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# Basics of Management of Medical Emergencies in Dental Office and Emergency Drug Kit

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## Abstract

Medical emergencies are rare medical events that may occur unexpectedly in the dental office during dental treatment. If encountered those events require immediate diagnosis and management to avoid potential consequences. In case of an emergency, the roles and activities of the dentist and the team members should be planned, documented, and displayed. The staff members should be trained and updated in first aid, cardiopulmonary resuscitation, and other emergency procedures. The best office emergency kit is one that is prepared and maintained by the dentist based on his/her needs and easily accessible for immediate use. The knowledge of management of medical emergencies will increase the confidence of the dental surgeons in their clinical practice.

**Key words:** Emergency drug dosage, Emergency drugs, Emergency kit, Emergency management

## INTRODUCTION

Medical emergencies at dental office are a rare situation. When the dentist encounters such occasional incidences, they should initiate emergency procedures to save the life of the patient. All the dental team members of the clinic should be well trained to recognize and handle medical emergencies in the dental office.<sup>1</sup> The aim of this article is to elucidate the primary sequential approach, essential medical equipment, and drugs required in the management of such emergencies.

## PRINCIPAL LINE OF TREATMENT: POSITION, CIRCULATION, AIRWAY, BREATHING, AND CIRCULATION APPROACH<sup>2-5</sup>

In a survey conducted in North America, dentists have reported 13,836 medical emergencies over a period

of 10 years which occurred during dental treatment procedures. These emergencies were not related to dental problems.<sup>2</sup>

The more common adverse events encountered during dental practice are vasovagal/hypoglycemic syncope, angina, epilepsy, asthmatic episode, and anaphylaxis (Table 1).

When such an emergency occurs, the sequential steps should be followed is listed here.

### Position of the Patient

The primary positions during emergency situations are supine position (seizure), supine position with elevated legs (syncope and cardiac arrest), semi-erect and upright position (angina, myocardial infarction, heart failure, and asthma).

### Circulation

To record heart rate by assessing carotid pulse in neck. To check carotid pulse, the rescuer must place the hand on victim's chin, and fingers should be placed in the groove between the thyroid cartilage and sternocleidomastoid muscle band in the neck and feel for pulse. If carotid pulse is not palpable, the rescuer has to start cardiopulmonary resuscitation (CPR) immediately. Look at the hands and

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**Table 1: Essential drugs and dosages**<sup>2-25</sup>

Drug	Indication	Administration	Adult dosage	Pediatric dosage
Oxygen	All medical emergencies except hyperventilation	Therapy mask nasal cannula Pocket mask bag valve mask	2-6 l/min 10-15 l/min	3-5 l/min
Epinephrine	Anaphylaxis	IM/SC IV	1:1000 dilution 0.3-0.5 mg 1: 10,000 dilution	1:1000 0.05-0.3 mg 1:10,000 0.01 mg/kg
Chlorpheniramine	Mild allergy	Oral/IM	10-20 mg 25-50 mg	1-2 mg q 6 h max 8 mg/day 1-1.25 mg/kg 50 mg q 6 h
Diphenhydramine				
Nitro-glycerine	Angina	Sublingual tablets Spray	0.4 mg q 5 min 2-3 times 400 µg per actuation	Amyl nitrate 0.3 mL vaporole
Salbutamol (albuterol)	Asthma	Metered aerosol inhaler	100 µg per actuation 2-3 inhalations/1-2 mn	100 µg per actuation 1 inhalation/1-2 mn
Aspirin	Myocardial infarction	Sublingual PO/PR	325 mg tablet	5-10 mg/kg q 6 h
Diazepam	Status epilepticus	Oral Rectal	2-10 mg 0.2 mg/kg	0.3-0.5 mg/kg
Midazolam		IM Intranasal	5-10 mg 0.2 mg/kg	0.1-0.2 mg/kg 0.2 mg/kg
Lorazepam		Oral/infiltration/topical IM/IV	5 mg/ml 4 mg	0.25-0.5 mg/kg 0.02-0.04 mg/kg
Morphine sulfate	Angina unresponsive to nitroglycerin	IM/IV RR<12 Don't re-administer SC	2-5 mg repeat every 5-30 mn	0.05-0.1 mg/kg max 10 mg/dose 0.1-0.2 mg/kg
Dextrose	Hypoglycaemia	IV	50% dextrose 100 ml	25% dextrose 1-4 ml/kg
Glucagon 50 mL amp		SC/IM/IV	1 mg	0.5 mg
Hydrocortisone	Adrenal crisis anaphylaxis	IM/IV	100 mg	1 mg/kg
Dexamethasone		IM	4 mg	0.25-0.5 mg/kg
Propranolol	Hypertension	Oral	Immediate release 40 mg	1-2 mg/kg/day
Atropine	Bradycardia	IV IM/SC	0.5-1 mg	0.02 mg/kg 0.04 mg/kg
Aromatic ammonia	Syncope	Inhalant buds	0.3 ml	0.3 ml
Lidocaine 2%	Premature ventricular tachycardia	IV IV/IO/ET	50 or 100 mg 1-1.5 mg/kg	Up to 100 mg 0.5-1 mg/kg
Nifedipine	Hypertension angina	Oral capsules	10-20 mg	0.25-0.5 mg/kg/dose max 10 mg
Verapamil	Hypertension supraventricular tachycardia	IV	2.5 mg/ml 2-4 ml 5-10 mg	0.1-0.3 mg/kg 2-5 mg/dose
Flumazenil	Benzodiazepine overdose	IV	0.2 mg	0.1-0.2 mg max 1 mg
Naloxone	Opioid overdose	IV IM	0.4 mg	0.1 mg/mn 0.01 mg/kg max 0.1-1 mg
Vitamin K	Bleeding due to liver damage	PO/IV/IM/SC	2.5-10 mg	1 mg, SC or IM
Tranexamic acid	Post-operative bleeding	IV PO Mouth wash Topical	10 mg/kg 25 mg/kg 5%	10 mg/kg 25 mg/kg
Gel foam with Thrombin/oxidized cellulose pack			Available as variably sized sheets	Per need

