Trauma Monthly 2026; 31(3): 1854-1863

10.30491/tm.2026.587840.1947

Trauma Monthly

Research Article

Emergency Management of a Symptomatic Mandibular Second Molar with a Fractured Instrument Using Intentional Replantation

Mehran Taheri Khafri[1], Mohammad Gharishvandi[2], Amirali Asadi[3], Seyede Aye Shekarbaghani[4*]

[1] Oral and Maxillofacial Surgery Department, School of Dentistry, Baqiyatallah University of Medical Sciences, Tehran, Iran

[2] Endodontist, Tehran, Iran

[3] Oral and Maxillofacial Surgeon, Tehran, Iran

[4] Department of Endodontics, School of Dentistry, Baqiyatallah University of Medical Sciences, Tehran, Iran

***Corresponding Author**: Seyede Aye Shekarbaghani, Department of Endodontics, School of Dentistry, Baqiyatallah University of Medical Sciences, Tehran, Iran, School of dentistry, Baqiyatallah University of Medical Sciences, sheikhbahaei street, Tehran, Iran, E-mail: aye.shekarbaghani@gmail.com, Tel: +989113828959

Received 2025-07-05 ; **Accepted** 2026-02-25; **Online Published** 2026-06-29

Abstract

Introduction: Fracture of endodontic instruments represents a significant clinical challenge, particularly in emergencies where infection and severe pain are present. When nonsurgical retreatment and apical surgery are not feasible, intentional replantation may serve as a valuable tooth-salvage option.

Case Presentation: A 60-year-old female presented with severe spontaneous pain (Visual Analog Scale [VAS] 9/10) in a mandibular second molar associated with an inadequate root canal filling and a fractured endodontic instrument in the mesial root. Emergency palliative care was initiated on the day of presentation, including a nonsurgical retreatment attempt, chemomechanical debridement to the extent possible, and intracanal medicament placement. This resulted in rapid symptom resolution (VAS reduced to 2/10 within 24 hours). Subsequently, at a scheduled follow-up visit, the fractured instrument was confirmed to be irretrievable. Given the persistence of the etiological factor and anatomical constraints precluding surgical endodontic access, intentional replantation was selected as the definitive elective treatment. The tooth was extracted atraumatically, and extraoral root-end management was performed, including removal of the fractured instrument, apical resection, and retrograde filling with Cold Ceramic. Histopathologic examination of the periapical tissue confirmed a diagnosis of periapical granuloma. The tooth was immediately replanted with suture splinting for 2 weeks, and occlusion was adjusted. Postoperatively, the patient experienced complete symptom resolution, and no complications were observed. At 6-month follow-up, clinical and radiographic examination revealed favorable short-term healing with evidence of bone regeneration.

Conclusion : Intentional replantation can be an effective tooth-salvage procedure in cases of symptomatic apical periodontitis complicated by a fractured endodontic instrument when conventional retreatment and apical surgery are not feasible. However, it should be clearly distinguished from emergency palliative care, which addresses the acute symptoms, whereas intentional replantation is an elective definitive procedure. Longer-term follow-up is necessary to confirm the long-term prognosis of the replanted tooth.

Keywords: Intentional replantation; fractured instrument; Symptomatic apical periodontitis; Emergency endodontic management; Periapical granuloma; Mandibular molar.

Introduction

Among these complications, fractured endodontic instruments are particularly problematic, occurring in approximately 1-5% of cases [2]. While small fragments may be left in situ without consequence if the canal is adequately cleaned and sealed, larger fragments or those located in the apical third can obstruct access, preventing complete debridement and disinfection 3. The presence of a fractured instrument is especially concerning when it contributes to persistent apical periodontitis—a condition affecting approximately 40-60% of teeth with prior root canal treatment [4]. In such cases, the retained fragment acts as a nidus for bacterial

colonization, perpetuating inflammation and preventing healing[5].

In the acute setting, the primary objectives are pain relief, infection control, and patient stabilization 6. The concept of "emergency" in endodontics is fundamentally distinct from definitive treatment: the former addresses immediate threats (pain, swelling, acute infection), while the latter resolves the underlying pathology. This distinction is critical for clinical decision-making and patient communication. Definitive procedures such as apical surgery or intentional replantation should not be performed in an emergency setting, as they require controlled conditions, informed consent, and comprehensive treatment planning[7].

