Managing Emergencies
What dentists and staff need to know to save lives
This special supplement to The Journal of the American Dental Association was made possible through an educational grant from HealthFirst Corp.
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Knowing your patients

Stanley F. Malamed, DDS
Guest Editor

The prevention and treatment of dental disease, maintenance of masticatory function and improvement of cosmetic appearance are among the prominent goals of contemporary dentistry. Accomplishing these goals without difficulty or surprise is considered the norm. The occasional patient whose mouth is difficult to numb or who exhibits a behavioral management problem remains in the memory of many dentists. Standing out also are those rare, but inevitable, medical emergencies that may occur during the dental visit.

Medical emergencies can, and do, happen in the practice of dentistry. In a survey of 2,704 dentists throughout North America, it reported a total of 18,836 emergencies occurring within a 10-year period (Table 1). None of these emergencies were truly dental emergencies. They were potentially life-threatening medical problems that patients developed while they were in a dental office.

This supplement to The Journal of the American Dental Association is designed to aid the dentist and staff members in preventing, preparing for, recognizing and effectively managing such emergencies.

The other articles in this supplement explore important topics that aid the dentist in equipping the office and in preparing office staff members to quickly and efficiently manage medical emergencies. Dr. Daniel Haas stresses the importance of preparing dental office staff members by developing a basic action plan. Another element of preparation—emergency drugs and equipment—is addressed by Dr. Morton Rosenberg. Dr. Kenneth Reed focuses on the basic management of medical emergencies and recognizing a patient’s distress.

More gratifying than treating emergencies, however, is preventing them. Three-quarters of all of the medical emergencies reported in my survey potentially developed as sequelae of pain (for example, inadequate local anesthesia), the dentist’s failure to recognize and treat a patient’s fear of dental care, or both (Table 1). Some medical emergencies that develop during dental care are unrelated to these two factors, such as allergy, postural hypotension and local anesthetic overdose (toxicity).

Preventing medical emergencies permits the dentist to carry out the planned dental treatment in an optimal environment. Therefore, dentists must obtain as much information as possible about their patients’ medical status before starting any dental treatment.

COMPONENTS OF PHYSICAL EVALUATION

Four steps constitute the basic physical evaluation of potential dental patients.

Medical history questionnaire. Completion of the medical history questionnaire before the start of any dental treatment is usual practice. The questionnaire may be completed by the patient, his or her guardian or, in the case of a minor, his or her parent. In recent years, computerized medical history forms have become available and have simplified the history-taking process.

Dialogue history. The dentist reviews the completed form with the patient and asks additional questions about any medical problems that the patient has reported. Through this dialogue, the dentist seeks to determine the significance of any reported medical disorder to the proposed dental treatment plan. For example, if a patient has had a myocardial infarction (MI), the dialogue history will include the following questions:

- When (month, year) did the MI occur?
- What degree of damage occurred to the myocardium? Is the patient chronically short of breath? Does he or she tire easily? Does he or she experience chest pain?
- What medications is the patient taking?

Physical examination. A physical examination, including visual inspection of the patient and monitoring of his or her baseline vital signs, is the next step in the evaluation process. Vital signs provide valuable real-time information about the status of the patient’s cardiovascular system. When possible, dentists should record baseline vital signs for all new patients as a routine part of their pretreatment evaluation.

Assessment of risk. After completion of the medical history questionnaire, dialogue history and physical examination, the dentist assigns the patient to a physical status category. For more than 40 years, hospitals worldwide have used the American Society of Anesthesiologists physical status (ASA PS) classification system to predict perioperative adverse outcomes in patients receiving general anesthesia (Table 2).
TABLE 1
Medical emergencies reported by 2,704 dentists.

<table>
<thead>
<tr>
<th>EMERGENCY SITUATION</th>
<th>NO. (%) OF EMERGENCIES REPORTED*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syncope†</td>
<td>4,161 (30.1)</td>
</tr>
<tr>
<td>Mild Allergic Reaction</td>
<td>2,583 (18.7)</td>
</tr>
<tr>
<td>Postural Hypotension</td>
<td>2,475 (17.9)</td>
</tr>
<tr>
<td>Hyperventilation†</td>
<td>1,326 (9.6)</td>
</tr>
<tr>
<td>Insulin Shock (Hypoglycemia)</td>
<td>709 (5.1)</td>
</tr>
<tr>
<td>Angina Pectoris†</td>
<td>644 (4.6)</td>
</tr>
<tr>
<td>Seizures†</td>
<td>644 (4.6)</td>
</tr>
<tr>
<td>Asthmatic Attack (Bronchospasm)†</td>
<td>385 (2.8)</td>
</tr>
<tr>
<td>Local Anesthetic Overdose</td>
<td>204 (1.5)</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>187 (1.4)</td>
</tr>
<tr>
<td>Anaphylactic Reaction</td>
<td>169 (1.2)</td>
</tr>
<tr>
<td>Cardiac Arrest</td>
<td>148 (1.1)</td>
</tr>
</tbody>
</table>

* Source: Malamed.†
† A few emergencies with low numbers were omitted from the table.
‡ Emergencies that potentially are stress related.

Khuri and colleagues used this system in a study of patients’ risks and outcomes. The system consists of six classifications—PS 1 to PS 6—that indicate the potential risk of an adverse medical event’s developing while a patient is under general anesthesia. McCarthy and Malamed adapted the ASA PS system for use in dentistry. The dentist assigns the ASA PS classification after considering all available medical history information, as described earlier.

**PS 1.** A patient in the PS 1 category is defined as normal and healthy. After reviewing the available information, the dentist determines that the patient’s heart, lungs, liver, kidneys and central nervous system are healthy and his or her blood pressure is below 140/90 millimeters of mercury. The patient is not unduly phobic and is younger than 60 years. A patient in the PS 1 category is an excellent candidate for elective surgical or dental care, with minimal risk of experiencing an adverse medical event during treatment.

**PS 2.** Patients in the PS 2 category have a mild systemic disease or are healthy patients (PS 1) who demonstrate extreme anxiety and fear toward dentistry or are older than 60 years. Patients classified as PS 2 generally are somewhat less able to tolerate stress than are patients classified as PS 1; however, they still are at minimal risk during dental treatment. Elective dental care is warranted in a patient classified as PS 2, with minimal increased risk during treatment. However, the dentist should consider possible treatment modifications (see Stress Reduction Protocols below).

**PS 3.** A patient in the PS 3 category has severe systemic disease that limits activity but is not incapacitating. At rest, a patient in the PS 3 category does not exhibit signs and symptoms of distress (such as undue fatigue, shortness of breath, chest pain); however, when stressed, either physiologically or psychologically, the patient does exhibit such signs and symptoms. An example is a patient with angina who is pain free while in the waiting room but develops chest pain when seated in the dental chair. Like PS 2, the PS 3 classification indicates that the dentist should proceed with caution. Elective dental care is not contraindicated, though the patient is at an increased risk during treatment. The dentist should give serious consideration to implementing treatment modifications.

**PS 4.** A patient in the PS 4 category has an incapacitating systemic disease that is a constant threat to life. Patients with this classification have a medical problem or problems of greater significance than the planned dental treatment. The dentist should postpone elective dental care until the patient’s physical condition has improved to at least a PS 3 classification. A patient in the PS 4 category exhibits clinical signs and symptoms of disease at rest. The risk in treating this patient is too great to permit elective care. In dental emergencies, such as cases of infection or pain, clinicians should treat patients conservatively in the dental office until their conditions improve. When possible, emergency treatment should be noninvasive, consisting of drugs such as analgesics for pain and antibiotics for infection. When the dentist believes that immediate intervention is required (for example, incision and drainage, extraction, pulp extirpation), I suggest that the patient receive care in an acute care facility (that is, a hospital) whenever possible.

**PS 5.** A PS 5 classification indicates a moribund patient not expected to survive 24 hours without surgery. In this category almost always are hospitalized and terminally ill. In many institutions, these patients are not to be resuscitated if they experience respiratory or cardiac arrest. Elective dental treatment is contraindicated; however, emergency care, in the

realm of palliative treatment (that is, relief of pain, infection or both) may be necessary. (PS 6 refers to a patient declared brain-dead and whose organs are being removed for donor purposes.)

