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LA Strategies & Updates: What You Don’t Know Can’t Help You

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Disclosure:

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Updates

**CASE: 38-year-old fitness instructor**

1. Are patients with chronic fatigue syndrome more or less susceptible to tachyphylaxis?

2. Are patients with uncontrolled diabetes, who are also under great stress, more or less susceptible to buffering?

What about patients with uncontrolled (difficult to control; high doses of insulin) and significant CVS compromise?
3. CO₂ generated during buffering procedures produces a more or less rapid anesthetic action?

4. CO₂ buffering readily penetrates nerve membranes?

Yes...

**Sulfites** are preservatives for solutions with vasoconstrictors. They selectively oxidize, minimizing vasoconstrictor oxidation, thus increasing the shelf-life of vasoconstrictors. Unfortunately, they generate more acid and...

If a patient is allergic to sulfites, solutions with vasoconstrictors should be avoided.

5. Do esters potentially interfere with the antibacterial activity of sulfonamide antibacterials, such as Bactrim and Septra? Yes.

**Articaine** is sometimes mistaken for an ester but it is an amide, not an ester, and does not interfere with sulfonamide antibacterial activity. Articaine has also been incorrectly labeled as unsafe in the presence of sulfa allergies. This is not correct.

6. If a patient is allergic to the element, **sulfur** (S on the periodic table), is it okay to administer articaine since it has a sulfur atom in its formula?

Yes, articaine is not a problem.

**Sulfur** is found in eggs, broccoli, cabbage, etc.
The sulfur atom in each articaine molecule is tightly bound and “not available as an antigen.”
Mini Case:

7. If a patient reports a Hx of methemoglobinemia, which of the following should be avoided:
   A. Prilocaine
   B. Articaine
   C. Benzocaine
   D. Lidocaine

Avoid Prilocaine, Articaine, Benzocaine

Package insert information:

• **Articaine** — “Septocaine® should not be used in patients with congenital or idiopathic methemoglobinemia, or in patients who are receiving treatment with methemoglobin-inducing agents . . .”

• **Benzocaine** — (https://www.drugs.com/mtm/benzocaine-topical.html, accessed 8-30-18) — “Benzocaine topical used in the mouth may cause a condition in which the oxygen in your body tissues can become dangerously low.”

• **Prilocaine** (Citanest™ and Citanest Forte™) — “Prilocaine has been associated with the development of methemoglobinemia.”

Is prilocaine more likely to induce methemoglobinemia in infants or adults?

Metabolite o-toluidine is thought to be responsible. Very young children are more susceptible (Citnest package insert). Doses exceeding 4mg/lb (8mg/kg) pose a risk to healthy adults (CDC)

• If a patient has no Hx of methemoglobinemia but has been taking acetominophen over the last 2 days what is the FDA’s advice regarding articaine, prilocaine, benzocaine? “. . . Septocaine® should not be used in patients with congenital or idiopathic methemoglobinemia . . . or in patients receiving treatment with methemoglobinemia-inducing agents . . .” (Septocaine package insert)

• This applies to prilocaine and benzocaine, as well.
Lidocaine is Okay

While there is some evidence of lidocaine-induced methemoglobinemia* it appears to be minimal and is not mentioned in inserts


Which drug(s) is(are) most dangerous re: methemoglobinemia?

1. Benzocaine
2. Articaine
3. Prilocaine
4. Lidocaine

Benzocaine topical & prilocaine parenteral

• **Benzocaine** - particularly in spray and teething usage
• **Prilocaine** – injectable

Both are mentioned in several FDA warnings
(Which one of these is different and how is it different?)

- Septocaine™
- Articadent™
- Zorcaine™
- Orabloc™

Orabloc is not end-sterilized. The only true 4% articaine of the four.

Adverse Event Report

- Med Hx: negative
- Limited patient information disclosed
- Mandibular anesthesia indicated
Adverse Event Report

Report
- Patient returned with pain and persistent numbness

History
- Hx: 3 cartridges 4% articaine, 1:100 epi
- Anesthesia for a maxillary procedure

Referral
- Referred for evaluation of post-op pain, rash, paresthesia and dysesthesia

Expert:
- “Articaine produces higher rates of complications compared to other anesthetics.”
- “It is a problem drug.”