Intentional replantation—the deliberate extraction, extraoral management, and immediate reinsertion of a tooth—has undergone a remarkable evolution in endodontic practice. First described by Grossman in 1966 [8], it was historically viewed as a desperate measure of last resort. However, advances in surgical techniques, magnification, and biomaterials have transformed IR into a more predictable procedure with reported success rates of 80-95% [9].

The fundamental advantage of IR lies in its ability to provide direct, unimpeded access to the root apex and surface. This permits precise management of complications that would be technically challenging or impossible to address intraorally. Unlike apical surgery, which requires access through bone and may be limited by anatomical constraints, IR allows complete visualization and manipulation of the root end under controlled conditions [10].

Clinical indications for intentional replantation include failed previous nonsurgical endodontic treatment, unfavorable conditions for root-end surgery due to anatomical limitations, and situations in which financial or anatomical factors preclude implant placement. A major advantage of IR is the ability to provide direct access and optimal visualization of the apical and furcation areas, allowing management of complications that may not be addressable intraorally. Reported success rates for IR range from 80% to 95%, indicating that it can be a predictable treatment option when performed under appropriate conditions [5].

Although modern surgical endodontic procedures performed under magnification have demonstrated success rates of up to 94%, root-end surgery may not be feasible in certain clinical scenarios. Anatomical constraints such as thick buccal cortical bone, limited surgical access, or proximity to vital structures including the mandibular nerve or maxillary sinus may preclude surgical intervention. In emergencies accompanied by severe symptoms, rapid decision-making is critical to control infection, relieve pain, and preserve the natural dentition [4-5].

The management of mandibular second molars presents particular challenges due to their posterior location, thick cortical bone, and proximity to the inferior alveolar nerve [12]. When a fractured instrument complicates symptomatic apical periodontitis in such a tooth, treatment options may be limited. This case report presents a two-phase approach: emergency palliative care to address acute symptoms, followed by elective intentional replantation as definitive treatment. We aim to demonstrate that IR remains a valuable tooth-salvage option in carefully selected cases when conventional approaches are not feasible, while emphasizing the critical distinction between emergency and elective care.

This case report presents the successful management of symptomatic apical periodontitis in a mandibular second molar with an inadequate root canal filling and a fractured endodontic instrument, treated with intentional replantation as an elective definitive tooth-salvage procedure following initial emergency palliative care. We present 6-month follow-up data demonstrating favorable short-term healing, while acknowledging that longer-term observation is required to confirm the long-term prognosis.

Case presentation

A 60-year-old female patient was referred to the Department of Endodontics, School of Dentistry, Baqiatollah University, as an emergency case with a chief complaint of severe spontaneous pain in the left mandibular second molar. The patient reported a pain intensity of 9 out of 10 on the Visual Analog Scale (VAS). Her medical history was noncontributory.

Clinical examination revealed intense spontaneous pain radiating to the buccal vestibular region. The affected tooth exhibited severe tenderness to percussion, while no sinus tract or fistula was detected. No additional abnormal intraoral or extraoral findings were observed (Figure 1).

Periapical radiographic examination demonstrated an inadequate root canal filling and a radiopaque object in

the apical region consistent with a fractured endodontic instrument, accompanied by a periapical radiolucency suggestive of secondary symptomatic apical periodontitis.

At this emergency visit, the patient was informed of the available treatment options, including nonsurgical endodontic retreatment, apical surgery, intentional replantation, and tooth extraction. However, the immediate priority was to provide emergency palliative care to relieve the acute symptoms. After discussion of the risks and benefits of each option, the patient elected to undergo nonsurgical endodontic retreatment as the initial emergency management approach.

Following the acquisition of written informed consent, emergency endodontic intervention was initiated on the same day of presentation. Local anesthesia was administered using an inferior alveolar nerve block with 2% lidocaine containing 1:80,000 epinephrine (Darupakhsh Pharmaceutical Co., Tehran, Iran) Rubber dam (Dental Dam, Sanctuary Dental,UK) isolation was achieved, and the access cavity was prepared using an air-turbine handpiece with a diamond bur (#301; Shofu, Kyoto, Japan).

