

Endodontic Rescue: A Case Series On Retrieving Separated Instruments With Precision

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Abstract

Instrument separation is one of the most common undesirable mishaps encountered by endodontists during root canal treatment. The separated instruments hamper endodontic therapy by blocking access to the apical third, inhibiting the proper chemomechanical preparation of the root canals and jeopardizing the prognosis of endodontic therapy. Hence, such fragments should be properly retrieved or an attempt should be made to bypass it. The purpose of this article was to describe, through clinical cases, the technique of retrieval of separated instruments, under dental operating microscope using ultrasonics.

Keywords: Dental operating microscope, instrument retrieval, magnification, separated instrument, ultrasonics.

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I. Introduction

Endodontic instrument separation remains a common and challenging occurrence in dental practice, affecting both clinicians and patients. The presence of a foreign instrument in the root canal system blocks the access to the apical third of the root and thus preventing effective cleaning and shaping procedures, which may ultimately compromise the outcome of the endodontic therapy. Hence, the level of difficulty of treating such cases increases and even the tooth healing is challenged¹. Therefore, it is crucial to attempt instrument retrieval or bypass before contemplating obturation at the site of separation or opting for surgical intervention.

The orthograde retrieval of broken instruments is often problematic. Nevertheless, an attempt to remove these separated fragments should be undertaken in every case. Intentionally leaving a fragment in the root canal may only be considered when nonsurgical removal has been attempted without success. No standardized procedure for successful removal even in difficult cases exists, although a number of different techniques and devices have been described in the literature². Several techniques are available for retrieving broken instruments, including forceps, file braiding technique, chemical solvents, hypodermic needles and specialized retrieval kits. Ultrasonic tips, used in conjunction with magnification, can also be effective. Ultrasonic vibrations can help loosen the fragment and dislodge it from the canal. Recent research by Cujé et al. and Fu et al. demonstrated that ultrasonic techniques can effectively remove broken instruments from root canals, with success rates of 88% and 95%, respectively³.

This case report presents three cases in which separated instruments were successfully retrieved from root canals using a combination of ultrasonics and a dental operating microscope.

II. Case Report

Case 1

A 40-year-old female patient presented to the department complaining of dull pain in her lower left back tooth region for a month. Intraoral examination revealed deep dentinal caries in tooth #36. The tooth was tender to percussion, and sensibility tests revealed a delayed response, suggesting symptomatic irreversible pulpitis with apical periodontitis. Root canal treatment was initiated under local anaesthesia (2% lignocaine with 1:80000 adrenaline) and rubber dam isolation. Access opening was done and four canals were located. Canals were negotiated using 10K file followed by 15K file. Upon the use orifice opener file (30/8%) to shape the coronal portion or orifice it was noted that about 3.5 mm of the file was separated in distobuccal canal in the coronal third. A digital radiograph was taken to confirm the exact location of the separated file [Figure 1(a)]. It was decided to

retrieve the file under dental operating microscope (DOM) using ultrasonics. The procedure was carried out under DOM (Carl Zeiss OPMI f170) with a magnification of 10X and the coronal part of file was visible [Figure 1(b)]. Dentin surrounding the fractured fragment was troughed out using ultrasonic tips (ProUltra ultrasonic tip No. 2 and 3). The pulp chamber was periodically irrigated with normal saline to remove debris from the canal. Additional troughing was performed to create a staging platform to loosen the file and free it from dentin. After loosening of the fractured fragment, it was decided to use the braiding technique for removal of separated instrument. Three H-files (two sized 20 and one sized 30) were inserted along the separated instrument as apically as possible from mesial, distal and buccal side, then twisted around one another to engage the file and withdrawn simultaneously [Figure 1(c)]. Length of separated instrument was measured on endogauge which was 3.5 mm [Figure 1(d)]. A confirmatory radiograph was taken after file retrieval [Figure 1(e)]. The working length was determined using an apex locator and verified with a radiograph [Figure 1(f)]. The canal was cleaned and shaped to a size of 30/4%, medicated with calcium hydroxide, and temporarily sealed. The patient was recalled after three days. At the follow-up visit, the patient reported no symptoms. The temporary dressing was removed and the canal was thoroughly irrigated with 2.5% sodium hypochlorite (NaOCl) and normal saline. Mastercone fit was evaluated and the canals were obturated with single cone technique with 30/4% gutta-percha (GP) using zinc oxide eugenol (ZOE) sealer [Figure 1(g)]. Further, furcation perforation that occurred as a mishap of ultrasonic overuse near the distobuccal canal was repaired with Mineral Trioxide Aggregate cement under DOM [Figure 1(i)]. It was followed by post endodontic restoration with Glass Ionomer Cement. Patient was recalled for a follow up after 6 months and the patient remained asymptomatic [Figure 1(k)]. Hence, crown preparation followed by cementation of porcelain fused to metal (PFM) crown was done [Figure 1(l)].

