ERURJ **2023**, 2, 4, 750-756

(Short Communication)

Separated Instrument Retrieval using Ultrasonic Vibration and the Braiding Technique: A Case Report

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Received 2nd August 2023, Revised 8th September 2023, Accepted 29th October 2023

DOI: 10.21608/ERURJ.2023.226672.1062

ABSTRACT

Ultrasonic retrieval of endodontic separated instruments, although proven to be highly successful, is a technique-sensitive process that might be accompanied by various complications including root lateral perforations, instrument secondary fractures, and unnecessary removal of radicular dentin, which in turn increases the odds of dentinal microcracks development and root fractures. Such complications increase the case difficulty and might lead the operator to modify the original treatment plan. The current case report describes the management of a separated Endo-Z bur, in a maxillary canine, that underwent a secondary fracture during ultrasonic retrieval. Ultrasonic application retrieved the coronal segment of the instrument, leaving behind a more apically located secondary fractured segment that would have sacrificed much more radicular dentin if removed ultrasonically. Therefore, the remaining fragment was bypassed using stainless steel hand files, and the braiding technique was alternatively used and successfully removed the apically located instrument conservatively.

Keywords: Separated instrument; ultrasonic, retrieval; braiding technique; secondary fracture.

1. Introduction

Instrument separation is one of the most frequent mishaps encountered during root canal treatment. Non-surgical management of such mishap involves attempting to either retrieve the separated instrument, bypass it, or prepare and fill the root canal to the level of separation (1). Although retrieving a separated fragment, to allow proper cleaning and shaping of the root canal, seems like the optimum treatment option, several factors influence its success rate. Higher success rates were reported in anterior rather than posterior teeth (2), less curved root canals (<30° angles of curvature) rather than canals with increased angles of curvature (3), and coronally-separated rather than apically-separated instruments (4). Moreover, achieving proper visibility of the separated fragment, high clinician skills, and armamentarium are crucial factors for successful retrieval (5).

The literature provides ample evidence of the high success rate of ultrasonic vibration in removing separated instruments (6,7). However, the drawbacks of this technique include the unavoidable removal of root dentin, excessive generation of heat that could transfer to the surrounding periodontium, possible secondary fracture of the separated instrument, and probable lateral root perforation (8).

The current case report aims to describe the management of a separated instrument, in a maxillary canine tooth, that underwent a secondary fracture during ultrasonic retrieval.

2. Materials and Methods:

A 43-year-old female patient presented at the Endodontic clinic, Faculty of Dentistry, Cairo University, with a chronic abscess related to the maxillary right canine. Following diagnosis, local anesthesia administration, and rubber dam isolation, a dental student started access cavity preparation, where an Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland) unfortunately separated in the access cavity. The case was then referred to an intern, who attempted to remove the instrument. However, the instrument was only pushed more apically into the root canal (Figure 1A). Therefore, the patient was referred to the Postgraduate clinic, Endodontic Department, Faculty of Dentistry, Cairo University, where a Master's degree student (the author) managed the case.

With the help of the magnification (10x) and illumination provided by the dental operating microscope (SEILER MEDICAL, St. Louis, Missouri), access cavity was first modified using a tapered stone with round end (Dentsply Maillefer, Ballaigues, Switzerland), followed by coronal flaring of the root canal, till the level of separation, using C1 Neoniti rotary file (Neolix, Raoul Vadepied, FR-53600 Chatres la Foret, France), while irrigating the canals with 2.5% sodium hypochlorite (Clorox, Household Cleaning Products, Tenth of Ramadan, Egypt).

According to the technique described by Ruddle, 2014 (1), the retrieval process started with creating a staging platform using modified Gates Glidden drills size 3 (MANI, INC. Industrial Park, Utsunomiya, Tochigi, Japan). After the removal of dentinal debris using copious irrigation and paper points dryness, ultrasonic activation started in dry condition, and using low power settings, with an E7 ultrasonic tip (NSK, Tochigi, Japan). The tip was activated between the separated fragment and the dentinal walls in a counterclockwise direction to help loosen it from the surrounding dentin. Unfortunately, the instrument underwent a secondary fracture and only its coronal segment jumped out of the canal, which was further confirmed with a periapical radiograph (Figure 1B).

Due to the apical position of the remaining fragment, and in fear of losing much more radicular dentin with further ultrasonic application, retrieving the remaining fragment was attempted with the braiding technique (9). The fragment was bypassed using small-sized K-files up to size 40 (MANI, INC. Industrial Park, Utsunomiya, Tochigi, Japan), to create the needed space for inserting the files of the braiding technique. Two K-files of size 15 and one of size 20 were then inserted, between the separated fragment and the surrounding dentin, and twisted around the fragment to form one assembly. The whole assembly was pulled in a coronal direction, where the separated fragment was loosened and pulled out of the canal (Figure 1C).

