Program Overview: Updates and Potential Benefits

- **Pharmacology**
  Septociane (4% articaine), 1:400,000 epi; 1.0 ml cartridge (Septodont)
  Prilocaine safety considerations
  Orabloc™ (4% articaine), 1:100,000 epi. (Pierrel Research USA Inc.)
  Onset™ (OnPharma)
  OraVerse™ (Septodont)

- **Techniques**
  Selected Injection Review – Case studies

- **Armamentarium**
  Wand STA™ system (Milestone)
  DentaVibe™, Vibraject (BING Innovations)

- **Upcoming Developments**
  KOVACAINE MIST™ (St. Renatus)
  LeEject® (Advanced Technology & Capital)
  Gebauer’s Pain Ease™ (Gebauer)
  Septociane (4% articaine), 1:400,000 epi. (Septodont)

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**Case Study (1) - Articaine and Sulfite, Sulfur, Sulfonamide Conundrum**

**History:** A 54-year-old female reports a previous allergic response to *sulfite antioxidants* in a restaurant salad. No other issues of concern to the patient are reported. **Health History:** Unremarkable.

**Are modifications to treatment indicated? What would you do?**
Select the most appropriate answer(s):

- No modifications necessary
- May use any drug except articaine
- Use only 3% mepivacaine or 4% prilocaine plain
- Use only 2% mepivacaine, 1:20,000 levonordefrin

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**Case Study (2) – Sulfur Allergy**

**History:** A patient reports an allergic response to onions and discovered it was from the natural sulfur content. **Health History:** Unremarkable.

**Examples of Foods High In Sulfur** (thiols):
• artichokes, Jerusalem but not French
• asparagus
• bakery products containing whey, cysteine, eggs or enzymes
• bean curd/ tofu milk
• bean sprouts
• beans of all sorts
• bok choy
• broccoli
• brussels sprouts
• cabbage
• carob
• cauliflower
• cheese of all sorts
• chives
• chocolate
• coffee
• collard greens
• cream
• daikon
• dairy products
• eggs
• garlic
• green beans
• greens
• horseradish
• jicama

• kale
• leeks
• lentils of all sorts
• milk from any animal
• miso soup
• onions
• papaya (slightly)
• peas
• peanuts
• pineapple (slightly)
• radishes
• rutabaga
• sauerkraut
• shallots
• sour cream
• soy cheese
• soy milk
• spinach
• split peas
• tempeh
• tofu
• turnip
• turmeric (though not high in thiols, it is really good at raising thiol levels)
• whey
• yeast extract

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**Case Study (3) - “Sulfa” Allergy”**

**History:** A patient is taking sulfa drugs for a urinary tract infection. No other issues of concern to the patient are reported. **Health History:** Unremarkable.

**Facts:**

- Sulfa drugs = sulfonamide antibacterials
- Articaine - No interference with sulfonamide antibacterial action
- Articaine - No cross-allergenicity with sulfonamides

**Are modifications to treatment indicated? What would you do?**

**Examples of LA drugs that can interfere with the antibacterial action of the sulfonamides:**

- Benzocaine
- Tetracaine
- Butamben (butyl aminobenzoate)
- Procaine

**Facts:**

1. 
2.
• Ester linkage local anesthetics are known as paba-derivatives
• Metabolites of drugs that are paba-derivatives "may antagonize sulfonamide antibacterials, especially if significant quantities have been absorbed over prolonged periods.

Articaine Update

Articaine does have a sulfur atom, but . . .

• The sulfur is firmly bound within the thiopene ring and cannot be antigenic
• Even during its biotransformation and elimination, the sulfur does not dissociate

In Terms Of CNS Toxicity and Overall Efficacy . . .

• Articaine is safer than lidocaine
• Articaine is as effective, or more effective, and more durable, depending on technique
• Articaine is more potent and has a 50% greater protein binding capability than lidocaine

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Articaine & Paresthesia

• Avoid IA blocks, or do we? 4
• Avoid more than ½ cartridge in the palate, or do we? 4
• High blocks likely OK – no increased incidence evidence 5
• Mostly: deposit slowly - limit volumes per injection
• Use decreased volumes (same mg as lidocaine, articaine is 4%)
• Deposit slowly (½ c cartridge per minute for 4% drugs)
• Avoid IA blocks & more than ½ cartridge in the palate
Articaine in Buccal Infiltrations of the Mandible

Comparison of articaine & lidocaine in buccal infiltrations for posterior mandibular anesthesia.6

- 2% lidocaine, 1:100,000 epinephrine 45% – 67%
- 4% articaine, 1:100,000 epinephrine 75% - 92%

Use of 4% articaine, 1:400,000 epinephrine

Do dilutions of 1:400,000 epinephrine effectively slow the systemic absorption of articaine?

