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Medical Emergency Management in Dental Practice: Proactive Risk Stratification and Simulation-Driven Clinical Readiness

Dwi Riski Saputra[1]*, Hendrijaya Permana[1], Zainul Cholid[1]
[1] Departmen of Oral and Maxillofacial Surgery, University of Jember, Indonesia

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ABSTRACT

The increasing prevalence of geriatric patients with complex comorbidities and polypharmacy has significantly elevated the incidence of chairside medical emergencies in dental practice. Although oral and maxillofacial surgeons possess comprehensive theoretical knowledge of the pathophysiology underlying emergencies such as vasovagal syncope and hypoglycemia, a critical "action gap" persists between academic understanding and real-time crisis management. This review aims to present a clinically actionable framework encompassing early detection, precision prevention protocols, and advanced stabilization strategies to optimize patient safety. A comprehensive literature search was conducted across PubMed, Scopus, and Google Scholar databases through early 2026, focusing on pre-procedural risk stratification, intraoperative Basic Life Support (BLS) competencies, and the measurable impact of high-fidelity simulation training. Findings demonstrate that formalized risk-matrix screening effectively prevents systemic crises through proactive treatment modifications. Importantly, evidence indicates that conventional didactic education is insufficient; only regular, simulation-based emergency drills successfully bridge this gap by enhancing stress-resilient psychomotor skills and team-based cardiopulmonary resuscitation performance. In conclusion, effective management of maxillofacial emergencies depends on proactive risk profiling and institutionalizing a culture of continuous simulation training. The transition from static theoretical knowledge to dynamic, simulation-driven clinical readiness represents the forefront of modern patient safety in dental practice prior to emergency medical services arrival.

Keywords: Dental practice, Medical emergencies, Simulation-based training, Patient safety, Basic Life Support

Corresponding Author:
Dwi Riski Saputra
Departmen of Oral and Maxillofacial Surgery, University of Jember,
Jalan Kalimantan No. 37, Kampus Tegalboto, Jember, Jawa Timur, 68121, Indonesia
Email: dwiriskifkg@gmail.com

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1. INTRODUCTION

Medical emergencies in dental practice, though relatively infrequent, pose significant life-threatening risks that demand immediate and competent clinical intervention (Mahmood & Muneeb, 2025). Epidemiological data underscore the pervasive nature of this challenge:

approximately 57% of dental practitioners encounter at least three emergency incidents annually, with 36% reporting more than ten episodes per year (Romero et al., 2024). This high incidence rate highlights a critical need to enhance clinical readiness among dental teams, ensuring rapid recognition and effective management to safeguard patient outcomes (Alves et al., 2024; Oliveira, 2024). Although these events occur unexpectedly, their successful management necessitates the seamless integration of theoretical knowledge, practical Basic Life Support (BLS) competencies, and the judicious provision of emergency apparatus and pharmacological resources (Cardoso et al., 2023).

The contemporary dental patient population is increasingly characterized by advanced age, complex medical comorbidities, and polypharmacy, all of which substantially elevate the risk of intraoperative crises (Botelho et al., 2022; Hussein et al., 2021; Špiljak et al., 2024). The rising prevalence of chronic conditions such as hypertension, diabetes, and cardiovascular disease, particularly among geriatric cohorts, has amplified the probability of systemic decompensation during routine procedures (Cardoso et al., 2023). Concurrently, procedural factors, including dental anxiety, the administration of local anesthetics, and conscious sedation, act as potent physiological stressors that can precipitate or exacerbate acute events (Ugalmugle et al., 2026). Consequently, comprehensive pre-procedural screening encompassing detailed medical history, baseline vital sign monitoring, and standardized risk stratification tools such as the American Society of Anesthesiologists (ASA) classification has become indispensable for preemptively identifying medically unstable patients and tailoring treatment modifications (Aloufi et al., 2022; Gupta et al., 2023; Aloriny & Alqahtani, 2025).

