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Building the Tooth Before the Root Canal: Clinical Advantages of Pre-Endodontic Adhesive Reconstruction

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Abstract

Aim: The prognosis of endodontically treated teeth is influenced by root canal treatment quality and the remaining coronal structure. Teeth requiring endodontic therapy often present with extensive caries, fractures, cervical defects, recurrent decay, or defective restorations. These conditions can compromise isolation, structural stability, and coronal seal. Pre-endodontic adhesive reconstruction may improve treatment conditions before root canal therapy. This article illustrates the clinical application of pre-endodontic adhesive reconstruction in structurally compromised teeth and discusses its role in endodontic and restorative treatment planning.

Methods: Eight clinical cases with varying degrees of coronal destruction were selected. The cases included teeth affected by extensive caries, recurrent decay, external cervical resorption, fractured cusps, previous endodontic treatment requiring retreatment, and defects extending to or below the gingival margin. Clinical management, adhesive reconstruction, endodontic procedures, and outcomes were documented with clinical photographs and radiographs.

Results: Pre-endodontic reconstruction improved isolation and moisture control, restored missing coronal walls, and provided stable reference points for endodontic procedures. In teeth with deep subgingival defects, staged soft-tissue management and coronal reconstruction enabled subsequent rubber dam isolation and definitive treatment. Reconstructed walls improved temporary restoration adaptation and simplified management of severely compromised tooth structure. Follow-up examinations showed favorable clinical and radiographic outcomes, including healing of periapical lesions and successful rehabilitation with definitive restorations.

Conclusions: Pre-endodontic adhesive reconstruction is a valuable adjunct in the management of structurally compromised teeth. Re-establishing coronal integrity before root canal treatment can improve isolation, asepsis, endodontic access, and restorative predictability. The cases presented suggest that rebuilding the tooth before root canal treatment should be considered an integral part of contemporary restorative-endodontic treatment planning rather than a preliminary restorative step alone.

Keywords: adhesive dentistry; deep margin elevation; endodontic retreatment; endodontic treatment; pre-endodontic build-up; restorability; structurally compromised teeth

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Introduction

The preservation of endodontically treated teeth depends on the successful integration of endodontic and restorative procedures (Patel et al., 2025). Although elimination of infection and adequate root canal obturation are essential for treatment success, long-term tooth survival is strongly influenced by the quantity and quality of the remaining tooth structure available for restoration (Al-Nuaimi et al., 2020; European Society of Endodontology, 2021). Teeth requiring root canal treatment frequently present with extensive coronal destruction caused by caries, fractures, defective restorations, or previous operative procedures, creating challenges that extend beyond the management of the root canal system (Anand et al., 2022; Al-Meshal et al., 2025; Mehta et al., 2025).

Traditionally, root canal treatment is completed before definitive coronal reconstruction (Slutzky-Goldberg et al., 2009). However, in severely compromised teeth this sequence may complicate treatment by limiting isolation, reducing structural stability, and increasing dependence on temporary restorations. Coronal leakage associated with inadequate interim restorations has long been recognized as a potential contributor to bacterial contamination and treatment failure (Abbott 1994; Ray & Trope 1995; Heling et al., 2002; Jensen et al. 2007). Consequently, greater attention has been directed toward restorative procedures performed before initiation of endodontic therapy (Moreira et al., 2023).

The evolution of adhesive dentistry has expanded the possibilities for managing structurally compromised teeth (Breschi et al., 2025). Contemporary techniques, including immediate dentine sealing (IDS), deep margin elevation (DME), cervical margin relocation (CMR), and adhesive coronal build-up, enable simultaneous reconstruction of lost tooth structure and preservation of sound dental tissues (Dietschi & Spreafico 1998; Magne 2005). By re-establishing coronal anatomy before root canal treatment, these procedures can facilitate clinical management and create a more predictable restorative-endodontic workflow (Heydrich 2005; Kameyama et al., 2020; Gavriil et al., 2021).

Recently, Khanvilkar et al. (2024) proposed a classification system for pre-endodontic build-up based on the extent of structural loss and the position of restorative margins relative to the gingival tissues. The classification includes five main types. Type I describes an occlusal cavity in which all cavity walls are present and is further divided according to the amount of dentin loss as minimal, moderate, or extensive. Type II describes proximal wall loss, with Type II-1 involving loss of either the mesial or distal wall and Type II-2 involving loss of both proximal walls. Type III describes loss of buccal, lingual, or palatal walls, with Type III-1 involving one missing wall and Type III-2 involving two missing walls. Type IV refers to defects in which more than two walls are missing but some coronal walls remain. Type V refers to complete loss of all cavity walls. For Types II to V, the gingival seat is further classified as supragingival, equigingival, or subgingival. This system provides a practical framework for describing structural compromise, estimating reconstruction complexity, and planning pre-endodontic adhesive build-up before root canal treatment.

Although the approach proposed by Khanvilkar et al. (2024) is useful for describing structural defects, this classification has several limitations. It primarily categorizes teeth according to the number of missing walls and the position of the gingival seat, but it does not fully account for other clinical factors that may influence treatment complexity. These include the quality and thickness of remaining dentin, the presence of cracks, external cervical resorption, previous endodontic treatment, posts, periodontal inflammation, and loss of the pulp chamber roof. The classification also does not determine whether rubber dam isolation, matrix adaptation, or reliable adhesive bonding can be achieved in a specific case. In deep subgingival defects, the true extent of structural loss may become evident only after removal of caries and defective restorative materials. There is also relatively limited clinical documentation illustrating its application across the wide range of defects encountered in daily practice.

Accordingly, the aim of this study is to present a

series of clinically documented cases representing progressively increasing structural compromise and to demonstrate different strategies for pre-endodontic adhesive reconstruction. Through detailed photographic documentation, the article highlights the decision-making process, technical considerations, and clinical advantages of rebuilding the tooth before root canal treatment within a comprehensive restorative-endodontic treatment approach.

Clinical assessment of structural loss before endodontic treatment

Treatment planning for teeth requiring root canal therapy should begin with a comprehensive assessment of restorability. Although pulpal and periapical diagnoses establish the need for endodontic intervention, they do not determine whether the tooth can be predictably retained in function. Long-term prognosis is influenced by biological, structural, periodontal, restorative, and strategic factors, all of which should be evaluated before treatment is initiated (Ricucci & Grosso 2006; Cárcamo-España et al., 2022).

Teeth presenting with endodontic disease are frequently affected by extensive caries (Figs. 2A, 5A), fractures (Fig. 6A–B), resorptive processes (Fig. 4A–I), defective restorations, or previous operative procedures subsequently complicated by recurrent caries (Figs. 3A; 7A–B; 8A–B; 9A–B), all of which may have already compromised their structural integrity. Consequently, assessment should extend beyond the root canal system and focus on the tooth as a whole, considering its potential for definitive rehabilitation after completion of endodontic treatment.

Particular attention should be given to the quantity, distribution, and quality of the remaining hard tissues. Clinically relevant parameters include the number of residual walls, the presence of intact marginal ridges, the degree of cuspal support, the location of defect margins, and the extent of any structural loss extending toward the root surface. These factors influence both the mechanical behavior of the tooth and the feasibility of restorative reconstruction.

Loss of marginal ridges and cuspal integrity has been associated with a substantial reduction in fracture resistance, particularly in premolars and teeth presenting with extensive mesio-occluso-distal defects (Moreira et al. 2023). Identification of weakened cusps, unsupported enamel, and areas requiring reinforcement is therefore an essential component of treatment planning. The clinician must determine whether the remaining tooth structure can support a predictable adhesive reconstruction and a subsequent definitive restoration, often involving cusp coverage.

Contemporary adhesive techniques have expanded the range of teeth considered restorable by allowing conservative reconstruction of missing walls and management of deep cervical defects. Nevertheless, these procedures do not replace careful pre-operative evaluation. The decision to preserve a severely compromised tooth should be based on realistic assessment of the structural foundation available for long-term function.

Systematic evaluation of structural loss should precede all endodontic procedures. Among the various parameters influencing treatment planning, two are particularly relevant: the amount of remaining coronal tooth structure and the apico-coronal position of the defect margins. These factors form the basis for selecting the most appropriate pre-endodontic reconstruction strategy and are reflected in the classification systems proposed for structurally compromised teeth.

