

A Collaborative Approach: Managing Bilateral Palatogingival Grooves in Maxillary Lateral Incisors - A Case Report

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Abstract

Background: This case report describes a collaborative, interdisciplinary approach to managing severe Bilateral Palatogingival Grooves (BPGGs) in maxillary lateral incisors. The treatment addressed complexities of combined periodontal-endodontic lesions, including a broken instrument fragment and the potential need for improved regenerative outcomes by utilizing newer dental materials. **Materials and Methods:** A detailed clinical presentation is provided, encompassing recent diagnostic techniques, treatment planning, and a novel collaborative strategy involving both endodontic and periodontal expertise under a dental operating microscope. Techniques for retrieving the broken file fragment and managing BPGGs with Emdogain® (Straumann AG, Basel, Switzerland) and Biodentine® (Bioactive Dentin Substitute Septodont) are outlined. **Results:** The minimally invasive approach successfully retrieved the broken file fragment and achieved complete sealing of the severe Palatogingival Grooves (PGGs) extending to the root apices. Follow-up revealed no sinus tract formation, reduced periodontal pocket depth, and near-complete periapical healing in both teeth. **Conclusion:** This rare case demonstrates an innovative interdisciplinary collaboration in managing complex BPGGs with the additional complication of broken instruments. The use of Emdogain for periodontal regeneration in a severe Type III PGG and newer biosilicate cement with improved handling properties facilitated the preservation of a natural tooth that would otherwise be required by an implant or fixed partial denture therapy.

Keywords: Biodentine, Emdogain, Endodontic microsurgery, File retrieval, Multidisciplinary approach, Palatogingival groove.

INTRODUCTION

Palatogingival grooves (PGGs), also known as palatal radicular grooves, distolingual grooves, or radicular lingual grooves, are developmental anomalies affecting the lingual surfaces of maxillary central and lateral incisor roots. Black (1908) first identified and described these grooves, with a reported prevalence ranging from 2.8% to 18%.^[1-10] PGGs can manifest on various tooth surfaces. They can be mesial, distal, or facial on central incisors (facial radicular grooves) and present unilaterally or bilaterally.^[2] In addition, maxillary second molars may also exhibit PGGs.^[2,3]

The exact cause of PGGs remains unclear. While the prevailing theory links their development to the invagination of the enamel organ or Hertwig epithelial root sheath during odontogenesis.^[3,4] Notably, a study documented an 18% prevalence of distolingual grooves in a Chinese population, suggesting a potential ethnic association that warrants further investigation.^[2]

The groove originates in the central fossa and traverses the cingulum and extends apically along the cemento-enamel

junction (CEJ) with variable lengths and depths.^[1-6] Their clinical significance lies in their ability to harbor microorganisms, plaque and debris within the V-shaped notch, potentially leading to localized periodontitis, with or without pulpal involvement.^[3] The depth, extent and complexity of the groove directly influence this risk.^[3-6]

Several classification systems exist for PGGs.^[6] Gu's classification (2011) categorizes PGG into three types (Table 1) based on groove depth, length and root canal complexity.^[1]

PGGs in maxillary incisors present a significant diagnostic and treatment planning challenge. Existing literature, primarily

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Table 1: Gu's Classification

Classification	Feature
Type I	Short groove confined to the coronal third of the root with a normal root canal anatomy
Type II	Long groove exceeding the coronal third but remaining shallow, with either a normal or uncomplicated root canal configuration
Type III	Long and deep grooves extending beyond the coronal third, are often associated with a complex root canal anatomy

documented through case reports, details a spectrum of treatment approaches tailored to the groove's severity.^[7,8] These modalities range from surgical interventions, such as resection of accessory roots, curettage, odontoplasty (saucerization), and periodontal guided tissue regeneration (GTR) techniques utilizing various biomaterials to intentional reimplantation.^[9,10]

CASE REPORT

This case report presents a patient with rare bilateral maxillary lateral incisors exhibiting Type II and Type III PGGs. This anatomical complexity was further compounded by a fractured endodontic file fragment lodged within the apical third of one of the root canals. The patients received treatment at the Department of Conservative Dentistry and Endodontics, New Horizon Dental College and Research Institute, Sakri, Bilaspur, India. Both cases involved combined periodontal-endodontic lesions with periodontal breakdown associated with severe PGGs, as confirmed by clinical and radiographic examinations. This report investigates the efficacy of periodontal GTR employing a combination of Emdogain and biosilicate cement for groove closure. Following a detailed explanation of the procedure, potential benefits and risks including written informed consent was obtained from the patient.

