Welcome to the Greater New York Dental Meeting

Greater New York Dental Meeting™
Executive Headquarters
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Sponsored by New York County & Second District Dental Societies

All programs and exhibits are held at the Jacob K. Javits Convention Center (unless otherwise indicated)
11th Avenue between 34th and 39th Street, New York City

General Registration Hours
Friday, November 29          12:00 Noon - 4:30 P.M.
Saturday, November 30         8:00 A.M. - 4:30 P.M.
Sunday, December 1 - Tuesday, December 3 8:00 A.M. - 5:30 P.M.
Wednesday, December 4        8:00 A.M. - 4:30 P.M.

Exhibit Hall Hours
Sunday, December 1 - Tuesday, December 3 9:30 A.M. - 5:30 P.M.
Wednesday, December 4         9:30 A.M. - 5:00 P.M.

COURSE REGISTRATION
Pre-registration is required for all continuing education courses with the exception of the “Live” Dentistry and Affiliated Groups. Your seat will be held for 15 minutes after the start of the course; after that, those without tickets will be seated according to space availability. When the room is filled, no additional people will be admitted due to fire department regulations. If you have not pre-registered, please be prepared to select an alternate session to attend.

Tickets
Tickets are required for all courses excluding Live Dentistry. Tickets for all functions can be purchased at all general registration booths located in the Registration Area on the Upper Level in the Crystal Palace and online.

6 Days of Education Seminars, Hands-on Workshops & Essays
Friday - Wednesday

3 Days of Education Seminars, Hands-on Workshops & Essays
Thursday - Saturday

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FREE “Live” Dentistry
Hi-Tech 450 Seat Arena

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Hi-Tech 450 Seat Arena

Friday, December 1
9:45 - 11:45
VOCO America, Inc.
Drs. Ron Kaminer & Marc Geissberger
Restorative

9:45 - 11:45
Shofu
Dr. Ron Kaminer
Restorative

SUNDAY
1:30 - 2:45
Philips Sonicare
Dr. Gerard Kugel
Whitening

1:30 - 2:45
First Fit
Drs. Frederick E. Solomon
Cyrus Tahmasebi
Digital

MONDAY
3:00 - 5:15
3Shape
Dr. Sundeep Rawal
Digital

3:00 - 5:15
Align I Invisalign l Itero
Drs. Karla Soto &
Christian Coachman
Restorative

TUESDAY
2:00 - 4:15
GlideWell
Dr. Justin Chi
Digital

2:00 - 4:15
Benco / Vatech
Dr. Aeklayya Panjali
Implant

WEDNESDAY
2:00 - 4:15
Apa / CareCredit
Drs. Michael Apa
Aesthetic

Welcome to the Greater New York Dental Meeting

John Quiñones
Monday, December 2nd
12:00 - 2:00 - Ticket 4010
$125.00

Celebrity Luncheon Speaker

5th Annual Global
Orthodontic Conference

3rd Annual
Pediatric Dentistry Summit

12th Annual
INVISALIGN® - GNYDM EXPO
4 Days of Programming:
Sunday - Wednesday

Botox and Facial Fillers
Seminar & Workshop

Over 1,700 Exhibit Booths
90% of all patients report being anxious about going to the dentist or dental hygienist and receiving a shot.

Physiology of Anesthetic Agents

- How do we assess anesthesia?
  - Question the patient
  - Probe the area
  - Electric pulp tester
  - Cold test

- How is anesthetic success defined in studies?
  - Ideal: 2 consecutive 80/80 readings with EPT within 15 minutes of injection (and sustained for 60 mins)

- Cold Test:
  - Spray some Endo Ice (or use an ice stick) on to a cotton swab and place it on the dried buccal surface of the tooth/teeth you need to work on

Physiology of Anesthetic Agents

- Onset of anesthesia:
  1. Dependent upon anesthetic agent
  2. Dependent upon technique, block versus infiltration

- Advantages of infiltrations
  1. Faster onset
  2. Simple
  3. Safe
  4. Good hemostasis (with vasoconstrictor)

- Disadvantages of infiltrations
  1. Multiple injections for multiple teeth
  2. Shorter duration of anesthesia, especially with children due to their higher metabolic rate
**Blocks versus Infiltrations**

- **Duration of pulpal anesthesia:**
  - Infiltration
  - Block Injection

**Physiology of Anesthetic Agents**

1. Overall diameter (size) of the nerve bundle
2. Amount of myelin (lipid) sheath present
   - Time for entire nerve bundle to be penetrated
   - Central Core Theory:
     - Peripheral fibers anesthetized first
     - To most proximal structures (molars)
     - Central fibers anesthetized last
     - To most distal structures (incisors)

**Physiology of Anesthetic Agents**

- How do local anesthetics work?
  - $BH^{+} = \text{acidic, ionized form: Can't pass through nerve membrane (water soluble)}$
  - $B = \text{basic, unionized form: Can pass through nerve membrane (lipid soluble)}$

**Physiology of Anesthetic Agents**

- How do we assess anesthesia?
  - Question the patient
  - Probe the area
  - Electric pulp tester
  - Cold test