Root canal obturation material was removed using Gates-Glidden drills (#2) Gates Glidden drills 1, 2, and 3 (Dentsply, Maillefer, Switzerland) , H-files(Henry Schein, USA) #25 and #30, and chloroform as a solvent. Attempts to bypass the fractured instrument in the mesial canals using RC-Prep (Well-Prep, Vericom Co, Anyang, Korea), 17% EDTA (Dent Wash, Prime Dental Products, Pvt. Ltd), and C-files (Dentsply

Sirona, Switzerland) (#8 and #10) were unsuccessful. The mesial canals exhibited a Vertucci type II (2-1) configuration.

Working length was determined using an electronic apex locator (Root ZX, J. Morita USA, Irvine, USA). Chemomechanical preparation was performed with rotary instruments up to size 30 with a 4% taper. Irrigation was carried out using 2.5% sodium hypochlorite (Septodont health care India Pvt. Ltd) delivered through a NaviTip double Side-port needle (31gauge/27mm) and enhanced with passive ultrasonic irrigation (Ultra X).

Calcium hydroxide was placed as an intracanal medicament, and the access cavity was sealed with a temporary restorative material (Zoliran, Golchadent, Iran).

The patient reported a significant reduction in pain (VAS score reduced to 2/10) within 24 hours following emergency intervention.

Despite emergency nonsurgical endodontic retreatment, the fractured instrument in the mesial root could not be bypassed or removed, limiting adequate debridement of the apical portion of the canal system. Given the persistence of the etiological factor, the presence of symptomatic apical periodontitis, and the anatomical limitations associated with surgical endodontic access to the mandibular second molar, alternative treatment strategies were reconsidered.

Following reassessment and further discussion with the patient, intentional replantation was selected as a definitive tooth-salvage procedure. This decision was made to allow direct extra-oral management of the fractured instrument and apical pathology while avoiding potential risks associated with apical surgery, including proximity to vital anatomical structures. The procedure was planned and performed under controlled conditions with the aim of achieving rapid resolution of symptoms and preservation of the natural tooth.

Intentional Replantation Procedure

Following reevaluation, intentional replantation was selected as the definitive tooth-salvage procedure. Written informed consent was obtained after explaining the surgical steps, potential risks, and possible outcomes.

Local anesthesia was administered using an inferior alveolar nerve block with 2% lidocaine containing 1:80,000 epinephrine (Darupakhsh Pharmaceutical Co., Tehran, Iran). The mandibular second molar was extracted atraumatically using physics forceps, with particular care taken to preserve the periodontal ligament and surrounding alveolar bone. The tooth was gently removed without excessive rotational or luxation forces (Figure 2, baseline).

Immediately after extraction, the tooth was kept moist using sterile saline-soaked gauze to prevent dehydration of the periodontal ligament cells and submersing the tooth in a bath of Hank's balanced salt solution (HBSS) to maximize the PDL survivability. Extra-oral manipulation time was strictly limited to less than 15 minutes.

Dental radiography and CBCT revealed apical pathology associated with the mesial root. Root-end management was performed extra-orally under dental operating microscope DOM (CJ-Optik GmbH & Co.

KG, Asslar-Werdorf, Germany), (figure2) to properly magnify and illuminate the areas being evaluated allowing direct visualization and removal of the fractured instrument and infected apical tissue. The apical portion of the root was resected, and the root-end cavity was prepared. Retrograde filling was performed using a biocompatible root-end filling material Cold Ceramic (CC) to achieve an adequate apical seal (Figure 3, retro-preparation and cold-ceramic).

The tissue collected from the apical area was sent for histopathologic analysis, which further revealed the diagnosis of periapical granuloma. Sections show fragments of inflamed granulation tissue, demonstrating severe mixed inflammatory cell infiltration, plasma cells, eosinophils, Russell bodies, red blood cell (RBC) extravasation, and hemosiderin pigmentation. Sections of curetted bone are also evident. There is no evidence of malignancy.