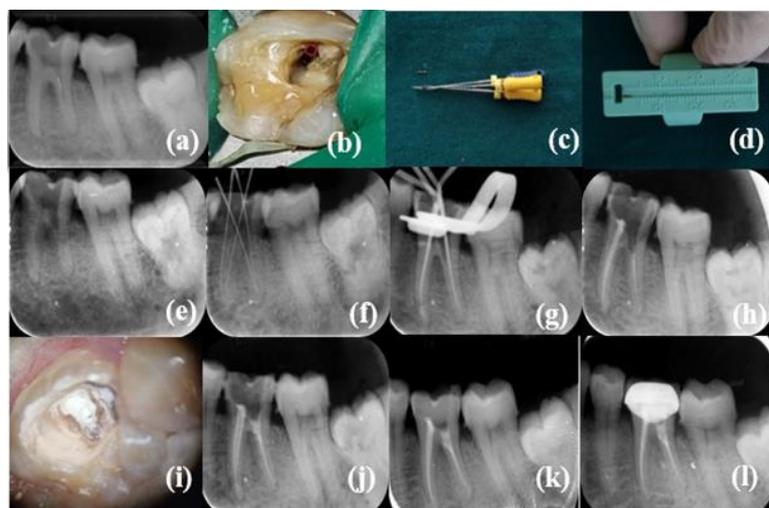


Figure 1: (a) 3.5 mm of the file separated in DB canal in the coronal third, (b) Coronal part of file under DOM, (c) Braiding technique for removal of separated instrument, (d) Length of retrieved instrument measured on endogauge, (e) Radiograph following retrieval, (f) Working length determination, (g) Mastercone verification, (h) Furcation perforation near the DB canal, (i) Furcation perforation repair with MTA under DOM, (j) Radiograph following furcation perforation repair with MTA, (k) 6 months follow-up, (l) PFM crown cementation

Case 2

A 31-year-old female patient presented to the department complaining of pain in her lower right back tooth region for a week. Clinical examination revealed dental caries in tooth #46. The tooth exhibited delayed response to pulp sensibility tests and was tender to vertical percussion. Based on clinical and radiographic evaluation, a diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made. Root canal treatment was initiated under local anaesthesia (LA) and rubber dam isolation. An access opening was made, and while negotiating the canals, a #15 K file measuring approximately 5 mm fractured inside the canal. A confirmatory radiograph was taken to pinpoint the exact location of the fractured fragment, which was extending into the middle third of the disto-buccal canal [Figure 2(a)]. Subsequently, it was planned to attempt retrieving the separated file under a dental operating microscope (DOM) with a magnification of 10X using ultrasonics. The dentin around the separated file was troughed using ultrasonic tip (ProUltra ultrasonic tip No. 3) to create a staging platform. The canal was irrigated intermittently with normal saline to flush out debris. Upon further troughing with ultrasonic tips, the file dislodged and the instrument was flushed out during subsequent irrigation of the canal [Figure 2(b)]. The working length was determined using an apex locator and confirmed with a digital radiograph [Figure 2(f)]. The canals were cleaned and shaped to a size of 30/4%. The canal was medicated with calcium hydroxide and a temporary filling was applied. The patient was recalled after seven days. The canals were obturated with single cone technique using ZOE sealer [Figure 2(h)].