Among the spectrum of potential crises, vasovagal syncope and hypoglycemia represent the most frequently reported emergencies in dental clinics, collectively accounting for a substantial proportion of chairside incidents (Abdulrahman et al., 2022; Al-Sebaei, 2024; Gomes et al., 2021). However, effective crisis management extends beyond acute stabilization; it requires a comprehensive understanding of the underlying pathophysiology to optimize therapeutic responses and prevent secondary complications (Herrera et al., 2021; Kaur et al., 2023). Clinicians must possess the diagnostic acuity to differentiate between benign

neurocardiogenic syncope and life-threatening conditions such as multisystemic anaphylaxis, acute bronchospasm, cardiovascular collapse, or status epilepticus (Javaid et al., 2024; Chérrez-Ojeda et al., 2024). This differential precision is critical, as overlapping clinical presentations, such as diaphoresis, altered mental status, or transient unconsciousness can easily lead to diagnostic hesitation, which in turn compromises time-sensitive interventions like epinephrine administration or parenteral glucose delivery (Sarkisyan et al., 2026; Kadu et al., 2024).

Despite the well-documented prevalence and pathophysiological complexity of these events, a critical operational "action gap" persists between practitioners' cognitive knowledge and their ability to execute high-stakes, real-time crisis management in the dental operatory. Traditional continuing education models, predominantly reliant on didactic lectures and passive learning, have proven insufficient in bridging this divide. Evidence indicates that while dental professionals may demonstrate theoretical competence, they frequently experience significant deficits in stress-resilient psychomotor performance, team coordination, and closed-loop communication during actual emergencies (Hutse et al., 2021; Javaid et al., 2024; Saeed et al., 2025). This vulnerability underscores the necessity of transitioning from static knowledge acquisition to dynamic, simulation-driven clinical preparedness grounded in Crisis Resource Management (CRM) principles. Regular, high-fidelity simulation drills within the clinical environment are essential to institutionalize automated, stress-resistant reflexes and ensure seamless team synchronization before emergency medical services arrive (Jafar et al., 2022; Kishimoto et al., 2023; IJDSIR, 2025a).

To address this systemic deficiency, the present review advances beyond conventional clinical summaries by explicitly integrating proactive risk-matrix stratification with experiential simulation training frameworks. This article aims to provide a comprehensive, evidence-based synthesis of common medical emergencies in dental practice, emphasizing prevention protocols, early recognition, and management strategies optimized for real-time surgical readiness. By aligning pre-procedural risk assessment with high-fidelity simulation paradigms, this review seeks to establish a standardized pathway for transforming theoretical knowledge into dynamic, life-saving clinical reflexes, ultimately redefining the frontier of patient safety in contemporary dental practice.

2. METHODS

This comprehensive review employed a structured literature search strategy to synthesize contemporary evidence on medical emergency management in dental practice, with explicit emphasis on proactive risk stratification and simulation-driven clinical readiness. A systematic search was conducted across three major electronic databases: PubMed/MEDLINE, Scopus, and the Cochrane Library. The search strategy integrated Medical Subject Headings (MeSH) and free-text keywords, including "medical emergencies," "dental practice," "oral surgery," "risk assessment," "risk matrix," "high-fidelity simulation," "crisis resource management," and "clinical preparedness." Boolean operators (AND, OR) were strategically applied to maximize search sensitivity and specificity. All searches were restricted to publications released between January 2021 and May 2026 to capture the most current clinical guidelines and simulation-based educational frameworks.

Inclusion criteria encompassed peer-reviewed original research articles, clinical trials, systematic and scoping reviews, meta-analyses, and evidence-based clinical guidelines published in English. Eligible studies were required to directly address one or more of the following domains: (1) epidemiology and prevalence of chairside medical emergencies, (2) pre-procedural risk assessment and patient stratification protocols, (3) emergency pharmacotherapy and immediate clinical maneuvers, or (4) outcomes of simulation-based training and crisis resource management in dental education. Publications focusing exclusively on out-of-hospital advanced cardiac life support (ACLS) without direct applicability to the dental operatory, conference abstracts, editorials, letters to the editor, and non-peer-reviewed commentaries were excluded.

