Revista Portuguesa de Estomatologia, Medicina Dentária e Cirurgia Maxilofacial

REV PORT ESTOMATOL MED DENT CIR MAXILOFAC. 2019;60(3):137-144

Case report

Endodontic treatment of the mandibular first molar with three distal root canals – Case series

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ARTICLE INFO

Article history:
Received 24 July 2019
Accepted 7 September 2019
Available online 30 September 2019

Keywords:
Anatomy
Endodontics
Molar
Morphology
Root canal therapy

ABSTRACT

The mandibular first molars may present several anatomic configurations, with the most prevalent being the presence of two roots and three root canals. Although the incidence of three root canals in the distal root is an uncommon occurrence, it must be considered. The present study reports two cases of non-surgical endodontic retreatment and one case of non-surgical endodontic treatment of mandibular first molars with three distal root canals. A meticulous analysis of the pulp chamber floor, using the dental operating microscope, showed unexpected root canals. Untreated canals that are missed during endodontic procedures are one possible cause for treatment failure. Misinterpretation of the complexity of the internal anatomy of a tooth subjected to endodontic treatment may lead to suboptimal chemo-mechanical debridement, risking the success of the therapy. (Rev Port Estomatol Med Dent Cir Maxilofac. 2019;60(3):137-144)

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http://doi.org/10.24873/j.rpemd.2019.09.453

Tratamento endodôntico de primeiro molar inferior com três canais radiculares distais – série de casos

Palavras-chave:
Anatomia
Endodontia
Molar
Morfologia
Tratamento endodôntico

RESUMO

O primeiro molar inferior pode apresentar várias configurações anatómicas, sendo a mais prevalente a presença de duas raízes com três canais radiculares. Apesar da incidência de três canais radiculares na raiz distal ser baixa, deve ser tida em consideração. Neste trabalho apresentamos o relato de dois casos clínicos de retratamento endodôntico não cirúrgico e um caso de tratamento endodôntico não cirúrgico de primeiros molares inferiores com três canais radiculares distais. Uma análise meticulosa do pavimento da câmara pulpar, com o auxílio do microscópio ótico, revelou a existência de canais inesperados. Canais radiculares não detetados durante os procedimentos endodônticos são uma das possíveis causas do fracasso do tratamento endodôntico. Uma má avaliação e interpretação da anatomia interna de um dente submetido a tratamento endodôntico pode levar a uma desinfeção e instrumentação deficitárias, pondo em risco o sucesso da terapia. (Rev Port Estomatol Med Dent Cir Maxilofac. 2019;60(3):137-144)

Introduction

The main goal of root canal therapy is to perform mechanical debridement and chemical disinfection of the root canal space, followed by root canal filling, which will ensure a good long-term prognosis of the treatment.[1] To achieve this objective, a good understanding of the root canal anatomy is mandatory.

The mandibular first molar anatomy has been the subject of several studies.[2,3,4] The most common anatomical configuration of this tooth is two roots and three root canals.[2] However, several other morphologies have been reported. Variations of the number of roots include *radix paramolaris*, *radix entomolaris* and root fusion.[5] The number of root canals may vary both in number and configuration.[2] An uncommon root canal configuration is the presence of three root canals in the distal root of the mandibular first molar. This clinical condition has been documented in very few case reports[6,7] and may present a prevalence as low as 0.2%.[7] The misinterpretation of the individual tooth morphology may lead to treatment failure.[8]

The purpose of this work is to present three cases of endodontic treatment of mandibular first molars with three root canals in the distal root.

Case reports

General clinical procedures

The reported cases were referred for treatment in private clinics in the area of Lisbon. After clinical evaluation, a diagnosis was established, the condition was explained to the patients and the treatment options were proposed. The patients signed an informed consent form before initiating the treatment.

