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Management of uncomplicated crown fracture of a permanent central incisor – case report

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Abstract

Traumatic dental injuries (TDIs) are highly prevalent among children and adolescents and often involve crown fractures of the maxillary incisors, which represent the most frequent type of trauma in the permanent dentition. Given the potential biological and psychosocial consequences—ranging from pulp necrosis and disturbances in maxillofacial development to reduced quality of life—prompt and predictable restorative interventions are essential. Direct composite restoration remains the treatment of choice in young patients when the fractured fragment is unavailable, owing to its conservative nature, favorable esthetic outcomes, and ability to preserve remaining tooth structure. This case report presents a minimally invasive restorative approach for the management of an uncomplicated crown fracture of a maxillary central incisor using a silicone index to accurately reproduce the original tooth morphology. The silicone key technique facilitates precise palatal shell formation, enables controlled layering of composite resin, and reduces operative time—factors that are particularly advantageous in pediatric and adolescent patients who may have limited treatment tolerance.

Keywords: wax-up technique, uncomplicated fracture, tooth restoration

Background

Traumatic dental injuries (TDIs) are common incidents involving damage to the teeth, periodontium, and surrounding soft tissues, and they represent a significant share of injuries among children, adolescents, and young adults (1). They account for about 5% of all traumatic injuries in individuals seeking first aid and up to 17% of all bodily injuries among preschool children (2). Crown fractures of the anterior teeth represent the most frequent traumatic injuries in the permanent dentition, with reported prevalence ranging from 26% to 76% (3). Around one quarter of school-aged children experience such trauma (4), most commonly between 8 and 12 years of age, with approximately 92% involving the maxillary central and lateral incisors (5-7). Luxation injuries predominate in primary teeth, whereas crown fractures are more commonly associated with permanent teeth (1, 7). Epidemiological data also show a global male-to-female ratio of 1.43, suggesting that boys are more prone to TDIs than girls (8).

The consequences of TDIs can vary widely. In primary dentition, trauma can disturb the development of permanent teeth, ranging from mild enamel defects to severe developmental complications depending on the area impacted (9, 10). In permanent teeth, TDIs may lead to pulp necrosis, internal or external root resorption, and may influence maxillofacial growth (11, 12). Given

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the potential severity of these outcomes, prompt emergency care is essential for improving prognosis.

Beyond clinical implications, TDIs may also significantly affect children's quality of life. Untreated trauma can result in impaired mastication and psychosocial challenges such as embarrassment, reduced social interaction, and avoidance of smiling, laughing, or speaking with peers (13-16). These burdens highlight the importance of accurate diagnosis, thorough treatment planning, and structured follow-up to achieve favorable outcomes.

Management becomes particularly complex in young patients with immature root development. When the fractured fragment is available and adequately preserved, reattachment provides a conservative solution that maintains the tooth's original anatomy (17-19). In cases where the fragment is lost or severely compromised, direct composite resin restoration remains the treatment of choice in children due to its predictable esthetic and functional results. The aim of the present study is to describe a clinical protocol for the restoration of an uncomplicated fracture of a central incisor using a silicone key, and to evaluate the postoperative outcomes over an 18-month follow-up period.

Case report

An 11-year-old systemically healthy boy was admitted for examination 1 day after traumatic injury sustained from a bicycle fall. The patient had been examined by the family dentist two hours after the accident and the exposed dentin was covered with glass-ionomer cement (Fig. 1). The parents and the child reported to neurological symptoms immediately after the trauma, such as nausea, vomiting, disorientation, headache, loss of consciousness, amnesia, or speech difficulties.

Fig. 1. Pre-operative status one day after the injury. The exposed dentin has been covered with glass-ionomer cement.

