



Bioactive Approach Of Pulp Preservation : A Series Of Three Cases

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Abstract

Background: Vital pulp therapy aims to preserve pulp vitality and avoid unnecessary root canal treatment in appropriately selected permanent teeth. Direct pulp capping is a type of vital pulp therapy which promotes pulpal healing and continued root development following pulp exposure in immature permanent teeth

Case Presentation: Three permanent mandibular molars with carious pulp exposures were managed using Mineral Trioxide Aggregate (MTA). Case 1 involved a carious tooth having transient stimulus-dependent sensitivity. Case 2 involved a tooth with secondary caries beneath a dislodged restoration in tooth and transient sensitivity. In Case 3, a 12-year-old female presented with deep dental caries associated with sensitivity in tooth number 47. In all cases, caries removal resulted in localized pulp exposure. Hemorrhage was controlled using 5.25% sodium hypochlorite, followed by direct MTA placement and restoration.

Results: Cases 1 and 2 remained clinically asymptomatic at 3- and 6-month follow-up, with no reported tenderness or apical pathology. In Case 3, the baseline radiograph demonstrated incomplete formation of both root ends, whereas the 2-year follow-up showed complete root-end formation without reported apical pathology.

Conclusion: MTA-based direct pulp capping demonstrated favorable clinical and radiographic outcomes in these selected cases. Accurate diagnosis, aseptic isolation, effective hemorrhage control, appropriate biomaterial placement, and an adequate coronal seal are essential for successful pulp preservation and continued root maturation. These findings highlight the potential of conservative vital pulp therapy as a biologically oriented alternative to immediate endodontic treatment in deep caries management with pulpal exposure^[2]

Keywords: calcium silicate; direct pulp capping; mineral trioxide aggregate; pulp preservation; vital pulp therapy

Introduction

Preservation of pulp vitality is an important goal of minimally invasive endodontics. Contemporary guidance supports vital pulp therapy (VPT) in selective clinical scenerios as it shifts the paradigm from pulpectomy to biologically driven prerservation of pulp dentin complex rather than routine root canal treatment after carious exposure. [1,2] Direct pulp capping involves placement of a biomaterial directly over exposed vital pulp, with outcome influenced by pulpal diagnosis, operative asepsis, hemorrhage control, material selection, and the quality of the definitive restoration. [3 ,4, 5]

MTA is a hydraulic calcium-silicate cement with favorable sealing and biomineralization properties. Clinical studies and evidence syntheses have reported favorable outcomes for MTA in Direct Pulp Capping (DPC) , including in cariously exposed permanent teeth. [6,7] The present series describes three cases managed with MTA-based DPC and highlights the clinical and radiographic outcome, including continued root maturation in an immature tooth.[13]

Case Report

Case 1. A 14-year-old male presented with food lodgement and transient sensitivity to cold and sweets in tooth 46. On clinical examination a deep cavitated lesion found on the occlusal surface. There was no tenderness on percussion, pulp neural testing with electric pulp tester elicited a positive response consistent with maintained pulp vitality. Radiograph showed deep caries approaching the pulp without periapical pathology. After taking written consent from patient, anaesthesia was administered, a pinpoint

exposure of <1 mm occurred during excavation. Minimal bleeding was controlled with a cotton soaked with 5.25% sodium hydrochlorite (Septodont Parcan Sodium Hypochlorite solution) and, MTA putty (SafeEndo Biostructure MTA putty) was placed on it. A moist cotton was placed over the MTA followed by temporary restoration was done (Cavit G). Finally the tooth was restored with composite resin after 24 hours. The patient remained asymptomatic at 24 hours, 48 hours, 7 days, 3 and 6 months.. [FIG 1]



Figure 1 (a) Diagnostic findings: Preoperative radiograph (b) Pin point pulpal exposure (c) Radiograph revealing pin point pulpal exposure (d) bleeding controlled with moist cotton soaked in 5.25% NaOCL (e) Direct pulp capping with MTA putty (f) Placement of moist cotton over MTA and interim restoration with cavit-G (g) Definitive Restoration with composite (h) 6 months follow up radiograph