  - Delayed **pulpal** onset: occurs in the mandible of 15 – 25% of patients (even though soft tissue is numb)
  - Delayed over 90 minutes in 8%

*Sources: Multiple, including: Malamed, Handbook of Local Anesthesia, 6th Ed, Elsevier, 2013; Jastak, Nagel; Local Anesthesia of the Oral Cavity, WB Saunders Co, 1995*
Physiology of Anesthetic Agents

- Reasons for delayed or failed onset
  - Disassociation rate, transport/perfusion rate, re-association rate, binding rate

BH+ = acidic, ionized form: Can’t pass through nerve membrane (water soluble)
BH- = basic, unionized form: Can pass through nerve membrane (lipid soluble)

Use of Distraction Techniques

- Surface vibration
  1. Creates a mucosal surface distraction
  2. Ultrasonic surface vibration enhances mucosal penetration of topical anesthetics
  3. Produce low-level sensory nerve stimulation, allowing greater anesthetic access to receptor sites to produce better anesthesia
  - By activating the Frequency Dependent Conduction phenomenon

Anesthesia Delivery Assistance Devices

- The Gate Control Theory of Pain
  - Upon injection of anesthetic solution:
    - Nociceptors send most of the pain messaging to the brain via slow conducting, thin C nerve fibers
    - By contrast, vibration stimuli of the oral mucosa are transmitted by rapid conducting, large A-beta fibers
  - By applying the vibrations before starting the injection, the vibration sensations reach the brain first and cause release from inhibitory interneurons, blocking the C fiber pain stimulation by “closing the pain gate”

Topical Anesthetics

- Penetrate 2 – 3 mm
- Adequate anesthesia for minor/superficial procedures
- Pre-injection anesthesia for all techniques

Note: esters have better absorption through mucosa*

- Benzocaine ≤ 20% (ester)
- Tetracaine 0.1 – 2% (ester)
- Cetacaine (benzocaine 14%, butanamine 21%, tetracaine HCl 2% - esters)
- Anbesol (benzocaine 10%, phenol 0.5%, alcohol 70% - ester)
- Compounded topicals: combine amide and ester (Profound, Profound PET (Profpet), TAC 20 percent Anesthesia, TheBestTopicalEver)

*Therefore, a decreased safety margin, especially with children
Topical Anesthetics for Children

- Use of topical anesthetics is recommended by the AAPD
- Gel type topicals are safer, more easily confined to a discrete area, with children
- Let the child smell the topical: “Can you guess the flavor?”
  Distraction: the child focuses on the flavor rather than the injection
- Dry the injection site with gauze to prevent generalized spreading
- Apply for up to 2 minutes
  The mucosa should have a stippled appearance due to absorption of the topical
- Keep talking, explaining what you’re doing: a distraction

Topical Anesthetics

- Compounded formulas:
  - Profound – 10% lidocaine, 10% prilocaine, 4% tetracaine
  - Profound PET (Profpet) – same as above plus 2% phenylephrine, more viscous
  - TAC 20 percent Alternate – 20% lidocaine, 4% tetracaine, 2% phenylephrine
  - TheBestTopicalEver – 12.5% lidocaine, 12.5% tetracaine, 3% prilocaine, 3% phenylephrine

Are neither FDA regulated nor unregulated:
“Unapproved drug products whose benefits may not outweigh their risks”

Topical Anesthetics

- Compounded formulas:
  - Maximum recommended dose is unknown
  - Narrow difference between optimal therapeutic dose and toxic dose level
  - Vary in composition, quality, and strength
  - Recommendation to avoid tissue sloughing:
    - Use only a small amount
    - Apply for maximum of 60 – 90 seconds
    - Rinse area thoroughly after application

- Refrigerant application: Pain Ease (Gebauer, Cleveland)
  - 1,1,1,3,3-pentafluoropropane/1,1,1,2-tetrafluoroethane
  - 5 second application
  - FDA approved for oral tissues
  - Nonirritant to oral mucosa
  - Nontoxic if inhaled
  - Significant reduction in posterior palatal injection pain
  - Good evidence from medical studies
  - Limited dental anecdotal reports

- Oraqix 2.5% lidocaine, 2.5% prilocaine periodontal gel
  - Approved for intraoral use
  - 30 second onset
  - 20 minute duration (range 14 – 31 min.)

