

# Partial Pulpotomy of Immature Anterior Permanent Teeth with Complicated Crown Fractures: Report of Two Cases

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## Abstract

**Aim:** This report aims to present the application of partial pulpotomy procedures in fractured maxillary central incisors with immature roots.

**Methodology:** Two cases of complicated crown fractures are reported. A 7-year-old male patient with a fractured maxillary left central incisor tooth and 8-year-old female patient with fractured maxillary right and left central incisor teeth were referred to the clinic after trauma. Partial pulpotomies were performed and MTA was applied directly onto the pulps followed by coronal restoration.

**Results:** The application of partial pulpotomy procedures in immature permanent teeth with complicated crown fractures has resulted in the formation of hard tissue barrier and complete root development. Follow up confirmed successful outcomes.

**Conclusions:** Partial pulpotomy procedures in immature maxillary anterior teeth with complicated crown fractures followed by a proper coronal restoration is a valid treatment approach in well-chosen cases.

**Keywords:** Complicated crown fracture, mineral trioxide aggregate, partial pulpotomy.

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## Introduction

Crown fractures account for the majority of all traumatic injuries (up to more than 75%) in the permanent teeth (1). A complicated crown fracture is defined as an enamel/dentin fracture with pulpal exposure (2), and it can reach up to 13% of all dental injuries (2). A crown fracture involving the pulp, if left untreated, will always result in pulp necrosis and subsequent periapical inflammatory

changes (2, 3). Treatment and prognosis depend on several factors such as the time period between the incidence of fracture and initiation of treatment, the degree of root development, and the restorability of the tooth (1, 2, 4).

Pulpotomy is defined as a procedure in which part of an exposed vital pulp is removed, usually as a mean of preserving the vitality and function of the remaining part (5). Partial pulpotomy is a procedure in which the damaged and inflamed pulp tissue

beneath an exposure is removed to a depth of about two millimeters to preserve the vitality of the remaining coronal and radicular pulp (2). This treatment procedure has been proposed several decades ago (6). Cvek (6) presented a clinical report demonstrating high levels of clinical success of partial pulpotomy procedures in mature and immature teeth. This was further confirmed in histological examinations (7). Along the years, literature continues to support this evidence (8, 9).

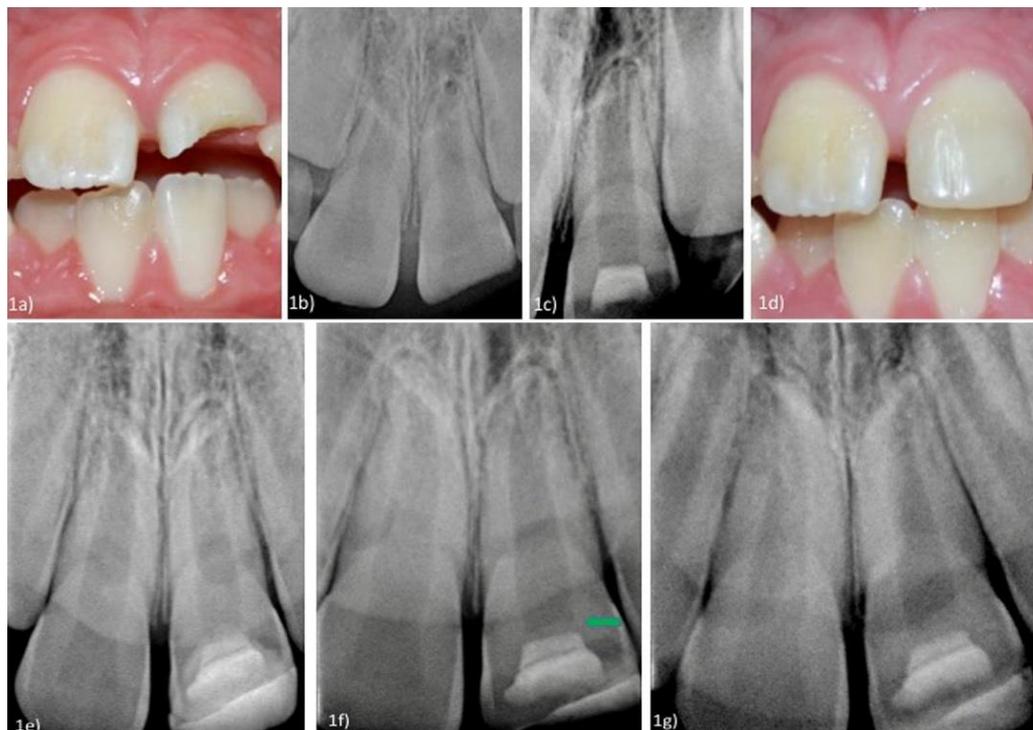
Many materials have been used for partial pulpotomy procedures followed by restoring the crown with direct restorations or others (4, 6, 8, 10). This report aims to describe treatment and follow up of complicated crown fracture by partial pulpotomy using mineral trioxide aggregate and coronal restoration using two different techniques.

