Revista ARACÊ
ISSN: 2358-2472

PREPARATION OF UPPER MOLAR WITH FIVE ROOT CANALS - CASE REPORT

PREPARO DE MOLAR SUPERIOR COM CINCO CANAIS RADICULARES - RELATO DE CASO

PREPARACIÓN DE UN MOLAR SUPERIOR CON CINCO CONDUCTOS RADICULARES - REPORTE DE CASO

https://doi.org/10.56238/arev7n7-225

Date of submission: 06/17/2025 **Date of publication:** 07/17/2025

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ABSTRACT

Introduction: The complex anatomy of the root canal system is a continuous challenge for endodontists. Permanent maxillary first molars may present several morphological variations, both in the number and location of roots and canals. Therefore, the success of the endodontic treatment depends on an accurate knowledge of root canal anatomy.
Objective and case report: This study describes the endodontic treatment of a permanent maxillary first molar diagnosed with irreversible pulpitis. The technology employed to evaluate the case, namely dental operating microscope associated with ultrasonic tips, was essential to delineate the anatomic characteristics of the tooth to be treated, revealing the presence of five root canals: two mesiobuccal, two distobuccal, and one palatal canal.
Conclusion: The knowledge of the tooth anatomy, as well as its possible anatomic variations, combined with the use of current technologies, such as dental operating microscope, ultrasonic tips, help to enhance the endodontic treatment success.

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Revista ARACÊ
ISSN: 2358-2472

Keywords: Endodontics. Root Canal Treatment. Morphology

RESUMO
Introdução: A complexa anatomia do sistema de canais radiculares é um desafio contínuo para os endodontistas. Os primeiros molares superiores permanentes podem apresentar diversas variações morfológicas, tanto no número quanto na localização das raízes e dos canais. Portanto, o sucesso do tratamento endodôntico depende do conhecimento acurado da anatomia do canal radicular.
Objetivo e relato de caso: Este estudo descreve o tratamento endodôntico de um primeiro molar superior permanente diagnosticado com pulpite irreversível. A tecnologia empregada na avaliação do caso, microscópio cirúrgico odontológico associado a pontas ultrassônicas, foi essencial para delinear as características anatômicas do dente a ser tratado, revelando a presença de cinco canais radiculares: dois mésio-vestibulares, dois disto-vestibulares e um canal palatino.
Conclusão: O conhecimento da anatomia dentária, bem como de suas possíveis variações anatômicas, aliado ao uso de tecnologias atuais, como microscópio cirúrgico odontológico e pontas ultrassônicas, auxiliam no sucesso do tratamento endodôntico.

Palavras-chave: Endodontia. Tratamento de Canal. Morfologia

RESUMEN
Introducción: La compleja anatomía del sistema de conductos radiculares representa un desafío continuo para los endodoncistas. Los primeros molares maxilares permanentes pueden presentar diversas variaciones morfológicas, tanto en el número como en la ubicación de las raíces y los conductos. Por lo tanto, el éxito del tratamiento endodóncico depende de un conocimiento preciso de la anatomía de los conductos radiculares.
Objetivo y caso clínico: Este estudio describe el tratamiento endodóncico de un primer molar maxilar permanente con diagnóstico de pulpitis irreversible. La tecnología empleada para evaluar el caso, concretamente el microscopio quirúrgico dental con puntas ultrasónicas, fue esencial para delinear las características anatómicas del diente a tratar, revelando la presencia de cinco conductos radiculares: dos mesiovestibulares, dos distovestibulares y uno palatino.
Conclusión: El conocimiento de la anatomía dental, así como sus posibles variaciones anatómicas, combinado con el uso de tecnologías actuales, como el microscopio quirúrgico dental y las puntas ultrasónicas, contribuye al éxito del tratamiento endodóncico.

Palabras clave: Endodoncia. Tratamiento de Conductos Radiculares. Morfología

Revista ARACÊ
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1 INTRODUCTION

The success of endodontic treatment depends on several factors, such as anatomical knowledge, correct instrumentation technique and efficient disinfection with auxiliary chemical substances. Some factors may not be controlled, such as the patient's immune capacity. Therefore, it is up to the professional to reduce the level of bacteria below the patient's resistance threshold, thus making it possible to combat the remaining pathogens and resulting in satisfactory treatment, repairing the periradicular tissues and presenting an absence of pathological signs and symptoms. (Zhang, et al., 2020).

