PAIN AND ANXIETY MANAGEMENT FOR CHILDREN: LOCAL ANESTHESIA CONSIDERATIONS
Assessment Findings

Medical History

- Patient is a healthy 6 year old Hispanic female
- No significant findings in patient’s health history were reported by the patient’s mother at the time of interview
- Patient has no known allergies
- Patient’s last physical exam was six months ago and her immunizations are up to date
  - Height = 45 inches
  - Weight = 44 pounds
Assessment Findings

- **Chief Complaint**
  - “My daughter needs a space maintainer and cavities filled.”
  - Her mother reports that patient had chronic pain in her upper right quadrant recently

- **Medical Consultations**
  - Based on the systems review, no medical consultations were required
Examination Findings

- Extra Oral Exam
  - Skin, eyes, lymph nodes, facial muscles, TMJ, and thyroid WNL

- Intra Oral Exam
  - Lips, tongue, floor of mouth, labial mucosa, hard and soft palate, tonsils, oropharynx, jaw relations WNL
  - Gingiva was described as not WNL due to an abscess with draining sinus tract above #B
  - Abscess above #B has extended to the furcation of #B as evident on radiograph
Diagnosis/Problem List

- Abscess with draining sinus tract
  - Determined through radiograph of #B and intraoral exam
- Caries with potential pulp exposures
  - Determined through radiographs and intraoral exam as listed above
- Premature loss of teeth
- Restoration of primary teeth
- Space maintenance
  - Determined intraorally (T) and expected (B)
- Preventive care

Wednesday, May 28, 14
Treatment History – Second Visit

- Patient presented for extraction of #B, A-Occ and C-DL resin composite restorations
- Patient was administered 1.5 carpules of 2% lidocaine with 1:100,000 epi via right buccal infiltrations, and palatal injection
- UR RDI utilized

- Teeth #s A & C restored with composite
- #B was extracted and granulation tissue removed
  - Hemostasis obtained with gauze pressure
  - Reviewed Post-op instructions
- Discharged under care of her mother

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Questions

Were the injections correct for the procedure?
What is the safety tolerated dose of local anesthetic used?
PAIN AND ANXIETY MANAGEMENT FOR CHILDREN: LOCAL ANESTHESIA CONSIDERATIONS
Enrichment Readings

- Casamassimo 5th Edition
  - Chapter 28
    - “Local Anesthesia and Oral Surgery in Children”
    - Pages 398 - 404

- McDonald 9th Edition
  - Chapter 13
Image Resources

  - Poul Buckhøj
    - Medical Artist


  - G.C. van Beek
    - Illustrator

Consider
Local Anesthesia as Behavior Management

Overview
Administration  Terminology  Dosage  Anatomy  Medical History
LOCAL ANESTHESIA AS A MANAGEMENT TOOL FOR CHILDREN

Attaining profound anesthesia for any patient helps to allay anxiety and discomfort
Local Anesthetic Use In Children

- Children should have a comfortable experience when going to the dentist.
- Local anesthetics are an important tool for the control of pain and discomfort during dental treatment.
Prevention of pain during dental procedures can nurture the relationship for the patient and dentist, building trust, allaying fear and anxiety, and promoting a positive dental attitude.
The technique of local anesthetic administration is an important consideration in the behavior guidance of a pediatric patient.

(notice positioning of patient)
AAPD Reference Manual

“Guideline on Appropriate Use of Local Anesthesia for Pediatric Dental Patients”

Age-appropriate “non-threatening” terminology, distraction, topical anesthetics, proper injection and nitrous oxide/oxygen analgesia/anxiolysis can help the patient have a positive experience during administration of local anesthesia.
AAPD Reference Manual

“Guideline on Appropriate Use of Local Anesthesia for Pediatric Dental Patients”

The dental professional should be aware of proper dosage, to minimize the chance of toxicity and the prolonged duration of anesthesia.
Knowledge of the gross and neuroanatomy of the head and neck allows for proper placement of the solution and helps minimize complications.
Familiarity with the patient’s medical history is essential to decrease the risk of aggravating a medical condition while rendering dental care; appropriate consultation should be obtained when needed.
Considerations (after Casamassimo)

- Child growth and development
  - Physical and mental
- Behavior management
- Physiologic pain modulation
- Pharmacology of local anesthetics
Behavior Management

- As to be discussed by Dr. Punwani
- In particular
  - Language choices
    - Sleepy juice, pinch, un poquito mosquito
  - Truth telling
    - Hurting vs. not hurting
- Distraction
  - Attention is diverted from an original focus
- Counter-irritation
  - Any irritation or annoyance that draws attention away from another
Wilson & Montgomery (in Pinkham)

- Counter-Irritation
  - Application of vibratory stimuli
    - Rapidly shaking cheek or lip
  - Or, of moderate pressure
    - Pressing of cotton swap at injection site

- Distraction
  - Method of diverting the patient’s attention away from the injection
    - Constant monologue

- Videos!
- Patients were provided with audio/video glasses loaded with animated children’s movies
- Children were taught how to control A/V glasses
- Given a five-minute lead time before injection procedure
- Pain assessment scales used to record reactions

Results: Pain scores significantly lower when the A/V glasses were used
Teamwork

If the dentist and the assistant approach are not confident and well timed, the child may easily sense their attitude and resist every effort they make.
Ideally, the assistant should not actively restrain or even touch the child’s arms unless an attempt is made by the patient to lift the arms to reject treatment.