All the teeth were anesthetized with a mandibular block infiltration using 1.8 ml of 4% articaine with 1:200,000 epinephrine (Artinibsa, Inibsa, Spain), and rubber dam isolation was established. A proper access cavity was obtained, and the pulp chamber floor anatomy was inspected through a dental operating microscope (Opmi Pico, Carl Zeiss Surgical, Germany). After being identified, all the root canal orifices were negotiated until the working length with a stainless-steel ISO size.10 hand file (Dentsply Maillefer, Switzerland). In the retreatment cases, Eucalyptol was used as a solvent. The working length was determined with an electronic apex locator (Root Zx II, Morita, USA) and confirmed radiographically. A manual glide path was performed with stainless steel ISO size.15 hand files (Dentsply Maillefer, Switzerland). The mechanical instrumentation was performed in all cases with NiTi rotary files ProTaper Universal (Dentsply Maillefer, Switzerland), following the instructions of the manufacturer. All instrumentation was performed under continuous and abundant syringe irrigation with 5.25% sodium hypochlorite at room temperature, with a side-vented Monoject 27G needle (Covidien, Mansfield, USA).

All treatments required two appointments. A calcium hydroxide dressing (Ultracal, Ultradent, USA) was used between appointments, and Cavit (Cavit W, 3M ESPE, Germany) was used as a provisional restoration.

In the second visit, a final irrigation protocol, which included rinses with 17% EDTA, 5.25% sodium hypochlorite and alcohol, was performed. The canals were dried with paper points, and root canal filling was completed with Zipperer gutta-percha cones (VDW, Munich, Germany) and sealer (AH Plus, Dentsply, Germany), using the continuous wave of condensation technique. The downpack was accomplished with a System B unit (System B, Sybron Endo, USA) and the backfill with an Obtura II unit (Obtura II, Obtura Spartan, USA). After canal obturation, the pulp chambers were cleaned with alco-

hol. The canals orifices were sealed with flowable composite resin. The access cavities were temporarily restored, and the patients were referred for coronal rehabilitation.

Case #1

A 34-year-old female presented for endodontic evaluation of her mandibular left first molar (tooth 46). The patient's chief complaint was feeling pain when chewing. Her medical history was noncontributory. Clinical and radiographic examination revealed a large and deep filling and previous endodontic therapy (Figure 1). The periodontal ligament space was wider than in normal conditions. Tooth mobility was within physiological limits, and there were no periodontal pockets. Tooth 46 was tender to percussion, but not the adjacent teeth, which also responded normally to the ice sensibility test. The diagnosis of previous endodontic treatment with symptomatic apical periodontitis on tooth 46 was established. Endodontic therapy was proposed and accepted by the patient.

After proper anesthesia and rubber dam isolation, the access cavity was performed. During the exploration of the pulp chamber floor with a DG16 Endo Explorer, three main root canals (two mesial and one distal) with gutta-percha filling were found, and a careful analysis of the area surrounding the distal canal revealed two untreated canals in the distal root (distobuccal and distolingual root canals) (Figure 2). The three root canals had three distinct root canal orifices but merged together in the apical area, presenting a Gulabivala Type 9 (3-1) configuration. After root canal negotiation and working length measurement, rotary instrumentation was performed to an F2 ProTaper file. The root canals were disinfected, and a calcium hydroxide dressing was used between visits. In the second visit, a new disinfection protocol was performed, and the root canal obturation was completed (Figures 3, 4 and 5). The 19-month follow-up showed no clinical or radiographic pathological findings (Figure 6).

Case #2

A 36-year-old male patient came to an emergency visit with a chief complaint of feeling permanent pain that increased when chewing with the mandibular right first molar (tooth

