International Journal of Dentistry Research

Case Report

ISSN: 2581-3218
IJDR 2026; 11(2): 45-49
Received: 12-06-2026
Accepted: 08-08-2026
Published: 31-08-2026

www.dentistryscience.com
doi: 10.31254/dentistry.2026.11206

Regenerative Endodontic Management of an Immature Maxillary Central Incisor Using a Novel Pre-Set MTA Plug Technique: A 1-Year Follow-Up Case Report

Raghavan Ragu[1], Shafie Ahamed[2], S Bhavani[3], G Rajaraman[3]

[1] Postgraduate, Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Cuddalore- 608002, Tamil Nadu, India

[2] Professor & Head, Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Cuddalore- 608002, Tamil Nadu, India

[3] Associate Professor, Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Cuddalore- 608002, Tamil Nadu, India

Abstract

Regenerative endodontic procedures provide a biologically based approach for the management of immature permanent teeth with necrotic pulps, allowing continued root development and healing of periapical tissues. Mineral trioxide aggregate is commonly used as a coronal barrier; however, placement of freshly mixed MTA over a blood clot scaffold can be technique-sensitive and may disturb the scaffold. This case report describes a novel custom-fabricated preset MTA plug technique for regenerative endodontic treatment of an immature maxillary central incisor. A 15-year-old female presented with pain and discoloration of the maxillary left central incisor following trauma six years previously. Clinical and radiographic examination revealed pulpal necrosis, chronic apical periodontitis, an immature root apex, thin dentinal walls, and periapical radiolucency. Minimal canal instrumentation and irrigation were performed, followed by placement of calcium hydroxide as an intracanal medicament. A canal impression was obtained using polyvinyl siloxane, and a custom MTA plug was fabricated extraorally and allowed to set before clinical placement. At the second visit, the canal was disinfected, apical bleeding was induced to create a blood clot scaffold, and the preset MTA plug was carefully positioned approximately 2 mm below the cementoenamel junction. The tooth was subsequently restored with resin-modified glass ionomer cement and composite resin. The patient remained asymptomatic and functional during follow-up, with progressive reduction of the periapical radiolucency. At one-year follow-up, a positive sensibility response and increased root thickness were observed, suggesting continued root development and favorable periapical healing. The preset MTA plug technique may provide a practical alternative to conventional placement of freshly mixed MTA in regenerative endodontic procedures by facilitating handling, improving placement, and reducing the risk of disturbing the blood clot scaffold. Further clinical studies with larger sample sizes and longer follow-up are required to establish the predictability and long-term effectiveness of this technique.

Keywords: Regenerative Endodontics, Mineral Trioxide Aggregate, Immature Tooth, Necrotic Pulp, Preset Mta Plug, Case Report.

INTRODUCTION

Management of a necrotic immature tooth is challenging because root development is incomplete, dentinal walls are thin and fragile, and the wide-open apex makes canal preparation and obturation difficult [1]. Traditionally, apexification has been used to create an apical hard tissue barrier using bioactive materials. However, it does not promote continued root development and may further weaken the fragile root structure [2].

Regenerative endodontic procedures (REPs) are biologically based treatment approaches that aim to restore damaged dentin, root structures, and the pulp-dentin complex. These procedures may allow continued root development, increased root length, thickening of dentinal walls, and healing of periapical tissues. Their success depends on adequate disinfection, a suitable scaffold, and an effective coronal seal [3].

Mineral trioxide aggregate (MTA) is widely used as a coronal barrier because of its biocompatibility, sealing ability, and antibacterial properties [4]. However, placement of freshly mixed MTA directly over a fragile blood clot scaffold can be technique-sensitive and may result in clot disruption, poor adaptation, and

***Corresponding author:**
Dr. Raghavan Ragu
Postgraduate, Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Cuddalore– 608002, Tamil Nadu, India
Email:
rgvnragu3012@gmail.com

increased treatment time. Recent evidence has also highlighted the need for improved clinical predictability of MTA-based regenerative protocols [5]. Regenerative endodontic approaches have evolved to promote continued root development and periapical healing [6]. Customized calcium silicate-based techniques, such as the BioRoot inlay, have also been described for teeth with wide open apices [7].

