Anatomic variation of mandibular first molar and the importance of effective cleaning: A case report

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ABSTRACT

Introduction: Literature relates many classic case reports about anatomic variations of mandibular molars. However, few recent reports have shown treatments of mandibular permanent first molars in according to the current Endodontics view. **Objective:** This study aims to report endodontic treatment of a mandibular first molar presenting five root canals emphasizing the importance of an efficient decontamination. **Clinical case:** The endodontic treatment was performed through chamber access followed by localization and exploration of the root canals. Three canals in the mesial root and two in the distal root were noted. Following that, chemical and mechanical preparations were made with rotary and manual files, copiously irrigated with sodium hypochlorite 2.5% throughout all instrumentation. The obturation was made using the Hybrid Tagger technique and the definitive restoration was completed one week later. **Conclusion:** Knowledge of root canal system anatomy of mandibular first molars aggregates information in this area, as it will help dental professionals more successfully attempt endodontic treatment.

Keywords: Models. Anatomic. Molar. Root canal therapy.

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Introduction

The main etiology of failure in endodontic treatment of molars is the partial removal of pulpal tissue of root canal systems, the infection of the remaining tissue and the consequent long-term failure.[1,2] To be successful, it is necessary to clean and shape the root canals completely and fill the total area with an inert material.[3,4]

A morphological study of root canals is of extreme importance to effective endodontic treatment, and much attention must be paid to their internal anatomy. In addition, to achieve success in endodontic treatments, the number, localization, shape and direction of root conducts must be considered.[3,4,5] With the advent of surgical microscopes, the detection of additional root canals has increased and provided higher pre-visibility to the treatment area, since the complexity of root canal systems is the greatest challenge to the endodontist from both a technical and a microbiological point of view.[4]

The first permanent mandibular molars generally present two roots containing two canals on the mesial root and one canal on the distal one. Occasionally, however, they may present a third canal on the mesial root, localized between the mesiovestibular and mesiolingual canal, which deserve special attention during the exploration of the pulp chamber before beginning endodontic treatment.[4,6,7,8] The incidence of this third canal on the mesial root varies from 1% to 15% according to some studies.[9] This third canal may be independent with an individual foramen, or may connect to the apical region with the mesiovestibular or mesiolingual canals.[1,9,10,11]

Another very common anatomic variation on these molars is the presence of an isthmus on the mesial root, a narrow slit between the buccal and lingual canals of this root, which makes access of the endodontic instruments and auxiliary chemical substances more difficult, and maintains microorganisms and residual tissues in this region.[12] The prevalence of an isthmus on the mesial root of first mandibular molars varies from 54% to 89%, and they are localized mainly on medium and apical thirds of the root.[13,14]

There are many recent reports in the literature of notable anatomic variations in third molars, first maxillary molars and second mandibular premolars,[7,15,16,17] however, few recent reports have shown cases of treatment of mandibular permanent first molars with five canals, with three in the mesial root, as in the current thought of Endodontics.[18-24]

Regarding the high incidence of anatomic variations, with the presence of additional root canals and isthmus in these teeth, the importance of an appropriate treatment is critical for successful outcomes in these cases. Thus, this paper aims to report and describe the successful endodontic treatment of a mandibular first molar presenting five root canals.

Case report

An 18-year-old male patient came to the Course of Actualization in Endodontics of Brazilian Dentistry Association of Alagoas, Brazil, complaining of spontaneous and acute pain on tooth #46. At radiographic examination (Fig 1), an extensive caries lesion and a slight enlargement of periodontal ligament space was noticed. Cold-test (Endo-Frost, Roeko, Germany), percussion (horizontal and vertical) and palpation tests were performed, allowing the diagnoses confirmation of symptomatic irreversible pulpits.

The treatment designed was a biopulpectomy. Treatment was initiated with local anesthesia using mepivacaine 2% and epinephrine 1:100.000 (DFL, Rio de Janeiro, Brazil), followed by the removal of all decayed tissue and creation of access to the pulp chamber. After this, a rubber dam was put in place, the operatory field was disinfected and the entrance

Figure 1. Initial radiography.

of the root canals was searched. First, four conducts (two at the mesial root and two at the distal root) were found with the use of manual exploration and a manual K file #10 (Maillefer Dentsply, Switzerland). At this time, the presence of a groove was noted, continuing in the center of the region between the mesiobuccal and mesiolingual canals. The groove contained a dentin of different coloration compared with the floor of the pulp chamber. Next, a #10 K file (Maillefer Dentsply, Switzerland) was inserted in this region, which suggested a possible presence of more than one canal on the mesial root, that was situated in the mesiomedian or mesiocentral canal (Fig 2). To improve the certainty of the diagnosis, the region was examined with a clinical microscope (Opto Eletrônica S.A., São Carlos, Brazil), which confirmed this finding.