The ASA PS classification system is not meant to be inflexible; rather, it is meant to function as a relative value system based on a dentist’s clinical judgment and assessment of the available relevant clinical data. When the dentist is unable to determine the clinical significance of one or more diseases, I recommend he or she consult with the patient’s physician or other medical or dental colleagues. In all cases, however, the treating dentist makes the final decision regarding whether to treat or postpone treatment. The ultimate responsibility for the health and safety of a patient lies solely with the dentist who decides to treat or not to treat the patient.

**STRESS REDUCTION PROTOCOLS**

Dentists in private practice assign most patients (85 percent) to PS 1 or PS 2 status, about 14 percent to PS 3 and the remainder to PS 4. All dental and surgical procedures potentially are stress inducing. Such stress may be of a physiological (pain, strenuous exercise) or psychological (anxiety, fear) nature. One response of the body to stress is to increase the release of catecholamines (epinephrine and norepinephrine) from the adrenal medulla into the cardiovascular system. This results in an increased workload for the heart (that is, increased heart rate and strength of myocardial contraction and an increased myocardial oxygen requirement). Although patients classified as PS 1 may be quite able to tolerate such changes in cardiovascular activity, patients classified as PS 2, 3 or 4 are increasingly less able to tolerate these changes safely.

A patient with stable angina (PS 3) may respond with an episode of chest discomfort, and various dysrhythmias may develop. Pulmonary edema may develop in patients with heart failure. In addition, patients with noncardiovascular disorders may respond adversely when faced with increasing levels of stress. A patient with asthma may develop an acute episode of respiratory distress, and a patient with epilepsy may experience a seizure. Unusual degrees of stress in patients in the PS 1 category may be responsible for psychologically induced emergency situations, such as hyperventilation or vasodepressor syncope.

Stress reduction protocols are procedures that minimize stress during treatment, thereby decreasing the risk to the patient. These protocols are predicated on the belief that the prevention or reduction of stress should begin before treatment, continue throughout treatment and, if indicated, continue into the postoperative period.

**Medical consultation.** When the dentist is uncertain about the degree of risk to the patient, he or she may consider consulting a physician. Medical consultation is neither required nor recommended for all medically compromised patients. In all cases, clinicians must keep in mind that consultation is a request for information concerning a

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**TABLE 2**

American Society of Anesthesiologists physical status (ASA PS) classification system.*

<table>
<thead>
<tr>
<th>ASA PS*</th>
<th>DEFINITION†</th>
<th>EXAMPLE</th>
<th>TREATMENT RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal healthy patient</td>
<td>—</td>
<td>No special precautions</td>
</tr>
<tr>
<td>2</td>
<td>Patient with mild systemic disease</td>
<td>Pregnancy, well-controlled type 2 diabetes, epilepsy, asthma, thyroid dysfunction, BP 140-159/90-94 mm Hg</td>
<td>Elective care OK; consider treatment modification</td>
</tr>
<tr>
<td>3</td>
<td>Patient with severe systemic disease that limits activity but is not incapacitating</td>
<td>Stable angina pectoris, postmyocardial infarction &gt; six months, post-CVA* &gt; six months, exercise-induced asthma, type 1 diabetes (controlled), epilepsy (less well controlled), symptomatic thyroid dysfunction, BP 160-199/95-114 mm Hg</td>
<td>Elective care OK; serious consideration of treatment modification</td>
</tr>
<tr>
<td>4</td>
<td>Patient with an incapacitating systemic disease that is a constant threat to life</td>
<td>Unstable angina pectoris, postmyocardial infarction &lt; six months, uncontrolled seizures, BP &gt; 200/115 mm Hg</td>
<td>Elective care contraindicated; emergency care: noninvasive (for example, drug) or in a controlled environment</td>
</tr>
<tr>
<td>5</td>
<td>Moribund patient not expected to survive 24 hours without surgery</td>
<td>End-stage cancer, end-stage infectious disease, end-stage cardiovascular disease, end-stage hepatic dysfunction</td>
<td>Palliative care</td>
</tr>
</tbody>
</table>

* The ASA physical status classification system is adapted with permission of the American Society of Anesthesiologists, 520 N. Northwest Highway, Park Ridge, Ill. 60068-2872.
† Sources: American Society of Anesthesiologists; Saavedra and Malamed.
‡ BP: Blood pressure.
§ mm Hg: Millimeters of mercury.
* CVA: Cerebrovascular accident.
specific patient or disease process. The dentist is seeking information to aid in determining the degree of risk and which modifications in therapy might be beneficial.

**Premedication.** Many apprehensive patients report that their fear of dentistry or surgery is so great that they are unable to sleep well the night before their appointment. Fatigued the next day, they are less able to tolerate any stress placed on them during treatment. In a patient who is medically compromised, the risk of an acute exacerbation of his or her medical problem is increased. In a patient in the PS 1 category, such stress might provoke a psychogenically induced response.

When heightened anxiety exists, the dentist should determine whether it interferes with the patient’s sleep. Restful sleep the night before an appointment is desired. One means of achieving this goal is to administer an oral sedative. The dentist may prescribe a sedative-hypnotic drug, such as diazepam, triazolam, flurazepam, zaleplon or zolpidem, for administration one hour before the patient goes to bed. As the appointment approaches, the patient’s anxiety level heightens. The dentist can administer a sedative-hypnotic drug about one hour before the scheduled start of treatment to permit the attainment of a therapeutic blood level of the agent. Whenever possible, oral sedatives should be administered in the dental office.

**Appointment scheduling.** Apprehensive or medically compromised patients are better able to tolerate stress when rested. Consequently, for most of these patients, including children, the ideal time to schedule dental treatment is early in the day.

**Minimize waiting time.** Once in the dental office, an apprehensive patient should not need to wait in the reception area or dental chair for extended periods before treatment begins. Anticipation of a procedure can induce more fear than the actual procedure.13

**Preoperative and postoperative vital signs.** Before treating a medically compromised patient, the dentist or a staff member should monitor and record the patient’s vital signs (blood pressure, heart rate and rhythm, and respiratory rate). Comparing these preoperative vital signs with the patient’s baseline values recorded at an earlier visit serves as an indicator of the patient’s physical and emotional status that day. Although especially relevant to patients with cardiovascular disease, preoperative and postoperative vital signs should be recorded for all medically compromised patients (that is, all patients classified as PS 3 or PS 4 and appropriate patients classified as PS 2).

**Sedation during treatment.** Should additional stress reduction procedures be required, the dentist may consider using any available sedation technique or general anesthesia. Non-drug techniques include iatrosedation (including music and video) and hypnosis; the more commonly used pharmacosedative procedures include oral, inhalational, intramuscular, intranasal and intravenous (minimum or moderate) sedation.14,15 The primary goal of iatrosedative and pharmacosedative techniques is to decrease or eliminate stress. Used properly, these techniques achieve the goal without adding risk to the patient.

**Pain control.** For stress reduction to be successful, the patient’s pain must be controlled. Successful pain management is of greater importance in medically compromised patients than it is in patients in the PS 1 category. The potential adverse actions of endogenously released catecholamines on cardiovascular function in a patient with significant cardiovascular disease (PS 3 and PS 4 classifications) warrant inclusion of vasoconstrictors in the local anesthetic solution.16 In the absence of adequate pain control, stress reduction cannot be achieved, making it almost impossible for the dentist to sedate the patient.

**Treatment duration.** The duration of treatment is significant for medically compromised and anxious patients. In the absence of factors dictating a need for shorter appointments (that is, PS 3 and PS 4 classifications), the dentist determines the appointment length after considering the patient’s desires. In many instances, a healthy but fearful patient may wish to have as few dental appointments as possible, regardless of their length. However, satisfying a patient’s (or parents’ or guardians’) desire for longer appointments is inadvisable if the dentist believes there are appropriate reasons for shorter appointments.

A medically compromised patient should not undergo unduly long appointments. To subject a patient at higher risk to extended treatment may increase his or her risk unnecessarily. Dental appointments for patients in PS 3 and PS 4 categories should not exceed the patient’s tolerance limit. Fatigue, restlessness, sweating and evident discomfort are signs that the patient has reached this limit. The dentist also can ask the patient if he or she would like to stop. The most prudent means of managing the care of the patient is to terminate the procedure as expeditiously as pos-
POSTOPERATIVE CONTROL OF PAIN

Postoperative management of pain and anxiety is equally as important as preoperative and perioperative management. This is especially relevant for a patient who has undergone a potentially traumatic procedure (that is, endodontics, periodontal or oral surgery, extensive oral reconstruction or restorative procedures). The dentist must consider carefully complications that might arise during the 24 hours after treatment, discuss these with the patient and take steps to assist him or her in managing them. These steps may include any or all of the following:

- availability of the dentist via telephone around the clock;
- pain control: a prescription for analgesic drugs, as needed;
- antibiotics: a prescription for antibiotics if the possibility of infection exists;
- anti-anxiety drugs if the dentist believes that the patient may require them;
- muscle relaxant drugs after prolonged therapy or if the patient has received multiple injections in one area (for example, inferior alveolar nerve block).