This case report presents a novel custom-fabricated preset MTA plug used as a coronal barrier in regenerative endodontic treatment of an immature non-vital tooth.

CASE REPORT

A 15-year-old female reported with pain and discoloration in the upper front tooth region for the past three months. The patient gave a history of trauma to the maxillary anterior tooth six years earlier, for which no treatment had been taken. Medical history was non-contributory.

Clinical examination revealed discoloration of tooth #21 with mild tenderness on percussion. The tooth was not mobile, and periodontal probing depths were within normal limits. Thermal and electric pulp tests showed no response. Periapical radiographic examination showed an immature root apex with thin dentinal walls and a periapical radiolucency associated with tooth #21 (Figure 1A-D). Based on the clinical and radiographic findings, a diagnosis of pulpal necrosis with chronic apical periodontitis in an immature maxillary left central incisor was made. After explaining the treatment options, written informed consent was obtained from the patient and her parents.

At the first visit, local anesthesia was administered using 2% lignocaine with 1:80,000 epinephrine, and the tooth was isolated under rubber dam. Access opening was performed, followed by minimal canal instrumentation using hand K-files. The canal was irrigated with 1.5% sodium hypochlorite and dried with sterile paper points. Calcium hydroxide paste was placed as an intracanal medicament, and the access cavity was sealed temporarily with Cavit.

Before medicament placement, canal impression was made using light-body polyvinyl siloxane supported by a putty index. The apical portion of the impression was trimmed, retaining the coronal segment extending approximately 2 mm below the cementoenamel junction. This mold was filled with freshly mixed mineral trioxide aggregate and allowed to set under moist conditions for 24 h. A custom-fabricated preset MTA plug was then retrieved and sterilized (Figure 2E-I).

After three weeks, the patient was asymptomatic. Local anesthesia without vasoconstrictor was administered, and the tooth was isolated under rubber dam. The temporary restoration was removed, and the intracanal medicament was flushed out using 17% EDTA. Apical bleeding was induced using a sterile #25 K-file passed 2 mm beyond the working length. Bleeding was allowed to rise to the cementoenamel junction to form a scaffold. The preset MTA plug was then carefully placed over the blood clot to a level approximately 2 mm below the cementoenamel junction. The access cavity was restored with resin-modified glass ionomer cement followed by composite resin (Figure 3J-L).

At the 3-month and 6-month follow-up visits, the tooth remained asymptomatic and functional, with radiographic reduction in the periapical radiolucency (Figure 3M). At the 1-year follow-up, the tooth showed a positive response to sensibility testing along with increased root thickness, suggesting continued root development and favorable healing (Figure 3N).

DISCUSSION

Regenerative endodontic procedures (REPs) are increasingly preferred for the management of immature permanent teeth with necrotic pulp because they promote periapical healing and allow continued root development [8,9]. Unlike apexification, which mainly creates an apical barrier, REPs may result in increased root length, thickening of dentinal walls, and improved long-term prognosis [10].

Successful regenerative treatment depends on adequate canal disinfection, formation of a suitable scaffold, and placement of an effective coronal seal to prevent reinfection [5]. Mineral trioxide aggregate (MTA) is widely used for this purpose because of its biocompatibility,

sealing ability, and favorable biological properties. Torabinejad *et al*. reported that MTA demonstrates good physical and chemical properties and is well tolerated by surrounding tissues [11]. In addition, MTA has been shown to stimulate mineralization-related activity, which may support hard tissue formation [12].

Despite these advantages, placement of freshly mixed MTA over a fragile blood clot scaffold can be technique-sensitive. Difficult handling, prolonged setting time, and the possibility of disturbing the scaffold during placement are recognized clinical limitations [13,14]. In esthetically important teeth, discoloration may also be a concern [13].

The BioRoot inlay concept has previously been described as a customized calcium silicate-based obturation approach for teeth with wide open apices [7]. In the present case, this concept was modified by fabricating a preset MTA plug only for the coronal portion of the canal, thereby preserving the apical space required for blood clot formation. This allowed extraoral setting of the material and simplified clinical placement. Similar modifications have been suggested to improve handling and placement predictability of MTA [15].

