Efficient Retrieval of Separated Endodontic Instruments: A Case Series Using the TS Infinite Loop System in the Coronal, Middle Thirds

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Endodontic Instrument, TS Infinite Loop System, mesiobuccal canal, ultrasonic troughing, root canal system

ABSTRACT
Instrument separation during endodontic treatment presents a significant challenge, often leading to compromised treatment outcomes. This case series focuses on the successful retrieval of separated instruments from the root canal system using the TS Infinite Loop System. Three clinical cases involving separated instruments in the mesiobuccal canals of mandibular molars are presented, demonstrating the procedural approach and techniques used for retrieval. A combination of ultrasonic troughing and the TS Infinite Loop System enabled precise removal of fractured instruments without unnecessary dentin removal or canal enlargement. This series highlights the efficacy, precision, and potential of the TS Infinite Loop System as a reliable tool for managing instrument retrieval in challenging clinical scenarios.

1. Introduction

Retrieval of separated endodontic instruments remains one of the most challenging and essential procedures in endodontic practice. Instrument separation can occur at various levels within the root canal system from coronal to apical third posing significant risks to successful treatment outcomes.[1] Instrument fractures are more common in molars than in anterior teeth, with the mesiobuccal canals of upper and lower first molars being particularly prone to fractures due to limited accessibility and curvature. Specifically, the mesiobuccal canal of the right and left mandibular molar is the most frequently affected.[2] The probability of fracture is highest in the apical third and is least in the coronal third.[3] Several factors, such as the curvature of the canal, the length of the separated file, and its location within the canal, play crucial roles in the decision-making process for retrieval. These variables can significantly impact the complexity and success rate of the retrieval procedure.[4,5]

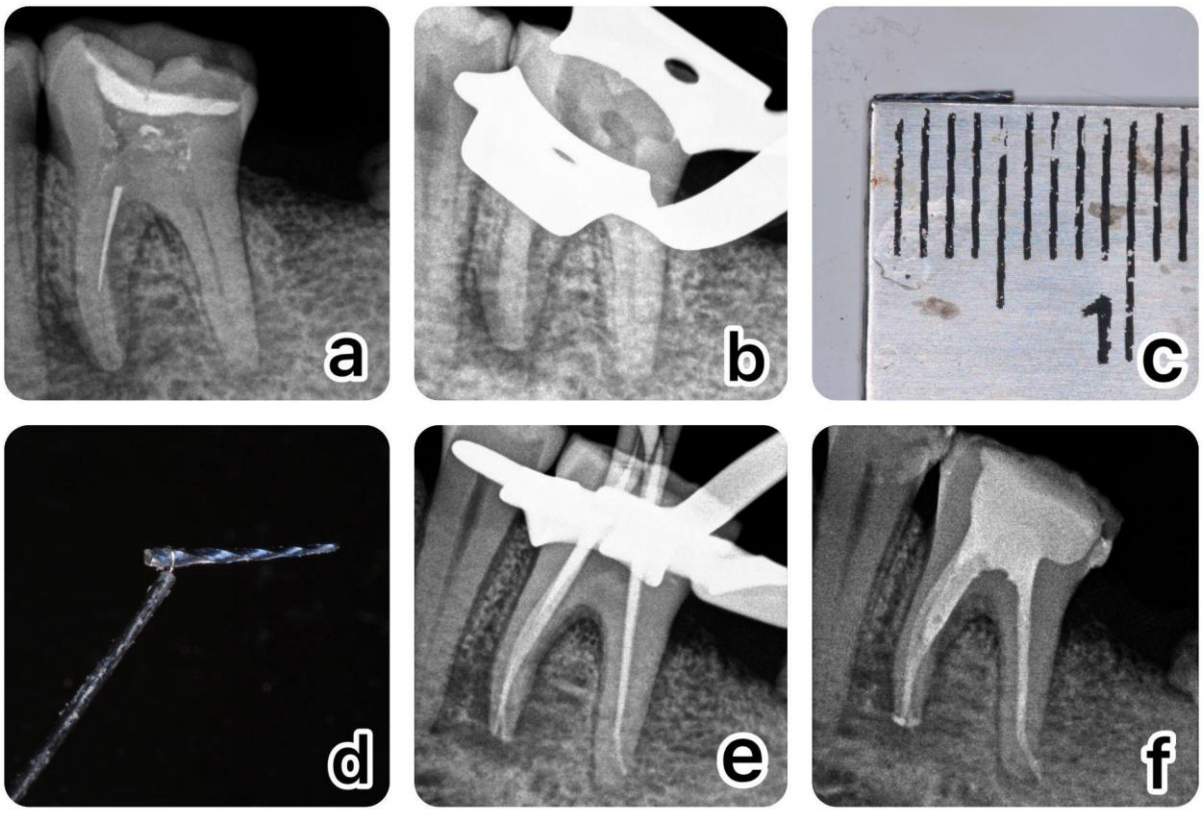
Particularly in the deeper portions of the root canal, traditional retrieval methods frequently suffer from inconsistency and inefficiency. This case series aims to evaluate the effectiveness of a novel instrument retrieval kit designed to overcome these challenges. By presenting a series of clinical cases, we highlight the kit's versatility and reliability in retrieving separated instruments from different levels of the root canal system. Each case demonstrates the procedural approach, clinical considerations, and outcomes, providing a comprehensive overview of the TS Infinite loop systems performance across different scenarios.

