Middle mesial canal in mandibular molars: follow-up of a clinical case by means of computed tomography

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ABSTRACT

Introduction: The location and cleaning of the middle mesial canal (MM canal) is important for the successful endodontic treatment in mandibular molars. **Objective:** The aim was to evaluate the endodontic retreatment of a mandibular molar presenting MM canal, which was monitored by clinical, radiographic and tomographic assessments. **Clinical case:** Patient with previous satisfactory endodontic treatment in tooth 36 presented fistula, periodontal pocket and furcation lesion next to mesial root. Retreatment was performed by using ultrasound device with straight edge for removal of filling material and for irrigation, oscillatory instrumentation (Reciproc) and operating microscope, which allowed the location and cleaning of the MM canal. Intracanal medication of calcium hydroxide was exchanged for three months and the canals were filled by Tagger Hybrid technique. After 17 months of follow-up the tooth presented radiographic and tomographic images compatible with bone formation and absence of signs and pathological symptoms. **Conclusion:** The operating microscope and computed tomography are tools that should be used routinely by endodontists to detect structures such as MM canals in the mandibular molars, which are difficult to find through conventional clinical examination. In addition, the use of activated irrigation by ultrasound device was essential for the location and cleaning of the MM canal.

Keywords: Cone-Beam Computed Tomography. Molar. Root canal preparation.

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Introduction

Mandibular molars are the most susceptible teeth to endodontic treatment, because they are among the first permanent teeth to erupt and those most affected by caries.[1] Usually mandibular molars have a mesial root with two canals and a distal root with one or two canals.[2] However, the morphology of the mesial root of mandibular molars may be more complex, frequently presenting isthmus, anastomoses[3] and the existence of more than two canals in up to 15% of the cases.[4,5]

The presence of a third canal between the mesiobuccal and mesiolingual canals, which is called middle mesial (MM) or mesial-central canal, typically ranges from 1% to 15%,[6,7] with a prevalence of 32.1% in patients under 20 years-old[1] and of 50% in patients between 20 and 39 years-old.[8,9] Middle mesial canal is classified into three types: 1- fin (when it is attached to one of the other two canals of the mesial root); 2- confluent (when it presents a separated orifice, and converges to one of the other canals at the apical region) and 3- independent (when it presents isolated orifice and foramen).[7]

The location and cleaning of the MM canal is very important for the successful endodontic treatment in mandibular molars. For this purpose, it is necessary an accurate knowledge of the root canal complex anatomy, specifically in the mesial root, besides the use of efficient irrigation solutions, instrumentation and proper magnification and illumination.[10] Operating microscopes are very effective in the clinical practice and improve the ability to detect this canal, which is not always visible without magnification.[11,12]

The aim of this paper was to evaluate the endodontic retreatment of a mandibular molar presenting MM canal, which was monitored by clinical, radiographic and tomographic assessments.

Case report

An 29-year-old male patient sought for treatment in a private practice (specialized endodontic service, Uberlândia, Minas Gerais, Brazil), presenting as clinical signs and symptoms in the left lower first molar (#36), presence of fistula and periodontal pocket of 3.0 mm in the furcal region, absence of spontaneous painful symptoms and mobility, and small sensitivity to vertical and horizontal percussion. In the digital radiographic examination (radiographic equipment: Spectro 70X; Dabi Altlante, Ribeirão Preto, SP, Brazil, associated to digital sensor: CDR 2000; Schick Technologies Inc., Long Island City, NY, USA), previous and satisfactory endodontic treatment was verified. However, the presence of a radiolucent area at the furcation with small apical diffuse lesion was detected in the mesial root. In addition, periodontal membrane thickening at the mesial and distal roots and lack of integrity of the lamina dura in the apical portion of the root was also observed (Fig 1A). Cone beam computed tomography examination (Pro Max 3D, Planmeca USA Inc., Illinois, USA) was conducted, and a hypodense image was verified in the distal surface of the mesial root, extending to the furcal region, suggesting an inflammatory lesion as observed in the sagittal tomographic section (Fig 1B). The patient reported that the endodontic treatment was performed four years earlier and remained with temporary restoration for two years after canal filling. The probable diagnosis was chronic apical periodontitis and the treatment of choice was the nonsurgical endodontic retreatment.

