LOCAL ANESTHESIA FOR CHILDREN

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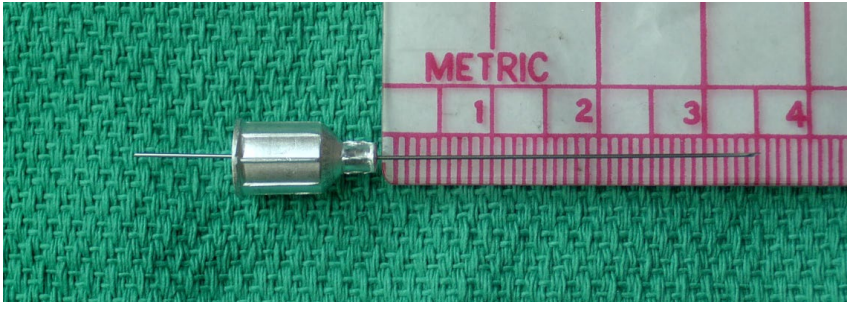
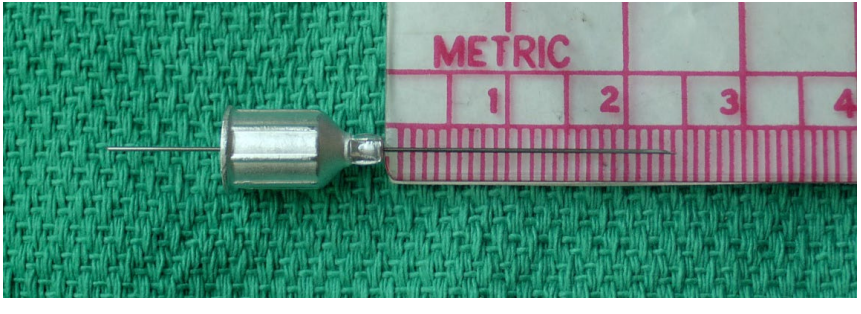
LOCAL ANESTHESIA (LA)

- ARMAMENTARIUM
- Anesthetic Choice
- Techniques
- Complications

NEEDLE LENGTH
Measured from hub to tip



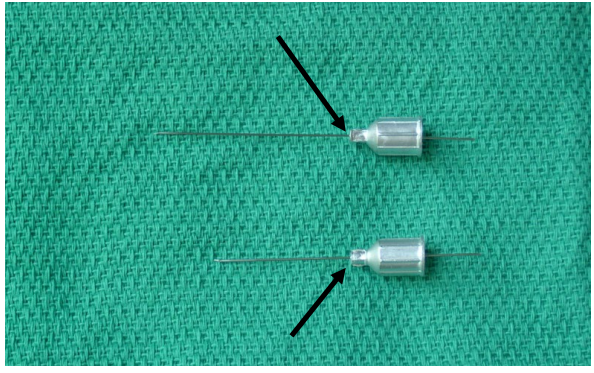
- **LONG: 32 mm.**



- **SHORT: 20 mm.**

NEEDLES

- The most rigid part of a needle is at its hub



- Needles, when they break, **ALWAYS** break at their hub

NEVER

bend needles or
insert a 25/27-gauge needle
to its hub,
unless it is
absolutely essential
for the success
of the injection

BROKEN NEEDLES — 1997 to 2002

Needle gauge	Needle length	#
25	Long	0
	Short	0
27	Long	0
	Short	0
30	Short	27

Dentsply – MPL Technologies, Franklin Park IL.

LARGE GAUGE vs. SMALL GAUGE

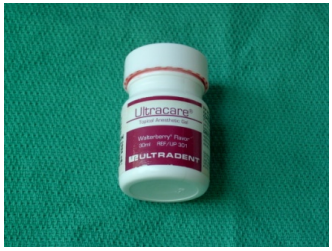
- **LARGE GAUGE PREFERRED BECAUSE**:
  - Less deflection
  - Greater accuracy
  - Aspiration easier
  - Less chance of breakage
  - Patient comfort

LOCAL ANESTHESIA

- Armamentarium
- **Drugs**
- Techniques
- Complications

TOPICAL ANESTHESIA

- Used to reduce the discomfort associated with insertion of the needle into the mucosal membrane.
- Usefulness – debated. May form a conditioned response because the injection follows the topical anesthetic.
- The operator's effectiveness in distracting the patient and managing the child's anxiety may supersede the disadvantages of topical anesthetic.
- Remember that esters, such as Benzocaine, have a better absorption rate through mucosa, but therefore a decreased safety margin especially for children (greater chance for toxic or allergic reactions).



