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Custom syringe and wire snare retrieval of a separated endodontic instrument

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Abstract
Separation of an endodontic instrument can obstruct apical access and compromise canal disinfection. Management should balance the biological benefit of fragment removal against the structural cost of dentin removal. This case report describes conservative retrieval of a separated instrument during root canal treatment of a maxillary right canine in a 42-year-old woman who presented with pain in the upper right posterior region. Deep proximal caries affected teeth 13 and 15, both were tender to percussion, and neither responded to cold or electric pulp testing. Root canal treatment was initiated under rubber-dam isolation. During instrumentation of tooth 13, an instrument separated in the apical third. Under magnification, the coronal end of the fragment was exposed conservatively with ultrasonics. A chairside custom snare was fabricated from a 22-gauge Luer-lock disposable pre-bent dispenser tip and 0.08-mm stainless-steel orthodontic ligature wire. The wire loop was positioned around the exposed fragment, tightened through the needle and withdrawn coronally. Radiography confirmed complete retrieval and canal patency. Cleaning, shaping and obturation of teeth 13 and 15 were subsequently completed. The combined use of direct visualisation, controlled ultrasonic troughing and a custom syringe-and-wire snare permitted nonsurgical removal while limiting unnecessary dentin sacrifice.

Keywords: Custom snare, dental operating microscope, fractured file, instrument retrieval, loop technique, ultrasonics

Introduction

Instrument separation is an important procedural complication of root canal treatment. Rotary nickel-titanium instruments may fail by torsional overload, cyclic fatigue or an interaction of both mechanisms, whereas stainless-steel hand instruments are more commonly affected by torsional stresses and repeated use [1, 2]. A separated fragment is not intrinsically responsible for post-treatment disease; the principal concern is that it may restrict access to the canal beyond the obstruction and thereby interfere with cleaning, shaping and disinfection [1, 3].

Available management options include retrieval, bypassing, preparation and obturation to the coronal level of the fragment, or surgical intervention. Selection depends on the preoperative pulpal and periapical status, stage of canal preparation, fragment type and length, root anatomy, fragment position relative to the canal curvature, remaining dentin thickness, visibility and operator experience [1, 4]. Because retrieval itself can cause excessive dentin loss, perforation, ledging, transportation or secondary fracture, the least destructive predictable approach should be chosen.

The dental operating microscope and fine ultrasonic tips have improved direct visualization and controlled dentin removal around a fragment [5, 7]. When ultrasonic vibration exposes or mobilizes but does not deliver the fragment, a wire loop or snare can engage the coronal end and provide controlled traction [8, 9]. This report presents the combined use of ultrasonics and a chairside custom snare fabricated from a 22-gauge Luer-lock disposable pre-bent dispenser tip and 0.08-mm stainless-steel orthodontic ligature wire to retrieve a separated instrument from a maxillary right canine.

Case Report

A 42-year-old woman reported pain in the upper right posterior region for two months. The pain was aggravated by food impaction and was temporarily relieved by medication. Clinical examination showed deep proximal caries in teeth 13 and 15. Both teeth were tender to percussion and showed no response to cold or electric pulp testing. Periapical radiographs demonstrated carious radiolucencies extending through enamel and dentin toward the pulp spaces of teeth 13 and 15 (Fig 1). on the basis of the combined clinical and sensibility findings, pulp necrosis with symptomatic apical periodontitis was diagnosed in teeth 13 and 15. Root canal treatment was planned for both teeth after the procedure, alternatives and risks had been explained and consent obtained.

Fig 1: Preoperative findings. A, Intraoral view showing deep carious lesions in teeth 13 and 15. B, Periapical radiograph of tooth 15. C, Periapical radiograph of tooth 13.

