

Conservative Direct Restorations for Traumatic Anterior Teeth Using Injection Molding Technique: A Case Report

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Abstract

Dental trauma is a common clinical condition with significant functional, aesthetic, and psychosocial consequences, particularly in children and adolescents. Anterior teeth are most frequently affected, and timely, appropriate management is essential to ensure a favorable prognosis and to minimize pulpal and periodontal complications. This article presents a clinical case of an 8-year-old systemically healthy boy who reported dental sensitivity two months after a traumatic incident. Clinical examination revealed an uncomplicated crown fracture of tooth 31 and a complicated crown fracture of tooth 32.

Based on the clinical findings and time elapsed since trauma, a comprehensive treatment plan was established. Tooth 31 was restored using an injection molding technique, allowing for minimally invasive reconstruction with predictable aesthetic and functional outcomes. Tooth 32 underwent endodontic treatment followed by direct composite restoration. The injectable technique involved the use of a transparent silicone index, adhesive protocols, and light-curing through the silicone key to ensure accurate morphology, optimal marginal adaptation, and reduced chairside time.

A four-year follow-up radiographic and clinical evaluation demonstrated completed root development, absence of periapical pathology, and long-term stability of the restorations with satisfactory aesthetics and structural integrity. The case highlights the advantages of direct restorative approaches in young patients, including preservation of tooth structure, reduced biological cost, reparability, and immediate aesthetic rehabilitation.

Keywords: Dental trauma; anterior tooth fracture; Pediatric dentistry; Direct composite restoration; Injectable composite technique.

Background

Dental trauma is defined as a disruption of the integrity of the teeth and/or other hard and soft tissues in and around the oral cavity (1). It affects not only the physical condition of the individual but also behavior and overall quality of life (2). The incidence of dental trauma affects approximately 5% of the global population, while prevalence shows a wide range from 6% to 59%,

with substantial variation depending on geographic region. The risk of dental trauma depends on several factors, including age, circumstances, geographic location, behavior, and culture, and increases in the home, school, and sports environments. Despite these variations, a general trend indicates that one third of all preschool children (primary dentition) and one quarter of adolescents and adults (permanent dentition) have experienced dental trauma at least once in their lifetime. In permanent dentition, sports activities represent the leading cause of traumatic injuries (3). Other causes of dental trauma reported in the literature include collisions, assaults, bicycle accidents, and road traffic accidents (4).

The teeth most susceptible to trauma are the anterior teeth, with the maxillary central and lateral incisors being affected most frequently. Dental trauma occurs more often in males (1.3–2.5 times more frequently) compared with females (4). Age represents another important risk factor. Studies indicate that dental trauma is more common among younger populations (toddlers, children, adolescents, and young adults) due to increased physical and sports-related activity (4). The International Association of Dental Traumatology (IADT) has developed a classification system for traumatic dental injuries (5, 6) and has issued guidelines to provide dentists and patients with evidence-based recommendations for optimal treatment selection (5).

Patients with dental trauma should be aware that certain injuries require repeated follow-up examinations over time. The management of dental trauma is complex and becomes even more challenging in children and adolescents due to limited cooperation and fear of pain during dental procedures. Therefore, the use of anesthesia during treatment is recommended (7). The aesthetic impact following dental trauma can be significant. Complicated or uncomplicated crown fractures may be restored using various techniques. When feasible, reattachment of the tooth fragment represents the treatment of first choice. By applying appropriate adhesive protocols, restoration can successfully re-establish both function and aesthetics (8). When fragment reattachment is not possible, alternative options include direct or indirect restorations. The clinician must decide which of these approaches to adopt, as the literature does not provide definitive guidelines regarding this choice. Composite materials, infiltrating resins, ceramic restorations, layering techniques, and CAD/CAM technologies may simplify therapy and enhance its predictability (9,10).

Possible pulpal complications following dental trauma include pulp necrosis, calcification of the root canal, and internal root resorption. Potential complications affecting the root and periodontal tissues include disturbances in root development, infection, apical periodontitis, ankylosis, external root resorption, soft tissue recession, and/or fibrous healing (11). The literature provides consolidated guidelines for cases in which endodontic treatment is required, although some uncertainties remain in specific situations, particularly following reimplantation procedures (12). It is estimated that 26–76% of lesions result in permanent tooth loss (13).

The prognosis of traumatic dental injuries depends on immediate and appropriate management and is reduced in the presence of concomitant lesions affecting the same teeth. Fractures that remain untreated demonstrate an almost threefold increase in the likelihood of pulp necrosis compared with treated teeth (14). The management of uncomplicated crown fractures is therefore essential not only from an aesthetic perspective but also in terms of prognosis.

Aim

The aim of the present article is to discuss the feasibility of using injection molding technique in direct restoration of fractured lower anterior tooth.

Case report

An 8-year-old boy, systemically healthy, presented for clinical examination with complaints of sensitivity triggered by cold stimuli, during oral hygiene procedures, and while eating, two months after a traumatic incident. Neither the parents nor the patient reported neurological symptoms such as nausea, vomiting, disorientation, headache, loss of consciousness, amnesia, or speech difficulties following the incident.

