

Mythbusters – Local Anesthesia Edition

Myth #1: “My Dentist Still Uses Novocain”

We all know this myth is totally BUSTED, but let’s briefly look back at the history of Novocain... by the way there is no “e” in Novocain (the brand name for procaine)

Historical Perspective

- The first local anesthetic was Cocaine
- Carl Koller (September 1884) used cocaine as a local anesthetic during a surgical procedure (for glaucoma)
- “The facts are that neither Freud nor I discovered that cocaine is a local anesthetic. This was discovered by Dr. Albert Niemann, who extracted the potent principle from coca leaves in 1860” ~ Dr. Koller (*JAMA* 1941;117(15)1284.)
- Dr. Koller was nominated for the Nobel Prize several times but never received it, mostly because his discovery was made 17 years before the Nobel Prize was created. (www.dentaleconomics.com/articles/print/volume-89/issue-3/features/the-story-of-local-anesthesia.htm)
- William Halsted (November 1884) developed the principles of nerve block using Cocaine
- Infraorbital and IA blocks were performed on him as a “guinea pig” it took him 3 years to overcome his resulting Cocaine addiction (*Ann Surg* 1997 May;225(5):445-58.)
- Due to the unfavorable therapeutic index of Cocaine the search was on for a less toxic compound with LA properties:
 - 1904 – Alfred Einhorn synthesized the ester Procaine (Novocain)
 - 1943 – Nils Lofgren synthesized Lidocaine which possessed:
 - Less allergenicity
 - More potency
 - More rapid onset of action
 - First brand name = Xylocaine (Astra Pharmaceutical)
 - 2000 – Articaine granted FDA approval in the US
 - 2008 – OraVerse (phentolamine mesylate) approved

A little more info on Procaine...

- First synthetic injectable local anesthesia used in dentistry
- Produced the greatest amount of vasodilation of all currently used local anesthetics
- Ester type – capable of allergy - PABA
- pKa=9.1, slow onset (6-10 minutes) and at physiologic pH existed as 90% charged (inactive) and 10% uncharged (active)
- Duration of action (epinephrine can be added to prolong action)
- Pulpal anesthesia (mx infiltration) lasts about 5 minutes.
- Soft tissue anesthesia lasts for approximately 30 minutes
- Blocks are not recommended (slow onset, ultra short duration)
- Systemic toxicity negligible because procaine is rapidly destroyed in the plasma

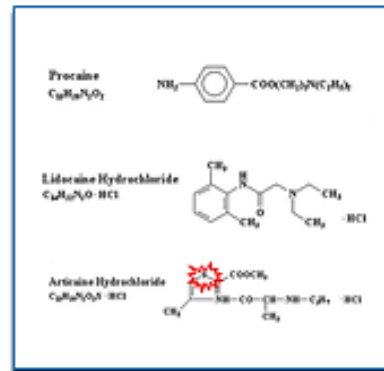
Local Anesthetics – Esters vs. Amides vs. Articaine?

Esters

- Cocaine
- Procaine (Novocain)
- Propoxycaïne
- Benzocaine
- Chlorprocaine
- Dyclonine (Cēpacol Maximum Strength)
- Tetracaine (Cēpacol Viractin, Pontocaine)

Amides

- Lidocaine
- Mepivacaine
- Prilocaine
- Bupivacaine
- Etidocaine
- Articaine



Malamed SF. Articaine 30 Years Later. Oral Health, Feb 2016.

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Approximate Year of First Clinical Use

- Articaine (mixed Ester and Amide)
- Developed in Germany in 1969
- FDA approved in US 2000 (Europe 1976, Canada 1983)
- Marketed as Articadent[®], Septocaine[®], Zorcaine[®], Orabloc[®]
- Supplied in 1.7 mL cartridges
- Half-Life is approximately 27 minutes
- Max number of cartridges in an adult is 7

Cocaine	1884
Benzocaine	1900
Procaine	1905
Dibucaine	1929
Tetracaine	1930
Lidocaine	1948
Nesacaine	1955
Mepivacaine	1957
Prilocaine	1960
Bupivacaine	1963
Articaine	1969
Ropivacaine	1992

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1.7mL vs. 1.8mL on Local Anesthetic Cartridges

- Average cartridge volume in U.S. is 1.76mL (*JADA* 2007;138:1104–1112.)
- During the approval process for Articaine in the 1990's the FDA asked the manufacturer, "Can you guarantee that each and every cartridge contains at least 1.8mL of solution?" the answer was "No." (Malamed SF. Clinical Action of Specific Agents. In: Handbook of Local Anesthesia. 6th Edition. 2014. p 56.)
- Therefore, manufacturers began printing a volume of 1.7mL on the cartridges

Lots of Brand Names for local anesthetic solutions...

- Retail costs for local anesthetics \$30-50
- Exception is Bupivacaine ~\$60

Myth #2: “Doctor, I’m allergic to epinephrine!”

Again, we know this myth is BUSTED, but this is such a common patient report that is worth looking into!

