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# Management of Vertical Root Fracture Using Intentional Reimplantation and Radicectomy: A Case Report

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**Abstract**

This case report describes the management of a clinically suspected vertical root fracture (VRF) using intentional reimplantation combined with radicectomy and documents the 36-month outcome with cone-beam computed tomography (CBCT). A 63-year-old man presented with spontaneous pain and intense pain on mastication associated with tooth 46. Clinical examination showed grade II mobility, positive percussion and buccal palpation, and an isolated 10-mm periodontal defect with bleeding and suppuration on the buccal aspect of the mesial root. Periapical radiography showed mesial-root underfilling and a radiolucency extending from the middle third towards the apex. Because preoperative CBCT was not obtained, VRF remained a clinical suspicion until direct visualization after extraction confirmed a fracture confined to the mesial root. Following atraumatic extraction, the fractured mesial root was resected at its cervical third; the apical 3 mm of the distal root were resected, ultrasonically retro-prepared, and sealed with Bio-C Repair. The tooth was replanted after an exact extraoral time of 11 minutes and stabilized with an X-shaped suture. At 2, 18, and 36 months, symptoms had resolved and periodontal, mobility, percussion, palpation, occlusal, and functional findings were favourable. CBCT at 36 months demonstrated complete periapical bone fill consistent with healing and no evidence of ankylosis or root resorption. Intentional reimplantation combined with radicectomy may be considered a tooth-preserving option in carefully selected multi-rooted teeth; this single case does not establish predictable effectiveness.

**Keywords:** Cone-beam Computed Tomography; Root Fractures; Tooth Replantation

## Introduction

Vertical root fractures occur in 3–25% of endodontically treated teeth and are a leading cause of extraction in such cases [1]. Conventional treatments, such as root canal retreatment or apical surgery, often fail to preserve long-term function, necessitating the exploration of conservative alternatives such as intentional reimplantation and radicectomy [2]. Vertical root fracture (VRF) is defined as a longitudinal lesion that affects the root of the tooth, thereby compromising its structure and function [3]. These fractures initially manifest as minor cracks that have the capacity to extend in either an apico-coronal or bucco-lingual direction [4].

Their location in subgingival areas poses a significant challenge to clinical and radiographic diagnosis, as they can mimic other pathologies, such as apical periodontitis [5].

Despite proposals of various risk factors, including loss of coronal dental tissue, age-related microstructural changes in dentin, root anatomy and invasive endodontic procedures, the extant evidence has not conclusively confirmed a significant association between these factors and the presence of VRF [2].

Intentional reimplantation and radicectomy have previously been described [6, 7]. This report documents the 36-month clinical, radiographic and CBCT follow-up of a mandibular molar with a VRF confined to the mesial root; it does not propose a novel technique.

## Case Report

### *Patient information and preoperative assessment*

A 63-year-old man with no relevant medical history was referred for persistent symptoms associated with tooth #46, which had undergone root canal treatment approximately 6 years earlier. He reported spontaneous pain and intense pain during mastication. The tooth remained in function. The patient did not report signs or a history suggestive of bruxism or other parafunctional habits.

Preoperative examination revealed grade II mobility, tenderness to vertical and horizontal percussion, and positive buccal palpation. Periodontal probing measured 5 mm at the mesiobuccal site and 10 mm on the buccal aspect of the mesial root, with bleeding and suppuration. The remaining recorded sites measured approximately 3 mm. The furcation was not involved. Occlusal examination showed no premature contact. The quality and marginal integrity of the existing coronal restoration were not documented in sufficient detail at baseline and are therefore recognised as a reporting limitation.

The initial periapical radiograph (Fig. 2A) demonstrated underfilling of the mesial root canal and a radiolucent area extending from the middle third of the mesial root towards the periapical region. The distal root showed no radiographic evidence of apical disease. Although the previous root canal treatment was clearly inadequate in the mesial root, a complete baseline assessment of obturation density and the coronal seal was not recorded.

