



ORIGINAL RESEARCH PAPER

Endodontics

RETRIEVAL OF A SEPARATED ROTARY INSTRUMENT IN A MAXILLARY FIRST MOLAR USING THE BTR PEN : A CASE REPORT.

KEY WORDS: BTR Pen, File retrieval, open apex, Ultrasonics, CBCT.

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ABSTRACT

Instrument separation is a challenging procedural complication in endodontics, particularly in maxillary molars, due to their complex canal anatomy and limited accessibility. This case report describes the successful retrieval and management of a separated rotary instrument from the distobuccal canal of a maxillary first molar using the BTR Pen under a dental operating microscope (DOM). A 22-year-old patient presented with pain in relation to tooth 16 following previous endodontic treatment. Radiographic examination revealed a separated instrument extending from the middle to apical third of the distobuccal canal, along with a wide palatal canal exhibiting open apex morphology. Ultrasonic trephination followed by the use of the BTR Pen loop technique enabled conservative and successful retrieval of the fractured fragment. CBCT evaluation confirmed the complete removal of the separated instrument. The case highlights the importance of magnification, ultrasonics, CBCT evaluation, and minimally invasive retrieval systems in the successful management of complex endodontic procedural mishaps.

INTRODUCTION

Successful endodontic therapy depends on complete debridement, disinfection, and obturation of the entire root canal system. However, procedural mishaps such as instrument separation may compromise treatment outcome by obstructing adequate cleaning and shaping of the canal system. Instrument separation is one of the most commonly encountered complications during root canal treatment, with a reported incidence ranging from 0.4% to 7.4%. Studies have shown that approximately 42.6% of separated rotary (NiTi) instruments occur in maxillary molars, with the highest frequency reported in the mesiobuccal canal (35.2%)³. Failure to assess the extent of caries, crown angulation before treatment, urge to use NiTi rotary instruments before confirming the root canal, are a few of the possible reasons for such iatrogenic error.⁶ Retrieval of separated instruments is challenging and often requires the use of magnification, ultrasonics, and specialised retrieval systems to minimize dentin loss and prevent procedural errors.^{1,2}

The prognosis of retrieval procedures depends on several factors, including the location and length of the separated fragment, canal anatomy, visibility and accessibility of the fragment, duration before management, and its proximity to vital anatomical structures.⁷ Furthermore, separated instruments may compromise effective canal debridement and increase stress and anxiety for both the clinician and the patient, often resulting in prolonged treatment duration.

Advancements in magnification and retrieval systems have significantly improved the predictability and safety of instrument retrieval procedures. Various commercially available retrieval kits have been introduced for this purpose. Among them, the Terauchi File Retrieval Kit has gained considerable popularity because of its comprehensive armamentarium, which includes ultrasonic tips, micro-explorers, and looping devices designed for conservative dentin removal and enhanced visualization.⁸

More recently, the BTR Pen has emerged as an effective alternative retrieval system. It utilizes a flexible nitinol wire loop that mechanically engages and secures the coronal portion of the separated fragment, enabling controlled retrieval from the root canal system with minimal additional dentin sacrifice.⁹

Management becomes further complicated when associated with an open apex or blunderbuss canal morphology. Teeth with open apices possess thin dentinal walls and lack an apical constriction, making cleaning, shaping, and obturation difficult while increasing the risk of extrusion of irrigants and obturation materials. Apexification using bioactive materials such as Mineral Trioxide Aggregate has gained popularity because of its superior sealing ability, biocompatibility and ability to promote hard tissue formation.^{3,4}

The present case report describes the successful retrieval of a separated instrument from the distobuccal canal of a maxillary first molar using the BTR Pen technique under a dental operating microscope, followed by nonsurgical endodontic management of the maxillary first molar.