- Dyclone (Dyclonine HCl)
  - Currently commercially unavailable
  - Available from compounding pharmacies
  - 0.5%, or 1.0% DS
  - Apply with swab or as a diluted rinse
  - ~45ml for 1 minute (swish & spit)
  - Slow onset, 5 – 10 minutes
  - Duration ~30 minutes
Slow Injection of Anesthetic Solutions

- Safety Guidelines for local anesthesia
- Inject slowly! A maximum rate of 1 minute per cartridge.
- Computer-controlled anesthetic delivery systems
- Objective is to deliver the anesthetic at a rate and pressure that is below the threshold of pain
- Potentially pain-free injections
- Reduced volumes of anesthetic injected

- The "Wand": Single Tooth Anesthesia (STA) system (Milestone Scientific)
- The Comfort Control Syringe (no longer marketed)
- New: Calaject (Aseptico)
- New: EZ-Flow (Denterprise International)
- New: Dentapen (Septodont)
- Objective is to deliver the anesthetic at a rate and pressure that is below the threshold of pain

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Reasons for Anesthetic Failures

- Inflammation and infection
  - Causes increased tissue acidity (decreased pH)
  - Less anesthetic solution can enter into the nerve due to change in dissociation equilibrium
  - Result is decreased anesthetic effect

- Injecting too much anesthetic, or injecting it too fast, may decrease the tissue buffering capacity
Troubleshooting Anesthesia

- The “Hot” Tooth / “Hot” Gum
  - Includes:
    1. Infected teeth with irreversible pulpitis
    2. Severe periodontal infections
    3. Hypoplastic teeth with severe sensitivity
    4. Teeth with hypersensitivity due to recession, occlusal trauma/bruxing, etc.

  All of these may be highly problematic to anesthetize

First, give a block injection

Well away from the site of any local inflammation or infection

The low pH will prevent the disassociation of the anesthetic agent

A needle should not be inserted into an area of active infection, such as a periodontal or periapical abscess

The volume of anesthetic is likely to increase pain

There is the potential for spreading the infection

Haas DA, Localized complications from local anesthesia, J Calif Dent Assoc, Vol 26 No 9, 1998

Patients who took 600mg of ibuprofen 1 hour before IANB for endodontic treatment of mandibular posterior teeth with irreversible pulpitis were 2x more likely to have “little or no pain during endodontic treatment.”

Lapidus D et al, Effect of premedication to provide analgesia as a supplement to inferior alveolar nerve block in patients with irreversible pulpitis, J Amer Dent Assoc, Vol 147 No 6, June 2016

Troubleshooting Anesthesia

- The “Hot” Tooth / “Hot” Gum
  - First, give a block injection (the further away from the infection site, the better)
  - The Gow-Gates mandibular division block has a significantly higher success rate than all other techniques
    - Gow-Gates 52%
    - Vazirani-Akinosi 41%
    - Conventional IA 36%
    - Buccal-plus-lingual infiltration 27%

  All with 4% articaine with 1:100,000 epinephrine

No technique was fully acceptable by itself


Intraligamentary Anesthesia

- The periodontal ligament (PDL) injection
  - Requires separate injection for each root
  - Duration unpredictable, generally quite short
  - Less volume of anesthetic used compared to other techniques
  - No lip anesthesia for anterior smile line assessment

BUT... patients frequently report post-op discomfort

Recommended to use plain, non-vasoconstrictor containing anesthetics

Injecting into a highly vascular space

Patients are more likely to experience cardiovascular side effects if vasoconstrictor is used
Troubleshooting Anesthesia

- The "Hot" Tooth / "Hot" Gum
- First, give a block injection
- Well away from the site of any local inflammation or infection
- Second, is topical/OraVac around the tooth adequate?
- If not, give a periodontal ligament (PDL) or intraosseous injection
- Or, give a buccal or lingual infiltration with articaine (or prilocaine)

Pharmacology of Anesthetic Agents

- A Practical Armamentarium:
  - From a meta-analysis of 13 clinical trials:
    - Evidence strongly supported articaine's superiority over lidocaine for infiltration anesthesia
    - Evidence was weak for any significant difference between lidocaine and articaine for block anesthesia
  - Articaine was 4 times more effective, with greater duration, than lidocaine as an infiltration injection when used for teeth diagnosed with irreversible pulps

Troubleshooting Anesthesia

- Why is the "hot" tooth / "hot" gum so hard to anesthetize?
- Yes, it's partly the low pH, but it's so much more!
  - Inflammation may cause an increase in anesthetic-resistant sodium channels that exist in pain neurons.
  - The barrage of pain impulses to the CNS produces "central sensitization": an exaggerated CNS response to even gentle peripheral stimuli.
  - Apprehensive patients have a reduced pain threshold.

Infiltration Anesthesia

- Works well for the maxilla, but for the mandible...
  - Works fairly well for anteriors and bicuspids
  - More variable predictability for molars
  - Greater success using articaine & faster onset
- Lidocaine 4.5–6.0%, articaine 75–90%
- Lidocaine 6.0–11.3 minutes; articaine 4.2–4.7 minutes

Troubleshooting Anesthesia

- There is no contraindication for combining any of the amide anesthetic agents
  - Plain anesthetics have better dissociation in a site of infection (but will wash out faster!)
  - Using an anesthetic with a vasoconstrictor is advantageous for better duration
  - Articaine tends to work well in an infected, low pH environment
- But proper disassociation of any anesthetic solution may be a problem
Buffering of Local Anesthetics

- Buffer with sodium bicarbonate immediately before delivery
- Increases dissociation of anesthetic agent for rapid uptake into the nerve
- Potentially more comfortable
- Potentially faster onset
- Potentially more profound
- Potentially higher success rate