A 33-year-old female patient presented to our department with a chief complaint of pain and pus discharge from tooth #22 for 5 days. Her dental history revealed root canal treatment was performed on tooth #22 6 months prior. Clinical Examination revealed a discolored tooth with an open access cavity, moderate percussion pain and tenderness on palpation. Sinus tract was present on the buccal aspect of tooth #22 (Figure 1a). Periodontal probing was within normal limits, except for an 8-mm narrow periodontal pocket located on the palatal surface of the tooth that was concomitant with the PGG (Figure 1c). The contralateral aspect of the tooth was subsequently probed for periodontal probing depth, revealing a pocket depth of 9-mm on the palatal surface (Figure 1d and e). An intraoral periapical (IOPA) radiograph revealed evidence of prior incomplete endodontic treatment with periapical radiolucency and an extruded endodontic instrument (Figure 1i). It disclosed a parallel radiolucent line to the root canal and teardrop periapical radiolucency with tooth #22 and tooth #12 (Figure 1g-i). Cone-beam computed tomography (CBCT) revealed a radiolucent groove on the palatal surface of the root extending up to the root apex on both teeth (Figure 1f, j and k). A combined

endodontic-periodontal lesion was identified (Figure 1m). There was a 2-degree resorption of the palatal alveolar bone (Figure 1l). Following comprehensive clinical and radiographic examinations, both cases received a diagnosis of a combined periodontal-endodontic lesion associated with significant periodontal breakdown secondary to the severe PGG.

Initially, phase-I periodontal treatment was performed to improve the patient's oral hygiene. Following thorough debridement with a Gracey curette, Periodontal Plus AB (Advanced Biotech Products, Chennai, India) was placed within the deepened periodontal pockets of both teeth (Figure 2a). Subsequently, under rubber dam isolation (Coltene AG, Altstätten, Switzerland), the endodontic intervention was commenced on tooth #22 and tooth #21. Initially, attempts to retrieve the fractured instrument fragment within tooth #22 through a non-surgical approach were unsuccessful. Efforts to bypass the fragment also proved infeasible due to the presence of root resorption confirmed by a periapical radiograph (Figure 2b).

Two weeks following the initial procedure, surgical intervention was undertaken to address the fractured instrument fragment within the root canal and radicular groove management of tooth #22. Intrasulcular incisions were made to reflect a labial flap. Utilizing a surgical operating microscope (Labomed Prima Dnt., Mumbai, Maharashtra, India) for enhanced visualization, the endodontic file fragment was identified and showed that the injury communicated with a labial cortical fenestration. Following visualization, meticulous removal of the fractured instrument fragment was performed (Figure 2c and d).

A bone grafting material (Novabone, PerioGlas, Jacksonville, FL, US) was then placed within the fenestrated area to promote healing. In addition, GelSpon (Eucare Pvt. Ltd, Chennai, India) was utilized to enhance graft stability (Figure 2e). Subsequent radiographic evaluation confirmed successful placement (Figure 2f) and the surgical site was then sutured following the closure of the labial flap.

An additional palatal flap reflection revealed a groove on the palatal root aspect (Figure 2g). Odontoplasty, a surgical procedure to reshape the groove, was subsequently performed (Figure 2h). After complete isolation with Teflon tape, the groove was sealed with biodentin (Figure 2i). The defect was sutured with 3-0 Polyglactin 910 (Aspiron, Gujarat, India) (Figure 2j). Periodontal dressings (Coe-Pak, Ward's Wondrpak and Peripac) were given to promote healing (Figure 2k).