Study selection followed a standardized two-stage screening process. Two independent reviewers initially evaluated titles and abstracts against the predefined eligibility criteria, followed by a comprehensive full-text review of potentially relevant articles. Inter-reviewer discrepancies were resolved through structured consensus discussions or adjudication by a third senior researcher. The methodological quality and risk of bias of included studies were critically appraised using the Joanna Briggs Institute (JBI) critical appraisal checklists, selected according to specific study designs (e.g., randomized controlled trials, observational studies, and systematic reviews). This rigorous appraisal ensured that only high-

quality, methodologically sound evidence informed the subsequent synthesis.

Given the heterogeneous nature of the included literature, a qualitative narrative synthesis approach was employed. Data extraction focused on key variables, including emergency incidence rates, risk stratification frameworks, simulation training modalities, pharmacological protocols, and measured outcomes in clinical performance, knowledge retention, and team coordination. Extracted findings were thematically organized and critically analyzed to map evidence-based risk assessment protocols directly onto high-fidelity simulation frameworks. This integrative approach explicitly targeted the operational "action gap," bridging the divide between theoretical cognitive knowledge and real-time, stress-resilient clinical execution in the dental setting.

3. RESULTS

Synthesis of Emergency Management Strategies

To resolve the operational "action gap" in dental practices, clinical interventions must shift from reactive management to structured, protocol-driven responses. Table 1 synthesizes the primary guidelines, immediate clinical maneuvers, and standard pharmacological dosages required to manage the most prevalent intraoperative crises.

Table 1. Clinical Management Protocols

Emergency Type	Primary Clinical Maneuver & Protocol	First Line Pharmacological Intervention & Dosing	Primary Guidelines
Vasovagal Syncope	Defer procedure immediately; place patient in a supine position with feet elevated (Trendelenburg position) to restore cerebral perfusion; maintain open airway.	Oxygen administration (4–6 L/min via nasal cannula or face mask); aromatic ammonia inhalants (if recovery is delayed).	American Heart Association (AHA) BLS Guidelines (Oliveira, 2024; Li & Ouanounou, 2026). Monitor vitals to rule out cardiac arrhythmias.
Anaphylactic Shock	Immediate cessation of allergen exposure; call Emergency Medical Services (EMS); maintain airway; monitor for laryngeal edema.	Epinephrine (1:1000), 0.3–0.5 mg intramuscularly (IM) into the anterolateral thigh; repeat every 5–15 mins if needed. Adjuncts: Antihistamines.	World Allergy Organization (WAO) Guidelines (Cangül et al., 2026; Sin et al., 2023). Never delay epinephrine for mild systemic signs.
Asthma Exacerbation	Stop dental procedure; sit the patient upright; clear oral cavity of instruments; coach breathing.	Fast-acting bronchodilator (Salbutamol/Albuterol inhaler): 2–4 puffs via spacer; supplemental oxygen (4–6 L/min).	Global Initiative for Asthma (GINA) (Pour et al., 2025; Enyew & Mehdi, 2025). Watch for progression toward status asthmaticus.
Hypoglycemia	Verify blood glucose levels via glucometer. Conscious: Oral rapid-acting carbohydrates. Unconscious: Activate EMS immediately.	Conscious: 15–20g oral glucose. Unconscious: Glucagon 1 mg IM/Subcutaneous or Intravenous (IV) Glucose (D50).	American Diabetes Association (ADA) (Khattak et al., 2024; Barros et al., 2022). Do not attempt oral administration if consciousness is altered.
Epileptic Seizure	Clear oral cavity; protect patient's head; do not restrain limbs; do not place objects between teeth; position in recovery position post-ictal.	Supplemental oxygen post-ictal (or during prolonged seizures); Midazolam 5–10 mg IM or Diazepam 5–10 mg IV if seizure > 5 mins.	Neurocritical Care Society / Epilepsy Foundation (Vázquez et al., 2023; Xu et al., 2024). Active status epilepticus (>5 mins) requires emergent EMS transfer.