New Technology: Buffering

- Improve patient satisfaction
- More comfortable injections
- More predictable anesthesia
- More profound anesthesia
- Decrease appointment times
  - Less waiting for anesthesia onset (1–2 minutes)
  - See more patients
    - Emergency patients
    - Hygiene patients

Buffering of Local Anesthetics

Concems with this system:
1. Uses medical multi-dose anesthetic vials
   - Contain preservative methylparaben: increased potential for allergic reaction
2. Uses commercial grade sodium bicarbonate
   - Variable pH so results of buffering are not as reliable

New Products: Kovanaze

- Intranasal spray delivery
- Utilizing the BD ACCUSPRAY technology currently used in the Flumist nasal product
- 3% tetracaine HCl plus 0.05% oxymetazoline vasoconstrictor
- Produces a unilateral regional block
  - For maxillary teeth #4 – 13 in adults and A – J in children ≥ 40 kg (88 lb.)
New Products: Kovanaze

- Spray administration
- No needle
- Non-invasive, painless
- Easy to administer

Anesthetic enters the trigeminal neural pathway within the nasal cavity
- Adult dosage: 2 sprays; 1st spray, wait 4 minutes; 2nd spray, wait 10 minutes
- Start work: about 15 minutes from 1st spray

Safety profile
- Tetracaine is an ester anesthetic; metabolism begins as soon as it enters the bloodstream
- Less burden on the liver; decreased toxicity risk
- No lip/face anesthesia
- Shorter duration of post-operative anesthesia
- Safer for children?
- More comfortable for adults?

BUT… it is an ester anesthetic
- Esters have a higher potential for patient allergic reactions

Phase 3 clinical trial results:
1. 88% success for restorative procedures for 1st premolar, canine, and incisors (compared to 93% success with infiltration injection of 2% lidocaine w/ 1:100,000 epi)
2. 60 – 66% success for 2nd premolar
3. Side effects: also common in OTC nasal decongestants
   a. Runny nose 57%
   b. Nasal congestion 26%

FDA approved June 2016

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FDA approved June 2016

New Research: Acupuncture

The "Hot" Tooth
- Ongoing research: Acupuncture
- For teeth with irreversible pulpitis:
  IA block alone: 20% success
  IA block + LI4 Hegu acupoint: 60% success

New Research: Iontophoresis

Uses a low-density electric current to introduce ionic drugs into the body through the skin or mucosa
- Over 100 years of research in medical settings
- In early stages of dental efficacy research
- Needle-free anesthetic delivery
- Faster onset and prolonged duration likely

New Research: Light-Reactive Anesthetics

- Anesthetic is clinically inactive when injected
- Activated by exposure of the overlying cheek to a particular wavelength of violet light
- At end of the procedure, anesthetic is inactivated by exposure to a particular wavelength of green light

The ultimate on-off switch!
OraVerse Reversal Agent

- Indicated for reversal of soft-tissue anesthesia, i.e., anesthesia of the lip and tongue, and the associated functional deficits resulting from an intraoral submucosal injection of local anesthetics containing a vasoconstrictor
- Restores normal sensation twice as fast*
- Accelerates the return to normal function so patients can speak, smile and drink normally

* Versus control group in clinical trials

This is the closest we currently have to an OFF switch

The Problem

- Pulpal anesthesia wears off in 45-60 minutes
- Soft tissue numbness can last 3-5 hours

OraVerse (Phentolamine Mesylate)

- Phentolamine mesylate (alpha adrenergic antagonist) is a vasodilator used in medical indications since 1952
- Administered by injection
  - With standard dental syringe, same injection site, and identical technique used for delivery of the original local anesthetic agent(s)
- Dilates blood vessels at the anesthetic site, speeding up vascular removal of the anesthetic
- Reverses the effect of vasoconstrictors

OraVerse Reversal Agent

- Safety Profile
  - Across all studies:
    - No contraindications
    - No evident toxicity
    - No known drug interactions with OraVerse
    - No difference in adverse events versus control
      - Only 1% difference in transient injection site pain for OraVerse group (5%) versus the Control group (4%)
    - All adverse events were mild and resolved within 48 hours

Anesthetic Cartridge Warmers

- Intent is to warm the anesthetic a little above body temperature
- Mechanism is not known
- Evidence in support is good in medicine
- Evidence not clear for intraoral injections

Needles

- **Length**
  - Long: 30 – 35 mm
  - Short: 20 – 25 mm
  - Ultra-short: ~10 mm

- **Gauge (25, 27, or 30)**
  - Patients report no perceived difference in pain due to needle gauge.
  - Aspiration requires more force the smaller the gauge.
  - Fluid injection velocity increases the smaller the gauge.
  - Recommendation: 30 gauge short for infiltrations only; 25 or 27 gauge long needles are best for blocks.

Aspiration During Injections

- **Safety Guidelines for local anesthesia**
  1. Aspirate carefully before injecting to reduce the risk of unintentional intravascular injection.
  2. Stop the injection and re-aspirate once or twice during the injection.
  3. Monitor the patient for unusual reactions both during and after the injection.

