Ultrasonic technique associated with manual files to remove broken files from root canals system: a case series

Jefferson José de Carvalho **MARION**[1]
José Arthur M. **PASSARÉLI**[2]
Márcia Esmeralda Bis Franzoni **ARRUDA**[3]
Danilo Mathias Zanello **GUERISOLI**[4]
Thais Mageste **DUQUE**[5]
Maíra do **PRADO**[6]

DOI: http://dx.doi.org/10.14436/2358-2545.6.2.034-040.oar

ABSTRACT

Introduction: The complex anatomy of root canals, combined with repeated and/or inadequate use of instruments, can lead to their fracture. The aim of this study was to demonstrate through 3 clinical reports a technique of fractured endodontic files removal, in different thirds of the root canal, through the association of hand files and ultrasound. **Methods:** In these cases, three teeth with fractured files inside the root canals were treated similarly, through the association of manual endodontic files and ultrasound. In all cases, there were an estimated failure due to the size and position of the fragments inside the canal. However, the protocol adopted demonstrated 100% efficacy. **Conclusion:** The present technique associating manual files and ultrasound was effective, allowing the removal of fractured hand files inside root canals.

Keywords: Root canal obturation. Dental instruments. Endodontics.

How to cite this article: Marion JJC, Passaréli JAM, Arruda MEBF, Guerisoli DMZ, Duque TM, Prado M. Ultrasonic technique associated with manual files to remove broken files from root canals system: a case series. Dental Press Endod. 2016 May-Aug;6(2):34-40.
DOI: http://dx.doi.org/10.14436/2358-2545.6.2.034-040.oar

» 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.

[1]Associated Professor at the Dental School of the Federal University of Mato Grosso do Sul (FAODO/UFMS).

[2]Specialist in Implant Dentistry by the University Center of Maringá (UniCesumar).

[3]Assistant Professor at Faculdade Ingá (Uningá, Department of Endodontics. Master in Health Sciences, State University of Maringá (UEM).

[4]Associated Professor at the Dental School of the Federal University of Mato Grosso do Sul (FAODO/UFMS).

[5]Assistant Professor at Faculdade Ingá (Uningá).

[6]PhD in Dental Clinic, Endodontics, Endodontics, FOP/Unicamp.

Submitted: 23/10/2015. Revised and accepted: 28/06/2016.

Contact address: Jefferson Marion
E-mail: jefferson@jmarion.com.br

Introduction

The complex anatomy of root canals, together with the repeated or inadequate use of instruments, may lead to fractures.[1,2] The presence of endodontic instrument fragments in the root canal system (RCS) complicates cleaning and shaping. Therefore, pulp fragments, necrotic tissue and microorganisms may remain in the RCS and lead to treatment failure.[3,4]

Studies about the prevalence of instrument fractures found that the frequency of stainless steel hand file fracture is relatively low (0.25%-6%), and slightly higher (1.3%-10%) for engine-driven nickel-titanium files (NiTi).[2,5-8]

The best treatment for file breakage is its prevention. However, when breaks occur, the fragment may sometimes be bypassed and possibly removed. Some of the suggested techniques are the use of hand files, ultrasound, chemical methods, specially prepared instruments, specific devices, combinations of methods and, finally, endodontic surgery.[9-14]

Technology advances have brought greater predictability to the removal of broken files. The use of ultrasound in combination with microscopy stands out among these techniques. Ward et al.[14] reported a success rate of 73% for the full removal of broken files in an ex-vivo study. The use of an operating microscope was recommended by Suter et al.[15] as a basic requisite for broken file removal, and their study reported a success rate of 87%. Cujé et at.[16] found that the use of an operating microscope and ultrasonic tips to remove broken files had a success rate of 95%. However, because clinical microscopes are expensive, they are rarely found in everyday endodontic clinical practice. Ultrasound, in contrast, is affordable for clinical dentists and endodontists.