Evidence-Based Decision Making

Paraesthesia after local anaesthetics: An analysis of reports to the FDA Adverse Event reporting system (2014).

How accurate are voluntary reports?

• Voluntary reports of adverse events (Piccinni, et al.)

“In conclusion, among local anaesthetics, only articaine and prilocaine generated a signal of paraesthesia, especially when used in dentistry.”

FDA’s comments regarding its database . . .

• The FDA Adverse Event Reporting System . . .
  1. Implies no certainty that the event was due to the product
  2. Estimates that only about 10% of adverse events are reported
  3. Concludes: “. . . AERS cannot be used to calculate the incidence of an adverse event and the US population.”

Pharmacovigilance Working Party of the European Union
“There is no need for new experimental studies or clinical trials.”

**Calculated risk estimate (with which PWPEU agreed):**

“... 1 case in 4.8 million treated patients.”
The effect of the 2006 Pharmacovigilance report: “Since 2005, we have seen a drop in the number of reports of new adverse reactions, up until 1 October 2011, we have received 2 reports on suspected adverse reactions from articaine which occurred in 2011.”

Danish Medicines Agency October 2011

“Well, we have seen a drop in the number of reports of new adverse reactions, up until 1 October 2011, we have received 2 reports on suspected adverse reactions from articaine which occurred in 2011.” (the Weber effect?)

Weber Effect:
An increased incidence of adverse reports in the first year of a drug’s introduction

Articaine Market Share

<table>
<thead>
<tr>
<th>Year</th>
<th>Market Share</th>
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</thead>
<tbody>
<tr>
<td>2014</td>
<td>90%</td>
</tr>
<tr>
<td>2016</td>
<td>97%</td>
</tr>
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Germany
“Overall, when it comes down to scientifically sound research and data, no general clear evidence can be found to support the claim that articaine is associated with increased paresthesia because of its inherent characteristics.”

“Based on the findings presented... procedural trauma appears to be a valid alternative explanation for the reported neurological complications.”


- “Health Canada Adverse Reaction Reports revealed that in about 25 years, there are only 20 cases which are associated with paresthesia-like events related to the use of 4% and 2% local anesthetics. In a country where approximately 80 million dental local anesthetic injections are given per year, this number should be deemed negligible.”

- Considering the total sales volume of more than 40 million cartridges (one case every 13.3 million injections) this result supports the conclusion that articaine products are likely to generate a negligible number of adverse reactions and bear no increased risk for paresthesia.”
Comparing the Haas, et al. Canadian Study to the Garisto, et al., US

• **It would appear** regarding articaine: “from the numbers in these two papers that the risk of paresthesia is 9.4 times greater in Ontario than in the United States.”*

• And “The overall risk of paresthesia from a dental local anesthetic injection in Ontario is **17.58** times greater.”*

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*MalamedSF (2016). Articaine 30 years later, *Oral Health*

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2018

“In conclusion, articaine does not damage neural cells more than lidocaine in this in vitro model. While this does not question the safety of lidocaine used clinically, it does suggest that articaine is no more neurotoxic, at least in the in vitro setting.”

Articaine

Administer slowly . . . Reduce the dose

2% lidocaine
60 seconds per cartridge

4% articaine
120 seconds per cartridge

Articaine Advantages

• **Formulations**
  1:100,000, 1:200,000, 1:400,000

• **Hepatic Compromise**

• **Nursing** (shorter Half Life, $t_{1/2}$)

• **Takes more before ODs develop** & ODs are generally less severe*, **

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Kovanaze™ Intranasal Topical Anesthetic

**Formula:**
- 3% tetracaine
- 0.05% oxymetazoline
- mucoadhesives

**Protocol:**
- 3 sprays per nostril
- 4 minutes between each pair of sprays

Source: UPenn ASDA’s Quarterly Newsletter, 3/19/2011

Tertacaine MRD 18 mg/appointment lethal dose ~ 160 mg
At MRD
Headache  1:4
Nasal stuffiness  1:3
Runny nose in  1:2

At MRD x2
Headache  1:4
Nasal stuffiness  3:4
Runny nose in  3:4

2012 limited study of adverse events using interval blood sampling

IMPORTANT NOTE:
After administering Kovanaze™ a single procedure can only be done on one side of the mouth. Wait at least 24 hours, or until there is complete resolution of the block, whichever is longer, before starting another procedure with Kovanaze™.
In order to ensure efficacy, wait the appropriate length of time after each dose before continuing to the next step.

