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Removal of fractured endodontic instrument: a case report

Removal of a fractured instrument in endodontics: a case report

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SUMMARY
Endodontics aims to eliminate bacteria and their by-products from inside the root canal, in order to stop the infection and thus maintain dental elements in function that would otherwise be lost, without causing harm to the patient's oral health. During the stages of the endodontic procedure, the professional is prone to errors, both due to instrument failures and/or root anatomy of the dental element, and due to the dentist's lack of knowledge/skill. The present study aims to report the case of a patient who was referred for endodontic retreatment of element 25, which had a fractured endodontic instrument inside the buccal root canal. After carrying out a clinical and radiographic examination of the patient, the CD decided to attempt to remove the fragment via a canal, with the aid of ultrasonic inserts. After one hour of ultrasonic vibrations with the E18 tip (HELSE) at 50% power, the fragment was removed.

KEY WORDS:fracture of rotary files; types of machined file fractures; fractured file removal.

ABSTRACT
Endodontics aims to eliminate bacteria and their by-products from inside the root canal, in order to paralyze the infection and thus keep dental elements in function that, otherwise, would be lost, not causing damage to the patient's oral health. During the stages of the endodontic procedure, the professional is prone to errors, both due to failure of the instruments and/or root anatomy of the dental element, as well as the lack of knowledge/skill of the dentist. The present study aims to report the case of a patient who was referred for endodontic retreatment of element 25, who had a fractured endodontic instrument inside the buccal root canal. After performing a clinical and radiographic examination of the patient, the DS decided to try to remove the fragment via the canal, with the aid of ultrasonic inserts. After one hour of ultrasonic vibrations with the E18 tip (HELSE) at 50% power, the fragment was removed.
KEYWORDS:fracture of rotary files; types of mechanized file fractures; fractured file removal.

1. INTRODUCTION

Endodontics is a specific area of dentistry that is based on the study of the structure, functioning and pathologies of the pulp and the tissues that surround it, as well as the prevention, treatment and control of pulp changes and their consequences on the periapical tissues[16]. The endodontic procedure aims to eliminate bacteria and their by-products from inside the root canal, in order to paralyze

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the infection. To achieve this, chemical mechanical preparation (PQM) of the root canal is necessary, which is one of the main stages of treatment. This preparation includes irrigation techniques with auxiliary chemical substances and also filing, which is carried out through the use of endodontic files, which together clean, shape and tend to disinfect the canal and its[10, 15].

In an attempt to optimize PQM, nickel-titanium alloy (NITI) rotary files were introduced onto the market, replacing stainless steel files, which are still used to this day. As an advantage, NiTi files have high elasticity and resistance, when compared to stainless steel ones, in addition to the shape memory effect and biocompatibility. These innovations enabled the development of mechanized systems, with their movements in the form of continuous rotation or alternating rotation.[8]. Although metallic alloys undergo constant evolution, with the aim of increasing flexibility and resistance to fracture, these instruments remain prone to incidents. This is due both to the high complexity of anatomical variations, since the files undergo tension and flexion when adjusting to the internal anatomy of the root canal, as well as to the integrity of the material and the skill of the operator.[7.2]. Therefore, during the clinical procedure, there is the possibility of fractures, whether due to torsion or flexion.[15].

Torsional fracture occurs when the end of the instrument is locked, while at the other end there is a torque greater than the resistance level of the material, which can be caused by excess apical pressure during instrumentation. Flexion fractures occur when the file circulates inside a curved canal, causing continuous stress that exceeds its elastic limit. Therefore, the recurrence of these tensions tends to cause irregularities in the microstructures of these instruments, leading to fragmentation[1]. Therefore, although NiTi files present an excellent metallic alloy and excellent results nowadays, the fracture of these rotary instruments, when it occurs, creates an additional challenge for endodontic treatment, since the PQM of the canal will be harmed when it is not possible to remove the fractured fragment. Therefore, each case must be evaluated uniquely before proceeding with the procedure, analyzing the region where the fracture occurred, being the third (cervical, middle, apical), the nature of the fracture, the size of the fragment, access to the part of the lime, in addition to observing the periapical state, considering the risks and benefits[8, 2]. The present work aims to present a clinical case that demonstrates a satisfactory result for removing a fractured endodontic file with the aid of ultrasonic inserts.

2. CLINICAL CASE

This work is a case report, which was provided with the patient's spontaneous permission, for the use of the clinical case and imaging examination. In order to preserve his anonymity and use information present in the anamnesis form, the aforementioned patient authorized, by issuing an Informed Consent Form, the use of the documentation.