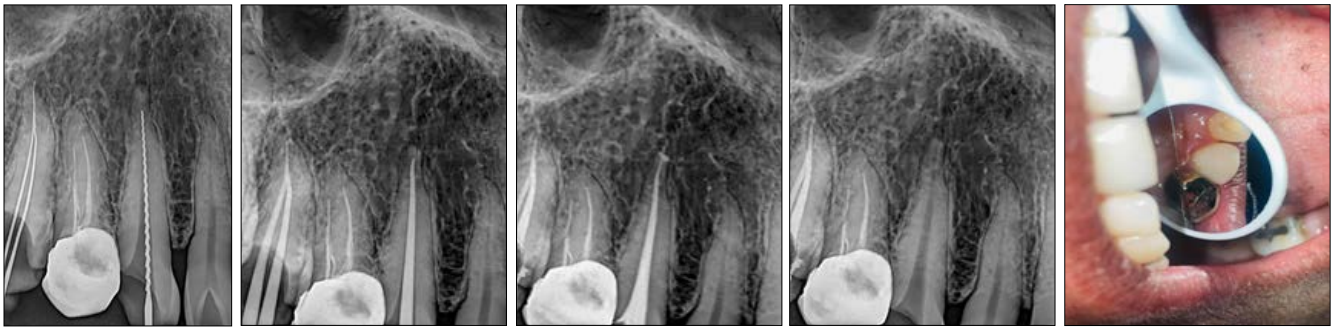
After local anaesthesia and rubber-dam isolation, access cavities were prepared. Canal scouting and working-length determination were performed radiographically (Fig 2). During instrumentation of the single canal of tooth 13, an endodontic instrument separated in the apical third. The fragment was visible radiographically and prevented unimpeded access to the apical canal. The patient was informed of the complication and of the options of retrieval, bypassing or retention with review. Because the canal was relatively straight, the fragment could be approached under direct vision and sufficient radicular dentin appeared to remain, conservative orthograde retrieval was attempted.

The access cavity was refined to establish straight-line visualization. Under magnification, a fine ultrasonic tip was activated at low power around the coronal aspect of the fragment in short, intermittent cycles. Irrigation and visual inspection were repeated between cycles to control heat and monitor dentin removal.

This created a limited staging platform and exposed the coronal end without aggressive circumferential enlargement. Ultrasonic vibration loosened the fragment but did not completely deliver it from the canal (Fig 2).

Fig 2: Endodontic access and instrument separation in tooth 13. A, Access cavity under rubber-dam isolation. B, Working-length radiograph of tooth 13. C, Radiographic localization during treatment. D, Magnified visualization of the coronal end of the separated instrument.

A custom snare was fabricated chairside using a 22-gauge Luer-lock disposable pre-bent dispenser tip and 0.08-mm stainless-steel orthodontic ligature wire. The fine wire was doubled to form a small loop, and its free ends were passed through the lumen of the needle so that traction on the free ends reduced the loop diameter. Under magnification, the loop was advanced over the exposed coronal end of the loosened fragment. The wire was tightened to secure the fragment, and the needle-loop assembly was withdrawn slowly along the long axis of the canal. The separated segment was removed intact and inspected clinically. A confirmatory radiograph showed an unobstructed canal, and a small hand file was advanced to working length to verify patency (Fig 3).



A B C D E

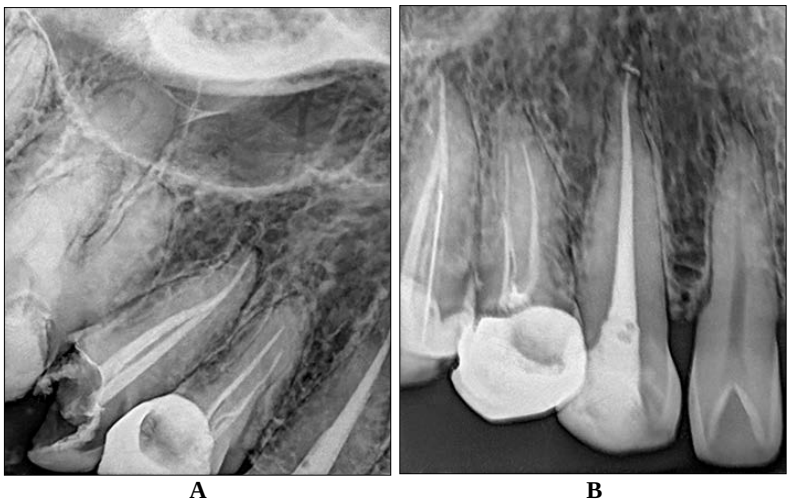
Fig 3: Retrieval sequence in tooth 13. A, Radiographic localization and creation of access to the separated fragment. B, Radiographic verification during retrieval. C, Separated fragment visible in the apical third. D, Canal after removal of the fragment. E, Clinical view during retrieval.

The retrieved fragment and its engagement by the fabricated snare were documented extraorally (Fig. 4). No perforation, ledge or transportation was evident clinically or radiographically.

A B

Fig 4: Extraoral documentation of the retrieved instrument and custom snare. A, retrieved instrument fragment displayed beside a millimetre ruler. B, Fabricated syringe-and-wire snare securely engaging the retrieved fragment.