Contraindicated for children < 2 years old, can cause methemoglobinemia.

TOPICAL ANESTHETIC RECOMMENDATIONS

Introduction to Dental Local Anaesthesia

- **Use a good tasting benzocaine containing gel**
- **Only use a small amount on a cotton applicator on dry tissue**
- **Avoid excessive amounts (potential toxicity)**
- **May take from 30 seconds to 5 minutes to be effective**
- **Use 2X2 gauze to help prevent taste from bothering patient and to hold lips which can be slippery**

NEEDLES

COMMONLY USED IN THE PEDIATRIC DENTAL CLINIC AT OHSU DENTAL SCHOOL

- 30 gauge (xshort) - good for intraligament
- 30 gauge (short) – good for infiltration (DO NOT USE FOR BLOCKS due to difficulty with aspiration and possible breakage)
- 27 gauge (short) - good for blocks, but avoid inserting needle all the way to the hub (if necessary, use a 27 long)

CHOICE/DOSAGE OF LOCAL ANESTHETIC FOR CHILDREN

- Supplied in a 1.8 cc CARTRIDGE (Carpule® is a brand and not in use at OHSU. The correct term is CARTRIDGE)
- 2% lidocaine with 1:100,000 epinephrine (2% = 20mg/ml x 1.8 ml/cartridge = 36 mg/cartridge)
- Use vasoconstrictors — they increase safety
- **Maximum dosage = 2 mg/pound** (know this for the test!)
  - Children have a higher metabolic rate, which means that more anesthetic enters their bloodstream in a shorter time.
- Always know maximum dose before administering any amount of local anesthetic to a patient. **A safe rule-of-thumb is 1 cartridge/20 lbs.**
- **CHECK EXPIRATION DATE & KEEP COUNT OF CARTRIDES!**
- **ASK "PERMISSION" FROM ATTENDING FACULTY BEFORE ADMINISTERING UP TO THE MAXIMUM DOSE IN THE PEDIATRIC DENTAL CLINIC.**

MAXIMUM RECOMMENDED DOSES OF LOCAL ANESTHETICS

DRUG	MAXIMUM DOSE (MG/KG)	MILLIGRAMS/CARTRIDGE*
Lidocaine (2%) w/wo epinephrine	4.4 (300 mg max)	36
Mepivacaine (2%) w/wo levonordefrin	4.4 (300 mg max)	36

	MAXIMUM DOSAGE	MAXIMUM DOSAGE
PATIENT WEIGHT (KG/LB)	MILLIGRAMS	NO. OF CARTRIDGES
10/23	44	1.2
15/34.5	66	1.8
20/46	88	2.4
25/57.5	100	2.7
30/69	132	3.6
40/92	176	4.8
50/115	220	6.1
60/138	264	7.3
70/161	300	8.3

MAXIMUM RECOMMENDED DOSAGE – How to Calculate

- 60 lb patient
- Lidocaine + epi 1:100K (.018µg)
  - 2.0 mg/lb
  - Total dose (over 90min) = 120mg
  - 120mg/36mg per cartridge = ~3.3 cartridges

- 40 lb patient
- Lidocaine + epi 1:100K
  - 2.0 mg/lb
  - Total dose (over 90min) = 80 mg
  - 80mg/36mg per cartridge = ~2.2 cartridges

(Once given max dose, must wait 24 hours before continued administration)

Table. INJECTABLE LOCAL ANESTHETICS (Adapted from Coté CJ et al.[32])

