Disclaimers

The opinions expressed in this presentation are those of the speaker and not necessarily those of the University of Texas School of Dentistry or the Academy of General Dentistry.

The opinions expressed in this course should not be construed as advice for the care of specific patients.

The drugs and techniques contained in this course must be based on the clinical judgment of the individual practitioner.
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713-486-4506
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Learning Objectives

- Understand the pharmacologic characteristics of newer medications and their impact on dental treatment
- Provide current, evidence-based information on major classes of drugs used in dentistry
- Review appropriate emergency drugs for general dental practice and methods of administration
- Review professional guidelines for the use of drugs in dentistry
Current Issues: Antibiotics

- Microbial antibiotic resistance
- Selection of traditional vs. newer antibiotics
- Minimizing adverse effects & adverse drug interactions
- Antibiotic prophylaxis
Newer Antibiotics (U.S.)

- Designed primarily for use against MRSA (non-beta-lactam PBP binders, oxadiazoles)
- Dalbavancin (DALVANCE)
- Tedezolid (SIVEXTRO)
- Oritavancin (ORBACTIV)
- Rifaximin (XIFAXAN, *E. coli*)
Antibiotic Resistance in Primary and Persistent Endodontic Infections

Jungermann GB et al.
Department of Endodontics, Prosthodontics and Operative Dentistry, Dental School, University of Maryland

J. Endod. 2011; 37(10)
<table>
<thead>
<tr>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampled bacteria in 30 primary/15 persistent infections</td>
<td><em>bla</em> TEM-1 = primary &gt; persistent</td>
</tr>
<tr>
<td>Characterized isolates for antibiotic resistance genes and phenotypic expression of resistance</td>
<td>Treatment reduced most EXCEPT <em>tetM</em></td>
</tr>
<tr>
<td></td>
<td>No <em>van</em> A, D or E detected</td>
</tr>
</tbody>
</table>
Antibiotic Resistance Genes in Anaerobic Bacteria Isolated From Primary Dental Root Canal Infections

Rocas I.N., Siqueira J.F.
Department of Endodontics, Estacio de Sa University, Rio de Janeiro, Brazil

Anaerobe – Volume 18, Number 6, December 2012, pp. 576-80
<table>
<thead>
<tr>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 26 endodontic patients</td>
<td>• 32% positive for at least one r gene</td>
</tr>
<tr>
<td>• All had necrosis + AP radiographically</td>
<td>• Most prevalent = blaTEM (17%), tetW (10%),</td>
</tr>
<tr>
<td>• Bacteriologic samples taken within 1 mm of</td>
<td>ermC (10%)</td>
</tr>
<tr>
<td>apices</td>
<td></td>
</tr>
<tr>
<td>• DNA extraction + PCR amplification for</td>
<td></td>
</tr>
<tr>
<td>resistance genes</td>
<td></td>
</tr>
</tbody>
</table>

Method & Findings, Rocas & Siqueira, 2012
Detection of Antibiotic Resistance Genes in Samples From Acute and Chronic Endodontic Infections and After Treatment

Rocas I.N., Siequeira, J.F. Department of Endodontics, Estacio de Sa University, Rio de Janeiro, Brazil

Archives of Oral Biology – Volume 58, Number 9, September 2013, pp. 1123-8
<table>
<thead>
<tr>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 25 abscess aspirates, 26 root canal samples</td>
<td>- 36% abscess samples &amp; 67% of asymptomatic cases positive for at least one resistance gene</td>
</tr>
<tr>
<td>- All had asymptomatic AP</td>
<td>- Most prevalent in abscesses = blaTEM (24%) &amp; ermC (24%)</td>
</tr>
<tr>
<td>- Also sampled root canals after chemomechanical preparation</td>
<td>- tetM (42%) &amp; tetW (29%) prevailed in asymptomatic cases</td>
</tr>
<tr>
<td>- DNA extraction + PCR amplification for resistance genes</td>
<td>- Tx eliminated detectable resistance genes</td>
</tr>
</tbody>
</table>
Beta-lactamic Resistance Profiles in Porphyromonas, Prevotella and Parvimonas Species Isolated from Acute Endodontic Infections

Montagner F, Jacinto RC et al.

Methods

- 20 patients with spontaneous pain & pulpal necrosis
- Sterile access, paper point samples
- Pure cultures for 3 organisms
- Assessed penicillin & aminopenicillin resistance

Findings

- 2 of 29 isolates positive for cfxA/cfxA2 gene
- Gene + lactamase production in 1 Prevotella strain
- Gene only in 1 Parvimoinas strain
- 3 strains expressed lactamase w/o gene
“Rational” Dental Antibiotics For Orofacial Infections

- Narrow spectrum
- Good activity vs. anaerobic organisms
- Bactericidal agents preferred
AAE Indications for Antibiotic Therapy (2006)

- Fever > 100 degrees F
- Malaise
- Lymphadenopathy
- Trismus
- Increased swelling
- Cellulitis
- Osteomyelitis
- Persistent infection
Conditions NOT requiring adjunctive antibiotics...

- **Pain** without signs and symptoms of infection (symptomatic reversible pulpitis, acute periradicular periodontitis)
- Chronic apical abscess
**AAE Antibiotic Recommendations (Adult)**

- **Penicillin VK**, 1,000 mg, then 500 mg q. 4-6 h. for 5 - 7 days
- **Amoxicillin**, 1,000 mg, then 500 mg q. 8 h. for 5 – 7 days (also with clavulanate)
- **Clindamycin**, 600 mg, then 300 mg q. 6 h. for 5 - 7 days
- **Metronidazole**, 1,000 mg, then 500 mg q. 6 h. for 5 - 7 days (add to Pen VK or clindamycin)
• **Clarithromycin**, 500 mg, then 250 mg q. 12 h. for 5 – 7 days

• **Azithromycin**, 500 mg, then 250 mg once daily for 5 – 7 days
### Comparative Pharmacokinetics

<table>
<thead>
<tr>
<th>Absorption/Distribution</th>
<th>Plasma Half-Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin V: moderate, inhibited by food, 80% protein-bound</td>
<td>Penicillin V: 1 hr</td>
</tr>
<tr>
<td>Amoxicillin: well absorbed, 20% protein-bound</td>
<td>Amoxicillin: 1.3 hr</td>
</tr>
<tr>
<td>Clindamycin: well-absorbed, 92-94% protein-bound</td>
<td>Clindamycin: 2.4-3 hr</td>
</tr>
<tr>
<td>Metronidazole: well-absorbed, &lt;20% protein-bound</td>
<td>Metronidazole: 8 hr</td>
</tr>
<tr>
<td>Clarithromycin: well-absorbed, 65-75% protein bound</td>
<td>Clarithromycin: 3-7 hr</td>
</tr>
<tr>
<td>Azithromycin: well-absorbed, 7-50% protein-bound</td>
<td>Azithromycin: 68 hrs</td>
</tr>
</tbody>
</table>
Clindamycin Serum Concentrations
2.5 mg/lb (5.5 mg/kg) After B.I.D.
Oral Dose of clindamycin hydrochloride to Dogs
Beta lactamase inhibitor + antibiotic combinations

