You Have A Lot of Nerve:
Demystifying Local Anesthesia Lecture and Workshop
Arthur DiMarco, DMD
Kathy Bassett, RDH

Friday, June 17, 2016
8:00 a.m. – 11:00 a.m. (Lecture)
1:00 p.m. – 4:00 p.m. (Workshop)

Official Disclaimer
Neither the content of a program nor the use of the specific products in courses should be construed as indication endorsement or approval by the Pacific Northwest Dental Conference or Washington State Dental Association
YOU’VE GOT A LOT OF NERVE: 
DEMYSTIFYING LOCAL ANESTHESIA 
PNDC 2016

Art DiMarco DMD
Kathy Bassett BSDH, RDH, MEd

Disclaimer:
Some content in this presentation is included to demonstrate variations in technique and 
its inclusion does not necessarily advocate its use.

LET’S TALK ABOUT

Anatomy Factors
Significance of Anatomy
Mandibular Foramen
Bone Density
Retromandibular region
Body of Mandible
Maxillary Plexus

Injections & Devices
Technique Variations
High Block vs Gow-Gates
Retromandibular injections
(Inferior alveolar, Lingual, Mylohyoid)
Short Needle IANB
PDL IANB
CCLAD vs Manual Devices
MANDIBULAR BLOCK TECHNIQUE VARIATIONS:

- Location of Mandibular Foramen
- Penetration site standard Halsted block – criteria?
- Actual location of mandibular foramen\(^1\)
  - \(\approx 86\%\) of the time > 10 mm above occlusal table
  - \(\approx 94\%\) of the time > 15 mm above occlusal table
- Depositing solution higher is more likely to place it above the foramen (Dr. GG referenced the lingula)
- Indirect Blocks
  - Retromandibular injections
  - Short Needle IANB
  - PDL IANB
  - The indirect IANB is a variation of the direct technique [Halstead] and will be discussed here as a version of the Short Needle IA.
- The depth of penetration [distance] from the oral mucosa at the pterygotemporal depression [depth of pterygomandibular sulcus], at the narrowest anteroposterior width of the ramus [depth of coronoid notch], to the inferior alveolar nerve [at mandibular foramen] was routinely 12 - 19 mm with a mean of 16 mm.
  - Short needles (or shallow penetrations) at this location may actually place solution closer to IA nerve trunks
  - “It was easier to estimate the depth of penetration with a short needle than with a long needle. A short needle also was less likely to go too deep and deviate from its course than was a long needle.”\(^2,3\)
- Retromandibular Zone
  - Nerves with possible innervation through the retromolar bone: *inferior alveolar, lingual, mylohyoid, buccal*
  - Retromolar foramen
  - Retromolar canal
  - Retromolar innervation supports retromolar infiltration
- 3 Rooted Molars
  - High instance of mylohyoid intervention
  - High instance in Alaskan native populations
- PDL Inferior Alveolar Block
  - Up to four aspects of mandibular 2\(^{nd}\) molar (MB, DB, ML, DL)
  - 1 stopper (0.2 ml) per site
• Maxillary Plexus Factors
  o Success of AMSA Injections
• High Block vs Gow-Gates
• A Picture Is Worth A Thousand Words (YouTube)
  o Gow-Gates
  o AMSA
• Individual Ergonomics
  o CCLADs
    ▪ Computer-Controlled Local Anesthesia Delivery
    ▪ The Wand® Computer-Assisted Anesthesia System
    ▪ Wand™ handpiece
    ▪ Dynamic Pressure Sensing Technology
  o Benefits
    ▪ Injection comfort (patients & clinicians)
    ▪ Accurate and reliable aspiration
    ▪ Controlled injection fluid dynamics
    ▪ Controlled flow rates
    ▪ Decreased inflammatory response
    ▪ Ergonomic advantage
  o Impact of Fluid Dynamics
    ▪ Drip vs Burst Flow Rates
    ▪ Injection Hydraulics
      • 25 and 27 gauge needles are associated with lower fluid pressures at needle tips when compared to 30 gauge needles
      • Smaller gauge needles (25ga, 27ga) are associated with reduced post injection pain and edema, which appears to contradict beliefs that 30 gauge needles are less traumatic
  o Flow Rates & Fluid Pressures
<table>
<thead>
<tr>
<th>Reference 7</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density Compliance</strong></td>
<td>low-density tissues high tissue compliance most adaptive</td>
<td>moderate-density tissues moderate tissue compliance less adaptive</td>
<td>high-density tissues very low tissue compliance minimal adaptive capacity</td>
</tr>
<tr>
<td><strong>Tissue Examples</strong></td>
<td>buccal mucosa, retro-molar fossae</td>
<td>attached gingiva palatal tissues</td>
<td>periodontal ligaments</td>
</tr>
<tr>
<td><strong>Flow Rates</strong></td>
<td>&gt; 0.005 cc/sec</td>
<td>~ 0.005 mL/sec slower rates than Ty 1</td>
<td>0.005 mL/sec requires a fixed slow rate</td>
</tr>
<tr>
<td><strong>Pressures</strong></td>
<td>9 psi to 12 psi</td>
<td>50 psi to 75 psi</td>
<td>225 psi to 350 psi</td>
</tr>
</tbody>
</table>

