CASE REPORT

Maxillary first molar with six canals

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In this case report, we present a maxillary first molar with six canals. A 40-year-old male patient was referred for non-surgical root canal therapy of tooth 16. Under magnification of a surgical operating microscope, a unique morphology with double canal systems in each root was identified. The morphology was characterized by a single palatal root with two canals joining in the apical third, two mesiobuccal canals, and two distobuccal canals with one orifice and two separate foramina.

Introduction

To ensure the long-term success of root canal treatment, it is essential to access, clean, and fill all of the canal spaces. However, the anatomic complexities and variations are constant challenges for successful endodontic therapy.¹

The morphology of the maxillary first molar has been extensively studied and reported in the literature. Studies have revealed a high incidence of double canal systems in the mesiobuccal root. It is generally accepted that four canals in the maxillary first molar should be regarded as the rule rather than the exception.² However, there are reports showing maxillary first molars with more than four canals. Pineda and Kuttler³ studied the radiographs of 262 maxillary first molars. The authors found a 3.6% incidence of two distobuccal canals, with no incidence of two canals in the palatal root.

In addition to morphologic studies, the presence of a double canal system in either the distobuccal or palatal root in maxillary first molars was documented in several case reports.³–⁸ Molars with two palatal canals with separate foramina were presented by Bond et al.³ and Harris⁶. Cecic et al.⁴ reported a case with a bifurcated canal system in the palatal root. Anatomic variations with two palatal roots were also reported.⁵, ⁶ A double canal system in the distobuccal roots was reported by Martinez-Berna and Ruiz-Badanelli⁸ and Hulsmann.⁷

This report presents endodontic treatment of an unusual maxillary first molar. The anatomic variation consisted of a double canal system in all three roots, which resulted in a total of six canals in a single tooth. There were two separate canal systems in the mesiobuccal root, and the distobuccal canal was bifurcated in the mid-root portion. In addition, the palatal root canal system was
Maxillary first molar with six canals

unique in that it contained two orifices and the canals joined in the mid-root portion.

Case presentation

A 40-year-old Chinese male was referred for root canal treatment of the right maxillary first molar. An emergency pulpectomy was carried out owing to symptoms of irreversible pulpitis. The patient had complained of pain of his right maxillary first molar for several days. The pain was intensified by thermal stimulation. The patient’s medical history was noncontributory.

A clinical examination revealed no swelling or sinus tract, and tooth 16 was the only one that was sensitive to percussion in the right upper quadrant. A preoperative radiographic examination showed the residual root of tooth 17, a deep composite restoration on tooth 16, distal caries on tooth 15, and sinus proximity of all three teeth. There were no periapical or furcal radiolucencies but great curvatures in the apical portions of the buccal roots of tooth 16 (Fig. 1). A diagnosis of irreversible pulpitis with acute apical periodontitis was made on tooth 16. Since tooth 15 responded normally to the electric pulp test, reversible pulpitis was diagnosed. After the diagnosis, the treatment plan was discussed with the patient. Endodontic treatment was initiated on tooth 16. Tooth 15 was referred for restoration, and tooth 17 was referred for extraction.

Local anesthesia was administered using 2% lidocaine with epinephrine (1:70,000). A rubber dam was applied. Upon access opening, four well-defined root canal orifices were located using a DG-16 explorer (Hu-Friedy, Chicago, IL, USA) on the pulpal floor, one orifice for each of the buccal roots and two separate orifices for the palatal root. The radiograph taken to determine the working lengths showed two independent palatal canals joining in the mid-root portion, and the distobuccal file was not in the center of the canal (Fig. 2A). After removing the dentinal lips around the mesiobuccal root, the mesiopalatal canal orifice was revealed under magnification of a dental operating microscope. In addition, a small hemorrhagic point was noted over the distal wall that was about 2 mm from the distobuccal canal orifice, and this was then confirmed as a distopalatal canal on the radiograph (Fig. 2B). Severe curvature in the apical third was identified when size 10K-files were used to negotiate the canals. The length was determined by both a radiograph and an electronic apex locator (Root ZX; Morita, Tokyo, Japan). The working lengths were: 21 mm for the mesiobuccal canal; 20.5 mm for the mesiopalatal canal; 20 mm for the distobuccal canal; 18 mm for the distopalatal canal; and 24 mm and 23.5 mm for the palatal canals. Biomechanical preparation was performed using the passive step-back technique with sizes 2 and 3 Gates Glidden burs (Mani Inc., Japan) in the cervical third of the root canals. The middle and apical thirds were instrumented with nickel-titanium (NiTi) rotary instruments (with a 0.04 tapered profile; Dentsply Maillefer, Ballaigues, Switzerland) and stainless steel K- and H-files. Sodium hypochlorite (2.5%) was used for irrigation. Calcium hydroxide was used as an inter-appointment dressing. After 2 months, tooth 16 became asymptomatic. The canals were dried with paper points and obturated with gutta-percha cones and Roth’s 801 sealer (Roth International, Chicago, IL, USA) using a lateral compaction technique (Fig. 3). The master cone sizes were 35 for the mesiobuccal, mesiopalatal and distobuccal canals, 30 for the distopalatal canal, and 40 for both palatal canals.

Fig. 1 Preoperative radiograph of tooth 16.

Fig. 2 (A) First working length radiograph showing two canals in the palatal root. (B) Second working length radiograph showing that both the mesiobuccal and distobuccal roots have two canals (arrowheads).
After canal preparation and enlargement, parts of the distobuccal and distopalatal canals were found to be connected. Tooth 16 was referred for crown restoration. The patient was asymptomatic at the 6-year recall. Tooth 16 had a metal crown restoration. Clinical examinations revealed no tenderness to percussion or palpation tests, and the periodontal probing depths of teeth 16 and 15 were within 3mm. The recall radiographs showed no periapical radiolucency on tooth 16 (Fig. 4).

**Discussion**

The feasibility of negotiating cases with an unusual morphology depends upon a thorough knowledge of the normal anatomy and an awareness of the existence of anomalies. Proper access opening is key to the success of identifying and negotiating root canals. The most common design of access preparation for maxillary molars is a triangle formed by the orifices of the two buccal canals and the palatal canal. However, in the present case, a more trapezoid form of access preparation was necessary for the inclusion of all of the canal orifices.

Another difficulty confronted in this case was the curvature presented in the apical portion of the root canals. Since two canals were contained in all roots, the thin canal walls of the mesiobuccal and distobuccal roots made root canal treatment even more difficult. Hand files, Gates Glidden burs, and rotary Ni-Ti instruments were used in combination to facilitate cleaning and shaping of the curved canals in this case.

The simultaneous occurrence of double canal systems in all roots of a maxillary molar is an unusual finding. However, it is important for clinicians to use all the armamentaria available to locate and treat the entire root canal system. If such anatomic variations are suspected, they may be recognized on radiographs taken at different angles, or by examining the pulp chamber floor with a sharp explorer, staining the chamber floor with 1% methylene blue dye, performing the sodium hypochlorite “champagne bubble” test, and visualizing canal bleeding points. All are important aids in locating root canal orifices. In addition, if the endodontic files are not well centered in the canal on the radiograph, the possibility of additional canals should always be considered. The use of magnification is also an aid in verifying the presence of morphologic variations. Although the occurrence of a second canal in the distobuccal and palatal roots is infrequent, it is important for clinicians to be aware of all possible anatomic variations for the success of the root canal therapy.
Maxillary first molar with six canals

References