At follow-up, the tooth remained asymptomatic and functional, with reduction of the periapical radiolucency and later return of sensibility response along with increased root thickness. These findings suggest favorable healing and continued root maturation, which are desirable outcomes in regenerative therapy [16].

This technique may offer practical advantages such as easier placement, reduced chairside manipulation, better adaptation, and less risk of disturbing the blood clot scaffold. However, this report describes a single case, and long-term clinical studies with larger sample sizes are needed to confirm the reproducibility and effectiveness of this approach.

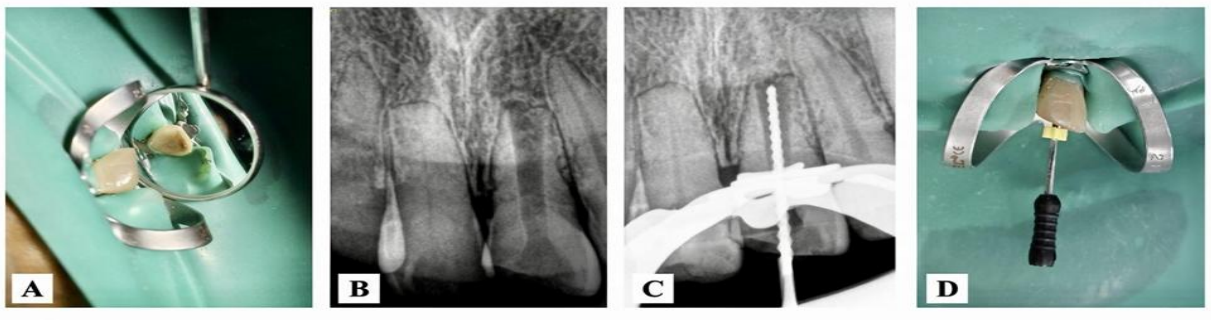

Figure 1: Preoperative assessment and working length determination. (A) Clinical view of tooth #21 after access opening under rubber dam isolation. (B) Preoperative radiograph showing immature root apex with associated periapical radiolucency. (C) Working length determination radiograph using endodontic file. (D) Clinical view of working length estimation under rubber dam isolation

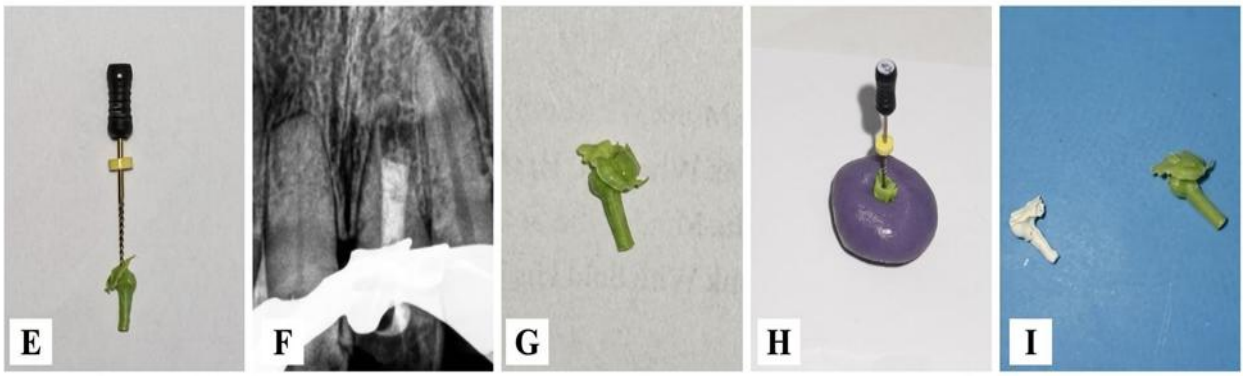

Figure 2: Fabrication of preset MTA plug. (E) Canal impression obtained using polyvinyl siloxane attached to an endodontic file. (F) Radiograph showing intracanal calcium hydroxide medicament placement. (G) Impression trimmed to a level 2 mm below the cementoenamel junction. (H) Positive replica prepared using putty support. (I) Preset mineral trioxide aggregate plug after setting alongside the original impression mold

