

MEDICAL EMERGENCIES IN THE DENTAL OFFICE

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B. Prevention

The second focus topic in Emergency Preparedness is **prevention**. Root cause analysis of morbidity and mortality in healthcare show that in a majority of cases, human error was responsible for the bad outcome. It is true that in many circumstances in dentistry, patients will experience medical emergencies without provocation from the dental team. However, in many instances, emergencies are brought about by:

- Failure to implement a stress reduction protocol
- Inadequate Medical History and Physical Exam

Therefore, it is important to focus on preventative measures to avoid iatrogenic causes of medical emergencies. The following section will focus on these two points.

Stress Reduction Protocol

Stress reduction protocols will result in a significant reduction in medical emergencies in the dental office. The points listed below are well known but often not attended to as a means of saving time.

- Gentle chairside manner
- Premedication and/or intraoperative sedation
- Slowly administered and attainment of profound local anesthesia
- Short appointments

Comment:

Gentle chairside manner

The demonstration of a compassionate, caring attitude will alleviate a majority of stress building and evolving situations. Most patients have some degree of anxiety regarding dental treatment which can lead to the development of medical emergencies even in the healthy population.

Premedication and/or intraoperative sedation

There are a small minority of patients that require more than gentle chairside manner to cope with treatment related anxiety. Preoperative administration of manufacturer recommended doses of anxiolytic agents are very effective in the reduction of stress. Consideration of very carefully titrated sedative doses of inhalational or intravenous agents intraoperatively is also very beneficial for the reduction of treatment related stress.

Slowly administered and attainment of profound local anesthesia

The backbone of pain and anxiety control in dentistry is and always will be effective local anesthesia. In most patients, the abolishment of pain sensation by attainment of profound anesthesia is adequate to control stress during the procedure. The most important consideration in local anesthesia administration is an understanding of correct technique, anatomical and neuroanatomy of the injection site. Accurate placement of local anesthetic agent (regardless of agent) results in a reduction in total dose of drug administered to the patient. It cannot be emphasized enough that the slow insertion of the local anesthetic needle and administration of local anesthetic drug greatly reduces the incidence of medical emergencies. Local anesthetic administration is often cited as the most stressful procedure for patients in the dental office. It should come as no surprise that a significant number of medical emergencies occur during or

immediately after administration of local anesthetic. In addition, multiple strategies/techniques must be learned by the clinician to accomplish profound and long-lasting regional anesthesia.

Short appointments

The trend in dentistry today is moving away from the traditional 45-60 minute appointment and towards longer block scheduling. These longer appointments are tolerated quite well by the healthy patient, but not so by the sicker class of patients. It should be appreciated that even the medically compromised patient can tolerate short, noninvasive and stress-free procedures. Therefore, careful consideration of the length of chair time in a medically compromised patient is of paramount importance

Medical History and Physical Exam

A general lack of knowledge among dentists regarding systemic disease is quite common. It is important to have a basic understanding of disease and more importantly the extent/severity of the disease. In the modern era of medicine, with the advances in knowledge and technology, patients are living much longer after their initial diagnosis of disease. As a result, patients may have advanced systemic disease and still function because of medical interventions/procedures and a myriad of medications that they are taking. This list of medications exposes that patient to possible adverse drug interactions as well as an exacerbation of their disease if they are not compliant with their medications. In this section we will focus on the following points of the medical history and physical exam:

- Prior And Current Medical Conditions
- Medications
- Allergies
- Social History
- Recent Hospitalizations/Surgery
- Anxiety assessment
- Baseline Vitals
- Assignment of ASA Physical Status

Prior and Current Medical Conditions

Prior as well as current medical diagnoses, tell the practitioner what sort of issues that the patient potentially might present with. This information allows the practitioner to be thinking about the possible emergencies associated with the patient's medical condition. For example, the patient with a diagnosis of diabetes, most commonly experiences hypoglycemia in the outpatient setting. It also allows the clinician to modify the treatment related to extent and severity of the disease.

A review of common medical diseases that carry a significant risk of systemic involvement (vital organ pathology) will be highlighted in this next section.

Cardiovascular

Hypertension

Hypertension is very prevalent in our society. The clinician should seek to understand the significance and extent of the hypertensive end organ disease (heart, kidney, cerebral) as well compliance with proscribed medical regimens. It is generally acceptable to provide elective treatment for a patient that has a BP reading of <180/110 provided that this patient does not have a co-diagnosis of cardiac and cerebrovascular disease and is asymptomatic (no chest pain, headache etc). However, it is assumed that the patient has controlled hypertension and the high blood pressure reading is the direct result of the patient's anxiety.