Classification of structural defects

To facilitate treatment planning in structurally compromised teeth, Khanvilkar et al. (2024) recently developed a classification system for pre-endodontic build-up. The system is based on two clinically relevant parameters: the number of missing coronal walls and the position of the restorative margin relative to the gingival tissues. The classification categorizes defects from Type I, in which all coronal walls remain present, to Type V, characterized by complete loss of coronal walls (Fig. 1, panel A). Each category is further subdivided according to whether the restorative margin is located supragingivally, equigingivally, or

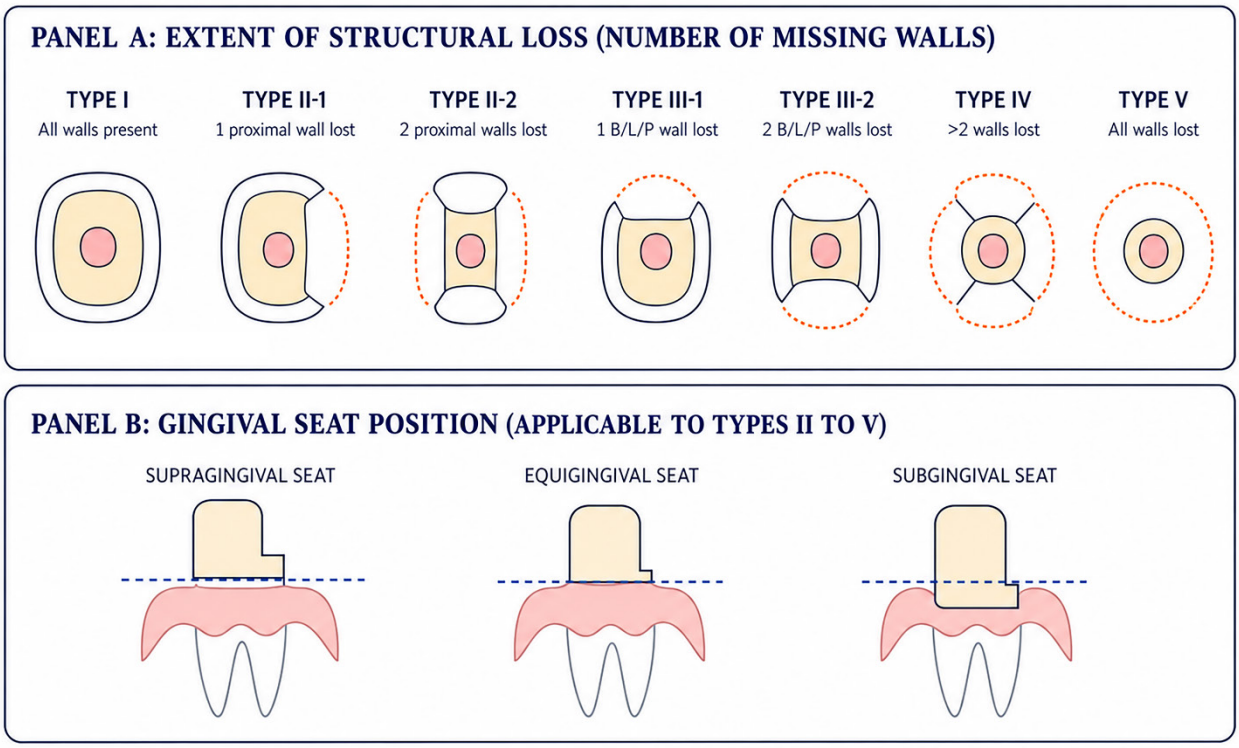


Fig. 1. Schematic classification of pre-endodontic build-up according to coronal wall loss and gingival seat position (modified from Khanvilkar et al. (2024)). Panel A illustrates the extent of structural loss based on the number and location of missing cavity walls. Type I represents an occlusal cavity with all walls present and varying levels of dentin loss. Type II-1 and Type II-2 represent loss of one or both proximal walls, respectively. Type III-1 and Type III-2 represent loss of one or two buccal (B), lingual (L), or palatal (P) walls, respectively. Type IV represents loss of more than two walls with residual coronal structure remaining. Type V represents complete loss of cavity walls. Panel B illustrates the position of the restorative margin relative to the free gingival margin: supragingival, equigingival, or subgingival.

subgingivally (Figure 1, panel B), for consistency.

The value of this classification lies in its ability to provide a standardized description of structural loss while linking the extent of destruction to the anticipated complexity of reconstruction. As the number of missing walls increases and defect margins extend apically, both restorative and endodontic procedures become progressively more challenging.

Influence of gingival extension of structural loss on treatment planning

In addition to the amount of remaining tooth structure, the apico-coronal position of the defect margin is a critical determinant of treatment complexity. Teeth requiring root canal treatment frequently present with structural loss extending beyond the cemento-enamel junction and, in some cases, into the subgingival environment. As defect margins extend apically, restorative procedures become progressively more challenging because access, visualization, isolation, and matrix adaptation are more difficult to achieve.

An important consideration is the relationship between the restorative margin and the supracrestal tissue attachment. Violation of this anatomical complex may result in persistent inflammation, attachment loss, bleeding on probing, and compromised periodontal health. Hence, careful clinical and radiographic assessment is required before selecting the restorative approach in teeth presenting with deep cervical destruction (Ricucci & Grosso 2006; Moreira et al. 2023; Khanvilkar et al. 2024).

Contemporary adhesive techniques have expanded the treatment options available for managing subgingival defects. Deep margin elevation (DME) and cervical margin relocation (CMR) allow

relocation of cervical margins to a more coronal position through adhesive composite reconstruction, facilitating isolation and subsequent restorative and endodontic procedures while preserving sound tooth structure (Dietschi & Spreafico 1998; Magne 2005). However, when structural loss extends close to the alveolar crest or compromises the supracrestal tissue attachment, periodontal procedures such as surgical crown lengthening (Qali et al., 2024) or orthodontic extrusion (Bosly et al., 2023) may be required to establish a maintainable restorative environment.

Evaluation of defect depth is not always possible through clinical and radiographic examination alone. In many cases, the restorative prognosis becomes evident only after complete caries excavation and exposure of sound tooth structure. A frequent finding is localized gingival inflammation associated with carious lesions and plaque accumulation, resulting in tissue edema that may hinder matrix adaptation and isolation (Figs. 6G; 7B–C). Initial management should therefore include elimination of local inflammatory factors through debridement (Fig. 6F), removal of carious tissue, and replacement of defective restorations when indicated. Resolution of inflammation often improves soft-tissue conditions and may significantly simplify subsequent restorative procedures (Fig. 6L–M).

As a general rule, when heavy plaque accumulation and pronounced gingival inflammation with bleeding are present, preliminary periodontal hygiene therapy should be performed before pre-endodontic build-up. Reduction of the inflammatory burden frequently improves soft-tissue conditions, facilitating isolation and matrix adaptation and increasing the predictability of subsequent restorative procedures.

In selected cases, limited soft-tissue recontouring may further improve access to sound tooth structure and facilitate matrix placement (Figs. 7D; 8D; 9C). Nevertheless, situations may arise in which restorative margins become clinically accessible but complete rubber dam isolation remains unattainable. When technically feasible, placement of a matrix system without rubber dam isolation may represent a pragmatic alternative to more invasive procedures such as surgical crown lengthening (Figs. 7D; 8D; 9C–D). The choice should be guided by a careful evaluation of the restorative, endodontic, and periodontal implications of each treatment option.

Case series

Case 1 involved the maxillary second premolar of a 63-year-old woman diagnosed with symptomatic irreversible pulpitis and normal periapex. A periapical radiograph revealed an existing mesial amalgam restoration and a large distal interproximal carious lesion extending close to the pulp chamber and apically into the cervical region (Fig. 2A). Based on the radiographic examination alone, the extent of pulpal involvement could not be determined with certainty. The patient was informed that an attempt would be made to preserve pulp vitality through pulpotomy; however, treatment would be converted to pulpectomy if a clear transition between vital and necrotic/infected pulp tissue could not be identified.

Following local anesthesia and rubber dam isolation (Fig. 2B), access to the carious lesion was established (Fig. 2C). The bulk of the decayed tissue was removed using low-speed burs under water spray in the superficial portion and sharp hand excavators in the deepest portion. This procedure revealed a substantial pulpal exposure caused by the carious process (Fig. 2D). A partial pulpotomy was attempted using a high-speed diamond bur under copious water irrigation. However, the pulp chamber tissue exhibited advanced degenerative changes, preventing identification of a continuous zone of vital, blood-filled pulp tissue and indicating the need for pulpectomy. To facilitate isolation, a waxed floss ligature was placed around the cervical aspect of the tooth, exposing the sound cervical margin (Fig. 2E).

Although optimal isolation had been achieved and single-visit endodontic treatment was feasible, a pre-endodontic build-up was performed to further enhance isolation and asepsis during root canal instrumentation. The build-up transformed the access cavity into a four-walled preparation to reduce the risk of coronal leakage during temporization,

and improve the structural integrity of the remaining tooth tissue. Prior to the build-up procedure, the pulpotomy wound was covered with chemically pure calcium hydroxide powder to achieve hemostasis. The cavity margins were refined using a sonic tip (SFD7, Komet Dental, Lemgo, Germany) mounted on an air scaler (SONICflex 2003 L; KaVo Dental GmbH, Biberach, Germany). A Slick Bands™ Tofflemire-Style Matrix (Garrison Dental Solutions, Spring Lake, MI, USA) was then tightly adapted to the cervical box using a matrix retainer (Fig. 2F). Under magnification, part of the cervical box margin was found to be devoid of enamel, with the cavosurface margin located in dentin (Fig. 2F).