Pharmacokinetics of Epinephrine

- Naturally occurring
- It is on the World Health Organization's List of Essential Medicines, the most important medications needed in a basic health system
- Onset of action: 1-2 minutes
- Duration of action: 1-2 minutes
- Acts directly on alpha and beta adrenergic receptors (50:50, alpha constricts and beta dilates)
- Antagonizes the effects of histamine
- Stimulates the liver to produce and raise blood glucose levels
- Increases HR, cardiac contractility, and systemic vascular resistance
- Increases myocardial oxygen demand

Epinephrine – Historical Progression

- In 1986, the AHA emphasized safety by concluding, “Vasoconstrictor agents should be used in local anesthesia solutions during dental practice only when it is clear that the procedure will be shortened or the analgesia rendered more profound. When a vasoconstrictor is indicated, extreme care should be taken to avoid intravascular injection. The minimum possible amount of vasoconstrictor should be used.”
- Malamed and Bennet, proposed 0.04mg as a maximum dose of epinephrine for patients with severe cardiac disease

Table 1. Contraindications to vasoconstrictors in dentistry

Absolute contraindications
Heart diseases
a. Unstable angina
b. Recent myocardial infarction
c. Recent coronary artery bypass surgery
d. Refractory arrhythmias
e. Untreated or uncontrolled severe hypertension
f. Untreated or uncontrolled congestive heart failure
Uncontrolled hyperthyroidism
Uncontrolled diabetes
Sulfite sensitivity; steroid-dependent asthma
Pheochromocytoma
Relative contraindications
Patients taking tricyclic antidepressants
Patients taking phenothiazine compounds
Patients taking monoamine oxidase inhibitors
Patients taking nonselective β -blockers
Cocaine abuser

References:

Dent Clin North Am 2002;46(4):733-46.

Oral Surg Oral Med Oral Pathol 1992;74:679-86.

0.04mg Maximum Dose?

- The graph illustrates why 1-2 cartridges of 2% lidocaine with 1:100,000 epinephrine can cause epinephrine concentrations that mimic moderate exercise.
- For patients with significant cardiac disease this dose should be able to be tolerated

Activity	Epinephrine concentration (pg/mL)	% Baseline
Lying	~10	~100
Sitting	~15	~150
Standing	~20	~200
Smoking	~35	~400
Public speaking	~40	~450
Moderate exercise	~100	~1000
Strenuous exercise	~200	~2000
Myocardial infarction	~200	~2000
Severe hypoglycemia	~200	~2000

WBS THE DENTAL CLINIC OF NORTH AMERICA
 Vasoconstrictors: indications and precautions
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The “Reaction”

- But what about those patients who suffer from the following symptoms after local anesthetic injection?
- Heart palpitations or racing heartbeat
- Pale, sweaty skin
- Dizziness
- Nervousness
- Headache
- Most likely to occur during IANB
- Rates of positive aspiration for IANB :
 - 5.8% in approximately 6000 injections (Ann Anat 1999;181:105-6.)
 - 8.1% in 731 injections (JADA 1999;130:496-9)
 - Other authors have suggested a wider range (2.6-30%) with factors such as needle size and anatomy playing a role (JADA 1992;123:69-73)
 -

Technique	Needle Gauge	Needle Length
Palatal Approach (ASA)	30	Ultrashort
PSA Nerve Block	27	Short
Infiltration	27	Short
Buccal (Long) Nerve Block	27	Short
PDL Injection	27	Short
IA Nerve Block	25	Long
Gow-Gates Nerve Block	25	Long
Vazirani-Akinosi Nerve Block	25	Long

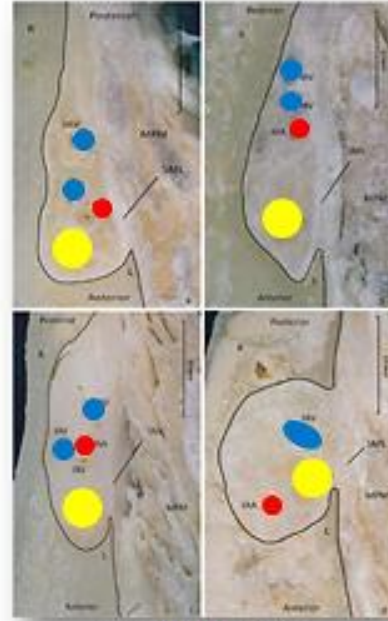
Source: Malamed SF. Handbook of Local Anesthesia. 2004, 5th Ed. p 106.

Location of the Nerve and Vessels in the Mandible

Transverse sections of the right mandibular ramus at the level of the lingula of four representative specimens

These specimens show the inferior alveolar nerve to be located posterolateral to the tip of the lingula

The location of the inferior alveolar artery and vein(s) varies significantly with the inferior alveolar artery being posterior or posterolateral



Take home message...

“The addition of a suitable vasoconstrictor in adequate concentration increases the efficiency of local anaesthetic preparations and reduces the toxicity; their presence is therefore desirable. There is far greater danger of untoward reactions from the use of preparations without a vasoconstrictor than from the small amount of adrenaline normally present.”

(*Aust Dent J* 1968 Feb;13(1):65-9.)

Recommendations:

- The “Reaction” is most likely to occur during IANB in the mandible
- Use the right size needle (avoid 30ga for IANB in adults and kids) (*Dent Clin North Am* 2010;54:745-756.)
- Aspirate (twice)
- Slow injection technique – fast injection technique may cause back pressure within the vessel and decrease chances of positive aspiration (*Ann Anat* 1999;181:105-106)
- Consider reduced/no epinephrine dose formulations:
 - 4% articaine with 1:200,000 (multiple brands)
 - 4% Citanest Forte with 1:200,000 epi (Prilocaine, Dentsply Sirona)
 - 3% mepivacaine (multiple brands)
 - 4% Citanest (Prilocaine, Dentsply Sirona)
 - 2% Xylocaine (Lidocaine, Dentsply Sirona), last available 2011 in the U.S. (*Pediatr Dent* 2015 Sep-Oct;37(5):71-77)

Myth #3: “First, I give a local anesthetic without epinephrine to my patients, because it stings less.”