Patient PJDC, 42 years old, male, attended a private dental clinic, referred by a referring dentist, for endodontic retreatment of tooth 25 and removal of the fractured file. During the anamnesis, it was reported that the patient had undergone endodontic treatment a year ago.

During the clinical examination, the presence of signs and symptoms in element 25 was observed. During palpation and percussion, the tooth showed a positive response. To the cold test (MaquiraEndo Ice Spray Vitality Test), the tooth also responded positively.

Radiographically, the tooth presented a file fragment in the middle third of the vestibular canal. The palatal canal had an unsatisfactory filling. Endodontic retreatment of element 25 was proposed. To begin treatment, a Computed Tomography examination of the tooth region was requested, as can be seen in figure 2. The computed tomography was requested because, although periapical radiographs in endodontics are of great importance, , they are a two-dimensional examination, since the

two

Cone beam computed tomography (CBCT) is three-dimensional. As advantages, CBCT images reveal greater evidence and details in the treatment, unlike periapical radiographs, mainly in the visualization of small areas, as it is three-dimensional, it allows in endodontics precision in visualizing the number, location, shape, size and direction of the roots , in addition to the position of the structures in the mesio-distal buccolingual dimension (tooth inclination) location of the root apex, they analyze the topographic nature of the alveolar bone and the thickness of the cortical bone[11].

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Figure 1: Computed tomography of element25 (oblique or parasagittal section).



Source: Personal archive.
note: The black arrows show the file fragment inside the buccal root canal, and unsatisfactory endodontic treatment in the palatal region.

In the first consultation, endodontic access to tooth 25 was planned. In this way, the opening began with a 1014 HL diamond spherical drill and removal of the temporary dressing that the tooth had. After locating the canals (Vestibular and Palatine), the tooth received absolute isolation and circular wear began with the ultrasonic tip EAD and E18D (HELSE) of the vestibular canal, then ultrasonic vibrations began with the tip E18 (HELSE) at 50% power. After 1 hour, the file fragment was removed as can be seen in figure 2.

Figure 2: File fragment, after removed from the canal.



Source: Personal archive.

The gutta percha was also removed with an R1 Black ultrasonic tip (HELSE) in the cervical third, and the remainder, as well as the endodontic retreatment, was performed with the R25 reciprocating file (RECIPROC). Exploration of the canal was performed with a #15 K-file, and odontometry was performed using the apical locator, which confirmed the CT = 21mm in both canals. During the entire process, irrigation was carried out with 40 ml of 2.5% sodium hypochlorite and activation with an Irrisonic ultrasonic insert (HELSE) coupled to an ultrasound with 20% power.

After 40 ml of NaOCl, the canal was irrigated with a sufficient amount of EDTA for the compound to be activated 3x 30 seconds with ultrasound. Finally, 10 ml of hypochlorite were used again and activated with ultrasound. The canal was dried with absorbent paper cones and ultracal XS ready-made calcium hydroxide paste (Ultradent) was inserted along the entire length of the canal and cotton balls were inserted into the pulp chamber. The channel was sealed with ionoseal (VOCO), as can be seen in figure 3.

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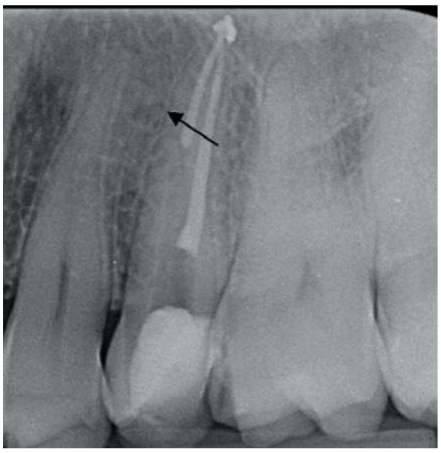
Figure 3: Element clear after cleaning and formatting



Source: Personal archive.
note: The black arrow indicates the canal after removal of the fractured file fragment, retreatment already carried out and intracanal medication.

After 15 days, the patient returned without signs and symptoms. After the entire instrumentation protocol, the final irrigation protocol was carried out to enhance the PQM. 40 ml of NaOCl were used, and the canal was irrigated with a sufficient amount of EDTA for the compound to be activated 3x 30 seconds with ultrasound. Finally, 10 ml of hypochlorite was used again and activation was performed with ultrasound. The canal was dried with paper cones.
In the last phase, the obturation process began. The standardized R25 Reciproc gutta-percha cone (VDW) was used, following the pattern of the last file that was used in the instrumentation. After testing the cone and checking, the cone was sterilized in NaOCl. The filling cement used was AH Plus (Dentsply). Lateral condensation and vertical compression were performed, followed by the use of a McSpadden 25mm #40 gutta-percha condenser. Finally, the tooth was provisionally sealed with ionoseal (Voco), as shown in figure 4. It was then sent to the referring dentist.