Common Dental Emergencies :

Dental visits commonly feature sudden events like vasovagal syncope, acute myocardial infarction, or anaphylaxis, necessitating rapid diagnostic skills and synchronized team actions (P. et al., 2026). Studies reveal that psychological stressors such as fear and anxiety trigger up to 75% of these incidents, emphasizing stress-reduction strategies alongside vigilant monitoring (Palmeira et al., 2021). In addition, systemic issues, including cardiovascular diseases, gastrointestinal disorders, and anesthetic allergies, constitute key risk factors requiring continuous observation during outpatient procedures (Josan & Zănoagă, 2021). Successful approaches encompass accurate differential diagnosis and customized emergency kits to address both localized injection-related complications and broader systemic crises (Kolisnyk et al., 2025).

Syncope Management

Vasovagal syncope remains the most frequent emergency in the dental setting, often manifesting through a transient loss of consciousness triggered by fear or pain (Li & Ouanounou, 2026). Management involves immediately positioning the patient in a supine posture with the feet elevated to restore cerebral perfusion, followed by maintaining an open airway and administering oxygen (Oliveira, 2024). Monitoring of vital signs is essential during this recovery phase to ensure rapid hemodynamic stabilization and to exclude underlying cardiac arrhythmias (Santana et al., 2023). In cases where consciousness is not promptly restored, practitioners should evaluate the patient for potential hypoglycemia, as this condition is similarly prevalent and frequently documented alongside syncopal episodes in clinical reports (Abdulrahman et al., 2022). Furthermore, maintaining a specialized emergency drug kit ensures that clinicians are prepared to administer pharmacological interventions if standard restorative measures fail to reverse the patient's condition (Hakeem et al., 2024; Kambarovich & Nasullaevna, 2025). Practitioners should also prioritize regular team training in Basic Life Support and the use of Automated External Defibrillators to maintain the competency required for rapid response (IJDSIR, 2025a, 2025b). Moreover, because the majority of emergencies occur during tooth extractions, clinicians must remain particularly vigilant during the surgical phase (Cangül et al., 2025). While vasovagal syncope is the most common diagnosis, approximately 8% of these acute medical incidents are classified as severe,

requiring a structured approach to prevent progression toward urgent medical transfer (Braimah et al., 2022; Tran et al., 2025).

Practitioners must distinguish benign syncopal episodes from true anaphylactic reactions, as the latter require immediate epinephrine administration rather than simple postural repositioning (Chérrez-Ojeda et al., 2024). Beyond anaphylaxis, clinicians must be prepared to address other critical events such as respiratory obstruction, acute asthma, and cardiac arrest (Kamran, 2024). Proactive clinical preparedness requires regular maintenance of emergency protocols and team training to ensure practitioners can effectively stabilize patients until professional emergency medical services arrive (Jafar et al., 2022). To ensure this level of readiness, regular assessment of staff competence in basic life support and simulation-based training remains imperative, as many dental professionals currently report feeling inadequately prepared to handle these critical scenarios (Hutse et al., 2021; Javaid et al., 2024; Saeed et al., 2025).

Anaphylactic Reactions

These hypersensitivity responses often present with sudden urticaria, angioedema, or bronchospasm, necessitating immediate intramuscular epinephrine to counteract airway compromise and hypotension (Cangül et al., 2026; Sin et al., 2023). Early recognition of these symptoms is critical, as delays in pharmacological intervention can lead to rapid cardiovascular collapse (Sarkisyan et al., 2026). Concurrent with epinephrine administration, the clinical team should provide supplemental oxygen and monitor the patient's respiratory status to detect signs of laryngeal edema or respiratory failure (Agnes & Manton, 2024). Subsequent management involves promptly activating emergency medical services to facilitate definitive care and stabilize the patient for potential hospital transport (Huxley et al., 2024). Establishing a definitive post-emergency diagnosis is equally essential to identify the specific causative agent, thereby preventing recurrence during future dental procedures (Goto, 2023). Because clinical preparedness directly correlates with the ability to navigate these high-stakes incidents, practitioners must maintain updated emergency drug protocols that include standardized dosing for immediate life-saving intervention (Kazempour et al., 2025; Sanuki et al., 2023).

