Practical Sedation in Dentistry

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Goals and Objectives

- Review: Need for sedation in the dental practice
- History of sedation in Dentistry
- Pre-Sedation Assessment
- Inhalation Sedation
  - (Nitrous Oxide)
- Oral Sedation
- I.V. Sedation
- Sedation Monitoring
- Sedation Emergencies

History

- Historical: dentists have been using sedation and anesthesia as part of dental practice since the 1840’s
  - Horace Wells, DDS, Hartford, Connecticut
  - Introduced nitrous oxide
  - Many dentists and physicians have built on this foundation to provide millions of people to access dental care

Disclaimers

- Neither I nor my immediate family have any financial interests that would create a conflict of interest or restrict my independent judgment with regard to the contents of this course.
- Each participant should be aware of the potential risks of using limited knowledge about products and techniques that are discussed in this presentation.

In 1863 Professor Colton in New Haven, Connecticut

- The Colton Dental Association devoted the next 33 years to extracting teeth under nitrous oxide
- Recorded 193,800 patients with its use and no recorded fatalities, nitrous became the most commonly used inhalation anesthetic, a position it still maintains today
Dr. William Morton
- A student of Horace Wells and then an associate in dental practice who later entered into medical school at Harvard
- Morton began to experiment with ether, possibly at "ether parties" medical students had at that time
- Morton experimented with ether on his family dog, and on himself, before using it for the first time on a patient, Mr. Eben Frost, on Sept. 30, 1846, where he extracted "a firmly rooted bicuspid tooth" by having the patient breath into a saturated handkerchief

Famous demonstration of Ether at Mass. General Hospital in 1846
- Famous surgeon Dr. John Warren excised a tumor from the jaw of Mr. Abbot
- Morton's Etherization
Spread rapidly though the US and Europe and Morton became a celebrity
- Dr. Oliver Wendell Holmes, a physician and father of the Supreme Court Justice, suggested the name Anesthesia from term used by Plato in 400BC

Morton was still a practicing dentist...
- When he gave up practicing dentistry in 1850s to practicing anesthesia full time, he became the first person to specialize in the field of anesthesiology
  - Involved in manufacturing anesthetic inhalers and other devices for administering anesthetic gases
- Morton fought bitterly to become recognized as the founder of anesthesia (but never was)
- 1868 Morton had stroke and died

Sir Frederick Hewitt (1857-1916)
- Invented the first practical anesthesia machine for administering Nitrous oxide and oxygen in fixed proportions in 1887
- By 1889, Nitrous oxide and oxygen was being used in dentistry for cavity preparation in Liverpool, England
- 1890, dentists were using cocaine injection into the gums as a way of pain control (local anesthesia)

The Main Goals of Sedation in Dental Practice
- Help to control fear or relieve anxiety
  - Provide a comfortable and cooperative patient
- Elevate pain threshold
- Diminish undesirable or unintentional behavior
- Enable the patient to receive planned care
- Rapid recovery

Patients who May Benefit from Sedation
- Fear and anxiety
  - Common in general population (6-14%)
  - Less common in older adults (3-10%)
- Uncooperative patients
  - Physical conditions: progressive or non-progressive neuromuscular disorders (PD), severe gagging,
  - Parkinson’s Disease
  - Mental conditions: Mental retardation, Alzheimer’s disease
- Minimize stress in presence of certain medical conditions (hypertension, CVA, diabetes)
- Complex dental procedures requiring long periods of time (periodontal surgery, complex oral surgery)
Objectives of Behavioral Management using Oral, Inhalation or IV Sedation

- Maintain adequate sedation with minimal risk
  - Patients ability to communicate should be preserved.
  - Monitoring should be used if beyond minimal.
  - Emergency equipment/drugs must always be on hand.
- Relieve anxiety and produce amnesia when desired:
  - Require good communication with patient (and/or caregiver) as well as administration of anxiolytic agents
  - Local anesthetics used along with opioids to supplement in moderate sedation cases as needed

Sedation and Analgesia is a continuum and consists of the following states:

- Minimal (anxiolysis)
- Moderate (conscious sedation)
- Deep Sedation/Analgesia
- General Anesthesia


Levels of Sedation and Analgesia

<table>
<thead>
<tr>
<th></th>
<th>Minimal Sedation (anxiolysis)</th>
<th>Moderate Sedation/Analgesia (conscious sedation)</th>
<th>Deep Sedation/Analgesia</th>
<th>General Anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>Normal</td>
<td>Purposeful response to verbal/active stimulation</td>
<td>Purposeful response to tactile or painful stimulation</td>
<td>Unresponsive even with painful stimulation</td>
</tr>
<tr>
<td>Airway</td>
<td>Unaffected</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
<td>Intervention often required</td>
</tr>
<tr>
<td>Spontaneous ventilation</td>
<td>Unaffected</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Frequently inadequate</td>
</tr>
<tr>
<td>Cardiovascular function</td>
<td>Unaffected</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

* Wilkerson withdraws from a painful stimulus in NOT considered a purposeful response.

Minimal Sedation

- Definition: “Minimal Sedation” means a drug-induced state, with or without nitrous oxide to decrease anxiety, in which patients respond normally to tactile stimulation and verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are maintained and do not require assistance.

Minimal Sedation: Clarifications

- Nitrous oxide/oxygen may be used in combination with a single enteral drug in minimal sedation
- When the intent is minimal sedation for adults, the appropriate initial dosing of a single enteral drug is no more than the maximum recommended dose (MRD) of a drug that can be prescribed for unmonitored home use.

- Drug(s) and/or techniques used should carry a margin of safety wide enough never to render unintended loss of consciousness.
- When the intent is minimal sedation, the appropriate initial dosing of a single enteral (oral) drug is no more than the maximum recommended dose (MRD) of a drug that can be prescribed for unmonitored home use.
- Nitrous oxide/oxygen may be used in combination with a single enteral drug in minimal sedation.
- Nitrous oxide/oxygen when used in combination with sedative agent(s) may produce minimal, moderate, deep sedation or general anesthesia.
Minimal Sedation: Clarifications

The following apply to administration of minimal sedation:

- **MRD**: maximum FDA recommended dose of a drug, as printed in FDA-approved labeling for unmonitored home use
- **Incremental dosing**: administration of multiple doses of a drug until a desired effect is reached, but not to exceed the maximum recommended dose (MRD)
- **Supplemental dosing**: during minimal sedation, supplemental dosing is a *single additional dose of the initial drug* that may be necessary for prolonged procedures. The supplemental dose should not exceed one-half of the initial dose and should not be administered until the dentist has determined the clinical half-life of the initial dosing has passed. The total aggregate dose must not exceed 1.5X the MRD.

Moderate Sedation

- **Definition**: *Moderate Sedation*
  Means a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. Intervention is not required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

- **Definition**: *Moderate Sedation*
  Drug(s) and/or techniques used should carry a margin of safety wide enough never to render unintended loss of consciousness.
  - *(Patients whose only response is reflex withdrawal from repeated painful stimuli would not be considered to be in a state of moderate sedation)*
  - **Titration** is the administration of incremental doses of a drug until a desired effect is reached. Knowledge of each drug’s time of onset, peak response and duration of action is essential to avoid over sedation.
  - When the intent is *moderate sedation*, one must know whether the previous dose has taken full effect before administering an additional drug increment.

Deep Sedation

- **Definition**: *Deep Sedation*
  A drug-induced depression during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Cardiovascular function is usually maintained
  - *(Patients may require assistance in maintaining a patent airway and spontaneous ventilation may be inadequate).*

General Anesthesia

- **Definition**: Drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation.
  - The ability to independently maintain ventilatory function is often impaired.
  - Patients often require assistance in maintaining a patent airway, and require positive pressure ventilation may be required because of depressed spontaneous ventilation, drug-induced depression, or changes in neuromuscular function.
  - Cardiovascular function may be impaired.

Because sedation and general anesthesia are a continuum, it is not always possible to predict how an individual patient will respond. Hence, practitioners intending to produce a given level of sedation should be able to diagnose and manage the physiologic consequences (rescue) for patients whose level of sedation becomes deeper than initially intended.

*Excerpted from Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia, 2004, of the American Society of Anesthesiologists (ASA).*
For all levels of sedation, the practitioner must have the training, skills, drugs and equipment to identify and manage such an occurrence until either assistance arrives (emergency medical service) or the patient returns to the intended level of sedation without airway or cardiovascular complications.

**ADA, JCAO, and State Requirements for Certification to practice sedation**

- **American Dental Association (2007)**
  - Qualified dentists
    - Meet the education requirements for the appropriate level of sedation in accordance with Section III of the Guidelines, or
    - A dentist providing sedation and anesthesia in compliance with their state rules and/or regulations prior to adoption of this document.
  - Dentists graduating from dental school
    - Should be trained in providing minimal sedation including enteral (oral) and/or combination inhalation-ental sedation (minimum of 16 hours)
    - Does NOT include minimal sedation in children, which requires addition course content and clinical learning experience

**Competency: displaying special skill or knowledge derived from training and experience**

**ADA Educational Guidelines for training to competency in minimal and moderate sedation techniques**

- May be acquired at the predoctoral, postgraduate, graduate, or CE level.
- Must complete formal training structured in accordance with the ADA’s Guidelines

**Minimal Sedation: Clarifications Training Guidance (not dental school)**

- **Enteral (Oral) and/or Combination Inhalation-ental Minimal Sedation Course**
  - 16 hours plus clinical experiences (not for children)
- **Moderate Enteral (oral) Sedation Course**
  - Duration: a minimum of 24 hours plus management of at least 10 adult case experiences by the enteral and/or enteral nitrous oxide/oxygen route are required to achieve competency.
- **Moderate Parenteral Sedation Course**
  - Duration: A minimum of 60 hours of instruction plus management of at least 20 patients by the intravenous route per participant is required to achieve competency in moderate sedation techniques.
Deep Sedation and General Anesthesia

- Providing Deep Sedation and GA are beyond the scope of predoctoral and CE programs.
- ADA expects that patient safety will be the foremost consideration of dentists who use sedation and anesthesia in their practices.