Case 2. A 24-year-old female presented with transient sensitivity after dislodgement of a dental amalgam restoration in tooth 47. Secondary caries was present beneath the restoration [Fig 2(a,b)]. There was no spontaneous or nocturnal pain and no radiographic periapical pathology..Under Rubber Dam isolation, the previous restoration was removed followed by excavation of secondary caries underneath. A localized pinpoint bleeding point was encountered which was controlled with a moist gauge piece Soaked with 5.25% NaOCL. (Septodont Parcan). Then Pulp capping was performed with MTA (Angelus) directly placed on the exposure site followed by a moist cotton placed over it. Temporary restoration (Cavit G) was placed. Patient was recalled after 24 hours for definitive Restoration. A followup period of 3 and 6 months Showed no clinical and radiographic changes with positive vitality on EPT. [FIG 2]

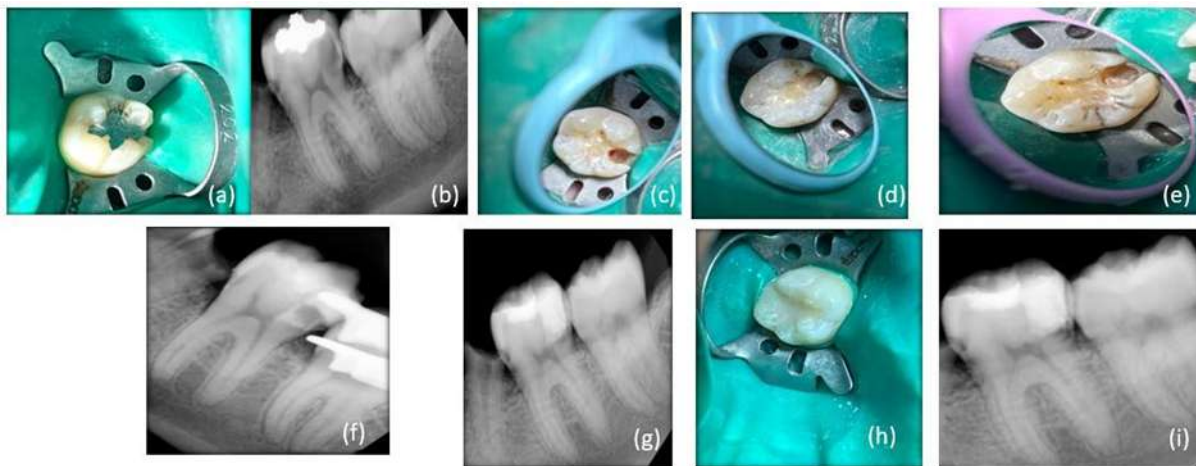


Figure 2 : (a) Preoperative picture (b) Diagnostic findings: Preoperative radiograph (c) Pin point pulpal exposure (d) bleeding controlled with moist cotton soaked in 5.25% NaOCL (e) Direct pulp capping with MTA putty (f) Radiograph revealing Placement of moist cotton over MTA interim restoration with cavit-G (g) Immediate postoperative Radiograph (h) Definitive restoration with composite (i) 6 months follow up radiograph

Case 3. A 12 -year-old female presented with sensitivity to cold beverages associated with tooth No 47. Clinical and Radiographic examination showed deep dentinal caries, on excavation pinpoint pulp exposure was observed, hemorrhage control with 5.25% sodium hypochlorite (Septodont Parcan Sodium Hypochlorite solution) was achieved, MTA (SafeEndo Biostructure MTA putty) was placed over exposure site, and temporary restoration with Cavit G was done. The baseline radiograph showed incomplete formation of both root ends. At 2-year follow-up complete formation of both root ends was evident without reported apical pathology, demonstrating continued root maturation [13]. [Fig 3]