After coronal opening, the gutta-percha was removed from the root canals with ultrasonic device (Enac OE-w10 assistance, Osada, Los Angeles, USA) with thin smooth intracanal tip (TU14, Trinity Ind. e Com. Ltda., Sao Paulo, Brazil). Three canals, two at the mesial root and one at distal, were initially located and instrumented with the hand Kerr files (Dentsply Maillefer, Ballaigues, Switzerland) and Reciproc files (VDW, Munchen, Germany) R25 (in the mesial) and R50 (in the distal). Intracanal medication was performed with PA calcium hydroxide (Biodynamic, Ibiraporã, Brazil) associated to physiological saline between the clinical sessions for three months.

Canals were irrigated with sodium hypochlorite 2.5% (Pharma Ind. Pharmaceutical Inc., Serrana, Brazil) in all sessions and in the final irrigation, before filling, the solution was stirred with the aid of ultrasound device (Enac OE-w10, Osada) using thin smooth tip (TU14-Trinity). Twenty seconds sonication was performed on each canal, three times with vibration intensities of 2 or 3, avoiding contacting the walls.[13] Then, the canals were dried with paper points (Dentsply Maillefer) and at this time, a purulent secretion was noted in the mesial canals. The existence of a third mesial canal (middle mesial canal - MM) was later confirmed (Fig 2A) with the aid of an operating microscope (MC12 model, DFV, D. F. Vasconcelos, Valença, RJ, Brazil) and digital radiography. A new odontometry was made (Fig 2B) and the canal was instrumented with R25 Reciproc file (VDW). The MM canal had its own entrance between the mesial canals converging the mesiolingual canal in the apical

region (type 2 – confluent). The filling was performed using Tagger Hybrid technique[14] using accessory cone FM (Injecta, São Bernardo do Campo, Brazil), zinc oxide eugenol-based sealer (Endofill, Dentsply Maillefer) and McSpadden compactor #40 (Dentsply Maillefer). The orifice of the root canal was sealed with provisional restorative material (Coltosol, Vigodent, Rio de Janeiro, Brazil) and the tooth was provisionally filled with zinc oxide eugenol cement (IRM, Dentsply).

In the proservation session, carried out seventeen months after the endodontic retreatment, the patient showed absence of painful symptoms, as well as no fistula or periodontal pockets in the furcation region. In the radiographic examination, the tooth had no radiolucency in the furcation and periapex areas (Fig 3A). Bone formation was confirmed in the furcation region by cone beam computed tomography (Fig 3B - yellow arrow and Fig 4B), made with the same equipment used for the first tomography.

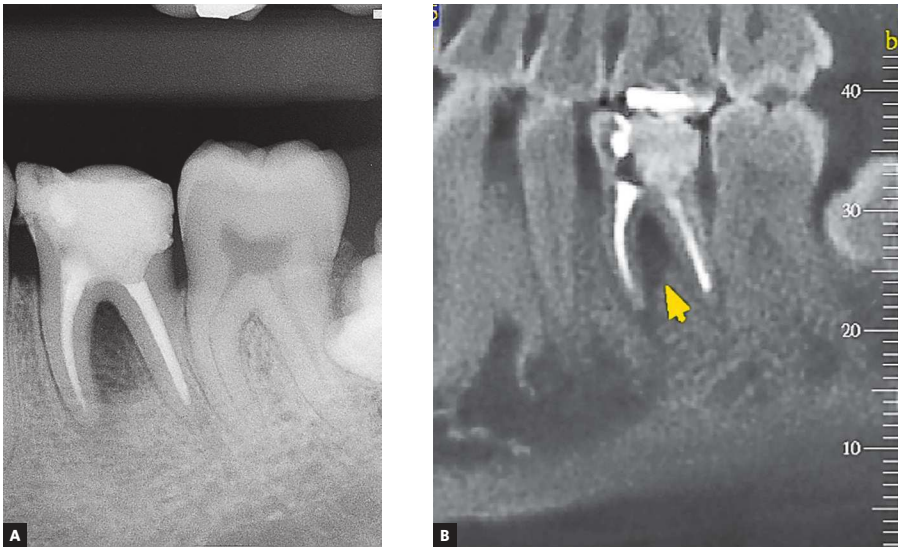

Figure 1. Periapical radiograph (**A**); Sagittal tomographic section (**B**).