Management:

1. Stress reduction protocol (gentle technique, profound local anesthesia, short appointments)
2. Minimize use of vasoconstrictors; restrict to 2-3 cartridges of 1:100000 epinephrine. However, vigilant monitoring of HR and BP is imperative. The total number of cartridges should be based on patient physiologic response, not textbook recommendations!
3. Sedation (Nitrous Oxide, oral, IV)

Ischemic heart disease/angina

Ischemic heart disease manifested as angina (chest pain) is a common complication seen in the dental office. Ischemic heart disease or angina is a condition in which there is a myocardial oxygen supply and demand imbalance. Atherosclerotic plaque is the most common cause of this condition which results in a narrowing of the arteries supplying the myocardium. Anginal attacks are the clinical manifestations of this disease. During an anginal attack, the supply and demand imbalance is brought on by physical activity, stress, anxiety, unexpected dental treatment pain, excitement, hot/humid weather etc. The resulting chest pain resolves when the imbalance is corrected, either by rest, administration of oxygen and/or nitrates. It is important to question the patient with regards to the following:

- **Nature and frequency of the anginal attack.** In other words, is the angina brought on by strenuous exercise, while climbing one flight of stairs or at rest (sitting on the couch).
- **Effectiveness of treatment.** When the anginal episode occurs, what is done to relieve the pain? Rest, oxygen, nitrates?

If the patient experiences chest pain while doing minimal exercise (washing dishes) or at rest, the patient is considered to have unstable angina. Also, if the patient requires multiple doses of nitrates before symptoms resolve places them at risk for a myocardial infarction. All of these clinical situations are poor risks for elective dental care and require medical consultation and follow-up before care is provided to them.

Management:

1. Stress reduction protocol (gentle technique, profound local anesthesia, short appointments)
2. Sedation (Nitrous Oxide, Oral, IV)
3. Pre-op nitroglycerin sublingually 5 min (1 tablet) before starting local anesthesia. Use patient's tablets if possible.
4. Consider administering oxygen (nasal cannula) during treatment
5. Minimize use of vasoconstrictors (2 cartridges of 1:100000 epinephrine)
6. Remember patient is a definite risk.

If the angina resolves after interventions (oxygen, nitrates, rest etc) and does not return, it usually is appropriate to continue dental treatment. However, steps must be taken to avoid triggers (pain, anxiety) of increased sympathetic tone.

Myocardial Infarction

Myocardial infarction is the actual death and necrosis of myocardial cells. The long term prognosis of these patients hinges on the extent and location of the damaged cardiac muscle.

Management:

1. No elective dental treatment for 6 months. This allows for complete repair of myocardial muscle.
2. Consultation with patient's cardiologist, to determine cardiac function/damage and whether patient has been optimized for elective dental care
3. Routine dental care can then be provided utilizing the same protocol as the patient with ischemic heart disease.

Congestive Heart Failure

Congestive heart failure defined in its simplest terms is a pump (heart) that is failing due to any number of underlying causes (i.e., ischemia, infarction, valvular disease, cardiomyopathy). This condition results in decreased cardiac output and a backing up of blood behind the failing heart. This manifests clinically as peripheral edema (swollen ankles) and pulmonary edema (fluid filled lungs) for right and left sided heart failure respectively.

Management:

1. No treatment until patient has been optimized medically (minimal evidence of edema, good exercise tolerance etc)
2. Stress reduction protocol (gentle technique, profound local anesthesia, short appointments)
3. **Position patient semi-supine or upright** to avoid fluid overload in patient's lungs
4. Minimize use of vasoconstrictors (2 cartridges of 1:100000 epinephrine)

Valvular Heart Disease

Patients with a history of valvular heart disease must be evaluated for the nature and hemodynamic significance of the condition. Basically, patients with a positive history of valvular heart disease have as an underlying pathology the inability to either open or close the heart valve properly which results in impeded forward blood flow or a significant regurgitation (backflow) of blood. In the cases of severe stenosis or regurgitation cardiovascular hemodynamics (cardiac output, BP) can be significantly altered. Also, valvular heart disease carries the risk of bacterial endocarditis.