### *Diagnostic reasoning*

The combination of spontaneous and mastication pain, grade II mobility, positive percussion and palpation, an isolated deep periodontal defect with bleeding and suppuration, and a longitudinally distributed radiolucency was strongly suggestive of a VRF involving the mesial root. Nevertheless, these findings are not pathognomonic, and two-dimensional periapical radiography cannot reliably demonstrate all fracture lines or their three-dimensional extent. A preoperative CBCT scan was not obtained because the initial clinical and periapical findings were considered sufficiently suggestive to justify direct assessment during atraumatic extraction, which was required for the proposed tooth-preserving procedure. Avoidance of additional imaging exposure was also considered. Consequently, the preoperative diagnosis was recorded as a clinically suspected VRF rather than a definitive diagnosis. Direct extraoral visualization after extraction subsequently confirmed a vertical fracture confined to the mesial root.

### *Treatment decision and patient preference*

The alternatives discussed with the patient included nonsurgical retreatment, apical surgery, root amputation, complete extraction followed by prosthetic or implant replacement, and intentional reimplantation combined with radicectomy. Nonsurgical retreatment could have addressed the mesial-root underfilling but would not have eliminated a fractured root. Apical surgery alone would likewise have been unlikely to remove a longitudinal fracture extending beyond the apical region. Root amputation without extraction was considered less suitable because direct extraoral inspection was needed to determine the fracture extent and the restorability of the remaining tooth. Complete extraction with replacement was a more definitive option but would have sacrificed the asymptomatic distal root and its supporting tissues.

The distal root had adequate length and periodontal support and showed no periapical radiolucency; the furcation was not involved, and the tooth had no premature occlusal contact. These findings favoured an attempt at tooth preservation. The patient stated that retention of his natural tooth was an important priority, provided that it remained clinically feasible. After discussion of the uncertain prognosis and potential complications, including ankylosis, external or replacement resorption, periodontal healing failure, fracture, and eventual tooth loss, a contingency-based decision was made: reimplantation with mesial radicectomy would proceed only if direct inspection confirmed that the fracture was limited to the mesial root and that the distal root was retainable; otherwise, definitive extraction would be performed.

### *Surgical procedure*

Infiltrative anaesthesia was administered using 2% lidocaine with 1:100,000 epinephrine (Huons, Cheonan, Korea). Tooth #46 was atraumatically luxated with an Apexo elevator No. 303 and delivered with mandibular universal extraction forceps No. 151 (Hu-Friedy, Chicago, IL, USA). Instrument contact was restricted to the crown whenever possible to minimize mechanical trauma to the root surface and periodontal ligament. After extraction, the tooth was held by the crown and continuously wrapped in sterile gauze moistened with saline during extraoral manipulation. Direct inspection under 1.6× magnification with a surgical microscope (RM-2000 Plus, Rogin Dental, Shenzhen, China) confirmed the vertical fracture of the mesial root (Figs. 1A-B).

Only the mesial-root portion of the socket was gently curetted to remove pathological tissue. The distal socket was not curetted, irrigated, or otherwise instrumented, thereby avoiding additional disruption of the periodontal ligament and socket wall at the reimplantation site.