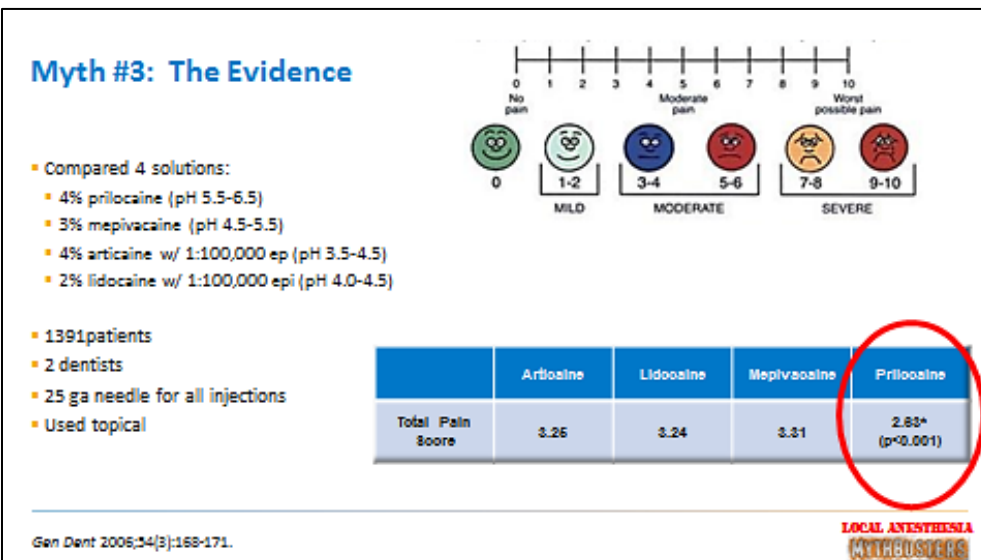
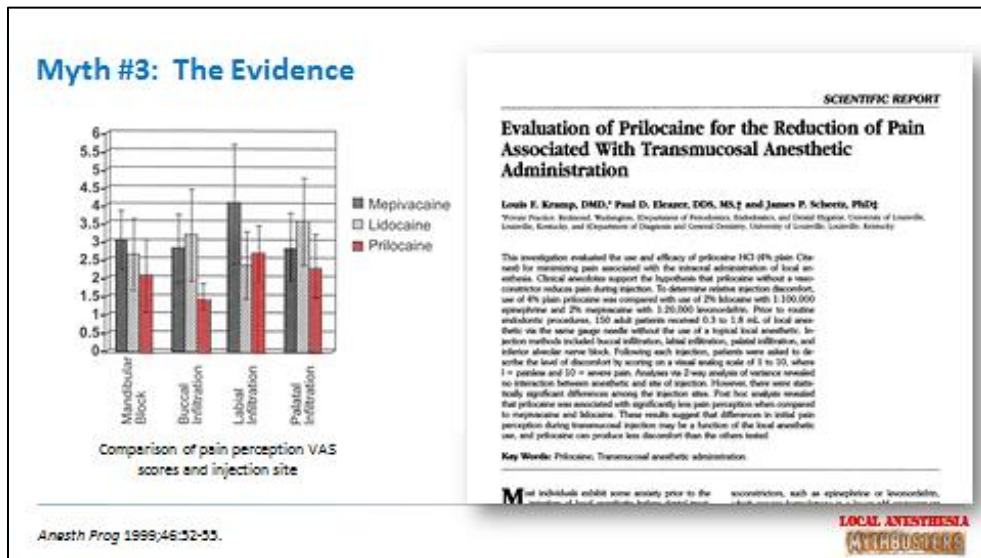
Background: Some dentists believe that by using a plain local anesthetic solution (ie, no epi) that the patient won't feel a pinch, sting, or burn at injection

Could be related to pH. It is well-known that solutions containing a vasoconstrictor (eg, epi) have a lower pH than plain solutions

Local Anesthetic Ph (Source: *Compend Contin Educ Dent* 2016 May;37(5):e6-e12.)

Average pH of solutions containing epinephrine: 3.82

Average pH of plain solutions: 6.34



Myth #3: The Evidence

MEAN REPORTED PAIN SCORES AT EACH OF THREE NONPALATAL INJECTION SITES.

INJECTION SITE	MEAN PAIN SCORE* (NO. OF PATIENTS)		T TEST RESULT
	Bupivacaine With Epinephrine (n = 300)	Prilocaine Plain (n = 291)	
Anterior Maxillary Infiltration	1.75 (26)	0.75 (40)	< .0002
Posterior Maxillary Infiltration	1.59 (117)	0.64 (110)	< .0001
Inferior Alveolar Nerve Block	1.41 (157)	0.74 (141)	= .0001

* 0, No pain; 1, mild pain; 2, moderate pain; 3, distressing pain; 4, unbearable pain; 5, intolerable pain.

JADA 2002;133:1652-1656.

Injection pain of bupivacaine with epinephrine vs. prilocaine plain

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The discovery of local anesthetic agents that are every age has enabled modern dentistry to be performed almost painlessly. However, the delivery of local anesthetic solutions still can be uncomfortable, with pain resulting not only from the needle puncturing the mucosa, but also because of properties of the anesthetic solution themselves. Local anesthetic solutions with low pH have been thought to cause a burning sensation and the pain of these drugs plus their anesthetics with more neutral pH. In a study, some stress agents have assumed that prilocaine plain (1% Citapan Plain, distribution with Pharmacia-Upjohn LP, Kalamazoo, Mich) and bupivacaine (0.5% Marcaine, distribution by Dentsply Pharmaceuticals, York, Pa.) is pH 4.0 to 7.0, which have pain on injection than do other anesthetics with lower pH. Reported 0.5 percent bupivacaine with epinephrine (Calk-Maine, Bannockburn, Ill.) is reported to have a pH of 4.0. Bupivacaine 0.5 percent is reported to have a pH of 4.0.