2. CASE SERIES

Case 1

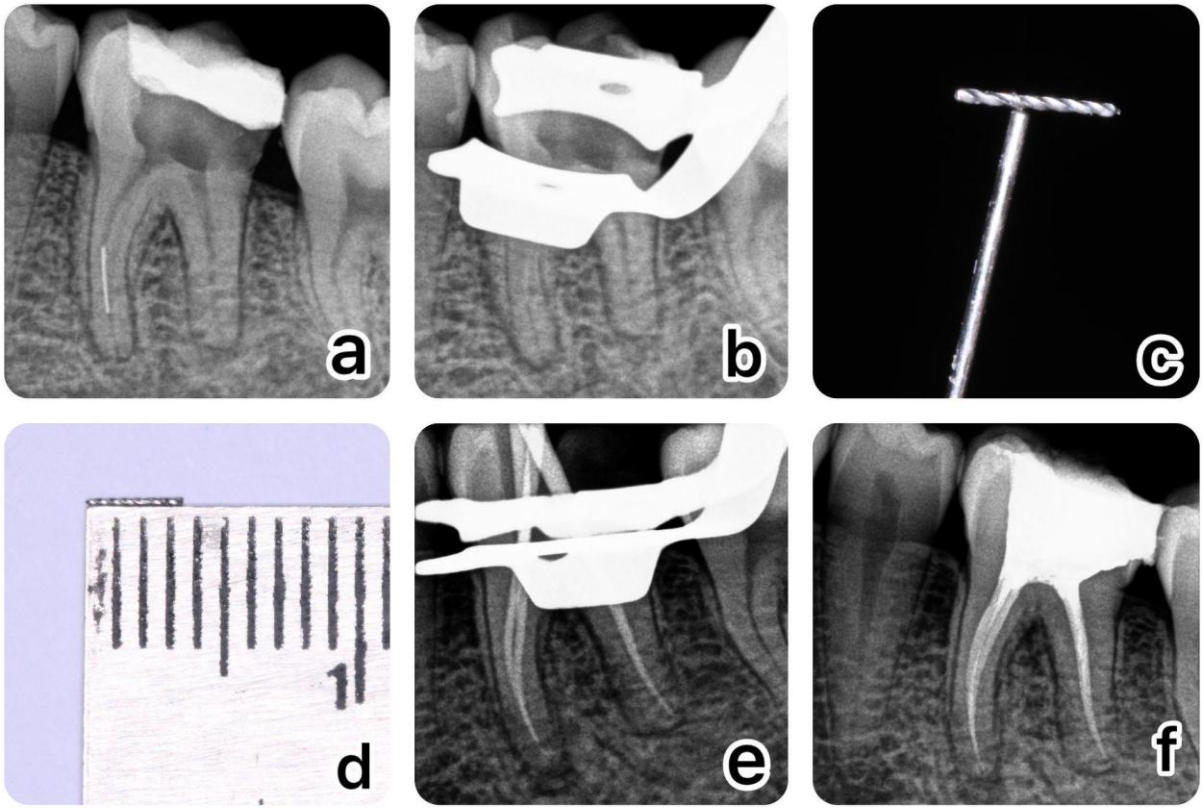
A 20-year-old patient presented to the clinic for the retrieval of a separated file in the mesiobuccal canal of tooth 36. Radiographic examination revealed a broken rotary file in the mesiobuccal canal,

