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Revisiting Braiding Technique Under Magnification to Enhance Predictability of Instrument retrieval - A Clinical Case Series

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ABSTRACT

Instrument fracture during root canal therapy is a significant complication that can disrupt proper cleaning and shaping, potentially impacting the tooth's long-term prognosis. This article discusses the occurrence, challenges, and retrieval techniques for fractured endodontic instruments. The incidence of intracanal instrument fractures ranges from 0.25% to 6%, with contributing factors including flexural fatigue, torsional fatigue, and manufacturing defects. Traditional retrieval methods, such as ultrasonics and loop devices, often face limitations, particularly with longer fragments or without magnification. This article introduces the dual-file retrieval technique under magnification as a more predictable and less technique-sensitive alternative. By strategically bypassing the broken instrument from multiple sides, this method ensures effective engagement and controlled removal, while minimizing dentin loss. Cases demonstrating the conventional braiding technique and the dual-file retrieval technique are presented, highlighting the advantages of modern visualization tools like dental microscopes in improving retrieval success rates. The dual-file retrieval technique enhances the reliability of endodontic treatments and contributes to better long-term outcomes for patients.

Keywords: Instrument Retrieval, Braided Technique, Broken file retrieval

Introduction

During routine root canal therapy, instruments may fracture due to various factors such as flexural fatigue, torsional fatigue [1]. The occurrence rate of intracanal fracture for these Roraty instruments typically falls within the range of 0.25% to 6% [2]. Endodontic instrument separation is an unfavorable occurrence that disrupts proper cleaning and shaping, potentially impacting the long-term prognosis of the tooth [3]. Numerous techniques have been explored for removing broken files, as removing fractured instruments exceeding 5.7 mm in length using

ultrasonics alone may pose considerable difficulty [4]. Conversely, utilizing a loop device necessitates a higher level of dexterity and frequently entails a longer staging period [5]. The loop technique necessitates the removal of more dentin, which in turn reduces the strength of the tooth. Hence, there arises a necessity for a technique that offers more predictability, requires less technique sensitivity, and minimizes damage to dentin. The aim of this case series is to emphasize the importance of magnification in increasing the predictability of the braiding method under a dental operating microscope. In this article, Case 1 explains the conventional braiding technique, followed by two cases of dual-file retrieval technique.

Case 1 - Conventional braiding technique

A 20-year-old patient was referred for the retrieval of a fractured instrument in the mesiobuccal canal of tooth #46 (Figure 1a). Radiographs revealed a 6.3 mm fractured file in tooth # 46 (Figure 1b). The diagnosis was previously initiated root canal therapy. Retreatment began with rubber dam isolation. Given the file head's length exceeding 4.5 mm, braided technique was planned. To prevent accidental extrusion, the tooth's other orifices were sealed with Teflon tape (Figure 1c). Straight-line access to the fragment head was achieved using a modified No. 2 GG Drill. Under a Carl Zeiss OPMI Pico microscope, the file head was visualized (Figure 1d). Bypassing the fragment commenced from the inner curvature with a 10K file (Mani, Inc., Japan), progressing to a size 15K file (Figure 1e). Bypassing from the other two sides followed, using a 10K file and then a 15K file (Figure 1f). Once bypassed from all sides, the files were braided to extract the fragment (Figure 1g and 1h). After retrieval, cleaning, shaping, and obturation were performed using AH Plus sealer (Dentsply Sirona, USA).

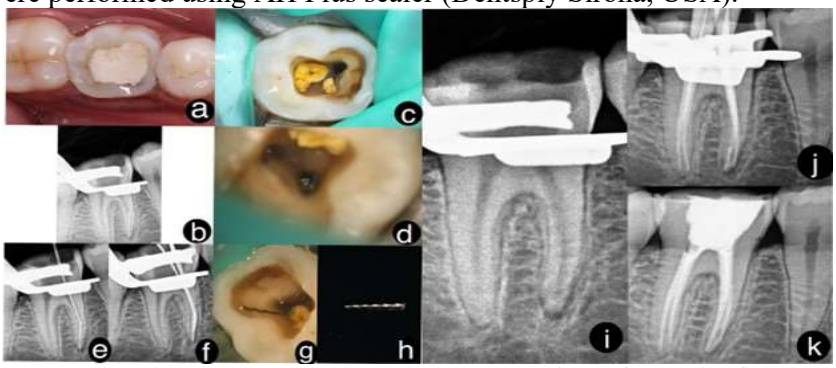

Figure 1:a)Pre operative clinical b)Pre operative radiograph c)Covering other orifices with teflon d)Straight line access e)Bypassing first file from inner curvature f)Bypassing BI from other 2 sides g)file popped out in access cavity h)retrieved file i)Post retrieval radiograph j)Master cone radiograph k)Obturation radiograph