ABSTRACT

Background. Prilocaine plain has been described to be less painful on injection than bupivacaine with epinephrine, possibly because of the higher pH of the prilocaine anesthetic solution.

Methods. In a double-blind study design, the maximum pain score for a general dental practice treated maxillary-inferior infiltration, posterior palatal infiltration or inferior alveolar block injections, administered under clinical conditions by two dentists, 100 patients were injected, patients noted the pain from each injection on a 5-point scale. The pain response was recorded according to timing device, location of injection, patient's age and anesthesia administered.

Results. The reported pain on injection of bupivacaine with epinephrine was significantly greater than that of prilocaine plain. Patients reported no significant difference in pain of different injection techniques, except that posterior injection caused significantly more reported pain than did inferior maxillary infiltration, posterior maxillary infiltration or inferior alveolar block injections.

Conclusions. Under clinical conditions, the injection of bupivacaine with epinephrine causes significantly more reported pain than the injection of prilocaine plain.

Clinical implications. Dentists using bupivacaine with epinephrine and prilocaine plain have similar advantages and disadvantages that should be considered before choosing an anesthetic for a dental procedure. A lower pH of bupivacaine with epinephrine is not a problem since patients report less pain than prilocaine plain.

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Myth #3: "First, I give a local anesthetic without epinephrine to my patients, because it stings less."

If injection pain is a concern...

- Consider the use of plain solutions, especially prilocaine
- Avoid solutions that contain epi, as a first injection



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One more thing... who has heard of buffering local anesthetics?

- Local anesthetic buffering involves adding Sodium Bicarbonate to low pH solutions to raise the pH closer to physiologic levels
- Possible benefits include:
 - Faster onset
 - Better efficacy
 - Less injection pain
 - The data on whether buffering decreases injection pain is equivocal (*Gen Dent* 2015;63(6):74-78.)
 - All the studies look at buffered vs. non-buffered lidocaine or articaine
 - We need to look at buffered vs. prilocaine!

Myth #4: “I use small needles for my injections because they are less painful to the patient compared to larger needles.”

Background: There is a long-standing belief in dentistry that using a smaller gauge needle will cause less discomfort to the patient

This myth has long persisted despite some early evidence:

- “patients are unable to differentiate among 23-, 25-, 27-, and 30-gauge needles” (*NY State Dent J* 1972;38:425-426.)
- “no significant differences in the perception of pain produced by 25-, 27-, and 30-gauge needles during inferior alveolar nerve blocks in adults” (*JADA* 1979;99:822-824.)

Myth #4: The Evidence

- 930 injections, 810 patients
- Topical used
- Needle sizes:
 - Maxillary 25-, 27-, 30-ga short needles
 - Mandibular 25-, 27-gauge long needles
- Pain rated on a 0-10 scale

“There is no statistically or clinically significant difference between perceived pain of injection based on the needle gauges commonly used in dentistry.”

Gen Dent 2007;55(3):216-7.

Size doesn't matter: Needle gauge and injection pain

Table 1. Overall results for needle gauge and pain.

Needle gauge	0	1	2	3	4	5	6	7	8	9	10	#
25	74	34	123	32	37	7	21	4	7	3	1	343
27	75	39	146	26	64	11	18	4	7	0	1	391
30	61	25	54	15	17	7	10	3	3	0	1	196

χ^2 (2df) square distribution value) = 30.6
df (degrees of freedom) = 20
 $p = 0.06$

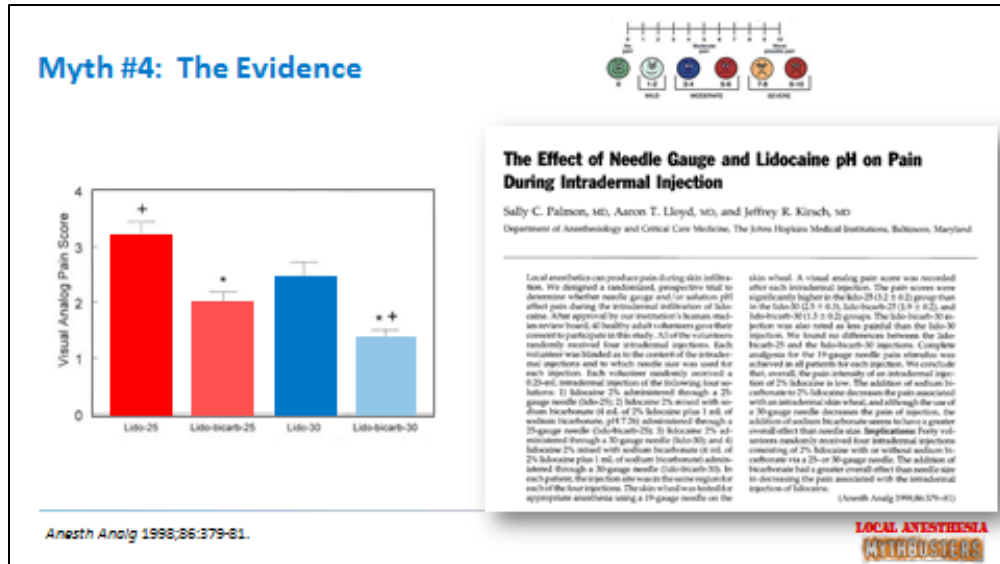
Myth #4: The Evidence

- 138 injections, 36 patients
- Into the abdomen
- Needle sizes: 21-, 23-, 27-gauge
- Each patient received all three injections and rated pain as:
 - Least painful
 - Intermediate
 - Most painful

J Plast Surg Hand Surg 2006;50:113-8.

