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REMOVAL OF AN INSTRUMENT IN THE MIDDLE AND APICAL THIRD OF THE MESIOLINGUAL CANAL OF THE LOWER MOLAR USING THE BYPASS TECHNIQUE

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ABSTRACT

The objective of this study was to describe a case fractured in the middle and apical third of the mesial canal of the lower molar by the bypass technique. The patient was referred to a private practice for endodontic retreatment of tooth 46. After removal of gutta-percha In the first session, it was decided to completely unfill the buccal canal using a reciprocating file (Reeciproc R#25, with the aid of 2% chlorhexidine + natrosol. Patency was achieved with the use of an Easy 15.05 rotary file at 400 rpm and torque of 1 N. The fragment was not located through microscopy. Therefore, it was decided to try to pass the fragment with file #15.02 C-Pilot since the biological cost of the removal attempt was considerable. It was decided to fill the canal with Bio-C Sealer cement, using the injectable technique to obtain an apical puff, locking the tip inside the canal and exerting positive pressure. An X-ray was

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performed to verify whether the cement would overcome the obstruction. It is concluded that the instrument bypass technique is a conservative and effective maneuver and an adequate solution in cases of fracture of endodontic files in the apical and middle third of the root canal.

Keywords: Endodontic Instrument Fracture. Root Canal Preparation. Endodontic Retreatment.

INTRODUCTION

Endodontic treatment in dentistry has generated more successes than failures in the field of dentistry, but accidents do happen, and endodontics is no different. Accidents such as instrument fractures can happen, either due to twisting, bending, fatigue, lack of knowledge of the professional or a combination of all these hypotheses. The endodontist must be prepared to solve this complication, either by removing the fragment with conventional or unconventional appliances and methods. They should also be prepared not to remove the fractured file and use the bypass technique to overtake the file to continue the treatment until the end, always prioritizing the correct prognosis. It is always recommended that the dental surgeon must foresee so that no inconvenience occurs during the procedure, so understanding and knowing the limit of your device and instrument is essential for correct prevention, avoiding instrument fracture and stress for professional and patient. (Diogo, 2023). When it happens, planning and dexterity is required by the dental surgeon who aims to remove it, as several factors such as the size of the fragment, anatomy of the canal and location of the fracture influence this decision.

Instrument fractures during the procedure cause a lot of anxiety for both the clinician and the patient, and maximum effort must be made to treat the tooth non-surgically. In addition, the patient needs to be informed that each case is different and that these differences determine the therapeutic procedure. (Travassos et al. 2024).

Removing fractured instruments using only an ultrasonic instrument is more time-consuming than other methods. The risk of iatrogenic incidents such as perforation is higher when the fractured fragment is in the apical third of the root canal, compared to the middle or coronary third. In the internal stem method, significant dentin removal is often required due to the large diameter of the tube, which in turn increases the risk of root perforation. Forceps-based methods for removal of fractured instruments are usually effective in the coronary third of the root canal. The type and size of the instrument, whether manual or rotary, do not appear to have an impact on the success of fractured file removal. (Lakshmaiah et al. 2023).

Instrument fracture in the root canal system is an unpleasant incident that can occur during root canal treatment. Modeling of root canals is often impossible in the presence of a fractured instrument. Therefore, it is often imperative to remove the fragment, and to date, several methods have been proposed for and there is no consensus on a safe technique with a high success rate for instrument removal. (Aminsobhani et al. 2024). Removing a fractured instrument is complicated and requires training and experience, as well as an in-depth knowledge of the methods, techniques, and equipment available. The success of the

removal procedure depends on several factors, including the location, visibility, size, length, and type of the fractured instrument, as well as the curvature and radius of the root canal. (Terauchi et al. 2021).

During the stages of endodontics procedures, the dental surgeon is subject to errors both due to the professional's lack of skill, instrument failures and/or anatomy of the element in question. Among these errors, the fracture of the endodontic instrument within the root canal should be highlighted. In instrumentation, the instrument suffers stresses that vary with the anatomy of the canal, fracture in clinical use can occur by torsion loading, rotary flexion and by their combinations, fractured and retained instruments inside the canal affect the result of endodontic treatment. The therapeutic alternatives for fractures of endodontic instruments inside the root canal generally consist of: removal of the fragment via a root canal, passing the fragment without being able to remove it, wrapping the fragment in the obturator mass, not exceeding the fragment by preparing the canal and filling it to the limit of the fragment and parendodontic surgery. (Andrade, Quintino, 2018).

