Prevention and Management of Medical Emergencies

James R. Hupp



CHAPTER

CHAPTER OUTLINE

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PREPARATION
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MEDICAL EMERGENCIES
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Respiratory Difficulty
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Hyperventilation
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Foreign-Body Aspiration
Gastric-Contents Aspiration
Altered Consciousness
Vasovagal Syncope
Orthostatic Hypotension
Seizure
Local Anesthetic Toxicity
Diabetes Mellitus
Thyroid Dysfunction
Adrenal Insufficiency
Cerebrovascular Compromise

Serious medical emergencies in the dental office are, fortunately, relatively rare. The primary reason for the limited frequency of emergencies in dental practice is the nature of dental education that prepares practitioners to recognize potential problems and manage them before they cause an emergency. However, when oral surgical procedures are necessary, the increased mental and physiologic stress inherent in such interventions can push the patient with a poorly compensated medical condition into an emergency situation. Similarly the advanced forms of pain and anxiety control frequently needed for oral surgery can predispose patients to emergency conditions. This chapter begins with a presentation of the various means of lowering the likelihood of medical emergencies in the dental office. It also details ways to prepare for emergencies and discusses the clinical manifestations and initial management of the more common emergencies.

PREVENTION

An understanding of the relative frequency of emergencies and knowledge of those likely to produce serious morbidity and mortality are important when the dentist sets priorities for preventive measures. Malamed's study of patients in the dental school setting revealed that hyperventilation, seizures, and hypoglycemia were the three most common emergency situations occurring in patients before, during, or soon after general dental care. These were followed in frequency by vasovagal syncope, angina pectoris, orthostatic hypotension, and hypersensitivity (allergic) reactions. It is important to remember

BOX 2-1

Medical Emergencies Commonly Provoked by Anxiety

- Angina pectoris
- Thyroid storm
- Myocardial infarction
- Insulin shock
- Asthmatic bronchospasm
- Hyperventilation
- Adrenal insufficiency (acute)
- Epilepsy
- Severe hypertension

though, that many of these diagnoses were presumptive and not completely verified, so the incidence of problems such as "hypoglycemia" may be overstated.

The incidence of medical emergencies is higher in patients receiving ambulatory oral surgery when compared with those receiving nonsurgical care because of the following three factors: (1) surgery is more often stress provoking, (2) a greater number of medications are typically administered to perioperative patients, and (3) often longer appointments are necessary when performing surgery. These factors are known to increase the likelihood of medical emergencies. Other factors that increase the potential for emergencies are the age of the patient (very young and old patients being at greater risk), the ability of the medical profession to keep unhealthy people ambulatory and able to seek dental care, and the increasing variety of drugs dentists administer in their offices.

Prevention of medical emergencies is the cornerstone of their management. The first step is risk assessment. This begins with a careful medical evaluation that, in the dental office, requires accurately taking a medical history, including a review of systems guided by pertinent positive responses in the patient's history. Vital signs should be recorded, and a physical examination (tailored to the patient's medical history and present problems) should be performed. Techniques for this are described in Chapter 1,

Although any patient can have a medical emergency at any time, certain medical conditions predispose patients to medical emergencies in the dental office. These conditions are more likely to turn into an emergency when the patient is physiologically or emotionally stressed. The most common conditions affected or precipitated by anxiety are listed in Box 2-1. Once those patients who are likely to have medical emergencies are recognized, the practitioner can prevent most problems from occurring by modifying the manner in which oral surgical care is delivered.

PREPARATION

Preparedness is the second most important factor (after prevention) in the management of medical emergencies. Preparation to handle emergencies includes four specific actions: (1) ensuring that the dentist's own education about emergency management is adequate and up-to-date, (2) having the auxiliary staff trained to assist in medical emergencies, (3) establishing a system to gain ready access to other health care providers able to assist during emergencies, and (4) equipping the office with supplies necessary to initially care for patients having serious problems (Box 2-2).

BOX 2-2

Preparation for Medical Emergencies

1. Personal continuing education in emergency recognition and management
2. Auxiliary staff education in emergency recognition and management
3. Establishment and periodic testing of a system to readily access medical assistance when an emergency occurs
4. Equipping office with supplies necessary for emergency care

BOX 2-3

Basic Life Support

ABCs:
- A—Airway
- B—Breathing
- C—Circulation

Airway obtained and maintained by combination of:
1. Extending head at the neck by pushing upward on the chin with one hand and pushing the forehead back with other hand
2. Pushing mandible forward by pressure on the mandibular angles
3. Pulling mandible forward by pulling on anterior mandible
4. Pulling tongue forward, using suture material or instrument to grasp anterior tongue

Breathing provided by one of the following:
1. Mouth-to-mouth or mouth-to-mask ventilation
2. Resuscitation bag ventilation

Circulation provided by external cardiac compressions

Continuing Education

In dental school, clinicians are trained in ways to assess patient risk and manage medical emergencies. However, because of the rarity of these problems, practitioners should seek continuing education in this area, not only to refresh their knowledge but also to learn new concepts concerning medical evaluation and management of emergencies. An important feature of continuing education should be to maintain certification in Basic Life Support (BLS) (Box 2-3). Many have recommended that continuing education in medical emergency management be obtained on an annual basis, with a BLS skills update and review obtained biannually. Dentists who deliver par-

enteral sedatives other than nitrous oxide are wise to become certified in Advanced Cardiac Life Support (ACLS), including the use of automated external defibrillator units, and to have the drugs and equipment necessary for ACLS available.

Office Staff Training

The dentist must ensure that all office personnel are trained to assist in the recognition and management of emergencies. This should include reinforcement by regular emergency drills in the office and by biannual BLS skills renewal. The office staff should be preassigned specific responsibilities so that in the event of a problem each person knows what will be expected during an emergency.

Access to Help

The ease of access to other health care providers varies from office to office. It is helpful to seek out individuals with training that would make them useful during a medical emergency. If the dental practice is located near other professional offices, prior arrangements should be made to obtain assistance in the event of an emergency. Not all physicians are well versed in the management of emergencies, and dentists must be selective in the physicians they contact for help during an emergency. Oral-maxillofacial surgeons are a good resource, as are most general surgeons and anesthesiologists. Ambulances carrying emergency medical technicians (EMTs) are useful to the dentist facing an emergency situation, and most communities now provide easy telephone access (911) to a rapid-response EMT team. Finally, it is important to identify a nearby hospital or freestanding emergency care facility with well-trained emergency care experts.

Once the dentist has established who can be of assistance in the event of an emergency, the appropriate phone numbers should be kept readily available. Easily identified lists can be placed on each telephone, or numbers can be entered into the memory of an automatic-dial telephone. The numbers should be called periodically to test their accuracy and to ensure that the person to be reached is available to respond.

Emergency Supplies and Equipment

The final means of preparing for emergencies is by ensuring that appropriate emergency drugs and equipment are available in the office. One basic piece of equipment is the dental chair that should be capable of allowing the patient to be placed in a flat position or, even better, in a head-down, feet-raised position (Fig. 2-1, *A).* In addition, the chair must be capable of being lowered close to the floor to allow BLS to be performed properly. Operatories should be large enough to allow a patient to be placed on the floor for BLS performance and provide enough room for the dentist and others to deliver emergency care. If the operatory is too small to allow the patient to be placed on the floor, specially designed boards are available that can be placed under the patient's thorax to allow BLS administration in the dental chair.

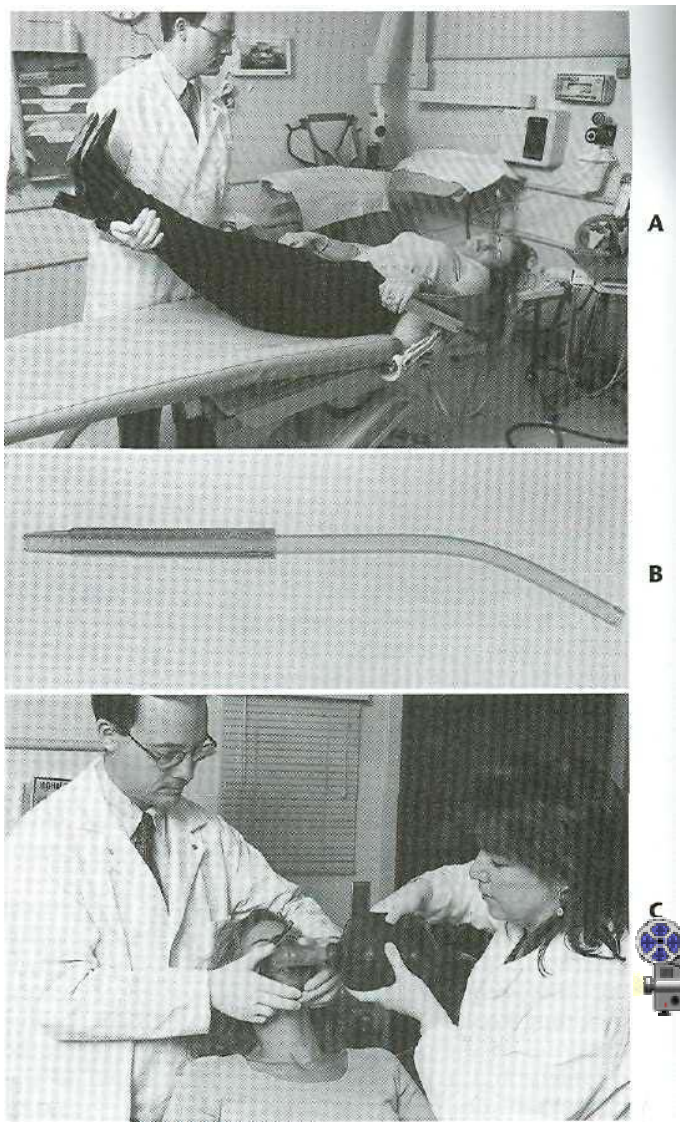


FIG. 2-1 A, Dental chair capable of placing patient in position such that the legs are raised above the level of the trunk. This position is useful for emergency conditions in which increased venous return to heart is necessary or when gastric contents or foreign body enters the upper airway. For fast and effective augmentation of venous return, the doctor can manually raise the patient's legs. B, Tonsil-type suction tip is useful for rapidly clearing large volumes of fluids out of the mouth and pharynx. C, Resuscitation (Air Mask Bag Unit [AMBU]) bag with clear face mask is properly positioned over the patient's nose and mouth. The doctor can use both hands to hold the mask in place while an assistant squeezes the bag. Oxygen-enriched air is provided by connecting the AMBU bag unit to an oxygen source at the other end of the bag.

Frequently, equipment used for respiratory assistance and the administration of injectable drugs is needed during office emergencies. Equipment for respiratory assistance includes oral and nasal airways, tonsil suction tips (Fig. 2-1, *B),* connector tubing that allows the use of high-volume suction, and resuscitation bags (e.g., Air Mask Bag Unit [AMBU bagsj) with clear face masks (Fig. 2-1, C). Oral and nasal airways, laryngoscopes, and endotracheal tubes may be helpful for dentists trained in their proper

TABLE 2-1

Emergency Supplies for the Dental Office

Use	Supplies
Establishment and maintenance of IV access	Plastic indwelling (catheter) Metal indwelling (catheter) IV tubing with flow valve Tourniquet 1-inch wide plastic tape Crystalloid solution (normal saline D_5W)
High-volume suction	Large-diameter suction tip Tonsillar suction tip Extension tubing Connectors to adapt tubing to office suction
Drug administration	Plastic syringes (5 and 10 mL) Needles (18 and 21 gauge)
Oxygen administration	Clear face mask Resuscitation bag (AMBU) Extension oxygen tubing (with and without nasal catheters) Oxygen cylinder with flow valve Oral and nasal airways* Endotracheal tube* Demand valve oxygen mask*

*For use by dentists with appropriate training or by those called to give medical assistance.