Bonding procedures were performed under optimal clinical conditions. The distal wall was initially rebuilt with resin composite for approximately 2 mm in the coronal direction. Subsequently, a second matrix band was adapted to complete reconstruction of the distal wall and establish an adequate proximal contact (Composi-Tight® 3D Fusion™ Full Curve Matrix, Garrison Dental Solutions, Spring Lake, MI, USA). The matrix was stabilized with a wooden wedge (Kerr Corporation, Orange, CA, USA) (Fig. 2G). The distal wall, marginal ridge, and proximal contact were then completed using resin composite, followed by finishing and polishing procedures (Fig. 2H–I).

Root canal orifices were prepared at the end of this session (Fig. 2J). A cotton pellet moist with metacresylacetate (Cresatina®, Ogna Laboratori Farmaceutici, Muggiò, MB, Italy) was placed over the canal orifices and the access was temporized with Cavit™ (3M ESPE, Seefeld, Germany). A post-operative radiograph obtained after the build-up procedure confirmed optimal adaptation of the restorative material and appropriate proximal contour (Fig. 2K).

Working length determination was performed at a subsequent visit. The root canals were instrumented



Fig. 2. (A) Preoperative radiograph. (B) Isolation of the operative field. (C) Access to the carious lesion. (D) Pulp exposure following caries excavation. (E) Hemostasis achieved and isolation enhanced with a ligature. (F) Matrix band closely adapted to the gingival margin.

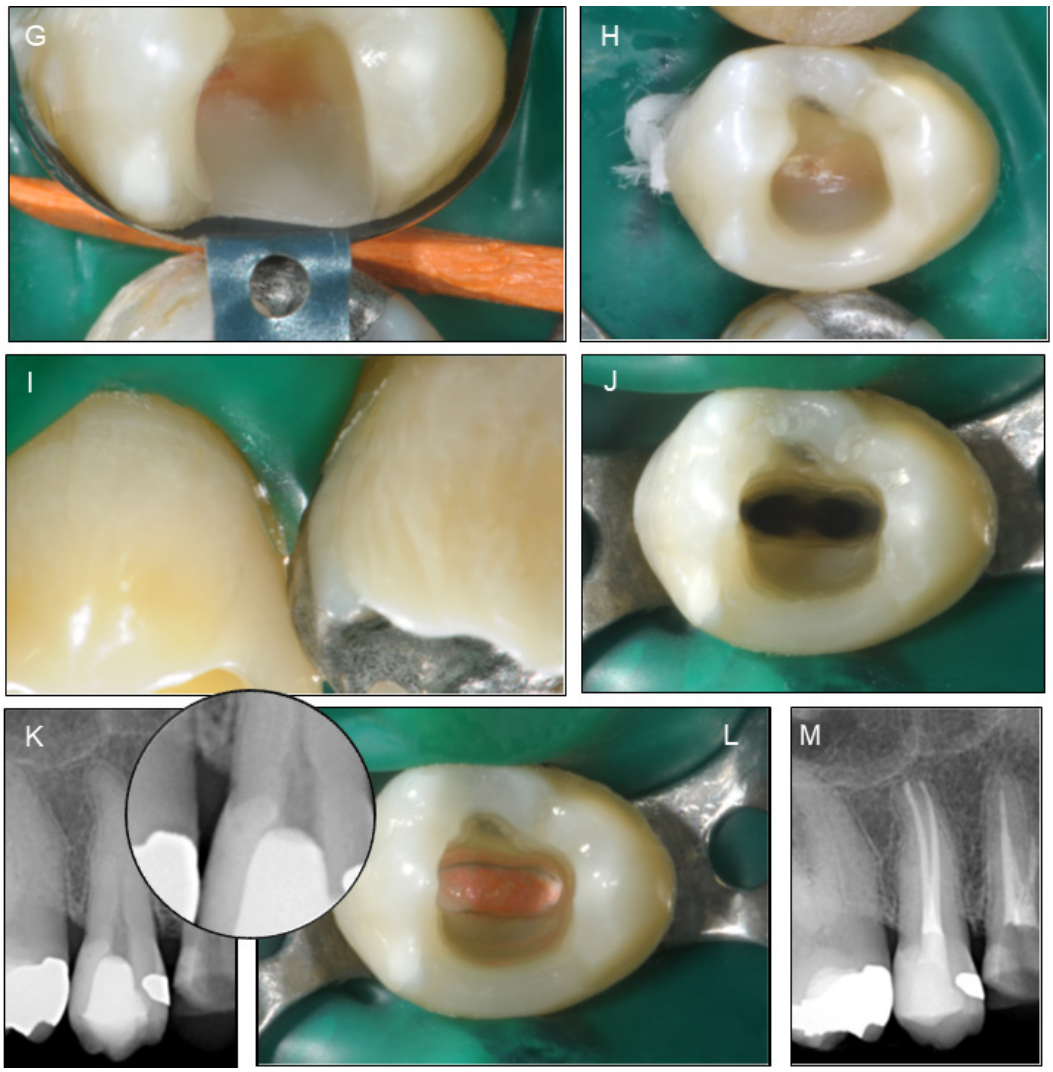


Fig. 2. (continued) (G) Placement of a second matrix after reconstruction of the distal wall emergence profile. (H) Distal wall build-up completed and polished. (I) Close-up view of the palatal profile demonstrating optimal composite adaptation. (J) Preparation of the canal orifices. (K) Radiograph obtained after completion of the build-up. (L) Pulp chamber view following root canal obturation. (M) Postoperative radiograph.

and obturated using a calcium silicate–based sealer and single-cone technique (Fig. 2L). The access cavity was restored with resin composite (Fig. 2M).

Considerations. This case would be classified as a Type II-1 defect according to Khanvilkar et al., (2024). Although the gingival seat was located subgingivally, the gingival margin of the cavity could be exposed and adequately isolated using a ligature. Consequently, a single-visit root canal treatment approach would have been feasible. Nevertheless, the pre-endodontic build-up provided several clinical advantages that facilitated treatment and contributed to an optimal outcome.

Case 2. A 67-year-old man presented with severe spontaneous dental pain but was unable to identify the offending tooth. The maxillary second premolar did not respond to cold testing, while heat testing elicited delayed, intense, and lingering pain. The tooth was tender to both vertical and lateral percussion. A periapical radiograph revealed a large recurrent carious lesion located apical to a distal composite restoration and extending close to the pulp chamber, along with widening of the apical periodontal ligament space (Fig. 3A).

The tooth was diagnosed as pulp necrosis and symptomatic apical periodontitis. Root canal

treatment was recommended. Following local anesthesia and rubber dam isolation, the existing restoration was removed and carious tissue excavated until sound dentin was reached at the cavity floor. The pulp chamber was exposed and contained avascular pulp tissue. Although the cavity floor could be adequately isolated for root canal treatment to be initiated immediately, the apical extent of the defect and the possibility of requiring intracanal medication favored performing a pre-endodontic build-up before canal treatment.

A procedure similar to that described in Case 1 was carried out. A matrix band was placed and stabilized with a sectional ring (Fig. 3B), and the distal anatomic contour was reconstructed and polished. Canal negotiation, working length determination, and chemomechanical preparation were then completed (Fig. 3C). The canals were medicated with calcium hydroxide mixed with sterile saline to a creamy consistency, and the access cavity was temporarily sealed.

The patient's symptoms resolved following this intervention. One week later, the canals were obturated using a bioceramic sealer and single-cone technique (Fig. 3D). For patient convenience, the definitive coronal restoration was placed at a subsequent appointment (Fig. 3E). At the two-year follow-up, the tooth remained asymptomatic, and the periapical radiograph demonstrated normal periapical conditions (Fig. 3F).

