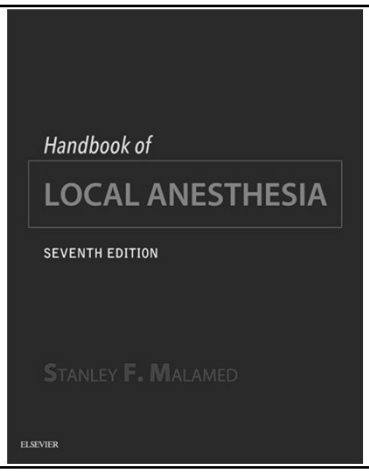
29 MAI
02 JUIN
2026

John L. Alonge, MS, DDS
jladoc@aol.com

Local Anesthesia

"There is no substitute for profound local anesthesia"

"Nurse, run outside and get his shoe."



Medical Emergencies in the Dental Office

Malamed – CDA Journal…survey of 4000 dentists over a 10 year period

Time of Occurrence of Reported Systemic Complications:

1.5% Just before treatment
54.9% During/after local anesthesia
22% During treatment
15.2% After treatment
5.5% After leaving office

"How many times have I told you not to snap your fingers while I'm extracting teeth under hypnosis?"

Local Anesthesia in the Dental Office

- Have you ever had a patient experience severe pain upon injection and then you observe their cheek blanch?
- Do you know why physicians commonly recommend NO epi?
- Have you ever had the situation where your patient affirmed a numb lip and tongue only to jump when you were treating a tooth?
- Have you ever had a patient you just could not get numb despite multiple injections and you call the patient that evening and they stated that an hour after they got home or back to work, they were the numbest they have ever experienced?
- Have you ever had a patient complain of limited opening for 2-3 weeks after an inferior alveolar/mandibular block?
- How well do you know your armamentarium?
- Do you know the most likely time of a medical emergency in the dental setting?
- Do you achieve IAN block 100% of the time?
- What local anesthetics can be used with a pregnant patient?
- Are there any clues to differentiate an ester from an amide?

Medical Emergencies in the Dental Office

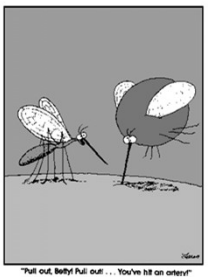
Of the 22% during dental treatment occurrence of complications:

38.9% Tooth extraction
26.9% Pulp extirpation
12.3% Unspecified
9.0% During other treatment

"I'll have to charge extra for that one."

Local Anesthesia

Armamentarium
- 30 gauge short
- 27 gauge long
- 25 gauge long



Local Anesthesia

100% **Aspiration with 25 gauge…3%**

87% **Aspiration with 27 gauge…38%**

2% **Aspiration with 30 gauge…59%**

Foldes and McNall, Dental Clinics of North Am, 1961

Local Anesthesia

100

87

2

Negative Aspiration

Local Anesthesia

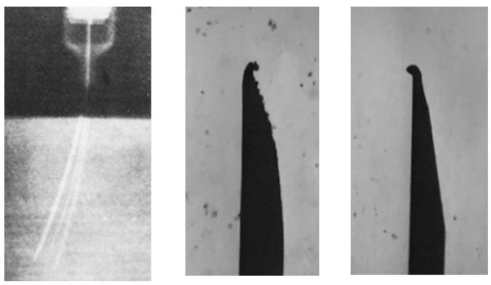
100% **Aspiration with 25 gauge**

87% **Aspiration with 27 gauge**

2% **Aspiration with 30 gauge**

Foldes and McNall, Dental Clinics of North Am, 1961

Needle Selection



Local Anesthesia

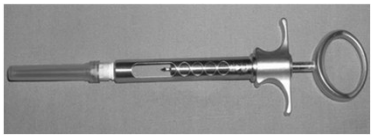
Basic Armamentarium

*Local Anesthesia

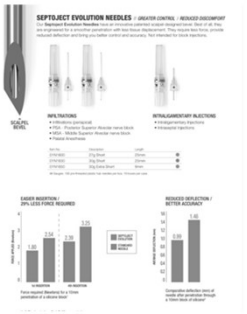
-Syringe type

-Needle choice

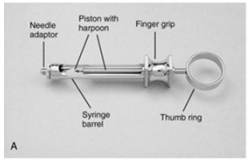
-Anesthetic choice

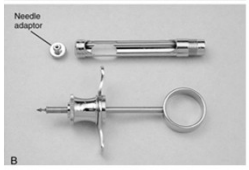


Needle Selection



Armamentarium





Pain Management Selection

- **PAIN MANAGEMENT**
  - **INJECTABLE ANESTHETICS**
    - Lignospan Special
    - Scandonest 3% Plain
    - Septanest 1:100,000
    - Septanest 1:200,000
  - **NEEDLES**
    - Septoject
    - Septoject Evolution
    - Septoject XL
    - Ultra Safety Plus TWIST
  - **TOPICAL ANESTHETICS**
    - Xylonor Gel
    - Xylonor Spray