Just touching the arms, as if to restrain, the youngster may attempt to resist physically.

The dental assistant should position his (her) hands above the child’s hands to intercept any untoward movement.
Most pediatric dentists today prefer to deliver local anesthetics with the patient in a supine position. In this position the mandible is at approximately a 30-degree angle to the floor, and the clinician’s elbow will be high, with the arm nearly parallel to the floor.
Positioning the patient’s head against the operator’s chest or abdomen and gently holding the head with non-dominant wrist gains better control of unfavorable movements.
Passing the Syringe

- The majority of pediatric dentists attempt to keep anesthetic syringes out of the sight of child patients
- Pass the syringe below the child’s chin and out of field of vision
- Try not to pass the syringe in front of the child’s eyes
  - This invites management problems
  - Keeping the needle hidden is not deceiving the child but helping him/her cope with the situation
Acceptable Behavior

- CRYING IS OKAY!!!!!!
- During the injection, you want to reinforce what they may be doing well
- For example-
  - Thank them for holding still, keeping their mouth open, and being brave
Safety
Local Anesthetic Use in Children

- When administered correctly, local anesthetics are safe for children
- Local anesthetics have a low margin of safety between the effective dose and the toxic dose
  - The lethal dose for many local anesthetic agents is only 3 times that of the effective dose
- Most deaths that are caused by local anesthetic administration are a result of overdosage
Xylocaine® - Lidocaine HCl

Most commonly used local anesthetic in PEDD
As Lidocaine 2% with 1:100,000 epinephrine
Xylocaine® - Lidocaine HCl

- Amide type of anesthetic
  - Less allergic reactions
- Onset ~ 2 minutes
- Duration
  - Manufacturer ~2.5 hours
  - Pulpal tissue ~ 60 minutes*
  - Soft tissue ~ 3-5 hours*
    - Lip bites
- Metabolized by liver
  - Caution if liver disease
- Excreted by kidney
- Motor function loss
  - Drooping face
- Pregnancy
  - No evidence of fetus harm in animal models
- Nursing mothers
  - Not known

*Casamassimo
Xylocaine® - Lidocaine HCl

- General precautions
  - Sodium metabisulfite
    - Sulfite allergies *(not sulfonamide allergies)*
  - Rubber stopper/diaphragm (silicone coated)
    - Latex allergies – not been demonstrated
  - Vasoconstrictor
    - Peripheral vascular disease
    - Hypertensive vascular disease
    - General anesthetic agents
      - Cardiac arrhythmia
  - CNS toxicity – Excitatory and depressant
    - Restlessness, anxiety, tinnitus, dizziness, blurred vision, tremors, depression, drowsiness, vomiting, sensations of heat, general coldness or numbness, twitching, convulsions, respiratory depression
  - Cardiovascular system – Usually depressant
    - Bradycardia, hypotension, cardiovascular collapse

- Drug interactions (epinephrine)
  - MAO inhibitors, tricyclic antidepressants, phenothiazines
    - Prolonged hypo- or hypertension
Maximum recommended dosages

- Lidocaine 2% 1:100,000 epinephrine
  - Adult – 7 milligrams per kilogram
  - Pediatric – as above*

“It is difficult to recommend a maximum dose of any drug for children since this varies as a function of age and weight. For children of less than years who have a normal lean body mass and normal body development the maximum dose may be determined by the application of one of the standard pediatric drug formulas (e.g., Clark’s rule‡) In any case, the maximum dose of Xylocaine Dental Injection with epinephrine should not exceed 7 mg/kg of body weight. When used without epinephrine, the amount of Xylocaine Dental Injection administered should not exceed 4.5 milligrams per kilogram of body weight.”

*Package insert

‡ Divide the child's weight in pounds by 150 to get an an approximate fraction of an adult dose
Xylocaine® - Lidocaine HCl

- Having said that – the maximum recommended dose for children is 4.4 milligrams per kilogram according to Wilson & Ganzberg in Casamassimo’s 5th Edition.

- This figure is also recommended by the AAPD in their “Clinical Guidelines on Appropriate Use of Local Anesthetics for Pediatric Dental Patients”
  - Adopted 2005, Revised 2009

- Absolute maximum is 300 milligrams or about 8 carpules

- Use the 4.4 mg/kg as your reference
Local Anesthetic Dosage

- Toxic doses are based on mg/kg patient weight
- The recommended maximum dose of lidocaine with vasoconstrictor for children is 4.4 mg/kg
- There are 34 mg lidocaine in one carpule of 2% solution (1.7 ml) of dental anesthetic
  - 2% solution (w/v) is 2 grams/100 ml = 20 mg/ml
  - 2% = (20 mg/ml) x 1.7 ml/carpule = 34 mg
Local Anesthetic Dosage