Several techniques and technologies have been proposed over the years to overcome this obstacle, including the use of ultrasound and the orthodontic wire loop technique. According to Ferreira. (2020), ultrasonic devices have proven to be an efficient system to unclog and remove various obstructions in root canals, due to the instrument's vibration capacity. Ultrasonic systems are recommended when fractured segments can be visualized, which usually occurs in straight canals, or when the fragment is in the cervical third or before the curvature of the root canal.

OBJECTIVE

The objective of this study was to describe a clinical case of an instrument fractured in the middle third and apical of the mesial canal of the lower molar by the by-pass technique.

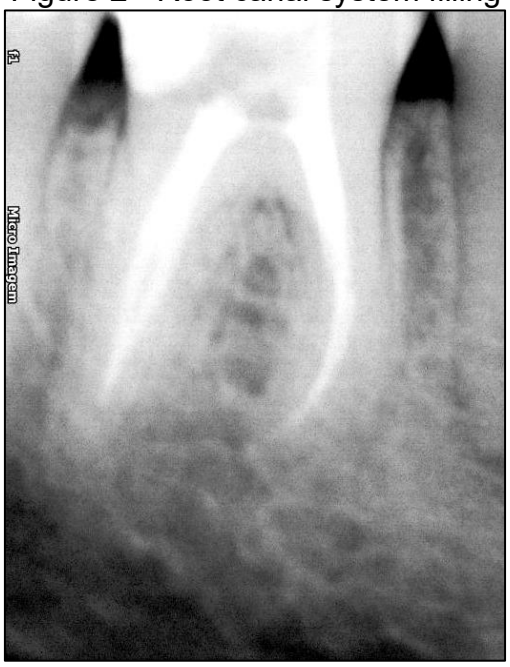
CASE REPORT

Patient M.C.B, a 49-year-old Caucasian male, was referred to the office of an endodontics specialist for the removal of a fractured file in tooth 46. Intraoral examination revealed the presence of provisional sealing. The vertical and horizontal percussion tests were negative. Periapical radiographic examination revealed a coronary chamber filled with radiopaque material and the presence of a fractured instrument apparently 8 mm long in the middle and pical third of the mesial root. (Figure 1).

Figure 1 - Fractured instrument in the middle and apical third of the mesial root.

The patient was anesthetized and coronary opening was initiated with a 1014 diamond ball drill (Angelus®, Londrina, PR), subsequently, a rubber dam (Hygenic®, Coltene® Switzerland) and 204 clamp were placed on tooth 46 and fixed with a Top Dam® gingival barrier (FGM, Joinville, SC, Brazil), ensuring absolute isolation. Then, the canals were filled using a reciprocating file (Reciproc R25) and irrigation with 2% chlorhexidine associated with natrosol. In order to overcome the fragment of the instrument in the mesiolingual canal of the mandibular molar, we used file #08, #10 and #15 (C pilot-VDW-Germany), and #15 of 25mm K-Flexofile (Maillefer-Dentsply, Switzerland) with a movement of 1/4 turn overtaking the fragment under abundant irrigation. Thus, the mesiolingual canal was prepared with pre-curved K-Flexofile manual files of numbers 15-20-25-30, in order to overcome the file. The patency of the apical foramen was performed with the same 25.01 file, and then the preparation of the disto-vestibular, distolingual, and vestibular mesium canals were completed with the ProDesign Logic 30.05 file. The root canal system was filled with a single 30.05 gutta percha cone (Bassi) associated with BIO-C Sealer filling cement. It is observed in the radiographic image that the filling cement reached the exit of the apical foramen. (Figure 2).

Figure 2 - Root canal system filling



DISCUSSION

Endodontic treatment is able to allow the tooth to remain and return it to function. However, during the procedure, accidents may occur due to the physical characteristics of the instruments and the anatomical complexity of the root canal system. The instruments are susceptible to fracture by torsion or flexion, and this can compromise disinfection and the success of the therapy. The presence of a foreign body inside the root canal makes the dentist need to identify the type of fragment and especially its location, in order to indicate the best technique for solving the case. Thus, when it is not possible to remove the fractured instrument, one of the techniques that can be used is bypass, which allows the instrument to be passed by creating a space between the fragment and the tooth wall, through smaller caliber manual files. (Castro et al. 2023).