Considerations. Similar to Case 1, this case would be classified as a Type II-1 defect according to Khanvilkar et al. (2024), with a subgingival defect extent that remained amenable to isolation and

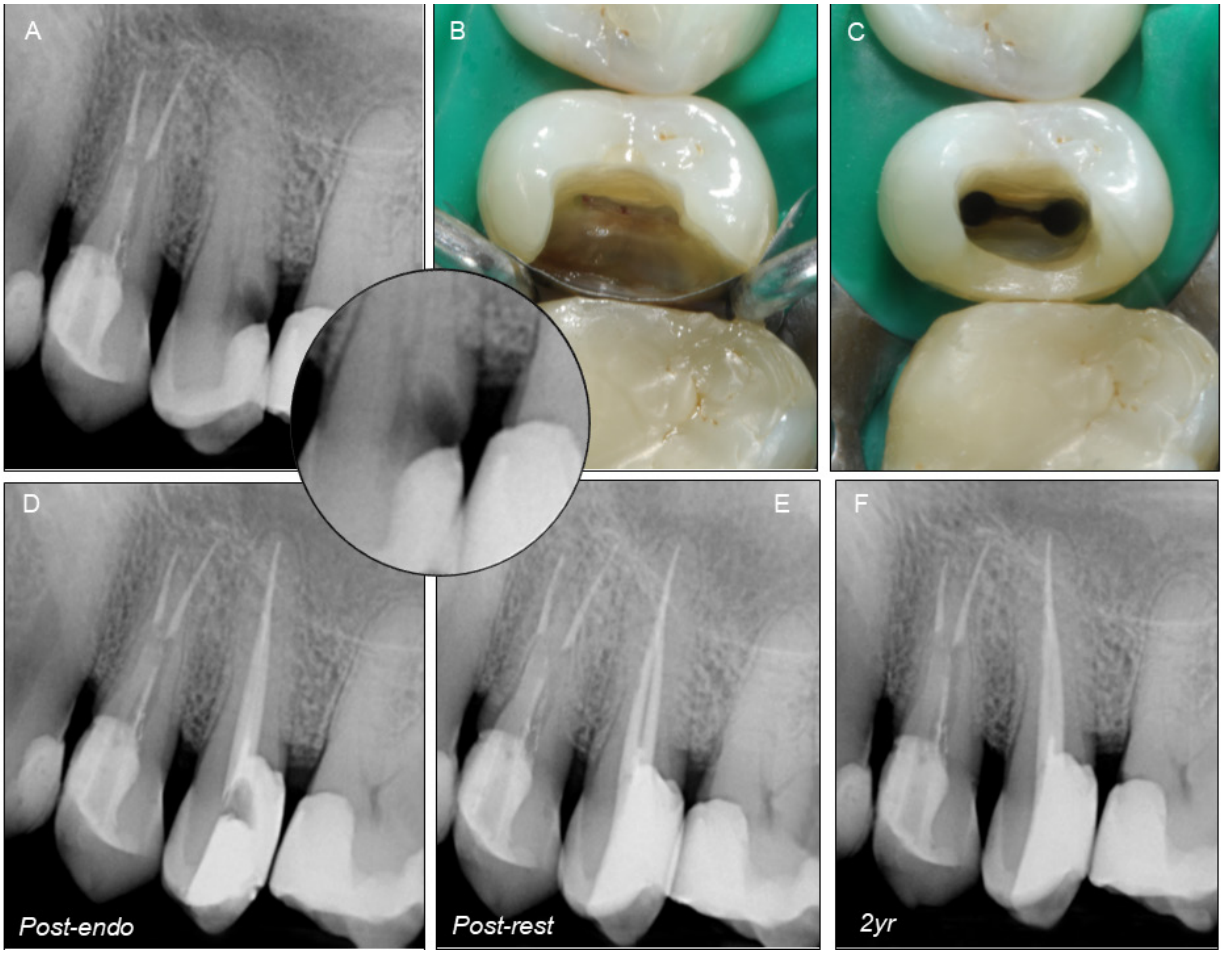


Fig. 3. (A) Preoperative radiograph showing a large recurrent carious lesion and widening of the apical periodontal ligament space. (B) Matrix band stabilized with a sectional ring prior to pre-endodontic build-up. (C) Completion of build-up and orifice preparation. (D) Radiograph obtained after root canal filling with a bioceramic sealer and single-cone technique. (E) Radiograph following definitive coronal restoration. (F) Two-year follow-up radiograph showing normal periapical conditions.

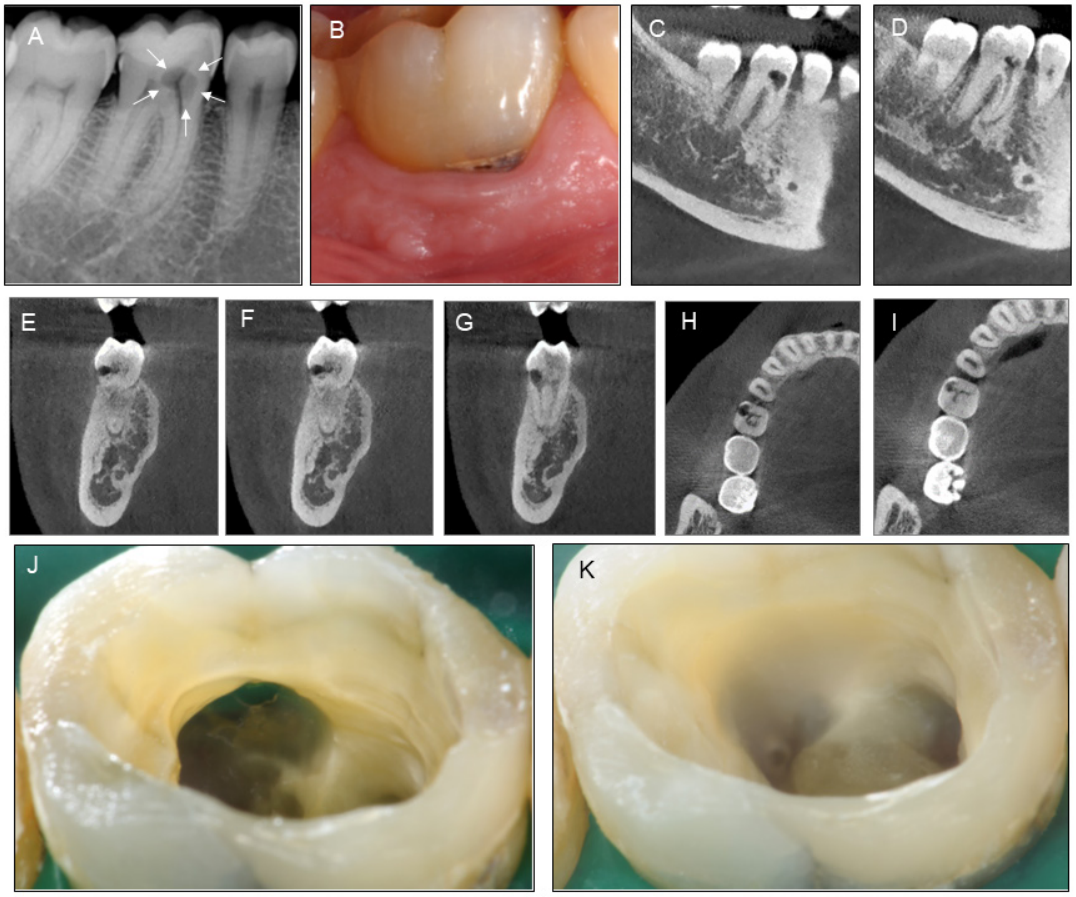


Fig. 4. (A) Preoperative radiograph. (B) Clinical view showing a small buccal nodular elevation, crown discoloration, and a cervical opening. (C–I) CBCT images demonstrating external cervical invasive resorption extending through the buccal dentinal wall and communicating with the pulp chamber. (J) Access and debridement of the resorptive tunnel from within the pulp chamber. (K) Reconstruction of the buccal wall with bonded composite resin.

restorative management. However, because of the presence of pulp necrosis and infection, and the consequent need for intracanal medication, a pre-endodontic build-up was strongly indicated. This procedure substantially reduces the risk of bacterial leakage associated with the inadequate adaptation of temporary restorative materials to a subgingival cavity floor. It also reinforces the remaining tooth structure.

Case 3. A 48-year-old man presented with pain associated with his mandibular first molar, which had undergone caries treatment approximately two years earlier. A periapical radiograph revealed a deep composite restoration and a radiolucent area superimposed over the mesial aspect of the pulp chamber (Fig. 4A). The tooth did not respond to thermal testing and exhibited slight tenderness to percussion. Clinical examination revealed a buccal swelling suggestive of a healed sinus tract that was not actively draining, along with a grayish discoloration of the crown and a small opening at the cemento-enamel junction (Fig. 4B). No periodontal pocketing was detected around the tooth or in association with the opening, with probing depths not exceeding 2 mm.

The tooth was diagnosed as external cervical invasive resorption (ECIR) associated with pulp necrosis. A cone beam computed tomography scan was requested. The scan revealed a resorptive tunnel extending through the buccal dentinal wall and communicating with the pulp chamber (Fig. 4C–I). Because this well-defined resorptive lesion was largely confined to the cervical region and exhibited

little or no extension into the radicular dentin, it was classified as a Heithersay Class 2 ECIR defect (Heithersay 1999). The treatment plan included root canal therapy. As a preliminary step, the existing resin composite restoration was removed, and the resorptive tunnel was accessed from within the pulp chamber. The defect walls were debrided with low-speed round burs up to the buccal portal of entry, which was located just coronal to the gingival sulcus (Fig. 4J). The buccal wall was then reconstructed with an adhesively bonded resin composite. (Fig. 4K).

The subsequent step involved removal of the defective restorative material on the distolingual aspect of the tooth (Fig. 4L–M). Existing crack lines were minimally extended with a thin fissure bur. The canal orifices were protected with calcium hydroxide prior to reconstruction of the distal and lingual walls (Fig. 4N). The restored walls were carefully finished and polished, after which root canal treatment was completed over two appointments (Fig. 4O–Q). The pulp chamber was then restored with adhesively bonded resin composite. A clinical photograph of the buccal aspect demonstrated recovery of the normal crown color (Fig. 4R). Prosthetic preparation was subsequently performed (Fig. 4S), and treatment was completed with cementation of a zirconia-ceramic full crown (Fig. 4T).