Vermont – Sedation, Analgesia, Anesthesia: Special Endorsements, Incident Reports

Preamble: The Board seeks to protect the public health, safety and welfare by adopting specific rules in the area of anesthesia and pain reduction. The Board recognizes the value of making comfortable dental services available to those who might otherwise postpone or necessary dental care. It recognizes that there can be some risk in the use of certain medications. By these rules the Board seeks to ensure that practitioners are adequately prepared to use such medications in their practice.

Incident Reports:
- a) Each dentist, whether or not holding a special endorsement provided under these rules, must submit a complete report to the Board within 30 days of any incident which occurs in the dentist’s office or outpatient facility during, or as a direct result of the administration of any anesthetic, local or general, anxiolysis, parenteral deep sedation, or parenteral conscious sedation, or sedation regardless of the route of administration, which results in a patient being transported to a hospital, hospitalization, or death.
- (b) The incident report shall be submitted whether or not the patient is admitted, and whether or not the incident has the potential for life-threatening consequences. A report of an incident shall include a statement setting forth the names and credentials of those present or participating during the anesthesia, anxiolysis or sedation. Failure to comply with this reporting requirement may result in disciplinary action including loss of a special endorsement.

Anesthesia Definitions and Guidelines

- (a) “Administering nitrous oxide analgesia” means: the dispensing, applying, or offering of nitrous oxide analgesia to a dental patient.
- (b) “Anxiolysis” means: the reduction of anxiety through the administration of pharmacological agent or agents. The administered dose should be within the guidelines for dosage on the manufacturer’s package insert, or using techniques taught by CODA approved programs.
Anesthesia Definitions and Guidelines

- When anxiolysis is achieved, the patient
  1. Is conscious;
  2. Can and does respond to conversation appropriately without extra stimulation; and
  3. Is fully able to independently and continuously maintain an unimpeded airway.

Anesthesia Definitions and Guidelines

- (c) "Conscious Sedation" means a depressed level of consciousness achieved through the administration of a pharmaceutical / pharmacological agent or agents in which:
  - 1. the patient retains the ability to independently and continuously maintain an airway;
  - 2. the patient's ability to comprehend questions and conversation and react appropriately is suppressed;
  - 3. protective reflexes remain active; and
  - 4. the patient is easily aroused.

Anesthesia Definitions and Guidelines

- (d) Techniques and pharmaceutical or pharmacological agents used to achieve conscious sedation must render unintended consequences unlikely. Doses shall be within the guidelines on the manufacturer’s package insert or used according to techniques taught by CODA approved programs. Intravenous pharmaceutical or pharmacological agents used to achieve conscious sedation are limited to those for which there is a reversal agent.

Anesthesia Definitions and Guidelines

- (e) Dentists who administer a pharmaceutical / pharmacological agent or agents with the intent to achieve conscious sedation in a patient and who do not possess a General Anesthesia Endorsement must obtain a Conscious Sedation Endorsement from the Board.

Anesthesia Definitions and Guidelines

- (f) "Deep Sedation" – Deep sedation is a controlled state of depressed consciousness accompanied by partial loss of protective reflexes, including the inability to continually maintain an airway independently and/or to respond purposefully to verbal command, and is produced by a pharmacologic or non-pharmacologic method or combination thereof. Deep sedation may not be employed without a General Anesthesia Endorsement issued by the Board.

Anesthesia Definitions and Guidelines

- (g) "General Anesthesia" – General anesthesia is a controlled state of unconsciousness accompanied by a partial or complete loss of protective reflexes, including inability to independently maintain an airway and respond purposefully to physical stimulation or verbal command, and is produced by a pharmacologic or non-pharmacologic method or combination thereof.
Anesthesia Definitions and Guidelines

- (h) “Monitoring” – For purposes of these rules, monitoring patients who have received analgesic or anesthetizing drugs or otherwise mind altering drugs means observing the patient and evaluating through clinical evaluation, electronic and mechanical means, recognizing adverse reactions or complications, and reporting any adverse reaction or complication to the supervising dentist, where applicable, immediately. The degree of monitoring necessary depends on the level of sedation or anesthesia achieved.

5.4 Subsection

- Subsection Regarding: Authorization to Administer Anesthesia or Certain Pharmaceuticals or Pharmacological Agents

When No Endorsement Required

- A dentist needs no special endorsement to employ the following:
  - Nitrous Oxide
  - Local Anesthesia
  - Anxiolysis

Nitrous Oxide

- Use of nitrous oxide in a dental office does not require a special license or endorsement.
- Under direct supervision of a licensed dentist, registered dental assistants and licensed dental hygienists instructed and trained by the dentist may monitor nitrous oxide analgesia during a dental procedure. Administration of nitrous oxide analgesia, as well as prescription, initiation, and determination of nitrous oxide analgesia levels and release and discharge of the patient after administration of nitrous oxide analgesia, shall be performed by and shall be the responsibility of the supervising dentist.

Local Anesthesia

- Administration of local anesthesia by dentists does not require a special endorsement from the Board.

Anxiolysis

- Dentists who administer a pharmaceutical / pharmacological agent or agents with intent to achieve a state of “anxiolysis” as defined in these rules do not require a specific Board endorsement of authority. This includes the prescription of orally-administered, rectally-administered, or nasally-administered sedatives by dentists for anxiolysis before treatment which may be supplemented by nitrous oxide.
### Duty for Use of Pharmaceuticals

- As licensed professionals, dentists employing the above, or any pharmaceuticals, are responsible to assure that they possess sufficient knowledge of the proper use of medications to achieve analgesia, anxiolysis, sedation, or anesthesia. They must be able to respond if pharmaceuticals intended to achieve anxiolysis have unintended effects. If patients given anxiolysis medications go to the next level beyond anxiolysis, dentists must have the knowledge and resources to manage the effect of the medication.

### Endorsements Required

- A Special Endorsement from the Board is required before use of Conscious Sedation or General Anesthesia.

### Conscious Sedation: Special Endorsement Required

- Dentists who do not have a general anesthesia endorsement and who wish to employ conscious sedation as defined by these rules must obtain a Conscious Sedation Privilege Endorsement from the Board.

### Introduction to Conscious Sedation

- The administration of conscious sedation carries with it inherent risks and added responsibility for care of the patient.
- Titration of oral medication for the purposes of sedation is unpredictable. Improper or repeated dosing of orally administered sedative agents can result in an alteration in the state of consciousness beyond the intent of the practitioner.
- The administration of conscious sedation on an outpatient basis by dentists is, with appropriate safeguards, an accepted patient care modality.

### Need for Conscious Sedation Endorsement

- (a) Dentists who do not possess a general anesthesia endorsement under rules 5.24 – 5.26 herein and who wish to use pharmaceutical / pharmacological agents to achieve conscious sedation may do so only in compliance with the requirements of these rules.
- (b) No Dentist may employ a pharmacological agent or agents with the intent of achieving conscious sedation without first obtaining from the Board an endorsement of authority to employ conscious sedation. The endorsement shall be maintained with the dentist’s license.

### Application for Conscious Sedation Endorsement

- A licensed dentist seeking conscious sedation administration privileges shall file an application with the Board, on the form provided by the Office. Applicants must submit:
Application for Conscious Sedation Endorsement

(a) Documentation of satisfactory completion of a conscious sedation training program provided under the auspices of a dental school or program accredited by the Commission on Dental Accreditation of the ADA. The program must:

- 1. Include a minimum of 60 hours of didactic and clinical study including training in conscious sedation, physical evaluation, venipuncture, technical administration;
- 2. Include training in recognition and management of complications and emergencies.

(b) Certification by an CODA accredited school showing that the applicant has completed a course of training in conscious sedation while a student in an accredited school of dentistry or through postgraduate training which meets the requirements of the ADA guidelines for Teaching the Comprehensive Control of Anxiety and Pain in Dentistry; or

(c) Conscious Sedation Endorsement Based on Endorsement from Another Jurisdiction: documentation showing that he or she is a licensed dentist in good standing in a jurisdiction of the United States or Canada having conscious sedation standards substantially equivalent to those of this state; or

(d) for those treating children under 12 years of age, documentation of appropriate training, in pediatric sedation techniques according to the guidelines of the American Academy of Pediatric Dentistry and in pediatric resuscitation including the recognition and management of pediatric airway and respiratory problems; and

The program must:

- 3. Include documented clinical experience in managing compromised airways and certification of competency in airway management from the program director
- 4. Include training in monitoring patient vital signs to assure expertise in interpretation of those signs and appropriate reaction to them;
- 5. Contain additionally supervised experience in providing conscious sedation including successful management of parenteral conscious sedation for no fewer than 20 patients
Application for Conscious Sedation Endorsement

(e) A signed affidavit certifying that the dentist:
   1. Understands the requirements of these rules; and
   2. Will use a properly staffed and equipped facility as defined in rule 5.13 of this Section for the administration of conscious sedation.

Issuance of Endorsement

(a) When the applicant has shown compliance with the rules, the Board will issue a conscious sedation endorsement. The endorsement, unless renewed with the biennial renewal, will expire at the end of the licensing period.

Facility and Personnel Requirements

(a) Facility Requirements: A dentist employing conscious sedation may do so only in a properly equipped facility which shall include at a minimum:
   1. Sphygmomanometer, stethoscope, and pulse oximeter,
   2. A positive pressure oxygen delivery system with full face masks and connectors capable of delivering to the sedated patient oxygen under positive pressure, plus a back-up system;
   3. Emergency drugs and equipment appropriate to the medications administered including drugs appropriate for ACLS or PALS;
   4. Suction equipment;
   5. An emergency back-up light source system that will permit safe termination of any procedure under way; and
   6. A defibrillator.

Facility and Personnel Requirements

(b) Staffing Requirements:
   1. In addition to the dentist or other professional permitted under these rules to administer pharmaceuticals to achieve conscious sedation, there must be a minimum of one assistant licensed or registered under Chapter 13 of Title 26 who possesses a current certification in cardio pulmonary resuscitation and is capable of assisting with procedures, problems and emergencies incident to the administration of such sedation.
Facility and Personnel Requirements

(b) Staffing Requirements, cont.
- 2. A licensed or registered dental assistant or dental hygienist trained in airway management must remain with the patient until the patient’s escort arrives, and the patient is able to maintain a patent airway unassisted.