Warnings and Important Notes

DO NOT use on children who weigh less than 40 kg.
DO NOT inject Kovanaze™.
DO NOT spray in the mouth.
DO NOT spray in the eye.
DO NOT re-use or refill device.
DO NOT use a cartridge warmer.
DO NOT submerge in water.
DO NOT immerse in or wipe with disinfectant or any solution.
DO NOT autoclave.
DO NOT use if dropped.
Detailed information can be found on the website: http://www.kovanaze.com/

Dentapen . . .

• Next generation CCLAD
• 1 mL in 30, 60, or 100 seconds

The last update . . .

• 5-Second Topical Anesthetic
Gebauer’s PainEase™
- Rapid onset vapocoolant
- FDA approved for use on skin and oral mucous membranes

Vapocoolant: No Pharmacologic load

**Study Parameters:**

- Left the applicator in place during the injection

- Did not apply pressure for the study but would highly recommend applying pressure for any palatal injection
Dental application of a 5-second, non-pharmacological topical agent
Study 2013-2014

“Local Anesthesia Strategies and Updates:
What You Don’t Know Can’t Help You”

Case One

- 29-year-old patient
- TxP: multiple mandibular restorations

Patient concern:
- “They’ve never been able to numb my lower jaw.”
**Subjective**

- Have you had injections around the gums? (Yes)
- Have you ever been asked to open widely and keep it open? (No)
- Do you have any difficulties opening widely? (No)

**Objective**

- Multiple existing failing restorations in the mandible
- Hx: Unsuccessful mandibular anesthesia in the past

**Assessment**

- Unusual anatomy and/or physiology

**Plan**

- TxP: Gow-Gates NB

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**Published success rates**

<table>
<thead>
<tr>
<th>IA</th>
<th>19 - 85%</th>
<th>= pulpitis &amp; endo.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gow</td>
<td>52 - 97%</td>
<td>= perio. &amp; restorative</td>
</tr>
</tbody>
</table>

After a Gow-Gates block . . .

The patient bolted from the chair holding his face ....

“I can’t feel my face, even my ear is numb. Is my ear supposed to be numb?”

Gow –Gates . . .

rationale for higher initial drug volumes
Does rate of deposition matter?

“. . . depositing 2 ml of solution of an anesthetic solution at the lingula in 18.3 seconds increases hydrostatic pressure from 14.5 to 469 mm Hg . . . The resulting loss of . . . anesthetic through . . . the capillary walls . . . may result in a partial or complete failure of the block.”

- Gow-Gates*,**, 

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In other words . . .

- Increased injection pressures can force anesthetic solution through capillary pores and the anesthetic . . .

enters the circulation

oops!
Observe the following . . .

- 1. Higher initials volumes of drugs
- 2. Upward angulation
- 3. Mouth wide open the entire time
- 4. Deposit slowly
- 5. Sit upright quickly before rinsing
- 6. Mouth open for a few more seconds

Case Two

- HHx unremarkable
- 25-year-old patient
- TxP: multiple mandibular restorations

Patient concern:
- “They’ve never been able to numb my lower jaw.”