Considerations. In cases like this, a large resorptive defect communicates with the gingival sulcus and is accompanied by a defective restoration and crack lines. Elimination of infection sources and closure of potential bacterial leakage pathways through

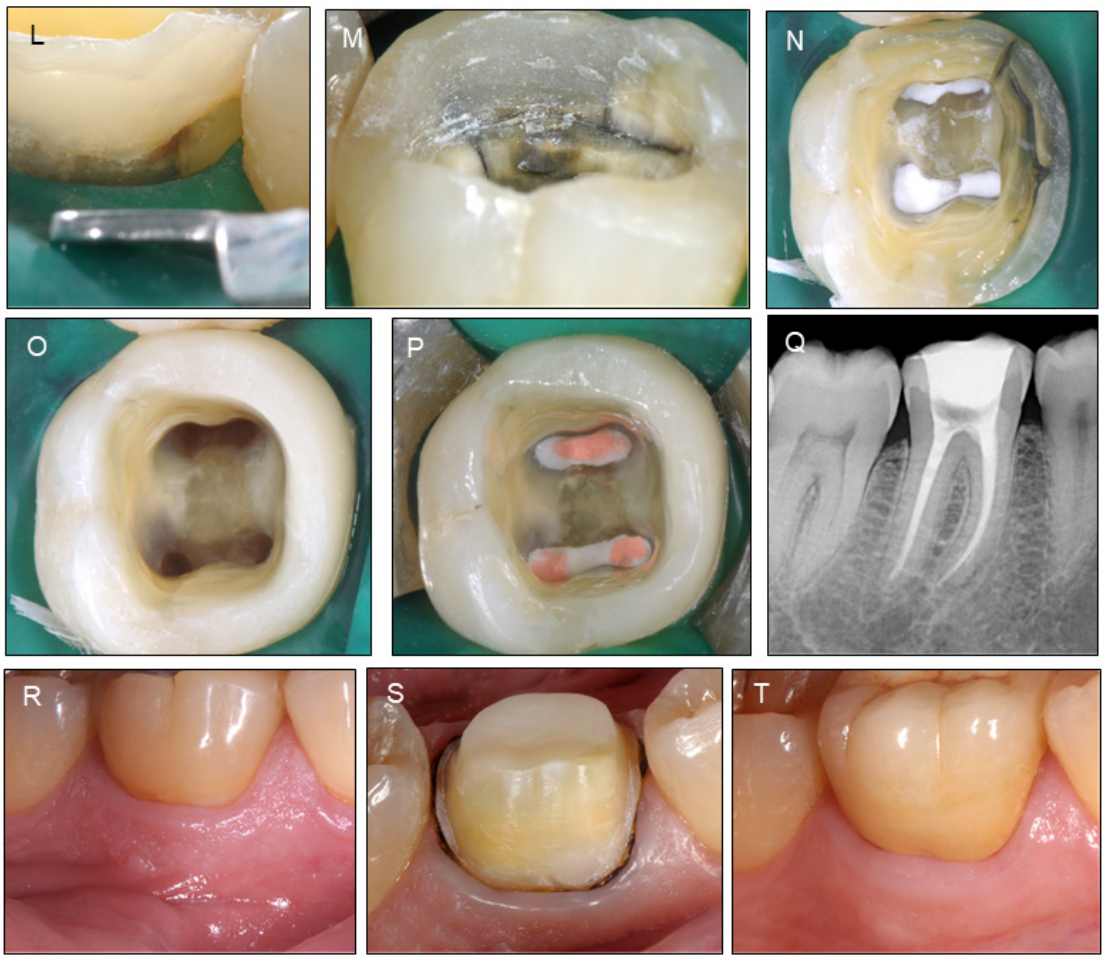


Fig. 4. (continued) (L–M) Defective distolingual restoration and identification of crack lines. (N) Protection of the canal orifices before reconstruction of the distal and lingual walls. (O–Q) Root canal treatment procedures and postoperative radiograph. (R) Buccal view showing recovery of normal crown color after restoration. (S) Prosthetic preparation. (T) Definitive zirconia-ceramic full crown.

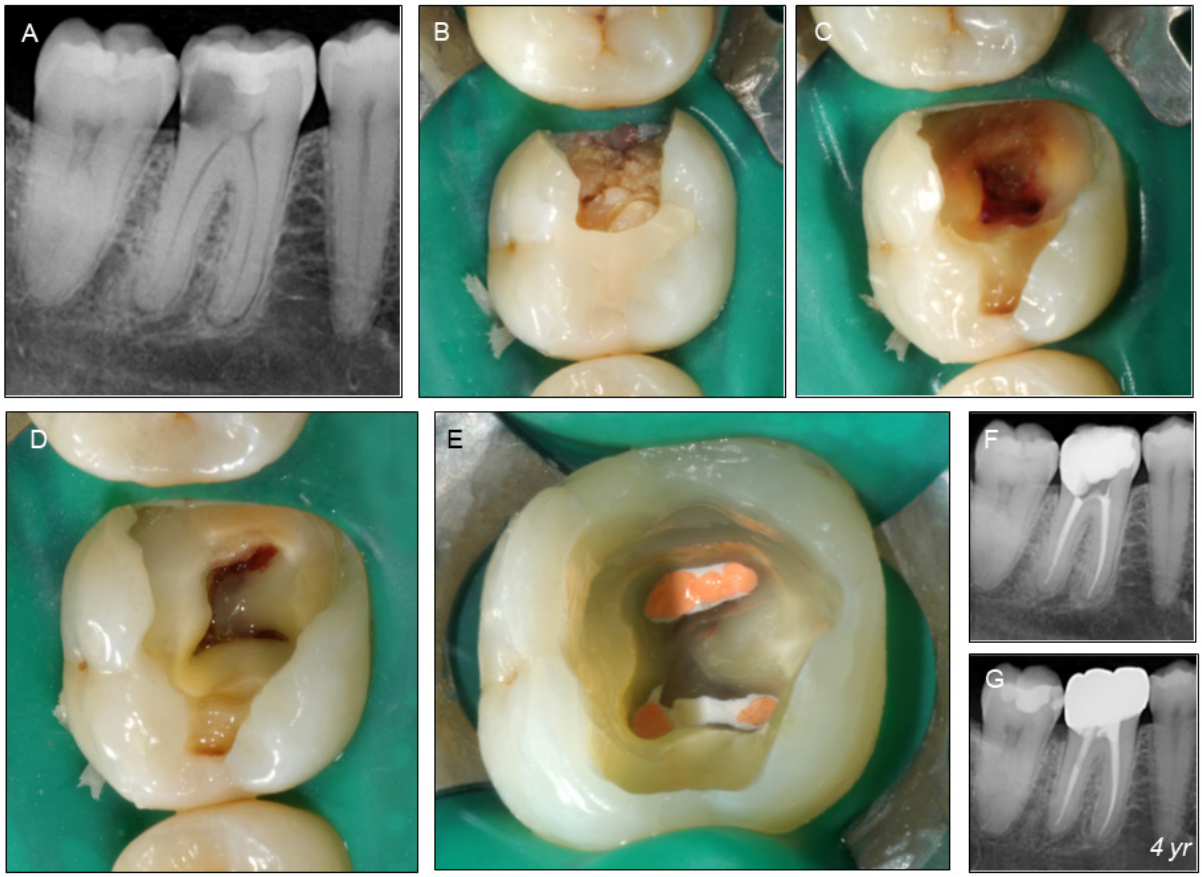


Fig. 5. (A) Preoperative radiograph showing extensive distal caries with pulp chamber involvement and periapical changes. (B) Access to the lesion revealing extensive soft carious dentin. (C) Absence of the pulp chamber roof after initial excavation. (D) Complete caries removal and elimination of unsupported distolingual enamel. (E) Pre-endodontic build-up of the distal and distolingual walls. (F) Postoperative radiograph following root canal treatment. (G) Four-year follow-up radiograph showing normal periradicular conditions. (Modified from Ricucci et al 2026, with permission)

a pre-endodontic build-up should therefore be considered mandatory from both biological and microbiological perspectives. By re-establishing a four-walled access cavity, the procedure creates a more favorable environment for root canal treatment. In addition, these preliminary measures substantially facilitate the endodontic workflow by enabling reliable isolation and providing stable reference points for working length determination and instrument manipulation. It should be noted that the management approach presented in this case of ECIR is applicable primarily to selected lesions, such as Heithersay Class II defects, and may not be appropriate for more advanced lesions with a less favorable prognosis.

Case 4. A 32-year-old woman presented with a mandibular first molar diagnosed with irreversible pulpitis. The preoperative radiograph revealed an extensive distal carious lesion extending into the pulp chamber, along with periapical changes (Fig. 5A). The treatment plan included root canal therapy followed by full-coverage crown restoration.

