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Endodontic Microsurgery for Post-Treatment Apical Periodontitis: A Case Series

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ABSTRACT

Persistent post-treatment apical periodontitis may remain after root canal treatment when microbial control is incomplete or orthograde retreatment is impractical. This four-case series describes endodontic microsurgery performed with magnification, root-end resection, ultrasonic retro-preparation, and calcium silicate-based retrograde materials, and places the cases in the context of a focused narrative review. Preoperative cone-beam computed tomography was used for surgical planning. The cases involved symptomatic or suppurative lesions in previously treated teeth for which existing crowns, posts, or prior retreatment limited further orthograde management. At 4–6 months, all patients were clinically asymptomatic and the available periapical radiographs showed early favorable healing. No standardized postoperative pain scores were collected. A focused narrative search of PubMed/MEDLINE, Crossref metadata, and journal websites identified nine recent case reports or small series (26 patients/cases) published from 2022 through August 2026. The reports included conventional, guided, navigated, and bone-lid approaches, together with case-based microbiologic and histologic findings; reported clinical outcomes were generally favorable but heterogeneous. The cases in this report are distinct from the 2023 case published by Soesilo et al.; no text or figures from that report were reused. Because this is a small uncontrolled series with short follow-up and nonstandardized outcome assessment, the findings are preliminary. Endodontic microsurgery can be considered a tooth-preserving option in carefully selected cases when nonsurgical retreatment is not feasible, but longer prospective follow-up with standardized clinical and radiographic outcomes is required.

Keywords: Apicoectomy; Cone-beam computed tomography; Endodontic microsurgery; Post-treatment apical periodontitis; Root-end filling.

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Introduction

Post-treatment apical periodontitis may persist after root canal treatment because microorganisms or irritants remain within complex apical anatomy, extraradicular infection is present, or coronal and restorative factors permit reinfection. When technically feasible, nonsurgical retreatment is generally considered first; however, crowns, posts, separated instruments, or procedural risks may make orthograde access impractical. In such situations, endodontic microsurgery provides direct access for debridement, root-end resection, retro-preparation, and sealing while preserving the tooth [1,2,5].

Modern microsurgical protocols use magnification and illumination, limited osteotomy, approximately 3 mm of root-end resection with a minimal bevel, ultrasonic retro-preparation, and biocompatible calcium silicate-based materials. Systematic reviews and long-term studies report favorable healing and survival, but outcomes vary with case selection, lesion characteristics, technique, material, outcome definitions, and follow-up duration [1-3]. Cone-beam computed tomography (CBCT) can improve three-dimensional assessment of lesion extent and anatomical relationships, although conventional periapical radiography remains commonly used for follow-up [4]. This report describes four cases treated with a standardized microsurgical workflow, reports the available early clinical and radiographic outcomes, clarifies the relationship of Cases 1 and 2 to the 2023 case report by Soesilo et al., and summarizes recent case-based literature through a focused narrative review. The aim is descriptive: the series does not test comparative effectiveness or establish long-term predictability.

Case Series and Methods

Ethics, Consent, and Preoperative Assessment

The procedures were conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent for treatment and publication of anonymized clinical and radiographic images was obtained from the patients. CBCT scans with a reported voxel size of 0.25 mm were used to assess lesion extent, cortical integrity, and proximity to relevant anatomical structures and to plan the osteotomy trajectory.

Standardized Microsurgical Protocol

All procedures were performed by an endodontist experienced in microsurgery, assisted by trained personnel, using a dental operating microscope (Zumax 2050; Zumax, China) and an aseptic protocol. Local anesthesia consisted of 2% lidocaine with 1:100,000 epinephrine. A marginal full-thickness mucoperiosteal flap with a vertical release over sound bone was reflected. A conservative osteotomy was performed under sterile saline irrigation, and periapical tissue was curetted until the surgical field was adequately visualized. Approximately 3 mm of the root end was resected with a 0–10° bevel. The cut surface was inspected under magnification after application of 1% methylene blue. A 3 mm retrograde cavity was prepared along the canal axis with diamond-coated ultrasonic tips under water cooling and filled with the case-specific calcium silicate material. The flap was repositioned and closed with 5-0 or 6-0 monofilament nylon sutures.