- **Hematoma**
  - A hematoma may form independently of aspiration results.
  - Aspiration results merely report the contents at the needle tip at the time of aspirating.

- **Conclusions:**
  - The MC1R gene does play a role in sensing pain and thus does affect the efficacy of dental local anesthetics in redheads.
  - The MC1R gene does influence the anxiety level of redheads, and the fear of dental care is believed to interfere with the efficacy of local anesthesia.
  - Therefore, red-haired people may require higher dosages of local anesthetics due to greater pain sensitivity and their higher levels of dental anxiety.

Relaxation Techniques

- **Techniques to minimize the discomfort of all injections**
  1. Topical anesthesia
  2. Pressure distraction/analgesia
  3. Slow injection with small volumes
  4. Buccal infiltrations
  5. Explain all that you do to minimize the discomfort.

Learn to give comfortable palatal injections!
Relaxation Techniques
- Anesthetic failures happen
- The “Three Strikes Rule”
  - 3 attempts at anesthesia, then stop
- It’s not about “fault”
  - It’s not the patient’s fault
  - It’s not your fault
  - Failures happen
- Reschedule the patient!

Pharmacology of Anesthetic Agents
- Adverse reactions to anesthetic agents:
  1. Psychogenic reactions
  - Syncope: the most common reaction
  - 76% of medical emergencies in the dental office are related to stress and anxiety
  - Low blood sugar, lack of sleep, and/or dehydration may also cause syncope
  - Hormonal fluctuations may also be a factor
  - To avoid syncope:
    - Give injections with the patient lying supine, then slowly sit the patient upright
- Allergic reactions
  - Question the patient carefully
  - Get a full history of the incident
  - Was it really an allergic reaction?
  - Allergy to an amide anesthetic is very rare
- Toxic reactions - uncommon
- Idiosyncratic reactions
  - Emotional factors may play a key role in producing unusual symptoms that cannot be related to pharmacology or anatomy

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Pharmacology of Anesthetic Agents
- Dental anesthetic agents: all amides
  1. Esters: high incidence of allergic reaction
    - Frequent cross-reactivity
    - No longer available in U.S. in dental cartridges
    - Available in multidose bottles
  2. Amides: <1% incidence of allergic reaction
    - True allergy very rare
    - Sensitive patients usually not reactive to other amide agents
    - Recommend patch testing by allergist
    - Note: This is not entirely reliable

Pharmacology of Anesthetic Agents
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  1. Allergic reactions
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    - Get a full history of the incident
    - Was it really an allergic reaction?
    - Allergy to an amide anesthetic is very rare

Pharmacology of Anesthetic Agents
- Allergic reactions
  - Mild
    - Rash, skin itches, runny nose and eyes (leaky capillaries)
    - Majority of allergic responses are contact dermatitis
  - Moderate
    - Swelling of tongue or throat
    - Asthmatic wheezing (respiratory constriction)
  - Severe
    - Anaphylaxis may develop within minutes!
    - CV system relaxes, BP drops, shock, failure
    - Most adverse drug reactions develop during the injection or within 5 to 10 minutes post-injection

Baluga JC et al, Allergy to local anesthetics in dentistry: Myth or reality?, Allergol Imunopathol, 30(1), 2002
Pharmacology of Anesthetic Agents

- Adverse reactions to anesthetic agents:
  - Allergic reactions
    - Primary reasons for allergic reactions to dental local anesthetics:
      - Methyl paraben: FDA ordered removed from all U.S. dental cartriges in 1984
      - Ester anesthetics: high allergic incidence, cross-reactive
        Replaced with amide anesthetics in mid 1990's
      - Latex in cartridge stopper and diaphragm: molecules leached into the anesthetic solution
        Replaced with silicone in early 2000's
      - The antioxidant for the vasoconstrictor: Sodium or potassium metabisulfite (0.50 mg/ml)
        Possible sulfite sensitivity, especially for corticosteroid-dependent asthmatics (10–20%)
        Ask about food sensitivities: Dried fruits, beer and wine, salami and pepperoni-type meats: all have sulfites
        Also sprayed on many foods in markets to give foods a "fresher" appearance
  - If an allergy to an amide anesthetic is suspected:
    1. Have patient patch tested (skin "prick" test followed by intradermal injection) for all amides and for at least one ester anesthetic (send dental cartriges with patient)
    2. A challenge test to duplicate symptoms can be used if there is no response to skin testing; this is more reliable
    3. May use 1% diphenhydramine (Benadryl) with 1:100,000 epinephrine as an alternative anesthetic
      Short duration (infiltrant), may require multiple injections
  - Local anesthetic dosage (FDA approved max. dosage)

Local anesthetic dosage:

