Management of Maxillary First Molar with Six Canals Using Operating Microscope

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Abstract

The purpose of this article was to highlight the importance of having a thorough knowledge about the root canal morphology. This case report highlights the unusual anatomy of a maxillary first molar with three mesiobuccal (MB) canals, two palatal canals, and one distobuccal canal which is extremely rare. The use of operating microscope was crucial, both for the detection and for the management of the additional canals. The use of surgical operating microscope and digital radiograph showed that MB root had Type 3-1 of Gulabivala classification and palatal canal showed Vertucci’s Type II canal morphology. This report describes and discusses the identification of variation in canal morphology of maxillary first molar and the use of latest adjuncts in successfully diagnosing and negotiating them.

Keywords: Maxillary molar, operating microscope, three mesiobuccal canals, two palatal canals

Introduction

The goal of root canal treatment is to clean the root canal system as thoroughly as possible and to fill it in all its dimensions. In-depth knowledge of the root canal anatomy of each tooth is crucial to reach the goal.[¹]

Knowledge of internal morphology of the tooth has been a complex and essential for the successful planning and execution of endodontic therapy. The variations in the internal anatomy of the root canal system have contributed to endodontic treatment failures.[²]

Currently, technological advances have been developed, and different techniques have been introduced to facilitate the assessment of internal anatomic variations of root canals. For this purpose, operating microscope usage in daily clinical practice could potentialize and facilitate the localization and handling of additional canals as a result of lighter and significantly higher magnification of the field of view.[³,⁴] Magnification could, therefore, increase the detection of additional canals. Studies have shown that when the operator experience had been increased as a result of regular use of an operative microscope, the prevalence of detection of additional canals increased to 93%.[⁵]

The literature suggests the incidence of second mesiobuccal canals (MB2) in the range of 33%–96%. Even though the clinical detection of MB2 in maxillary molars has been lower than that of in vitro studies, the additional canals could be detected in <40% of maxillary first molars.[⁶]

The purpose of the present case report is to highlight the endodontic management of a rare case of a maxillary first molar with three roots and six canals and also to focus on the role of surgical operating microscope and Digital radiographs to ascertain root canal morphology.

Case Report

A 15-year-old male patient reported to the department of conservative dentistry and endodontics with a complaint of pain in the upper right back region of the jaw for 2 weeks.

On intraoral examination, the right maxillary first molar was carious. The patient’s medical and family history was noncontributory. Radiographic examination revealed dental caries involving enamel, dentin, and pulp. On the basis of clinical and radiographic examination, it was diagnosed as chronic apical periodontitis.

After extensive clinical and radiographic examination [Figure 1a], the maxillary
right first molar was prepared for endodontic therapy. The tooth was isolated with rubber dam, and a conventional endodontic access cavity was prepared.

Clinical evaluation of the internal anatomy revealed three principal root canal systems: MB, DB, and palatal. The access cavity was visualized under the operating microscope (Labomed Dental Microscope Prima DNT, USA). While floor of the pulp chamber was being explored with a DG 16 explorer (Dentsply-Maillefer, Ballaigues, Switzerland), a catch was felt between the line joining the MB2 and the palatal canals, more closely toward the MB2 canal. The presence of an extra root/root canal or a perforation was suspected. A number of 10 K-file (Mani Inc, Japan) was placed in the suspected canal, and a digital radiograph (Sopix, Satelec, Cedex, France) was taken at different horizontal angulations which confirmed the presence of the third MB canal. Clinically, a second palatal canal was suspected because of the eccentric position of the palatal orifice, which was confirmed with the help of digital radiographs [Figure 1b and c].

After negotiation of the six canals and initial exploration with hand files, working length was determined using digital radiograph [Figure 1d and e] and reconfirmed with an electronic apex locator. The canals were initially instrumented with number of 15 nickel–titanium (Ni-Ti) file under irrigation with 3% sodium hypochlorite and normal saline. All canals were cleaned and prepared under rubber dam isolation, using the rotary Pro taper Ni-Ti system (Dentsply-Maillefer, Ballaigues, Switzerland) with Glyde (Dentsply-Maillefer, Ballaigues, Switzerland) as lubricant. Final irrigation was performed with saline followed by root canal drying and placement of a calcium hydroxide root canal dressing (Calen, SS White, Rio de Janeiro, Brazil).

