Use of technology and calcium silicate cement in the resolution of endodontic retreatment complications: Case report

Ericke Mucke **SILVA**[1]
Murilo Priori **ALCALDE**[1,2]
Rodrigo Ricci **VIVAN**[1]
Marcelo **POMINI**[1,3]
Marco Antonio Hungaro **DUARTE**[1]

DOI: https://doi.org/10.14436/2358-2545.10.2.086-093.oar

ABSTRACT

Introduction: Accidents and complications may happen at any endodontic treatment stage. These are likely to change the prognosis of treatment and can be due to factors related to instrumental failure, anatomic difficulties and the professional's limitations. **Objective:** This case report addresses a case where a patient presenting two separated instruments and a root perforation in a lower molar with apical periodontitis. **Case report:** The separated instruments have been removed by mechanical and ultrasonic standardized method and the perforation was treated and sealed by silicate cement-based material. **Conclusion:** The use of technological resources favored the resolution of the case, increasing its predictability. The reestablishment of the normal condition of the tooth and surrounding tissues was confirmed by radiograph and computed tomography exams.

Keywords:: Ultrasonics. Root Canal Preparation. Silicate Cement.

How to cite: Silva EM, Alcalde MP, Vivan RR, Pomini M, Duarte MAH. Use of technology and calcium silicate cement in the resolution of endodontic retreatment complications: Case report. Dental Press Endod. 2020 May-Aug;10(2):86-93.
DOI: https://doi.org/10.14436/2358-2545.10.2.086-093.oar

[1] Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Dentística, Endodontia e Materiais Odontológicos (Bauru/SP, Brazil).

[2] Universidade do Sagrado Coração, Departamento de Endodontia (Bauru/SP, Brazil).

[3] Universidade do Oeste Paulista, Faculdade de Odontologia de Presidente Prudente, Departamento de Endodontia (Presidente Prudente/SP, Brazil).

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

Submitted: September 18, 2018. Revised and accepted: February 11, 2019.

Contact address: Ericke Mucke Silva
Rua Nove de Julho, nº 865, sala 03 – Centro
CEP: 19.800-021 – Assis/SP
E-mail: ericke_mucke@hotmail.com

Introduction

Endodontic treatment is made up of several interdependent stages and each one, from diagnosis to root canal filling, requires a careful approach to achieve treatment success. However, during these steps, some accidents and complications may occur, such as ledge formation, filling material extrusion, file separation, root perforation, etc. These mishaps may arise as much from the anatomical difficulty imposed by the case as from carelessness or operator malpractice.[1]

One of the most unfortunate accidents that can occur is the separation of an endodontic file during its use. Generally, instruments driven by automated kinematics can be basically fragmented by twisting or cyclic fatigue.[2] This sort of accident is associated with several factors, such as severe canal curvature,[3] inadequate speed and torque configuration to which the instrument is subjected by the motor,[4] manufacturing process, absence of glide path[5] and file overuse.[6]

Given this sort of occurrence, the probability of treatment failure can become particularly high when the separate instrument remains obliterating the canal path and preventing its complete cleaning and shaping, especially in cases where periapical lesions already exist[7]. When an infection is installed, surpassing or removing the separate instrument becomes essential for more predictable results.[8]

Other sort of accidents that can occur during endodontic treatment are root perforations. These can be defined as involuntary and artificial lesions that cause undesirable communication between the pulp cavity and the periodontal ligament. They usually occur during the coronary access, root canal preparation to receive posts or even during the cleaning and shaping of root canal.[1]

The clinical possibilities for treatment of perforations and their prognosis depend on their location, amplitude and absence of infection.[1] This case report aims to describe the treatment of a tooth with periapical lesion, which underwent endodontic treatment, causing a series of accidents that could make the case prognosis quite unfavorable.

Case report

A 43-year-old female patient was referred for dental element 36 treatment by another professional due to the presence of a separate instrument fragment in the mesial root.