q 6 h - every 6 h, q 5 min - every 5 min

fingers for color changes. Touch the patient's hand to assess the upper limb temperature. Apply blanching pressure for 5 s on the fingertip at heart level to assess capillary refill time. Normal refill time is <3 s. Dentist should record and monitor all vital signs.

**Airway**

- Assess airway patency: Try to maintain a patent airway in unconscious patients by head tilt–chin lift technique or jaw thrust maneuver.

- Opening Airway Technique: The rescuer must stand behind the victim's head to perform this procedure.
- Head tilt: Place one hand on patient's forehead and apply backward pressure with the palm to rotate the head upward and backward.
- Chin lift: Place the tips of middle and index fingers on the symphysis of the mandible to lift the mandible.
- Jaw thrust technique: Place the fingers on the angle of the mandible and displace the mandible forward.

**Breathing**

Using the “look – listen – and – feel” technique, the rescuer can determine the victim’s breathing status. The rescuer must place his ear 1 inch from the nose and mouth while looking toward the victim’s chest. If airway is obstructed, signs may be gurgling, “stridor,” expiratory “wheeze,” or silent chest with no breath sounds.

Count respiratory rate (RR): Normal adult RR is 12-20 breaths/min and child RR is 20-30 breaths/min. To assess depth and symmetry of inspiration by observing chest expansion. The signs of respiratory distress are sweating, central cyanosis (tongue and mucous membranes), use of accessory muscles of respiration (neck muscles), and abdominal breathing. Oxygen must be administered if the patient is not ventilating adequately.

This can be done by three ways:

- Exhaled air ventilation
- Atmospheric air ventilation
- O<sub>2</sub> Enriched ventilation.

Exhaled air ventilation: This can be given by 2 methods.

- Mouth-to-mouth breathing
- Mouth-to-nose breathing.

Atmospheric air ventilation: Manually operated self-inflating bag-valve-mask device is used to deliver atmospheric air to the victim’s lungs (trained person only).

Oxygen enriched ventilation: Portable E cylinder with adjustable O<sub>2</sub> flow (10-15 L/min) and a face mask.

**Definitive Management**

If patient is unconscious, the initial steps to be followed are P-C (position of the patient - assessing circulation). Next step is A-B (airway maintenance - adequate breathing) - if carotid pulse is not palpable, then the team must immediately start CPR. After achievement of adequate ventilation, diagnosis must be made, and definite treatment must be provided. The basic procedures are same for all the age groups of the patients, but for the adults, the main effort is to bring early defibrillation, and for children, the focus should be on early ventilation.