A post-operative medicinal regimen was prescribed to minimize the risk of infection. Gentle toothbrushing was recommended, with the surgical site being meticulously avoided for the initial 48 h. To further augment oral hygiene, the use of 0.12% chlorhexidine gluconate mouthrinse was also advised.

The sutures were removed after 10 days and a post-operative radiograph confirmed the placement of MTA within the canal till the CEJ (Figure 2l). The coronal groove was sealed with

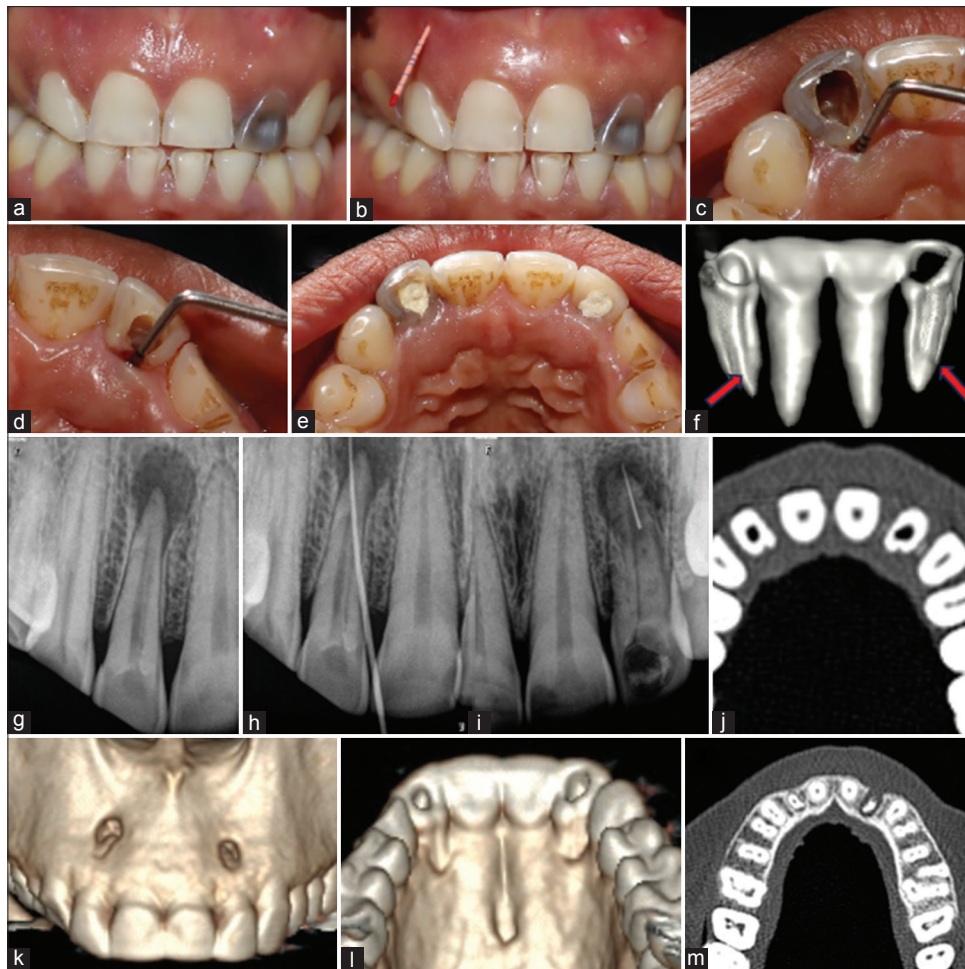


Figure 1: Preoperative clinical and radiographic findings: (a) Intraoral photograph (labial view) demonstrates discoloration of tooth #22 and the presence of sinus tracts associated with teeth #12 and #22. (b) Reveals gutta-percha cone tracing. (c-e) Intraoral photographs (Palatal view) depict deep periodontal pockets (9 mm and 8 mm, respectively) within the PGGs of teeth #12 and #22. (f) Cone-beam computed tomography (CBCT) image reveals a tooth with a severe PGG extending from the cingulum to the root apex in tooth #12 and a similar groove reaching near the apex in tooth #22. (g-i) Periapical radiographs demonstrate a para-pulpal radiolucency and periapical radiolucency with gutta-percha cone tracing to the apex in tooth #12 and periapical radiolucency associated with a separated endodontic instrument was evident in tooth #22. (j and k) CBCT images show classic "V" shaped notches within the PGGs and resorption of the labial cortical plate on both sides of teeth #12 and #22. (l) CBCT palatal view reveals resorption of the palatal cortical plate. (m) CBCT section highlights a combined periodontal-endodontic lesion with resorption of the labial cortical plate

