Anesthesia, Sedation, Pain Management, & Pharmacology - A Review
FAGD Review 2013

Outline

Pain Control
A. Local Anesthesia
B. Analgesia/Nitrous Oxide
C. Conscious Sedation
   1. Oral
   2. IV
D. Hypnosis & Others

Chronic Pain Management

Local Anesthesia
Sensation Sequence
- Sensation will occur and disappear in a sequential order.
- Touch: Not in dentistry. General anesthesia is needed.

Local Anesthetic: Action
- Alter the basic resting potential of the nerve membrane.
- Alter the threshold potential (firing level)
- Decrease the rate of depolarization
- Prolong the rate of repolarization
- Primary action: decrease the permeability of the ion channels to sodium channels.
- “Safety rate” decreases to slow the rate of rise of the action potential (impulses) and its conduction velocity.
- When safety rate decreases, conduction fails and nerve block occurs.

Mechanism of action
Mechanism of action
Properties of LA base and salt forms
Issues with pH and pKa
- Normal tissue pH 7.4
- pKa = pH at which drug is ½ base and salt
- Salt = solid, water soluble, stable, acidic, charged cation, active form, present in carpules
- Base = viscous liquid, fat soluble, unstable, alkaline, uncharged, penetrates nerve tissue, present in tissue pH

Normal vs. Infected tissue
Pharmacokinetics: ADME
- Absorption
- Depends on vascularity
- Also depends on LA type, pH of tissue
- Decreased absorption: decreased toxicity

Distribution- throughout body

Metabolism
- Esters- plasma and liver
- Amides- liver

Excretion- kidney

Chemistry
- Two major types of local anesthesia for dentistry:
  - Amide
    - Principle injectable
    - Low allergy factor
  - Ester
    - Highly allergenic
    - Rarely used as injectable
    - Mostly topical

Three segments:
- Aromatic nucleus
- Linkage by amide or ester
- Amino group

Composition of LA
- Vasoconstrictor (if added)- retards absorption, reduces toxicity, and prolongs action
- Antioxidant- prolongs shelf life
- Sodium hydroxide- adjusts pH
- Sodium chloride- isotonic
- Methylparaben / propylparaben (not in carpules)

Ester Local Anesthetics
- Hydrolyzed in the Plasma the enzyme pseudocholinesterase
- Rate of Hydrolysis Has Impact on TOXICITY of LA
Esters: Higher Rate of Allergic Reactions not related to Procaine but to PABA which is major metabolic product of ester LA’s

One in 2800 persons has inability to hydrolyze Ester LA’s

Amide Local Anesthetics

Metabolism more complex. Primary site of biotransformation is the liver, entire metabolic process occurs in liver for

Lidocaine, Mepivacaine, Articaine, Etidocaine, Bupivacaine

Prilocaine undergoes primary metabolism in the liver and some occurring in lungs

Amides

Rates of Biotransformation of lidocaine, mepivicaine, articaine, etiocaine and bupivacaine are similar

Prilocaine undergoes MORE RAPID biotransformation…..

Liver function influences rate of biotransformation of AMIDE LA’s

Commonly used amide local anesthetic dosages

According to Malamed in his 5th edition of Local Anesthesia:

<table>
<thead>
<tr>
<th>Local Anesthetic</th>
<th>MRDa (author)</th>
<th>MRDm (manufacturer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lidocaine w/ 1:100,000 epi</td>
<td>300mg max (8.4 carpules)</td>
<td>500mg max (13.9 carpules)</td>
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<tr>
<td>36mg/carpule</td>
<td>2.0mg/lb</td>
<td>3.0mg/lb</td>
</tr>
<tr>
<td>4% Articaine w/ 1:100,000 epi</td>
<td>500mg max (6.9 carpules)</td>
<td>500mg max (6.9 carpules)</td>
</tr>
<tr>
<td>72mg/carpule</td>
<td>3.2mg/lb</td>
<td>3.2mg/lb</td>
</tr>
<tr>
<td>3% Mepivacaine w/o epi</td>
<td>300mg max (5.9 carpules)</td>
<td>400mg max (7.8 carpules)</td>
</tr>
<tr>
<td>51mg/carpule</td>
<td>2.0mg/lb</td>
<td>3.0mg/lb</td>
</tr>
<tr>
<td>0.5% Bupivacaine w/ 1:200,000 epi</td>
<td>90mg max (10 Carpules)</td>
<td>90mg max (10 carpules)</td>
</tr>
<tr>
<td>9mg/carpule</td>
<td>0.6mg/lb</td>
<td>0.6mg/lb</td>
</tr>
</tbody>
</table>

Malamed also very clearly states that “some caution must be advised when considering the use of 4% local anesthetics for nerve blocks in the mandible.” The risk of parathesia is a 1 in 1.2 million chance for 2% and 3% anesthetics and 1 in 500,000 chance with 4% anesthetics., Page 289

Malamed states in his book that even though Articaine states 1.7ml, there is actually 1.8 and that is the number that should be used for dose computations. Page 73.