The removal of broken instruments, particularly in cases of pulp necrosis, and the need to reach the full length of the canal are important for adequate cleaning and shaping and for the success of endodontic treatments. Therefore, this study describes three clinical cases to illustrate a technique to remove broken files from different thirds of root canals using hand files and ultrasound.

Case report

Clinical case 1

A 33-year-old woman was referred to our service for endodontic retreatment of the maxillary right lateral incisor. The patient said the tooth was asymptomatic and that the canal had been treated about 10 years before. Clinically, there were no signs of fistulas, mobility or crown color changes. Percussion tests did not reveal any symptoms.

Radiographs showed the presence of a crown restoration and a cavity on the mesial surface. There was a radiolucent area in the periapical region, which indicated that endodontic treatment was not satisfactory. Moreover, a radiopaque image in the apical third of the root suggested the presence of a broken endodontic file (Fig 1A).

After anesthesia and rubber dam isolation, coronal flaring was followed by gutta-percha removal (Fig 1B). After that, slight apical pressure was used to introduce a Kerr (K-file) #15 hand file (Maillefer, Ballaigues, Switzerland), with a ¼ rotation to the right and filing movements to reach actual working length (AWL). The metal endodontic fragment was bypassed, and a space between the fragment and the canal wall was created (Fig 1C). After that, a sequence of K-file #20 and # 25 files were used to AWL, bypassing the fragment, and filing movements were used in an attempt to remove the broken file. As this attempt was unsuccessful, a Gnatus Multisonic-S unit (Satelec System, Gnatus, Ribeirão Preto, Brazil), together with an A90 tip and a K-file#15 file, were used. The tip was inserted to where the fragment was while the unit was off (Fig 1D). The tip was activated and pushed between the fragment and the canal wall. This movement moved the fragment to the periapical area (Fig 1E). Because of that, a new attempt to remove the fragment was made using a pre-curved K-file #25 hand file. The file was taken to AWL in an

attempt to engage the fragment and pull it out, and the fragment was successfully removed (Fig 1F).

After removal of the hand file, endodontic treatment was performed using a Reciproc R40 file (VDW, Munich, Germany) and calcium hydroxide intracanal medicaments. The root canals were obturated using gutta-percha and AH Plus sealer (Dentsply Maillefer, Ballaigues, Switzerland) (Fig 1G and 1H). At four-year follow-up, the periapical lesion was healed (Fig 1I).