Patient Risk Criteria

(a) Conscious sedation may be provided in a dental office for patients who are Class I and II as classified by the American Society of Anesthesiologists (ASA)
- (b) Conscious sedation shall not be provided in a dental office for patients in ASA risk category V.

Patient Risk Criteria

(c) Patients in ASA risk categories Class III and Class IV shall only be provided conscious sedation:
  - 1. by an oral and maxillofacial surgeon after performing an evaluation and documenting the ASA risk assessment category and any special monitoring requirements that may be necessary; or
  - 2. by a dentist with a conscious sedation endorsement after consultation with the patient’s primary care physician or other medical specialist regarding potential risk and special monitoring requirements may be necessary.

Monitoring Requirements

To minimize risks to patients, a dentist who uses conscious sedation shall:
- 1. Ensure that monitoring of a patient under conscious sedation begins prior to the administration of sedation, and takes place continuously during the procedure and recovery from sedation. The person who administers the sedation or another licensed practitioner qualified to administer conscious sedation shall remain on the premises until the patient is responsive and discharged.

- 2. Ensure that monitoring includes:
  - continuous direct clinical observation of the patient;
  - interval recording of blood pressure and pulse;
  - continuous evaluation of oxygen saturation; and
  - 4. additional devices such as EKG for monitoring when dictated by the medical needs of the patient.
- (c) Ensure that alarms on devices used for monitoring are enabled.

Conscious Sedation Protocols

The dental office shall develop written protocols for sedation of dental patients addressing the following:
- 1. preoperative patient evaluation and selection prior to conscious sedation
- (b) informed consent,
- (c) sedation monitoring procedures
- (d) sedation record keeping procedures, and
- (e) patient discharge assessment.
Emergency Protocols

(a) The dental office shall develop written protocols for sedation-related emergencies addressing the following:
   1. Laryngospasm
   2. Bronchospasm
   3. Aspiration of emesis
   4. Angina pectoris
   5. Myocardial infarction
   6. Hypotension
   7. Hypertension

Emergency Protocols

(a) Written protocols, continued:
   8. Cardiac arrest
   9. Hyperventilation
  10. Hypoventilation
  11. Convulsions
  12. Allergic and toxic reaction, and
  13. Airway occlusion by foreign body

(b) Training to educate assistants with respect to these protocols must be provided to all sedation team assistants and updated periodically.

Emergency Protocols

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Emergency Protocols

Records of Conscious Sedation Administration

The following records shall be made for each administration of conscious sedation:
   (a) relevant medical history of the patient
   (b) consent for administration of conscious sedation prior to the performance of any procedure and administration of any drugs;
   (c) preoperative, intra operative and pre-discharge monitoring of blood pressure, pulse, respiration, and oxygen saturation where the level of patient cooperation and/or medical / physical limitations of the patient allows; and
   (d) drugs and dosages of drugs used during the operative procedure, and times of their administration over the course of the procedure.

Records of Conscious Sedation Administration

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(d) drugs and dosages of drugs used during the operative procedure, and times of their administration over the course of the procedure.

Renewal of Conscious Sedation Endorsement: Continued Competence

At the time of license renewal, a dentist who wishes to renew the conscious sedation endorsement shall:
   (a) provide documentation of:
      (1) 6 hours of continuing education in conscious sedation during the licensing period; and
      (2) treatment of a minimum of ten patients in the preceding two years. In cases where the renewal occurs less than two years after the conscious sedation endorsement was initially issued, the Board may waive all or part of this requirement.
   (b) provide documentation of current, successful completion of an Advanced Cardiac Life Support (ACLS) or Pediatric Advanced Life Support (PALS) training as appropriate. This training may be applied toward the continuing education requirement in this rule.

Renewal of Conscious Sedation Endorsement: Continued Competence

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   (2) treatment of a minimum of ten patients in the preceding two years. In cases where the renewal occurs less than two years after the conscious sedation endorsement was initially issued, the Board may waive all or part of this requirement.
   (b) provide documentation of current, successful completion of an Advanced Cardiac Life Support (ACLS) or Pediatric Advanced Life Support (PALS) training as appropriate. This training may be applied toward the continuing education requirement in this rule.

Others Permitted to Administer Conscious Sedation: CRNA

(a) A dentist who holds a valid conscious sedation endorsement from the board may permit a Certified Registered Nurse Anesthetist (CRNA) to administer conscious sedation. Use of a CRNA does not relieve the dentist of responsibility for the patient.
(b) A dentist who does not hold a conscious sedation endorsement may not have a CRNA administer conscious sedation.

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(b) A dentist who does not hold a conscious sedation endorsement may not have a CRNA administer conscious sedation.
Exemptions from Conscious Sedation Endorsement Requirement

- A dentist does not need to hold a conscious sedation endorsement when conscious sedation is administered by:
  - (a) another assisting dentist who possesses one, or
  - (b) a physician anesthesiologist.
  - (c) "Physician" means a physician who is licensed to practice medicine and all of its branches under the laws of Vermont and is authorized to provide anesthesia services in a licensed hospital or licensed ambulatory surgical center, or is an anesthesiologist.
  - (d) Administration of conscious sedation under the exemption sections above is permitted only in facilities which meet the equipment and staffing requirements of these rules.

Incident Reports

- (a) Each dentist whether or not holding a special endorsement provided under these rules, must submit a complete report to the Board within 30 days of any mortality, or other incident which occurs in the dentist’s office or outpatient facility during, or as a direct result of, the administration of any anesthesia, local or general, anxiolysis, parenteral deep sedation, or parenteral conscious sedation or sedation regardless of the route of administration, and which results in a patient being transported to a hospital, hospitalization, or death.

Incident Reports

- (b) The incident report shall be submitted whether or not the patient is admitted, and whether or not the incident has the potential for life-threatening consequences. A report of an incident shall include a statement setting forth the names and credentials of those present or participating during the anesthesia, anxiolysis or sedation. Failure to comply with this reporting requirement may result in disciplinary action including loss of a special endorsement.

Effective January 1, 2007 no dentist shall administer a pharmaceutical agent or agents to induce conscious sedation without first obtaining a conscious sedation endorsement or general anesthesia endorsement from the Board.

Anesthesia and Sedation in Dental Practice

Pre-sedation Assessment

“A satisfactory outcome of anesthesia is largely determined by the quality of preanesthetic and postanesthetic care.”

Robert Dripps

Goals of Pre-sedation assessment:

- Identify pre-sedation risk factors
- Determine if any pre-sedation investigations or specialty consultations are required
- Optimize the patient’s condition prior to the procedure
- Review available documentation related to previous sedation/analgesia
- Formulate a sedation plan
- Obtain informed consent
- Reduce patient’s anxiety through education and communication
The ABCDs of Presedation Concerns
John Yagiela, DDS, PhD, Professor and Chair, Division of Diagnostic Science, UCLA: from Special Care in Dentistry, Annual Session, April 2007

- **A**irway
  - Evaluation and control of the airway for sedation and anesthesia
- **B**reathing
  - Position, sleep apnea, and positive pressure ventilation
- **C**irculation
  - Perioperative cardiac evaluation for noncardiac surgery
- **D**rugs
  - Are there drugs patients should stop taking before sedation/anesthesia?

The three components of the pre-sedation evaluation

1. Past medical history (which is relevant)
2. Focused physical examination
3. Collecting relevant consultations and/or ordering lab tests

Pre-sedation Assessment should include:

- Significant Medical History
- Height and weight (obesity vs malnourishment)
- Major organ system abnormalities and evaluation of the airway
- History of any previous adverse experiences with sedation/analgesia as well as regional and general anesthesia
- Drug allergies and current medications
- Tobacco, alcohol or substance use or abuse
- Risk assessment (eg, The American Society of Anesthesiologists Physical Status)

Know the ASA risk classification & use it!

The ASA classification system was not intended to be used in patients undergoing procedures under sedation/analgesia. Still, it remains useful in identifying high risk patients.

PMH: rating a patient’s **functional capacity** (heart and lungs) by metabolic equivalents (MET)

- 1 MET = 3.5 ml/kg/min for a 70kg, 40 year old man at rest
- Functional capacities=peak oxygen utilization rates
  - Excellent: > 10 METs
  - Good: 7-10 METs
  - Moderate: 4-7 METs
  - Poor: < 4 METs
- Functional capacity is the **gold standard** for estimating ischemic risk during anesthesia
- Lower the MET score, less functional capacity > risk

PMH: Estimating Functional Capacities by using the Duke Activity Index Questionnaire

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<th>Activity Index Questionnaire</th>
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<tbody>
<tr>
<td>1. Can you take care of yourself (cooking, dressing, bathing, or using the toilet)?</td>
<td>1</td>
</tr>
<tr>
<td>2. Can you do light work around the house like dusting or washing clothes?</td>
<td>2</td>
</tr>
<tr>
<td>3. Can you walk indoors, such as around your house?</td>
<td>2</td>
</tr>
<tr>
<td>4. Can you sell outdoor, such as around your house?</td>
<td>3</td>
</tr>
<tr>
<td>5. Can you walk a block or two on level ground?</td>
<td>3</td>
</tr>
<tr>
<td>6. Can you climb a flight of stairs or walk up a hill?</td>
<td>4</td>
</tr>
<tr>
<td>7. Can you do moderate work around the house like vacuuming, sweeping floors, or moving in groceries?</td>
<td>5</td>
</tr>
<tr>
<td>8. Can you do heavy work around the house like scrubbing floors or lifting and moving heavy furniture?</td>
<td>6</td>
</tr>
<tr>
<td>9. Can you do yard work like raking leaves, weeding or pushing a power mower?</td>
<td>6</td>
</tr>
<tr>
<td>10. Can you participate in moderate recreational activities like golf, bowling, dancing, doubles tennis or throwing a football?</td>
<td>7</td>
</tr>
<tr>
<td>11. Can you have sexual relations?</td>
<td>8</td>
</tr>
<tr>
<td>12. Can you participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?</td>
<td>&gt;10</td>
</tr>
</tbody>
</table>
A Person’s MET Score approximates ability to withstand stress