Postoperative Care and Outcome Assessment

Ibuprofen 400 mg was prescribed as needed, and 0.12% chlorhexidine mouth rinse was recommended twice daily for 1 week. Sutures were removed after 7–10 days. Follow-up consisted of clinical assessment and periapical radiography at the available 4- or 6-month visit. Standardized visual analog scale pain scores, patient-reported outcome measures, calibrated radiographic scores, and postoperative CBCT measurements were not prospectively collected; these data cannot be reconstructed retrospectively.

Case 1

A 20-year-old man presented with mastication pain associated with a previously treated maxillary first premolar. Nonsurgical retreatment had been attempted, but CBCT showed a persistent apical radiolucency and clinical examination showed sulcular suppuration. Because the patient wished to preserve the existing crown and a long intraradicular post limited further orthograde access, endodontic microsurgery was selected. The standardized protocol was followed. The root-end cavity was filled with mineral trioxide aggregate (MTA) Repair HP (Angelus, Londrina, Brazil), and an intraoperative radiograph showed satisfactory placement. At 4 months, the patient reported no symptoms; the periapical radiograph showed reduction of the radiolucency and increased trabecular density consistent with early healing. The short interval does not support a claim of complete or long-term healing.

Case 2

A 23-year-old man with a history of dental trauma presented with swelling and suppuration in the maxillary incisor region. CBCT confirmed a periapical lesion. A

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cast post was present, and the patient declined replacement of the existing crown; microsurgery was therefore chosen instead of further orthograde retreatment. A full sulcular flap was used to permit inspection of the root surface and lesion boundaries. The root-end cavity was filled with mineral trioxide aggregate (MTA) Repair HP (Angelus, Londrina, Brazil). At 6 months, the swelling and symptoms had resolved and the periapical radiograph showed favorable healing.

Case 3

A 37-year-old woman described a nonspecific, localized abnormal sensation in the maxillary anterior region. A validated pain score and more detailed symptom description were not available in the clinical record. Clinical examination identified a draining sinus tract, which was traced radiographically to the involved apex. CBCT demonstrated an apical radiolucency with cortical involvement. Microsurgery was selected to permit direct debridement and apical sealing, and mineral trioxide aggregate (MTA) Repair HP (Angelus, Londrina, Brazil) was used for the root-end filling. Suture removal at 1 week showed uneventful soft-tissue healing. At 6 months, the patient was asymptomatic, the sinus tract was absent, and periapical radiography showed favorable healing.

Case 4

A 37-year-old woman presented with occasional pain associated with a previously treated mandibular molar. Percussion and palpation were positive; swelling and a sinus tract were absent. Periapical radiography and CBCT showed an apical radiolucency. The tooth had a full-coverage crown with an intraradicular post, which limited predictable orthograde access. Microsurgery was performed using the standardized protocol, and the root-end cavity was filled with L-root mineral trioxide aggregate (MTA) (Tabriz, Iran). Sutures were removed at 1 week. At 6 months, the patient reported no symptoms and the periapical radiograph showed findings consistent with early healing.

Originality and Relationship to the 2023 Soesilo Case

Cases 1 and 2 are not republications of the patient described by Soesilo et al. [6]. That article reported a single 32-year-old patient with tooth #24, a semilunar flap, mineral trioxide aggregate (MTA) plus bone grafting, and no postoperative follow-up because the patient relocated. In contrast, the present Case 1 involved a 20-year-old patient treated without bone grafting and followed for 4 months, and Case 2 involved a 23-year-old patient with a traumatized maxillary incisor followed for 6 months. The clinical and radiographic images in Figures 1 and 2 are distinct from the figures in the 2023 article; no text or images from that publication were reproduced. Soesilo et al. is cited only as related literature.

