Day 1

Introduction to Minimal Sedation
Clinically-Useful Pharmacology
Patient Assessment
Pharmacology of Oral Sedatives
Keeping Patients Safe: Flumazenil & Naloxone

Day 2

Oral Sedation Protocols
Beyond Sedation: Appropriate Analgesic Prescribing
Physiological Monitoring
What’s in Your Emergency Kit and Why?
Minimal Sedation Regulations
Our Clinicians:

**Dr. Jason Goodchild** received his undergraduate degree from Dickson College in Carlisle, Pennsylvania. He went on to receive his dental training at the University of Pennsylvania School of Dental Medicine (Philadelphia, PA). He is currently the Director of Clinical Affairs at Premier Dental Products Company (Plymouth Meeting, PA) involved in developing and educating dentists on new materials and techniques to improve clinical practice. He is also Adjunct Associate Professor in the Department of Diagnostic Sciences at Creighton University School of Dentistry (Omaha, NE), and Adjunct Assistant Professor in the Department of Diagnostic Sciences at the Rutgers School of Dental Medicine (Newark, NJ). Dr. Goodchild has published numerous peer-reviewed articles and lectures internationally on the topics of treatment planning, treatment of medical complex dental patients, restorative dentistry, pharmacology, emergency medicine in dentistry, enteral sedation dentistry, and dental photography. He has been an invited speaker for the Academy of General Dentistry and American Association of Dental Examiners. He is a reviewer for the Journal of the American Dental Association, General Dentistry, Compendium, and Quintessence International. Dr. Goodchild maintains a private general dental practice in Havertown, PA.

**Dr. Mark Donaldson** received his baccalaureate degree from the University of British Columbia and his Doctorate in Clinical Pharmacy from the University of Washington. He completed a residency at Vancouver General Hospital, and has practiced as a clinical pharmacy specialist, clinical coordinator and director of pharmacy services at many healthcare organizations in both Canada and the United States. He is currently the Senior Executive Director, Pharmacy Advisory Solutions for Vizient, in Whitefish, Montana. Dr. Donaldson is a Clinical Professor in the Department of Pharmacy at the University of Montana in Missoula, Clinical Associate Professor in the School of Dentistry at the Oregon Health & Sciences University in Portland, Oregon and Adjunct Professor, in the Faculty of Dentistry at the University of British Columbia. He has a special interest in dental pharmacology and has lectured internationally to both dental and medical practitioners. He has spent the last 18 years focusing on dental pharmacology and dental therapeutics, and is a leader in the field. Dr. Donaldson has published numerous peer-reviewed works and textbook chapters. He currently serves on the Editorial Boards for the Journal of the American Dental Association, Compendium and ACHE Healthcare. He is board certified in healthcare management and was the 2016 recipient of the Dr. Thaddeus V. Weclew Award. This award is conferred upon an individual who has made outstanding contributions to the art and science of dentistry and/or enhanced the principles and ideals of the Academy of General Dentistry.
Mastering Adult Minimal Sedation: Oral and Inhalational Techniques
Jason H. Goodchild, DMD

Why is this talk important to you?
- Oral sedation is a hot topic in dentistry
- You may see advertisements for CE courses
- Your patients might see or hear advertisements for oral sedation
- It works!

Updates to the ADA Sedation and Anesthesia Guidelines: (first introduced in 1971)
- 2005: Anxiolysis & Conscious Sedation
- 2007: Minimal & Moderate Sedation
- 2012: They updated some definitions
- 2016: Updated Guidelines!

The course manual is intended to follow the agenda and slides.
Additional information and reference reading is given in your workbooks!
**Definitions**  
(Source: ADA teaching and use guidelines for sedation and general anesthesia, October 2016)

**Enteral** – any technique of administration in which the agent is absorbed through the gastrointestinal (GI) tract (i.e., oral, rectal, sublingual)

**Parenteral** – a technique of administration in which the drug bypasses the gastrointestinal (GI) tract (i.e., IM, IV, intranasal, SM, SC, IO)

**Minimal Sedation** - a minimally depressed level of consciousness, produced by a pharmacological method, that retains the patient's ability to independently and continuously maintain an airway and respond NORMALLY to TACTILE stimulation AND verbal command. Although cognitive function and coordination may be modestly impaired, ventilatory and cardiovascular functions are unaffected.

**Dosing for minimal sedation via the enteral route** – minimal sedation may be achieved by the administration of a drug, either singly or in divided doses, by the enteral route to achieved the desired clinical effect, not to exceed the maximum recommended dose. Minimal Sedation

**Nitrous oxide/oxygen** when used in conjunction with sedative agent(s) may produce minimal, moderate, deep sedation, or general anesthesia

**Teaching Minimal and Moderate Sedation**
- Nitrous oxide / oxygen sedation: 14 hrs with clinical component
- Minimal Sedation: 16 hrs plus clinically oriented experiences
- Moderate Sedation (either enteral or parenteral): 60 hrs plus administration of sedation for at least 20 individually managed patients

**Important Point:** The ADA makes Guidelines but your State Dental Boards make the Rules! – READ YOUR STATE RULES & REGULATIONS!

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**Other Notes or Questions to Ask:**

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Case Example...

C.O. 46 yo female

- Tx Plan: Complete extractions and insertion of full upper and lower immediate dentures
- Tx length: 5 hours
- MHx:
  - MVP with regurgitation
  - No meds
  - No Known Drug Allergies (NKDA)
  - Patient smokes 1 ppd x 25 years
- Preoperative Vitals
  - BP 127/82 mmHg
  - Pulse 80 bpm
  - SpO₂ 98%

Drug Regimen:
Triazolam 0.50 mg total

Why Oral Sedation?
- Many people require additional measures to minimize anxiety and fear
- Anxious and fearful patients underserved
  - Costs to the patient are typically less than IV sedation or general anesthesia
  - How many people in need? Up to 100M?

Other Notes or Questions to Ask:
- Not enough O.S. & Anesthesiologists. Out of approximately 190,000 dentists in the US, only 10,000 are OS and DA.


Source: American Society of Anesthesiologists. Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia (last amended on October 15, 2014) Available at: www.asahq.org

Other Notes or Questions to Ask:

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Clinically-Useful Pharmacology

Pharmacology is a broad term encompassing the overall study of drugs. The answer to the question, “What Happens When Drugs Enter the Body?” is explained by two branches of pharmacology:

1. **Pharmacokinetics** deals specifically with the absorption of drugs from the outside environment, the distribution to their site of action within the body, their metabolism within the body, and finally their excretion.

2. **Pharmacodynamics** studies the interaction of the drug with the receptors at the site of action.

Once we gain an understanding of the pharmacodynamics and pharmacokinetics, we will concern ourselves with selecting those drugs which are most appropriate for our desired clinical results. Pharmacotherapeutics involves the study of choosing drugs for their desired actions in selective situations.

Patient response to medications can be represented by a bell-shape population curve where about 70% or one standard deviation will demonstrate the intended effect at a particular dose. As we extrapolate this curve out to two and even three standard deviations, we begin to recognize the “outliers”, also referred to as hyper- and hypo-responders: those individuals requiring either much less or much more of the same medication in order to elicit the desired effect. Protocols are very useful to capture the majority of the general population; however, the outliers require a slightly higher level of expertise and experience to determine the most appropriate dosing scheme. This section looks at how to recognize and treat these “outliers”, and more importantly, how to ensure you always practice within the safest possible dosing ranges. Remember our oath, “First, do no harm.”


Remember: the **HYPER Responder** is fairly easy to recognize preoperatively based on:

- Past Medical History
- Underlying Medical Condition(s)
- Current Medications
- Genetics

In the case of a sedation appointment, a preoperative protocol can account for this since a small amount of medication may be administered prior to the appointment. In general, always stick with the mantra: “Go Low, Go Slow!”

**Other Notes or Questions to Ask:**
Conversely, a significant percentage of patients are hypo-responders after normal or average doses of medications. These patients may require larger than normal doses of medications to achieve a desired effect. Many factors can contribute to a patient’s hypo-response to medication. Again in some sedation cases a combination of factors may culminate to antagonize the clinical effects of sedative drugs leaving the patient needing more medication to tolerate dental treatment.

The **HYPO Responder** is more difficult to recognize preoperatively, but can be inferred if the patient has evidence of the following clues:

- High Anxiety
- Liver Enzyme Inducers
- High Degree of Body Fat
- Use of Stimulants (caffeine, nicotine, others)
- Past History of Drug Abuse
- Psychiatric Conditions
- Not Following the Preoperative Protocol
- Genetics

**What is Pharmacogenomics? = Pharmacology + Genetics**

Since mapping the human genome this new branch of science truly represents the future of medicine since we have the opportunity to prescribe the right drug at the right dose, *the first time* without needlessly exposing patients to the side effects of medications through inappropriate initial dosing. We will be able to individualized pharmacotherapy based on every individual’s genetic make up, thus revolutionizing medicine. Every individual does have a unique genetic predisposition to drug effects and by marrying a patient’s genetic information with a drug’s pharmacological information we can improve outcomes in our patients.

Roche Molecular Diagnostics developed the world’s first pharmacogenomic microarray designed for clinical applications. It provides comprehensive coverage of gene variations and is intended to be an aid for physicians in individualizing treatment doses for patients on therapeutics metabolized through these genes. This tool has now been cleared for in vitro diagnostic use in both the United States and the European Union.

**Other Notes or Questions to Ask:**
Genetics and Dentistry?


The clinical implications of this type of testing and screening are tremendous. A laboratory capable of genetic analysis can complete the test in 8 hours using a standard blood sample and the cost of the test to the laboratory is about $500. The question that still remains, however, is whether it will be covered by insurance carriers. Oncotype DX is a test that examines a breast cancer patient's tumor tissue at a molecular level, and gives information about her individual disease. This information can help tailor treatment for her breast cancer. Oncotype DX is the first and only gene expression test that has been accepted as demonstrating the ability to predict a patient's benefit from chemotherapy as well as her risk of recurrence (http://www.genomichealth.com).

Absorption of oral medications occurs in the gastrointestinal tract, specifically the small intestine where most drugs cross the phospholipid bilayer via passive diffusion. Others may be only partially removed from the circulation. The following drugs show poor bioavailability when given orally due to extensive first-pass hepatic elimination:

A small portion of medications and their metabolites may also undergo a cycle of biliary secretion from the liver through the bile duct and back into the small intestine. Here the molecules are either excreted via passage onto the large intestine, or they may be reabsorbed by the small intestine traveling back to the liver via the portal vein again. This cycle is known as enterohepatic circulation.

Pharmacokinetics vs. Pharmacodynamics

Kinetics refers to what the body does to a drug; Dynamics refers to what the drug does to the body. More specifically, Pharmacokinetics is the sequence of events which influence a drug’s ability to reach the receptor in sufficient quantity and for sufficient duration of time. Pharmacokinetics consists of:

Absorption, Distribution, Metabolism, Elimination

Other Notes or Questions to Ask:
Absorption

The route of administration is the principle factor which governs rate by which a drug reaches its receptors in sufficient quantity.

- Intravenous (IV) is the fastest route with onset usually within 1 minute.
- Inhalation is almost as fast as IV, administered as a vapor or gas through the pulmonary alveoli in the lungs.
- Subcutaneous and Intramuscular (IM) are similar and require approximately 30 minutes to reach the blood stream. Absorption is largely governed by how much blood flow is present to allow drug to be carried away. Large volumes cannot be given.
- Enteric routes (oral and rectal) are the slowest way of introducing drugs into the blood stream. Oral ingestion of drug usually requires about 1 hour before effects are discerned.
- Sublingual (SL) has rapid onset, no first-pass effect, but not all drugs can be absorbed this way.

Bioavailability

Bioavailability is the physiological availability of a given amount of a drug. Regardless of the route of administration, usually only a fraction of unchanged drug reaches the systemic circulation:

<table>
<thead>
<tr>
<th>Route of Administration</th>
<th>Bioavailability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intravenous</td>
<td>100% by definition</td>
</tr>
<tr>
<td>Intramuscular</td>
<td>75 to &lt; 100%</td>
</tr>
<tr>
<td>Subcutaneous</td>
<td>75 to &lt; 100%</td>
</tr>
<tr>
<td>Oral</td>
<td>5 to &lt; 100%</td>
</tr>
<tr>
<td>Sublingual</td>
<td>more than oral</td>
</tr>
<tr>
<td>Rectal</td>
<td>30 to &lt; 100%</td>
</tr>
<tr>
<td>Inhalation</td>
<td>75 to &lt; 100%</td>
</tr>
<tr>
<td>Transdermal</td>
<td>80 to &lt; 100%</td>
</tr>
</tbody>
</table>

The extent of absorption is affected by such factors as: the lipophilicity of the drug; pH-dependent active transport; gut metabolism by bacteria; p-glycoprotein pump and the dissolution of some tablets.

Most drugs are given orally and are absorbed via passive diffusion through cell membranes of the GI tract. These membranes are composed of a lipid bilayer, so the drug’s lipid solubility is crucial for absorption and distribution. Only uncharged drug is lipid soluble.

Other Notes or Questions to Ask:

http://bestdentalCE.com
But do you really care about “pH-dependent active transport”?

Principles of Local Anesthetics

**pKₐ**
- All LA are weak bases with a pKₐ range of 7.7-8.9.
- All LA molecules exist in 2 states:
  1. **Cation**, positively charged species – impermeable to cells.
  2. **A free base, uncharged** – readily penetrates connective tissues and lipid-rich membranes.

\[ \text{RNH}^+ \rightleftharpoons \text{RN} + \text{H}^+ \]

Principles of Local Anesthetics

**pKₐ**
- When pH=pKₐ, then the proportion of the two species is 50:50.
- If pKₐ, or pH of the surrounding environment then a greater proportion of the charged form will exist.

\[ \text{RNH}^+ \rightleftharpoons \text{RN} + \text{H}^+ \]

This may explain in part why it is more difficult to get a patient numb when they have an abscess and the microenvironment in that area has a lower pH than normal.

Should I Buffer Local Anesthetic? How? The easy answer to should I – YES! How is a bit more difficult...

- OnPharma (elegant but expensive)
- By-Hand (super cheap but tedious)
- Anutra Local Anesthetic Delivery System (brand new, not enough information)

1. Less sting or pinch on injection
   a. Buffered pH (closer to 7.4)
   b. CO₂ at tip of the needle
2. Improves lipid solubility (uncharged form dominates)
   a. Faster onset
   b. More profound anesthesia
   c. More forgiving for mandibular blocks
3. May work better in infected areas
   a. Low pH situations

Can We Buffer Local Anesthetics By Hand? (9:1 anesthetic to sodium bicarbonate ratio)

- 50mL vial of 8.4% Sodium Bicarbonate (approx. $9)
- ½ cc 28G x ½” needle (Box of 100 @ $29.99)

**Buffering Conclusions**
- Easy to do and may decrease onset, decrease injection pain, and improve efficacy (Lidocaine only?)
- Can be done by hand or via Onpharma mixing device.

**Other Notes or Questions to Ask:**

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Differences in Bicarbonate?

<table>
<thead>
<tr>
<th>Bicarbonate</th>
<th>Mean pH</th>
<th>±</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Bicarbonate</td>
<td>8.12</td>
<td>0.13</td>
</tr>
<tr>
<td>Onpharma Sodium Bicarbonate</td>
<td>8.11</td>
<td>0.11</td>
</tr>
</tbody>
</table>

pH testing of sodium bicarbonate used to buffer local anesthetic solutions: 50mL vial of 8.4% Sodium Bicarbonate inj., USP ( Hospira Inc, Lot#: R1-143-EV) and Onpharma Sodium Bicarbonate inj., 8.4%, USP; Neutralizing Additive Solution (Irvine, Ca, Lot#: W0007128 and W0007163).

Goodchild JH, Donaldson M. Compendium 2015
Absorption Effected By:
- Presence of food in the stomach – inhibits absorption
- Mucosal surface area – less surface area will inhibit absorption
- Gastric emptying time – slower emptying time will inhibit absorption
- pH of the tissues – antacids inhibit absorption
- Dosage form of the drug – lipophilic or lipophobic
- Drug inactivation – p450 enzyme complex
- Bioavailability of the drug – plasma protein binding

Drug distribution is often thought of in terms of compartments too, where highly lipophilic drugs cross readily from the plasma compartment to tissue compartments such as the brain. The Blood-Brain Barrier for example, is not a true “barrier”, but more like a selective gatekeeper for highly lipophilic medications whose site of action is the central nervous system.