Table 1. Participants' preferences with regard to needle gauge.

Needle gauge	Most painful	Intermediate	Least painful
21G	15	15	6
23G	12	17	7
27G	5	19	21

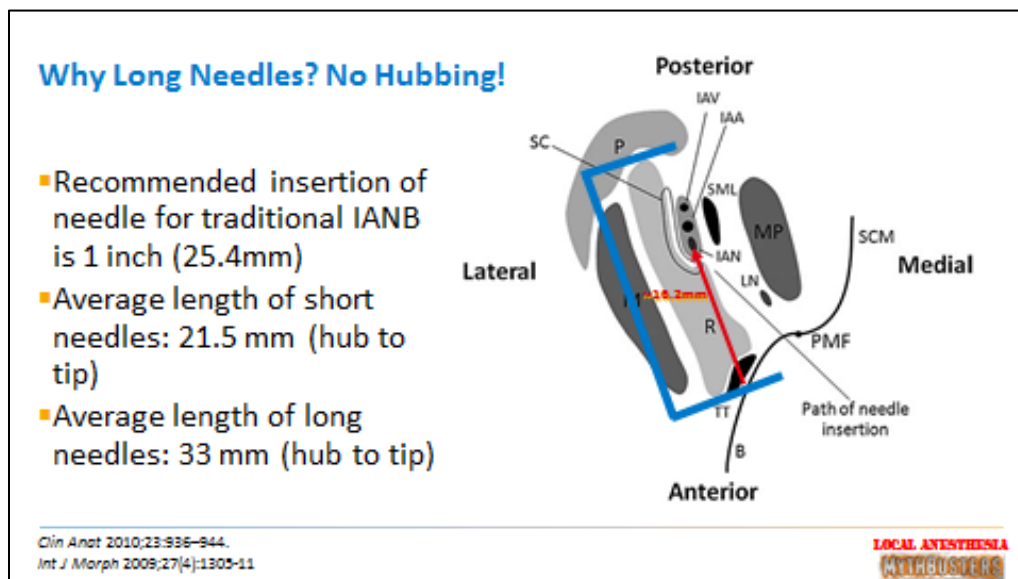


The Verdict...UNCLEAR

Recommendations

- Use the right size needles!
- Why? Not for patient comfort but for reasons such as:
 - Needle deflection
 - Ability to aspirate (less pressure required)
 - Decreased risk of breakage
- For IANB use 25- or 27-ga long needles
- For infiltrations use 27-ga (or 30-ga) short needles
- To help avoid needle breakage:
 - Minimize bending of needles
 - Minimize reorienting needles when in tissue
 - Avoid hubbing the needle

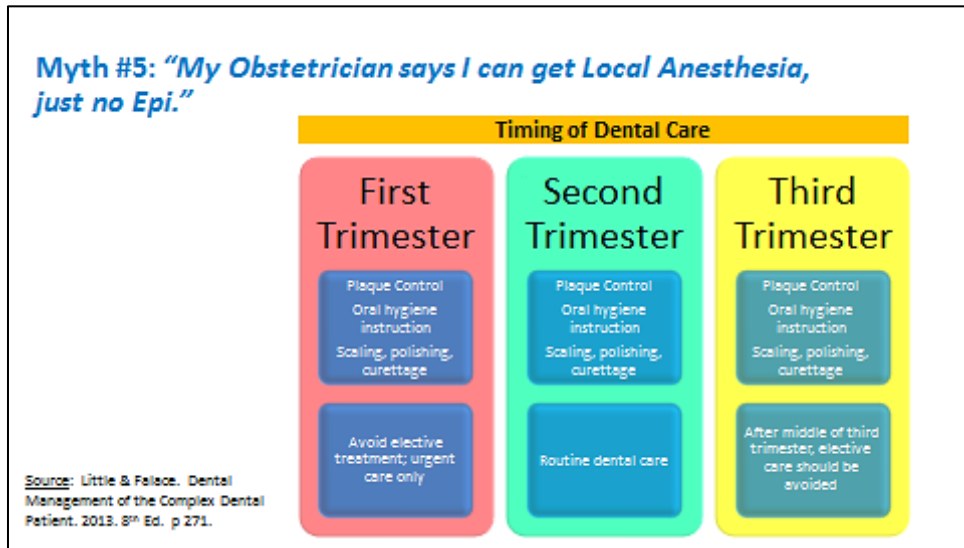
Why Long Needles? No Hubbing!



Myth #5: “My Obstetrician says I can get Local Anesthesia, just no Epi.”

Changes in 2014:

- On 12/13/2014, the FDA published the Pregnancy and Lactation Labeling Final Rule (PLLR), which changed the labeling requirements for the pregnancy and lactation sections for prescription drugs and biological agents
- The final rule removed the pregnancy letter categories, and created descriptive subsections
- Labeling changes from this rule begin on June 30, 2015. Previously approved drugs from June 30, 2001 will switch to the new labeling gradually.
- This rule does not apply to OTC medications



What is a TERATOGEN?

Any agent that can disturb the development of an embryo or fetus. Teratogens may cause a birth defect in the child. Or a teratogen may halt the pregnancy outright. The classes of teratogens include radiation, maternal infections, chemicals, and drugs.

