



ACADEMY OF DENTAL LEARNING & OSHA TRAINING

Medical Emergencies in the Dental Office

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Answer Sheet: Medical Emergencies in the Dental Office

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|----------|-----------|-----------|
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| 2. _____ | 7. _____ | 12. _____ |
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Educational Objectives

Upon completion of this course, the student will:

- Understand the rationale behind being prepared for emergencies in the dental office.
- Describe an adequate medical evaluation for every patient before administration of medication or dental treatment.
- Describe proper treatment protocol for:
 - Choking
 - Airway Obstruction
 - Hyperventilation
 - Syncope
 - Orthostatic Hypotension
 - Allergic Reactions
 - Local Anesthesia Overdose
 - Epinephrine Overdose
 - Asthma
 - Heart Failure
 - Angina
 - Heart Attack (Myocardial Infarction)
 - Stroke
 - Diabetes
 - Seizures (Convulsions)

Introduction

Medical emergencies have a way of happening unexpectedly. Are you prepared to deal with emergencies that may arise during your workday? What if one of your coworkers collapsed, would you immediately know what to do? the best time to prepare for an emergency is well before it happens. This course will teach you the proper response in an emergency setting, but it's up to you to practice these principles until they become second nature. Mark your calendar for six months from now to review this course so the material is fresh in your mind. Excellent books by the American Red Cross or American Medical Association are readily available online or at your local bookstore. Dr. Malamed's *Medical Emergencies in the Dental Office* is highly recommended.

When a true emergency happens in the office the first few minutes can mean the difference between life and death. If you review the protocol well before the stress of an emergency, you will be better able to think with a clear head. this will enable you to react effectively and quickly to render aid to someone who really needs it.

Each staff member (including the Dentist) should fill out a medical history form. File the forms in a convenient area. This medical record should remain confidential, except for use during an emergency. This will enable you to react effectively and quickly to render aid.

Each staff member should be trained in Basic Life Support. Design an office meeting specifically for establishing and reviewing emergency protocol. Assign specific duties to each staff member for a variety of situations including fire, earthquakes, and medical emergency management.

Patient Evaluation

Medical History

A thorough medical history is an indispensable part of any patient's dental record. It is essential from the medicolegal standpoint that all medical conditions be charted and noted with the date of entry. A good medical history form is available from the American Dental Association.

Orally review any positive answers and provide an explanation in the chart. Note the specific date of the patient's last physical exam. If the patient doesn't go to the doctor be suspicious that there may be an undiagnosed underlying medical problem and recommend a complete physical evaluation. Update at every appointment with a clear notation in the chart as to the status of the medical history (e.g., "12/20/19 Medical History Reviewed, no changes). Make sure the form is signed and dated by the patient and the reviewing dentist. Complete the entire form in ink.

The patient's vital signs: blood pressure, heart rate, pulse, and respiration rate should be recorded in the patient's chart at the initial exam and before the injection of local anesthetic. To take the pulse, palpate the radial or brachial artery with your first two fingers (never the thumb because your own pulse is felt there) and count the beats for one minute. Characterize the beats as strong and steady, bounding, thready or weak. Strong and steady beats indicate a normal, healthy pulse and variations may indicate a problem. Normal respiration is 16 to 18 breaths per minute. Count the breaths per minute without calling attention to it; the patient will not consciously change the rate. It is important to evaluate the patient's health before beginning any treatment because certain factors may change the method of treatment. The dentist must evaluate the patient's ability to tolerate the stress (both physically and psychologically) of treatment. He or she must decide proper protocol for each patient, even if that might mean postponing treatment for another day.

Taking Blood Pressure

A baseline blood pressure reading should be taken on all patients at the initial exam. Seat the patient in the dental chair with their arm at heart level, elbow slightly flexed, and resting on the armrest or another supportive surface. Let the patient relax for a few minutes before taking the blood pressure. Wrap the cuff around the arm closest to you with the center of the inflatable portion over the brachial artery. The rubber tubing should lie medially to the arm. The bottom edge should be one inch above the bend of the elbow. The cuff should be tight enough that it will not slip off the arm and loose enough that two fingers can fit under it when it is deflated. Find the radial pulse at the medial aspect of the wrist. Inflate the cuff about 30 torr above the point where the pulse disappears. Place a stethoscope at the antecubital fossa (inside the bend of the elbow), where it doesn't touch the tubes or cuff. Gradually deflate the cuff and note the number on the gauge when the first sound is heard. This is the systolic pressure. Continue gradually deflating the cuff until there is no sound. This point is the diastolic pressure. Continue gradually deflating the cuff until there is no sound. This point is the diastolic pressure. Note the pressure on the patient's chart as a fraction: systolic/diastolic and right or left arm (120/85 R).

Common errors in taking blood pressure include:

Cuff too loose	Can result in a reading that is too high. Use a cuff that is about 20% larger than the diameter of the arm.
Wrong cuff size	Have a pediatric cuff for children, a regular cuff for adults, and a large cuff for heavy patients.
Not palpating the pulse and under inflating the cuff	Blood pressure may be high, but because the cuff wasn't inflated above the pulse cessation point the reading may be falsely low.
Using visual cues rather than audio indicators	Though the gauge may "twitch" rely only on the sounds appearing and disappearing.

The American Society of Anesthesiologists' Physical Status Classification System is a good reference for blood pressure relative to safety for treatment.

If the patient's blood pressure is less than **140/90** it is safe to deliver routine dental treatment. Check the pressure in six months.

If the patient's blood pressure ranges from **140 to 159 systolic** or over **90 to 94 diastolic**, routine dental treatment can be delivered. Recheck the pressure before the next three appointments. If it is still in this range refer the patient to their physician for evaluation.

If the patient's blood pressure ranges from **160 to 199 systolic** or over **95 to 114 diastolic**, retake it after waiting five minutes. If it is still in this range, refer the patient to their physician for evaluation and consider stress reduction instruction. Routine dental care can be delivered but a consultation with the patient's physician is recommended before administration of anesthesia.

If the patient's blood pressure is more than **200 systolic** over **115 diastolic** recheck it after five minutes. If still elevated consult with the patient's physician. If emergency dental treatment is necessary, it may need to be performed in the hospital.