Is it as effective as or effective enough?

- 4% articaine, 1:100,000 epinephrine
- 4% articaine, 1:200,000 epinephrine
- 2% lidocaine, 1:100,000 epinephrine

So . . . does plain articaine work?7

- 88 patients in need of single tooth mandibular extractions received IA blocks with 4% articaine with 1:100,000 epinephrine (n = 41) or without epinephrine (n = 47)
- Compared the differences in onset as well as length of soft tissue anesthesia. Also compared the amount of solution needed, the need for a second injection, pain while injecting, pain during treatment, postoperative pain, and complications.

Study Results:

- Sufficient anesthesia occurred for all extractions in both groups.
- Those receiving 4% articaine with 1:100,000 epinephrine, had a significantly faster onset (7.2 min vs. 9.2 min) and a longer duration of soft tissue anesthesia (3.8 h vs. 2.5 h).

According to the study results . . . there was no difference:

- In the amount of solution needed
- In the need for a second injection
- In the pain of injection
- In the experience of pain during the procedure
- In post-operative analgesia
- In the type or rate of complications
But ... 4% articaine plain or with 1:400,000 epinephrine is not available for us yet ... so, what else that we do have might work?

- 3% mepivacaine to anesthetize the nerve
- Then add, very slowly, a very small volume of a drug with 1:200,000 epinephrine – keep it minimal
- The patient must let you know immediately if they feel any palpitations during the deposition.
- The area will be numb from the mepivacaine, decreasing the chance for anxiety (& endogenous epinephrine spikes) due to painful stimuli

**Levonordefrin versus Epinephrine**

“Clinically, the higher concentration of levonordefrin makes it equipotent to epinephrine in clinical and systemic effects, so 1:20,000 levonordefrin offers no clinical advantage over 1:100,000 epinephrine.”

**When can levonordefrin be of benefit?**

1. 2% mepivacaine, 1:20,000 levonordefrin is a substitute for 2% lidocaine, 1:100,000 epinephrine
2. When patients have palpitations after even minimal amounts of epinephrine are administered, levonordefrin may not cause the same reaction
3. Whenever epinephrine is contraindicated due to other drugs a patient is taking

**Case Study (4) - Local Anesthetics & Nursing**

**History:** A patient is a nursing mother who is concerned about exposing her baby to anesthetic drugs. She has read that it is not known whether or not local anesthetics pass into breast milk but she wants to avoid it. No other issues of concern to the patient are reported. **Health History:** Unremarkable

**Facts:** Most drugs are available in breast milk once introduced but little harm is predicted. Product information generally states that caution must be exercised when nursing following administration of local anesthetics.

**Use of Articaine in nursing women:**

- Very short half-life
- The metabolic products are inactive.
- Articaine is a good choice for reassurance.
- Can nurse 4 hours after administration.
Septodont uses figures in their product information that are based on maximum dosing and states that:

“Nursing mothers may choose to pump and discard breast milk for approximately 4 hours (based on plasma half-life) following an injection of Septocaine® (to minimize infant ingestion) and then resume breastfeeding.”

New Articaine Formulation - Orabloc™

- Not end-sterilized which can decrease the potency of the cartridge contents
- Increases shelf life from 18 to 24 months
- Made in Italy; Health Canada- and USFDA-approved

Buffering - Onset™

Facts:
- An increase of one point (pH) represents an exponential decrease in hydrogen ions.
- A higher pH promotes the formation of neutral base molecules. More neutral base increases the effectiveness & decreases the onset.
- Currently approved with lidocaine only
- The more acidic, potentially the more painful

FDA-approved - Caveat: Newer solutions (with vasoconstrictors) are less acidic than older solutions yet the recommended volume of buffering relates to the drug only, not the age of the cartridge.