Ordering information

- Box of 100 needle stick injury prevention devices, individually packed and sterilized + 1 sterilizable handle
- Item #01N4400 – Ultra Safety Plus Twist XL 30g Extra Short (purple) box of 100 injection units + 1 syringe handle
- Item #01N4401 – Ultra Safety Plus Twist XL 30g Short (blue) box of 100 injection units + 1 syringe handle
- Item #01N4452 – Ultra Safety Plus Twist XL 25 g Long (red) box of 100 injection units + 1 syringe handle
- Item #01N4471 – Ultra Safety Plus Twist XL 27g Short (orange) box of 100 injection units + 1 syringe handle
- Item #01N4472 – Ultra Safety Plus Twist XL 27g Long (yellow) box of 100 injection units + 1 syringe handle
- Item #01N3100 – Ultra Safety Plus Twist XL Reusable Handle (blue)
- Item #01N3500 – Ultra Safety Plus Twist XL 50 Pre-sterilized handles single use (white)

Needle Selection

***mandatory in the UK (2013)**

Local Anesthesia

WARNINGS

DENTAL PRACTITIONERS WHO EMPLOY LOCAL ANESTHETICS IN THEIR OFFICES SHOULD BE WELL VERSED IN DIAGNOSIS AND MANAGEMENT OF EMERGENCIES WHICH MIGHT ARISE FROM THEIR USE. RESUSCITATIVE EQUIPMENT, OXYGEN, AND OTHER RESUSCITATIVE DRUGS SHOULD BE AVAILABLE FOR IMMEDIATE USE.

Reactions resulting in fatality have occurred on rare occasions with the use of local anesthetics, even in the absence of a history of hypersensitivity.

Topical Anesthesia

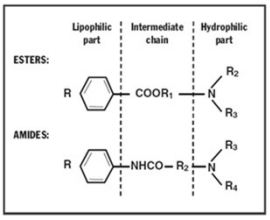
Considerations?

Diphenhydramine (Benadryl)
Skin refrigerant/Cold spray (Endo-Ice™)

Malamed-Handbook of Local Anesthesia

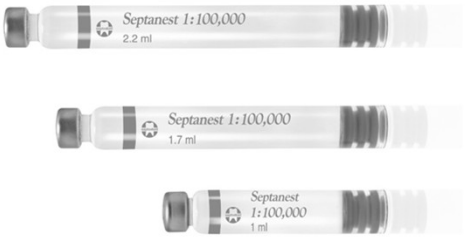
- The dental local anesthetic **cartridge** is, by common usage, referred by dental professionals as a *carpule*. *Carpule* is actually a registered trade name for the dental cartridge prepared by Cook-Waite Laboratories, which introduced it into dentistry in 1920. The patent was originally issued by the US Patent Office on August 4, 1925. The patent on the name *carpule* expired on May 6, 2006.
- Carpules no longer exist

Local Anesthesia



- Cocaine
- Procaine
- Lidocaine
- Mepivacaine
- Benzocaine
- Prilocaine
- Tetracaine
- Bupivacaine
- Chlorprocaine
- Articaine

Local Anesthesia



Local Anesthesia

- Cocaine
- Procaine
- Benzocaine
- Tetracaine
- Chlorprocaine
- Lidocaine
- Mepivacaine
- Prilocaine
- Bupivacaine
- Articaine

Local Anesthesia

Posology (the scientific study of drug dosages)
Greek posos (how much) logos (study)
*Ratio Solutions = Grams/mL

e.g., adrenaline (epinephrine) 1:100,000 =1Gram/1,000,000mL
1:100,000 =10mcg/mL
.01mg/mL
.017mg or .018mg or .022mg/cartridge

e.g., 0.5% Bupivacaine……5mg/mL…...1.3mg/kg….(10)
2% Lidocaine……..20mg/mL…..4.4mg/kg…..(8)
3% Mepivacaine….30mg/mL…..4.4mg/kg….(5.5)
4% Prilocaine……..40mg/mL…...6mg/kg……5.5)
4% Articaine…….40mg/mL…..6mg/kg…..(5.5)