- For a child weighing 44lbs
  - \((44 \text{ lbs}) \div (2.2 \text{ lbs/kg}) = 20 \text{ kg}\)
- The maximum single recommended dose is
  - \(4.4\text{mg/kg} \times 20\text{kg}=88\text{mg}\)
- The maximum # of carpules you can safely give is
  - \((88\text{mg}) \div (34\text{mg/carpule})= 88/34= 2.58\) carpules or 2 carpules
Local Anesthetic Dosage

Why Two?
To make the math easier using pounds (lbs)

The recommended maximum dose of lidocaine with vasoconstrictor for children is 2 milligrams per pound

\[
(4.4 \text{ mg/kg}) \div (2.2 \text{ lbs/kg}) = 2 \text{ mg/lb}
\]
### Other Examples

<table>
<thead>
<tr>
<th>Weight in LBS</th>
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To Add A Bit Of Confusion

We are currently using 1.7 milliliter carpules (Henry Schein Brand)

Other brands are 1.8 milliliter carpules which equate to 36mg/carpule
Milligrams Per Carpule

So the milligrams per carpule with other brands becomes

\[20\text{mg/ml} \times 1.8\text{ ml/carpule} = 36\text{ mg/carpule}\]
Septocaine® - Articaine HCl

Articaine 4% with 1:100,000 epinephrine
Not routinely used in the Department
FDA approved for use in US in 2000
Study (Pediatric Dentistry 2000;22:307-311)

- Author: Stanley F. Malamed, Suzanne Gagnon, Dominique Leblanc
- Title: A Comparison Between Articaine HCl and Lidocaine HCl in Pediatric Dental Patients
- Conclusions
  - Visual Analogue Scale* scores indicate that articaine is an effective local anesthetic in children and that articaine is as effective as lidocaine when measured on this gross scale
  - Articaine 4% with epinephrine 1:100,000 is a safe and effective local anesthetic for use in pediatric dentistry
  - Time to onset and duration of anesthesia are appropriate for clinical use and are comparable to those observed for other commercially available local anesthetics

* A testing technique for measuring subjective or behavioral phenomena (as pain or dietary consumption) in which a subject selects from a gradient of alternatives (as from “no pain” to “worst imaginable pain” or from “every day” to “never”) arranged in linear fashion — abbreviation VAS
Septocaine® - Articaine HCl

One challenge is the concentration

Recommended pediatric dose (package insert)
US = 7 mg/kg
Canada = 5 mg/kg

- Points gleaned from the article
  - Thiophene ring versus benzene ring making it more lipid-soluble
    - Enhances diffusion through membranes and neural sheathes
    - Increased potency ~ 1.5-1.9 (Malamed)
  - But double-blind studies show its efficacy compared to lidocaine was the same
  - Acknowledge other papers that reported a higher incident of paresthesia with its use for IAN blocks, possible due to the higher concentration (4% versus 2%) although the actual numbers are very low
  - The use of articaine became more prevalent as the age of the patient increased

Wednesday, May 28, 14

- **Results**: Prolonged paresthesia at 3 hours post-injection was reported for 40% of the population and at 5 hours for 11%
- Soft tissue injury occurred in 14% of the patients at 3 hours and was found to be highest among children younger than 7 years old
- The lip was the most commonly affected site for accidental injury and it was not related to injection site
  - (note: injections appear to be both infiltrations and nerve blocks in this study)
- Twenty percent reported post-procedural pain at 3 and 5 hours post-treatment
- **Conclusion**: Parent must be prepared for post-procedural adverse events, especially for young patients
2% Lidocaine versus 4% Articaine

2% = (20 mg/ml) x 1.7 ml/carpule = 34 mg/carpule
4% = (40 mg/ml) x 1.7 ml/carpule = 68 mg/carpule
## Lidocaine versus Articaine

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Black = USA  
Red = Canada
Bupivicaine (Marcaine) is an amide local anesthetic with a high toxic potential, and **should not** be used in children.

Bupivicaine’s duration of anesthesia can be as long as 24 hours.

Lidocaine is less toxic than many other local anesthetics.
Local Anesthetic Overdose - Vasoconstriction

- Many local anesthetic agents are vasodilators, leading to
  - faster vascular uptake, and
  - a shorter duration of anesthetic activity

- Because many pediatric dental appointments are 30 minutes or less, one may think that it is not necessary to use an anesthetic with a vasoconstrictor (epinephrine), perhaps feeling that a shorter duration of anesthesia is desirable in that it may avoid self-inflicted injuries to soft tissues
Local Anesthetic Overdose - Vasoconstriction

- However, the use of a “plain” drug, especially when there may be multiple injection sites
  - increases the risk of potential overdose
- Recommend the use of local anesthetic agents with a vasoconstrictor
  - especially if multiple quadrants are being anesthetized
Consider

2% Lidocaine without vasoconstrictor
- Rapid onset of less than 2 minutes on average for infiltration
- Average pulpal duration of 5 minutes for infiltration

3% Mepivacaine without vasoconstrictor
- Intermediate duration anesthetic agent
  - approximately 20 minutes in the maxilla, and
  - 40 minutes in the mandible
- 54mg/carpule at 3mg/pound
- For a 44 lbs child = 2 carpules
Local Anesthetics