AMBU, Air Mask Bag Unit.



FIG. 2-2 Example of commercialiy available emergency kit of appropriate size and complexity for dental office.

use or for others called into the office to assist during an emergency.

Useful drug administration equipment includes syringes and needles, tourniquets, intravenous (IV) solutions, indwelling catheters, and IV tubing (Table 2-1). Although emergency kits containing a variety of drugs are commercially available (Fig. 2-2), dentists may prefer to assemble their own kits. This allows properly educated dentists to choose only those agents they feel are likely to be most useful during an emergency. It also helps the dentist to organize the kit in a manner that is easy to use during emergency situations. If dentists have made arrangements for help from nearby professionals, they may also want to include drugs in their kits that the assisting individuals suggest may be helpful. The drugs and any equipment in the kit must be well labeled and checked frequently for completeness and to ensure that no drugs have gone out of date. Labeling can include not only the drug name but also situations in which the drug is most commonly used. A list of drugs that should be considered for inclusion in a dental office emergency kit appears in Table 2-2.

One emergency drug that must be available in dental offices is oxygen. Many dentists use oxygen supplied in a portable tank. If properly trained or assisted by a properly trained individual, the dentist needs to provide a means of delivering the oxygen *under positive pressure* to the patient. It is important to establish a system to periodically check that a sufficient supply of oxygen is always available. Dentists who use a central oxygen system also need to have oxygen available that is portable for use outside of the operatory, such as in the waiting room or during transport to an emergency facility.

MEDICAL EMERGENCIES

A brief description of the pathophysiology, clinical manifestations, and acute management of several emergency situations is presented in the following section. It has been organized into a combination of *specific* problems, such as hypersensitivity reactions, and *symptom-oriented* problems, such as chest discomfort.

Hypersensitivity Reactions

Several of the drugs administered to patients undergoing oral surgery can act as antigenic stimuli, provoking allergic reactions. Of the four basic types of hypersensitivity reactions, only type I (immediate hypersensitivity) can cause an acute, life-threatening condition. Type I allergic reactions are mediated primarily by immunoglobulin E (IgE) antibodies. As with all allergies, initiation of a type I response requires exposure to an antigen previously seen by the immune system. The reexposure to the anti-

TABLE 2-2

Emergency Drugs for the Dental Office

General Drug Group	Common Examples
Parenteral preparations	
Analgesic	Morphine sulfate
Anticonvulsant	Diazepam, midazolam
Antihistamine	Diphenhydramine (Benadryl), chlorpheniramine (Chlor-Trimeton)
Antihypoglycemic	50% dextrose in water, glucagon
Corticosteroid	Methylprednisone (Solu-Medrol), dexamethasone (Decadron), hydrocortisone (Solu-Cortef)
Narcotic antagonist	Naloxone (Narcan)
Sympathomimetic	Epinephrine
Vagolytic	Atropine
Oral preparations	
Antihistamine	Diphenhydramine (Benadryl), chlorpheniramine (Chlor-Trimeton)
Antihypoglycemic	Candy, fruit juice, sugar
Vasodilator	Nitroglycerine (Nitrostat, Nitrolingual)
Inhaled preparations	
Bronchodilator	Metaproterenol (Alupent), epinephrine bitartrate (Medihaler-Epi)
Oxygen	
Respiratory stimulant	Aromatic ammonia

gen triggers a cascade of events that then are exhibited locally, systemically, or both in varying degrees of severity. Table 2-3 details the manifestations of type I hypersensitivity reactions and their management.

The least severe manifestation of type 1 hypersensitivity is dermatologic. Skin or mucosal reactions include localized areas of pruritus (itching), erythema, urticaria (wheals consisting of slightly elevated areas of epithelial tissue that are erythematous and indurated), and angioedema (large areas of swollen tissue generally with little erythema or induration). Although skin and mucosal reactions are not in themselves dangerous, they may be the first indication of more serious allergic manifestations that will soon follow. Skin lesions usually take anywhere from minutes to hours to appear; however, those appearing rapidly after administration of an antigenic drug are the most foreboding.

Allergic reactions affecting the respiratory tract are more serious and require more aggressive intervention. The involvement of small airways occurs with wheezing, as constriction of bronchial smooth muscle (bronchospasm) and airway mucosal inflammation occurs. The patient will complain of dyspnea and may eventually become cyanotic. Involvement of the larger airways usually first occurs at the narrowest portion of those air passages—the vocal cords in the larynx. Angioedema of the vocal cords causes partial or total airway obstruction. The patient is usually unable to speak and produces high-pitched crowing sounds (stridor) as air passes through constricted cords. As the edema worsens, total airway obstruction eventually occurs, which is an immediate threat to life.

Generalized anaphylaxis is the most dramatic hypersensitivity reaction, usually occurring within seconds or minutes after the parenteral administration of the antigenic medication; a more delayed onset occurs after oral or topical drug administration. A variety of signs and symptoms of anaphylaxis exist, but the most important with respect to early management are those resulting from cardiovascular and respiratory tract disturbances.

An anaphylactic reaction typically begins with a patient complaining of malaise or a feeling of impending doom, Skin manifestations soon appear, including flushing, urticaria, and pruritus on the face and trunk. Nausea and vomiting, abdominal cramping, and urinary incontinence may occur. Symptoms of respiratory embarrassment soon follow, with dyspnea and wheezing. Cyanosis of nail beds and mucosa will next appear if air exchange becomes insufficient. Finally, total airway obstruction occurs, which causes the patient to quickly become unconscious. Disordered cardiovascular function initially occurs with tachycardia and palpitations. Blood pressure tends to fall because of falling cardiac output and peripheral vasodilation, and cardiac dysrhythmias appear. Cardiac output eventually may be compromised to a degree sufficient to cause loss of consciousness and cardiac arrest. Despite the potentially severe cardiovascular disturbances, the usual cause of death in patients having an anaphylactic reaction is laryngeal obstruction caused by vocal cord edema.

As with any potential emergency condition, prevention is the best strategy. During the initial interview and subsequent recall visits, patients should be questioned about drugs to which they have a history of allergy. In addition, dentists should ask patients specifically about medications they intend to use during the planned oral surgical care. If a patient claims to have an allergy to a particular drug, the clinician should question the patient further concerning the way in which the allergic reaction is exhibited and what was necessary to manage the problem. Many patients will claim an allergy to local anesthetics. However, before subjecting patients to alternative forms of anesthesia, the clinician should try to ensure that an allergy to the local anesthetic does indeed exist, because many patients have been told they had an allergic reaction when in fact they experienced a vasovagal hypotensive episode or mild palpitations. If an allergy is truly in question, the patient may require referral to a physician who can perform hypersensitivity testing. After it is determined that a patient does have a drug allergy, the information should be displayed prominently on the patient's record in a way to alert care providers but still protect patient confidentiality.

Management of allergic reactions depends on the severity of the signs and symptoms. The initial response to any sign of untoward reaction to a drug being given parenterally should be to cease its administration. If the allergic reaction is confined to the skin or mucosa, an antihistamine should be administered either IV or intramuscularly (IM). Diphenhydramine hydrochloride (Benadryl) 50 mg or chlorpheniramine maleate (Chlor-Trimeton) 10 mg are the commonly chosen antihistamines.* The antihistamine is then continued in an oral form

TABLE 2-3

Manifestations and Management of Hypersensitivity (Allergic) Reactions

Manifestations	Management
Skin signs	
■ Delayed-onset skin signs: erythema, urticaria, pruritus, angioedema	■ Stop administration of all drugs presently in use ■ Administer IV or IM Benadryl* 50 mg or Chlor-Trimeton† 10 mg ■ Refer to physician ■ Prescribe oral antihistamine, such as Benadryl 50 mg q6h or Chlor-Trimeton 10 mg q6h
■ Immediate-onset skin signs: erythema, urticaria, pruritus,	■ Stop administration of all drugs presently in use ■ Administer epinephrine 0.3 mL of 1:1000 SC, IM, or IV or epinephrine 3 mL of q5min if signs progress) ■ Administer antihistamine IM or IV: Benadryl 50 mg or Chlor-Trimeton 10 mg ■ Monitor vital signs ■ Consult patient's physician ■ Observe in office for 1 hr ■ Prescribe Benadryl 50 mg q6h or Chlor-Trimeton 10 mg q6h
Respiratory tract signs with or without cardiovascular or skin signs	
■ Wheezing, mild dyspnea	■ Stop administration of all drugs presently in use ■ Place patient in sitting position ■ Administer epinephrine‡ ■ Provide IV access ■ Consult patient's physician or emergency department physician ■ Observe in office for at least 1 hr ■ Prescribe antihistamine
■ Stridorous breathing (i.e., crowing sound), moderate-to-severe dyspnea	■ Stop administration of all drugs presently in use ■ Sit the patient upright and have someone summon medical assistance ■ Administer epinephrine‡ ■ Give oxygen (6 L/min) by face mask or nasally ■ Monitor vital signs frequently ■ Administer antihistamine ■ Provide IV access; if signs worsen treat as for anaphylaxis ■ Consult patient's physician or emergency room physician; prepare for transport to emergency room if signs do not improve rapidly
■ Anaphylaxis (with or without skin signs): malaise, wheezing, moderate-to-severe dyspnea, stridor, cyanosis, total airway obstruction, nausea and vomiting, abdominal cramps, urinary incontinence, tachycardia, hypotension, cardiac dysrhythmias, cardiac arrest	■ Stop administration of all drugs ■ Position patient supine on back board or on floor and have someone summon assistance ■ Administer epinephrine‡ ■ Initiate BLS and monitor vital signs ■ Consider cricothyrotomy if trained in use and if laryngospasm is not quickly relieved with epinephrine ■ Provide IV access ■ Give oxygen 6 L/min ■ Administer antihistamine IV or IM ■ Prepare for transport

*Brand of diphenhydramine.
†Brand of chlorpheniramine.
‡As described in "Immediate Onset" section.
BLS, Basic Life Support; *IM*, intramuscular; *IV*, intravenous; *SC*, subcutaneous.

(Benadryl 50 mg or Chlor-Trimeton 8 mg) every 6 to 8 hours for 24 hours. Immediate, severe urticarial reactions warrant immediate parenteral (subcutaneous [SC] or IM) administration of 0.3 mL of a 1:1000 epinephrine solution, followed by an antihistamine. The patient's vital signs should be frequently monitored for 1 hour; if stable the patient should be referred to a physician or an emergency care facility for further follow-up.

If a patient begins to show signs of lower respiratory tract involvement (i.e., wheezing during an allergic reaction), several actions should be initiated. Outside emer-

***A11** doses given in this chapter are those recommended for an average adult. Doses will vary for children, for older adults, and for those with debilitating diseases. The clinician should consult a drug reference book for additional information.

gency assistance should be summoned. The patient should be placed in a semireclined position and oxygen administration begun. Epinephrine should be administered either by parenteral injection of 0.3 mL of a 1:1000 solution or with an aerosol inhaler (e.g., Medihaler-Epi, each inhalation of which delivers 0.3 mg). Epinephrine is short acting; if symptoms recur or continue, the dose can be repeated within 5 minutes. Antihistamin.es such as diphenhydramine or chlorpheniramine are then given. The patient should be transferred to the nearest emergency facility to allow further management as necessary.