Articaine

Articaine, like lidocaine, has a maximum dose of 7 mg/kg for healthy individuals.

Articaine is a 4% solution. Since articaine is a 4% solution and lidocaine is a 2% solution,
one can only give approximately half as much articaine as lidocaine.

- If treating a small child (ie, weight of 15 kg or approximately 30 lbs.) the toxic dose is approached with less than two cartridges of a 4% solution.

**LA Options**

- ADA update Sep 2011
  - Inf Alveolar
    - Intratragic notch (ear) and corner of mouth
    - 10-15% aspiration
    - Nerves: IAN, Incisive, Mental, and Lingual
    - 3 to 5 minute onset
  
  - Gow Gates
    - Wide open mouth
    - 2% aspiration
    - Nerves: Above plus Buccal, Mylohyoid, and Auriculotemporal
    - 5 to 10 minute onset
  
  - Akinosi
    - Closed mouth- ideal for pt with trismus
    - Bending of needle (not recommended due to possible breakage)
    - Needle at level of MCG of max molars
    - No bony landmarks

**LA Options**

- Intraosseous (IO) and PDL
  
  - Pain
  
  - Cardiac (epi)
  
  - Pressure

**Mandibular infiltration**

- Best with 4% articaine
- No difference with % epi
- Split buccal and lingual dose

**Analgesia**
Pain
- Protective
- Diagnostic tool
- Perception and reaction
  - Low threshold- high (over) reaction to pain due to anxiety, emotional state, fatigue, fear, apprehension
  - High threshold- low reaction to pain due to rest, sympathy, meds

Analgesia
- A reduced perception and responsiveness to noxious stimuli
  - Non-narcotics
    - Peripherally acting analgesics reduce or control pain by directly inhibiting the biochemical mediators of pain at the site of injury.
  - Narcotics
    - Opioids decrease the perception of pain in the CNS. The opioid analgesics act in the CNS where they impact the perception of pain.

Analgesic meds
- Two types:
  - Nonopioids
    - Salicylates (aspirin)- ASA
    - Acetaminophen
    - NSAIA/NSAID
  - Opioids

ASA
- Analgesic
- Antipyretic
- Anti-inflammatory
- Anti-platelet
- Inhibits prostaglandin synthesis by inhibiting cyclooxygenase
- Prostaglandins sensitize pain receptors
- Low dose- 2 to 3 hour half life; high dose 15 to 30 hour half life

ASA
- Mild to moderate pain
- Reduces fever by causing vasodilation and sweating
- Decreases erythema and swelling of inflamed tissues
- Irreversibly binds to platelets

ASA
- Bleeding
- GI effects
- Reye’s syndrome
- Hepatic and renal effects
- Pregnancy and nursing
- Hypersensitivity
- Toxicity
- Interactions:
  - Warfarin- increases anticoagulant effect
  - Probenecid- cause gout attack
  - Methotrexate- toxicity
  - Sulfonylureas- hypoglycemia
  - Antihypertensives- reduces effects

ASA
- Regular
- Enteric-coated
- Combinations
- Other forms- sodium, choline, magnesium, salsalate
- Dose:
  - Adult- 5 mg/lb
  - Child- 60 to 80mg/kg/24hrs- max 3.6gm/24hrs

NSAIA/NSAID
- Resemble actions of ASA
- Inhibits cyclooxygenase
- Peak effect 1 to 2 hours
- Reversibly affect platelets
- NSAIs usual analgesic dose equals 650mg ASA plus codeine

NSAIDs
- Ibuprofen
- Naproxen
- COX-1; COX II

Acetaminophen
- Analgesic and antipyretic; not anti-inflammatory
- Useful for kids
- Peak level 1 to 3 hours; ½ life 1 to 4 hours
- Metabolized in the liver
- Equal to ASA in pain relief
- Can be hepatotoxic in high doses

