

Case Report

Aesthetic and Endodontic Management of Traumatized Immature Maxillary Central Incisors with Open Apices Using MTA Apexification, Internal Bleaching, and Porcelain Laminate Veneers: A One-Year Follow-Up

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Abstract: **Background:** Immature permanent teeth with pulpal necrosis and open apices are difficult to manage because of incomplete root development and the absence of an apical constriction. **Case Presentation:** A 29-year-old male with a history of trauma 20 years earlier presented with discolored, fractured maxillary central incisors. Clinical and radiographic findings confirmed pulpal necrosis with chronic apical abscess and open apices. Treatment comprised chemomechanical preparation, calcium hydroxide intracanal medication, MTA apexification, thermoplasticized gutta-percha obturation, internal bleaching, and porcelain laminate veneer rehabilitation. **Conclusion:** A multidisciplinary approach successfully restored periapical health, function, and esthetics with satisfactory one-year follow-up.

Keywords: Apexification, Mineral Trioxide Aggregate, Open Apex, Internal Bleaching, Porcelain Laminate Veneer, Dental Trauma.

INTRODUCTION

Traumatic injuries to immature permanent incisors frequently result in pulpal necrosis before completion of root development, producing open apices, thin dentinal walls, and compromised structural integrity. Mineral trioxide aggregate (MTA) has become the material of choice for apexification because of its biocompatibility, sealing ability, and ability to promote hard tissue formation. Following biological rehabilitation, esthetic management is equally important. Internal bleaching and porcelain laminate veneers provide conservative solutions for restoring smile esthetics. This report describes the multidisciplinary rehabilitation of traumatized immature maxillary central incisors using MTA apexification, internal bleaching, and porcelain laminate veneers.

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CASE PRESENTATION

A 29-year-old male presented with fractured and discolored maxillary central incisors following trauma 20 years earlier. Clinical examination revealed Ellis Class IV fractures involving teeth 11 and 21 as shown in Figure-1. Electric pulp testing showed no response in the affected teeth, whereas adjacent teeth responded normally. Intraoral periapical radiographs demonstrated Cvek stage III root development, open apices, and periapical radiolucencies. The diagnosis was pulpal necrosis with chronic apical abscess associated with immature permanent teeth.



Fig. 1: Pre-operative Image Showing Ellis Class IV Fracture irt 11 and 21

TREATMENT PROCEDURES

PHASE I: Endodontic Management and Mta Apexification

Access cavities were prepared under rubber dam isolation. Working length was determined with a size 80 K-file. Cleaning and shaping were performed using hand K-files and ProTaper Universal rotary instruments with copious irrigation using 3% sodium hypochlorite, saline, sonic activation, and a final rinse with 2% chlorhexidine. Calcium hydroxide was placed as an intracanal medicament. After resolution of symptoms, a 4-mm MTA apical plug was placed, followed by thermoplasticized gutta-percha obturation and composite restoration.

PHASE II: Internal Bleaching

Internal bleaching was performed using the walking bleach technique. After placement of a glass ionomer cervical barrier, bleaching agent was placed into the pulp chamber and renewed until the desired shade was achieved, as shown in Figure-2. The access cavity was then restored with composite resin one week later after final appointment of bleaching.

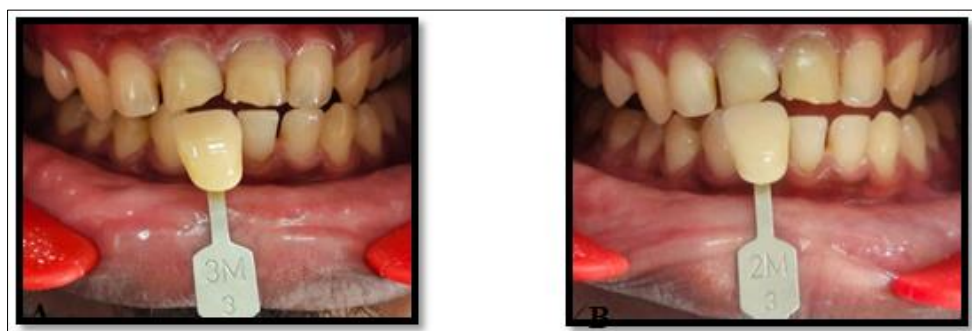


Fig. 2: A) Before Bleaching B) After Bleaching

PHASE III: Esthetic Rehabilitation

Minimal facial preparation preserving enamel was completed for porcelain laminate veneers as shown in Figure-3. Shade selection, elastomeric impression, provisionalization, adhesive cementation, finishing, polishing, and occlusal adjustment were performed according to standard adhesive protocols as shown in Figures 4 and 5.