Furthermore, dental professionals must avoid the tendency to hastily diagnose anesthetic allergies without

thorough clinical evaluation or specialist consultation (Chérrez-Ojeda et al., 2024). Proper management strategies for hypersensitivity vary by severity, utilizing antihistamines for mild reactions while reserving epinephrine as the first-line treatment for severe, multisystemic anaphylactic shock (Chérrez-Ojeda et al., 2023). Beyond pharmacological administration, dentists must be aware that common clinical materials, including latex, chlorhexidine, and certain antibiotics, can act as potential allergens, requiring a detailed review of the patient's medical history prior to any intervention (Sigcha & Morales, 2025). Operational preparedness, encompassing the systematic anticipation and prevention of adverse events, remains a fundamental pillar of patient safety that distinguishes proficient dental practices (Iacobescu et al., 2026).

Asthma Exacerbation

Dental clinicians must be prepared to manage acute bronchospasm, which is characterized by wheezing, dyspnea, and excessive accessory muscle use, often triggered by stress or anxiety during treatment. Effective management requires immediate cessation of the procedure and administration of a fast-acting bronchodilator to alleviate airway obstruction (Pour et al., 2025). When patient stabilization is not achieved with initial inhaled medication, supplemental oxygen should be delivered to address potential hypoxemia while the emergency medical team is summoned (Enyew & Mehdi, 2025). Clinicians should maintain a clear, unobstructed airway and continuously monitor the patient's vitals, as delays in recognizing progression toward status asthmaticus can lead to severe respiratory failure (Dym & Fan, 2023; Lima et al., 2023). Accordingly, maintaining a salbutamol inhaler as an essential component of the emergency drug kit is mandatory for every dental office to facilitate timely bronchodilation (Arivazhagan et al., 2022). Additionally, practitioners should perform a thorough review of the patient's medical history to identify known respiratory triggers or chronic airway conditions, as these factors significantly elevate the risk of intraoperative bronchospasm (Khattak et al., 2024). Furthermore, implementing objective pulmonary function testing for patients with a history of poorly controlled asthma may serve as a useful preventive strategy to identify underlying airway obstruction before elective procedures commence (Chhabra & Nigam, 2021). Establishing a standardized protocol for drug administration and equipment

maintenance ensures that clinicians can rapidly stabilize the patient while coordinating definitive care from specialized medical services (Vázquez et al., 2023). Given that asthma remains a highly prevalent respiratory condition with significant potential for acute complications, clinicians must adopt proactive measures such as scheduling early morning appointments and implementing stress-reduction strategies to minimize the likelihood of an intraoperative crisis (Baghani & Ouanounou, 2021; Saini et al., 2026)

Hypoglycemia

Hypoglycemia presents with symptoms such as tremors, diaphoresis, and confusion, frequently occurring in patients who have fasted prior to appointments or have poorly managed diabetes. Management requires immediate verification of blood glucose levels followed by the administration of rapid-acting carbohydrates for conscious patients, or parenteral glucose in cases of severe altered mental status (Khattak et al., 2024). For patients who remain unresponsive despite these efforts, emergency protocols mandate activation of advanced life support services to provide intravenous glucose (Barros et al., 2022; Kadu et al., 2024). Furthermore, clinicians must distinguish between transient hypoglycemic episodes and other metabolic crises by maintaining a comprehensive medical history for all patients, particularly those with chronic conditions requiring regular medication (Dubin & Kademani, 2025; Dym & Fan, 2023). Regular maintenance of an emergency kit containing standardized doses of glucagon and accessible glucose monitors is vital to ensure that dental offices remain equipped for these metabolic interventions (Nemati & Hamedani, 2024). Furthermore, addressing metabolic stability requires that clinicians monitor glucose levels throughout the treatment phase, particularly for patients at risk of diabetic ketoacidosis or hyperosmolar hyperglycemic syndrome (Silva et al., 2025).