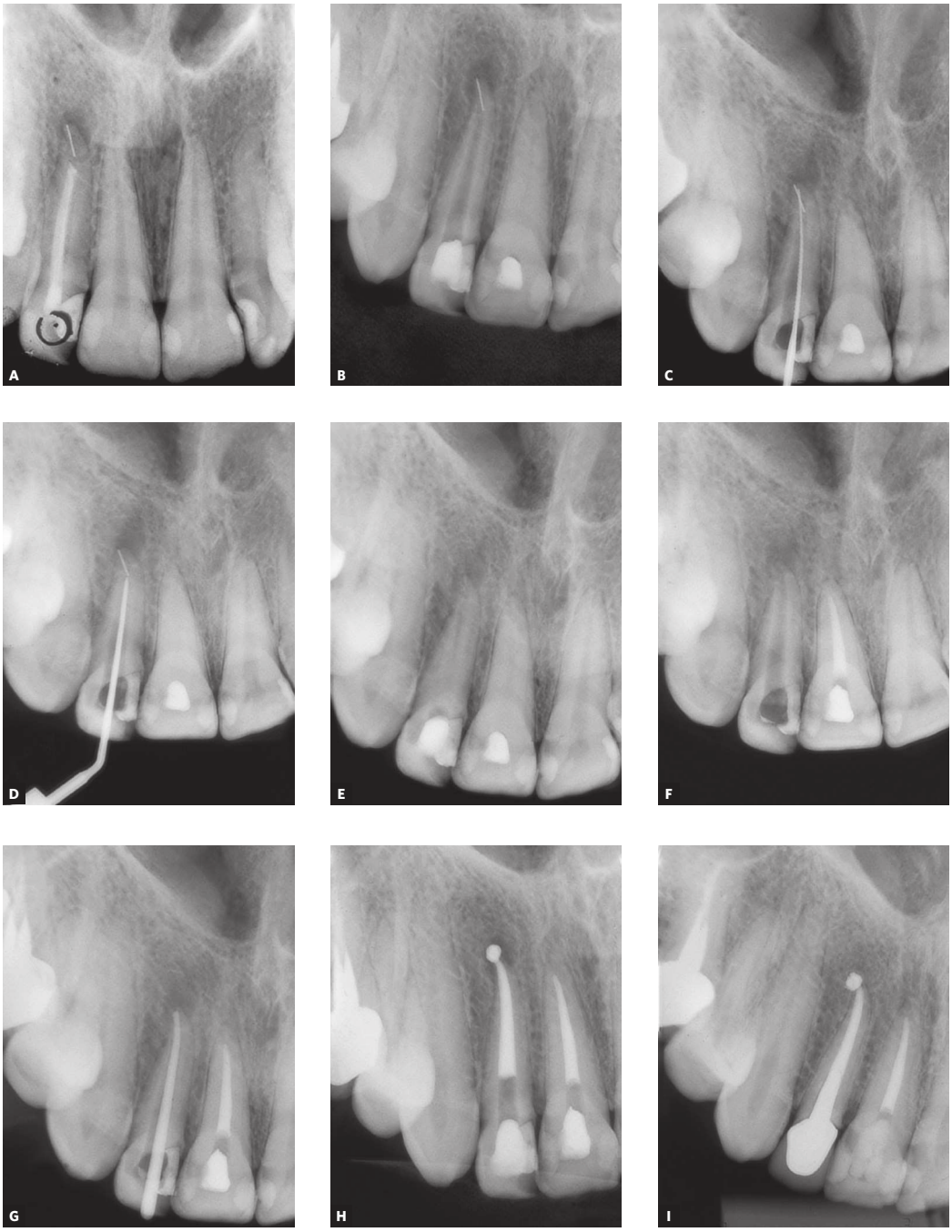

Figure 1. A) Baseline radiograph shows broken metal file in apical third of root; **B**) Removal of obturation material; **C**) Broken fragment bypassed by K-file #15; **D**) Multisonic-S A90 ultrasonic tip; **E**) Broken fragment moved past root apex after ultrasound was used; 1F- Removal of metal fragment; **G**) Cone fit; **H**) Final radiograph; **I**) Four-year follow-up.

Clinical case 2

A 66-year-old woman was referred to the clinic for endodontic treatment and removal of broken files from the mesiobuccal and mesiolingual canals of the mandibular right second molar (Fig 2A). Clinical examination did not reveal any fistula or mobility. Pulp sensitivity and percussion tests did not reveal any symptoms.

Coronal flaring was performed after anesthesia and rubber dam isolation. A K-file#08 file was used to bypass the metal fragment as described in Case 1 (Fig 2B). A sequence of #20 and #25 K-files were used to bypass the fragment in filing movements in an attempt to remove the fragment. After that, ultrasound was used as described in Case 1. During that attempt, the fragment moved into the cervical third of the canal and then removed (Fig 2C). After that, endodontic treatment was performed using a Reciproc R40 file (VDW, Munich, Germany), and the root canals were obturated using gutta-percha and Sealapex™ sealer (Kerr-Sybron, Orange, CA) (Fig 2D and 2E).