extending from the coronal to the middle third.tooth was diagnosed for previously initiated root canal therapy and retrieval using the loop technique was planned. To create a straight-line access to the file head, a modified GG drill size 3 was used. An Endostar ISO size 25 ultrasonic tip was employed to trough along the inner curvature and the circumference of the separated instrument to create space for the loop. Once adequate troughing was achieved, the TS Infinite Loop System was used to engage and retrieve the file with an anti-clockwise spiral pull motion. After retrieval, the tooth was obturated, and the patient was directed back to the general dentist for final restoration.



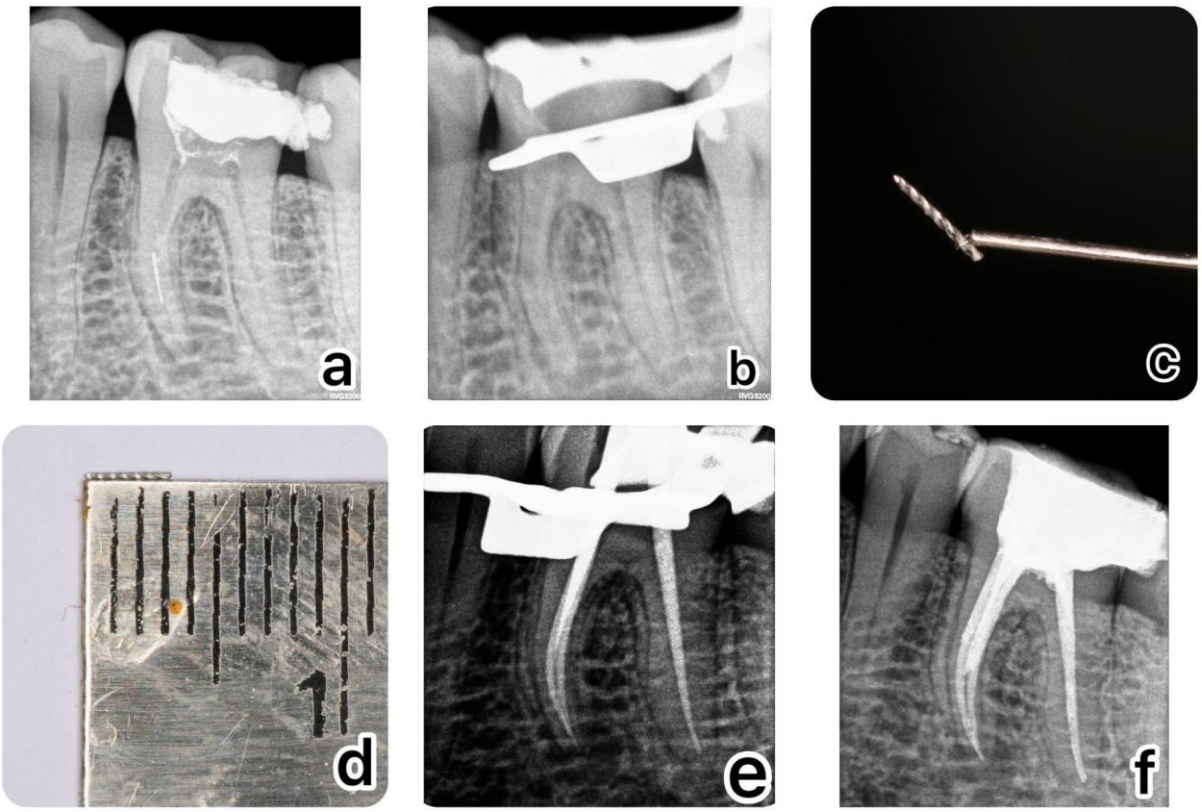
Case 2

In the second case of the series, a 25-year-old patient presented with a broken file in the mesiobuccal canal of tooth 36, extending from the middle to the apical third. Radiographic examination confirmed the presence of the broken hand file. Tooth was diagnosed as previously initiated root canal therapy, and the retrieval was planned using the loop technique. To create a straight-line access to the file head, a modified GG drill size 2 was utilized. The Endostar ISO size 25 ultrasonic tip was then used to trough along the inner curvature and the circumference of the separated instrument to facilitate the loop's placement. Following adequate troughing, the TS Infinite Loop System was employed to engage and retrieve the file using an anti-clockwise spiral pull motion. After the retrieval, the tooth was obturated, and the patient was referred back to the previous dentist for final Restoration.