Epileptic Seizure

Seizures in the dental chair necessitate immediate measures to prevent patient injury, beginning with the removal of all instruments from the oral cavity and the protection of the patient's head to avoid trauma. Clinicians should refrain from restraining the patient's limbs or placing objects between the teeth to minimize the risk of secondary injury during the ictal phase. Once the active convulsing subsides, the clinical team must clear the airway and

monitor respiratory function, as airway obstruction represents a significant risk in the post-ictal period (Vázquez et al., 2023). Oxygen supplementation should be initiated promptly if the patient displays signs of respiratory distress, and continuous observation is required until consciousness is fully restored (Abraham et al., 2022). For cases where seizure activity persists beyond five minutes, clinicians must initiate immediate airway support and administer anticonvulsant medication to prevent status epilepticus (Xu et al., 2024). Emergency medical services must be contacted immediately if the seizure duration exceeds this timeframe or if the patient fails to regain consciousness, as these scenarios often indicate a life-threatening medical emergency (Gomes et al., 2021). In addition to these direct interventions, ensuring that all clinical staff are trained in basic life support and familiar with the location of emergency equipment is paramount for managing post-ictal recovery effectively (Bhagol & Maheshwari, 2023; Zingade et al., 2021).

4. DISCUSSION

The synthesis of contemporary literature up to early 2026 highlights a critical paradox in outpatient oral and maxillofacial surgery: while practitioners possess an advanced theoretical grasp of systemic pathophysiology, a profound "action gap" persists regarding real-time crisis leadership, stress management, and tactical psychomotor execution during acute chairside emergencies. The transition from a controlled elective surgical procedure to an unmanaged medical crisis requires immediate cognitive shifting, which is often compromised by clinical panic and team desynchronization.

The Pathophysiological Trigger Matrix: Anxiety, Surgical Trauma, and Risk Preemption

Our analysis of the aggregated data confirms that vasovagal syncope remains the most ubiquitous emergency encountered in dental operatories (Li & Ouanounou, 2026). However, the literature warns against a complacent approach to syncopal episodes. Vasovagal syncope is not merely a transient inconvenience; its clinical presentation can mimic or precipitously cascade into profound bradyarrhythmias or severe cardiovascular collapse, particularly in patients with underlying subclinical cardiac conditions (Santana et al., 2023; Tran et al., 2025).

The data strongly indicate that up to 75% of these acute episodes are directly triggered by endogenous catecholamine surges driven by fear, dental phobia, and surgical anxiety (Palmeira et al., 2021). This

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neurocardiogenic reflex is heavily concentrated during specific high-stress surgical phases, most notably during the administration of local anesthesia and active tooth extractions (Cangül et al., 2025).

For the oral and maxillofacial surgeon, this reality necessitates a paradigm shift from reactive crisis management to proactive risk-matrix stratification. Implementing formalized, mandatory pre-procedural protocols, including recording baseline vital signs and using objective risk-screening tools, serves as the primary defense mechanism. For instance, identifying poorly controlled asthmatics or brittle diabetics through rigorous history-taking allows for targeted interventions, such as pre-operative anxiolysis, strategic morning scheduling, and selective pre-procedural pulmonary function checks to preempt intraoperative bronchospasms or acute metabolic shifts (Baghani & Ouanounou, 2021; Chhabra & Nigam, 2021; Khattak et al., 2024).