Case 2 - Dual file approach

A 45-year-old female patient was referred to the department with a broken file lodged in the distal canal of tooth #36 (Figure 2a). The patient reported mild pain in the left lower back tooth region for the past two weeks, which was exacerbated during chewing. The fractured file, measuring 14.7 mm (>4.5 mm), was a NiTi file lodged in a straight canal with the tip extending 4 mm beyond the canal (Figure 2b). The tooth was diagnosed with previously initiated endodontic therapy, and retrieval of the file using a dual-file technique was planned. Rubber dam isolation was performed (Figure 2c), followed by the creation of a straight-line access using a modified GG drill size 2. File bypassing commenced with a 10K file (Mani, Inc., Japan), reaching 2 mm short of the apex, while leaving the portion of the broken instrument beyond the apex untouched. The procedure continued until a size 20 file was reached. Once the 20K file reached 2 mm short of the apex, it was replaced with a 20H file. File bypassing was then conducted from the other side of the broken instrument following the same procedure and replacing the file with a 20H file (Figure 2d). Subsequently, both 20H files were braided and gently pulled out in clockwise and anticlockwise directions until the file popped out (Figure

2e). Steiglitz forcep was used to remove the popped-out file from the canal (Figure 2f, 2g). Cleaning and shaping were then performed, and obturation was completed using AH Plus sealer (Dentsply Sirona, USA)(Figure 2h and i).

Figure2 : a)Pre operative clinical b)pre operative radiograph c)Creating straight line access c)Dual file braiding using two 20k files e)File popping in the access cavity f)Retrieved file g)Post retrieval radiograph g)Master cone radiograph h)Obturation radiograph

Case 3 - Dual file approach

A 23-year-old patient presented to the clinic for the retrieval of a broken instrument (BI) in the tooth # 16 during selective retreatment of the tooth. The patient had reported to the previous dentist one week after obturation. The dentist opted for partial retreatment of the mesiobuccal and distobuccal canals due to the obturated gutta-percha cones extending beyond the canals. Clinical and radiographic examination confirmed that the tooth had previously initiated endodontic therapy. The broken instrument, measuring 6.2 mm, extended from the coronal third to the apical third (Figure 3a]. Rubber dam isolation was performed, and straight-line access was created using a modified GG drill size 2 (Figure 3b). Under microscope visualization, the file was observed pressing against the curvature (Side B, Figure 3c). A probe was utilized to separate the file from the external wall, and a size 10K file was employed to bypass the file from the external wall (Side B), followed by bypassing with a 15K file until two-thirds of the broken instrument was bypassed (Figure 3d). A 20K file was then used to bypass from the inner curvature. Both files were braided together and gently pulled out in clockwise and anticlockwise directions until the file was successfully removed (Figure 3e and 3f). Following the successful retrieval of the broken file (Figure 3g), the patient was referred back to the general dentist. Subsequent examination by the dentist revealed that the tooth was asymptomatic. Obturation was performed, followed by a post-endodontic restoration to ensure the tooth's structural integrity and functionality (Figure 3h and 3i).

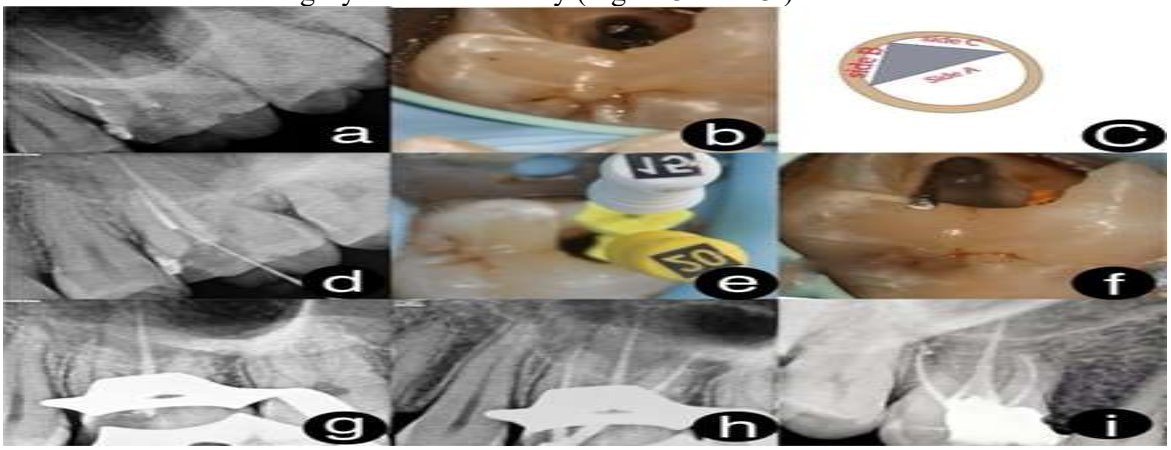

Figure 3 : a)Pre operative radiograph b)Creating straight line access c)Pictorial representation of Mesiobuccal canal

d)Bypassing file from outer curvature e)Dual file braiding using 15K,20K file f)file popped out in access cavity g)Post retrieval radiograph h)Master cone radiograph i) Obturation radiograph

Discussion.