a definitive restorative material, GIC Type II (GC, Tokyo, Japan) (Figure 2m).

The access cavity was made with tooth #21, Working length determination (Root ZX, J. Morita Mfg. Corp., Kyoto, Japan), and Chemomechanical preparation was done using hand K file 70/0.02% (Mani Inc, Japan) with standard irrigation protocol by ultrasonic (Orikam Eighteenth Ultra X) activation. After drying the canals with paper points, a calcium hydroxide (Avuecal, Dental Avenue, India) dressing was placed for 7 days. Upon revaluation, a noticeable reduction in inflammation and gingival firming was observed. Calcium hydroxide dressing was removed and irrigation was done using 3% NaOCl (Parcan, Septodont, USA) and 17% EDTA (Prevest DenPro, USA). Root canal obturation was done using a lateral condensation technique with a Bio-C Sealer (Angelus, Londrina, PR, Brazil), the tooth was sealed using temporary restorative

material (Cavitemp; Ammdent, India) and IOPA was taken (Figure 3a).

For the surgical management of the opposite side of the PGG with tooth #12, intrasulcular incisions were made to reflect a palatal flap that allowed access to the deep periodontal groove. Intrasulcular incisions were made to reflect a palatal flap that allowed access to the deep periodontal groove (Figure 3b). Subsequently, odontoplasty of the groove was performed using a size #2 round diamond bur, Emdogain was applied within the defect, and partially mixed with bone graft material before placement (Figure 3c-e). A GTR membrane (Gore-Tex non-resorbable barrier) was positioned between the tooth and flap (Figure 3f), which was then approximated and sutured with 3-0 Polyglactin 910 suture (Aspiron, Gujarat, India) (Figure 3g).

