Pain Pathways

- Can be blocked by blocking depolarization, conduction, or synaptic transfer
- Head/neck region takes up ½ of the homunculus

- Types of Anesthesia
  - Topical
  - Transdermal – applied with intent of deeper penetration
  - Infiltration – placed near tissue, diffused in
  - Local – placed to affect specific nerve trunk
    - Ideal LA
      - Water soluble
      - Non-irritating to nerve
      - Low systemic toxicity
      - Short induction
      - Adequate duration
      - No side effects
      - Vasoconstriction

- Neuroanatomy
  - Type A – pressure/motor
  - Type B – myelinated, boderate in size
  - Type C – pain/temperature

- Calculations per Carpal – 1.8cc per carpal
  - 1% = 10mg/cc
  - 1:1000 = 1.0mg/mL 1:100,000 = 0.01mg/mL

- Carpal contents
  - Anesthetic agent
  - Vasoconstrictor – epi or levonordefrin
  - Vasoconstrictor preservative – sodium metabisulfite
  - Isotonic NaCl
    - Note – methylparaben present in multidose vials – anesthetic preservative (slightly allergenic)

- Types of LA – aromatic lipophilic group and hydrophobic tertiary amino sandwiching an intermediate chain
  - Amides – have an “i” before “_caine”
    - Metabolized in liver, use low dose to avoid toxicity
  - Esters – all others (exception – piperocaine is an ester LA)
    - Metabolized in plasma via pseudocholinesterase
    - PABA is major metabolite – known allergen
    - Patients with atypical pseudocholinesterase may have systemic toxicity from ester Las

- Nerve Conduction
  - RMP = -80mV
  - Nerve excitation → increased permeability → Na⁺ influx → reaches firing threshold (-50mV) → action potential → peak (+40mV) → membrane becomes impermeable → K⁺ efflux, return to -80mV

- LA Mechanism
  - Depress depolarization
  - Blocks reaching threshold potential
  - Blocks AP formation – blocks Na⁺ channel influx (blocks action potential formation)
  - Blocks conduction
- Infected tissues have a lower pH
  - Non-ionized base crosses nerve membrane – less non-ionized base to cross membrane → less potent
    - pKa 9.1 – procaine
    - pKa 8.1 – bupivacaine
    - pKa 7.9 – lidocaine, prilocaine
    - pKa 7.7 – etidocaine
    - pKa 7.6 – mepivacaine
  - Lower pKa – more rapid onset
  - Increased lipid solubility – more potent
  - Increased protein binding – longer duration

- Vasoconstrictors
  - Attach and directly stimulate adrenergic receptors
  - Act indirectly provoking release of endogenous catecholamines from intraneuronal storage sites
  - Both

- Toxicity
  - Systemic
    - Inadvertent IV injection
    - Large quantities
    - Altered metabolism
  - Local response
  - Idiosyncratic reactions
  - Allergies
    - Agent (xylocaine)
    - PABA
    - Sodium metabisulfite (vasoconstrictor preservative)
    - Methyl paraben (agent preservative)

- Side Effects
  - Convulsions – self limiting
    - Treat with diazepam, barbiturate, succinylcholine
  - Respiratory depression
  - CV collapse

- No drug exerts only 1 effect
- No drug is without some toxicity
- Danger lies in hands of the user
Acute and Chronic Pain

- Acute pain – transient pain from noxious stimulus – protects from injury, promotes healing
- Chronic pain – spontaneous pain/hypersensitivity in association with damage/lesion to nervous system
- Anxiety – vague unpleasant emotional state, objectless
- Fear – anxiety with an object
- Phobia – intense, unreasonable fear

Neurons
- A-delta fibers – low threshold mechanoreceptors (crude touch, pressure, pain, temperature)
- C-fibers – nociceptive specific (pain, temperature, touch, pressure)
- A-beta fibers – wide dynamic range (touch, kinesthesia)

Types of Pain
- Central – emanates from CNS structures
- Referred – felt in area innervated by different nerve than mediates primary pain
- Projected – felt in peripheral distribution of same nerve that mediates primary nociceptive input