Focused Narrative Review

Search Approach and Eligibility

A focused narrative review was undertaken to contextualize contemporary case-based practice rather than to estimate a pooled treatment effect. PubMed/MEDLINE was searched from January 1, 2022, through August 17, 2026, using combinations of 'endodontic microsurgery,' 'apical microsurgery,' and 'apicoectomy' with 'case report,' 'case series,' 'guided,' 'navigation,' 'healing,' and 'outcome.' Supplementary title and DOI searches were performed in Crossref metadata and on journal websites, and reference lists of eligible reports were hand-searched. English-language full-text clinical case reports or case series were eligible if they described root-end surgery for persistent or secondary apical disease in a previously treated tooth and provided case-level information relevant to surgical technique, root-end material, clinical or radiographic outcome, or lesion characterization. For the technique/outcome comparison, reports were required to describe the surgical approach and provide a clinical or radiographic follow-up outcome. One additional case series was retained for contextual CBCT, microbiologic, and histologic findings. Reviews, laboratory studies, nonclinical technique papers, reports without apical resection/root-end treatment, implant-only periapical lesions, duplicate reports, and publications with insufficient case-level information were excluded. Because this was a focused narrative review, screening was not performed in duplicate, no protocol was registered, no formal risk-of-bias tool was applied, and the search should not be interpreted as systematic or exhaustive.

Narrative Findings

Nine reports comprising 26 patients/cases were summarized [7-15]. Eight described microsurgical techniques and follow-up outcomes, while one provided CBCT, microbiologic, and histologic characterization of secondary apical periodontitis specimens [15]. Among the technique/outcome reports, conventional microsurgery with a limited osteotomy, approximately 3 mm of apical resection, ultrasonic retro-preparation, and a calcium silicate root-end material remained the most common approach. Biodentine, mineral trioxide

aggregate (MTA), and premixed bioceramic putties were all represented. Follow-up ranged from 4 weeks to 3 years, and outcome definitions were heterogeneous. Table 2. Characteristics of the nine case reports or case series included in the focused narrative review. Eight contributed technique/outcome data; Mora-Carabali et al. was retained for etiologic context. The Lee et al. article was published online in 2025 and assigned to a 2026 journal issue. Guided and navigated approaches were used to localize apices and limit osteotomy size, but the evidence consisted mainly of small descriptive reports [11,13,14]. Regenerative adjuncts were selectively used in extensive or combined endodontic-periodontal defects [8,20]. The bone-lid series showed that technically demanding approaches can have variable outcomes and complications [12]. These reports support feasibility and illustrate technique, but their small samples, selective reporting, inconsistent follow-up, and nonuniform outcome criteria preclude comparative or causal conclusions.