<table>
<thead>
<tr>
<th>Activity Index Questionnaire</th>
<th>Approx. MET</th>
<th>Risk of sedation/tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Can you take care of yourself (eating, dressing, bathing, or using the toilet)?</td>
<td>1</td>
<td>&lt;4 POOR</td>
</tr>
<tr>
<td>2. Can you do light work around the house like dusting or washing dishes?</td>
<td>2</td>
<td>4-6 MOD</td>
</tr>
<tr>
<td>3. Can you walk indoors, such as around your house?</td>
<td>2</td>
<td>4-6 MOD</td>
</tr>
<tr>
<td>4. Can you walk a block or two on level ground?</td>
<td>3</td>
<td>7-10 GOOD</td>
</tr>
<tr>
<td>5. Can you climb a flight of stairs or walk up a hill?</td>
<td>4</td>
<td>7-10 GOOD</td>
</tr>
<tr>
<td>6. Can you do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?</td>
<td>5</td>
<td>&gt;10 EXCELLENT</td>
</tr>
<tr>
<td>7. Can you do heavy work around the house like scrubbing floors or lifting and moving heavy furniture?</td>
<td>6</td>
<td>&gt;10 EXCELLENT</td>
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<td>6</td>
<td>&gt;10 EXCELLENT</td>
</tr>
<tr>
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<td>7</td>
<td>7-10 GOOD</td>
</tr>
<tr>
<td>10. Can you have sexual relations?</td>
<td>8</td>
<td>&gt;10 EXCELLENT</td>
</tr>
<tr>
<td>11. Can you run a short distance?</td>
<td>9</td>
<td>&gt;10 EXCELLENT</td>
</tr>
<tr>
<td>12. Can you participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?</td>
<td>&gt;10</td>
<td>&gt;10 EXCELLENT</td>
</tr>
</tbody>
</table>

Focused Physical Exam should include at least the following:
- Baseline vital signs (BP, HR, RR, room air SpO₂)
- Mental status, level of awareness
- Airway assessment

If the collected information suggests presence of a new serious medical problem, further detailed evaluation will be necessary and elective procedures should be delayed.

Focused Physical Exam: the Airway
- American Society of Anesthesiologists Difficult Airway Algorithm (www.asahq.org)
- The #1 cause of morbidity and mortality (death) in sedation and anesthesia by far is the inability to manage the airway
- Definitions:
  - Difficult airway: anesthesiologist experiences difficulty in managing the airway
  - Difficult face mask ventilation: not possible to provide adequate ventilation
- An Airway history and Physical exam should be conducted, whenever feasible, prior to the initiation of anesthetic care and airway management in ALL patients

What makes a difficult airway?

4Ds
- Disproportion
- Distortion
- Decreased mobility
- Dentition

Guidelines to identify “high risk” patients:
- Difficult airway
- Sleep apnea or airway obstruction
- Age > 70 years
- Morbid obesity
- Drug or alcohol abuse
- Severe major organ system disease resulting in ASA score greater than 3

Although the majority of “high risk” patients are safely managed by an experienced practitioner, consideration should be given to consult an anesthesiologist if significant difficulties are expected or invasive monitoring is required.

Evaluating the Airway: MOUTHs
- MANDIBLE: is mandible advanced or not
- OPENING: how wide can the mouth open
- UVULA: assess/classify pharyngeal structures
- TEETH: assess if loose teeth/dental appliances
- HEAD: flexion, extension, rotation of head/neck and cervical spine
- SILOUETTE: upper body abnormalities, both anterior and posterior
Mallampati Classification of the airway

- Based on the principle that the tongue is the largest occupant of the oropharynx
- Close proximity to laryngeal inlet
- Classification based on how much the tongue obscures visualization of the laryngeal structures:
  - Class I – uvula, faucial pillars, soft palate
  - Class II – faucial pillars, soft palate
  - Class III – soft palate
  - Class IV – hard palate

Sleep apnea and moderate sedation

What is sleep apnea?

- Sleep apnea is the cessation of air flow for longer than 10 sec leading to arterial hypoxemia and hypercarbia
- If sleep apnea is suspected, pre-sedation assessment should include questioning about associated signs and symptoms including:
  - Morning headaches
  - Overwhelming somnolence during normal waking hours
  - Loss of initiative
  - Memory problems
  - Etc (other signs which may suggest sleep deprivation)

Recommendation for Sedation in Patients with Sleep Apnea

- Ask those patients who use CPAP at home to bring their personal CPAP machines when coming for the procedures:
  - Beginning CPAP immediately after the procedure results in significantly fewer desaturation episodes
  - Must determine how practical this is for your facility
- Since sleep apnea patients are at increased risk for hypoxemia after the procedure:
  - Avoid prescribing CNS depressants when possible!
  - Avoid consuming alcohol in immediate post-op period
  - Written information at discharge regarding CNS/alcohol
  - In some cases 24-hours in-house observation may be needed

When do you need to get a medical consult before sedation?

- Undiagnosed, Uncontrolled, Uncertain
- When your patient is at high risk of having a "problem" during the sedation or procedure.
- Consideration to getting a consult from a physician if:
  - ASA IV patients: severely compromised or medically unstable
  - Patient has a difficult airway
  - Patient has a known history of complicated or unsuccessful moderate sedation/analgesia
- Also, need to consider if patient should be seen in O.R. by anesthesia for a MAC or G.A.
Anesthesia and Sedation in Dental Practice

**Sedation Pharmacology**

1. **Sedation Pharmacology**

   **Definitions: Anxiety & Pain Control**
   - **Analgesia**: reduction or elimination of pain
   - **Anxiolysis**: reduction or elimination of anxiety (with little or no apparent evidence of drowsiness or impairment)
   - **Sedation**: noticeable change in patient awareness, often accompanied by drooping eyelids, slurred speech, repetition and ataxia
   - **Hypnosis**: a state of apparent sleep: somnolence

2. **Sedation Pharmacology**

   **Definitions: Levels of Sedation**

<table>
<thead>
<tr>
<th>Level</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Awake and calm (anxiolysis, no evidence of drowsiness)</td>
</tr>
<tr>
<td>2</td>
<td>Awake but sedated. (Slowed or slurred speech)</td>
</tr>
<tr>
<td>3</td>
<td>Asleep but easily aroused. (Verbally)</td>
</tr>
<tr>
<td>4</td>
<td>Asleep but difficult to arouse. (Shake/Shout)</td>
</tr>
<tr>
<td>5</td>
<td>Asleep and unarousable. (Except by surgical stimulus)</td>
</tr>
</tbody>
</table>

   **Level 1 = Minimal sedation/anxiolysis**
   **Levels 2-3 = Moderate sedation (“conscious”)**
   **Levels 4-5 = Deep sedation**

3. **Sedation Pharmacology: Definitions**

   **Does anxiolysis imply sedation? Does sedation imply anxiolysis?**

   **No and Yes.**

   “Anxiolysis” does **NOT** necessarily imply sedation, and usually is considered “subcortical” Level 1.

   “Sedation” **implies** the occurrence of anxiolysis and involves higher cortical levels of depression in the cerebrum (Levels 2,3).

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**Sedation Pharmacology**

**Definitions: Routes of Administration**

- **Enteral**: any technique of administration in which the agent is absorbed through the GI tract or oral mucosa (oral, rectal, sublingual)
- **Parenteral**: a technique of administration in which the drug bypasses the GI tract (IM, IV, intranasal (IN), submucosal (SC), intraocular (IO))
- **Transdermal/transmucosal**: a technique of administration in which the drug is administered by patch or iontophoresis
- **Inhalation**: a technique of administration in which a gaseous or volatile agent is introduced into the pulmonary tree and whose primary effect is due to absorption through the pulmonary bed (e.g. Nitrous oxide/oxygen sedation)
Sedation Pharmacology
Definitions: Levels of Skill

- **Exposed**: the level of skill attained by observation or participation in a particular activity
- **Competent**: displaying special skill or knowledge derived from training and experience
- **Proficient**: the level of skill attained when a particular activity is accomplished with repeated quality and a more efficient utilization of time (highest level of skill)

Pharmacology: Nitrous Oxide (N₂O)

General Principles:

- Nitrous Oxide: colorless, nonflammable gas, mild odor and taste, non-irritating to mucosa
- Supplied as a liquid in cylinders (750 psi)
- Only inhalational agent practical for producing sedation in the dental practice
  - Poor solubility in blood
  - Low potency

Pharmacology: Nitrous Oxide

Solubility

- CNS depression that results in sedation depends on the concentration of the sedative in the specific brain regions and how these change as the sedative agent attempts to achieve a state of equilibrium with other bodily tissues (eg. Muscle, fat)
- Same properties apply to nitrous oxide

Pharmacology: Nitrous Oxide

Potency:

- Nitrous Oxide is the **least potent** of the anesthetic gases.
- Minimum alveolar concentration (MAC) = 105
  - MAC=alveolar concentration at which 50% of patients fail to respond to a standard surgical stimulus.
  - Because the concentrations for producing sedation and analgesia in dentistry are typically in the range of 20-50% reaching a state of CNS depression (where patients are nonresponsive) is very unlikely

Anesthetic	| MAC  |
---|-----|
Nitrous Oxide | 105  |
Halothane     | 0.77 |
Isoflurane    | 1.15 |
Enflurane     | 1.70 |
Desflurane    | 6.0  |

70% nitrous oxide/30% oxygen can produce general anesthesia when combined with conventional doses of a barbiturate and narcotic!

Nitrousoxide's use as a general anesthetic is limited due to the high MAC
- MAC can be reduced by other depressants (opioids and inhalation agents)
- Nitrous DOES produce analgesia (patient’s perception of pain)
  - Estimated that 20% produces the effect of 10mg Morphine
Inhalation Sedation: Nitrous Oxide

**Indications**
- Anxious patients
- Able to cooperate
- Able to breathe through nose
- Understands that will not be “asleep” for procedure
- Medically compromised patients:
  - Cardiovascular
  - Respiratory
  - CVA
  - Hepatic
  - Epilepsy
  - Diabetics
- GAGGERS!

**Contraindications**
- Claustrophobic patients
- Compulsive personality (can’t lose control)
- Children with severe behavior problems
- Severe personality disorders
- Upper respiratory tract infections (or other acute respiratory conditions)
- Neurologic conditions: AD, PD
- Patients who don’t want it!
- COPD – relative (rare)
- Pregnancy – JUST DON’T DO IT!

Yes! It can be!