The patient was aware of the presence of the fragment in the root canal, complained of painful tenderness in the affected tooth region and reported a history of edema. A periapical radiograph of the tooth 36 was performed and it was observed that the tooth had not only one, but two separate instruments (Fig 1A). The fragment reported by the indicator was in the mesial root, between the cervical and middle thirds, and the other metallic fragment in the apical region of the distal root. Initially, it was not possible to identify the type of fractured instrument; however, it was thought to be a conical drill fragment. In addition, it was possible to radiographically notice excessive dentin wear on the mesial root near the furcation region and the presence of periapical lesion on the mesial root.

At the first visit, the patient was anesthetized by lower alveolar nerve block (MEPIADRE 100, Nova DFL, Taquara, Rio de Janeiro, Brazil), rubber dam isolation and removal of the temporary filling material was done. Pulp chamber observation was performed using an operating microscope (DF Vasconcelos MC1232, São Paulo, Brazil). Then, the presence of fractured instruments was detected in the mesiobuccal canal (Fig 1B) and in the distal canal (Fig 1C).

Attempts were made to remove the fragments, starting with the mesial root fragment. Initially, careful widening of the mesiobuccal canal with modified Gates-Glidden # 3 drill (Terauchi file retrieval kit accessories, Dental Cadre, California, USA) was performed (Fig 2A). in order to enlarge the canal and create a larger surface up to the coronal portion of the fragment, allowing better access and visualization of it. In the next step, a micro trephine drill that has inner and outer diameter of 0.45 mm and 0.6 mm respectively (Terauchi file retrieval kit accessories, Dental Cadre, California, USA) (Fig 2B) driven at low counterclockwise rotation was used to create a space around the coronal part of the fragment. After this procedure, the micro spoon type ultrasonic tip (TFRK-6, Dental Cadre, California, USA) (Fig 2C) was used to assist in the creation of a space between the instrument and the root canal wall, allowing a careful wear of the area. Next, a straight ultrasonic tip (TFRK-S Dental Cadre, California, USA) was used (Fig 2D), which was placed laterally to the fragment, activated with intermittent and short propulsion and recoil movements applied to the fragment in an attempt to dislodge it.

During the removal procedure, a second fracture of the fragment being removed ocurred, which was visualized on the periapical radiograph (Fig 3A). Additionally, a perforation could be observed in the area. Once the secondary fragment was removed by vigorous saline irrigation, the slit was deepened parallel to the remainder broken file using the TFRK-6 instrument (Fig 2C). The process of removing the fragment in the mesiobuccal canal was continued. This step was performed using a TFRK-S (Fig 2D) straight ultrasonic tip driven with lower power. Following the correct protocol, the fragment was removed, and the canal path was found (Fig 3C).

The next step was the removal of the metallic fragment present in the distal root canal. For this, a set of 1st series K files (Dentsply Maillefer, Ballaigues, Switzerland) was used under constant irrigation and aspiration to create a lateral space to the fragment and the inner wall of the canal. This was facilitated by the elliptical anatomy of the distal canal itself. Then, TFRK-S ultrasonic tip was used between the instrument and the canal wall, performing short axial movements, allowing the fragment to be removed (Fig 3D).

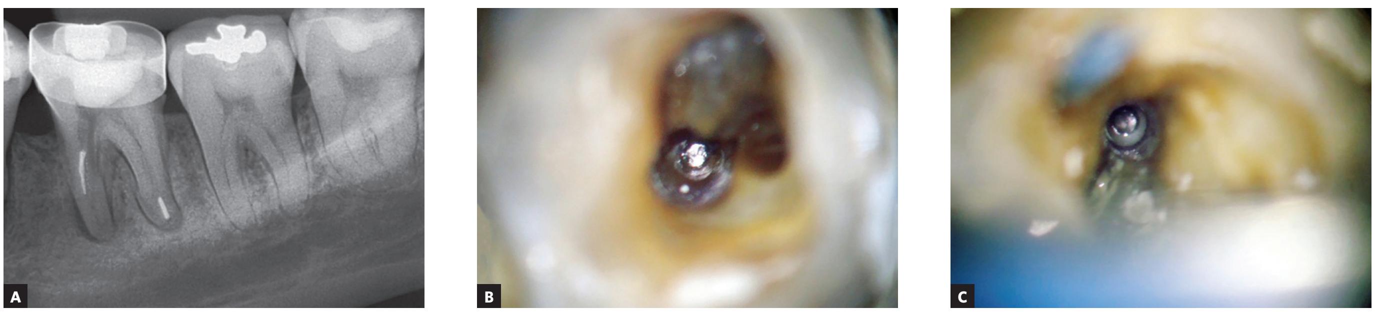


Figure 1. Preoperative: **A**) Initial periapical radiograph of the case, in which it is possible to observe fragments both mesial and distal roots and the presence of radiolucency in the periapical region. **B**) Microscopic image of the fragment stuck in the mesiobuccal canal. **C**) Microscopic image of the fragment stuck in the distal canal.