If a patient shows signs of laryngeal obstruction (i.e., stridor), epinephrine (0.3 mL of 1:1000 solution) should be given and oxygen administered. If a patient loses consciousness and appears to be unable to ventilate, an emergency cricothyrotomy or tracheotomy may be required to bypass the laryngeal obstruction.* A description of the technique of cricothyrotomy or tracheotomy is beyond the scope of this book, but these techniques may be lifesaving in an anaphylactic reaction. Once an airway is reestablished, an antihistamine and further doses of epinephrine should be given. Vital signs should be monitored, and steps necessary to maintain the patient should be taken until emergency assistance is available.

Patients who show signs of cardiovascular system compromise should be closely monitored for the appearance of hypotension, which may necessitate initiation of BLS if cardiac output falls below the level necessary to maintain viability or if cardiac arrest occurs (see Box 2-3).

Chest Discomfort

The appearance of chest discomfort in the perioperative period in a patient who may have ischemic heart disease calls for rapid identification of the cause so that appropriate measures can be taken (Box 2-4). Discomfort from cardiac ischemia is frequently described as a squeezing sensation, with a feeling of heaviness on the chest (Box 2-5). It usually begins in a retrosternal location, radiating to the left shoulder and arm. Patients with documented heart disease who have had such discomfort in the past will usually be able to confirm that the discomfort is cardiac in origin. For patients who are unable to remember such a sensation in the past or who have been assured by their physician that such discomfort does not represent heart disease, further information is useful before assuming a cardiac origin of the symptom. The patient should be asked to describe the exact location of the discomfort and any radiation, how the discomfort is changing with time, and if postural position affects the discomfort. Pain resulting from gastric reflux into the esophagus because of chair position should improve when the patient sits up and is given an antacid. Discomfort caused by costochondritis or pulmonary conditions should vary with respirations or be stimulated by pressure on the thorax. The only other common condition that can occur with chest discomfort is anxiety, which may be difficult to differentiate from cardiogenic problems without the use of monitoring devices not commonly present in the dental office.

If chest discomfort is suspected to be caused by myocardial ischemia or if that possibility cannot be ruled out, measures should be instituted that decrease myocardial work and increase myocardial oxygen supply. All dental care must be stopped, even if the surgery is only partially finished. The patient should be reassured that everything is under control while vital signs are being obtained, oxygen administration is started, and nitroglycerin is administered sublingually or by oral spray. The nitroglycerin dose should be 0.4 mg dissolved sublingually and repeated (if necessary) every 5 minutes as long as systolic blood pressure is at least 90 mm Hg, up to a maximum of 3 doses. If vital signs remain normal, the chest discomfort is relieved, and the amount of nitroglycerin that was

*Cricothyrotomy is the surgical creation of an opening into the cricothyroid membrane just below the thyroid cartilage to create a path for ventilation that bypasses the larynx.

BOX 2-4

Clinical Characteristics of Chest Pain Caused by Myocardial Ischemia or Infarction

Discomfort (Pain) Described by Patients as Being:

1. Squeezing, bursting, pressing, burning, choking, or crushing in character (not typically sharp or stabbing in quality)
2. Substernally located, with variable radiation to left shoulder, arm, or left side (or a combination of these areas) of neck and mandible
3. Frequently associated at the onset with exertion, heavy meal, anxiety, or upon assuming horizontal posture
4. Relieved by vasodilators, such as nitroglycerin, or rest (in the case of angina)
5. Accompanied by dyspnea, nausea, weakness, palpitations, perspiration, or a feeling of impending doom (or a combination of these symptoms)

BOX 2-5

Differential Diagnosis of Acute-Onset Chest Pain

Common Causes

Cardiovascular system: Angina pectoris, MI
Gastrointestinal tract: Dyspepsia (i.e., heartburn), hiatal hernia, reflux esophagitis, gastric ulcers
Musculoskeletal system: Intercostal muscle spasm, rib or chest muscle contusions
Psychologic: Hyperventilation

Uncommon Causes

Cardiovascular system: Pericarditis, dissecting aortic aneurysm
Respiratory system: Pulmonary embolism, pleuritis, tracheobronchitis, mediastinitis, pneumothorax
Gastrointestinal tract: Esophageal rupture, achalasia
Musculoskeletal system: Osteochondritis, chondrosternitis
Psychologic: Psychogenic chest pain (i.e., imagined chest pain)

MI, Myocardial infarction.

required to relieve the discomfort was not more than normally necessary for that patient, they should be discharged with plans for future surgery to be done in an oral and maxillofacial surgery office or in a hospital after conferring with their physician (Fig. 2-3).

Some circumstances do require transport to an emergency facility. If the pulse is irregular, rapid, or weak, or the blood pressure is found to be below baseline, outside emergency help should be summoned while the patient is placed in an almost supine position and oxygen and nitroglycerin therapy are started. Venous access should be initiated and a slow D_5W drip begun, if possible, for use by emergency personnel. Another serious situation requiring transfer to a hospital is a case in which the patient's discomfort is not relieved after 20 minutes of appropriate therapy. In this case it should be presumed that a myocardial infarction (MI) is in progress. Such a patient is especially prone to the appearance of serious cardiac dysrhythmias or cardiac arrest; therefore vital signs should be monitored frequently, and BLS should be instituted if indicated. Morphine sulfate (4 to 6 mg) may be administered IM or SC to help relieve the discomfort and reduce anxiety. Morphine also provides a beneficial effect for patients who are developing pulmonary edema (see Fig. 2-3). Transfer to a hospital should be expedited because thrombolytic agents and/or an angioplasty procedure may be able to preserve some or all of the ischemic myocardium.

Respiratory Difficulty

Many patients are predisposed to respiratory problems in the dental setting; these patients include patients with asthma or chronic obstructive pulmonary disease (COPD), extremely anxious patients, patients who are atopic, and those in whom a noninhalation sedative technique using respiratory depressant drugs is to be used. Special precautions should be taken to help prevent the occurrence of emergencies. If these patients are not treated promptly, the situation may become life threatening.

Asthma. Patients with a history of asthma can be a particular challenge to safely manage if emotional stress or many pharmacologic agents easily trigger their respiratory problems. Most patients with asthma are aware of the symptoms that signal the onset of bronchospasm. Patients will complain of shortness of breath and want to

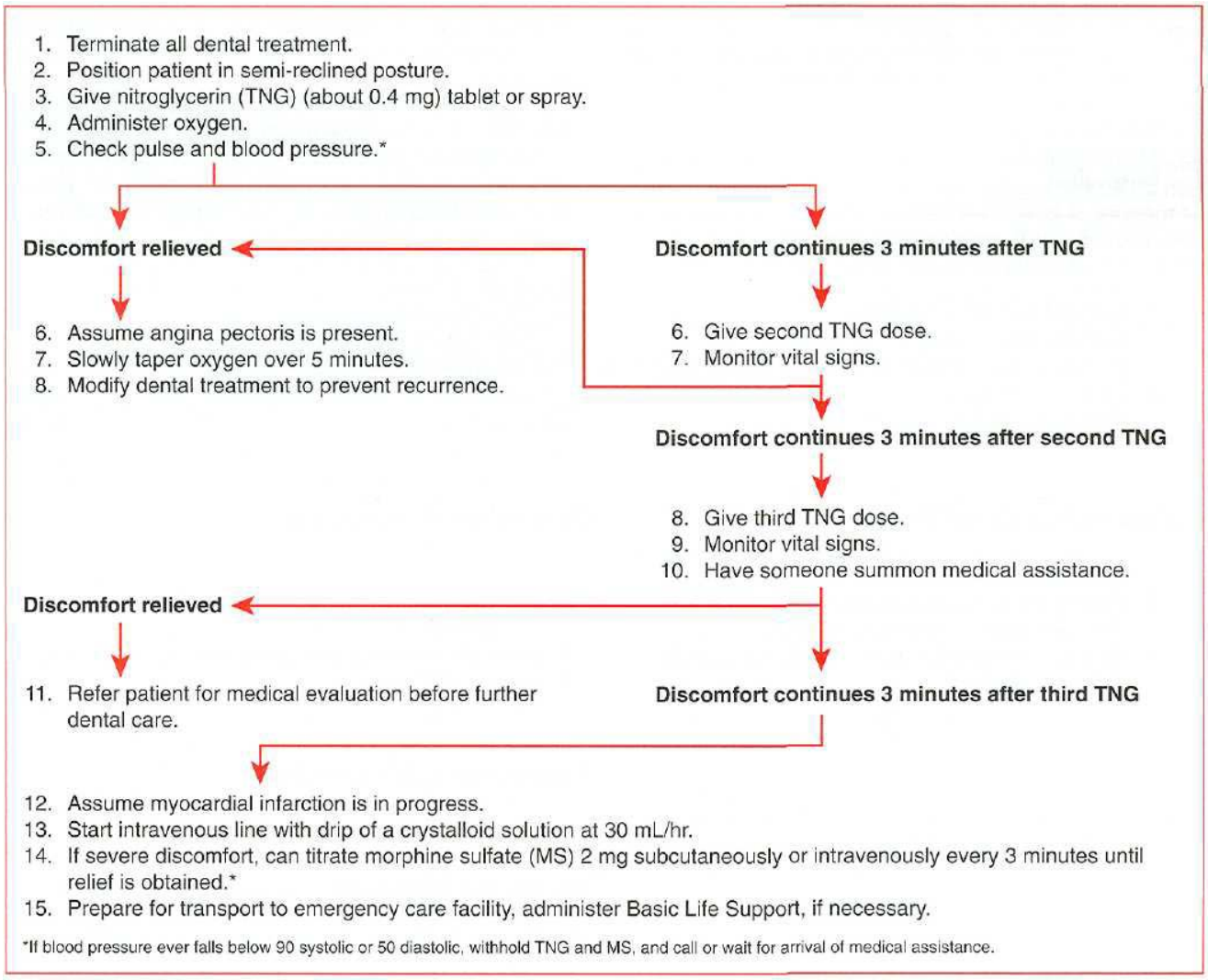


FIG. 2-3 Management of patient having chest discomfort while undergoing dental surgery.

sit erect. Wheezing is usually audible, tachypnea and tachycardia begin, and patients start using their accessory muscles of respiration. As bronchospasm progresses, patients may become hypoxic and cyanotic, with eventual loss of consciousness (Box 2-6).

Management should start with placing patients in an erect or semierect position. Patients should then administer bronchodilators, using their own inhalers or one provided from the office emergency supply. The inhaler may contain epinephrine, isoproterenol, metaproterenol, or aibuterol. Repeated doses should be administered cautiously to avoid overdosing the patient. Oxygen administration should follow, using nasal prongs or a face mask. In more severe asthmatic episodes or when aerosol therapy is ineffective, epinephrine (0.3 mL of a 1:1000 dilution) may be injected SC or IM. When patients have severe respiratory embarrassment, it may be necessary to obtain outside emergency medical assistance (Fig. 2-4).

BOX 2-6

Manifestations of an Acute Asthmatic Episode

Mild to Moderate
- Wheezing (audible with or without stethoscope)
- Dyspnea (i.e., labored breathing)
- Tachycardia
- Coughing
- Anxiety

Severe
- Intense dyspnea, with flaring of nostrils and use of accessory muscles of respiration
- Cyanosis of mucous membranes and nail beds
- Minimal breath sounds on auscultation
- Flushing of face
- Extreme anxiety
- Mental confusion
- Perspiration

Respiratory problems caused by drug allergy may be difficult to differentiate from those resulting from asthma. Management of the respiratory problems is the same in either case.