Chemomechanical preparation of tooth 13 was completed after retrieval. Tooth 15 was prepared through its two canals. The canals were dried and obturated to their established working lengths, and the access cavities were restored (Fig 5). The available clinical record documents successful instrument retrieval and completion of endodontic treatment; a defined long-term follow-up interval was not supplied.



A B

Fig 5: Completion of treatment. A, Obturation of teeth 13 and 15 after retrieval. B, Post-obturation radiograph confirming dense fills to the established working lengths.

Discussion

The negative responses to both cold and electric pulp testing, together with percussion tenderness, support a pulpal diagnosis of necrosis and an apical diagnosis of symptomatic apical periodontitis. This differs from the provisional wording of symptomatic irreversible pulpitis

recorded in the presentation notes. Sensibility tests do not directly measure pulpal blood flow and can yield false-negative results; nevertheless, concordant negative responses to two tests should not be described as irreversible pulpitis without additional evidence of vital inflamed tissue. The diagnosis in this manuscript was therefore aligned with the documented findings.

The decision to retrieve a fragment should be based on whether the expected improvement in canal disinfection justifies the risks of removal. Fragments located coronally or before the canal curvature, those visible under magnification, and those in straight canals are more amenable to retrieval [1, 4]. Nevares *et al*. reported an overall removal-or-bypass success rate of 70.5%, increasing to 85.3% when the fragment was visible through the operating microscope [4]. Suter *et al*. reported successful removal in 87% of cases and identified the microscope as integral to the technique used [6]. These data describe experienced operators and should not be interpreted as universal success rates.

Ultrasonic retrieval is effective because fine tips can selectively trephine dentin and transmit vibration directly to the exposed fragment. In a specialist series of 170 consecutive cases, Cujé *et al*. used an operating microscope and ultrasonic tips and reported high retrieval success, although success decreased when fragments were located apically or beyond a canal curvature [5]. Fu *et al*. also found favorable outcomes when ultrasonics were combined with microscopic visualization [7]. The same combination allowed controlled exposure and mobilization in the present case.

The loop or snare technique is useful when a loosened fragment cannot be grasped directly. A fine wire loop projecting from a hollow needle is passed around the exposed end of the obstruction; traction on the wire tightens the loop, allowing the fragment to be withdrawn with the needle-loop assembly [8, 9]. Commercial loop systems are available, but customized syringe-and-loop devices offer a simple and economical alternative. Penukonda *et al*. described successful retrieval with a customized syringe and loop under microscopic visualization [8]. In the present case, a 25-gauge Luer-lock syringe needle provided the tubular guide and 0.10-mm orthodontic ligature wire formed the snare. The method remains technique-sensitive: sufficient fragment length must be exposed for loop placement, the loop must not displace the fragment apically, and traction should follow the canal long axis. The snare was therefore used only after ultrasonics had conservatively exposed and mobilized the coronal end.

Removal is not always mandatory. A case-control study found healing rates of 91.8% for teeth containing a fractured instrument and 94.5% for matched controls; preoperative periapical disease, rather than the fragment alone, was the principal adverse prognostic factor [3]. If retrieval would substantially weaken the root, bypassing or retaining the fragment with informed review may be safer. The straight canal, direct visibility and retrievable position favored removal in this patient.

The principal limitation of this report is the absence of documented long-term clinical and radiographic follow-up. Successful retrieval and satisfactory immediate obturation do not alone establish healing. Recall should evaluate symptoms, percussion response, restoration integrity and periapical status. The report also lacks a manufacturer-specific record of the separated instrument, ultrasonic tip, irrigants and obturation materials; these details should be added from the treatment chart before submission if available.

Conclusion

A separated instrument in the apical third of tooth 13 was retrieved nonsurgically by combining conservative ultrasonic exposure under magnification with a custom snare fabricated from 22-gauge Luer-lock disposable pre-bent dispenser tip and 0.08mm stainless-steel orthodontic ligature wire. The approach restored canal patency and allowed cleaning, shaping and obturation of teeth 13 and 15. Careful case selection and preservation of radicular dentin remain more important than fragment removal at any cost.

Declaration of Patient Consent

The authors certify that appropriate patient consent for treatment, clinical photography and publication was obtained. The patient was informed that identifying information would be concealed as far as possible, although complete anonymity cannot be guaranteed.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

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