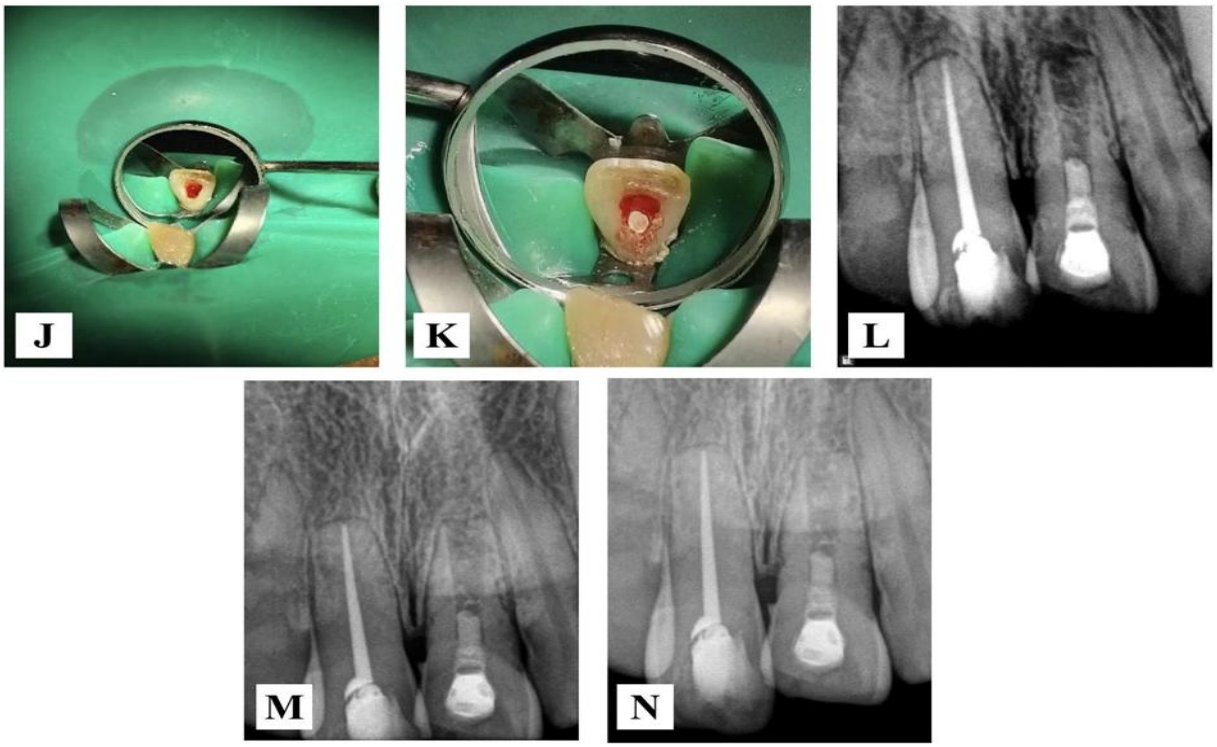

Figure 3: Placement of preset MTA plug and follow-up outcomes. (J) Induction of intracanal bleeding to create a scaffold for regeneration. (K) Clinical placement of the preset MTA plug over the blood clot scaffold. (L) Immediate postoperative radiograph after final restoration. (M) Six-month follow-up radiograph showing reduction in periapical radiolucency. (N) One-year follow-up radiograph showing continued healing and increased root thickness