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Extraorally slight bruising and hematoma with swelling of the upper and lower lips were observed. The opening of the mouth, movement of the lower jaw and occlusion were normal.
Intraoral examination revealed no soft tissue lacerations or foreign bodies in the oral cavity. An oblique noncomplicated fracture of the crown of tooth 11 was observed with no increased mobility or displacement. The patient reported pain on percussion. No tooth discoloration was observed. Increased sensitivity to thermal stimuli was observed as a result of exposed dentin. Tooth vitality was evaluated using an electric pulp test (Scorpion, 405-7A, Optica Laser, Bulgaria), which revealed a threshold of 36 microamperes (μA), consistent with a vital pulp exhibiting reduced sensitivity following recent trauma.
Treatment plan: Soft tissues were cleaned with hydrogen peroxide and chlorhexidine. Parents were informed about potential complications including swelling, crown discoloration, mobility, or fistula. Oral hygiene instructions included training in the modified Stillman method and cleaning after meals for 3–5 days post-incident, plus gingiva care with chlorhexidine products. Occlusal contacts were not restored at this stage.
To restore the missing dental tissues, a two-layer, step-by-step impression was taken with C Silicone (Zetaplus Putty, Zhermack, Badia Polesine, Italy). An additive wax model was then made on a duplicate plaster model. A silicone key was taken from the model of the palatal surface of the restoration, including the incisal edge of the anterior teeth and the tooth to be restored. This silicone key was used as a guide for the direct restoration of the tooth with composite material (Fig. 2 A, B, C).

Fig. 2. Wax-up of the fractured incisor and silicon index key.
A. Labial surface; B. Palatal surface; C. Silicone Key.

The restoration was done two weeks after the trauma, preceded by a re-evaluation of the vitality using electric pulp test. The response to the stimulation was again positive.

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The treatment protocol was as follows:
- Isolation with rubber dam (Fig. 3A);
- Removal of the GIC that was placed on the first appointment;
- Adhesive protocol – etching with orthophosphoric acid gel and bonding with single-bottle universal adhesive;
- Placement of the silicon key and building of a palatal shell with enamel composite (Fig. 3B);
- Dentin mass was applied to reproduce the mamelons;
- Enamel composite for restoring the buccal surface;
- Creation of a surface texture with a diamond bur;
- Finishing and polishing;
- Removal of the rubber dam and final check of the occlusion (Fig. 3C).

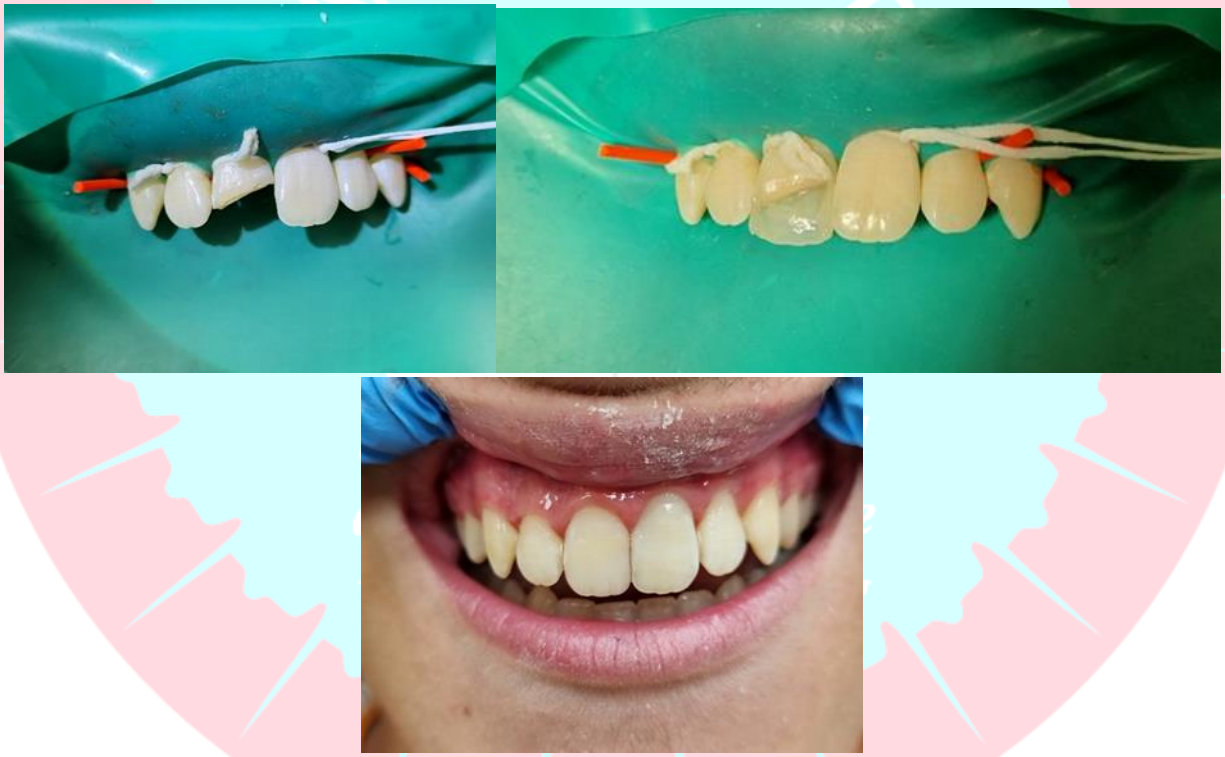

Fig. 3. Treatment Protocol
A. Isolation with rubber dam; B. Placement of the silicon key and building of a palatal shell with enamel composite; C. Tooth restoration.