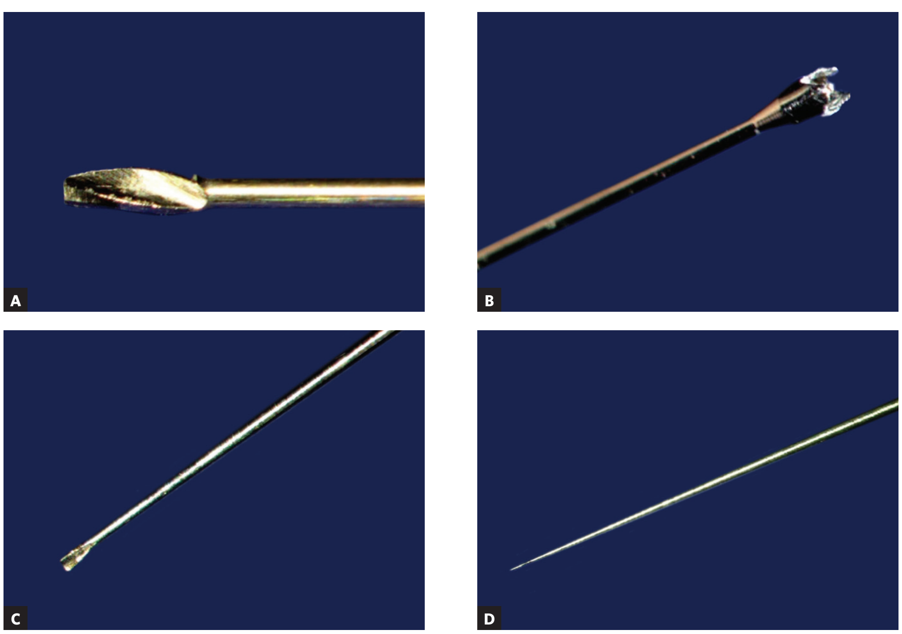


Figure 2. Rotary instruments: **A**) Modified Gates-Glidden III drill. **B**) Microtrephine Drill # 5. **C**) Micro spoon TRFK-6 ultrasonic tip. **D**) TFRK-S straight thin ultrasonic tip.

Once the fragments have been removed and the canals paths unblocked, intracanal medication was placed into the mesiobuccal canal . A paste of calcium hydroxide (Chemical and Pharmaceutical Biodynamics, Ibiporã, Paraná, Brazil) mixed with propylene glycol to assist in the repair of perforation was used (Fig 3D). Later, in the mesiolingual and distal channels, calcium hydroxide was also employed, but with an Ultracal paste (Ultradent Dental Products of Brazil, Indaiatuba, São Paulo, Brazil).

After 14 days, the patient returned for sealing of the mesiobuccal canal perforation. The material of choice was MTA Repair HP (Angelus, Londrina, Paraná, Brazil). The medication was removed, keeping only a small portion inside the perforation (Fig 4A), so that it could serve as a support for MTA[9], thus avoiding material extrusion. In order to prevent the MTA from being accidentally inserted into the mesiobuccal canal, it was provisionally obliterated with a gutta-percha cone (Fig 4B).