Root canal preparation was completed using manual K-files, followed by applying an intracanal medication (Meta-Paste, Meta Biomed Co., Ltd., Korea) and a coronal intermediate restoration. One week later, the patient presented with no clinical signs or symptoms. The intracanal medication was removed and obturation was performed using cold lateral compaction (Figure 1D).

3. Discussion

Instrument separation during root canal treatment is a frequent mishap that affects the ability to properly clean and shape root canals to the full working length, and therefore the success rate of endodontic treatment. Such mishap was reported to take place in one of two ways; torsional failure, where a continuous large load exceeding the instrument's torsional strength causes its separation, or flexural cyclic fatigue failure, where repeated cycles of small load subject the instrument to repeated compression and tension, forming cracks that propagate rapidly until the instrument separates (10). Removing separated instruments is a time-consuming process that requires much time and effort (7).

In the current case report, combining the utility of the dental operating microscope and the ultrasonic energy was the chosen approach for removing the separated instrument due to its previously reported high success rate (11,12). As described by Ruddle, 2014 (1), the ultrasonic tip was applied between the separated instrument and the radicular dentin, and activated with a counterclockwise motion. Ultrasonic activation was performed in dry conditions, in order not to impair the visibility under the dental operating microscope, and using low power settings, in order not to generate excessive heat that could affect the surrounding periodontium (13).

Secondary fracture of separated instruments, such as that encountered in the current case, was reported to take place during their retrieval due to flexural cyclic fatigue failure induced by ultrasonic activation, making the removal of the remaining fragment a more difficult procedure (14). Based on this finding, together with the more apical position of the remaining fragment, and the fact that ultrasonic application is accompanied by unavoidable dentinal loss (15,16), a more conservative approach had to be adopted for removing the apical fragment.

The braiding technique was formerly reported to help remove separated instruments or silver points from root canals, where two or three small-sized manual files are inserted alongside the object to be removed, then braided together to form one unit with the said object. This unit can easily be withdrawn from the root canal using a pulling force with no need to sacrifice any radicular dentin (9). Therefore, it was the technique of choice in the current case. The separated fragment was first bypassed to create the space required for applying the three hand files alongside the fragment and to ensure the success of the procedure.

Based on the current case report, it is of great importance to consider the separated instrument level inside the root canal, as well as the potential loss of radicular dentin thickness, during the treatment planning of separated instrument retrieval.

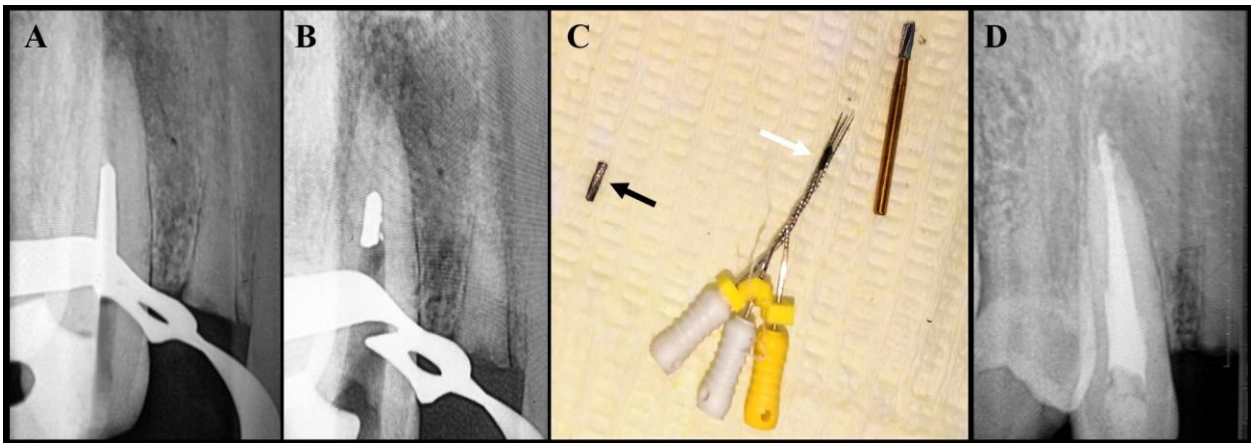

Figure 1. A: Preoperative periapical radiograph showing the separated instrument in the coronal and middle parts of the root canal. **B**: Intraoperative periapical radiograph showing the apical segment of the secondary-fractured instrument after ultrasonic retrieval of the coronal segment. **C:** Clinical photograph showing the separated instrument coronal segment retrieved by ultrasonic technique (black arrow), and the apical segment retrieved by the braiding technique (white arrow). **D:** Postoperative periapical radiograph showing the root canal obturation.

4. Conclusion

Ultrasonic retrieval of separated instruments validates as a highly successful method of retrieving separated instruments. However, it carries the risk of instrument secondary fracture, which may affect the operator's decision-making and require using an alternative retrieval method in order not to jeopardize the root dentin.

Conflict of Interest

The author denies any conflict of interest.

5. References

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