The tooth was followed for 18 months after the trauma. Normal responsiveness to pulp vitality testing was observed, with no detectable changes in marginal adaptation and no discoloration of the restoration. The patient reported no subjective symptoms throughout the follow-up period.

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Discussion

Despite significant advances in materials and techniques, achieving highly esthetic anterior composite restorations remains clinically demanding. Shade selection has been improved through customized shade guides (20) and digital photocolorimetric or spectrophotometric tools (21), yet accurate shade matching alone does not ensure a natural result. Tooth esthetics arise from the interaction of light with enamel and dentin, producing five key color dimensions. Therefore, precise composite layering guided by pre-operative photographs is essential to replicate chromaticity, value, intensives, opalescence, and surface characterizations (22). The final polishing and texturizing phase is critical for achieving seamless integration with adjacent tissues but is typically time-consuming and technique-sensitive. The Stratified Stamp Technique (SST) simplifies directly transferring the wax-up morphology to the final labial composite layer (23, 24). SST is highly versatile and serves as a predictable alternative to indirect veneers (with or without preparation) in cases including: reshaping, lengthening, or widening anterior teeth; crown fractures; congenital malformations; enamel hypocalcification; and discoloration unresponsive to bleaching. It carries the same contraindications as indirect veneers (23).

Oblique fractures are generally considered to carry a higher risk of complications related to pulp injury (25). To prevent such complications, the exposed dentin was kept covered with GIC, without direct restoration of the occlusion.

Another widely used method for the restoration of dental structures is the fabrication of crowns. This approach requires additional tooth preparation and the removal of intact tissues, which carries risks of pulp involvement and subsequent complications (26, 27). In our case, we employed direct composite restoration, adhering to the principles of minimally invasive treatment. Follow-up over the past 18 months demonstrated the stability of the aesthetic restoration, including its integrity and adaptation to the dental structures, preservation of color. The electric pulp test demonstrated a threshold of 17 microamperes (μA), indicating restoration of normal pulp responsiveness and suggesting functional recovery of the pulpal neurovascular complex.

Conclusion

Adherence to the fundamental principles of minimally invasive treatment and to established protocols for managing trauma in permanent immature teeth ensures the preservation of pulp vitality, continued root development, and the restoration of speech, masticatory function, and aesthetics. The use of a silicone index significantly facilitates the clinician and enhances both the esthetics and the overall quality of the restoration.

References

1. Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth, 4th edn. Oxford, UK: Wiley-Blackwell; 2007.