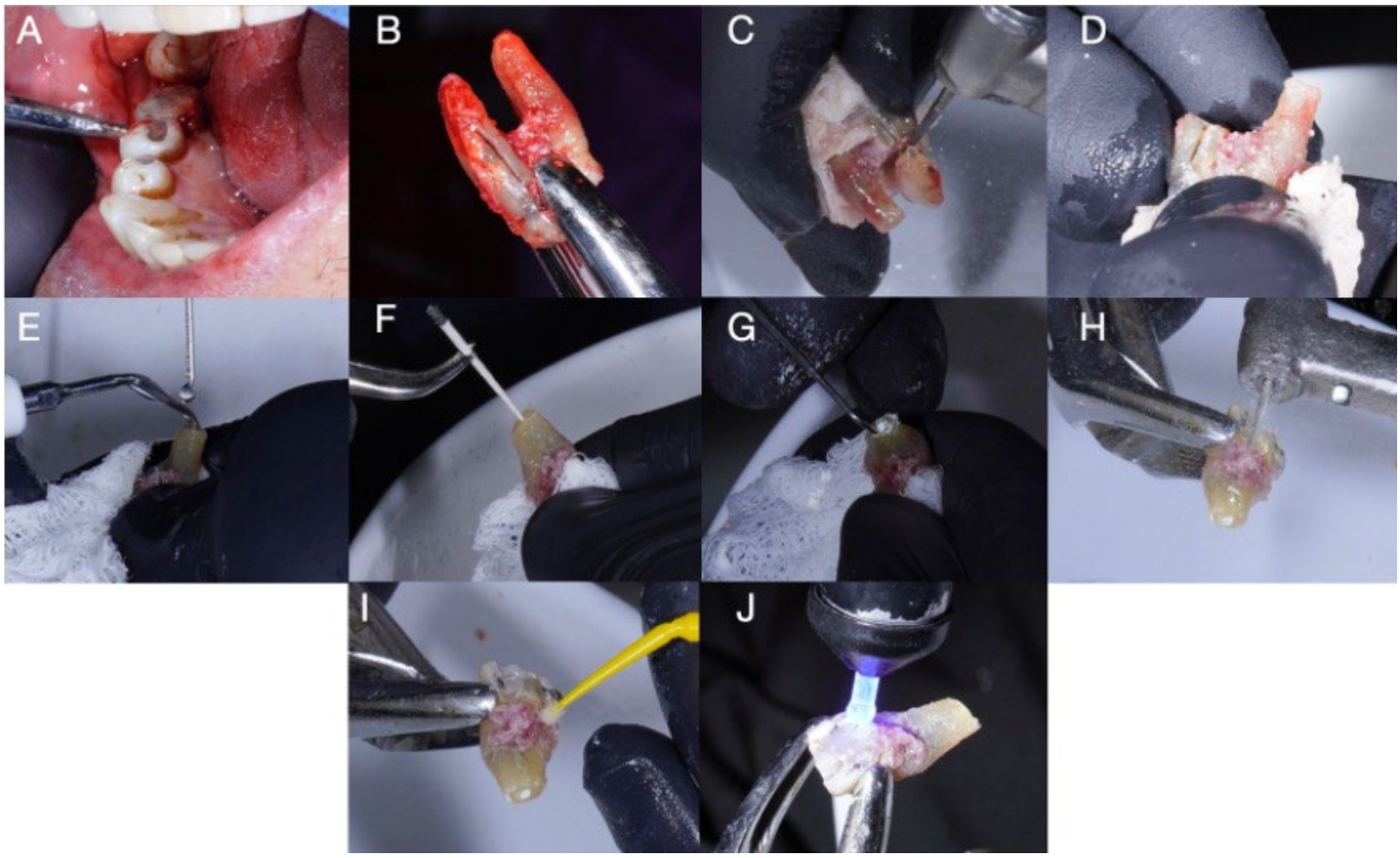


***Figure 1.*** Surgical procedure; *A*) Atraumatic extraction; *B*) Direct visual confirmation of the vertical fracture involving the mesial root; *C-D*) Mesial radicectomy; *E*) Distal root-end cavity preparation performed exclusively with a P1 ultrasonic tip; *F*) Drying of the retro-preparation; *G*) Root-end filling with Bio-C Repair; *H*) Regularization of the coronal fracture area; *I*) Application of universal adhesive; and J) Light curing of the flowable composite resin

The mesial root was resected at the level of its cervical third with a Zekrya 151 bur (JOTA AG, Ruthi, Switzerland) operated at 200,000 rpm under saline cooling (Figs 1C-D). The apical 3 mm of the distal root were resected with the same Zekrya bur under the same operating conditions. A 3-mm-deep root-end cavity was then prepared exclusively with a P1 ultrasonic tip connected to a Helse ONE ultrasonic unit (Helse Ultrasonic, Santa Rosa de Viterbo, Brazil) at 10% power under saline irrigation (Fig. 1E). Residual gutta-percha was removed, and the cavity was dried with sterile paper points (Fig. 1F).

The retrograde cavity was filled with a premixed calcium silicate material (Bio-C Repair; Angelus, Londrina, Brazil) (Fig. 1G). Excess material was removed carefully. The coronal fracture area was regularised with an ultra-fine diamond bur (Fig. 1H), treated with a universal adhesive, and sealed with a flowable composite resin (Opus Bulk Fill Flow; FGM, Joinville, Brazil) (Figs. 1I-J). Root-surface manipulation was minimized throughout, and the saline-moistened gauze was maintained until replantation.

The tooth was repositioned in its socket after an exact extraoral time of 11 min. Passive stabilization was achieved with an X-shaped 3-0 silk suture; this approach was selected to provide short-term stabilization without rigid splinting. A small amount of flowable composite was placed on the occlusal surface to retain the suture. An immediate periapical radiograph confirmed tooth repositioning (Fig. 2B). The suture was removed after 15 days.