Following completion of extra-oral procedures, the tooth socket was gently irrigated with sterile saline and teeth immediately replanted into its original socket (Figure 2, final). Proper positioning was verified clinically. The tooth demonstrated adequate stability upon reinsertion, and suture splinting was done for 2 weeks. Occlusion was evaluated and adjusted to eliminate any premature contacts.

Postoperative instructions were provided, including maintenance of oral hygiene and avoidance of excessive occlusal forces. The patient was prescribed appropriate medications to control pain and prevent infection. The procedure was well tolerated, and no intraoperative complications were observed (Figure 3, follow-up).

Table 1. Clinical Timeline of Diagnosis and Emergency Management

Time Point	Clinical Event
Presentation	Patient presented as an emergency with severe spontaneous pain in the left mandibular second molar (VAS 9/10).
Examination	Clinical examination revealed severe percussion tenderness without sinus tract formation.
Imaging	Periapical radiograph showed inadequate root canal filling, fractured instrument in the apical region, and periapical radiolucency.
Decision Making	Treatment options including retreatment, apical surgery, intentional replantation, and extraction were discussed with the patient.
Emergency Intervention	Same-day nonsurgical endodontic retreatment initiated under local anesthesia.
Retreatment Outcome	Fractured instrument in mesial canals could not be bypassed; chemomechanical preparation completed to the extent possible.
Temporary Management	Calcium hydroxide placed as intracanal medicament and access cavity temporized.
Follow-up Evaluation	Persistent etiologic factor identified; intentional replantation selected as definitive tooth-salvage procedure.
Subsequent Visit	Intentional replantation performed under controlled surgical conditions.