CPR Guidelines<sup>6,7</sup>

- Call 108 (emergency management of India) or call adjacent hospital ambulance number.
- Call for assistance.
- Open air way by head tilt–chin lift procedure.
- Give 2 breaths and make the chest rise.
- Check the person’s responsiveness; if patient is unconscious, then start chest compressions.
- The lower half of the sternum is compressed, with care taken not to compress the xiphoid process (infants –

just below nipples and children and adults – between nipples).

- Place the heel of your hand on the center of the victim’s chest and keep your other hands on top of the first with the interlaced fingers.
- Press down so you compress the chest at least 2 inches deep in adults and children and 1.5 inches deep in infants (Rate of compression 100/mn).
- 30 compressions with short pause (10 s or less) between the compressions.
- After each compression, the chest must be allowed to recoil fully.
- After 30 compressions, the rescuer must start to ventilate the patient, by mouth-to-mouth/mouth-to-mask breath (1 s breath 2 with a gap of 3 s).
- Continue compressions and breaths - 30 compressions, two breaths - until help arrives.
- For a pediatric patient, start with 30 chest compressions and two rescue breaths should be given if there is absent of palpable pulse.
- 15 chest compressions and 2 rescue breath are advised for children with the presence of two rescuers.
- If palpable pulse >60/mn give rescue breath 12-20/mn (1 breath lasting for 1 s for every 3-5 s).

**EMERGENCY EQUIPMENT FOR THE DENTAL OFFICE<sup>2-25</sup>**

1. Portable oxygen cylinder (E size) with regulator (supplemental oxygen-delivering devices - oxygen therapy mask, nasal cannula, pocket mask, and bag valve mask unit).
2. Oropharyngeal airways (sizes 1-4).
3. Portable suction with suction catheters.
4. Intravenous (IV) fluids/lines, syringes, needles, and tourniquets.
5. Automated blood glucose measurement device.
6. Stethoscope.
7. Sphygmomanometer.
8. A spacer device for inhaled bronchodilators.
9. Magill intubation forceps.
10. Pulse oximeter with audible alarm.
11. Automated external defibrillator (AED).

**Pulse Oximeter**

Pulse oximeter should be used to check heart rate (pulse) and the oxygen saturation level of the patient. Tachycardia was above 100 beats/mn. Bradycardia was below 60 beats/mn. Targeted oxygen saturation level is 94-98%.<sup>26</sup>

**AED**

Early defibrillation with the use of AED in cardiac dysrhythmias, ventricular fibrillation, and ventricular tachycardia by passing an electric current across the

myocardium restores normal sinus rhythm and blood perfusion to vital organs.<sup>21</sup> For the emergency management of cardiac arrest, dentist requires strong training of basic CPR with additional knowledge and practice of AED.<sup>10,11,18,19</sup> Modified AED with pediatric pads is available for children.

#### **AED Algorithm<sup>6,7</sup>**

- Turn on the AED and attach adult pad (use child pad for children)
- Allow the AED to check heart rhythm (push analyze button if needed)
- Do not touch the patient
- If shock is advised, deliver shock, and start CPR after shock delivery (CPR 30:2 repeat for 2 min).
- For children CPR, 15:2 for 2 min.
- If shock is not advised, repeat the CPR cycles till patient's responsiveness.

## **EMERGENCY MEDICATIONS USAGE IN DENTAL OFFICE**

### **Aromatic Ammonia**

It acts as respiratory stimulant for patients experiencing syncope. It should be administered after maintaining patent airway of the patient.<sup>2,21</sup>

### **Oxygen**

Oxygen is indicated for all emergency conditions except hyperventilation.<sup>27,28</sup> A portable full "E" size cylinder should be readily available for the patient oxygenation until the arrival of emergency services. Oxygen is delivered with a clear full face mask at a flow rate of 10 l/min for the spontaneously breathing adult patient and 3-5 l/min for breathing children. Bag-valve-mask device is required for the administration of oxygen for the unconscious and apnoeic patient at a flow rate of 10-15 l/min, and in case of positive pressure device usage, the flow rate should not exceed 35 l/min for adults.<sup>2,8,17,28</sup>

### **Atropine**

This anticholinergic drug is used to manage hypotension accompanied with bradycardia. IV atropine in a dose of 0.5 mg for every 3-5 min is needed. Pediatric dose of atropine sulfate: 0.02 mg/kg for IV route and 0.04 mg/kg for intramuscular injection. Maximum dose for IV injection is 1 mg.<sup>3</sup>

### **Antihistamines**

Oral administration of antihistamines is advisable for mild non-life-threatening allergic reactions. Parenteral administration (IM) is required for life-threatening reactions. Diphenhydramine (25-50 mg) or chlorpheniramine - avil (10-20 mg) is administered by oral or parenteral route.