After manipulation of the MTA according to the manufacturer's instructions, it was taken and inserted into the perforation area using a MAP System apical microapplication system (Produits Dentaires SA, Vevey, Switzerland) and accommodated in the perforation area using a properly sized plugger. After this, the gutta-percha cone was removed from the mesiobuccal canal. At this point (Fig 4C), it could be observed that

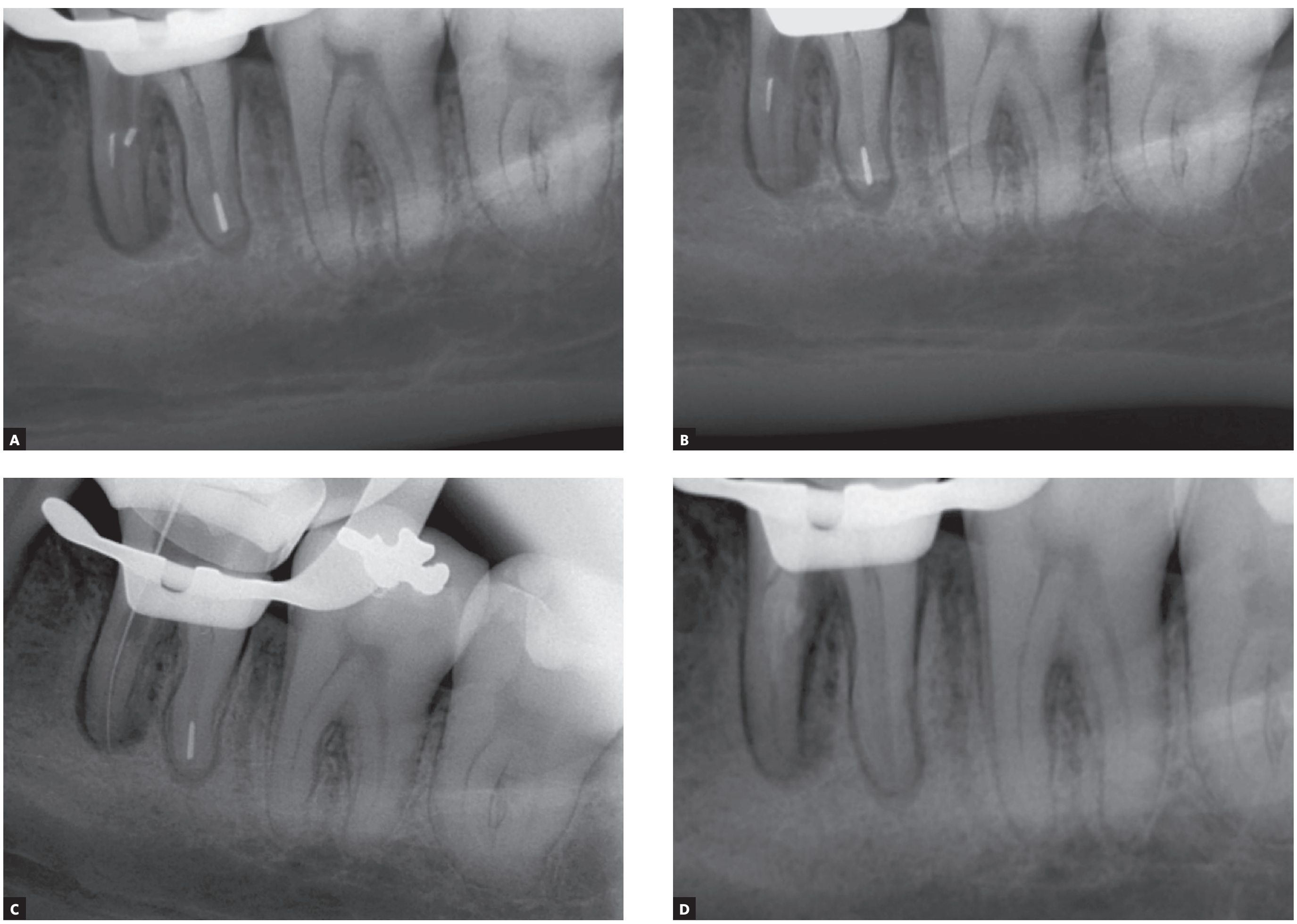


Figure 3. Transoperative: **A**) Periapical radiograph of lower left first molar, in which it is possible to visualize the secondary fragment. **B**) Periapical radiograph of lower left first molar after removal of the secondary fragment. **C**) Periapical radiograph of lower left first molar showing that the canal path was unblocked. **D**) Periapical radiograph of lower left first molar after insertion of dense calcium hydroxide paste in the mesiobuccal canal.

the perforation was properly filled by the repair material. A sterile sponge moistened with distilled water was applied over the MTA so that it could have its prey consolidated. At the end of this session, temporary sealing was performed with Ionoseal glass ionomer material (Voco, Porto Alegre, Rio Grande do Sul, Brazil).