Category	FDA Pregnancy Risk Factor Definitions
A	<u>Controlled studies in women</u> fail to demonstrate a risk to the fetus in the first trimester (and there is <u>no evidence of risk</u> in later trimesters), and the possibility of fetal harm appears remote.
B	Either animal reproduction studies have not demonstrated a fetal risk but there are <u>no controlled studies in pregnant women</u> or <u>animal reproduction studies have shown an adverse effect</u> (other than a decrease in fertility) that was not confirmed in controlled studies in women in the first trimester (and there is no evidence of risk in later trimesters).
C	Either studies in animals have revealed adverse effects on the fetus (teratogenic, embryocidal, or other) and there are no controlled studies in women or studies in women and animals are not available. <u>Drugs should be given only if the potential benefit justifies the potential risk to the fetus.</u>
D	<u>There is positive evidence of human fetal risk</u> , but the benefits of use in pregnant women may be acceptable despite the risk (for example, if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective).
X	Studies in animals or human beings have demonstrated fetal abnormalities or there is evidence of fetal risk based on human experience, or both, and <u>the risk of the use of the drug in pregnant women clearly outweighs any possible benefit.</u> The drug is contraindicated in women who are or may become pregnant.
N	FDA has not classified the drug

The Facts:

- Medication use during pregnancy is common; two out of every three women take prescription medications during pregnancy. (*American Journal of Obstetrics and Gynecology* 2004; 191:398-407.)
- Medication use during pregnancy still causes great anxiety and misunderstanding among both the public and health care professionals.
- The majority of birth defects have an unknown cause, however one early publication estimated that 2-3% of birth defects are thought to be caused by medications taken during pregnancy. (*Teratology* 1973; 7:3-15.)

Local Anesthetics	Pregnancy Category	Safe during Pregnancy?	Safe during breastfeeding?
Articaine	C	Use with Caution	Use with caution
Bupivacaine	C	Use with Caution	Yes
Lidocaine (with or without epinephrine)	B	Yes	Yes
Mepivacaine (with or without levonordefrin)	C	Use with Caution	Yes
Prilocaine	B	Yes	Yes
Benzocaine (topical)	C	Use with caution	Use with caution
Dyclonine (topical)	C	Yes	Yes
Lidocaine (topical)	B	Yes	Yes
Tetracaine (topical)	C	Use with caution	Use with caution

Source: *JADA* 2012;143(8):858-871.

The Concern:

The effects on the uterus, specifically:

- Uterine blood flow (alpha effects)
- Uterine muscle tone (beta effects)

Myth #5: "My Obstetrician says I can get Local Anesthesia, just no Epi."

- **Background:** Dentists and Hygienists are often faced with a request from the OB and/or patient to avoid using epinephrine in local anesthesia during dental treatment
- **The Concern:**
 - The effects on the uterus, specifically:
 - Uterine blood flow (alpha effects)
 - Uterine muscle tone (beta effects)

Evidence:
Studies concur that the addition of epinephrine to a bolus of local anesthetic agent decreases the total dosage of the local anesthetic agent required to provide for adequate pain relief during labor without compromising uterine blood flow.
These results suggest that local anesthetic agents with epinephrine (< 0.1 mg bolus dose) are safe in healthy pregnant patients.

References:
1. Br J Anaesth 1991;67:678-682.
2. Br J Anaesth 1993;71:384-353.
3. Reg Anesth Pain Med 2000;25:328-334.

JADA 2012;143(8):858-871.
Dent Clin North Am 2002;46(4):733-746.

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A true contraindication to epinephrine in local anesthetics for pregnant dental patients is if the pregnancy is complicated by hypertension.

References:

- Br J Anaesth 1991;67:678-682.
- Br J Anaesth 1993;71(3):348-53.

Myth #5: "My Obstetrician says I can get Local Anesthesia, just no Epi."

▪ Background: Dentists and Hygienists are often faced with a request from the OB and/or patient to avoid using epinephrine in local anesthesia during dental treatment

▪ The Concern:

- The effects on the uterus, specifically:
 - Uterine blood flow (alpha effects)
 - Uterine muscle tone (beta effects)

Evidence:

A number of investigators have shown that less than 0.1 mg of epinephrine as a bolus dose prolonged the duration of epidural anesthesia without affecting the duration of labor. (equivalent to 5 cartridges 1:100,000 epinephrine)

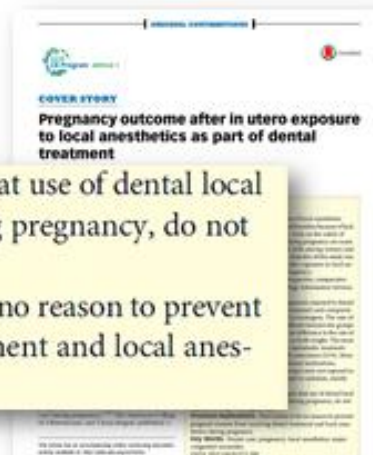
References:

1. Anesth Analg 1987;66:447-451.
2. Anaesthesia 1988;43:100-103.
3. Anesth Analg 1987;66:71-73.
4. Anesth Analg 1984;63:973-979.
5. Anesth Analg 1985;64:383-391.

JADA 2012;143(8):838-871.
Dent Clin North Am 2002;46(4):733-746.

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Myth #5: The Evidence



Conclusions. This study's results suggest that use of dental local anesthetics, as well as dental treatment during pregnancy, do not represent a major teratogenic risk.

Practical Implications. There seems to be no reason to prevent pregnant women from receiving dental treatment and local anesthetics during pregnancy.

JADA 2015;146(8):572-580.

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The Verdict...

This myth is BUSTED. Your safest choices if a local anesthetic is indicated for a pregnant patient are:

- Lidocaine with or without EPI
- Prilocaine with or without EPI

Myth #6: “I don’t use articaine for blocks because it causes paresthesia.”