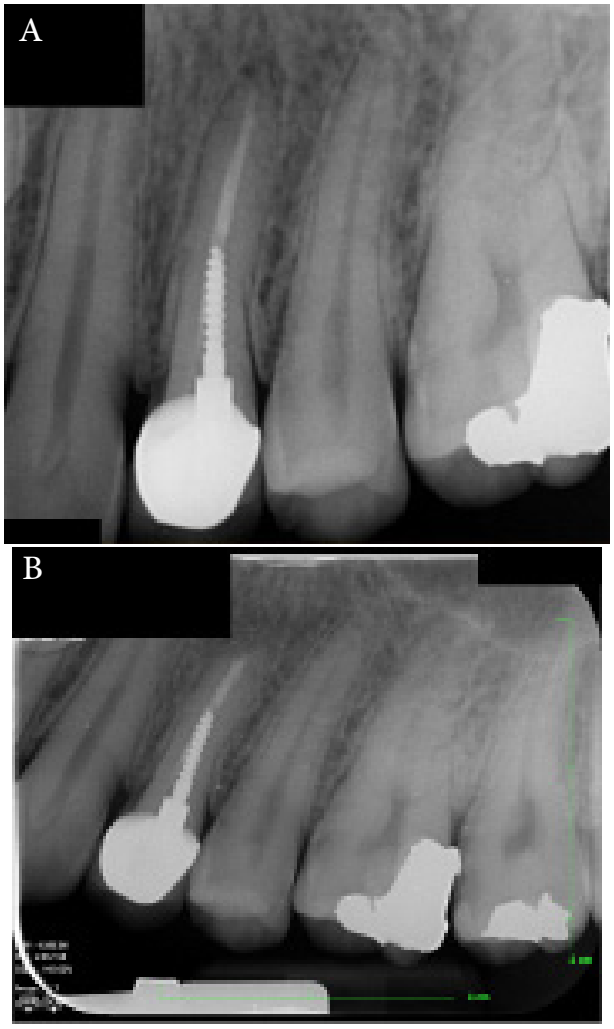


Figure 1. A. Preoperative periapical radiograph of the maxillary first premolar showing persistent apical radiolucency. B. Four-month follow-up radiograph showing reduction of the radiolucency and increased trabecular density consistent with early healing. C. Microsurgical view of the osteotomy and exposed root apex after lesion curettage. D. Root-end cavity after retrograde filling with mineral trioxide aggregate (MTA). E. Immediate postoperative view after flap repositioning and suturing. F. Four-month clinical view showing soft-tissue healing.

