

Case Report

DOI: 10.62046/gijams.2026.v04i05.014

Management of a Broken Instrument in the Middle Third of the Root Canal of a Maxillary Central Incisor-A Case Study

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Received: 03.07.2026 | Revised: 28.07.2026 | Accepted: 30.08.2026 | Published: 19.09.2026

Abstract: Instrument separation is a recognised procedural complication during endodontic treatment and may interfere with effective cleaning, shaping, and on top of that the disinfection of the root canal, which adversely impact treatment outcomes. The management of a fractured instrument depends on several factors, including its location within the canal, root canal anatomy, accessibility of the fragment, and the amount of remaining dentine. In the present case, retrieval of the separated instrument from the middle third of the root canal was clinically challenging because adequate exposure of the fragment was required for its removal while preserving the surrounding dentine. Excessive dentine removal during retrieval could weaken the remaining root structure and increase the risk of root perforation, and subsequent root fracture. Therefore, careful assessment of the location, orientation, and accessibility of the broken instrument is essential for selecting an appropriate management approach. This case report presents the surgical management of a fractured instrument located in the middle third of the root canal of a maxillary right central incisor.

Keywords: Management, Broken, Instrument, Root Canal, Case Report.

Citation: Nazih Shaban Mustafa *et al.* Management of a Broken Instrument in the Middle Third of the Root Canal of a Maxillary Central Incisor-A Case Study. Grn Int J Apl Med Sci, 2026 Sep-Oct 4(5): 471-475.

INTRODUCTION

Separation of endodontic instruments is a relatively common procedural complication during root canal treatment [1].

Successful root canal therapy required a thorough cleaning, and obturation of the canal. However, procedural complications may arise during treatment, potentially affecting the prognosis of the treatment. During root canal preparation, there is inclusion of various objects which may inadvertently enter or become lodged within the canal, as a result of procedural complications or accidental incidents. The presence of such objects especially metallic objects can interfere with effective cleaning, shaping, and obturation of the canal, making their removal essential for achieving successful treatment outcomes [2,3]. Broken instrument such as fissure bur is not confined to endodontic treatment; it also extends to other treatment modalities, including the surgical removal of impacted mandibular third molars [4].

Management of separated fragments can be addressed with surgical or nonsurgical endodontic treatment. This case presents the successful retreatment of a root canal

with a broken fissure bur near the apical third using a surgical approach.

CASE REPORT

A 32-year-old male patient was referred to the Oral Surgery Specialist Clinic, Faculty of Dentistry, International Islamic University Malaysia (IIUM), with a complaint of mild pain and tenderness associated with tooth 11. Clinical examination revealed a discoloured maxillary right central incisor. The patient's dental history indicated that endodontic treatment had been initiated on the affected tooth. During the first treatment visit, the patient was informed by his dentist that a bur had fractured within the root canal. A subsequent appointment was scheduled to retrieve the fractured fragment.

CASE HISTORY

According to the referral letter, the treating dentist was unable to retrieve the fractured instrument despite the use of a dental operating microscope and ultrasonic tips. Consequently, the patient was referred to the Oral Surgery Specialist Clinic for surgical management of the retained fragment.

A 32-year-old male patient presented with mild, localized pain in the upper right maxillary central incisor. The pain was rated as 3/10 and was aggravated by mastication, causing the patient to avoid biting in the affected area. Clinical examination revealed discolouration of tooth 11. The patient reported a history of dental trauma approximately three years earlier, which resulted in avulsion of the tooth 21. The tooth 11 was affected from the previous trauma but there were no any sign and symptoms associated. However, the patient subsequently noticed progressive discoloration of the

tooth, followed by the onset of pain and tenderness, prompting her to seek dental treatment. Extra oral examination revealed no any abnormality and the patient is fit and healthy.

Patient sent for periapical radiograph which showed a localized radiolucency (pathologic lesion) at the apical area, with thickened lamina dura of 11, internal apical resorption, and a radiopaque object about 5mm inside the canal at the level of the middle third, resembling a metallic instrument. Figure (1A&B)

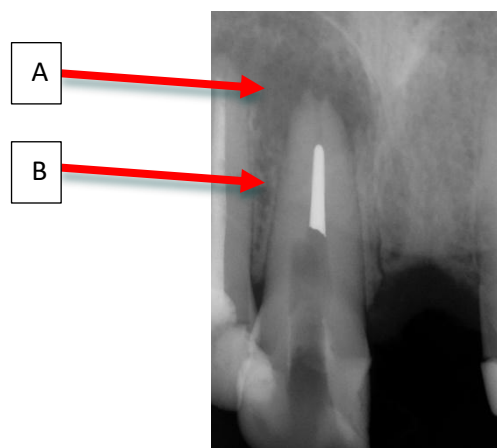


Figure 1: Periapical Radiograph Showing the Preapical Lesion(A), Broken Instrument (B)

After the examination and investigations obtained, the patient was briefed about the surgical procedure and the treatment options were explained to the patient, he agreed to undergo surgery to retrieve the broken instrument. The patient given appointment for the surgery one week after.