Should the possibility exist of posttreatment discomfort or pain, the patient should be forewarned and an analgesic drug (such as ibuprofen 800 mg three times a day or 600 mg four times a day) made available.17,18

The stress reduction protocols described above have made it possible to manage the dental health care needs of a broad spectrum of anxious and medically compromised patients with a low complication rate.

CONCLUSIONS

When medical emergencies occur in the dental office, they represent a possible threat to the patient's life and a hindrance to the delivery of dental care. Preventing medical emergencies is predicated on gathering information about any preexisting medical conditions, drugs and other medications the patient may be taking and the patient's level of dental care–related anxiety. The dentist obtains this information through a physical evaluation before the start of treatment. The four components of a physical evaluation are medical history questionnaire, dialogue history, physical examination (including monitoring and recording of vital signs and visual examination) and assessment of risk.

To assess risk, the dentist assigns an ASA PS classification to the patient (1 through 5). PS 1, 2 and 3 represent candidates for elective dental treatment, albeit with increasing degrees of medical compromise evident. Patients who are more medically compromised may require treatment modifications to enable them to tolerate the stresses involved in treatment. The stress reduction protocols described above are designed to minimize the stress associated with the delivery of dental care.

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Preparing dental office staff members for emergencies
Developing a basic action plan

Daniel A. Haas, DDS, PhD

The dentist’s role in managing any medical emergency begins with prevention. This requires that all staff members, including dentists, dental hygienists, dental assistants and receptionists, be prepared for such emergencies. A team approach should be used, and each staff member can play an important role. Appropriate preparation makes this teamwork effective and should improve the patient’s chance of achieving a good result.

How does one develop a basic action plan for an unforeseen event? There are numerous potential medical emergencies and numerous protocols to follow. Ideally, the dentist and support staff members should be knowledgeable about all of them. However, when an emergency first develops, the precise diagnosis may not be clear. Without a diagnosis, how can one formulate a treatment plan? This problem can be circumvented by following a key principle: the most important objective of nearly all medical emergencies in the dental office is to prevent or correct insufficient oxygenation of the brain or heart.

On a simple level, if a patient has lost consciousness, it is a result of a lack of oxygenated blood in the brain. If a patient is experiencing an episode of acute angina pectoris, it is a result of a relative lack of oxygenated blood to specific sites in the cardiac muscle. The management of all medical emergencies in a dental office should include

**Abstract**

**Background and Overview.** A medical emergency can occur in any dental office, and managing it successfully requires preparation. The dentist should develop a basic action plan that is understood by all staff members. The goal is to manage the patient’s care until he or she recovers fully or until help arrives. The most important aspect of almost all medical emergencies in dentistry is to prevent or correct insufficient oxygenation of the brain or heart. The dentist or a staff member needs to position (P) the patient appropriately. He or she then needs to assess and, if needed, manage the airway (A), breathing (B) and circulation (C). The dentist and staff members then can consider “D,” which stands for definitive treatment, differential diagnosis, drugs or defibrillation. A team approach should be used, with each staff member trained in basic life support and understanding the role expected of him or her ahead of time. Clear and effective communication is essential during any emergency.

**Conclusions.** All staff members should understand the basic action plan so that they can put it into effect should any emergency arise in the dental office.

**Clinical Implications.** Preparing staff members is integral to the successful management of a medical emergency in the dental office.

**Keywords.** Medical emergencies; basic life support.

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ensuring that oxygenated blood is being delivered to the brain and heart. If the dentist and team members remember this principle, then everything else should make sense. If this approach makes sense to each member of the office staff, knowing what to do becomes straightforward.

In fact, this principle is the basis of the training in basic life support (BLS), also known as cardiopulmonary resuscitation (CPR). The goal of BLS is to keep the brain oxygenated and, therefore, protected until something more definitive can be done. Clinicians always should begin with the “PABC” approach, particularly if the diagnosis is not clear. The dentist or a staff member needs to position (P) the patient appropriately. He or she then needs to assess and, if necessary, manage the airway (A), breathing (B) and circulation (C). After the dentist and staff members have addressed the PABCs, they can consider “D,” which stands for definitive treatment, differential diagnosis, drugs or defibrillation. Therefore, all team members should be trained and competent in BLS/CPR.

BASIC ACTION FOR EVERY EMERGENCY

What should be done in every medical emergency? The goal is to manage the care of the patient until he or she recovers fully or help arrives. Team members should position the patient and initiate the ABCs. Assess and, if needed, manage each one of A, then B and then C. This orderly approach will help staff members avoid missing a step.

P: Position. If conscious, the patient should sit in any position that is comfortable. If unconscious, the patient should be supine with the legs elevated slightly to about 10° to 15° (Figure 1). This position facilitates blood flow to the brain, thus helping to correct any deficient oxygen delivery.

A: Airway. Practitioners must consider airway assessment. If the patient is conscious, this should not be an issue, and one typically can move quickly to breathing. If the patient is talking, then the airway is patent, but the clinician should look at the throat in case of allergy to rule out airway compression from laryngeal edema, which is a sign of anaphylaxis. He or she should remove any foreign objects, such as cotton rolls, to eliminate the potential for airway blockage or aspiration.

If the patient is unconscious, assessing and managing the airway becomes crucial. Practitioners and staff members must ensure patency by tilting the patient’s head and lifting his or her chin immediately (Figure 2). By itself, this maneuver may prevent brain damage, as it moves the tongue away from the back of the pharynx, thereby eliminating the obstruction (the tongue). In turn, this permits oxygenation. If the airway is not patent after this maneuver, the clinician should reposition the patient’s head once more. If the airway still is not opened, the clinician should perform a jaw-thrust maneuver by placing his or her thumbs posterior to the angle of the patient’s mandible and advancing them (and the mandible) anteriorly.

B: Breathing. The dentist and staff members should consider the second step—breathing—immediately after taking care of the patient’s airway. If he or she is conscious, this usually is not a problem, and the team can move on quickly to circulation. If the patient is talking, then he or she is breathing, but in cases of asthma or allergy, the dentist must rule out wheezing (bronchospasm). He or she also needs to consider whether the patient is breathing too slowly or rapidly. Any team member can monitor the respiratory rate and adequacy of respiration. In adults, the normal respiratory rate is 12 to 15 breaths per minute. In children, the rate is higher, with an 8-year-old averaging 18 breaths per minute and a 3-year-old averaging 22 breaths per minute.

Bradypnea is any respiratory rate significantly below the normal rate; it may result in hypventilation and inadequate oxygenation. Tachypnea, often a sign of anxiety, is any respiratory rate significantly above the normal rate; it may lead to hyperventilation syndrome. For offices in which the clinician induces moderate or deep sedation or administers a general anesthetic, a pulse oximeter should be available and can be used to assess the adequacy of oxyhemoglobin saturation. Monitoring the adequacy of respiration also includes observing the color of the mucosa, skin and blood to rule out signs of cyanosis.

If the patient is unconscious, dealing with breathing becomes crucial. As taught in BLS, “look, listen and feel.” If the patient is not breathing, administer two slow deep breaths, with each breath lasting one second. The clinician

or staff member should use a barrier device, such as a pocket mask or the mask from a bag-valve-mask device, if available. He or she should see the chest rise with each ventilation. However, he or she should not ventilate too rapidly or administer excessive volumes. The clinician should administer rescue breaths at a rate of 10 to 12 per minute for an adult. In children younger than the age of adolescence—defined as the age just before the onset of puberty, as determined by the presence of secondary sex characteristics—the rate should be 12 to 20 breaths per minute.6

C: Circulation. The dental team should assess the patient’s circulation immediately after the breathing step. If the patient is conscious, a team member should check the pulse by using the radial, brachial or carotid artery. The team member can palpate the radial artery by placing the ends of two fingers on the lateral and ventral aspects of the patient’s wrist. The brachial artery can be palpated on the medial aspect of the antecubital fossa. To locate the carotid pulse, the team member palpates the patient’s thyroid cartilage and moves his or her fingers laterally into the groove formed by the sternodeidomastoid muscle (Figure 3).