Conceptual models – biomedical vs biopsychosocial
- Biological
- Behavioural
- Emotional
- Social
- Cognitive
- Environmental
Local Anesthesia Administration

- Armamentarium = syringe, needle, cartridge
  - Syringe
    - Non-disposable
      - Breech loading, metallic, cartridge type, aspirating
      - Breech loading, plastic, cartridge type, aspirating
      - Breech loading, plastic, cartridge type, self-aspirating
      - Pressure syringe, PDL injection
    - Disposable syringe
    - Safety syringe
    - Computer controlled systems
      - Needle adapter
      - Piston with harpoon
      - Syringe barrel
      - Finger grip
      - Thumb ring
  - Needle – larger gauge = smaller internal diameter
    - 25G – red cap
    - 27G – yellow cap
    - 30G – blue cap
      - Long needle = 32mm
      - Short needle = 20mm
  - Cartridge (carpal)
    - 1.7/1.8mL (North America)
    - 2.2mL (UK, Australia)
    - Stored at room temp
    - NOT autoclavable, NOT soaked in ^OH, NOT exposed to sunlight

- Remove syringe → attach needle → retract piston and load carpal → engage harpoon → remove cap → landmark → insert → aspirate, rotate 90°, aspirate again → inject → remove → recap needle
  - Recap using scoop technique
  - Do not bend needles
  - Never insert needle to need hub depth
  - Place needles and carpal in sharps, do NOT remove needle adaptor

- Other armamentarium
  - Topical anesthetics – ointments, gels, pastes, sprays (metered and unmetered)
    - Best applied on dry tissue
      - Hurricaine spray
      - Dentipatch – lidocaine transoral delivery
        - Pre-injection – 10-15min before injection
        - Scale/root planning – 5-10min before procedure
  - Applicator sticks
  - Cotton gauze
  - Hemostat
Complications of LA

- Local pain
  - pH < 5.0
  - Cold temp
  - Rapid injection
  - ^OH contamination
  - Touching periosteum
    - Treat via careful administration

- Difficult anesthesia
  - Discuss with patient
  - Lots of LA
  - Block anesthesia
  - PDL, intrapulpal Las
  - Consider adjuncts (N₂O, IV sedation)
  - Consider local anatomy, systemic physiology

- Local Complications
  - Needle breakage
    - Unexpected patient movement
    - Needle size (25G – 30G)
    - Needle manipulation (bending)
      - Visible – remove
      - Invisible – refer to OMFS
  - Trismus
    - IAN, Akinosi, Gowgates, IM injection (M. pterygoid, temporalis)
    - Hemorrhage
    - Barbed needle
    - ^OH contamination
      - Moist towel 20min/hr
      - Physiotherapy, analgesia, R/O infection
  - Hematoma
    - Arterial/venous disruption
    - Less common in palate
      - Good anatomy knowledge
      - Apply pressure to site
      - Analgesics
      - Heat application (>6h post injection – vasodilatory)
  - Facial nerve paralysis
    - Deposition in parotid gland
      - Transient paralysis – protect cornea
      - Reassure patient, saline eye drops, eye patch
  - Self inflicted
  - Children and MR at high risk
  - Use short-acting LA (prilocaine)
  - Give good instructions
  - Closely observe
- **Post-anesthetic lesions**
  - Resemble HSV outbreak
  - Local trauma/hypoxia/necrosis
  - Activation of HSV
    - Reassure patient
    - Self limiting lesions – 10-14 day course
    - Provide analgesia

- **Epithelial dequamation**
  - Prolonged topical
  - High [ ] vasoconstrictors
  - Usually palatal mucosa
    - Resolution 7-10 days
    - Provide analgesics, saline rinses

- **Persistent paresthesia/anesthesia**
  - Nerve sheath trauma
  - Hemorrhage around neural sheath
  - Usually lingual nerve following IAN block
    - Explain pathophysiology
    - Explain normal nerve recovery signs – tingling, intermittent burning/sharp pain
    - Re-evaluate in 2 weeks, refer to OMFS if persistent
    - Document degree and extent if >2 months, refer to OMFS within 3 months of consultation