Distribution Effected By:
- Number of drug binding sites on the protein
- Protein concentration
- Weak acids are bound more extensively than weak bases
- Competing molecules
- Disease

Metabolism:

Drugs are chemically transformed by the body to make them more water soluble, and thus more easily excreted. The primary organ of metabolism for the oral sedative medications is the liver (although some similar enzymes exist in the cells of the gastrointestinal mucosa). The enzyme complexes in the liver chemically transform the medication molecules into either active or inactive metabolites. These enzymes are known as the Cytochrome P450 (CYP450) family of enzymes.

Other Notes or Questions to Ask:


“Increasing the pH of lidocaine reduced pain and improved patient comfort and satisfaction. No adverse events were reported. Therefore, increasing the pH of commercial lidocaine solutions with bicarbonate immediately prior to their use should be considered.”
Drugs can act as either substrates for these enzymes, inducers or inhibitors, and these differences are the basis for drug interactions and the interpatient variability of responses to medication.

Drugs that enter the body parenterally can also be metabolized in the liver, but not until a certain proportion of the drug has had the opportunity to act at the site of action, in the case of sedative agents this would be the central nervous system (CNS). This accounts for the faster onset of action of parenterally administered drugs since the “first-pass effect” is essentially bypassed. This is also true for medications administered via the inhalation, rectal, topical and submucosal routes.

**Metabolism Effected By:**
Individual differences in metabolic rate (genetic polymorphism); Age of the patient (consider the very young and the very old); Liver disease (impairment of enzyme activity or defective formation of enzymes); Cardiac disease (by limiting blood flow to the liver may impair rate of metabolism); Pulmonary disease (especially in the case of inhaled medications); Endocrine dysfunction (hypothyroid patients have a slowed metabolism versus hyperthyroid patients who have a revved up metabolism); Drug interactions (inhibition or induction); Cigarette smokers metabolize some drugs more rapidly than nonsmokers because of enzyme induction.

**Cytochrome P450 3A4**
Metabolism determines blood levels of active drug and therefore, predictability of response.

**Other Notes or Questions to Ask:**
Elimination:

Renal clearance is the major pathway of elimination for most drugs and their metabolites. In fact, the role of the liver in metabolism is to generally convert lipophilic (fat-soluble) molecules into more hydrophilic (water-soluble) molecules for easier excretion via the kidneys. Elimination can also occur via the bile and feces. Sometimes an active metabolite is formed from metabolism and can target the kidney as it is eliminated. Such is the case with Ciprofloxacin, which is used to treat urinary tract infections.

Factors affecting elimination include:

- Age
- Drug Half-Life
- Liver Function
- Compartment Models
- Kidney Disease

This becomes important when considering that different drugs are cleared from the body at different rates, and are therefore dosed differently and with different frequency. In terms of pharmacokinetics, we can then determine the half-life of a drug so that we may dose a patient appropriately. Half-life indicates the time it takes to attain 50% of steady state blood level. After one half-life, one half of the drug in the system will have been eliminated. After four half-lives, greater than 90% of drug in the system will have been eliminated:

100% divided by 2 = 50% (after one half life 50% of a drug has been cleared)
50% divided by 2 = 25% (after 2 half lives 75% of a drug has been cleared)
25% divided by 2 = 12.5% (after 3 half lives 87.5% of a drug has been cleared)
12.5% divided by 2 = 6.25% (after 4 half lives > 90% of a drug has been cleared)

The binding of drugs to receptors cannot be quantified, so clinically we describe a drugs’ therapeutic level in terms of plasma levels. The therapeutic level for a drug is the plasma concentration at which we know a majority of the population will have a desired clinical effect. Although, there is a wide interpatient variability

Other Notes or Questions to Ask:
in response to medications, referenced plasma levels of medications help us guide treatment and are recorded as a balance between dose per unit time and factors which will decrease the level of active drug (metabolism, excretion, dilution). Plasma levels of drugs are always changing.

A **Steady-state** can be achieved when the rate of drug accumulation in a body is equal to the rate of elimination. This is also achievable if identical multiple doses of drug are given every half-life: relatively constant levels will be produced after 4 half-lives.

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**Pharmacodynamics**

*Pharmacodynamics* studies the interaction of a drug with a receptor at the site of action. Receptor occupancy explains the response of drugs. Binding to receptors is usually reversible and falls into one of two categories: agonists and antagonists. Agonists have an affinity for receptors and their binding to these receptors leads to the effect and efficacy of the medication. An antagonist only has an affinity for binding to the receptor, but this interaction does not illicit a response and it therefore it antagonizes or blocks an active drug from combining to the receptor and causing an effect.

As we age we may have enhanced sensitivity to drugs due to: changes in receptor numbers; changes in receptor affinity or; alterations in the processes after a drug binds a receptor. For example, the elderly are more sensitive to benzodiazepines, more sensitive to the analgesic effects of narcotics and they have enhanced response to anticoagulants such as warfarin and heparin. In general, elderly patients require a reduction in sedative drug dosage.


Changes in receptor numbers or affinity can also lead to alterations in the processes after a drug binds a receptor. Drug interactions further compound the unpredictability of pharmacodynamics as they too can be: antagonistic (theophylline & propranolol) or synergistic (warfarin and aspirin, benzodiazepines and opiates).

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**Other Notes or Questions to Ask:**
Medical Assessment of Dental Patients

The challenge for practicing dentists is to evaluate the stability of patients in order to provide safe dental care.

Medical Clearance Does Not Clear the Patient or Dentist of Risks

- "Medical Clearance" is when a dentist requests clearance from an assessing physician before performing treatment on a patient
- Cardiovascular risk is the number one reason to request medical clearance, but other risks that call for medical clearance include congestive heart failure, pulmonary embolism, anticoagulation, obesity, and high blood pressure
- Medical clearance is a misnomer because it implies that the patient is cleared and there are no risks
- No patient is free of risk when undergoing a procedure. The goals of the assessment are to determine the level of risk and to identify opportunities to mitigate risk—with the surgeon and the assessing physician working in concert
- The decision about whether to proceed with the operation belongs to the surgeon and the patient

“Unfortunately, many dentists erroneously believe they can limit their liability by requesting ‘medical clearance’ for a procedure.”

“Regardless of whether the dentist requests or the physician provides ‘medical clearance,’ it does not shift liability for the treatment rendered by the dentist from the dentist to the consulting physician.”

“The physician provides information; the dentist makes the decisions on appropriate dental care.”

Reference: JADA 2012;143(11):1180-1

Other Notes or Questions to Ask:
TEN FOOT POLE PATIENTS: Those patients that, because of their medical history or dental condition, can be risky to treat!

Focusing on Medical History, who are they? Some possible examples:
- Recent Heart Attack or Stroke
- Recent Cardiac Stent
- On Anticoagulant or Antiplatelet
- Uncontrolled Diabetes
- Undergoing Chemotherapy
- Pregnancy
- Illicit Drug Users/Abusers

**Recent Heart Attack or Stroke** *(JADA 2012;143(11):1190-98.)*
- How long do I have to wait to treat?
- Myocardial Infarction
  - Complicated MI = 6 month or more
  - Uncomplicated MI = 1 month
- Stroke
  - Unstable = emergent care only
  - Stable = 1 month
- Tips for safer appointments
  - Short, morning appts
  - Stress mitigation
  - Control risk factors (BP, drug interactions, hemostasis)
  - Monitor vital signs
  - Judicious use of vasoconstrictors

**Recent Cardiac Stents** *(JADA 2008;139(1):3S-24S.)*
- Do I need to give antibiotic prophylaxis? Generally, NO!
- Indicated if treatment to be performed within the first 30 days after insertion
- May be useful when treating acute dental infection, regardless of time since placement
- Do not stop/interrupt antiplatelet agents
- Also, applies to pacemakers

Other Notes or Questions to Ask:
**Anticoagulants and Antiplatelets** *(JADA 2003;134:1492-7.)*

- Assess underlying medical stability
- In general, do not interrupt anticoagulants or antiplatelets unless procedure involves potential for moderate/severe bleeding
  - Platelets > 150,000 mcL (Plavix, Brilinta, Effient, ASA)
- Risk/Benefit ratio often indicates it is safer to treat patients on these medications and control bleeding with local measures
- INR ≤ 3.5 may receive conservative dental care
- INR does not apply to newer anticoagulants (eg, Pradaxa, Xarelto, Eliquis, etc.)

**Uncontrolled Diabetes** *(JADA 2003;134 suppl 1:24S-33S)*

- Assess stability (BG, HgA1c)
- Comorbid diseases (CV, Neuropathy, Kidney dz, delayed wound healing, etc)
- Medication regimen and prevention of hypoglycemia
- Emergent care only, consider Abx prophylaxis if HgA1c ≥ 9%

**Patient Undergoing Chemotherapy** *(Burket’s Oral Medicine 2014, p. 201-10.)*

- Level of immune suppression (WBC, ANC)
- Abx prophylaxis may be necessary
- Drug interactions (eg, bisphosphonates)
- Palliation of xerostomia and oropharyngeal pain
- Bleeding risk?

**Pregnancy** *(JADA 2012;143(8):858-71.)*

- Dentistry is usually safe during pregnancy
- Be mindful of patient positioning
- Safest local anesthetic = Lidocaine WITH epi (or prilocaine)
- Radiographs are ok with appropriate shielding
- Pain medications (Tylenol with opioid) and Abx (penicillins, Z-pak, clindamycin) are ok
“A physician cannot ‘clear’ a patient for treatment.”

“A physician’s advice and recommendation may be helpful in managing a dental patient, but the responsibility to provide safe and appropriate care lies ultimately with the oral health-care provider.”

Other Notes or Questions to Ask:
Dentists are faced with several problems that make risk assessment difficult:

- Patients are getting older
- Patients are retaining their teeth later in life
- More ambulatory patients with medical conditions
- More patients on polypharmacology

More patients will present to the dental office with chronic medical conditions:

- $153$ billion in lost production each year due to chronic disease
- 27 million people visit a dentist and not a physician each year
- Screening for chronic diseases in dental offices could reduce U.S. health care costs by $102.6$ million per year or...$37.72$ per patient screened

American Journal of Public Health: April 2014, Vol. 104, No. 4, pp. 744-
Question...Do your patients tell you the truth on the medical history questionnaire?

<table>
<thead>
<tr>
<th>Reasons noted for refusing to reveal information on a health history form</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unimportant information</td>
<td>17%</td>
</tr>
<tr>
<td>Privacy</td>
<td>62%</td>
</tr>
<tr>
<td>Afraid of refusal of treatment</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>14%</td>
</tr>
</tbody>
</table>

23% of respondents would be reluctant to note current drug abuse on a dental history questionnaire!

10% of respondents believed that dental health professionals do not need to be fully aware of a patient’s health status!


Other Notes or Questions to Ask:
**Medical History Questionnaire**
- Screening for medical problems
- Monitoring medical conditions
- Assessing and evaluating medical conditions and diseases that may create risks to the dental patient
- Assessing and evaluating modifications to dental care
- Verify history with verbal interview

**ASA Physical Status Classification**

1. A normal healthy patient
2. A patient with a mild systemic disease
3. A patient with a severe systemic disease that limits activity, but is not incapacitating.
4. A patient with an incapacitating systemic disease that is a constant threat to life.
5. A moribund patient not expected to survive 24 hours with or without operation.
6. A declared brain-dead patient whose organs are being removed for donor purposes

In the event of an emergency, precede the number with an "e"

**ASA Physical Status Classification.** American Society of Anesthesiologists. Available at: www.asahq.org/clinical/physical status.htm

**Limitations of ASA Classifications**

- Devised in 1941 as a statistical tool for retrospective analysis of hospital records; the ASA physical status classification was revised in 1961 (JAMA;178:261-6).
- Originally, ASA classification was not intended to assign “operative risk”, but merely to describe the “physical status” of a patient prior to an operation.

**Limitations of ASA Classifications**

The classification makes no adjustments for:
- Age
- Sex
- Weight
- Pregnancy
- Type of operation
- Type of anesthesia
- Skill or training or surgeon

Therefore, the same assignment of “risk” cannot be given to a single patient undergoing different surgical procedures

**Other Notes or Questions to Ask:**
ASA Classification Examples

ASA 1: Patient without systemic disease; a normal, healthy patient

ASA 2: Patient with mild systemic disease

- Type II Diabetes Mellitus
- Controlled or exercise induced asthma
- Controlled epilepsy
- Controlled HTN

ASA 3: Patient with severe systemic disease that limits activity but is non-incapacitating

- Stable angina
- Myocardial infarction or Stroke (>6 mos)
- Type 1 Diabetes Mellitus
- Congestive Heart Failure (CHF)
- Chronic Obstructive Pulmonary Disease (COPD)
- Uncontrolled asthma
- BP > 160/95

ASA 4: Patient with an incapacitating systemic disease that is a constant threat to life

- Myocardial infarction or Stroke (<6 mos)
- Unstable angina
- BP > 200/115
- CHF or COPD on O₂
- Uncontrolled epilepsy
- Uncontrolled Diabetes Mellitus

ASA 5: Moribund pt. who is not expected to survive 24 hours with or without an operation

- Ruptured aortic aneurysm
- Massive pulmonary embolism

ASA 6: A declared brain dead pt. whose organs are being removed for donor purposes

An “E” can be assigned to any classification to denote emergency status

Other Notes or Questions to Ask:
Medical Risk Assessment for Dentistry

Operative Risk should be assigned based on:
- Medical Complexity (Controlled vs. Uncontrolled)
- Potential severity of adverse events
  - None
  - Minor
  - Major
- Potential modifications needed (e.g. before, during, and/or after)

Medical Complexity Status

<table>
<thead>
<tr>
<th>MC-o</th>
<th>No significant medical problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC-1A</td>
<td>Controlled and stable condition/disease</td>
</tr>
<tr>
<td></td>
<td>No anticipated complications</td>
</tr>
<tr>
<td>MC-1B</td>
<td>Controlled and stable condition/disease</td>
</tr>
<tr>
<td></td>
<td>Anticipated/possible minor complications</td>
</tr>
<tr>
<td>MC-1C</td>
<td>Controlled and stable condition/disease</td>
</tr>
<tr>
<td></td>
<td>Anticipated/possible major complications</td>
</tr>
<tr>
<td>MC-2A</td>
<td>Poorly controlled and/or unstable condition/disease</td>
</tr>
<tr>
<td></td>
<td>No anticipated complications</td>
</tr>
<tr>
<td>MC-2B</td>
<td>Poorly controlled and/or unstable condition/disease</td>
</tr>
<tr>
<td></td>
<td>Anticipated/possible minor complications</td>
</tr>
<tr>
<td>MC-2C</td>
<td>Poorly controlled and/or unstable condition/disease</td>
</tr>
<tr>
<td></td>
<td>Anticipated/possible major complications</td>
</tr>
<tr>
<td>MC-3</td>
<td>Cardiac or other conditions needing continuous monitoring</td>
</tr>
</tbody>
</table>


Potential for Adverse Events

1. Drug actions and interactions of medication patients are taking and oral sedative given by the dentist
2. Patient’s ability to withstand the stress of dental care
3. Patient’s ability to achieve hemostasis
4. Patient’s susceptibility to infections

Modification of dental care or when to institute changes to protocol

- Before Treatment
- During Treatment
- After Treatment

Setting or the most appropriate place to treat

- Patient can be treated as an out-patient in a general dental office
- Patient can be treated as an out-patient in a hospital dental setting
- Patient requires continuous monitoring in an operating room or short-procedure unit

Other Notes or Questions to Ask:
Pharmacology of Sedatives and Reversal Agents

Anxiolysis is a minimal level of sedation whereby the patient has decreased anxiety to facilitate coping skills while retaining interaction ability. Conscious sedation is a moderate level of sedation whereby the patient retains their protective reflexes as well as their own airway, and can respond to physical and verbal stimuli.

The Spectrum of Anesthesia

- **Normal**: Protective reflexes intact, patient can independently and continuously maintain an airway, patient can respond appropriately to verbal commands.
- **Minimal Sedation**: Partial loss of protective reflexes, inability to independently maintain an airway, may not respond to verbal commands.
- **Moderate Sedation**: Loss of protective reflexes, inability to independently maintain an airway, no pain sensation or reflex withdrawal from stimuli, total unconsciousness.

Relationship Between Efficacy and Safety for Anesthesia and Sedation

- **General Anesthesia**: Moderate to deep sedation, no protective reflexes, total unconsciousness, possibility of mortality.
- **Deep Sedation**: Moderate sedation, loss of protective reflexes but ability to independently maintain an airway.
- **Moderate Sedation**: Consciousness, ability to independently maintain an airway.
- **Minimal Sedation**: Consciousness, ability to independently maintain an airway.
- **Normal**: Consciousness, ability to independently maintain an airway.

