering discomfort to hot and cold stimulus for approximately 1 month prior to attending for treatment. Periapical radiolucency was not present in the preoperative radiograph (Fig 1a). Root canals in the distobuccal and palatal roots appeared to be sclerotic.

After the administration of local anaesthesia (2% lignocaine with 1:80,000 adrenaline), the tooth was isolated with rubber dam and the operating field disinfected with 0.2% chlorhexidine prior to the removal of caries and conventional access cavity preparation. To facilitate the location of root canal orifices, the calcified tooth tissue on the pulpal floor was carefully removed using an ultrasonic tip (Spartan MTSTM, Obtura Spartan, Fenton, MO, USA) under a dental operat-

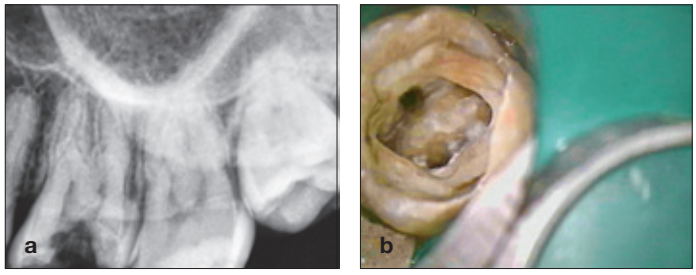

Fig 1 a) Preoperative periapical radiograph revealed extensive coronal caries extending into the pulp chamber. b) Access cavity and orifices after root canal instrumentation.

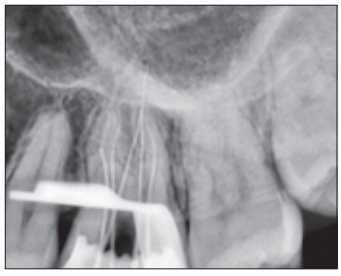

Fig 2 Working length radiograph with five files in position, demonstrating four patent canals and one blocked canal.

ing microscope. Five canal orifices were found – two mesiobuccally (MB1 and MB2), two palatally (P1 and P2) and one distobuccally (DB) (Fig 1b). The working lengths of these canals were determined with an electronic apex locator (Root ZX®, J. Morita, Irvine, CA, USA) and verified with a periapical radiograph (Fig 2). It was noted that the MB2 canal could only be negotiated to the mid-root level. Patency was assessed with a size 10 K-file and was achieved in all canals except for the MB2 canal. Further negotiation in the MB2 canal revealed a bifurcation at the mid-root level. The canals were instrumented with rotary nickel titanium instruments (ProTaper® Universal, Dentsply Maillefer, Ballaigues, Switzerland) to size F2. The canal was lubricated with a chelating agent (File-Eze, Ultradent, South Jordon, UT, USA) for 5 min, and then irrigated with 5.25% sodium hypochlorite aided by ultrasonic activation.

Before obturation, all canals were thoroughly irrigated with ultrasonic activated 17% EDTA solution. After drying these canals, obturation was performed with gutta percha and AH Plus™ (Dentsply DeTrey, Konstanz, Germany) sealer, using a warm vertical compaction technique. Special attention was given to the two bifurcated canals in MB2. The 'downpack' was completed first for the bifurcated canals (apical third), followed by 'backfilling' of the middle and coronal thirds of the MB2 canal. The postoperative radiograph showed that these canals were homogenously filled with slight extrusion of sealer in the P1 canal (Fig 3a). The tooth was restored with resin composite (Filtek™ Z250 Universal Dental Restorative, 3M ESPE, St. Paul, MN, USA). A cone-beam computerised tomography (CBCT) image was obtained (NewTom QR-DVT 9000, Quantitative Radiology, Verona, Italy), and a three-dimensional image was generated using specialist software (SimPlant Pro 11.04, Materialise Dental, Leuven, Belgium) to reveal the root filling pattern and canal configuration of this tooth (Figs 3b and 3c). The patient was then referred to the Prosthodontic Department for the provision of a crown.

Discussion

Cases with three canals in the mesiobuccal root of a first maxillary molar have been reported in the literature[1,5]. The present case is somewhat special due to the two-canal configuration in MB2, with one common orifice, but separate apical foramina. The present authors classified the canals as MB2-1 and MB2-2. In fact, this occurrence has not been previously reported in the endodontic literature. Initially, the MB2 canal could not be negotiated to the apex; it was thought this was due to canal obliteration. Further negotiation with the aid of an ultrasonic instrument and chelating agent, EDTA[6], revealed a bifurcation located at the mid-root level.

Locating MB2 in daily clinical practice is not usually straightforward if one is not familiar with the root configuration and canal arrangement. Bifurcation in the MB2 canal can further complicate the endodontic

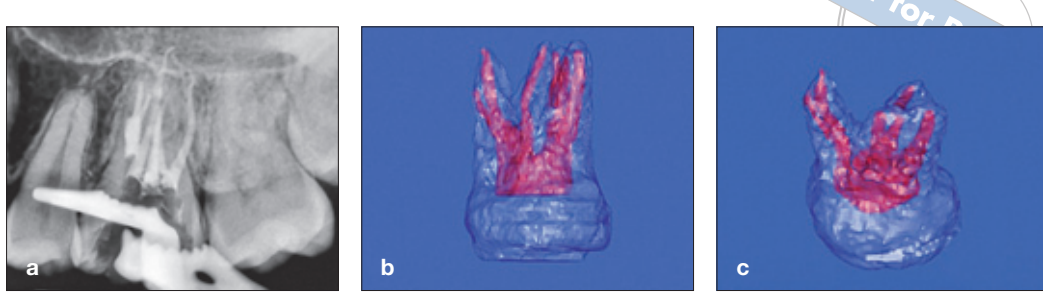

Fig 3 a) Postoperative periapical radiograph. b and c) Three-dimensional image reconstruction showing a six-canal configuration, with a bifurcation in the MB2 canal at the mid-root level.

treatment, as it is often impossible to determine this anatomical variation through preoperative periapical radiographs. However, one would not be surprised to see an increase in the occurrence of such a finding, along with the successful location and negotiation of this additional canal, with advanced endodontic techniques, especially with the use of a dental operating microscope[7]. Ultrasonic instrumentation should be used with caution in this situation due to its aggressiveness. Furthermore, the root canal wall in the mesiobuccal root is already compromised by a thin dentine root wall at the furcal area after initial preparation. Thus, there is a potential risk that the imprudent use of an ultrasonic tip in locating the additional canal path can lead to excessive removal of root dentine, resulting in a weakened root structure and possibly root perforation.

The use of CBCT in endodontics has gained popularity over recent years. It has the ability to visualise three-dimensional anatomical structure, which is not possible with a conventional periapical radiograph[8]. Most importantly, it has a low effective dose compared with conventional medical computerised tomography and with current CBCT scanners the field of view can be limited to an area of interest. The use of CBCT in the present case revealed the post-obturation quality of the root filling material in three dimensions, as well as demonstrating the complexity of the root canal configuration. CBCT definitely has an important role in preoperative and treatment outcome assessments for some complex cases due to its superior sensitivity[9,10].

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