Several factors influence the successful removal of BI, including their position in relation to the canal curvature, depth within the canal, type, and size of the fragment.[6] Stainless steel files are indeed generally easier to remove compared to NiTi files due to their inherent properties, such as greater flexibility and resistance to fracture [7]. NiTi files, while highly flexible and efficient during root canal shaping [8,9], can be more prone to secondary breakage[10], especially when subjected to stress during ultrasonic retrieval procedures. This increased susceptibility to fracture is often attributed to factors like heat accumulation and cyclic fatigue [11]. The dual-file retrieval technique may reduce the reliance on ultrasonics for instrument retrieval thereby preventing secondary fracture.Moreover, 66%–78% and 91% of NiTi rotary instruments have been reported to fracture because of cyclic and torsional fatigue failure respectively [12]. This suggests that fractured NiTi rotary instruments were most likely not engaged in the canal walls [13]. In such cases there will be space along the broken instrument which can be used for bypassing followed by Dual file retrieval technique.

Fractured austenite-phase NiTi instruments tend to straighten out on the outer curvature wall, which may require a longer time for extending the space along the inner wall to loosen them given the instrument's restoring forces despite the creation of an inner space of about one third of the BI length [14] in such cases also we can use this technique by bypassing a file along inner curvature followed by using another file along outer curvature to retrieve the file as done is case 3. BI that measure between 4.6 and 5.7 mm typically necessitate at least double the time for ultrasonic retrieval compared to those measuring less than 4.5 mm, which typically takes an average of 34 seconds. However, when dealing with FI larger than 5.7 mm, it can be notably challenging to remove them solely using ultrasonics[15]. In such cases, the dual-file retrieval technique becomes particularly advantageous.

Even though the braiding technique is one of the oldest techniques practiced for instrument retrieval, its predictability and success can be increased by using a dental operating microscope. This use of magnification helps in precise bypassing of the file from the intended side of the broken file to increase anchorage. During dual-file retrieval technique, it's crucial to adhere to several key points observed during this case series, which are mentioned in the following points. Firstly, bypassing the broken instrument (BI) from two different sides is imperative (Figure 4a) ; attempting to bypass with two files from the same side may not yield the desired outcome (Figure 4b). Secondly, if the file is pressing against the curvature and space exists on the other side of the canal (inner curvature), the initial file should be bypassed from the outer curvature, ensuring at least two-thirds of the file is bypassed to disengage the BI from the outer wall (Figure 4c). Initially we can take help of DG-16 Probe or Spreader to to aid in insertion of this file. Subsequently, the size of the second file should be chosen based on the remaining space. Lastly, when selecting files for braiding, careful consideration is necessary to ensure a snug fit between the file and the canal wall (Figure 4d). It shouldn't be too loose, preventing slipping, or too tightly engaged (Figure 4e), risking secondary fracture. These points are pivotal for successful retrieval of BI while minimizing potential complications.

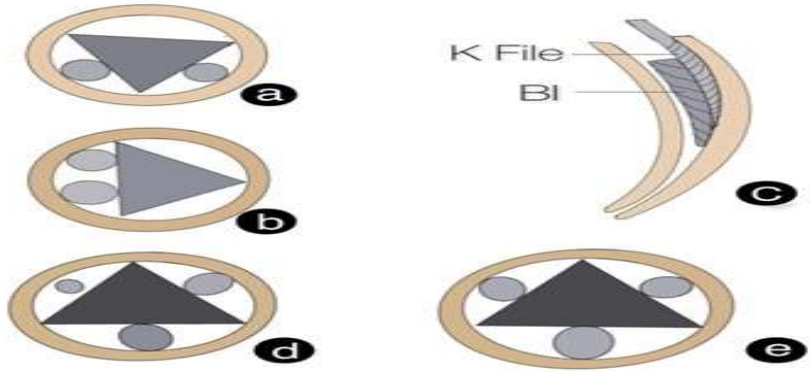

Figure 4 : a) Bypassing the BI from two different sides b)Bypass two files from the same side - not advised c)Initial file should be bypassed from the outer curvature, ensuring at least two-thirds of the file is bypassed d)Bypassed file shouldn't be too loose or too tightly engaged e)Bypassed file should be snuggly fit between BI and canal wall

Conclusion

In conclusion, the retrieval of fractured endodontic instruments is vital for the long-term success of root canal therapy. Traditional methods like ultrasonics and loop devices are often challenging, especially without magnification or when dealing with longer fragments. The dual-file retrieval technique offers a more predictable and less technique-sensitive alternative, minimizing dentin removal and preserving the tooth's structural integrity. By bypassing the broken instrument from multiple sides, this method ensures better engagement and controlled removal. Advancements in retrieval techniques and the use of modern visualization tools, such as dental microscopes, significantly improve the success rates and reliability of these procedures, ultimately enhancing patient outcomes.