Maxillary first molars are among the most common teeth requiring root canal treatment in the dental office. Plethora of literature exists on the variation present in the root canal anatomy of this tooth.Generally, the maxillary first molar has three roots and three major canals, the Mesiobuccalcanal, the distobuccal canal and the palatal canal. (Singh, 2024).

Thus, clinicians must have adequate knowledge of the root and root canal anatomy along with its variations to avoid plausible failure of endodontic therapy. Maxillary first molars are commonly present with three roots and three or four root canals. (Cleghorn et al. 2006).

The occurrence of an additional palatal root in maxillary first molars has also been documented. These root canal variations may be challenging to the clinician and pose difficulty in their detection, debridement, shaping, cleaning, and adequate filling. (Schryvers et al. 2019).

One of the most important steps of a successful root canal treatment process is to understand the morphology of the root canal. Therefore, the clinicians should consider and release the anatomic variations in the process of diagnosis and treatment of the maxillary and mandibular molar. (Çiçek Demiryürek , Özsevik, 2012.

Martinez–Berna et al. 1983, investigated the anatomical configuration and the number of root canals of the mandibular molars in several in vitro and in vivo studies. They reported 29 teeth with five root canals in a sample of 2362 mandibular permanent molars. Fabra–Campos, 1985, studied 145 mandibular first molars and found that 2.75% of the teeth had five canals.

Knowledge of the internal and external anatomy of teeth is of utmost importance for planning and executing the cleaning, shaping and disinfection of the root canal system (Villas-Bôas et al. 2011). The anatomical variation of the molar with five root canals can make it difficult to correctly diagnose the clinical case, making the stages of endodontic treatment even more challenging, requiring good planning by the professional.

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The evolution of new techniques, instruments and materials leads to a better understanding of the anatomy of the canal and root system, increasing the predictability and prognosis of endodontic treatments, making single-session endodontic treatment a possible biological alternative, presenting very satisfactory clinical results that will be similar to those obtained in multiple sessions. (Yingying et al. 2010, Pereira, 2021).

The present case report describes the root canal treatment of maxillary first molar with two mesial canals, one distal canal and two palatal canals.

2 CASE REPORT

A 16-year-old female presented to an emergency endodontic appointment with a chief complaint of spontaneous pain, and increasing pain to temperature variations in the maxillary right side. The medical history was non-contributor. There was no widening of the periodontal ligament. Based on the clinical sign and symptoms a diagnosis of acute irreversible pulpit was made and non-surgical root canal treatment was planned.

The tooth was tender on percussion. Radiographic examination the radiolucency encroaching the pupal horn of the maxillary right first molar the tooth 26. (Figure. 1). The reaction to the ice sensibility test was an intense pain that remained present for more than one minute. The adjacent teeth had a normal response to this test. The diagnosis was an irreversible pulpitis on tooth 16. The endodontic therapy was proposed and accepted.

Figure 1. Maxillary first molar with five root canals

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ISSN: 2358-2472

Root canal therapy was initiated by administering 2% local anaesthesia in 1: 200,000 concentration and after remaining caries removal subsequent access cavity was prepared using #2 round bur and straight burs followed by Endo Access bur (Dentsply Maillefer , Switzerland) . The outline of access cavity was triangular in shape initially and mesiobuccal , distobuccal and palatal canals were located. The figure 2 shows bleeding after coronary opening, confirming the diagnosis of irreversible pulpitis.

