

Masterclass in Clinical Practice

Endodontics

with

Prof Peet J. van der Vyver¹

Dr Nicoline Potgieter²

Dr Martin Vorster³



Direct Pulp Capping on Permanent Teeth Using MTA

¹ Peet J. van der Vyver,
BChD (Pret); Dip. Odont (Aest Dent);
Dip.Odont (Endo); MSc Odont (Endo), PhD (Endo)

² Nicoline Potgieter,
BChD (Pret); PGDip (Paedo); PGDipDent (Endo); MSc

³ Martin Vorster,
BChD (Pret); PGDipDent (Endo); MSc (Odont)

Introduction

Vital pulp therapy (e.g., direct pulp capping, partial or full pulpotomy) is generally the treatment of choice for traumatized or carious teeth with a vital pulp and open apex at the time of exposure.^{1,2} Successful vital pulp therapy has also been reported for teeth with closed apices.³

Farsi et al.⁴ reported a success rate of 93% over a 24-month recall period in a clinical study in which 30 young, permanent, cariously exposed, asymptomatic teeth were pulp capped with Mineral Trioxide Aggregate (MTA). Clinical and radiographic success was reported as all the teeth remained asymptomatic, tested vital, had no visible periapical radiolucencies and showed evidence of continued root development (apexogenesis).

Studies show that the sealing ability, alkalinity and biocompatibility of pulp capping material, could be responsible for dentine bridge formation.⁵ MTA is the material of choice for pulp capping and other applications as it has been shown to induce hard tissue formation between exposed pulpal tissue and surrounding tooth structure or materials.⁵ The placement of MTA on exposed pulp tissue stimulates the release of bone morphogenetic proteins and transforming growth factors, which is necessary for pulpal cells to recruit and organize odontoblasts to lay down reparative dentine.⁶ In comparison to Calcium Hydroxide Ca(OH)₂, MTA produces a thicker dentinal bridge at a faster rate,^{2,7} reduces inflammation, reduces hyperaemia and reduces pulpal necrosis.^{5,8}

Direct Pulp Cap Technique - illustrated with a clinical case report

The patient, a 15-year-old male, presented with a large carious lesion under a previously placed occluso-distal composite restoration on his left maxillary second premolar (25), as well as a carious lesion on the distal aspect of the first maxillary premolar (24) (Figure 1). Local anaesthetic was administered and rubber dam placed as an essential step to ensure complete isolation and success when performing a direct pulp capping technique.

Cavity preparation was initiated using a diamond bur while protecting the adjacent tooth with a WedgeGaurd (Dentsply Sirona) (Figure 2a). Caries indicator dye (Sable Seek, Ultradent, South Jordan, UT, USA) was applied to identify and facilitate caries excavation which was done using a slow-speed carbide bur in a contra-angle hand piece under 12x microscope magnification (Zumax OMS 3200Pro). Excavation of the caries infected dentine resulted in a large pulp exposure. Effective operative magnification and careful caries removal have been identified as important prerequisites for success.⁹

A 6% sodium hypochlorite solution (NaOCl) (Chlor-Xtra, Vista Dental, Racine, WI) was placed on the exposed pulp in order to achieve haemostasis as suggested by several studies.^{9,10} After three minutes, the NaOCl was gently rinsed

