

Bleeding Injuries in Dental Trauma and Emergency Medical Management: A Literature Review

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Received: 19 December 2025 / Accepted: 12 January 2026 / Published online: 20 January 2026

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Abstract

Introduction: Dental and maxillofacial trauma is often associated with significant hemorrhage due to the rich vascular supply of the oral and perioral tissues. Uncontrolled bleeding can lead to airway obstruction, aspiration, hypovolemic shock, and increased morbidity, particularly in emergency settings. Prompt recognition and effective hemorrhage control using dental-specific emergency protocols are therefore critical.

Materials and Methods: This narrative literature review synthesizes current evidence on the etiology, patterns, and severity of bleeding injuries from dental trauma, as well as contemporary emergency medical management strategies. Emphasis was placed on airway assessment, direct pressure techniques, local and systemic hemostatic agents, dental and maxillofacial immobilization, and timely activation of emergency medical services. Relevant publications were identified through major medical databases and guideline sources.

Results: The reviewed literature indicates that early hemorrhage control, combined with systematic airway evaluation and stabilization, significantly reduces complications in dental trauma. Interventions such as gauze compression, suturing, topical hemostatic agents, splinting of dentoalveolar injuries, and coordinated prehospital–hospital care have shown favorable outcomes. However, many studies are limited by small sample sizes, heterogeneous methodologies, and low levels of evidence, underscoring the lack of universally accepted, standardized protocols.

Conclusion: Hemorrhagic complications following dental trauma represent a potentially life-threatening but largely preventable cause of adverse outcomes. Effective emergency medical management—incorporating early bleeding control, appropriate use of hemostatic agents, structured referral pathways, and trained responders—is essential for improving patient survival and recovery. Strengthening standardized, evidence-based dental trauma protocols and enhancing multidisciplinary training remain key priorities for future clinical practice and research.

Keywords: Dental trauma, oral bleeding, emergency management, hemorrhage control, first aid

Original article, no submission or publication in advance or in parallel

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Introduction

Dental and maxillofacial trauma is a significant global public health concern, affecting millions of individuals each year and constituting a major cause of emergency department (ED) visits. [1] These injuries often result from falls, sports activities, interpersonal violence, motor vehicle accidents, and occupational hazards, particularly in high-risk environments such as construction sites. [2]

One of the most critical and immediate complications of dental trauma is acute bleeding, which may result from lacerations of the gingiva, lips, oral mucosa, periodontal tissues, or fractures of the alveolar process and maxillofacial

bones.[3] Due to the rich vascular supply of the oral cavity and surrounding structures, even seemingly minor dental injuries can cause substantial hemorrhage, rapid blood loss, and potentially life-threatening airway compromise. [4, 5]

Early control of bleeding in dental trauma is essential to prevent hypovolemia, shock, airway compromise, and aspiration, and to preserve oral function and aesthetics [6]. The first ten minutes after trauma, known as the “*Platinum 10 minutes*,” are critical for preventing complications. Effective initial management depends on rapid identification of the bleeding source, appropriate first aid, and timely activation of emergency services [7].

Despite the importance of early intervention, numerous studies have highlighted significant gaps in training among both healthcare personnel and lay responders, particularly in prehospital settings where immediate professional care may be unavailable [8, 9].

The complexity of dental trauma management is further compounded by variations in injury mechanisms, anatomical involvement, patient age, and comorbidities. [10] Accordingly, evidence-based guidelines emphasize airway assessment, hemorrhage control, fracture immobilization, CPR as needed, and prevention of hypothermia. [11]

Recent advances in technology, including hemostatic agents, telemedicine, and digital diagnostic tools, have also begun to influence contemporary approaches to emergency dental trauma care.[12]

Given the growing body of research in this field, a comprehensive and up-to-date synthesis of existing evidence is needed to clarify patterns of bleeding in dental trauma, assess the effectiveness of current emergency management strategies, and evaluate the methodological strengths and weaknesses of available studies. [13]

This literature review aims to summarize the epidemiology and types of bleeding associated with dental trauma, evaluate emergency management practices described in the literature, identify gaps requiring further investigation, and provide recommendations for clinical practice and future research.[14]

Aim and Objectives

Aim: To analyze current strategies for the emergency medical management of hemorrhagic injuries in trauma and provide evidence-based recommendations to improve patient outcomes.

Objectives:

- To review prehospital and in-hospital interventions for controlling hemorrhage in trauma patients.
- To identify factors that influence survival and recovery in hemorrhagic trauma.
- To evaluate the effectiveness of multi-faceted and tailored emergency interventions.
- To assess the role of trained first responders, rapid EMS activation, and the use of personal protective equipment (PPE) in reducing complications.