Fig. 3: Tooth Preparation for Porcelain Laminate



Fig. 4: Shade Selection



Fig. 5: Postoperative Clinical Photograph

OUTCOME

At six months and one year, clinical and radiographic examinations demonstrated resolution of symptoms, satisfactory periapical healing, and excellent esthetic integration with high patient satisfaction, as shown in Figure 6(a-d).

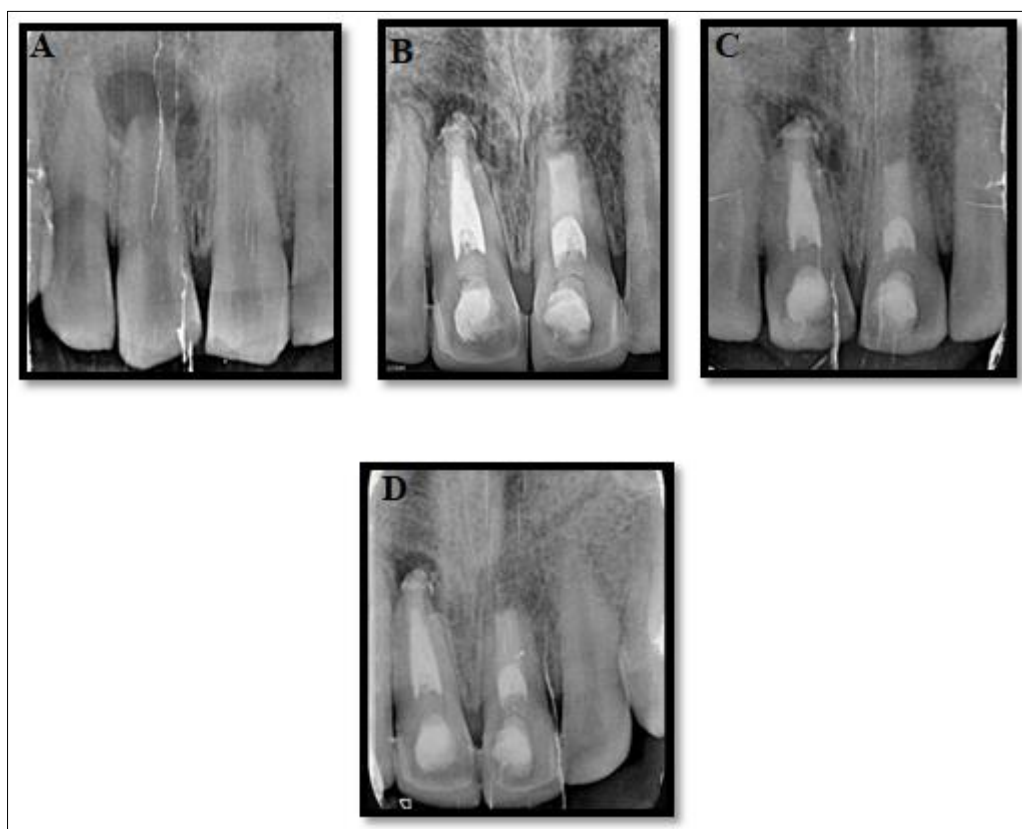


Fig. 6: A) Preoperative B) Postoperative C) 6-month follow-up D) 1-year follow-up

DISCUSSION

Management of immature permanent anterior teeth with pulp necrosis and discoloration presents a significant clinical challenge because it requires simultaneous resolution of biological and esthetic concerns [1-3]. The presence of an open apex compromises conventional endodontic treatment by preventing the establishment of an adequate apical stop during obturation, while intrinsic discoloration of anterior teeth adversely affects smile esthetics and patient confidence [1-

4]. Therefore, successful management requires a multidisciplinary treatment approach that addresses both periapical healing and esthetic rehabilitation [1-3].

In the present case, the affected tooth exhibited pulpal necrosis associated with a chronic apical abscess and an incompletely developed root with an open apex. Such cases are commonly encountered following traumatic injuries to immature permanent teeth, where interruption of pulpal blood supply may result in cessation of root development and failure of normal apical maturation [1-5]. Consequently, treatment objectives include elimination of intracanal infection, establishment of an apical barrier to facilitate adequate obturation, preservation of the remaining root structure, and restoration of the tooth's esthetic appearance [1-3].