- Amoxicillin/clavulanate (AUGMENTIN)
- Ampicillin/sulbactam (UNASYN)
- Ticarcillin/clavulanate (TIMENTIN)
- Piperacillin/tazobactam (ZOSYN)
Microbiological Analysis of a Prospective, Randomized, Double-Blind Trial Comparing Moxifloxacin and Clindamycin in the Treatment of Odontogenic Infiltrates and Abscesses
**Methods**

- Subjects randomized to moxifloxacin (MXF) or clindamycin (CLI)
- Isolates obtained from infiltrates & abscesses
- All bacteria identified
- Antibiotic susceptibilities determined to MXF, CLI, LVX, PEN, AMC & DOX

**Outcomes (overall susceptibility absecess/infilt.)**

- MXF: 98%/98%
- AMC: 97%/96%
- LVX: 83%/86%
- PEN: 66%/67%
- CLI: 59%/60%
- DOX: 51%/49%
- 8/71 subjects failed to recover
What are the Antibiotics of Choice for Odontogenic Infections, and How Long Should the Treatment Course Last?
Outcomes from Flynn 2011

**Studies Included**

- Clinical (8), laboratory (4)
- A penicillin used in all studies
- Aerobes & anaerobes lab-tested with a pen, a pen + lactamase inhibitor, clindamycin, & a fluroquinolone

**Outcomes**

- Difference in patient cure rate in only 1 study
- No one antibiotic superior
- Antibiotics of choice (outpatients) = amoxicillin clindamycin, azithromycin, metronidazole, moxifloxacin
The Use of Systemic Antibiotics in the Treatment of Refractory Periodontitis

Santos R. et al.

JADA 2016;147(7):577-585
Methods

- Systematic review
- 6 included RCTs
- Assessments based on reductions in probing depth or loss of attachment
- SRP alone vs. SRP + antibiotics
- 5 antibiotics (incl. metronidazole & tetracycline)

Findings

- No Meta analysis done
- 1 study only had parallel design
- High risk of bias across all studies (lack of controls)
- “Quality of evidence does not allow the conclusion that adjunct systemic antibiotics are of additional benefit to SRP alone.”
Dentists, Antibiotics and *Clostridium difficile*-associated Disease

**BEACHER N, SWEENEY MP, BAGG J**

*British Dental Journal*

2015;219(6):275-279
### Spectrum of *Clostridium difficile*-associated Disease (CDAD)

<table>
<thead>
<tr>
<th>Severity</th>
<th>Defined by</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>3 loose stools/day (no change WCC)</td>
<td>Oral metronidazole (500 mg tid/10-14 d)</td>
</tr>
<tr>
<td>Moderate</td>
<td>5-7 loose stools/day + elevated WCC</td>
<td>Oral metronidazole (500 mg tid/10-14 d)</td>
</tr>
<tr>
<td>Severe</td>
<td>Variable loose stools, WCC&gt;15x109/L or 50% ↑Serum [Creatinine] or temp &gt; 101° or abdominal/radiologic signs</td>
<td>Oral vancomycin 125 mg qid/10-14 d</td>
</tr>
<tr>
<td>Life-Threatening</td>
<td>Above + hypotension, ileus/toxic megacolon or CT evidence</td>
<td></td>
</tr>
<tr>
<td>Risk Factors</td>
<td>Warnings</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Antibiotic exposure</td>
<td>Risk factors NOT necessary to produce CDAD</td>
<td></td>
</tr>
<tr>
<td>Severe systemic disease</td>
<td>Fluoroquinolones &amp; cephalosporins increasingly implicated</td>
<td></td>
</tr>
<tr>
<td>Older age</td>
<td>Onset typically within 7 weeks of beginning of antibiotic therapy</td>
<td></td>
</tr>
<tr>
<td>Immune suppression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Incidence of Infective Endocarditis in England, 2000-2013

Lodi G, Figini L, Sardella A et al.
Dayer MJ, Jones S, Prendergast B, Baddour LM, Lockhart PB, Thornhill MH
Volume 385, March 28, 2015
“Although our data do not establish a causal association, prescriptions of antibiotic prophylaxis have fallen substantially and the incidence of infective endocarditis has increased significantly…”
“This increase in the incidence of infective endocarditis was significant for both individuals at high risk of infective endocarditis and those at lower risk.”
Areas of Controversy

• Routine removal of third molars (uninfected)
• Patients with breast, chin and other non-cardiovascular plastic surgical implants
• Routine periodontal surgery
• Diabetic patients
• Patients with HIV-AIDS

• Practitioners should consider changing their long-standing practice of prescribing prophylactic antibiotics for patients who undergo dental procedures

• No direct evidence that oral topical antimicrobials before dental procedures will prevent joint infections

• Consensus supports the maintenance of good oral hygiene
“In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection. The practitioner and patient should consider possible clinical circumstances that may suggest the presence of a significant medical risk in providing dental care without antibiotic prophylaxis, as well as the known risks of frequent or wide-spread antibiotic use.”
“*should only be considered after consultation with the patient and orthopedic surgeon”

“In cases where antibiotics are deemed necessary, it is most appropriate that the orthopedic surgeon recommend the appropriate antibiotic regimen and when reasonable write the prescription.”
Antibiotics to Prevent Complications Following Tooth Extractions

Lodi G, Figini L, Sardella A et al.

Cochrane Database Syst. Rev. 2012 Nov 14; 11:CD003811
<table>
<thead>
<tr>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviewed literature to 25 January 2012</td>
<td>NNT infection = 12</td>
</tr>
<tr>
<td>18 double-blind RCTs</td>
<td>NNT dry socket = 38</td>
</tr>
<tr>
<td>2,456 subjects</td>
<td>No evidence of effect for fever, swelling, trismus</td>
</tr>
<tr>
<td></td>
<td>NNH = 21</td>
</tr>
</tbody>
</table>
The Use of Prophylactic Antibiotics Prior To Dental Procedures in Patients With Prosthetic Joints

Sollecito TP et al.