Anesthetic	Duration in minutes[A]	Maximum dose[B]		mg anesthetic/ 1.7 mL cartridge	mg vasoconstrictor/ 1.7 mL cartridge
		mg/kg	mg/lb		
Lidocaine[C]	90-200	4.4	2		
2%+1:50,000 epinephrine				34	0.034 mg
2%+1:100,000 epinephrine				34	0.017 mg
Articaine	60-230	7	3.2		
4%+1:100,000 epinephrine				68	0.017 mg
4%+1:200,000 epinephrine				68	0.0085 mg
Mepivacaine[D]	120-240	4.4	2		
3% plain				51	—
2%+1:20,000 levonordefrin				34	0.085 mg
Bupivacaine[E]	180-600	1.3	0.6		
0.5%+1:200,000 epinephrine				8.5	0.0085 mg

A Duration of anesthesia varies greatly depending on concentration, total dose, and site of administration; use of epinephrine; and the patient's age.
B Use lowest total dose that provides effective anesthesia. Lower doses should be used in very vascular areas. Doses should be decreased by 30 percent in infants younger than six months. For improved safety, AAPD, in conjunction with the American Academy of Pediatrics, recommends a dosing schedule for dental procedures that is more conservative that the manufacturer's recommended dose (MRD).
C The table lists the long-established pediatric dental maximum dose of lidocaine as 4.4 mg/kg; however, the MRD is 7 mg/kg.
D Use in pediatric patients under four years of age is not recommended.
E The prolonged anesthesia of bupivacaine can increase risk of self-inflicted soft tissue injury.

Reference #2, pg 319.

LOCAL ANESTHESIA

- Armamentarium
- Drugs
- **TECHNIQUES**
- Complications

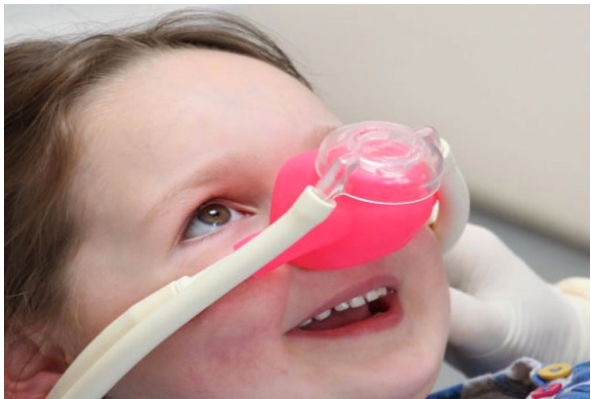
PRE-ADMINISTRATION

- Patient management – psychological preparation. TSD. N_2O-O_2 if necessary (MAKE YOUR PATIENT COMFORTABLE)
- Language level must be appropriate for age and understanding of child. Never lie!

GOOD WORDS	BAD WORDS
Put to sleep, tube	Needle
Take a nap	Novocain
Numb, fuzzy, sleepy	Sharp
Sleepy juice	Shot
Pinch	Hurt, Pain, Sting

BEHAVIOR MANAGEMENT

- Patient management = psychological preparation
- Tailor to patient's developmental stage
- "Tell - (Show) - Do"
- Nitrous Oxide anxiolysis if necessary
- Visual distraction
- Music, story telling



ADMINISTRATION OF LOCAL ANESTHETIC

- **Competent injection process. Follow landmarks. Inject <u>SLOWLY</u> over 1-2 minutes/cartridge (solution acidic). <u>Aspirate Repeatedly</u>! Slowly withdraw syringe. Do not leave alone after injection (adverse reactions can happen quickly!)**
- **Use the minimum amount of anesthetic solution that is needed to achieve adequate anesthesia to keep the patient comfortable throughout the procedure**
- **Do not let child sit up or stand immediately after injection. Do not leave child alone!**
- **Testing the anesthetic – Never ask if it hurts. Ask if it bothers him or her? Test before beginning treatment**

COMPETENT INJECTION TECHNIQUE

- **Make tissues taut**
  - **stretch tissues at injection sight, use 2 x 2 when appropriate**
  - **Needle penetration easier**
  - **More comfortable during and after injection**
- **Keep syringe out of patient's line of sight**
- **Gently insert needle into mucosa**
- **Give child option to signal if discomfort**
- **Use finger rests**
- **Watch & communicate with patient**
  - **Furrowing of brows or forehead**
  - **Squinting of eyes**
  - **Flaring of nostrils**
- **Inject several drops of anesthetic**
- **Slowly advance needle towards target**
- **Deposit several drops before touching periosteum**

