

# **Nitrous Anesthesia Course Outlines**

## **INTRODUCTION: 3min.**

### **Organization of the Seminar Series**

**Goal**- Review Anesthesia with Nitrous Oxide

**Audience**- Health Care Providers

**Format**- Recorded video seminars with participation of students and residents

**Requires**- Access to relevant recommended literature

**Suggested**- On site knowledgeable clinician available for discussion of the presented subject

**Seminar Length**- Each topic could be covered in less than 45 minutes

**Faculty**- responsible for production for production

Raymond White DDS, PhD

Dalton L McMichael Distinguished Professor

UNC Oral and Maxillofacial Surgery

William Proffit DDS, PhD

Kenan Distinguished Professor

UNC Orthodontics

## **SEMINAR ONE: Depths of Sedation/ Anesthesia and the Central Nervous System 32min.**

### **REFERENCES**

*Fenster JM: How nobody invented anaesthesia. Invention and technology. Summer 1996, pp24-35*  
*de Vasconcellos et al: Nitrous oxide: are we still in equipoise? A qualitative review of current controversies. Br J Anaesth 111:877, 2013*  
*Donaldson et al: Nitrous Oxide-Oxygen administration. JADA 143:134, 2012*

### **Outline**

History of nitrous oxide is the history of anesthesia:

    Jos Priestley, Humphry Davy, James Watt, Horace Wells, Gardner Colton

Sedation / Anesthesia and Central Nervous System

### **Objectives**

Explain how anesthesia evolved

Differentiate among the changes in the CNS with sedation/anesthesia drugs

### **Evaluation Seminar One**

1) Administration of oral drugs for sedation may render a patient unable to respond to verbal stimulation

a-True

b-False

2) Nitrous oxide is the only anesthetic drug discovered in the 19<sup>th</sup> century still commonly administered today.

a-True

b-False

3) Levels of Sedation / Anesthesia should be determined by the route of administration of the drugs

a-True

b-False

## **SEMINAR TWO: Routes for Drug Administration, Pharmacology of Nitrous Oxide, and Benzodiazepines 41min.**

### **REFERENCES**

*Sanders et al: Biologic effects of Nitrous Oxide. Anesthesiology 109:707, 2008*

*Papineni et al: safety of oral midazolam sedation use in paediatric dentistry; a review.  
Int J Ped Dent 24:2, '14*

*Dionne et al: Balancing efficacy and safety in the use of oral sedation in dental outpatients.  
JADA 137:502, '06*

### **Outline**

Options for Administration of Drugs for Sedation / Anesthesia

Enteral (PO), Transmucosal, Intravenous, Inhalation, Intramuscular, Multiple routes

Review of pharmacology of Nitrous Oxide and Benzodiazepines

### **Objectives**

Compare sedation and general anesthesia by physiologic outcomes

Compare drug administration by access, control of dosage

Relate drug administration to elimination; alpha half-life (redistribution) and beta half-life (elimination)

Describe possible clinical outcomes associated with choice of drug administration

### **Evaluation Seminar One**

1)The blood/gas ratio of Nitrous oxide enables a rapid induction of anesthesia and then elimination of the drug at procedure's end.

a-True

b-False

2)Redistribution of a sedative drug implies

a-The drug may no longer have a pharmacologic effect

b-Metabolic degradation in the liver

c-Excretion by the kidney in urine

d-Dispersal throughout the body from the primary pharmacologic site of action

e-A and D

3)All Patients usually respond to similar doses of drugs in the same manner

a-True

b-False

## **SEMINAR Three: Pulmonary/Respiratory Physiology: A Review 43min.**

### **REFERENCES**

*Krauss et al: Capnography for procedural sedation and analgesia in the emergency department.*

*Ann Emerg Med 50:172, '07*

[www.howequipmentworks.com](http://www.howequipmentworks.com) Carbon Dioxide monitoring–capnography,  
Oxygen monitoring–Pulse Oximetry

### **Outline**

Gas mixtures in respiration

Gas exchange across alveolar-blood interface

Monitoring arterial Oxygen levels: Arterial blood gases vs. Pulse Oximetry

Monitoring exhaled Carbon Dioxide: Capnography

### **Objectives**

Discuss relationship between lung function and gas exchange at the alveolus

Discuss relationship between monitoring with pulse oximetry and arterial Oxygen levels