Management:

1. Medical consultation with the patient's physician to determine the need for antibiotic prophylaxis and the hemodynamic significance of the valvular disease
2. Maintain patient's heart rate and blood pressure as close to baseline as possible to avoid hemodynamic derangements
3. Provide antibiotic prophylaxis if indicated

Cardiac Pacemaker, Implanted Cardioverter/Defibrillator

Cardiac pacemakers are most commonly placed in patients with symptomatic arrhythmias and heart blocks that are unresponsive to medical therapy. The device is implanted under the skin and leads are fed through blood vessels into the right atrium or ventricle. Implanted cardioverter/defibrillator (ICD's) is placed in a similar fashion to pacemakers. These devices detect life threatening arrhythmias and deliver a shock in these susceptible patients.

Management:

1. Consultation with the patient's physician to determine if the patient is medically optimized and evaluation of the device to check for proper function is vital
2. There is no need for antibiotic prophylaxis as the device is not placed into the heart
3. Extreme caution when using electrocautery units

4. No contraindication for administration of local anesthetic

Pulmonary

Asthma

Asthma is an inflammatory condition of smooth muscle of the tracheobronchial tree. An acute attack is brought on by intrinsic and extrinsic stimuli such as environmental allergens (pollen) as well as exercise, colds, foods, food preservatives and emotional stress. However, most asthmatic attacks are brought on by inhaled allergens, but attacks brought on by food and food preservatives can be life-threatening.

Management:

1. Stress reduction protocol
2. Bronchodilator (B-2 agonist) such as albuterol (preferably the patient's) must be immediately available
3. Avoid local anesthetics containing bisulfites antioxidants in susceptible patients
4. Nitrous oxide/oxygen is suggested if sedation is needed
5. Patients must not have signs and symptoms of an acute asthmatic attack (wheezing, dyspnea) on day of treatment

COPD (bronchitis, emphysema)

Patients with a diagnosis of COPD (chronic obstructive pulmonary disease) have lung disease in which the lungs are damaged making it difficult to breathe. The airways are partially obstructed (bronchitis) and some of the alveolar walls are destroyed (emphysema) making it difficult to move air in and out of the lungs. Treatment options include bronchodilators and inhaled steroids and patients with severe disease are often maintained on supplemental oxygen. In advanced cases of some COPD diseases (bronchitis), patients retain high levels of CO₂ due to the obstructive nature of the disease. The primary drive for respiration in the normal population is increased levels of CO₂, however, in these patients who have chronic elevated levels of CO₂ the primary stimulus for breathing is decreased levels of oxygen (hypoxia). Therefore, theoretically, high levels of oxygen may depress the drive for respiration. Therefore, oxygen flow levels of 4L/minute or less are acceptable to maintain the hypoxic drive.

Management:

1. Consultation with physician to determine if patient is medically optimized
2. Avoid nitrous oxide/oxygen sedation
3. Position semi-supine or upright
4. Avoid bilateral mandibular blocks and local anesthesia of the soft palate
5. If supplemental oxygen is given, keep oxygen flow levels below 4L/min

Endocrine

Diabetes Mellitus

Diabetes is a metabolic disorder in which there is a derangement in carbohydrate metabolism. This results from either insufficient or a complete absence of insulin secretion or there is a lack of receptor response to circulating insulin. Patients are typically classified as type 1 or 2 diabetics. Type 2 diabetics are usually managed with diet modifications or by an oral medication regimen (some require insulin). Type 1 diabetics have an absolute lack of insulin and therefore require exogenous insulin. Patients with diabetes develop long term complications such as cardiovascular disease, blindness (retinal damage), renal failure, nerve damage (neuropathy) and gangrene. Diabetics that have tight control over their blood glucose levels have less long term complications and can lead a relatively normal life. On the other hand, those with poor control of their plasma glucose levels have more serious end organ disease.

Management:

1. Avoid hypoglycemia
2. Stress reduction protocol

3. No treatment modification necessary provided there is no evidence of end organ disease (cardiac, kidney, neuropathy). In other words, it is okay to administer routine doses of local anesthetic with vasoconstrictor to patients with controlled disease
4. Elective dental treatment is contraindicated in the poorly controlled diabetic (brittle diabetes)

Hyperthyroidism (thyrotoxicosis)

Patients with a diagnosis of hyperthyroidism that are not being treated are at risk for developing a thyrotoxic crisis ("thyroid storm") the most severe form of thyrotoxicosis. Infection, trauma, dental procedures and stress may precipitate the crisis.