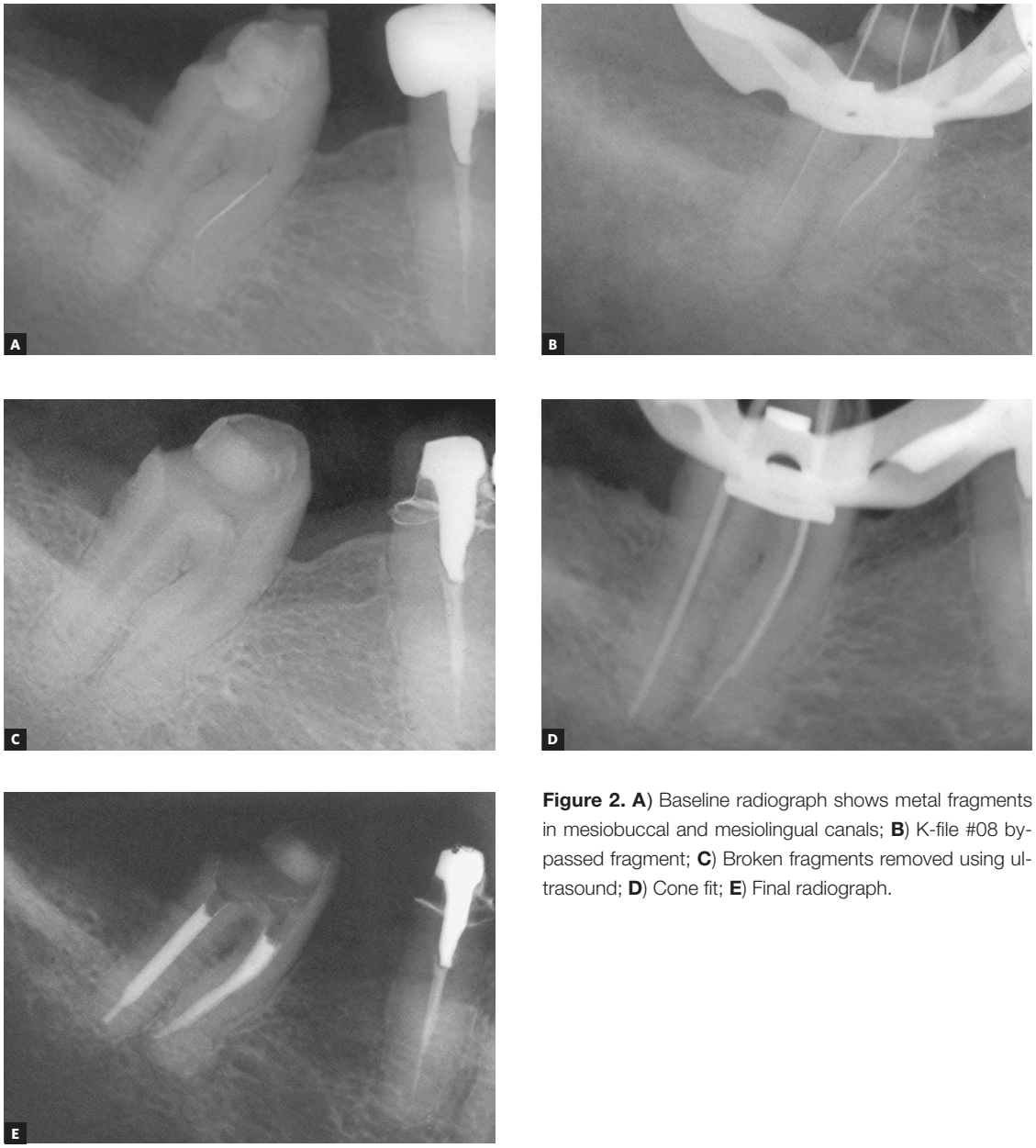

Figure 2. A) Baseline radiograph shows metal fragments in mesiobuccal and mesiolingual canals; **B**) K-file #08 bypassed fragment; **C**) Broken fragments removed using ultrasound; **D**) Cone fit; **E**) Final radiograph.

Clinical case 3

A 14-year-old girl, accompanied by her mother, was seen in the office after referral for endodontic treatment of her mandibular left first molar. History, extra- and intraoral clinical examination and radiographs revealed that the tooth had already been accessed and medicated at an urgency department to control the patient's pain (Fig 3A). Clinical examination did not reveal any fistula or mobility. Pulp sensitivity and percussion tests did not reveal any symptoms.