Hyperventilation. The most frequent cause of respiratory difficulty in the dental setting is anxiety that is expressed as hyperventilation, which is usually seen in patients in their teens, 20s, and 30s, and can frequently be prevented through anxiety control. Dentists should be attuned to the signs of patient apprehension and, through the health interview, should encourage patients to express their concerns. Patients with extreme anxiety should be managed with an anxiety reduction protocol. In addition, pharmacologic anxiolysis may be necessary.

The first manifestation of hyperventilation syndrome is frequently a complaint of an inability to get enough air. They breathe very rapidly (tachypnea) and become agitated. The rapid ventilation increases elimination of CO_2 through the lungs. The patient rapidly becomes alkalotic; may complain of becoming lightheaded and of having a tingling sensation in the fingers, toes, and perioral region; and may even develop muscle twitches or convulsions. Eventually loss of consciousness occurs (Box 2-7).

Management of a hyperventilating patient involves terminating the surgical procedure, positioning the patient in a semierect position, and providing reassurance. If

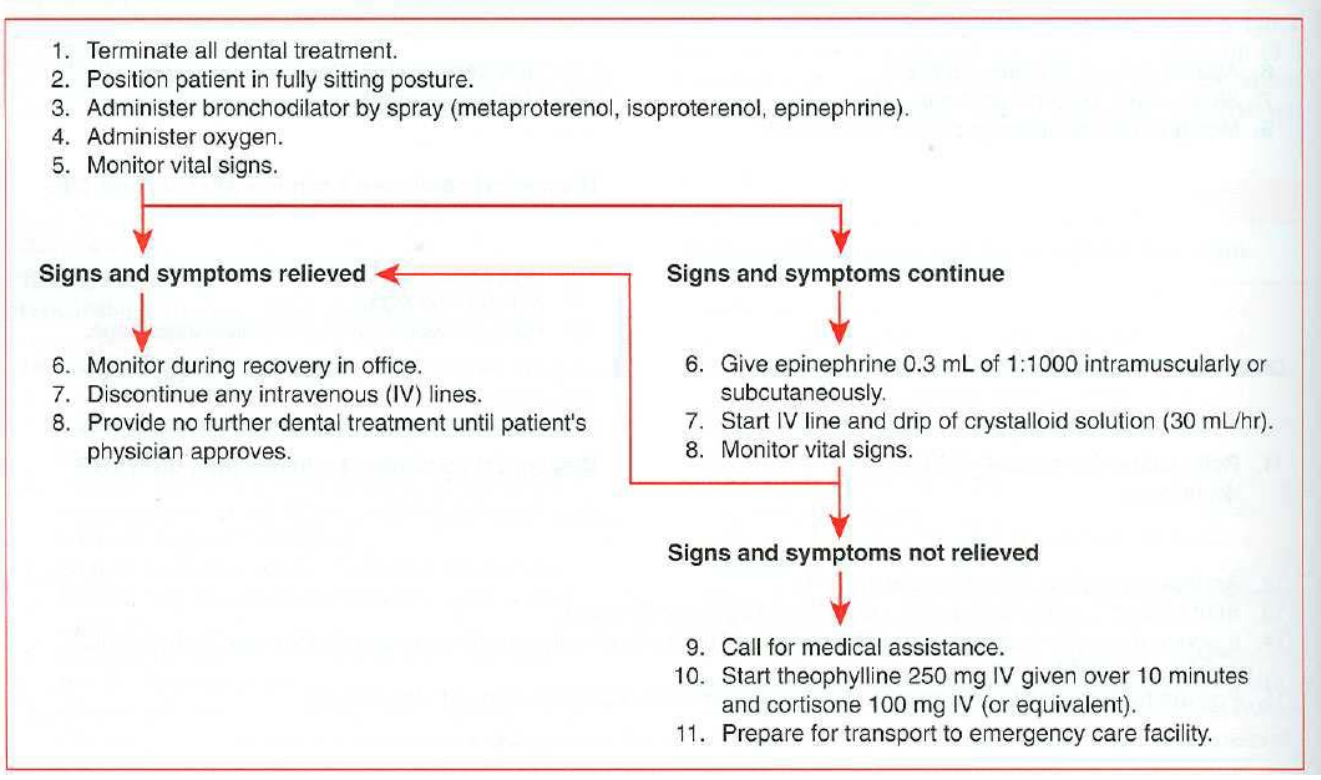


FIG. 2-4 Management of acute asthmatic episode occurring during dental surgery.

symptoms of alkalosis occur, the patient should be forced to breathe into and out of a small bag (Fig. 2-5). Oxygen-enriched air is not indicated. If hyperventilation continues, the clinician may have to administer a sedative such as midazolam, by giving 2 to 4 mg IM or by IV titration of the drug until hyperventilation ceases or the patient is sedated. Once hyperventilation stops, the patient should be rescheduled, with plans to use preoperative or intraoperative sedation (or both) in future visits (Box 2-8).

Chronic obstructive pulmonary disease. Patients with well-compensated COPD can have difficulty during oral surgery. Many of these patients depend on maintaining an upright posture to breathe adequately. In addition, they become accustomed to having high arterial CO_2 levels and use a low level of blood oxygen as the primary stimulus to drive respirations. Many of these patients experience difficulty if placed in an almost supine position or if placed on high-flow nasal oxygen. Patients with COPD often rely on their accessory muscles of respiration to breathe. Lying supine interferes with the use of these accessory muscles; therefore patients will usually ask to sit up before problems resulting from positioning occur. Excessive lung secretions that are more difficult to clear when supine also accompany COPD.

If excessive oxygen is administered to a patient susceptible to COPD, the respiratory rate will fall, which produces cyanosis, and apnea may eventually occur. The treatment for such a problem is to discontinue oxygen administration before the patient becomes apneic. The respiratory rate should soon improve. If apnea occurs and the patient loses consciousness, artificial ventilation must be initiated and emergency assistance summoned.

Foreign-body aspiration. Aspiration of foreign bodies into the airway is always a potential problem during oral surgical and other dental procedures. This is especially true if the patient is positioned supine or semierect in the chair or is sufficiently sedated to dull the gag reflex. Objects that fall into the hypopharynx are frequently swallowed and usually pass harmlessly through the gastrointestinal tract. Even if the clinician feels confident the material was swallowed, chest and abdominal radiographs should be obtained to eliminate the possibility of asymptomatic aspiration into the respiratory tract. Occasionally the foreign object is aspirated into the larynx, where, in the lightly sedated or nonsedated patient, violent coughing will ensue that may expel the aspirated material. The patient can usually still talk and breathe. However, larger objects that are aspirated may obstruct the airway and become lodged in such a manner that coughing is ineffective because the lungs cannot be filled with air before the attempted cough. In this situation the patient usually cannot produce any vocalizations and becomes extremely anxious. Cyanosis soon appears, followed by loss of consciousness (Box 2-9).

The manner in which aspirated foreign bodies are managed depends primarily on the degree of airway obstruction. Patients with an intact gag reflex and a partially obstructed airway should be allowed to attempt to expel the foreign body by coughing. If the material will not come up, the patient should be given supplemental oxygen and transported to an emergency facility to allow laryngoscopy or bronchoscopy to be performed. The completely obstructed but awake patient should have abdominal thrusts (Fig. 2-6, *A)* or Heimlich maneuvers (Fig. 2-6, B) performed until successful or consciousness is lost. If a patient has a diminished gag reflex as a result of



FIG. 2-5 Bag placed over nose and mouth to force rebreathing of CO_2-enriched air, reversing tendency for alkalosis caused by hyperventilation. In this case a plastic headrest cover is being used.

BOX 2-7

Manifestations of Hyperventilation Syndrome

Neurologic
- Dizziness
- Tingling or numbness of fingers, toes, or lips
- Syncope

Respiratory
- Increased rate and depth of breaths
- Feeling of shortness of breath
- Chest pain
- Xerostomia

Cardiac
- Palpitations
- Tachycardia

Musculoskeletal
- Myalgia
- Muscle spasm
- Tremor
- Tetany

Psychologic
- Extreme anxiety

BOX 2-8

Management of Hyperventilation Syndrome

1. Terminate all dental treatment and remove foreign bodies from mouth.
2. Position patient in chair in almost fully upright position.
3. Attempt to verbally calm patient.
4. Have patient breathe CO_2-enriched air, such as in and out of a small bag.
5. If symptoms persist or worsen, administer diazepam 10 mg IM or titrate slowly IV until anxiety is relieved, or administer midazolam 5 mg IM or titrate slowly IV until anxiety is relieved.
6. Monitor vital signs.
7. Perform all further dental surgery using anxiety-reducing measures.

IM, Intramuscular; *IV,* intravenous.

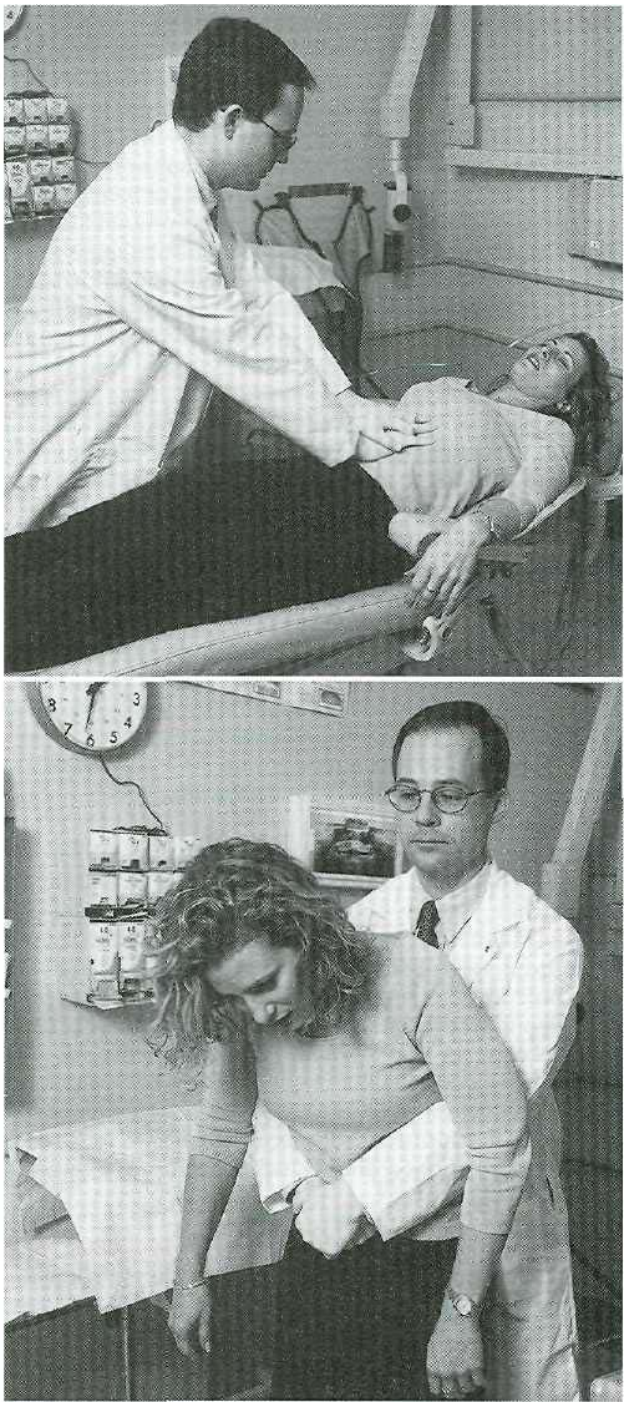


FIG. 2-6 A, Method of performing abdominal thrusts for an unconscious patient with foreign body obstructing airway. Chair is first placed in recumbent position. The heel of the dentist's right palm is placed on the abdomen just below the xiphoid process, with the elbow kept locked and the left hand placed over the right for further delivery of force. Arms are quickly thrust into the patient's abdomen, directing force down and superiorly. B, Proper positioning for Heimlich maneuver is shown. Rescuer approaches the patient from behind and positions hands on the patient's abdomen, just below the rib cage. Rescuer's hands are then quickly pulled into the abdominal area, attempting to have any residual air in the lungs dislodge the obstruction from airway.