Again, primarily use Lidocaine 2% with 1:100,000 epinephrine
Mechanism of Action

- Not in the scope of this lecture series
- Mechanism has been theorized, but not exactly known
  - Alteration in the reactivity of neural membranes to propagate action potentials that may be generated in tissues distal to the anesthetic solution
  - Action potentials are blocked
  - Fail to transmit information to the central nervous system
Efficacy

- Dependent upon the concentration of the anesthetic on a segment of nerve
  - Too much
    - may be toxic
  - Too little
    - will be ineffective
Efficacy

- Local infection and inflammation
  - Modify the normal physiology of tissue
  - Also lowers pH
    - from ~7.4 to 5-6 or lower
  - Both reduce the lipid solubility of the anesthetic and interfere with its ability to penetrate nerve tissue
    - Antibiotics administered may reduce the extent of infection and permit local anesthetics to work
      - May take several days

“If a local anesthetic is injected into an area of infection, its onset will be delayed or even prevented. The inflammatory process lowers the pH of the extracellular tissue – this low pH inhibits anesthetic action because little of the free base form of the anesthetic is allowed to cross into the nerve sheath to prevent conduction. Inserting a needle into an active site of infection also could lead to possible spread of the infection.”

AAPD Guidelines
The Carol Burnett Show

Tim Conway & Harvey Korman

techniques
“Anatomic” Types

Nerve Block
- Placement of anesthetic on or near a main nerve trunk
- Results in a wide area of tissue anesthesia

Field Block
- Placement of anesthetic on secondary branches of a main nerve trunk
- Results in a smaller area of tissue anesthesia

Local Infiltration
- Placement of the anesthetic on the terminal branches of a nerve
- Results in a small area of tissue anesthesia
a brief history of regional anesthesia
William Stewart Halsted earned a doctorate in Medicine in 1877 from the College of Physicians and Surgeons at the University of Columbia (NY).

Richard John Hall was born in Ireland, emigrated as a child to New York, earned a Doctorate in Medicine in 1878 from College of Physicians and Surgeons at the University of New York.

About the same time, a report was published of the first use of cocaine as a topical anaesthetic for the mucosa of the eye (1884).

Halsted and Hall learned about the discovery.

Halsted started to work at the Roosevelt Hospital, met Hall, with whom he began to develop nerve block anaesthesia, teaching their colleagues and students in practical exercises.
Halsted was a meticulous and very patient anatomist
- He started to test 4% cocaine solution on his students
- The results were spectacular
- When the cocaine was injected along the course of a nerve it anaesthetised the innervated region
- One of the most striking applications was tooth extraction, which until then had always been extremely painful
- Halsted approach for nerve blocks - still sited in literature

Halsted W S. “Practical comments on the use and abuse of cocaine; suggested by its invariably successful employment in more than a thousand minor surgical operations.” *N Y Med J* 1885; 42: 294–295.

Self-experimentation, became addicted (~65 mg per day), lost his position, rehabilitated (with morphine), died

Hall, moved to Santa Barbara in California working as a surgeon in a rural hospital, although he was never to free himself of his own addiction
Although Halsted and Hall were not the first physicians to perform nerve blocks, they should both be considered pioneers in describing many nerve block techniques of great use in dentistry and oral surgery.

In April 1922, just six months before Halsted's death, the American National Dental Association recognized the significance of his discovery in local and regional anaesthesia, presenting him with a gold medal and giving him full credit for the discovery of neuroregional anaesthesia.
back to the subject
Block Versus Infiltration In Children

Although their bones are less dense than those of adults, and a greater degree of diffusion of local anesthetic can be obtained, infiltration anesthesia should not be considered as equal to block anesthesia or adequate for procedures requiring profound anesthesia.
Fifth Cranial Nerve

Trigeminal

It’s our nerve
Local Anesthesia Recommendations

- Maxilla
  - Central & lateral
  - Canine region
  - Primary molars
    - Premolars
  - Permanent molar
- Mandible
  - Most everything
A Word About the Images

Practically all of the images represent the adult dentition.

If you recognize what permanent teeth replaced the primary teeth, you will automatically recognize the innervation common to both.
Topical Anesthetic

- Benzocaine 20%
- Primary goal is to minimize the sensation of needle penetration
- Drying the mucosa with gauze before application may increase effectiveness
- Keep in mind-
  - Topical can actually make things worse when agents with bad taste sensitize the child to the coming injection, heightening the child’s anxiety
  - **DON’T USE TOO MUCH!!!**
  - The metabolite PABA may be responsible for a true allergic reaction in some people
Topical Anesthetic

- Benzocaine 20%
- FDA
  - New or resurrected concerns about causing methemoglobinemia
Benzocaine 20%

- New or resurrected concerns about causing methemoglobinemia
  - Disorder characterized by the presence of a higher than normal level of methemoglobin (metHb) in the blood
    - Oxidized form of hemoglobin
    - *Increased affinity for oxygen*
    - Resulting in a reduced ability to release oxygen to tissues
    - Tissue hypoxia can occur
- Signs/symptoms may occur in minutes or hours and include
  - Pale, gray, or blue-colored skin, lips, and nail beds
  - Shortness of breath
  - Fatigue
  - Confusion
  - Headache
  - Lightheadedness
  - Rapid heart rate
Needles

27- Gauge versus 30-Gauge
Short versus Long

**RESULTS**

- Children's reactions to maxillary buccal infiltration either with a 27- or 30-gauge needle were similar
- Significantly more children cried while receiving mandibular block injection with a 27-gauge needle than they did when receiving the injection with a 30-gauge needle (P = 0.002)
- According to subjective evaluation, most children rated both injections as a positive, non-painful experience.