Apexification was selected as the treatment of choice to establish an artificial apical barrier before root canal obturation [2, 3]. Historically, calcium hydroxide has been regarded as the conventional material for apexification because of its ability to promote formation of a calcified apical barrier [2-6]. However, successful calcium hydroxide apexification may require repeated placement of the material over an extended treatment period, requiring patient compliance and multiple clinical visits [6, 7]. In addition, prolonged exposure of immature dentin to calcium hydroxide has been associated with reduction in fracture resistance, which may increase the susceptibility of structurally compromised immature roots to cervical root fracture [7, 8]. These limitations have encouraged the development and adoption of alternative biomaterials for management of immature non-vital teeth [2, 3].

Mineral trioxide aggregate (MTA) has become an important biomaterial for apexification because of its favorable biological properties, sealing ability, and capacity to promote hard-tissue formation [2-9]. MTA demonstrates excellent biocompatibility and has the ability to induce deposition of mineralized tissue at the apical interface.^[9,10] Furthermore, MTA permits formation of an artificial apical barrier within a substantially shorter treatment period than conventional calcium hydroxide apexification, allowing obturation to be completed in fewer appointments [2-9]. Recent systematic reviews have reported high clinical and radiographic success rates following MTA apexification, although the certainty of evidence varies among studies [2-11]. The use of MTA in the present case facilitated effective apical barrier formation while minimizing treatment duration and avoiding prolonged exposure of the immature root dentin to calcium hydroxide.

Following successful endodontic management, attention was directed toward correcting the intrinsic discoloration of the non-vital tooth. Discoloration of non-vital teeth may result from pulpal hemorrhage, degradation products of necrotic pulp tissue, penetration of blood-derived chromogenic compounds into dentinal tubules, and staining associated with endodontic materials [4-12]. Such discoloration may persist following root canal treatment and can compromise the esthetic outcome, particularly in anterior teeth [4-12].

The walking bleach technique was selected for internal bleaching because it is a conservative and minimally invasive method for management of intrinsic discoloration in endodontically treated teeth [13, 14]. Placement of a bleaching agent within the pulp chamber allows oxidation of chromogenic compounds responsible for intrinsic staining without extensive removal of sound tooth structure.^[13,14] Systematic-review evidence demonstrates that internal bleaching produces significant improvement in the color of discolored root-filled teeth [14]. Proper placement of a cervical sealing barrier before internal bleaching is essential to limit penetration of bleaching agents toward the periodontal tissues and reduce the potential risk of external cervical root resorption [13-15]. When appropriate clinical protocols are followed, internal bleaching can provide satisfactory esthetic improvement, although recurrence of discoloration and variability in treatment response should be considered [13, 14].

Although internal bleaching produced a marked improvement in tooth shade, complete esthetic integration with the adjacent dentition required additional restorative intervention. Residual discoloration and differences in optical characteristics may persist after bleaching, particularly in teeth with severe or longstanding intrinsic discoloration [13, 14]. In such situations, porcelain laminate veneers provide a conservative option for further esthetic rehabilitation when adequate enamel is available for adhesive bonding [16, 17].

Porcelain laminate veneers have become an established treatment modality for anterior esthetic rehabilitation because conservative preparations can preserve a substantial amount of enamel, which is advantageous for predictable adhesive bonding [16, 17]. Their optical properties allow them to reproduce important characteristics of natural tooth structure and provide highly esthetic outcomes when appropriately designed and bonded [16, 17]. Ceramic veneers also demonstrate favorable color stability, surface characteristics, and long-term clinical survival [16-19]. Compared with direct composite restorations, ceramic veneers may offer advantages in long-term color stability and resistance to surface staining; however, clinical selection should be based on the amount of remaining enamel, extent of discoloration, functional requirements, and patient expectations [17, 18].

The successful outcome of the present case highlights the importance of adopting a sequential, multidisciplinary treatment protocol for managing immature discolored anterior teeth [1-3]. The combination of MTA apexification, internal bleaching, and porcelain laminate veneer restoration addressed both the biological and esthetic requirements of the tooth [2-17]. This integrated approach resulted in resolution of periapical pathology, establishment of an apical barrier, satisfactory esthetic rehabilitation, and restoration of function while preserving as much natural tooth structure as possible [2-17]. Long-term clinical and radiographic follow-up remains essential to monitor periapical healing, evaluate the integrity of the coronal restoration, and assess the longevity of the esthetic rehabilitation [1-20].