BOX 2-9

Acute Manifestations of Aspiration into the Lower Respiratory Tract

Large Foreign Body	*Gastric Contents*
■ Coughing	■ Coughing
■ Choking sensation	■ Stridorous breathing
■ Stridorous breathing (i.e., crowing sounds)	■ Wheezing or rales (i.e., cracking sound) on chest auscultation
■ Severe dyspnea	■ Tachycardia
■ Feeling of something caught in throat	■ Hypotension
■ Inability to breathe	■ Dyspnea
■ Cyanosis	■ Cyanosis
■ Loss of consciousness	

sedation or has a completely obstructed airway and loses consciousness, abdominal thrusts should be performed with the patient in a supine position. After each volley of thrusts, the patient should be quickly turned onto the side and the clinician should finger sweep the mouth to remove any object that may have been forced out. If the patient is not exchanging air, BLS should be started. If air cannot be blown into the lungs, additional abdominal thrusts should be attempted, followed by oral finger sweeps and BLS. Dentists trained in laryngoscopy can look into the larynx and use Magill forceps to try to remove any foreign material. If several attempts to relieve the obstruction fail, an emergency cricothyrotomy may be necessary (Fig. 2-7).

Gastric-contents aspiration. Aspiration of gastric contents into the lower respiratory tract presents another situation that frequently leads to serious respiratory difficulties. The particulate matter in gastric contents causes physical obstruction of pulmonary airways, but it is usually the high acidity of gastric material that produces more serious problems. The low pH of gastric juice quickly necrotizes the pulmonary tissue it contacts, and a respiratory distress syndrome soon follows, with transudation of fluid into pulmonary alveoli and a loss of functioning lung tissue. The patient with an intact gag reflex rarely aspirates gastric contents during vomiting. Rather it is the patient with a diminished gag reflex caused by sedation, unconsciousness, or topical anesthesia in the oropharynx who is at greatest risk for gastric aspiration. The sedated or unconscious patient who aspirates a significant amount of gastric material will first show signs of respiratory difficulty, such as tachypnea and wheezing. Tachycardia and hypotension may soon occur and, as ventilatory capability worsens, cyanosis appears. Eventually respiratory failure occurs that is refractory to BLS and requires both intubation and the delivery of high concentrations of oxygen.

Prevention of gastric aspiration involves instruction to patients to avoid eating or drinking for 8 hours before any oral surgery appointment during which they are to be moderately or deeply sedated.

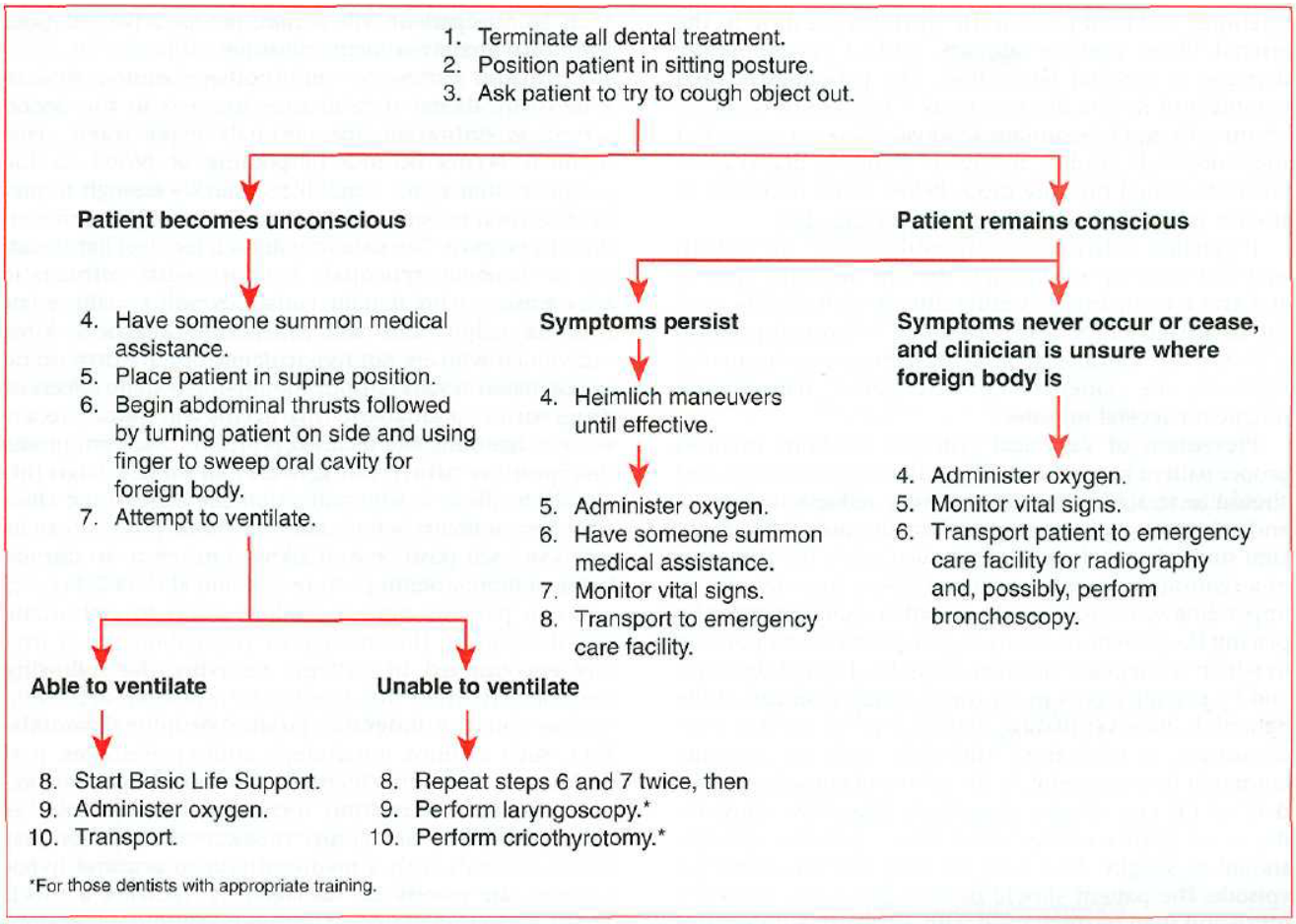


FIG. 2-7 Management of respiratory tract foreign-body aspiration in patient undergoing dental surgery.

A deeply sedated or unconscious patient who begins to vomit should be immediately placed into a head-down, feet-raised position and turned onto the right side to encourage oral drainage of vomitus. Box 2-10 lists several symptoms exhibited by patients preparing to vomit. High-volume suction should be used to assist removal of vomitus from the oral cavity. If the clinician suspects that gastric material may have entered the lower respiratory tract, a call should be placed for emergency assistance. The patient should be placed on supplemental oxygen and vital signs monitored. If possible, the dentist should gain venous access (i.e., start an IV) and be prepared to administer crystalloid solution (e.g., normal saline or D_5W) to help treat a falling blood pressure and allow emergency technicians to administer IV bronchodilators if necessary. Immediate transportation to an emergency facility is mandatory (Fig. 2-8).

BOX 2-10

Manifestations of Patient Preparing to Vomit

- Nausea
- Frequent swallowing
- Perspiration
- Feeling of warmth
- Feeling of anxiety
- Gagging

Altered Consciousness

An alteration in the level of consciousness of a patient may result from a large variety of medical problems. The altered state can range from lightheadedness to a complete loss of consciousness. Without attempting to include all possible causes of altered consciousness, a discussion is presented of commonly occurring conditions that may lead to an acutely altered state of consciousness while patients are undergoing oral surgical procedures.

Vasovagal syncope. The most common cause of a transient loss of consciousness in the dental office is vasovagal syncope. This generally occurs because of a series of cardiovascular events triggered by the emotional stress brought on by the anticipation of or delivery of dental care. The initial event in a vasovagal syncopal episode is the stress-induced release of increased amounts of catecholamines that cause a decrease in peripheral vascular resistance, tachycardia, and sweating. The patient may complain of feeling generalized warmth, nausea, and pal-

pitations. As blood pools in the periphery, a drop in the arterial blood pressure appears, with a corresponding decrease in cerebral blood flow. The patient may then complain of feeling dizzy or weak. Compensatory mechanisms attempt to maintain adequate blood pressure, but they soon fade, leading to vagally mediated bradycardia. Once the blood pressure drops below levels necessary to sustain consciousness, syncope occurs (Fig. 2-9).

If cerebral ischemia is sufficiently severe, the patient may also develop seizure activity. The syncopal episode and any accompanying seizure usually ends rapidly once the patient assumes or is placed in a horizontal position with the feet elevated (Fig. 2-10). Once consciousness is regained, the patient may have pallor, nausea, and fatigue for several minutes.

Prevention of vasovagal syncopal reactions involves proper patient preparation. The extremely anxious patient should be treated by using an anxiety reduction protocol and, if necessary, given pretreatment anxiolytic drugs. Oral surgical care should be provided while the patient is in a semisupine or fully supine position. Any signs of an impending syncopal episode should be quickly treated by placing the patient in a fully supine position or a position in which the legs are elevated above the level of the heart and by placing a cool moist towel on the forehead. If the patient is hypoventilating and is slow to recover consciousness, a respiratory stimulant such as aromatic ammonia may be useful. If the return of consciousness is delayed for more than a minute, an alternative cause for depressed consciousness other than vasovagal syncope should be sought. After early recovery from the syncopal episode, the patient should be allowed to recover in the office and then be discharged with an escort. Future office visits by the patient will require preoperative sedation, additional anxiety-reducing measures, or both.

Orthostatic hypotension. Another common cause of a transient altered state of consciousness in the dental setting is orthostatic (or postural) hypotension. This problem occurs because of pooling of blood in the periphery that is not remobilized quickly enough to prevent cerebral ischemia when a patient rapidly assumes an upright posture. The patient will therefore feel lightheaded or become syncopal. Patients with orthostatic hypotension who remain conscious will usually complain of palpitations and generalized weakness. Most individuals who are not hypovoiemic or have orthostatic hypotension resulting from the pharmacologic effects of drugs such as antihypertensive agents will quickly recover by reassuming the reclined position. Once symptoms disappear the patient can generally sit up (although this should be done slowly) and sit on the edge of the chair for a few moments before standing. Blood pressure can be taken in each position and allowed to return to normal before a more upright posture is assumed (Box 2-11).