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2. Andersson L. Epidemiology of traumatic dental injuries. J Endod 2013;39(3, suppl) :S2–S5.
3. Andreasen JO, Andreasen FM, Andersson L. Textbook and Color Atlas of Traumatic Injuries to the Teeth. 4th ed. Hoboken, NJ, USA: Wiley Blackwell 2018.
4. Levin L, Day PF, Hicks L, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. Dent Traumatol 2020; 36(4): 309-13.
5. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries A clinical study of 1,298 cases. Eur J Oral Sci 1970; 78(1-4): 329-42.
6. Bissinger R, Müller DD, Reymus M, et al. Treatment outcomes after uncomplicated and complicated crown fractures in permanent teeth. Clin Oral Investig 2021; 25(1): 133-43.
7. Bissinger R, Müller DD, Hickel R, Kühnisch J. Survival analysis of adhesive reattachments in permanent teeth with crown fractures after dental trauma. Dent Traumatol 2021; 37(2): 208-14.
8. Petti S, Glendor U, Andersson L. World traumatic dental injury prevalence and incidence, a meta-analysis-one billion living people have had traumatic dental injuries. Dent Traumatol 2018;34(2):71–86.
9. Lenzi MM, Alexandria AK, Ferreira DM, Maia LC. Does trauma in the primary dentition cause sequelae in permanent successors? A systematic review. Dent Traumatol 2015;31(2):79–88.
10. Flores MT, Onetto JE. How does orofacial trauma in children affect the developing dentition? Long-term treatment and associated complications. Dent Traumatol 2019;35(6):312–323.
11. Lin S, Pilosof N, Karawani M, Wigler R, Kaufman AY, Teich ST. Occurrence and timing of complications following traumatic dental injuries: A retrospective study in a dental trauma department. J Clin Exp Dent 2016;8(4):e429–e436.
12. Trope M. Avulsion of permanent teeth: theory to practice. Dent Traumatol 2011;27(4):281–294.
13. Frujeri MdeL, Frujeri JA, Bezerra AC, Cortes MI, Costa ED Jr. Socio-economic indicators and predisposing factors associated with traumatic dental injuries in schoolchildren at Brasília, Brazil: a cross-sectional, population-based study. BMC Oral Health 2014;14:91.
14. Feldens CA, Senna RA, Vargas-Ferreira F, Braga VS, Feldens EG, Kramer PF. The effect of enamel fractures on oral health-related quality of life in adolescents. Dent Traumatol 2020;36(3):247–252.
15. Borges TS, Vargas-Ferreira F, Kramer PF, Feldens CA. Impact of traumatic dental injuries on oral health-related quality of life of preschool children: a systematic review and meta-analysis. PLoS One 2017;12(2):e0172235
16. Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Impact of treated and untreated dental injuries on the quality of life of Ontario school children. Dent Traumatol 2008;24(3):309–313
17. Madhubala A, Tewari N, Mathur VP, Bansal K. Comparative evaluation of fracture resistance using two rehydration protocols for fragment reattachment in uncomplicated crown fractures. Dent Traumatol 2019; 35(3): 199-203.
18. Diangelis AJ, Andreasen JO, Ebeleseder KA, Kenny DJ, Trope M, Sigurdsson A, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. Dent Traumatol 2012;

DOI: 10.18044/MEDINFORM.2025124.2300 ISSUE 4, 2025

19. Bruschi-Alonso RC, Alonso RCB, Correr GM, et al. Reattachment of anterior fractured teeth: Effect of materials and techniques on impact strength. Dent Traumatol 2010; 26(4): 315-22.
20. Notarantonio, A.; Seay, A. A system for reliable composite shade matching: Custom shade tabs and an intra-oral mockup. J. Esthet. Restor. Dent. 2023, 35, 787–795.
21. Philippi, A.G.; Sabatini, G.P.; Freitas, M.S.; Oshima, S.N.; Tango, R.N.; Gonçalves, T. Clinical Tooth Color Matching: In Vivo Comparisons of Digital Photocolorimetric and Spectrophotometric Analyses. Oper. Dent. 2023, 48, 490–499.
22. Vanini, L.; Mangani, F.M. Determination and communication of color using the five color dimensions of teeth. Pract. Periodontics Aesthet. Dent. 2001, 13, 19–26, quiz 28.
23. Gaviria-Martinez, A.; Castro-Ramirez, L.; Ladera-Castañeda, M.; Cervantes-Ganoza, L.; Cachay-Criado, H.; Alvino-Vales, M.; Garcia-Luna, G.; López-Gurreonero, C.; Cornejo-Pinto, A.; Cayo-Rojas, C.F. Surface roughness and oxygen inhibited layer control in bulk-fill and conventional nanohybrid resin composites with and without polishing: In vitro study. BMC Oral Health 2022, 22, 258.
24. D'Arcangelo, C.; De Angelis, F.; Vadini, M.; Carluccio, F.; Vitalone, L.M.; D'Amario, M. Influence of curing time, overlay material and thickness on three light-curing composites used for luting indirect composite restorations. J. Adhes. Dent. 2012, 14, 377–384.
25. Robertson A. A retrospective evaluation of patients with uncomplicated crown fractures and luxation injuries. Endod Dent Traumatol 1998;14:245–56.
26. Lampl S, Gurunathan D, Mehta D, Krithikadatta J, Moodley D. Effective Management of a Fractured Tooth in a Child Using an Aesthetic Pediatric Crown: A Case Report and Review of Literature. Case Rep Dent. 2024 Nov 6;2024:6888443. doi: 10.1155/2024/6888443.
27. Sztyler K, Wiglusz RJ, Dobrzynski M. Review on Preformed Crowns in Pediatric Dentistry-The Composition and Application. Materials (Basel). 2022 Mar 11;15(6):2081.

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