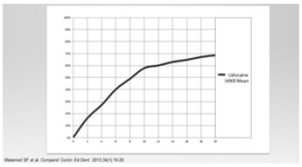
Local Anesthesia

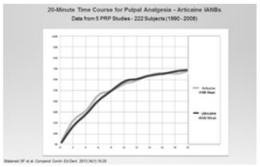
Articaine 4%(Septodont® /Septanest® / Articadent®)

* Unique Features
  - only amide with thiophene linkage (lipophilic)
  - contains sulfur molecule which supposedly improves diffusion

* Paresthesia…predominantly lingual

Local Anesthesia





The curve represents the percentage of patients achieving pulpal analgesia in IANB at any time from 0 to 20 minutes.

One might expect that regularly returning to the operatory when only one-third of patients are numb enough to treat would not become the preferred routine, which it has not.

- At 5 minutes, the percentage of patients that are numb is about one-third.
- At 10 minutes, according to the curve, the percentage approaches 60%.

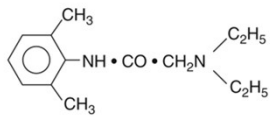
Waiting 15 or 16 minutes means that the practitioner is likely to return and find that about two-thirds of his/her patients are completely numb.

At about 15 minutes, the curve flattens, meaning waiting longer for onset to occur delivers fewer and fewer additional patients who would become numb. Thus, there appears to be practical wisdom in waiting about 15 minutes for patients receiving IANBs to get numb.

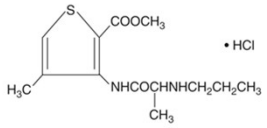
Malamed SF, Tavana S, Falkel M. Faster onset and more comfortable injection with alkalinized 2% lidocaine with epinephrine 1:100,000. *Compend Contin Ed Dent.* 2013;34(1):10-20.

Local Anesthesia

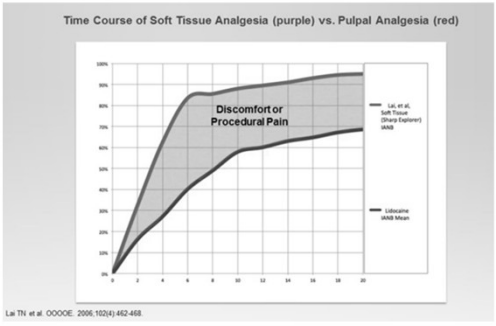
Lidocaine Hydrochloride
Pertinent Information



Articaine Hydrochloride
Pertinent Information



Local Anesthesia



Lai TN et al. OOOOE. 2006;102(4):462-468.

Local Anesthesia

Approximate Duration of Pulpal and Soft Tissue Anesthesia for Available Local Anesthetics

	Duration (min)	
Drug Formulation	**Pulpal**	**Soft Tissue**
3% mepivacaine (infiltration)	5–10	90–120
4% prilocaine (infiltration)	10–15	60–120
4% prilocaine (nerve block)	40–60	120–240
4% articaine + epinephrine 1:200,000	45–60	180–240
2% lidocaine + epinephrine 1:50,000	60	180–300
2% lidocaine + epinephrine 1:100,000	60	180–300
2% mepivacaine + levonordefrin 1:20,000	60	180–300
2% mepivacaine + epinephrine 1:100,000	60	180–300
4% articaine + epinephrine 1:100,000	60–75	180–300
4% prilocaine + epinephrine 1:200,000	60–90	180–480
0.5% bupivacaine + epinephrine 1:200,000	>90	240–720

Local Anesthesia

Local Anesthesia

Buffering

- pH without vasoconstrictors is ~**6.5**
- pH with vasoconstrictors is ~**3.5-3.9**

***Sodium bicarbonate decreases discomfort and increases onset of action**

✓***Onset***® (On**ph**arma Co.)

- Transfers precise amount of sodium bicarbonate into cartridge

✓*BufferPro*™

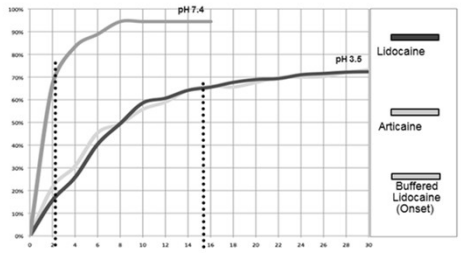
- Plastic (Septodont + Premier Dental)

* **Cost?**

Tips to achieve successful mandibular block anesthesia

"If you touch that nerve again, I'm gonna teach you a new meaning for the word *pain*."