**Minimizing Nitrous Levels to Office Personnel**
- Test equipment for leaks
  - Visualize rubber
  - Soapy water connectors
  - Outside company (Environmental Mgmt)
  - Infrared Analyzer (IR)
- Venting waste gases
- Scavenging nasal hoods
- Air-sweep (portable fan)
- Minimizing patient talking
- Monitoring air (IR-best)
  - <50 ppm safe
  - 400 ppm = reasonable
  - >1000 ppm = too high

---

**Pharmacology of Oral Agents**

- **Benzodiazepines**
  - Most effective drugs for managing anxiety
  - Possess skeletal muscle relaxant properties
  - Are anticonvulsants
  - Do not potentiate the respiratory effects of opiates

---

**Benzodiazepines-Contraindications**

- Allergic to Benzodiazepines
- Psychoses
- Narrow-angle glaucoma
- Pregnancy (risk of teratogenesis)

Warning: Psychological and physiological dependence may develop. Should not use other CNS depressants (alcohol, narcotics, and barbiturates when taking BZDs. Patients should be advised against driving and using hazardous machinery. Use of BZDs during the first trimester of pregnancy increases the risk of congenital malformations (eg. Cleft palate).

---

**Pharmacology: Oral Agents Benzodiazepines (BZD)**

- **Mode of action**
  - Depressant effects on subcortical levels of the CNS, specifically the limbic system and thalamus (areas of brain dealing with emotions and behavior)
  - **Patients with liver disease may take benzos!**
  - All absorbed rapidly and reliable from GI tract
  - Wide margin of safety between therapeutic / toxic doses

- **Receptors for BDZ located in brain & spinal cord**
  - Location of receptors parallels that of gamma-aminobutyric acid (GABA), the major inhibitory neurotransmitter in the brain and glycine, the major inhibitory neurotransmitter in the spinal cord
Pharmacology of Benzodiazepines (BZD)

Mode of action:
- Bind to BZD receptor sites (parallel GABA but are not identical)
- Open chloride ion channels on postsynaptic neurons resulting in hyperpolarization (affect postsynaptic neurons)

Pharmacology of Benzodiazepines (BZD)

Mode of action:
- May have two classes of receptors
  - Type I (anti-anxiety) (anxiolysis)
  - Type II (other effects) include muscle relaxation and generalized CNS depression
- Each BZD has its own subtle pharmacologic difference
- Deciding which BZD to use includes pharmacology!

Pharmacology of Benzodiazepines
Pharmacokinetics and Pharmacodynamics

Pharmacokinetic properties
- What the body does to the drug...as the BZD gets to and from the receptor
  - Includes absorption, metabolism (bioavailability depends on lipid or water solubility, gastric degradation, and first-pass metabolism)
  - Distribution (alpha ½ life), and Elimination (beta ½ life)

Pharmacodynamic properties
- What the drug does to the body
  - Desirable (primary) effects (sedation)
  - Secondary effects: memory impairment
  - Potency: a milligram dose amount required to produce a certain effect (EG. A level 2 sedation)
  - Same effect may be produced by: Halcion 0.25mg, Ativan 2mg, or Valium 15mg (Termed: Equipotent doses)

The 3 most widely used BZDs in Oral Sedation
- Diazepam (Valium)
- Lorazepam (Ativan)
- Triazolam (Halcion)

Pharmacology: BZDs

What is the most common problem encountered when prescribing BZDs for the first time to a new patient?

Knowing which BZD to use at which dose!
Oral meds are least predictable due to variable absorption, first-pass metabolism, and relative lipid solubility (protein binding).

Pharmacology: BZDs

Most BZDs heavily bound to plasma proteins (such as albumin) which determine onset and duration of sedation
- Results in less than 5% of the ingested dose being free to bind to the receptor to exert an effect
- Patients with reduced plasma protein, BZD dose may be significantly less than normal
- Elderly patients, Alcohol abusers
- Malnutrition, Severe liver disease
- Many BZDs undergo oxidative metabolism by the hepatic cytochrome P450 enzymes
- Other meds pt taking may alter BZD available by either delaying the metabolism or accelerating it

BZDs fit the typical dose response curve for oral sedatives:
- 68% will respond to dose given
- 27% will be under/over sedated
- 5% will be significantly over-sedated or will have little effect
Pharmacology: Oral Sedation
Comparison of Pharmacology of BZDs

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Triazolam</th>
<th>Lorazepam</th>
<th>Diazepam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolites</td>
<td>Insignificant</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Alpha half-life (minutes)</td>
<td>3-7 min</td>
<td>3-10 min</td>
<td>45 min</td>
</tr>
<tr>
<td>Beta half-life (hours)</td>
<td>2 - 3 hrs</td>
<td>10-20 hrs</td>
<td>20-40 hrs</td>
</tr>
<tr>
<td>Onset (minutes)</td>
<td>30 - 60</td>
<td>90 -120</td>
<td>60 - 90</td>
</tr>
<tr>
<td>Anxiolyis Dose (PDR*)</td>
<td>mg</td>
<td>0.25 – 0.5</td>
<td>2 - 4</td>
</tr>
<tr>
<td>Sedative Dose (in office)</td>
<td>mg</td>
<td>0.5 – 0.75</td>
<td>4 - 6</td>
</tr>
</tbody>
</table>

Final Notes Regarding BZDs

- These dosages should be at least HALVED in elderly (>70 years)
- Sedation dosages MUST be given in the office!
- If using BZDs for sedation in doses above, or in additive doses, must provide monitoring identical to IV sedation.
- Will discuss individual drugs under oral sedation.

Other Oral Sedation Drugs

- Antihistamines
  - Benadryl
  - Vistaril
- Sleep Aids
  - Ambien
  - Sonata
  - Xanax

Oral Sedation: Reversal Agent
Flumazenil (Romazicon)

- **USE**: Only to reverse an inadvertently deeply sedated and poorly responsive patient (levels 3 and above)
  - It must NOT be used as part of a sedation regimen
  - Duration of reversal is SHORTER than the oral BZD that you are trying to reverse
  - Hospital policy (for IV and moderate sedation = 2 hours)
  - Private dental practice: If you use a reversal, patients should stay at least 1 hour to guard against re-sedation
- Pharmacology:
  - Specific, high affinity with and competition for BZD receptors
  - No intrinsic (agonist) activity of its own
  - Not highly lipid soluble, but low binding to plasma proteins allow rapid onset
  - Short distribution ½ life, rapid hepatic biotransformation

- **Precautions**:
  - For children: start with 0.1 mg, observe, continue with airway support. In most cases some alertness starts to return in 5-7 minutes. If no results after 10 minutes, inject another 0.1 mg.
  - For adults: start with 0.2 mg. Then, give 0.1 to 0.2mg Q3-5 minutes up to 1.0mg
  - Remember: the objective is to reverse the poorly responsive SEDATION without reversing anxiolysis!
  - **CAUTION**: Do not over reverse an epileptic, anxiety disorder pt, or chronic BZD use (Seizures can occur)
Pharmacology: IV Sedation Drugs
Diazepam (Valium) vs Midazolam (Versed)

- Midazolam similar in most pharmacological aspects to diazepam. Note the 2nd nitrogen which closes in the body (pH 7.4) to give it its clinical efficacy.

Pharmacology: Comparison of Midazolam (Versed) & Diazepam (Valium)

- Pharmocokinetics: Advantage M
- Tissue irritation: Advantage M
- Cost: Advantage D
- Therapeutic efficacy: Equal
- Systemic toxicity: Equal

Pharmacology: IV Sedation Drugs
Midazolam (Versed)

Diazepam ring is closed and it is insoluble in water, whereas Midazolam has a buffered pH of 3.3, which provides for water solubility. Once in the body, the physiologic pH (7.4) acts to close the ring. Water solubility results: lack of burning sensation and minimizes vein irritation (phlebitis) at injection site.

Pharmacology: Midazolam (Versed)
Pharmacokinetics & Biotransformation

- Undergoes metabolism in the liver by hydroxylation into three major metabolites (none are active compared to diazepam(2))
- Alpha half-life (distribution) = 4 – 18 minutes
- Beta half-life (metabolism and excretion)
  - Midazolam = 1.7 – 2.4 hours (Diazepam = 20-40 hours)
- Lack of metabolites and shorter half-life
  - Results in NO rebound effect
  - More suitable for ambulatory procedures
- 94% protein bound (primarily serum albumin)
- Rapid onset of action: induction from 55 to 143 seconds
- Clinical duration: 45 minutes

Pharmacology: Midazolam (Versed)
Effects on Major Systems

- Cardiovascular: Systemic blood pressure is slightly decreased
- Respiratory: Usually insignificant unless drug is administered quickly or combined with other CNS depressants
- CNS: Midazolam provides antiseizure effect, produce anterograde (forward) amnesia, anxiolysis, and centrally-mediated muscle relaxation

When should you use Flumazenil (Romazicon) in moderate sedation cases?

- Criteria for using Flumazenil
  1. Reverse moderate sedation when patients appear to be having an untoward reaction to BZDs.
  2. In confirmed BZD overdose, where respiratory failure requiring intubation appears imminent.
  3. In poly-pharmaceutical overdoses of unknown agents, where respiratory failure requiring intubation appears imminent.
- IT IS NOT to be used routinely for:
  - Getting patients “street ready” following sedation
Flumazenil (Romazicon) Dosage

- Comes in 5 and 10 ml vials (0.1mg/ml)
- Vial 0.5mg (0.5mg/5ml costs about $18), Vial 1.0mg (1.0mg/10ml costs about $40)
- Initial dose for reversal of sedation is 0.2mg.
- If desired result is not reached in 45 seconds – 1 minute another 0.2 mg may be administered.
- Doses may be repeated at 60 second intervals to a maximum of 1 mg.
- IF GIVING FOR A BZD OVERDOSE:
  - Initial dose 0.2mg followed 30 seconds later by 0.3mg.
  - 0.5mg doses given every minute up to 3-5mg.

I.V. Opioid Analgesics Overview

- Opioids are NOT sedatives
  - Sedative effects cannot be titrated
  - Should not be used orally!
- Excellent for relief of moderate to severe pain (analgesia)
- Primary action derive from effects on the CNS: analgesia, drowsiness, changes in mood, and mental clouding.
- Analgesia is produced without loss of consciousness.