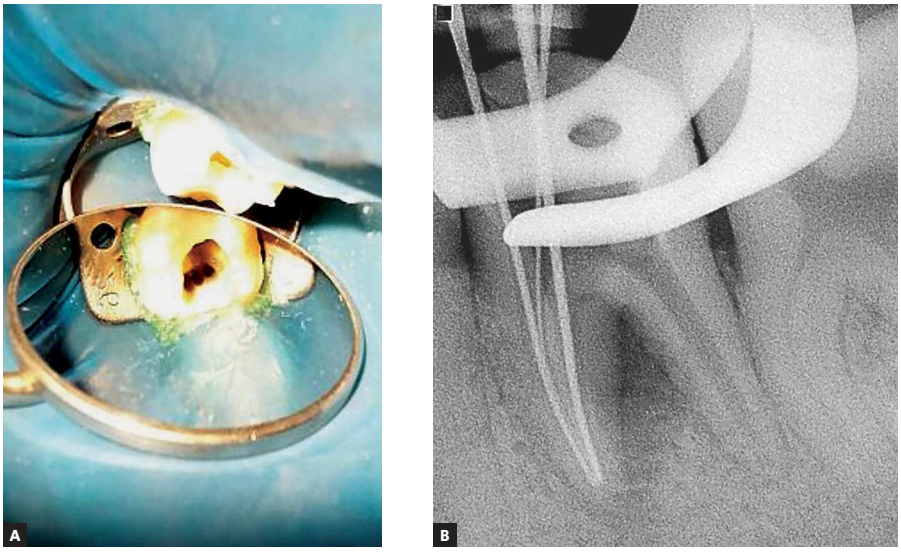

Figure 2. Middle mesial canal presence, at clinical exam (**A**) and in odontometry radiography (**B**).

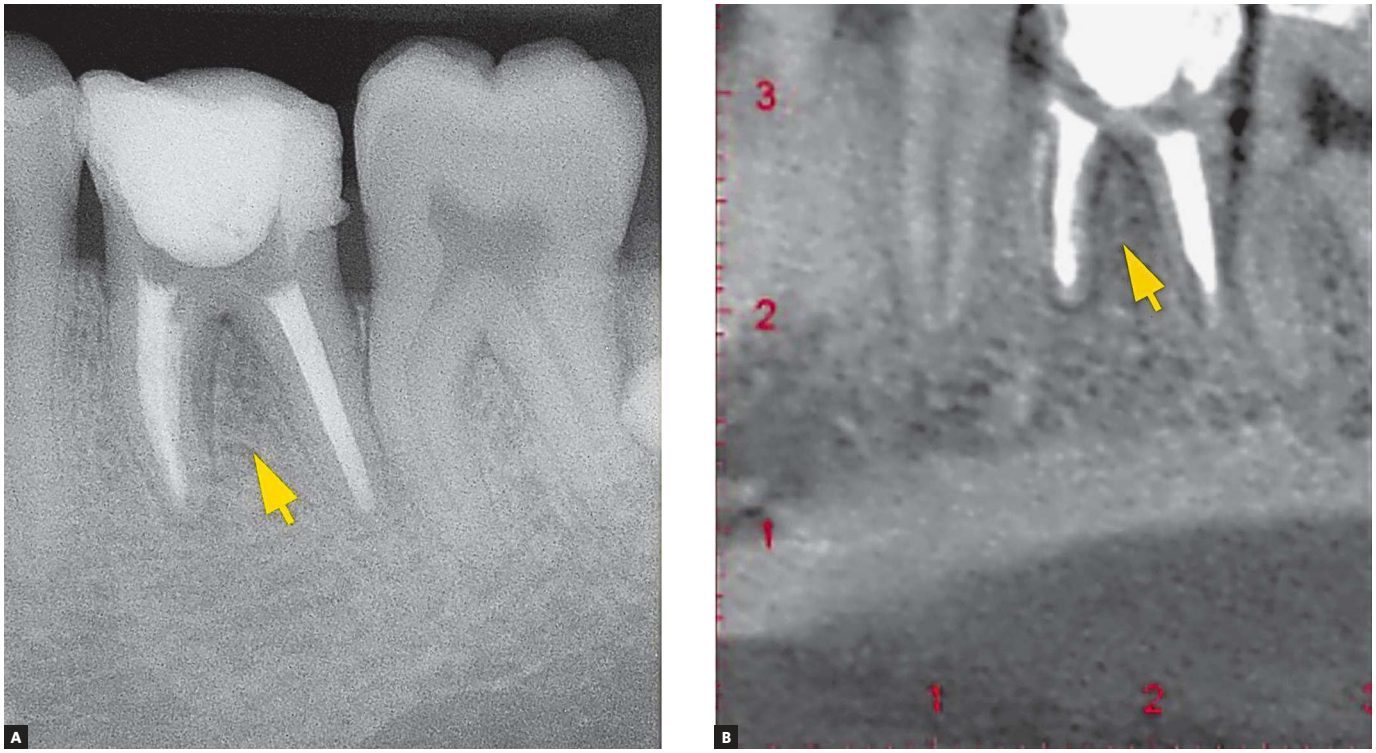

Figure 3. Follow-up: periapical radiographic (**A**) and sagittal tomographic section (**B**) taken 17 months after filling.