Patient Information Sheet

Please print legibly

Date: _____ Phone: _____

Name: _____
(Last) (First) (Middle)

Home Address _____

Sex: (Number) M F (City) Marital status: (State) Married (Zip) Single Divorced Widower

Birth date: _____

Who will be responsible for payment of the dental bill? _____

Address if different from above: _____

If home address is less than 2 years, give former address: _____

Insurance Carrier and Group Number _____

Name of nearest relative not living with you: _____

Address: _____

Relationship: _____

Phone _____

Who referred you to our office? _____

Medical History:

Medical History:
Certain illnesses and drugs may require us to alter our treatment. We want to render the best possible dental care to you and your family, so please answer these questions to the best of your ability.

Are you having pain or discomfort at this time? Yes No

Are you having any dental treatment? Yes No

Are you having pain or discomfort at this time? Yes No
Do you feel very nervous about having dental treatment? Yes No
Do you feel very nervous about visiting a dental office? Yes No

Do you feel very nervous about having dental treatment? Yes No

Have you ever had a bad experience in a dental office? Yes No

Have you ever had a bad experience with a dentist during the last two years? Yes No

Have you ever had a bad experience in a dental office? Yes No

Have you been under the care of a medical doctor during the past two years? Yes No

Are you currently taking any medicine or drugs? Yes No

Are you currently taking any medicine or drugs? ☐ No ☐ Yes
if yes please list on the reverse side

Are you allergic to or made sick by penicillin, aspirin, codeine, or any other medicine? Yes No

Are you allergic to or made sick by penicillin, cephalosporins, or other drugs or medication?..... Yes No

If yes, please list them here..... Yes No

Have you ever had any excessive bleeding requiring special treatment? Yes No

When you walk up stairs or take a walk, do you ever have to stop because of pain in your chest, or shortness of breath, or because you are very

of pain in your chest, or shortness of breath, or because you are very tired?

tired?..... Yes No

Do your ankles swell during the day?..... Yes No

Do your ankles swell during the day?..... Yes No

Do you wake up at night to urinate frequently?..... Yes No

Do you wake up at night to urinate frequently?..... Yes No

Are you thirsty most of the time?..... Yes No

Are you thirsty most of the time?..... Yes No
Do you use more than 2 pillows to sleep?..... Yes No

Do you use more than 2 pillows to sleep?..... Yes No
Do you get dizzy when you sit up quickly?..... Yes No

Do you get dizzy when you sit up quickly?..... Yes No
Have you lost or gained more than 10 pounds in the past year?..... Yes No

Have you lost or gained more than 10 pounds in the past year? Yes No
Do you ever wake up short of breath? Yes No

Do you ever wake up short of breath? Yes No
Are you on a special diet? Yes No

Do you or have you ever had any of the following: _____ Infectious Mononucleosis

Do you or have you ever had any of the following:

Heart Failure	Emphysema	Infectious Mononucleosis
		AIDS Related Diseases

Heart Failure	Emphysema	Infectious Mononucleosis
Heart Disease or Attack	Cough	AIDS Related Diseases

Angina Pectoris
High Blood Pressure
Heart Murmur
Rheumatic Fever
Congenital Heart Lesions
Scarlet Fever
Artificial Heart Valve
Heart Pacemaker
Heart Surgery
Artificial Joint
Anemia
Stroke
Kidney Trouble
Ulcers
Bruise Easily

Tuberculosis (TB)
Asthma
Hay Fever
Sinus Trouble
Allergies or Hives
Diabetes
Thyroid Disease
X-ray or Cobalt Treatment
Venereal Disease
Arthritis
Rheumatism
Cortisone Medicine
Glaucoma
Pain in Jaw Joints
Sickle Cell Disease

AIDS/HIV Infection
Hepatitis A (Infectious)
Hepatitis B (Serum)
Liver Disease
Yellow Jaundice
Blood Transfusion
Drug Addiction
Hemophilia
Chemotherapy
Cold Sores (Herpes)
Genital Herpes
Epilepsy or Seizures
Fainting or Dizzy Spells
Spina Bifida
Psychiatric Treatment

Women: Is there any chance that you are pregnant? Yes No
Are you practicing birth control? Yes No
Name of Medical Doctor: _____ Phone: _____

To the best of my knowledge, all of the preceding answers are true and correct. If I ever have any change in my health, or if my medicines change, I will inform the Dentist at the next appointment.

Date: _____ Signature of patient or guardian: _____

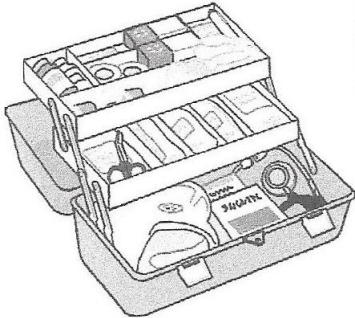
I hereby grant complete authority to the Dentist to administer any treatment, anesthetics, x-rays, and dental procedures that may be necessary or advisable in the diagnosis and treatment of my dental condition.

Date: _____ Signature of patient or guardian: _____

Initials of Reviewer	Date

Emergency Kit

Assemble all emergency medications and supplies in one container that can be transported to any area of the office within a moment's notice. In the stress of an emergency situation, disorganization can be fatal. Commercial kits are available but make sure it meets the needs of the individual practice and skill levels of the user.

	Standard Kit:		
	Gauze bandage, 3"	Sterile gauze pads 4x4"	Adhesive bandages
	Butterfly bandages	Adhesive tape, 1"	Scissors
	3" ACE bandage	Cotton tipped swabs	Absorbent cotton
	Aspirin	Acetaminophen	thermometer
	Tweezers	Safety pins	Hydrogen peroxide
	Calamine lotion	Antihistamine	Ammonia vaporole
	Resuscitation mask	Cricothyrotomy set	Positive pressure device
	Airway set	Sugar or frosting tube	Blood pressure equipment

In most emergency situations, it is better to use basic life support rather than administer drugs, especially if the dentist is unsure of either dosage, indications of use, or method of administration.

The epinephrine should be available in both a preloaded syringe (1:1000, .3 to .5 ml) and a 1 ml ampule of 1:1000. The antihistamine most commonly used is diphenhydramine 50 mg/ml or chlorpheniramine 10 mg/ml in a 1 ml ampule. It is best to have only the epinephrine in a preloaded syringe for quick administration. The best form of nitroglycerin is nitrolingual spray because of its longer shelf life when compared to tablets. An ammonia vaporole should be in each operatory within arm's reach of the dental professional. Check the oxygen deliver system regularly to make sure the cylinder is charged and the mechanism is working.