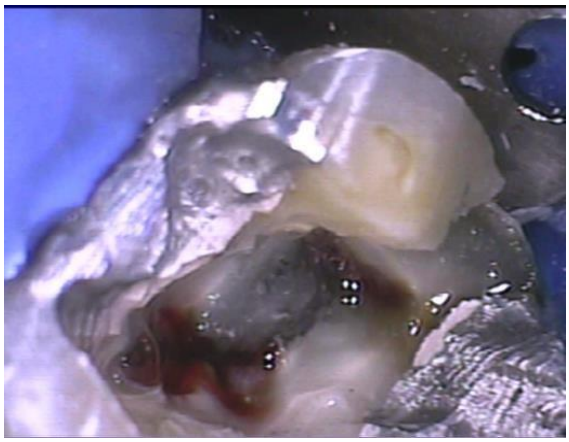

Figure 2. Shows bleeding after coronary opening

During examination with an operating microscope (Alliance, São Paulo, SP, Brazil), four canal orifices were found. With the aid of TRA 24 ultrasonic inserts (Dental Trinks, Pirituba, São Paulo, SP, Brazil) attached to an ultrasound device (Gnatus, Ribeirão Preto, SP, Brazil), the access was rectified, enabling the location of the fifth canal – distopalatine. Upon further exploration of the pulpal floor and following the dentinal map with DG 16 explorer (Hu-Friedy, Chicago, Illinois, USA) a second mesiobuccal canal(MB2) and palatal canal (P-2) were located (Figure. 3).

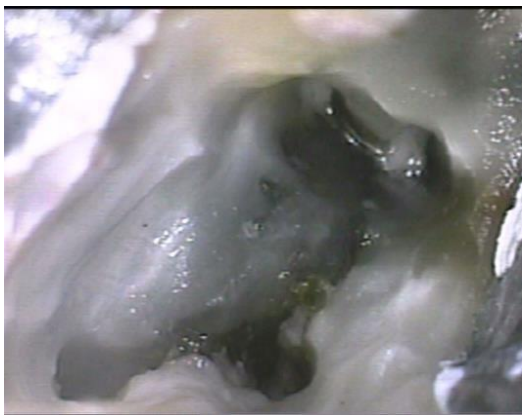

Figure 3. Five canal orifices two in the mesiobuccal root (MB and MP canals), one distobuccal root and two in the palatal root

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The working lengths of the five canals located were measured with #8 K file (Dentsplay) in MB1 and DB canals , #6 K file in MB2 canal and #10 K file in two palatal canals with the use of electronic apex locator (Root ZX II, J Morita, Suita City, Osaka, Japan. Readings of 23 mm each for MB1 and MB2 canals, 21 mm for DB canal, 20 mm for mesiopalatal canal (Palatal 1) , 19 mm for distopalatal canal respectively were recorded . Cleaning and shaping of canals was done with Rotary file system in crown down technique . Sequential preparation with SX, S1 , S2 and F1 was done in MB1 , MB2 , DB canals while both palatal canals were prepared with reciprocating files R25. Canals were thoroughly irrigated with 2.5% NaOCl and normal saline during the entire process of instrumentation.

The filling of the root canal system was performed using the single-cone technique associated with Bio-C Sealer cement. Post obturation radiographs with different angulation (Figure 4). there was leakage of cement into the periapical region. The surgical access was sealed with composite resin, and the patient was referred for restorative treatment.

Figure 4. Post obturation radiographs with different angulation.

3 DISCUSSION

Knowledge of internal anatomy, as well as its diversities, is of utmost importance for the success of endodontic treatment. Technologies that enable visual magnification combined with increased luminosity, safe grinding of dental structures and three-dimensional visualization of the dental element can increase knowledge of anatomy.

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Maxillary first molars have the most variable anatomy of root canals. A thorough knowledge and awareness about the number of canals is crucial for the success of a root canal treatment. Subsequent access cavity preparation and debridement of the canals with necessary chemo mechanical preparation and three dimensional obturation to obtain a hermetic seal is paramount to the long-term good prognosis for a tooth treated with Endodontic therapy. (Singh, 2024). Illumination and magnification are critical for successfully identifying additional canals. The dental operating microscope has proven effective in locating MB2 canals in maxillary molars.

Proper use of radiographs with different angulations , careful exploration of the pulpal chamber following the dentinal grooves along with additional diagnostic aids like endodontic explorers , dye , fibre optic hand piece , magnification loupes and computed tomography are of extreme significance in locating the hidden extra canals. (Kim, Baek, 2004). Modification of the access cavity shape from triangular to rhomboidal shape and following the groove extending from MB to palatal canals can help in locating the extra canals. (Weller, Hartwell, 1989). Knowledge of the internal dental morphology is a complex and extremely important point for planning and performing of endodontic treatment. The several anatomical variations existing in the root canal system may contribute for failure of root canal therapy. Several authors have attempted to clarify this topic and have proposed new techniques to provide a broader description of the anatomy of permanent teeth. (Gusiyska, 2009).