Buffering: Does faster onset of anesthesia (i.e., early labial and mental signs & symptoms) indicate an increased likelihood of successful IA block?¹²

- Following a lower block, lip numbness is a primary indicator of success.¹²
- Faster onset away from the lip (i.e., molar areas), not so much.

Note: Although discussions of “off label” use with other LA drugs may be found, the manufacturer currently only identifies use of Onset with lidocaine / epinephrine.

Anesthesia Reversal - OraVerse® (phentolamine mesylate)¹³

Is there a way to decrease the duration of numbness?

- Vasodilator
- Non-selective, reversible α-adrenergic blocker used in hypertensive emergencies due to drugs such as cocaine
- Approved on patients 6 and up (not below 6 . . . Yet)
- Lip recovery times reduced from 1.0 – 1.5 hours
- One or less (some recommend ½) cartridge per site
Adverse Reactions\textsuperscript{13}
- similar to sham injection reactions
- no serious events reported
- optimal use may require some modifications

Case Studies: Discussion on Inadequate Anesthesia

Common Causes of Anesthetic Inadequacy
- \textit{Lack of or faulty anatomic assessment}
- \textit{Physical barriers}
- \textit{Physiology}
- \textit{Lack of comfort with alternative techniques}
- \textit{Tachyphylaxis}
- \textit{Ineffective or expired cartridges}
- \textit{Accessory or aberrant innervations}

Case Study (5) - Inadequate Mandibular Anesthesia

\textbf{History:} A 22-year-old male received an IA with 2\% lidocaine, 1:100,000 epinephrine for restorative treatment of #18 and #22. Minimal anesthesia occurred, even after a second injection with the same drug. \textbf{Health History:} Unremarkable.

What would you do? Select the most appropriate answer(s):
- Wait longer, expecting anesthesia to develop
- Re-evaluate your technique and repeat the injection a 3\textsuperscript{rd} time
- Repeat the injection a 3\textsuperscript{rd} time \textit{but} adjust the depth of penetration
- Repeat the injection a 3\textsuperscript{rd} time \textit{but} use 2\% mepivacaine, 1:20,000 levonordefrin
- Give a supplemental:
  - PDL injection
  - Intraosseous
  - Gow-Gates
  - Akinosi (Vazirani-Akinosi)

Inadequate Anesthesia: Inferior Alveolar Nerve Discussion

\textbf{Facts:}
1. The mandibular foramen is below a point that is 10 mm above the mandibular occlusal plain \textit{84\%} of the time.\textsuperscript{14}
2. The mandibular foramen is below a point that is 15 mm above the mandibular occlusal plain \textit{96\%} of the time.\textsuperscript{14}
3. The trunk of the IA nerve is typically several millimeters medial to the foramen in this location (the horizontal axis 15 mm above the mandibular foramen).
4. A short needle length (typically 21 mm) may approximate the distance from the pterygomandibular raphe to the IA nerve trunk when it is approximately 15 mm above the mandibular occlusal plane. \textit{Depositing solution higher is more likely to place it above the foramen.}

\textbf{Caveat:} This can increase risk due to variations in vascular patterns.\textsuperscript{15}
Case Study (6) - Inadequate Anesthesia

**History:** A 22-year-old female who comes in with an endodontic emergency for #31. A right IA was administered with 2% lidocaine, 1:100,000 epinephrine, which the patient reported as very uncomfortable; and the pain persisted despite the injection. **Health History:** Unremarkable.

You decide to re-inject, what would you use? Select the most appropriate answer(s):

- Articaine
- Intraosseous
- Bupivacaine
- *Buffered* bupivacaine
- *Buffered* articaine

Case Study (7) - Inadequate Anesthesia - IA block

**History:** A 28-year-old female who comes in for restorations in the lower left quadrant and received 2 cartridges of 2% lidocaine, 1:100,000 epinephrine for an IA. Insufficient anesthesia developed despite excellent technique and appropriate pre-anesthetic assessment. **Health History:** Unremarkable.

Repeating the same injection usually works but hasn’t worked in this instance.

- What are the potential advantages of administering a plain drug (without vaso)?
- What are the potential concerns?