Drug Kit			
Critical:			
Injectable epinephrine	Injectable antihistamine	Vasodilator (nitroglycerin)	Oxygen
Secondary:			
Anticonvulsant	Analgesic	Vasopressor	Antihypoglycemic
Corticosteroid	Antihypertensive	Anticholinergic	Respiratory stimulant
bronchodilator			

Choking: The Heimlich Maneuver Review

Choking: when a patient is choking and his/her airway is completely obstructed, s/he can't speak, and will involuntarily grasp at his/her neck.

If the patient can talk or cough, carefully monitor the patient to make sure the obstruction passes the airway completely. If a patient is truly choking and needs assistance, use the Heimlich Maneuver. Stand behind the patient and place the thumb

side of your fist against the stomach slightly above the navel or belt area and below the ribs. Bring the other hand around and grasp your fist. Deliver four forceful upward thrusts. Repeat this technique until the object is dislodged or the patient becomes unconscious. If the patient loses consciousness, lay him/her carefully on the floor, face side up. Tilt the chin up to open the airway. Sweep the mouth to locate any foreign objects. Try mouth to mouth resuscitation. If the air will not pass through the airway to the chest, deliver four upward thrusts to the same area as before, except straddle the patient's knees and keep your arms straight. Check the mouth for any foreign object and try breaths again. Continue until the object is dislodged or trained help arrives.



Mouth to Mouth Resuscitation and CPR Review

	One Rescuer Adult CPR	Two Rescuer Adult CPR	Infant and child CPR
Compressions	30	30	15
Breaths	2	2	2

Most licensed Dental Professionals are required to renew their Cardiopulmonary Resuscitation Certification (CPR) for their license renewal. This chapter is not intended to replace a course in CPR. The following is a review of techniques that need regular refreshing.

Mouth to mouth resuscitation delivers oxygen to the patient's lungs so the bloodstream can absorb it. CPR is used when the patient's heart, for whatever reason, has stopped beating. The object of CPR is to provide manual heart activity that will keep oxygenated blood circulating to the brain of the patient.

The first step is to establish that the patient is truly unconscious. Speak loudly to the patient, for example: "Brian, Brian are you OK"? and tap firmly on the patient's hand. If there is no response immediately yell for help and specifically designate someone to call 911. Position an unconscious patient on a firm rigid surface, preferably the floor. If the patient has lost consciousness in the dental chair, position the back so s/he is laying flat. Look in the mouth to remove any obvious obstructions. Tilt the patient's head back if you are sure there is no neck injury. If there is neck injury, you could cause more damage to the spinal cord by moving the neck. Place one hand on the patient's forehead and lift the bony part of the mandible with the fingers of the other hand. Look, listen and feel:

- ✓ **Look** at the chest to see if it rises and falls in respiration.
- ✓ **Listen** to the nose and mouth for noises of air passing through.
- ✓ **Feel** with the side of your face for air coming from the mouth.

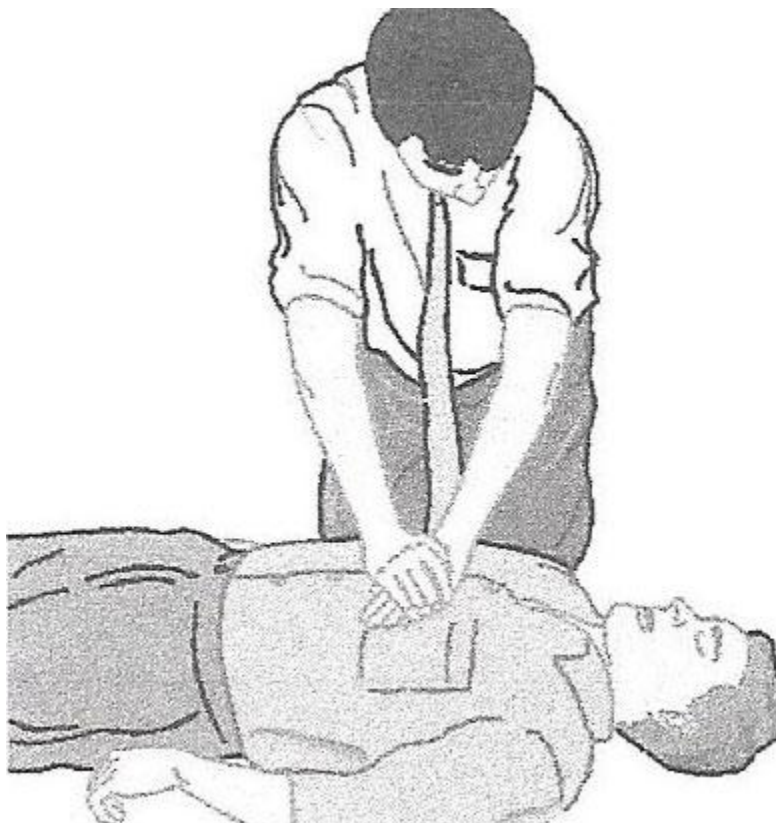
Count to ten to make sure respiration is not just depressed. When you are sure that the patient is not breathing, pinch the nose and give two slow breaths. (Every office should have a CPR mask with a one-way valve.) Watch the chest rise and fall. If the airway does not allow air to reach the lungs, reposition the head and try again with two short breaths. If air still does not reach the lungs, there may be an obstruction in the airway. Deliver four to six upward abdominal thrusts against the stomach slightly above the navel or belt area and below the ribs. Check the mouth for any foreign objects and reposition the patient as before, on his or her back with the chin tilted upwards.



Try the breaths again. When you are successful in delivering air to the patient's chest and it rises and falls, deliver two slow breaths, then check for breathing and pulse.

Use your index finger and second finger to check the carotid pulse at the side of the neck. If there is a pulse, continue with one breath every five seconds until the patient is breathing or until another trained individual states that s/he will take over.