After administration of local anesthesia, rubber dam isolation of the quadrant, and access to the lesion, a large mass of soft carious dentin was encountered (Fig. 5B). Following gross caries removal and elimination of the remaining restorative material, the roof of the pulp chamber was found to be completely absent (Fig. 5C). Complete caries excavation was then performed, together with removal of the thin unsupported distolingual enamel (Fig. 5D).

At the completion of caries removal, isolation remained suboptimal despite the use of a cervical ligature. Therefore, the pulp tissue was protected



Fig. 6. (A–B) Preoperative clinical views showing extensive amalgam restorations and fracture of the buccal cusp of the second premolar. (C) Preoperative radiograph demonstrating marked reduction of the pulp chamber volume and absence of periapical pathology. (D–E) Removal of existing restorations. (F) Removal of subgingival calculus deposits. (G) Caries excavation revealing extensive loss of coronal tooth structure and subgingival cavity margins. (H–I) Pre-endodontic build-up of both premolars using circumferential matrices and composite resin. (J) Pulpectomy performed after coronal reconstruction. (K) Post-endodontic radiograph. (L–M) Prosthetic preparation and improved periodontal tissue conditions prior to impression making.

and a pre-endodontic build-up of the missing distal and distolingual walls was carried out. This reconstruction re-established the coronal contours and facilitated completion of root canal treatment at subsequent appointments under straightforward isolation of the individual tooth (Fig. 5E). A post-operative radiograph was then obtained (Fig. 5F).

Following root canal treatment, a glass fiber post was placed in the distal canal, and the coronal structure was rebuilt with resin composite. Prosthetic preparation was subsequently performed, and treatment was completed with cementation of a zirconia-ceramic crown. The tooth remained asymptomatic at the four-year follow-up. Radiographic examination demonstrated normal periradicular conditions (Fig. 5G).

Considerations. The condition of this tooth is difficult to categorize within the Khanvilkar et al. classification. This case exemplifies a clinical scenario in which a pre-endodontic build-up offers clear procedural advantages. By re-establishing the missing coronal walls prior to root canal treatment, the procedure significantly improves isolation and moisture control, facilitates rubber dam management, and creates a more contained and predictable operative field. In addition, the reconstructed walls provide stable reference points for access refinement, canal location, working length determination, and instrument manipulation.

Case 5. A 60-year-old woman presented after noticing the fracture of the buccal cusp of a maxillary premolar. She expressed a desire to replace metallic restorations that had been in service for more than 30 years with tooth-colored restorations. Clinical

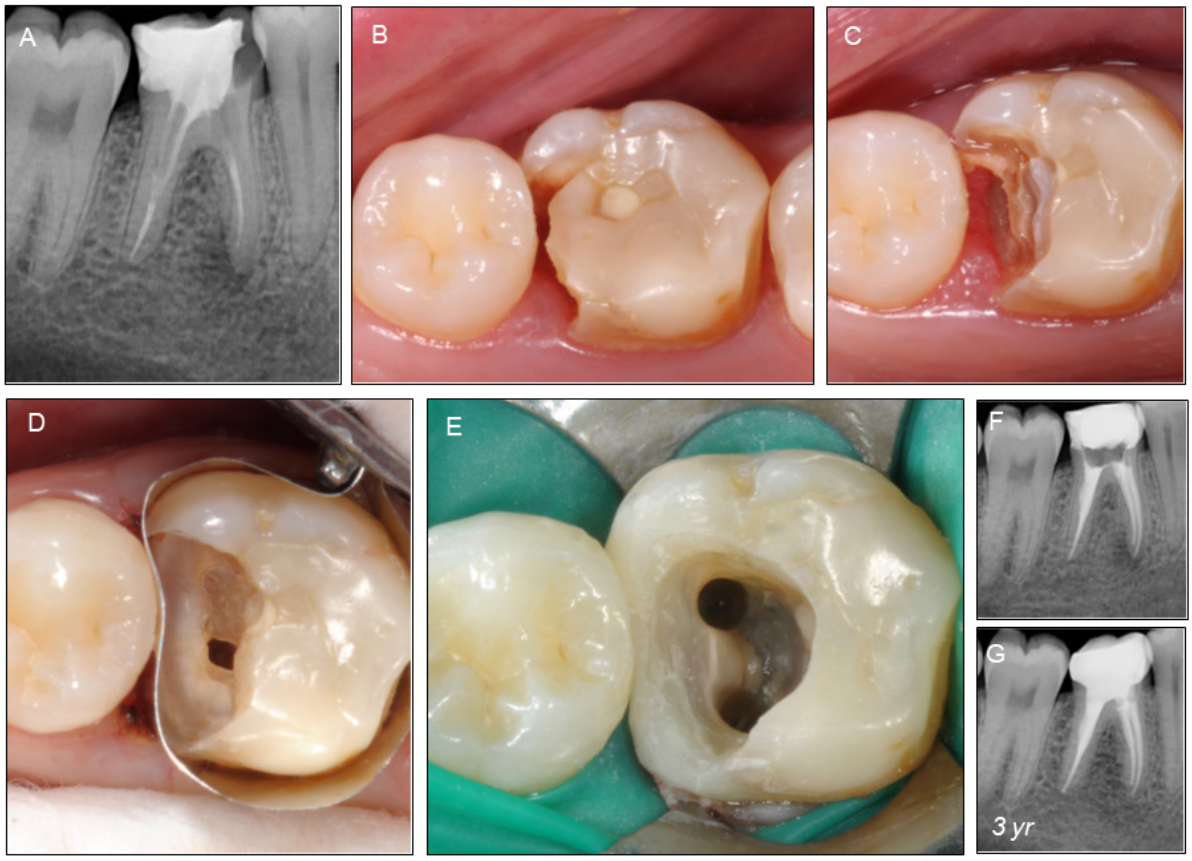


Fig. 7. Management of a previously root canal–treated mandibular first molar requiring retreatment and pre-endodontic build-up. (A) Preoperative radiograph showing a periapical radiolucency associated with the mesial root, a large mesial cavitated lesion, and a post in the distal root. (B) Clinical view showing gingival tissue proliferation into the cavity. (C) Removal of part of the existing composite restoration, confirming that gingival overgrowth impeded isolation. (D) Matrix placement following electrosurgical exposure of the cervical margin. (E) Endodontic retreatment initiated after mesial wall reconstruction and rubber dam placement. (F) Postoperative radiograph after obturation. (G) Three-year follow-up radiograph demonstrating complete periapical healing. (Modified from Ricucci et al 2026, with permission)

examination revealed extensive interproximal amalgam restorations on both maxillary premolars and the first molar, together with fracture of the buccal cusp of the second premolar (Fig. 6A–B). The patient reported that all teeth were asymptomatic and denied any history of spontaneous pain or discomfort. Both premolars responded weakly to pulp sensibility tests.

Radiographic examination showed no evidence of periapical pathology and revealed marked reduction in pulp chamber volume in both premolars, consistent with extensive tertiary dentin deposition (Fig. 6C).

The treatment plan included replacement of the first molar amalgam with an MO resin composite restoration and restoration of both premolars with full-coverage crowns. Because of the extensive loss of tooth structure and the anticipated need for substantial prosthetic preparation, preventive root canal treatment was planned for both premolars.

Following local anesthesia, the existing restorations were removed without rubber dam isolation to enable direct assessment of the underlying cavity dentin (Fig. 6D–E). The interdental periodontal tissues were then examined, and large deposits of subgingival calculus were removed using curettes (Fig. 6F). Residual carious tissue beneath the restorations was meticulously excavated (Fig. 6G). This procedure confirmed the extremely limited amount of remaining coronal tooth structure and revealed that the interproximal cavity margins of both premolars were located subgingivally, largely as a consequence of inflammation and edema of the interdental papillae (Fig. 6G). The cavities were temporarily restored with Cavit™ and the patient was instructed to improve oral hygiene.

A pre-endodontic build-up was performed at a subsequent appointment, following local anesthesia and rubber dam isolation. The cusps were reduced to facilitate future prosthetic preparation, and the remaining dentin and enamel were thoroughly cleaned. Circumferential matrix bands (AutoMatrix®, Dentsply Caulk) were then placed, and both premolars were sequentially rebuilt with resin composite (Fig. 6H–I). The reconstructed coronal walls subsequently allowed pulpectomy of both premolars to be carried out under optimal isolation conditions and with stable coronal reference points for endodontic procedures (Fig. 6J–K). The root canal orifices were intentionally left unfilled to maximize composite retention, and the access cavities were restored with bonded resin composite. Prosthetic preparation was then performed, followed by placement of provisional crowns. This approach promoted resolution of the periodontal inflammation and allowed maturation of the soft tissues, resulting in optimal periodontal conditions for impression making after a few weeks (Fig. 6L–M).