Systematic review

Journal of the American Dental Association 2015; Jan 146:11-16
Administer prophylactic dose 30 mins to 1 hr before procedure.
General Considerations in Antibiotic Therapy

- Most agents can be taken with food (except Pen VK, some erythromycins)

- Prescribe Pen VK 1 h. a.c. or 2 h. p.c.

- Prescribe with a large glass of water

- ANY antibiotic can cause pseudomembranous colitis
General Considerations in Antibiotic Therapy

- Discontinue immediately if allergy occurs
- Consider possible interactions with oral contraceptives and other drugs
- Have patient avoid ingestion of alcohol while taking antibiotics
Penicillins/amoxicillin remain first-choice drugs
Alternative agents include clarithromycin, clindamycin & metronidazole
New evidence in favor of doxycycline & moxifloxacin in specific cases
Antibiotic resistance increasing but still limited in dentistry
Antibiotic prophylaxis required in specific, limited cases
NO COMPELLING EVIDENCE FOR CHANGE
Analgesics/Current Issues

- Role of NSAIDs
- Role of Opioids
- OTC Combinations vs. Rx products
- Heroin abuse
Prescribing Decisions in Pain Management

- Stimulus intensity ("level")
- Stimulus quality
- Aggravating factors (fatigue, stress, etc.)
- “Pharmacodynamic array” required (analgesia + sedation + antipyresis, etc.)
- Concurrent contributions of procedural intervention
- New scientific evidence
PGE2 Levels in Inflamed Dental Pulps

With permission, copyright University of Michigan, 2014
Peripheral Sensitization/Neurogenic Inflammation (chemical/mechanical axotomy)
Adverse Effects of NSAIDs

- **CNS**: headaches, tinnitus, dizziness
- **CVS**: fluid retention, hypertension, edema, rarely MI and CHF
- **GI**: pain, dysplasia, nausea, vomiting, bleeding, ulceration (long-term use)
- **Hepatic**: abnormal liver function tests, rarely liver failure
- **Pulmonary**: asthma
- **Skin**: rashes, pruritus
- **Renal**: renal insufficiency, failure, hyperkalemia, proteinuria
Conditions With Risk for NSAID-Induced Nephropathy

- Volume depletion/dehydration (diarrhea, vomiting)
- Renal insufficiency
- Heart failure
- Diabetes
- Advanced age

A Flexible Analgesic Strategy

**If aspirin-like drugs are indicated:**

- 200 to 400 mg ibuprofen or 650 mg aspirin
  
  *inadequate pain relief*
  
  - 600 to 800 mg ibuprofen
    
    *inadequate pain relief*
    
    - 400 mg ibuprofen plus non-narcotic/narcotic combination analgesic equivalent to 60 mg codeine (See sample plan below.)
  
  **Moderate Pain**

  - 600 to 800 mg ibuprofen plus non-narcotic/narcotic combination analgesic equivalent to 10 mg oxycodone

**Severe Pain**

**If aspirin-like drugs are contraindicated:**

- 650 to 1000 mg acetaminophen
  
  *inadequate pain relief*
  
  - 600 to 1000 mg acetaminophen and narcotic equivalent to 60 mg codeine
  
  **Severe Pain**

- 1000 mg acetaminophen and narcotic equivalent to 10 mg oxycodone
Dental Pain Model for Analgesic Research

The Third-Molar Model
Dental Pain Model for Analgesic Research

- Standard surgery (2 impacted mandibular third molars)
- Narrow age range (young adults)
- Subjects generally ASA I (not on medications)
- Predictable time course of pain onset, etc.
- Pain level moderate to severe
- Very sensitive and robust
- Minimal placebo effect (15%)
Pain-time cycle after oral surgery

“Number Needed to Treat (NNT)”

- Relative proportion of patients who have a **50%** or greater reduction in pain
- Pain reduction for **4 – 6 hours**
- **Single** oral dose
- **Lower NNT = better** analgesic efficacy (**<2** = very effective)

Moore RA, Straube S, Paine J, Derry S, McQuay HJ

2011, Vol. 152, pp. 982-989
Etoricoxib 120 mg NNT = 1.7 (1.6 in 2007 Oxford League Table) (Merck, 2004-05, n = 1,126)

Ibuprofen 200/400 mg + 500/1,000 mg APAP NNTs = 1.5/1.6 (not reported in 2007 Oxford League table) (Reckitt Benckiser data, 2010, n = 969, 3 or 4 third molars) (confirmed Cochrane)

“the lowest (best) NNTs we have seen in the dental pain model.”
Single Dose Oral Analgesics for Acute Postoperative Pain in Adults—an Overview of Cochrane Reviews (Review)

MOORE RA, DERRY S, ALDINGTON D, WIFFEN PJ

Cochrane Database Syst. Rev.
2015, Issue 9
Art. No. CD008659
DOI: 10.1002/14651858.pub3
Outcomes: Moore et al. 2015

- Current through 4 May 2015
- Inclusion required 2 studies with >200 participants
- Reviewed 39 Cochrane Reviews
- ~50,000 unique participants (all reviews)
- 460 individual studies
- NNTs ranged from 1.5 to 20
- Subjects in RCTs FASTING (“food can have a major impact on speed of absorption and probably effect.”)
Ibuprofen/200 mg + acetaminophen/500 mg: 1.6
“Fast-acting” ibuprofen 200 mg: 2.1
Ibuprofen /200 mg + caffeine/100mg: 2.1
Diclofenac/50 mg: 2.1
Etoricoxib/120 mg: 1.8
Ibuprofen/400 mg: 2.5
Long duration (>8hrs): etoricoxib, difunisal/500 mg, acetaminophen/650 mg + oxycodone/10 mg, celecoxib/400 mg, ibuprofen/400 mg + APAP/1,000 mg
No evidence for analgesia: aspirin/500 mg & oxycodone 5 mg
No data for meloxicam, nabumetone, sulindac
- Diflunisal/500-1,000 mg: 2.1 – 2.6
- Etodolac /100-400mg: 2.9 – 4.8
- Ketoprofen/25-100 mg: 2.0 – 3.3
- Naproxen/200-220 mg: 3.4
- Naproxen/500-550 mg: 2.7
- Acetaminophen/300 mg + codeine/30 mg: 6.9
- Acetaminophen/600 mg + codeine 60 mg: 3.9
- Acetaminophen/650 mg + oxycodone/10 mg: 2.7
- Acetaminophen/500 mg + oxycodone/10 mg: 1.8
Comparison between Prescription of Regular or On-demand Ibuprofen on Postoperative Pain After Single-visit Root Canal Treatment of Teeth with Irreversible Pulpitis

Parirokh M et al.