If there is no pulse chest compressions will be necessary along with breaths. Give two slow breaths and then position your hands on the patient's chest two finger widths above the sternum. Remember the technique learned from CPR class: keep arms straight and bend from the waist. Press down approximately 1 ½ to 2 inches at the count of "One and two and three and . . . " up to 30. Return to the head and deliver two breaths. After four cycles of breaths and compressions, check again for pulse and breathing. If the patient has a pulse but is not breathing, discontinue chest compressions and deliver breaths (one every five seconds). If there is no pulse, return to the 30 compressions and two breaths. Continue until trained help arrives. Two man CPR uses fifteen compressions to one breath. The person giving compressions is in charge to counting and calling for position changes.



Common CPR Mistakes

Remember to kneel next to the patient when giving compressions; don't rock back and forth or sit back on your heels. Lock your elbows; don't bend them or use the strength in your arms for compressing. Use your upper body strength. Deliver quick, forceful compressions straight down on the chest, not from the side. Don't lift your hands off the patient's chest until you are moving to give a breath, keep them in position and give smooth, even compressions. Keep your fingers interlocked to concentrate the pressure on the heel of your bottom hand.

Airway Obstruction

The small objects used during a dental procedure are easily dropped into the esophagus. Usually, a conscious patient will swallow the object or cough it back up as a reflex action. If the object can pass through the esophagus, it will usually pass through the entire gastrointestinal tract. It may, however, lodge somewhere in the tract and cause a perforation, an abscess, or a blockage. If the object is aspirated into the lung, it may produce infection, pneumonia, or an abscess. Use of a rubber dam is effective in blocking the throat, with a piece of floss attached to the clamp.

If an object is dropped, the assistant should immediately try to aspirate it out with the high speed suction. Magill intubation forceps are specially designed to reach into the pharynx without trauma to the surrounding tissues. Keep a sterilized forceps in the sterile pouch within easy reach of the operatory area.

Where practical, tie dental floss to items like endodontic instruments, rubber dam clamps, and the pontic of a bridge being placed. If the item is dropped, pulling on the floss can retrieve it.

Patients will instinctively want to sit up but gravity will work against the object being retrieved and it is more likely to be swallowed. Reposition the dental chair so the patient's head is down below the chest, and have him or her turn on their side to try to expel the item. If the entire object is retrieved, the patient may be dismissed without radiographs. The patient should be referred to their physician for a follow up examination to make sure that no damage was done to the pharynx.

If the object is not retrieved, radiographs should be taken to determine the location of the item. The patient should be accompanied (by the doctor if possible) to an emergency room or radiology laboratory. Radiographs of the abdomen, lateral view of the chest, and anteroposterior view of the chest should be taken. The patient should then be referred to a specialist for consultation.

Hyperventilation

Hyperventilation is a fairly common emergency in the dental office. A patient may hyperventilate due to extreme anxiety, pain, metabolic acidosis, drug use, hypercapnia, cirrhosis, and some central nervous system disorders. The best prevention for hyperventilation is to address any anxieties about dentistry before starting treatment. Many patients will be anxious but will not share the feelings with the dental staff. Internalizing fears can lead to a hyperventilation episode.

The patient's breathing accelerates and s/he feels as though not enough air is getting into his or her lungs. As the breaths increase, carbon dioxide is released from the blood stream and causes the patient's chest and throat to tighten more, making the patient more anxious and increasing the respiration rate even more. Symptoms include: lightheadedness, numbness or tingling in the extremities and around the mouth and lips, muscle twitches, and difficulty in catching a deep breath. The patient usually does not lose consciousness, but prolonged hyperventilation may lead to convulsions.

Stop whatever treatment is being rendered and remove all instruments, rubber dam, etc. from the patient's mouth. The patient usually exhibits differing levels of inability to breathe. Allow the patient to sit partially or fully upright. Speak calmly to the patient and don't get nervous yourself. Try to have the patient regulate his or her breathing in a slower, more even rate. This may help balance the respiratory alkalosis and the episode may be self-limiting. If the episode continues, have the patient breathe into a small paper bag at a rate of six to ten breaths per minute. Do not administer oxygen. Once the episode has ended the dentist and patient should discuss the root of the attack and address the fears of the patient. After being reassured, the patient should be offered the opportunity to terminate the appointment or continue with treatment. The patient can be discharged with no medical consultation. If respiration does not return to normal, transport the patient to their physician or an emergency room.

Syncope

The most common cause for loss of consciousness in the dental office is simple fainting under stress. A medically compromised patient will have a more serious reaction to stress (both psychological and physiological) than a healthy counterpart undergoing the same procedure. Most drugs used in the dental treatment are central nervous system depressants and have the potential to induce loss of consciousness. The most common time of occurrence of vasodepressor syncope (simple fainting) is during or immediately after the dental injection.

Evaluate the patient for dental anxiety and phobia at the initial treatment planning appointment and at consecutive appointments to make sure that s/he is able to deal

with the treatment. Nitrous oxide and oxygen sedation, pharmacological sedative, or stress reduction training may be appropriate before starting treatment.

Vasodepressor syncope is caused by a lack of blood to the brain. The patient usually loses consciousness only a few minutes. The most common reasons for vasodepressor syncope include: stress, anxiety, sudden or unexpected pain, the sight of blood or needles, and other fear inducing situations. Symptoms include: feeling of warmth, pallor, heavy perspiration, lightheadedness, and nausea. If a patient starts to feel faint, have him or her lay down and elevate his or her legs to 8 to 12 inches. When the patient is positioned in this manner, a complete fainting episode may be avoided. If the patient loses consciousness, maintain an open airway and loosen any tight clothes especially around their neck. If the patient begins to vomit, position him or her on the side. Administer oxygen and aromatic ammonia. Place a cool cloth on the patient's face and monitor his or her vital signs until S/he recovers. If the patient is still unconscious or incoherent after a few minutes, call 911 for medical assistance and transport the patient to the hospital.

There are various other more serious reasons why a patient may lose consciousness in the dental office besides simple fainting. Be suspicious if the patient did not report some symptoms before collapse. Other causes of syncope include:

- Drug reaction
- Orthostatic hypotension
- Epileptic seizure
- Diabetic hypoglycemia
- Diabetic hyperglycemia
- Acute allergic reaction
- Variety of heart diseases
- Cerebrovascular accident
- Hyperventilation

Orthostatic Hypotension

The second most common cause of loss of consciousness is orthostatic (or postural) hypotension. It is not usually related to anxiety like vasodepressor syncope. Sitting upright or standing can lead to a drop in blood pressure in some patients. Standing systolic blood pressure drops at least 25 MM Hg, and standing diastolic blood pressure drops at least 10 mm Hg. Groups at greater risk for orthostatic hypotension include the elderly, pregnant patients, reclining for a long time, patients with Addison's Disease, and those medicated with nitrous oxide and oxygen, diazepam, or some drugs used in the IV sedation. The patient is usually asymptomatic just before the incident and returns to consciousness after laying down. Check the patient's vital signs and administer oxygen

if needed. Reposition the patient slowly from the supine position when s/he feels recovered.