Management:

1. No elective treatment until medical consultation and treatment of hyperthyroidism completed
2. Important to manage dental infections
3. **Avoid epinephrine** and other sympathomimetic drugs in the uncontrolled hyperthyroid patient

Adrenal Gland Insufficiency (Addison's disease)

Normal function of the adrenal gland allows for the body to cope with stress. Glucocorticoids (cortisol), mineralocorticoids (aldosterone) and epinephrine are produced by the adrenal gland for this purpose. Therefore, in scenarios where the adrenal gland is suppressed either by **primary causes** (Addison's) or **secondary causes** (corticosteroid therapy), there is a theoretical chance that under certain conditions (extreme stress) the patient could suffer cardiovascular collapse. However, it is unlikely that routine dental treatment with local anesthesia will precipitate a cardiovascular collapse. There is considerable controversy in management of the patient with adrenal insufficiency and whether it is appropriate to increase the steroid dose or not and if so, for how long.

Management:

1. No additional dosing of steroid for minor procedures (dental treatment), however, should take daily dose of steroid
2. Consider additional steroid coverage for major surgical procedures (abdominal, thoracic surgery) for patients taking steroids for systemic inflammatory diseases (rheumatoid arthritis, asthma, lupus)
3. Consult with physician if unsure how to manage steroid coverage

Cerebrovascular

Stroke (cerebrovascular accident)

A stroke is the end result of a disruption of oxygenated blood flow to a part or parts of the brain. The most common causes of stroke are hemorrhage and occlusion of a vessel (thromboembolism). The outcome of a stroke is at the worst death and if the patient survives there is a high probability that the patient will suffer long term neurologic and motor deficits depending on the area of the brain affected. As in myocardial infarction, the most common cause of a stroke is hypertension and atherosclerosis.

Management:

1. No elective dental care for 6 months (post CVA)
2. Consultation with physician to determine patient's recovery and to manage anticoagulants (see hematology section)
3. Avoid treatment in patient experiencing transient ischemic attacks (TIA's)
4. Limit local anesthetic with vasoconstrictor (2-3 cartridges of 1:100000 epinephrine)
5. Stress reduction protocol

Coagulation Disorders

Patients at risk for bleeding during a dental procedure have either an inherited defect in the coagulation pathway, an acquired form of hemophilia observed in patients taking anticoagulation medications (coumadin, aspirin, NSAIDS, heparin) or patients with some types of cancer (leukemia). In the dental office, bleeding abnormalities are usually elicited from the health history and **should raise concern on the part of the practitioner** and requires further questioning and consultation with the patient's physician.

Management:

1. Consultation with the patient's physician to determine how to manage anticoagulants.
2. The target INR (international normalized ratio) should be less than 3.0 before dental treatment. This corresponds to a PT (prothrombin time) of about 1.5- 2.0 of normal value.
3. If a patient is on coumadin and the physician elects to reduce the anticoagulant, then a period of 3 days is required before a change in the INR will be reflected. A repeat INR should be done on the day of surgery to determine if the desired therapeutic level has been reached.
4. Infiltration, PDL and intraosseous injection techniques are suggested when administering local anesthesia to any patient with an increased risk for bleeding. Avoid block anesthesia if possible due to risk of damaging blood vessels.
5. Local measures such as pressure packs, sutures, gelfoam etc should be used if postop bleeding is encountered.

Medications

A review of the patient's medication list gives insight into the patient's medical diagnosis as well as severity of disease. For example, the patient taking one medication for hypertension is less concerning than a patient taking three different classes of drugs to optimize blood pressure control. It is important to know the pharmacologic class of the drug, its primary indication and its mechanism of action. Equally important is determination of the patient's compliance with their prescribed medications. Non-compliance with prescribed medications may potentially bump a patient up one level in the ASA PS classification system (see below). Certain classes of medications interact negatively with epinephrine formulated with local anesthetics. Table 4 below lists important negative interactions with vasoconstrictors.