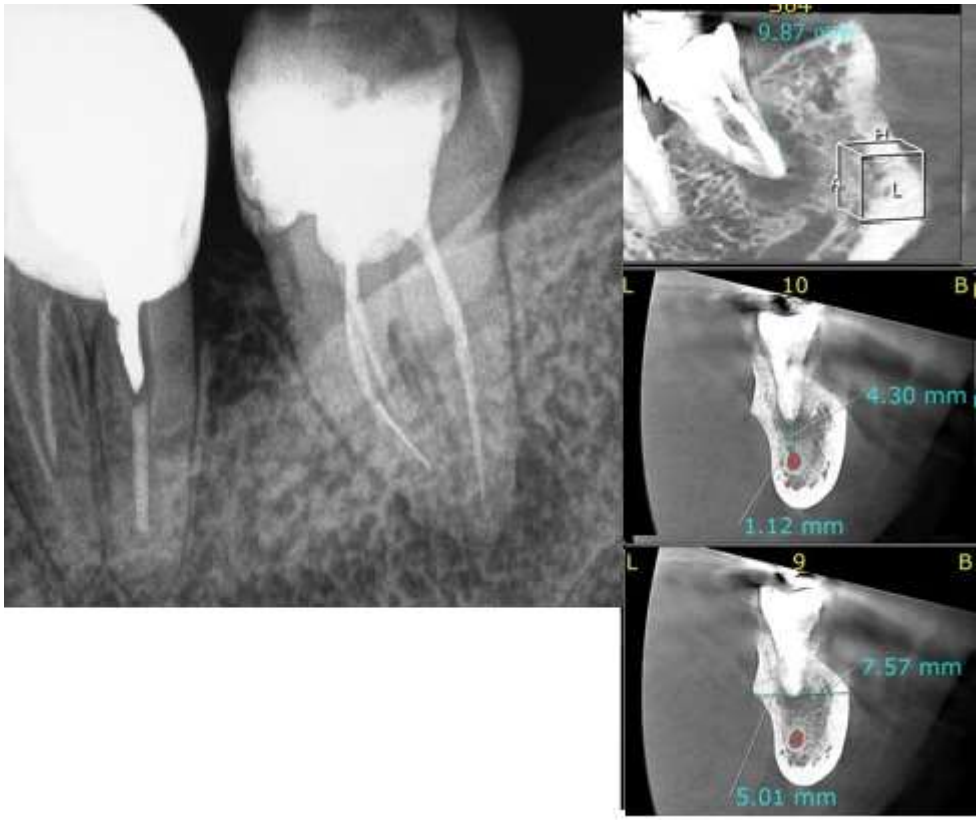

Figure 1. Radiographic images showing a fractured endodontic instrument in the mesial root of a mandibular second molar. The left image displays a periapical radiograph with labeled areas indicating the gutta-percha filling and the separated instrument. Gutta percha is seen in the coronal part and a broken file is seen in the apical part. The right images show 3D cone-beam computed tomography slices with measurements of the fractured instrument and apical pathology. Measurements include the instrument's location (9.87 mm) and the distance from apex to nerve was 4.30 mm and thickness of bone was 5.01 mm the fracture site to the root apex (and in different slices).

Figure 2. Radiographic progression of treatment for a fractured mandibular second molar with symptomatic apical periodontitis. The top row includes the baseline radiograph showing the fractured instrument and inadequate root canal filling (left), the treatment setup with instrumentation (center), and the immediate post-treatment radiograph in first Appointment (right). Middle row: Continued treatment in the second session and canal filling at the end of the second session.
The bottom row shows Preoperative radiograph (left) the final radiograph after intentional replantation (middle), and the follow-up 6months radiograph (right) showing favorable healing of the periapical area and proper root canal obturation.