Considerations. Similar to Case 4, the condition of these two premolars would be difficult to categorize within the Khanvilkar et al. classification. The defects correspond most closely to type II-2 but are further complicated by the absence of the buccal wall in the second premolar and the need to remove the very thin residual buccal and palatal enamel walls in the first premolar, as well as the palatal wall in the second premolar. Nevertheless, successful isolation of both teeth enabled reconstruction of the missing walls with resin composite. This provided aseptic operating conditions, stable reference points for working length determination and instrument manipulation, and allowed placement of the temporary restoration within a four-walled access cavity.

Case 6. A 26-year-old man presented with a complaint of food impaction in a cavity of the mandibular right first molar during mastication. The diagnostic radiograph revealed a previously root canal–treated tooth with a periapical radiolucency associated with the mesial root and a large cavitated lesion on the mesial aspect of the crown. A post was present in the distal root (Fig. 7A). Clinical examination showed gingival tissue proliferation into the cavity, obscuring the cervical margin of the tooth (Fig. 7B). Nonsurgical root canal retreatment was planned.

The treatment plan included nonsurgical root canal retreatment followed by cuspal coverage. Preliminary procedures to facilitate rubber dam isolation were considered necessary. Access to the

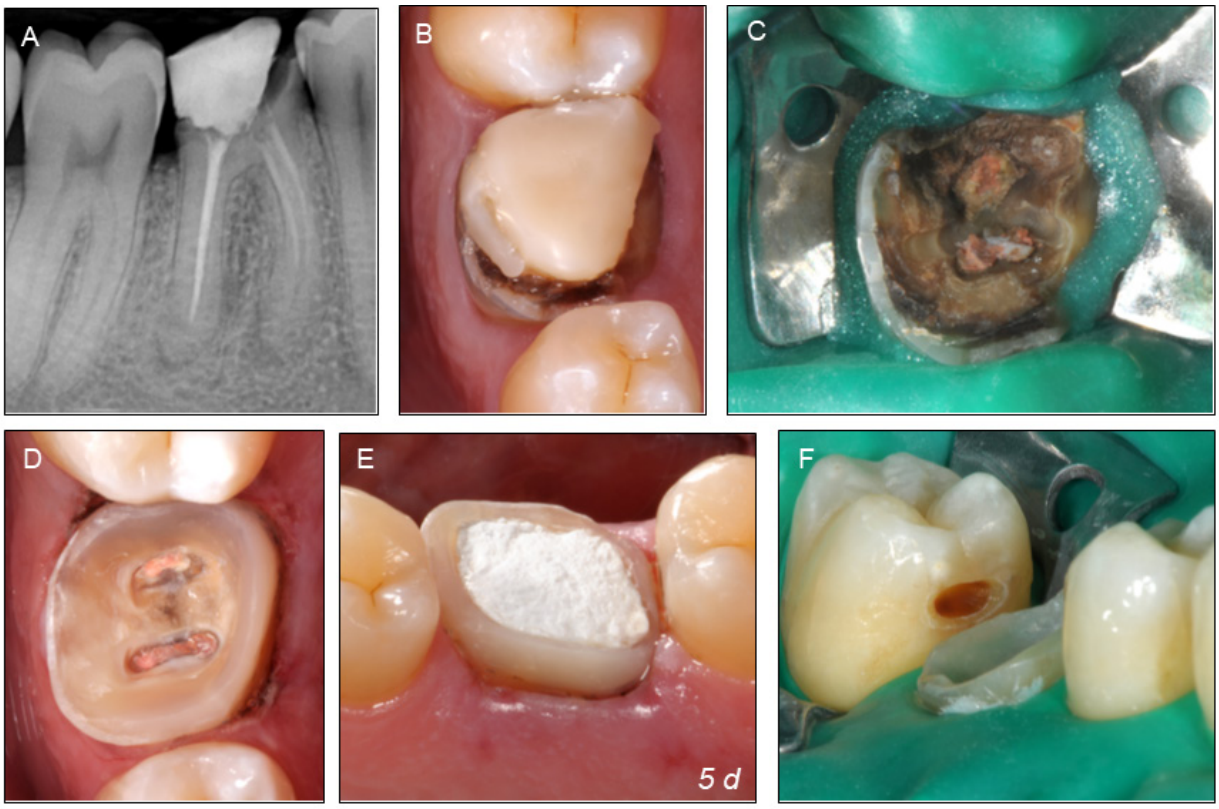


Fig. 8. Management of a severely broken-down mandibular first molar requiring retreatment and pre-endodontic build-up. (A) Preoperative radiograph showing inadequate root canal treatment and periapical radiolucencies associated with both roots. (B) Clinical view showing complete loss of the coronal walls and residual composite surrounded by carious tissue. (C) Defect margins extending below the gingival level, preventing rubber dam isolation. (D) Circumferential composite build-up following caries excavation and electrosurgical gingivectomy. (E) Gingival healing after 5 days. (F) Rubber dam isolation achieved after healing.

mesial cavity, achieved by removing a portion of the existing composite restoration, confirmed that the gingival overgrowth would interfere with proper isolation (Fig. 7C). Carious tissue was excavated, and electrosurgery was carefully performed to expose the cervical margin on the mesial surface without violating the periodontal attachment. This allowed placement of a matrix band (Fig. 7D) and reconstruction of the mesial wall with resin composite. Because of the apical extension of the mesial defect margin, placement of a rubber dam was not feasible during the pre-endodontic build-up procedure. Nevertheless, every effort was made to minimize moisture contamination during the adhesive procedures. Following refinement and polishing of the build-up, root canal retreatment was initiated under optimal isolation conditions (Fig. 7E). The root canals were obturated after two weeks of calcium hydroxide medication (Fig. 7F), and the crown was subsequently restored. At the three-year follow-up, complete periapical healing was observed (Fig. 7G).

Considerations. Ideally, adhesive build-up procedures should be performed under rubber dam isolation. In this case, however, the apical position of the mesial margin precluded dam placement before reconstruction. The decision to proceed with the build-up under carefully controlled relative isolation was based on the need to create a coronal wall that would permit rubber dam placement and optimal asepsis during retreatment. The favorable three-year outcome suggests that this compromise was clinically acceptable in the present case.

Case 7. A 34-year-old man requested restoration of a previously treated, severely broken-down mandibular first molar. A periapical radiograph revealed inadequate root canal treatment and



Fig. 8. (continued) (G–I) Canal instrumentation during retreatment. (J–K) Root canal obturation. (L) Composite restoration of the pulp chamber. (M–N) Adhesively cemented lithium disilicate crown. (O) Two-year follow-up radiograph showing healthy periapical conditions.

periapical radiolucencies associated with both roots (Fig. 8A). Clinical examination showed complete loss of the coronal walls, with residual composite material surrounded by carious tissue (Fig. 8B). The treatment plan included nonsurgical root canal retreatment followed by restoration with a full-coverage crown.

After removal of the existing restorative materials, it became evident that rubber dam isolation could not be achieved because the defect margins extended well below the gingival margins (Fig. 8C). It was decided to proceed with complete caries excavation. A cautious gingivectomy was performed using electrosurgery. This enabled circumferential exposure of sound tooth structure, although rubber dam isolation remained unfeasible at this stage. A tightly adapted matrix was then placed under careful moisture control, allowing reconstruction of 2–3 mm of the missing coronal walls circumferentially with resin composite. The build-up was subsequently finished and polished (Fig. 8D), and the access cavity was temporized. After five days, gingival healing

was progressing satisfactorily (Fig. 8E), and the tooth could then be isolated readily with a rubber dam (Fig. 8F). After removal of the root filling materials, the canals were instrumented (Fig. 8G–I) and medicated with calcium hydroxide. Root canal obturation was performed two weeks later (Fig. 8J–K). The pulp chamber was subsequently restored with resin composite (Fig. 8L), followed by tooth preparation for full-coverage restoration. After impression taking, a lithium disilicate crown was fabricated and adhesively cemented (Fig. 8M–N). A two-year follow-up radiograph demonstrated normal periapical conditions, and the tooth remained asymptomatic (Fig. 8O).

Considerations. Similar to the previous case, a compromise was required, as the initial build-up had to be performed without rubber dam isolation. The deep subgingival extension of the defect precluded immediate dam placement. Nevertheless, reconstruction of the coronal walls was necessary to create the conditions for subsequent isolation and retreatment. This approach allowed preservation of the tooth and avoided the need for periodontal surgical procedures, such as crown lengthening, to expose the defect margins. Careful moisture control during the build-up phase and definitive treatment under rubber dam isolation resulted in a favorable clinical and radiographic outcome.