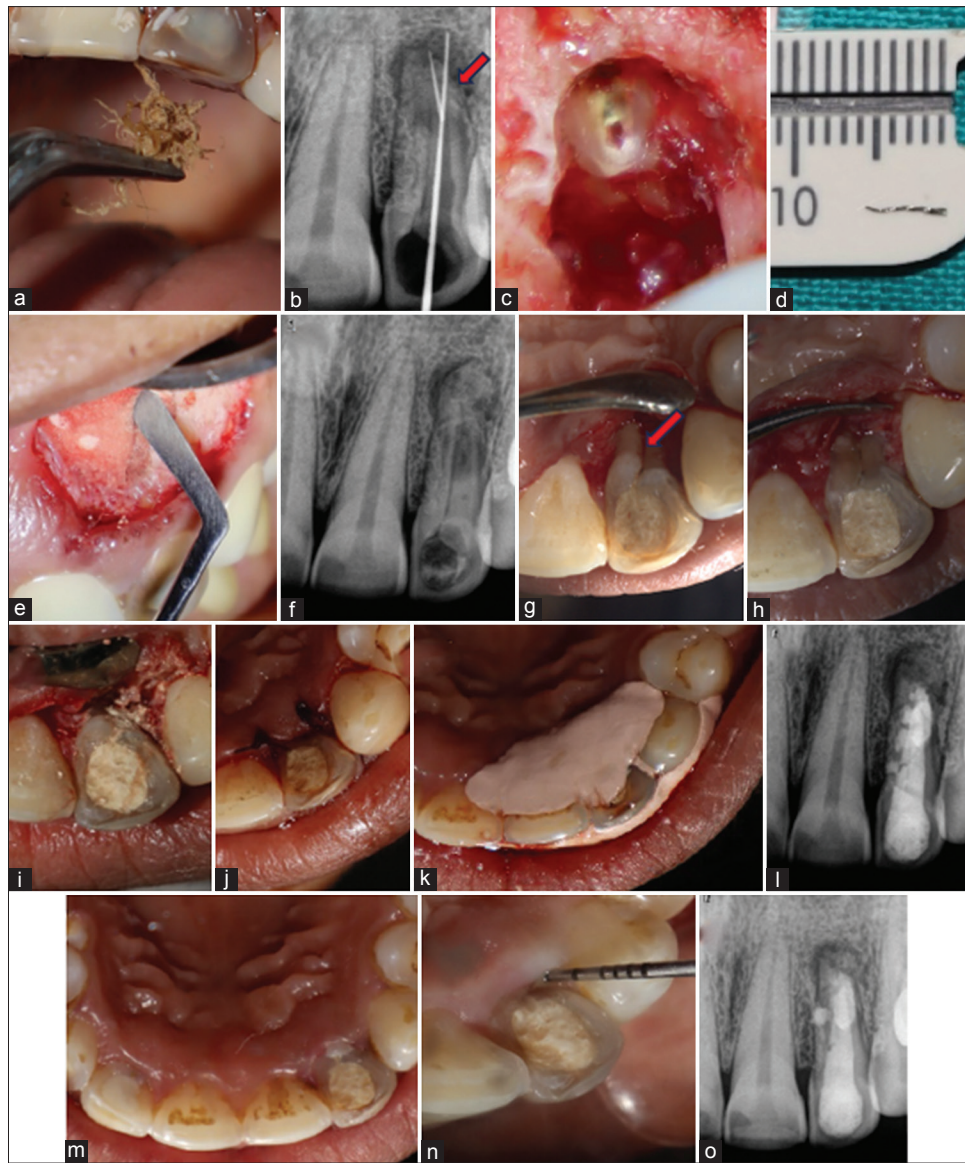


Figure 2: Treatment sequence of tooth #22 (a) Intraoperative photograph demonstrates placement of tetracycline fibers 2 weeks before surgical intervention. (b) A preoperative periapical radiograph reveals a resorbed root surface indicating the path of the extruded endodontic file through the root structure. (c and d) A 3 mm root resection with successful retrieval of the 6 mm separated file fragment from the root apex using Stieglitz forceps. (e) A CollaPlug was placed to achieve stability of bone graft material. (f) A subsequent periapical radiograph confirms the removal of the fractured instrument. (g) The surgical exposure of the PGG as denoted by an arrow for clarity. (h-j) A series of photographs show the odontoplasty procedure, followed by the definitive sealing of the groove with Biodentin and subsequent suturing of the surgical site. (k) The placement of a periodontal pack to facilitate healing. (l) Post-operative periapical radiograph confirms repair of resorption site with MTA. (m) Depicts the sealing of the coronal groove with glass ionomer cement. (n and o) Follow-up intraoral picture and radiograph after 6 months, demonstrated progressive healing with a marked reduction in pocket depth and near-normal periapical tissue

Post-operative instructions and medications were provided to the patient. Immediate post-operative radiograph is shown in (Figure 3h). Subsequent evaluations at the 3rd and 6th months demonstrated the continued absence of the sinus tract, reduction in probing depth around tooth #12 and a significant reduction in the size of the periapical radiolucency as confirmed by radiographic imaging (Figure 3i and j).

Following the observed improvement in pocket depth around teeth #12 and #22, zirconia prosthesis was cemented with resin cement (Multilink, Ivoclar Vivadent). A CBCT scan was then acquired, as shown in (Figure 4a-l).