Table 4

Drug interactions with local anesthetic containing epinephrine		
Drug Class	Systemic Effect	Recommendation
Tricyclic anti-depressants (TCA's) <i>(amitriptyline, nortriptyline, imipramine, doxepin, desipramine)</i>	Elevation in Blood pressure	<ul style="list-style-type: none"> • Monitor and titrate local anesthetic • Limit dose to 2-3 cartridges of 1:100000 epi
Serotonin-norepinephrine reuptake inhibitors (SNRI's) <i>(venlafaxine, duloxetine, desvenlafaxine, milnacipran)</i>	Elevation in blood pressure	<ul style="list-style-type: none"> • Monitor and titrate local anesthetic • Limit dose to 2-3 cartridges of 1:100000 epi
Non-selective beta-blockers <i>(propranolol)</i>	Elevation of blood pressure/bradycardia	<ul style="list-style-type: none"> • Careful injection of 1 mL aliquots of local anesthetic • Obtain BP/HR after each 1 mL administered

Allergies

Allergic responses to normally harmless environmental substances are common. Usually this requires previous exposure to the substance (allergen) and on subsequent exposure; the immune system mounts an exaggerated response to the allergen. Essentially all drugs have the potential to cause an allergic reaction, therefore, it is important to gather this information from the patient on the health history form and display a visible alert on the patient chart. It is also common for patients to develop allergies to latex products. This is more of a concern in patients that are routinely exposed to these products, such as health care workers.

Management:

1. Display a visible alert on the chart
2. Avoid chemically similar drugs
3. Oral route rather than IM or IV for antibiotics
4. Allergy testing if diagnosis uncertain

Social History

The presentation of patients to the dental office that have recently abused drugs is a reality. Long-term or acute abuse of these substances can result in life-threatening medical emergencies even in the healthy, young patient. All drugs of abuse are of a concern to the practitioner as this may lead to aberrant behavior in these individuals. However, the drugs that are the most problematic are those which activate the sympathetic nervous system.

Cocaine is a widely abused drug in America which results in tachycardia and hypertension as a result of elevated sympathetic nervous system activity. Acute ingestion of cocaine results in direct coronary artery vasoconstriction and vasospasm with the combined result of myocardial ischemia and infarction.¹⁶ This pathophysiology was dramatically emphasized by Mittlemen who reported that the risk of myocardial infarction was increased by greater than 20-fold during the first hour after cocaine use as compared to other times.¹⁷ Cocaine ingestion may be responsible for as much as 25% of acute myocardial infarctions in younger patients (18-45), independent of route or frequency of administration, drug quantity, or plasma concentration.¹⁸

Similar to cocaine, all drugs in the amphetamine class, *d,l*-amphetamine, methylphenidate (Ritalin), methamphetamine, and 3,4-methylenedioxy methamphetamine ("Ecstasy") elevate sympathetic tone. As with cocaine, these hemodynamic changes increase myocardial oxygen consumption and are associated with acute myocardial ischemia and infarction as well as sudden death.

Management:

- Questions on health history form must address illicit drug use and rationale for this question
 - *"Have you used or have you ever used illegal drugs (We need to know for your safety!)"*
 - *"If yes, what substance did you take and when did you use this drug? (Medications we use interact with certain illegal drugs causing serious heart problems or sudden death!)"*
- There is considerable variation in delay of treatment for the patient that has recently abused drugs such as cocaine or amphetamines. The concern is related to the concurrent administration of sympathomimetic drugs (epinephrine) during the course of the dental treatment. The current recommendations in delay of treatment range from 24-72 hours.

Recent Hospitalizations/Surgery

Questions regarding recent hospitalizations and emergency room visits are important to ask on the medical history form. Questions regarding the nature of the visit provide information pertaining to acute

exacerbations and possible escalating disease pathophysiology. Also, recent surgical procedures often modify or delay treatment for a specified period of time.

Anxiety Assessment

It is important to ask questions on the medical history form regarding anxiety levels related to dental treatment. One of the most common medical emergencies in the dental office is syncope, often related to anxiety. Any patient with a moderate to severe level of anxiety is at increased risk for either an anxiety attack (hyperventilation) or syncope. It is very helpful to know if the patient has experienced an untoward reactions in the past related to their fear and what the outcome and management strategy was.

Baseline Vitals

The routine taking of vital signs at initial consultation allows baseline establishment for subsequent appointments as well as for management of emergencies. Vitals should also be taken at each treatment appointment and protocols in place to determine acceptable value ranges. For example, a patient that was previously normotensive on initial consultation (<120/80), with no significant underlying medical disease, who presents for treatment with a preoperative blood pressure reading of 179/100 should be managed differently (i.e., treatment can proceed) than a patient with cardiovascular disease (cancel treatment and refer for evaluation). The rationale for cancelling the appointment, even though the patient is asymptomatic, is that the blood pressure values, more than likely, will continue to climb as treatment commences precipitating a crisis.