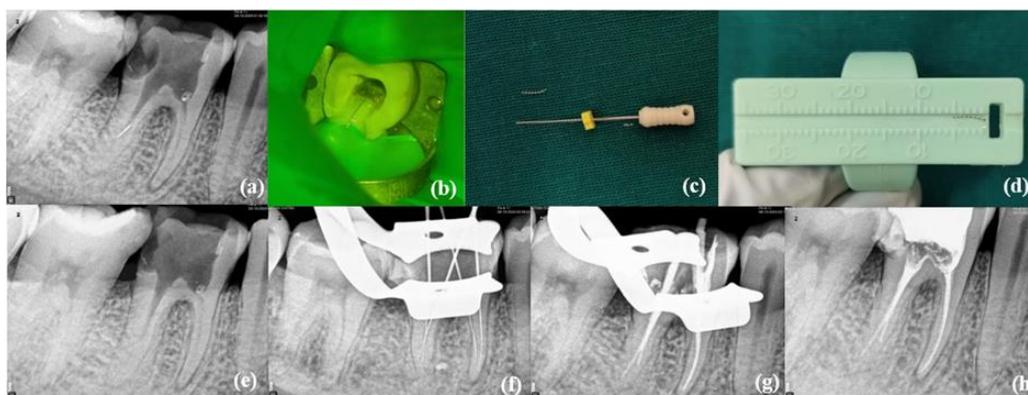


Figure 2: (a) 5 mm of separated instrument in the distobuccal canal irt 46; (b) Retrieved file under DOM; (c) Retrieved instrument; (d) Length of the retrieved instrument measured on endogauge; (e) Radiograph following retrieval; (f) working length determination; (g) Mastercone verification; (h) Obturation

Case 3

A 40-year-old male patient reported complaining of decay in his upper right back tooth region for the past 2 months. On intraoral examination, deep dentinal caries was noted in the mesio-occlusal aspect of right maxillary first molar (16), which gave a negative response to both cold test and vertical percussion. Based on the clinical, radiographic examination and vitality tests, a diagnosis of pulpal necrosis was made [Figure 3(a)]. Consequently, non-surgical endodontic treatment was initiated for the tooth under LA. Access cavity was prepared followed by working length determination with apex locator and it was confirmed with a digital radiograph. However, while cleaning and shaping the canals, the 20/4% file measuring about 16 mm fractured in the palatal canal around the coronal third. A digital radiograph was taken to confirm the exact location of the separated file [Figure 3(b)]. It was decided to retrieve the file under dental operating microscope (DOM) with 10X magnification along with the use of ultrasonics [Figure 3(c)]. Dentin surrounding the separated fragment was troughed out using a Gates Glidden bur (size #2) to expose the tip of the separated fragment in the palatal canal. An ultrasonic tip (ProUltra ultrasonic tip No. 2) was then used intermittently at a medium frequency (36 kHz) with simultaneous coolant irrigation to successfully retrieve the instrument fragment. The endogauge was used to measure the length of the broken instrument [Figure 3(e)], and a post-retrieval radiograph was taken for verification [Figure 3(f)]. The mesiobuccal and distobuccal canals were prepared until 30/4% and palatal canal was prepared until 25/6% with copious irrigation of 2.5% NaOCl solution followed by normal saline. The master cone fit was assessed and a confirmatory radiograph was taken [Figure 3(h)]. The canals were dried and obturated with single cone technique using ZOE sealer [Figure 3(i)]. The access cavity was immediately sealed with temporary restorative cement and then replaced one week later by a composite restoration followed by crown preparation and cementation of PFM crown [Figure 3(j)].

