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Endodontic Management Of Separated Instruments : A Case Series

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Abstract

Instrument separation during endodontic treatment is a challenging procedural error that can compromise cleaning, shaping, and disinfection of the root canal system, potentially affecting the long-term prognosis. Separated instruments - commonly fractured nickel-titanium or stainless-steel files may occur due to cyclic fatigue, torsional stress, inadequate instrumentation techniques, anatomical complexities and overuse of instruments. The endodontic management of such cases involves a decision-making process based on factors such as the instrument's location within the canal, canal anatomy, accessibility, and the stage of treatment at which separation occurs. Retrieval techniques include the use of ultrasonic tips, microtubes, bypassing methods, or specialized retrieval systems under dental operating microscopes, while in certain cases, retaining the fragment and modifying the treatment plan may be considered. Thorough irrigation with sodium hypochlorite, enhanced disinfection protocols, and obturation strategies are essential when bypassing or retaining the fragment. This case series focuses on retrieval and bypassing the separated instrument.

Keywords: Separated instrument, endodontic complication, iatrogenic error, instrument retrieval, ultrasonic tips, bypassing technique, retrieval kit

Introduction

Endodontic treatment aims to thoroughly clean, shape, disinfect, and obturate the root canal system, thereby eliminating infection and preventing reinfection. The success of treatment relies on the complete removal of necrotic tissue, microorganisms, and debris from the canal space. However, procedural accidents such as instrument separation pose a significant clinical challenge, potentially compromising the treatment outcome. A separated instrument, commonly a fractured segment of a hand file or rotary NiTi instrument, can obstruct canal patency and hinder access to apical regions, limiting effective cleaning and shaping (1,2).

Instrument separation can occur due to multiple contributing factors including cyclic fatigue, torsional stress, improper use, inadequate lubrication, complex canal anatomy, repeated sterilization cycles and overuse of instruments (3,4). The incidence varies depending on operator skill, instrument type, and clinical scenario, with higher prevalence reported in narrow, curved canals. Nickel-titanium rotary files, while offering superior flexibility and efficiency, are more prone to fracture without visible signs of distortion compared to stainless-steel instruments, making prevention and management more challenging (5,6).

Management strategies for separated instruments range from non-surgical retrieval techniques using ultrasonic tips, microtube systems, and specialized retrieval kits, to bypassing the fragment or, when necessary, surgical intervention (7,8). Successful retrieval requires careful assessment and minimally invasive removal to preserve dentin and prevent root weakening (9).

Preventive measures remain the most effective approach, including proper instrument selection, adherence to recommended usage protocols, avoiding overuse, ensuring adequate canal lubrication, and respecting the canal anatomy and mechanical limitations of instruments (10).

This case series aims to describe the etiology, clinical considerations, and contemporary management options for separated instruments in endodontics. All three cases focuses on improving the prognosis of the cases with separated instruments.

Case Report – I

A 32 year old female patient reported to the department of conservative dentistry and endodontics with chief complaint of pain in the lower left back region of jaw . The patient gave history of severe pain and swelling with 36, four months back after which initiation of root canal treatment with 36 was done. On clinical examination there was fractured temporary restoration with # 36 and there was tenderness on percussion with 36.

Radiograph revealed, access opening with 36 and two separated instruments seen in the distal canals of #36. Periapical rarefaction was seen with 36

Diagnosis – symptomatic apical periodontitis with 36. Instrument separation with distal canal of 36.

Treatment procedure –

Informed consent was obtained After explaining the treatment plan to the patient and treatment was initiated with administration of 2% Lignocaine with 1:80,000 adrenaline.

Tooth #36 was isolated using rubber dam, followed by complete removal of remaining temporary restoration and carious tooth structure. Access opening was modified to gain straight line access.

Pulp chamber was flooded with 5.25% sodium hypochlorite and canal orifices were widened using orifice opener.

Endoactivator was used to activate sodium hypochlorite and ultrasonic tip was used for the troughing the dentin around the instrument. After loosening of separated instrument, the instrument retrieval kit was used to engage the coronal tip of the separated instrument to retrieve it. By using clamping and locking mechanism, the first instrument was retrieved which was measured 9mm in length.

After retrieval of the first instrument, radiograph was taken to confirm the retreieval and to assess the position of the second instrument in the same canal. After radiographic analysis, the second instrument was bypassed using small 8k hand file.

Copious irrigation was done using 5.25% sodium hypochlorite, working length was determined and cleaning and shaping was completed. Canals were dried using paper points and obturation was completed. Post obturation restoration and prosthetic rehabilitation was done with 36.

Patient was followed for 3 months. Patient was completely asymptomatic and radiograph revealed healing of periapical lesion with 36.

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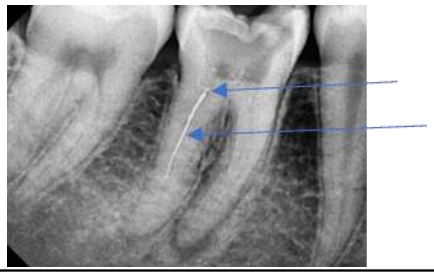
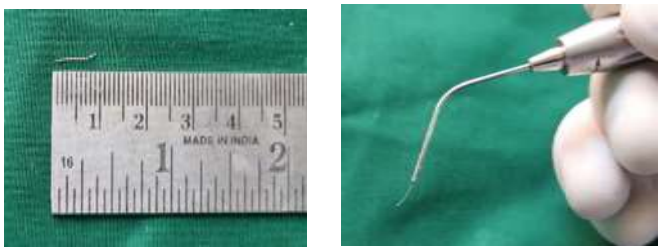


Pre-operative radiograph showing separation of two instruments inside the distal canal with 36