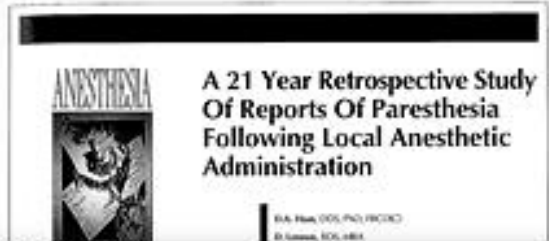
- A paresthesia as an abnormal sensation, such as of burning, pricking, tickling, or tingling
- Paresthesias are one of the more general groupings of nerve disorders known as neuropathies
- Paresthesias may manifest as total loss of sensation (ie, anesthesia), burning or tingling feelings (ie, dysesthesia), pain in response to a normally nonnoxious stimulus (ie, allodynia), or increased pain in response to all stimuli (ie, hyperesthesia)

Articaine important dates: (Malamed SF. Articaine 30 years later. Oral Health. Feb 2016)

- 1969: Developed in Germany
- Entered clinical use
 - 1976: Germany
 - 1983: Canada
 - 1998: United Kingdom
 - 2000: United States
 - 2005: Australia

Myth #6: the Evidence

- The study revealed a higher than expected frequency of paresthesia following the use of articaine and prilocaine¹
- A follow-up study by Haas in 2009 also found a higher than normal frequency of nerve injuries for articaine during a 10-year period (1999-2008)²
 - Articaine: 109
 - Lidocaine: 23
 - Prilocaine: 29
 - Multiple agents: 15



Chi-Square Analysis of All Agents: 1993

Anesthetic Agent	Total # of Cartridges Used	Observed Frequency	Expected Frequency	(Obs - Exp) ² / Exp
Articaine	4,398,970	10	5.298	4.173
Bupivacaine	241,679	0	0.291	0.291
Lidocaine	3,052,613	0	3.688	3.688
Mepivacaine	1,569,037	0	1.890	1.890
Prilocaine	2,352,615	4	2.833	0.481
Total	11,624,914	14	14	Chi-square = 10.523, 4df, p < 0.035

1. J Can Dent Assoc 1995 Apr;81(4):519-30.
 2. J Can Dent Assoc 2009 Oct;75(8):579-84.

LOCAL ANESTHESIA MYTHBUSTERS

Myth #6: The Evidence

- Examined nerve injuries in Denmark from 1997-2004
- 56 total
- Highlighted the lingual nerve as a high risk area for nerve injury



	Inferior alveolar nerve	Lingual nerve	Sum N (%)
Articaine 4%	5	24	29 (54%)
Prilocaine 3%	4	6	10 (19%)
Lidocaine 2%	3	7	10 (19%)
Mepivacaine 3%	0	4	4 (7%)
Mepivacaine 3% + Articaine 4%	0	1	1 (2%)
Number of nerve injuries	12	42	54 (100%)

Int J Oral Maxillofac Surg 2006;35:437-443.

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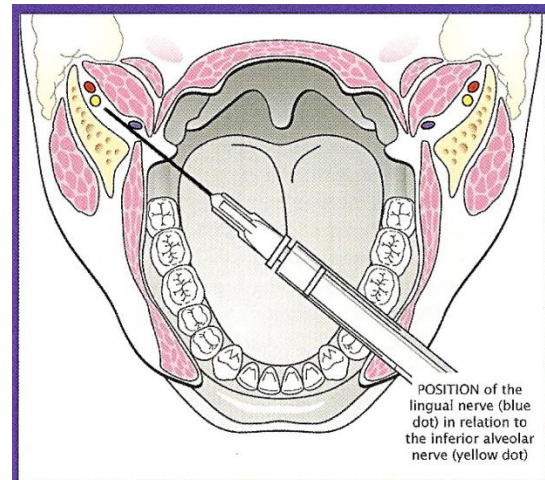
A 2003 study showed a range in the number of fascicles present within the lingual nerve, being anywhere from 1 to 8. Of the 12 nerves studied, 4 (33%) had only 1 fascicle

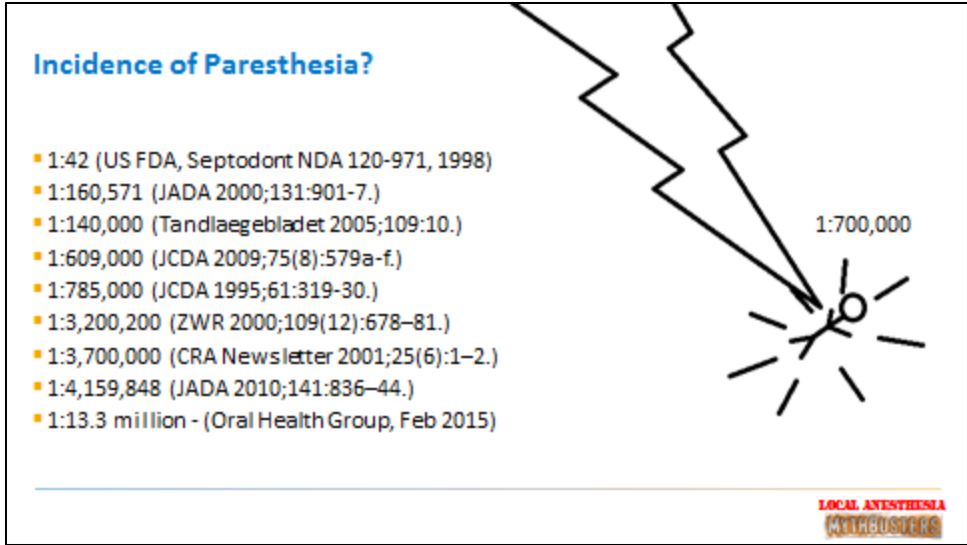
The investigators speculated that a unifascicular nerve may be injured more easily than a multifascicular one

To date, this seems to be the most plausible explanation for the finding of the predilection of the lingual nerve for permanent paresthesia

References:

- JADA* 2003;134(2):195-199.
- Team Work* 2009;2(2):28-34.