JOE – Volume 40, Number 2, February 2014
<table>
<thead>
<tr>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>58 subjects</td>
<td>No difference in pain scores between groups at 24 &amp; 48 hours</td>
</tr>
<tr>
<td>Allocated to 2 groups</td>
<td>Group 2 used more pain medication</td>
</tr>
<tr>
<td>Group 1 = single dose 400 mg ibuprofen plus “rescue bag”</td>
<td>% moderate to severe pain 33-36% at 24 h</td>
</tr>
<tr>
<td>Group 2 = regular Rx for 400 mg ibuprofen q. 6 h. for 24 hours</td>
<td>Only 6.9% not relieved</td>
</tr>
<tr>
<td>NO controls</td>
<td></td>
</tr>
</tbody>
</table>
Double-Blind Randomized Placebo-Controlled Clinical Trial of Nonsteroidal Anti-inflammatory Drugs in the Control of Post-endodontic Pain

Methods and Findings: Elzaki et al.

**Methods**
- 170 subjects with moderate to severe pain
- Allocated to 5 groups
- 1,000 mg APA
- 600 mg ibuprofen + 1,000 mg APAP
- 500 mg mefenamic acid + 1,000 mg APAP
- 50 diclofenac + 1,000 mg APAP
- Placebo

**Findings**
- Best pain relief = ibuprofen+APAP
- Mefenamic acid+APAP, diclofenac+APAP
- APAP alone
- APAP alone = placebo
Post-Endodontic Treatment Pain Level/Day (VAS, 0-10)

*Modified heavily and shamelessly from Pak JG & White SN, J. Endod. 2011;37:429-38
Plasma Ibuprofen 19.83 (ug/ml)

Whither opioids???

- Less efficacious than NSAIDs as single agents
- Controlled substances, abuse liability
- Nausea, vomiting (-)
- Sedation (+ or -)
- Important alternatives
“Metabolically-Dependent”

- Prodrug
- Response partially dependent on activity of CYP2D6
- Extensive, poor and ultra-rapid metabolizers
<table>
<thead>
<tr>
<th>Genetic Type</th>
<th>CYP2D6 Activity</th>
<th>Ethnic Differences (Approximate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor metabolizers</td>
<td>None</td>
<td>Caucasians 6%-10%</td>
</tr>
<tr>
<td>Intermediate metabolizers</td>
<td>Low</td>
<td>Mexican Americans 3%-6%</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>African Americans 2%-5%</td>
</tr>
<tr>
<td>Extensive metabolizers</td>
<td>High</td>
<td>Asians ~1%</td>
</tr>
<tr>
<td>Ultrarapid metabolizers</td>
<td></td>
<td>Not established</td>
</tr>
</tbody>
</table>

Most people are extensive metabolizers.
### Pain Management Drugs Covered

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advil</td>
<td>Ibuprofen</td>
</tr>
<tr>
<td>Aleve</td>
<td>Naproxen</td>
</tr>
<tr>
<td>Alfenta</td>
<td>Alfentanil</td>
</tr>
<tr>
<td>Celebrex</td>
<td>Celecoxib</td>
</tr>
<tr>
<td>Codeine</td>
<td>Codeine</td>
</tr>
<tr>
<td>Duragesic</td>
<td>Fentanyl</td>
</tr>
<tr>
<td>Flexeril</td>
<td>Cyclobenzaprine</td>
</tr>
<tr>
<td>Lidoderm</td>
<td>Lidocaine</td>
</tr>
<tr>
<td>Methadose</td>
<td>Methadone</td>
</tr>
<tr>
<td>Mobic</td>
<td>Meloxicam</td>
</tr>
<tr>
<td>Naropin</td>
<td>Ropivacaine</td>
</tr>
<tr>
<td>Oxycontin</td>
<td>Oxycodone</td>
</tr>
<tr>
<td>Relpax</td>
<td>Eletriptan</td>
</tr>
<tr>
<td>SOMA</td>
<td>Carisoprodol</td>
</tr>
<tr>
<td>Subutex</td>
<td>Buprenorphine</td>
</tr>
<tr>
<td>Sufenta</td>
<td>Sufentanil</td>
</tr>
<tr>
<td>Ultracet</td>
<td>Tramadol hydrochloride/</td>
</tr>
<tr>
<td></td>
<td>Acetaminophen</td>
</tr>
<tr>
<td>Ultram</td>
<td>Tramadol</td>
</tr>
<tr>
<td>Vicodin</td>
<td>Hydrocodone</td>
</tr>
<tr>
<td>Voltaren</td>
<td>Diclofenac</td>
</tr>
<tr>
<td>Zanaflex</td>
<td>Tizanidine</td>
</tr>
<tr>
<td>Zomig</td>
<td>Zolmitriptan</td>
</tr>
</tbody>
</table>
Narcotic Prescribing Habits and Other Methods of Pain Control by Oral and Maxillofacial Surgeons After Impacted Third Molar Removal

Mutlu I, Abubaker AO, Laskin DM
Department of Oral and Maxillofacial Surgery,
Virginia Commonwealth University
Richmond, VA

384 members of AAOMS surveyed
Hydrocodone Rx’d by 233/384 (5 mg) (55 used oxycodone), 20 dosage units common
66% “recommended” NSAIDs
Oxycodone blood level following single oral dose (manufacturer’s data)
Single-dose
Assesses pain levels, not subjective interpretation of pain
Pharmacogenomic variations

- Why “NNT” does not tell the entire story about opioids
Recently Reported NNTs for Opioids

- Oxycodone 5 mg + APAP 325 mg: 5.5 (n=150)
- Oxycodone 5 mg + APAP 500 mg: 2.2 (n=149)
- Oxycodone 10 mg + APAP 1,000 mg: 2.7 (n = 83)
- Oxycodone 5 mg + ibuprofen 400 mg: 2.3
- Codeine 25-60 mg + ibuprofen 400 mg: 2.2
- Morphine 10 mg i.m.: 2.9 (n = 946)
- Codeine 60 mg: 16.7 (n = 1,305)
Focus on removal of diseased tissue (tooth extraction or root canal procedure)

Use drugs as adjuncts to surgical intervention

Use drugs with anti-inflammatory component if possible (NSAID)

Therapy can be very successful with OTC agents

Usual time course of therapy = 2-3 days

Antibiotics are NOT analgesics

USE TWO AGENTS IN COMBINATION
Analgesics/Current Issues

- Role of NSAIDs
- Role of Opioids
- OTC Combinations vs. Rx products
- Heroin abuse
How to use the Top Ten