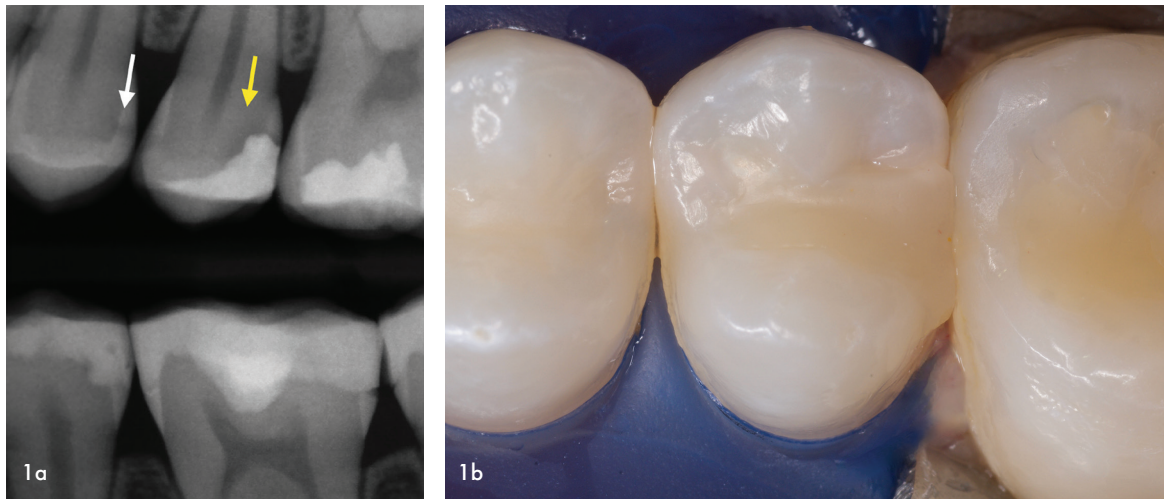


Figure 1: a) Pre-operative bitewing radiograph showing caries distally on the 24 (white arrow) and secondary caries beneath an existing restoration on the 25 (yellow arrow); b) Pre-operative clinical view under high magnification.

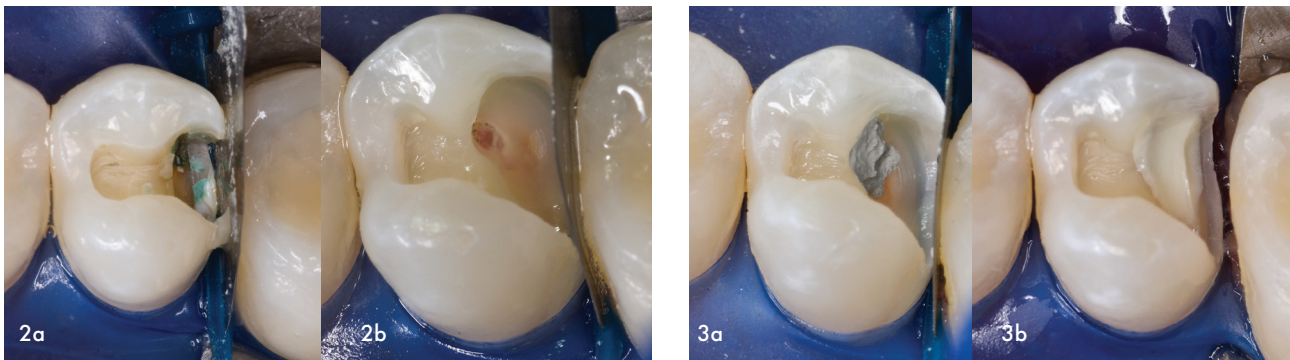


Figure 2: Clinical photographs under 12x magnification showing: a) initial cavity preparation with protective WedgeGuard in place; b) the large pulp exposure after haemostasis was achieved with Sodium Hypochlorite.

Figure 3: Clinical photographs under 12x magnification showing: a) MTA flow placed over the pulp exposure and surrounding dentine; b) the MTA covered with a base layer.

