

TWO DIFFERENT TREATMENT APPROACHES IN COMPLICATED CROWN FRACTURES: A CASE REPORT

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Abstract

Complicated crown fractures (CCF) involving enamel, dentin, and pulp exposure are among the most commonly encountered traumatic dental injuries during the mixed dentition period, predominantly affecting the maxillary anterior teeth. Early diagnosis and individualized treatment selection are critical for preserving pulp vitality and long-term tooth function. This case report presents two pediatric patients with complicated crown fractures of the permanent maxillary central incisors managed with different treatment modalities based on their clinical and radiographic presentations. In Case 1, a 10-year-old male with an acute complicated crown fracture of tooth 21, presenting with vital pulp response and an intact periapical region, was treated with partial pulpotomy using mineral trioxide aggregate (MTA), followed by reattachment of the fractured fragment. In Case 2, a 12-year-old male presenting one week post-trauma with a non-vital pulp and an established periapical radiolucency in tooth 11 underwent root canal treatment, followed by composite restoration using the strip crown technique. Clinical and radiographic follow-up evaluations at 1, 3, and 6 months revealed no complications in either case. Both treatment modalities demonstrated satisfactory short-term clinical and radiographic outcomes, and both restorative approaches yielded good esthetic results.

Keywords: complicated crown fracture, dental trauma, mineral trioxide aggregate, fragment reattachment, strip crown

1. Introduction

Dental trauma constitutes a significant global public health burden, with traumatic dental injuries (TDIs) affecting an estimated 20–30% of children during the permanent dentition period. Maxillary central incisors are the most frequently involved teeth due to their prominent position and limited protection from the surrounding soft tissues (Bourguignon et al., 2020). Among the various types of TDIs, complicated crown fractures — defined as fractures extending through enamel and dentin with concomitant pulp exposure — demand immediate clinical attention, as bacterial contamination of the exposed pulp tissue can rapidly lead to pulpitis, necrosis, and periapical pathology if left untreated (Bourguignon et al., 2020; Cvek, 1978).

The clinical management of complicated crown fractures in young patients is directly influenced by pulp vitality status, the time elapsed between the traumatic event and clinical presentation, the stage of root development, and the condition of the fractured fragment if available (Andreasen et al., 2007). In teeth with vital pulp and immature root formation, partial pulpotomy — historically referred to as the Cvek pulpotomy — has been established as the

most biologically conservative treatment approach (Donnelly et al., 2022). The procedure involves removal of a small amount of the superficially contaminated coronal pulp tissue, followed by pulp capping to promote dentin bridge formation and preserve the remaining vital pulp (Cvek, 1978). The use of mineral trioxide aggregate (MTA) as the pulp-capping agent has further optimized outcomes in such cases, given its well-documented biocompatibility, sealing capacity, and ability to stimulate tertiary dentin formation (Torabinejad & Parirokh, 2010).

When pulp vitality is irreversibly lost — typically following delayed presentation with periapical involvement — root canal treatment becomes the treatment of choice, followed by appropriate coronal restoration (Bourguignon et al., 2020). In cases where the fractured tooth fragment is available and structurally intact, fragment reattachment provides a highly conservative and esthetically optimal restoration option that preserves the original color, morphology, and surface texture of the tooth (Andreasen et al., 2007). When the fractured fragment is unavailable or unsuitable for reattachment, direct composite restoration using a strip crown technique offers a reliable and predictable alternative with satisfactory functional and esthetic outcomes (Andreasen et al., 2007; Eden & Taviloğlu, 2016).

The present case report documents two pediatric patients with complicated crown fractures of the maxillary permanent central incisors, managed with individualized treatment strategies tailored to their distinct clinical presentations. The aim is to illustrate the importance of thorough diagnostic assessment and adaptable treatment planning in traumatic dental injuries, and to report short-term clinical and radiographic outcomes.

2. Case Presentation

2.1. case 1

A 10-year-old male patient presented to the Department of Pediatric Dentistry, Faculty of Dentistry, Ankara University, with a chief complaint of a fractured upper left central incisor (tooth 21). Dental history revealed that the injury had occurred approximately one hour prior to presentation following a fall onto a pavement surface. The fractured fragment was transported to the clinic preserved in milk, which is recognized by the International Association of Dental Traumatology (IADT) as an appropriate short-term biological storage medium for dental tissues (Bourguignon et al., 2020).

Clinical examination revealed a complicated crown fracture with evident pulp exposure (Figure 1).