Compare monitoring: Pulse Oximetry vs. Capnography

Describe how sedative drugs might affect blood Oxygen levels

### **Evaluation Seminar Three**

1)Oxygen is very soluble in blood plasma

a-True

b-False

2)Respiratory rates, number of breaths and depth of breaths, is driven by carbon dioxide levels in healthy patients

a-True

b-False

3)A rapid decrease in Oxygen saturation during conscious sedation measured by pulse oximetry from 97% to 89% is usually the result of

a-Malfunction of the monitor

b-Airway obstruction

c-Allergic response to drugs

d-Pain from the procedure

e-Carbon dioxide build-up in the blood

4)Capnography, a measure of exhaled Carbon Dioxide, offers an estimate of pulmonary gas exchange

a-True

b-False

## **SEMINAR Four: Evaluation of patients for sedation / anesthesia 19min.**

### **REFERENCES**

Lee A et al: A systematic review (meta-analysis) of the accuracy of the Mallampati tests to predict the difficult airway". *Anesthesia and analgesia* 102:1867, 2006

Nuckton TJ et al: Physical examination: Mallampati score as an independent predictor of obstructive sleep apnea. *Sleep* 29: 903, 2006

<http://www.nhlbi.nih.gov/guidelines/obesity/BMI/bmicalc.htm>

Kiser M et al: Accuracy of fingerbreadth measurements for Thyromental Distance estimates: A brief report. *AANA J* 79:15, 2011

### **Outline**

American Society of Anesthesiologists Classification: ASA I to V

Pertinent medical History

History related to nitrous oxide side effects

Examination targeted to airway / Malampati Score / Body Mass Index

### **Objectives**

Classify patients by Health Status

Assess patients specifically as candidates for inhalation anesthetics

### **Evaluation Seminar Two**

1)A history of sleep apnea is not a relative contraindication for sedation with nitrous oxide

a-True

b-False

2)A patient classified as ASA III because of uncontrolled hypertension might benefit from nitrous oxide sedation within limits.

a-True

b-False

3)The difference between classifications ASA II and ASA III could be based on

a-medications the patient is taking

b-a patient's disease impact on lifestyle

c-a primary care physician's consultation

d-medical history

e-all of the above

4)A Body Mass Index at least 30 is often associated with a compromised airway

a-True

b-False

## **SEMINAR Five: Anesthesia / Monitoring Equipment 25min.**

### **REFERENCES**

*Lightdale et al: Microsteam capnography improves patient monitoring during moderate sedation: A randomized controlled trial. Pediatrics 117:e1170 '06*

*Burton et al: Does end-tidal carbon dioxide monitoring detect respiratory events prior to current sedation monitoring practices. Acad Emerg Med 13:500 '06*

[www.howequipmentworks.com](http://www.howequipmentworks.com) (capnography, pulse oximetry, vaporisers)

### **Outline**

Anesthesia machines for administering N<sub>2</sub>O

Monitoring options for Minimal Sedation-Anxiolysis, Moderate Sedation:

Pre-cordial auscultation, Pulse oximetry, Capnography

Monitoring arterial Oxygen levels: pulse oximetry

Monitoring exhaled Carbon Dioxide: Capnography

### **Objectives**

Sequence technical steps for administration of N<sub>2</sub>O

Select monitoring protocol for individual patient

Compare clinical uses of Pulse Oximetry and Capnography

### **Evaluation Seminar Four**

1) Administration of 100% Oxygen at the start of the procedure

a-Removes carbon monoxide from the ambient room air

b-Offers protection to staff from leaking N<sub>2</sub>O

c-Reduces the Nitrogen content in the patient's lungs

d-Facilitates transfer of N<sub>2</sub>O to the bloodstream

e-Answers C and D

2) Monitoring with pulse oximetry provides an estimate of the Oxygen content of the blood

a-True

b-False

3) Anesthesia machines with "Fail Safe" alarms detect a decreasing concentration of Nitrous Oxide

a-True

b-False

4) Capnography outcomes can be observed before outcomes of oxygen desaturation/hypoventilation with Pulse Oximetry

a-True

b-False

## **SEMINAR Six: Administration of Nitrous Oxide 17.5min.**

### **REFERENCES**

*White PF et al: New criteria for fast-tracking after outpatient anesthesia:*

*A comparison with the modified Aldrete's scoring system. Anesth Analg 88:1069, 1999*