Intraoral examination revealed an uncomplicated fracture of tooth 31 and a complicated fracture of tooth 32 (Fig. 1). The traumatic findings were consistent with the symptoms reported by the patient. The affected teeth showed no tenderness on palpation or percussion and exhibited no pathological mobility.



Figure 1. Pre-operative status 2 months after the injury.

A treatment plan was established. Considering the elapsed time since the traumatic incident, tooth 31 was restored using an injection molding technique. To restore the missing dental tissues, a two-layer, step-by-step impression was taken using C-silicone material (Zetaplus Putty, Zhermack, Badia Polesine, Italy) and a wax-up diagnostic model was created. After patient approval of the shape, size, and volume, an injection silicone key was fabricated from transparent silicone. Prior to restoration, sharp fracture margins were rounded. The adjacent teeth were isolated (Fig. 2A).



Fig. 2. Tooth restoration procedure:

- A. Tooth isolation;*
- B. Placement of the silicone key for injection of the composite material;*
- C. Removal of the silicone key and occlusal control;*
- D. Final aesthetic restoration after finishing and polishing.*

Tooth preparation:

A 37% orthophosphoric acid etchant was applied for 30 seconds, followed by application of the bonding agent G-Premio Bond (GC, Tokyo, Japan). The adhesive material was light-polymerized for 20 seconds. The silicone key was positioned, and the injectable composite material G-ænial



Injectable was introduced (Fig. 2B). The restoration was inspected for voids and for complete filling of the silicone key. The material was polymerized through the transparent silicone key and again after its removal (Fig. 2C). Occlusion was checked and adjusted. The restoration was then finished and polished (Fig. 2D).

After 4 years, a follow-up radiographic examination was carried out, revealing completed root development and absence of periapical pathology (Fig. 3). The restorations demonstrated long-term stability with respect to both aesthetics and structural integrity.

Fig. 3. Follow-up radiograph after 4 years.

Discussion

One of the most effective methods for managing dental fractures is the reattachment of the missing fragment, when feasible. This approach is simple, highly aesthetic, and cost-effective, while preserving the structural integrity of the tooth. A limitation of the technique is that the fragment, having remained outside the oral environment, may be dehydrated and discolored. However, these changes typically resolve within approximately one month (15).

When anterior tooth fractures occur as a consequence of trauma, both direct and indirect restorative approaches may be employed to reestablish proper tooth morphology. A wide range of restorative materials is available for each technique, and both approaches present specific advantages and limitations that influence clinical decision-making (16). Composite resins, predominantly used in direct restorations, may also be applied in indirect procedures, and their extensive clinical use is attributed to their satisfactory longevity combined with relatively low costs (17). In contrast, ceramic materials—such as lithium disilicate, feldspathic ceramics, and zirconia—are exclusively indicated for indirect restorative techniques. Despite the well-documented reliability of composite materials, many clinicians continue to favor more invasive indirect procedures, relying on dental technicians to fabricate veneers or crowns with optical characteristics that closely mimic natural dentition. Currently, no definitive criteria exist to universally guide the selection between direct and indirect techniques; therefore, factors such as invasiveness, financial cost, and expected longevity of the restoration must be carefully evaluated (17).

Direct restorative techniques are associated with several advantages, including a reduced incidence of endodontic complications, the possibility of retreatment in the event of subsequent fractures, and the immediate restoration of aesthetics within a single clinical appointment. Moreover, direct restorations preserve all future therapeutic options. However, compared with indirect techniques, they exhibit lower mechanical strength, increased surface roughness, and polymerization shrinkage. Conversely, indirect ceramic restorations offer superior aesthetic outcomes due to their enamel-like translucency, as well as advantages related to color stability, rigidity, marginal adaptation, and reduced microleakage (18). When selecting between direct and indirect restorative approaches, clinicians must consider factors such as technical sensitivity, treatment duration, reparability, and the patient's economic situation. The comprehensive knowledge of restorative techniques, tissue healing mechanisms, and long-term treatment management plays a fundamental role in determining therapeutic success (19, 20). Restoration using an injection silicone key and composite materials allowed for rapid recovery of function and aesthetics, with long-term stability confirmed by a four-year follow-up radiograph

Conclusion

Dental traumatic injuries represent a significant concern for both oral health and quality of life, with anterior teeth being the most frequently affected, particularly in children and adolescents. The presented clinical case demonstrates the successful application of direct restorative techniques for the management of uncomplicated and complicated coronal fractures.. Literature evidence

supports the use of direct restorations as an effective and conservative approach, providing the possibility for future interventions, minimizing the risk of endodontic complications, and delivering satisfactory aesthetic outcomes. The choice between direct and indirect techniques should be guided by clinical indications, technical complexity, patient financial considerations, and the expected longevity of the restoration. Timely and properly executed treatment remains the key factor for a favorable prognosis, reducing the risk of complications such as pulp necrosis and root-related issues. The presented case, along with a review of the current literature, confirms that direct composite restorations constitute a reliable and predictable therapeutic option in the management of traumatic dental injuries.

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Georgieva N, Conservative Direct Restorations for Traumatic Anterior Teeth Using Injection Molding Technique: A Case Report. *J. Med. Dent. Pract*,2026; 13(1):2328-2334.