Pulse. In an unconscious patient, the carotid is the best artery for assessing the pulse. BLS training for laypeople recommends skipping the pulse check, but that rule does not apply to healthcare providers, including those of us in dentistry. Health care professionals are expected to be able to detect a pulse. If no pulse can be palpated after 10 seconds, the dentist or a staff member should assume that the patient has experienced cardiac arrest and begin chest compressions at a rate of 100 per minute, consistent with current BLS training.6

Chest compressions. The health care professional should place his or her hands over the lower half of the patient’s sternum between the nipples. He or she should push down by using the heel of one hand with the other hand on top. Each compression should depress the chest 1/2 to 2 inches. It is important that the clinician push hard and fast and allow full chest recoil. The compression to ventilation ratio for adults is 30:2. For children older than 1 year but younger than the age of adolescence, the compressions should depress the chest by one-third to one-half its depth. The compression to ventilation ratio for one-person CPR in children is the same as that in adults, but for two-person CPR in children, the ratio should be 15:2.5

Heart rate. In addition to noting the presence or absence of a pulse, a team member should record the heart rate (in beats per minute [BPM]), its quality (weak or strong) and its rhythm (regular or irregular). A tachycardia is a rapid rate, defined in an adult as anything above 100 BPM. Bradycardia is a slow rate, defined as anything below 60 BPM. Not all bradycardias need management. For example, the well-trained athlete or the patient receiving treatment with a β-blocker could have a rate below 60 BPM and not require treatment. Only when a bradycardia is accompanied by symptoms such as lightheadedness, nausea or chest pain should health care professionals act to manage it. Heart rates typically are higher in children and decrease with increasing age. For example, the normal ranges are from 80 to 130 BPM in a 2-year-old and 70 to 110 BPM in a 10-year-old.6,7 A full or bounding pulse often is associated with high blood pressure (BP). A weak and thready pulse is associated with hypotension. The team member should record an irregular rhythm as an abnormality.
It is important to note that assessing circulation involves more than just a pulse check. Health care professionals should check BP for a better indication of the adequacy of the patient’s circulation.

**Measuring BP.** Blood pressure can be measured in a number of ways; I describe the auscultatory method here. A standard BP cuff, also called a sphygmomanometer, can be used along with a stethoscope. Alternatively, a team member can use an automated device. Even if an automated device is in the office, a standard cuff and stethoscope should be available to confirm any readings that the dentist may question. An automated device also may not be as accurate as a standard cuff in the event of an irregular heart rate, such as that found in atrial fibrillation.

To measure BP, a team member wraps the deflated BP cuff evenly and firmly around the patient’s upper arm, about one inch above the antecubital fossa with the artery indicator resting on the patient’s brachial artery, which should be palpated. With the earpieces of the stethoscope facing forward, the team member places the diaphragm firmly over the brachial artery, being careful not to touch the BP cuff. With the other hand, he or she closes the valve on the inflating bulb of the BP cuff by turning it fully clockwise. He or she inflates the cuff to about 20 to 30 millimeters of mercury above the point at which pulsations disappear from the palpated radial pulse. The staff member then reduces the pressure slowly at a rate of 2 to 3 mm Hg per second by turning the valve on the inflating BP cuff counterclockwise until he or she hears the first sound through the stethoscope. This first sound indicates the systolic BP produced by turbulent blood flow through the partially collapsed underlying artery. These are known as “Korotkoff sounds.” The team member continues to deflate the cuff slowly until the sounds become muffled and disappear; this is the diastolic BP. The blood flow through the artery returns to a smooth (laminar) flow and, thus, no sounds are produced. At this stage, the staff member deflates the cuff fully and records the measurements obtained.

The accuracy of BP readings can depend on a few factors. Proper BP cuff size is important. The cuff’s bladder should extend at least halfway around the arm, with the width of the cuff being at least 25 percent greater than the diameter of the arm. Another means of determining the appropriate size is that the bladder length is 80 percent of the arm’s circumference and the width is 40 percent of the circumference. A cuff that is too narrow may result in a large overestimation of systolic BP. Conversely, a cuff that is too wide may lead to underestimation of systolic BP. Firm placement is important because a cuff that is too loose results in falsely elevated readings.

The accuracy of BP readings can be affected by what is known as the “auscultatory gap.” This is defined as Korotkoff sounds that cannot be heard through part of the range from systolic to diastolic pressure. It is most common in patients with hypertension and can lead to an inaccurate diastolic measurement. Fear and anxiety also can cause transient elevations in BP, primarily with systolic BP. Normal BP in an adult approximates 120/80 mm Hg. Blood pressures typically are lower in children and increase with age. These approximate from 100/60 mm Hg in a 4-year-old to 110/60 mm Hg in a 10-year-old.

One sign of circulation adequacy is the color of the mucosa, with pink and red indicating good peripheral circulation and pale or blue (cyanosis) indicating inadequate circulation. Capillary filling is another indicator, which can be determined by depressing the nail bed and noting whether or not it blanches and then quickly regains color. To assess central perfusion, the dentist or a staff member notes the patient’s orientation to person, place and time.

**TEAM MEMBERS’ ROLES**

The dental office should have a written plan that describes the expected roles of team members. These roles should be reviewed regularly during staff meetings. The dentist should arrange emergency simulations or drills to enable team members to practice their roles periodically. The emer-
Emergency duties of a four-member dental team.*

TEAM MEMBER 1: LEADER
- Directs team members
- Positions the patient and stays with him or her
- Performs "ABCs" of cardiopulmonary resuscitation (CPR)
- Takes command and appears calm
- States instructions clearly and distinctly
- Requests acknowledgment from team members that instructions are understood
- Fosters open exchange among team members
- Concentrates on what is right for the patient, not who is right†

TEAM MEMBER 2
- Brings emergency kit
- Brings oxygen tank and attaches appropriate delivery system
- Brings automated external defibrillator
- Assists with ABCs of CPR, including monitoring vital signs
- Checks oxygen tank regularly
- Checks emergency kit regularly
- Prepares drugs for administration

TEAM MEMBER 3
- Telephones emergency medical services (9-1-1)
- Meets paramedics at building entrance
- Keeps chronological log of events
- Assists with ABCs of CPR

TEAM MEMBER 4
- Assists with ABCs of CPR
- Assists with other duties as needed

* Source: Malamed.†
† ABC: Airway, breathing, circulation. Source: American Heart Association.‡
‡ Source: Gaba and colleagues.³

Emergency medical services (EMS) telephone number should be posted if it is other than 9-1-1.

The specific roles of team members will depend, in part, on the number of people on the team. Most dental offices have at least three team members: a dentist, a dental assistant and a receptionist. As the size of the staff increases, duties can be shared among more members. Team member 1 is the leader, but the other roles often are interchangeable. Box 1 provides suggestions for the roles of a four-member team. 1,2,3

Leader. Team member 1 is the leader and usually is the patient’s dentist. However, depending on individual circumstances, another team member may be the leader. The leader’s role is to be in charge and lead the management of the crisis. The leader decides when to announce an emergency situation. If in doubt, it is better to call an emergency early rather than late; however, bear in mind that calling for help unnecessarily too often may be detrimental when help truly is needed. The leader assigns a team member to telephone for outside assistance, positions the patient and initiates the ABCs until assistance arrives. The leader should remain with the patient throughout the emergency until he or she has recovered or until EMS has arrived and takes the patient to a hospital.

Being the leader requires leadership skills that include knowing how to prioritize actions by determining what is most important at any time relative to the actions that can be deferred. Leadership skills include the ability to appear calm and in control. Although the leader may be worried about the events unfolding, a calm demeanor must prevail. Panic can be infectious. If team members see the leader panicking, they may follow suit. Remaining calm and collected will help the leader and team members think and act rationally during a stressful time.

Team member 2. Team member 2 knows the location of the emergency kit, portable oxygen and automated external defibrillator and brings them as instructed. He or she also can be assigned to check the emergency kit on a regular basis to ensure that all contents are present and within the expiration date. This team member ensures that sufficient oxygen remains in the tank and assists the team leader with BLS, including monitoring vital signs. He or she also can prepare emergency drugs for administration.

Team member 3. Team member 3, or team member 4 if present, can fulfill various functions, including telephoning EMS (9-1-1) and walking to the building’s main entrance to meet the paramedics and lead them to the patient. One of these team members keeps a written chronological record of all events, including the patient’s vital signs, timing and amount of drug administered, and the patient’s response to treatment.