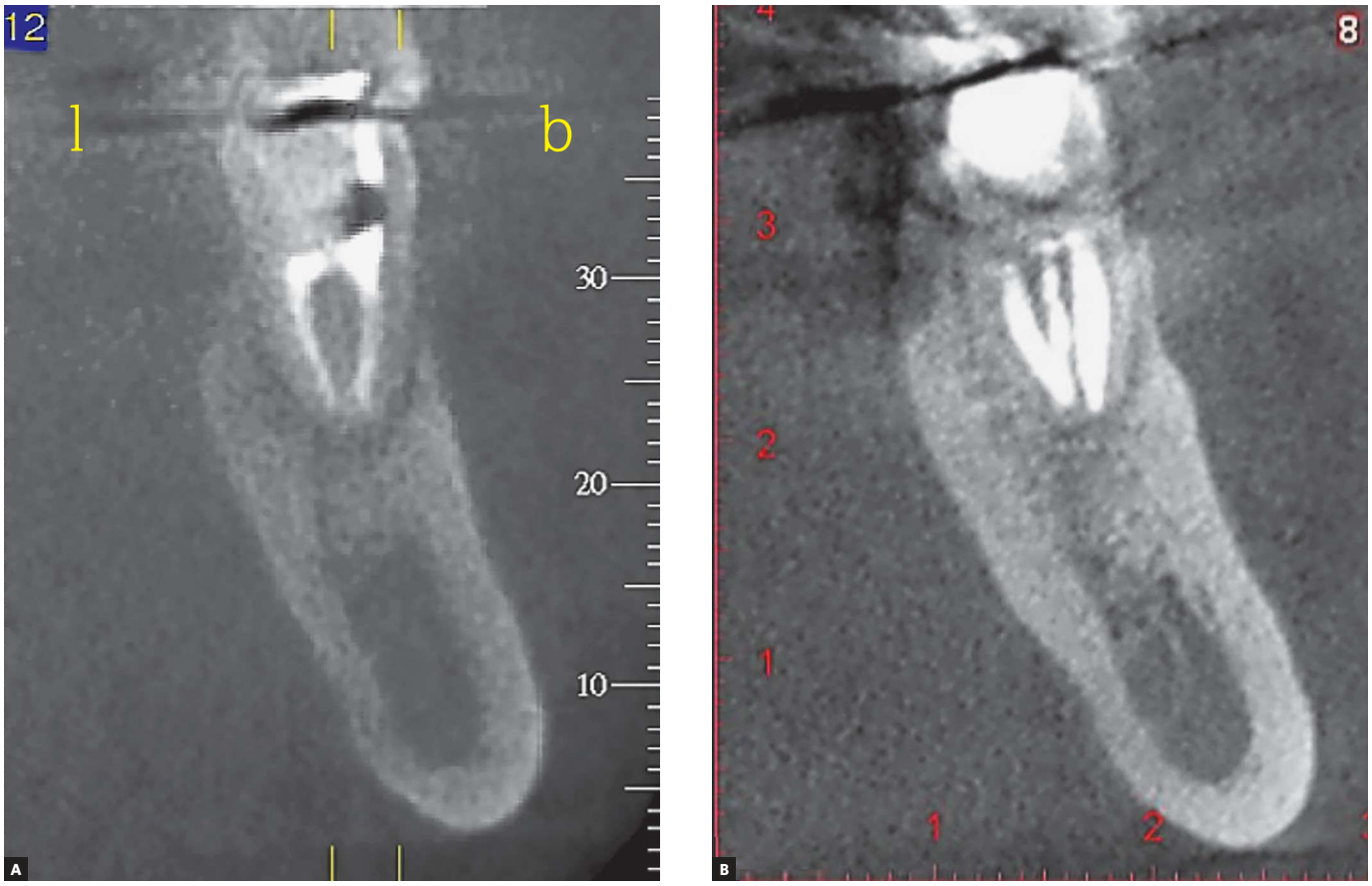

Figure 4. Middle mesial canal in sagittal tomography sections, before (**A**) and after the retreatment (**B**). (l- lingual; b- bucal).

Discussion

The presence of MM canal in mandibular molars is a hypothesis to be taken into account for the cases in which failures in the endodontic treatment may occur without any apparent cause. In the case reported, the tooth had satisfactory previous endodontic treatment at both clinical and computed tomography examinations. Initially, we suspected that coronal leakage of the restoration could be the main cause of the lesion at the furcation area and the distal regions of the mesial root. Only after canal retreatment, bone formation was observed during patient follow-up sessions and then, we found that the failure of the first endodontic treatment occurred due to not-location, cleaning and filling of the MM canal.