COMMON MISTAKES WITH ADMINISTRATION OF LA

- **Waving needle in front of patient (HIDE IT!) There are only a few situations where you may want to show a child the needle.**
- **NOT getting "firm" control of child's head and hands (use assistant or parent)**
- **Using long needles when not needed**
- **Using inappropriate doses for children**
- **Forgetting palatal anesthesia during SSC or extraction procedures in the maxilla**

- **Forgetting long buccal injection with inferior alveolar block**

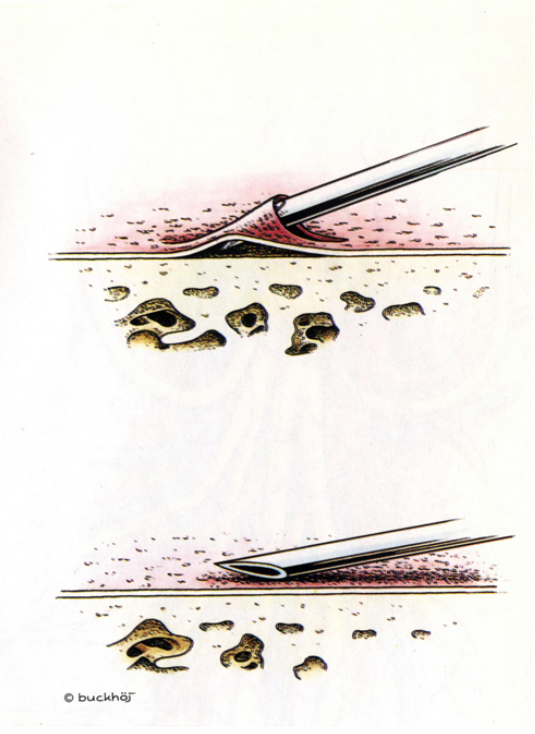
FUNDAMENTAL DIFFERENCES IN CHILDREN VS. ADULTS

- **There are three specific anatomic differences to be conscious of in children.**
- **The proximity of vascular structures in the maxillary tuberosity area, where penetrating too deeply with the needle can result in injury to the pterygoid venous plexus or posterior superior alveolar vasculature with a resulting hematoma.**
- **The mandibular ramus is shorter and narrower anteriorposteriorly; therefore, for an inferior alveolar nerve block, the depth of penetration of the needle must be reduced.**
- **The bone in children is less dense and generally less mineralized and, in the area of the primary dentition, contains the permanent tooth buds. Because of this, adequate operative anesthesia can frequently be obtained in many areas by local infiltration anesthesia, utilizing relatively small amounts of anesthetic solution. More rapid diffusion of the anesthetic solution is obtained on primary teeth.**

MAXILLARY ANESTHESIA

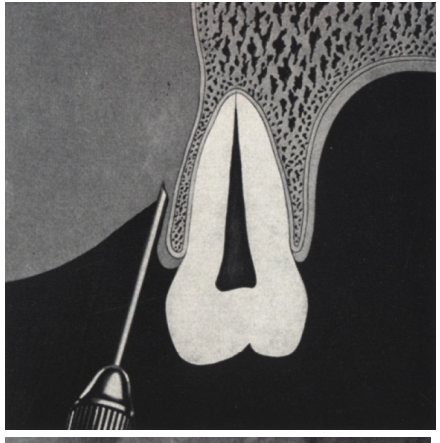
- Maxillary anesthesia – All maxillary primary teeth, as well as permanent molars can be anesthetized by supraperiosteal infiltration in the vestibule. PSA may not be necessary for permanent molars.
- 27-gauge short needle
- Anterior maxilla is VERY sensitive
- 1/3 – 2/3 cartridge is average