Additional team members may be other dentists or support staff in the office. All of them should be able to relieve other team members as required.

TEAM COMMUNICATION
In addition to understanding each other’s roles, members of an effective team need to communicate effectively. The team leader should consider using a “closed-loop” approach. This means that when the leader sends a message, the team member acknowledges receiving the instruction, thereby confirming that he or she heard and understood the message. Pilots and air traffic controllers use this model successfully, and many gourmet coffee shops use it as customers place their orders. Consequently, this model should work easily in a dental office.
The team leader should state clearly the next task to be assigned only after he or she has received a clear response from the team member that the first task was understood. This approach reduces the likelihood of key steps being missed through oversight, such as shouting “call 9-1-1” to no one in particular; everyone assumes that someone else has made the telephone call, when in fact no one has acted on this command.

An example of a correct scenario is as follows. The leader states, “Mary, call 9-1-1.” Mary then replies, “I am going to call 9-1-1.” The team leader then listens for confirmation that the task has been performed. Mary returns and says, “I’ve called 9-1-1 and the paramedics are on their way.” In another example of a correct scenario, the leader states, “John, bring the oxygen tank.” John acknowledges having received the instruction by replying, “I am going to get the oxygen tank.” When he returns, John says, “Oxygen tank is here.” The team leader responds, “Good. Now attach the bag-valve-mask device.” This communication continues in a similar way with all team members.

Effective communication requires each team member to speak clearly and directly. Good eye contact should be maintained when giving instructions. It is not appropriate to let the stress of the situation result in yelling or shouting. If any instruction is unclear, the recipient should ask for clarification. The best teams are composed of members who respect each other and work together in a supportive and collegial way. There should be an open exchange such that any team member can speak freely to any other team member without fear or embarrassment. No one should feel patronized or any perceived dental office hierarchy should be ignored for this purpose. For example, any team member should feel comfortable making a suggestion to the team leader, in particular if he or she believes that something important has been missed or is being performed incorrectly. The team leader should welcome any comment that might benefit the patient. The team must concentrate on what is right for the patient, not who is right, during management of the medical emergency.

It is useful to have a planned protocol regarding what to say when calling EMS (9-1-1). Box 2 summarizes the information that should be communicated clearly when talking with the dispatcher. This protocol should be documented in writing, and team members should review it periodically.

### BOX 2

**Information to provide when calling emergency medical services (9-1-1).**

- **Preliminary diagnosis** (for example, “possible myocardial infarction”)
- **Information about the patient** (for example, “58-year-old man with chest pain; conscious; blood pressure of 152 over 90; heart rate of 84 beats per minute”)
- **What is being done for the patient** (for example, “The patient is being given 6 liters of oxygen per minute by face mask”)
- **Provide exact street address** with office number and names of cross streets, if possible (for example, “Dr. Jones’s dental office at 123 Main St., Suite 202, one block east of the intersection at Pine and Oak streets”)
- **Telephone number from which the call is being made**

*Source: Malamed.1*

### CONCLUSION

Each team member should understand the basic action plan described above to permit its effective implementation in emergencies that may arise in the dental office. Differences exist in the level of training that dentists receive in the management of medical emergencies. The final decision regarding the exact roles of each team member will be determined by a number of factors, including the dentist’s and staff members’ training and ability. Clearly, dentists need to do what they can to prevent emergencies in the dental office but, unfortunately, they still may arise despite dentists’ best efforts. However, taking the time to prepare staff members and develop a basic action plan for all emergencies may save a life.2

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Preparing for medical emergencies
The essential drugs and equipment for the dental office

Morton Rosenberg, DMD

Every dentist can expect to be involved in the diagnosis and treatment of medical emergencies during the course of clinical practice. These emergencies may be related directly to dental therapy, or they may occur by chance in the dental office environment. Although just about any medical emergency can occur during the course of dental treatment, best practice dictates that dental personnel must be prepared to provide effective basic life support (BLS) and seek emergency medical services in a timely manner.

Dentists also must be able to diagnose and treat common emergent problems (for example, syncope or hyperventilation syndrome), as well as respond effectively to certain less common, or even rare, but potentially life-threatening emergencies, especially those that may arise as a result of dental treatment (for example, anaphylactic reaction to an administered drug). Although many medical emergencies can be treated properly without drugs, every dental office must have a basic emergency kit that contains drugs and equipment appropriate to the training of the dentist, state requirements, the type of patients being treated (for example, geriatric, special-needs, pediatric or medically compromised patients), the procedures performed (for example, whether sedation or general anesthesia is induced) and the geographical location (for

**ABSTRACT**

**Background.** Acute medical emergencies can and do occur in the dental office. Preparing for them begins with a team approach by the dentist and staff members who have up-to-date certification in basic life support for health care providers. The ability to react immediately to the emergency at hand, including telephoning for help and having the equipment and drugs needed to respond to an emergency, can mean the difference between successful management and failure.

**Overview.** The purpose of this article is to provide a vision of the training, basic and critical drugs, and equipment necessary for staff members in general dental offices to manage the most common and anticipated medical emergencies.

**Conclusions and Clinical Implications.** Completion of annual continuing education courses and office medical emergency drills ensure a rapid response to emergency situations. It is the combination of a knowledgeable and skilled dental team with the equipment for basic airway rescue and oxygenation, monitoring equipment, an automated external defibrillator and a basic drug emergency kit that make the dental office a safer environment for patients and enhance dental professionals' capability to render competent and timely aid.

**Key Words.** Blood pressure; cardiac arrest; dental team; coronary heart disease; automated external defibrillator; dental office staff members; drug therapy; medical emergencies; epinephrine.

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example, an urban setting in which emergency help is close at hand versus a rural location in which there may be a significant delay until help arrives. Many factors determine the degree of preparedness needed for medical emergencies in a specific dental practice, but all dental offices must be ready at some minimum level. An overall emergency preparedness plan that includes equipment and a drug kit is essential for all dental practices (Box 1).

Continuing education courses incorporating task training and high-fidelity human simulators (that is, computer-controlled simulated patients) that emphasize crisis management for life-like practice in managing medical emergencies are gaining popularity among dentists and clinical staff members. No drug can take the place of properly trained health care professionals in diagnosing conditions and treating patients in emergency situations. Nevertheless, having an appropriate emergency drug kit and equipment often plays an integral role in the course and outcome of emergency treatment.\(^4\)\(^-\)\(^7\)

**EQUIPMENT**

Oxygen is of primary importance in any medical emergency and must be available in a portable E cylinder that can be transported easily to any office location in which an emergency may arise. A dental office should be equipped with a device for the administration of supplemental oxygen to a spontaneously breathing patient—such as nasal cannulae, nonbreathing masks with an oxygen reservoir or a nitrous oxide-oxygen nasal hood. Every office must have the ability to deliver oxygen under positive pressure for use in situations in which the patient is unconscious and not ventilating adequately. Although mouth-to-mask devices such as pocket masks are useful, the best and most efficient method of ventilating with high concentrations of inspired oxygen in apneic patients is with a bag-valve-mask device with an oxygen reservoir connected to an oxygen source or a manually triggered oxygen-powered device (Table 1).

Oropharyngeal airways come in several sizes (7, 8 and 9 centimeters for adults) and are a useful adjunct in overcoming airway soft-tissue obstruction in an unconscious patient. Magill forceps can be lifesaving in retrieving foreign objects lost in the hypopharynx during dental therapy. The immediate availability of an automated external defibrillator (AED) adhering to the American Heart Association’s (AHA) 2005 guidelines\(^8\) is an evolving standard of care in all health care settings. The AHA has made early defibrillation an integral part of the BLS chain of survival.

for the treatment of patients in cardiac arrest. Since January 1998, the AHA's BLS health care provider cardiopulmonary resuscitation courses have included a mandated module regarding AED use. Some states (Florida, Washington, Illinois) have mandated the presence of an AED in dental offices. The immediate availability of an AED has been demonstrated to increase the success of resuscitation. Early defibrillation with these easy-to-operate devices will convert two of the most common lethal cardiac dysrhythmias—ventricular fibrillation and ventricular tachycardia—into a normal sinus rhythm and restore perfusion to vital organs.