CASE 3

In the third case of the series, a 23-year-old patient presented with a broken file in the mesiobuccal canal of tooth 36, extending from the middle to the apical third. Radiographic examination confirmed the presence of the broken hand file. The diagnosis was previously initiated root canal therapy, and the retrieval was planned using the loop technique. To create a straight-line access to the file head, a modified GG drill size 3 was utilized. The Endostar ISO size 25 ultrasonic tip was then used to trough along the inner curvature and the circumference of the separated instrument to facilitate the loop's placement. Following adequate troughing, the TS Infinite Loop System was employed to engage and retrieve the file using an anti-clockwise spiral pull motion. After the retrieval, the tooth was obturated, and the patient was referred back to the previous dentist for final Restoration.



3. Discussion

Managing separated instruments during root canal treatment presents a significant challenge, as it directly impacts the thorough cleaning and shaping, which are essential to the long-term effectiveness of endodontic therapy.[6] Since it allows the root canal to be thoroughly cleaned and shaped, the removal of broken files is generally considered the most accepted procedure.In order to make the removal of these broken files easier, numerous techniques have been created, each having pros and cons of its own.[7]

Among these techniques, the use of ultrasonic devices has been extensively studied and is generally recommended due to its effectiveness and precision.[8] Ruddle's method, which involves preparing a staging platform and using ultrasonic tips to carefully trough the coronal dentine around the broken fragments, is particularly noteworthy.[9] This approach, especially when combined with a dental operating microscope, has been shown to enhance both the safety and success of instrument retrieval while minimizing the loss of dentine.[10] The importance of conserving dentine during these procedures cannot be overstated, as excessive removal increases the risk of tooth fracture, potentially compromising the structural integrity of the tooth and the overall success of the treatment.[11]

Despite the advantages of ultrasonic techniques, the retrieval of separated files remains a complex and time-consuming task, with success rates varying across studies. Reported success rates for ultrasonic methods range from 80% to 88%, depending on the technique used and the specific conditions of the case.[12] Factors such as the type of instrument, its location within the canal, and the length of the broken fragment significantly influence the success of removal.[13] Another major factor influencing the success of retrieval is the type of instrument.niti rotary files reducce canal preparation times as compared to hand filing[14,15] but their retrieval becomes difficult when fractured inside the canal. Cujé and colleagues reported success rates—89% for NiTi Files and 100% for stainless steel files.[16] Despite this risk, the use of NiTi rotary instruments is inevitable, as their advantages outweigh the disadvantages.[17,18] Therefore, it is important to develop newer techniques

for managing mishaps when they occur. In addition to traditional ultrasonic methods, recent advancements in retrieval techniques have further improved success rates. The TS Infinite loop system used in this report was developed by dentist at developed by dentists at saveetha dental college and hospitals (SIMATS), which includes a loop device alongside a troughing bur and measuring probe, has been particularly effective. This system allows for the secure grasping and removal of the fractured instrument without the need for further canal enlargement, even when the fragment remains lodged after partial exposure. This method is especially useful for retrieving instruments from curved sections of the canal, where traditional methods might struggle.

The innovative design of this retrieval kit, with its advanced materials and ergonomic features, enhances control and precision during the retrieval process. Our case series highlights the technical advancements in endodontic instrumentation and underscores the importance of developing reliable solutions to improve patient outcomes. The use of this advanced system in our cases resulted in successful retrieval of broken instruments, demonstrating its efficacy and potential for broader clinical application. By combining these advanced tools with established techniques, clinicians can achieve higher success rates in managing the challenging scenario of separated instruments in root canals.

4. Conclusion

This case series highlights the successful application of the TS Infinite Loop System for retrieving separated instruments from the coronal and middle thirds of the root canal. The system demonstrated a high level of efficiency and precision, providing consistent outcomes in challenging clinical scenarios. By utilizing the ergonomic design of the TS Infinite Loop System in conjunction with established ultrasonic troughing techniques, instrument retrieval was accomplished without causing unnecessary dentin removal or canal enlargement.

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