Make sure the patient's blood pressure returns to the preoperative baseline level before allowing him or her to leave the office. Orthostatic hypotension may be avoided by slowly repositioning the patient after a long procedure and encouraging the patient to stay in the dental chair for a few minutes after s/he is sitting upright.

Anaphylactic Shock

The most serious and life threatening allergic reaction is anaphylactic shock. The body's vital functions of breathing and circulation are impaired and oxygen cannot reach organs like the brain. Signs and symptoms include: weakness, coughing or wheezing, strained respiration, itching of hives, swelling, stomach cramps, nausea and vomiting, anxiety, perioral edema, bluish tinge to the skin, dizziness, and collapse which may lead to unconsciousness.

If the allergic reaction is mainly affecting the respiratory system, it may result in bronchospasm or laryngeal edema. The treatment for bronchospasm is the same as for an asthma attack. A laryngospasm (swelling of the larynx) can partially or completely obstruct the airway. There will be no movement of the lungs when the larynx swells to completely block the airway. Because of its immediately life-threatening nature, quick action is required. The patient should be positioned supine and medical assistance summoned immediately. Check the patient for breathing and heartbeat. Administer 0.5mg epinephrine IM or SC and oxygen, then diphenhydramine 50mg IV or IM and hydrocortisone 100mg IV or IM (if trained in the use of these drugs). Dentists trained in surgical technique may choose to perform a cricotomy if the patient's airway is completely obstructed with no air moving in or out of the mouth or nose and the blockage is known to be in the larynx. The patient should be transported to the hospital by the emergency team for further treatment.

If a patient exhibits milder symptoms like rash or itching, s/he should be given diphenhydramine 50-100 mg IV or IM and vital signs should be monitored. A preloaded syringe of epinephrine should be close by in case it is needed. These symptoms could advance to anaphylactic shock. Monitor vital signs. The patient's physician should be contacted for a consult and s/he should be dismissed according to the physician's recommendations.

Local Anesthesia Overdose Toxicity

Toxicity Equations

$\text{mg per cc} \times 1.8 = \text{mg per cartridge}$

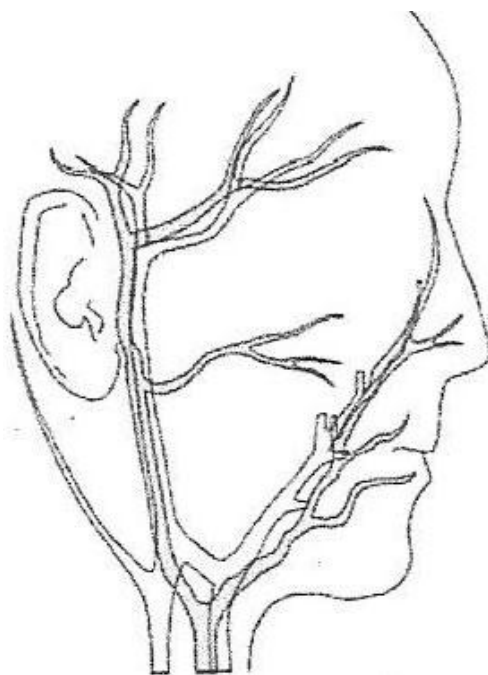
$\text{patient weight} \times \text{toxic limit for the drug} = \text{toxic limit in mg}$

$\text{toxic limit in mg} / \# \text{ mg in cartridge} = \text{maximum cartridges allowed}$

Administer Less Than Maximum Cartridges Allowed or Less Than Maximum Dosage Allowed, Whichever is Less.

Always take the weight of the patient into account.

Local anesthetics are linked to 50% of the deaths in the dental office. Use the smallest dose that will produce adequate anesthesia. Toxicity can be reached for any anesthetic by administering too much of the drug (especially as related to a patient's body weight), administering the drug to a sensitive individual, administering the drug into a blood vessel, or by improper drug combinations. If the level of the local anesthetic is too high, it can become toxic causing a dangerous reaction in the nervous system, cardiovascular system, or in the local tissues. The rate of absorption and elimination of the drug is directly related to its toxic effects. The faster it is absorbed by the bloodstream and the slower it is metabolized, the more toxic it is to the body.



Injection of even a small amount of anesthetic solution directly into a blood vessel can result in an immediate toxic level. It is critical to aspirate each time an anesthetic is administered into an area that is very vascular, but negative aspiration does not guarantee that the bevel of the needle is not in the vessel. However, if the practitioner aspirates multiple times during the slow injection of anesthetic, chances of injection into a vessel are reduced.

Toxic limits are for normal, healthy patients. Some patients will be more sensitive to drugs so s/he may react to an even smaller dose than someone else regardless of their weight. If the patient is overly sleepy or lethargic after administration of the local anesthetic, it may be a symptom of toxicity.

Any time the patient is taking another CNS depressant, the mixture of the drugs will reduce the toxic level for the anesthetic. Patients should be questioned as tactfully as possible prior to anesthetic administration if there have been any drugs (prescription, over the counter, or street contraband) ingested recently. If the dentist prescribes preoperative anxiety relieving drugs such as Valium or Demerol, the dose of local anesthetic should be monitored even more carefully.

Signs and symptoms of local anesthetic toxicity include: slurred speech, excitement, shivering, muscular twitching, and tremor of facial muscles and extremities. The patient may also feel numbness of the tongue (on the opposite side of a mandibular block or in maxillary anesthesia), warm, flushed skin, lightheadedness, dizziness, diminished sight, tinnitus, and disorientation. These signs and symptoms may not be present when using Lidocaine and prilocaine. Toxic levels of these anesthetics usually produce mild sedation or drowsiness. If the patient indicates an excitement reaction, observation is usually all that is necessary. Do not dismiss a patient or leave the patient alone if s/he is exhibiting any reaction symptom. As the concentration of anesthetic in the bloodstream increases, the patient may go into a seizure. As with all seizures, the most important first aid measure is to place the patient in a position where s/he will not be hurt and move all dental instruments away from the area. Do not put anything in the patient's mouth. If the seizure continues and the patient has lost the ability to breathe, artificial respiration must be administered. If the seizure does not become self-limiting, it may be necessary to administer 5mg of Valium. Watch the patient's vital signs, s/he may go into respiratory arrest. Usually if the patient is properly ventilated, the effect of the anesthetic will wear off and the patient should be able to breathe on his or her own after about fifteen minutes.

