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ENDODONTIC TREATMENT OF A LOWER MOLAR WITH INCOMPLETE ROOT FORMATION USING THE IMMEDIATE TECHNIQUE: CASE REPORT

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Abstract: Endodontics, a specialty of dentistry, plays an essential role in maintaining oral health, with specific challenges when it comes to treating teeth with incomplete root formation, that is, those that do not fully develop their roots due to factors such as trauma, cavities, genetics or developmental problems. This makes these teeth more susceptible to infections. In treatment, there are two main approaches: apexification, used when there is pulp necrosis, and apexification, applied when the pulp of the tooth is healthy. In addition, there are two predominant techniques: a single session, which removes the infected pulp, cleans, shapes and fills the root canals in a single appointment, and multiple sessions, in which the pulp is removed in an initial session, followed by subsequent appointments to clean, shape and fill the canals. The objective of this study is to evaluate through a case report the endodontic treatment in a lower molar with incomplete root formation using the immediate technique. In the first session, anesthesia, access surgery, absolute isolation, irrigation with saline solution and 2% chlorhexidine gel, odontometry, instrumentation with rotary files at the working length, drying and insertion of intracanal medication (calcium hydroxide) were performed. In the second session (after 15 days), the intracanal medication was removed and the distal canal was filled with aggregated mineral trioxide (MTA) and the mesial canal was filled with gutta-percha and AH plus sealing cement. Follow-up was performed at 8 months and 1 year, and progression of mesial and distal root formation and asymptomatology were observed. It is possible to conclude that endodontic treatment in a lower molar with incomplete rhizogenesis through the immediate technique is feasible and presents favorable results.
Keywords: Endodontics. Periradicular abscess. Pathological tooth resorption.

INTRODUCTION

Pulp involvement as a result of trauma or caries in immature permanent teeth can trigger loss of pulp vitality, in addition to directly affecting root development, resulting in short roots with very thin walls, producing a greater risk of fracture and thus making conventional root canal treatment difficult.

Root development occurs through the continuous deposition of dentin and cementum by stimulation and differentiation of the Hertwig Epithelial Root Sheath (HERS) and surrounding progenitor cells. Interference in this development by trauma or infection can lead to interruption and arrest of root development, which presents with a thin and fragile dentin wall and absence of natural apical constriction. Thus, cleaning and shaping become complex and obturation can be unpredictable due to the atypical root apex (Kumar et al., 2014).

The resolution of cases of teeth with incomplete root formation, with pulp involvement, can be achieved through two techniques:

- Apexigenesis - is the treatment designed to preserve vital pulp tissue in the apical part of a root canal in order to complete the formation of the root apex.
- Apexification, or apical closure, is the process by which a nonvital immature permanent tooth that has lost its capacity for root development is induced to form a calcified barrier at the apex. This barrier forms a matrix against which the root filling or restorative material can be condensed with controlled length.

A Food and Drug The U.S. Food and Drug Administration presented a favorable evaluation of mineral trioxide aggregate (MTA) in 1998 as a therapeutic endodontic material for humans. MTA was shown to have superior sealing capabilities to amalgam, zinc oxide eugenol, and intermediate restorative material (IRM). It was also shown to have

superior characteristics as a direct pulp capping agent when compared to Ca(OH)2 in animals and humans in the root canal, which would result in intracanal bone formation and arrest of root development (Vijayran et al., 2013).

Apexification with calcium hydroxide and apexification with mineral trioxide aggregate (MTA) are classic treatments for necrotic immature permanent teeth. The former tends to fail due to lack of adhesion given the high number of sessions required; the latter presents technical difficulties such as material manipulation and excessive filling. With both techniques, root development is interrupted, leaving the tooth with a fragile root structure, a deficient crown-root relationship, periodontal rupture and a high risk of fracture, compromising the long-term prognosis of the tooth. (Staffoli, et al., 2019).

Thus, the objective of this study is to evaluate, through a case report, endodontic treatment in a lower molar with incomplete rhizogenesis using the immediate technique.

CASE REPORT

This work is a basic, qualitative and descriptive study of a clinical case report. Approved by the ethics committee **(CAAE: 7796842400005516)**

The patient was approached in the triage sector of the multidisciplinary clinic of Itpac / Porto - TO, and anamnesis, clinical inspection and periapical radiography of element 46 were performed (Figure 01). The dental element presented with pulp necrosis and incomplete rhizogenesis of the distal root (Figure 02).