Acetaminophen
- Free of drug interactions
- Used to decrease pain, fever, and those with ASA allergy
- No more than 4 grams in 24 hours

Opioid Classification
- Receptor site activity: agonists, mixed opioids, and antagonists
- Chemical structure:
  - Morphine and codeine
  - Methadone
  - Morphinan
  - Meperidine
  - Other

Efficacy
Mechanism of action
- Bind to receptors in CNS and spine
- Three natural opioid-like substances:
  - Enkephalins
  - Endorphins
  - Dynorphins
Mu, Delta, and Kappa (dysphoria) receptors with varying affinities

Pharmacokinetics

ADME:
- Absorption (oral, mucosa, lungs, nasal, dermal)
- Distribution (first pass thru liver or intestines- 2/3 codeine available; ¼ morphine),
- Metabolism- conjugated with glucoronic acid in liver
- Excretion (renal filtration)

Bound to plasma proteins
Onset in an hour with 4 to 6 hour action

Pharmacologic effects

Analgesia
- Morphine > oxycodone > hydrocodone > codeine
- Mu and Kappa receptors involved in analgesia
- Raise pain threshold

Sedation and euphoria
- Sedation via Kappa

Cough suppression
- Depress cough center in medulla

GI effects
- Increase smooth muscle tone and decrease motility

Opioid Adverse reactions

- Adverse effects are related to dose not organ damage
- Respiratory depression related to decrease in sensitivity of brainstem to CO₂
- Nausea due to stimulation of chemoreceptor trigger zone in medulla
- Constipation due to decrease in GI motility
- Myosis- pinpoint pupils
- Urinary retention due to increase of urinary smooth muscle tone

Opioid Adverse reactions
CNS stimulation
- Cardiovascular effects due to depression of vasomotor center and vagus stimulation with hypotension and syncope
- Biliary tract constriction with resulting biliary colic
- Histamine release result in itching
- Pregnancy- may prolong labor; infants can experience withdrawal and respiratory depression; no problem in milk

Addiction
- An addict will not overcome miosis or constipation
- Overdose
- Withdrawal
- Addict ID
  - Drug seeking behavior
  - Specific requests
- Treatment

Allergic reactions
- Skin rashes and itching most common reaction
- Look for cross reactivity
- Choose from another class
- Look at sulfite allergy

Drug interactions
- Additive to other CNS depressants
- Additive with alcohol and sedative hypnotics
- Meperidine can interact with MAOs

Specific opioids
- Morphine
- Oxycodone
- Hydrocodone
- Codeine
- Propoxyphene
- Meperidine
- Hydromorphone
- Methadone
Fentanyl

Mixed opioids

- Agonist-antagonist
- Partial agonists
- Opioid antagonists
  - Naloxone
  - Nalmefene
  - Naltrexone

Tramadol

- Mu opioid action
- Opioid like properties
- Inhibition of reuptake of norepi and serotonin (antidepressant effect)

Dental use of opioids

- Most dental pain should be handled by NSAIA or NSAIDs
- Wide range for needs - surgical, severe acute pain
- Small doses
- Not for chronic pain

Nitrous Oxide

Chemistry

- Nitrous oxide is most commonly prepared by careful heating of ammonium nitrate, which decomposes into nitrous oxide and water vapor. The addition of various phosphates favors formation of a purer gas at slightly lower temperatures.

Mechanism of action

- The mechanism of action of nitrous oxide is trifold:
  - Analgesia
  - Anxiolysis
  - Anesthesia

- Its analgesic mechanism of action is described as opioid in nature and may involve a number of spinal neuromodulators.
- The anxiolytic effect is similar to that of benzodiazepine and may involve gamma aminobutyric (GABA) receptors.
- The anesthesia mechanism may involve GABA and possibly N-methyl-D-aspartate
receptors as well.

- In general, the effect of nitrous oxide ceases as soon as the inhalation stops, with no residual effect.

**Neuropharmacology**

- The pharmacological mechanism of action of \( \text{N}_2\text{O} \) in medicine is not fully known. However, it has been shown to directly modulate a broad range of ligand-gated ion channels, and this likely plays a major role in many of its effects.

- While \( \text{N}_2\text{O} \) affects quite a few ion channels, its anesthetic, hallucinogenic, and euphoriant effects are likely caused predominantly or fully via inhibition of the NMDA receptor thus causing the altered state.