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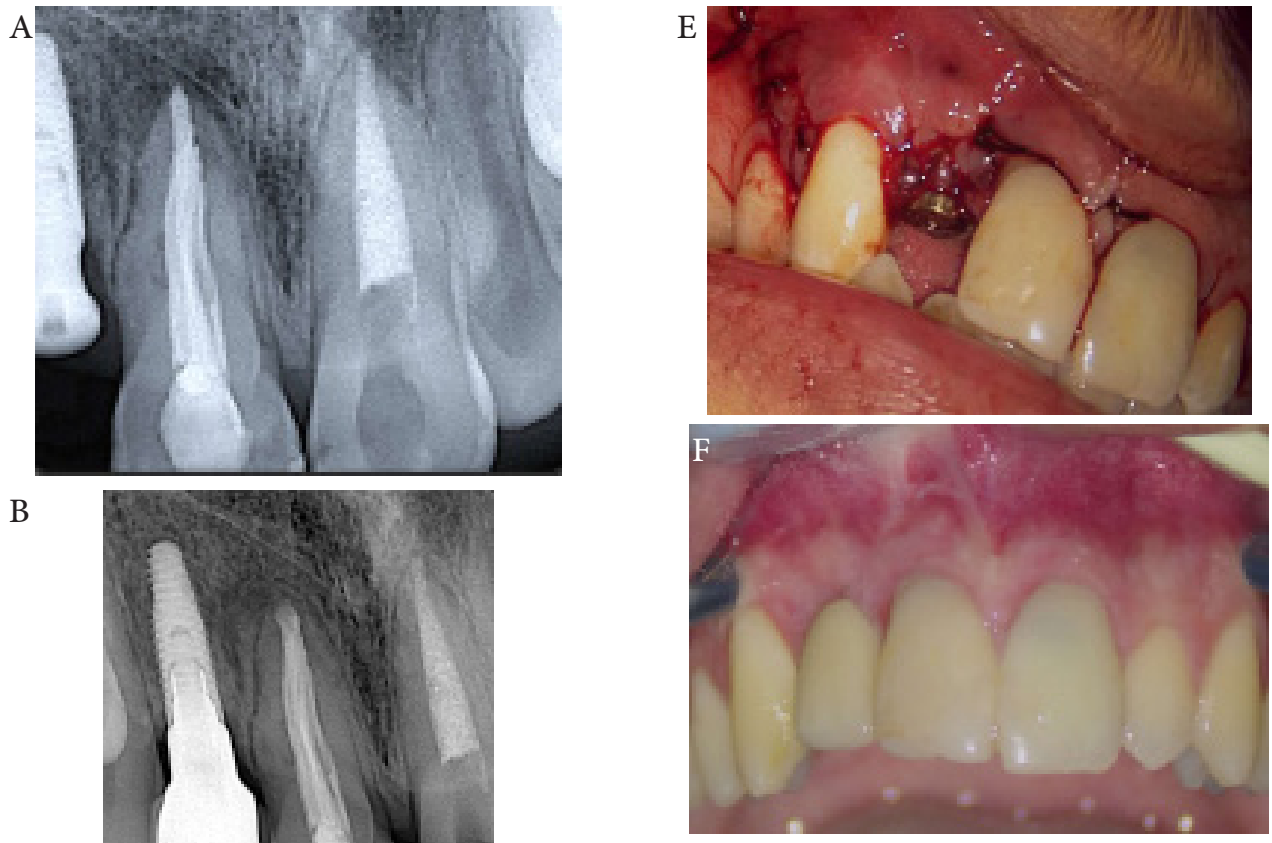