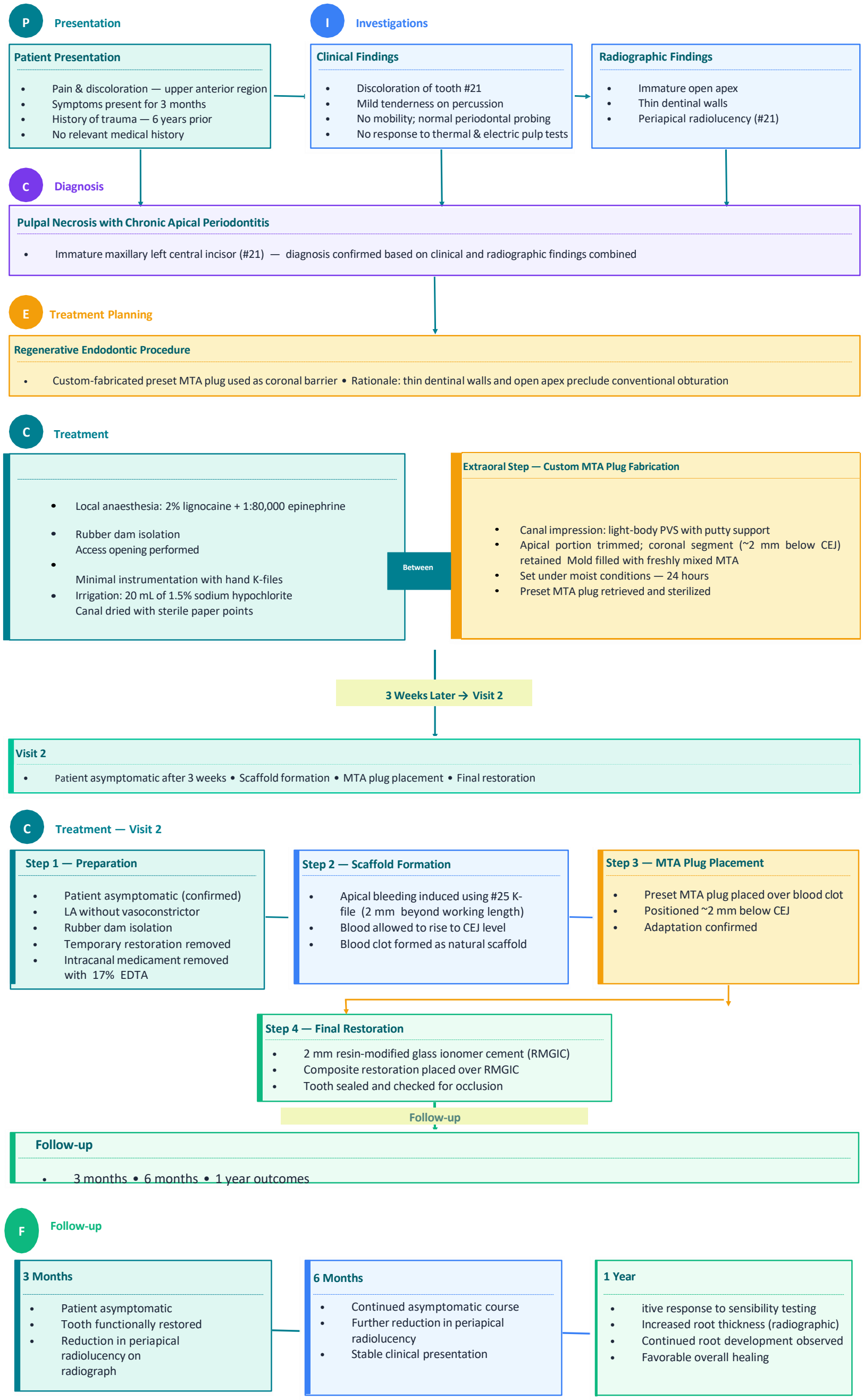

Figure 4: PRICE 2020 Checklist

CONCLUSION

This case report presents a novel preset MTA plug technique as a modification of conventional regenerative endodontic treatment in an immature non-vital tooth. Extraoral fabrication of the MTA plug allowed easier placement, preservation of the blood clot scaffold, and an effective coronal seal. Favorable clinical and radiographic outcomes were observed during follow-up, with evidence of continued root development. Further clinical studies with larger sample sizes and longer follow-up periods are needed to validate the predictability and long-term success of this technique.

Authors Contributions

RR conceptualized the case report, performed the clinical procedure, collected clinical and radiographic data, and drafted the manuscript. SA supervised the clinical management, critically reviewed the manuscript, and provided overall guidance. SB assisted with clinical management, reviewed the manuscript, and contributed to the interpretation of clinical and radiographic findings. GR assisted with clinical management, reviewed and edited the manuscript, and provided overall supervision. All authors reviewed and approved the final version of the manuscript.