[http://www.meddentalsafety.com/catalog/safe\\_sedate](http://www.meddentalsafety.com/catalog/safe_sedate) (Safe Sedate Nasal Masks)

<http://www.flexicare.com> then search nasal hoods (Masks with Capnography port)

### **Outline**

Preparation of the patient for N<sub>2</sub>O anesthesia/diet modifications

Levels of N<sub>2</sub>O appropriate for the patient

Signs of N<sub>2</sub>O effects on the patient

Recovery from N<sub>2</sub>O anesthesia /Discharge protocol

Anesthetic complications: Nausea, Excitability, Loss of Airway

### **Objectives**

Prepare patient for planned anesthesia: Diet, Care giver responsibility

Decide levels of anesthesia based on the patient's responses

Sequence steps if patient becomes agitated, disoriented, nauseated

Sequence steps if airway blocked

Implement discharge protocol after anesthesia

### **VIDEO CLIPS**

Flexicare Mask (Length 4min.)

Safe Sedate Mask (Length 4Min.)

### **Evaluation Seminar Six**

1)Restricting solid food intake 6hr prior to anesthesia minimizes nausea and vomiting

a-True

b-False

2)On repeat dental visits most patients respond similarly to the same levels of N<sub>2</sub>O anesthesia

a-True

b-False

3)After N<sub>2</sub>O anesthesia it is advisable to have the patient accompanied home

a-True

b-False

4)The Aldrete Scoring System is very useful, but not the only consideration in discharge of patients after a procedure under sedation.

a-True

b-False

## **SEMINAR Seven: Side Effects / Hazards to Staff of Nitrous Oxide 47min.**

### **REFERENCES**

*Sanders et al: Biologic Effects of Nitrous Oxide. Anesthesiology 109:707, '08*

*Yagiela JA: Health Hazards and Nitrous Oxide: A Time for Reappraisal Anesth Prog 38:1, '91*

*Tramer M et al: British Journal of Anaesthesia Omitting nitrous oxide in general anaesthesia: meta-analysis of intraoperative awareness and postoperative emesis in randomized controlled trials 76:186 '96; 76*

*Gan TJ et al: Society for Ambulatory Anesthesia Guidelines for the Management of Postoperative Nausea and Vomiting Anesth Analg 105:1615, '07*

### **Outline**

Nitrous oxide levels in ambient air with/without scavenging  
 Patients at risk for acute Nitrous oxide exposure, mechanisms  
 Staff at risk for chronic Nitrous oxide exposure, mechanisms  
 Monitoring for chronic Nitrous oxide exposure

### **Objectives**

Evaluate patients for high risk of nausea / vomiting  
 Evaluate patients for high risk of vitamin B<sub>12</sub> deficiency  
 Explain hazards to staff  
 Understand mechanisms of reducing N<sub>2</sub>O in ambient air

### **VIDEO CLIPS**

Nausea (Length 3min.)

Stage Two Anesthesia (Length 7min.)

Deep Sedation with Airway Compromise (Length 4min.)

**Evaluation Seminar Seven**

1) Which of the following does not pose an increased risk of nausea and vomiting with nitrous oxide anesthesia?

- a-History of "car sickness"?
- b-Nausea and vomiting with a previous anesthetic?
- c-Female gender
- d-Anesthetic with propofol
- e-Opioids as a component of the anesthetic regimen

2) A patient's previous history includes anesthetics with N<sub>2</sub>O and no nausea and vomiting. This suggests a low risk with future anesthetics.

- a-True
- b-False

3) A history of inflammatory bowel disease suggests the possibility of a vitamin B<sub>12</sub> deficiency.

- a-True
- b-False

4) Chronic exposure to Nitrous Oxide even at low levels

- a-Affects immune cell development
- b-Retards red cell proliferation
- c-Affects myelin maintenance on peripheral nerves
- d-Inhibits Ovulation similar to the effect of intensive exercise
- e-All of the above

SEMINAR EIGHT: NC State Board of Dentistry Regulations for Sedation / Anesthesia  
Pending Regulation Changes-Coming Soon

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