Appt 1: Tx – lower L, multiple failing restorations; previous dental Hx – inadequate mandibular anesth.
- Techniques – IA, Gow-Gates, articaine infiltrations;
- Lidocaine, mepivacaine, articaine
- Patient dismissed & reappointed – inadequate anesthesia

Appt 2: Dismissed and reappointed – inadequate anesthesia (same drugs & techniques used)
Appt 3: Same plan, same drugs, new technique

Success

### Subjective
- Failed anesthesia
  - No treatment previous 2 appointments

### Objective
- Multiple carious teeth in mandible
- Hx: Unsuccessful anesthesia in the past; all clinicians
- IA, Gow-Gates, Akinosi, and mandibular infiltrations
- Lidocaine, articaine, mepivacaine

### Assessment
- Frustration
- How many attempts do we get?
- Pressure’s on

### Plan
- IA blocks?
  - Success unlikely
- Unique anatomy and/or physiology
  - Probably
- TxP: Gow-Gates + PDL-IA Block

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**Reported Success Rates***

- **IA** 19-85% Lowest success rates of all three in pulpitis
- **Gow-Gates** 52-97% Higher success rates in periodontal therapy & restorative
- **PDL** 58-100% Higher success rates in periodontal therapy & extractions

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PDLs around all four line angles of 2nd molars

“PDL- inferior alveolar approach”*, **

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PDL IA (Approach) Block

Volume Per Site
1 stopper (0.2 ml) per site

Total Drug Volume = 1.8 ml

Drug Volume Expelled by 1 stopper = 0.2 ml
Total volume & mg of drug to achieve profound anesthesia for this patient:

1.5 cartridges = 108 mg articaine

MRD for this patient = 500 mg per appointment

Previous total of lidocaine & articaine:

5 cartridges, 288 mg

PDL Inferior Alveolar Blockade

Site Selection and Sequence

PDL injection at four (or fewer) aspects of
mandibular 2\textsuperscript{nd} molar
(MB, DB, ML, DL)
Selection based on radiographs
Want all four sites in PDL IA blocks...

- To provide the greatest useful volume & best chance of reaching the mandibular canal

Does depositing more than 0.8mL increase duration of PDL IA blockade?

Probably not*

Mandibular Canal Proximity to Second Molar

Proximity to IANerve

Proximity of the roots of 2nd molar to the mandibular canal
My favorite

With a 45° adaptor

Needle-less PDL?

Numbee™

Numbee™ by Novoject
Steps for effective PDL Injections:

1. **Critical:** Pre-anesthesia
2. Insert needle into sulcus using perio. probe angles until firm resistance
3. Maintaining firm, steady pressure, deposit slowly
4. **Critical:** Maintain penetration depth entire time
5. **Critical:** Each stopper should take a full 20 seconds to deliver
6. Do not deposit if no blanching or if back flow noted
7. If 2\textsuperscript{nd} attempt fails, move on to another nearby site
• Maintaining the depth of penetration

• I’m using my thumb to keep the needle from lifting; when under pressure & these require firm pressure, you can easily lose the penetration depth

• And it’s less likely to be successful

• Deposit 0.2 ml (one stopper) per click

• 20 full seconds per click

• One click per site

• Less than ½ cartridge total
Steps for PDL – IA Approach Injections

1. **Pre-anesthesia**
2. Insert needle into sulcus using perio. probe angles until firm resistance
3. Maintaining **firm, steady pressure**, deposit slowly
4. **Critical: Each stopper should take a full 20 seconds to deliver**
5. Do not deposit **if no blanching** or **if back flow** noted – 2nd try fails? Move on
6. **Critical: Maintain penetration depth entire time**
7. Check radiographs for apical location near the mandibular canal
8. **Administer PDL injections in MB, DB, ML, DL line angles (need all 4)**

How is a PDL IA Approach Block technique different?

- Single tooth PDL, one root: 1 – 2 sites
- Single tooth PDL, multiple roots: 3-4 sites
- PDL IA Approach IA block: 4 sites
“Rescuing Failed Inferior Alveolar Nerve Blocks”

Why is blanching critical in PDL injections?
Why is comfort critical in PDL injections?

How is a PDL IA Approach Block technique different?

