## **Case Report**

# Retrieval of a Long Separated Instrument Using Combination of Extractor Kit, Ultrasonics, and Wire Loop Device Under Magnification: A Case Report with a 3-Month Follow-Up

#### Mohammed Essam Othman<sup>1</sup>

<sup>1</sup>Department of Endodontics, Faculty of Dentistry, Cairo University, Cairo, Egypt

Email: mohamed.essam@dentistry.cu.edu.eg

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# Abstract

**Aim:** The purpose of this case report is to present a case of a separated instrument retrieval in a mandibular first molar using a combined preparation technique and a loop device. **Case Presentation:** A 21-year-old female was referred to the Department of Endodontics at the Faculty of Dentistry, Cairo University, with a chief complaint of pain on biting in the lower left quadrant for the past 3 months. Clinical and radiographic examination revealed a previously endodontically treated left mandibular first molar, having a 5 mm separated instrument in the mesiobuccal canal and a periapical radiolucency related to the mesial root. The tooth was diagnosed as previously treated with symptomatic apical periodontitis. Two-visit non-surgical endodontic retreatment and mechanical retrieval was the treatment of choice. The first visit comprised the removal of old root canal filling material and preparation of a staging platform using the guide drills of (TOQ extractor Kit) and ultrasonics, retrieval of the separated instrument using a loop device (Leo pen), and placement of intracanal medication. The tooth was obturated at the second visit (1 week later) and referred to a prosthodontist for endo-crown construction. At 3 months follow-up, the patient was asymptomatic, and function was restored. **Conclusion:** The case report highlights the importance of the combination of different retrieval techniques of separated instruments by demonstrating their clinical applicability and favorable outcomes in complex settings.

Keywords: Non-surgical retreatment, Retrieval, Separated instrument, Loop device, Extractor kit

#### Introduction

Instrument separation in the root canal, which obstructs access to the root apex and compromises the outcome of the treatment, is one of the most distressing occurrences in endodontics. Endodontic instrument fracture is influenced by root canal curvature, instrument design and manufacturing processes, instrumentation procedures, and operator experience (Amza et al., 2020).

Attempting to retrieve the detached instrument, by-passing it, or preparing and filling

the root canal to the point of separation are the three non-surgical approaches to managing such an incident (Ruddle, 2004). The canal morphology, the type of instrument, and its position inside the canal all affect how easily the separated instrument may be recovered. For example, a fragment placed in the coronal third of the root has a greater chance of recovery because of its improved visibility, accessibility, and radicular dentin preservation (Terauchi et al., 2022). A number of methods, such as the Masserann kit, the ultrasonic technique, and the instrument removal system, have been proposed to recover separated instruments. The purpose of this case report is to present the non-surgical retrieval of a separated instrument in a mandibular first molar using a combination of an extractor kit, ultrasonics, and a loop device under magnification.

#### **Case presentation**

This case report has been written according to Preferred Reporting Items for Case reports in Endodontics (PRICE) 2020 guidelines (Figure 1). 21-year-old female was referred to the Department of Endodontics, Faculty of Dentistry, Cairo university, Cairo, Egypt in December 2023 with a chief complaint of pain on biting in the lower left quadrant for the past 3 months. The patient reported a history of previous endodontic treatment of the left mandibular first molar 5 years ago. Medical history was non-contributary and extraoral examination was normal. Intraoral examination revealed a large amalgam restoration in the mandibular left first molar. There was no evidence of swelling or sinus tracts. Percussion was positive for the suspected tooth and palpation of the buccal soft tissues over the mandibular left first molar elicited slight pain. There was no mobility of the suspected tooth and periodontal probing revealed normal results. Periapical radiograph of the region showed a previously treated mandibular first molar with a separated instrument (H-file) in the middle third of the mesio-buccal canal and a periapical radiolucency related to the mesial root (Figure 2a). Cone beam computed tomography (CBCT) of the region revealed an underfilling of both mesiobuccal and mesio-lingual canals, a 5 mm separated instrument in the mesio-buccal canal with only 2 mm present above the canal curvature, and a periapical lesion related to the mesial root of the mandibular first molar (Figure 2b,c).

According to clinical and radiographic findings, the diagnosis of the left mandibular first molar was previously endodontically treated with symptomatic apical periodontitis. Based on the length, location and size of the separated instrument, retrieval of the separated instrument in a non-surgical approach was recommended to the patient and a written informed consent was obtained.