Declaration of patient consent

The authors confirm that they have obtained all necessary patient consent forms. In these forms, patients have agreed to have their images and clinical information included in the journal. Patients understand that their names and initials will not be published, and all efforts will be made to protect their identity, though complete anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

Key Messages

1. Bypass the broken instrument (BI) from two different sides
2. If the file is pressing against the curvature with space on the other side of the canal (inner curvature), bypass the initial file from the outer curvature.
3. Choose the size of the second file based on the remaining space to ensure proper fit.
4. Carefully select files for braiding to ensure a snug fit between the file and the canal wall.

References

1. Antony SDP, Subramanian AK, Nivedhitha MS, Solete P. Comparative evaluation of canal transportation, centering ability, and dentin removal between ProTaper Gold, One Curve, and Profit S3: An in vitro study. J Conserv Dent. 2020 Nov-Dec;23(6):632–6.
2. 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.
3. Hirani AJ, Arora A, Hadwani KD, Cherian A. Cyclic and spontaneous movement of a fractured and extruded instrument back into the root canal: A rare case report. J Conserv Dent. 2022 May 2;25(1):105–8.
4. Fu M, Zhang Z, Hou B. Removal of Broken Files from Root Canals by Using Ultrasonic

Techniques Combined with Dental Microscope: A Retrospective Analysis of Treatment Outcome. J Endod. 2011 May 1;37(5):619–22.
5. Pruthi PJ, Nawal RR, Talwar S, Verma M. Comparative evaluation of the effectiveness of ultrasonic tips versus the Terauchi file retrieval kit for the removal of separated endodontic instruments. Restor Dent Endod. 2020 May;45(2):e14.
6. Solomonov M, Ben-Itzhak J, Kfir A, von Stetten O, Lipatova E, Farmakis ET. Self-adjusting file (SAF) separation in clinical use: A preliminary survey among experienced SAF users regarding prevalence and retrieval methods. J Conserv Dent. 2015 May-Jun;18(3):200–4.
7. Khasnis SA, Kar PP, Kamal A, Patil JD. Rotary science and its impact on instrument separation: A focused review. J Conserv Dent. 2018 Mar-Apr;21(2):116–24.
8. Akshaya K, Ravindran V, Pandurangan SM. Pediatric dentists' preference on usage of hand ϑiles or rotary ϑiles for pulpectomy of primary molars - A retrospective study. International Journal of Research in Pharmaceutical Sciences. 2020 Oct 19;11(SPL3):1500–5.
9. Lakshmanan L, Mani G, Jeevanandan G, Ravindran V, Ganapathi SEM. Assessing the quality of root canal filling and instrumentation time using kedo-s files, reciprocating files and k-files. BDS. 2020 Jan 31;23(1):7 p. – 7 p.
10. Khirtika SG, Ramesh S. Comparative evaluation of dentinal cracks and detachments after instrumentation with hand and rotary files at various instrumentation lengths: An in vitro study. Journal Of Advanced Pharmacy Education And Research. 2017 Jul 1;7(3):236–9.
11. Mariona P, DelphinePriscillaAntony S, Dharman S. Association of type of file fracture and method of removal in a university setting. International Journal of Research in Pharmaceutical Sciences. 2020 Oct 22;11:1761–5.
12. Shen Y, Coil JM, Haapasalo M. Defects in nickel-titanium instruments after clinical use. Part 3: a 4-year retrospective study from an undergraduate clinic. J Endod. 2009 Feb;35(2):193–6.
13. Terauchi Y, Ali WT, Abielhassan MM. Present status and future directions: Removal of fractured instruments. Int Endod J. 2022 May;55 Suppl 3:685–709.
14. Mandke L, Koparkar T, Bhagwat S, Vimala N, Vandekar M. Endodontic retreatment practice trends among dental surgeons: A survey-based research. J Conserv Dent Endod. 2023 Nov 22;26(6):663–70.
15. Abdeen MA, Plotino G, Hassanien EES, Turky M. Evaluation of Dentine Structure Loss after Separated File Retrieval by Three Different Techniques: An Ex-vivo Study. Eur Endod J. 2023 May;8(3):225–30.