**CONCLUSIONS**

- Mandibular block is “less unpleasant,” and children cry less when administered with a 30-gauge needle than they do when it is delivered with a 27-gauge needle
- No difference in crying during injection is observed when maxillary infiltration is provided with 27- or 30-gauge needles
Needle Selection and Injection Rate

- Shorter needles are used routinely for all local anesthetics for children
  - Smaller face
  - Less deflection
- Inject slowly
  - 45 seconds or more per carpule
  - Reduces the discomfort from the expansion of the soft tissue
- Following injection allow the child to rinse mouth with water
  - Removes tastes
  - Gives them a break/control
- Children like to succeed, so encourage them and thank them for their cooperation
- AAPD – any 23-30 gauge needle may be used
  - Blood can be aspirated through them
    - More difficult through the smaller
- Do not bend
  - Needle breakage

**Clinical Preventive Measures**
- Patient awareness prior to injection
- Inspect needle irregularities
- Never insert the needle up to its hub
- Never bend the needle prior to injection
- Avoid needle deflection or change needle’s direction while administrating anesthetics
- Injection should be given slowly
- Avoid aggressive contact with periostium and hard tissue

**Emergency Treatment**
- Visible tip of needle
  - Retrieve immediately by grasping it with a hemostat
- Non-visible needle
  - Calm the patient and prevent jaw movements
  - Never attempt to palpate or surgically explore the retromolar region
  - Refer to an oral and maxillofacial surgeon’s attention
Needle breakage. The weakest part of the needle is where it attaches to the hub; this is where most needle breaks occur. When injecting, never bury the entire length of the needle into soft tissue, as doing so places greater stress on the needle/hub joint. Should the needle break when completely buried, it will often disappear entirely into the soft tissue and make retrieval significantly more difficult. If you are unable to retrieve a broken segment of needle, refer the patient to an oral surgeon or appropriate physician specialist.

*We received 37 claims from 1995 through 2002 that alleged a needle broke during a dental injection.*
Anesthesia Technique

- **Dr. Slaughter’s Tips**
- **Needle size**
  - Maxillary injections
    - 3/4 carpule 30 gauge most of the time
  - Inferior alveolar block
    - 30 gauge most of the time
    - 27 gauge for children greater than 12 years of age
    - Bimandibular blocks not generally recommended
A Word About Cross-Innervation

- Frequently at the midline of the maxilla and mandible
- Terminal nerve endings will ‘cross’ the midline
- This may require supplemental infiltrations to yield profound anesthesia for those teeth nearest the midline
Maxilla

- Anterior superior branch
  - Central
  - Lateral
  - Canine
- Middle superior branch
  - Primary molars
  - Premolars
  - Part of first molar
- Posterior superior branch
  - Sometimes
    - Second primary molar
  - Rest of first molar
  - Rest of the molars
Maxilla: Pyramid-like
Maxillary Anterior Teeth

- Nerve
  - Anterior Superior
- Injection Type
  - Local infiltration
- Amount Injected
  - 0.25-0.5 carpule
- Supplemental
  - Cross-Innervation
    - Contralateral infiltration
  - Endodontic or Surgical Procedure
    - Nasopalatine
Maxillary Anterior Teeth

- Pull out the cheek or lip, stretching the mucolabial fold in the area to be injected
- Direct the syringe at a 45-degree angle to the maxillary teeth, just above the attached gingiva
  - Compensates for the pyramid-like shape of the maxilla
- Penetrate to a point above the root apices
- Penetrate to a point close to the bone, as near as possible to the apex of the tooth being anesthetized
- If two teeth are to be anesthetized, inject between them
Maxillary Anterior Teeth

- Area anesthetized
  - Central
  - Lateral
  - Most of the canine
    - Supplement by additional deposition above canine root
  - Buccal/Labial mucosa
    - Not palatal
Maxillary Anterior Teeth

Dr. Slaughter’s Tip

When anesthetizing maxillary anteriors, try to bring the needle in at an angle from the side.