After 2 days, the root canals preparation was performed using Prodesign Logic 25.06, 35.05 and 40.05 rotary files (Easy Dental Equipment, Belo Horizonte, Minas Gerais, Brazil) under copious irrigation and aspiration of the canals using 2,5% sodium hypochlorite (ASFER Indústria Química LTDA, São Caetano do Sul, São Paulo, Brazil). At the end of the preparation, after the use of Trisodium Edta (Biodinâmica Dental Products LDA, Figueiró dos Vinhos, Portugal), a calcium hydroxide paste (Ultracal) was used as intracanal medication and then agitated by an Irrisonic E1 ultrasonic tip (Helse Dental Technology, Santa Rosa de Viterbo, São Paulo, Brazil), in order to increase calcium hydroxide penetration inside the dentinal tubules and optimizing the release of calcium ions.[10,11] Coronary sealing was performed with Ionoseal glass ionomer cement (Voco, Porto Alegre, Rio Grande do Sul, Brazil) and awaited a period of 28 days. After this period, the mesial canals were filled by the single-cone hydraulic compression technique compatible with the preparation. The distal canal was filled with conventional gutta-percha cones by the active lateral condensation technique. The endodontic sealer used was AH Plus (Dentsply, Konstanz, Germany). At the end, the tooth was temporary sealed with Ionoseal glass ionomer cement (Voco, Porto Alegre, Rio Grande do Sul, Brazil), and the patient was referred back to the referee.

Figure 4. Perforation sealing: **A**) Microscopic image of the perforation located at the mesial root. **B**) Gutta-percha cone inserted into the buccal middle canal to avoid path obliteration by MTA. **C**) Image of sealed perforation after insertion of HP MTA. **D**) Periapical radiograph of lower left first molar after root canal filling.

The patient was clinically and radiographically controlled for 6 months, within this period of time, it was noticed the normality of the periapical tissues, remission of the periapical lesion in the mesial root (Fig 5A), and absence of symptoms. After this time, a CBCT exam was requested for a more accurate observation of the of periradicular tissues, especially in the perforation region, as well as a better analysis of the presence or absence of lesions. The tomographic images in the sagittal (Fig 5B) and coronal (Fig 5C) sections showed normality of the periapical tissues and integrity of the bone tissue in the furcation region, where the perforation was located. Finally, in the axial cuts of the cervical, middle and apical thirds (Figs 5 D, E, F), respectively, it was possible to observe, especially in the cervical section, the integrity of the bone tissue in the region where the root perforation was located. , proving the success of the procedure proposed to the patient.