- **Nerve Injury** – compression, retraction, partial/complete severance
  - Type I (neuropraxia) – mild temporary conduction failure, no damage to nerve, no degeneration, recovery in 4 weeks, no intervention needed
    - Sunderland I
  - Type II (axonotemesis) – wallerian degeneration of axons, but nerve intact. Recover within 1-3 months, but never complete, surgery required.
    - Sunderland II – IV
  - Type III (neurotemesis) – complete nerve severance, degeneration, lose fasicular pattern, scar tissue formation, no recovery, surgery required
    - Sunderland V, VI
  - Neurona – disorganized collagen mass with randomly organized fascicles
    - Trigger point via Tinels test – tap nerve area and see if distal areas tingle – signifies regeneration
    - Spontaneous ectopic generation of impulses

- **Evaluating nerve injuries**
  - History/physical
  - Etiology
  - Onset and time course
  - Quantitative sensory examination, directional strokes, 2 point discrimination, pinprick sensation, thermal discrimination
    - Articaine = 2.5x more likely to cause paresthesia than prilocaine
- LA Overdose
  - Too large a dose
  - IV injection
  - Altered metabolism/excretion
    - Hepatic insufficiency
    - Renal dysfunction
    - Pseudocholinesterase for ester Las

- Dosing

<table>
<thead>
<tr>
<th>Name</th>
<th>pKa</th>
<th>Inset</th>
<th>Duration</th>
<th>Max Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procaine</td>
<td>9.1</td>
<td>Slow</td>
<td>45-90min</td>
<td>8-10mg/kg</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>7.9</td>
<td>Fast</td>
<td>120-240min</td>
<td>4.5-7mg/kg</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>8.1</td>
<td>Slow</td>
<td>240-480min</td>
<td>2.5-3mg/kg</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>7.9</td>
<td>Mid</td>
<td>90-360min</td>
<td>5-7.5mg/kg</td>
</tr>
<tr>
<td>Articaine</td>
<td>7.8</td>
<td>Fast</td>
<td>140-270min</td>
<td>4-7mg/kg</td>
</tr>
</tbody>
</table>

- Articaine – same pKa and toxicity as lidocaine, \( t^{1/2} = \frac{1}{4} \text{ lidocaine} \)

- Systemic complications
  - Allergens
    - PABA in esters
    - Metabisulfite – vasoconstrictor preservative
    - Sulfa – articaine
    - Latex
      - Obtain accurate history
      - 1% diphenhydramine
  - Signs (low dose)
    - Lightheadedness, dizziness
    - Visual/auditory, disorientation, drowsiness
    - Tachycardia
  - Signs (high dose)
    - CNS excitation \( \rightarrow \) rapid CNS depression
    - Bradycardia
    - Convulsions/seizures
    - Syncope, coma, RS depression, CVS depression, collapse
  - Management
    - ABCs, supplemental \( O_2 \), activate EMS
    - Treat symptoms – 5mg diazepam/1mg midazolam IV (anxiety/convulsions)
    - Monitor vitals, cardiopulmonary resuscitation
  - Epi overdose signs
    - Fear, anxiety, headaches, restlessness, heart palpitations, tremors, seizures
    - Levonordefrin = 5x stronger than epi

- Methemoglobinemia
  - \( Fe^{2+} \rightarrow Fe^{3+} = Hb \) cannot release \( O_2 \)
    - Respiratory depression, syncope, cyanosis, chocolate brown arterial blood
  - Drugs that can cause methemoglobinemia – prilocaine, lidocaine, large dose nenzocaine
  - Treat with 1% methylene blue (1.5mg/kg)
    - Congenital methemoglobinemia – relative contraindication
**Mandibular Injections**

- **Block** – anesthetic near main nerve trunk, anesthetizes entire nerve distally
- **Infiltration** – anesthetic near distal fibers, only area that anesthesia is beside