Figure 1. Pre-operative radiograph

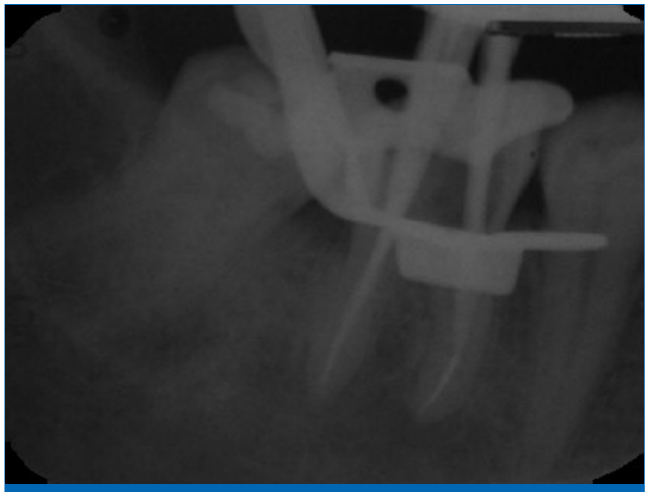

Figure 3. Working length measurement

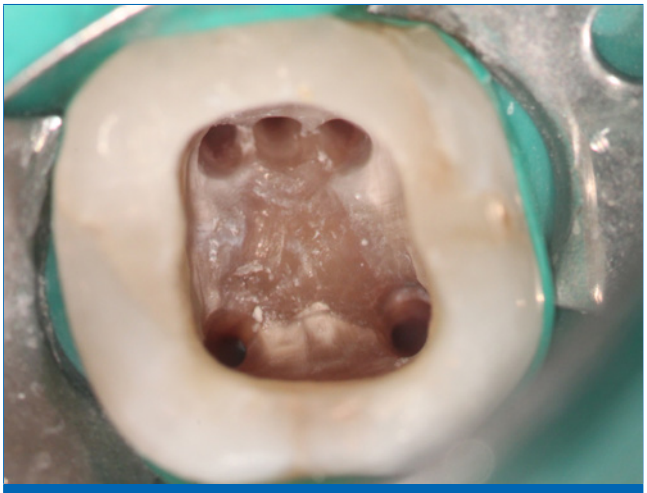

Figure 2. Pulp chamber floor showing three root canals in the distal root

Figure 4. Final root canal filling

Figure 5. Post-operative radiograph

Figure 6. 19-month follow-up

36). His medical history was non-contributory. Clinical and radiographic examination showed a very deep restorative filling on tooth 36 (Figure 7). No radiolucency was visible on the periapical radiograph, and no periodontal pockets were present. Tooth 36 was sensitive to palpation and percussion and did not respond to the ice sensibility test, contrary to the adjacent teeth. The diagnosis of necrosis with symptomatic apical periodontitis on tooth 36 was established.

The tooth was anesthetized, a rubber dam was placed, and a proper access cavity was prepared. A careful exploration of the distal root, under magnification, showed a single root canal orifice that split into three root canals at the middle portion of the root (Figure 8) and then these merged together at the apical area. The endodontic treatment procedures were very similar to the previously described case (Figures 9, 10 and 11). Both the 14-month and 3-year recalls showed no clinical or radiographic findings; however, the tooth was not restored yet (Figures 12 and 13). The patient was again referred for oral rehabilitation.

Case #3

A 28-year-old male patient presented for endodontic evaluation of the mandibular left first molar (tooth 46). The patient had a buccal swelling adjacent to tooth 46. He had no permanent pain at this visit but had reported intense pain a few days earlier. Clinical and radiographic observation revealed a deep resin filling and previous root canal treatment on teeth 46 and 47 (Figures 14 and 15). A large periapical radiolucency was identified surrounding both teeth on the periapical radiograph. No periodontal pockets were present. Tooth 47 had mobility within physiological limits while tooth 46 had class I mobility. Tooth 45 responded to the ice sensibility test normally. Both teeth 46 and 47 were sensitive to percussion, but tooth 46 more than tooth 47. A diagnosis of previous endodontic treatment with an acute apical abscess on tooth 46 was established. Although problems with tooth 47 were not discarded, they were not addressed at this appointment.