○ It is easier to control the movement of the head in the frontal plane

○ If the needle is inserted at an angle, you can minimize tissue trauma caused by head movement of the child
Maxillary Posterior Teeth (Primary Molars)

- Nerve
  - Middle Superior
- Injection Type
  - Local infiltration
- Amount Injected
  - 0.5-1.0 carpule
- Supplemental
  - Primary second molar
    - Infiltration superior and posterior to the distal root
    - Posterior superior innervation
  - Endodontic or Surgical Procedure
    - Greater Palatine
Maxillary Posterior Teeth (Primary Molars)

- As before:
  - Pull out the cheek or lip, stretching the mucolabial fold in the area to be injected
  - *If two teeth are to be anesthetized, inject between them*
  - Direct the syringe at a 45-degree angle to the maxillary teeth, just above the attached gingiva
    - Compensates for the pyramid-like shape of the maxilla
  - Penetrate to a point above the root apices
  - Penetrate to a point close to the bone, as near as possible to the apex of the tooth being anesthetized
  - *Infiltrate distal to second primary molar*
    - Cross innervation from posterior superior alveolar
Maxillary Posterior Teeth (Primary Molars)

- Area Anesthetized
  - Primary molars
  - Some of the permanent first molar
  - Buccal mucosa
  - Not palatal
Maxillary Posterior Teeth (Permanent Molars)

- Nerve
  - Posterior Superior

- Injection Type
  - Local infiltration

- Amount Injected
  - 0.5-1.0 carpule

- Supplemental
  - First molar
    - Infiltration superior and anterior to the mesial root
      - Middle superior innervation
  - Endodontic or Surgical Procedure
    - Greater Palatine
Maxillary Posterior Teeth (Permanent Molars)

- As before:
- Pull out the cheek or lip, stretching the mucolabial fold in the area to be injected.
- Direct the syringe at a 45-degree angle to the maxillary teeth, just above the attached gingiva.
  - Compensates for the pyramid-like shape of the maxilla
- Penetrate to a point above the root apices.
- Penetrate to a point close to the bone, as near as possible to the apex of the tooth being anesthetized.
- *Supplement with infiltration superior and anterior to the mesial root*
Maxillary Arch Injections  Nasopalatine & Greater Palatine

- Indications
  - Anesthetize the soft tissue when performing endodontic and/or surgical procedures

- Nasopalatine
  - Anterior one-third of the palate
  - Bilaterally

- Greater Palatine
  - Unilaterally, from the tuberosity to the cuspid
Maxillary Arch Injections  Nasopalatine & Greater Palatine

- Using pressure anesthesia at points of needle entry
- Nasopalatine
  - Puncture point is along side the incisive papilla
  - Direct needle toward the anterior palatine canal
Maxillary Arch Injections  Nasopalatine & Greater Palatine

- Using pressure anesthesia at points of entry
- Greater Palatine
  - Puncture point is at any point along its course from the posterior palatal foramen forward
  - Direct needle *distal* to that area to be anesthetized at a point half-way between the gingival margin and the palatal raphe
Maxillary Arch Injections
Nasopalatine & Greater Palatine

- Area Anesthetized
  - Nasopalatine
    - Bilateral palatal tissue from canine to canine
  - Greater Palatine
    - Unilateral palatal tissue from canine distal to tuberosity area

*image a bit confusing - only innervates palatal mucosa & alveolus*
Maxillary Arch Injections
Nasopalatine & Greater Palatine

Okay, they hurt
Maxillary Arch Injections  Nasopalatine & Greater Palatine

- **Method 1**

- **Nasopalatine**
  - Apply pressure with the tip of cotton tip applicator at point of injection for 60 seconds immediately prior to injection
    - This minimizes pain via pressure anesthesia
    - You may use the same applicator used for the topical anesthetic
  - Inject at 45-degree angle to palate, lingual to tooth, and approximately 1 cm from gingival margin toward the midline
  - Deposit 0.25 carpule solution
Maxillary Arch Injections  Nasopalatine & Greater Palatine

- **Method 2**
- **Nasopalatine**
  - After the buccal vestibular soft tissue has been anesthetized, inject the interdental papilla from the buccal aspect
  - Inject into the blanched area on the palate for nearly painless palatal anesthesia
Maxillary Arch Injections

- **Method 1**
  
  - **Greater Palatine**
    
    - Apply pressure with the tip of cotton tip applicator at point of injection for 60 seconds immediately prior to injection
      
      - This minimizes pain via pressure anesthesia
      
      - You may use the same applicator used for the topical anesthetic
    
    - Inject at 45-degree angle to palate, lingual to tooth, and approximately 1 cm from gingival margin toward the midline of the palate
    
    - Deposit 0.25 carpule
Maxillary Arch Injections  Nasopalatine & Greater Palatine

Method 2

Greater Palatine

- After the buccal vestibular soft tissue has been anesthetized, inject the interdental papilla from the buccal aspect

- Inject into the blanched area on the palate for nearly painless palatal anesthesia
Maxillary Arch Injections  Nasopalatine & Greater Palatine

- Method 2
- Greater Palatine
Mandible

- Inferior alveolar
- Lingual nerve
- Buccal branch

○ (Mylohyoid branch)
Mandible

- Inferior alveolar
- Lingual nerve
- Buccal branch
Recommend Block Anesthesia for Most Procedures

Even with the high degree of porosity of children’s bone, mandibular local infiltration should be reserved for supplemental injections or when soft tissue anesthesia only is required.
Differences in Anatomy - Mandibular Foramen
Differences in Anatomy - Mandibular Foramen
Differences in Anatomy - Mandibular Foramen

Primary dentition

Below the plane of occlusion
6 - 12 years
About even with the plane of occlusion
Over 12 years

palate the deepest curvature of the anterior border of the ramus with the thumb and bisect
Differences in Anatomy - Mandibular Foramen