Monitoring equipment that provides basic information for primary assessment should include a stethoscope and a sphygmomanometer with adult small, medium and large cuff sizes. An automated vital signs monitor can provide physiological data, including systolic, diastolic and mean blood pressure, along with the patient's oxygen saturation level, heart rate and temperature. A wall clock with a second hand is invaluable in assisting with the determination of heart rate and in documenting contemporaneous events and interventions (Box 2).

**EMERGENCY DRUG KITS**

Practitioners can organize emergency kits themselves or purchase them. Many dentists are not comfortable choosing and purchasing individual drugs for their emergency kits, and a high-quality, commercially available emergency drug kit modified for dentistry can provide consistent drug availability (an automatic drug updating service often is included) in an organized fashion. Emergency drugs generally are powerful, rapidly acting compounds. The correct approach to using drugs in any medical emergency essentially should be supportive and conservative.

**BASIC EMERGENCY DRUGS**

All dentists must keep a fresh supply of critical drugs in the office for immediate administration (Table 2). Dentists must know reflexively when, how and in what doses to administer these specific agents for life-threatening situations. The drugs described should be included in a basic medical emergency kit for the general dental practice. They consist of agents that are noninjectable or can be administered via subcutaneous, intramuscular or sublingual routes, and, for dentists with advanced training, via intravenous or intraosseous routes.

**Oxygen.** Oxygen is of primary importance in any medical emergency in which hypoxemia might be present. These emergencies include, but are not limited to, acute disturbances involving the cardiovascular system, respiratory system and central nervous system. In the hypoxic patient, breathing enriched oxygen elevates the arterial oxygen tension, which, in turn, improves oxygenation of peripheral tissues. Because of the steepness of the oxyhemoglobin dissociation curve, a modest increase in oxygen tension can significantly alter hemoglobin saturation in the hypoxic patient. Hypoxemia leads to anaerobic metabolism and metabolic acidosis, which often diminish the efficacy of pharmacological interventions in emergencies.

**Epinephrine.** Epinephrine is the single most important injectable drug in the emergency kit. Epinephrine is an endogenous catecholamine with both α- and β-adrenergic receptor—stimulating activity. It is the drug of choice for treating cardiovascular and respiratory manifestations of acute allergic reactions. The beneficial pharmacological actions of epinephrine, when administered in resuscitative dosages, include bronchodilatation and increased systemic vascular resistance, arterial blood pressure, heart rate, myocardial contractility, and myocardial and cerebral blood flow.

For effective treatment of life-threatening signs and symptoms of an acute allergic reaction, the clinician must administer epinephrine immediately after recognizing the condition. He or she can inject the drug subcutaneously (0.3 to 0.5 milligram of a 1:1,000 solution) or intramuscularly for a more serious emergency (0.4 to 0.6 mg of the
TABLE 2

<table>
<thead>
<tr>
<th>INDICATION</th>
<th>DRUG</th>
<th>ACTION</th>
<th>ADMINISTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchospasm (Severe Allergic Reaction)</td>
<td>Epinephrine</td>
<td>α- and β-adrenergic receptor agonist</td>
<td>Autoinjectors or preloaded syringes, ampules; 1:1,000 solution subcutaneously, intramuscularly or sublingually; adults, 0.3 milligram; children, 0.15 mg</td>
</tr>
<tr>
<td>Mild Allergic Reaction</td>
<td>Diphenhydramine</td>
<td>Histamine blocker</td>
<td>50 mg intramuscularly; 25 to 50 mg orally every three to four hours</td>
</tr>
<tr>
<td>Angina</td>
<td>Nitroglycerin</td>
<td>Vasodilator</td>
<td>Sublingual tablet; one every five minutes up to three doses; translingual spray; one spray every five minutes up to three times</td>
</tr>
<tr>
<td>Bronchospasm (Mild Asthma)</td>
<td>Bronchodilator such as albuterol</td>
<td>Selective β₂-adrenergic receptor agonist</td>
<td>Two or three inhalations every one to two minutes, up to three times if needed</td>
</tr>
<tr>
<td>Bronchospasm (Severe Asthma)</td>
<td>Epinephrine</td>
<td>α- and β-adrenergic receptor agonist</td>
<td>Autoinjectors or preloaded syringes, ampules; 1:1,000 solution subcutaneously, intramuscularly or sublingually; adults, 0.3 mg; children, 0.15 mg</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>Glucose, as in orange juice</td>
<td>Antihypoglycemic</td>
<td>If the patient is conscious, ingest</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>Aspirin</td>
<td>Antiplatelet</td>
<td>One full-strength tablet (165-325 mg) chewed and swallowed</td>
</tr>
<tr>
<td>Syncope</td>
<td>Aromatic ammonia</td>
<td>Respiratory stimulant</td>
<td>Inhalant crushed and held four to six inches under nose</td>
</tr>
</tbody>
</table>

same solution). Epinephrine should be available in preloaded syringes or autoinjectors for immediate use, as well as in ampules. Because of its profound bronchodilating effects, epinephrine also is indicated for the treatment of acute asthmatic attacks that are unrelieved by sprays or aerosols of β₂-adrenergic receptor agonists.

Diphenhydramine. Histamine blockers reverse the actions of histamine by occupying H₁ receptor sites on the effector cell and are effective in patients with mild or delayed-onset allergic reactions.

Nitroglycerin. Although nitroglycerin is available in many preparations—long-acting oral and transmucosal preparations, transcutaneous patches and intravenous solutions—the appropriate forms for the dental office are the sublingual tablet or translingual spray. Nitroglycerin is the treatment of choice for an episode of acute chest pain in a patient with a history of angina pectoris. It acts primarily by relaxing vascular smooth muscle, dilating systemic venous and arterial vascular beds, and leading to a reduction in venous return and systemic vascular resistance. These actions combine to reduce myocardial oxygen consumption.

If the patient does not bring his or her own nitroglycerin to the dental office, the clinician should administer one tablet or metered spray (0.4 mg). This dosage may be repeated twice at five-minute intervals for a total of three doses. Relief should occur within one to two minutes; if the discomfort is not relieved, the dentist must consider a diagnosis of evolving myocardial infarction. If the patient has never received a diagnosis of angina pectoris and develops symptoms of a possible acute myocardial infarction, such as chest pain or chest pressure, the clinician should consider administering 0.4 mg of sublingual nitroglycerin if the patient’s systolic blood pressure is acceptable (> 90 to 100 millimeters of mercury) after first calling 9-1-1 and administering aspirin.

Contraindications to the administration of nitroglycerin are chest pain and hypotension or treatment with drugs prescribed for erectile dysfunction, such as sildenafil (Viagra, Pfizer, New York City), tadalafil (Cialis, Lilly USA, Indianapolis) or vardenafil (Levitra, Bayer HealthCare, Leverkusen, Germany). The combination of nitroglycerin and these compounds may lead to profound hypotension and unconsciousness.

Bronchodilator. Inhalation of a β₂-adrenergic receptor agonist such as metaproterenol or albuterol is used to treat acute bronchospasm that may be experienced during an asthmatic attack or anaphylaxis. This results in bronchial smooth muscle relaxation and the inhibition of chemical mediators released during hypersensitivity reactions. Albuterol is an excellent choice because it is associated with fewer cardiovascular adverse effects than are other bronchodilators.

Glucose. Clinicians use glucose preparations
to treat hypoglycemia resulting from fasting or an imbalance between insulin and carbohydrate in a patient with diabetes mellitus or in nondiabetic patients with hypoglycemia. If the patient is conscious, oral carbohydrates such as orange juice, a chocolate bar, cake icing or a cola drink act rapidly to restore circulating blood sugar. On the other hand, if the patient is unconscious and the dentist suspects acute hypoglycemia, he or she never should administer oral drugs because of the potential for airway obstruction and/or aspiration. There is no place for insulin in the vast majority of dental offices.

Aspirin. The antiplatelet properties of aspirin decrease myocardial mortality dramatically by preventing further clot formation when administered to patients during an evolving myocardial infarction. There is no substitute for aspirin for this indication, and contraindications to its use include allergy to aspirin and severe bleeding disorders. Patients who exhibit chest pain suggestive of ischemia and an evolving myocardial infarction should chew the aspirin and then swallow it.

Aromatic ammonia. Aromatic ammonia is a commonly used respiratory stimulant in dentistry. It is a general arousal agent that clinicians administer to patients experiencing vasodepressor syncope after ascertaining the patency of the patient’s airway, repositioning him or her and administering oxygen.