Figure 4: Canal finished and obturated, with preparation of the conduit (vestibular) for pin placement already carried out.



Source: Personal archive.
note: The white arrow indicates the vestibular canal that has already been endodontically treated and with post preparation already carried out. And the black arrow indicates the obturated palatal canal.

3. DISCUSSION

Despite all the evolution of NiTimecanized files, there is still one problem, which is mechanical resistance. This can be noticed when subjected to constant effort, associated with chemicals, sterilization cycles, in addition to the operator's skill, making them subject to fractures.[5].
This accident may be related to numerous factors, such as the number of uses. Some professionals use instruments abusively and repetitively[12]. Some authors have suggested that instruments be used

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for a maximum of ten times, making it necessary to routinely carry out an assessment to assess signs of deformation[3]. Others opted to use the instruments up to eight times in simulated canals with a 35-degree curvature. Therefore, as the number of uses of files increases, there is a decrease in the instruments' resistance to torsional fracture[5]. There are also those who claim that the literature is not clear in offering guidelines on the number of uses, especially NiTi files, since deformations are not always visible to the naked eye. Manufacturers advocate single use, although failure is more influenced by the way the files are handled than by the number of uses.[9.5.]

Among the main causes of endodontic instrument fracture are anatomical characteristics, such as radii and curvature angles of the root canal, arch length, number of uses of the instrument, increased torque and operator experience.[5]. Deformation may also be associated with excessive torque, as well as the amount of tension treated and the decompression forces used in the instrument's flexibility region.[15].

Although this incident increases the difficulty of treatment, there are several ways to continue the procedure effectively. The technique of overtaking the fragment can be used,*bypass*, a strategy that consists of using another instrument of smaller caliber to pierce the fractured equipment in this way, the particle can be incorporated into the filling material. There is also the possibility of intervening surgically, through endodontic surgery, or even removing the fragment, as was done in the case presented in this work.[15].

In the case in question, the patient arrived at the dental office with the file fragment fractured in one of the canals, and the other canal with filling material, showing signs and symptoms, in which case endodontic retreatment was necessary. After failure of previous treatments, non-surgical retreatment is the best method[6]. Furthermore, fragment removal was performed with the ultrasonic technique, the use of this ultrasonic device has proven to be an effective and safe method for removing fractured instruments. Among the benefits of an ultrasonic instrument, its ability to loosen the obstruction while causing minimal damage to the dentin walls of the root canal stands out. However, ultrasonic techniques are time-consuming and have been shown to have a moderate success rate.[14].

Removal of the gutta percha from the cervical third of the palatal canal was also performed with the aid of an ultrasonic tip. The remainder of this material, as well as the endodontic retreatment, was carried out with a specific file for retracting canals, the R25 (RECIPROC), which is widely used for endodontic retreatment, due to the ease of handling curved canals, in addition to being more safe and effective way to remove filling material faster than continuous rotary and manual instruments. Furthermore, reciprocating files demonstrate greater fracture resistance when compared to rotary instrumentation.[6].

Finally, it is worth highlighting that several of the factors that contribute to file fractures can be minimized by prevention instructions. It is very important to perform hands-on training on teeth extracted with the NiTi system of choice prior to clinical use; start instrumentation with*glide path*(create an initial path) with #10, #15 files or even NiTi files*pathfiles*, to make sure that the passage is unobstructed for access with larger caliber files; in addition to applying the technique*crown down*, which consists of crown-to-apex instrumentation. It is also recommended to use the endodontic motor with the speed and torque indicated by the manufacturer, in addition to keeping the auto reverse function activated, as this reduces the risk of torsional fracture. If it is not possible to adopt a single-use file policy, avoid excessive use. Furthermore, when used on challenging root morphology, immediate disposal of these files should be considered. Finally, an appropriate instrument must be used in sharply curved or torn canals[14].

CONCLUSION

The present study allowed reporting and discussing a case of removal of a fractured endodontic file in the middle third of the root canal, given that, despite all the evolution of metallic alloys, the possibility of fracture still exists. Therefore, the dental surgeon must always ensure good planning and technical protocol throughout the endodontic treatment, preventing fractures of the instrument. However, if this fracture occurs, there are several possibilities for removing the fragment. To do this, a good study of the case must be carried out, thinking about the best possibility and technique to be performed. In the case presented, the removal of the fragment was carried out satisfactorily, making it possible to consider it a valid attempt to improve the predictability of endodontic treatment, when the benefits of the treatment outweigh the risks.

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