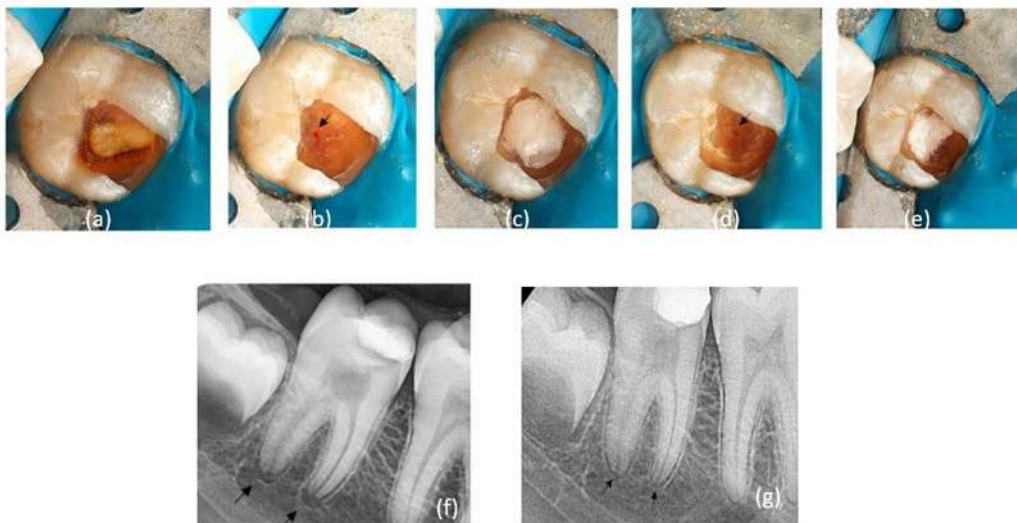


Figure 3 : (a) Preoperative picture revealing deep dentinal caries in 47 (b) Pin point pulpal exposure on excavation (c) Pin point pulpal bleeding controlled with moist cotton soaked in 5.25% NaOCL (d) Arrest of bleeding (e) Direct pulp capping with MTA over exposure site (f) Radiograph revealing Placement of moist cotton over MTA and interim restoration with cavit-G (g) 2 years post operative follow up radiograph showing root end formation

Discussion

The favorable outcomes in these cases support that case selection is utmost to VPT.[3]

Hemorrhage control is an important intraoperative indicator. Localized bleeding that can be controlled within 5 minutes before capping is generally more favorable than persistent uncontrolled hemorrhage, which may reflect more extensive inflammation. Sodium hypochlorite also, provides antimicrobial activity when appropriately used. [1,2,3] MTA was selected for its bioactivity, biocompatibility, sealing ability, and capacity to promote hard-tissue formation and maintain pulp vitality.

Clinical evidence demonstrates superior outcomes compared with calcium hydroxide, with higher success reported by Mente et al.[5] and Hilton et al.[8]. Calcium hydroxide lacks inherent adhesive properties and does not bond chemically to dentin, limiting interfacial sealing and increasing the risk of microleakage.

Beside that the reparative dentin formed by calcium hydroxide may exhibit tunnel defects—porous channels traversing the dentinal bridge—which can permit bacterial penetration and compromise long-term pulp protection.[8]

Systematic review evidence further supports MTA as a predictable pulp-capping material, demonstrating higher clinical success and reduced treatment failure.

An effective coronal seal is equally important because bacterial microleakage can compromise pulp healing. The two-year maturation observed in Case 3 is particularly noteworthy because preservation of vital radicular pulp permits continued physiological root development in immature permanent teeth.[9]

Conclusion

MTA-based DPC may be a conservative treatment option for carefully selected permanent teeth with pulp exposure. Favorable outcomes depend on accurate diagnosis, aseptic isolation, effective hemorrhage control, appropriate Material placement, and a durable coronal seal.

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