- **Ergonomics**<sup>8,9,10</sup>
  - Work Related Musculoskeletal Disorders
  - Cumulative Trauma Disorders
  - Aspiration Pressures<sup>11</sup>
- **CCLAD vs Manual Devices**
  - Aspiration, grasp

- **Individual Ergonomics**
  - Basic elements for good ergonomics
    - Do not twist truck
    - Bend from hips
    - Keep wrists at a neutral angle
    - Do not raise arms > 30 degrees
    - Do not extend the neck > 30 degrees forward
  - Non-dominant hand injections, opposite side approach

- **Relaxation Breathing**
  - During conventional mouth sympathetic nervous system activity increases, while parasympathetic system activity decreases
  - During nasal breathing sympathetic nervous system activity goes up ~50%, while calming parasympathetic system increases by 50%!
  - When mouth breathing, brain waves rev up into a very fast and stressed state of beta activity
Anatomy

- While nose breathing, brain waves became calm and coherent; the brain goes into an alpha state, which is seen in deep relaxation states like meditation

Techniques

- Buteyko Breathing
  - Operatory Set-up & Habits

People

- The House Factor

Pharmacology

- Articaine
  
  Stenver DI, Case number: 3200-1367, Adverse effects from anaesthetics used in relation with dental care with a special focus on anaesthetics containing articaine. Pharmacovigilance Working Party of the European Union. 20 October, 2006

Buffering

- pH of local anesthetics; impact of multiple cartridges on pH
- The base form (RN) of a drug moves through the nerve membrane.
- Principles of Buffering
  - Acid hurts (burning & stinging); decreased acidity may result in increased comfort
  - Increase in pH of one point represents an exponential decrease in hydrogen ions (acid)
  - A higher pH promotes neutral base molecules; more base molecules can lead to a faster onset
  - Lidocaine HCL is non-lipid soluble (99% RNH+) at 3.5 pH, 0.004% in lipid soluble form (RN)
  - Buffers pH closer to 7.35 – 7.45
  - Sodium bicarbonate interacts with hydrochloric acid to form CO₂, potentiates the action of lidocaine HCL, and yields an immediate, independent depressive effect on the nerve
  - Buffering elevates extracellular pH

Potential use of buffering

- THEORY - Alcohol and Alcoholics: Patients under the influence of large amounts of alcohol (as well as recovering alcoholics) can be quite difficult to anesthetize. High alcohol intake produces a state of metabolic acidosis (due to lactic acidosis, ketoacidosis and acetic acidosis). An acidic environment at the site of the injection reduces the ability of the anesthetic to cross the cell membrane limiting its effects.
**Buffering Systems**
- Orapharma’s Onset™ - single cartridge system
- Anutra™ - multi-dose system, disposable syringe

**Dosages:**
- **FDA Approved Adult MRDs**
  - MRDs are weight based for all patients
  - Standardizes adult dosages nationwide

<table>
<thead>
<tr>
<th>Drug*</th>
<th>mg/lb</th>
<th>MRD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articaine 4%</td>
<td>3.2**</td>
<td>(none provided) **</td>
</tr>
<tr>
<td>Bupivacaine 0.5%</td>
<td>0.9***</td>
<td>90 mg</td>
</tr>
<tr>
<td>Lidocaine 2%</td>
<td>3.2</td>
<td>500 mg</td>
</tr>
<tr>
<td>Mepivacaine 2%</td>
<td>3.0</td>
<td>400 mg</td>
</tr>
<tr>
<td>Prilocaine 4%</td>
<td>4.0</td>
<td>600 mg</td>
</tr>
</tbody>
</table>

*Note: "per appt." values represent dosages for healthy adults. Values may need to be adjusted for children, elderly, and medically compromised individuals.