**Advantages -**

**Concerns -**

**Discussion on administering 3% mepivacaine after 2% lidocaine, 1:100,000 epi:**

- While controversial, the argument: the mepivacaine solution has a much higher pH compared to lidocaine with a vasoconstrictor. Small increases in the pH at the nerve membrane, even if very transient could potentially increase the efficacy of the drug.

- 3% drugs have 50% more local anesthetic molecules per volume.

- Must consider the increased dose per volume when calculating toxicity

- There is also a benefit from the epinephrine vasoconstriction already in effect, essentially combining the two drug actions in this manner: 3% mepivacaine, 1:100,000 epinephrine.

- Although the benefit is speculative and unknown, patients can be informed that a safe but stronger drug is being used to overcome psychological factors.
Why 3% Mepivacaine Versus 4% Prilocaine plain?

Prilocaine is supplied in 4% plain and 1:200,000 epinephrine formulations. The plain formulation works in this scenario. We selected mepivacaine for several reasons, including its similarity to lidocaine including its dosing recommendation (lidocaine 7.0 mg / kg; mepivacaine 6.6 mg / kg) as well as literature including FDA bulletin information regarding benzocaine and prilocaine administration.16,17,18

According to the FDA:16

*Certain underlying conditions may predispose an individual to the development of methemoglobinemia if benzocaine or prilocaine is administered. The FDA Advisory states that, “...patients with underlying breathing problems, such as asthma or emphysema, patients with heart disease, and those who smoke may be more susceptible”*

Case Study (8) - Inadequate Anesthesia - IA block

**History:** A 61-year-old female comes in with pain in #19, a abutment for her bridge. She has an appointment with the endodontist the next day but “the pain is horrible” and narcotic pain meds are not helping. She states "I have to have some relief." At previous appointments she had demonstrated sensitive to epinephrine. **Health History:** Unremarkable.

You have decided to administer a long anesthesia to get her out of pain, what would you use? Select the most appropriate answer(s):

- 0.5% bupivacaine (Marcaine), 1:200,000 epi
- 4% articaine, 1:200,000 epi.
- 3% mepivacaine + 0.5% bupivacaine, 1:200,000 epi
- 4% Prilocaine, 1:100,000

Case Study (9) - Mandibular Anesthesia After PSA

**History:** A 53-year-old female comes in for restorative treatment of #2 and #3. She receives PSA and an infiltration over the MB root of #3. Following the injections, mandibular anesthesia developed, the patient, now confused, asks if you were working on an upper tooth instead. **Health History:** Unremarkable.

What do you think has occurred? Select the most appropriate answer(s):

- The injection was too posterior to the target site
- The injection was too lateral to the target site
- The injection was too inferior to the target site

Case Study (10) – *Routine* Inadequate Anesthesia I
**History:** A 45-year-old male comes in for restorative treatment of #4. He reports “no one has ever been able to numb #4 before”. He receives two infiltrations over #4 of 4% articaine, 1:100,000 epinephrine. No anesthesia develops (including soft tissues). **Health History:** Unremarkable. **What injection would you do next? Select the most appropriate answer(s):**

- IO
- PDL
- AMSA
- Maxillary (V2) nerve block
- Intraosseous

**Case Study (11) – Routine Inadequate Anesthesia II**

**History:** A 21-year-old male comes in for restorative treatment of #19, #20, and #23. **Health History:** Unremarkable.

As you read the schedule for the day … you recall: "This patient’s been in twice and I haven’t been able to get anything done. Everyone in the office has tried to get him numb, and and no one has been able to anesthetize him. Ok, we’ve tried an IA, Gow-Gates, Akinosi. Geeze .. what next?"

**Treatment Hx - Past injections with:** 2% lidocaine, 1:100,000 epinephrine + 3% mepicavaine plain and 4% articaine, 1:100,000 epinephrine. **Rescheduled** twice, the second time at a different time of day (*diurnal pharmacological* consideration). **Third Appt.** appointment an unsuccessful Gow-Gates with 4% articaine, 1:100,000 epinephrine.

**Case Study (12) – Fear of Palatal Injections**

**History:** A 35-year-old female comes in for pre-surgical periodontal therapy (maxillary right quadrant). The TxP is for 2% lidocaine, 1:100,000 epinephrine and includes palatal anesthesia. When she arrives, the patient *begs you* to not use palatal injections. You explain that you feel palatal anesthesia is valuable for her case. She asks that you then limit the number of “pokes” to as few as possible. **Health History:** Unremarkable.

