Case Report

Surgical Treatment of a Three-rooted Premolar: A Case Report

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Abstract:
The success of endodontic therapy is a consequence of the cleaning and disinfection, followed by a complete root filling. The endodontic morphology characteristics are related to the frequency of number, location, direction, and shape that can determine the therapeutic success. The knowledge of root internal anatomy is essential for the localization of all the root canals and properly treatment. The aim of this study was to describe an endodontic surgical complementation with mineral trioxide aggregate based cement filling of a premolar with anatomical variation with 32-month follow-up.

Key Words: Apicoectomy, endodontics, surgery, retrofilling materials

Introduction
The success of endodontic therapy is a consequence of the removal of dentin tissue to promote cleaning and disinfection, as well as to prepare root canal system to receive the filling material.¹ Complete root filling is achieved by the three-dimensional obturation of the root canal system with the association of a solid filling material to the endodontic sealer.² The endodontic morphology characteristics are related to the frequency of number, location, direction, and shape that can determine the therapeutic success.³ The knowledge of root internal anatomy is essential for the localization of all the root canals and properly treatment.⁴ The amount of root canals may vary within the same type of tooth, resulting in different configurations to ground level of the pulp chamber.⁵ It is imperative that professional stay tuned for the occurrence of these variations, avoiding the permanence of contaminated root canals, ensuring success of the treatment.⁶,⁷

Signals of endodontic treatment failure, characterized by the presence of apical periodontitis and post-treatment symptomatology are important points that a further intervention will be necessary.⁸ In clinical situations, when was impossible to solve the problem by the orthograde access, it is important a surgical root canal treatment to establish the health.⁹ The apicoectomy with retrograde filling is a kind of surgery, which involves the apical root resection, followed by the cavity confection and the placement of a retrograde material.¹⁰ To be considered ideal, a retrofilling material should present dimensional stability, adequate solubility when in contact to tissue fluid, radiopacity, easy to be manipulated, adequate working time, antimicrobial activity, and biocompatibility and if possible, stimulate healing process.¹¹ Several retrofilling materials have been studied for these purposes, including gutta-percha, amalgam, zinc oxide, and eugenol cement, zinc oxide and eugenol-based cements (IRM, Super-EBA), cavit and composite resins,¹² but none of them had been considered as an ideal material.¹³

In 1993, Torabinejad developed mineral trioxide aggregate (MTA) at the Loma Linda University.¹⁴ In 1999, MTA was approved for human use by the Food and Drug Administration and commercially is available as ProRoot MTA (Tulsa Dental, Oklahoma, USA) and MTA-Angelus (Angelus, Soluções Odontológicas Ltda, Londrina-PR, Brazil).¹⁵ MTA is currently the most indicated material for root-end filling and repair of root canal perforations.¹⁶,¹⁷,¹⁸ This material has excellent physical,¹⁹ chemical,¹⁴ and biological properties.¹⁶ It is considered a biomaterial, and its ability to induce mineralized tissue may be related to the presence of calcium phosphate.¹⁷ MTA-based cements have been widely investigated for endodontic applications.¹⁸ The use of MTA as retrofilling material has shown an induction of lower inflammatory response.¹⁶,¹⁷,¹⁹ MTA has been also employed for pulp capping¹⁹ in root perforations reparation¹⁹ and as barrier for teeth with open apexes.²⁰

The inner anatomy knowledge is fundamental for the localization and proper treatment of the present root canals.²¹ However, variation in normal conditions may occur. The aim of this study was to describe an endodontic surgical complementation with MTA-based cement filling of a premolar with anatomical variation.