- Single tooth PDL, one root: 1 – 2 sites
- Single tooth PDL, multiple roots: 3-4 sites
- PDL IA Approach IA block: 4 sites

CASE 3

- 35-year-old
- 2rd appointment, lower left
- IA’s and Gow-Gates failed to provide adequate anesthesia
- Patient recalls considerable trauma in the past and being numb for “hours and hours” but never for the dental Tx
- Even the lingual nerve distribution wasn’t adequately anesthetized

Tx Plan

- Competent Gow-Gates
- Followed by PDL-IA
- Good plan . . . But . . .
- Without adequate lingual nerve anesthesia to administer a comfortable PDL IA block, we decided to try a different approach which provided good pre-anesthesia of the lingual sulcus for good PDLs
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<tr>
<th>Subjective</th>
<th>Objective</th>
<th>Assessment</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;It's a little numb.&quot;</td>
<td>Following 3/4th cartridge 2% lidocaine + 1:100 epi</td>
<td>Try something else Options:</td>
<td>Short needle IA 2% lidocaine, 1:100 epi</td>
</tr>
<tr>
<td>&quot;I can feel it on my lip and a little on my chin.&quot;</td>
<td>½ cart. 3% mepivacaine plain for Gow-Gates</td>
<td>Lingual block</td>
<td></td>
</tr>
<tr>
<td>After 15 minutes</td>
<td>Probing for PDL not comfortable</td>
<td>Buccal block</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Now what?</td>
<td>Oraqix</td>
<td></td>
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Dissections in this presentation

Courtesy of Kathy B. Bassett, BSDH, RDH, MEd
Dear IA Nerve Block: It’s Not Me, It’s YOU!

Katrina Sanders, RDH, BSDH, M.Ed., RF
January 7, 2018
Accessed 1-7-2018 at:
https://www.todaysrdh.com/dear-ia-nerve-block-not/

Section titles in this paper . . .

1. You took it too far, and I didn’t feel safe!
2. And don’t get me started on your little issue with premature bc
3. I’m cheating on you
4. You’ve got some nerve!
5. You were never reliable!
6. I’ve moved on
Some complications with Halsted IA Blocks

(Besides providing less than adequate anesthesia at times)

Risks

Intravascular injection – highest rate, except Div. 2 blocks (tuberosity)
Paresthesia, especially the lingual nerve – highest rate
Post-operative trauma - highest rate
Trismus – particularly if medial pterygoid fibers encountered
Additional Risks of Halsted IA Nerve Block:

• 1. Carotid complications* – rare, but they have happened
  “First, one should consider the possibility of a direct intraprocedural
  needle-related internal carotid artery injury.”*
• 2. Transient facial paralysis (Facial N)
• 3. Eye protection often needed

artery dissection after inferior alveolar nerve block for third molar dental care presented as

Failure of Halsted IA

• We know that too low is worse than too high
• Too deep worse than too shallow?

Shallow means *anterior* to the foramen and deep means *posterior* to the foramen
Deep Versus Shallow

• Depositions of solution 5mm *deep* to the foramen are successful ~40% of the time*

• Depositions 5mm *shallow* to the foramen are successful ~80% of the time*

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Short Needle IA nerve block . . .

The *depth of penetration to the IA nerve* “ranged from 12 to 19 mm; the *mean* depth was 16 mm.”*

This depth was in each case half the width of the ramus at its narrowest anteroposterior aspect.*

---

Menke and Gowgiel got their information from . . .

35 cadaver heads

- Measured the distance between the penetration site in the lateral depression of the pterygomandibular raphe to the IAN nerve

- By the way, what 2 muscles does the raphe connect?

Establishing Width of Ramus

Narrowest aspect of ramus
[at the depth of the coronoid notch]

Example:
Arrow tip to Arrow tip = 34 mm
Penetration depth = 17 mm
(⅓ of 34 mm depth of ramus)

Needle Length

Disposable dental needles: 27G **25mm short**
(Smedent, Henry Shein, etc.)

At a penetration depth of 16mm using a 25mm needle, 9mm of needle are exposed

In the modified Halstead IA technique, 6-11mm exposed on average, sometimes less than 6mm

**Hubbing isn’t necessary . . .**

Short Needle Variables

<table>
<thead>
<tr>
<th>Needle Length</th>
<th>Penetration Depth</th>
<th>Exposed Needle</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 mm</td>
<td>16 mm</td>
<td>5 mm</td>
</tr>
<tr>
<td>25 mm</td>
<td><strong>16</strong> mm</td>
<td>9 mm</td>
</tr>
<tr>
<td>25 mm</td>
<td><strong>19</strong> mm</td>
<td>6 mm</td>
</tr>
</tbody>
</table>
Location of Mandibular Foramen

Does this look too high, too low, or appropriate?