After anesthesia and rubber dam isolation, coronal flaring was repeated, and radiographic measurements were obtained (Fig 3B). In that moment, a Flexofile (FF) #15 file broke in the apical third of the distal root (Fig 3C). A hand #10 K-file was used to bypass the endodontic fragment, as described in the cases above, which created some space between the fragment and the canal wall (Fig 3D). The same file sequence was used to AWL, and the ultrasound technique described above was used. During these movements, the fragment was eventually moved from the distal canal to the cervical third of the mesiolingual canal (Fig 3E). We believe this was the result of the constant flow of water of the ultrasound tip, and also of the provisional closing of the orifices of the other canals with sterile cotton pellets. Because of that, we decided to close the canals with cotton pellets at that moment, and ultrasound was used to remove the file fragment from the cervical third of the mesiolingual canal (Fig 3F). Endodontic treatment was completed using a Reciproc R40 file (VDW, Munich, Germany), and the root canals were obturated using gutta-percha and Sealapex™ sealer (Fig 3G and 3H).

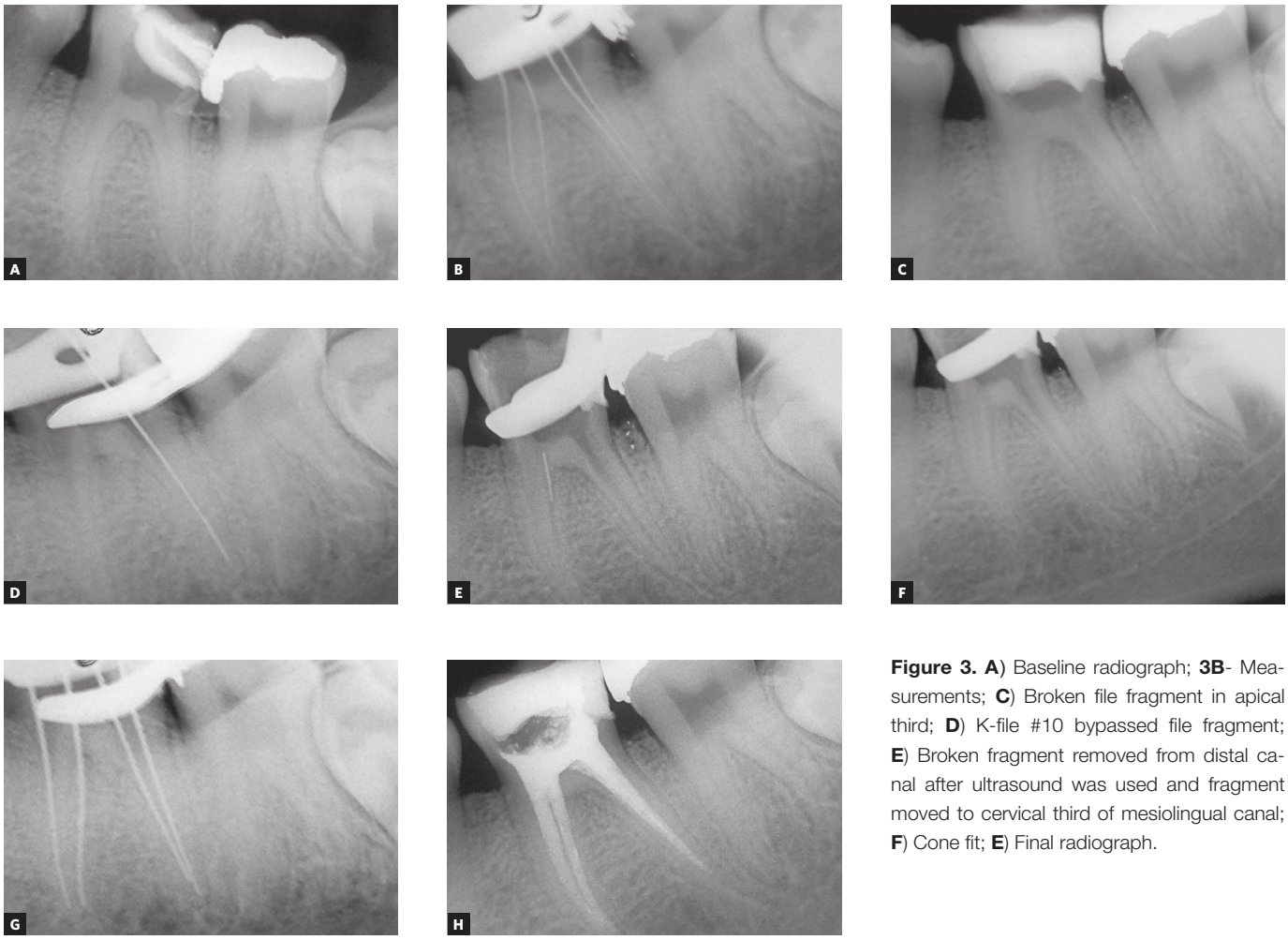

Figure 3. A) Baseline radiograph; **3B**- Measurements; **C**) Broken file fragment in apical third; **D**) K-file #10 bypassed file fragment; **E**) Broken fragment removed from distal canal after ultrasound was used and fragment moved to cervical third of mesiolingual canal; **F**) Cone fit; **E**) Final radiograph.

Discussion

The removal of file fragments depends on several factors, such as fragment location, shape, size and access.[17,18] This study described a series of cases of broken fragment removal, in which the fragment was in different thirds of the canal: apical (cases 1 and 3), middle (case 2) and cervical (case 3). When the fracture is in the cervical or middle third of the root, removal is less difficult than when it is in the apical third, from where removal is more difficult.[9,13,18] This was confirmed in this study, in which the difficulty to remove a broken file from the apical third was greater than from the middle and cervical thirds.