- Let's keep it real... PARESTHESIA IS A RARE EVENT!
- The mechanism is UNCLEAR
- Factors thought to be involved with Paresthesia:
 - Direct needle trauma
 - Intra-neural hematoma
 - Extra-neural hematoma
 - Edema (extra- and intra-neural)
 - Chemical neurotoxicity of articaine

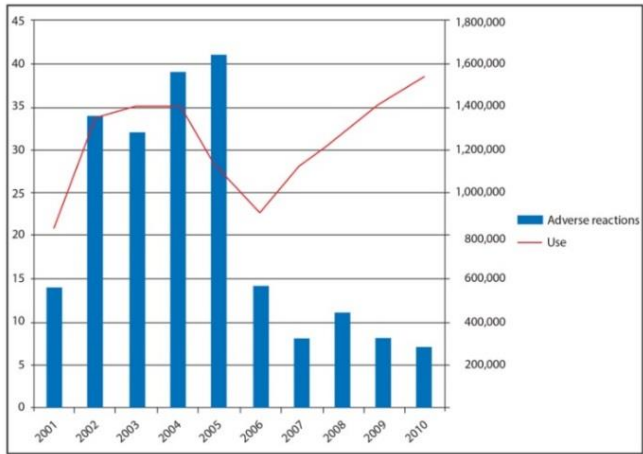
“Weber Effect”:

where a new product when introduced to the marketplace is subject to a closer level of scrutiny by users than more traditional, well-known products

At some point you see... fewer reports of adverse events despite increased use

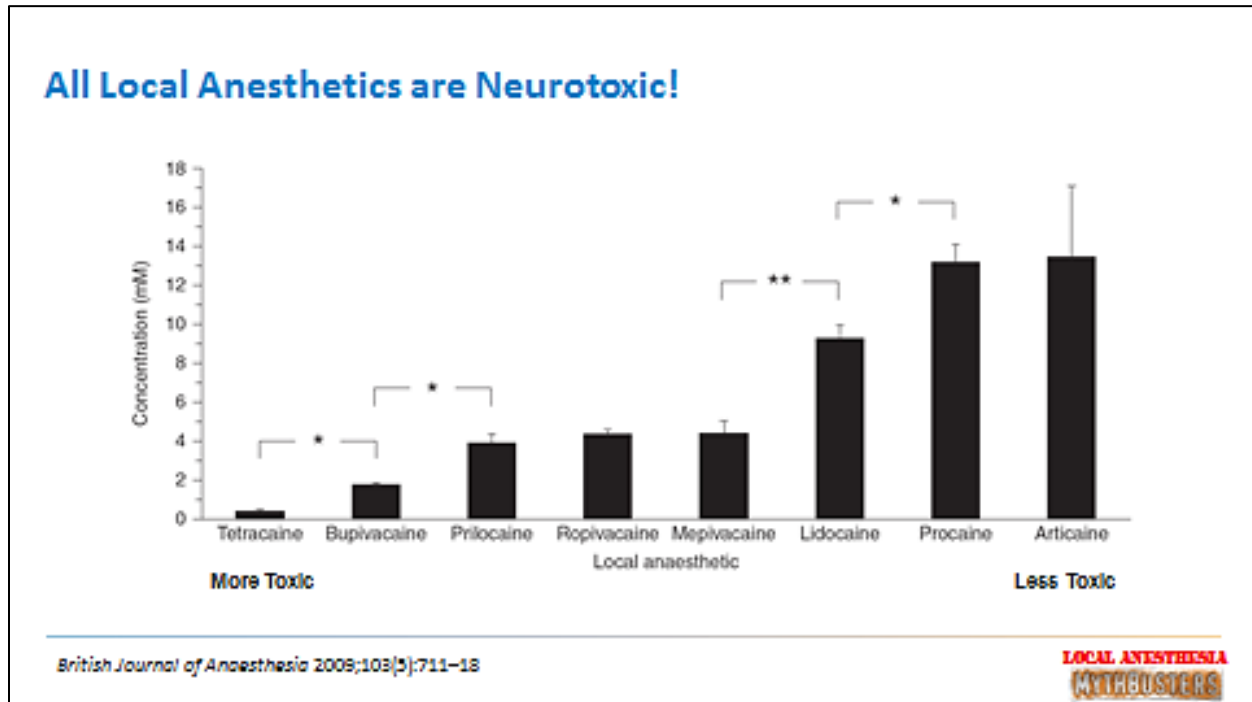
Reference:

- *Dent Update* 2015; 42: 88-93.
- *JADA* 2010;141(7):836-844.
- www.OralHealthGroup.com



Neurotoxicity?

- Articaine may be less neurotoxic than other local anesthetics
- 4% versus 2%?



The Verdict... UNCLEAR

- Despite reports about paresthesias and articaine – the data linking the two is largely anecdotal and of insufficient quality to make clinical guidelines - retrospective and biased
- Controlled studies are needed!
- Clinical neurotoxicity of 2% vs. 4% solutions is unclear and unproven
- The risks ratios are all over the map!
- Change technique rather than local anesthetic?

So what should I do?

- Use articaine for IANB injections
- If not convinced, use lidocaine (buffered?)
- Or, use lidocaine for IANB, use articaine via buccal infiltration
- Or, use articaine only on the maxilla or not at all