The MM canal is not visible without the magnification of operating microscopes in most cases. Also, it may be not detected in the first clinical session,[15] as shown in the present case report, in which the MM canal was found only after a few sessions. Matos et al.[16] studied the number and configuration of canals in the mandibular first molars by four different methods: periapical radiography, clinical examination after coronary opening and use of operating microscopes before and after removal of the crown. The authors found that the number of canals increased to four or five in the mandibular molars when observed with the operating microscope, because this equipment enabled the identification of atresic and calcified canals not seen by traditional clinical examination.[16]

In addition to the operating microscope, a magnifying glass,[17] root canal explorer,[18] fine files and tips attached to ultrasound[12] are usefull to inspect the pulp chamber, remove small debris from gutta-percha into the recesses of the walls of the chamber and locating the entrance of the MM canal. After the complete removal of the pulp chamber in the crown opening, the floor of the chamber must be examined thoroughly, seeking for the canals entrance and isthmus. Isthmus between the mesiobuccal and mesiolingual canals are frequent and must be observed, since they are present in 88.5% of cases in which failures occurred in the endodontic treatment, besides it is a region with high incidence of MM canal.[19] Nosrat et al.[1] located the MM canal with the aid of the microscope, using files and endodontic explorers performing clock winding movement and light apical pressure. Very few cases reported the location of this canal without the use of special instruments or microscope.[4]

In the case reported, the use of the operating microscope and ultrasonic device with straight and fine tip with abundant irrigation of sodium hypochlorite in the mesial root canals were essential for accessing the MM canal. The irrigation solution associated with the ultrasound device removes more dentin debris, bacteria and pulp tissue from the root canal system and the gutta-percha remains in the canal walls compared with a syringe irrigation.[20] The ultrasonic tip must be placed in the center of the root canal to avoid contact with the root walls and thus vibrate freely in order to transfer their energy to the irrigating solution through the canal.[20]

The radiographic images are important during all phases of the endodontic treatment, and the intraoral periapical radiographs are the most commonly option used by endodontists.[16] Sung-Ho et al.[18] managed to locate the MM canal after observing the cone proof radiograph, indicating that the mesial root seemed to have another apex. However, despite the large applications of periapical radiographs, they provide limited information and do not reveal all details contained in tridimensional structures.[21] The computed tomography (CT) overcome this limitation by producing images in three orthogonal planes (axial, sagittal and coronal), which allow a comprehensive assessment of the anatomy and spatial relationship of anatomic structures.[22] Also, CT are able to provide higher resolution images delivering better diagnostic quality with high dimensional accuracy and lower exposure to radiation, when compared to periapical radiographs taken of the whole mouth.[23] CT examinations can be used to detect the extension of injuries, to find out if they are from endodontic origin[24] and to locate accessory canals.[12,25] Digital radiographs are not an efficient method for identification of accessory canals in the mesial root of mandibular molars, even when they are taken in different angulations.[12]

Some of the limitations of tomography are: the effective dose of cone beam computed tomography scans is higher than periapical and panoramic radiography, the scan time devices can be is longer than 20 s and, thus, it is significantly longer compared with that of an intra-oral radiograph (<0.3 s). Besides that, the slightest movement of a patient during the scan may render the resulting reconstructed images of minimal diagnostic use. Metal restorations, metal posts and root fillings, and adjacent dental implants typically cause artefacts to the reconstructed images.[22]

In the present clinical report, the use of cone beam computed tomography was efficient to determine the size and location of the lesion before retreatment and to preserve the treatment, evidencing even bone formation. After canal retreatment, CT allowed to confirm that a confluent MM canal was present, with a separate orifice, converging to the mesiolingual canal at the apical region. Importantly, the MM canal was not noticed by the technician that performed the first computed tomography exam, although it can be verified in the image. Its presence was only noticed by the endodontist in this image after it was used for comparisons with the new exams retreatment. With this, we reaffirm the importance of the use and careful analysis of cone beam computed tomography images for planning and monitoring the endodontic treatment/retreatment.

Conclusion

The location, cleaning and filling of all root canals is critical to the success of endodontic treatment. The operating microscopes and computed tomography are tools that should be used routinely by endodontists to detect structures such as MM canals in the mandibular molars, which are difficult to find through conventional clinical examination. Also, the use of irrigation activated by ultrasound device was essential for the location and cleaning of the MM canal in the present case report.

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