Listed below (Table 5) are the BP guidelines that are used at Loma Linda School of Dentistry.

Table 5

BP Guidelines at Loma Linda University School of Dentistry			
Systolic BP	Diastolic BP	Medical Risk Factors	Recommendations
120 – 139	80 - 89	Yes or No (see list below)	Routine dental care OK, discuss BP guidelines with patient
140 – 159	90-99	Yes/No	Routine dental care OK; consider stress reduction protocol; refer for med consult
160 – 179	100 - 109	No	Routine dental care OK; consider stress reduction protocol; refer for med consult
160 – 179	100 - 109	Yes	Urgent dental care OK; consider stress reduction protocol; refer for med consult
180 – 209	110-119	No	No dental treatment without medical consult; refer for prompt medical consult
180 – 209	110-119	Yes	No dental treatment; refer for urgent medical treatment (see your MD or Urgent Care TODAY)
➤ 210	➤ 120	Yes/No	No dental treatment; refer for urgent medical treatment (see your MD or Urgent Care TODAY)
Medical Risk Factors examples: medical history of myocardial infarction, angina pectoris, high coronary disease risk, recurrent stroke history, diabetes, chronic renal disease, pregnancy, patient age factor, smoking, obesity, physical inactivity, stress, greater than one alcohol drink/day, etc.			
<i>Adapted from Yagiela et al. CDA Journal, Vol 35, Jan 2007</i>			

All medical history factors should be taken into consideration when planning the treatment protocol for the medically compromised patient. The above are meant to be guidelines to assist in the treatment design. Please take into consideration the treatment that is planned for that day before rescheduling the patient's appointment. Any decision to send a patient home or for a medical consult should be made using the above guidelines, the patient's medical history and using the wisdom and experience of the supervising faculty.

Assignment of ASA Physical Status

After careful review of the medical history form, baseline vitals and discussion with the patient, assignment of an ASA (American Society of Anesthesiologists) physical status classification should be done (see table 6).

Table 6

ASA Physical Status Classification System Table		
ASA PS	Preoperative Health Status	Comments
ASA PS I	Normal healthy patient	No organic, physiologic, or psychiatric disturbance; excludes the very young and very old; healthy with good exercise tolerance
ASA PS II	Patients with mild systemic disease	No functional limitations; has a well-controlled disease of one body system; controlled hypertension or diabetes without systemic effects, cigarette smoking without chronic obstructive pulmonary disease (COPD); mild obesity, pregnancy
ASA PS III	Patients with severe systemic disease	Some functional limitation; has a controlled disease of more than one body system or one major system; no immediate danger of death; controlled congestive heart failure (CHF), stable angina, old heart attack, poorly controlled hypertension, morbid obesity, chronic renal failure; bronchospastic disease with intermittent symptoms
ASA PS IV	Patients with severe systemic disease that is a constant threat to life	Has at least one severe disease that is poorly controlled or at end stage; possible risk of death; unstable angina, symptomatic COPD, symptomatic CHF, hepatorenal failure
ASA PS V	Patients who are not expected to survive without surgery	Not expected to survive > 24 hours without surgery; imminent risk of death; multiorgan failure, sepsis syndrome with hemodynamic instability, hypothermia, poorly controlled coagulopathy
ASA PS VI	Brain dead patient Organ donor	
<small>Modified from Cleveland Clinic website (my.clevelandclinic.org) accessed 6/14/2011</small>		

The American Society of Anesthesiologists (ASA) Physical Status classification system was initially created in 1941 by the American Society of Anesthetists, an organization that later became the ASA.