Ethics Statement

This study did not require approval from a Research Ethics Committee, as it consists of a single case report without experimental intervention and without patient identification. The requirement for ethics approval was waived according to institutional and national guidelines. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Data Availability Statement

The data that support the findings of this study are available and will be made available upon request.

Use of AI in Drafting of Manuscript

The authors declare that they have not used any generative AI/AI-assisted technologies in the writing of this manuscript.

Conflicts of Interest

The authors declared no conflict of interest.

Financial Support

None declared.

ORCID ID

Raghavan Ragu: https://orcid.org/0009-0003-1109-7303

REFERENCES

1. Aricioglu B, Gunacar DN, Kosar T, Sanal Cikman A, Pertek Hatipoglu F, Maras E. Assessment of bone quality of apical periodontitis treated with MTA plug and regenerative endodontic techniques. *Aust Endod J*. 2022;48:444-50.
2. Raddall G, Mello I, Leung BM. Biomaterials and scaffold design strategies for regenerative endodontic therapy. *Front Bioeng Biotechnol*. 2019;7:317.
3. Chopra S, Bansal P, Bansal P. Regenerative endodontic procedures: A review. *J Adv Med Dent Sci Res*. 2020;8:184-6.
4. Parolia A, Yu A, Feghali M. Management of teeth with open apex and apical periodontitis using MTA and OrthoMTA. *G Ital Endod*. 2022;36:151-68.
5. Thakur V. Clinical challenges in regenerative endodontic therapy: A review. *J Dent Sci*. 2025;17:1-6.
6. Diogenes A, Ruparel NB, Shiloah Y, Hargreaves KM. Regenerative endodontics: A way forward. *J Am Dent Assoc*. 2016;147:372-80.
7. Rosaline H, Rajan M, Deivanayagam K, Reddy S. BioRoot inlay: An innovative technique in teeth with wide open apex. *Indian J Dent Res*. 2018;29:521-4.
8. Murray PE, Garcia-Godoy F, Hargreaves KM. Regenerative endodontics: A review of current status and a call for action. *J Endod*. 2007;33:377-90.
9. Lopes LB, Neves JA, Botelho J, Machado V, Mendes JJ. Regenerative endodontic procedures: an umbrella review. *Int J Environ Res Public Health*. 2021;18(2):754.
10. Lin LM, Kahler B. A review of regenerative endodontics: Current protocols and future directions. *J Istanbul Univ Fac Dent*. 2017;51:41-51.
11. Torabinejad M, Hong CU, McDonald F, Pitt Ford TR. Physical and chemical properties of a new root-end filling material. *J Endod*. 1995;21:349-53.
12. Gomes-Filho JE, Watanabe S, Bernabé PFE, de Moraes Costa MT. A mineral trioxide aggregate sealer stimulated mineralization. *J Endod*. 2009;35:256-60.
13. Bolhari B, Noori F, Assadian H, Raee A, Ghabraei S, Shamshiri AR, *et al*. The effect of three additives on properties of mineral trioxide aggregate cements: a systematic review and meta-analysis of *in vitro* studies. *BMC Oral Health*. 2024;24:1-22.
14. Zbańska J, Herman K, Kuropka P, Dobrzyński M. Regenerative endodontics as the future treatment of immature permanent teeth. *Appl Sci*. 2021;11:6211.
15. Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review-Part III: clinical applications, drawbacks, and mechanism of action. *J Endod*. 2010;36:400-13.
16. Bansal R, Hegde V. Healing of the periapical lesion in posterior teeth with mineral trioxide aggregate using orthograde technique: two case reports. *Endodontology*. 2012;24:264-8.

HOW TO CITE THIS ARTICLE-
Ragu Raghavan, Ahamed Shafie, S Bhavani , G Rajaraman. Regenerative Endodontic Management of an Immature Maxillary Central Incisor Using a Novel Pre-Set MTA Plug Technique: A 1-Year Follow-Up Case Report. Int J Dent Res 2026; 11(2):45-49. doi: 10.31254/dentistry.2026.11206