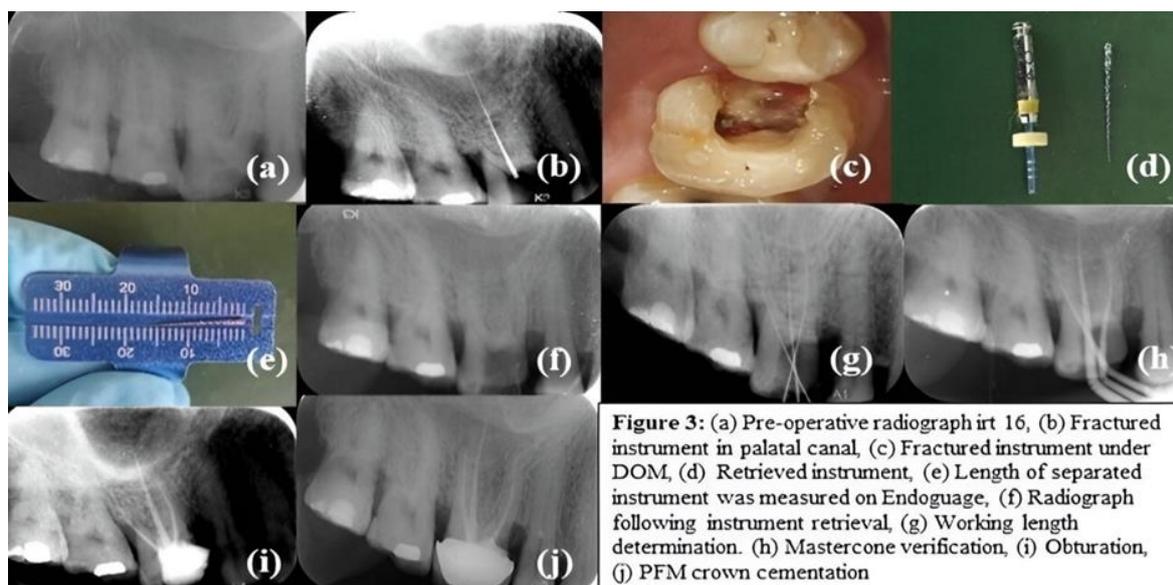


Figure 3: (a) Pre-operative radiograph irt 16, (b) Fractured instrument in palatal canal, (c) Fractured instrument under DOM, (d) Retrieved instrument, (e) Length of separated instrument was measured on Endogauge, (f) Radiograph following instrument retrieval, (g) Working length determination. (h) Mastercone verification, (i) Obturation, (j) PFM crown cementation

III. Discussion

The separation of instruments in the root canal is a significant barrier to effective cleaning and shaping procedures. As a result, there is an uncertainty to endodontic treatment outcome and a decreased likelihood of successful retreatment^{2,8}. Various factors attribute to the breakage of rotary files, namely the canal curvature, anatomic variations, practitioner experience, cooperation from patient, frequency of use, torque and speed of rotation⁴. The separation rate of Nickel Titanium (NiTi) rotary instruments was reported to range between 1.3% and 10.0%, whereas separation rates of stainless steel (SS) instruments were reported to range between 0.25% and 6%⁵.

The primary objective in management broken instruments is to protect the tooth's structural integrity. The best course of action when an instrument breaks, according to Machtou and Reit, is to retrieve it⁷. As a result, every attempt should be taken to retrieve or avoid using the detached instrument. The root canal's length, curvature, diameter, dentin thickness, root morphology, instrument type, cutting action, the position, length and degree of the instrument's entanglement within the canal are all variables that affect the feasibility of orthograde retrieval².

There are different techniques available for retrieval of fractured instrument. Some methods for retrieving broken instruments include Stieglitz pliers, the Masseran Kit, micro tube removal systems like Lasso and Anchor, Tube and Glue, Tap and Tread, the Endo extractor removal system, and ultrasonic tips in combination with a dental operating microscope. Among all techniques and devices described in the literature for retrieving the separated instrument fragment, the most successful method is use of ultrasonic files along with a dental operating microscope⁹. The most conservative method for managing a broken instrument involves using an ultrasonic tip assisted by a microscope. This approach offers advantages such as better illumination, higher magnification, improved irrigation and oscillation, easier access to the broken instrument, and a safer and more predictable retrieval⁴.

In this case series, the retrieval of the fragment has been done with the combination of ultrasonic tips and DOM which helped in better visualization and the minimal loss of root dentin.

IV. Conclusions

Instrument separation is an iatrogenic error which can impede the success of endodontic therapy. Hence it should be minimized to the lowest extent possible. Thorough knowledge of root canal anatomy, instrument design and instrumentation technique, reduces the occurrence of instrument separation. In case instrument separation occurs, using ultrasonic devices along with magnification is effective in successfully removing instruments that have been encased within the canal. However, to minimize instrument separation proactive prevention should be the primary focus as it is easier to prevent instrument separation than managing the fractured file.

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