- The NMDA receptor controls memory function.

**Nitrous Oxide**

- Signs of sedation/analgesia
  - Circumoral numbness
  - Floating feeling
  - Tingling of extremities

- High stress procedure - 50% to 70%
- Low stress procedure - 20% to 50%
- 100% oxygen for 3 to 5 minutes to decrease risk of diffusion hypoxia

**Nitrous Oxide**

- Must have scavenging system
  - Exposure must be less than 25ppm
- Risks to chronic exposure include:
  - Teratogenicity
  - Neurologic symptoms
    - Parathesias
    - Diminished proprioception
    - Vision impairment
  - Reproductive problems
    - Increased risk of spontaneous abortion

**Pharmacology - Anxiolysis**

- In behavioral tests of anxiety, a low dose of \( \text{N}_2\text{O} \) is an effective anxiolytic due to an enhanced activity of \( \text{GABA}_\text{A} \) receptors.
GABA is the brain’s principle inhibitory transmitter with resulting “sedating” effects
Mirroring this, animals which have developed tolerance to the anxiolytic effects of benzodiazepines are partially tolerant to N₂O.
Indeed, in humans given 30% N₂O, benzodiazepine receptor antagonists reduced the subjective reports of feeling "high", but did not alter psycho-motor performance, in human clinical studies.
Pharmacology- Analgesia
The analgesic effects of N₂O are linked to the interaction between the endogenous opioid system and the descending noradrenergic system. When animals are given morphine chronically they develop tolerance to its pain-killing effects, and this also renders the animals tolerant to the analgesic effects of N₂O.
It seems N₂O-induced release of endogenous opioids causes disinhibition of brain stem noradrenergic neurons, which release norepinephrine into the spinal cord and inhibit pain signaling. Exactly how N₂O causes the release of endogenous opioid peptides is still uncertain.
Pharmacology- Euphoria
N₂O appears to stimulate the mesolimbic reward pathway via inducing dopamine release and activating dopaminergic neurons in the ventral tegmental area and nucleus accumbens, presumably through antagonization of NMDA receptors localized in the system. This action has been implicated in its euphoric effects, and notably, appears to augment its analgesic properties as well.
Though, it is noteworthy that in human clinical studies, N₂O was found to produce mixed responses similar to rats, reflecting high subjective individual variability.
Contraindications
Overall, nitrous oxide is a very safe drug with few absolute contraindications.
Nitrous oxide is contraindicated in patients with significant respiratory compromise.
Caution must be exercised in individuals with a history of stroke, hypotension, and known cardiac conditions.
Nitrous oxide is relatively contraindicated in pregnancy. It is known to have potential teratogenic and fetal toxic effects, particularly with chronic use.
Contraindications
Dental nitrous oxide may be contraindicated in patients with OSA, severe nasal congestion, those who breathe through their mouths, or those unable to wear a nasal mask.
Patients, especially children, with severe anxiety or extreme uncooperativeness may not be good candidates for this milder therapy and may require more potent sedating intravenous or general anesthesia.
Complications
Potentially dangerous adverse effects include overdose, hypoxia, severe hypotension, unconsciousness, or death. High nitrous oxide concentrations have been associated with severe hypoxia and death from asphyxiation.

While most adverse effects are reversible, peripheral neuropathies and limb spasms may become nonreversible manifestations.

Anxiolysis

Benzodiazepines

- Most commonly used sedative and anxiolytic
- High margin of safety
- Also effective anterograde amnesia, muscle-relaxation, and anticonvulsant activity
- No analgesic effect
- Preoperative sedation and as a sleep adjunct the night before surgery
- Higher doses can produce deep sedation and even general anesthesia
- Can produce noticeable reduction in blood pressure and heart rate
- Minimal effects on respiration

Benzo Types

- Diazepam
  - Lipid soluble with lingering sedative effects.
  - Diazepam can also be given orally (5 to 10 mg) for anxiolysis and sedation.
- Midazolam
  - Water soluble with less pain with use (IV or IM)
  - 2 to 3 times as potent as diazepam, with a faster onset, elimination, and shorter duration
  - Respiratory depression is a concern
  - Ideal for short oral surgical procedures.