The purpose of the grading system is simply to assess the degree of a patient's "sickness" or "physical state" prior to performing treatment. After assigning an American Society of Anesthesiologist Physical Status (ASA PS) classification for the patient, decisions can be made regarding consultation with their physician and treatment strategy. These strategies might include:

- Administration of preoperative medication (e.g., sedatives, nitrates)
- Modifications to treatment plan (shorter appointments)
- Administration of oxygen during treatment

Determination of exercise capacity is very helpful in assigning an ASA PS classification for patients. The patient should be questioned regarding the most vigorous activity that they have undertaken in the last six months. Normal activity can be defined or correlated with the following activities: (See table 7)

- climbing 1-2 flights of stairs
- walking 2 level city blocks at a normal pace
- mowing lawn for 5 - 10 minutes (push mower)

Table 7

Exercise Tolerance Correlation Table	
Classification	Symptoms
ASA PS I	No symptoms and no limitation in ordinary physical activity, e.g. shortness of breath when walking, climbing stairs etc
ASA PS II	Mild symptoms (mild shortness of breath and/or angina) and slight limitation during ordinary activity
ASA PS III	Marked limitation in activity due to symptoms, even during less-than-ordinary activity, e.g. walking short distances (20–100 m), comfortable only at rest
ASA PS IV	Severe limitations. Experiences symptoms even while at rest . Mostly bedbound patients

Modified and adapted from New York Heart Association Functional Classification System

Determination of treatment modifications can be made after a data has been collected, reviewed and an ASA PS classification and exercise tolerance has been assigned. Table 8 below summarizes recommendations for treatment modifications based on these findings.

Table 8

ASA Physical Status and Stress Tolerance Correlation Table		
Classification	Stress Tolerance	Recommendations
ASA PS I	Psychological/procedural stress: well tolerated by the patient	No treatment modification necessary (stress reduction)
ASA PS II	Psychological/procedural stress: tolerated by the patient	No treatment modification (stress reduction)
ASA PS III	Psychological/procedural stress: don't tolerate well	<ul style="list-style-type: none"> • Alter treatment plan- avoid long complex procedures • Stress reduction protocol is good idea • Medical consult is advised
ASA PS IV	Psychological stress/procedural: may decompensate the patient	<ul style="list-style-type: none"> • Emergency care only that is simple in nature • Invasive procedures such as multiple extractions should be referred to oral and maxillofacial surgery for removal in a hospital setting • Medical consultation required

Summary

a. At the end of the medical history and physical exam, you should be able to answer these questions:

1. Does the patient have the physical and emotional reserve to undergo the planned treatment without complication?
2. Can we safely administer medications to this patient?
3. Should treatment be modified?
4. Should treatment be rendered?

b. Which patient's are at risk for having complications during dental treatment?

Listed below are the types of patients that will be at higher risk for problems during dental treatment:

1. Cardiovascular
 - i. Recent MI (risk for recurrent MI)
 - ii. Unstable/severe angina (often have chest pain at rest or with minimal stress)
 - iii. Decompensated CHF (don't respond to stress well, don't tolerate supine position well)
 - iv. Significant dysrhythmias (poor cardiac output, risky for lethal arrhythmia's)
 - v. Severe valvular disease (poor cardiac output)
2. Respiratory
 - i. Active pulmonary disease such as asthma or COPD (difficulty breathing and poor oxygen delivery to cardiovascular system)
3. Obesity
 - i. Respiratory obstruction (because of increased incidence of obstructive sleep apnea in this group of patients, more problematic for sedation/GA)
4. High levels of anxiety

c. Which offices are at higher risk for complications?

1. Low risk
 - a. *Low volume*
 - b. *Few "sick" patients*
 - c. *Limited scope of practice*

Practices which focus on minimally invasive procedures (e.g., recall, complete denture services) will have less problems with medical emergencies
 - d. *No parenteral meds given*
 - e. *Stress reduction protocols utilized*
2. Mod-high risk
 - a. *High volume*

The more patients seen, the odds are greater for medical emergencies
 - b. *Invasive procedures*

Offices that provide long, complex and invasive-type procedures on a routine basis are at greater risk for medical emergencies. Even advanced medically compromised patients can usually tolerate short, minimally invasive type procedures using only local anesthetic (2 cartridges) without complication

- c. *Parenteral medications given or oral sedation > minimal sedation level*
Offices that provide levels of sedation greater than minimal sedation (i.e., moderate/deep sedation and general anesthesia) are at greater risk for complications if there is a lack of training and understanding of drug pharmacology. Anesthetic agents are very safe if administered carefully and the patient's cardiovascular and respiratory status is monitored on a continuous basis. An understanding of drug pharmacokinetics (peak effect, half-life etc) and pharmacodynamics (therapeutic as well as toxic effects on organ systems) is crucial for patient safety and outcomes.

- d. *No stress reduction protocol*
Offices which do not implement a stress reduction protocol are at greater risk for complications. A significant percentage of emergencies occur as a direct result of stress to the patient.