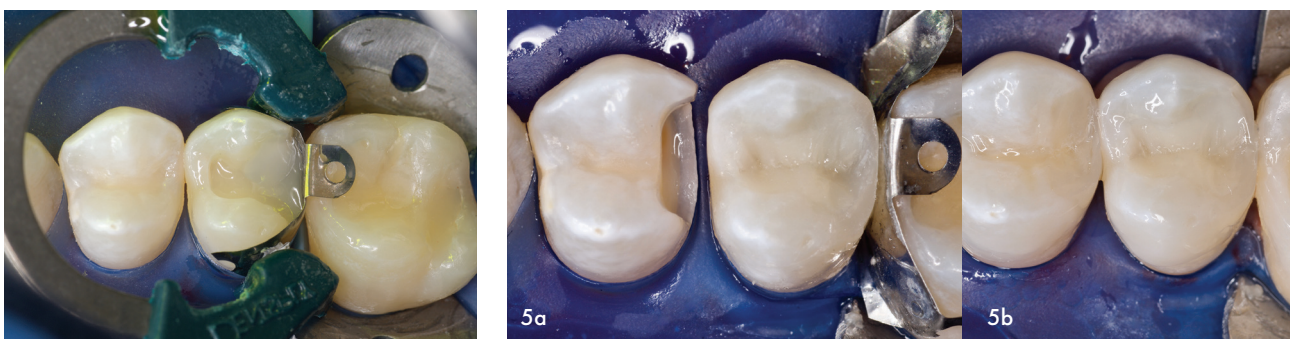


Figure 4: High magnification view of the sectional matrix system in place, as well as the first bulk fill composite layer.

Figure 5: Clinical photographs under 12x magnification showing: a) the completed restoration on tooth 25 and the cavity preparation on tooth 24; b) the final restorations on both the 24 and 25.

away with water using a two-way syringe, and the area was blot-dried with sterile cotton pledges (Figure 2b). NaOCl is an excellent haemostatic agent with the added benefits that it can disinfect microbiologically contaminated dentinal chips and micro-debris, inhibit fibrin clot formation and disinfect the adjacent perforated dentin interface.⁹ However, NaOCl

has potent cytotoxicity, and should therefore be handled with care.¹¹

MTA Flow (Ultradent) was mixed according to the manufacturer's instructions, and a thick layer of the cement was placed directly over the exposure site and surrounding dentine (Figure 3a). The MTA was then directly covered with

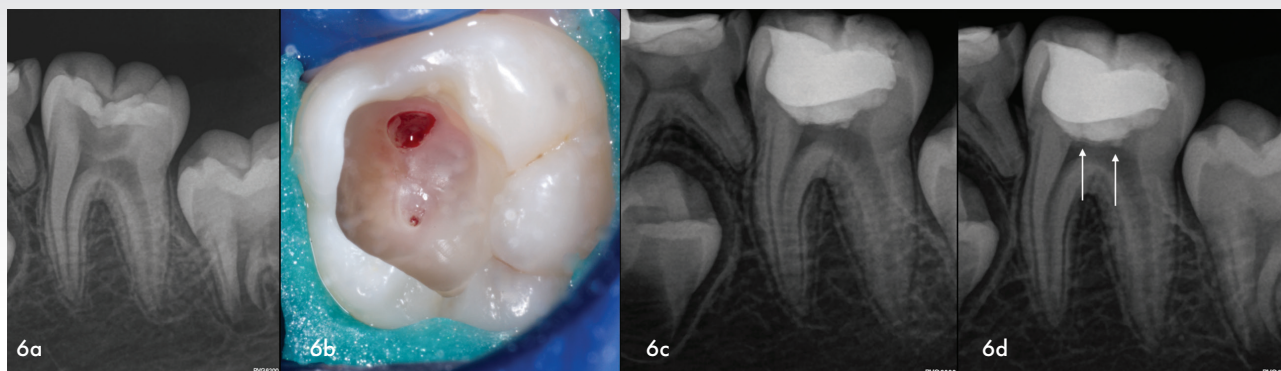


Figure 6: a) Preoperative peri-apical radiograph of a left mandibular first molar presenting with extensive occlusal decay on a 9-year-old female patient; b) high magnification view of the cavity preparation showing one large and one small pulp exposure; c) immediate post-operative peri-apical radiograph after a direct MTA pulp cap and composite restoration; d) peri-apical radiograph showing dentine bridge formation at the exposure sites (arrows).

a resin modified glass-ionomer material (Vitrebond, 3M) (Figure 3b). Placement of glass-ionomer material over MTA enables a single visit pulp capping procedure by protecting it during the resin bonding procedure.¹² Without this layer of glass ionomer it would be necessary to place a water-moistened cotton pellet directly over the unset MTA material, and the patient would need to attend a second appointment for the definitive restoration.¹²

Several studies have highlighted the importance of achieving a coronal seal after pulp capping.^{13,14} The sectional matrix system, Palodent Plus (Dentsply Sirona), was used to ensure an adequate interproximal contact and morphology (Figure 4). The definitive restoration was constructed using Prime and Bond Universal in total etch mode, Smart Dentine Replacement material (Dentsply Sirona) as the initial bulk fill layer and Spectra ST composite resin (Dentsply Sirona) as the final layer.