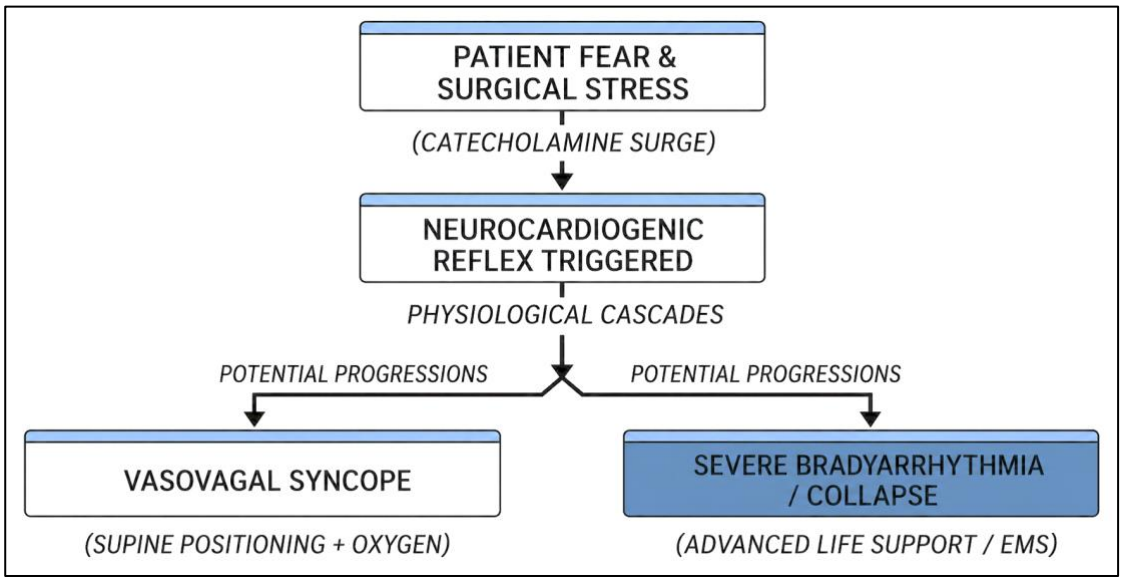

Figure 1. Neurocardiogenic Pathway

Pharmacological Vigilance and the Dilemma of Differential Diagnosis Under Stress

A critical vulnerability identified across the reviewed literature is the acute cognitive load placed on clinicians during differential diagnosis under high-stress conditions. The initial clinical manifestations of several life-threatening emergencies can overlap significantly, complicating immediate intervention. A prime example is the challenge of distinguishing between a benign psychogenic syncopal episode, an acute asthma exacerbation, and the early stages

of a multisystemic anaphylactic shock (Chérrez-Ojeda et al., 2024).

While a syncopal patient recovers rapidly with simple supine positioning and legs elevated to restore cerebral perfusion, an anaphylactic reaction demands immediate, aggressive intramuscular deployment of epinephrine (Oliveira, 2024; Sin et al., 2023). Any diagnostic hesitation or structural delay in administering epinephrine, often caused by a clinician's misinterpretation of a psychogenic reaction or an unverified local anesthetic allergy, can lead to catastrophic laryngeal edema and irreversible cardiovascular collapse (Sarkisyan et al., 2026).

Similarly, metabolic crises like hypoglycemia present a diagnostic challenge; symptoms such as confusion, diaphoresis, and tremors can easily be mistaken for standard syncope or panic attacks. The literature emphasizes that an emergency drug kit is only as effective as the clinician's diagnostic speed and access to immediate verification tools, such as chairside glucometers (Kadu et al., 2024; Nemati & Hamedani, 2024). Clinicians must maintain strict pharmacological protocols, ensuring that life-saving agents such as epinephrine, salbutamol inhalers, and glucagon are not only stocked but also readily accessible, with standardized dosing algorithms to bypass cognitive lag during an active crisis (Arivazhagan et al., 2022; Kazempour et al., 2025).

The Failure of Didactic Continuing Education and the Mandate for High-Fidelity Simulation

The most compelling and revolutionary insight derived from the contemporary 2021–2026 literature is the definitive documentation of the failure of traditional, lecture-based continuing education. Historically, professional regulatory bodies have relied on static textbooks, lectures, and passive recertification courses to maintain emergency preparedness. The data demonstrate this approach is inadequate: despite high scores on theoretical examinations, a vast majority of dental professionals consistently report severe subjective unpreparedness and a lack of operational confidence when confronted with real-world clinical deterioration (Hutse et al., 2021; Javaid et al., 2024; Saeed et al., 2025).