Local Anesthesia



Local Anesthesia

Inferior Alveolar Nerve Block

100% success!!!

Local Anesthesia

Onset® **(Onpharma, Inc.)**

BufferPro™ **(Septodont)**

Local Anesthesia

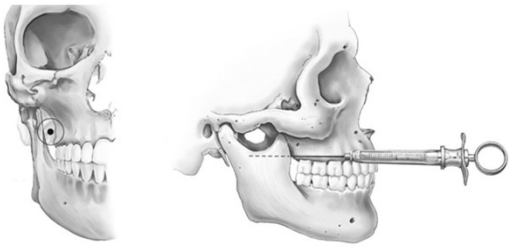
Mandibular Conduction Anesthesia

✧ Gow-Gates

- ✓Maximum opening
  - *2.2 mL
  - *2% Lidocaine w/ 1:80K
  - *Open for 20 seconds
  - *50K patients

J Oral Surg 1973

Closed Mouth Technique



✧Vazirani
Mandibular Nerve Block: A New Technique; Dental Digest 1960

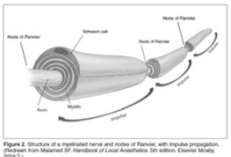
✧Akinosi
A New Approach to the Mandibular Block; Br J Oral Surg 1977

Differential Nerve Block

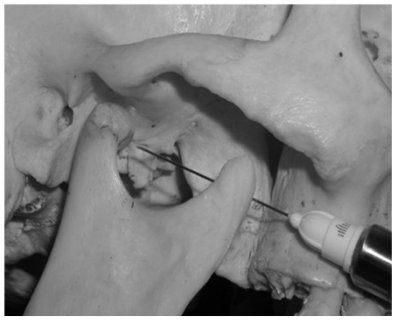
✓There is a clear relationship between the length of nerve exposed to the local anesthetic and the resultant type of anesthesia that is produced.

✓If the length of the nerve bathed by the anesthetic is sufficient, the depolarization will diminish over distance until it becomes too weak to activate sodium channels.

Raymond SA, et al. AnesthAnalg.1989;563-570



Local Anesthesia



Differential Nerve Block

JADA+ Clinical Scans

Romina Brignardello-Petersen, DDS, MSc, PhD

Combination of Gow-Gates and inferior alveolar nerve block may result in a higher rate of successful anesthesia than either technique alone

Saatchi M, Shafiee M, Khademi A, Memarzadeh B. Anesthetic efficacy of Gow-Gates nerve block, inferior alveolar nerve block, and their combination in mandibular molars with symptomatic irreversible pulpitis: a prospective, randomized clinical trial [published online ahead of print December 19, 2017]. *J Endod.* https://doi.org/10.1016/j.joen.2017.10.008.

Forty percent of participants in the GGNB group, 44% in the IANB group, and 70% in the GGNB plus IANB group had successful anesthesia. Participants who received GGNB plus IANB were 1.75 times and 1.59 times more likely to achieve successful anesthesia than those who received GGNB or IANB, respectively.

Local Anesthesia

Mandibular Differential Nerve "Alonge" Block

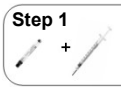
Buffering Options

Do It Yourself
(Remove & Replace)

Onset System

Do It Yourself Technique

Step 1

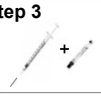


Using a tuberculin syringe, remove some of the LA from cartridge

Step 2

Using a 2nd TB syringe, draw up bicarbonate from vial

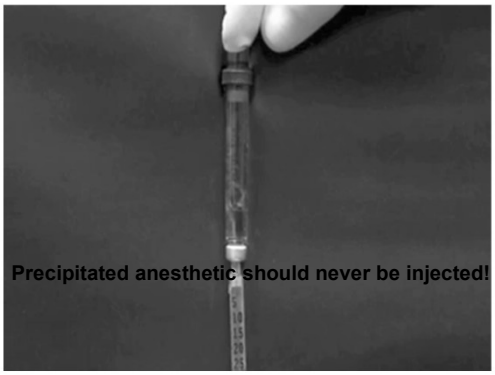
Step 3



Add bicarbonate to LA cartridge - then inject as usual

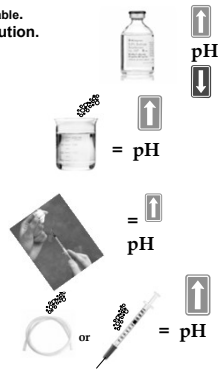
Overall
- Pretty simple, not highly precise
- Takes time; may or may not save money
- Practitioner can't control pH of bicarbonate, resulting in:
  - Risk 1 = inconsistent results
  - Risk 2 = potential harm from injecting precipitated LA
  - Risk 3 = edema if hypertonic solution