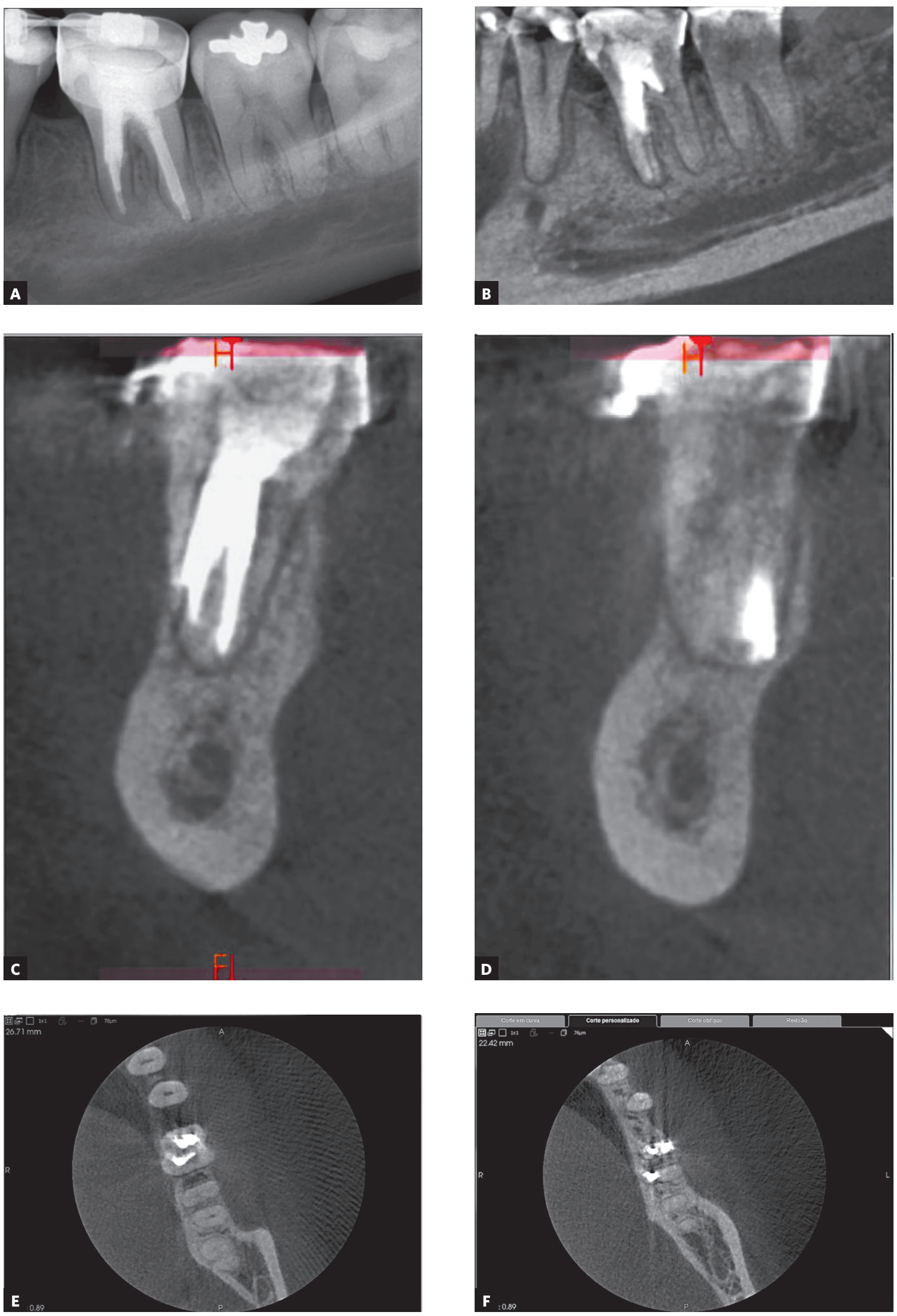
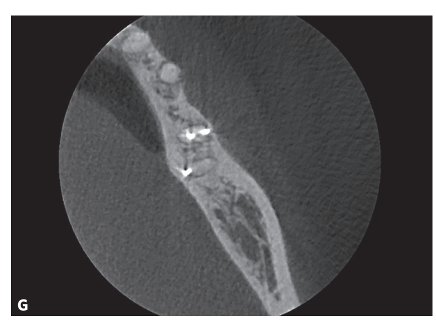


Figure 5. Follow up: **A**) Periapical radiograph of the lower left first molar, 6 months after the conclusion of the case. **B**) Tomographic image of the sagittal section of the lower left first molar, 9 months after the conclusion of the case. **C**) Tomographic image of the coronal section of the buccal mesial root. **D**) Tomographic image of the coronal section of the distal root. **E**) Tomographic image of the axial section at the cervical third level of lower left first molar. **F**) Tomographic image of the axial section at the middle third level of the lower left first molar. **G**) Tomographic image of the axial section of the apical third of the lower left first molar.



Discussion

During the treatment or endodontic retreatment, we may face complications or accidents caused by other professionals, making it difficult to properly perform the treatment.[1] In addition, in the attempt of resolution, the clinician may lead to a new iatrogenesis, which may further complicate the case. The present case report involved the complex resolution of three types of complications that may occur during endodontic treatment: two instrument separations and a root perforation.