** no absolute maximum dose of articaine provided (some manufacturers recommend 500mg maximum when questioned)
*** No U.S. recommendations are available

Source: FDA 2013; ADA/PDR 5e; 2009; Malamed, 6e, 2013; Local Anesthesia for Dental Professionals 2e, 2015.

- **Pediatric Dosages**
  - The American Academy of Pediatric Dentists, 2009 Guideline on Use of Local Anesthesia for Pediatric Dental Patients maintains the previous lower values.

- **Pediatric Obesity**
  - Body Mass Index Calculator

<table>
<thead>
<tr>
<th>BMI Classification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18.5 or less</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5 to 24.99</td>
<td>Normal Weight</td>
</tr>
<tr>
<td>25 to 29.99</td>
<td>Overweight</td>
</tr>
<tr>
<td>30 to 34.99</td>
<td>Obesity (Class 1)</td>
</tr>
<tr>
<td>35 to 39.99</td>
<td>Obesity (Class 2)</td>
</tr>
<tr>
<td>40 or greater</td>
<td>Morbid Obesity</td>
</tr>
</tbody>
</table>
### Anatomy

<table>
<thead>
<tr>
<th>Pediatric Drug Dosages *</th>
<th>mg/lb</th>
<th>MRD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articaine 4%</td>
<td>3.2</td>
<td>500 mg</td>
</tr>
<tr>
<td>Bupivacaine 0.5%</td>
<td>0.6</td>
<td>90 mg</td>
</tr>
<tr>
<td>Lidocaine 2%</td>
<td>2.0</td>
<td>300 mg</td>
</tr>
<tr>
<td>Mepivacaine 2%</td>
<td>2.0</td>
<td>300 mg</td>
</tr>
<tr>
<td>Prilocaine 4%</td>
<td>2.7</td>
<td>400 mg</td>
</tr>
</tbody>
</table>

*Note: "per appt." values represent dosages for healthy children. Values may need to be adjusted for children, elderly, and medically compromised individuals. Source: AAPR, 2009; ADA/PDR 5e; 2009; Malamed, 6e, 2013; Bassett, DiMarco, Naughton, Local Anesthesia for Dental Professionals 2e, 2015.

### Non-Pharmacological

- **Topical** - Gebauer’s Pain Ease™
- **Gate Control**
  "Gate control" is pain relief by causing sensations other than pain, and then sending them down the same pathway. Using the body’s own nervous system, cold, vibration, and other non-painful impulses are generated to block or “gate” pathways of sharp pain to the brain. Stimulating C [cold] and A-beta [vibration] fibers prior to needle penetration can decrease pain.
  - DentalVibe®
  - Buzzy®
  - DistrACTION® Cards
- **Cognitive Distraction**
  Neurocognitive models of pain demonstrate that young children benefit more from interactive than passive distraction.
  - Actions vs Words
  - Interactive vs passive – an intentional effort aimed at interrupting and capturing attention

---

COPYRIGHT – DIMARCO / BASSETT - 2016
<table>
<thead>
<tr>
<th>Anatomy</th>
<th>Techniques</th>
<th>People</th>
<th>Pharmacology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Age appropriate – child must be competent enough at the skill to sustain attention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Non-Injectable Local Anesthesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intranasal: Kovanaze™ Nasal Mist Topical Anesthetic (3% Tetracaine = an ester local anesthetic, with 0.05% oxymetazoline = a vasoconstrictor found in many OTC products) + mucoadhesives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Tetracaine: a potent local anesthetic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o <strong>At MRD:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Headache in 1/4th</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Nasal stuffiness in 1/3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Runny nose in 1/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Major metabolite:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o = parabutylaminobenzoic acid (inactive)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Maximum blood concentration reached in ~53 minutes @ MRD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Oraqix™ Periodontal Gel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Contains poliaximers which set up at body temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Formulated for use in the pocket</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Cetacaine® Topical Anesthetic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Both Oraqix® (prilocaine) and Cetacaine® (benzocaine) pose a risk for methemoglobinemia</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


WEB LINKS

1. Dr. Murph: Inferior Alveolar Nerve Block Technique (Short Needle IA) YouTube: https://www.youtube.com/watch?v=7owclxgckb4