Categories of Opioids

- Opioid agonist: Meperidine, Morphine, Fentanyl, Alfentanil, Sufentanil
  - Drugs that interact with an opioid receptor producing a physiologic change
- Opioid antagonists: Naloxone (Narcan)
  - Drug that occupies a receptor site with no resultant pharmacologic effect
- Opioid agonist/antagonist: Pentazocine, Nalbuphine (Nubain), Butorphanol
  - Possess properties of both above groups

Pharmacology: Opioid Analgesics Agonist: interact with opioid receptors

- 4 different opioid receptors identified: mu, kappa, sigma, and delta
- Mu and Kappa are the primary receptors used in IV sedation

Pharmacology: Opioid Analgesics Precautions and Contraindications

- Allergy or hypersensitivity to Opioids
- MAOIs taken within 14 days
- COPD: those patients with decreased respiratory drive
- Significant liver and renal dysfunction are also relative contraindications

Pharmacology: Meperidine (Demerol) Pharmacokinetics

- Most frequently used IV opioid in dentistry
- Has “atropine like” (anticholinergic) properties
  - Antisialagogue, increases ht. rate, dilates pupils
- Causes histamine release
  - “tracking” skin overlying will appear red and itching may be present (not an allergic rxn)
  - Reddening will continue up the arm along the path of the vein (allergic reaction: over the entire region)
- Metabolites: Normeperidine
- Beta ½ life: 3-8 hours
- Clinical duration: 45 minutes - 1 hour
- Equipotent doses:
  - 100mg Meperidine = 100mcg Fentanyl = 10mg Morphine
Pharmacology: Meperidine (Demerol) Properties and Dosage

- Desirable properties
  - Elevated pain threshold
  - Rapid onset of action
  - "smooth" duration of action
  - Feeling of euphoria

- Dosage:
  - 25-100mg (ampules)
  - 50 mg syringe

Pharmacology: Fentanyl (Sublimaze)

Pharmacokinetics

- Very potent analgesic: 100x more potent than morphine
  - 0.1mg of fentanyl = 10 mg Morphine
- After IV administration, onset of analgesia and sedation occurs almost immediately (less than 1 minute)
- Maximal analgesic and respiratory depressant effects do not develop for several minutes
- Can cause "chest wall rigidity": related to rapid rate and high dose
  - If this should occur (I have never seen it) control ventilation and reverse (Narcan)
- Metabolites: Unknown
  - Alpha ½ life = 13 minutes; Beta ½ life: 3.5 hours
- Clinical duration: 30 - 60 minutes
- Caution: Respiratory depression appears to last longer than the analgesic action! Observed 15 minutes following dose.
  - Recover at least 30 minutes to observe following last dose.

Pharmacology: Fentanyl (Sublimaze) Dosage

- AMPs: 50mcg in 2 mls
  - May dilute for better visualization! Use a 10mL syringe. Or smaller syringe. Add 8cc to produce a 10ml syringe with a concentration of 100mcg/10mL syringe (or 10mcg in 1 ml)
  - Give 25mcg (0.25 mg) x 4 increments
  - Always titrate to effect!

Pharmacology: Nalbuphine (Nubain) Indications and Dosage

- Only indication: For longer procedures
  - (Consider for patients where respiratory depression is a concern).
- Dosage: comes in 1 and 2ml ampules and and 10ml (10mg) vials
  - Use a 10mL syringe. If 10mg/mL vial will be a concentration of 1mg/ml.
  - Give 2.5mg x 4 increments
  - Always titrate to effect!

Pharmacology: Nalbuphine (Nubain) Pharmacokinetics

- Similar to morphine in analgesic properties
  - Considered equipotent 10mg Nubain = 10mg Morphine
- Duration of action longer than morphine
  - Approximately 3-6 hours
- Metabolites: None
  - Beta (plasma) ½ life: 2-3 hrs
- Magnitude of respiratory depression is not increased with higher doses (ceiling effect) but not significant for doses used in dentistry (10 mg)
- Does not increase cardiac work load or blood pressure.

Pharmacology: Opioids Comparison of Opioids for IV sedation

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Meperidine</th>
<th>Nalbuphine</th>
<th>Fentanyl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacokinetics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEASUREMENTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to peak effectiveness</td>
<td>3-4 hr</td>
<td>2-3 hr</td>
<td>Unknown</td>
</tr>
<tr>
<td>Duration (H)</td>
<td>6-9 hr</td>
<td>4-6 hr</td>
<td>1-2 hr</td>
</tr>
<tr>
<td>Pharmacodynamics</td>
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<tr>
<td>Mu Receptor</td>
<td>**</td>
<td>-</td>
<td>**</td>
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<tr>
<td>Kappa Receptor</td>
<td>-</td>
<td>**</td>
<td>**</td>
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<tr>
<td>Unique Effects</td>
<td>Antidepressant, Antagonist Effect</td>
<td>Withdrawn Syndrome in opioid-dependent patients</td>
<td>May produce skeletal muscle rigidity</td>
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<tr>
<td>Potency</td>
<td>100 mg</td>
<td>10 mg</td>
<td>100 mcg</td>
</tr>
<tr>
<td>Concentrations</td>
<td>50 &amp; 100 mcg</td>
<td>10 mg</td>
<td>50 mcg</td>
</tr>
<tr>
<td>Increment</td>
<td>25 mg x 4</td>
<td>25 mg x 4</td>
<td>25 mg x 4</td>
</tr>
</tbody>
</table>
Reversal Agent for Opioids
Naloxone (Narcan)
- Competitive inhibitor
- Use care in drug addicts
- Beware of long acting narcotics
- Dosage: comes in 0.4mg/ml
  - Give 0.1 to 0.2 mg q 3-5 minutes
  - Large doses may precipitate hypertension, severe pain, arrhythmias or pulmonary edema
  - KEY: Give SMALL doses!

Anesthesia and Sedation in Dental Practice

Inhalation Sedation

Inhalation Sedation: Nitrous Oxide Administration
- Must inspect system prior
  - Adequate pressures of gas (What is maximum pressure for nitrous & oxygen tanks?)
  - No gas leaks (listen)
  - Face mask correct size
  - Scavenging system working
- What type of system?
  - Portable system
  - Central storage
  - Both are continuous flow
  - All systems are fail safe and maximum is 78% (30% oxygen)

Inhalation Sedation: Nitrous Oxide Administration: Technique
1. Consider consent
2. Discuss probable clinical effects of using nitrous BEFORE beginning procedure!
3. Make sure nose piece fits and scavenger system works (hook to large suction)
4. Measure and record vital signs: BP, HR, RR
5. Give 100% oxygen initially at a flow rate of 5-7 liters per minute (lpm)
   1. Determine by reservoir bag
   2. If bag collapses, not enough LPM
6. Titrate nitrous: 20% initially for most patients
7. Instruct patient to inhale and exhale exclusively through nose speeds induction
8. Slow, regular breathing is important!

Inhalation Sedation: Nitrous Oxide Administration: Titrate to effect
- Signs and symptoms of sedation
  - Relaxation
  - Extremities tingling
  - Circumoral numbness
  - Floating/sinking sensations
  - Body warmth
  - Changes in perception of auditory stimuli
- Titration should increase until patient is comfortable and experiences any of these.

Inhalation Sedation: Nitrous Oxide Administration: What are signs/symptoms that N2O is too high?
- Dysphoria (feeling of depression and unrest)
- Uncontrolled laughter
- Sweating
- Nausea
- Marked lethargy
- Inability to follow commands
- Unresponsiveness

The concentration of nitrous oxide should be either immediately decreased or discontinued if any of these symptoms are encountered!
Inhalation Sedation: Nitrous Oxide

Ending the case (procedures)

- Discontinue the nitrous flow
- Use 100% Oxygen for 3-5 minutes
- Engage in conversation as a way to assess for a patient's return to baseline
- Prudent to measure and record post-procedure vital signs: BP, HR, RR
- On return to baseline, unlike any other sedation technique, dismiss patient!
  - (An adult escort is not necessary!)

Anesthesia and Sedation in Dental Practice

- Oral Sedation

Oral Sedation

Why are oral sedatives used so much in Dentistry?

- Ease of administration
- Universal acceptability (no needles)
- High safety margins
- Reversible with antagonist (flumazenil)
- Fast onset, mixed durations
- Drug and dose-dependent anterograde amnesia
- Minimal cardiovascular depression

Oral Sedation: What are some precautions you must tell your patients before prescribing these as a sedative?

- Must have someone drive you to the office!
  - In the case of Diazepam, you may not be able to drive for days. (1/2 life = hours as a person's age)
- In general, not to be used in pregnancy
- Most work to “take the edge off” but if patient is expecting to be “put to sleep” need to consider other options:
  - Supplementing with nitrous oxide
  - Moderate sedation (IV)

Oral Sedation: Diazepam (Valium)

- Most familiar sedative in dentistry
- Strong anxiolytic effect, minimal somnolence, and no amnesia
- Lipid soluble with long-acting metabolites (oxazepam and desmethyldiazepam) with sedative properties
- Est. working time from 1-2 hours
- “Rebound” can occur when sequestered drug is re-released into the bloodstream after a meal
  - Patients should be warned about this!
  - (May get drowsy after eating!)