After proper anesthesia, rubber dam placement and access cavity preparation, the pulp chamber was inspected under mi-

Figure 7. Pre-operative radiograph

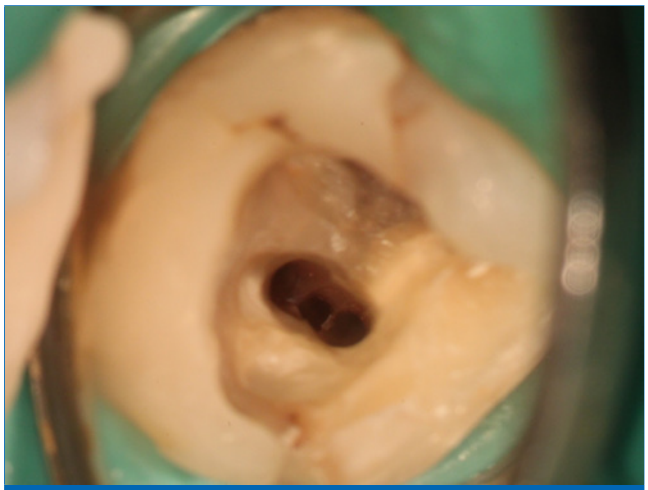

Figure 8. Three distal root canals with a common root canal orifice

Figure 9. Obturation of the three distal root canals

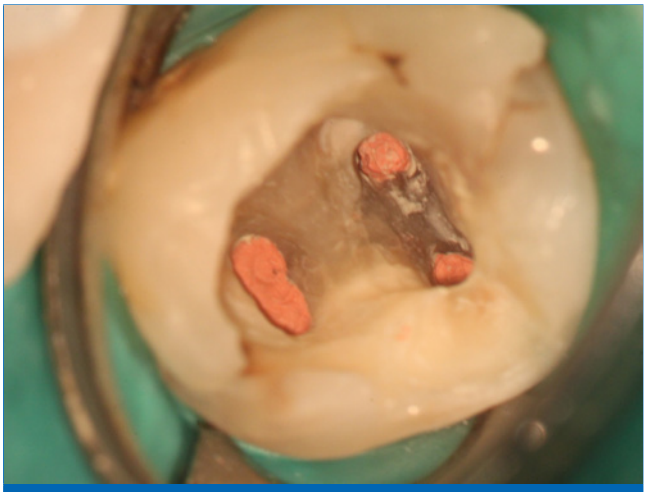

Figure 10. Pulp chamber after root canal filling

Figure 11. Post-operative radiograph

Figure 12. 14-month recall radiograph

Figure 13. 3-year recall radiograph

croscope. Four main root canals (two mesial and two distal) with gutta-percha filling were found, as well as a fifth independent root canal (distobuccal) that had not been instrumented (Figure 16). The distal root had a Gulabivala Type 12 (3-2) configuration (Figures 17 and 18). All root canals were instrumented to an F2 ProTaper rotary file. A rigorous irrigation protocol was performed, and the root canals were dressed with calcium hydroxide. At the second visit, three weeks later,