Retrieval of the first separated instrument

Endoactivator and ultrasonics used to loosen the separated file

Instrument Retrieval kit

Second instrument present in the canal

Radiograph after retrieval of first separated instrument showing second instrument present in the canal

Second instrument bypassed with 8k file

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Working length determination with 36

Master cone selection with 36

Obturation and post obturation restoration done with 36

Pre operative radiograph with 36

3 months follow up radiograph

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Case Report – II

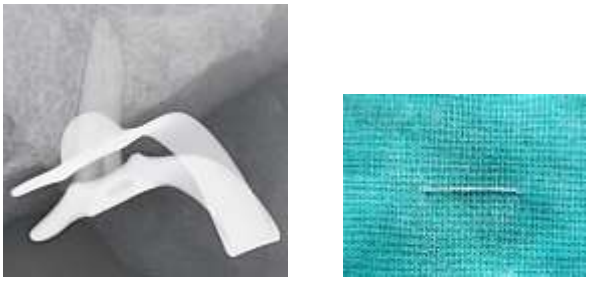
A 58 year old male patient reported to the department of conservative dentistry and endodontics with chief complaint of pain in upper right back region of the jaw. The patient gave history of initiation of root canal treatment with #25. On clinical examination there was temporary restoration with #25 with tenderness on percussion.

Radiograph revealed separated instrument, which was seen 2 mm beyond the apex of 25.

Diagnosis – Incomplete root canal treatment with separated instrument beyond apex with 25.

Treatment procedure – Retrieval of separated lentinospiral using ultrsonic tips and retrieval forceps and completion of endodontic treatment with 25

Pre-operative radiograph showing separated instrument beyond apex with 25



Retrieval of separated instrument with 25

Working length determination with 25

Master cone selection with 25

Obturaion done with 25

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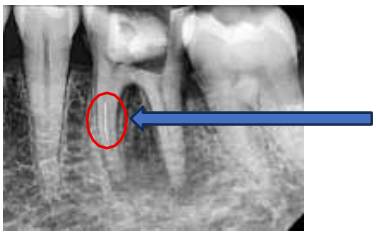
Case report – III

A 29 year old female patient reported to the department of conservative dentistry and endodontics with chief complaint of pain and swelling in lower right back region of the jaw. The patient gave history of initiation of root canal treatment with #46. On clinical examination there was pus draining sinus with 46, temporary restoration and tenderness on percussion with #46.

Radiograph revealed access opening with 46, separated instrument in the mesiolingual canal and periapical radiolucency with 46.

Diagnosis – Chronic apical periodontitis with 46, incomplete root canal treatment with separated instrument in mesiolingual canal with 46.

Treatment procedure - Bypassing the separated instrument with small 8k hand file followed by completion of endodontic treatment with 46.



Pre-operative radiograph showing separated instrument inside the mesiolingual canal of 46

Bypassing the separated instrument in the mesiolingual canal of 46 with 8k file

Working length determination with 46

Calcium hydroxide intracanal dressing given with 46

Mastercone selection with 46

Obturation and POR done with 46

Pre operative radiograph with 46

3 months follow up radiograph with 46

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Discussion :

The separated instrument can hinder adequate debridement and disinfection beyond the obstruction, potentially allowing microbial persistence and apical periodontitis.

Management strategies must balance the goals of fragment removal, bypassing, or retention, while minimizing additional dentin loss and procedural complications.

The decision to remove or bypass a separated instrument is influenced by factors such as the location of the fragment (coronal, middle, or apical third), canal curvature, tooth type, root morphology, and the length of the fragment. Literature indicates that fragments in the coronal

or middle third are more accessible for retrieval, whereas those in the apical third, particularly in curved canals, present higher risk for perforation or excessive dentin removal (11).

Techniques for fragment removal have evolved considerably. Ultrasonics, microtube devices (Masserann kit), and modified needle techniques remain common approaches. Ultrasonics,

under magnification from an operating microscope, have significantly improved visualization and success rates while conserving dentin. Studies have demonstrated higher retrieval success when using ultrasonics in combination with dental operating microscopes, especially in

straight or moderately curved canals (12,13). However, excessive ultrasonic use may cause dentin microcracks or weaken the root structure, underlining the importance of conservative application.

In situations where retrieval is unfeasible or carries high risk, bypassing the fragment may be the preferred approach. Successful bypassing allows continuation of shaping and irrigation

beyond the obstruction, improving disinfection outcomes. If both retrieval and bypass fail, the fragment may be left in situ, provided adequate coronal sealing and disinfection have been achieved; long-term follow-up is essential in such cases.

Irrigation protocols play a pivotal role, particularly when the separated instrument impedes mechanical cleaning. Copious irrigation with sodium hypochlorite, combined with activation techniques, enhances the penetration of irrigants beyond the fragment, reducing microbial load (14).

The prognosis after instrument separation depends largely on the preoperative condition, stage of treatment, and microbial status at the time of separation. If the canal segment beyond the obstruction is already cleaned and disinfected, the prognosis is generally favorable (15).

Conversely, separation early in the procedure before adequate cleaning may compromise outcomes.

Ultimately, prevention remains the best strategy. Regular instrument inspection, adherence to recommended usage cycles, avoiding excessive force, and following manufacturer's guidelines reduce the likelihood of separation. Modern nickel-titanium rotary systems with improved metallurgy and heat treatment have further enhanced flexibility and resistance to cyclic fatigue, thereby lowering fracture incidence (16).

Conclusion :

The management of a separated instrument requires a case-specific, minimally invasive, and well-informed approach. Advances in magnification, ultrasonic technology, and irrigation activation have improved success rates, but clinical judgment remains the cornerstone of decision-making for optimal patient outcomes.

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