Oral Sedation: Diazepam (Valium)

- Usual dose is 5-10mg and supplied in 5-10mg tablets (above this is sedative dose)
- Substrate of cytochrome P450 and meds. That affect these can activate or retard the metabolism of diazepam
- Can’t drive for up to 3 days in some patients!
- Recommendation: Don’t use routinely! Not recommended for elderly patients or those with impaired liver function
Oral Sedation: Lorazepam (Ativan)

- One of the more hydrophilic BZDs available for PO administration
- Difficult to cross the blood-brain barrier
  - Results in longer time to onset of sedation
  - Requires a long time for recovery
- Long-acting anxiolytic
  - Minimal amnesic or somnolent effects
- No active metabolites
  - No rebound effects

Oral Sedation: Triazolam (Halcion)

- One of the more potent BZDs
- Short alpha & beta half-lives (3-10 minutes, 2-3 hours) due to rapid distribution & metabolism & elimination
- Profound anterograde amnesia as dose increases
- Able to induce somnolence (first introduced as sleeping aid)
- Adverse effects: CNS depression, amnesia
- Muscle relaxation dose related
- Metabolized by cytochrome P450
- Precautions: myasthenia gravis, pulmonary disease, narrow angle glaucoma, pregnancy category X

Oral Sedation: Titration

Conclusions by ADA and ADSA

- No data support the safety of this practice.
- Growing concern that many patients may become profoundly sedate, and perhaps even lose consciousness, with more than one oral sedative in a short window of time
- Dentists should be certified for moderate sedation and monitor patients accordingly when using re-dosing (BP, HR, RR, and pulseoximetry)
Anesthesia and Sedation in Dental Practice

**IV Sedation**

- **IV Sedation Drugs**
  - **Midazolam (Versed)**
    - Dosage forms: injection: 1 and 5 mg/ml in 2, 5, and 10mL vials and 5mg/mL in 2 mL syringes
    - Can dilute in sterile water due to water solubility
    - Directions: IV: Titrated to effect (2-10 mg at 1 mg/min: Average dose = 5 mg

**IV Sedation Drugs**

- **Meperidine (Demerol) or Fentanyl (Sublimaze)**
  - Dosage forms:
    - Meperidine: 25mg x 4 (Comes in syringe or dilute)
    - Fentanyl: 25 mcg x 4 (Dilute 100mcg in 10ml syringe so 10 mcg/ml)
  - Directions: IV: Titrated to effect. Avg dose = 50 - 100

**IV Sedation Drugs: Administration and Doses (selective drugs)**

<table>
<thead>
<tr>
<th>DRUG</th>
<th>SINGLE DOSE</th>
<th>ONSET</th>
<th>PEAK</th>
<th>DURATION</th>
<th>ANTAGO SUMED</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midazolam (Versed)</td>
<td>0.5-5 mg IV</td>
<td>0.5-10 min</td>
<td>5-10 min</td>
<td>20-60 min</td>
<td>Nilatorine</td>
<td>No active metabolite</td>
</tr>
<tr>
<td>Fentanyl (Sublimaze)</td>
<td>10-50 mcg IV</td>
<td>0.5-10 min</td>
<td>5-10 min</td>
<td>30-60 min</td>
<td>Nilatorine</td>
<td>May cause the S+ or S- impact</td>
</tr>
<tr>
<td>Magnitson (Narcan)</td>
<td>0.5-10 mcg IV</td>
<td>0.5-10 min</td>
<td>5-10 min</td>
<td>60-120 min</td>
<td>Nilatorine</td>
<td>Causes the S+ impact</td>
</tr>
</tbody>
</table>

**IV Sedation Drugs: Reversal Agents and Doses**

<table>
<thead>
<tr>
<th>DRUG</th>
<th>DOSE (mg/kg)</th>
<th>ADMINISTRATION</th>
<th>ONSET</th>
<th>DURATION</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flumazenil (Romazicon)</td>
<td>0.2-0.4 mg</td>
<td>IV bolus 15 sec</td>
<td>5-10 min</td>
<td></td>
<td>May precipitate seizures in patients chronically treated with benzodiazepines. May cause hallucinations, nausea, vomiting, flushing, respiratory depression, 40%</td>
</tr>
<tr>
<td>Narcan (Naloxone)</td>
<td>0.1-0.2 mg</td>
<td>IV bolus every 2 minute</td>
<td>0.5 min</td>
<td>15-30 min</td>
<td>Cautions: must be used cautiously in patients with a history of opioid dependence to prevent precipitating acute opioid withdrawal symptoms in opioid-dependent patients.</td>
</tr>
</tbody>
</table>
IV Sedation:  
Which drug first: BZD or Opioid?

Correct answer: it depends!
- On what: goals of sedation
  - Anxiolysis (BZD) or analgesia (Opioid)
  - Anxiolysis with amnesia (larger dose of BZD)
  - Profound amnesia and profound sedation with minimal patient movement (initial dose of BZD with incremental dose of Opioid)
  - This decreases the amount of BZD needed!
  - Profound sedation, minimal movement, rapid recovery, and some amnesia (Opioid first, followed by dose of BZD)
  - Supplement local anesthesia with IV sedation (reduce pain), Opioid first, add BZD to produce some amnesia
  - Maintain a slow heart rate and minimize increase in BP for a patient with CAD who is not anxious (Start with a significant dose of Opioid and then add a small dose of BZD)

Monitoring and Emergency Equipment
- Oxygen delivery system (positive pressure)
- Pulse oximeter
- Bld. pressure cuff
- Stethoscope
- Suction system w/ back-up
- Oral airways:
  - Small, med, large
- Face mask:
  - Small, med, large
- IV access equipment
- IV Fluids

Monitoring and Documentation
- Records:
  - Informed consent
  - Vital signs (all six)
  - Medical hx. form
  - Pt. anesthesia form
  - Office narcotic & scheduled drug being recorded
  - Level of consciousness
  - Ekg for pts w/ significant cardiac disease

Records of Conscious Sedation Administration
- The following records shall be made for each administration of conscious sedation:
  - (a) relevant medical history of the patient
  - (b) consent for administration of conscious sedation prior to the performance of any procedure and administration of any drugs;

Records of Conscious Sedation Administration
- (c) preoperative, intra operative and pre-discharge monitoring of blood pressure, pulse, respiration, and oxygen saturation where the level of patient cooperation and/or medical / physical limitations of the patient allows; and
- (d) drugs and dosages of drugs used during the operative procedure, and times of their administration over the course of the procedure.

Personnel
- Chair-side assistant with current CPR
- Deep-sedation requirement “a person to observe and monitor the patient” apart from the assistant

The monitoring person should have no other responsibilities apart from the continuous monitoring of the patient. Under certain circumstances institutional sedation policy may allow the monitoring person to assist with minor tasks while maintaining adequate monitoring once the patient’s level of sedation/initial signs have stabilized.
Monitor Alarms
- All monitors have alarms activated when the patient's vital signs deviate from the preset thresholds. These alarms become activated by default whenever the monitors are turned on.
- Alarms must not be disabled during the procedure, and the volume of the alarm should be set high enough to be heard despite ambient noises of the procedure room.
- Alarm limits should not be set broadly since it may obscure a dangerous situation. Initial Alarm limits should be set approximately 20% above/below the patient's pre-sedation baseline vital signs.

What is the best monitor to use when doing sedation in the dental office?
- The eyes, ears, and attention of the monitoring person who is watching your patient:
  - Skin and mucosal color (adequate perfusion)
  - Chest rise and fall (respiration)
  - Feeling a pulse (heart beating)
  - Checking airway (no obstruction)
  - Ensuring monitors are working and recording as needed

Monitoring Requirements
(In general VT requirements mirror ADA guidelines)
- Procedure flow sheet should include:
  - Pre-anesthetic evaluation
  - Why sedation indicated
  - Medications & allergies
  - Medical system review
  - Previous sedation experience
  - Pre-op vital signs
  - Aldrete (pre-sedation) rating
  - Mallampati assessment
  - ASA (Risk) classification
  - Immediate pre-procedure reassessment

Monitoring Requirements
Vermont Regulations
- To minimize risks to patients, a dentist who uses conscious sedation shall:
  - Ensure that monitoring of a patient under conscious sedation begins prior to the administration of sedation, and takes place continuously during the procedure and recovery from sedation. The person who administers the sedation or another licensed practitioner qualified to administer conscious sedation shall remain on the premises until the patient is responsive and discharged.

(b) Ensure that monitoring includes:
  - 1. continuous direct clinical observation of the patient;
  - 2. interval recording of blood pressure and pulse;
  - 3. continuous evaluation of oxygen saturation; and
  - 4. additional devices such as EKG for monitoring when dictated by the medical needs of the patient.
- (c) Ensure that alarms on devices used for monitoring are enabled.

Moderate Sedation Flow Sheet
- Intraoperative record
  - During any sedation/analgesia procedures vital signs, given medications, performed measures, and other intra-procedure events must be documented. Most facilities will use a flow sheet for this documentation.
Moderate Sedation Flow Sheet

- Procedure flow sheet should include vital signs:
  - Before giving first dose of any drug
  - After the administration of the sedative/analgesic
  - At regular intervals during the procedure (max. interval is 5 min)
- POST-OPERATIVE
  - During the initial recovery
  - Just before discharge
  - Monitor LOC and Oxygen
  - Aldrete discharge criteria and rating of sedation
  - Disposition of patient

Managing Complications during Sedation

Complications:

- Complications: What can and does happen in dentistry

Being Mortal

"We look for medicine (& dentistry) to be an orderly field of knowledge and procedure. But it is not. It is an imperfect science, an enterprise of constantly changing knowledge, uncertain information, fallible individuals, and at the same time lives on the line. There is science in what we do, yes, but also habit, intuition, and sometimes plain old guessing. The gap between what we know and what we aim for persists. And this gap complicates everything we do."


Complications…

"An element that introduces, usually unexpectedly, some difficulty, problem, or change."

Emergency vs Urgency….

Emergency: “a sudden, generally unexpected occurrence demanding immediate action.”

Urgency: “calling for haste, immediate action.”
Complications in Dentistry

The only way NOT to have complications is …
- NOT to see patients,
- NOT to practice dentistry!

Boy Dies During Dental Procedure

- May 17, 2010

Treated under general anesthesia at Virginia Commonwealth University

- Died of cardiac arrest
- Was cleared by his pediatrician the day before the procedure

Tonsillectomy – related fatalities not uncommon

- 1 in every 30,000
- 530,000 tonsillectomies done on children under 15 years of age, per year
- 17.6 deaths per year

Dental Sedation Responsible For At Least 31 Child Deaths Over 15 Years

The Huffington Post
7/13/2012

Poorly trained dentists are killing U.S. kids: report

A joint investigation by FRONTLINE and the Center for Public Integrity
Death, Greed at the Dentist: American Children at Risk

July 12, 2012

Dentist the Menace

Children Killed Undergoing Procedures at the Dentist – Blog with a Bite

Don’t judge too quickly!