To address this systemic deficiency, modern oral surgery frameworks must mandate the integration of regular, high-fidelity simulation-based emergency drills into the clinical environment (IJDSIR, 2025a). Managing a complex crisis, such as status epilepticus or status asthmaticus, requires competencies that transcend

individual knowledge. It demands complex psychomotor skills, coordinated team dynamics, explicit role assignment, and closed-loop communication under extreme stress (Vázquez et al., 2023; Xu et al., 2024). This mandate for immersive training is firmly grounded in Crisis Resource Management (CRM) theory, which stipulates that technical medical expertise is non-functional without non-technical skills like situational awareness, clear leadership, and dynamic resource allocation during acute stress. By transitioning from passive lectures to experiential simulations, dental institutions effectively operationalize adult learning theory, specifically Kolb's Experiential Learning Cycle, in which concrete clinical experiences and immediate debriefing systematically transform abstract conceptual data into deeply ingrained, stress-resilient psychomotor reflexes.

Table 2. Most Common Medical Emergencies in a Dental Office

Emergency Type	Core Manifestation	First-Line Action	Critical Risk Factor
Vasovagal Syncope	Transient loss of consciousness, bradycardia	Supine positioning, feet elevated, O2	Progression to cardiac arrhythmia
Anaphylaxis	Angioedema, urticaria, bronchospasm	Immediate IM Epinephrine (1:1000)	Delayed delivery leading to airway collapse
Status Asthmaticus	Refractory wheezing, severe dyspnea	Salbutamol inhaler, EMS activation	Rapid progression to respiratory failure
Severe Hypoglycemia	Confusion, tremors, altered mental status	Oral glucose (conscious) / Glucagon	Misdiagnosis as a psychogenic event
Status Epilepticus	Seizure activity exceeding 5 minutes	Airway protection, Anticonvulsants	Post-ictal airway obstruction / Hypoxia

When a patient experiences a tonic-clonic seizure in the dental chair, the clinical team must execute a series of rapid, synchronized actions: safely removing all sharp surgical instruments from the oral cavity, protecting the patient's head without manual restraint, clearing the airway during the post-ictal phase, and preparing anticonvulsant protocols if the seizure crosses the critical five-minute threshold (Abraham et al., 2022; Zingade et al., 2021). These actions cannot be effectively learned through reading; they must be developed into stress-resilient muscle memory.

In-office simulation drills act as the definitive bridge that converts passive academic knowledge into dynamic, automated clinical reflexes. Cultivating this simulation-driven operational readiness within the surgical team represents the true frontier of modern

patient safety, ensuring the team can successfully stabilize a deteriorating patient during the critical "golden hour" before specialized emergency medical services arrive (Jafar et al., 2022; Kamran, 2024).

Limitations

While this synthesis offers a critical advancement in conceptualizing crisis readiness, several institutional limitations within the included literature must be acknowledged. First, there is potential publication bias, as studies demonstrating successful interventions via simulation are disproportionately published relative to those with neutral or negative outcomes. Second, there is substantial heterogeneity among the evaluated studies in terms of clinician demographics, baseline competencies, and specific clinical settings. Finally, the dental education sector currently lacks universally standardized simulation metrics, limiting the ability to objectively measure and benchmark long-term skill retention across different training programs globally.

5. CONCLUSION

Effective emergency management in dental practice must transcend passive theoretical knowledge by addressing the operational "action gap" directly. To bridge this gap, clinic administrators and dental educators must prioritize two actionable mandates: first, institutionalize mandatory pre-procedural risk matrix protocols within daily clinical workflows to preemptively stratify medically compromised patients, and second, replace passive didactic recertification with regular, in-office high-fidelity simulation drills focused on Crisis Resource Management (CRM). Mandating these integrated, hands-on preparedness frameworks is essential to transform cognitive algorithms into rapid, stress-resilient psychomotor reflexes, thereby fundamentally securing patient safety during critical, chairside emergencies.

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AUTHOR CONTRIBUTIONS

DRS: Main Idea, Conceptualization, Methodology, Data Curation, Formal Analysis, Writing, Original Draft. HP: Investigation, Validation, Writing–Review

& Editing. SC: Supervision, Review & Editing.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the publication of this article.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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