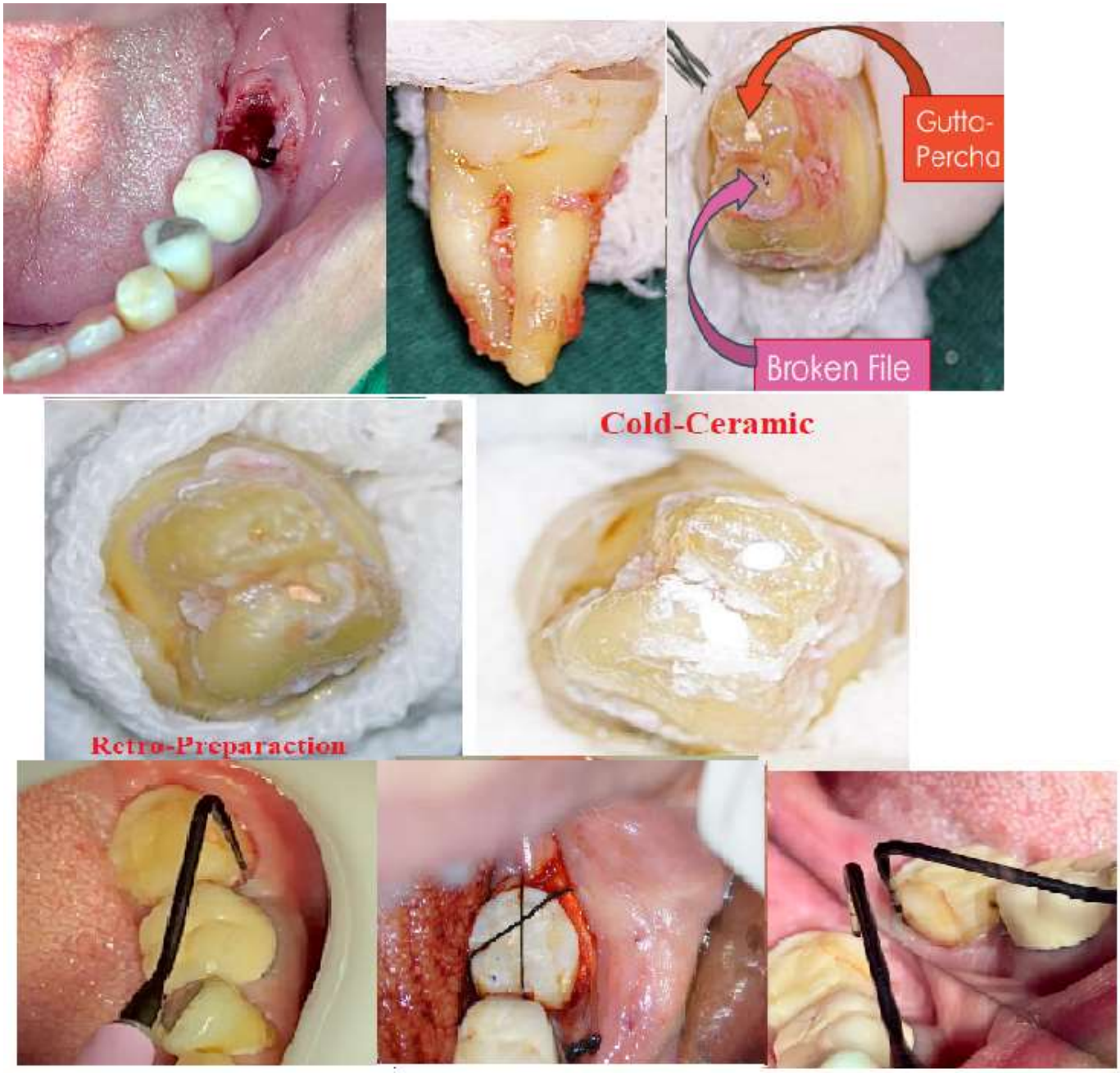

Fig 3. Clinical images of the intentional replantation procedure for a mandibular second molar with a fractured instrument. The top row shows: the baseline with the access cavity and fractured instrument (left), the broken file with gutta-percha in place (center), and the retro-preparation of the root-end for retrograde filling (right). The bottom row includes: the final root-end filling using cold ceramic material (left), and the follow-up image at 6 months showing the replanted tooth in function with proper healing (right). Intraoral image after tooth extraction, Examination and examination of the tooth under a microscope, Root-end cutting and observation of the root filling and broken file, RETRO PERARATION, Root-end filling using cold ceramic material, Intraoral examination and probe depth before treatment, SUTURE SPLINT, Intraoral examination and probe depth at the 6-month follow-up session.

Discussion

This case illustrates a fundamental principle in endodontic practice: the distinction between emergency palliative care and elective definitive treatment. The patient presented with acute symptoms (VAS 9/10) requiring immediate intervention. Emergency management—including access preparation, debridement, irrigation, and intracanal medication—successfully reduced pain to VAS 2/10 within 24 hours. This rapid symptom resolution confirmed that the acute phase was effectively managed.

However, the definitive treatment—intentional replantation—was an elective procedure performed at a scheduled visit. This two-phase approach is ethically and clinically appropriate: emergency care addresses immediate threats, while definitive care resolves the underlying pathology under optimal conditions [13]. Performing complex surgical procedures such as IR in an emergency setting would be inappropriate and potentially harmful, as it would compromise the controlled conditions essential for success.

The presence of a fractured instrument in a tooth with symptomatic apical periodontitis presents a therapeutic dilemma. While not all fractured instruments require removal, those that prevent adequate apical debridement and disinfection must be addressed [14]. In this case, the instrument was located in the apical third and could not be bypassed, limiting canal preparation and irrigation. This compromised the goal of eliminating the bacterial biofilm responsible for the periapical inflammation 15.

The success of IR depends on several critical factors:

1. Atraumatic Extraction: The use of physics forceps and gentle technique minimized trauma to the PDL and alveolar bone. Excessive rotational or luxation forces can damage PDL cells, increasing the risk of root resorption and ankylosis [16].

2. PDL Cell Preservation: The tooth was stored in Hank's Balanced Salt Solution (HBSS), which has been shown to maintain PDL cell viability better than saline or dry storage 17. HBSS provides essential nutrients and maintains osmotic balance, preventing dehydration and cellular damage.

.3Limited Extraoral Time: The extraoral manipulation time was strictly limited to less than 15 minutes. Studies have shown that PDL cell survival decreases exponentially with extraoral time, with significant cell death occurring after 20-30 minutes [18]. The use of a dental operating microscope (DOM) facilitated efficient root-end management, minimizing time outside the socket.

.4Retrograde Filling: Cold Ceramic was selected as the retrograde filling material due to its biocompatibility, sealing ability, and favorable handling properties. Its alkaline pH promotes healing and inhibits bacterial growth [19].