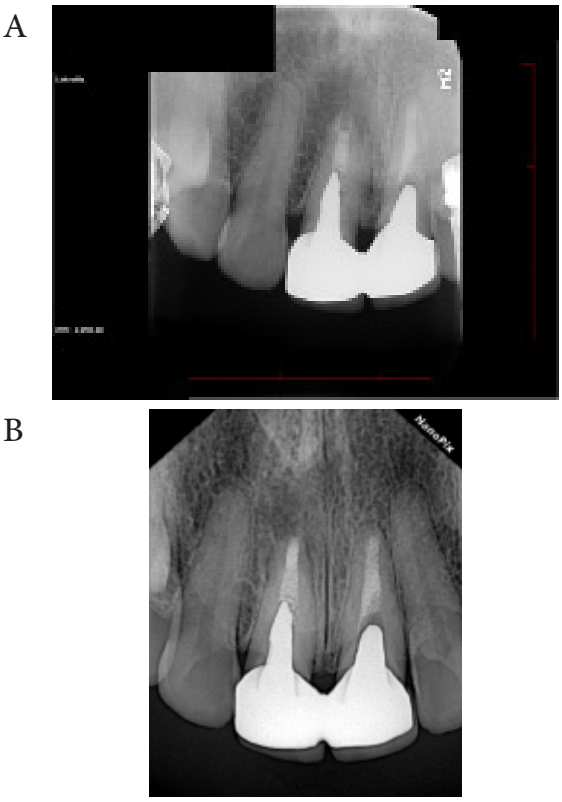
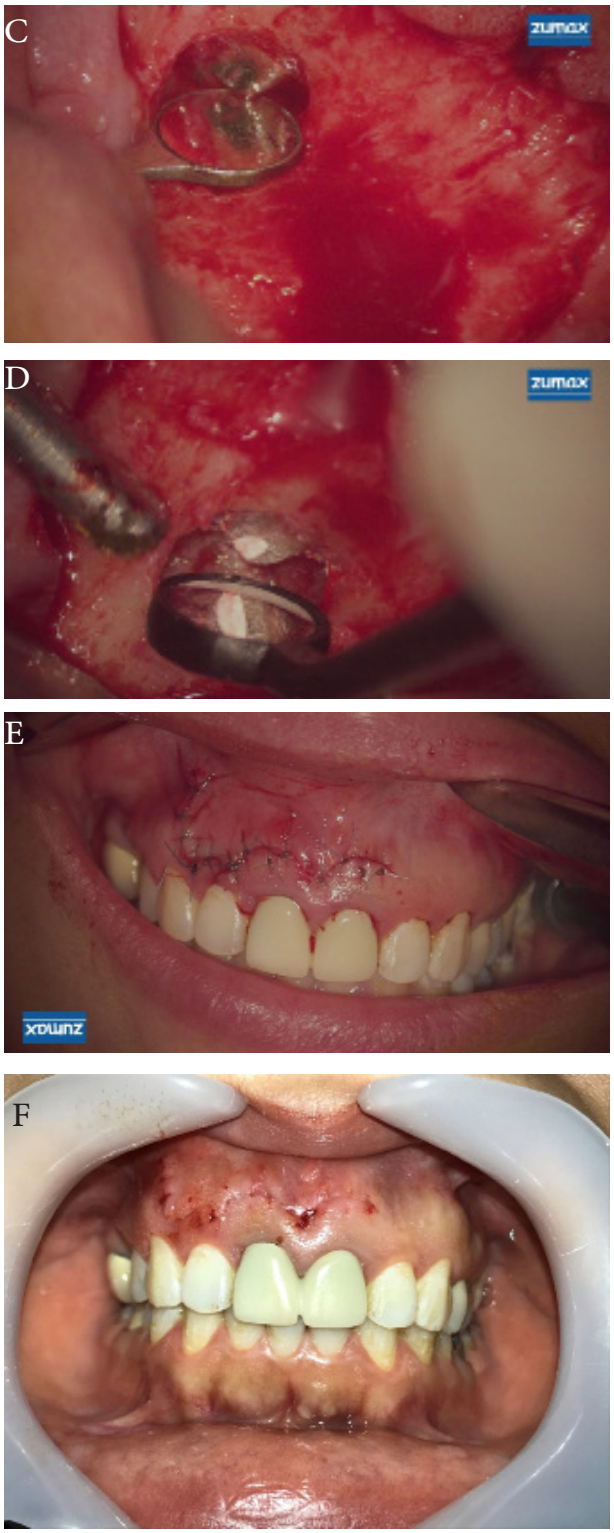