- Don’t wimp out (on dosage)
- Never substitute a drug for a curative dental procedure
- Antibiotics are NOT for pain of SIP
- WAIT for onset of pulpal anesthesia
- Don’t waste your time repeating blocks
- Evaluate anxiety level BEFORE sedating
- Never underestimate OTC products
- Don’t get cute
The diagram illustrates the relationship between concentration and time for a drug. Key terms and measurements include:

- **Concentration (C<sub>max</sub>)**: The maximum concentration of the drug at a given time.
- **Onset time**: The time at which the drug begins to affect the system.
- **t<sub>max</sub>**: The time at which the concentration reaches its maximum value.
- **Duration of action**: The time period during which the drug is effective.
- **AUC (Area Under the Curve)**: The total area under the concentration-time curve, which is proportional to the total amount of drug administered.
- **Therapeutic Range**: The range of drug concentrations that is considered safe and effective.
- **MTC (Minimum Therapeutic Concentration)** and **MEC (Minimum Effective Concentration)**: Threshold concentrations for the drug to be effective.
Scope of the Problem: The “Perfect Storm” (DEA)

- Pharmaceutical companies producing a wider array of controlled substances
- Use of Medicare/Medicaid or insurance to fund drug habits
- Internet (instant access to information)
You’re on the “front line”...
Value of Street Drugs (DEA)

- OXYCONTIN®: $80/tab
- OXYCODONE IR®: $30-40/tab
- Heroin: $15/bag
- Oxycodone combinations (PERCOCET®): $7-10/tab
- Hydrocodone combinations (VICODIN®): $5-7/tab
“Video surveillance revealed this employee attempting to retrieve narcotics from an intact sharps container by sticking her hand blindly into the container, resulting in her hand being cut and bleeding from contact with needles and glass.”

“A night custodian was discovered rummaging through sharps waste containers holding nearly empty vials of fentanyl. On questioning, the custodian revealed that he had been withdrawing and consolidating miniscule remaining fentanyl from each vial, which he later self-injected.”

Schedule I: no current accepted medical usefulness and a high potential for abuse (heroin, LSD, marihuana)

Schedule II: high potential for abuse but accepted medical usefulness as well (hydrocodone, oxycodone, morphine, amphetamines)

Schedule III: less abuse potential and accepted medical uses (codeine combinations, e.g., Tylenol with Codeine #3)

Schedule IV: lower abuse potential and accepted medical uses (benzodiazepines)

Schedule V: lowest abuse potential, Rx not required in some jurisdictions (antitussives/anticough, antidiarrheal opioids)
New DEA Form 41

Sections:
A) Registrant Information
B) Items Destroyed
   1) Inventory
What’s “drug diversion”?

“What’s “drug diversion”?

“Any criminal act involving a prescription drug.”

(National Association of Drug Diversion Investigators)
Sources of “Diverted” Drugs

- Physicians, dentists, veterinarians
- Parents/relatives
- “Leftovers”
- Travel (Mexico, South America, Caribbean)
- Direct sales on street and in clubs
- Theft (pharmacies, hospitals, offices)
- Friends/acquaintances
- “Stealing from grandma’s medicine cabinet”
What’s a “doctor shopper”?

A person who obtains the same controlled substance from more than one provider in the same time frame.
“Most people wouldn’t think of this, but at a methadone clinic, everybody is either looking to get rid of something, or looking to purchase something, will come around a methadone clinic and will come up to you and say, ‘I’ve got Xanax’.

As a matter of fact, last week I had three people come up to me and tell me they had methadone biscuits and Dilaudid and Xanax.”

“Doctor Shopper” Traits

- Cross state lines
- Pay cash (doctor & pharmacy)
- Very cooperative
- Request specific drugs
- Request small quantities of drugs
Lost or Stolen Opioid Doses, U.S. (2000-2003, DEA data)

- Oxycodone: 4,434,731
- Morphine: 1,026,184
- Methadone: 454,503
- Hydromorphone: 325,921
- Meperidine: 132,950
- 28 million total doses lost/stolen
Pharmacology of Opioids

- Analgesia
- Sedation
- Nausea & vomiting
- Respiratory depression
- CV depression
- Euphoria/dysphoria
- Suppression of cough reflex
- Miosis
- Constipation
Is this an ethical issue?

Do you believe that a Schedule II opioid is the best drug for a given clinical situation?
Why do we prescribe Vicodin?

Moore PA et al.  
*J. Am. Dent. Assoc.* 2016;147(7):528-33
Well, why DO we??

- “Established Prescribing Behaviors”
- “Image of US DEA Controlled Substances”
- “Enhanced Placebo Response”
- “Prescribing for the Most Severe Outcome”
- “Unfounded Expectations of APAP Efficacy”
- “Patient Expectations and Demands”
Randomized clinical trial of hydrocodone acetaminophen versus codeine acetaminophen in the treatment of Acute extremity pain after emergency department discharge

Chang AK et al.

(Tylox vs. Tylenol with Codeine #3)
Severe Myeloneuropathy From Acute High-Dose Nitrous Oxide Abuse

Alt RS et al.

Journa of Emergency of Medicine – 2010, June 3 (Epub ahead of print)
“We recommend an investigation of a history of nitrous oxide abuse where an individual presents with acute numbness characterized by megaloblastic red cells and symmetric neurologic deficits.”
The Drug Diversion Market for AIDS Medications

- Intensify effect of drugs of abuse (pharmacokinetic interaction, especially crystal meth)
- High value on the black market
- Hidden phenomenon
- Drug abusers can exchange AIDS drugs for preferred drug of abuse (high $ value)
“High Value” HIV/AIDS Drugs

- NORVIR® (ritonavir)
- SUSTIVA® (efavirenz)
- COMBIVIR® (lamivudine+zidovudine)
- KALETRA® (lopinavir+ritonavir)
- TRIZIVIR® (abacavir+zidovudine)
“Tricks of the Trade”

- Breaks appointments, needs medication
- Pain “increasing”
- “Motrin is worthless, they sell it everywhere”
- “My prescription was stolen”
- “My dog ate my bottle of pills”
- “I’m going out of town, can you give some refills?”
- “My doctor (physician) always gives me _____ for pain”.
- “I’m already taking ______.”
“They act as CNS stimulants by causing the release of dopamine, norepinephrine & serotonin and blocking their reuptake.”