Surgical Procedures and Outcome

Verbal and written consent was gain from the patient to start with the periapical surgery to remove the broken instrument. The patient rinsed his mouth with chlorhexidine 0.12% then swabbing of the lips and perioral area was done, after that dripping including the head and the chest of the patient was performed. The operating site was anaesthetized with 2% mepivacaine with epinephrine (1:100 000). A three-sided flap performed, and a mucoperiosteal flap was raised. Following the removal of the temporary filling from the access cavity of tooth 11, a surgical window was created

to access the periapical area via a retrograde approach. Subsequently, 2 mm of the root apex was resected using a fissure bur, with the bur oriented at a 90° angle to the long axis of the tooth. Figure (2).

Then circumferential filing was started around the broken instrument while employing both orthograde and retrograde irrigation with normal saline under controlled pressure. Owing to the firm engagement of the fractured instrument within the canal, the procedure was repeated several times to enlarge the space between the canal walls and the broken fragment. This approach facilitated gradual loosening of the fragment and promoted its coronal displacement. Once sufficient mobility was achieved, the fractured instrument was successfully retrieved through controlled coronal manipulation Figure(3A&B). The canal was filled & the flap sutured. Figure (4)



Figure 2: Apex of the Root after Resection



Figure: 3A- Radiograph showing the fractured instrument in the root canal



Figure: 3B Endo Z bur



Figure: 4 Surgical retrieval of the fractured endodontic instrument from the root canal



Figure: 5 showing the tooth11 with separated instrument (A) & (B) after the canal obturation

DISCUSSION

Broken endodontic instrument stays a well-recognized complication in root canal treatment. While several studies and case reports have addressed this issue, it continues to warrant further investigation due to its clinical significance and potential impact on treatment outcomes. The present case contributes to many previous studies with evidence regarding breakage of instruments and highlights the importance of reporting such complications in clinical practice.

Instrument fracture during endodontic treatment can cause considerable emotional and professional distress for dentists, leading to fear of consequences, hesitation in treatment decisions, reduced professional confidence, and ethical dilemmas. These incidents may adversely affect treatment outcomes, reputation, financial security, and well-being, increasing the risk of burnout. Strengthening legal and insurance protections, implementing secure reporting systems, establishing standardized guidelines, and ensuring comprehensive informed consent are essential measures to support clinicians and improve patient care [5,6].

Several endodontic methods are used for managing a separated instrument when removal is indicated, example of that is the dental operating microscope (DOM) and fine ultrasonic tips is considered the most effective approach [6]. Other used the ethylenediaminetetraacetic acid (EDTA) aided bypassing technique compared to the ultrasonic removal method [7].

Separation of an endodontic file is a procedural complication that may compromise adequate canal disinfection. The prognosis depends on factors such as the presence of apical pathology, the location of the fractured fragment, and the possibility of bypassing or retrieving it. In anterior teeth with straight canals, the

prognosis is generally favourable when the fragment can be bypassed, allowing completion of cleaning, shaping, and obturation. In contrary of present case report where retrieval of the broken instrument was mandatory because of the pathologic periapical lesion and the separated part is near the apical area of the root, where the removal allows adequate disinfection of the canal leading clinical and radiographic healing [7].

Camacho-Aparicio *et al* 2022 used a dental operating microscope (DOM) combined with ultrasonic tips is considered one of the most effective methods using for locating the MB2 canal in maxillary first molars (MFMs). This approach significantly increases the detection rate of the MB2 canal and enhances visualization and precision, in addition to selective dentin removal thereby assisting clinicians in identifying and managing complex root canal anatomy more effectively. As well as ultrasonic technique is useful to retrieve a separated instrument like (Rotary Nickel-Titanium) [8-11].

Modern equipment enables safer endodontic procedures with a reduced risk of instrument separation, particularly in curved roots and narrow canals.

The objective of documenting these cases is not merely to identify procedural errors or assign the complication as purely iatrogenic, but rather to enhance the understanding of the multifactorial factors involved in instrument separation. These factors may include instrument design, material fatigue, repeated clinical use, sterilization cycles, canal anatomy, and operator-related variables. Continued reporting and analysis of instrument fracture cases are essential for enriching the literature, facilitating knowledge sharing among practitioners, and improving preventive strategies.



CONCLUSION

By openly discussing these complications, clinicians can learn from previous experiences, identify potential risk factors, and adopt measures to minimize their occurrence. Therefore, further exploration of instrument separation through case reports and clinical studies remains valuable for advancing endodontic practice and improving patient care.

Retrieval the fragment and completing canal preparation proved to be an effective approach in this case, in single visit as evidenced by the favourable follow-up.

ACKNOWLEDGMENT

I would like to acknowledge the dental surgery assistants, Department of Oral and Maxillofacial Surgery and Oral Diagnosis, Oral Surgery Unit, Faculty of Dentistry, International Islamic University Malaysia, for their valuable assistance during the surgical procedure and follow-up.

Conflicts of Interest: There are no conflicts of interest.

Funding: No funding or financial support was received for this case report.

Ethical Statement: Written informed consent was obtained from the patient for publication of the case details and clinical photographs. The patient was informed about the purpose and nature of the publication, and consent was provided for anonymized use of the clinical information and images in print, electronic, and online formats.

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