Some patients have a predisposition to orthostatic hypotension. In the ambulatory population this is usually encountered in patients receiving the following medications: drugs that produce intravascular depletion, such as diuretics; drugs that produce peripheral vasodilation, such as most nondiuretic antihypertensives, narcotics, and many psychiatric drugs; and drugs that prevent the heart rate from increasing reflexly, such as beta-sympathetic antagonist medications (e.g., propranolol). Patients with a predisposition to postural hypotension can usually be managed by allowing a much longer period to attain a standing position (i.e., by stop-

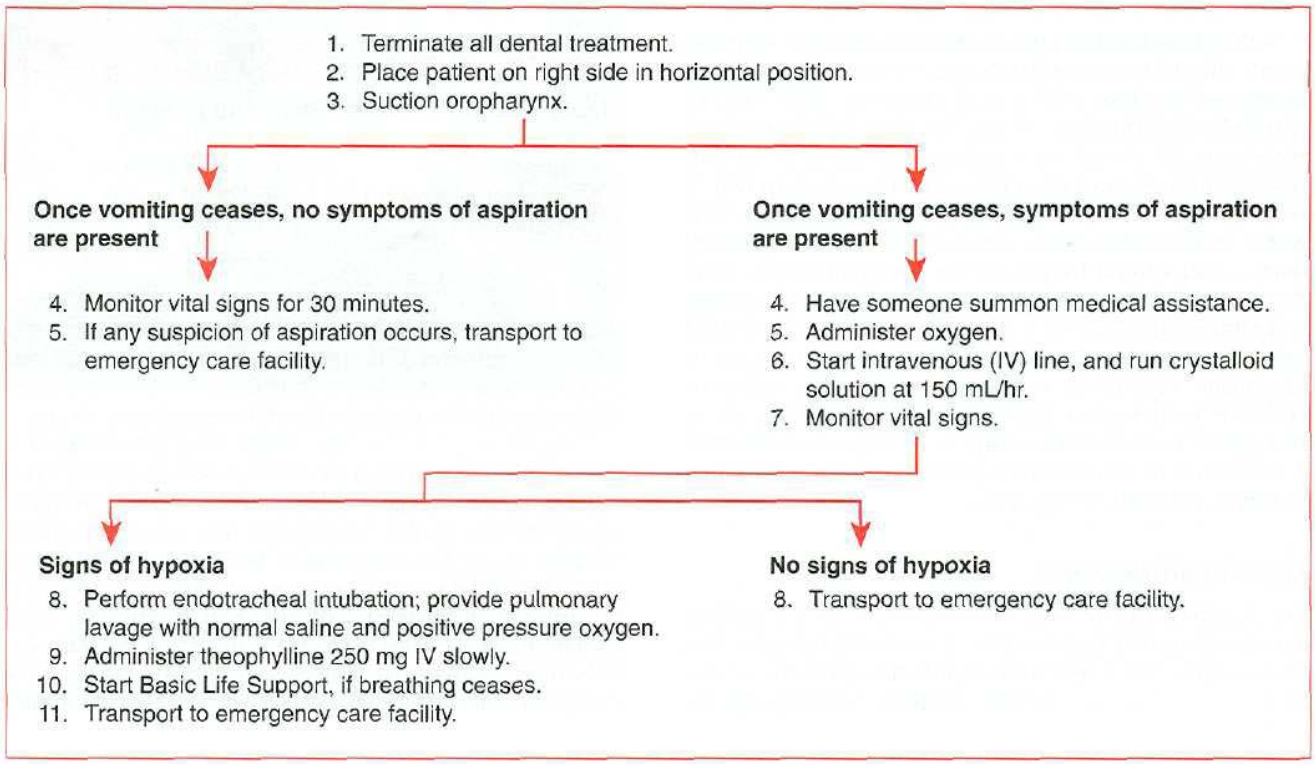


FIG. 2-8 Management of vomiting patient and of possible aspiration of gastric contents.

ping at several increments while becoming upright to allow reflex cardiovascular compensation to occur). If the patient was sedated by using long-acting narcotics, an antagonist such as naloxone may be necessary. Patients with severe problems with postural hypotension as a result of drug therapy should be referred to their physician for possible alteration of their drug regimen.

Seizure. Idiopathic seizure disorders are exhibited in many ways, ranging from grand mal seizures, with their frightening display of clonic contortions of the trunk and extremities, to petit mal seizures that may occur with only episodic absences (e.g., blank stare). Although rare, some seizure disorders, such as those secondary to injury-induced brain damage or damage from ethanol abuse, have a known cause. Usually the patient will have had the seizure disorder previously diagnosed and will be receiving antiseizure medications, such as phenytoin (Dilantin), phenobarbital, or valproic acid. Therefore the dentist should discover through the medical interview the degree of seizure control present to decide if oral surgery can be safely performed. The patient should be asked

BOX 2-11

Management of Orthostatic Hypotension

1. Terminate all dental treatment.
2. Position patient in supine posture, with legs raised above the level of the head.
3. Monitor vital signs.
4. Once blood pressure improves, slowly return patient to sitting posture.
5. Discharge to home once vital signs are normal and stable.
6. Obtain medical consultation before any further dental care.

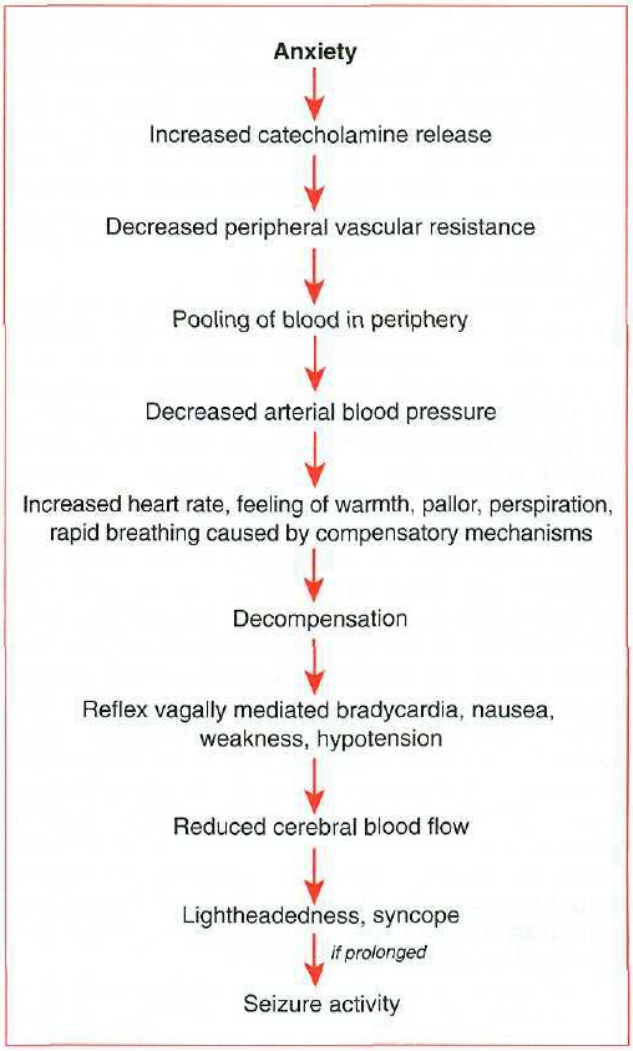


FIG. 2-9 Pathophysiology and manifestations of vasovagal syncope.

Prodrome:

1. Terminate all dental treatment.
2. Position patient in supine posture with legs raised above level of head.
3. Attempt to calm patient.
4. Place cool towel on patient's forehead.
5. Monitor vital signs.

Syncopal episode:

1. Terminate all dental treatment.
2. Position patient in supine posture with legs raised.
3. Check for breathing.

If absent:

4. Start Basic Life Support.
5. Have someone summon medical assistance.
6. Consider other causes of syncope, including hypoglycemia, cerebral vascular accident, or cardiac dysrhythmia.

If present:

4. Crush ammonia ampule under nose, administer O_2.
5. Monitor vital signs.
6. Have patient escorted home.
7. Plan anxiety control measures during future dental care.

FIG. 2-10 Management of vasovagal syncope and its prodrome.

to describe what witnesses have said occurs just before, during, and after the patient's seizures. It is helpful to discover any factors that seem to precipitate the seizure, the patient's compliance with antiseizure drugs, and the recent frequency of seizure episodes. Patients with seizure disorders who appear to have good control of their disease, that is, infrequent episodes that are brief in duration and are not easily precipitated by anxiety, are usually able to safely undergo oral surgery in the ambulatory setting. (See Chapter 1 for recommendations.)

The occurrence of a seizure while a patient is undergoing care in the dental office, although usually creating great concern among the office staff, is rarely an emergency that calls for actions other than simply protecting the patient from self-injury. However, management of the patient during and after a seizure varies, based on the type of seizure that occurs. The patient's ability to exchange air must be monitored by close observation. If it appears that the airway is obstructed, measures to reopen it must be taken, for example, by placing the head in moderate extension (chin pulled away from the chest) and moving the mandible away from the pharynx. If the patient vomits or seems to be having problems keeping secretions out of the airway, the patient's head must be positioned to the side to allow obstructing materials to drain out of the mouth. If possible, high-volume suction should be used to evacuate materials from the pharynx. Brief periods of apnea may occur, which require no treatment other than ensuring a patent airway. However, apnea for more than 30 seconds demands that BLS techniques be initiated. Although frequently described as being important, the placement of objects between the teeth in an attempt to prevent tongue biting is hazardous and therefore usually unwarranted.

Continuous or repeated seizures without periods of recovery between them are known as *status epilepticus*. This problem warrants notification of outside emergency assistance because it is the most common type of seizure disorder to cause mortality. Therapy includes instituting measures already described for self-limiting seizures; in addition, administration of a benzodiazepine is indicated. Injectable water-insoluble benzodiazepines such as diazepam must be given IV to allow predictability of results, which may be difficult in the seizing patient if venous access is not already available. Injectable water-soluble benzodiazepines such as midazolam provide a better alternative, because 1M injection will give a more rapid response. However, the doctor administering benzodiazepines for a seizure must be prepared to provide BLS, because patients may experience a period of apnea after receiving a large rapid dose of benzodiazepines.

After seizures have ceased, most patients will be left either somnolent or unconscious. Vital signs should be monitored carefully during this time, and the patient should not be allowed to leave the office until fully alert and in the company of an escort. The patient's primary care physician should be notified to decide if medical evaluation is necessary and if or when ambulatory dental care is advisable in the future (Fig. 2-11).

Tremors, palpitations, and anxiety usually precede seizures caused by ethanol withdrawal. Therefore the appearance of these signs in a patient should warn the clinician to defer treatment until proper medical care for the patient's condition is instituted- Control is usually obtained by the use of benzodiazepines, which are used until the uintoward effects of abstinence from ethanol cease. Seizures that occur in ethanol-abusing patients are treated in a similar manner to other seizures.

Local anesthetic toxicity. Local anesthetics, when properly used, are a safe and effective means of providing pain control when performing dentoalveolar surgery. However, as with all medications, toxicity reactions occur if the local anesthetic is given in an amount or in a manner that produces an excessive serum concentration.