Postoperative medication comprised amoxicillin 875 mg with clavulanic acid 125 mg every 12 h for 7 days and etoricoxib 120 mg once daily for 4 days. Standard postoperative instructions were provided.

### *Follow-up and outcomes*

At the 2-month review (Fig. 2C), the tooth was asymptomatic, and percussion and palpation responses were negative. The probing depth around the retained distal root was no greater than 3 mm, without bleeding or suppuration; the furcation was normal and unexposed. Grade I mobility was present and was considered compatible with the healing stage. There were no


***Figure 2.*** Control radiographs; *A*) Initial periapical radiograph; *B*) Immediate X-ray after the procedure; *C*) Periapical control radiograph 2 months after reimplantation and radicectomy; *D*) Periapical control radiograph 18 months after reimplantation and radicectomy

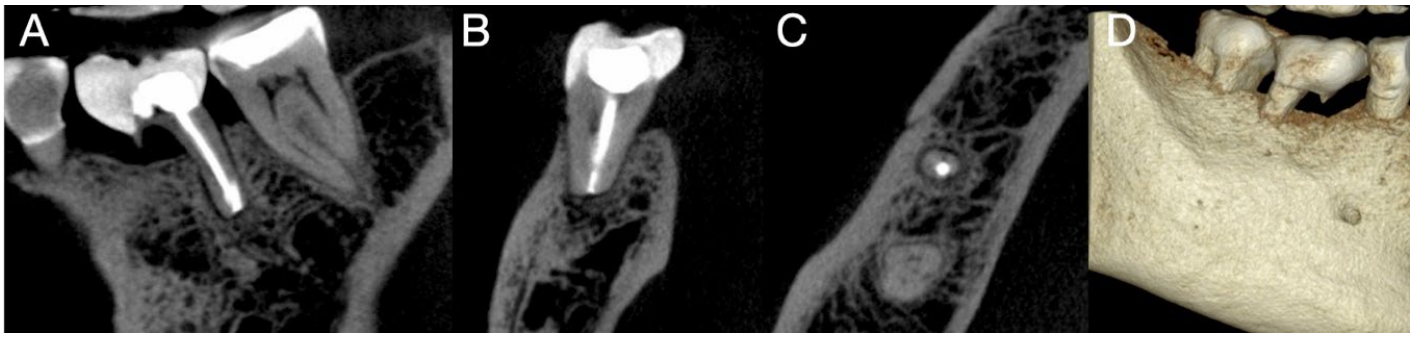


***Figure 3.*** Cone-beam computed tomography images obtained at the 36-month follow-up; *A–C*) Cross-sectional views demonstrating complete periapical bone fill consistent with healing in the distal root area following radicectomy, with preservation of surrounding periodontal structures and absence of radiolucent lesions; *D*) Three-dimensional reconstruction showing structural integrity and adequate bone architecture at the 36-month follow-up

direct occlusal contacts or interferences. The patient reported that he could chew comfortably on the treated side and was satisfied with the procedure. A definitive coronal restoration was placed after this review and remained in service through the 36-month follow-up.

At 18 months (Fig. 2D), there was no spontaneous pain or pain during mastication. Responses to vertical and horizontal percussion and to palpation were normal, with no metallic percussion sound. No pathological mobility was detected. Periodontal probing was within normal clinical limits, without bleeding or suppuration, and the furcation remained normal and unexposed. Occlusal contacts were stable and free of interferences. Masticatory function was normal, and the patient remained satisfied. Periapical radiography demonstrated progressive bone healing in the radicectomy area.

At 36 months, the patient remained free of spontaneous and mastication pain. Vertical and horizontal percussion and palpation findings were normal, with no metallic sound, and there was no pathological mobility. Probing depths remained within normal clinical limits, without bleeding or suppuration; the furcation was normal and unexposed. Occlusion and masticatory function were normal, the definitive restoration remained clinically satisfactory, and the patient reported continued satisfaction. CBCT (Fig. 3) demonstrated complete periapical bone fill consistent with healing, preservation of the periodontal supporting tissues, and no evidence of recurrent disease, ankylosis, external root resorption, or replacement resorption. No validated patient-reported outcome measure was administered.