DISCUSSION

An optimal treatment strategy for a PGG should encompass:

The eradication of bacterial plaque and calculus within the radicular groove, achieved through thorough debridement and subsequent sealing to prevent recolonization.^[6-13]

The promotion of periodontal tissue regeneration leads to improved patient clinical outcomes.^[6]

The management of the coronal portion of the groove through appropriate cleaning and sealing techniques to prevent bacterial recolonization.^[6]

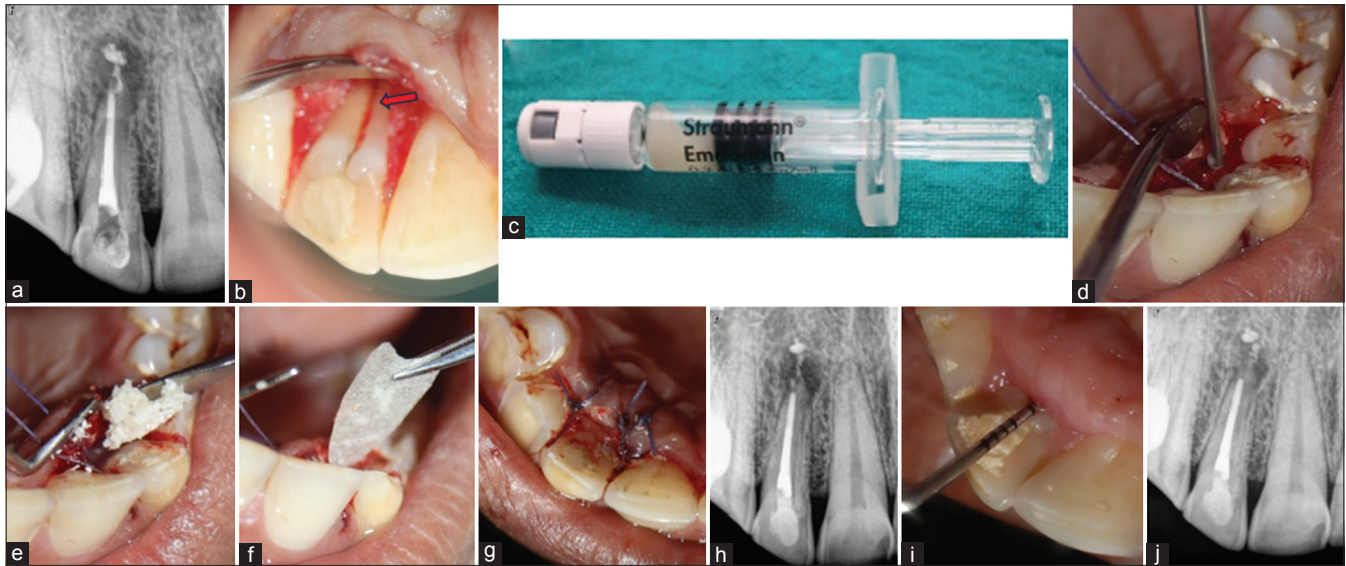


Figure 3: Treatment sequence of tooth #21 (a) Preoperative radiograph confirms root canal treatment completion in tooth #12. (b) Highlights the surgical opening of the PGG. (c) Photograph of Emdogain material. (d and e) Odontoplasty procedure with subsequent placement of Emdogain within the defect and placement of bone graft material mixed with Emdogain. (f) The placement of a GTR membrane. (g) Suturing of the surgical site. (h) A radiograph was taken immediately after the procedure. (i and j) follow-up intraoral picture and radiograph after 6 months, demonstrating progressive healing with a marked reduction in pocket depth and near-normal periapical tissue

It is important to acknowledge that while various treatment options, both surgical and non-surgical, can achieve satisfactory clinical results, complete periodontal and periapical healing, particularly concerning periodontal tissue regeneration, may remain elusive due to inherent limitations and associated defects within each approach.^[6,18,17]

This report presents a rare bilateral case classified as Gu Type II or III. Consistent with prior research, root canal treatment alone is likely insufficient for these Gu Type II or III cases and a combined endodontic-periodontal approach is recommended.^[1,4,8,15,16]