- Primary dentition
  - Below the plane of occlusion
- 6 - 12 years
  - About even with the plane of occlusion
- Over 12 years
  - Palpate the deepest curvature of the anterior border of the ramus with the thumb and bisect
Mandibular Anesthesia

- Nerve
  - Inferior Alveolar
- Injection Type
  - Block
- Amount Injected
  - 0.75-1.0 carpule
- Supplemental
  - Buccal soft tissue
    - Buccal branch
      - Infiltration
  - Lingual soft tissue
    - Lingual branch
      - Infiltration
  - Mylohyoid (?)
    - Accessory innervation to the pulps of both anterior and posterior mandibular teeth by the sensory component of this nerve has been proposed to be one possible anatomical variation leading to failure of an inferior alveolar nerve block
Mandibular Anesthesia

Clark, Reader, Beck & Meyers @ Ohio State


“Anesthetic efficacy of the mylohyoid nerve block and combination inferior alveolar nerve block/mylohyoid nerve block.”

CONCLUSIONS: The results of this study suggest that the mylohyoid nerve block does not by itself predictably provide pulpal anesthesia in mandibular teeth and does not significantly enhance pulpal anesthesia when administered in combination with the IAN block.
Mandibular Anesthesia – Supplemental

- If supplementation is necessary, consider reviewing technique and reinject
- If still lack of profound anesthesia, consider:
    - Intraligamentary (periodontal ligament) injection
    - Intraosseous injection (example - Stabident ®)
    - Mandibular buccal infiltration injection with Articaine 4% with epinephrine
    - Intrapulpal injection
    - Buccal infiltration with Articaine 4% with epinephrine
    - Intraosseous injection
Mandibular Anesthesia - Technique

- Triangular depression
  - Pterygomandibular space

- Borders (Landmarks)
  - Medial (Internal)* pterygoid
  - Anterior border of the ramus

- Aim toward apex

*Obsolete term for medial pterygoid
The IAN, IAV and IAA are wrapped together by a fibrous sheath, in a neurovascular bundle, which occupies a spooned-out depression on the medial surface of the ramus.
Mandibular Anesthesia - Technique
Common Mistakes

- Too far lateral
  - Inject into buccinator proper
- Too far medial
  - Inject through soft palate
Mandibular Anesthesia - Technique

- Palpate the retromolar fossa thumb or index finger
- Move thumb posteriorly along the external oblique ridge up the ramus of the mandible
- Locate the deepest concavity of the anterior border of the ramus (coronoid notch)
  - This is the level of the penetration of the needle
- Fingernail lies over internal oblique line
Mandibular Anesthesia - Technique

- Barrel of syringe between primary molars (premolars) of opposite side
- Direct needle in age appropriate relation to the occlusal plane
- Tell the child to expect to feel a slight pinch
- Insert to a depth one-half the palpated width of the ramus
  - Aiming for mandibular foramen

Distraction Technique – shake cheek while inserting needle
Mandibular Anesthesia - Technique

- Advance the needle slowly until bone is gently contacted at the posterior surface of the mandibular sulcus
- Aspirate
  - If blood is aspirated, withdraw the needle slightly and aspirate again
  - If no blood is aspirated, deposit one-half carpule slowly over a period of one minute to minimize the pain caused by expansion of the tissue
Mandibular Anesthesia - Technique

- **Lingual nerve**
  - Soft tissue on lingual
  - Inject small amounts during insertion and withdrawal of the needle during inferior alveolar

- **Long buccal**
  - Soft tissue on buccal
  - Inject small amount in mucobuccal fold distal to area required
  - Dr. Slaughter’s Tips
    - This is especially noticeable when placing a rubber dam clamp

**Dr. Slaughter’s Tips**

This is especially noticeable when placing a rubber dam clamp.
Mandibular Anesthesia – Mental Nerve Block

- Nerve
  - Mental Nerve
    - Branch of Inferior Alveolar

- Injection Type
  - Field anesthesia

- Amount Injected
  - 0.25-0.5 carpule

- Supplemental
  - Lingual
  - Buccal

- Indications
  - *Complete block is unnecessary or contraindicated*
Mandibular Anesthesia – Mental Nerve Block

Technique

- Visualize foramen between roots
- Judge the location of the apicies of the primary molars (premolars)
- Judge the location of the apices of the lower premolars or primary molars both clinically and radiographically
  - The mental foramen is usually found close to the apex of these teeth
- Stretch the cheek buccally
Mandibular Anesthesia – Mental Nerve Block

- Direct the syringe at an angle of about 45 degrees to the buccal plate of bone of mandible
  - Aiming at the apex of the second primary molar, or in the case of an older child, the premolar root
- Penetrate the mucous membrane between the premolars and about 10 millimeters externally to the buccal plate of the mandible
- Advance the needle until bone is contacted (ouch)
Mandibular Anesthesia – Mental Nerve Block

- Deposit slowly about 0.25 carpule of solution
- Wait a few moments, then locate and enter the mental foramen with the point of the needle
  - Posterior approach may be necessary
- Deposit 0.5 ml of solution slowly
Mandibular Anesthesia – Mental Nerve Block

- Area anesthetized
  - Note that area is limited and not on lingual
Mandibular Anesthesia – Incisor Infiltration

- It is possible to anesthetize the four anterior teeth through the infiltration method by injecting in both sides of the midline where the overlying bone is thin.