Benzo Types

- Lorazepam
  - Long-acting benzodiazepine with a slow onset.
  - Used for PO and IV sedation
• Oral preoperative anxiolysis
• Long operative appointments.
• Dosage for an adult is 0.05 mg/kg, not to exceed 4 mg total.

Triazolam
• Oral formulation as 0.125 mg and 0.25 mg tablets.
• Can be used off-label for anxiolysis and sedation at a dose of 0.25 to 0.5 mg for an adult.
• Very short-acting benzodiazepine and its effects are observed in 30 to 45 minutes with clinically effective sedation lasting from 30 to 90 minutes.

Benzo Reversal - Flumazenil
• Flumazenil is as a reversal agent for benzodiazepine agonists
• It will reverse benzodiazepine sedation, excessive disinhibition, and the additive ventilatory depression
• Reversal effects may take several minutes to manifest. The effect of flumazenil will last 30 to 60 minutes and may require redosing since agonist drug activity may outlast the reversal effects.

Enteral Sedation
• Advantages
  • Easy for adults
  • No special equipment for delivery
• Disadvantages
  • Inability to titrate
  • Latency of effect
  • Variability/Improper dosing
• Variability of training requirements
• Single vs. Multiple meds

Enteral Sedation Medications
• Benzodiazepines
  • Wide safety margin
  • Be aware of cytochrome P450 interaction
• Imidazopyridine (Ambien)
Rapid onset (rescue sedation)

- Antihistamines
  - Poor onset with single oral administration for adults

- Barbiturates
  - Out of favor due to severe side effects and narrow margin of safety

Conscious Sedation

“Conscious Sedation”

- Oxymoron – implies alert yet sedated

- Goal is rarely to be “conscious”

- Term no longer recognized

- “Procedural Sedation and Analgesia”

- PSA

Sedation Continuum

ASA PHYSICAL STATUS CLASSIFICATION SYSTEM (for Dentistry)*

Pre-sedation Assessment

Who should we sedate?

- ASA I – Normal healthy patient

- ASA II – Mild systemic disease

- ASA III – Severe systemic disease

- ASA IV – Severe disease / constant life threat

- ASA V – Moribund, not expected to survive

GA vs. PSA

- Relative risk likely much lower during PSA
  - Should not be manipulating airway!
Depth of sedation – goal to maintain airway reflexes

- No inhalational agents (more emetogenic)
- Patients tend to be younger and healthier
  - ASA I and II
  - GA patients are often ASA III-V

Risk of aspiration during general anesthesia
- Multiple pooled studies
- Aspiration: 1:3420
- Aspiration mortality: 1:125,109!

Medications

- Analgesics
  - Fentanyl (also non-dissociative sedation)
  - Morphine

- Sedatives
  - Versed (no analgesic properties)
  - Ketamine (dissociative)
  - Etomidate (sedative-hypnotic)
  - Propofol (sedative-hypnotic)

- Combination agents/New Medications
  - Ketofol
  - Dexmedetomidine
  - Sucrose

Opioids

- Opioid medications are used in oral surgery primarily for analgesia and mild sedation or euphoria.
Narcotic medications do not produce amnesia or classic sedation, nor do they induce loss of consciousness or sensation of touch at clinically relevant doses.

Patients given opioid medications alone will retain awareness and memory.

Opioids are often used in combination with sedative-hypnotic medications such as benzodiazepines and barbiturates to provide analgesia and augment the desired level of anesthesia.

Opioid Agents

**Morphine**

- Morphine is the standard agent by which other opioids are compared
- Poor lipid solubility and therefore has a slow onset.
- Histamine release from morphine can result in
  - Skin flushing
  - A decrease in blood pressure
  - May be of concern in an asthmatic patient.

**Meperidine**

- Synthetic opioid
- Rapid onset time
- Duration of action between 2 and 3 hours
- Can be used for both intravenous sedation and postoperative pain control.

Opioid Agents

**Fentanyl**

- Synthetic opioid
- High lipid solubility, high potency, rapid onset (1 min) and shorter duration of action
- Fentanyl does not induce histamine release
- Not associated with vasodilatory or bronchospastic effects
- At higher doses can cause more pronounced bradycardia than morphine

**Fentanyl**
- Narcotic of choice during PSA
- Rapid onset, short duration of action
- No histamine release
- Few CV side effects
  - Rarely causes hypoxemia, apnea, vomiting, pruritis
- No amnestic effects
  - Should not be used as solo agent
- Dose: 0.5 to 1 mcg/kg IV
  - Halve dose in elderly
  - Do not give IM or PO for PSA

**Morphine/Dilaudid**
- More histamine release than fentanyl
- Emetogenic
- May result in hypotension
- Longer onset but longer acting
  - May be a good choice for longer procedures
- Morphine dose: 0.05 to 0.1 mg/kg IV
- Dilaudid dose: 0.015-0.02 mg/kg IV

**Opioid Caution**
Respiratory depression is the most common and pronounced side effect as used in anesthetic practice.

This effect can be significantly exacerbated with concurrent administration of other medications such as benzodiazepines, barbiturates, propofol, and other opioids.