### *Clinical timeline*

Root canal treatment had been completed approximately 6 years before referral. At baseline, the clinical and periapical radiographic findings led to suspicion of a mesial-root VRF. The fracture was definitively confirmed after atraumatic extraction, followed during the same appointment by mesial radicectomy, distal root-end resection and retrofilling, and intentional reimplantation after 11 min extraorally. The suture was removed at 15 days. Clinical and periapical radiographic reviews were performed at 2 and 18 months, and clinical and CBCT assessment was performed at 36 months. The definitive coronal restoration was placed after the 2-month review.

### *Patient perspective*

The patient considered preservation of his natural tooth an important priority and accepted the procedure after the

alternatives, uncertain prognosis, and possible complications had been explained. He reported comfortable mastication on the treated side at 2 months and normal function at 18 and 36 months. At the final review, he remained satisfied with his decision and the treatment outcome.

Written informed consent was obtained before treatment after discussion of the proposed procedure, alternatives, risks, and uncertain prognosis. Additional written consent was obtained for publication of the anonymized clinical findings and radiographic and photographic images. This case report was prepared in accordance with the CARE reporting guidelines.

## Discussion

VRF is a difficult diagnostic problem, particularly in root-filled teeth, because its clinical and radiographic features may resemble apical or marginal periodontal disease [8]. In this case, the isolated 10-mm periodontal defect with suppuration, mobility, mastication pain, positive percussion and palpation, and a radiolucency extending along the mesial root supported a strong clinical suspicion. Nevertheless, conventional periapical radiography compresses three-dimensional anatomy into a two-dimensional image; fracture orientation, small separation between fragments, superimposed structures, and root-filling materials may therefore obscure a fracture line. The diagnosis should consequently be understood as a clinically suspected VRF that was definitively confirmed only by direct visualization after extraction [2].

Preoperative CBCT could have improved assessment of the lesion configuration and fracture extent, although artefacts generated by radiopaque root-filling materials can also reduce diagnostic performance [9]. It was not obtained because the clinical and periapical findings were considered sufficiently suggestive to proceed with direct extraoral inspection as part of the proposed intervention, while avoiding additional imaging exposure. This decision limits the strength of the preoperative diagnostic work-up and precludes comparison between preoperative and follow-up three-dimensional findings. The 36-month CBCT should therefore be interpreted as an outcome assessment rather than evidence that CBCT established the initial diagnosis.

Treatment selection was based on fracture location, the condition of the distal root, periodontal support, furcation status, restorability, and the patient's preference. Nonsurgical retreatment could have corrected the mesial-root underfilling but could not remove a longitudinally fractured root [10]; apical surgery would not have addressed a fracture extending coronally; and complete extraction with implant or prosthetic replacement would have removed the unaffected distal root and altered the existing alveolar architecture. Root amputation was a possible tooth-preserving alternative, but intentional extraction permitted definitive assessment of fracture extent and controlled extraoral management. The strategy was conditional on confirming that the fracture was confined to the mesial root and that the distal root was structurally and periodontally retainable. This shared decision-making process balanced preservation of the natural tooth against the uncertain prognosis and recognized risks of reimplantation.

The biological plausibility of healing in this case depends principally on preservation of viable periodontal ligament cells on the root surface and socket wall. Atraumatic extraction, handling by the crown, avoidance of instrumentation or irrigation of the distal socket, continuous contact with saline-moistened gauze, and an extraoral time of 11 min were intended to limit desiccation and mechanical injury. Surviving periodontal ligament cells can repopulate the interface and support re-establishment of a functional periodontal attachment. Where root-surface damage is limited, repair may include deposition of new cementum over localized defects, insertion of periodontal fibres, and remodelling of the adjacent alveolar bone. Conversely, extensive loss of viable periodontal ligament favours direct bone-to-root contact and subsequent ankylosis or replacement resorption [11].

Removal of the fractured mesial root eliminated a persistent pathway for bacterial contamination and allowed the pathological tissue in the corresponding socket region to be curetted. Preservation of the distal socket and stable repositioning provided a protected environment for clot organisation, vascular ingrowth, bone deposition, and subsequent remodelling. The progressive periapical radiographic changes and the 36-month CBCT bone fill are compatible with these repair processes, although imaging alone cannot histologically demonstrate cementogenesis or regeneration of a true periodontal attachment.