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Case Report

A 52-year-old male patient in good general health sought treatment at the School of Dentistry from Federal University of Goias, Brazil. A periapical radiographic examination showed unsatisfactory endodontic treatment and asymptomatic apical periodontitis in tooth 14. A clinical examination showed a gingival enlargement located at the bottom of the vestibule in the region of the right upper premolar and fistula and fluctuation point were observed (Figure 1a). By the periapical exam, it was possible to observe a premolar with three roots: One palatine, one mesiobuccal, and one distobuccal (Figure 1b). The endodontic treatment was observed only in palatine root canal. A radiolucent area was observed in the apical area of the tooth 14. This information was confirmed by the cone-beam tomography (Figure 1c and d). The possibility of maintaining the tooth through surgical procedure was presented as an alternative. After the patient was anesthetized, the surgical phase was initiated by Neumann’s incision with mucoperiosteal flap. The total division of the flap was done in the meeting point of the vertical and horizontal incision, enabling the visualization of the apical area of tooth 14. The burs #2 and 3, in high rotation, were used for osteotomy. After this, the apical curettage was followed with the remotion of a smooth tissue with elastic consistency, cystic form, and measuring 0.7 cm × 0.6 cm × 0.5 cm. The anatomic and pathologic exam revealed the presence of a connective fibrous tissue with mononuclear inflammatory cells and some Russel’s corpuscles, reaching the diagnosis of periapical abscess. The apicoectomy of the roots was realized with Zekrya burs, 3 mm from the radicular vertex with 0° angle (no bevel). After apicoectomy was possible to observe that only, the palatine root canal was filled with sealer material, and the buccal root canals were calcified and with no endodontic treatment (Figure 1e). The retrocavities were made with ultrasound points (Figures 1f and g) and followed the filling of the cavities with white MTA (Angelus, Soluções Odontológicas Ltda, Londrina-PR, Brazil) (Figure 1h). The surgical space was filled with blood clot and the suture realized (Figure 1i). 1 week later, the patient returned for control and then the suture was removed. No complications were observed on postsurgical period. On 6-month follow-up (Figure 2a) and 18-month follow-up (Figure 2b), the periapical radiograph showed the apical portion of the three root canals filled with the material, new bone formation, and reduction of the radiolucent area. On 32-month follow-up period, the cone-beam tomography image showed signs of repair with the presence of bone formation (Figure 2c-e). Clinically, it was possible to observe absence of pain, fistulas, edema, and periodontal pockets, as well as a normal tissue color.

Discussion

The complications during the endodontic treatment are related to irregular dental morphology, increasing the difficulty of instrumentation and filling. The morphological endodontic characteristics and complexity inner anatomy knowledge are fundamental for the proper root canal treatment. However, variation in normal conditions may occur. The prognostic of
the treatment depends on the cleaning of the root canal system and ignoring this aspect may cause failure and eventually tooth loss.\textsuperscript{23} In this context, the premolars present diversity of anatomic abnormalities mainly in relation to the number of roots and root canals.\textsuperscript{24} In the first premolar, the presence of root canals in three different roots is reported in 2.5-5\% of cases.\textsuperscript{25,26} The anatomical configuration in this situation shows two root canals buccal, divided into one or two roots, and a palatal channel characteristic aspect of molar.\textsuperscript{27} The coronal access in these teeth is reduced, being necessary more wear on the mesial-distal direction for adequate visualization of the area.\textsuperscript{28,29} The presented case report showed the tooth 24 with three distinct roots, two buccal, and one palatine. Referring to the number of roots, it is a rare situation.\textsuperscript{25,29} On examination evidenced, the presence of three root canals arranged according to the location of the roots, a commonly situation.\textsuperscript{35,37}

A great number of variations may occur in formation, number of roots, and their shape.\textsuperscript{3} Extra roots are an extra challenge that involves all phases during the endodontic treatment, including cavity design, canal access, localization, cleaning, shaping, and obturation of the root canal system.\textsuperscript{30} Proper treatment can be performed by the two different ways: Access through the radicular root canal or by surgical access to the external root surface.\textsuperscript{3} In the present case report, the retrograde approach was necessary because of the presence of apical periodontitis, as a consequence of an inadequate root canal therapy performed before.

Among the root-end materials, the MTA-based cement is proper to avoid root canal apical sealing\textsuperscript{7} and favors the induction of repair, through its osteogenic and cementogenic abilities.\textsuperscript{31} Moreover, this material strengthens the root canal structure, an important point for the dental element maintenance.\textsuperscript{32} The use of a biological material is required to seal a perforation cavity. MTA is hygroscopic, promotes expansion, and seals the perforation cavity.\textsuperscript{8} During the hydration process, the calcium silicates react to form a calcium hydroxide and hydrous silicate gel with a high alkaline pH.\textsuperscript{15,33} Furthermore, MTA is a biocompatible substrate that provides cell adhesion and differentiation stimulating the mineralized tissue formation.\textsuperscript{34} It is considered to be a non-irritating bioactive silicate cement that is capable of stimulating the biosynthesis activity of the periodontal ligament cells and to play a role in cement formation and induction of bone tissue repair.\textsuperscript{32,33}

**Conclusion**

The main purpose of case report is to highlight a successful surgical procedure of a three-rooted premolar. Inadequate sanification of the root canal system will bring the failure to the endodontic treatment. The knowledge of the endodontic anatomy and its possibilities is imperative for the correct therapeutic procedures.