Respiratory depression is dose dependent.

Ketamine

- Phencyclidine derivative
  - NMDA Receptor antagonist
  - Also binds opioid µ receptors at higher doses

Dissociation between thalamoneocortical and limbic systems

- Prevents higher centers from perceiving
  - Visual and auditory stimulation
  - Pain
- Muscle tone (thus airway reflexes) maintained
- Eyes open – nystagmus

Ketamine - Advantages

- Airway and respirations maintained
- Analgesia in addition to sedation
- Cardiac stability
  - Hypertension and tachycardia
  - Good for sepsis
- Amnestic agent

Ketamine – Side Effects

- Hypertension and tachycardia
- Vomiting
  - Vast majority after patient awake and oriented
Emergence reaction
- Hallucinations / nightmares
- Rarely in kids (esp <5 yo)
- Can be blunted by low dose benzos (0.02-0.05 mg/kg versed)

Hypersalivation – can be blunted but usually not necessary
- Atropine 0.02 mg/kg
- Glycopyrrolate (Robinul) 0.2 mg

Ketamine - Dose and Use
- Dose:
  - 1-2 mg/kg IV, redose 0.25-0.5 mg/kg if needed
  - 4-5 mg/kg IM, redose 1 mg/kg if needed
- Redosing: Judge on arousal and movement

Contraindications
- Infants < 3 months
- History of psychosis
- Airway abnormalities
- Severe CV disease
- Any process with possible elevated ICP
- Thyroid disease
- Active respiratory disease*

Etomidate
- Sedative/Hypnotic
- Rapid onset / Short duration of action
- Anesthetic and amnestic properties
  - No analgesic properties
Dose 0.1-0.2 mg/kg IV
  - Onset within one minute
  - Redose as necessary 0.05 mg/kg

Etomidate – Safety Profile
  - Minimal cardiovascular effects
    - Four trials, 243 pts
    - One episode of transient hypotension
      - Responded to IV fluids
  - Minimal respiratory depression
    - One clinically significant case – intubation
    - > 75 yo male, dose 0.33mg/kg
  - Nausea and vomiting slightly more common
  - Myoclonus
    - 0% to 21% rate
    - Brief (usually 1 min or less) but may be dramatic
    - Often associated with respiratory depression
  - Adrenal Suppression
    - Likely not an issue for ED PSA – enough said!

Propofol
  - Non-opioid, non-barbiturate, sedative-hypnotic
    - No analgesic properties
  - Rapid onset, short duration of action
  - Predictable efficacy, especially for deep sedation
    - Criticism! Concern for ease of General Anesthesia
    - Easy to overshoot
  - Dose: 1 mg/kg initially
- 0.25 to 0.5 mg/kg redose as necessary

Propofol – Safety Profile

- Hypotension
  - Less so in sedation doses

- Transient apnea

- Rare:
  - Nausea/vomiting (may actually be protective)
  - Myoclonus (very rare)

- Localized pain at injection site
  - Mitigated with lidocaine

Propofol - Comparisons

- Fastest recovery time (all agents)
- Compared to Midazolam difference in recovery 25.3 minutes
- Successful procedure 97.2% (propofol) vs. 90% (versed) vs 89.5% (etomidate)

Ketofol

- Propofol
  - Predictable deep sedation
  - Blunts psychomemetic effects
  - Minimizes nauseant effects
  - Blunts hypertension

- Ketamine
  - Analgesia
  - Counters cardiorespiratory effects

Equipment

- What equipment should be on hand?
- Oxygen
- Suction
- BVM
- Intubation equipment
- IV access
  - Optional if ketamine being used
- IV fluids

Managing Adverse Reactions
- Have equipment and medications on hand!