Figura 01 – Inspeção clínica

Fonte – Autoria própria

Figura 02 – Radiografia de diagnóstico

Fonte – Autoria própria

The treatment was carried out in two sessions following the following protocol:

1ST SESSION

Anesthesia was applied with Lidocaine 1:200000 (Dentsply / Sirona, Ballaigues - Switzerland). Subsequently, tooth prophylaxis was performed with a straight white CA brush (Microdont, Socorro - SP) and Herjos prophylaxis paste (Vigodent, Rio de Janeiro - RJ) and coronal opening with 1014 and 3082 drills (KG Sorensen, Barueri - SP).

Absolute isolation was performed with a rubber sheet (Madeitex, São José dos Campos - SP), an Ostby isolation arch (Prisma, São Paulo - SP) and a clamp for varied isolation (KSK, Rio de Janeiro - RJ), disinfecting the operating field with 2% chlorhexidine (A Fórmula compounding pharmacy, São Paulo - SP).

Initial exploration with a K file # 10 (Dentsply / Sirona, Ballaigues - Switzerland) was performed until the apical region of the tooth was reached. Subsequently, the cervical third was prepared with Prodesing S_2 15/10 rotary files, odontometry with a foraminal locator and preparation of the apical third with Prodesing S_2 15/03 and 25/06 files in all root canals.

During all instrumentation, irrigation was performed with saline solution and 2% chlorhexidine gel (Compounding Pharmacy – Fórmula e Ação – São Paulo – SP.

The root canals, at the end of preparation, were dried with capillary tips tips (Ultradent Products, Inc, South Jordan, Utah, USA) coupled to a high-power suction device and absorbent paper cones (Tanari, Manacapuru - AM). Immediately afterwards, intracanal medication, calcium hydroxide (Calen, SSWhite, Ballaigues - Switzerland), was inserted with the aid of a number 30 lentule and coronal sealing with glass ionomer.

2ND SESSION (THE SECOND SESSION WILL BE HELD AFTER 15 DAYS)

Anesthesia was applied with Lidocaine 1:200000 (Dentsply / Sirona, Ballaigues - Switzerland) and coronal opening with 1014 drills (KG Sorensen, Barueri - SP), absolute isolation, irrigation with 2% chlorhexidine gel and saline solution (Compounding Pharmacy - Fórmula e Ação - São Paulo - SP) and compatible hand files to the apical third of the dental element, for removal of intracanal medication.

The root canals, after completion of preparation, will be dried with capillary tips. tips (Ultradent Products, Inc, South Jordan, Utah, USA) coupled to a high-power suction device and absorbent paper cones (Tanari, Manacapuru - AM).

Final irrigation was performed with 3 mL of 17% EDTA (ethylenediaminetetraacetic acid) (Compounding Pharmacy – Formula and Action – São Paulo – SP). First, 1 mL of 17% EDTA was introduced followed by ultrasonic vibration with a 25 IRRI S insert (VDW; Endo Ultrasonic Files, Endodontic Synergy, Munich, Germany) at a frequency of 30 kHz. The ultrasound insert was connected to a piezoelectric ultrasound operating at 30 kHz (CVDent 1000; CVD Vale, São José dos Campos, SP, Brazil), set at power level 3, for a period of 20 s. This process was repeated 2 more times. After this process, irrigation was performed with 5 mL of 2% chlorhexidine gel and saline solution (Farmácia Fórmula & Ação, São Paulo – SP). The canals were dried with capillary tips. tips (Ultradent Products, Inc, South Jordan, Utah, USA) coupled to a high-power suction device and absorbent paper cones (Tanari, Manacapuru - AM).

The filling was performed with insertion of aggregated mineral trioxide through a Lentulo throughout the length of the distal root canal and the mesial canals were filled with gutta-percha and AH plus obturator cement (Figure 03). The definitive restoration with composite resin was performed after the treatment and the final radiograph was taken with a radiographic positioner (Indusbello, Londrina - PR) (Figure 04). The dental element was monitored for 8 months and 1 year, analyzing the regression of the pathology (through periapical radiographs) and symptoms (Figures 05 and 6). The patient presented neoformation of the distal and mesial root.