- Calculating dosage:
  - In dental cartriges:
    1. 2% lidocaine w/epi
    2. 4% articaine w/epi
    3. 3% mepivacaine
    4. 4% prilocaine
    5. 0.5% bupivacaine w/epi
  - ~18 mg anesthetic/concentration
  - Calculating dosage: 150 lb. adult
    - 2% lidocaine w/epi
    - 36 mg/cartridge
    - 4% articaine
    - 68 mg/cartridge
    - Cartridge volume officially 1.78 to 1.82 ml; all labeled as 1.7 ml.
  - 3% mepivacaine plain
    - 3.0 mg/lb
    - 54 mg/cartridge
  - 2% mepivacaine w/levorphanol
    - (30 mg/ cartridge for any patient)
    - 60 mg max.
  - 4% prilocaine plain or w/epi
    - (36 mg/ml max. for any patient)
    - 4.0 mg/lb
    - 72 mg/cartridge
  - 4% articaine
    - 68 mg/cartridge
  - 0.5% bupivacaine w/epi
    - (48 mg/ml max. for any patient)
    - 0.6 mg/lb
  - 4.0 mg/lb
  - 36 mg/cartridge
  - 14 cartridges is the maximum for any patient ≥ 156 lb.
    - (Exceeds the maximum safe dosage of epinephrine as cartridge with a vasoconstrictor)

- 2% lidocaine with epinephrine
  - 350 mg x 3.2 mg/lb = 480 mg
  - 500 mg is the maximum for any patient
  - 480 mg
  - 36 mg/cartridge = 33-33 cartridges
  - 14 cartridges is the maximum for any patient ≥ 156 lb.
  - (Exceeds the maximum safe dosage of epinephrine as cartridge with a vasoconstrictor)

Canfield DW & Gage TW, A guideline to local anesthetic allergy testing, Anesth Prog, Vol 34, 1987
Manufacturer package insert information, 2014

Pharmacology of Anesthetic Agents

- 2% lidocaine
  - 36 mg/cartridge
  - 3% mepivacaine
  - 54 mg/cartridge
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  - 72 mg/cartridge
  - 4% articaine
  - 68 mg/cartridge
  - Cartridge volume officially 1.78 to 1.82 ml; all labeled as 1.7 ml.
  - *These are approximate mg/cartridge numbers
  - 30 mg/ cartridge
  - 48 mg/ml max. for any patient

- 2% mepivacaine
  - 3.0 mg/lb
  - 54 mg/cartridge

- 4% prilocaine
  - 4.0 mg/lb
  - 72 mg/cartridge

- 4% articaine
  - 68 mg/cartridge

- 0.5% bupivacaine w/epi
  - 0.6 mg/lb

- *Within a 24 hour timeframe
Pharmacology of Anesthetic Agents

- Local anesthetic dosage (FDA approved max. dosage)
- Calculating dosage: For children
  - Maximum recommended dosage is 2.0 mg/lb. for all anesthetics*, and use of a vasoconstrictor is strongly recommended
  - Note: Children have a higher metabolic rate, which means that more anesthetic enters their bloodstream in a shorter time.
  - Hence the reduction of maximum dosage to 2.0 mg/lb. for children for all anesthetics
*Systemic absorption of topical anesthetics must also be considered when calculating total anesthetic dosage.

Guidelines on the Use of Local Anesthesia for Pediatric Dental Patients, American Academy of Pediatric Dentistry, 2009

- Moore PA & Hersch EV, Local Anesthetics: Pharmacology and Toxicity, Dent Clin North Am, Vol. 54 No. 4, 2010

Pharmacology

- Local anesthetic dosage (FDA approved max. dosage)
- Calculating dosage: 150 lb. adult

3% mepivacaine plain
150 lb. x 3.0 mg/lb. = 450 mg
But...400 mg is maximum for any patient!

400 mg
54 mg/cartridge = 7.40 cartridges
7 cartridges is the maximum for any patient ≥ 135 lb.

2% mepivacaine with levonordefrin
150 lb. x 3.0 mg/lb. = 450 mg
But...400 mg is maximum for any patient!

400 mg
36 mg/cartridge = 11.11 cartridges
11 cartridges is the maximum for any patient ≥ 135 lb.

4% prilocaine plain or with epinephrine
150 lb. x 4.0 mg/lb. = 600 mg
600 mg is maximum for any patient!

600 mg
72 mg/cartridge = 8.33 cartridges
8 cartridges is the maximum for any patient ≥ 150 lb.

4% articaine with epinephrine
150 lb. x 3.2 mg/lb. = 480 mg
500 mg is the maximum for any patient

480 mg
72 mg/cartridge = 6.66 cartridges
7 cartridges is the maximum for any patient ≥ 156 lb.
Local anesthetic dosage (FDA approved max. dosage)
Calculating dosage: 150 lb. adult
0.5% bupivacaine with epinephrine
150 lb. x 0.6 mg/lb. = 90 mg
90 mg is the maximum for any patient

90 mg
9 mg/cartridge = 10 cartridges
10 cartridges is the maximum for any patient ≥150 lb.