Case report

A patient aged 22 years reported to the department of conservative dentistry and endodontics with pain in the upper right back tooth region, for which the patient had previously undergone dental treatment one week ago. The tooth was temporarily restored. The pain was sharp, continuous and aggravated on chewing food. An intraoral periapical radiograph (IOPA) showed radiopacity extending from the middle third to the apical third of the Distobuccal root, indicating a separated instrument along with a wide Palatal canal exhibiting an open apex and with PDL widening with respect to 16. Based on the clinical and radiographic findings, a diagnosis of Symptomatic Apical Periodontitis with respect to tooth 16 was established. The treatment plan aimed at retrieval of the separated instrument followed by non-surgical root canal treatment with apexification of the palatal root with 16. Patient was informed about the treatment plan, and consent was obtained.

Under local anaesthesia with 2% lignocaine in 1:80,000 adrenaline (Indoco Remedies Ltd., Chennai, India) the temporary restoration was removed, and the canals were reaccessed with respect to 16 under Dental Operating Microscope (ZEISS OPMI pico) under 10x magnification. The 3 canals were located and the head of the separated file fragment was visualized in the Distobuccal canal. Coronal enlargement was performed, and a modified Gates Glidden size 3 (GG3) was utilized to create a staging platform. Endodontic ultrasonic tip, ED87 (Woodpecker, China) was used to trephine the dentine

around the coronal tip of the broken instrument in 360 degree. Once the instrument head was clearly visible and slight mobilization of the fragment was observed, the BTR assembly was then engaged. A 0.3 mm diameter loop was placed over the broken file and the coronal 1mm of the broken instrument was grasped with BTR pen loop (Cerkamed Medical Company, Stalowa Wola, Poland) by moving the slider's cap up and the assembly was carefully moved in a back-and-forth direction until the instrument was extracted from the root canal.

Post retrieval Cone-beam computed tomography (CBCT) imaging demonstrated successful removal of the separated instrument from the Distobuccal canal. A wide palatal canal with open apex was observed. Owing to the open apical configuration of the palatal canal, an apical barrier procedure was planned for the Palatal canal.

Working length of all the three canals were established and biomechanical preparation of the Mesio Buccal and Distobuccal canals were prepared up to F1 Protaper Gold (Dentsply Sirona, Ballaigues, Switzerland). Irrigation during instrumentation was performed using 5.2% sodium hypochlorite and 17% EDTA. The palatal canal was prepared up to F4 Protaper gold (Dentsply Sirona, Ballaigues, Switzerland). Calcium hydroxide dressing was given and the patient was recalled after a week.

During the next appointment, an apical barrier was established using MTA Angelus (Angelus, Londrina, Brazil) followed by thermoplasticized obturation of the palatal canal. The mesio buccal and distobuccal canals were obturated using single cone obturation with Bioceramic sealer (Bio C Sealer, Angelus, Londrina, Brazil). Postoperative composite restoration was placed and a radiograph was taken to confirm the obturation.

The patient remained asymptomatic and a partial-coverage crown restoration was given.

DISCUSSION

Instrument separation is considered one of the most challenging procedural complications in endodontics because of restricted accessibility, complex root canal anatomy, and the need to preserve radicular dentin during retrieval procedures. Management of separated instruments depends on several factors, including the location of the fragment, canal anatomy, root curvature, visibility, remaining dentin thickness, and accessibility of the fractured segment.¹⁰

Various techniques are employed to remove intracanal separated instruments, including the use of mini forceps, braiding endodontic files, wire loops, broach with cotton, hypodermic needles, Masserann instruments, extractors, ultrasonics, and canal finder systems. Among the available retrieval methods, loop techniques have gained popularity because of their conservative approach, predictable outcomes, and ability to retrieve fragments from different levels of the root canal system. The loop technique is a widely adopted method for fractured instrument retrieval, known for its high success rates and safety.¹¹

In the present case, retrieval was performed using the BTR Pen following ultrasonic exposure of the coronal portion of the fragment. The BTR Pen utilises a flexible nitinol wire loop that mechanically engages the separated instrument and facilitates its controlled coronal removal. Compared with conventional retrieval techniques, the BTR Pen offers several advantages, including conservative dentin removal, maintenance of structural integrity, improved control during retrieval, and reduced risk of perforation. In addition, the flexibility of the nitinol loop permits engagement of fragments located in deeper portions of the canal, making it a minimally invasive and effective retrieval option.