“Severe toxicity signs of excessive serotonin activity (hyperthermia, metabolic acidosis, and prolonged rhabdomyolysis).”
Potential Diversion of Local Anesthetics From Dental Offices for Use as Cocaine Adulterants

Saraghi M, Hersh EV

Cocaine: The Bottom Line

- Beta blockers
- Muscle Relaxants
- VIAGRA
- Antidepressants
Emerging Concepts in Dental Local Anesthesia

Nasal Administration
Emerging Concepts in Dental Local Anesthesia

Tooth-Dependent & Tooth-Independent Anesthesia
Renaissance in Topical Anesthesia
Does Articaine Provide an Advantage Over Lidocaine in Patients With Symptomatic Irreversible Pulpitis? A Systematic Review and Meta-analysis

Kung J, McDonagh M, Sedgley CM

Journal of Endodontics, Volume 41, Number 11, November 2015, pp. 1784-1794
Maxillary infiltration. . . no significant difference for pulpal anesthesia between articaine and lidocaine.

No difference for mandibular block. . .

No reports of adverse events
Evidence-Based Algorithms for Pulpal Anesthesia of Permanent Teeth*

Anesthetizing the Maxillary Premolars & Molars

1. Buccal infiltration 3.6 ml
   - 2% lidocaine + 1:100K epi

2. IO or PDL injection*
   - 2% lidocaine + 1:100K epi

3. Repeat IO or PDL injection
   - 2% lidocaine + 1:100K epi

*3% mepivacaine plain in medically compromised patients
Anesthetizing the Maxillary Canine & Incisors

1. Labial infiltration (1.8 ml)  
   - 2% lidocaine + 1:100K epi

2. IO (1.8 ml) or PDL (0.2 ml) injection*  
   - 2% lidocaine + 1:100K epi

3. Repeat IO or PDL injection  
   - 2% lidocaine + 1:100K epi

*3% mepivacaine plain in medically compromised patients
Anesthetizing the Mandibular Second Molar

1. IAN (1.8 ml) + long buccal blocks (0.9 ml)
   - 2% lidocaine + 1:100K epi

2. IO (1.8 ml) or PDL injection (0.2 ml)*
   - 2% lidocaine + 1:100K epi

3. Repeat IO or PDL injection
   - 2% lidocaine + 1:100K epi

*3% mepivacaine plain in medically compromised patients
Anesthetizing the Mandibular First Molar

1. IAN (1.8 ml) + long buccal blocks (0.9 ml)
   - 2% lidocaine + 1:100K epi

2. Buccal infiltration (1.7 ml)
   - 4% articaine + 1:100K epi

3. IO (1.8 ml) or PDL injection (0.2 ml)
   - 2% lidocaine + 1:100K epi

*3% mepivacaine plain in medically compromised patients
Anesthetizing the Mandibular Premolars

1. IAN block
   - 2% lidocaine + 1:100K epi (1.8 ml)

2. Buccal infiltration
   - 4% articaine + 1:100K epi (1.7 ml)

3. IO (1.8 ml) or PDL injection (0.2 ml)
   - 2% lidocaine + 1:100K epi*

*3% mepivacaine plain in medically compromised patients
Anesthetizing the Mandibular Canine & Incisors

1. IAN block
   - 2% lidocaine + 1:100K epi (1.8 ml)

2. Labial infiltration
   - 4% articaine + 1:100K epi (1.7 ml)

3. Lingual infiltration
   - 4% articaine + 1:100K epi* (1.7 ml)

*3% mepivacaine plain in medically compromised patients
- Repeat IANB (only if lower lip NOT numb) (note initial success rate of 25% pulpal anesthesia even when lip numbness is achieved)
- Intraosseous or PDL injection (48-68% success rate)
- Infiltration with 4% articaine (1.7 ml) (72% success rate)
- Apply the Bubba Rule
### Approximate Onset of Pulpal Anesthesia Following Inferior Alveolar Nerve Block*

<table>
<thead>
<tr>
<th>Tooth Pulp</th>
<th>Onset Time</th>
<th>Cases with slow onset (&gt;30 mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second molar</td>
<td>5.2 min</td>
<td>12%</td>
</tr>
<tr>
<td>First molar</td>
<td>9.2 min</td>
<td>14%</td>
</tr>
<tr>
<td>Second premolar</td>
<td>9.5 min</td>
<td>19%</td>
</tr>
<tr>
<td>First premolar</td>
<td>9.9 min</td>
<td>20%</td>
</tr>
<tr>
<td>Canine</td>
<td>13.6 min</td>
<td>20%</td>
</tr>
<tr>
<td>Lateral incisor</td>
<td>13.8 min</td>
<td>20%</td>
</tr>
<tr>
<td>Central incisor</td>
<td>19.2</td>
<td>16%</td>
</tr>
</tbody>
</table>

*modified from Reader et al., *Successful Local Anesthesia*, 2011
<table>
<thead>
<tr>
<th>DRUG</th>
<th>2012 (MRD) (+ABSOLUTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articaine</td>
<td>7 mg/kg (no MRD for absolute)</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>2 mg/kg (90 mg absolute)</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>7 mg/kg (500 mg absolute)</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>6.6 mg/kg (400 mg absolute)</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>8 mg/kg (600 mg absolute)</td>
</tr>
</tbody>
</table>
++ (adult surgery)
+++ (ASA II, III)
--- (levonordefrin?)
++++ (max. infilt., IANB = articaine)
++++ (mandibular infiltration, all teeth)
Efficacy of Articaine vs. Lidocaine in Block and Infiltration Anesthesia in Teeth with Irreversible Pulpitis: A Prospective, Randomized, Double-Blind Study

Ashraf H et al.

JOE – Volume 39, Number 1, January 2013
Anesthetic Comparisons of 4% Concentrations of Articaine, Lidocaine and Prilocaine as Primary Buccal Infiltrations of the Mandibular First Molar

Nydegger, B. et al.
*J. Endod.* 2014;40:1912-16
60 Adult subjects, healthy mandibular \(1^{\text{st}}\) molars
- Double-blind, crossover design
- Success assessed using EPT
- 1.8 ml anesthetic
- 4% articaine with 1:100,000 epi
- 4% lidocaine with 1:100,000 epi
- 4% prilocaine with 1:200,000 epi
- \(55\% \gg 33\% = 32\%\)
Recent News From the Big Ten

• 100 Subjects
• Irreversible pulpitis, mandibular molars
• IANB 4% articaine + buccal infiltration with articaine or lido
• IANB = 26%
• BI = 62% vs. 37% (p<.05)

Rogers, B. et al.
University of Michigan
J. Endod. 2013
Efficacy of Articaine versus Lidocaine In Supplemental Infiltration For Mandibular First versus Second Molars with Irreversible Pulpitis

Shapiro M. et al.