The prognosis for teeth with PGGs is primarily dictated by the severity of periodontal disease and the characteristics of the groove itself. Intentional replantation, while potentially an option for complex PGG cases carries inherent drawbacks such as the increased risk of root resorption, ankylosis, and surgical complexity. In addition, this approach may not address existing buccal bone resorption. In contrast, periodontal flap surgery with bone grafting offers a predictable and tooth-preserving approach for managing severe bone loss associated with type III PGGs. This technique boasts a high success rate (between 89% and 95%)^[12] due to its ability to address both the groove and the bone defect directly. Furthermore, advancements in microsurgical endodontics, including the use of diagnostic tools, such as the operating microscope, staining agents, ultrasonic instrumentation, and biocompatible root-end filling materials, have further enhanced the predictability of this treatment modality.^[11]

Periodontal flap surgery presents as a well-established, minimally invasive technique boasting high success rates (89–95%).^[19] This approach facilitates direct visualization of

the entire PGG, enabling thorough cleaning, debridement and complete closure while minimizing damage to the periodontal ligament.^[9] Notably, in cases of concomitant bone loss, flap surgery allows for the concurrent execution of bone grafting procedures, promoting regeneration and bolstering long-term tooth stability.^[19]

The success of groove closure in palatogingival defect management is heavily influenced by the chosen filling material. The dental literature has documented the use of various materials, such as amalgam, glass ionomer cement (GIC), composite resin, and mineral trioxide aggregate (MTA).^[1–14] MTA offers excellent biocompatibility, antibacterial properties, sealing ability and bioactivity, potentially promoting periodontal tissue regeneration. However, MTA may be susceptible to washout from the transgingival defect and longer setting time.^[1] Biodentine, a novel bioceramic material introduced to address the limitations of MTA, offers comparable biocompatibility, antibacterial effects, sealing ability and bioactivity. Furthermore, Biodentine boasts a significantly faster setting time (9–12 min), improved handling characteristics and potentially superior sealing properties compared to MTA.

Emdogain, a scaffold and signaling molecule containing enamel matrix derivative (EMD), serves to attract periodontal progenitor cells and promote their differentiation into functional ligament tissue, thereby facilitating periodontal regeneration.^[18,19] Conversely, GTR membranes function as a physical barrier, selectively excluding faster-growing epithelial cells while allowing slower periodontal ligament cells to populate the defect and re-establish a functional attachment.^[11] In essence, Emdogain and GTR play distinct yet potentially