Parenteral vs. Enteral Sedation

**Parenteral**
- IV, IM, SC
- No “First-Pass” effect
- Drug effect is rapid
- Adverse effects can be rapid
- Requires specialty training
- Patient acceptance?

**Enteral**
- Oral, SL, rectal
- Long latency period
- “First-pass” effect
- Presentation of adverse effects is slow
- Lower incidence of adverse effects
- Requires less specialty training
- Patient acceptance?

All things considered equal, the lower the sedation level, the less chance for a serious adverse event to occur. The adage, “go low and go slow” is an excellent philosophy for the practice of sedating dental patients.


Other Notes or Questions to Ask:
**Who is a candidate for oral sedation?**

<table>
<thead>
<tr>
<th>Good</th>
<th>Difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Pts who have difficulty achieving profound local anesthesia</td>
<td>➢ Pts with complex medical histories</td>
</tr>
<tr>
<td>➢ Gaggers</td>
<td>➢ Pts taking medications which may cause adverse reactions</td>
</tr>
<tr>
<td>➢ Fearful or anxious patients</td>
<td>➢ Severely depressed patients</td>
</tr>
<tr>
<td>➢ Pts needing longer procedures</td>
<td>➢ Pts with a severe mental handicap</td>
</tr>
<tr>
<td>➢ Helpful with invasive procedures</td>
<td>➢ Pregnant patients</td>
</tr>
</tbody>
</table>

---


<table>
<thead>
<tr>
<th>Role</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentists</td>
<td>1:260,000</td>
</tr>
<tr>
<td>Physicians</td>
<td>1:248,000</td>
</tr>
<tr>
<td>Single Operator/Anesthetist</td>
<td>1:143,000</td>
</tr>
<tr>
<td>One Operator &amp; One Anesthetist</td>
<td>1:598,000</td>
</tr>
<tr>
<td>Conscious Sedation</td>
<td>1:1,000,000</td>
</tr>
</tbody>
</table>

- patient died on a motorcycle later the same day
- this study was pre pulse oximeter usage


---

**The Drugs**

The goal of conscious sedation dentistry is to create a patient who is calm, and comfortable enough to receive dental care, and who can maintain a patent airway without assistance. Medications used for anxiolysis or conscious sedation should carry an inherent margin of safety such that overdose or unconsciousness is unlikely.

Because there are many medications that are anxiolytic (reduces anxiety) and hypnotic (involves the induction and increase of sleep duration), there may be instances that alternate regimens may be indicated. The decision to use drugs other than triazolam should be based on the practitioners’ level of training and should take into account many factors. The factors that may influence drug selection include:

- Medical History
- Drug interactions
- Allergies
- Length of appointment
- Depth of sedation needed
- Adverse reactions

---

**Other Notes or Questions to Ask:**
Anxiolytic and Sedative agents are not new to the practice of medicine. Alcohols have been used for centuries to “numb” the mind to both painful as well as anxiety producing procedures. The use of opium has been traced back to Ancient Egypt. In the nineteenth century, drugs such as bromide (1853), chloral hydrate, paraldehyde, urethane and sulfonal (all pre-1970) were employed with varying degrees of success. Early in the twentieth century, the barbiturates were discovered (Barbital – 1903 and Phenobarbital – 1912), and the age of modern anesthesia was born. While these early drugs were effective, their level of safety was questionable.

Safety of a given medication can be measured pharmacologically by determining the **Lethal Dose 50 (LD50)**. The LD50 is that dose of a given drug that will result in mortality of 50% of the population when administered. Likewise, the **Effective Dose 50 (ED50)** is the dose of a given drug that will cause the desired results in 50% of a population. The two terms can be related to one another by the Therapeutic Index (TI = LD50/ED50), which is a relative measurement of drug safety. The greater the Therapeutic Index of a drug, the greater the margin of safety.

Chloral Hydrate, a drug that has been used as a sedative for over a century, when compared to a drug in the benzodiazepine class (Diazepam - early 1960s), is an example of the lower degree of safety as demonstrated by drugs of the past. One of the attributes that make newer classes of drugs safer than those in the past is their ability to more selectively depress areas of the central nervous system that affect consciousness. Most anxiolytic and sedative agents, if given in inappropriate doses, have the capacity to elicit undesired effects, including coma and death.

**Chloral Hydrate Induced Arrhythmias**

<table>
<thead>
<tr>
<th>Age</th>
<th>Dose (grams)</th>
<th>Arrhythmia</th>
<th>Cardiac Arrest</th>
<th>Antiarry. Drug Res.</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.5</td>
<td>PVC</td>
<td>No</td>
<td>No</td>
<td>Survived</td>
</tr>
<tr>
<td>9</td>
<td>0.6</td>
<td>SVT</td>
<td>No</td>
<td>Yes</td>
<td>Survived</td>
</tr>
<tr>
<td>17</td>
<td>14</td>
<td>PVC, VT</td>
<td>No</td>
<td>Yes</td>
<td>Survived</td>
</tr>
<tr>
<td>19</td>
<td>17.5</td>
<td>PVC, VF</td>
<td>Yes</td>
<td>Yes</td>
<td>Survived</td>
</tr>
<tr>
<td>21</td>
<td>20</td>
<td>VT</td>
<td>No</td>
<td>No</td>
<td>Survived</td>
</tr>
<tr>
<td>29</td>
<td>10</td>
<td>PVC, VT</td>
<td>No</td>
<td>-</td>
<td>Survived</td>
</tr>
<tr>
<td>32</td>
<td>20</td>
<td>PVC, VF</td>
<td>Yes</td>
<td>-</td>
<td>Survived</td>
</tr>
<tr>
<td>33</td>
<td>40</td>
<td>PVC</td>
<td>Yes</td>
<td>-</td>
<td>Died</td>
</tr>
</tbody>
</table>

In large doses it shortens the cardiac refractory period and may sensitize heart to circulating catecholamines. *Jastak. JADA 1988 (vol.116)*

**Chloral Hydrate vs Diazepam**

*Margin of Safety*  

In large doses it shortens the cardiac refractory period and may sensitize heart to circulating catecholamines.
**Chlordiazepoxide** (1957) was the first drug in the benzodiazepine class to be synthesized. The benzodiazepines, being more selective in their effects on the central nervous system, are much less likely to induce coma and death; therefore they have a much higher LD50 and Therapeutic Index than drugs in other anxiolytic/sedative classes.

**The “Ideal” Oral Agent should have the following properties:**
- Fast onset
- No adverse effects – large margin of safety (respiratory, cardiovascular, others)
- “Short” acting (for office use)
- Anxiolytic with some amnesic properties
- Reversal agent available

**Benzodiazepines meet these requirements and have the following properties:**
- Sedative-Hypnotic
- Muscle Relaxant
- Anxiolytic
- Anticonvulsant
- Antidepressant
- Anterograde Amnesia

**Medications for Oral Conscious Sedation**

The family of medications most commonly used for oral conscious sedation is the benzodiazepines. They were first introduced in the early 1960’s, and are among the most widely prescribed drugs in the world. Like members of your own family they are closely related and share very similar properties due to a common mechanism of action on the gamma amino butyric acid (GABA) receptors in the brain. These GABA receptors are the neuromodulators responsible for levels of alertness, so the shared pharmacological property of this family of drugs denotes them as sedatives or hypnotics: they cause relaxation, can induce sleep and may even allow for post-hypnotic suggestions. The interaction of the benzodiazepines at the GABA molecule occurs in the limbic, thalamic and hypothalamic levels of the CNS. Specific high-affinity benzodiazepine receptors have been identified. When the benzodiazepine and GABA molecules interact, a macromolecular complex is formed. The complex results in an influx of chloride ions as the chloride ionophore channel in the nerve axon increases in diameter, causing hyperpolarization, and an associated new resting membrane potential.

**Other Notes or Questions to Ask:**
To further the familial analogy, these medications still maintain their own uniqueness despite their underlying similarity. Each medication may or may not have active metabolites, such as diazepam (Valium), and their individual plasma half-lives and mean peak concentrations vary among agents, which gives rise to different medication properties. It is only through experience that practitioners learn how to match the best medication and dose with each clinical situation and patient.

**The Benzodiazepine Family of Medications**

All of the benzodiazepine drugs have a similar chemical structure:

**Benzodiazepines**

- **Macromolecular Complex**
- **Neuron Action Potentials**

Other Notes or Questions to Ask:
**Diazepam (Valium)**
- Produces mild sleep and mild amnesia
- Onset: 30-60 minutes
- Half-Life: 50 hours (20-100) due to active metabolites
- Duration of action can be >8 hours
- Supplied in 2, 5, and 10 mg tablets
- Usual Dosage is 2-40 mg
- FDA approved anxiolytic
- High Lipid Solubility

Indications for use of diazepam as listed in the Physicians’ Desk Reference (PDR):
- Preoperative anxiolytic
- Night-time sleep (hypnotic)
- Anticonvulsant

**THE BLOOD-BRAIN BARRIER**

A complex group of blood-brain barrier mechanisms closely controls both the kinds of substances which enter the extra-cellular space of the brain and the rate at which they enter. This mechanism is not a true “barrier” but acts like a selective gatekeeper, and comprises both anatomical structures and physiological transport systems which handle different classes of substances in different ways. The blood-brain barrier mechanisms precisely regulate the chemical composition of the extra-cellular space of the brain and prevent harmful substances from reaching neural tissue, and gives rise to a second and third compartment model for the benzodiazepines.

**Lorazepam (Ativan)**
- Produces mild/moderate sleep with moderate amnesia
- Onset: 60-120 minutes
- Half-Life: 10-20 hours
- No active metabolites
- Duration: 6-8 hours
- Supplied in 0.5, 1, and 2 mg tablets
- Dosage: 2-(6) mg
- Moderate Lipid Solubility

Other Notes or Questions to Ask:
Indications for use of lorazepam as listed in the Physicians’ Desk Reference (PDR):
- Preoperative anxiolytic
- Night-time sleep (hypnotic)
- Anticonvulsant

**Triazolam (Halcion)**
- No active metabolites
- Plasma half-life is 1.5 – 2.5 hours
- Wide effective dose range
- Mean peak concentration is achieved at 1.3 hours
- Has anticonvulsant properties – can be used with the epileptic patient
- May act as a respiratory depressant at very high doses (greater than 2mg)
- Relaxation for adequate pain control – important for hard to numb patients
- Does not cause nausea (unlike nitrous oxide)
- **LD₅₀** is 5 grams per kilogram in rats (very safe)

Respiratory depression represents the principal negative that is introduced with conscious sedation and left unrecognized and untreated is the cause of the most serious complication!

Indications for use of triazolam as listed in the Physicians’ Desk Reference (PDR):
- Preoperative sedation
- Night-time sleep
- Onset: 1 hour
- Peak effect: 1.3 hours
- Duration: 2-3 hours

Dosage (PDR):
- Adult: 0.5 mg Healthy adult
- Elderly or debilitated: 0.125 mg
- Always use the lowest effective dose
- Child: Safety and efficacy not tested for patients below the age of 18


**Other Notes or Questions to Ask:**
**Midazolam (Versed)**
- Produces moderate sleep and high amnesia
- Onset: 15-30 minutes
- Half-Life: 1.5 - 5 hrs.
- No active metabolites
- Duration: 1 hr.
- Supplied in 118 ml bottles, each mL contains 2mg midazolam
- Dosage: 0.25 to 0.75 mg/kg in children >6 months (relative maximum at 10 mg)
- High Lipid Solubility
- Not an FDA approved anxiolytic

Indications for use of midazolam as listed in the Physicians' Desk Reference (PDR):
- Preoperative anxiolytic
- Night-time sleep (hypnotic)
- Anticonvulsant


*Goodchild JH and Donaldson M. Calculating and justifying total anxiolytic doses of medications for in-office use. General Dentistry 2006 Jan-Feb;54-57.*

**Other Medications (non-Benzodiazepines)**

**Zaleplon** is a pyrazolopyrimidine, differing in structure from the benzodiazepines but still acting selectively at the benzodiazepine receptor. The benefits of this medication are in producing sedation without many of the other effects seen with benzodiazepines. It has modest anxiolytic, myorelaxant, and anticonvulsant properties. Significant drug interactions are uncommon, and synergy with ethanol does not occur. Patients with zaleplon overdose generally do well with supportive care alone. Overdose information for zaleplon is limited and no fatalities have been reported with ingestions of up to 100 mg. Adverse effects with therapeutic use include anterograde amnesia and transient visual hallucinations. Other non-benzodiazepines include Eszopiclone (Lunesta), Zopiclone (Imovane) and Zolpidem (Ambien).

**Other Notes or Questions to Ask:**
Zaleplon (Sonata, Starnoc)
- Produces high sleep with only mild amnesia
- Onset: 30 minutes
- Half-Life: 1-2 hours
- No active metabolites
- Duration: up to 6 hours
- Supplied in 5 and 10 mg capsules
- Dosage: 10 mg (start at 5mg in the elderly or patients with liver disease)
- Overdosage can be treated with flumazenil
- Not an FDA approved anxiolytic (approved for treatment of insomnia in adults only)

Cautions:
- hypersensitivity to zaleplon products
- depressed patients
- elderly or debilitated patients
- hepatic or severe renal impairment
- compromised respiratory condition
- concurrent use of alcohol
- tartrazine sensitivity
- Coadministration with the following medications can effect metabolism: cimetidine, digoxin, and rifampin (diphenhydramine may augment zaleplon’s effects)
- Pregnancy: risk category C

<table>
<thead>
<tr>
<th>Drug</th>
<th>Lipid Solubility</th>
<th>Onset (mins)</th>
<th>T1/2 (hrs)</th>
<th>Site of Metabolism</th>
<th>Active Metabolite</th>
<th>Working Time (hrs)</th>
<th>Usual Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diazepam</td>
<td>High</td>
<td>30-60</td>
<td>&gt;24</td>
<td>CYP 1A2, 2C8, 2C19, 3A3-4</td>
<td>Yes</td>
<td>n/a</td>
<td>2-40 mg per day</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>Moderate</td>
<td>60-120</td>
<td>10-20</td>
<td>Hepatic glucuronidation</td>
<td>No</td>
<td>4</td>
<td>2-6 mg</td>
</tr>
<tr>
<td>Triazolam</td>
<td>High</td>
<td>15-30</td>
<td>1.5-2.5</td>
<td>CYP 3A4, 5-7</td>
<td>No</td>
<td>2</td>
<td>0.125-0.25 mg</td>
</tr>
<tr>
<td>Midazolam</td>
<td>High</td>
<td>0 (IM) 15-30 (PO)</td>
<td>1.5-5</td>
<td>CYP 3A3-5</td>
<td>No</td>
<td>1</td>
<td>0.25-0.75 mg/kg</td>
</tr>
<tr>
<td>Zaleplon</td>
<td>Moderate</td>
<td>30</td>
<td>1-2</td>
<td>Aldehyde oxidase, CYP 3A4</td>
<td>No</td>
<td>1</td>
<td>10-20 mg</td>
</tr>
</tbody>
</table>


Other Notes or Questions to Ask:
Triazolam is a near ideal sedative agent due to its pharmacological properties, which make it not only highly effective for dental sedation purposes, but it also comes with a high margin of safety.

**Triazolam: Cautions and Contraindications** (Nearly all of these cautions and contraindications apply to all benzodiazepines):

**Absolute Contraindications**
- Known hypersensitivity
- Pregnancy – benzodiazepines are known teratogens (esp. 1st trimester)
- Lack of Knowledge
- Inability to resuscitate
- Concurrent with CYP3A4 inhibitors: grapefruit juice, ketoconazole, itraconazole, nefazodone, cimetidine, and macrolide antibiotics

**Relative Contraindications**
(Risk benefit should be considered when the following medical conditions exist)
- Alcohol intoxication – additive CNS
- Glaucoma
- Drug abuse or dependence
- Pediatric patients
- Elderly (oversedation, dizziness, or impaired coordination)
- Psychiatric patients
- Renal impairment
- Severe hepatic impairment
- Lactating patients

**Precautions**
- Cardiovascular Disease (tachycardia 0.5%)
- Patients on Steroids (stimulation, mania, increased agitational state)
- Potential Drug Interactions: alcohol & CNS depressants
- Potential Herb Interactions: golu kola, kava, melatonin, SAMe, St. John’s Wort, valerian (may increase CNS depression)
- Food may decrease the rate of absorption

**Other Notes or Questions to Ask:**
“Triazolam is chemically related to diazepam and is used for the short-term treatment of insomnia. Its rapid onset, short duration of action, and lack of active metabolites also makes it a near ideal anti-anxiety medication for dental patients”.