SUPPLEMENTAL INJECTABLE DRUGS AND EQUIPMENT

Dentists with advanced training may consider including drugs and equipment in addition to those described earlier. These might include the following injectable drugs:
- analgesics;
- anticholinergics;
- anticonvulsants;
- antihypertensives;
- antihypoglycemics;
- corticosteroids;
- vasopressors.

ADJUNCTIVE GENERAL ANESTHESIA DRUGS AND EQUIPMENT

Educationally qualified dentists who use deep sedation and general anesthesia must have additional emergency drugs immediately available (for example, if they use depolarizing neuromuscular blocking agents, they must have dantrolene sodium, as well as other drugs specific to these practices, such as those for advanced cardiac life support [ACLS]), and additional equipment, such as advanced monitoring systems and airway rescue equipment.

REVERSAL DRUGS

If dentists administer opioids or benzodiazepines to induce moderate or deep sedation, general anesthesia or both, they must include antidotal drugs in the emergency kit. Naloxone is a specific opioid antagonist that reverses opioid-induced respiratory depression. Flumazenil is a specific benzodiazepine antagonist that reverses sedation and respiratory depression resulting from benzodiazepine administration.

INJECTABLE DRUG ACCESS

The injection of many emergency drugs into the vascular system is crucial to speed drug action. The intravenous route is rapid but requires skill in venipuncture. The intramuscular route, either into the vastus lateralis or mid-deltoid regions, results in slower uptake but perhaps easier access for many dentists, as does the sublingual approach. Establishing intravenous access may be difficult or impossible during medical emergencies. As advocated in the AHA’s ACLS/PALS guidelines, intraosseous access is often a significant amount of time, which can benefit patients in medical emergencies by decreasing the time needed to achieve access and administer medications and other fluids, especially in pediatric patients. Establishing intraosseous access requires specialized equipment and training (Figure). All of these routes of adminis-
tration require adequate circulation for the drugs to be effective.

ADVANCED CARDIAC LIFE SUPPORT

ACLS for adults and pediatric advanced life support (PALS) for children are the standards of care for comprehensive resuscitation by health care providers with advanced skills and training. Pharmacotherapy plays an important role in the treatment of these patients, with guidelines for specific drug therapies centering on the use of many antidysrhythmic and vasoactive drugs.8,19

ADVANCED AIRWAY DEVICES

Dentists with advanced training may wish to include advanced airway devices in their emergency kits. The indications for, the technique in using, and ensuring correct placement of these devices require training and clinical experience. Endotracheal intubation is accomplished with the use of a laryngoscope and an endotracheal tube. Gaining in popularity in airway rescue are supraglottic devices such as the laryngeal mask airway.1

CONCLUSION

Urgent and emergent medical emergencies can and do occur in the dental office. Early diagnosis, telephone calls for help and proper management will increase the likelihood of a successful response. Accomplishing this depends on the combination of training and preparation by the dentist and staff members and the immediate availability of basic and critical emergency drugs and equipment.

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Basic management of medical emergencies
Recognizing a patient’s distress

Kenneth L. Reed, DMD

Early recognition of medical emergencies begins at the first sign or symptom. Familiarity with the patient’s medical profile aids immensely in recognition; knowing what to expect and what to look for promotes a faster response. The dentist needs to focus on what is happening with a patient minute by minute because distractions slow response time.

By performing a simple visual inspection of the patient, the dentist can determine if he or she has various diseases such as obesity, a history of cerebrovascular accident (CVA) (stroke), Parkinson disease, jaundice, exophthalmos, breathing difficulties and heart failure (orthopnea).

When treatment is indicated, the dentist should proceed without hesitation. Often, management of medical emergencies in the dental office is limited to supporting patients’ vital functions until emergency medical services (EMS) arrives. This is especially true in the case of major morbidity such as myocardial infarction or CVA. Treatment should consist minimally of basic life support and monitoring of vital signs. The dentist never should administer poorly understood medications.

An emergency management plan, as described by Haas in this supplement and by Peskin and Siegelman, is of paramount importance. The dental team’s ultimate goal

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is the prevention of life-threatening emergencies.

While the focus of this article is the recognition of patients in distress, I should point out that dentists initially should manage all medical emergencies in the same way by using what is known as the basic algorithm:

- position (P) the patient;
- airway (A);
- breathing (B);
- circulation (C);
- definitive treatment, consisting of differential diagnosis, drugs and defibrillation (D).

Although many different medical emergencies may occur in the dental office, some are seen more often than others. I will not attempt to be exhaustive in this article; for a comprehensive review, readers should refer to one of the textbooks on the topic. This article serves as a brief review of some of the commonly encountered medical emergencies in the dental office. I examine some of these medical emergencies and their most common manifestations and lightly touch on some potential treatments.

**RESPIRATORY DISTRESS**

Respiratory distress in a dental patient may take one of many forms. For example, the precipitating problem may be asthma, an allergic reaction, tachypnea (hyperventilation, a pulmonary embolus, acute congestive heart failure, diabetic ketoacidosis, hyperosmolar hyperglycemic nonketotic syndrome) or unconsciousness.

Clinicians can recognize respiratory distress in a patient through a variety of manifestations. Probably the most common cause of respiratory distress seen in dental patients is asthma, also known as acute bronchospasm. Patients with this type of respiratory distress typically will want to sit upright (position). The dentist follows this with an evaluation of the patient's airway. Is it patent? By definition, conscious patients who can talk have a patent airway, are breathing and have sufficient cerebral blood flow and blood pressure to remain conscious. Definitive treatment includes administration of a bronchodilator. For conscious patients, this bronchodilator commonly is albuterol, administered via a metered-dose inhaler. If the patient loses consciousness or is uncooperative with administration of albuterol via inhalation or if bronchospasm is refractory to administration of albuterol, telephoning EMS (9-1-1) and administering epinephrine parenterally (intramuscularly) are indicated. Subcutaneous administration no longer is thought to be most efficacious.

**CHEST PAIN**

Another potential medical emergency seen in dental offices is chest pain. Many factors may precipitate chest pain, such as acute myocardial infarction (AMI), angina, paroxysmal supraventricular tachycardia, gastroesophageal reflux disease, anxiety and costochondritis.

When describing their chest pain, many patients do not describe the feeling as pain per se. They commonly use terms such as “squeezing,” “tightness,” “fullness,” “constriction,” “pressure” or “a heavy weight” on the chest. There are many potential causes of chest pain. I will examine two that the dentist can manage, or begin to treat, in the dental office. I will not address chest pain of noncardiac origin, although it certainly is valid and somewhat common in the population at large.

If a patient is experiencing chest pain, he or she will let the dentist know, so recognition of the problem will not be difficult. A conscious patient experiencing chest pain is free to be in any position that is comfortable. As stated earlier, these patients often will want to sit upright. Conscious patients who can talk have a patent airway, are breathing and have sufficient cerebral blood flow and blood pressure to retain consciousness. The difficulty for the dentist is the differential diagnosis of chest pain.

Angina pectoris and AMI are the two most likely cardiac problems in a conscious patient who is exhibiting chest pain in the dental office. Other possibilities exist, but this article focuses on the recognition and early treatment of these two common entities. If the patient had experienced cardiac arrest, he or she would not be conscious.

**Differential diagnosis.** A differential diagnosis of chest pain involves looking at a number of signs and symptoms. One consideration is the patient's history. Has he or she ever experienced anginal chest pain? If so, it is likely that the current chest pain is angina pectoris. However, if this is the patient's first episode of chest pain, the dentist should treat him or her as if it were an AMI and have EMS transfer the patient as

quickly as possible to a hospital.

The differential diagnosis of chest pain in a conscious patient in the dental office also includes an evaluation of the quality of the pain. If the pain is significant but not severe, the chances are better that it is caused by angina pectoris, not AMI. Pain that radiates, commonly to the left side of the body—the left mandible, left arm, left shoulder—more likely is caused by AMI than by angina pectoris. However, not all pain associated with AMI radiates, and some patients have atypical pain when experiencing an AMI. For example, patients with diabetes and women often experience an unusual shortness of breath, an unexplained elevation of blood sugar levels or both as a symptom of an AMI but often experience no chest pain at all (that is, silent myocardial infarction).

**Blood pressure.** Blood pressure also might indicate whether the patient is experiencing angina pectoris or an AMI. If the patient’s blood pressure is elevated during this episode of chest pain, angina more likely is the cause. This elevation may be a response to the pain being experienced. If the blood pressure falls below the patient’s baseline value or the immediate preoperative value, the dentist should consider an AMI; if the pump (the heart) has been injured, it is less efficient, resulting in a decreased cardiac output and subsequent drop in blood pressure.