Figura 03 – Obturação dos canais radiculares

Fonte – Autoria própria

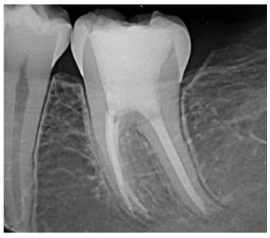

Figura 04 – Radiografia após tratamento endodôntico

Fonte – Autoria própria

Figura 05 – Proservação de 8 meses

Fonte – Autoria própria

Figura 06 – Proservação de 1 ano

Fonte – Autoria própria

DISCUSSION

The goal of an apexification is to remove the necrotic pulp from immature permanent teeth, effectively disinfect the root canal, and obturate the root canals with calcium hydroxide, MTA, or a bioceramic root repair material to induce a calcified barrier to help save the tooth (Rafter, 2005).

A meta-analysis comparing MTA and Endosequence bioceramic root repair materials for apexification revealed that they had similar success rates of over 90% (Shaik et al., 2021), which represents a 10% improvement over the 80% reported success rate of calcium hydroxide for apexification (Damle et al., 2016). A disadvantage of using calcium hydroxide for apexification is that multiple appointments are required to replace the calcium hydroxide, whereas MTA only needs to be applied once (Guerrero et al., 2018). However, the practical limitations of apexification are that it cannot promote maturation of the immature tooth root and therefore cannot increase the thickness of the dentinal walls to strengthen the tooth. Therefore, apexification may be an ideal endodontic treatment for immature teeth with necrotic pulp, where the dentin root walls are already thick enough to resist fracture. However, apexification is not an ideal endodontic treatment for fragile, immature teeth with very thin dentin roots, because it fails to mineralize the thickness of the dentin roots to strengthen the tooth and resist fracture.

The main components of white MTA are tricalcium silicate, dicalcium silicate, tricalcium aluminate, calcium sulfate dehydrate, and bismuth oxide. The setting time of the cement is 3–4 h, and its compressive strength after setting is 70 MPa—comparable to that of IRM. MTA is a material that has less leakage, better antibacterial properties, high marginal adaptation, short setting time (4 h), and a pH of 12.5, is more biocompatible, and can promote hard tissue formation. Clinicians can restore the tooth after MTA has set. Thus, the fracture resistance of teeth with thin dentin walls is increased. MTA can be used in teeth with pulp necrosis and inflamed periapical lesions because it can set in moist environments. In the MTA plug technique, the root canals should be disinfected with temporary calcium hydroxide before MTA placement for 2 weeks. This is because performing chemomechanical preparation alone is not effective for the complete elimination of microorganisms. Therefore, we used calcium hydroxide, in this case, between root canal appointments for disinfection. In the present study, calcium hydroxide was used as an intracanal medication for 15 days and in the second appointment, gutta-percha was used in the mesial canals and MTA in the distal canal. Thus, corroborating the authors cited.

Apexification should create an environment to allow deposition of periodontal tissues to continue root development. However, conventional apexification material Ca(OH)2 has shown inherent disadvantages, such as variability in treatment time, unpredictability of apical closure, difficulty in patient follow-up, failure to control infection, recurrence of infection, cervical fracture, and increased risk of root fracture (Maroto et al., 2003; Andreasen et al., 2002). MTA has superior biocompatibility and is less cytotoxic, and the presence of calcium and phosphate ions results in the attraction of blast cells and promotes a favorable environment for cementum deposition (Weldon et al., 2002; De-Deus et al., 2006). It was possible to observe in the present study, neoformation in the distal root, where MTA was inserted.

Similar to apexification with calcium hydroxide, the apical plug technique using MTA has limitations in cases of necrotic teeth and incomplete rhizogenesis, leaving the tooth with a fragile root structure and a poor crown-root relationship, leading to a higher risk of root fracture (Cvek, 1992; Andreasen et al., 2002). However, a retrospective study reported that MTA apexification provided a predictability of 95% of cases. During the follow-up periods, asymptomatology and progression of the apical third of the mesial and distal roots of the tooth were observed in the present study.

Three systematic reviews and meta-analyses by Lin *et al.,* 2016, Chala *et al.,* 2011 and Nicoloso *et al.,* 2017 compared calcium hydroxide and MTA for apexification of immature permanent teeth and concluded that MTA showed better healing in terms of clinical and radiographic success, and the apical barrier was formed in a shorter period compared to calcium hydroxide. Although MTA has shown to be a promising material for apexification, it has some disadvantages, such as discoloration and weakening of the dentin walls.

CONCLUSION

It is possible to conclude that endodontic treatment in a lower molar with incomplete root formation using the immediate technique is viable and presents favorable results.

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