## Case Report 1

A 7-year-old male patient was referred with a complain of a broken maxillary left central incisor tooth (# 21). Medical history was non-contributory. Clinical examination revealed a complicated crown

fracture involving enamel, dentin and the pulp, in addition to lip lacerations, they presented to the clinic 5 to 6 hours later to the trauma (Fig. 1a). The tooth was non-tender to percussion and not mobile. The periapical radiographic image showed no evidence of alveolar bone or root fracture and the tooth showed incomplete root formation (Fig. 1b). Based on the above findings, the tooth was scheduled for partial pulpotomy.

In the first visit, an access cavity was performed and part of the coronal portion of the pulp chamber was removed using a sterile round diamond high speed bur under copious coolant. The bleeding was controlled using 20% ferric sulfate (Ultradent, USA), The pulp chamber was irrigated using 5.25% sodium hypochlorite. Mineral trioxide aggregate (MTA, ProRoot MTA White, Densply Sirona, Konstanz, Germany) was prepared according to manufacturer's instructions, and applied on the remaining pulp tissue (Fig. 1c). The access cavity was temporarily sealed with a resin modified glass ionomer (Photac™ Fil Quick Aplicap™ 3M, USA). One week later, the tooth was restored using an adhesive resin composite restoration (Filtek Z250, 3M ESPE, USA) (Fig. 1d).



**Figure 1.** **a)** Preoperative photograph showing a complicated crown fracture of the tooth 21. **b)** Preoperative periapical radiographic view showing incomplete root formation. **c)** Mineral trioxide aggregate (MTA) applied on the remaining pulp tissue. **d)** The tooth was restored using an adhesive resin composite restoration. **e)** 5-month recall periapical radiograph showing continued root formation. **f)** 9-month recall periapical radiograph showing hard tissue barrier formation beneath MTA. **g)** 21-month recall periapical radiographic view.

## Case Report 2

Follow up recalls up to 21 months showed no tenderness to percussion, vitality examination using electric pulp tester (Elements™ Diagnostic Unit, Kerr) showed a negative response probably because of the presence of MTA which acts as a barrier. However, radiographically, the root has continued formation and no periapical radiolucency was noticed (Fig. 1e, g). A radiopaque bridge was observed beneath the MTA indicating hard tissue formation (Fig. 1f).

An 8-year-old female patient was referred with a complaint of a fractured maxillary right and left central incisor teeth (# 11 and 21). Medical history was non-contributory. Clinical examination revealed a complicated fracture involving enamel, dentin and the pulp. Clinical examination showed no pain on palpation and no tenderness to percussion (Fig. 2a, b). The parents kept the broken segment in water for about 10 hours (Fig. 2c). Periapical radiographic examination showed no evidence for alveolar or root fracture. The roots of both teeth were immature (Fig. 2d).



**Figure 2.** **a)** Clinical view (Buccal) of the fractured maxillary incisors. **b)** Clinical view (incisal) showing the exposed pulp horns of the maxillary incisors. **c)** A photograph showing the broken segments. **d)** Preoperative periapical radiographic view. **e)** MTA was applied directly onto the pulp. **f)** Cementation of the broken segments using resin composite. **g)** 3-month follow up periapical radiographic view. **h)** 12-month follow up periapical radiographic view showing continued root formation & hard tissue barrier formation. **i)** and **j)** Follow up after 12 months.

Access cavity was done through the incisal edge, and partial pulpotomy was performed using a round diamond bur high speed under copious coolant. The bleeding was controlled by a cotton pellet moistened with sterile saline under pressure and irrigation with NaOCl 5.5%. MTA was mixed according to manufacturer's instructions (ProRoot MTA White, Dentsply Sirona, Konstanz, Germany), and was applied directly onto the pulp (Fig. 2e). The tooth was temporarily restored with a resin modified glass ionomer (Photac™ Fil Quick Aplicap™ 3M, USA). After one week, the broken segments were cemented in their position using the total etch technique; the remaining tooth structure and the broken segment were etched with an etchant (Etchant 15, Coltene, Ohio, USA), a bond was applied (Adper™ single bond 2, 3M ESPE, St. Paul, MN, USA) according to manufacturer's instructions, and a flowable composite (Filtek Z350XT Flowable, 3M ESPE, USA) was used for cementation. Sof-Lex discs (3M ESPE, St. Paul, MN, USA) were used for finishing, polishing & contouring (Fig. 2f).

The patient was called for follow up after 3 and 12 months. Periapical radiographic views showed no periapical radiolucency, and the root continued development (Fig. 2g, 2h). Hard tissue barrier was observed beneath MTA (Fig. 2h). Clinical examination showed no tenderness to percussion, and the electric pulp tester showed a negative response (Fig. 2i, j).

## Discussion

Many treatments have been proposed for the management of exposed vital pulp in extensively decayed or traumatized teeth such as direct pulp capping and partial or total pulpotomy (5, 8, 11). This report discusses the application of partial pulpotomy procedures in maxillary central incisors with complicated crown fractures. Partial pulpotomy was scheduled for these two cases to preserve the vitality of the remaining pulp tissues and to promote complete root formation. It is generally accepted that teeth with open apex have a favorable response because the remaining pulp is relatively healthy with a high regeneration potential (8, 12).