At the second visit, the tooth was asymptomatic and the canals were obturated with gutta-percha points and resin-based sealer (AH Plus, Dentsply-Maillefer, Ballaigues, Switzerland). Final radiograph was taken to evaluate the quality of the obturation [Figure 1f]. After completion of root canal treatment, the tooth was restored with silver amalgam followed by metal ceramic crown.

Discussion

The prevalence of additional root canals has been reported and discussed by several authors. With regard to variations in the number of canals, the most common occurrence in maxillary molars is the fourth canal in the MB root since this root tends to present an oval cross section, as mentioned by Pécora et al.\cite{7} and Baratto Filho et al.\cite{2} However, there may be a larger variation in the number of root canals, as described by Beatty,\cite{8} who reported a maxillary first molar with five root canals (three in the MB roots).

This case report highlights the unusual anatomy of a maxillary first molar with three MB canals, two palatal canals, and one DB canal which is extremely rare. The use of operating microscope was crucial both for the detection and for management of the additional canals.

Different methods of locating extra canals have been discussed by many authors:\cite{9-14}

1. Additional off-angle radiographs (at least three radiographs at varying horizontal angles)
2. Use of computed tomography (CT)
3. Use of magnification (loupes and dental operating microscopes)
4. Examine dentinal map minutely and use DG 16 to explore the floor of the pulp chamber
5. Look for hemorrhagic spots (indicate the presence of extra canals)
6. Perform champagne or bubble test with sodium hypochlorite
7. Staining the pulp chamber with dye (e.g., 1% methylene blue)
8. Use of ultrasonic tips, special round burs, and thin tapering finishing burs to remove a small amount of tooth structure or calcification and trough the line angles of the pulp chamber will help
9. Modify the conventional outline form to include the extra canals
10. Ensure adequate straight-line access to improve visibility.
Before initiating treatment, the dentist cannot precisely determine the actual number of root canals present. The varying morphology of the root canals is normally ascertained with radiographs of different angulations or careful examination of the floor of the pulp chamber.[15]

Furthermore, recent articles described the use of cone-beam (CB) or spiral CT scans as a valuable method for initial identification of the internal or external morphology.[16-18] Matherne et al.[12] compared the use of CBCT scans as a diagnostic tool for identifying root canal systems with images obtained by charge-coupled device and photostimulable phosphor plate digital radiography in vitro. They concluded that the evaluation of CBCT images always resulted in a greater number of root canal systems.[18]

In this case, however, we did not feel the need for any objective analytical tool, such as CT and spiral or helical CT, to ascertain root canal morphology, because there were no doubtful circumstances in either radiographs of different angulations or examination of the floor of the pulp chamber. Furthermore, such equipment may not always be present in routine clinical practice, and the patient can be exposed to unwarranted radiation.[19]

Baldfssari-Cruz et al. evaluated 39 maxillary molars in vitro and concluded that the surgical operating microscope did aid in the identification of mesiolingual canal orifices. In their study, they detected mesiolingual canals in 20 teeth with unaided vision, but the presence of mesiolingual canals was located in additional 12 teeth using the surgical operating microscope.[20]

In this case, we used the surgical operating microscope for better visualization of the complex root canal system and with the confirmation of the additional canals using digital radiography with different angles, and we found six root canals, namely MB₁, MB₂, MB₃, DB, mesiopalatal, and distopalatal.[21] MB root showed Type 3-1 of Gulabivala classification, and palatal canal showed Vertucci’s Type II canal morphology.[22] CBCT depicts the three-dimensional radiographic view of the definite canal anatomy. At the same time, digital radiographs with different horizontal angulations also offer constructive information confirming the canal configuration along with comparatively minimal radiation dose.[21]

In this case, the canals were obturated using lateral condensation technique in an effective manner. However, various other obturation techniques such as warm vertical compaction and thermoplasticized obturation technique may equate or improve the outcome.[24,25]

Therefore, a thorough knowledge of root and root canal morphology and a good anticipation of their possible morphologic variations are essential and will help to reduce endodontic failure caused by incomplete root canal preparation and obturation.

Conclusion
This case report discusses the endodontic management of an unusual case of a maxillary first molar with three roots and six canals and also highlights the role of surgical operating microscope and digital radiographs to ascertain root canal morphology.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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