Vasoconstrictors in local anesthetics
Absolute contraindications:
Unstable angina
Myocardial infarction within 6 months*
Coronary artery bypass surgery within 3 months*
Refactory arrhythmias
Untreated or uncontrolled hypertension
Untreated of uncontrolled congestive heart disease
Uncontrolled diabetes, hyperthyroidism, or other endocrine diseases
*The timeframe is variable; a physician consult is recommended

Vasoconstrictors in local anesthetics
Patients with stabilized hypertension or other cardiovascular diseases
The results of a number of studies indicate that the use of 1 or 2 cartridges of vasoconstrictor-containing anesthetic is of little clinical significance for most patients with stabilized hypertension or other CV diseases.
The benefits of maintaining adequate anesthesia for the duration of the procedure should not be underestimated.

Epinephrine in local anesthetics
1:100,000 = 0.018 mg epinephrine/cartridge
1:200,000 epinephrine = 0.009 mg/cartridge
Maximum dosage of epinephrine
Healthy patients: up to 0.2 mg
equals 11 cartridges (1:100,000)
Cardiac patients: up to 0.04 mg
equals 2.2 cartridges (1:100,000)

American Dental Society of Anesthesiology, The Pulse, Vol 41 No 1, 2008

In emergency situations such as anaphylactic shock, the dosage recommended is 0.3 to 0.5 mg of 1:1,000 epi injected intramuscularly
The equivalent of 30 – 50 cartridges
Pharmacology of Anesthetic Agents

- Metabolism of local anesthetics
  - Amide agents primarily biotransformed in the liver by P450 cytochrome enzymes
  - Articaine begins rapid biotransformation in the bloodstream due to its ester moiety, then completed in the liver
  - > 95% metabolized in the blood stream; 5–10% metabolized in the liver
  - Articaine may be a better local anesthetic agent for patients with impaired liver function

- Other local anesthetic complications
  - Excessive doses (injectable or topical) have been associated with drug-induced methemoglobinemia
  - Risk may be increased in presence of oxidizing drugs such as acetaminophen, nitroglycerin, or sulfonamides.
  - Particular caution recommended with use of prilocaine (Citanest) in patients at risk
  - Respiratory obstruction: COPD, emphysema
  - Anemia
  - Pregnancy

- Safest local anesthetics during pregnancy and breast-feeding:
  - Lidocaine and prilocaine are FDA Category B
  - All others are Category C
  - Risk of methemoglobinemia with topicals (especially esters: benzocaine, tetracaine) and injectable prilocaine
  - Epinephrine is OK!
  - 2% lidocaine with 1:100,000 epinephrine is the safest anesthetic to use during pregnancy
  - Always use only as much as is truly necessary

- Treating medically complex patients
  - Local anesthetics, with or without vasoconstrictors, may be safely used in most medically complex patients.
  - Observance of simple safety guidelines for administration of local anesthetics should be universally applied to all patients.

- Safety Guidelines for local anesthesia
  1. Aspirate carefully before injecting to reduce the risk of unintentional intravascular injection.
  2. Inject slowly! A maximum rate of 1 minute per cartridge.
  3. For safety, efficacy, and comfort!
  4. Monitor the patient for unusual reactions both during and after the injection.
Pharmacology of Anesthetic Agents

- Safety Guidelines for local anesthesia
  - A useful guideline for the majority of medically complex patients is to reduce the amount of vasoconstrictor containing anesthetic to no more than 2 cartridges, if possible.
  - If additional volume of anesthetic solution is required, consider switching to a plain, non-vasoconstrictor containing agent.

- Preventing local anesthetic complications
  - One more suggestion: In severely immunocompromised patients, an antimicrobial rinse such as chlorhexidine prior to injection can reduce the risk of infection from the injection – a risk that is normally very low.

It's the thought that counts!

Haas DA, Localized complications from local anesthetics: J Calif Dent Assoc, Vol 26 No 5, 1998

4% Dental Anesthetic Agents

- Articaine is a unique "hybrid" amide anesthetic:
  - Classified as an amide agent because it has the low allergenicity rate of other amides
  - Ester group means it is metabolized in both the bloodstream and the liver
  - Shorter plasma half-life potentially reduces risk of toxicity

Potential for Nerve Injury

In 1995, Haas DA & Lennon D published:
A 21 year retrospective study of reports of paresthesia following local anesthetic administration
J Can Dent Assoc, Vol 61 No 4

Articaine (Septocaine) and prilocaine (Citanest) were more likely to be associated with paresthesia injuries compared with other anesthetics, and this was statistically significant when compared to the distribution of use.