The complexity of the root canal system of the first and second permanent maxillary molars is a constant challenge in endodontics, being associated with high rates of failure in endodontic treatment. This is due to the complexity of the anatomy that often presents curved canals, multiple accessory canals and variations in the shape and number of canals. Adequate access and meticulous instrumentation of these are essential for the success of the treatment, requiring advanced skills. (Castro et al. 2024). Failure of endodontic treatment is due to a lack of adequate knowledge about the anatomy of the pulp space in the root canals. The inability to locate, modify, or obturate one or more root canals is one of the most common failures in endodontics. Therefore, dentists must have complete knowledge of the most common root canal morphologies, as well as the most common anatomical variations in the different groups of teeth, before starting endodontic treatment (Karabucak et al., 2016).

Endodontic research and technology are continually evolving to enable practitioners to identify, disinfect and obturate root canal system predictably and efficiently. Since the ultimate goal for patients and practitioners alike is the retention of natural teeth for a lifetime,

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endodontic therapy remains, and will continue to be, the primary treatment choice for teeth with pulpal and periradicular pathologySuccessful root canal treatment depends on proper cleaning, shaping and compact filling of the root canal under aseptic conditions. In order to achieve these, clinicians need to know thoroughly the morphology of the individual root canal and atypical root canal configuration. The mesiobuccal root of the maxillary first molar has generated more research, clinical investigation, and pure frustration than probably any other root in the mouth. (Gusiyska , 2009). This case emphasizes the importance of looking for canals and of ensuring adequate access to improve the likelihood that additional canals will be located. The conservation of tooth structure must be kept in mind when establishing an endodontic access to allow for successful restoration of the tooth after root canal therapy.

Prior to treatment, a tooth with unusual anatomical appearance on a radiograph should be carefully assessed, and additional radiographs with different angulations should be taken as its interpretation may reveal external and internal anatomic details that suggest the presence of extra canals and /or roots. The use of radiographic techniques to study the morphology of the root canal system might appear to have certain disadvantages. The operator can only see the tooth in a two- dimensional image, and conceivably extra root canals could be missed in the radiograph. Unfortunately, radiographs are still the most reliable method in the clinical setting. In the present case, probing with an endodontic explorer, use of ultrasonics, modification of the access cavity (triangular to trapezoidal) with access burs, and angulated radiographs were used to identify the additional root canals.

The introduction of nickel-titanium (NiTi) mechanical instruments has dramatically changed clinical endodontics over the past few decades. Before NiTi, more instruments were required to create an ideal root canal shape, and many approaches, sequences, and techniques have been developed over the years. Recently, NiTi endodontic instruments have undergone a series of changes brought about by design modifications, surface treatments, and heat treatments to improve their root canal preparation results and reduce the risks associated with canal preparation during root canal treatment. Heat treatment is one of the most fundamental approaches to improving the fatigue resistance and flexibility of NiTi endodontic instruments. In addition, new kinematics have been developed to provide greater safety and efficiency (Grande et al. 2023). Manufacturers tend to increase the cutting efficiency of NiTi to reduce the possibility of the instrument getting stuck inside the root canal. The improvement in cutting efficiency leads to a reduction in “natural” torque levels, even though torque-controlled endodontic motors are still widely used in common endodontic practice, especially for

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ISSN: 2358-2472

inexperienced clinicians. (Gambarini et al., 2019). Thus, automated instrumentation was chosen for this case because it provides varied conicities and presents benefits such as better apical control of the instruments, greater capacity for cleaning the root canal and better adaptation of the main gutta-percha cone during obturation.

Determining the correct working length during root canal preparation is essential to promote periapical tissue repair. The most widely used method to date for determining odontometry is radiography. However, due to the limitations of this technique – two-dimensional image of three-dimensional structure, image distortion, overlapping of anatomical structures, exposure to radiation, and errors in interpretation – alternatives that aid in determining the ideal working length are increasingly sought (Travassos et al. 2024). Therefore, in this study, the foraminal apex locator was used.

4 CONCLUSION

Successful endodontic treatment starts with proper clinical and radiographic examinations. It is important for clinicians to be aware of all possible anatomic variations for a good endodontic practice.

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