Pediatric dose of chlorpheniramine is 1-2 mg every 6 h and diphenhydramine dose is 1-1.25 mg/kg every 6 h.<sup>2,17,28</sup>

### **Adrenaline**

Adrenaline is used for acute allergic reactions which manifest as hypotension, bronchospasm, and laryngeal edema. Preloaded syringes of adrenaline are useful for the management of acute asthmatic attack which is not relieved by albuterol and in case of cardiac arrest. Epinephrine IV has very rapid and short duration of action, but it may be associated with high risks if given to ischemic heart disease, hypertension, cerebrovascular disease, and patients taking nonselective beta blockers.<sup>20,17,28</sup>

Adrenaline 1:1,000 (1 mg/ml) for intramuscular, intralingual, and subcutaneous injections and 1:10,000 (1 mg/10 ml) is advisable for IV injections. Initial dose for the management of anaphylaxis and asthma not relieved by beta-2 adrenergic receptor agonists is 0.3-0.5 mg subcutaneously/intralingually, 0.4-0.6 mg intramuscularly, or 0.1 mg of Adrenaline 1:10,000 solution IV. The dose in cardiac arrest is 1 mg IV. Repeat the doses in 5 min as required until the resolution of the event or the arrival of ambulance.<sup>8,17,28,29</sup> Acceptable alternative is EpiPen a self-injector device. Available as 300 µg single dose for adults and 150 µg single dose for 4-11-year-old children.<sup>2,24,30</sup>

## **PAEDIATRIC DOSES OF ADRENALINE**

Epinephrine: Prepared as 1: 1000, which equals 1 mg per mL for SC/IM/Intra lingual injections (0.05 - 0.3 mg Maximum); diluted to 1: 10,000 for IV administration.

Children 12-18 yrs: 500 mcg (0.5 ml). Repeat Dose: 300 mcg (0.3 ml).

Children 6-12 years: 300 mcg (0.3 ml).

Children less than 6 years: 150 mcg (0.15 ml). Repeat every five minutes until the arrival of ambulance.<sup>5,6,8,24,28-31</sup>

### **Ephedrine**

Ephedrine is like adrenaline but a less potent vasopressor agent with prolonged action. For severe hypotension, 5 mg IV or 10-25 mg IM should be given.<sup>17,28</sup>

### **Nitroglycerin**

Nitroglycerin is the drug of choice to treat acute angina or myocardial infarction. It has a rapid onset of action. It is available as oral and transmucosal preparations, transcutaneous patches, and IV solutions. Sublingual tablets or spray are suitable forms for dental office.<sup>8,21</sup> Sublingual tablets should be freshly opened because of short shelf-life of opened bottle tablets.<sup>17</sup> For Angina -1 tablet/metered

spray (0.4 mg) should be administered. If angina pain is not relieved within 1-2 min, then repeat this dosage to 2-3 times at 5 min intervals.<sup>2,21,17,28</sup>

### Aspirin

Aspirin reduces overall mortality from acute myocardial infarction by preventing further clot formation. Patient experiencing ischemic chest pain should chew and swallow aspirin 325 mg tablet. For pediatric patients, 10-15 mg/kg is recommended. Aspirin is contraindicated in asthma, bleeding disorders, and in known hypersensitivity to aspirin.<sup>17, 21,28</sup>

### Morphine

Morphine is used for the management of severe pain of myocardial infarction. The dose involves titration in 1-3 mg increments IV/5 mg increments intramuscularly until the relief of pain. Lower doses should be considered for older patients.<sup>17,28</sup>

### Naloxone

Naloxone is a specific opioid antidote that reverses opioid-induced respiratory depression. This should be used for the emergency management of opioid (morphine) overdose. For intramuscular injection, adult dose 0.4 mg and pediatric dose of 0.01 mg/kg are advisable. The dose involves titration in 0.1 mg increments IV with slower administration for the beneficial effect.<sup>17,21,28</sup>

### Nitrous Oxide

This is an alternative to morphine to manage pain of myocardial infarction. It should be administered in a concentration of approximately 65% with 35% oxygen.<sup>17,28</sup>