- Conclusions:
  - Articaine (Septocaine) and prilocaine (Citanest) were more likely to be associated with paresthesia injuries compared with other anesthetics
  - This was statistically significant when compared to the distribution of use
  - Although it can occur, the risk of paresthesia from injection itself is extremely low
  - The extremely low risk does not warrant advising every patient prior to injection

Haas DA & Lennon D, A 21 year retrospective study of reports of paresthesia following local anesthetic administration, J Can Dent Assoc, Vol 61 No 4, 1995
Potential for Nerve Injury

Clinical Research Associates, in a study of 13,000 patient treatments by 94 dentists using articaine, reported 2 paresthesias.
- Both were associated with "mandibular" blocks
- Both resolved: Incidence = 0.03%

CRA follow-up 2005: 73% of articaine paresthesias were with "mandibular" nerve block injections

"Mandibular" block = conventional inferior alveolar regional nerve block

Potential for Nerve Injury

In a second publication by Haas and Gaffen using the same source:
- 182 paresthesias from 1999 to 2008
- 180 associated with the inferior alveolar nerve block
- 72 inferior alveolar block alone
- 8 inferior alveolar block combined with 1 or more other injections
- Incidence of 1/609,000 injections

Potential for Nerve Injury

From the U.S. FDA Adverse Event Reporting System data:
- 248 paresthesias from 1997 to 2008
- 94.5% associated with the inferior alveolar nerve block
- Prilocaine associated injuries 7.3 times greater than expected
- Articaine associated injuries 3.6 times greater than expected

Garisto et al, Occurrence of paresthesia after dental local anesthetic administration in the United States, J Am Dent Assoc, Vol 141, July 2010

Potential for Nerve Injury

Theories of causes:
1. Injury due to direct contact of the needle with the nerve (traumatic injury)
2. Injury due to direct contact of the anesthetic solution with the nerve (toxicity injury)
3. Injury due to hematoma within the nerve sheath or in close proximity to the nerve (compression injury)
4. Injury due to stretching of the nerve (morphology injury)


Potential for Nerve Injury

- US usage
  - Lido: 15%
  - Mepi: 33%
  - Prilo: 37%
  - Arti: 15%

Injuries
  - Lido: 35%
  - Mepi: 0%
  - Prilo: 30%
  - Arti: 30%

Articaine < Lido < prilocaine < bupivacaine

Conclusion: Prilocaine appears to have the highest incidence of injury; articaine less risk than prilocaine


9/17/2019

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Nerve Paresthesia Injury

- Theories of causes:
  1. Injury due to direct contact of the anesthetic solution with the nerve (toxicity injury)
  2. In an in vitro study, when neural cells were bathed in either lidocaine or articaine directly from the dental cartridge:
     - Neither anesthetic had a significant effect on cell viability
     - Lidocaine caused a reduced cell responsiveness 30 minutes post-treatment; articaine showed no significant reduction in cell responsiveness
  3. Conclusion: articaine did not directly cause any neuronal damage in vitro

- It is noteworthy that in Denmark, where prilocaine is marketed as a 3% solution, 2 studies have linked paresthesia to 4% articaine use, but not to prilocaine use.

- In addition to concentration, genetic polymorphisms in the ionic channels may contribute to differential rates of paresthesia.

Potential for Nerve Injury

- To reduce the risk of nerve injury when using prilocaine (Citanest) or articaine (Septocaine):
  1. Inject less, usually about half the dosage, than for lidocaine or mepivacaine
  2. Inject that reduced volume more slowly – about twice as long as the rate with lidocaine or mepivacaine – particularly with the inferior alveolar nerve block technique

Potential for Nerve Injury

- The risk of nerve injury with administration of prilocaine (Citanest) or articaine (Septocaine) may be reduced by using "high" mandibular division block techniques
  - Gow-Gates technique
  - Vazirani – Akinosi technique
Potential for Nerve Injury

- Anesthesia-induced nerve injuries are VERY rare (Temporary 0.15 – 0.54%; permanent 0.0001 – 0.01%)
- Most paresthesias are reversible, resolving within 2 to 8 weeks
- Mandibular nerve injuries are far more common than maxillary
  - 8%-15% of injuries caused by injections recover spontaneously within 2 to 12 weeks
  - <5% will recover within 9 months
  - Up to 50% of remaining injuries will likely never recover completely

Nerve Paresthesia Injury

- Prevention
  - There is no guaranteed method to prevent nerve injuries due to injections.
  - Such injuries are not de facto indications of improper technique; they are a risk of carrying out intraoral injections.

Troubleshooting Mandibular Anesthesia

- The great auricular nerve and/or the transverse cervical nerve reached the mandible in 60% of 250 cadavers
- Anastomoses between the cervical plexus and trigeminal nerves were observed in 15% of 250 cadavers
- With the auriculotemporal nerve was most common
- With the mental nerve was less common
- The likelihood of innervation from the cervical plexus reaching mandibular teeth is small, but can occur

Potential for Nerve Injury

- The No Fault Theory
  - It is important to note that complications with oral injections are not always preventable, and their occurrence does not necessarily imply poor technique by the dentist or dental hygienist.

Troubleshooting Mandibular Anesthesia

- Repeated failure to achieve adequate anesthesia
  - Take a panoramic radiograph
  - Incidence of bifid IA nerve: 4 patients in 5,000 films

Troubleshooting Mandibular Anesthesia

- Solution: a buccal &/or lingual infiltration below the apices of the teeth is likely to block any innervation coming up from the neck

With Cone Beam Computed Tomography (CBCT), the incidence of bifid mandibular canals/inferior alveolar nerves has been found to be at least 15.6%, and may be as high as 30%.