All the root canals were explored with #10 K files (Maillefer Dentsply, Switzerland) and Odontometry was performed using an electronic apical localization Root ZX (Morita, Tokyo, Japan). Then chemical mechanical preparation was initiated in crown-down direction working with a hybrid technique that combined the use of a rotary sequence with the ProTaper system (Dentsply, Catanduva, Brazil) and manual files (Maillefer Dentsply, Switzerland). During all the instrumentation, the canals were profusely irrigated with 2.5% sodium hypochlorite. After the instrumentation, the canals were filled using the Tagger hybrid technique (Fig 3), employing gutta-percha and AH PLUS cement (Dentsply, Catanduva, Brazil) (Fig 4 and 5) and the tooth was temporarily restored with glass ionomer cement (Vidrion, SS White, Rio de Janeiro, Brazil). This was done because making a restoration with a resin composite during the same visit might have damaged the adhesion property due to the interference produced by the sodium hypochlorite solution 2.5%. After one week of endodontic treatment, the tooth was permanently restored with 37% phosphoric acid conditioning for 15 seconds, Single Bond 3M application (3M Dental Products, St Paul, USA) and restoration with resin composite Z 250 (3M Dental Products, St Paul, USA). The patient gave formal consent to the disclosure of this case report.

Discussion

The anatomy of root canal system of mandibular first molars presents many complexities. It is extremely important to achieve an optimal cleaning and shaping

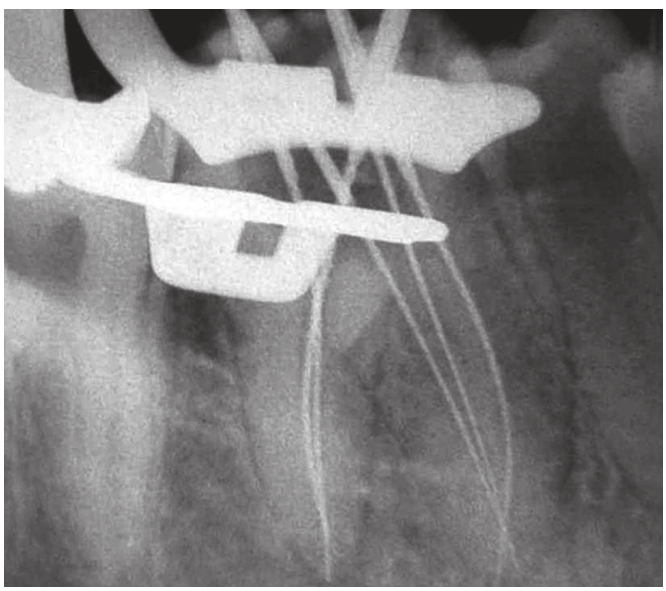

Figure 2. Odontometry evidencing the presence of three canals on mesial root.

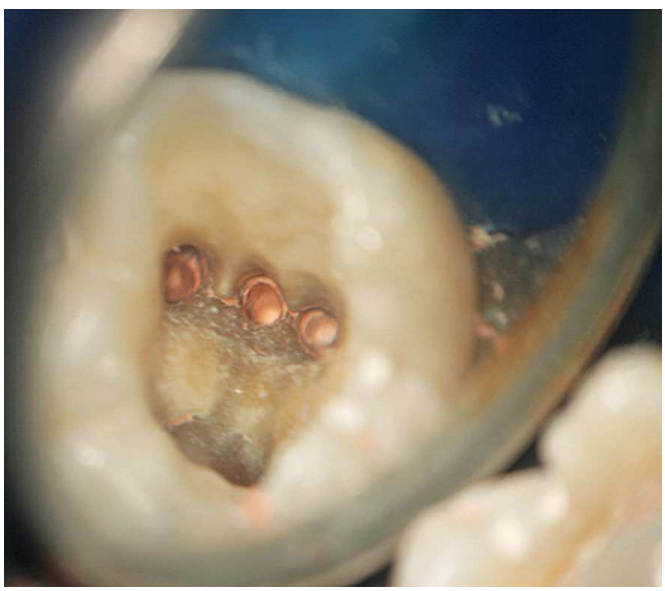

Figure 3. Mesial root with three root canals seen through a microscope with a 20X magnification.