In cases where a good visualization of the instrument is not possible or where removal would cause excess dentin wear, the best approach is the Bypass. The technique consists of overcoming the fragment, using a smaller caliber file supported between the segment and the canal wall, in order to create a space between them and reach the patency length, seeking correct instrumentation and filling of the root canals. The Bypass technique consists of the use of another instrument, usually of smaller dimensions, which is used to try to laterally overcome the fractured instrument. The shape of the canal can allow the lateral passage to be carried out and its remnant can be instrumented by a clean instrument. The fractured fragment is thus subsequently encompassed in the tooth filling, after a correct irrigation of the entire canal along its length. (Travassos et al. 2024). In the present case, it was decided to fill the canal with Bio-C Sealer cement, using the injectable

technique with the objective of obtaining an apical puff, locking the tip inside the conduit and exerting positive pressure. The fluidity of the material allowed it to penetrate the recesses of the instrument with less bubble formation and fewer filling deficiencies compared to conventional techniques. Even with minimal extravasation, bioceramics have good biocompatibility, even in the initial phase of their curing (hardening), in addition to having excellent properties to prevent the growth of bacteria and biofilm.

The factors related to fracture of endodontic instruments are: variability of the internal dental anatomy, repeated use of the instruments and inability of the operator. And the removal of the fragment can be influenced by aspects such as: type and size of the fragment, location, instrumentation phase in which the fracture occurs and periapical condition of the tooth to be treated. Among the techniques used in the intervention of fractured instruments inside the canal, the associated use of microscopes and ultrasonic systems to enable the passage and removal of the fragment Fernandes et al. 2022 stands out. However, the removal of a fractured instrument is a sophisticated process that requires training, experience, and knowledge of the methods, techniques, and devices that can be used. In fact, attempts to remove fractured instruments are influenced by several factors and may be associated with complications that can compromise the prognosis of the tooth. In light of these factors, limitations, and potential complications, the management of fractured instruments should be a systematic yet dynamic process, with the clinician constantly reassessing progress and considering alternative treatment options when necessary. (Travassos et. al, 2024). It is necessary for the clinician to correctly evaluate each case in relation to the anatomy of the root canal, as well as the working technique to be used before carrying out the treatment. Whatever the technique applied, the use of magnifying media is an essential condition for any procedure, as it allows a constant visualization of the fragment and the area being treated. Ananias et al. 2024.

Endodontic instruments are metal tools, manufactured from stainless steel or nickel-titanium (NiTi) alloys used as mechanical agents in root canal instrumentation. During root canal instrumentation, the instrument experiences stresses that vary with the anatomy of the canal. Tensions, lack of knowledge of the mechanical properties of the materials and little skill and clinical experience of the professional can induce their rupture inside the canal. Fracture during clinical use can occur by torsional loading, rotary flexion, and by combinations thereof. Fractured instruments retained inside the canal can affect the outcome of endodontic treatment. (Lopes et al. 2011). The authors also report that when the tip of an endodontic instrument is immobilized inside a root canal and the rotation (rotation) to the right is achieved, there will initially be a plastic deformation (distortion) of its helices.

The presence of plastic deformation of the helices observed when the endodontic instrument is removed from a root canal during instrumentation gives a warning that a torsion fracture is imminent. Thus, during the instrumentation of a root canal, it is important that the professional removes the instrument from the inside of a canal more frequently and examines it carefully. Deformed endodontic instruments should be discarded before failure (fracture) occurs. Plastic deformation also allows the professional to perform correction and adjustments in the advance of the instrument inside the canal and in the torque to be applied to a new instrument used in root canal instrumentation. These measures aim to avoid the immobilization and plastic deformation of the new endodontic instrument used in instrumentation.

Rotary flexion fracture occurs when an endodontic instrument (NiTi or stainless steel) rotates inside a curved canal, which is within the elastic limit of the material. In the flexion region of an endodontic instrument during its rotation, alternating tractive and compressive tensions are induced. The repetition of these fractures promotes cumulative microstructural changes that induce nucleation, growth, and coalescence of cracks, which propagate to fatigue fracture of the endodontic instrument (Lopes et al. 2007).

CONCLUSION

The bypass technique to overcome the fractured instrument is a conservative, effective method and an appropriate solution in cases of fracture, preserving as much as possible of the original dental structure and avoiding more invasive procedures.

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