CONCLUSION

The management of immature non-vital anterior teeth with discoloration requires both endodontic and esthetic treatment. In the present case, accurate diagnosis, careful treatment planning, and the sequential use of MTA apexification, internal bleaching, and porcelain laminate veneer restoration resulted in successful preservation of the tooth, complete functional rehabilitation, and excellent esthetic integration. This case demonstrates that the judicious combination of contemporary endodontic and adhesive restorative techniques can provide predictable and long-lasting clinical outcomes.

REFERENCES

1. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. *Dent Traumatol.* 2020;36(4):314-330. doi:10.1111/edt.12578.
2. Shamszadeh S, et al. Management strategies for immature teeth with pulp necrosis: an umbrella review of systematic reviews. *Int Endod J.* 2024;19(4). doi:10.22037/iej.v19i4.46292.
3. Stefanidou M, Kostenkova A, Siudikienė J, Lodienė G. Evaluation of outcomes in immature teeth after revitalization or apexification procedures: a systematic review and meta-analysis. *Cureus.* 2024;16(5):e60357. doi:10.7759/cureus.60357.
4. Krastl G, Allgayer N, Lenherr P, Filippi A, Taneja P, Weiger R. Tooth discoloration induced by endodontic materials: a literature review. *Dent Traumatol.* 2013;29(1):2-7. doi:10.1111/j.1600-9657.2012.01141.x.
5. Andreasen JO, Andreasen FM, Andersson L, editors. *Textbook and Color Atlas of Traumatic Injuries to the Teeth.* 5th ed. Oxford: Wiley-Blackwell; 2018.
6. Frank AL. Therapy for the divergent pulpless tooth by continued apical formation. *J Am Dent Assoc.* 1966;72(1):87-93.
7. Andreasen JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. *Dent Traumatol.* 2002;18(3):134-137.
8. Rosenberg B, Murray PE, Namoratto D. The effect of calcium hydroxide root filling on dentin fracture strength. *Dent Traumatol.* 2007;23(1):26-29.
9. Torabinejad M, Chivian N. Clinical applications of mineral trioxide aggregate. *J Endod.* 1999;25(3):197-205.
10. Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review—Part III: clinical applications, drawbacks, and mechanism of action. *J Endod.* 2010;36(3):400-413.
11. Nair PN, Duncan HF, Pitt Ford TR, Luder HU. Histological, ultrastructural and quantitative investigations on the response of healthy human pulps to experimental capping with mineral trioxide aggregate: a randomized controlled trial. *Int Endod J.* 2008;41(2):128-150.
12. Plotino G, Buono L, Grande NM, Pameijer CH, Somma F. Nonvital tooth bleaching: a review of the literature and clinical procedures. *J Endod.* 2008;34(4):394-407.
13. Attin T, Paqué F, Ajam F, Lennon AM. Review of the current status of tooth whitening with the walking bleach technique. *Int Endod J.* 2003;36(5):313-329.
14. Kwon SR, Wertz PW. Review of the mechanism of tooth whitening. *J Esthet Restor Dent.* 2015;27(5):240-257.
15. Rotstein I, Zalkind M, Mor C, Tarabeah A, Friedman S. In vitro efficacy of sodium perborate preparations used for intracoronary bleaching of discolored non-vital teeth. *Endod Dent Traumatol.* 1993;9(4):157-162.
16. AlJazairy YH. Survival rates for porcelain laminate veneers: a systematic review. *Eur J Dent.* 2021;15(2):360-366. doi:10.1055/s-0040-1715914.
17. Alenezi A, Alsweed M, Alsidrani S, Chrcanovic BR. Long-term survival and complication rates of porcelain laminate veneers in clinical studies: a systematic review. *J Clin Med.* 2021;10(5):1074. doi:10.3390/jcm10051074.
18. Kihara M, et al. Clinical performance of laminate veneers: a review of the literature. *J Prosthodont Res.* 2024. doi:10.2186/jpr.D_23_00151.
19. Alqutaibi AY, Saker S, Alghauli MA, Algabri RS, AbdElaziz MH. Clinical survival and complication rate of ceramic veneers bonded to different substrates: a systematic review and meta-analysis. *J Prosthet Dent.* 2025;134(4):1030-1039. doi:10.1016/j.prosdent.2024.03.019.
20. Mahmoud E, Beshir Omer Beshir S, Wadhaj NT, et al. Tooth discoloration after regenerative endodontic therapy in immature permanent teeth: a systematic review. *Cureus.* 2026;18(4):e107948. doi:10.7759/cureus.107948.