Prevention of a toxicity reaction to local anesthetics generally involves several factors. First, the dose to be used should be the least amount of local anesthetic necessary to produce the intensity and duration of pain control required to successfully complete the planned surgical procedure. The patient's age, lean body mass, liver function, and history of problems with local anesthetics must be considered when choosing the dose of local anesthesia. The second factor to consider in preventing a local anesthetic overdose reaction is the manner of drug administration. The dentist should give the required dose slowly, avoiding intravascular injection, and use vasoconstrictors to slow the entry of local anesthetics into the blood. It should be remembered that topical use of local anesthetics in wounds or on mucosal surfaces allows rapid entry of local anesthetics into the systemic circulation. The choice of local anesthetic agents is the third important factor to consider in attempting to lessen the risk of a toxicity reaction. Local anesthetics vary in their lipid solubility, vasodilatory properties, protein binding, and inherent toxicity. Therefore the dentist must be knowledgeable about the various local anesthetics available to allow a rational decision to be made when choosing which drug to administer and in what amounts (Table 2-4).

The clinical manifestations of a local anesthetic overdose vary, depending on the severity of the overdose, how rapidly it occurs, and the duration of the excessive serum concentrations. Signs of a mild toxicity reaction may be limited to increased patient confusion, talkativeness, anxiety, and slurring of speech. As the severity of the overdose increases, the patient may display stuttering speech, nystagmus, and generalized tremors. Symptoms such as headache, dizziness, blurred vision, and drowsiness may also occur. The most serious manifestations of local anesthetic toxicity are the appearance of generalized tonic-clonic seizure activity and cardiac depression leading to cardiac arrest (Table 2-5).

Mild local anesthetic overdose reactions are managed by monitoring vital signs, instructing the patient to hyperventilate moderately with or without administering oxygen, and gaining venous access. If signs of anesthetic toxicity do not rapidly disappear, a slow IV 2.5- to 5-mg dose of diazepam should be given. Medical assistance should also be summoned if signs of toxicity do not rapidly resolve or progressively worsen.

If convulsions occur, patients should be protected from hurting themselves. Basic life-support measures are instituted as needed and venous access gained, if possible, for administration of anticonvulsants. Medical assistance should be obtained. If venous access is available,

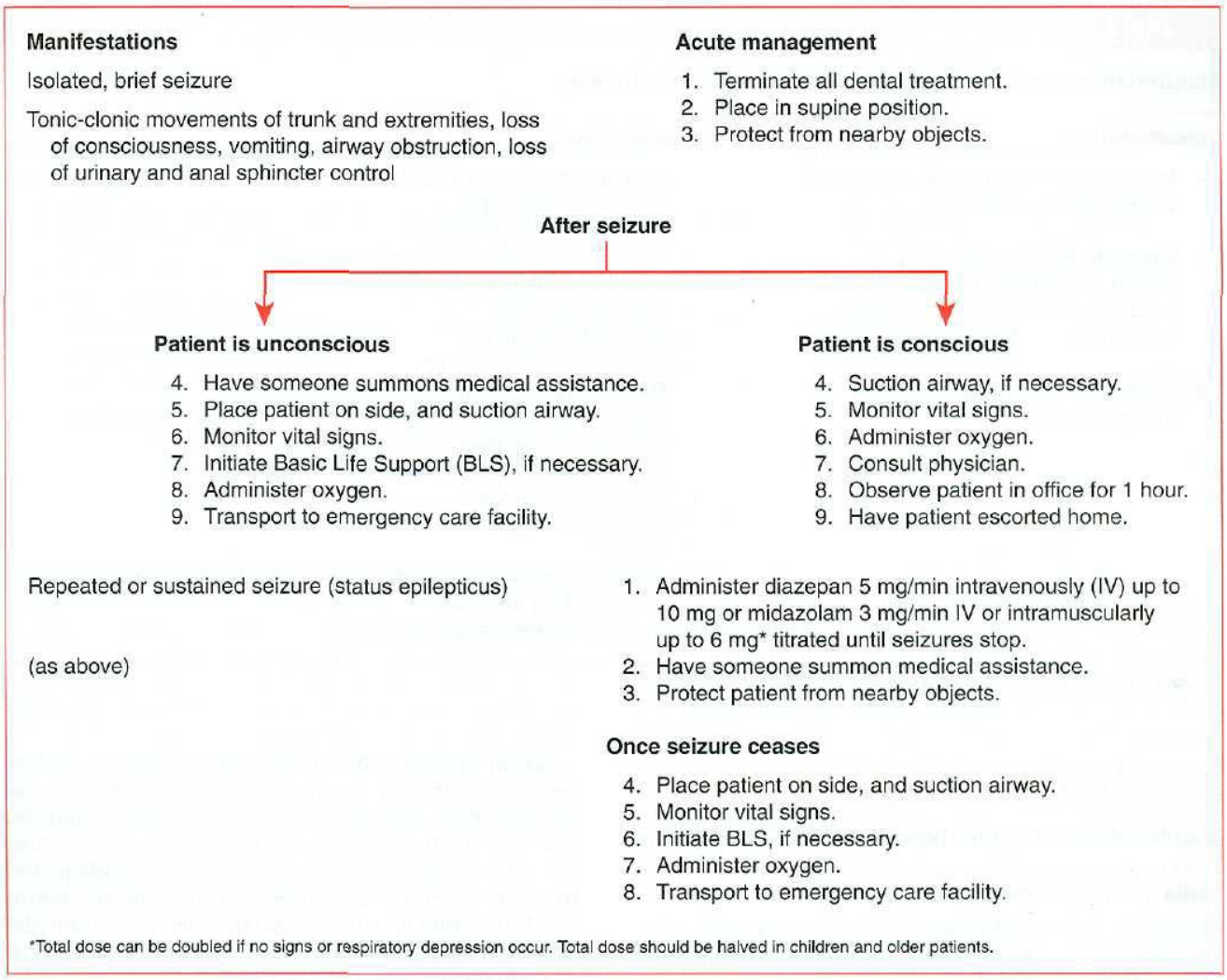


FIG. 2-11 Manifestations and acute management of seizures.

TABLE 2-4

Suggested Maximum Dose of Local Anesthetics*

Drug	Common Brand		Maximum Dose (mg/kg)	Maximum Number of 1.8 mL Cartridges
Lidocaine	Xylocaine	2%	5	10
Lidocaine with epinephrine†	Xylocaine with epinephrine	2% lidocaine 1/10^5 epinephrine	5	10
Mepivacaine	Carbocaine	3%	5	6
Mepivacaine with levonordefrin	Carbocaine with Neo-Cobefrin	2% mepivacaine 1:20,000 levonordefrin	5	8
Prilocaine	Citanest	4%	5	6
Bupivacaine with epinephrine	Marcaine with epinephrine	0.5% bupivacaine 1:200,000 epinephrine	1.5	10
Etidocaine with epinephrine	Duranest with epinephrine	1.5% etidocaine 1:200,000 epinephrine	8	15

*Maximum doses are those for normal healthy individuals.
†Maximum dose of epinephrine is 0.2 mg per appointment.

TABLE 2-5

Manifestations and Management of Local Anesthetic Toxicity

Manifestations	Management
■ Mild toxicity: talkativeness, anxiety, slurred speech, confusion	■ Stop administration of local anesthetics ■ Monitor all vital signs ■ Observe in office for 1 hr
■ Moderate toxicity: stuttering speech, nystagmus, tremors, headache, dizziness, blurred vision, drowsiness	■ Stop administration of all local anesthetics ■ Place in supine position ■ Monitor vital signs ■ Administer oxygen ■ Observe in office for 1 hr
■ Severe toxicity: seizure, cardiac dysrhythmia or arrest	■ Place in supine position ■ If seizure occurs, protect patient from nearby objects; suction oral cavity if vomiting occurs ■ Have someone summon medical assistance ■ Monitor all vital signs ■ Administer oxygen ■ Start IV ■ Administer diazepam 5-10 mg slowly or midazolam 2-6 mg slowly ■ Institute BLS if necessary ■ Transport to emergency care facility

BLS, Basic Life Support; *IV,* intravenous.

TABLE 2-6

Manifestations of Acute Hypoglycemia

Mild	Moderate	Severe
Hunger	Tachycardia	Hypotension
Nausea	Perspiration	Unconsciousness
Mood change	Pallor	Seizures
Weakness	Anxiety	
	Behavior change: belligerence, confusion, uncooperativeness	

diazepam should be slowly titrated until the seizure activity stops (5 to 25 mg is the usual effective range). Vital signs should be checked frequently.

Diabetes Mellitus. Diabetes mellitus is a metabolic disease in which the patient's long-term prognosis appears dependent on keeping serum glucose levels close to normal. An untreated insulin-dependent diabetic constantly runs the risk of developing ketoacidosis and its attendant alteration of consciousness, requiring emergency treatment. Although a compliant insulin-taking diabetic may suffer long-term problems because of relatively high serum glucose levels, the more common emergency situation they encounter is hypoglycemia resulting from a mismatch of insulin dose and serum glucose. Severe hypoglycemia is the emergency situation dentists are most likely to face when providing oral surgery for a diabetic patient.

Serum glucose concentration in the diabetic patient represents a balance between administered insulin, glucose placed into the serum from various sources, and glucose use. The two primary sources of glucose are dietary and gluconeogenesis from adipose tissue, muscle, and glycogen stores. Physical activity is the principal means by which serum glucose is lowered. Therefore serum glucose levels can fall because of any or all of the following:

1. Increasing administered insulin
2. Decreasing dietary caloric intake
3. Increasing metabolic use of glucose (e.g., exercise, infection, emotional stress)

Problems with hypoglycemia during dental care usually arise because the patient has acutely decreased caloric intake, an infection, or an increased metabolic rate caused by marked anxiety. If the patient has not compensated for this diminution of available glucose by decreasing the usual dose of insulin, hypoglycemia results. Although patients taking oral hypoglycemics can also have problems with hypoglycemia, their swings in serum glucose levels are usually less pronounced than those of insulin-dependent patients with diabetes, so they are much less likely to quickly become severely hypoglycemic.

Many patients with diabetes are well informed about their disease and are capable of diagnosing their own hypoglycemia before it becomes severe. The patient may feel hunger, nausea, or lightheadedness or may develop a headache. The dentist may notice the patient becoming lethargic, with decreased spontaneity of conversation and ability to concentrate. As hypoglycemia worsens, the patient may become diaphoretic or have tachycardia, piloerection, or increased anxiety and exhibit unusual behavior. The patient may soon become stuporous or lose consciousness (Table 2-6).

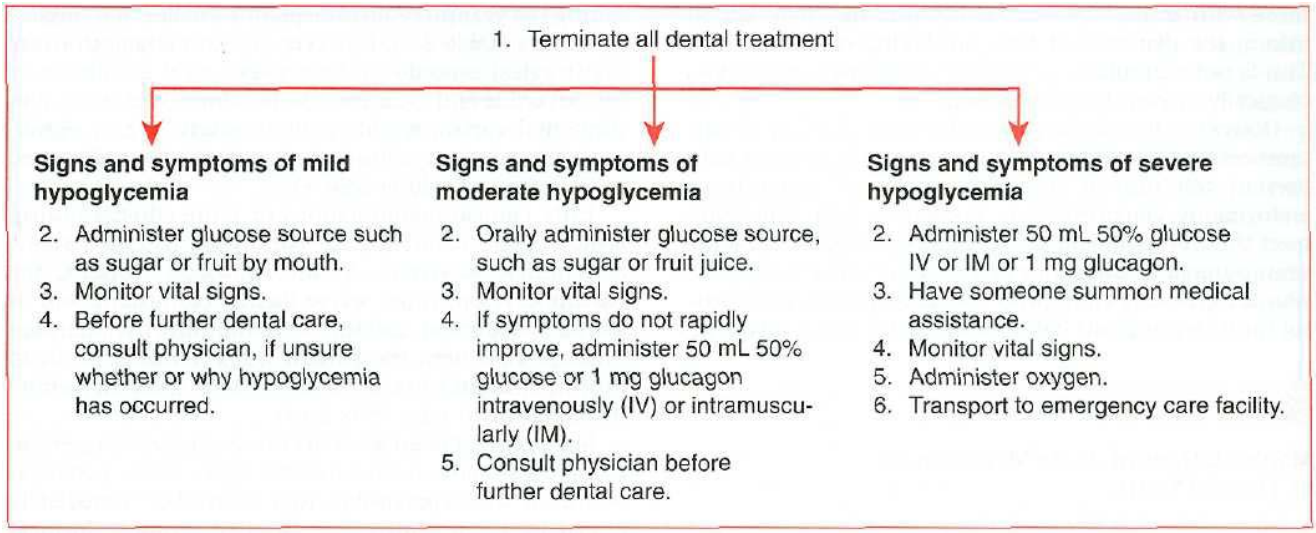


FIG. 2-12 Management of acute hypoglycemia.