The introduction of NiTi alloy in endodontics by Walia et al.[2] provided more safety in the preparation of curved canals and made mechanized preparation a reality, favoring a safe, efficient preparation and reduction of working time.[2] However, the use of mechanized instruments requires prior training and knowledge of the characteristics and proper kinematics applied to the instruments, as well as their timely disposal. Otherwise, it may favor the occurrence of fracture of the instruments inside the root canals.[12]

Instrument fractures may compromise the quality of endodontic treatment, as they may hinder the cleaning and shaping of root canals, resulting in persistence of microorganisms and, consequently, compromising treatment success[13]. Therefore, the attempt to remove the fragment or to surpass it must be performed, allowing the entire root canal lenght to be cleaned.[14]

There are several techniques for removing fractured instruments from the root canals.[14,15,16,17] In this particular case, for the separeted instrument in the middle third of the mesiobuccal canal, a technique recommended by Terauchi et al.[18] was applied, which involves a kit composed of manual instruments, drills and, mainly, ultrasonic tips, which are used in a similar way, in order to retrieve separate fragments trapped within root canals.

During the process of removing the mesiobuccal canal fragment, a secondary fracture occurred, a fact that further increased the complexity of the case. This occurrence can be explained by some factors: 1) lack of the creation of a deeper space with the micro spoon inserts between the fragment and the canal wall - this space or semicircular rift must have at least 1/3 of the total length of the fragment so that it can be more easily displaced by ultrasonic activation and 2) excessive power imposed by the device on the ultrasonic tip should be minimal and activation applied intermittently, especially when ultrasonic tips are used without water cooling for easy viewing.[18] According to Madarati,[19] when the heat-treated NiTi alloy is heated above 200°C, there is a loss of metal flexibility that returns to the austenitic phase. This makes the alloy more susceptible to fractures. Once these protocols were executed correctly, it was possible to remove the remnant of the mesiobuccal canal fragment.

To achieve removal of the instrument, there was a higher dentin wear than would normally have occurred in a conventional treatment. However, if the canal path remained obliterated by the fragment and could not have been instrumented to its full extent, only one surgical procedure could have been performed to heal apical periodontitis. Retrieving the fragment located in the distal canal was facilitated by the anatomy of the distal canal itself, which was quite flat. Since the distal canal was elongated in the buccolingual direction, the lateral areas of the fragment allowed easier access to the ultrasonic tip, which was activated inside the irrigated canal, promoting acoustic current formation and then displacing and expelling the fragment.

It was not possible to state whether the existing perforation was caused during the act of fragments retrieving. Since excessive dentin wear was already performed and the area was already fragile, it may have been burrowed by one of the instruments employed in the procedure. However, it is suspected that perforation occurred during previous treatment, because when it was clinically identified through magnification, there was no bleeding or sign of an older process and probably contamination was present. The perforation was initially treated with calcium hydroxide to promote decontamination of the affected area and to organize the adjacent tissues, as well as to create a stand so that the sealing material did not extrude when inserted. The material used was MTA HP Repair (Angelus). The MTA was chosen due to its biocompatibility and bioactivity, being a material widely used for sealing root perforations, promoting a proper seal and stimulating the formation of mineralized tissue in the areas adjacent to the perforation.[20] Inserting the MTA into a root perforation can be a challenging process depending on its root location. In the present case, MTA HP Repair (Angelus) favored its application, as its more plastic physical property facilitated its insertion in the perforation site. In order to prevent the sealing material from accidentally obliterating the canal path, a compatible taper gutta-percha cone was inserted into the canal, temporarily obliterating the mesiobuccal canal path. Then the MTA was prepared according to the manufacturer's instructions and inserted into the perforation using an appropriate MTA applicator (MAP System, PD Produits Dentaires, Switzerland). Subsequently, the material was gently condensed with an appropriately sized plugger.

Clinical and radiographic control over a period of 6 months showed total remission of the lesion and normality of the periradicular tissues. In addition, the patient reported absence of symptomatology. Estrela et al.[21] demonstrated that periapical radiographs have a limitation in the detection of periapical lesions. For this reason, after 9 months, a CBCT scan was requested to visualize the treated area more accurately. The tomographic images showed normality of the periapical tissues. In the axial sections of the cervical, middle and apical thirds (Fig 5 D, E, F), it was possible to observe the integrity of the bone tissue in the region where the root perforation was present, proving the success of the procedure proposed to the patient until the present moment. , one year and four months of follow up.