Journal of Endodontics; SUBMITTED/IN PRESS
METHODS

- Randomized, double-blind
- 100 patients with SIP (1\textsuperscript{st} & 2\textsuperscript{nd} molars)
- Failed IANB (articaine)
- Buccal infiltration 2\% lidocaine or 4\% articaine with 1:100K epi

FINDINGS

- Success rate articaine group = 61\% 1\textsuperscript{st} molar, 63\% second
- Success rate lidocaine group = 78\% 1\textsuperscript{st} molar, 40\% 2\textsuperscript{nd} molar (p<.005)
- Articaine “tooth-independent”, lidocaine “tooth-dependent

Shapior et al., J. Endod. In press
Lidocaine = Articaine
Buccal Infiltration

Articaine > Lidocaine
Buccal Infiltration
Gadgets, Gizmos & Other Tricks
Is a Volume of 3.6 mL Better than 1.8 mL for Inferior Alveolar Blocks in Patients with Symptomatic Irreversible Pulpitis?

Fowler S, Reader A, Beck M

Journal of Endodontics 2013; Volume 39, Number 8, pp. 970-72
Does the Combination of 3% Mepivacaine and 2% Lidocaine Improve Anesthesia And Reduce the Pain of Inferior Alveolar Block?

Lammers E et al.

Incidence of Missed Inferior Alveolar Nerve Blocks in Vital Asymptomatic Subjects and in Patients With Symptomatic Irreversible Pulpitis

Fowler S, Reader A, Beck M

Journal of Endodontics – Volume 41, Number 5, 2015, pp. 637-9
<table>
<thead>
<tr>
<th>Needle Gauge</th>
<th>Inferior Alveolar Block</th>
<th>Infiltration (Maxillary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>67%</td>
<td>19%</td>
</tr>
<tr>
<td>27</td>
<td>32%</td>
<td>60%</td>
</tr>
<tr>
<td>30</td>
<td>0%</td>
<td>21%</td>
</tr>
</tbody>
</table>
Lack of Pain Reduction by a Vibrating Local Anesthetic Attachment: A Pilot Study

Saijo M, Ichinohe T, Kaneko Y.

Anesthesia Progress
2005;52:620-64
The Effect of Vibration on Pain During Local Anesthetic Injections

Nanitsos E, Vartuli R, Forte A, Dennison PJ, Peck CC.

*Australian Dental Journal*

2009;54:94-100
Methods & Results, Nanitsos et al.

**METHODS**
- 62 adult subjects
- VAS pain scale
- Received IANB & maxillary infiltrations
- Control was pressure from device w/o vibration

**RESULTS**
- VAS = 22.2 mm w/o vibration (across all injections) (range 0-83)
- VAS = 12.9 mm with vibration (range = 0-67)
Randomized Clinical Trial

A Comparison of the Anterior Middle Superior Nerve Block and Infraorbital Nerve Block for Anesthesia of Maxillary Anterior Teeth

Corbett IT, Jaber AA, Whitworth JM, Meechan JG

Journal of the American Dental Association
Volume 141, Number 12, 2010, pp. 1442-8
Effect of Sodium Bicarbonate-Buffered Lidocaine on the Success of Inferior Alveolar Nerve Block for Teeth with Symptomatic, Irreversible Pulpitis: A Prospective, Randomized, Double-Blind Study

Saatchi M. et al.

METHODS

- Randomized, double-blind
- 80 patients with SIP (posterior teeth only)
- 2 carts 2% lidocaine with 1:80K epi or
- 2 carts 2% lidocaine with 1:100K epi BUFFERED (8.4% HCO₃⁻)
- Success rate buffered group = 63%
- Success rate non-buffered group = 48% (n.s.)
- No difference in VAS pain scores between groups (endo access)

Saatchi et al., J. Endod. 2015
Effect of Buffered 4% Lidocaine on the Success of the Inferior Alveolar Nerve Block in Patients With Symptomatic Irreversible Pulpitis

Schellenberg J, Drum M, Reader A, Nusstein J, Fowler S, Beck M

Journal of Endodontics
Volume 41, Number 6, 2015, pp. 791-6
- Randomized, double-blind
- 100 patients with SIP
- 2.8 ml 4% lidocaine with 1:100K epi or
- 2.8 ml 4% lidocaine with 1:100K epi BUFFERED (8.4% HCO₃)

- Success rate buffered group = 32%
- Success rate non-buffered group = 40% (n.s.)
- No difference in pain of injection between groups
Effect of Sodium Bicarbonate-Buffered Lidocaine on the Success of Inferior Alveolar Nerve Block in Mandibular Molars with Symptomatic, Irreversible Pulpitis: A Prospective, Randomized, Double-Blind Study

Saatchi M. et al.

Journal of Endodontics 2016; 42:1458-1461 August
Saatchi et al., J. Endod. 2016

- Randomized, double-blind
- 100 patients with SIP lower 1st molars
- BI with 2% lido/1:80K epi or BI with 2% (1 ml) lidocaine + 8.4 NaHCO3
- Conventional IANB, 3.6 ml 2% lido/1:80K epi
- VAS pain/endo access

- Success rate BI buffer group = 78%
- Success rate non-buffered BI group = 44% (p<.001)
- Buccal infiltration of buffer increases success rate of IANB in “hot” molars
**Simultaneous Buffering:** The buffer is added to the local anesthetic solution prior to injection and both buffer and anesthetic delivered at the same time *(co-localized)*

**Sequential Buffering:** The buffer is administered buccally *prior* to administration of a block injection with a standard local anesthetic solution
Effect of Premedication to Provide Analgesia as a Supplement to Inferior Alveolar Nerve Block for Teeth with Irreversible Pulpitis

Lapidus D. et al.

JADA 2016;147(6):427-435
- Systematic review
- 9 included RCTs
- Oral premedications compared to placebo, \( \frac{1}{2} \text{-} 1 \) hr before procedure
- All studies used 2\% lidocaine
- Included NSAIDs, BZs and corticosteroids

- RR NSAIDs = 1.989
- RR BZs \( \sim 1 \) (2 studies)
- Best evidence for 600 mg ibuprofen

Lapidus et al., JADA 2016
Topical Anesthetics

Benzocaine
[ Benzoic acid, 4-amino-, ethyl ester ]
Lidocaine Contact Allergy Is Becoming More Prevalent

To D., Kossintseva I, de Gannes G. 


“The prevalence of allergic contact dermatitis to local anesthetics is significant at 2.4%. The most common allergen is benzocaine (45%), followed by lidocaine (42%) and dibucaine (23%).
An Evaluation of 10% and 20% Benzocaine Gels In Patients With Acute Toothaches

Hersh EV et al.
University of Pennsylvania (primary center)
5 study centers
576 subjects (276 males, 300 female)
All subjects had “toothache” (VAS score >49 mm), permanent tooth, “cavity”
Primary outcome measure was improvement by one unit (pain scale 0-3)
Measured for 2 assessments over 20 min

Average age = 31 yrs
Vehicle = 70.4% pain relief
10% benzocaine = 80.7% pain relief
20% benzocaine = 87.3% relief
Safety and Efficacy of a Novel Nasal Spray for Maxillary Dental Anesthesia

Ciancio SG et al.