The table below lists maximum recommended doses and toxic limits for the most common anesthetics (from Malamed *Handbook of Local Anesthetics*).

Drug	Toxic Limit	Maximum
2% Lidocaine (Xylocaine)	2mg/lb	300mg
3% Carbocaine (Mepivacaine)	2mg/lb	300mg
4% Citanest (Prilocaine)	2.7mg/lb	400mg
1.5% Duranest (Etidocaine)	3.6mg/lb	400mg
0.5% Marcaine (Bupivacaine)	0.6mg/lb	90mg

Before administering any anesthetic, calculate the dose of anesthetic in the cartridge. The percent of the solution is the indicator of concentration. For example, 2% Lidocaine is 20mg of xylocaine per cc of the drug. Multiply this number 1.8 (because of the cartridge containing 1.8cc of solution). 2% xylocaine is 20mg per cc x 1.8cc = 36mg per cartridge. So for a 180 lb patient the maximum does is 2mg/lb x 180 divided by 36mg in the cartridge = 10 cartridges. But the maximum does for this drug is 300mg, which is **8 cartridges**. In the same patient, the maximum dose for citanest would be 5.5 cartridges.

Children will have a smaller body weight, so the toxic level will be reached faster. Remember to take the patient's weight into account when figuring the maximum dose of any local anesthetic. For a 50lb child, using 2% Lidocaine; **2mg/lb x 50 divided by 36mg in the cartridge = 2.7 cartridges**.

Epinephrine Overdose

Symptoms of epinephrine overdose include: fear, anxiety, restlessness, headache, tenseness, perspiration, dizziness, tremor of the limbs, palpitation, and weakness. The patient's blood pressure and heart rate will be elevated. Patients with weakened hearts are especially at risk because their cardiovascular system is already compromised.

Position the patient comfortable and administer oxygen. If the patient's blood pressure is elevated and signs of a cerebrovascular incident occur, summon medical assistance. The patient should gradually recover. If there are no symptoms of cerebrovascular problems, the patient can be dismissed home. otherwise s/he should go to their physician or the emergency room depending on the seriousness of the episode.

Asthma

Asthma is a disease in which the bronchial tubes in the lungs narrow to such a degree that the patient has difficulty breathing, especially exhaling. Asthmatics usually have a very sensitive cough reflex. Asthmatic patients should be reminded to bring their medication with them to all dental appointments.

Attacks can result from exposure to an allergen, infection, exercise, cold weather, an inhaled irritant, or emotional factors. If a patient were know to have had asthma attacks due to emotional stress, s/he would benefit from a stress reduction exercise before beginning treatment (especially if s/he indicates a fear of dentistry). Use of nitrous oxide may be indicated because it is nonirritating to the respiratory mucosa, and has an excellent calming effect. Some asthmatics are claustrophobic, in which case a nasal cannul may be used instead of a nosepiece.

Asthmatics should not be prescribed aspirin and other nonsteroidal anti-inflammatory drugs or penicillin because they have been linked to asthmatic attacks. Any anesthetic containing bisulfate as a preservative is contraindicated for use on an asthmatic patient.

Symptoms include: difficulty in exhalation, wheezing or whistling as air moves through the narrowed airways, anxiety, nervousness, coughing, perspiration on forehead, choking sensation, possible vomiting or fever and bluish tinge to the skin. The patient sits straight up because it is easier to breathe in this position. If the patient has medication, administer it at this time, according to the directions. If the patient fully recovers from the episode, the treatment may continue if the patient and Dentist feel it is appropriate. The patient should receive medical treatment if the condition doesn't improve. If the patient's physician is unable, have the patient transported to the emergency room. If not treated, respiratory failure may result. The condition becomes life threatening if the patient is unable to cough, the pulse rate increases, breathing becomes even more labored, or if the patient tries to pull up his or her shoulders and chin to move air into their chest. Call the paramedics or immediately transport the patient to the nearest hospital emergency room. Epinephrine and Isoproterenol are not appropriate to administer in an asthma attack because of their potentially severe cardiac side effects.

Heart Failure

When a patient's heart cannot supply the oxygenated blood needed by the body to function, it is referred to as Heart Failure. If only the left ventricle fails, the pulmonary vasculature becomes congested. If the failure is primarily in the right ventricle, the veins and capillaries will become congested. If both ventricles fail at the same time it is referred to as congestive heart failure. Acute pulmonary edema will exhibit excess fluids in the lungs and the patient will have difficulty breathing. All the situations are life threatening. Patients who report history of heart failure are at increased risk during dental treatment. Hypertension makes the heart work harder, and eventually can lead to heart failure.

The patient health history should be reviewed for any heart disease that may have weakened the muscle of the heart, and current circulatory and heart condition that may predispose a patient to congestive heart failure. A physical evaluation of the patient should be considered as well. Note the vital signs at the initial appointment and compare them to the present signs. Anyone with blood pressure over 160/95 is considered to have hypertension. Medical treatment for known hypertension includes diet, exercise, and medication. Many hypertensive patients do not receive proper therapy, or do not take their medication properly.

Weight gain of more than three pounds in seven days may indicate edema immediately preceding acute heart failure. Ankle edema may present and the jugular vein may be prominent even in an upright position. If any of these signs are present, dental treatment should be deferred and the patient sent to their physician immediately.

Treatment should be altered for patients with hypertension. The treatment should be conducted in a stress free environment. If the patient exhibits anxiety about dental treatment, consider oral sedatives, nitrous oxide-oxygen, or intravenous sedation. The patient should be instructed to take his or her medication regularly, especially the days before and the day of treatment. The dentist must consider the medications for dental treatment. Usually, vasoconstrictor in the anesthetic will be acceptable, but consult the patient's physician. Make sure the patient is comfortable during treatment and take the vital signs a few times during the procedure. Special care should be taken to provide adequate analgesia for postoperative discomfort. The patient should be instructed to take pain medication prior to the onset of discomfort.