Root-end resection and ultrasonic retro-preparation of the distal root created access for removal of potentially contaminated apical filling material and for placement of an apical barrier. Bio-C Repair is a calcium silicate-based material with reported cytocompatibility and sealing properties [12, 13]. Hydration of calcium silicates produces an alkaline environment and releases calcium ions, which may favour apatite-like interfacial precipitation and mineralized-tissue deposition. In this case, the 3-mm retrograde cavity and

adaptation of the material were intended to limit apical microleakage and reduce continued microbial stimulation. These properties provide a biologically plausible contribution to periapical repair, but the favourable outcome cannot be attributed to the material alone because infection control, mechanical sealing, periodontal ligament preservation, and case selection acted together.

Intentional reimplantation is nevertheless technique-sensitive and carries recognized risks. Mechanical or desiccation injury to the periodontal ligament can result in surface resorption, inflammatory external resorption, ankylosis, or progressive replacement resorption. Contamination, inadequate apical sealing, excessive mobility, or damage to the socket may cause periodontal healing failure or recurrent apical disease. Structural complications may include recurrent fracture, loss of coronal seal, unfavourable occlusal loading, periodontal breakdown, and eventual tooth loss. Ankylosis and replacement resorption may also appear after an initially asymptomatic period; therefore, the absence of a metallic percussion sound, pathological mobility, probing abnormalities, and radiographic resorption at 36 months is reassuring but does not eliminate future risk [14, 15].

The principal advantages of this approach are retention of the natural tooth, preservation of alveolar bone and proprioception, direct access for fracture assessment and root-end management, and avoidance or postponement of prosthetic or implant replacement [15, 16]. Its limitations include the need for atraumatic extraction, a short and well-controlled extraoral interval, adequate remaining root and periodontal support, a restorable crown, and patient acceptance of an uncertain prognosis. It is unsuitable when the fracture involves all roots or renders the crown unrestorable, when periodontal support is inadequate, or when atraumatic extraction is not feasible.

Published reports describe intentional reimplantation, root resection, and related tooth-preserving procedures, so the operative approach itself is not novel [6, 8, 16]. The present report adds detailed longitudinal clinical assessment and 36-month CBCT documentation after intentional reimplantation with radicectomy. In contrast with reports limited to shorter radiographic follow-up, the CBCT assessment permitted three-dimensional evaluation of bone fill and screening for root resorption or ankylosis [17]. However, comparison with previous case reports remains inherently limited by heterogeneous indications, surgical protocols, follow-up intervals, and outcome definitions.

Several limitations must be considered. This is a single case without a comparator and cannot establish treatment effectiveness, predictability, or superiority over extraction, root amputation, retreatment, apical surgery, or implant therapy. Preoperative CBCT was not performed; the baseline coronal restoration and complete obturation quality were not documented in sufficient detail; exact numerical probing depths were unavailable at the 18- and 36-month reviews; and no validated patient-reported outcome instrument was used. Histological confirmation of periodontal regeneration, cementogenesis, or bone regeneration was not possible. Finally, a favourable 36-month result does not exclude later resorption, ankylosis, structural failure, or periodontal deterioration. Continued clinical and radiographic surveillance is therefore required.

## Conclusion

Within the limitations of a single case report, intentional reimplantation combined with radicectomy may represent a tooth-preserving option for carefully selected multi-rooted teeth when a VRF is confined to one root and the remaining root has adequate structural and periodontal support. This case demonstrated favourable clinical, periapical radiographic, and CBCT findings at 36 months. The result does not establish predictable effectiveness or comparative superiority. Careful diagnosis and case selection, shared decision-making, atraumatic handling, periodontal ligament preservation, effective apical sealing, and long-term monitoring for resorption, ankylosis, periodontal breakdown, and structural complications remain essential.

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***Conflict of interest***

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***Author contributions***

Conceptualization: HPVH; Methodology: HPVH; Formal Analysis and Investigation: HPVH/ADEC; Writing-Original draft preparation: HPVH/ADEC; Writing-review and editing: ADEC; Supervision: HPVH. All authors read and approved the final manuscript.