- **IAN block** – Most often used, 10-15% aspiration, 15-20% failure
  - **Landmarks**
    - Coronoid notch/anterior ramus
    - Pterygomandibular raphe
    - Occlusal plane (6-10mm superior)
    - Medial aspect of Mn, near Mn foramen
  - **Inject** cross arch, by contralateral canine – 20-25mm deep, lingual N block on way out
  - **Failure**
    - Anatomic – too low, too anterior (needle hits ramus prematurely)
    - Hematoma, trismus, transient facial paralysis (injection in parotid gland)

- **Gow-Gates** – Mn nerve block
  - **Landmarks**
    - Lateral side of condylar neck – mouth must be wide open – bring condylar neck inferior
    - Distal to Mx 2nd/3rd molars
    - High of Mn 2nd molar ML cusp
  - **Inject** – cross arch, 25mm deep, as if trying to hit the ear

- **Akinozi** – Mn nerve block
  - **Landmarks**
    - High of mucogingival junction adjacent to Mx 3rd molar
    - Closed mouth, no bony landmarks
  - **Inject** 25mm deep

- **Long Buccal** – Mn posterior vestibule
  - **Landmarks**
    - Distobuccal of 3rd molar
    - Mucobuccal fold along ascending ramus/external oblique ridge
  - **Inject** 1-2mm deep

- **Mental Block** – LEAST frequently used, premolars forward, soft tissue anesthesia

- **Incisive Block** – premolars forward, pulpal anesthesia
  - **Landmarks**
    - Between apices of 2 premolars
    - Mucobuccal fold/just anterior to foramen
  - **Inject** with 25-27G short needle, 5-6mm deep

- **PDL injection** – special syringe to force anesthesia into small space
- **Intraosseous** – requires access into bone (drilling) at apex of tooth
- **Intrapulpal** – for acute pulpitis (hot tooth)

- **Charting**
  - Drug name, dosage, location of injection
  - Concentrations, LA agent, vasoconstrictor
Maxillary Injections

- Infiltration – most Mx “blocks” are infiltrations
  o Individual teeth – 1-2 teeth for pulpal anesthesia
  o Landmarks
    ▪ Root apex
    ▪ Mucobuccal fold
  o Inject syringe parallel to long axis of tooth, insert roughly 45° to Mx
- Posterior-superior alveolar – 3.1% aspiration (vessel plexus), molars
  o Landmarks
    ▪ Superior to 2nd molar
    ▪ Mucobuccal fold, no bony landmarks
  o Inject posteriorly, superiorly, medially, 15-20mm
  o Failure
    ▪ Hematoma
    ▪ Sometimes does not get mesial half of first molar
- Infraorbital block – canine to central incisor
  ▪ 72% get anesthesia of premolars and mesiobuccal root of 1st molar
  o Landmarks
    ▪ Over first premolar, lateral to canine (avoid zygoma)
    ▪ Infraorbital foramen
  o Inject 25mm, 0.9-1.2mL
- Nasopalatine – painful (apply pressure on injection, topicals, etc), canine to canine
  o Palatal approach
    ▪ Get incisive papilla, then palatal aspect of premaxilla
  o Labial approach
    ▪ Get labial frenum, then interdental papilla, then incisive papilla
  o Inject with ¼ carpal
- Greater Palatine – secondary hemipalate
  o Landmarks – distal to 2nd molar
  o Inject until tissue blanches
- Maxillary nerve block - hemimaxilla
  o Higher tuberosity approach – pterygopalatine fossa
  o Greater palatine approach – through greater palatine foramen
Treatment Plan Development

- pKa of LA usually means ½ exists as non-ionized form at physiologic pH 7.4
  - Remember – solubility determines onset (potency)
- Infection lowers tissue pH
- Maximum dosage is usually 2 carpals for CV complicated patients, 11 for normal patients
  - Healthy patient – 0.2mg
  - Cardiac patient – 0.04mg
    - 0.018mg epi in 1.8mL carpal, [1:100,000]
      - 0.01mg/mL ratio
- Diabetics
  - Type I – use 50% in morning, short acting
  - Type II – stop oral insulin prior day
  - Post-operative – insulin sliding scale (titrate insulin, don’t give too much)
    - Glucose check day of therapy
- N₂O contraindicated for pregnant women
  - Blocks B₁₂ absorption, needed for folate metabolism → thymidine, DNA base acid
- N₂O fine for asthma, COPD
- Seizures – hypoxia warning, precipitated by stress
  - N₂O is okay
  - O₂ is good
Nitrous Oxide