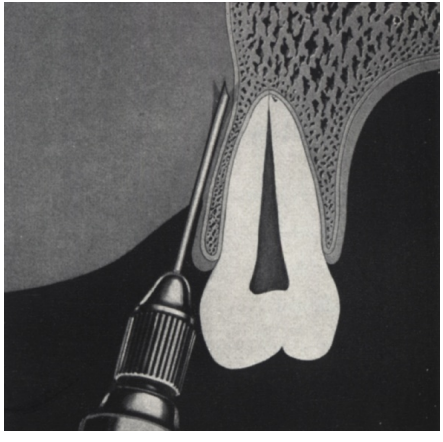
MAXILLARY ANESTHESIA TECHNIQUE

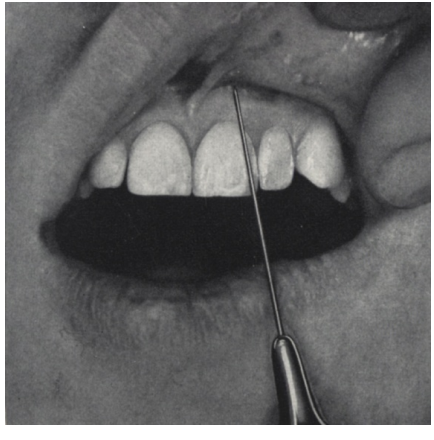


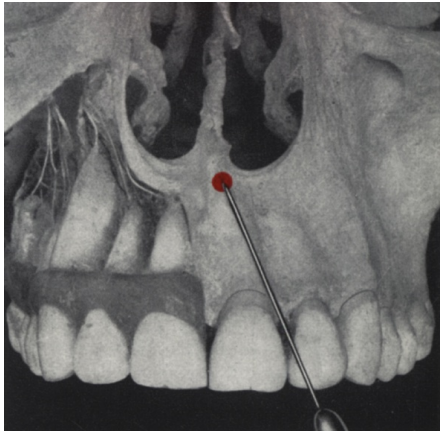
1. Reflect tissue to expose injection site.
2. Orient bevel of needle to be parallel to the bone.
3. Insert needle in mucobuccal fold.
4. Proceed to depth approximating that of root apices. This depth less in the 1° dentition.
5. The bevel of the needle should be adjacent to the periosteum of the bone. ASPIRATE!
6. Inject the bolus of anesthetic very slowly.
7. Remove needle slowly and apply pressure to area with 2 x 2 gauze for hemostasis.

MAXILLARY ANESTHESIA









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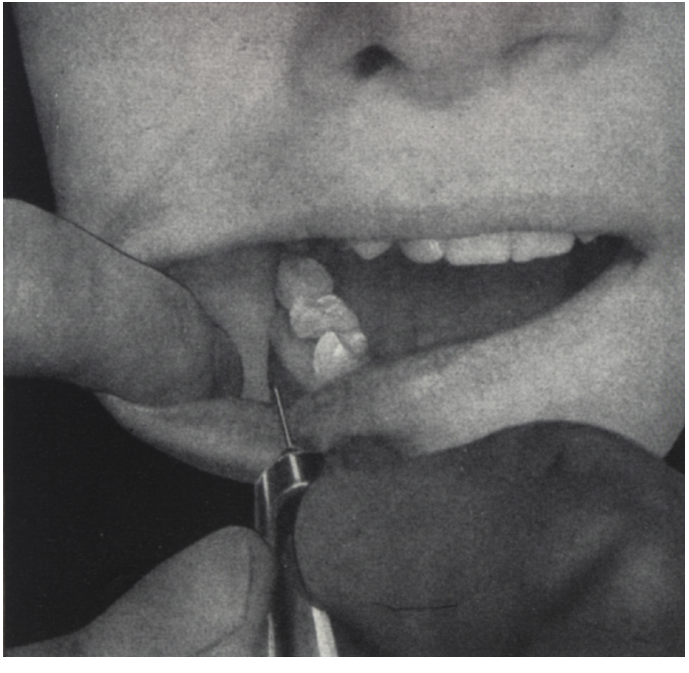
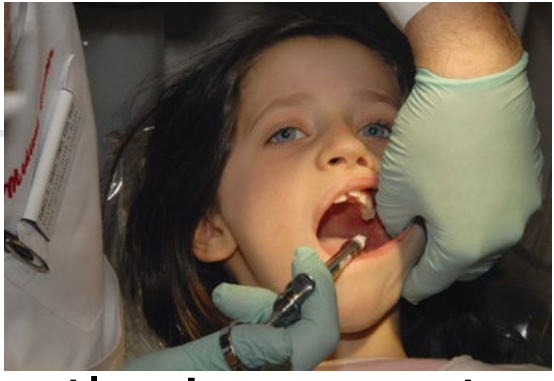
INFILTRATION ANESTHESIA



- **DO NOT** use infiltration anesthesia to anesthetize posterior teeth once the 6-year permanent teeth have begun eruption.
- The cortical plate is too dense!