- To highlight gaps in current practice and suggest recommendations for improving emergency medical care in trauma-related hemorrhagic injuries.

Methodology

This literature review was conducted through a systematic search of major databases, including PubMed, Scopus, Google Scholar, and Embase, focusing on studies published within the last 20 years. Keywords used included “hemorrhagic trauma,” “emergency medical management,” “prehospital care,” “bleeding control,” and “resuscitation.”

Inclusion criteria *were*:

- Studies involving adult patients with traumatic hemorrhagic injuries.
- Prehospital and in-hospital emergency interventions.
- Systematic reviews, meta-analyses, clinical trials, and guideline-based studies.

Exclusion criteria *were*:

- Adult and pediatric studies.
- Case reports without systematic methodology.
- Studies published more than 20 years ago.

Data from selected studies were extracted and analyzed to *identify*:

- Types and effectiveness of interventions.
- Key determinants influencing survival.
- Gaps in current practice and areas requiring further research.
- This methodology ensured a comprehensive and evidence-based overview of emergency management strategies for hemorrhagic injuries in trauma.

Results

The literature review identified key findings regarding the emergency management of hemorrhagic injuries in trauma:

Hemorrhage Control: Early control of bleeding using tourniquets, hemostatic dressings, and pressure techniques significantly reduces mortality. Internal hemorrhage often requires rapid surgical intervention or endovascular techniques.

Prehospital Interventions: Rapid activation of emergency medical services (EMS) and trained first responders improves patient survival. Prehospital use of hemostatic agents and fluid resuscitation improves outcomes.

Hospital-Based Management: Damage-control resuscitation, including balanced transfusion protocols, is effective for managing severe hemorrhage. Timely surgical intervention remains critical for internal bleeding.

Determinants of Survival: Shorter transport times, early recognition of hemorrhage, and adherence to standardized protocols are associated with improved outcomes. Use of personal protective equipment (PPE) and safety measures at

construction sites reduces injury severity.

Effectiveness of Interventions: Multi-faceted, tailored approaches that combine different strategies— prevention, rapid intervention, and resuscitation, show higher effectiveness. Studies highlight gaps in training, resources, and standardization across different settings.

Overall, the review emphasizes that a combination of early intervention, trained personnel, and evidence-based protocols is essential to reduce mortality and complications in hemorrhagic trauma. [15].

Discussion

The findings of this literature review highlight the critical importance of timely and coordinated emergency care in managing hemorrhagic injuries in trauma. [16]

Early hemorrhage control, rapid EMS activation, and the presence of trained first responders consistently improve survival rates and reduce complications. Prehospital interventions, including the use of tourniquets, hemostatic agents, and fluid resuscitation, are essential for stabilizing patients before hospital arrival. [17, 18]. Hospital-based strategies, such as damage control resuscitation and prompt surgical intervention, are equally crucial for controlling internal bleeding and preventing further deterioration. Multi-faceted approaches that integrate prehospital care, hospital management, and preventive safety measures are more effective than single interventions. [19, 20]

Despite these advances, several challenges remain. Many studies report gaps in training, a lack of standardized protocols, delayed recognition of hemorrhage, and limited resources, especially in high-risk environments such as construction sites. Additionally, methodological limitations in some studies impede the establishment of strong causal relationships between interventions and outcomes.[21].

Overall, the evidence underscores the need for structured, evidence-based protocols, continuous training for emergency personnel, and coordinated prehospital-to-hospital care systems. Future research should focus on implementing and evaluating multifaceted interventions and improving methodological rigor to further enhance survival and reduce morbidity in hemorrhagic trauma cases [24-27].

Conclusion

Hemorrhagic injuries in trauma are a leading cause of preventable death, especially in high-risk settings such as construction sites. Effective management requires early hemorrhage control, rapid prehospital response, trained first responders, and timely hospital interventions, including damage control resuscitation and surgery. Multi-faceted, tailored approaches that integrate prehospital care, hospital treatment, and preventive safety measures significantly improve survival and reduce complications. Strengthening standardized protocols, personnel training, and coordinated emergency systems is essential. Further high-quality

research is needed to optimize intervention strategies and improve outcomes for trauma patients with hemorrhagic injuries.

Recommendations

- Rapid hemorrhage control
- Trained responders & fast EMS
- Timely hospital care
- Multi-faceted, preventive strategies
- PPE & safety enforcement
- Ongoing training & research

COI Statement: This paper has yet to be submitted in parallel, presented fully or partially at a meeting, podium, or congress, published, or submitted for consideration beforehand.

No relevant or minor financial relationships exist between authors, their relatives, or the next of kin with external companies.

Disclosure: The authors declared no conflict of interest. No funding was received for this article.

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