**Benzodiazepine Reversal Agent**

**Flumazenil** (Romazicon® in U.S., Anexate® in Canada):

- First clinical trials done in 1979
- Displaces BDZ's from their receptor site, reversing their sedative action
- Onset of reversal after I.V. injections is 1-2 minutes (neutral ligand)
- Duration of effect depends on the dose of flumazenil and the dose of the BDZ
- Adult dose is 0.2mg q1min up to 5 doses

Flumazenil, a nonspecific competitive antagonist of the benzodiazepine receptor, is used for reversal of benzodiazepine-induced sedation, and overdose. It binds to GABA-receptor sites, but has no agonist activity.

*** It is not recommended for routine reversal as seizures and cardiac dysrhythmias can occur with flumazenil administration, and although the majority of these effects are uncommon and well tolerated. Co-ingestion of drugs with proconvulsant properties is associated with an increased risk of seizures, presumably due to loss of the benzodiazepine’s protective anticonvulsant effect when the antagonist is administered. Combined overdose of benzodiazepines with tricyclic antidepressants accounts for 50% of these seizures. Coingestants possessing prodysrhythmic properties, such as carbamazepine or chloral hydrate, may increase the likelihood of cardiac effects by a similar mechanism.

*** Although flumazenil reverses benzodiazepine-induced sedation, it does not consistently reverse respiratory depression. The initial adult dose of flumazenil is 0.2 mg given intravenously over 30 seconds. A second dose of 0.2 mg may be given, followed by 0.2mg doses at 45-60 second intervals, to a total of 1mg in twenty minutes. Most patients will respond to less than 1 mg.

**Other Notes or Questions to Ask:**
*** In children, the initial dose is 0.01 mg/kg.

*** Because the duration of action of flumazenil is short (40-80 minutes), resedation occurs in up to 65% of patients and requires either redosing or continuous infusion (0.25 to 1.0 mg/hr).

**In summary, flumazenil should be used for selected patients with significant symptoms from a known benzodiazepine overdose, and not routinely used on patients following an oral sedation procedure.**

**Flumazenil** -- Other points to note are:

1. Insoluble in water
2. Slightly soluble in acidic solutions
3. Dilute concentration of 0.1mg/mL
4. 5 mL and 10 mL vials
5. One hour duration (triazolam’s half-life is about 2 hours so patients could re-sedate)
6. Can be given sublingual in the canine to first molar area, 2-3 mm under the mucosa, not in the midline
7. Buy the 5mL vials and be aware of expiry dates!

Contraindications:
- Known hypersensitivity to benzodiazepines
- Patients with known seizure disorders treated with a benzodiazepine

Several studies support the use of flumazenil in the treatment of benzodiazepine overdose. :

✓ “Respiratory depression mediated by benzodiazepines can be reversed using the specific antagonist flumazenil (Romazicon). It can be titrated intravenously or injected sublingually in 0.2 mg increments every 2-3 minutes, up to 1 mg. Flumazenil should not be administered to patients with a history of seizure disorder or dependence on benzodiazepines.”

✓ “Clinical trials using flumazenil to reverse the CNS depression associated with intravenous diazepam sedation for third molar extractions have demonstrated its efficacy.”

✓ “Although intended for intravenous administration in 0.2 mg increments up to 1 mg, it may be injected submucosally as well.”

**Other Notes or Questions to Ask:**
“Intraoral submucosal injection of flumazenil appears to be a viable concept based upon the following findings. The drug is rapidly and complete absorbed into the systemic circulation, as evidenced by comparable serum concentrations to those obtained by IV administration.”

Dionne R, Phero J, Becker D; Management of Pain and Anxiety in the Dental Office. WB Saunders 2002;18:289


Some Definitions

- **Synergism:** When two or more drugs with similar pharmacologic effects act together to produce a greater effect than either drug alone. Synergism can either be additive or potentiating.
  
  - **Additive:** The combined drug effects are essentially the algebraic sum of their individual effects (e.g. $1 + 1 = 2$).
  
  - **Potentiating:** The combined drug effects are greater than the sum of their individual effects (e.g. $1 + 1 > 2$).

**Antihistamines**

There are several other drugs that are effective for oral sedation, but don’t fall into the previous drug classes that have been discussed. The H1-receptor antagonist hydroxyzine (Atarax) has both sedative and hypnotic properties. The OTC anti-histamine diphenhydramine (Benadryl) have hypnotic properties and can be an inexpensive and safe adjunct to sedation. Both Atarax and Benadryl are useful in allergic rhinitis and urticaria, and are antiemetic.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Trade Name</th>
<th>Half-Life (hrs)</th>
<th>Dose Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphenhydramine</td>
<td>Benadryl</td>
<td>2-8</td>
<td>25-50 mg</td>
</tr>
<tr>
<td>Dimenhydrinate</td>
<td>Dramamine</td>
<td>4-6</td>
<td>50-100 mg</td>
</tr>
<tr>
<td>Hydroxyzine</td>
<td>Atarax, Vistaril</td>
<td>3-7</td>
<td>50-100 mg</td>
</tr>
<tr>
<td>Promethazine</td>
<td>Phenergan</td>
<td>2-6</td>
<td>25-50 mg</td>
</tr>
</tbody>
</table>

**Other Notes or Questions to Ask:**
Hydroxyzine (Atarax or Vistaril)

- Diphenylmethylene, unrelated to benzodiazepines, phenothiazines, or opiates
- H1-receptor antagonist
- Bronchodilator
- Antisialogogue (anticholinergic)
- Antiarrhythmic
- Anxiolytic
- Even at high doses produces minimal CV and respiratory depression
- High therapeutic index
- Produces moderate sleep with no amnesia
- Antihistaminic, Decongestant, and Anti-emetic actions
- Onset: 1 hour
- Half-Life: 3-7 hours
- No active metabolites
- Duration: 3-6 hours
- Supplied in 10, 25, and 100 mg tablets and a 10mg/5mL syrup
- Dosage: Adults 50-100 mg, Children 10-50 mg
- Overdosage: No specific antidote
- FDA approved anxiolytic and as a pre- and postoperative adjunctive medication

Contraindications:
- Early Pregnancy
- Known Hypersensitivity
- Nursing Mothers
- Children <1 year
- Acute narrow angle glaucoma
- Use with other CNS depressants cautiously

Nitrous Oxide

“I am sure the air in heaven must be this wonder working gas of delight”
- Robert Southey, about Nitrous Oxide

Historical Perspective

The discovery of nitrous oxide (and also oxygen) is credited to Joseph Priestley in 1793. During experiments with iron filings, ammonium nitrate, and water, he found that a residual gas was given off which later became known as nitrous oxide.

\[
\text{NH}_4\text{NO}_3 + \text{H}_2\text{O} + \text{Fe} \rightarrow \text{N}_2\text{O} + \text{Fe(OH)}_2 + \text{H}_2\text{O}
\]

Other Notes or Questions to Ask:
Ammonium nitrate is heated in the presence of iron filings. The resultant gas is then passed through water to remove toxic by-products. The result is nitrous oxide.

The first to person to inhale pure nitrous oxide was Humphrey Davy (at the Pneumatic Institute in Bristol, England), in 1798. At that time, nitrous oxide (N₂O) was thought to be responsible for many diseases, however after breathing the gas he reported a euphoric feeling, and "overwhelming joy."

For the first half of the 19th century, the analgesic properties of N₂O went unnoticed and nitrous was widely used as a recreational drug. It was not until the mid-1840’s that a dentist named Horace Wells while attending a demonstration was exposed to N₂O. During this demonstration a man named Samuel Cooley, after inhaling the gas, injured his leg. Dr. Wells noticed that Mr. Cooley appeared to be unaware of the injury to his leg, and he instantly envisioned the gas as an adjunct to the field of dentistry. Horace Wells in fact became the first person to have a tooth extracted while under N₂O anesthesia.

Dental schools began teaching inhalation anesthesia in the early 1960’s and it is estimated that “56% of GP’s and 85% of oral surgeons” use N₂O in their practice today.

Advantages of Combination Oral-Inhalation Sedation

♦ Decreased dose required of either medication alone
♦ Decreased overall side effects
♦ Potentiation vs Synergy
Flumazenil (Romazicon in U.S., Anexate in Canada):

Flumazenil, a nonspecific competitive antagonist of the benzodiazepine receptor, is used for reversal of benzodiazepine-induced sedation, conscious sedation, and overdose. It binds to GABA-receptor sites, but has no agonist activity. In the emergency room it can quickly confirm a clinical diagnosis, thereby obviating the need for time-consuming and expensive interventions. In the dental office, with patients undergoing conscious sedation with benzodiazepines, it speeds return to baseline alertness in emergency situations.

It is not recommended for routine reversal as seizures and cardiac dysrhythmias can occur with flumazenil administration, and although the majority of these effects are well tolerated, fatalities have been reported. Coingestion of drugs with proconvulsant properties is associated with an increased risk of seizures, presumably due to loss of the benzodiazepine’s protective anticonvulsant effect when the antagonist is administered. Combined overdose of benzodiazepines with tricyclic antidepressants accounts for 50% of these seizures. Coingestants possessing prodysrhythmic properties, such as carbamazepine or chloral hydrate, may increase the likelihood of cardiac effects by a similar mechanism.

Because the mechanism of action is specific to the benzodiazepine receptor in the central nervous system, other medications that work via this receptor can also be reversed with this antagonist. Examples include zolpidem (Ambien), zopiclone (Imovane), eszopiclone (Lunesta) and zaleplon (Sonata, Starnoc).

Contraindications:
- Known hypersensitivity to benzodiazepines
- Patients with known seizure disorders treated with a benzodiazepine

Other Notes or Questions to Ask:
Although flumazenil reverses benzodiazepine-induced sedation, it does not consistently reverse respiratory depression. The initial adult dose of flumazenil is 0.2 mg given intravenously over 30 seconds. A second dose of 0.2 mg may be given, followed by 0.2 mg doses at 1-minute intervals, to a total of 1 mg in twenty minutes. Most patients will respond to less than 1 mg. In children, the initial dose is 0.01 mg/kg. Because the duration of action of flumazenil is short (0.7 to 1.3 hours), re-sedation occurs in up to 65% of patients and requires either re-dosing or continuous infusion (0.25 to 1.0 mg/hr).

In summary, flumazenil should be used for selected patients with significant symptoms from a known benzodiazepine overdose and not routinely used in patients with altered mental status. Other points to note are:

2. Insoluble in water
3. Slightly soluble in acidic solutions
4. Dilute concentration of 0.1 mg/mL
5. 5 mL and 10 mL vial
6. One hour duration (triazolam’s half-life is about 2 hours so patients could re-sedate)
7. Can be given sublingual in the canine to first molar area, 2-3 mm under the mucosa, not in the midline
8. Buy the 5 mL vials and be aware of expiry dates!
Growing Body of Evidence: References with Summaries


PURPOSE: The purpose of this study was to examine intralingual (IL) and submucosal (SM) delivery of flumazenil as viable alternatives to immediate intravenous (IV) administration for reversing benzodiazepine sedation in an animal model. METHODS: A dog animal model was chosen based upon comparable body weight to children (12-17 kg) and the ease of oral access in this species. Research design was a non-randomized matched pair study. This type of "before and-after study" allowed the dogs to receive 3 different routes of flumazenil administration (IV, IL, and SM) following an initial dose of midazolam (0.5 mg/kg IV). Blood samples were obtained (at 0, 2, 4, 8, 15, and 30 minutes) for high performance liquid chromatography (HPLC) analysis of flumazenil and midazolam, and oxygen saturation values were recorded. RESULTS: Both IL and SM delivery of flumazenil were determined to be viable alternatives to immediate IV administration for reversing benzodiazepine-induced oxygen saturation (SaO2) desaturation. For flumazenil to be able to reverse the SaO2 desaturation, the plasma levels must be greater than 5ng/ml, which was exceeded by IL and SM drug delivery. CONCLUSION: In a benzodiazepine-induced desaturation, the submucosal and intralingual routes are viable alternatives to intravenous administration of flumazenil in an animal model.


PURPOSE: This study was performed to determine the bioavailability and local tissue toxicological safety of flumazenil (Romazicon) when administered by oral submucosal (SM) as opposed to intravenous (i.v.) injection. METHODS: Six dogs each received SM flumazenil (0.2mg), and their serum was collected at predetermined time intervals (0-2 h) and frozen (-70 degrees C). Seven days later, the dogs received an identical dose of i.v. flumazenil, and serum samples were again collected, as above. Comparative quantitation of flumazenil levels (i.v. vs.SM) was made using a sensitive HPLC assay (UV detection). Direct/local drug toxicity was visually scored by unbiased raters of color photographs (test and control mucosa) taken at 1, 2, and 7 days following SM flumazenil injection. An oral pathologist examined slides processed from control and treatment tissues (hematoxylin and eosin staining) taken (punch biopsy) 1 week following SM injection to compare with direct clinical scores. RESULTS: Serum flumazenil levels reached a plateau (8.5 +/- 1.5 ng/mL, mean +/- SD) within 4 min of SM drug injection and declined thereafter to -2 ng/mL by 2 h. Bioavailability of SM flumazenil was 101 +/- 14%, based upon measuring the area under the serum concentration-time curves over 1.5 h (AUC 0-1.5 h, SM vs. i.v. drug). Thus, serum drug levels following SM drug administration were broadly comparable to those obtained during the elimination phase of corresponding i.v. drug delivery. Regarding drug tissue toxicity, no evidence of direct drug toxicity was observed by unbiased raters of color photographs (test and control mucosa) taken at 1, 2, and 7 days following SM flumazenil injection. Following pathologic review, no difference was seen in the degree of inflammation between treatment and control tissue. CONCLUSION: At the quantity and concentration used, SM drug flumazenil administration appears to be both a safe and a viable alternative to bolus i.v. drug delivery and worthy of further investigation.


OBJECTIVE: To determine whether flumazenil, a drug used to reverse benzodiazepine-induced respiratory depression and approved only for i.v. use, is effective by alternative routes. METHODS: A randomized, controlled, nonblinded, crossover canine trial was performed to evaluate reversal of midazolam-induced respiratory depression by flumazenil when administered by alternative routes. Mongrel dogs were sedated with thiopental 19 mg/kg i.v., then tracheally intubated. With the dogs spontaneously breathing, tidal

Other Notes or Questions to Ask:
volume, end-tidal CO2, and O2 saturation were observed until a stable baseline was achieved. Incremental doses of midazolam were administered until respiratory depression (30% decline in tidal volume, 10% decrease in O2 saturation, and 15% increase in end-tidal CO2) occurred. Flumazenil was administered by a randomly selected route [0.2 mg followed 1 minute later by 0.3 mg i.v., sublingual (s.l.) or intramuscular (i.m.); or 1 mg followed 1 minute later by 1.5 mg per rectum (PR)]. Time to return to baseline respiratory functions was recorded ("time to reversal"). Each of 10 dogs was studied using all 4 routes of flumazenil administration with a washout period of at least 7 days. An additional dog served as a control (no flumazenil).

RESULTS: The control time to reversal was 1,620 seconds. The i.v. route was significantly faster (mean 120 +/- 24.5 sec) than the other 3 routes (p<0.005). The SL route was the second fastest (mean 262 +/- 94.5 sec), the IM route was the third fastest (mean 310 +/- 133.7 sec) and the PR route was the slowest (mean 342 +/- 84.4 sec). The SL, IM, and PR routes did not differ significantly from one another. CONCLUSIONS: Flumazenil administered by all 4 routes reversed midazolam-induced respiratory depression in a dog model. For the selected dosages used, the i.v. route was significantly faster than all 3 other routes, and SL was the second fastest.


In an open design, randomised, two-way cross-over study, a single 2 mg i.v. dose and a single 30mg oral dose of flumazenil were each administered to a group of healthy young (n = 6) and elderly (n = 12) volunteers (male: female 2/1). Plasma samples were collected at intervals and intact drug was assayed. Both the i.v. and oral doses of flumazenil were well tolerated by both age groups and no severe or unexpected adverse effects were observed. The main complaints were dizziness and headache, mainly after oral dosing, probably due to the higher Cmax and AUC following this route of administration. After 2 mg i.v. the disposition parameters in the two age groups (elderly/young) were very similar: volume of distribution (Vss): 0.88/0.90 L/kg; total body clearance (ClPL): 0.86/0.99 L/min; terminal elimination half-life (t1/2 beta): 1.02/0.91 h. After the 30 mg oral dose the mean Cmax of 87.6 ng/mL (elderly) and 78.4 ng/mL (young) were generally reached within 0.5 to 1 h. In 26% (elderly) and 23% (young), the absolute bioavailability of flumazenil was very similar. It is concluded that the absorption and disposition parameters of flumazenil were not significantly affected by aging.