According to Grossman,[19] the prognosis of endodontic treatment is poor when the broken fragment cannot be bypassed. The prognosis depends on what the endodontist decides to do after a file breaks. If the canal cannot be cleaned and shaped successfully, pulp tissue fragments and bacteria may remain in the canal and compromise the result of endodontic treatment,[3] as observed in Case 1, for which retreatment was indicated.

In Case 1, there was a translucent area associated with the tooth apex. In Cases 2 and 3, radiographs did not show periapical commitment. To control infection during endodontic treatment, a calcium hydroxide intracanal medicament was used.[20,21]

The technique used to remove file fragments combines the use of progressively numbered hand files, from the smallest (K-file #08 or #10) to the largest (K-files #15 to #25), to bypass the fragment, access the rest of the canal, and then enlarge the lateral space, so that the fragment may be removed more easily. After that, ultrasound is used, and ultrasonic vibrations are transmitted to the broken fragment, which displaces the fragment from the root canal wall and makes its removal easier.[22,23]

Studies[13,23] have demonstrated that the use of ultrasound to remove a broken file is an effective technique, particularly when the fragment is in the cervical or middle third of curved canals. When the fragment is in the apical third, removal is more difficult and the risk of perforation is higher.[11] This study did not find any deviations or perforations, but it was more difficult to remove the broken fragment in the first case, in which the file was in the apical third. In that case, the fragment was moved to the periapical region when ultrasound was used. As the fragment was loose, it was possible to remove it using a pre-curved file.

The cases described here showed that the technique to remove broken files using ultrasound may have positive results. However, it should be used carefully to avoid deviations, perforations, fragment extrusion into the periapical region, or fragment migration into another canal. Therefore, endodontists should master this technique to be sure to use it safely and effectively.

Conclusion

The cases described here demonstrated that the technique combining hand files an ultrasound was efficacious and removed fractured broken files from root canals.