Figure 2. A. Preoperative periapical radiograph of the involved maxillary incisor. B. Six-month follow-up radiograph showing favorable periapical healing. C. Exposed root apex after osteotomy and lesion curettage. D. Root-end cavity after retrograde filling with mineral trioxide aggregate (MTA). E. Immediate postoperative view after flap repositioning and suturing. F. Six-month clinical view showing soft-tissue healing.





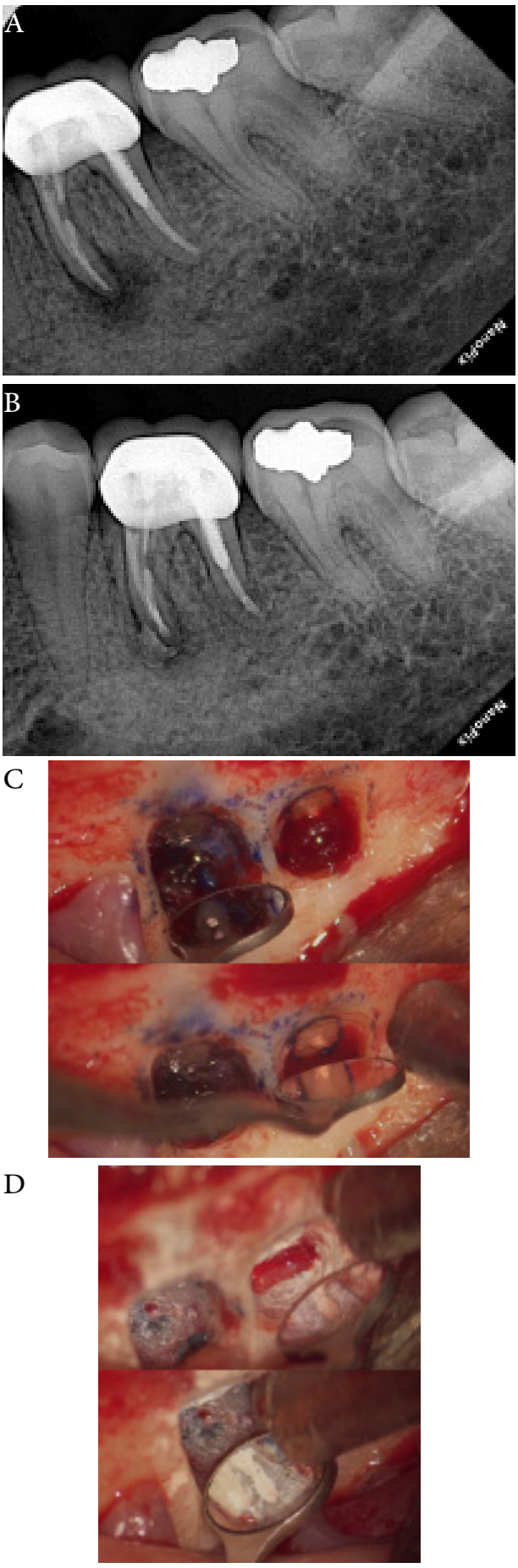


Figure 3. A. Preoperative periapical radiograph of the involved maxillary incisor. B. Six-month follow-up radiograph showing favorable periapical healing. C. Microsurgical view after apical resection and before retrograde filling. D. Root-end cavity after retrograde filling with mineral trioxide aggregate (MTA). E. Immediate postoperative view after flap repositioning and suturing. F. Six-month clinical view showing resolution of the sinus tract and soft-tissue healing.

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E



F



Figure 4. A. Preoperative periapical radiograph showing a previously treated mandibular molar with a full-coverage crown, intraradicular post, and apical radiolucency. B. Six-month follow-up radiograph showing radiographic findings consistent with early periapical healing. C. Root-end cavity after retro-preparation and before retrograde filling.. D. Root-end cavity after retrograde filling with mineral trioxide aggregate (MTA). E. Immediate postoperative view after suturing. F. Six-month clinical view showing soft-tissue healing.

Table 1. Baseline presentation, treatment rationale, and available early outcomes. No validated perioperative pain score was recorded for any case.

Case	*Presentation and objective findings*	*Reason for microsurgery*	*Root-end material*	*Available outcome*
1	*20-year-old man; mastication pain; sulcular suppuration; persistent maxillary first-premolar radiolucency*	*Existing crown and long intraradicular post; prior nonsurgical retreatment*	*mineral trioxide aggregate (MTA) Repair HP*	*4 months: asymptomatic; radiographic reduction of the lesion and increased trabecular density consistent with early healing*
2	*23-year-old man; trauma history; swelling and suppuration in maxillary incisor region*	*Cast post; patient declined crown replacement*	*mineral trioxide aggregate (MTA) Repair HP*	*6 months: symptoms and swelling resolved; radiographic findings consistent with favorable healing*
3	*37-year-old woman; nonspecific localized abnormal sensation; sinus tract traced to the apex; cortical involvement*	*Persistent lesion requiring direct debridement and apical sealing*	*mineral trioxide aggregate (MTA) Repair HP*	*6 months: asymptomatic and sinus tract absent; radiographic findings consistent with favorable healing*
4	*37-year-old woman; occasional pain; positive percussion and palpation; no swelling or sinus tract*	*Full-coverage crown with intraradicular post limited orthograde access*	*L-root mineral trioxide aggregate (MTA)*	*6 months: asymptomatic; radiographic findings consistent with early periapical healing*

Table 2. Characteristics of the nine case reports or case series included in the focused narrative review.