On the first visit, the tooth was anesthetized using inferior alveolar nerve block with 1.8 ml of articaine 4% 1:100000 epinephrine (Alexandria Co. for Pharmaceuticals, Alexandria, Egypt). All steps of endodontic treatment were done under microscope magnification (Seiler Alpha Air 6, Seiler medical, Germany). Following rubber dam isolation, removal of old amalgam restoration and access cavity were done using high speed round bur size 3 and endo z bur (Dentsply Maillefer, Ballaigues, Switzerland). Gutta percha was removed by creating an initial entry to the canals using M-pro rotary file (25/.06) (Innovative Materials and Devices, Shanghai, China) mounted on an endodontic motor (E-connect Pro, Eighteeth, Changzhou, China) in a rotation motion (450 rpm-2 N.cm) followed by hand H-files # 50 till # 30 (MANI, INC., Tochigi, Japan) in a crown-down technique (Figure 2d).

Bypass of the separated instrument was not feasible due to its length, size, and location. A staging platform was prepared in the mesio-buccal canal up to the coronal part of the separated instrument. The working length of from the coronal reference point to the coronal part of the instrument was 15mm. Preparation was done using the guide drills of the TOQ extractor Kit (TOQ Dental Co. Ltd, Shanghai, China) (Figure 3a) in the following sequence (60/04), (70/03), (80/02), (90/02) operated in rotation (350 rpm – 3N.cm); followed by using the cannula drill of the same kit (90/02) in rotation (150 rpm – 1.5N.cm). Frequent radiographic monitoring was employed during preparation phase to avoid occurrence of mishaps.

Exposure of the instrument was further enhanced by using ED6 ultrasonic tip at low power (Guilin Woodpecker Medical Instrument Co., LTD, China) (Figure 3b). After 2 mm exposure of the separated instrument, the loop device (Leo pen, Leo Dent, Daqahliyah, Egypt) (Figure 3c) was used as follows: an 0.08 flexible wire threaded in an 0.4 head is inserted into the canal around the instrument and tightened, followed by multiple controlled movements of the instrument until it became loose and was extracted (Figure 2e-g).

Patency was verified in all canals using K-file # 10 and working length was determined by an electronic apex locator (Root ZX mini, J. Morita, Osaka, Japan) (Figure 2h). Canal shaping was done using MG3 gold rotary files (Shenzhen Perfect Medical Instruments Co., Ltd, China) in the following sequence:(20/.04), (25/.04), (35/.04) in all canals and completed to K-file #40 in the distal canal to achieve a satisfactory apical stop. All files were used in rotation motion (450 rpm - 2 N.cm) in a single length technique. Irrigation protocol was NaOCl 5.25% 3 ml for 3 mins between each file with 30 G side vented needle. Ca(OH)2 paste (Metapaste, Meta Biomed Co. Ltd, Korea) intracanal medication was used and the tooth was temporized (MD-Temp plus, Meta Biomed Co. Ltd, Korea). The first visit lasted for two a half hours (15 minutes for removal of old filling - 90 minutes for separated instrument retrieval - 45 minutes for canal preparation and disinfection).

At the second visit one week later, the patient was asymptomatic. After anesthesia, rubber dam isolation and accessing the tooth as before, intracanal medication was removed using copious saline irrigation. Final rinse was NaOCl 5.25% 10 ml for 5 mins followed by EDTA 17% 3 ml for 3 min and activated by Ultra-X (Eighteeth, Changzhou, China) (silver tip, 2 cycles, 30 seconds per cycle). After master cone verification (Figure 2i), obturation was done by cold lateral compaction with corresponding master cones using AdSeal resin sealer (Meta Biomed Co. Ltd, Korea). Resinmodified glass ionomer (Riva light cure, SDI. Ltd, Victoria, Australia) was used to restore the tooth (Figure 2j) and the patient was referred to a prosthodontist for endo-crown construction. On the 3 months follow-up, the patient was asymptomatic, and function was restored with an endo-crown (Figure 2k,l).