Journal of Dental Research – Volume 92, Suppl. Number 1, 2013, pp. 43S-48S
Tetracaine 3% + oxymetazoline 0.05% (KOVANAZE®)
Safety and Efficacy of a Novel Nasal Spray for Maxillary Dental Anesthesia

Ciancio SG et al.

Journal of Dental Research – Volume 92, Suppl. Number 1, 2013, pp. 43S-48S
Kovanaze® Clinical Trials

SUBJECTS

- Randomized, double-blind
- 110 adults (both sexes)
- Normal facial sensation
- Unobstructed nares on the treatment side
- Excluded HBP, thyroid disease, nose bleeds, allergies, MAOIs, nursing/pregnant
- Need single restorative procedure #4-13 (resins)

ASSESSMENTS

- 2 “sprays” + 1 (if anesthesia insufficient)
- Placebo controlled (saline inhalation)
- Success if procedure completed w/o need for injection (with 2 sprays)
Comparison of 3 Intranasal Mists for Anesthetizing Maxillary Teeth in Adults

Ciancio SG et al.

JADA 2016, May, 147(5):339-347
110 subjects, randomized to 3 groups
- 44 received K305 (Kovacaine)
- 44 received tetracaine-only spray
- 22 received placebo

Performed routine restorative procedures, premolar to premolar

- K305 success = 84%
- Tetracaine success = 27%
- Placebo success = 27%
- Anteriors > premolars
- K305 = significant but brief increased BP
- Most frequent adverse effects: runny nose, nasal congestion (~2 hrs)
Weaknesses: Kovanaze® Trial

- Did not use EPT/cold as measure of pulpal anesthesia
- Relatively small number of subjects
- Did not test in molar teeth
- Utilized primarily resin restorations
Answers to “Why inject?”

- Shelf-life
- No need to refrigerate
- Co$t
- Onset (<14 mins)
- Ability to use in children <40 kg (88 lbs)
- Number of administrations (1 cartridge)
- Procedure > 11 mins
## Current Maximum Dosages

<table>
<thead>
<tr>
<th>AGENT</th>
<th>DOSAGE MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articaine</td>
<td>7 mg/kg (no MRD for absolute) (use 500)</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>2 mg/kg (90 mg)</td>
</tr>
<tr>
<td>Lidocaine with epi</td>
<td>7 mg/kg (500 mg)</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>6.6 mg/kg (400 mg)</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>8 mg/kg (600 mg)</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>16 mg (3 sprays)</td>
</tr>
</tbody>
</table>
Articaine: 7 mg/kg, 500 mg absolute
Lidocaine: 4.4 mg/kg, 300 mg absolute
Mepivacaine: 4.4 mg/kg, 300 mg absolute
Prilocaine: 6 mg/kg, 400 mg absolute
Bupivacaine: 1.3 mg/kg, 90 mg absolute
1. Selection of agents should be based upon:
   a. patient’s medical history and mental/developmental status
   b. anticipated duration of the procedure
   c. need for hemorrhage control
   d. administration of other agents (sedatives)
   e. Practitioner’s knowledge of the agent
2. **Use of vasoconstrictors is recommended to decrease risk of toxicity, especially when treatment extends to 2 or more quadrants**

3. In cases of bisulfite allergy, an anesthetic without vasoconstrictor is recommended and can be used for shorter treatment needs

4. The established maximum dosage for any anesthetic should not be exceeded
1. Practitioner should possess appropriate training and skills & have proper facilities, personnel & equipment to manage emergencies
2. Ensure proper needle placement & aspiration, slow injection
3. Remain with patient after injection
4. Minimize residual soft-tissue anesthesia
5. Recommend behavioral precautions regarding self-inflicted, soft-tissue trauma, even if phentolamine mesylate used as reversal agent (Oraverse®)
Alternative techniques for the delivery of local anesthesia may be considered to minimize dose, improve patient comfort and/or improve successful dental anesthesia

Mandibular buccal infiltration AS EFFECTIVE as IAB for “some operative procedures”

Intraosseous techniques contraindicated for primary teeth and/or infection/inflammation at injection site
The Medication “Triage”

- What are the possible conditions for which the drug(s) is/are being prescribed?
- Is the patient complying with the medication regimen(s)?
- What is the ASA classification of the patient?
- What are the systemic adverse effects of the drug(s)?
- What are the oral adverse effects of the drug(s)?
- What are the potential adverse interactions between the medical and dental drugs and how do I avoid them?
What about drug interactions?
Most Beneficial Drug Interactions in Dentistry

- Local anesthetics/epinephrine
- NSAIDS (APAP)/Opioid analgesics
- Benzodiazepine/nitrous oxide
- Penicillins/metronidazole
- Local anesthetics/corticosteroids
- Phentolamine/epinephrine (ORAVERSE)
- Local anesthetics/nitrous oxide
Most Potentially Harmful Drug Interactions in Dentistry

- Local anesthetics/sedatives
- Opioid analgesics/sedatives
- Alcohol/sedatives
- Cocaine (amphetamine, meth)/epinephrine
- Anti-arrhythmic drugs/epinephrine
Dental Drug Exposure Times

- **Topical**: minutes
- **Injectable local**: hours
- **Oral analgesics**: days
- **Antibiotics**: weeks
The Medication “Triage”

- What are the possible conditions for which the drug(s) is/are being prescribed?
- Is the patient complying with the medication regimen(s)?
- What is the ASA classification of the patient?
- What are the systemic adverse effects of the drug(s)?
- What are the oral adverse effects of the drug(s)?
- What are the potential adverse interactions between the medical and dental drugs and how do I avoid them?
The “Bottom Line” for the Dental Team

- Drug Interactions of Concern
- Dental Considerations (vital signs, chair positioning, emergency prevention)
- Consultations
- “Teach Patient/Family to:”
Serotonin Syndrome

- Agitation
- Muscle hyperactivity
- Hyperthermia
- Potentially fatal
Potential need for additional sedation
Avoid CNS depressant interactions
Assess salivary flow as a factor in caries, periodontal disease and candidiasis
Consider other interactions (e.g., macrolide antibiotics)
Recommended Internet Sites

- ADA Center for Evidence-Based Dentistry
- drugs.com
- fda.gov
- University of Washington
- Cochrane Library (systematic reviews)
- Global RPh (dosage calculations)
- AAOMS
- AAOS
- AAE
- AAPD