References

1. Parashos P, Messer HH. Questionnaire survey on the use of rotary nickel-titanium endodontic instruments by Australian dentists. Int Endod J. 2004 Apr;37(4):249-59.
2. Correia-Sousa J, Braga AC, Pina-Vaz I, Carvalho MF. Prevalência da fratura dos instrumentos endodônticos por alunos de pré-graduação: estudo clínico retrospetivo de 4 anos. Rev Port Estomatol Med Dent Cir Maxilofac. 2013;54(3):150-5.
3. Sjogren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. J Endod. 1990 Oct;16(10):498-504.
4. Tavares WLF, Lopes RCP, Henriques LCF, Ribeiro Sobrinho AP. Removal of fractured endodontic instruments using the operating microscope and ultrasonic tips: report of clinical cases. Rev Cient SOMGE. 2012;1(1):35-40.
5. Hülsmann M, Schinkel I. Influence of several factors on the success or failure of removal of fractured instruments from the root canal. Endod Dent Traumatol. 1999 Dec;15(6):252-8.
6. Iqbal MK, Kohli MR, Kim JS. A retrospective clinical study of incidence of root canal instrument separation in an endodontics graduate program: a PennEndo database study. J Endod. 2006 Nov;32(11):1048-52. Epub 2006 Sept 25.
7. Wolcott S, Wolcott J, Ishley D, Kennedy W, Johnson S, Minnich S, et al. Separation incidence of protaper rotary instruments: a large cohort clinical evaluation. J Endod. 2006 Dec;32(12):1139-41. Epub 2006 Sept 28.
8. Madarati AA, Watts DC, Qualtrough AJ. Opinions and attitudes of endodontists and general dental practitioners in the UK towards the intracanal fracture of endodontic instruments: part 1. Int Endod J. 2008 Aug;41(8):693-701.
9. Tzanetakis GN, Kontakiotis EG, Maurikou DV, Marzelou MP. Prevalence and management of instrument fracture in the postgraduate endodontic program at the Dental School of Athens: a five-year retrospective clinical study. J Endod. 2008 Jun;34(6):675-8.
10. Meidinger DL, Kabes BJ. Foreign object removal utilizing the Cavi-Endo ultrasonic instrument. J Endod. 1985 July;11(7):301-4.
11. Fors UGH, Berg J-O. A method for the removal of broken endodontic instruments from root canals. J Endod. 1983;9(4):156-9.
12. Roig-Greene JL. The retrieval of foreign objects from root canals: a simple aid. J Endod. 1983 Sept;9(9):394-7.
13. Souter NJ, Messer HH. Complications associated with fractured file removal using an ultrasonic technique. J Endod. 2005 Jun;31(6):450-2.
14. Ward JR, Parashos P, Messer HH. Evaluation of an ultrasonic technique to remove fractured rotary nickel-titanium endodontic instruments from root canals: clinical cases. J Endod. 2003 Nov;29(11):764-7.
15. Suter B, Lussi A, Sequeira P. Probability of removing fractured instruments from root canals. Int Endod J. 2005;38(2):112-23.
16. Cujé J, Bargholz C, Hülsmann M. The outcome of retained instrument removal in a specialist practice. Int Endod J. 2010 July;43(7):545-54.
17. Hülsmann M. Methods for removing metal obstructions from the root canal. Endod Dent Traumatol. 1993 Dec;9(6):223-37.
18. Shen Y, Peng B, Cheung GS. Factors associated with the removal of fractured NiTi instruments from root canal systems. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2004 Nov;98(5):605-10.
19. Grossman LI. Endodontic failures. Dent Clin North Am. 1972;16:59-70.
20. Guerreiro-Tanomaru JM, Chula DG, Lima RKP, Berbert FL, Tanomaru-Filho M. Release and diffusion of hydroxyl ion from calcium hydroxide-based medicaments. Dent Traumatol. 2012 Aug;28(4):320-3.
21. Gomes BP, Ferraz CC, Garrido FD, Rosalen PL, Zaia AA, Teixeira FB, et al. Microbial susceptibility to calcium hydroxide pastes and their vehicles. J Endod. 2002 Nov;28(11):758-61.
22. Ruddle CJ. Nonsurgical retreatament. J Endod. 2004;30:827-45.
23. 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 Aug;32(8):789-97.