Signs and symptoms of heart failure include: cool, pale skin; sweating, pitting edema of the ankles (depression made by pressure remains even after the pressure is removed); difference between systolic and diastolic blood pressure narrows; fatigue, dyspnea (shortness of breath) on exertion; symptoms of acute pulmonary edema include: all signs and symptoms of heart failure, moist rales (cough), cyanosis (bluish tinge to the skin), frothy pink sputum, increased anxiety, and dyspnea at rest.

Angina

Patients who indicate angina on their medical history should be questioned further as to when their last episode occurred. A patient is considered stable if there has been no change in the frequency, duration, and depth of pain in the past 60 days. If attacks are occurring more frequently or produced by less activity, the angina is considered unstable. Elective dentistry should be postponed until the patient's angina is stable.

A patient experiencing an angina attack will feel substernal chest pain that sometimes radiates to the left neck and arm. Stress and exercise induce angina attacks. The symptoms are usually relieved by rest and sublingual nitroglycerin. Oxygen can be administered. Dental therapy should be discontinued and the patient's physician consulted prior to further treatment. If the initial dose of nitroglycerin is ineffective after three to five minutes, call for medical assistance and administer a second dose of the same amount. The patient should be transported to the hospital for further treatment if recovery is not complete.

Heart Attack

Heart attacks occur when there is a limitation of the blood supply to the heart because of narrowing of the coronary artery. The heart muscle relies on the coronary artery for oxygenated blood and without it part of the muscle of the heart can die. Symptoms of a heart attack include: severe, crushing central chest pain that can radiate through the chest to the arm, shoulder, neck, jaw, mid-back, or pit of stomach; profuse sweating; nausea and vomiting; extreme weakness; anxiety and fear; pallor of skin, bluish fingernails and lips; and extreme shortness of breath. Sometimes a patient comes to a dental office on an emergency visit because s/he thinks there is an infection of the jaw with the pain radiating to the chest and arms when actually the symptoms originate in the chest. If the patient is conscious, seat him or her and loosen any clothing in the neck area. Keep the patient comfortable, calm and warm. Call 911 or transport immediately to the hospital. If the patient loses consciousness, maintain an open airway and monitor vital signs. Restore breathing and circulation if necessary until emergency assistance arrives. Patients should avoid elective dentistry for six months following a myocardial infarction.

Stroke

A stroke (also called a cerebrovascular accident or cerebral apoplexy) occurs when there is an interruption to the blood supply to all or part of the brain. A clot, a narrowing of an artery, or the bursting of an artery, can cause a stroke. It is a life-threatening situation.

Symptoms of a major stroke include: sudden headache, paralysis, weakness, or numbness of the face, arm, or leg on one side of the body; loss or slurring of speech; unconsciousness or mental confusion; fall; impaired vision, pupils of the eyes are different size, difficulty breathing, chewing, talking, or swallowing; loss of bladder or bowel control and a strong, slow pulse. Immediate treatment includes: call 911, maintain an open airway, resort breathing or circulation if necessary, and transport to the hospital.

Symptoms of a minor stroke include: slight mental confusion, dizziness, minor speech difficulties and muscle weakness. The patient should be referred to his or her physician promptly. Symptoms of a transient ischemic attack (a spasm of the brain vessel) are the same as for a minor stroke. The situation is not immediately life threatening, but the patient should be referred to their physician for testing.

Elective dental treatment should be delayed for at least six months following a stroke. Infections should be managed with medication if at all possible. If invasive treatment is necessary, it should be done in a hospital setting. After six months, dental treatment

may proceed but the anesthetics used should produce a profound anesthesia so the patient is not stressed under pain, and if necessary, s/he should be mildly sedated (nitrous or light oral medication).

Gingival retraction cord with epinephrine should never be used on a patient with history of cerebrovascular accident.

Diabetes

Diabetes inhibits insulin production and, depending on the severity, is treated with diet modification, oral medications, and/or injectable insulin therapy. Diabetics often have associated cardiac renal disease. The patient should be treated in a stress-free environment. S/he should be instructed to eat and take their medication regularly prior to the appointment. Appointment times should not require the patient to miss a regular meal.

Hyperglycemia Leading to Diabetic Coma

A diabetic coma can occur when there is not enough insulin in the body, either because the body is not using the insulin properly; the patient forgot their insulin shot, dietary problems, pregnancy, epinephrine therapy, fever, or infection. Patients experience gradual onset of all or most of the following symptoms:

- Extreme thirst
- Warm, red, dry skin
- Drowsiness
- Fruity smelling breath
- Deep rapid breathing
- Dry mouth and tongue
- Nausea
- Vomiting
- Frequent urination

The onset is usually not acute and coma can result 48 hours from the first signs and symptoms. The patient should receive treatment as soon as possible, but it is not a life-threatening situation like hypoglycemia. Transport the patient to their physician to evaluation the insulin regimen immediately. Postpone dental treatment until the patient's insulin level is under control.

Hypoglycemia Leading to Diabetic Shock

When a diabetic's sugar level drops below a certain level, s/he can go into diabetic shock. This can occur if s/he takes too much insulin, eats too little food after taking their

diabetes medication, are under stress, or ingest ethanol. Patients experience sudden onset of all or most of the following symptoms:

- Hunger but no thirst
- Pale and sweaty skin
- Excited behavior
- Normal smelling breath
- Normal or shallow breathing
- Tongue and mouth moist with no vomiting

Treatment includes giving the patient any food or liquid containing sugar (like the sugar cube in the emergency kit) and seeking medical attention promptly. If the patient is awake, administer oral glucose. If the patient loses consciousness, apply glucose paste (tube cake icing) to the mucobuccal fold. If the patient loses consciousness, transport him or her immediately to the hospital. If hypoglycemia is not treated quickly, the patient may die or be seriously injured.

If there is a doubt of diagnosis of hyperglycemia or hypoglycemia and the patient's condition is rapidly deteriorating, administer glucose and call 911. The patient must not take more insulin unless hyperglycemia is the definitive diagnosis because of the life threatening nature of hypoglycemia.