Figure 1. Clinical photograph of traumatized tooth 21 presenting with complicated crown fracture and exposed pulp

Intraoral assessment demonstrated mild sensitivity to percussion; no pathological tooth mobility or adjacent soft tissue injury was noted. Pulp vitality testing elicited a positive response. Radiographic evaluation confirmed healthy periapical tissues with no evidence of root fracture, alveolar bone involvement, or periapical pathology (Figure 2).



Figure 2. Initial periapical radiograph of tooth 21 showing intact periapical tissues and absence of root fracture

Based on the clinical and radiographic findings — a vital pulp response, minimal time elapsed since injury, intact periapical region, and available fragment — partial pulpotomy was selected as the treatment of choice.

Under local anesthesia, hemorrhage control was achieved using 2.5% sodium hypochlorite (NaOCl) irrigation. Approximately 2 mm of the coronal pulp tissue was removed, followed by placement of MTA as the pulp-capping material (Figure 3, Figure 4).



Figure 3. Intraoperative view following partial pulpotomy procedure



Figure 4. MTA placement over the remaining coronal pulp following partial amputation

The fractured tooth fragment was retrieved, and after acid etching of the fracture surface with phosphoric acid, it was reattached to the remaining coronal tooth structure using a dental adhesive system and composite resin (Figure 5, Figure 6). The restoration demonstrated satisfactory marginal adaptation and esthetic outcome immediately after placement.



Figure 5. The fractured tooth fragment retrieved and preserved in milk, prepared for reattachment



Figure 6. Final clinical appearance of tooth 21 following partial pulpotomy and fragment reattachment

Clinical and radiographic follow-up evaluations were conducted at 1, 3, and 6 months post-treatment (Figures 7, 8, 9). At all recall visits, the tooth remained asymptomatic, with no clinical signs of pulp necrosis, restoration failure, or periapical pathology. Ongoing monitoring of the case is being continued.

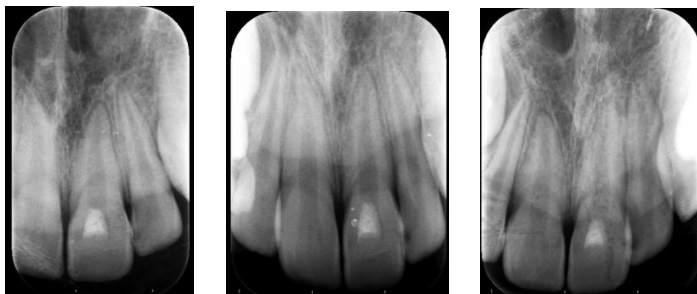


Figure 7–9. Clinical views at 1-month (Fig. 7), 3-month (Fig. 8), and 6-month (Fig. 9) follow-up, showing an intact restoration and healthy surrounding tissues

2.2. case 2

A 12-year-old male patient presented to the clinic with a chief complaint of a fractured upper right central incisor (tooth 11) (Figure 10).



Figure 10. Clinical photograph of traumatized tooth 11 with complicated crown fracture, presenting one week after injury

The dental history indicated that the injury had occurred approximately one week prior to the visit, resulting from a collision with a peer. The patient had not sought dental care immediately following the traumatic event.

Clinical examination demonstrated a complicated crown fracture with no available tooth fragment. Pulp vitality testing yielded a negative response, indicating pulp necrosis (Teeth, 2009). Radiographic evaluation revealed a periapical radiolucent lesion at the root apex (Figure 11), consistent with chronic periapical infection secondary to the untreated pulp exposure.



Figure 11. Initial periapical radiograph of tooth 11 demonstrating periapical radiolucency and loss of periapical integrity

A working length film was obtained during the treatment planning phase (Figure 12). Based on these findings, root canal treatment was indicated.

Root canal treatment was completed over two clinical sessions under local anesthesia. Chemomechanical preparation was performed using sodium hypochlorite irrigation, and the canal was obturated with gutta-percha and root canal sealer following standard protocols. Following successful obturation, coronal restoration was carried out using the strip crown technique with composite resin. The enamel surface was etched with phosphoric acid prior to application of the adhesive system and composite resin (Figure 13, Figure 17).

Clinical and radiographic follow-up at 1, 3, and 6 months (Figures 14, 15, 16) demonstrated complete resolution of the periapical radiolucency, an absence of clinical symptoms, and a satisfactory esthetic restoration outcome. Continued periodic follow-up of this case is ongoing.