### Salbutamol

This is a short-acting selective beta-2 adrenergic receptor agonist. This is the first drug of choice for bronchospasm with acute asthmatic episode. 2-3 inhalations from a metered dose inhaler (MDI) provide selective bronchodilation with lesser systemic cardiovascular effects. MDI with spacer remarkably increases the dose deposited in the respiratory tract. It has peak effect in 30 min to 1 h and duration of action is 4-6 h. Adult dose is 2-3 sprays/1-2 mn, up to 3 times if needed. Pediatric dose is 1 spray/1-2 mn, up to 3 times if needed.<sup>2,17,20,21,28</sup>

### Corticosteroids

Corticosteroids such as hydrocortisone used to prevent recurring anaphylaxis and manage adrenal insufficiency. Onset of action is slow (1 h) on IV administration; for this reason, their use in emergency is limited. Hydrocortisone 100-200 mg IV/IM is administered for the management of acute phase of these emergencies. Pediatric dose is 50-100 mg.<sup>17,28</sup>

### Benzodiazepines

Benzodiazepine is administered to manage prolonged or recurrent seizures (status epilepticus). IV diazepam 5-10 mg is rapid in stopping all types of seizures. An alternative treatment for status epilepticus is midazolam or lorazepam IM/IV. Patients should be monitored carefully after administration since respiratory depression and sedation are the side effects of these drugs which can be reversed by antidote drug. Adult doses for lorazepam are 4 mg IM or midazolam 5-10 mg IM. A repeat dose can be given if necessary for a normally breathing patient. Pediatric dose of diazepam is 0.5 mg/kg for 2-5 year olds and 0.3 mg for 6-11-year-old children. Pediatric dose for lorazepam is 0.05-0.1 mg/kg. Pediatric dose of midazolam is 0.1-0.3 mg/kg. For IV administration, these drugs should be slowly titrated for the favorable effect. Recently, buccal midazolam is also recommended to treat seizures.<sup>6,25,28,29</sup>

### Calcium Channel Blockers

This group of drugs is indicated for the management of hypertension, angina, and supraventricular tachycardia. Nifedipine 10-20 mg sublingual administration is recommended for a known patient of coronary artery spasm. Verapamil IV (5-10 mg) administration is primarily indicated for paroxysmal supraventricular tachycardia.<sup>3</sup>

### Flumazenil

The benzodiazepine antagonist flumazenil antagonizes the side effects of sedation and respiratory depression induced by benzodiazepines administration. Dosage is 0.1-0.2 mg IV increments with a maximum dose of 1 mg.<sup>17,21,28</sup>

### Oral Carbohydrate

Oral carbohydrates such as fruit juice or non-diet soft drink or glucose gel in a 30 g tube are used to manage early hypoglycemia in conscious patients. Oral carbohydrates act rapidly to restore blood sugar level. Missed meal may be the possible etiology for hypoglycemia for insulin-dependent diabetic patient.<sup>2,8,17,20,21,28</sup>

### Glucagon

Glucagon intramuscular administration is required to manage hypoglycaemia in unconscious patients. Glucagon acts within 10 min after administration. Adult dosage for glucagon is 1 mg. Pediatric dose is 0.5 mg. Alternative for glucagon for severe hypoglycemia management is 50% IV dextrose (glucose) 50-100 ml.<sup>17,20</sup>

## PREVENTION OF MEDICAL EMERGENCIES

The physical examination of the patient and assessment of previous medical history are essential to prevent emergencies.<sup>32</sup>

With careful planning of emergency protocol with team approach and specialized theoretical and practical training in effective expired air resuscitation, CPR, and oxygen administration, many emergency conditions can be prevented.<sup>5,33</sup> A poster listing basic life support measures should be prominently displayed in the dental office.

## ACTIVATION OF EMERGENCY MEDICAL SERVICE<sup>7</sup>

The goal of most emergency medical services is to deliver first-line treatment and transfer the patient to a nearest hospital for definitive care. Emergency contact numbers of adjacent hospital oral surgeon, physician, and ambulance should also be displayed visibly near the phone. Duty for every member of the dental staff should be pre-planned for an emergency.

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## CONCLUSION

Adequate staff training and availability of appropriate drugs and equipment are all essential for the management of emergencies of dental clinic. Prevention, by ensuring good history and physical examination, is better and cheaper than embarking on therapeutic measures.

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