Seizures

Seizures or convulsions are caused by a disturbance in the electrical activity in the brain. This disturbance causes a series of uncontrolled muscle movements. The patient may be totally or partially unconscious with a temporary interruption in breathing. The episode usually lasts one or two minutes. Seizures occur when there has been a head injury, brain tumor, epilepsy, poisoning, electric shock, withdrawal from drugs, heat stroke, scorpion or poisonous snakebites, hyperventilation, or high fever.

Symptoms include: utterance of a short cry or scream, muscles become rigid, jerky twitching movements, temporary interruption of breathing, face and lips turn blue, eyes roll up into the patient's head, loss of bladder and bowel control, drooling and unresponsiveness during the seizure. The patient is sleepy and confused following the episode.

The best thing to do during an epileptic episode is to help the patient to a safe place on the ground so s/he doesn't injure him or herself and let the convulsion run its course. do not put anything in the patient's mouth and do not try to hold him or her down. after the convulsion has subsided, check the patient's respiration. If breathing does not start soon after the seizure is over, reposition the patient's head to open the airway. Check that the tongue has not blocked the back of the throat. As soon as breathing returns to

a normal pace, roll the patient on their side to avoid choking on any secretions.

Let the patient rest and take him or her to their physician promptly; especially if there is a second convulsion or if she is pregnant. Seizures are only life-threatening if a series follow one another closely.

Conclusion

Severe headaches with nausea, vomiting, visual disturbances, or in conjunction with a stiff neck requires immediate medical attention. It may be a symptom of meningitis, encephalitis, stroke, or tumor. Unexpected loss of consciousness may be a symptom of stroke, heart attack, or the patient may have stopped breathing. Severe chest pain may be a heart attack and is a life-threatening emergency. Loss of vision in one eye may be the onset of a stroke. Transport the patient to the doctor right away. Loss of sensation or lack of ability to move an extremity may be symptomatic of a stroke or brain tumor. The patient should be referred to a physician right away even if the symptom disappears. Shortness of breath without physical exertion may be the onset of an asthma attack or allergic reaction, or may be a symptom of congestive heart failure. Refer patient to their physician and do not proceed with treatment. A patient with critical symptoms like unconsciousness, anaphylactic shock, drug overdose, or chest pains should be transported to the hospital as soon as possible.

Emergency personnel will want to know when the symptoms began, what makes them worse or better, what happened when they began, how have they changed since the onset, what medicine the patient has been taking, allergies, and any significant information from the patient's medical history.

It is better to err on the side of safety in emergency situations. If the dentist (or most experienced member of the staff) feel that the patient is not improving, or if there is any doubt about the patient's ability to recover fully from the emergency, paramedics or emergency technicians should be called.

Medical emergencies can happen anywhere. The stressful nature of a dental visit can trigger an emergency in sensitive patients. Knowledge is power. Know what to do, know your limitations, and most of all, know when to call in the experts.

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Office Protocol for Medical Emergencies

Date: _____

Code For Medical Emergency: _____

Person In Charge Of Directing The Management of the Patient Until the Emergency
(Paramedic) Team Arrives (most experienced in Medical Care)

Location Of Emergency Supplies Kit:

Person In Charge of Bringing Emergency Supplies Kit:

Person In charge of Calling 911

Person In Charge Of Waiting Outside To Direct Emergency Team (Paramedics) To
Site of Incident

Location Of Staff Medical History Forms

Additional Notes:

Course Exam: Medical Emergencies in the Dental Office

1. The most frequent medical emergency in the dental office is:
 - a. myocardial infarction
 - b. syncope
 - c. respiratory arrest
 - d. allergic reactions
2. In an emergency, the best place to check the pulse is the:
 - a. carotid artery
 - b. brachial artery
 - c. radial artery
 - d. femoral artery
3. The best position in which to place a syncopal patient is:
 - a. seated with the patient's head between their legs
 - b. supine with the legs elevated
 - c. on their side
 - d. in a seated position
4. Which best illustrates the "normal" vitals for an adult?
 - a. Pulse 108, BP 160/90, respirations 22, temperature 101°F
 - b. Pulse 50, BP 88/40, respirations 28, temperature 98.6°F
 - c. Pulse 80, BP 118/70, respirations 16, temperature 98.6°F
 - d. Pulse 98, BP 208/110, respirations 18, temperature 97.2°F
5. Most emergencies occur:
 - a. in the reception room
 - b. in the reception room
 - c. while under nitrous oxide sedation
 - d. during or immediately following local anesthesia administration
6. A conscious patient is unable to breathe or talk. When you ask if they are choking, they nod their head. You should administer:
 - a. Oxygen
 - b. four back blows
 - c. fifteen chest compressions
 - d. abdominal thrusts
7. Immediately upon recognizing cardiac arrest in the office you should:
 - a. call 911
 - b. ventilate with a bag-valve-mask
 - c. begin chest compressions
 - d. administer oxygen

8. While administering lidocaine anesthesia to a 21-year-old male, he becomes pale, pushes the dentist's hand away and passes out. You suspect:
 - a. lidocaine toxicity
 - b. allergic reaction
 - c. epinephrine reaction
 - d. syncope
9. A severe allergic reaction involving several body systems is called:
 - a. Convulsions
 - b. Syncope
 - c. Anaphylaxis
 - d. angina pectoris
10. An older patient becomes restless during treatment. He seems unable to move one arm and his speech is slurred. He may be having:
 - a. cerebrovascular accident/transient ischemia attack
 - b. acute myocardial infarction
 - c. angina pectoris
 - d. angina pectoris
11. Anxiety hyperventilation is best treated using:
 - a. a paper bag
 - b. high flow oxygen
 - c. coaching techniques to slow breathing
 - d. anti-anxiety agents
12. The medication most often used to relieve anginal pain is:
 - a. Nitroglycerin
 - b. Dilantin®
 - c. Epinephrine
 - d. Insulin
13. Nitroglycerin is administered:
 - a. Intravenously
 - b. Intravenously
 - c. Sublingually
 - d. by inhalation
14. A heart rate greater than 100 is called:
 - a. Tachycardia
 - b. Arrhythmia
 - c. Hypertension
 - d. Bradycardia

15. A patient health history should be taken:
- a. at the patient's first visit and an update at each visit
 - b. in ink at the end of each treatment
 - c. in ink before each treatment
 - d. at the patient's first visit and again if the patient mentions a medical problem