Triazolam is increasing in popularity as a premedication prescribed by dentists to help their fearful and anxious patients tolerate the potentially aversive nature of some dental procedures. Recent anecdotal reports suggest that incremental sublingual dosing of triazolam may be an effective technique for producing conscious sedation in the dental setting. Although promising, no laboratory or clinical data have been available to evaluate the efficacy or safety of this approach. This study was designed to determine the pharmacokinetics and sedative effects of incremental sublingual dosing of triazolam (total, 1.0 mg) in healthy adults. Ten healthy adult volunteers received sublingual triazolam (0.25 mg) followed by additional doses after 60 (0.50 mg) and 90 (0.25 mg) minutes. Plasma triazolam concentrations, clinical effects (Observer's Assessment of Alertness/Sedation score), and processed electroencephalogram (bispectral index score) were measured intermittently for 3 hours. Plasma triazolam concentrations (mean +/- SD, 5.1 +/- 1.1 ng/mL) and drug effects (Observer's Assessment of Alertness/Sedation score, 2 +/- 1; and the bispectral index score, 62 +/- 16) were greatest in all subjects at the end of the 3-hour evaluation period. Eight of the subjects had Observer's Assessment of Alertness/Sedation scores consistent with the definition of deep sedation or general anesthesia (Observer's Assessment of Alertness/Sedation score, <3) at some of the later time points in the 180 minutes of data collection. In comparison, 4 of the subjects had bispectral index scores less than 60 during these later time points of data collection. Given the considerable intersubject variability in triazolam concentrations and effects, additional research is needed to assess this multidosing strategy before it can be endorsed as a useful and safe sedation technique for managing fearful and anxious patients in dental practice.

Other Notes or Questions to Ask:
Can we make sedation even safer?

- Start with intrinsically safe medications that have the best evidence for use.
- Ensure that you and your staff are well-educated, trained and up to date with your certifications (BLS, HCPBLS, ILS, PALS, ACLS).
- Practice, practice, practice
- Monitoring will keep your patients safer too: Blood pressure, pulse, heart rate, oxygen saturation (pulse oximetry).
- Regardless, you need to know what to look for clinically, and how your monitoring equipment works.

Other Notes or Questions to Ask:
In the blood, carbon monoxide combines with hemoglobin to form carboxyhemoglobin (COHb).

- In smokers, the amount of COHb in the blood ranges from 5-15%.
- In non-smokers the level is 0.3-1.6%.
- Affinity of carbon monoxide for hemoglobin is 200x that of oxygen.
- Causes a left shift in the oxyhemoglobin dissociation curve – more difficult for tissues to extract oxygen.
- Result is chronic tissue hypoxia – body compensates with more RBC:

Net effect = increased oxygen availability at the expense of plasma viscosity

- Currently pulse oximeters can only measure oxyhemoglobin (HbO2) and deoxyhemoglobin (HHb); carboxyhemoglobin (COHb) is not being measured.
- The pulse oximeter will grossly overestimate the oxygen saturation in chronic smokers!
- Pulse oximeter shows the combination of HbO2 + COHb, not the individual components.
- Example: Pulse oximeter reads 99% on a chronic smoker. If they have 10% COHb then the true reading of HbO2 is 89%!!!
Can we make sedation even safer?

- Bispectral Index System (BIS) Monitoring Video (courtesy of Aspect Technologies).
- Clinical Interpretation of Bispectral Analysis


And, of course, there will always be new drugs . . .

**Ramelteon (Rozerem®)**
- Approved for use by the FDA in October 2005
- First in a new drug class of melatonin receptor agonists.
- More potent than melatonin. It helps people FALL asleep, but doesn't necessarily help them STAY asleep.
- People take Rozerem 8 mg a half hour before bedtime - higher doses don't work any better.
- ONSET. Generally works within 30 minutes.
- LENGTH OF USE. Only Rozerem is NOT limited to short-term use in true insomniacs.
- DEA. Rozerem is the only anxiolytic/sedative that's NOT a controlled substance.
- COST. Less than Ambien, Sonata, or Lunesta but generics are always on the horizon.

**Other Notes or Questions to Ask:**
Naloxone (Narcan®) – Narcotic Antagonist

Indications:
• Reversal of narcotic depression including respiratory depression induced by opioids, (both natural and synthetic narcotics), propoxyphene, and narcotic-antagonist analgesics
• Diagnosis of suspected acute narcotic overdosage
• Not effective in counter-acting depression due to barbiturates, tranquilizers or other non- narcotic anesthetics or sedatives

Routes of Administration:
• IM, SC - when IV route not feasible; onset of action not as prompt as with IV and may be delayed in patients who are hypotensive and have impaired peripheral circulation
• IV direct - slowly over at least 1 minute


Dosage, Adults:
• Known or suspected overdose: 0.4-2 mg IV; if no response, repeat 2-4 mg in minutes; in cases of large narcotic overdoses, or methadone, pentazocine, propoxyphene overdose, higher doses may be required; if no response after 10 mg, reassess diagnosis; effective dose may be repeated every 20-60 minutes
• Post-operative respiratory depression: 0.1-0.2 mg at 2-3 minute intervals until desired response is obtained; repeat doses may be required at 1-2 hour intervals
• Partial reversal of opioid-associated respiratory depression in palliative patient: if respiratory rate < 6/minute, administer 0.1-0.2mg IV q2-3 minutes or 0.1-0.2mg SC q5-10minutes until respiratory rate > 10/minute. Continue to monitor respiratory rate q15minutes until no naloxone given x 1 hour.

Dosage, Children:
• Known or suspected overdose:
  • Birth to 5 yrs or 20 kg: 0.1 mg/kg/dose; repeat at 2-3 minute intervals until desired response obtained
  • > 5 yrs or > 20 kg: 2 mg; repeat as above
• Post-operative respiratory depression: 0.005-0.01 mg/kg IV repeated if necessary at 2-3 minutes intervals
• Onset of effect: within 1-2 minutes following IV, within 2-5 minutes following IM or SC
• Duration of effect: 45 minutes to 3-4 hours
• Since duration of action of narcotic agent may exceed that of naloxone, repeated doses or administration of naloxone via IV infusion may be required


Other Notes or Questions to Ask:

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**Minimal Oral Sedation Protocols**

**Anxiolysis**
A pharmacologically induced state of consciousness where an individual is awake but has decreased anxiety to facilitate coping skills, retaining interaction ability.

Anxiolysis = the elimination of anxiety

**Medications**
- Diazepam - Valium
- Zaleplon - Sonata
- Triazolam - Halcion
- Hydroxyzine - Atarax or Vistaril
- Lorazepam - Ativan
- Alprazolam - Xanax
- Nitrous Oxide - Laughing Gas
- Ramelteon - Rozerem

The same anxiolytic drug given in different doses can cause different responses. In the case of benzodiazepines, a small dose will cause anxiolysis, while larger doses may cause sedation.

---

**Other Notes or Questions to Ask:**

________________________________________________________________
________________________________________________________________
________________________________________________________________
Pre-Sedation Checklist:

- Medical history reviewed (including past anesthesia history)
- Complete Airway Evaluation (eg, Mallampati classification)
  - Difficult Airway Patients
    - Previous difficult airway
    - Obesity (BMI > 30)
    - Retrognathia, micrognathia
    - Severe Rheumatoid Arthritis (TMJ, cricoarytenoid joint)
    - Obstructive Sleep Apnea
    - Uncontrolled diabetics (with “Prayer Sign”)

Mallampati Classifications

Class 1: Entire uvula vestibule, as well as hard palate, soft palate, and tonsillar pillars are visible

Class 2: Only part of the uvula and part of the tonsillar pillars are visible

Class 3: Uvula invisible, but soft palate and hard palate remain visible

Class 4: Soft palate invisible, only hard palate remains visible

Other Notes or Questions to Ask:

________________________________________________________________
________________________________________________________________
________________________________________________________________
Pre-Sedation Checklist (continued)

- All potential drug interactions researched
  - When assessing potential drug interactions for oral sedation the two main types of interactions are: 1) Additive CNS depression, and; 2) Cytochrome p450 inhibition/induction
  - In addition to prescribed medications, interactions with herbals and nutritional supplements should be also considered
- All drug allergies or intolerances noted
- Baseline vitals taken
- Pre-operative instructions reviewed with the patient
- Dietary, habit, or medicine restrictions reviewed with the patient
- Informed consent given and signed
- Responsible companion identified for transportation to/from the appointment
- Post-operative condition is described
  - When to resume normal activity
  - When to resume eating/hydration
  - Pain management
- How to recognize a problem and when/how to contact the office

Early published directions for triazolam dental sedation...
(CDAJ 1988;54(7):511-4.)

1. The drug should be given one hour before the procedure begins
2. The drug should be administered with a small amount of water on a stomach that has been empty for at least 4 hours
3. As fear “slows” gastric emptying, it is often advantageous to administer a “night before” dose, and then treat the patient in the morning, following a restful sleep. In this case, the patient should be driven to the office for the treatment appointment.
4. Following treatment, the patient should be escorted from the office by a responsible adult companion and cautioned against operating a vehicle or similar activities for the remainder of the day.
5. Do not combine triazolam with other CNS depressants, especially ethanol
6. The drug, ideally, should be administered in the dental office with the patient being placed under observation in a recovery-type facility

According to the authors, “Doses should be individualized on the basis of age, size, anxiety, and medical history.”
Table 2. Total triazolam anxiolytic dosing guidelines (in mg).

<table>
<thead>
<tr>
<th>Weight (lb./kg)</th>
<th>18–40</th>
<th>41–64</th>
<th>65 and older</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤100/≤45</td>
<td>0.3125*</td>
<td>0.250*</td>
<td>0.1250*</td>
</tr>
<tr>
<td>110/50</td>
<td>0.3428</td>
<td>0.275</td>
<td>0.1375</td>
</tr>
<tr>
<td>120/55</td>
<td>0.3750</td>
<td>0.300</td>
<td>0.1500</td>
</tr>
<tr>
<td>130/60</td>
<td>0.4063</td>
<td>0.325</td>
<td>0.1625</td>
</tr>
<tr>
<td>140/65</td>
<td>0.4375*</td>
<td>0.350</td>
<td>0.1750</td>
</tr>
<tr>
<td>150/70</td>
<td>0.4688</td>
<td>0.375*</td>
<td>0.1875*</td>
</tr>
<tr>
<td>160/75</td>
<td>0.5000*</td>
<td>0.400</td>
<td>0.2000</td>
</tr>
<tr>
<td>170/80</td>
<td>0.5313</td>
<td>0.425</td>
<td>0.2125</td>
</tr>
<tr>
<td>180/85</td>
<td>0.5625*</td>
<td>0.450</td>
<td>0.2250</td>
</tr>
<tr>
<td>190/90</td>
<td>0.5928</td>
<td>0.475</td>
<td>0.2375</td>
</tr>
<tr>
<td>200+/95+</td>
<td>0.6250*</td>
<td>0.500*</td>
<td>0.2500*</td>
</tr>
</tbody>
</table>

*Indicates possible triazolam dosing increments, based on available tablet strength. Note: Always round down to the nearest tablet strength.

Table 3. Total lorazepam anxiolytic dosing guidelines (in mg).

<table>
<thead>
<tr>
<th>Weight (lb./kg)</th>
<th>18–40</th>
<th>41–64</th>
<th>65 and older</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤100/≤45</td>
<td>1.250*</td>
<td>1.0*</td>
<td>0.50*</td>
</tr>
<tr>
<td>110/50</td>
<td>1.375</td>
<td>1.1</td>
<td>0.55</td>
</tr>
<tr>
<td>120/55</td>
<td>1.500*</td>
<td>1.2</td>
<td>0.60</td>
</tr>
<tr>
<td>130/60</td>
<td>1.625</td>
<td>1.3</td>
<td>0.65</td>
</tr>
<tr>
<td>140/65</td>
<td>1.750*</td>
<td>1.4</td>
<td>0.70</td>
</tr>
<tr>
<td>150/70</td>
<td>1.875</td>
<td>1.5*</td>
<td>0.75*</td>
</tr>
<tr>
<td>160/75</td>
<td>2.000*</td>
<td>1.6</td>
<td>0.80</td>
</tr>
<tr>
<td>170/80</td>
<td>2.125</td>
<td>1.7</td>
<td>0.85</td>
</tr>
<tr>
<td>180/85</td>
<td>2.250*</td>
<td>1.8</td>
<td>0.90</td>
</tr>
<tr>
<td>190/90</td>
<td>2.375</td>
<td>1.9</td>
<td>0.95</td>
</tr>
<tr>
<td>200+/95+</td>
<td>2.500*</td>
<td>2.0*</td>
<td>1.00*</td>
</tr>
</tbody>
</table>

*Indicates possible lorazepam dosing increments, based on available tablet strength. Note: Always round down to the nearest tablet strength.

Goodchild JH, Donaldson M. Calculating and justifying total anxiolytic doses of medications for in-office use. General Dentistry 2006 Jan-Feb; 54-57.
Total Anxiolytic Dose is calculated by:

- Considering age, weight, and medical status

- Three age groups
  - 18-40 (dose increased by 25% to account for ↑ metabolism)
  - 41-64
  - 65+ (dose reduced dose 50% bc of sensitivity, and ↓ metabolism)

- ASA 3 patients – reduce dose on the chart by an additional 50%

- ASA 4 patients – contraindicated

- Relative potency of triazolam to lorazepam is 4:1

Case Example 1

triazolam

- 34 yo H female
- 160 lbs
- PMHx: Mitral valve prolapse (MVP) w/o regurgitation, verified by Echo 5 years ago
- No medications
- No known drug allergies
- Vitals: BP 110/65 mmHg, pulse 60 bpm

CORRECT DOSE_________________________

Case Example 2

triazolam

- 42 yo AA male
- 200 lbs
- PMHx: Asthma
- Meds: Albuterol prn
- No known drug allergies
- Vitals: BP 135/85 mmHg, pulse 100 bpm

CORRECT DOSE_________________________

Other Notes or Questions to Ask:

________________________________________________________________
________________________________________________________________
________________________________________________________________
Case Example 3

triazolam

- 65 yo male
- PMHx:
  - Type 2 Diabetes Mellitus
  - BG range 215-250 mg/dL
  - HgA1C 12%
  - Meds: glimepiride 4 mg q.d.
  - No known drug allergies
- Vitals: BP 135/82 mmHg, pulse 87 bpm, Height 6’0”, Weight 275 lbs.

CORRECT DOSE

Case Example 4

lorazepam

- 22 yo male, 160 lbs
- PMHx:
  - Inguinal hernia repair 5 years ago
  - Prolapsed mitral valve w/ regurgitation
  - Seasonal allergies
  - Meds: Fexofenadine
  - No known drug allergies
- Vitals: BP 120/75 mmHg, pulse 90 bpm

CORRECT DOSE

Case Example 5

lorazepam

- 74 yo male, 225 lbs
- PMHx: Angina (2-3 attacks/week)
- Meds:
  - Metoprolol 200 mg bid
  - Atorvastatin 20 mg qd
  - Aspirin 81 mg qd
  - Nitroglycerin prn
  - No known drug allergies
- Vitals: BP 129/85 mmHg, Pulse 80 bpm

CORRECT DOSE

Other Notes or Questions to Ask:

________________________________________________________________
________________________________________________________________
________________________________________________________________
Case Example 6
lorazepam
- 21 yo female, 140 lbs
- PMHx: Recently gave birth (3 weeks ago) and breastfeeding
- Meds:
  - Multivitamins
  - Herbal diet medication
- Allergic to PCN → hives
- Vitals: BP 105/60 mmHg, Pulse 85 bpm
- SHx: Quit smoking 9 mos. ago. Before that 1 ppd x 3 years

CORRECT DOSE

Case Example 7
lorazepam
- 58 yo male, 215 lbs
- PMHx:
  - CABG x 4
  - MVP w/ regurgitation
  - Joint replacement (Right knee and hip)
- Meds:
  - Cyclobenzaprine 10 mg
  - Viagra prn
- Allergies:
  - PCN
  - Clindamycin (intolerance)
- Vitals: BP 150/87 mmHg, Pulse 90 bpm
- SHx: Smokes 1 cigar/day x 30 yrs

CORRECT DOSE

Other Notes or Questions to Ask:
**Are there other strategies?**

- A dose of medication could be given the night before the sedation
  - May help anxious patients to relax and get to sleep
  - Establishes a blood level of the medication that can be added to the next morning
  - Reduces total drug amounts
- Incremental dosing – “oral titration” (usually not allowed without conscious sedation permit)

![Diagram showing drug effect over time](https://via.placeholder.com/150)

**What medications could be used the night before the sedation?**

- Stick with a Benzodiazepine or Hydroxyzine
- Use longer half-life drugs
- For patients who smoke, use Hydroxyzine the night before

<table>
<thead>
<tr>
<th></th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elderly/Debilitated/CNS depressants</td>
<td>Diazepam 2.5 mg</td>
</tr>
<tr>
<td>Average</td>
<td>Diazepam 5 mg</td>
</tr>
<tr>
<td>High Fear/Resistant</td>
<td>Diazepam 10 mg</td>
</tr>
</tbody>
</table>

**Other Notes or Questions to Ask:**

________________________________________________________________________

________________________________________________________________________
Incremental Oral Administration

Table 4. Protocol for incremental oral administration.  