Case 8. A 38-year-old woman presented with fracture of a resin composite restoration and food impaction in a mandibular first molar. A periapical radiograph revealed a periapical radiolucency associated with the distal root and separated instruments within the mesial root canals (Fig. 9A). The treatment plan included nonsurgical root canal retreatment followed by restoration with a full-coverage crown. Access to the pulp chamber was established as a preliminary step (Fig. 9B), and all existing restorative materials were removed. This procedure revealed that the lingual defect margin extended well below the gingival level. Consequently, gingivectomy was performed using electrosurgery to expose sound tooth structure (Fig. 9C). Because rubber dam isolation could not be achieved initially, a matrix band was tightly secured with a matrix retainer under careful moisture control. This enabled reconstruction of the missing coronal walls with composite resin (Fig. 9D). The build-up was then finished and polished (Fig. 9E), after which ideal rubber dam isolation could be established (Fig. 9F). Root canal retreatment, including removal of the separated instruments, was completed during subsequent visits (Fig. 9G). The pulp chamber was then restored with resin composite, and the tooth was rehabilitated with a zirconia-based porcelain crown (Fig. 9H). At the two-year follow-up, the tooth was asymptomatic, and radiographic examination demonstrated ongoing healing of the periapical radiolucency (Fig. 9I).

Considerations. In this case, the deep lingual extension of the defect prevented rubber dam placement at the outset of treatment. Although performing the pre-endodontic build-up without rubber dam isolation represented a compromise, reconstruction of the missing walls was necessary to create the conditions required for definitive isolation. Careful moisture control and a tightly adapted matrix allowed establishment of a stable coronal build-up, after which ideal rubber dam isolation could be achieved for retreatment. The favorable clinical and radiographic outcome suggests that this staged approach provided an acceptable solution when immediate isolation was not feasible.

Discussion

Preservation of structurally compromised teeth requires close integration of endodontic and restorative procedures (Gavriil et al., 2021). Although successful elimination of infection and adequate root canal obturation remain fundamental objectives of endodontic treatment, long-term tooth survival depends equally on the ability to restore and maintain the remaining tooth structure. The cases presented in this article illustrate how pre-endodontic adhesive reconstruction can facilitate both biological and technical aspects of treatment by re-establishing coronal integrity before initiation or completion of root canal therapy.

Traditionally, root canal treatment is performed



Fig. 9. Management of a mandibular first molar requiring endodontic retreatment and pre-endodontic build-up. (A) Initial periapical radiograph showing a periapical radiolucency associated with the distal root and separated instruments in the mesial root canals. (B) Access cavity preparation and removal of existing restorative materials. (C) Electrosurgical gingivectomy to expose sound tooth structure. (D) Reconstruction of missing coronal walls with composite resin using a matrix band under moisture control. (E) Finished and polished composite build-up. (F) Rubber dam isolation achieved after coronal reconstruction. (G) Completion of nonsurgical endodontic retreatment with removal of separated instruments. (H) Definitive restoration with composite resin core and zirconia-based porcelain crown. (I) Two-year follow-up radiograph demonstrating healing of the periapical radiolucency. (Modified from Ricucci et al 2026, with permission)

before definitive restoration of the tooth. However, this sequence may be problematic when extensive coronal destruction is present. Loss of coronal walls compromises isolation, reduces structural stability during treatment, and often necessitates placement of temporary restorations in cavities with unfavorable geometry. In contrast, reconstruction of missing walls before root canal treatment creates a more contained operative field, improves access and visibility. This procedure also allows more predictable placement of temporary restorations when multiple visits are required. The clinical cases presented here demonstrate these advantages across a spectrum of structural defects ranging from localized proximal destruction to near-complete loss of the clinical crown.

The extent and distribution of structural loss are major determinants of treatment complexity. While the quantity of remaining tooth structure has long been recognized as an important factor influencing fracture resistance and restorative prognosis, its effect on the technical execution of endodontic procedures is often underappreciated. Missing walls and marginal ridges reduce the ability of a clinician to maintain asepsis, manipulate instruments, and establish stable reference points for working length determination. Reconstructing lost coronal structures before root canal treatment can restore these reference points and improve the predictability of endodontic procedures. Moreover, re-establishing missing coronal walls facilitates maintenance of an irrigant reservoir within the pulp chamber, improving irrigant containment and potentially enhancing the effectiveness of irrigation during canal preparation. In the present series, the benefits of reconstruction became progressively more evident as the severity of structural compromise increased.

Among the factors influencing treatment planning, the apico-coronal position of defect margins deserves particular attention. Defects extending toward or below the gingival margin present challenges related to access, visualization, matrix adaptation, and moisture control. Furthermore, the relationship between restorative margins and the supracrestal tissue attachment must be carefully evaluated to avoid compromising periodontal health. Contemporary adhesive techniques such as DME (Aldakheel et al., 2022; Taylor & Burns, 2024) and CMR (Ghezzi et al., 2019; Geo et al., 2023) have expanded the range of defects that can be managed conservatively. Nevertheless, clinical decision-making is dependent on the depth and configuration of the defect, the condition of the surrounding periodontal tissues, and the feasibility of obtaining adequate isolation. The cases presented here illustrate that management of the soft tissues, including removal of inflammatory enlargement and limited gingivectomy when indicated, may substantially improve access to sound tooth structure and facilitate restorative procedures.

A particularly important clinical issue highlighted by several cases is the relationship between adhesive reconstruction and rubber dam isolation. Ideally, all adhesive procedures should be performed under rubber dam isolation to maximize bond quality and minimize contamination. However, severely compromised teeth occasionally present a paradoxical situation in which rubber dam placement is impossible until sufficient coronal structure has first been rebuilt. Cases 6 through 8 exemplify this dilemma. In these situations, a carefully controlled compromise was adopted: the initial build-up was performed under meticulous moisture control and with tightly adapted matrix systems, with the primary objective of creating conditions that would subsequently permit ideal rubber dam isolation. Although this approach deviates from the ideal restorative protocol, it allowed definitive endodontic treatment to be completed under optimal aseptic conditions. The favorable clinical and radiographic outcomes observed during follow-up suggest that such a staged approach may be a reasonable alternative when immediate isolation is not feasible. Nevertheless, further research is needed to evaluate the long-term performance of adhesive restorations placed under these challenging circumstances.

The biological rationale for pre-endodontic reconstruction extends beyond improvements in isolation and clinical convenience. Coronal leakage has long been recognized as a potential source of endodontic contamination and treatment failure (Gillen et al., 2011). Reconstruction of missing walls

before root canal treatment can reduce pathways for bacterial ingress and improve adaptation of temporary restorative materials, particularly in teeth requiring multiple treatment visits. This consideration may be especially important in cases of pulp necrosis, retreatment, cervical resorption, and extensive carious destruction, where bacterial contamination of both the root canal system and surrounding structures is already established. By restoring coronal integrity at an early stage, the clinician may improve the microbiological environment in which endodontic treatment is performed.

The cases presented also reinforce the importance of restorability assessment before initiating endodontic treatment. Endodontic diagnosis alone does not determine whether a tooth can be predictably maintained in function. Careful evaluation of the quantity, distribution, and quality of the remaining tooth structure, together with periodontal and restorative considerations, should precede treatment decisions. Advances in adhesive dentistry have expanded the range of teeth that can be preserved through conservative means. Several cases in this series involved teeth that would historically have been considered questionable candidates for retention, yet successful rehabilitation was achieved through a combination of adhesive reconstruction, endodontic treatment, and definitive cuspal coverage.

The classification proposed by Khanvilkar et al. (2024) provides a useful framework for describing structural defects and planning pre-endodontic build-up procedures. The present cases generally support the clinical relevance of considering both the number of missing walls and the position of restorative margins. However, the series also highlights certain limitations of the classification. Several cases could not be categorized easily because treatment complexity was influenced by factors not directly incorporated into the system, including the presence of cracks, external cervical resorption, complete loss of the pulp chamber roof, periodontal inflammation, previous endodontic treatment, and the feasibility of achieving isolation. These observations suggest that although classification systems can facilitate communication and treatment planning, comprehensive clinical evaluation remains essential.

From a practical perspective, the cases demonstrate that treatment planning should remain flexible until complete caries excavation and removal of defective restorative materials have been performed. The true extent of structural loss and the relationship of defect margins to the gingival tissues are often impossible to determine accurately from clinical and radiographic examination alone. Consequently, the final restorative strategy frequently becomes apparent only after exposure of sound tooth structure. In many situations, pre-endodontic reconstruction should be viewed not as an optional adjunctive procedure but as an integral component of treatment that contributes directly to both endodontic and restorative success.

The present article has several limitations. As a clinical case series, it does not permit direct comparison with alternative treatment approaches or establish causal relationships between pre-endodontic build-up and treatment outcomes. The cases represent a heterogeneous group of clinical situations with varying degrees of structural loss, different treatment objectives, and different follow-up periods. In addition, long-term survival of the adhesive reconstructions themselves was not specifically evaluated. Prospective clinical studies are needed to determine the influence of pre-endodontic build-up on treatment efficiency, coronal leakage, restoration longevity, and long-term tooth survival.

Within these limitations, the cases presented support the concept that pre-endodontic adhesive reconstruction can play an important role in the management of structurally compromised teeth. By facilitating isolation, improving asepsis, restoring structural integrity, and creating a more predictable restorative-endodontic workflow, rebuilding the tooth before the root canal may enhance both the technical execution of treatment and the long-term prognosis of the restored tooth.

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