After completing the restoration on the maxillary second premolar the cavity preparation on the first premolar was finalised (Figure 5a). The same restorative technique was followed as described for the first primary premolar, and the postoperative result can be seen on Figure 5b.

Post-op instructions and follow up

Patients are instructed to call immediately if any pain or discomfort occur post-operatively. It is recommended to do a 2 week, 3 month, 6 month and 1 year recall visit to assess vitality. At the 6 month - 1 year recall visits, it can be expected to see dentine bridge formation at the site of the exposure or even apexogenesis in a tooth with an open apex. Figure 6 depicts a case that was treated following the protocol as outlined above, showing the formation of a dentine bridge between the pulp and the MTA (white arrows).

Conclusion

Direct pulp capping of permanent teeth, can be successful when applying accurate diagnosis, rubber dam isolation and

biocompatible materials. Proper techniques and materials will ensure the safekeeping and vitality of the capped pulp tissue, allowing healing and dentine bridge formation. The ideal capping material for vital pulp therapy should facilitate bridge formation to re-establish an enclosed, protected pulp. MTA has gained popularity for this purpose in both mature and immature teeth and is indicated for use as a pulp capping material.

References

1. Rafter M. Apexification: A review. *Dent Traumatol.* 2005;21:1-8.
2. Witherspoon DE. Vital pulp therapy with new materials: New directions and treatment perspectives—permanent teeth. *J Endod.* 2008;34(7):25-8.
3. H Alqaderi, CT Lee, S Borzangy, TC Pagonis. Coronal pulpotomy for cariously exposed permanent posterior teeth with closed apices: a systematic review and meta-analysis. *J Dent.* 2016;1(44):1-7.
4. Farsi N, Alamoudi N, Balto K, et al. Clinical assessment of mineral trioxide aggregate (MTA) as direct pulp capping in young permanent teeth. *J Clin Pediatr Dent.* 2007;31(2):72-6.
5. Ford TRP, Torabinejad M, Abedi HR, et al. Using mineral trioxide aggregate as a pulp-capping material. *J Am Dent Assoc.* 1996;127(10):1491-4.
6. Guven G, Cehreli ZC, Ural A, et al. Effect of mineral trioxide aggregate cements on transforming growth factor β 1 and bone morphogenetic protein production by human fibroblasts in vitro. *J Endod.* 2007;33(4):447-50.
7. Junn D, McMillan P, Bakland L, et al. Quantitative assessment of dentin bridge formation following pulp capping with mineral trioxide aggregate (MTA). *J Endod.* 1998;24(4):278.
8. Asgary S, Eghbal MJ, Parirokh M, et al. A comparative study of histologic response to different pulp capping materials and a novel endodontic cement. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2008;106(4):609-14.
9. Bogen G, Kim JS, Bakland LK. Direct pulp capping with mineral trioxide aggregate: An observational study. *J Am Dent Assoc.* 2008;139(3):305-15.
10. Hafez AA, Cox CF, Tarim B, et al. An in vivo evaluation of haemorrhage control using sodium hypochlorite and direct capping with a one- or two-component adhesive system in exposed nonhuman primate pulps. *Quintessence Int.* 2002;33(4).
11. Patel E, Gangadin M. Managing sodium hypochlorite accidents. The reality of toxicity. *S Afr Dent J.* 2017; 72(6):271-4.
12. Hilton TJ. Keys to clinical success with pulp capping: A review of the literature. *Oper Dent.* 2009;34(5):615-25.
13. Barthel CR, Rosenkranz B, Leuenberg A, et al. Pulp capping of carious exposures: Treatment outcome after 5 and 10 years: A retrospective study. *J Endod.* 2000;26(9):525-8.
14. Cox CF, Keall CL, Keall HJ, et al. Biocompatibility of surface-sealed dental materials against exposed pulps. *J Prosthet Dent.* 1987;57(1):1-8.