This example is for an 8 a.m. appointment when dentistry is planned to begin at 9 a.m.

Prior to appointment: The patient (Adult ASA 1 or 2) has been evaluated by the dentist preoperatively and accepted for oral sedation dentistry; prior to appointment, the patient has received a single dose of triazolam (0.25 mg; for elderly, debilitated, or patients with potential drug interactions, 0.125 mg should be dispensed).

7:00 a.m.: The patient, having gone six hours without eating, takes 0.25 mg triazolam; a responsible companion escorts the patient to the office

8:00 a.m.: The patient arrives at the office with the companion and compliance with preoperative instructions is verified

8:03 a.m.: The patient is seated in the operatory for the beginning of continuous physiologic monitoring; at that time, the patient’s wristwatch and glasses are removed and given to a companion

8:06 a.m.: The patient is assessed for susceptibility to the sedative medication; additional medication may be provided sublingually

8:35 a.m.: The patient’s sedation state is reassessed; if additional medication is necessary, the dentist should deliver it sublingually

8:54 a.m.: Oxygen is introduced with the appropriate protocol

8:57 a.m.: Nitrous oxide is introduced with the appropriate protocol

9:00 a.m.: Local anesthesia is administered; at this point, nitrous oxide administration is terminated and dentistry begins

The above graph represents a rough kinetic model of an additional dose of triazolam (i.e., supplemental dosing) to maintain sedation for a longer dental appointment.

Pharmacokinetic modeling of oral triazolam

- F = 44%
- Dose = 0.25mg
- Vd = 70 L
- Kab = 1.5 h⁻¹
- Kel = 0.35 h⁻¹
- Number of doses = 8
- Dose interval = 2hrs

The above graph is a representation of what the plasma concentration may be after multiple doses of oral triazolam. At a dose of 0.25mg given every 2 hours, the plasma concentration approaches 2.5 μg/mL. A single 0.5mg dose typically results in plasma concentrations of approximately 4.0 μg/mL.

Other Notes or Questions to Ask:
Pre-Sedation Instructions

- NPO for 4-6 hours (clear liquids ok), exception – diabetic patients
- No CNS depressants or sedatives for 24 hours before/after (other than night-time anxiolytic prescribed by treating dentist)
  - Smokers
  - Coffee drinkers
  - Herbal diet medications (eg, Ephedra)
  - Herbal medications
    - (eg, Kava Kava, Valerian, Chamomile, Melatonin, St. John’s Wort)
  - Nutritional supplements
- No chance of pregnancy (triazolam is pregnancy factor X)
- No allergies to the sedative medications (possible, but very rare)
- Must have a responsible person to bring them to the office and take them home (no exceptions!)
- No contact lenses (anticholinergic effects → dry eyes)
- No driving for 24 hours after the sedation appointment
- Because of prolonged psychomotor impairment - No operating hazardous machinery
- No heavy lifting (balance disturbances)
- No stairs without assistance (balance disturbances)
- No important decisions (amnesia)

Reminders

- Always remember the definition of anxiolysis...pt is conscious, responds to verbal commands, patent airway at all times
- Patients may respond that they are still awake (“You are an excellent patient”)
- Do not treat any patient that has a questionable or complex medical history! (ASA 1 and 2, ASA 3 with possible medication consult)
- Sedation patients are never left unattended
- If a reversal agent for any reason, no additional sedative should be administered, and the patient should be monitored for the appropriate time (at least 1 hour)

Patient Dismissal

Patient readiness for discharge needs to be addressed in a simple, clear, reproducible manner that meets accepted guidelines

Aldrete Score (Phase 1 discharge)
Postanesthesia Discharge Scoring System (PADSS)

Other Notes or Questions to Ask:

________________________________________________________________
________________________________________________________________
________________________________________________________________
Aldrete Scoring System
Designed for assessment of patients for Phase 1 discharge (i.e., discharge from ICU or post-anesthesia care unit.

Aldrete’s score is not intended to determine home-readiness.

The modified PADSS differs from its original form by not including oral intake of fluids as a criterion for discharge.

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Other Notes or Questions to Ask:

________________________________________________________________
________________________________________________________________
________________________________________________________________

Aldrete Scoring System

- Activity
  - Can move voluntarily on command
  - 2 = 4 extremities
  - 1 = 2 extremities
  - 0 = 0 extremities

- Consciousness
  - 2 = Fully awake
  - 1 = Arousable by calling
  - 0 = Not responding

- Respiration
  - 2 = Can deep-breathe and cough freely
  - 1 = Dyspnea, shallow, or limited breathing
  - 0 = Apneic

- Color
  - 2 = Normal
  - 1 = Pale, dusky, blotchy
  - 0 = Cyanotic

- Circulation
  - Pre-operative BP (mmHg)
  - 2 = +/- 20 mmHg of baseline
  - 1 = +/- 20-50 mmHg from baseline
  - 0 = +/- 50 mmHg from baseline

A score of 10 is ready for discharge.


Modified Postanesthesia Discharge Scoring System (MPADSS)

- Vital Signs
  - 2 = Within 20% of pre-operative value
  - 1 = 20-40% of pre-operative value
  - 0 = 40% of pre-operative value

- Pain
  - 2 = Minimal
  - 1 = Moderate
  - 0 = Severe

- Ambulation
  - 2 = Steady gait / no dizziness
  - 1 = With assistance
  - 0 = none / dizziness

- Surgical bleeding
  - 2 = Minimal
  - 1 = Moderate
  - 0 = Severe

- Nasal/Oral Vomiting
  - 2 = Minimal
  - 1 = Moderate
  - 0 = Severe

The total score is 10. With patients scoring ≥ 10 considered fit for discharge home.

Patient Dismissal
The patient is always escorted by their companion, or a team member, while walking in the office

Team member helps companion assist (or via wheelchair/companion chair) patient into departing vehicle

Patient is taken directly home

Make follow-up calls to all patients that night and remind them to hydrate

Unconditional positive regard (always be encouraging!)

Review all post-operative instructions with the patient’s companion

Flumazenil should not routinely be used to aid in patient dismissal (short duration and possible re-sedation)

A Second Single Dose Appointment
Adjust on the following variables:

- Pt. Good/office good = Rx remains the same
- Pt. Good/office bad = Rx adjustment by increasing or decreasing dosage appropriately
- Pt. Bad/office bad = reassess for referral (different type of sedation) or test appt. with adjustments to protocol

Dr. Fred Quarnstrom’s
Triazolam Manual
http://faculty.washington.edu/quarn/halciindex.html

Dose (mg) = 0.25mg + 0.125mg
(for every 70lb weight increase > 40lbs)

Therefore mean dose = 0.005mg/lb
or 0.5mg for 180-pound man

- Dosing is simple (based on the “Q-factor”)
- Good body of evidence reporting it’s successful use
- Does not require the same “risks” and costs you may be currently undertaking

Other Notes or Questions to Ask:
Inadequate Sedation
Nitrous Oxide Supplementation

Some Important Caveats to Remember:

. . . Increased number of drugs lowers safety . . .

. . . Respiration most likely source of anesthetic mishap . . .

. . . Be careful not to practice beyond your Level of Training . . .

Other Notes or Questions to Ask:
Better Medicine, Better Dentistry: Appropriate Analgesic Prescribing

Classification of Pain: Most Americans experience three or four types of pain per year. There are over 50 million Americans partially or totally disable by pain with an annual cost to the system of $336 billion (American Academy of Pain Medicine 2015). The goals of therapy for pain are to decrease the intensity, increase physical activity, appropriate use of medications, regulation of sleep patterns and moods, as well as reestablishing work habits.

Acute pain has a treatment goal of a cure. Most of the symptoms associated with chronic pain are not present. Chronic pain often results in dependence and tolerance, psychological component is a major problem, a significant environmental change and family involvement and insomnia. The treatment goal for chronic pain is rehabilitation, not a cure.

Treatment may involve one or more of the following pain management options: Physical, Psychological or Pharmacological. Physical management involves exercise, cutaneous stimulation, repositioning and counterstimulation (acupuncture). Psychological management involves relaxation techniques, patient education support groups and meditation. Pharmacological management involves non-opioid analgesics, opioid analgesics and co-analgesic medications.

Dentists write approximately 20 million prescriptions for analgesics annually in U.S.. The major indication in dentistry is to manage postoperative pain, requiring a prescription of only a few days duration. Most often the challenge is to give high enough doses over a few short days to cover the inflammatory period, without putting the patient at risk of adverse sequelae. Although the cornerstone of these prescriptions focus on the non-opioid analgesics and opioid analgesics, it is important to remember that most pain of dental origin is due to the inflammatory process, which is why non-steroidal antiinflammatory drugs (NSAIDs) make the most sense for treatment. Opioid-based medications act centrally and do not have antiinflammatory properties.

The Drug Armamentarium: We will discuss pharmacological pain management by dividing the discussion into Peripheral Analgesics (non-opioid analgesics), Central Analgesics (opioid analgesics), Co-Analgesics and Local Anesthetics.

**Analgesics used for Postoperative Dental Pain**

- Acetaminophen - Tylenol
- Aspirin - Aspirin (various)
- Ibuprofen - Advil, Motrin, Nuprin
- Flurbiprofen - Ansaid
- Diflunisal - Dolobid
- Naproxen - Naprosyn, Aleve
- Ketorolac - Toradol
- Ketoprofen - Orudis
- Etodolac – Lodine
- Codeine - Codeine (in various)
- Oxycodone - Percocet, Percodan
- Meperidine - Demerol
- Pentazocine - Talwin
- Hydrocodone - Lortab, Vicodin
- Dihydrocodeine - Synalgos-DC
- Propoxyphene - Darvon

* Propoxyphene-containing products such as Darvon were removed from the US market in 2010.*
Peripheral Analgesics: non-Opioid Analgesics

**Acetaminophen** may be the most ubiquitous medication in this category. It is comparable to ASA and NSAIDs in analgesic and antipyretic activity, but only has a weak anti-inflammatory activity. In patients who are maintained on blood thinners or have a history of bleeding complications, acetaminophen dose offer one major advantage over ASA and NSAIDs as it has a minimal antiplatelet effect and does not injure the gastric mucosa. Adult dosages range from 325mg to 1000mg administered three to four times per day, with a maximum daily dose of no more than 4.0 grams (4000mg) to avoid hepatotoxicity. In those patients at risk for liver problems (e.g., Chronic alcoholics, hepatitis patients), the maximum recommended dose should not exceed 2.0 grams (2000mg). The pediatric dose of acetaminophen is 10-15 mg/kg/dose orally every 4-6 hrs (maximum 5 doses/day).

**Prostaglandins** generated during tissue damage direct some actions of inflammation: fever, pain and vasodilation. Inhibiting prostaglandin synthesis leads to a decrease in this response, which led to the advent of **NSAIDs** as an alternative to acetaminophen.

**The mechanism of action** of NSAIDs is to block the conversion of arachidonic acid to prostaglandins. Arachidonic acid is a by-product of the breakdown of injured cell membrane phospholipids by the enzyme phospholipase. Non-selective **COX inhibitors** not only block the inflammatory prostanooids which produce pain, tenderness, vasodilation and fever, but they also inhibit the cytoprotective prostanooids that maintain a normal gastric mucosa and normal platelet aggregation. **COX-2 inhibitors** only block the inflammatory prostanooids and do not effect the protective gastric mucosa and hemostosis.

There are a plethora of NSAIDs on the market and rather than reviewing each one individually, some key points should be stressed. Be familiar with at least three agents and their usual dosing regimens and maximum daily dosages. Some examples are:

- Ibuprofen (Motrin) 400-600 mg four times a day (max daily dose is 2400mg)
- Diclofenac (Voltaren) 25-50mg two or three times a day (max daily dose is 200mg)
- Naproxen (Naprosyn) 250-500mg two or three times a day (max daily dose is 1500mg)


**Other Notes or Questions to Ask:**

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**NSAID Mortality:** Fortunately or unfortunately, many of these medications are now available without a prescription, which may give prescribers the false sense that they are completely “safe” (without adverse sequelae). In fact, **16,500 people die in US each year due to NSAID complications.** The mechanism of action of NSAID’s is to inhibit both COX-1 and COX-2 (cyclooxygenase isoenzymes) which are responsible for the production of prostaglandins: the mediators of inflammation. Some of these prostaglandins are cytoprotective, however, as part of the body’s natural homeostatic process. By nonspecifically inhibiting both isoenzymes, NSAIDs have been associated with an increased rate of gastritis, gastric erosion and even ulceration.


**Baseline Risk of Peptic Ulceration:** Hospitalization risk due to peptic ulceration is about 0.2% per year in non-NSAID users. The risk increase to 0.8% in patients currently taking NSAIDs and GI hemorrhage is the most common presentation. The risk is higher in men than women. The range of risk is from 0.5% to 1.7% depending on dose, drug and duration.

**NSAID Prescribing:** Not all NSAIDs are created equally. The risk of GI toxicity varies from: _ibuprofen → ASA → diclofenac → naproxcen → indomethacin → piroxicam → ketoprofen → ketorolac_. When you prescribe NSAIDs, do so only to patients who do not respond to acetaminophen. Select the NSAID with the lowest toxicity and prescribe the lowest possible dose for the shortest duration of time. The use of NSAIDs may be considered relatively safe when prescribed at the most effective dose and for the shortest duration of time, which was defined as 10 days or fewer.


**COX - 2 INHIBITORS:**

COX-2 Inhibitors were developed to decrease GI effects of NSAIDs. Older NSAID’s inhibit both COX-1 and COX-2 prostanoids. COX-1 is responsible for protecting the GI mucosa (cytoprotective). COX-2 is responsible for inflammatory mediation. COX-2 selectivity increases from:

_ketorolac → ketoprofen → indomethacin → ASA → ibuprofen → piroxicam → diclofenac → celecoxib → meloxicam_

**Other Notes or Questions to Ask:**
When rofecoxib (Vioxx) was available, it was the most selective of available NSAIDs (>50-fold potency for COX-2 over COX-1) and was twice as selective as celecoxib. Vioxx was unfortunately removed from the US market in 2004. The COX-2 inhibitor seemed to be equally effective as the NSAIDs. There seems to be no difference in overall adverse effects. There seems to be no difference in real effects. In these 3 studies no dyspeptic symptom differences were noted. However, there was an absolute difference in endoscopically proven ulcer of 10 – 25% decrease. Also note that where COX-2 inhibitors were used, they had no effect on platelets.

**Differences between the COX-2s:** If a patient has a sulfa allergy you should avoid the Celecoxib/Valdecoxib medications. There is still a question if one should not prescribe COX-2s if an aspirin allergy exists. Recognize that Celecoxib has a slightly slower onset of activity. Obviously, with the removal of Vioxx & Bextra from the market, adverse effects cannot be ruled out!

**When to use a COX-2?** Use a COX-2 inhibitor if other less expensive NSAIDs have been shown to be ineffective or not tolerated. Use a COX-2 inhibitor if cost is not an issue. Use a COX-2 inhibitor if your patient is controlled on a blood thinner like coumadin. Use a COX-2 inhibitor if you are planning to use misoprostol with an NSAIDs.

These newer medications can be up to ten times more expensive than the traditional NSAIDs, and should generally be reserved for those patients who have failed prior treatment with NSAIDs, or if they are controlled on a blood thinner like coumadin.

- rofecoxib (Vioxx) 50mg QD
- valdecoxib (Bextra) 10mg QD
- celecoxib (Celebrex) 200mg BID


**What about the use of Steroids?**

Dexamethasone is a glucocorticoid (FDA approved 1958). Supplied as Tablets (0.25 mg, 0.5 mg, 0.75 mg, 1 mg, 1.5 mg, 2 mg, 4 mg, 6 mg); Injection (4mg/mL, 10mg/mL, 20mg/mL); Elixir (0.5 mg/5 mL)

Plasma Half-Life: 3-5 hours Duration of Action: 2.5-6 days to treat pain, swelling and trismus.