- 34-year-old patient
- TxP: crown #31

Patient Concerns:
- None
<table>
<thead>
<tr>
<th>Subjective</th>
<th>Objective</th>
<th>Assessment</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It’s not numb.”</td>
<td>Following 2 cartridges 4% prilocaine; 1:200 epi (Citanest Forte™)</td>
<td>2 IANBs failed, over 15-20 minutes.</td>
<td>Dentist’s exact words: “Let’s go ahead and start. It’ll be numb by the time we get there.”</td>
</tr>
<tr>
<td>“I can feel everything.”</td>
<td>No signs of anesthesia to probing</td>
<td>Li<strong>kelihood High</strong> Pt is not going to get numb today if nothing different tried</td>
<td></td>
</tr>
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</table>

This patient also bolted from the chair ...  

... and asked if he could see the syringe?
Case Four

- 33-year-old patient
- TxP: multiple mandibular restorations lower R

Patient concern:
- “Novocaine never seems to work well for me. And it always seems to take a lot and never lasts very long.”

TP: crown on the lower left first molar

- 1. Gow-Gates block with 3% mepivacaine (pH 4.5 – 6.8)
- 2. Followed by GGNB with 4% articaine, 1:200,000 epi.
- 3. Following verbally confirmed symptoms of block anesthesia
- 4. 2% lidocaine, 1:100,000 epi for PDLs (MB, ML, DB, DL) #31
- 5. Waited until LA + supplemental LA in effect, then . . .
- 6. EPT, which was negative
Subjective
- Reduced sensitivity to local anesthetics
- Likely not anatomic or technique-specific since she says it’s always a problem

Objective
- Which local anesthetics were used in the past?
- Did any work better?

Assessment
- Couldn’t determine which local anesthetics were used in the past
- Did any work better? It wasn’t possible to determine.

Plan
Buffering and proactive local anesthesia

A few important considerations . . .

- This was a customized plan for this patient
- Not one that is typically needed
- This occurred before the availability of buffering agents in dentistry
Proactive LA . . .

- 1. Prior to endodontic therapy
- 2. Prior to oral surgery including extractions, etc.
- 3. Prior to Tx on fearful & / or previously traumatized patients
- 4. Patients who relate that they've been hurt many times before

Buffering
Benefits and Outcomes

- Reduced onset time
  May start Tx more quickly

- Profound pulpal anesthesia & decreased pain (due to CO₂?)
How does buffering work?

- Lidocaine HCl is non-lipid soluble (99% RNH+) at pH 3.5 (only 0.004% is in lipid soluble form at that pH)

- Buffering closer to 7.35 – 7.45 provides optimal effectiveness

- Sodium bicarbonate reacts with hydrochloric acid to produce CO₂ which potentiates the action of lidocaine by yielding an immediate, independent depressive effect on the nerve while lidocaine is taking effect

Pulpal Anesthesia IANB

- 71% of the participants receiving buffered anesthetic achieved pulpal anesthesia in under two minutes

12% of the control participants achieved pulpal anesthesia in under two minutes
Buffering for difficult to numb patients, including alcohol-dependent patients...

- Excellent strategy for those difficult to anesthetize, also...
- Patients under the influence of large amounts of alcohol (as well as recovering alcoholics) can be difficult to anesthetize
- High alcohol intake produces a state of **metabolic acidosis** which causes
- An acidic environment at the site of injection & **reduces the ability of the anesthetic to cross nerve cell membranes.**

Onset™ Buffering System Onpharma

"Now approved for all dental anesthetics cartridges"  
Personal communication with Mic Fakkal, Nov 2015
Also, leverage drugs*

- 3% mepivacaine plain  pH = 4.5 – 6.8
- 4% prilocaine plain  pH = 6.0 – 7.0
- 2% lidocaine w/epi.  pH = 3.3 – 5.5
- 4% articaine w/epi.  pH = 4.0 – 5.2