- Anxiety most frequent factor for office medical emergency
  - Combined with labile patient, can produce medical crisis
  - Use anesthesia, analgesia, anxiolysis agents

- Anesthesia – loss of sensation
- Analgesia – loss of pain sensation, pain relief without loss of consciousness
- Anxiolysis – reducing anxiety
- Sedation
  - Conscious sedation – depressed level of consciousness from pharmacologic agent, patient still independently continuously maintains airway and communication
  - General anesthesia – controlled state of depressed consciousness produced by pharmacologic agent, complete loss of reflexes and unable to responds purposefully to physical/verbal stimuli

- Psychological factors

<table>
<thead>
<tr>
<th>Increased pain</th>
<th>Decreased Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sadness, depression</td>
<td>Happiness</td>
</tr>
<tr>
<td>Fatigue, insomnia</td>
<td>Rest, sleep</td>
</tr>
<tr>
<td>Anger, discomfort</td>
<td>Diversion, symptom relief</td>
</tr>
<tr>
<td>Anxiety, fear</td>
<td>Sympathy, understanding</td>
</tr>
</tbody>
</table>

- Inhalation anesthesia
  - N₂O
    - Advantages
      - Fast onset – similar to IV, faster than IM, oral, or rectal
      - Titration possible
      - Rapid complete recovery – 3-5min, escort not needed post-op
      - No injection needed, few side effects, analgesic properties (highly variable)
    - Disadvantages
      - Initial cost of tech, equipment maintenance (gas cylinders)
      - Variable potency, patients must breathe through nose, chronic exposure issues

- Must understand anatomy and physiology – CV, pulmonary, and CNS
  - Mechanics of respiration
    - Ventilation
      - Healthy individuals driven by CO₂ levels
        - CO₂ ↑ causes person to take a breath, CO₂ ↓ decrease ventilation rate
    - Muscles expand and contract chest cavity
      - Diaphragm, intercostals, SCM, abdominals, muscles of the spine
  - Principles of gas exchange – N₂O coefficient = 0.47 (very low)
    - High blood:gas coefficient – slow onset and recovery
    - Low blood:gas coefficient – insoluble in blood, so fast onset/recovery
  - Higher [N₂O] allows for rapid induction
    - Second gas effect
      - High potent but low concentration gas has slow onset
      - Giving gas that’s less potent but high concentration causes first gas to have more rapid effect
        - Giving N₂O with a more fast acting gas (halothane) speeds N₂O onset
- MAC – minimal alveolar concentration
  - Minimum [agent] prevents movement in 50% of individuals from surgical incision
  - $N_2O$ MAC > 100 – not possible to produce surgical anesthesia alone in 50% of people

- Preparation
  - Heating ammonium nitrate crystals – decomposes to $N_2O$ and $H_2O$
  - Compressed and stored – 30% of $N_2O$ is liquid
  - Purity of gas usually approaches 99.5%

- $N_2O$ properties
  - Not flammable or explosive
  - Support combustion (even w/o $O_2$)
    - Needs to be heated to 450°C $\rightarrow$ $N_2$ and $O_2$
  - $N_2O$ is inhaled
    - Rapid diffusion into blood $\rightarrow$ ↑tension of gas $\rightarrow$ ↑[$N_2]$ in brain $\rightarrow$ fast onset
      - Rapidly replaces $N_2$ in blood
      - Enters closed air space (middle ear, intestine) 35x faster than $N_2$
        - Increases cavity pressure/volume
  - Recovery
    - Rapid diffusion back into alveoli from blood (brain $\rightarrow$ blood $\rightarrow$ alveoli)
      - Causes diffusion hypoxia $\rightarrow$ dilution of $O_2$ and $CO_2$, decreasing respiratory drive
        - $N_2O$ largely released from alveoli for first 5-10min post-op
      - Treat with 5-10min post-op 100% $O_2$
    - Diffusion hypoxia – nausea, headache, lethargy, hangover effect
  - Side Effects
    - Cutaneous vasodilation (flushing, perspiration)
    - Depression of myocardial contraction (at high [$N_2O$])
    - Does not affect HR, CO, BP in healthy patients
    - Anxiety reduction from deeper slow breathing
      - Deeper sedation may produce rapid shallow breathing
    - CNS depression, variable analgesia
    - Hypoxia – nausea and vomiting
    - $B_{12}$ metabolism causing bone marrow suppression and neuropathies (chronic exposure)