With Do-It-Yourself, the practitioner cannot safely control the pH of the bicarbonate solution, which can result in overly high pH and precipitate



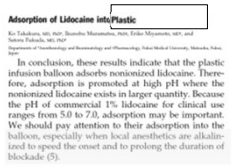
What Practitioners Should Know About CO_2 & Buffering

- The pH of sodium bicarbonate ($NaHCO_3$) solution is unstable.
- pH is determined by the amount of dissolved CO_2 in solution.
- CO_2 wants to escape solution; in fact if allowed to volatilize CO_2 will rapidly leave $NaHCO_3$ solution until pH of the solution rises to almost 10.
- Dissolved CO_2 (thus the pH of the bicarbonate buffer) must be controlled for safe and consistent results when buffering local anesthetics.
- Problem 1: By drawing up sodium bicarbonate from a vial the practitioner places the vial under a vacuum. This pulls CO_2 out of solution, increasing the pH of the buffering solution in the vial with each dose.
- Problem 2: Because CO_2 is one of the smallest molecules, CO_2 gas in solution can move right through plastic. The pH will rise as long as sodium bicarbonate solution is held in a plastic vessel, such as in a tuberculin syringe, or is transferred through plastic parts or tubing.
- Practitioners who buffer the local anesthetic must take care to manage these elements of the process so that they do not to lose control of the pH of their buffering solution.



De-ionized anesthetic: Adsorption issues with plastic contact

- Purpose of buffering is to create more de-ionized or "active" anesthetic by raising pH of the LA.
- Care should be taken when buffered local anesthetic is held in, or passes through, plastic.
- Studies indicate that some or all of the de-ionized anesthetic created by buffering will "adsorb" or stick to the surfaces of plastic in the fluid path, reducing effectiveness of the buffering and potentially reducing the efficacy of the local anesthetic.



Adsorption of Lidocaine into Plastic

In conclusion, these results indicate that the plastic infusion balloon adsorbs nonionized lidocaine. Therefore, adsorption is promoted at high pH where the nonionized lidocaine exists in larger quantity. Because the pH of commercial 1% lidocaine for clinical use ranges from 5.0 to 7.0, adsorption may be important. We should pay attention to their adsorption into the balloon, especially when local anesthetics are alkalinized to speed the onset and to prolong the duration of blockade (5).

ANESTH ANALG 2000;91:192–4

Does controlling the pH of sodium bicarbonate buffer matter?

Buffering practitioners lose control of pH by:
- Drawing $NaHCO_3$ up from multi-dose vials
- Transferring $NaHCO_3$ through plastic tubing
- Placing $NaHCO_3$ solution in plastic syringes

= pH

Failure to control pH of the buffering solution (prevent its rise) can result in:
- Inconsistent results
- Buffering the local anesthetic above physiologic pH, causing edema and tissue irritation

Best Case

- Buffering above precipitation point for the LA which risks injecting precipitated local anesthetic, causing tissue necrosis and/or permanent nerve damage

Worst Case

Buffering Options

DIY*

- $4.10 per injection
- Simple, small learning curve
- Takes prep time, imprecise
- pH of bicarbonate not controlled (utilizes vacuum and plastic vessel) causing:

= inconsistent results
= potential complications from overly high pH

Onset System*

- $3.19 per injection
- Simple, small learning curve
- No plastic in LA fluid path (no adsorption)
- Controls for pH of bicarbonate
- Consistent results using dental armamentarium

In 2016 and again in 2019, "Hand Mixing" (DIY) was compared to the Onset System by Donaldson and Goodchild. In both studies the authors found that either process could be used to achieve the same pH change in a local anesthetic cartridge, although in the latter study the authors commented that Hand Mixing represented the more complex process. See, e.g., Novel Direct Injection Chairside Buffering Technique for Local Anesthetic Use in Dentistry, Goodchild JH, Donaldson M, Compend Contin Educ Dent, 2019, July/Aug;40(7):e1-e10, and Comparing the pH Change of Local Anesthetic Solutions Using Two Chairside Buffering Techniques, Donaldson M, Goodchild JH, Compend Contin Educ Dent, 2016, May; 37(5): e6-e12.

Hypertonic Solution