Are there ways to avoid palatal injections entirely?

- Buccal infiltrations with articaine (at times)
- Interpapillary injections
- Intraseptal injections
- Maxillary (V2) nerve block

**Case Study (13) – Routine Inadequate Mandibular Anesthesia: Saving the Day**

**History:** A 24-year-old male comes in for restorative treatment of #27, #28, and #30. The patient reports: "I never get numb in my lower jaw. Last time they gave me a lot of shots and it still wasn’t numb." **Health History:** Unremarkable.
What would you want to know? Questions to ask:

- Have you ever received injections along the gums next to your teeth?
- Have you ever had to open really wide, and then stay open for a bit after the injection was done?
- Do you have difficulty keeping your mouth open for periods of time or have jaw pain?
- Were you ever asked to close your mouth before the injection?
- Were you ever told that a small hole was made in the bone to inject anesthetic into?
- Did anyone ever put a small electrode on your teeth (send a small shock) to test for numbness?

The patient answered that he remembered "shots on the gums" and a lot of pain indicating he had had some traumatic (and likely ineffective) PDLs since he’s "never been numb" in the lower jaw. He did not remember closing before an injection, having a hole drilled in the bone, or being asked about keeping his jaw open nor keeping it open after an injection. He also did not remember a pulp tester being used.

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**Case Study (14) – Inadequate to Proactive Anesthesia**

**History:** A 35-year-old female comes in for a root canal on #30 (her third RCT tooth). She is anesthetized with 2% lidocaine, 1:100,000 epinephrine and 4% articaine, 1:100,000 epinephrine. After the procedure she comments: "That was the best root canal I’ve ever had" *(Is she referring to the endodontic expertise?)*. **Health History:** Unremarkable

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**Case Study (15) – Limiting Epinephrine**

**History:** A 62-year-old male is scheduled for a restorative procedure. **Health History:** Medication (propranolol - non-selective beta blocker), BP - 134/88

**Are there any modifications or treatment considerations for the use of LA?**

**Which anesthetic is the safest?**

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**Case Study (16) – Compromised Liver Function**

**History:** A 58 year-old male is scheduled for a restorative procedure. **Health History:** Hepatitis C, cirrhosis of the liver, Medications – multiple for cardiovascular disease and Type 2 diabetes.

**Are there any modifications or treatment considerations for the use of LA?**

**Which anesthetic is the safest?**

**Fact:** Nonselective beta blockers + epinephrine can cause precipitous spikes in blood pressure in some individuals which usually produce only headache in most but can lead to catastrophic strokes in others.*
Did you also know that\textsuperscript{19} . . .

- "...patients on beta-blockers who develop anaphylaxis are likely to be resistant to the therapeutic effects of epinephrine used to treat the anaphylaxis."\textsuperscript{*}
- "...it is generally assumed that all beta-blockers can inhibit the response to epinephrine in anaphylaxis."\textsuperscript{*}
- "There also is evidence that patients on beta-blockers have an increased incidence and severity of anaphylaxis, ..."\textsuperscript{20}

Updates and Interesting Stuff!

- ml cartridges (4\% articaine)
- Wand STA system
- DentaVibe
- Vibraject
- Buzzy
- Quick Sleeper

Upcoming Developments – What’s On the Horizon?

- KOVACAINE MIST
- LeEject
- Gebauer's Pain Ease

Informal Case Discussion 1:

Your next patient "hates" palatal injections and will not let you administer "one more shot in the roof of my mouth."

What can you do?

Informal Case Discussion 2:

A dental assistant working in your office sticks herself with a needle while discarding it in sharp's container.

Is there a safer way to dispose of needles?

Informal Case Discussion 3:

It takes too long waiting for gel topicals to work. Even one minute seems like an eternity sometimes.

Is there a fast-acting topical on the market?
<table>
<thead>
<tr>
<th>LA Drug</th>
<th>mg/kg</th>
<th>mg/lb</th>
<th>MRD (in mg)</th>
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* none listed by USFDA

Thank you for joining us!
References