3% mepivacaine and 4% prilocaine plain

- 3% mepivacaine plain  pH = 4.5 – 6.8
- 4% prilocaine plain  pH = 6.0 – 7.0

- 4% prilocaine plain (Citanest™) has the highest pH but also has the shortest durations in infiltrations but 3% mepivacaine is the least vasodilative – so I personally prefer mepivacaine (Carbocaine™); however, with epinephrine present in the local tissues, prilocaine’s duration is augmented significantly.
Review: 3% Mepivacaine or 4% prilocaine after failed anesthesia with drugs w/vasos.

- Both will work; prilocaine has the highest pH
- Mepivacaine is more effective in infiltrations compared to prilocaine
- Mepivacaine is also the least vasodilative of all 5 amides in cartridges

3% mepivacaine potential advantages

- 50% more drug
- More molecules available to the nerve membrane
- Equivalent to 3% mepivacaine, 1:100,000 epi.
- Least vasodilative drug

Case Four

- 17-year-old patient
- TnP: multiple mandibular restorations
- No Tx modifications needed
- IA block with 2% lidocaine, 1:100,000 epi.

Patient concerns:

- None
After the 1st Halsted block – inadequate anesthesia
After the 2nd – inadequate anesthesia
After the 3rd – inadequate anesthesia
After the 4th – inadequate anesthesia; patient dismissed
Received a phone call: What would I have done?

Ideas???????

What would you have done?

At a pH of 3.5:

• “... 99.994% of a lidocaine solution is BH+ [in the cationic form which does not provide significant anesthesia].”*

• In other words, tissue buffering has to occur before the anesthetic is effective . . . at all.

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Therefore . . .

• Administering 2% lidocaine, 1:100,000 epi. four times
• **Directly opposes the body’s innate buffering system**
• On top of that, trauma from repeated injections lowers pH, which
• **Directly opposes the body’s innate buffering system**

Does a second injection of 2% lidocaine, 1:100k epinephrine ↑ or ↓ rate of success?

↑ - (and significantly)

• The first injection, although inadequate, likely blocked some sodium channels (which prevented some impulses from generating)

• But not enough

• A subsequent injection has fewer channels to block and is usually more successful

• This explains the success we experience most of the time
A second attempt is an excellent strategy!

(We’ll talk about ways to increase the success of this strategy even more . . . in a few seconds)

What about a 3\textsuperscript{rd} attempt?

\begin{itemize}
\item 99.994\% ineffective, initially
\item +
\item 99.994\% ineffective, initially
\item +
\item 99.994\% ineffective, initially
\end{itemize}

pH decreases in response to trauma; epi keeps pH low after 4 attempts; innate buffering slows down.

What would I do? I almost never administer lidocaine twice.
Do I have concerns 3% mepivacaine has no epi and duration will be shortened. None. It won’t be. Epi. from the lidocaine injection is in effect. Durations have been excellent, in other words = 3% mepivacaine, 1:100,000 epinephrine

Remember the **Tri-Rooted Molars?**

![Image of dental X-rays showing tri-rooted molars with arrows pointing to each root]

Solution: mylohyoid supplemental block

Case 6

- 25-year-old male patient
- TxP: multiple mandibular restorations

Concerns:
- Painful past experiences
- Very anxious, sweating profusely

- 1st appointment:
  insufficient anesthesia - nothing accomplished

- 2nd appointment:
  profound anesthesia achieved \((\text{wasn't easy})\)

- 3rd appointment:
  insufficient anesthesia, Tx was completed but the recommendations from the successful 2nd appt were ignored; "white knuckle" conditions

- Patient left appointment ... visibly shaken
Patient lost consciousness, hit a boulder, and rolled...

ER Dx: Epi washout

typical response to inadequate anesthesia? Give more

This is a good strategy
Except when it doesn’t work
What worked previously . . .

The short needle IA & PDL IA approach block

Total dose of 2% lidocaine, 1:100k . . .
less than 1.5 carpules

Thank you!