- OMSNIC has over 11,000 closed claims since it’s inception in 1988!
- Every open and closed case is an opportunity to learn and make things better....especially in regards to anesthesia
- In the Risk Management world, this is known as “The Culture of Safety”

11 year Morbidity and Mortality

- Anesthesia Morbidity and Mortality as reported by Oral Surgeons Insurance Claims from 2000-2011 (5,300 Oral Surgery policy holders in the United States)
- Average # of anesthetics administered per OMS = 671
- Total number of Office Anesthetics = 33,191,562 (over 11 years)
- General Anesthetics = 71%; Moderate Sedation = 29%

Death and Brain Damage Cases

Office = 91
Hospital = 33
Total = 124

OMSNIC from 2000-2011
Incidence of in-office anesthesia deaths and brain damage cases

91 out of 33,191,562 cases
= 1 out of 364,742
Frequency = 91 office deaths per 49,581 Insured years

- 1 in every 545 OMS will experience an office anesthetic death per year
- In a 30 year practice life, 1 in 18 OMS will experience an office anesthetic death

O.S. anesthesia claims by prevalence*

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</tr>
<tr>
<td>2</td>
<td>Phlebitis</td>
<td>17</td>
<td>13</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>* Requiring transferring patient from office to Emergency Room</td>
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</table>

Additional O.S. anesthesia claims

<table>
<thead>
<tr>
<th></th>
<th>Inadequate anesthesia</th>
<th>Ocular Injuries</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Phlebitis</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Nerve injuries (needle stick ≥9, and positioning ≥2)</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>Recovery room falls</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>Deaths after taking post-up pain meds at home</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>Inappropriate anesthesia</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>Billing disputes</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Stormy induction, restraint (physical abuse)</td>
<td>4</td>
<td>NOT requiring transferring patient from office to E.R.</td>
</tr>
</tbody>
</table>

Managing Complications

- Minimal risk, provided sedation is maintained at the ‘Moderate’ level
- Deep Sedation introduces airway compromise and depressed ventilation
- If an adverse event occurs, always perform a complete Primary Assessment

Airway Considerations

- Always maintain patency
  - Head position
  - Clear debris
- Use throat partitions or rubber dam when possible
- Know each patient’s airway
  - Mallampati Classes

Always Initiate Primary Assessment and Oxygenate If...

- Patient loses consciousness
- Sudden change in patient status

**Doctor**

- Head Patency
- Breathing
- Carotid Pulse
- Primary Assessment

**Aux. 1**

- Oxygen 4 LPM via Cannula

**Aux. 2**

- BP
- Radial Pulse
Primary Assessment
Always Oxygenate a Patient!

- Increased Oxygen Concentration in FRC
- Greater Time from Apnea to Hypoxemia
- Oxygen source and regulator
- Oxygenate if breathing
  - If COPD, supplement to SpO₂ >90
  - Nasal cannula (4-6L/Min)
  - Nonrebreathing mask (6-10 L/Min)

Time to Hb Desaturation

![Graph showing time to hemoglobin desaturation with initial Fio2 = 0.87](image)

- Preoxygenated (~Fio2 = 0.87)
- Analysis of 7 studies

![Graph showing increased oxygen concentration in FRC and greater time from apnea to hypoxemia](image)

Primary Assessment
Ventilate if Patient is Apneic

- Highest Fio2 (10-15 L/Min)
- BVM with Reservoir
  - Fio2 = 75-90

Unconscious Patient Airway Algorithm

<table>
<thead>
<tr>
<th>Primary Assessment</th>
<th>Airway, Breathing, Supplemental Oxygen 4 L/min nasal cannula or 10 L/min mask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing Status</td>
<td>Breathing Continue Oxygen Apnea BVM 10-15 L/min</td>
</tr>
<tr>
<td>SpO₂ Status</td>
<td>≥95 &lt;95 ≥95 &gt;95</td>
</tr>
<tr>
<td>Interventions</td>
<td>Monitor &amp; Support Consider Reversal Agent* Assist Ventilation: BVM 10-15 L/min Continue BVM Reversal Agent* Add Adjunct in sequence: Oral Airway LMA Reversal Agent*</td>
</tr>
</tbody>
</table>

![Diagram of unconscious patient airway algorithm](image)

Results from Primary Assessment will Direct Appropriate Action

Primary Assessment

- Airway Patency
  - Anatomical or Foreign Body Obstruction
  - Laryngospasm
  - Laryngeal Edema
  - Brochospasm

- Breathing
  - Obstructions
    - Respiratory Depression
  - Bradycardia
  - Hypotension

Always Oxygen via Cannula

Must be performed prior to drug administration
**Upper Airway Obstruction**

- **Anatomic**
  - Tongue
  - Epiglottis
  - Tonsils and Adenoids
- **Foreign Body**
  - Mucus
  - Blood
  - Impression material
  - Other

**Treatment**
- Chin lift/Head tilt
- Jaw thrust
- Suction
- BLS Protocols

**Pathological Obstructions**

- **Normal Larynx**
- **Laryngospasm**
  - Spasm of cords obstructs airway completely
  - Patient cannot speak
  - BVM with mild pressure

**Pathological Obstructions**

- **Anaphylactoid Syndrome**
  - Patient will complain of swollen tongue, throat (laryngeal edema) or exhibit wheezing
  - Epinephrine 0.3 mg IM (0.2 mg SL)
  - Consider Abuterol inhaler if wheezing only

**Allergic Reaction Algorithm**

**Primary Assessment**

- Airway
- Breathing
- Supplemental Oxygen
- Pulse
- Blood Pressure

**Allergy Symptoms**

- Cutaneous: Pruritis, Rash, Hives
- Airway: Swelling, mouth or throat, wheezing

**Treatment**

- Benadryl: 50 mg PO, IM
- Epi: 0.3 mg IM

**Respiratory Depression**

- Standard airway support / oxygenation
- Drug reversal
  - Naloxone: Opioids (.2-0.4 SLI or IV)
  - Flumazenil: Benzodiazepines (0.2mg SLI or IV)
- Dependence?
- Re-sedation?
Flumazenil (Romazicon)

- Benzodiazepine receptor antagonist
- Formulation 0.1 mg/ml (5 and 10ml vials)
- Indicated for postoperative somnolence and respiratory depression
- Contraindications
  - Evidence of BZ dependence / severe anxiety
  - History of seizures or TCA overdose
- Administration
  - Onset 1-3 Min./Peak 6-10 Min.
  - 0.2mg initially; 0.1-0.2mg Q3-5M to 1.0mg
  - Amnesia may not be fully reversed

Facts & Comparisons 2006

Re-sedation

- Distribution $T_{12} = 4-11$ Min.
- Elimination $T_{12} = 40-80$ Min.
- “Resedation is least likely in cases where flumazenil is administered to reverse a low dose of a short-acting benzodiazepine (less than 10mg Midazolam). It is most likely in cases where a large single or cumulative dose of a benzodiazepine has been given in the course of a long procedure along with neuromuscular blocking agents and multiple anesthetic agents.”

Flumazenil (Romazicon)

**Administration**

**Routes:**
- 10 mongrel dogs
- 0.2 mg + 0.3 mg after 1 minute

<table>
<thead>
<tr>
<th>Route</th>
<th>Time (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM</td>
<td>310</td>
</tr>
<tr>
<td>SL</td>
<td>262</td>
</tr>
<tr>
<td>IV</td>
<td>120</td>
</tr>
</tbody>
</table>

Primary Assessment

- Assess Circulation
  - Pulse and Blood Pressure
    - If BP Difficult
      - SBP ~ 80 if Radial Pulse
      - SBP ~ 70 if Brachial Pulse
      - SBP ~ 60 if Carotid Pulse
  - Assess Perfusion
    - Color & Capillary Filling
    - Orientation X 3 (Time, Place, Person)

Hypotension

- Decrease in Blood Pressure
- NOT dictated by BP readings alone!
- Key is Diminished Perfusion
  - Color and Capillary Filling
  - Orientation X 3 (Time, Place, Person)

Vasovagal Syncope

- A transient and abrupt loss of consciousness due to inadequate cerebral blood flow.
- “The only difference between syncope and sudden death is that in one you wake up.”

Vasomotor Center

- Pain
- Fear/Anxiety
- Cardiac Mechanoreceptors
- Arterial baroreceptors
- Bladder/bowel strain

Enhanced vagal discharge
**MAP**

- MAP
- SBP
- DBP
- Rate
- Stroke Volume
- Arterial Resistance

**Adrenergic Receptors**

- Beta\(_1\) = Rate and Force
- Alpha = Vasoconstriction
- Beta\(_2\) = Vasodilation
- Beta\(_2\) = Bronchodilation

**Drugs for Hypotension**

- **Atropine**
  - Anticholinergic Action Blocks Vagal Slowing of Heart Rate
  - 1 mg/ml SDV

- **Ephedrine**
  - Mixed Action: Alpha and Beta Agonist Plus Stimulates Release of Norepinephrine
  - 50 mg/ml SDV

**Hypotension Algorithm**

- **Primary Assessment**
  - Airway Breathing
  - Supplemental Oxygen
  - Pulse
  - Blood Pressure

- If Hypotension, Confirm HR
  - HR < 60
  - HR > 60

- If Symptomatic, Administer Drug
  - Atropine 0.5 mg IV, SLI Q5min x 4
  - Ephedrine 25 mg SLI Q5min x 2, 10 mg IV Q3min x 5

**Delirium**

- Pathogenesis of delirium focuses on the roles of neurotransmission, inflammation, and chronic stress.
- Extensive evidence supports the role of cholinergic deficiency.
- Anticholinergic drugs can influence delirium.
- Physostigmine reverses delirium associated with anticholinergic drugs, and cholinesterase inhibitors appear to have some benefit even in cases of delirium that are not induced by drugs.
- Dopaminergic excess also appears to contribute to delirium, possibly owing to its inhibitory influence on the release of acetylcholine.
- Dopaminergic drugs (e.g., levodopa and bupropion) are recognized precipitants of delirium, and dopamine antagonists (e.g., antipsychotic agents) effectively treat delirium symptoms.


**Managing Delirium**

- Mechanisms poorly understood
- Rule out pain or full bladder
  - Cannot be ignored
  - Assist to restroom
- Two choices:
  - Deepen or General Anesthesia
  - Partial reversal of sedation
How do I receive sedation training?

- List of programs found on:
  - American Dental Society of Anesthesiology (ADSA) website: ADSAhome.org/iv.html
  - DOCS Education website:
    - DOCSeducation.com