## References


1. Patel S, Bhuva B, Bose R. Present status and future directions: vertical root fractures in root filled teeth. Int End J. 2022;55(S3):804-26.
2. Haupt F, Wiegand A, Kanzow P. Risk Factors for and Clinical Presentations Indicative of Vertical Root Fracture in Endodontically Treated Teeth: A Systematic Review and Meta-analysis. J Endod. 2023;49(8):940-52.
3. von Arx T, Maldonado P, Bornstein MM. Occurrence of Vertical Root Fractures after Apical Surgery: A Retrospective Analysis. J Endod. 2021;47(2):239-46.
4. Sugaya T, Nakatsuka M, Inoue K, Tanaka S, Miyaji H, Sakagami R, et al. Comparison of fracture sites and post lengths in longitudinal root fractures. J Endod. 2015;41(2):159-63.
5. Arkhipova A, Bovanova N, Lastovichek D, Ramonova A, Generalov E, Byakova S. Radiographic Criteria for Differential Diagnosis Between Vertical Root Fracture and Apical Periodontitis in Single-Rooted Endodontically Treated Premolars Using Cone-Beam Computed Tomography. J Endod. 2024;50(3):329-35.
6. Valverde Haro HP, Parra Martinez PA, Erazo Conde AD. Intentional replantation of a mandibular second molar with atypical internal apical morphology: A case report. J Eugenio Espejo. 2024;18(3):125-35.
7. Gonapa P, Rambabu T, Podugu UK, Gondi D, Rathod T. Radicectomy of radix entomolaris: An alternative treatment approach for persistent periapical lesion assisted by cone-beam computed tomography and operating microscope. J Conserv Dent Endod. 2022;25(2):206-10.
8. Nogueira Leal da Silva EJ, Romao Dos Santos G, Liess Krebs R, Coutinho-Filho Tde S. Surgical Alternative for Treatment of Vertical Root fracture: A Case Report. Iran Endod J. 2012;7(1):40-4.
9. Dalili Kajan Z, Taramsari M, Khosravi Fard N, Khaksari F, Moghasem Hamidi F. The Efficacy of Metal Artifact Reduction Mode in Cone-Beam Computed Tomography Images on Diagnostic Accuracy of Root Fractures in Teeth with Intracanal Posts. Iran Endod J. 2018;13(1):47-53.
10. De Carlo Bello M, Pillar R, Mastella Lang P, Michelon C, Abreu da Rosa R, Souza Bier CA. Incidence of Dentinal Defects and Vertical Root Fractures after Endodontic Retreatment and Mechanical Cycling. Iran Endod J. 2017;12(4):502-7.
11. Plotino G, Abella Sans F, Duggal MS, Grande NM, Krastl G, Nagendrababu V, et al. Clinical procedures and outcome of surgical extrusion, intentional replantation and tooth autotransplantation - a narrative review. Int Endod J. 2020;53(12):1636-52.
12. Kunam D, Bode Y, Narra PM, Krishna CHNVM, Reddy SN, Venkateshwarlu M. Comparative evaluation of apical microleakage of mineral trioxide aggregate, Biodentine, and Bio-C Repair as root-end filling materials using dye extraction method: An in vitro study. J Conserv Dent Endod. 2024;27(12):1305-9.
13. Klein-Junior CA, Zimmer R, Dobler T, Oliveira V, Marinowic DR, Ozkomur A, et al. Cytotoxicity assessment of Bio-C Repair Ion+: A new calcium silicate-based cement. J Dent Res Dent Clin Dent Prospects. 2021;15(3):152-6.
14. Plotino G, Abella Sans F, Duggal MS, Grande NM, Krastl G, Nagendrababu V, et al. Present status and future directions: Surgical extrusion, intentional replantation and tooth autotransplantation. Int Endod J. 2022;55 Suppl 3:827-42.
15. Javed F, Zafar K, Khan FR. Outcome of intentional replantation of endodontically treated teeth with periapical pathosis: A systematic review and meta-analysis. Aust Endod J. 2023;49 Suppl 1:494-507.
16. Asgary S. Management of a hopeless mandibular molar: a case report. Iran Endod J. 2011;6(1):34-7.
17. Safi Y, Hosseinpour S, Aziz A, Bamedi M, Malekashtari M, Vasegh Z. Effect of Amperage and Field of View on Detection of Vertical Root Fracture in Teeth with Intracanal Posts. Iran Endod J. 2016;11(3):202-7.


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