Study	n	Technique/material	Follow-up	Reported outcome
Lara Munoz et al., 2024 [7]	1	Conventional surgery; Biodentine; mandibular first molar	4 weeks	Clinical and radiographic improvement
Wang et al., 2022 [8]	1	Apicoectomy plus guided tissue regeneration; bioceramic putty	1 year	Asymptomatic with bone fill
Hashem, 2025 [9]	1	Microsurgery without grafting; mineral trioxide aggregate (MTA); through-and-through lesion	3 years	Clinical success with incomplete/partial radiographic healing
Rajic et al., 2023 [10]	1	Piezoelectric retro-preparation; Biodentine; maxillary incisor	1 year	Clinical and radiographic healing
Manishaa et al., 2024 [11]	2	Dynamic-navigation-guided osteotomy/resection; mineral trioxide aggregate (MTA) with or without graft	1 year	Both cases asymptomatic with healing
Lee et al., 2026 [12]	6	Bone-lid microsurgery; bioceramic putty; molars	14 months-3 years	Variable: two complete healings, one limited healing, three complications
Abella Sans et al., 2025 [13]	1	Static guide plus subperiosteal tunnelling; Biodentine	2 years	Clinical and radiographic healing without visible scarring
Mahendran et al., 2023 [14]	3	Template-guided surgery; Biodentine with or without platelet-rich fibrin	1 month	Early satisfactory healing
Mora-Carabali et al., 2023 [15]	10	CBCT, microbiology, and histology of secondary apical periodontitis specimens	Not reported	12 granulomas and three cysts among 15 lesions; anaerobes frequently detected

Discussion

The principal observation in this four-case series was early symptom resolution accompanied by favorable periapical radiographic change at 4–6 months after microsurgery. This finding is clinically encouraging but should not be equated with complete long-term healing. Established classifications of surgical healing generally require longer follow-up and standardized interpretation; the present report therefore uses the terms 'early' and 'favorable' rather than 'complete' or 'predictable.' The cases illustrate a common indication for microsurgery: persistent disease in teeth for which further nonsurgical access would require removal of a crown or post, carried procedural risk, or had already been attempted. This indication is consistent with contemporary reviews and long-term outcome literature [1,2,5]. CBCT helped define lesion extent and surgical access, whereas follow-up relied on two-dimensional periapical radiographs. The latter cannot provide volumetric healing measurements and may underdetect residual disease [4]. Calcium silicate-based root-end materials were used in all four cases. Randomized trials have reported favorable outcomes for mineral trioxide aggregate (MTA), iRoot BP Plus, root repair materials, and related combinations, but the present uncontrolled series cannot separate the contribution of material choice from debridement, surgical execution, case selection, or host factors [16-19]. Likewise, the absence of regenerative grafting in these cases should not be interpreted as evidence against grafts; systematic review evidence suggests that regenerative adjuncts may be useful in selected apicomarginal or through-and-through defects [20]. Among the eight technique/outcome reports, magnification, conservative access, root-end resection, ultrasonic preparation, and calci-

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um silicate sealing were common features, while guidance technology, defect management, and outcome assessment varied [7-14]. The predominantly favorable case-report literature is susceptible to publication bias. Accordingly, it is best used to describe techniques and generate hypotheses rather than to estimate success rates.

Limitations

This report has several limitations. The small case series and short 4–6-month follow-up limit generalizability and long-term assessment of healing or recurrence. Standardized patient-reported outcomes, blinded healing assessments, and CBCT evaluation were not available. Differences in case characteristics and treatment variables limited direct comparison. Histopathologic data and standardized lesion measurements were also unavailable. The literature component was a focused narrative review rather than a systematic review. Therefore, the findings should be considered descriptive and hypothesis-generating.

Conclusion

In this preliminary four-case series, endodontic microsurgery was followed by symptom resolution and favorable early radiographic change at 4–6 months. The findings suggest that microsurgery can be a tooth-preserving option for carefully selected teeth when non-surgical retreatment is not feasible or has failed. They do not establish treatment predictability or long-term effectiveness. Prospective studies with larger samples, standardized patient-reported and radiographic outcomes, independent assessment, and follow-up of at least 12 months are needed.

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Conflict of Interest

There is no conflict of interest to declare.

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