3. Results and Discussion

Both cases presented in this report yielded favorable short-term clinical and radiographic outcomes, although the treatment strategies required were fundamentally different based on each patient's individual clinical circumstances. The central differentiating factors — pulp vitality status and the time elapsed since injury — directly determined the treatment approach selected, underscoring the indispensability of prompt and thorough clinical assessment in the management of traumatic dental injuries.

In Case 1, partial pulpotomy with MTA was performed within one hour of the traumatic event, while the pulp remained vital and uninfected. Partial pulpotomy, first systematically described by Cvek (1978), aims to remove only the superficially contaminated layer of coronal pulp tissue, thereby preserving the biological capacity of the remaining pulp to form reparative dentin. Success rates reported in the literature for this procedure are consistently high, ranging from 90% to 96% over extended follow-up periods, provided that treatment is initiated promptly (Bourguignon et al., 2020; Cvek, 1978; Tziafas et al., 2001). The utilization of MTA as the capping material, as applied in this case, offers additional advantages over the historically used

calcium hydroxide. MTA demonstrates superior antibacterial activity, consistent formation of a mineralized tissue barrier, and favorable biocompatibility with the pulp-dentin complex, resulting in enhanced long-term pulp preservation (Torabinejad et al., 1995; Torabinejad & Parirokh, 2010). The positive clinical and radiographic outcomes observed at 1, 3, and 6 months in this case are consistent with these reported success rates.

In Case 2, the one-week delay in presentation allowed bacterial invasion of the entire pulp, resulting in irreversible pulp necrosis and secondary periapical inflammation. This case reinforces the critical importance of early treatment, as prolonged bacterial contamination of exposed pulp tissue invariably compromises pulp vitality and necessitates root canal treatment rather than vital pulp therapy (Andreasen et al., 2007). Following root canal treatment, radiographic evidence of periapical healing was observed by the 3-month follow-up visit, consistent with previously reported healing timelines for periapical lesions following successful endodontic intervention (Bourguignon et al., 2020; Orstavik, 2020).

With regard to coronal restoration, both approaches demonstrated excellent esthetic results. Fragment reattachment, as performed in Case 1, is increasingly recognized as the most conservative and biomimetically superior restorative approach when the fractured fragment is available and structurally sound. This technique preserves the natural color, surface texture, translucency, and morphology of the original tooth, providing an esthetic result that is difficult to replicate with synthetic materials (Andreasen et al., 2007; Baratieri et al., 1998). An important contributing factor in this case was the patient's transportation of the fragment in milk, which maintained the hydration and structural integrity of the dentinal tubules, facilitating optimal bonding at the fracture interface. The IADT guidelines recommend milk as an appropriate short-term storage medium for avulsed teeth and fractured fragments (Bourguignon et al., 2020). In Case 2, where no fragment was available, the strip crown technique with composite resin provided a functionally reliable and esthetically acceptable restoration, consistent with current evidence supporting direct composite restorations for anterior tooth rehabilitation in the pediatric population (Andreasen et al., 2007; Waggoner, 2002).

This report carries certain limitations that must be acknowledged. The 6-month follow-up period, while adequate for short-term assessment, is insufficient to draw conclusions regarding the long-term prognosis of either case. Extended longitudinal follow-up — with particular attention to pulp status in Case 1 and bone healing in Case 2 — is warranted. Additionally, as a two-patient case report, generalizability to the broader population is inherently limited. Larger prospective studies comparing different pulp therapy modalities and restorative approaches in complicated crown fractures are needed to provide higher levels of clinical evidence.

4. Conclusion

The present case report demonstrates that both partial pulpotomy with MTA and root canal treatment represent clinically and radiographically successful short-term treatment modalities for complicated crown fractures in pediatric patients, when the treatment approach is appropriately matched to the patient's pulp vitality status and post-trauma time interval. Fragment reattachment and strip crown composite restoration both provide satisfactory esthetic and functional outcomes as restorative strategies. Early clinical intervention, guided by thorough clinical and radiographic assessment, is essential to optimize the prognosis of traumatized anterior teeth in children. Individualized treatment planning remains the cornerstone of successful management in this patient population.

Authors' Contribution Statement

All authors contributed equally to the preparation of this manuscript, have reviewed and read the final version of the article, and approve its submission for publication.

Conflict of Interest Statement

All authors declare that there is no conflict of interest for this study.

Ethical Approval

This case report describes routine clinical dental procedures performed as part of standard patient care. Formal ethics committee approval was not required, as no experimental intervention was applied and all procedures were conducted in accordance with established clinical protocols within the accepted standard of care. Written informed consent was obtained from the parents/legal guardians of both patients prior to all procedures and for the use of clinical records and photographs for academic publication purposes.

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