The histopathological examination confirming periapical granuloma provided valuable diagnostic confirmation. Periapical granulomas are the most common periapical lesions (50-60%), characterized by mixed inflammatory infiltrates, granulation tissue, and epithelial proliferation [20]. The presence of plasma cells, eosinophils, Russell bodies, and hemosiderin pigmentation is consistent with chronic inflammation, often associated with bacterial persistence. Importantly, no evidence of malignancy was found, ruling out more serious pathology such as squamous cell carcinoma or odontogenic tumors [21].

One of the key advantages of IR in this case was circumventing the anatomical limitations that precluded apical surgery. CBCT imaging revealed:

Distance from apex to inferior alveolar nerve: 4.30 mm (less than the recommended 5-6 mm safety margin for apical surgery) [22].

Buccal bone thickness: 5.01 mm (requiring significant bone removal for surgical access)

Performing apical surgery through 5 mm of cortical bone in the mandibular molar region would risk nerve injury, excessive bone loss, and postoperative complications [23]. IR provided direct access without these risks.

The outcomes in this case are consistent with contemporary literature on IR. A systematic review by Torabinejad et al. [9] reported survival rates of 80-95% for intentionally replanted teeth, with factors such as extraoral time (<15 minutes) and PDL preservation being critical. The 6-month healing observed in this case—clinical resolution of symptoms and radiographic bone regeneration—aligns with patterns reported by Cho et al. 24, who demonstrated progressive healing at 6 months to 1 year.

However, it must be acknowledged that IR carries specific risks:

Root resorption: External or replacement resorption may occur months to years' post-treatment [25].

Ankylosis: Progressive replacement resorption can lead to tooth immobility and eventual loss [26].

Periodontal complications: Pocket formation or gingival recession may develop 27.

Factors including PDL damage, prolonged extraoral time, and patient age influence these risks during extraction [28].

Follow-Up and Assessment of Success

The 6-month follow-up in this case demonstrated favorable short-term healing. However, this observation period is insufficient to establish definitive long-term success. Healing of apical periodontitis is a gradual

process; complete radiographic resolution may require 1-2 years or more [29]. Furthermore, late complications such as root resorption and ankylosis typically manifest over longer observation periods.

The patient has been enrolled in a long-term follow-up protocol, with planned evaluations at 1, 2, and 5 years post-treatment. At each visit, clinical parameters (pain, mobility, probing depths, sinus tracts) and radiographic findings will be assessed. Should signs of root resorption or ankylosis develop, appropriate interventions—such as monitoring, periodontal treatment, or eventual extraction—will be considered.

This case highlights that intentional replantation should not be viewed solely as a last-resort procedure, but rather as a viable and predictable emergency treatment modality when conventional endodontic and surgical approaches are limited or unsuccessful.

Conclusion

Intentional replantation can be an effective tooth-salvage procedure in carefully selected cases when conventional nonsurgical retreatment and apical surgery are not feasible. This case demonstrates that a two-phase approach—emergency palliative care followed by elective definitive treatment—is both clinically appropriate and ethically sound. The 6-month follow-up reveals favorable short-term healing, although longer-term observation is essential to confirm definitive success. Clinicians should consider IR as a viable alternative to extraction in complex endodontic scenarios, provided that appropriate patient selection, atraumatic technique, and long-term follow-up protocols are implemented.

Conflict of Interest Disclosures

There is no conflict of interest.

Funding Sources

None.

Authors' Contributions

All authors contributed equally in the case report.

Ethical Statement

We received consent from patients for using the data.

Declaration of Generative AI and AI-assisted technologies

None.