Respiratory Depression/Transient Apnea
- Most commonly, reposition airway or stimulate
- Less commonly, oral/nasal airway or BVM
- Rare: Intubation

Laryngospasm
- If mild, reposition airway or attempt to BVM through it
- If unable, administer paralytic and intubate

Myoclonus/rigidity
- If mild, wait. Provide respiratory support as needed
- If moderate to severe, give benzos or paralytics worst case

Managing Adverse Reactions
- Hypotension
  - Do nothing if mild, if severe IV fluids and decrease/halt sedation meds
  - Administer naloxone if due to opioids
- Emesis:
  - Suction to minimize aspiration
Consider peri-sedation administration to minimize
Emergence Reaction (Ketamine)
- Low dose benzos
- Use ketofol up front

Reversal agents
- Naloxone (Opioids)
- Flumazicon (Benzos)

What is Remifentanil?
Ultra-short acting opioid characterized by:
- Rapid termination of effect, independent of infusion duration
- Rapid onset
- Predictable accurate and precise titration

Comparison of Remifentanil to Fentanyl, Sufentanil, Alfentanil
Remifentanil:
- *Deeper analgesia* and anesthesia
- *Fewer responses to noxious stimuli*
- Potentially more frequent bradycardia
- Potentially more hypotension
- Less hypertension
- *Faster recovery*
- No difference in PONV
- *Use at higher doses without concern for residual effects*
- More shivering
- Allows use of lower doses of hypnotics

Unique pharmacologic profile facilitates…
- A dose-dependent choice of sedation through to full general anesthesia
- Real time management of intraoperative stress
- Precise titration to the following endpoints:
  - Anesthetic
  - Respiratory- rate and depth of ventilation
• Cardiovascular- HR and BP
• Upper airway tone

Rapid termination of effects
• Improves/hastens recovery experience
• Minimizes duration/severity of recovery experience
• Overdose less likely, mistakes tend to go away quickly

Why might one consider using this technique for office based anesthesia?

► Patient comfort

► Versatility:
  • 1 minute to 3 hours working time
  • Age extremities, obese, OSA
  • Moderate>deep>full GA

► Accuracy
  • Facilitates rapid and accurate titration to multiple endpoints

► Safety
  • Facilitates lower doses of each drug and slower rates of administration

► Facility
  • Easily and rapidly move between various depths of sedation/anesthesia

Chronic Pain and CAM

Hypnosis

► Hypnotherapy can reduce the fear and anxiety that some people feel before dental procedures.

► Hypnotherapists use exercises that bring about deep relaxation and an altered state of consciousness, also known as a trance.

► This does not mean that a hypnotist can control the person's mind and free will.

► Studies show that dental patients who underwent hypnosis had a significantly higher threshold for pain than those who were not hypnotized. Hypnosis may also improve recovery time and reduce anxiety and pain following surgery.

Chronic Pain- Complementary and Alternative Medicine (CAM)

► Pain is one of the most common conditions for which adults use complementary and alternative therapies. Because chronic (long-term) pain can be resistant to many medical treatments and can cause serious problems, people who suffer from chronic pain often turn
to (CAM) for relief. This fact sheet provides basic information on chronic pain and “what the science says” about the effectiveness of CAM therapies. If you are considering a CAM therapy for chronic pain, talk with your health care provider first.

**CAM**

- A person may have two or more co-existing chronic pain conditions. Such conditions can include chronic fatigue syndrome, endometriosis, fibromyalgia, interstitial cystitis (painful bladder syndrome), irritable bowel syndrome, temporomandibular joint dysfunction, and vulvodynia (chronic vulvar pain). It is not known whether these disorders share a common cause.

**CAM**

- Other CAM approaches.
- People suffering from various types of chronic pain sometimes turn to other CAM practices, such as hypnotherapy, meditation, or qi gong. Again, reviews of the research on these therapies have found some evidence of effectiveness.
- Magnets are widely marketed for pain control, a review of the related research concludes that the evidence does not support this practice.

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**Additional References**

**Key Concepts in Pain Management for the Federal Healthcare Professional**

Current medical literature, military medical experts, Army Task Force and Congressional findings, Veterans Administration studies, and other sources indicate that military and other patients in the federal healthcare setting experience different types of pain than patients seen in the civilian population. A supplement to U.S. Medicine, this publication describes different types of pain, reviews pharmacologic and integrative strategies for pain management, and discusses challenges that can complicate pain management.


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**Pain Management in Dentistry**