Figure 4. Final radiography evidencing obturation of the mesial root isthmus.

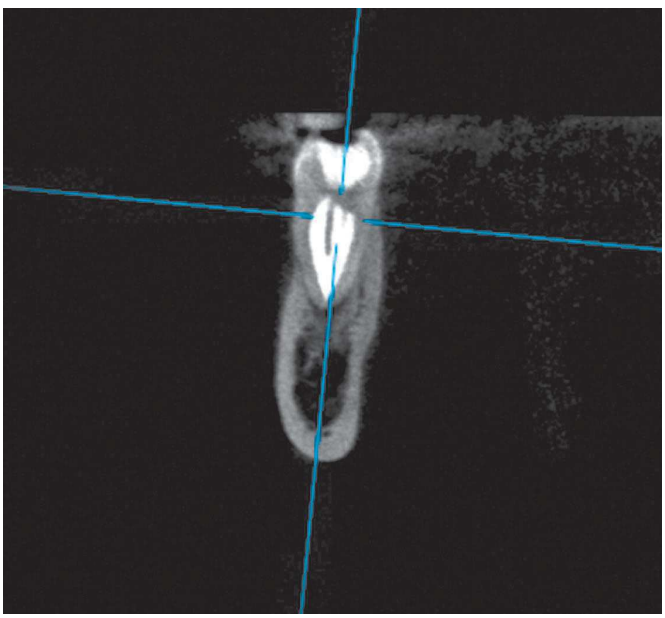

Figure 5. Tomography image evidencing isthmus filling.

of these canals to achieve successful endodontic treatment.[26] As a result, before beginning the treatment, the dental professional should have knowledge of the morphology of the pulp chamber and root canals, as well as any possible variations the tooth may present.[4,10,27] Many cases in the literature have reported anatomic variations in mandibular first molars and the presence of a third canal at the mesial root occurs with an incidence from 1% to 15%.[9] This additional canal may vary at its apical ending and may occur independently or join itself to the mesiobuccal or mesiolingual canals in different thirds of the root.[4] When this is the case, the tooth presents three canals at the mesial root, which are join at the apical third in a unique foramen. The confluence of the three canals in a unique foramen is the most common anatomic finding, as compared to the presence of three distinct apical foramen.[11,28]

The localization of the canals may be facilitated through the use of magnification and illumination sources. Operatory microscopes have been employed more frequently as an essential tool to discover additional canals, because they provide better visualization and perception of the color variations between the floor and the entrance of the root canals.[29] In this case, a microscope was used throughout the entire treatment, which contributed greatly to its success.

In addition to localizing any additional root canals, the correct cleaning of the entire root canal system is of great importance. For this, knowledge of the anatomy of each root and the use of efficient irrigation is indispensable. It is known that the mesial root of mandibular first molars is flattened in the mesiodistal direction and there is a high incidence of this in the presence of an isthmus. For this reason, the cleansing of this region is a challenge in endodontic treatment of root canal systems.[12] The final radiograph and the computed tomography showed that the entire isthmus region was filled with the obturation material, confirming that the area had been correctly cleaned, thanks to the instrumentation and chemical substances, all of which contributed to the success of the endodontic treatment.

Regarding the high frequency of reports in the literature about anatomic variations in mandibular molars, to ensure the success of endodontic therapy, clinics should pay special attention to the floor of the pulp chamber in attempting to find possible additional canals. Even though this case report has shown one of the most common anatomic variations of this tooth, it is important to emphasize that the analysis of the final radiography demonstrated a total filling of the three canals by the obturation material creating the unique canal shown in the radiographic image (Fig 4). This fact may be explained by the presence of an isthmus between the root canals, and it demonstrates the importance of performing an efficient cleaning and hermetic and tridimensional obturation of the canal root system.

This allows the complete filling and closure of the regions when this has not been achieved by the endodontic files during the chemical and mechanical preparation.

Conclusion

Knowledge of the anatomy of mandibular first molar root canal systems is associated with an efficient and hermetic instrumentation and tridimensional obturation, which allows sealing of possible retention areas for microorganisms such as the isthmus, are essential factors in achieving successful endodontic treatment. Furthermore, employing mechanisms that contribute to the accuracy of the diagnosis, such the operatory microscope, may add greatly to the success of the treatment.

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