- Procedure
  - 6L flow
  - 100% $O_2$ 3-5min
  - Titrate 20% $N_2O$, increase 10%/min as needed
  - Treatment
    - 100% $O_2$ 3-5min recovery
Patient Evaluation

- Delivery of N₂O/O₂
  - Central gas supply system
    - Cost savings, convenience, space
    - Manifold
    - Alarm system (<45psi, >60psi)
    - Pressure reducing value (regulator) 50psi
  - Portable delivery
    - For not frequent use
    - Moved easily
    - Holds 2-4 tanks
    - Pin index safety system

- Equipment involved:
  - Tanks
    - N₂O tank (blue)
      - Gas in liquid form, 750psi
      - Gauge will not indicate gas use until almost empty (20%)
      - Use 1 tank for every 3-4 O₂ tanks
    - O₂ tank (white/green)
      - 2000 psi, gas only, gauge measures gas accurately
    - N₂O cylinders
      - 95% liquid, 5% gas, 750 psi at 70°F
      - Decreasing pressure (liquid/gas) – 20% contained
    - O₂ cylinder
      - 2000 psi, pressure gauge indicates accurately
      - O₂ tank is empty → no N₂O flow
  - Reducing valves (gauges)
    - High pressure to low pressure, 50psi
  - Hoses/pipes/manifold
  - On/flush switches
  - Flow meter
    - Gas flows through the meter, read to center of the sphere/cylinder
    - Note – columns are NOT equal
    - Can flush, has a percent dial
  - Reservoir bag
    - 2-3L, gases mixed, most likely source of leak
    - Source of additional gas if needed (Positive O₂)
    - Monitor breathing (respiration here)
  - Conducting tubes
    - Non-collapsible
  - Nasal hood
    - Double mask system, should fit well to minimize gas leak
  - Gas scavenger
    - Standard of care
# Safety Features

- **Color Codes**
  - Blue – N₂O
  - Green – O₂ (USA)
  - White – O₂ (international)
- **O₂ failsafe mechanism**
  - Standard of care before 1976
  - Minimum 30% O₂ (ambient air is 21% O₂)
- **Index safety system**
  - Pin index system – can’t get into the wrong socket
  - Diameter index system – can’t get into the wrong socket
- **Scavenger**
  - Connection to suction, vent away from breathing area

- **Major industries**
  - Health settings – 85-90%
    - Hospitals – 80-85%
    - Dentists – 10%
  - Chemical industry – 5%
  - Food industry – 5-8%

## Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Anxiety, gagging, pain relief</td>
<td>- Compulsive personality</td>
</tr>
<tr>
<td>- Procedures where more than LA is needed</td>
<td>- Claustrophobic persons</td>
</tr>
<tr>
<td>- Lengthy procedures for medically compromised patients</td>
<td>- Unable to breathe through nose</td>
</tr>
<tr>
<td></td>
<td>- Pregnancy</td>
</tr>
<tr>
<td></td>
<td>- Severe behavior problems</td>
</tr>
<tr>
<td></td>
<td>- URI, COPD</td>
</tr>
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</table>

## Advantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid onset</td>
<td>Equipment cost</td>
</tr>
<tr>
<td>No biotransformation, no injection</td>
<td>Not potent</td>
</tr>
<tr>
<td>Variable analgesia</td>
<td>Requires cooperative patient</td>
</tr>
<tr>
<td>Titratable (incremental dosing = standard of care)</td>
<td>Chronic exposure problems</td>
</tr>
<tr>
<td></td>
<td>Need person in room at all times (preferably same gender)</td>
</tr>
</tbody>
</table>

- **Common signs/symptoms**
  - Light headedness/dizziness
    - Transient feeling, [N₂O] inadequate for treatment
  - Tingling sensation of oral cavity, extremities
    - Good [N₂O] for starting IV, scaling, LA
  - Feeling of warmth, floating/heaviness
    - Near ideal [N₂O] for treatment
  - Note – patient variability is high – patient should feel relaxed and comfortable

- **Elimination of N₂O**
  - Stop leaks, use ventilation and scavenging nasal hoods
  - Minimize talking to the patient (N₂O can be exhaled orally)
  - Air monitoring – caution above 50ppm
Pain and Anxiety - Course Review
Enoch Ng, DDS 2014

- Monitoring
  o Questionable usefulness as decrease in respiratory drive should be minimal
  o NOT standard of care (oximetry and capnography)
  o Usually very few changes in vital signs present

- Primary indications
  o Fear and anxiety management
    ▪ Anxiolysis
    ▪ Analgesia (variable)
    ▪ Reduction of pain threshold – useful prior to injection
  o Medically compromised patient
    ▪ Anxiolysis
    ▪ Minimal risk of hypoxia (if used properly)
    ▪ Used in patients with angina, heart failure, dysrhythmia, MI
    ▪ Fine for asthma patients – non-irritating to mucosa, no increase in bronchospasm
    ▪ Good for epilepsy – if used properly, prevents hypoxia (hypoxia increases seizure risk)
      ▪ Used in post-CVA patients (prevents hypoxia, same as epilepsy)
  o Gagging, gingival retraction cord
    ▪ Provides analgesia, anxiolysis, decreased gag reflex
  o Incision and Drainage
    ▪ Infection → ccidic pH – decreased LA effect
    ▪ N₂O provides analgesia and anxiolysis
  o Dry socket dressing changes, suture removal
    ▪ Short procedure, but can be discomforting
    ▪ N₂O provides analgesia and anxiolysis
  o Initial dental/perio exam, insertion of wedges/matrix bands, rubber dam retainers
    ▪ Anxiety reduction, analgesia for sensitive tissues/pain/pressure
  o Removal of provisional crowns
    ▪ Avoids use of LA because of analgesia/anxiolytic effects
  o Scaling/root planning/curettage
    ▪ Painful procedure require debridement of necrotic tissue (ANUG) and from ultrasonics
    ▪ N₂O provides analgesia and anxiolysis

- N₂O Recovery (after 100% O₂)
  o Check for normal feeling, common sense
  o Does not require patient escort if recovery is proper

- Pediatric patients
  o Nasal hood can be challenging
  o Can increase [N₂O] for “induction”
  o Use “tell-show-do” technique
  o Observation of sedation level should be apparent
  o Teenage patients may be aware of N₂O and request it
    ▪ “the substance”
    ▪ “nitrous”
    ▪ “laughing gas”
    ▪ “hippy crack”
    ▪ “N₂O”
Nitrous Oxide and Abuse

- Addiction – repeated, compulsive use despite negative psychosocial consequences
- Physical dependence – absence of substance leads to signs/symptoms of withdrawal
- Withdrawal syndrome – overactivity of physiologic functions that were suppressed by drug

- Uses of N₂O
  - Medical/dental anesthesia
  - Engine injection for boosting horsepower in automobile racing
  - Oxidant for semiconductor industry and analytical chemistry
  - Raw material in production of chemicals used to inflate airbags
  - Propellant in food industry (whip cream)

- Abuse Effects
  - Myeloneuropathy, equilibrium and coordination problems
  - Muscle weakness
  - Headache, memory/mood alteration
  - Multiple-sclerosis like symptoms
  - Depletion of B₁₂ – peripheral nerve numbing (fingers/toes), bone marrow depletion