**Other Notes or Questions to Ask:**
**Opioid-Based Analgesics: Central Analgesics**

**When to use them:** Opioids such as morphine, meperidine, hydromorphone, fentanyl and others should not always be considered the drugs of choice for all postoperative analgesia cases. They act centrally, have no effect on the inflammatory process, and are associated with adverse sequelae in many patients ranging from constipation to more acute narcotizing effects.

**How to use them:** Having said this, they may still have a role in pain management, as interpatient response to any type of drug therapy is highly variable. The same general prescribing guidelines described above hold true for opioid-based analgesics: be familiar with at least three agents and their usual dosing regimens. Be aware of drug interactions with other CNS depressant. Most drug interaction software available today does not recognize the obvious interactions between opioid and benzodiazepines.

**Pain Control:** the site of action for the opioid narcotics is in the brain stem. Where as NSAIDs and COX-2 inhibitors work at the site of injury.

Maximum daily dosages do not readily apply to these agents and it may be more clinically useful to be aware of the minimum effective dosages and potential equiefficacious dosing when switching between agents.

In trying to achieve the best of both worlds there are several combination products which incorporate either acetaminophen or an NSAID with an opioid-based analgesic (eg. Percocet, Vicodin, and Vicoprofen). The practitioner should still decide if an opioid-based analgesic is appropriate therapy for the particular case, and they should also be aware of the maximum recommended daily doses of acetaminophen or the NSAID being used in the combination product. This is especially important in those patients who are ordered both Tylenol and Percocet, for example (since they both contain acetaminophen).

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Equianalgesic dose</th>
<th>Duration of Action (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>IM, SC PO</td>
<td>10mg</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-60mg</td>
<td></td>
</tr>
<tr>
<td>Meperidine</td>
<td>IM, SC PO</td>
<td>100mg</td>
<td>2-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200mg</td>
<td></td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>IM, SC PO</td>
<td>2mg</td>
<td>4-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6-8mg</td>
<td></td>
</tr>
<tr>
<td>Oxycodone/</td>
<td>PO</td>
<td>30mg</td>
<td>3-4</td>
</tr>
<tr>
<td>Hydrocodone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Codeine</td>
<td>IM, PO</td>
<td>60mg</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120-180mg</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>IM Transderm</td>
<td>0.1-0.2mg</td>
<td>Very short 72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25µg/hr</td>
<td></td>
</tr>
</tbody>
</table>

**Equianalgesic dosing tables** are available for opioid-based analgesic medications, which aid in prescribing or changing a patient’s regimen to a different agent, but it must be stressed that these are only guidelines and are usually based on single-dose studies in healthy individuals. Some examples of these guidelines are shown below:

**Other Notes or Questions to Ask:**
1 x Tylenol #3 = 300mg Acetaminophen + 30mg Codeine
2 x Tylenol #3 = 10mg oral Morphine
1 x Vicodin = 500mg Acetaminophen + 5mg Hydrocodone
2 x Vicodin = 10mg oral Morphine
1 x Tylenol #3 = 1 x Vicodin tablet

Morphine: Morphine is still the gold standard in pain control because of the wide range of dosage forms and low cost. There are even sustained release preparations that allow a dose once every 12 hours. These sustained release medications are MS Contin, M-Eslon, Kadian. In the elderly M=Eslon offers some advantages because the capsule can be pulled apart and contents mixed as long as the granules are not crushed.

Hydromorphone (Dilaudid): This drug is excellent for patients allergic to morphine. Dilaudid SR (sustained release) comes in 3, 6 and 12mg capsules. The dosing is every 12 hours and the capsules can be opened. This drug is also effective when morphine tolerance develops. You should switch from morphine to hydromorphone when morphine doses needed by the patient are increasing rapidly. In the non-narcotic naïve patient the ratio is about 5:1.

Meperidine (Demerol): There is no advantage with Demerol over morphine for chronic pain. This drug has a shorter half-life, but its active metabolite (normeperidine) has an extended half-life of 8-12 hours. Meperidine may accumulate with repeated administration leading to CNS stimulation that manifests itself as agitation, irritability, nervousness, tremors, twitching and seizures. Since this drug is eliminated by the kidneys, patients with decreased renal function are more susceptible to CNS stimulation from repeated administration. A major contraindication is in patients receiving MAO inhibitors. This may cause severe respiratory depression, coma and decrease in blood pressure.

Fentanyl (Duragesic): Fentanyl can be useful if enteral narcotics are not an option. The dose is limited to 25, 50, 75 and 100mcg increments. One need to wait 24 hours to evaluate the effectiveness for pain control. This drug is not for acute pain! It may take 6 days after increasing the dose before a new steady state level is achieved. If the drug is administered in a patch, the serum concentration will take approximately 17 hours to re-equilibrate.

Other Opioids: Codeine is a relatively weak analgesic. Oxycodone and Hydrocodone usually are in combination products such as Percocet and Vicodin. Be aware that because of these combination products a toxicity level may be reached if doses of acetaminophen exceed 4 grams per day.

Constipation: ... the eleventh commandment? “the hand that writes the narcotic order shall write the laxative order!”

Other medications for pain: TCA Antidepressants such as amitriptyline, nortriptyline and imipramine are examples. SSRI (Selective Serotonin Reuptake Inhibitors) Antidepressants such as fluoxetine (Prozac), sertraline (Zoloft), citalopram (Celexa) and escitalopram (Lexapro) are examples. Anticonvulsants such as valproate (Epival), carbamazepine (Tegretol) and gabapentin (Neurontin) are examples. Finally Glucocorticoids such as dexamethasone, prednisone, methylprednisolone and hydrocortisone are examples.

Efficacy of Tramadol: Ibuprofen>Tramadol/Acetaminophen>acetaminophen>Tramadol>Placebo

Other Notes or Questions to Ask:
Physiologic Monitoring For Adult Enteral Sedation

Protective reflexes intact
Patient can independently and continuously maintain an airway
Patient can respond appropriately to verbal commands

Source: American Society of Anesthesiology (www.asahq.org)

Other Notes or Questions to Ask:
Monitoring:  *In office conscious sedation mortality & serious morbidity are exceedingly rare in modern practice*

~ Dr. John Yagiela

**Blood Pressure:**
- Systolic Blood Pressure (SBP)
  Reflects peak pressure in vascular system
- Diastolic Blood Pressure (DBP)
  Reflects resting pressure in vascular system
- Mean Arterial Pressure (MAP)
  Reflects average pressure in vascular system
  \[
  MAP = SBP + \left( 2 \times DBP \right) / 3
  \]

**Heart Rate:**
- Normal 60-100 bpm
- Bradycardia <60 bpm
- Tachycardia >100 bpm

*On November 21, 2017 the American College of Cardiology and American Heart Association introduced new blood pressure guidelines...*
Definitions:

*Ventilation* – refers to carbon dioxide elimination and is monitored by a stethoscope and/or end-tidal CO₂

*Oxygenation* – refers to O₂ being delivered to cells and is monitored by a pulse oximeter

Respiration
Monitoring the respiratory status of the patient is vitally important for sedation patients!

During sedation, changes in breathing are often noted well before cardiovascular changes

Respiration may be monitored by:
1) Determining the respiratory rate
2) Observing rise and fall of the chest wall
3) Observing the color of mucous membranes
4) Observing inflation and deflation of the reservoir bag if inhalation sedation is used

Visualization of inflation/deflation of the reservoir bag is a valid method of determining air exchange if an airtight seal of the mask is maintained. Holding a mirror or an ungloved hand in front of the patient’s mouth or nose so that air is felt (or seen fogging the mirror) is a good method of determining exchange of air is occurring.

Respiration - devices used to assess respiration include:
- Precordial stethoscope
- Pretracheal stethoscope
- Esophageal stethoscope

A precordial / pretracheal stethoscope involves a weighted stethoscope head secured in place with tape to either the precordial or pretracheal area.

The esophageal stethoscope is designed for placement into the patient’s esophagus through their nose or mouth

- This obviously would not be tolerated during oral sedation, but is excellent for general anesthesia

*Other Notes or Questions to Ask:*
Oxyhemoglobin Dissociation

Pulse Oximeter

- $\text{PaO}_2$ = partial atmospheric pressure of oxygen that is dissolved in the blood. Measured in mmHg
- $\text{SaO}_2$ = oxygen saturation of the blood as defined as % of heme sites occupied by an oxygen molecule
- $\text{SpO}_2$ = estimate of oxygen saturation as calculated by the pulse oximeter

The relationship between the amount of oxygen dissolved in the blood and the amount attached to the hemoglobin is called the oxyhemoglobin dissociation curve

- 97% saturation = 97 mmHg ($\text{PaO}_2$) $\rightarrow$ Normal
- 90% saturation = 60 mmHg ($\text{PaO}_2$) $\rightarrow$ Danger!
- 80% saturation = 45 mmHg ($\text{PaO}_2$) $\rightarrow$ Severe Hypoxia!

Other Notes or Questions to Ask:
**Changes in this curve can be caused by:**
1. Alkalosis/Acidosis
2. Changes in PaCO₂
3. Hypothermia/Hyperthermia
4. Increased or decreased 2-3-DPG (a normal by-product of red blood cell metabolism)

**Considerations for Pulse Oximetry:**

- Effect of non-functioning hemoglobin:
- Pulse ox only measures oxygenated hemoglobin (HbO₂) and deoxygenated hemoglobin (Hb)
- When patients have large amounts of non-functioning hemoglobin pulse oximeter readings can vary widely!
  - Carboxyhemoglobin (HbCO)
  - Methemoglobin (METHb)

Anemia (a lack of red blood cells causes anemia)

- Hemoglobin
  - The small amount of hemoglobin may be well saturated with oxygen
  - Pulse ox readings will be normal
  - Changes in pulse ox are concerning b/c pt may not have enough O₂ going to tissues

**Dyes**

- Some surgical dyes can impact Pulse Ox use
- Dyes can alter light transmission thru blood
- If the patient’s blood contains the following dyes, pulse oximetry cannot be used:
  - Methylene blue
  - Indiocyamine green
  - Indiocarmine

- Bilirubin, the breakdown product of RBC, does not affect Pulse Ox readings

Common sources of error:

- Light interference – consider covering the site
- Movement artifacts – usually pulse readings
- Sensor application – tight vs. loose
- Inadequate blood flow – BP cuff, tight clothing
- Nail polish

**Other Notes or Questions to Ask:**
What else is out there for patient assessment during in-office sedation?

Bispectral Index Monitoring (BIS)

BIS Monitoring measures EEG on a dimensionless scale from 0-100. A BIS reading of 0 corresponds to flat-line EEG (no brain activity). A BIS of 95 to 100 is normal. A BIS reading of ≤ 60 is commonly considered general anesthesia.

What about Pulse CO-Oximetry?

Pulse CO-Oximeter measures:
1. Pulse
2. Oxygen saturation
3. Carboxyhemoglobin
4. Methemoglobin

Other Notes or Questions to Ask:
Remember that pulse oximeters show oxygen saturation as SpO2 (an estimate of the true oxygen saturation)

“True” oxygen saturation is written as SaO2

In the blood, carbon monoxide combines with hemoglobin to form carboxyhemoglobin (COHb)

In smokers, the amount of COHb in the blood ranges from 5-15%.

In non-smokers the level is 0.3-1.6%
Even in places of environmental pollution the level does not exceed 1.9%
Affinity of carbon monoxide for hemoglobin is 200x that of oxygen

High levels of carboxyhemoglobin causes a left shift in the oxyhemoglobin dissociation curve – more difficult for tissues to extract oxygen. Result is chronic tissue hypoxia – body compensates with more RBC

Net effect = increased oxygen availability at the expense of plasma viscosity

Currently pulse oximeters can only measure oxyhemoglobin (HbO2) and deoxyhemoglobin (HHb); COHb can not be measured.

The pulse oximeter will grossly overestimate the oxygen saturation in chronic smokers!

For every 1% of circulating carboxyhemoglobin, the pulse oximeter over reads by 1%. Fifty percent of cigarette smokers have a carboxyhemoglobin concentration of 6%.6

Source: Anesthesia Progress 2000;47:143-150

Pulse oximeter will show HbO2 + COHb (normal pulse oximeters can not differentiate the two hemoglobin species)

Example: Pulse oximeter reads 99% on a chronic smoker. If they have 10% COHb then the true reading of HbO2 is 89%!!!

Other Notes or Questions to Ask:
How do Pulse Oximeters calculate SpO₂?

\[
\text{Fractional SpO}_2 = \frac{O_2\text{Hb} \times 100\%}{O_2\text{Hb} + \text{Hb} + \text{COHb} + \text{MetHb}}
\]

Clinically…\(\text{SpO}2 = O_2\text{Hb} - \text{COHb}\)

What is Methemoglobinemia?

- Can occur in patients given extremely large doses of Prilocaine (>8 mg/kg or >8 carps in a 70 kg adult)
- The metabolite of Prilocaine, o -toludine, causes oxidation of the iron atom in hemoglobin from the reduced to the oxidized state. \(\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}\)

Medications associated with Methemoglobinemia:

- Local Anesthetics (Prilocaine, Benzocaine)
- Analgesics (Acetaminophen, Celecoxib)
- Antibiotics (Sulfonamides)

Methemoglobin:

- The resultant species of hemoglobin - Methemoglobin is unable to transport oxygen
- Patient appears cyanotic
- Blood takes on a bluish hue

*Fortunately, for most patients methemoglobinemia is well tolerated*

Of concern are pediatric patients, patients with cardiovascular or pulmonary disease, or patients with hereditary methemoglobinemia

**Other Notes or Questions to Ask:**
For compromised patients or patients with hereditary methemoglobinemia, Prilocaine should be avoided.

Treatment of Methemoglobinemia = IV methylene blue

Organs with high oxygen demands (ie CNS, cardiovascular) usually are the first systems to manifest toxicity

Normal methemoglobin fraction = 1%
- At 3-15% signs may include changes in skin color
- At 15-20% patients may be relatively asymptomatic, but cyanosis is likely present
- At 25-50%, the signs and symptoms are:
  - Headache
  - Dyspnea
  - Lightheadedness
  - Weakness
  - Confusion
  - Palpitations, Chest pains
  - Methemoglobinemia
- At 50-70%, the signs and symptoms are:
  - Altered mental status
  - Delirium
- Death occurs when methemoglobin fractions approach 70%

End-Tidal CO₂ Monitoring (ET CO₂)
The ability to measure a patient’s exhaled carbon dioxide (CO₂)

Advantages
- Measures ventilation via detecting exhaled CO₂
- Rate
- Alarm

Disadvantages
- Non-intubated patient – difficult and inaccurate if patient is a mouth breather
- Expensive

Capnography:
Refers to the comprehensive measurement & display of CO₂, including end-tidal, inspired, and the capnogram (real time CO₂ waveform)

Other Notes or Questions to Ask:
Capnometry:
References to the measurement and display of CO2 in numeric form only
Normal PaCO2 = 40 ± 5 mmHg

ET CO2 = 0 mmHg indicates the patient is not being ventilated
- Upper airway obstruction
- Apnea
- ET misplaced
- Ventilator disconnect / malfunction
- Disconnect of sample line

Other Notes or Questions to Ask:
What’s in Your Emergency Kit and Why

What is an Emergency? Any condition which if left untreated may lead to patient morbidity or mortality.

Why Should You Care About Emergencies?

- In a survey of 2,704 dentists throughout North America, a total of 13,836 emergencies occurring within a 10-year period was reported.
- 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.
- Almost all medical emergencies that occur in a dental office are fear-related.
- If fear and apprehension are reduced, the chances of having a medical emergency are also reduced.
- Three-quarters of all of these medical emergencies developed as sequelae of pain (i.e., inadequate local anesthesia), the dentist’s failure to recognize and treat a patient’s fear of dental care, or both.

**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.


How Do You Manage Emergencies?

The Best Preparation is Prevention:
- Know your patient: get a complete medical and pharmacological history.
- Review any problem areas.
- Take training.
  - Practice
  - Practice
  - Practice
- Emergency Kit.
- Equipment - Less is better.
- Phone – Cell.
- Medication - Only what you will use and are comfortable using . . .

Other Notes or Questions to Ask:
Stress-Reduction Protocol

- Recognize medical risk.
- Consult patient’s physician(s).
- Pharmacosedation, as indicated.
- Short appointments.
- Morning appointments.
- Excellent intraoperative pain control.
- Minimize waiting room time.
- Excellent post-operative pain control.