References

1. Ng YL, Mann V, Gulabivala K. A prospective study of the factors affecting outcomes of nonsurgical root canal treatment: part 1. International Endodontic Journal. 2011;44(7):583-609.
2. Siqueira JF. Aetiology of root canal treatment failure. Dental Update. 2002;29(2):80-6.
3. Hьlsmann M, Schinkel I. Influence of several factors on the success or failure of removal of fractured instruments from the root canal. Endodontics & Dental Traumatology. 1999;15(6):252-8.
4. European Society of Endodontology. Quality guidelines for endodontic treatment. International Endodontic Journal. 2006;39(12):921-30.
5. Haapasalo M, Endal U, Zandi H, Coil JM. Eradication of endodontic infection by instrumentation and irrigation solutions. Endodontic Topics. 2005;10(1):77-102.
6. American Association of Endodontists. Guide to clinical endodontics. Chicago: AAE; 2019.
7. Walton RE, Torabinejad M. Principles and practice of endodontics. 3rd ed. Philadelphia: WB Saunders; 2002.
8. Grossman LI. Intentional replantation of teeth. Journal of the American Dental Association. 1966;72(6):1385-90.
9. Torabinejad M, Dinsbach NA, Turman M, Handysides R, Bahjri K, White SN. Survival of intentionally replanted teeth and implant-supported single crowns: a systematic review. Journal of Endodontics. 2015;41(7):992-8.
10. Rouhani A, Jafarzadeh H, Habibi M. Intentional replantation: a procedure as a last resort. Journal of Contemporary Dental Practice. 2012;12(6):486-92.
11. Bender IB, Rossman LE. Intentional replantation of endodontically treated teeth. Oral Surgery, Oral Medicine, Oral Pathology. 1993;76(5):623-30.
12. von Arx T. Failed root canals: the case for apicoectomy (periradicular surgery). Journal of Oral and Maxillofacial Surgery. 2005 Jun 1;63(6):832-7.
13. Carrotte P. Endodontics: Part 7—Preparing the root canal. British Dental Journal. 2004;197(9):545-50.
14. Witherspoon DE, Gutmann JL. Analysis of the fractured instrument and the methods of removal. Journal of Endodontics. 2004;30(7):501-7.
15. Nair PN. On the causes of persistent apical periodontitis. International Endodontic Journal. 2006;39(4):249-81.
16. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal ligament healing. Endodontics & Dental Traumatology. 1995;11(2):76-89.
17. Hupp JG, Mesaros SV, Aukhil I, Trope M. Periodontal ligament vitality and histologic healing of teeth stored in various solutions. Endodontics & Dental Traumatology. 1998;14(5):201-6.
18. Krasner P, Rankow HJ. New philosophy for the treatment of avulsed teeth. Oral Surgery, Oral Medicine, Oral Pathology. 1995;80(2):211-20.
19. Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review—Part III. Journal of Endodontics. 2010;36(3):400-13.
20. Shear M, Speight P. Cysts of the oral and maxillofacial regions. 4th ed. Oxford: Blackwell; 2007.
21. Neville BW, Damm DD, Allen CM, Chi AC. Oral and maxillofacial pathology. 4th ed. St. Louis: Elsevier; 2016.
22. Mardinger O, Abba M, Hirshberg A, Schwartz-Arad D. Prevalence, diameter, and course of the mandibular

incisive canal. Journal of Oral and Maxillofacial Surgery. 2007;65(12):2602-7.
23. von Arx T, Jensen SS, Hanni S. Clinical and radiographic assessment of various predictors for healing outcome 1 year after periapical surgery. Journal of Endodontics. 2007;33(2):123-8.
24. Cho SY, Lee Y, Shin SJ, Kim E, Jung IY, Lee SJ, et al. Retention and healing outcomes after intentional replantation. Journal of Endodontics. 2016;42(9):1326-30.
25. Andersson L, Bodin I, Sυrensen S. Progression of root resorption following replantation of human teeth after extended extraoral storage. Endodontics & Dental Traumatology. 1989;5(1):38-47.
26. Kahnberg KE. Intentional replantation of teeth. A retrospective study. Swedish Dental Journal. 1987;11(1-2):45-52.
27. Krug R, Krastl G, Filippi A. Intentional replantation of an avulsed immature permanent incisor. Dental Traumatology. 2016;32(4):331-6.
28. Barrett EJ, Kenny DJ. Survival of avulsed permanent maxillary incisors in children following delayed replantation. Endodontics & Dental Traumatology. 1997;13(6):269-75.
29. Ωrstavik D. Time-course and risk analyses of the development and healing of apical periodontitis in man. International Endodontic Journal. 1996;29(3):150-9.