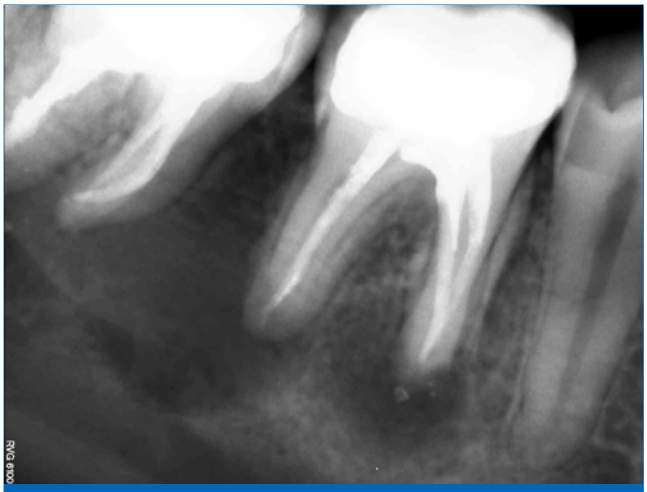

Figure 14. Pre-operative radiograph

Figure 15. Initial condition

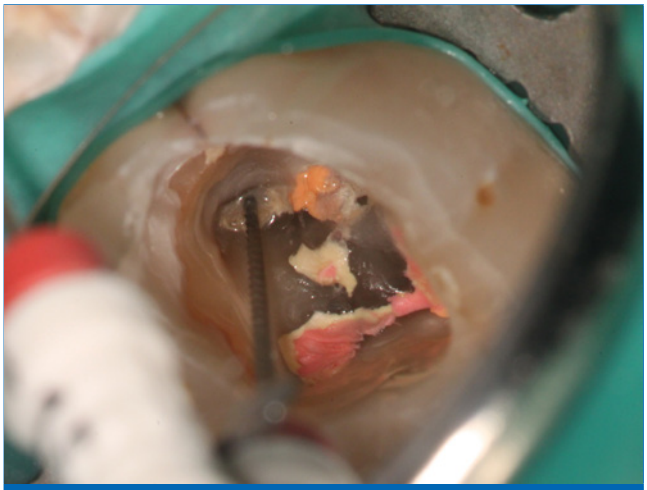

Figure 16. Detection of an untreated root canal

Figure 17. Pulp chamber floor after root canal instrumentation

Figure 18. Three root canals in the distal root

Figure 19. Radiographic working length confirmation

Figure 20. Obturation of the three distal root canals

Figure 21. Pulp chamber floor after root canal filling

there were no signs of swelling and the patient was asymptomatic. A new disinfection protocol was performed, as well as root canal obturation (Figures 19, 20, 21 and 22). The patient was scheduled for a 12-month follow-up but missed the appointment. However, after being contacted, he reported that he had no complaints and the tooth was functional.

Discussion and conclusions

Although other anatomic configurations have been reported, the presence of three root canals appears to be the most common configuration for mandibular first molars.[2,3,4] In a systematic review[2] that analyzed this tooth anatomy, the prevalence of two roots was higher than 85.0% in a combined sample of 18.781 teeth. Three canals were present in 61.3% of the cases, four canals in 35.7% and five canals only in approximately 1.0%.[2] When analyzing just the mesial root, 94.4% of the cases had two root canals, and 2.3% had three, in a sample of 4335 mesial roots.[2] This review also found 22 studies that analyzed the distal root. In a combined sample of 3378 distal roots, 62.7% had a single root canal.[2] Despite not mentioning any prevalence for this condition, that research found a few case reports of three canals in the distal root.[6,7,9] One other study[7] stated that the prevalence of the configuration with three distal root canals ranged from 0.2%, in the Senegalese population, to approximately 3.0%, in the Sudanese population.

Figure 22. Post-operative radiograph

The mandibular first molars are the first posterior teeth to erupt and, as a result, become more prone to carious lesions, which may lead to endodontic treatment. An incorrect evaluation of the anatomy of a tooth under treatment may lead to incomplete and incorrect endodontic procedures that may, in turn, lead to treatment failure. One study[10] analyzed the possible causes of endodontic treatment failures on a sample of 493 teeth submitted to endodontic microsurgery. 19.7% of the analyzed teeth had canals that were not identified when the root section was performed. More recently, a study[11] assessed the prevalence of apical periodontitis in root-filled teeth in a Brazilian subpopulation, using cone-beam computed tomography (CBCT). Of the included 2294 teeth, 12.0% had at least one untreated missed canal. Untreated canals were more frequent in maxillary molars, followed by mandibular molars. Moreover, the authors reported that the odds for apical periodontitis to be present was over six times greater in teeth with a missed canal. The same conclusion was made.

In the present work, three cases with the uncommon anatomy of three distal canals were reported, all with different configurations. These morphologies appear to be characterized by having several isthmus and canal merging between the root canals. Two of the presented cases were retreatments in which untreated root canals were detected, which may justify the previous endodontic treatment failure. It has been suggested previously[11,12] that the difficulties posed by mandibular molars during the root canal treatment, including the complexity of their internal anatomy, may require more skilled and experienced operators. The operating microscope represents a clear advantageous and indispensable tool to achieve a successful endodontic treatment.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Conflict of interest

The authors have no conflicts of interest to declare.

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