Severe hypoglycemia in diabetic patients usually can be avoided through measures designed to keep serum glucose levels on the high side of normal or even temporarily above normal. During the health history interview, the dentist should get a clear idea of the degree of control of the patient's diabetes. If patients do not regularly check their own urine or serum glucose, their physician should be contacted to determine whether routine dental care can be performed safely. Before any planned procedures, measures discussed in Chapter 1 concerning the diabetic patient should be taken.

If a diabetic patient indicates a feeling of low blood sugar or if signs or symptoms of hypoglycemia appear, the procedure being performed should be stopped and the patient allowed to consume a high-caloric carbohydrate, such as a few packets of sugar, a glass of fruit juice, or other sugar-containing beverages. If the patient fails to rapidly improve, becomes unconscious, or is otherwise unable to take a glucose source by mouth, venous access should be gained and an ampule (50 mL) of 50% glucose (dextrose) in water should be administered IV over 2 to 3 minutes. If venous access cannot be established, 1 mg of glucagon can be given IM. If 50% glucose and glucagon are unavailable, a 0.5-mL dose of 1:1000 epinephrine can be administered SC and repeated every 15 minutes as needed (Fig. 2-12).

A patient who seems to have recovered from a hypoglycemic episode should remain in the office for at least 1 hour, and further symptoms should be treated with oral glucose sources. The patient should be escorted home with instructions on how to avoid a hypoglycemic episode during the next dental appointment.

Thyroid dysfunction. Hyperthyroidism and hypothyroidism are slowly developing disorders that can produce an altered state of consciousness but rarely cause emergencies. The most common circumstance in which an ambulatory, relatively healthy-appearing patient develops an emergency from thyroid dysfunction is when a thyroid storm (crisis) occurs.

Thyroid storm is sudden, severe exacerbation of hyperthyroidism that may or may not have been previously diagnosed. It can be precipitated by infection, surgery, trauma, pregnancy, or any other physiologic or emotional stress. Patients predisposed to thyroid crisis frequently have signs of hyperthyroidism, such as tremor, tachycardia, weight loss, hypertension, irritability, intolerance to heat, and exophthalmos; they may have even received therapy for the thyroid disorder.

Patients with known hyperthyroidism should have their primary care physician consulted before any oral surgical procedure. A determination of the adequacy of control of excessive thyroid hormone production should be obtained from the patient's physician, and, if necessary, the patient should receive antithyroid drugs and iodide treatment preoperatively. If clearance for ambulatory surgery is given, the patient should be managed as shown in the outline in Chapter 1.

The first sign of a developing thyroid storm is an elevation of temperature and heart rate. Most of the usual signs and symptoms of untreated hyperthyroidism occur in an exaggerated form. The patient becomes irritable, delirious, or even comatose. Hypotension, vomiting, and diarrhea also occur.

Treatment of thyrotoxic crisis begins with termination of any procedure and notification of those outside the office able to give emergency assistance. Venous access should be attained, crystalloid solution started at a moderate rate, and the patient kept as calm as possible. Attempts may be taken to cool the patient until he or she can be transported to a hospital, where antithyroid and sympathetic blocking drugs can be administered safely (Box 2-12).

Adrenal insufficiency. Primary adrenocortical insufficiency (Addison's disease) or other medical conditions in which the adrenal cortex has been destroyed are rare. However, adrenal insufficiency secondary to exogenous corticosteroid administration is relatively common because of the multitude of clinical conditions for which therapeutic corticosteroids are given. Patients with adrenal insufficiency are frequently not informed concerning their potential need for supplemental medication, and

those with secondary adrenal insufficiency may fail to inform the dentist that they are taking corticosteroids. This is not a problem, provided the patient is not physiologically or emotionally stressed.

However, should the patient be stressed, adrenal suppression that results from exogenous corticosteroids may prevent the normal release of increased amounts of endogenous glucocorticoids needed to help the body meet the elevated metabolic demands. Patients at risk for acute adrenal insufficiency as a result of adrenal suppression are generally those who take at least 20 mg of cortisol (or its equivalent) daily for at least 2 weeks any time during the year preceding the planned major oral surgical procedure (Table 2-7). However, in most straightforward oral surgical procedures done under local anesthesia or nitrous oxide and local anesthesia, administration of supplemental corticosteroids is unnecessary. When significant adrenal suppression is suspected, the steps discussed in Chapter 1 should be followed.

Early clinical manifestations of acute adrenal insufficiency crisis include mental confusion, nausea, fatigue, and muscle weakness. As the condition worsens, the patient develops more severe mental confusion; pain in the back, abdomen, and legs; vomiting; and hypotension. Without treatment the patient will eventually begin to drift in and out of consciousness, with coma harkening the preterminal stage (Box 2-13).

Management of an adrenal crisis begins by stopping all dental treatment and taking vital signs. If the patient is found to be hypotensive, they must be immediately placed in a head-down, legs elevated position. Medical assistance should be summoned. Oxygen should be administered and venous access gained. A 100-mg dose of hydrocortisone sodium succinate should be given IV (or IM, if necessary). IV fluids are rapidly administered until hypotension improves. Vital signs should be measured frequently while therapeutic measures are being taken. Should the patient lose consciousness, the need for initiation of basic life-support measures should be evaluated (Box 2-14).

Cerebrovascular compromise. Alterations in cerebral blood flow can be compromised in three principal ways: (1) embolization of particulate matter from a distant site, (2) formation of a thrombus in a cerebral vessel, or (3) rupture of a vessel. Material that embolizes to the brain comes most frequently from thrombi in the left side of the heart, from the carotid artery, or from bacterial vegetations on infected heart surfaces. Cerebrovascular thrombi generally form in areas of atherosclerotic changes. Finally, vascular rupture can occur because of rare congenital defects in the vessel, that is, berry aneurysms.

BOX 2-12

Manifestations of Acute Management of Thyroid Storm

Manifestations
Hyperpyrexia (i.e., fever)
Tachycardia
Nervousness and agitation
Tremor
Weakness
Palpitations
Cardiac dysrhythmias
Nausea and vomiting
Abdominal pains
Partial or complete loss of consciousness

Management
Terminate all dental treatment
Have someone summon medical assistance
Administer oxygen
Monitor all vital signs
Initiate BLS if necessary
Start IV line with drip of crystalloid solution (150 mL/hr)
Transport patient to emergency care facility

BLS, Basic Life Support; *IV,* intravenous.

TABLE 2-7

Equivalency of Commonly Used Glucocorticosteroids

Relative Duration of Action	Generic	Common Brand Name	Relative Glucocorticoid Potency	Relative Glucocorticoid Dose (mg)
Short	Cortisol (hydrocortisone)	Solu-Cortef	1	20
	Cortisone	—	0.8	25
	Prednisone	Deltasone	4	5
	Prednisolone	Delta-Cortef	4	5
	Methylprednisolone sodium succinate	Solu-Medrol	5	4
Intermediate	Triamcinolone	Kenalog	5	4
Long	Betamethasone	Celestone	25	0.6
	Dexamethasone	Decadron	30	0.75
	Methylprednisolone acetate	Depo-Medrol	5	4

The effect on the level of consciousness of a cerebrovascular problem depends on the severity of the cerebral lesion. If the problem rapidly resolves, such as happens with transient ischemic attacks, the symptoms of cerebral vascular compromise may last only a few seconds or minutes. However, if ischemia is severe enough, an infarction may occur in an area of the brain leaving a neurologic deficit.

A transient ischemic attack (TIA) that occurs during dental care requires that the procedure be terminated. However, little must be done for the patient other than reassurance, because most patients experience only a temporary numbness or weakness of both of the extremities on one side of the body or visual disturbance. Consciousness is usually unaltered. TIAs frequently precede a cerebral infarction, so immediate physician referral is important.

Cerebrovascular compromise that results from embolism usually occurs first with a mild headache, followed by the appearance of other neurologic symptoms, such as weakness in an extremity, vertigo, or dizziness. On the other hand, cerebral hemorrhage typically has the abrupt onset of a severe headache, followed in several hours by nausea, dizziness, vertigo, and diaphoresis. The patient may go on to lose consciousness (Box 2-15).

If signs or symptoms of a cerebrovascular compromise arise and are not transient, a major problem affecting the cerebral vasculature may be occurring. The procedure should be stopped and frequent monitoring of vital signs begun. Medical help should be called to assist in the event the patient becomes hypotensive or unconscious and to transport the patient to a hospital where neurosurgical intervention or thrombolytic therapy can be initiated, as indicated. If the patient develops respiratory difficulty, oxygen should be administered. However, oxygen is otherwise contraindicated in patients with cerebrovascular insufficiency. Any narcotics that the patient has been administered should be reversed. If consciousness is lost, vital signs should be frequently monitored and cardiopulmonary resuscitation begun if necessary (Box 2-16).

BOX 2-13

Manifestations of Acute Adrenal Insufficiency

- Weakness
- Feeling of extreme fatigue
- Confusion
- Hypotension
- Nausea
- Abdominal pain
- Myalgias
- Partial or total loss of consciousness

BOX 2-14

Management of Acute Adrenal Insufficiency

1. Terminate all dental treatment.
2. Position patient in supine position, with legs raised above level of head.
3. Have someone summon medical assistance.
4. Administer corticosteroid (100 mg of hydrocortisone or its equivalent) IM or IV.
5. Administer oxygen.
6. Monitor vital signs.
7. Start IV line and drip of crystalloid solution.
8. Start BLS, if necessary.
9. Transport to emergency care facility.

BLS, Basic Life Support; *IM,* intramuscular; *IV,* intravenous.

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BOX 2-15

Manifestations of Cerebrovascular Compromise in Progress

- Headache can range from mild to the worst the patient has ever experienced
- Unilateral weakness or paralysis of extremities or facial muscles, or both
- Slurring of speech or inability to speak
- Difficulty breathing or swallowing, or both
- Loss of bladder and bowel control
- Seizures
- Visual disturbance
- Dizziness
- Partial or total loss of consciousness

BOX 2-16

Management of Cerebrovascular Compromise in Progress*

1. Terminate all dental treatment.
2. Have someone summon medical assistance.
3. Position patient in supine posture, with head slightly raised.
4. Monitor vital signs.
5. If loss of consciousness, administer oxygen and institute BLS, as necessary.
6. Transport to emergency care facility.

*If symptoms are present only briefly (i.e., transient ischemic attacks), terminate dental treatment, monitor vital signs, and consult patient's physician concerning safety of further dental care.

BLS, Basic Life Support.