**Definitive treatment.** Definitive treatment for angina pectoris requires the administration of a nitrate, commonly nitroglycerin, via sublingual tablet or translingual or transmucosal spray. Prehospital treatment of a patient suspected of having AMI typically involves the administration of morphine, oxygen, nitroglycerin and aspirin (MONA), in addition to notifying EMS. Given that most dental offices do not have morphine, the dentist may substitute nitrous oxide/oxygen in a 50:50 concentration.

**ALTED CONSCIOUSNESS**

As with respiratory distress, altered consciousness or unconsciousness may occur owing to a variety of precipitating factors. Some of these include significant hypotension from any cause, hypoglycemia, CVA, illicit drug use, AMI and seizure.

Dizziness developing in the dental office may have many origins, but low blood pressure in the brain often is the ultimate cause. The easiest and least invasive way to increase blood flow to the brain is to place the patient in a supine position. Patients in whom dizziness is the only symptom are conscious and able to talk (airway, breathing and circulation have been assessed and ensured). Definitive treatment consists simply of placing the patient properly in a supine position. Once the patient is positioned, the dentist should determine the cause of the dizziness. Was it initiated by vasovagal syncope? Hypoglycemia? Hypovolemia?

**Vasovagal syncope.** Vasovagal syncope in the dental office often is caused by anxiety, which needs to be addressed properly. For some patients, this may mean that the dentist simply needs to take more time explaining the dental procedure to them, thus allaying their fears. Other patients may require pharmacological intervention (that is, sedation). Inhalation sedation (nitrous oxide/oxygen) may be ideal for some patients, while enteral sedation may be more appropriate for others. Some patients benefit most from parenteral (that is, intramuscular, intranasal) moderate sedation and others may require general anesthesia to properly address their anxiety.

**Hypoglycemia.** Dentists also should consider hypoglycemia in a differential diagnosis of dizziness. Frequently, the patient has a history of diabetes. Patients with type 1 diabetes (and some with type 2) self-administer insulin to lower a high glucose level (hyperglycemia) toward the upper limit of normal (120 milligrams/deciliter). Patients with diabetes must ingest food immediately after administering insulin to prevent the development of hypoglycemia as a result of the insulin injection. The most common cause of hypoglycemia in patients with type 1 diabetes is not eating after administering insulin.

Patients with clinically significant hypoglycemia may be recognizable because they commonly experience diaphoresis and tachycardia and feel faint. Subsequently, they may experience mental confusion and, ultimately, the loss of consciousness. As long as the patient retains consciousness, the clinician should allow him or her to remain in a comfortable position. Conscious patients with hypoglycemia have a patent airway, are breathing and have an adequate pulse. The treatment of choice for patients with hypoglycemia is administration of sugar. Unconscious patients with hypoglycemia require parenteral administration of sugar. Absent a proficiency in venipuncture, the dentist should activate EMS.

Malame recommends that a dentist never
place any drug or other substance in the mouth of an unconscious patient that is a liquid or might become a liquid at body temperature.

Fainting, or vasovagal syncope, is the most common medical emergency seen in the dental office. The basic algorithm for dealing with it is the same as that for dizziness described earlier. The dentist or a team member should place the patient in a supine position. Most patients with syncope have a patent airway, are breathing and demonstrate an adequate pulse. Patients who faint typically respond to positional changes within 30 to 60 seconds. If the patient does not respond in this time frame, he or she did not simply faint, and the dentist must consider a more complete differential diagnosis of loss of consciousness. Although many possible explanations exist, the more common reasons a patient loses consciousness in the dental office (assuming no medications have been administered) are syncope, low glucose level, CVA and cardiac arrest.

In each of these examples of unconsciousness, the initial management of the emergency is the same. The dentist should place the patient in a supine position. If he or she has not responded within one minute, the clinician probably can rule out syncope. The dentist then should open the airway and assess breathing (“look, listen and feel”). If the patient is breathing, the next step is to check his or her circulation. Does the patient have a palpable pulse at the carotid artery (brachial artery in infants)?

Patients who are breathing spontaneously and normally may be experiencing hypoglycemia or a CVA, but not cardiac arrest. In cardiac arrest, the patient does not breathe spontaneously (agonal breathing notwithstanding). A patient with apnea requires positive pressure ventilation with 100 percent oxygen.

Patients placed in a supine position who do not respond within 30 to 60 seconds but are breathing spontaneously likely are experiencing hypoglycemia or a CVA. If the patient's blood pressure is normal (that is, close to baseline values—part of assessing circulation), the problem probably is a low glucose level. If the patient's blood pressure is alarmingly high, the dentist must strongly consider the possibility that the event is a CVA.

**SEIZURES**

Seizures are rare in dental offices, especially in patients who never have had them. Patients who convulse in the dental office typically have a seizure history and often are characterized as having epilepsy. The initial treatment for seizures is the same as that for any other medical emergency. The patient experiencing a generalized tonic-clonic seizure is unconscious and should be placed in a supine position. The dentist should perform a "head tilt and chin lift" to the extent possible. Patients who are seizing are breathing, and have adequate cardiovascular function, which the dentist can verify by checking for and finding a strong pulse.

The dentist or a team member must remove all dental instruments and supplies from the patient’s mouth and protect the patient from harm. No one should place anything in the mouth of a patient who is seizing. If someone familiar with the patient is present (such as a parent, spouse or professional caregiver), a team member should bring the person into the operatory and ask him or her to evaluate the patient. He or she may determine that this is a typical seizure for the patient, in which case simple monitoring is sufficient, or he or she may feel that this seizure is unusually severe and suggest that someone contact EMS.

**ALLERGY-RELATED EMERGENCIES**

Allergy-related emergencies are rare but possible in the dental office. The most common allergen in the dental environment today is latex. An allergy can be mild or severe. If the patient has itching, hives, rash or a combination of these, the allergy may be considered mild (non-life threatening). However, if the patient experiences respiratory or cardiovascular compromise—that is, the loss of consciousness due to difficulty in breathing or inadequate blood pressure and blood flow to the brain—the dentist should treat the allergy as a life-threatening situation.

**Mild allergy.** If the allergy is mild (that is, itching, hives, rash or a combination of these) and the patient remains conscious, he or she should be made comfortable. The conscious patient who is talking has verified that the airway is patent, he or she is breathing and he or she has cardiovascular function adequate to maintain consciousness. In this case, the dentist should administer a histamine blocker, such as diphenhydramine, via intramuscular or intravenous injection.

**Severe allergy.** If the allergy is severe, the patient has lost, or soon will lose, consciousness. The dentist should place the patient in a supine position, open the airway and evaluate breathing.
Often, breathing is spontaneous. If the patient is not breathing, the clinician must administer positive pressure oxygen via a bag-valve-mask device. If the patient has lost consciousness, his or her cerebral blood pressure is too low. To support circulation, as well as to dilate the bronchioles and minimize any potential swelling of laryngeal tissues, the dentist must administer epinephrine as soon as possible. Someone also must contact EMS, as the patient requires additional treatment in a hospital’s emergency department.

**BLEEDING**

Dentists deal with bleeding every day, so it rarely constitutes a significant medical emergency. However, there are times when significant bleeding may turn into a medical emergency. If the greater palatine artery is inadvertently cut, for example, the dentist must control the bleeding quickly or the outcome may be poor. Patients who are hemorrhaging typically are conscious, so keeping them comfortable is a key component in managing the emergency. Placing the patient in a supine position will increase blood pressure in the head and generally is not indicated. Although it is important to verify that the airway is patent at all times, only the most severe and unrelenting cases of intraoral hemorrhage require placement of an advanced airway (that is, nasopharyngeal airway, laryngeal mask airway, supraglottic airway [King LT airway, King Systems, Noblesville, Ind.] or endotracheal tube). These conscious, spontaneously ventilating patients who are bleeding profusely are treated most commonly with local measures only. Pressure to the affected site, with or without suturing, addresses the problem adequately in most cases.

**CONCLUSION**

Medical emergencies can occur in the dental office, and it is important for the entire dental team to be prepared for them. Regardless of their specific type, they are best managed in basically the same way: position the patient; assess the airway, breathing and circulation; and provide definitive treatment.

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3. Haas DA. Preparing dental office staff members for emergencies: developing a basic action plan. JADA 2010;141(5 suppl):S8-10S.
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