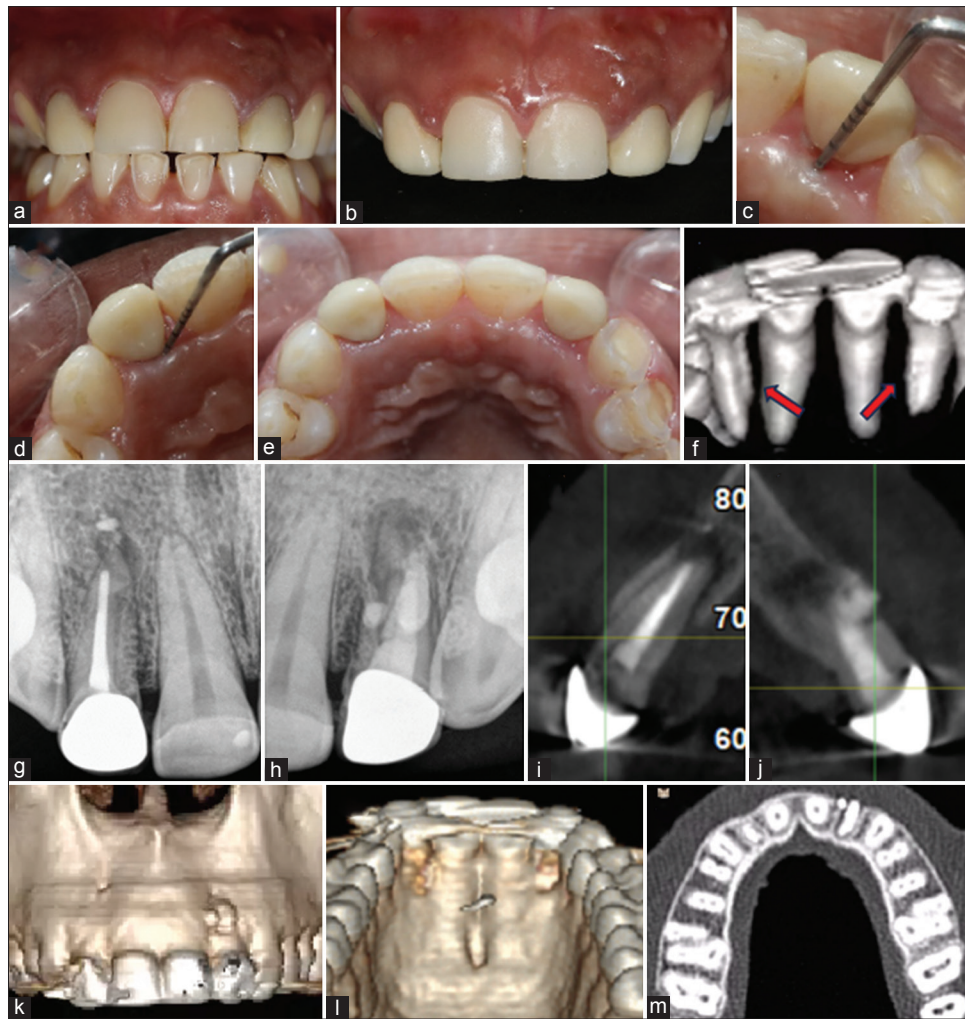


Figure 4: Postoperative clinical and radiographic findings: (a and b) Intraoral photographs (labial view) demonstrate the cementation of a zirconia prosthesis with resin cement to teeth #12 and #22. (c-e) Intraoral photographs (palatal view) show a reduction in periodontal pocket depths around teeth #12 and #22. (f) Cone-beam computed tomography (CBCT) imaging reveals sealing of the groove with restorative material on teeth #12 and #22. (g and h) Periapical radiographs demonstrate a significant reduction in the size of the periapical lesion on 1-year follow-up visit compared to baseline. (i and j) CBCT images show repair of the perforation in the labial cortical plate of tooth #22 with MTA and a marked reduction in the size of the associated periapical lesion. (k) The CBCT palatal view reveals healing of the resorption in the labial cortical plate. (l) A CBCT section highlights new bone formation and ongoing healing of the labial cortical plate. (m) CBCT section highlights healing of the labial cortical plate

complementary roles in the successful treatment of PGG. The coronal portion relative to the CEJ was filled with a GIC material to induce the junctional epithelium to reattach and form a good dentogingival junction.^[1]

CBCT imaging demonstrated near-complete periapical healing, characterized by the regeneration of healthy periapical tissues, including cementum, periodontal ligament, and alveolar bone, which effectively covered the resected root-end surface. Furthermore, the combined application of GTR and Emdogain material demonstrably facilitated periodontal tissue regeneration on the left lateral incisor, as compared to the right lateral incisor.

Limited research has previously explored minimally invasive approaches for managing severe PGG. This study presents promising evidence for two treatment strategies:

1. Periodontal flap surgery combined with bone grafting and apical surgery.
2. GTR and Emdogain regenerative material offer a well-established and effective treatment modality. This approach has the potential to eliminate infection, promote regeneration of periapical tissue and restore both function and esthetics. Notably, intentional replantation should be considered only after these primary approaches have been exhausted.

CONCLUSION

Limited research has previously explored minimally invasive approaches for managing severe PGG. This study presents promising evidence for two treatment strategies:

1. Periodontal flap surgery combined with bone grafting

and apical surgery.

2. GTR and Emdogain regenerative material offer a well-established and effective treatment modality. This approach has the potential to eliminate infection, promote regeneration of periapical tissue and restore both function and esthetics. Notably, intentional replantation should be considered only after these primary approaches have been exhausted.

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