- Delegation of responsibilities (if authorized and when dentist is present in office)
  - RDAs – monitor N₂O patients
  - Hygienist – administer N₂O to patients

- Requirements for Certification
  - Must graduate from N₂O administration course at accredited university
    - 16h lectures, supervised clinical experience using fail-safe equipment with positive pressure
  - Must be trained biannually in CPR/BLS
  - Equipment must be fail safe and capable of positive-pressure ventilation
Review and Case Discussions

- 6-14% of Americans avoid dental care because of fear
- More invasive procedures can be done in outpatient clinics
- Anxiolysis – reduction of anxiety. Cognitive function and coordination may be impaired, but CV and Resp are not
- Moderate sedation – minimally depressed level of consciousness, patient retains ability to independently continuously maintain their own airway and response to physical/verbal stimuli
- Deep sedation – drug induced controlled state of depressed consciousness with partial loss of protective reflexes. Unable to maintain airway independently continuously and/or respond to purposeful verbal command
- General Anesthesia – elimination of all sensation, loss of consciousness. Not arousable by painful stimuli, may require mechanical ventilation and CV support

- Other inhalation anesthesia agents besides N₂O – usually used in OR or surgery, not usually dental office
  - Sevoflurane
  - Halothane
  - Desflurane
  - Isoflurane
- Oral Sedation
  - Advantages – no IV, good patient acceptance, minimal armamentarium
  - Disadvantages – not titratable, may not achieve desired effects, not predictable, multiple dosing not desirable, late onset (20-45min), monitoring needed, additional training needed, pre-op fasting required
    - Triazolam/halcion
    - Diazepam/valium
    - Lorazepam/Ativan
    - Midazolam/versed
    - Chloral hydrate
- IM
  - Advantages – no IV access needed, faster than oral onset, more reliable absorption than oral
  - Disadvantages – not titratable, overdose potential, lag time before seen effects, needle needed, potential 2-4h duration, monitoring needed, additional training required, pre-op fasting required
- IV
  - Advantages – titratable, more predictable, rapid onset, rapid reversal if needed, emergency drug admin if needed, replace fluid deficit from fasting
  - Disadvantages – monitoring needed, IV access needed, additional training needed, pre-op fasting required
    - Midazolam/versed
    - Fentanyl
    - Ketamine
    - Propofol
    - Brevital/methohexital
- Common side effects of sedatives
  - CNS depression, amnesia
  - Respiratory depression/arrest
  - Nausea
  - Disphoria/dreaming
  - CV effects
  - Drug interactions

- Monitoring
  - Moderate sedation
    - BP – before, during, after
    - Pulse oximetry
    - Respiration – chest rise, precordial stethoscope, capnography
  - Deep sedation/general anesthesia
    - BP – intermittent throughout procedure (every 5min)
    - Continuous pulse oximetry
    - Respiration
    - ECG
    - May also need airway support

- Patient evaluation for sedation
  - ASA PS level (prefer I and II)
    - ASA I – no known systemic disease
    - ASA II – mild/well controlled systemic disease
    - ASA III – multiple/moderately controlled systemic diseases
    - ASA IV – poorly controlled systemic diseases
    - ASA V – moribund patients
    - ASA VI – brain dead patients
  - Airway evaluation – most serious and common office emergencies involve airways/resp complications
    - Anatomy
    - Range of motion
    - Mallampati classification
      - Class I – tongue doesn’t block vision of uvula
      - Class II – tongue blocks lower vision of uvula, can still see oropharynx
      - Class III – can barely see oropharynx
      - Class IV – tongue blocks vision of oropharynx
    - BMI/neck circumference
  - Considerations for specific organ systems

- Preoperative considerations of anesthesia
  - NPA for >6h (no food for 6h)
  - Patient escort present/accounted for
  - Check daily medication regimen – prescription drugs, OTC meds, herbals
  - Comfortable clothing and shoes

- Systemic evaluation – CV, pulmonary, renal, hepatic, endocrine
  - Diabetes – HbA1c <6 for healthy, <7 for diabetic controlled