- This injection is also useful for blocking nerve fibers to incisor teeth that may cross the midline from the opposite side when a unilateral mandibular or mental block is administered.
Evaluation of Anesthesia

- You need to be certain that a behavior problem is not really a problem
- It is not always reliable to ask the patient
- Test with an explorer
- For an operative procedure, explaining that the tooth ring will hug the tooth tightly will avoid a negative response when it is placed
  - Try “Tell-Show-Do"

- Trick
  - Run the handpiece outside of the mouth
  - Next, run the handpiece in the mouth, but not touching the tooth
  - Observe the reaction – **successive approximation**

**LOOK AT THEIR EYES!!!!!!**
Why don’t some children get numb?

- An imperfect injection technique is the most common cause of problems with getting numb.
- Another common cause of problems is that local anesthetics do not work well in an acidic environment, such as an inflamed or abscessed area.
  - It is therefore sometimes useful to control a dental infection with antibiotics before a local anesthetic can be successfully used.
- If an upper primary or permanent molar is not getting numb, try a palatal injection.
Sequelae

- Self-Inflicted Wound
  - Most common
- Haematoma
  - Mass of usually clotted blood that forms in a tissue, organ, or body space as a result of a broken blood vessel
- Trismus
  - Spasm of the jaw muscles that makes it difficult to open the mouth
- Sympaticus (sympathicus stimulus) Reaction
  - (Possible) vascular spasm
Self-Inflicted Wounds

- Remember to warn the child not to bite the “numb” lip or cheeks
- Give the warning during the dental appointment as well as at the end of the appointment
Sequelae

- Trismus

- Sympaticus Reaction

**CASE**
- 10-year-old received IAN
- Subsequently developed pallor
- Ulcerated, crusted, healed
- Ruled out self-inflicted wound, allergic reaction, infection
- Postulated - skin necrosis secondary to vascular spasm of the terminal branches of the inferior alveolar artery
  - Possible injection of vasoconstrictor into the artery
  - Triggering vascular spasm
Recommended Documentation

AAPD Guidelines

- Type and dosage of local anesthetic in milligrams
  - Vasoconstrictor can be recorded as concentration
- Type of injection
  - Infiltration, block, intrapulpal

**Example** - 34 milligrams lidocaine (1 carpule) with 1:100,000 epinephrine right mandibular block with long buccal and lingual infiltration
Recommended Postoperative Instructions
AAPD Guidelines

- Behavioral
  - Soft tissue is ‘numb’ – be careful not to bite or chew it
  - Do not scratch face if anesthetized

- Dietary precautions
  - Soft diet (?)
  - "Eat what you want, but chew on the other side"
Management of Local Anesthetic Emergencies

Overdose
Toxicity – different than adults?

- Agents tend to be absorbed more rapidly because
  - Higher degree of cardiac output
  - Higher basal metabolic rate
  - Higher degree of tissue perfusion

- Less mature liver enzymes may detoxify these chemicals at a lower rate

- Immature central nervous system & cardiovascular system are probably more susceptible at lower drug levels

*Wilson & Montgomery*
Management of Local Anesthetic Emergencies

- First consideration is prevention
  - Good medical history
  - Weight-related doses

- Recognition of overdose signs
  - CNS toxicity – Excitatory and depressant
    - Restlessness, anxiety, tinnitus, dizziness, blurred vision, tremors, depression, drowsiness, vomiting, sensations of heat, general coldness or numbness, twitching, convulsions, respiratory depression
  - Cardiovascular system – Usually depressant
    - Bradycardia, hypotension, cardiovascular collapse
Management of Local Anesthetic Emergencies

911
Monitor vital signs
Administer oxygen
Maintain airway
Anticonvulsants
Alternative Techniques

Electronic Dental Anesthesia

Computer-Controlled Electronic Delivery System
Alternative Techniques
new ‘stuff’

- Possible failures for the IAN is the perineural barrier around the nerve sheath
  - May not allow complete diffusion of the anesthetic solution into the nerve trunk
- Mannitol solution may open the perineural membrane for macromolecules
  - Study suggest that the addition of 0.5M mannitol in a lidocaine with epinephrine solution was significantly more effective in achieving a greater percentage of total pulpal anesthesia than a formulation without the mannitol

Dry skulls were used to determine an alternative technique for the inferior alveolar nerve block using several anatomical points for reference with greater success

- Mandibular primary second or permanent first molar
  - Mesiobuccal groove
  - Distolingual cusp
    - Mesial slope
    - Midpoint
- Occlusal plane of the contralateral side
- Junction is at or very near the mandibular foramen
- Coincidence is higher in the primary dentition
- Useful? Clinical studies have begun

<table>
<thead>
<tr>
<th>Table 1: Mean and percentage values obtained</th>
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<tbody>
<tr>
<td>Reference tooth</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Permanent first molar</td>
</tr>
<tr>
<td>Primary second molar</td>
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