Conclusion

The use of new technologies favored the removal of fractured instruments during endodontic retreatment of a lower molar. In addition, clinical, radiographic and tomographic control demonstrated the importance of using a biologically compatible material to seal the perforation.

References

1. Bramante CM. Acidentes e complicações na abertura coronária. In: Bramante CM. Acidentes e complicações no tratamento endodôntico. São Paulo: Ed. Santos; 2004. v. 2, p. 19-54.
2. Walia H, Brantley WA, Gerestein H. An initial investigation of the bending and torsional properties of nitinol root canal files. J Endod. 1988;14(7):346-51.
3. Masserann J. Removal of metallic fragments from the root canal. J Br Endod Soc. 1971;5:55-9.
4. Sano S, Miyake K, Osada T. A clinical study on the removal of the broken instrument in the root canal using Masserann kit. Kanagawa Shigaku. 1974;9:50-7.
5. Ward JR, Parashos P, Messer HH. Evaluation of an ultrasonic technique to remove fractured rotary nickel-titanium endodontic instruments from root canals: an experimental study. J Endod. 2003;29(11):756-63.
6. Yared G. In vitro study of the torsional properties of new and used Profile nickel titanium rotary files. J Endod. 2004;30(6):410-2.
7. Panitvisai P, Parunnit P, Sathorn C, Messer H. Impact of a retained instrument on treatment outcome: a systematic review and meta-analysis. J Endod. 2010;36(5):775-80.
8. Nevares G, Cunha RS, Zuolo ML, Bueno CES. Success rates for removing or bypassing fractured instruments: a prospective clinical study. J Endod. 2012;38(4):442-4.
9. Duarte MHA, Balan NV, Zeferino MA, Vivan RR, Morais CAH, Tanomaru-Filho M, et al. Effect of ultrasonic activation on ph and calcium released by calcium hydroxide pastes in simulated external root resorption. J Endod. 2012;38(6):834-37.
10. Arias MPC, Maliza AGA, Midena RZ, Graeff MSZ, Duarte MAH, Andrade FB. Effect of ultrasonic streaming on intra-dentinal disinfection and penetration of calcium hydroxide paste in endodontic treatment. J Appl Oral Sci. 2016;24(6):575-81.
11. Bargholz C. Perforation repair with mineral trioxide aggregate: a modified matrix concept. Int Endod J. 2005;38(1):59-69.
12. Alomairy KH. Evaluating two techniques on removal of fractured rotary nickel-titanium endodontic instruments from root canals: an in vitro study. J Endod. 2009;35(4):559-62.
13. Yang Q, Shen Y, Huang D, Zhou X, Gao Y, Haapasalo M. Evaluation of two trephine techniques for removal of fractured rotary nickel-titanium instruments from root canals. J Endod. 2017;43(1):116-20.
14. Hulsmann M. Removal of fractured instruments using a combined automated/ultrasonic technique. J Endod. 1994;20(3):144-6.
15. D'Arcangelo C, Varvara G, De Fazio P. Broken instrument removal-two cases. J Endod. 2000;26(6):368-70.
16. Roig-Greene JL. The retrieval of foreign objects from root canals: a simple aid. J Endod. 1983;9(9):394-7.
17. Madarati AA, Hunter MJ, Dummer PMH. Management of intracanal separated instruments. J Endod. 2013;39(5):569-81.
18. Terauchi Y, O'Leary L, Suda H. Removal of separated files from root canals with a new file-removal system: case reports. J Endod. 2006;32(8):789-97.
19. Madarati AA, Qualtrough AJE, Watts DC. Efficiency of a newly designed ultrasonic unit and tips in reducing temperature rise on root surface during the removal of fractured files. J Endod. 2009;35(6):896-99.
20. Pitt Ford TR, Torabinejad, McKendry DJ, Hong C, Kariyawasam SP. Use of mineral trioxide aggregate for repair of furcal perforations. Oral Surg Oral Med Oral Pathol. 1995;79(6):756-62.
21. Estrela C, Bueno MR, Azevedo BC, Azevedo JR, Pécora JD. A new periapical index based on Cone-Beam Computed Tomography. J Endod. 2008;34(11):1325-31.