Traditionally, calcium hydroxide apexification was advocated for open apex cases; however, prolonged treatment duration

and increased susceptibility to cervical root fracture have limited its use. The introduction of Mineral Trioxide Aggregate has significantly improved apexification procedures because of its superior sealing ability, biocompatibility, hydrophilic nature, and ability to induce hard tissue formation. In the present case, MTA was used as an apical barrier in the palatal canal, allowing predictable obturation and apical sealing in a shorter treatment duration.⁴

The mesio buccal and Distobuccal canals were obturated using a Bioceramic sealer because of its bioactivity, excellent sealing ability, dimensional stability, hydrophilic nature, ability to promote biomineralization and improved sealing of the root canal system, which favours periapical healing outcomes.¹³

The successful management of this case highlights the importance of advanced magnification, conservative retrieval techniques, and bioactive endodontic materials in managing complex endodontic procedural mishaps while preserving tooth structure and ensuring favourable clinical outcomes.

Figures

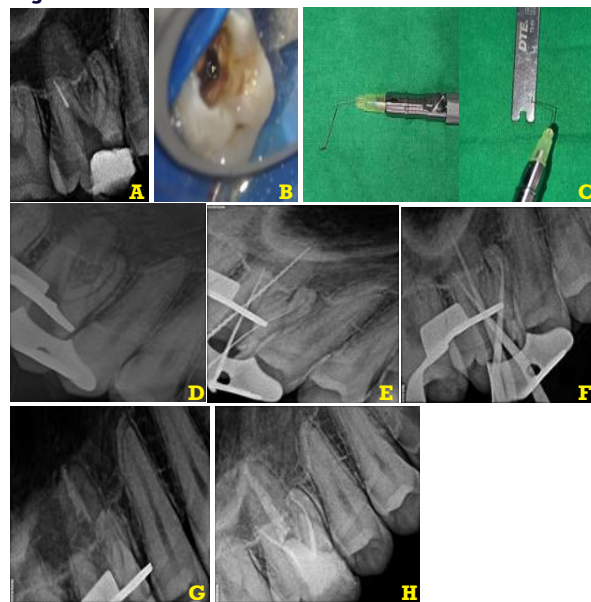


Figure 1- A. Preoperative Radiograph, B. File fragment in the distobuccal canal as seen under 10X magnification in DOM, C.Fragment retrieved using BTR pen, D. Post file retrieval radiograph, E. Working length Radiograph, F. Mastercone radiograph, G. MTA plug placed, H. Obturation and composite restoration done.

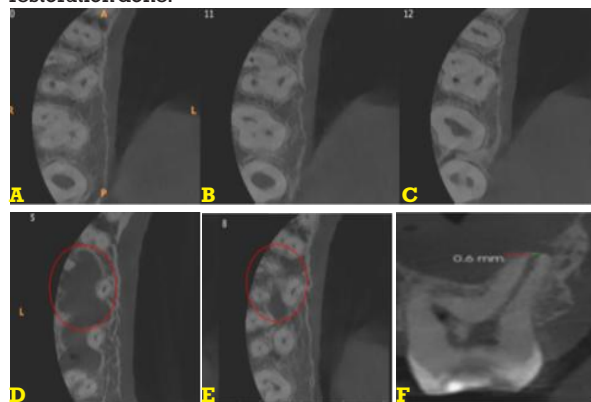


Figure 2- A.,B.,C- axial section wrt 16 as seen at the apical, middle and coronal level (CBCT). Denotes complete removal of the separated instrument. D.,E.- axial sections at the apical third and F.- Sagittal section shows open apex of the palatal canal.

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