Mineral trioxide aggregate (MTA) is a biocompatible endodontic material used for wide clinical applications (13). A recent randomized clinical study reported favorable clinical and radiographic outcomes for partial pulpotomy performed in permanent teeth with three different types of MTA (including ProRoot MTA) after one year (8). Investigators of that study observed the formation of a calcified barrier below MTA, which is a favorable response to vital pulp therapy. This

finding was observed in the two cases presented in this report. Despite favorable outcomes, coronal discoloration is one potential drawback of MTA formulations (14, 15), which was evident in the second case. The use of other alternatives, such as bioceramic-based cements, has been reported (10). A good restoration that prevents bacterial penetration into the tooth is essential for the success of partial pulpotomy (16). Regaining the normal shape and function of a crown severed with a complicated fracture is challenging. In the first case, the tooth was restored using a direct resin composite restoration. In the second case, the parents were able to keep the fractured segments which were adhesively bonded back to the teeth using flowable resin composite (17). Investigators (18) examined the success of reattaching the fractured crown fragment to the remaining tooth. Results showed that the combination of flowable and hybrid resin composite used to reattach the tooth's fractured incisal part was successful. In addition, this technique was satisfactory to patients and parents, which was observed in this report.

## Conclusion

Partial pulpotomy procedure in immature maxillary anterior teeth with complicated crown fractures is a warranted treatment approach in well-chosen cases. Proper coronal restoration is essential for the success of partial pulpotomy.

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## References

1. Olsburgh S, Jacoby T, Krejci I. Crown fractures in the permanent dentition: pulpal and restorative considerations. *Dental Traumatol* 2002;18(3):103-15. [Crossref](#)
2. Sigurdsson A, Trope M, Chivian N. The role of endodontics after dental traumatic injuries. In: Hargreaves K, Cohen S, editors. *Cohen's pathways of the pulp*. 10 ed. St. Louis: Mosby; 2010. p. 620-54.
3. Ahmed HM, Al Rayes MH, Saini D. Management and prognosis of teeth with trauma induced crown fractures and

- large periapical cyst like lesions following apical surgery with and without retrograde filling. *Journal of conservative dentistry*: JCD 2012;15(1):77-9. [Crossref](#)
4. Aggarwal V, Logani A, Shah N. Complicated crown fractures - management and treatment options. *Int Endod J* 2009;42(8):740-53. [Crossref](#)
  5. Zanini M, Hennequin M, Cousson PY. A Review of Criteria for the Evaluation of Pulpotomy Outcomes in Mature Permanent Teeth. *J Endod* 2016;42(8):1167-74. [Crossref](#)
  6. Cvek M. A clinical report on partial pulpotomy and capping with calcium hydroxide in permanent incisors with complicated crown fracture. *J Endod* 1978;4(8):232-237. [Crossref](#)
  7. Cvek M, Lundberg M. Histological appearance of pulps after exposure by a crown fracture, partial pulpotomy, and clinical diagnosis of healing. *J Endod* 1983;9(1):8-11. [Crossref](#)
  8. Kang CM, Sun Y, Song JS, Pang NS, Roh BD, Lee CY, et al. A randomized controlled trial of various MTA materials for partial pulpotomy in permanent teeth. *Journal of dentistry* 2017;60:8-13. [Crossref](#)
  9. Barrieshi-Nusair KM, Qudeimat MA. A prospective clinical study of mineral trioxide aggregate for partial pulpotomy in cariously exposed permanent teeth. *J Endod* 2006;32(8):731-5. [Crossref](#)
  10. Tuloglu N, Bayrak S. Partial Pulpotomy with BioAggregate in Complicated Crown Fractures: Three Case Reports. *The Journal of clinical pediatric dentistry* 2016;40(1):31-5. [Crossref](#)
  11. Hilton TJ. Keys to clinical success with pulp capping: a review of the literature. *Operative dentistry* 2009;34(5):615-25. [Crossref](#)
  12. Mass E, Zilberman U. Long-term radiologic pulp evaluation after partial pulpotomy in young permanent molars. *Quint Int* 2011;42(7):547-54.
  13. 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):400-13. [Crossref](#)
  14. Belobrov I, Parashos P. Treatment of tooth discoloration after the use of white mineral trioxide aggregate. *J Endod* 2011;37(7):1017-20. [Crossref](#)
  15. Ahmed HM, Abbott PV. Discolouration potential of endodontic procedures and materials: a review. *Int Endod J* 2012;45(10):883-97. [Crossref](#)
  16. Bimstein E, Rotstein I. Cvek pulpotomy - revisited. *Dental Traumatol* 2016;32(6):438-42. [Crossref](#)
  17. Liddelow G, Carmichael G. The restoration of traumatized teeth. *Australian dental journal* 2016;61 Suppl 1:107-19. [Crossref](#)
  18. Yilmaz Y, Zehir C, Eyuboglu O, Belduz N. Evaluation of success in the reattachment of coronal fractures. *Dental Traumatol* 2008;24(2):151-8 [Crossref](#)