*Rosenberg, M. Preparing for Medical Emergencies: Essential Drugs and Equipment for the Dental Office. J Am Dent Assoc 2010; 141;14S-19S.*

### Suggested basic emergency drugs for the general dental office.

<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; transdermal 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 (bronchodilator)</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>Almost Anything</td>
<td>Oxygen</td>
<td>Respiratory Support</td>
<td>Ad Lib</td>
</tr>
</tbody>
</table>

#1: Epinephrine 1:1,000 Injection

- **Uses:** to reverse hypotension, bronchospasm, and laryngeal edema that result from an acute anaphylactoid type reaction. Also used to reduce bronchospasm resulting from an acute asthmatic episode that is refractory to inhaler therapy.

- **Pharmacology:** Causes vasoconstriction that in turn increases blood pressure, heart rate, and force of contraction. Also causes bronchial dilatation. Reduces the release of histamine. Can be ineffective if the patient is taking beta-blocker.

- **Adverse Effects:**
  a) Cardiovascular: Tachycardia, Tachyarrhythmia’s, and hypertension.
  b) Central Nervous System: Agitation, headache, and tremors.
  c) Endocrine System: Increased blood glucose.
  d) Pregnant Female: Can decrease placental blood flow.

- **Dose:** Supplied in vials, ampules, or pre-loaded syringes in concentration of 1:1000 (1mg/mL); 0.3mg for adults, 0.15mg for children. IV give 0.5-2.0mg (0.5mL-2.0mL) depending on severity of hypotension, titrate to effect repeat in 2 minutes if needed.

Other Notes or Questions to Ask:
#1: EpiPen Instead??


CONCLUSION: The needle on epinephrine auto-injectors is not long enough to reach the muscle in a significant number of children. Increasing the needle length on the auto-injectors would increase the likelihood that more children receive epinephrine by the recommended intramuscular route.

#2: Diphenhydramine (Benedryl) 50mg Injection

- **Uses:** To reduce the affects of histamine release that is associated with allergic reactions, anaphylaxis, and acute asthma attack precipitated by exogenous causes.
- **Pharmacology:** An antihistamine that blocks the release of histamine in the body. It does not prevent the action of the histamine once released and thus must be given quickly. Prevents histamine responses such as bronchospasm, hypotension, rash, and edema.
- **Adverse Effects:**
  2. Central Nervous System: CNS depression (sedative effects including drowsiness, lethargy, and mental confusion).
- **Dose:** 50-100mg IM or IV. For mild cases of pruritis, urticaria, or erythema an oral dose of 50mg every 6 hours can be used.

#3: Nitroglycerin

If patients have a history of angina and you are considering giving them their nitro or yours (from the EMG kit), what MUST you know?

- For **Viagra** and **Levitra**, at least 24 hours should have elapsed since the last dose of a PDE5 inhibitor.
- For **Cialis**, allow at least 48 hours before using nitrates.

- **Uses:** Used to relieve or eliminate chest pain associated with angina pectoris, to differentiate between angina and a myocardial infarction.
- **Pharmacology:** A coronary and peripheral vasodilator and as such helps increase the flow of oxygenated blood to the heart muscle.

Other Notes or Questions to Ask:
✓ It also causes venous pooling of blood decreasing venous return to the heart thus improving the pumping efficiency of the heart. Because of this improved efficiency myocardial oxygen demand is decreased.

✓ **Adverse Effects:**
  a) Cardiovascular: Rapid heart rate, facial flushing, and orthostatic (Postural) hypotension.
  b) Central Nervous System: Dizziness and headache.

✓ **Dose:**
  a) Tablet: 1 tablet sublingually repeat after 2 minutes if no relief up to 3 doses.
  b) Metered Dose Spray: 1 spray sublingually repeat after 2 minutes if no relief up to 3 doses.

Called "remote ischemic preconditioning," the procedure developed by Toronto’s Hospital for Sick Children was found to significantly limit the amount of damage to the heart muscle caused by a blockage in a cardiac blood vessel.

Ischemic preconditioning involves using the device to interrupt blood flow in the arm, off and on over a period of 35 to 40 minutes: the cuff is inflated for five minutes, then deflated for five minutes, with the procedure being repeated consecutively four times.

http://www.cbc.ca/health/story/2010/02/26/heart-attack-blood-pressure-cuff.html#ixzz0gfLoHNbP

### #4: Oxygen

**Bag-Valve Concentrations:**
- Without oxygen - 21%
- With oxygen, no reservoir - 60%
- With oxygen and reservoir - 90 to 95%
- With demand valve attachment - 100%

**Other Notes or Questions to Ask:**
#5: Aspirin (for Acute Coronary Syndromes)

- **Pharmacology:** Irreversibly inhibits cyclooxygenase-1 and 2 (COX-1 and 2) enzymes, via acetylation, which results in decreased formation of prostaglandin precursors; irreversibly inhibits formation of prostaglandin derivative, thromboxane A2, via acetylation of platelet cyclooxygenase, thus inhibiting platelet aggregation; has antipyretic, analgesic, and anti-inflammatory properties.

- **Uses:** Treatment of mild-to-moderate pain, inflammation, and fever; prevention and treatment of myocardial infarction (MI), acute ischemic stroke, and transient ischemic episodes; management of rheumatoid arthritis, rheumatic fever, osteoarthritis, and gout (high dose); adjunctive therapy in revascularization procedures (coronary artery bypass graft [CABG], percutaneous transluminal coronary angioplasty [PTCA], carotid endarterectomy), stent implantation.

- **Precautions:**
  - Bleeding disorders: Use with caution in patients with platelet and bleeding disorders.
  - Dehydration: Use with caution in patients with dehydration.
  - Ethanol use: Heavy ethanol use (>3 drinks/day) can increase bleeding risks.
  - Gastrointestinal disease: Use with caution in patients with erosive gastritis or peptic ulcer disease.
  - Hepatic impairment: Avoid use in severe hepatic failure.
  - Renal impairment: Use with caution in patients with mild-to-moderate renal impairment (only at high dosages); avoid in severe impairment.

#6: Albuterol Inhaler (bronchodilator)

- **Uses:** Used during acute asthma or Anaphylaxis to reduce or control bronchospasm.

- **Pharmacology:** A β₂-adrenergic drug that relaxes the bronchial smooth muscle. It has rapid onset and duration of action of up to 6 hours. Also reduces the stimulation of mucous production.

**Women are different!**

**Most frequent symptoms:**
- Prodromal
  - 71% unusual fatigue
  - 48% sleep disturbance
  - 42% shortness of breath
  - 39% indigestion
  - 35% anxiety
  - > 30% had chest pain
- During Acute MI
  - 58% short of breath
  - 55% weakness
  - 43% unusual fatigue
  - 39% cold sweat
  - 39% dizziness

43% did not have chest pain during Acute MI
95% knew their symptoms were new and different a month or more prior to the Acute MI.

**M.I. “Heart Attack”**

1. **Call 911**
2. **M.O.N.A.**
   - **Morphine for pain control**
   - **O₂ Administration**
   - **Nitroglycerine** 1 dose q5min to max of 3.
     - Ask both men and women if they have had Viagra in the last 24 hr.
     - No nitro if yes as it can lead to dangerously low BP.
   - **ASA** Chew one tablet (81mg or 325mg).
     - This is as important as nitroglycerin.
3. **Be prepared to administer CPR.**
4. **The sooner they get to the hospital the better for dilation of vessels or fibrinolysis.**

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✓ Albuterol and Beta-Blockers tend to inhibit each other.

✓ **Adverse Effects:**
   Should be used with caution in patients with cardiovascular disorders especially coronary artery disease, arrhythmias, and hypertension.

✓ **Dose:**
   2 puffs every 2 minutes to a maximum of 20 puffs. Hold inhaler about 2 inches from mouth. Have patient take two deep breaths and then exhale forcefully. Dispense one puff on slow deep inhalation. Hold breath for 10 seconds and repeat.

---

#7: **Glucose (for hypoglycemia)**

✓ **Symptoms:**
   - Appears confused
   - Cool, moist skin
   - May be hungry
   - May seem “drunk” but not alcohol breath odor
   - Slurred speech

   If patient becomes unconscious or does not respond readily after sugar/carbohydrate administration, activate EMS. They will give IV treatment.

   Never give unconscious patient anything orally!

---

**Should I Have Other Drugs?**

- Flumazenil (Romazicon®) - YES
- Naloxone (Narcan®) - YES
- Nitrous Oxide?
- Midazolam (Versed®)?
- Corticosteroids?
- Aromatic Ammonia?

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**Do Not Get Yourself Locked Into A Serious Drug Collection!**

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**Other Notes or Questions to Ask:**
#8: Flumazenil (Romazicon®) for Benzodiazepine Sedation Reversal

- **Uses:** Selectively blocks benzodiazepine receptors, reversing sedation and respiratory depression
- **Preparation:** 0.1 mg/ml, in 5 ml and 10 ml MDV
- **Dose:** IV or sublingual, 0.2 mg every 1 minute up to 5 doses

“Respiratory depression mediated by benzodiazepines can be reversed using the specific antagonist flumazenil (Romazicon). It can be titrated intravenously or injected sublingually in 0.2 mg increments every 2-3 minutes, up to 1 mg. Flumazenil should not be administered to patients with a history of seizure disorder or dependence on benzodiazepines.”

Dionne R, Phero J, Becker D; Management of Pain and Anxiety in the Dental Office. WB Saudners 2002;18:289

“Intraoral submucosal injection of flumazenil appears to be a viable concept based upon the following findings. The drug is rapidly and complete absorbed into the systemic circulation, as evidenced by comparable serum concentrations to those obtained by IV administration.”


#9 Naloxone (Narcan®) – Narcotic Antagonist

**Indications:**
- Reversal of narcotic depression including respiratory depression induced by opioids, (both natural and synthetic narcotics), propoxyphene, and narcotic-antagonist analgesics
- Diagnosis of suspected acute narcotic overdosage
- Not effective in counter-acting depression due to barbiturates, tranquilizers or other non- narcotic anesthetics or sedatives

**Routes of Administration:**
- IM, SC - when IV route not feasible; onset of action not as prompt as with IV and may be delayed in patients who are hypotensive and have impaired peripheral circulation
- IV direct - slowly over at least 1 minute


**Dosage, Adults:**
- Known or suspected overdose: 0.4-2 mg IV; if no response, repeat 2-4 mg in minutes; in cases of large narcotic overdoses, or methadone, pentazocine, propoxyphene overdose, higher doses may

**Other Notes or Questions to Ask:**
be required; if no response after 10 mg, reassess diagnosis; effective dose may be repeated every 20-60 minutes

- Post-operative respiratory depression: 0.1-0.2 mg at 2-3 minute intervals until desired response is obtained; repeat doses may be required at 1-2 hour intervals
- Partial reversal of opioid-associated respiratory depression in palliative patient: if respiratory rate < 6/minute, administer 0.1-0.2mg IV q2-3 minutes or 0.1-0.2mg SC q5-10minutes until respiratory rate > 10/minute. Continue to monitor respiratory rate q15minutes until no naloxone given x 1 hour.

**Dosage, Children:**
- Known or suspected overdose:
  - Birth to 5 yrs or 20 kg: 0.1 mg/kg/dose; repeat at 2-3 minute intervals until desired response obtained
  - > 5 yrs or > 20 kg: 2 mg; repeat as above
- Post-operative respiratory depression: 0.005-0.01 mg/kg IV repeated if necessary at 2-3 minutes intervals
- Onset of effect: within 1-2 minutes following IV, within 2-5 minutes following IM or SC
- Duration of effect: 45 minutes to 3-4 hours
- Since duration of action of narcotic agent may exceed that of naloxone, repeated doses or administration of naloxone via IV infusion may be required


**Midazolam (Versed®) for Seizures**

- **Uses:** For seizures, since it can be injected IM or subcutaneously or swallowed (orally). Realistically you want to call 911 if the seizure lasts more than a minute or if it is the first seizure for a patient.
- **Pharmacology:** A short-acting hypnotic-sedative drug with anxiolytic and amnesic properties. It is used in dentistry, cardiac surgery, endoscopic procedures, as preanesthetic medication, and as an adjunct to local anesthesia. The short duration and cardiorespiratory stability makes it useful in poor-risk, elderly, and cardiac patients.
- **Dose:** Inject 1-1.5mg (1-1.5mL) into buccal fold and repeat after a minute or two if the seizure has not stopped. If buccal fold is too difficult due to patient clenching inject IM on upper arm.
- **Beware:** Midazolam is also available as a 5mg/mL vial in which case 5mL would be 25mg: too much!!

**Corticosteroids for Acute Adrenal Insufficiency**

The adrenal cortex produces over 25 different steroids. These steroids are broken into three groups: sex steroids, mineralocorticoids, and glucocorticoids. Of primary concern in dentistry are the glucocorticoids. A physiologic dose of approximately 20mg/day of cortisol is produced. This plays a key role in the body’s
ability to adapt to stress. Cortisol provides a chemical link within the cells of the body allowing regulation of vital functions including blood pressure and glucose utilization.

Cortisol production is triggered by real or threatened “stress” such as trauma, illness, fright, and anesthesia. In a patient with suppressed adrenal function a failure of this cortisol production eliminates the chemical link to regulate vital functions resulting in sudden shock and possibly death. Suppressed adrenal function or Adrenal Failure is classified as either Primary (Addison’s disease caused by Disease states such as TB, Bacteremia, Carcinoma, and Amyloidosis.) or Secondary (caused by Pituitary disorders, Hypothalmic disorders, or Steroid Therapy).

Steroid therapy suppresses the function of the adrenal cortex reducing the production of natural cortisol. Because of this suppression patient’s who have been on long term steroid therapy lose their ability to respond to stress. If these patients are stressed symptoms of acute adrenal insufficiency may result.

**Signs and Symptoms of Acute Adrenal Insufficiency:**

1. Mental confusion.
3. Fatigue.
4. Nausea and vomiting.
5. Hypotension.
6. Intense pains in abdomen, lower back, and/or legs.
7. Mucocutaneous pigmentation.
8. Hypoglycemia.
10. Increase heart rate, decreased blood pressure.

**Dental Treatment Considerations**

For patients with a history of glucocorticoid therapy use stress reduction protocols. The following guidelines can be used to determine if replacement therapy is indicated but it is always a good idea to get a medical consult in such cases.

If the patient has undergone supraphysiologic (more than 20mg/day) glucocorticoid therapy that was discontinued more than 30 days prior to the planned dental treatment no supplementation is required.

If the patients has undergone supraphysiologic glucocorticoid therapy within 30 days of the planned dental procedure considered the patients suppressed and provide steroid supplementation equivalent to 100mg of cortisol.

If the patient has undergone or is undergoing alternate day dosing schedule glucocorticoid therapy no supplementation is required but it is best to provide dental treatment on the off day of the patient’s dose schedule.

If the patient is currently receiving daily glucocorticoid therapy at a supraphysiologic level (more than 20mg) supplementation is required. If the daily dose is subphysiologic supplementation is not required.

**Equivalent Doses of Corticosteroids**

<table>
<thead>
<tr>
<th>Corticosteroid</th>
<th>Equivalent Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortisone</td>
<td>25mg</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>20mg</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>5mg</td>
</tr>
<tr>
<td>Prednisone</td>
<td>5mg</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>4mg</td>
</tr>
<tr>
<td>Triamcinolone</td>
<td>4mg</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>0.75mg</td>
</tr>
<tr>
<td>Betamethasone</td>
<td>0.6mg</td>
</tr>
</tbody>
</table>

**Fundamentals of Emergency Preparation**

- Training (BLS, ILS, ACLS, PALS).
- Development and implementation of an emergency plan.
- Purchase and maintenance of emergency equipment and drugs.
- Periodic mock emergency drills.
- Training new staff members.
- Monitoring and Patient Assessment.

**Other Notes or Questions to Ask:**
Minimal Oral Sedation Regulations

READ YOUR STATE REGULATIONS!!!

For overview on Sedation Regulations: www.SedationRegulations.com

For Nebraska: http://dhhs.ne.gov/publichealth/pages/crlDentAnesthSedation.aspx

Things I’ve learned...

- Stay up-to-date on your State Regs!
- Maintain BLS for you and your Team
- Sedation Team is at least the Dr and one other trained person (who has BLS)
- Get a focused Medical History (determine ASA 1-4)
- Take baseline vitals (Pulse, BP, O2 sat%)
- Never leave sedation patients alone
- Pre-procedure dietary restrictions must be considered based on the sedative technique prescribed
- Pre-op & Post-op verbal and written instructions must be given to the patient, parent, escort, guardian, or care-giver
- Get a pulse oximeter!
- Make sure you have appropriate reversal agents based on the drugs used
- Use a time-oriented sedation record for documentation of monitoring parameters and drugs used
- Patient satisfies discharge criteria for dismissal (if benzos and/or narcotics, then they are discharged to another person for transport)