Figure (1): PRICE 2020 Flowchart



**Figure (2): (Clinical workflow)** All periapical radiographs were taken with a bisecting angle technique (Digora digital sensor size 2), CBCT images were obtained with (8.7s exposure time,85µm, 90 kV, and 6 mA), photographs were taken with an iPhone 15 pro max camera at 2x magnification. (a) Preoperative periapical radiograph showing a previously treated mandibular first molar with a long, separated instrument (H-file) in the middle third of the mesiobuccal canal and a periapical radiolucency related to the mesial root. (b) Coronal cut of CBCT showing underfilling of both mesio-buccal and mesio-lingual canals, a separated instrument in the mesio-buccal canal, and a periapical lesion related to the mesial root of the mesio-buccal canal. (d) Gutta-percha removal. (e) Instrument retrieval. (f) Instrument grasped with the loop device. (g) Instrument is a 5 mm H-file. (h) Patency achieved in all canals. (i) Master cone verification. (j) Postoperative radiograph. (k) Periapical radiograph at 3-months follow-up. (l) Clinical photograph at 3-months follow-up.



Figure (3): (Retrieval instruments) (a) TOQ extractor Kit (b) ED6 ultrasonic tip (c) Leo Pen

#### Discussion

The present case's apical diagnosis was symptomatic apical periodontitis, the separated instrument needed to be removed in order to enhance the prognosis of root canal therapy, since a bypass was not practical given the instrument's size, placement, and length. According to (Iqbal et al., 2006), the frequency of endodontic instrument fractures varies greatly, ranging from 0.4% to 23%. The location of the instrument, the level of cleaning and shaping at the time of separation, the tooth's status (symptomatic/asymptomatic, with/without periapical pathology), and the condition of the root canal (vital/nonvital) are some of the factors that affect the prognosis of such cases (Terauchi et al., 2022). The prognosis of the present case is considered questionable due to the persisting apical radiolucency.

The CBCT (Figure 2b,c) showed that in the current case, the coronal 2mm of the 5 mm separated instrument was present in the straight region of the canal and that there was enough root thickness accessible to permit recovery efforts.

Basically, two phases would be employed in the mechanical retrieval technique: preparation and retrieval. The first phase would be exposure of the separated instrument using ultrasonic or rotational (trephine) instruments. The second phase would be retrieval utilizing ultrasonics or grasping/loop devices (such as the Leo pen, TOQ extractor kit, Masserann kit, or Cancellier extractor kit) is performed (Terauchi et al., 2022).

For the present case, it was decided to follow the following combination of extractor kit, ultrasonics, and wire loop device under magnification: To provide improved visibility, preliminary preparation was done using the guide and cannula drills in the TOQ extractor kit in conjunction with ultrasonics. The TOQ extractor alone was not suitable for retrieval because the use of relatively large, hard trephines can cause significant dentin removal, weaken the tooth, or increase the risk of perforation (Pai et al., 2006). A loop device was employed instead of the extractor. The separated instrument was a Hedström hand file and because H-files penetrate deeper into dentin compared with K-files, they are more challenging to remove (Cujé et al., 2010). Therefore, the separated instrument required multiple movement attempts with the loop device to retrieve it.

There are three ways to retrieve separated instruments: chemical, mechanical, and surgical. The mechanical instrument retrieval technique way was most suitable in the present case. Surgery should be the first option, when the detached fragment is mostly or entirely outside of the root. Chemical procedures are ineffective for recovering instruments since they take a long time to dissolve the metallic object completely. Moreover, it is believed that they may be detrimental to the neighboring soft and hard tissues (Terauchi et al., 2022).

Calcium hydroxide was employed as an intracanal medicament to help with the disinfection process in this case because of its many beneficial features, most notably its antibacterial actions and suppression of bacterial enzymes (Nascimento et al., 2021). Furthermore, Ultrasonic activation of the irrigant was used as its effect on bacterial reduction was demonstrated in the literature (Abouzaid and Dhaimy, 2021).

Retrieving separated instruments may result in significant harm to the remaining root structure and excessive tooth structure removal, which might cause a vertical root fracture or root perforation (Gerek et al., 2012). In this case, an endo-crown was constructed to increase the tooth's resistance to fracture since it has a lower stress concentration on the inner wall of the root canal than a traditional post-core crown does, and molars repaired with endo-crowns are less likely to experience root fractures than those with posts (Lin et al., 2020). Furthermore, the crown was constructed with flattened cuspal inclines and made out of occlusion as to not increase the occlusal stresses.

#### Conclusion

Technological developments, high-end tools, and operators' expertise enable the correct management of separated instruments. Combining several currently available procedures and tailoring them to specific situations makes it predictable to retrieve separated instruments from a root canal with the least amount of dentine loss.

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