MANDIBULAR ANESTHESIA



To block or not to block?

In pediatric dentistry, block anesthesia may not be required for less invasive procedures:

- Thin cortical plate
- Mental nerve "block" for primary molars
- Avoids tongue numbness

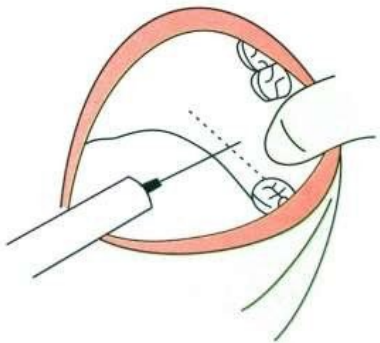
Inferior alveolar nerve block may still be the best choice for extractions and pulp treatments in the mandible.

INFERIOR ALVEOLAR NERVE BLOCK + LINGUAL NERVE BLOCK

- The mandibular foramen is situated at a the level or lower than the occlusal plane of the primary teeth of the pediatric patient in primary and mixed dentition.
- The injection must be made slightly lower and more posteriorly than for an adult patient.

BELOW 6 YEARS

6 – 12 YEARS

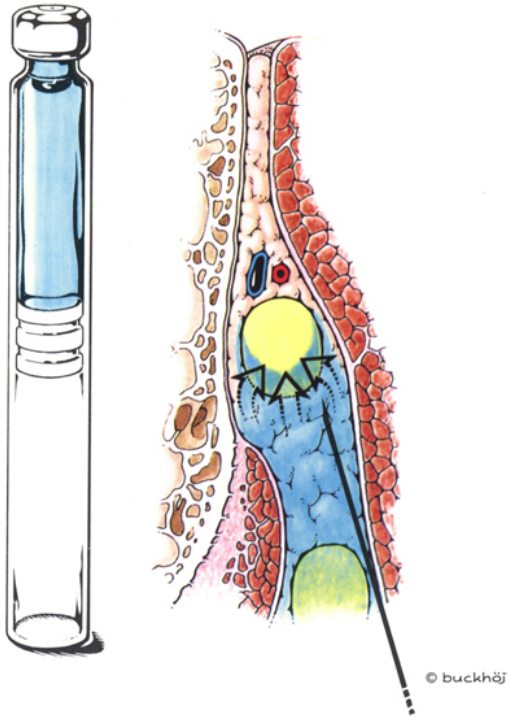


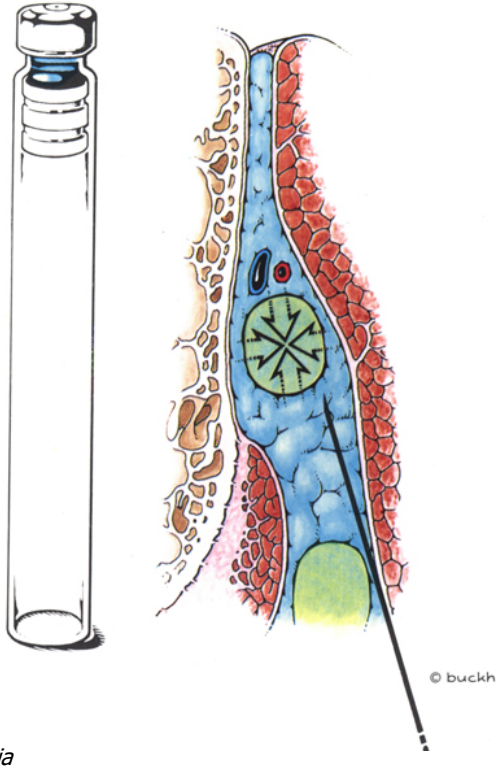
ABOVE 12 YEARS

LANDMARKS

1. Coronoid notch
2. Pterygomandibular raphe
3. Occlusal plane of the mandibular posterior teeth.

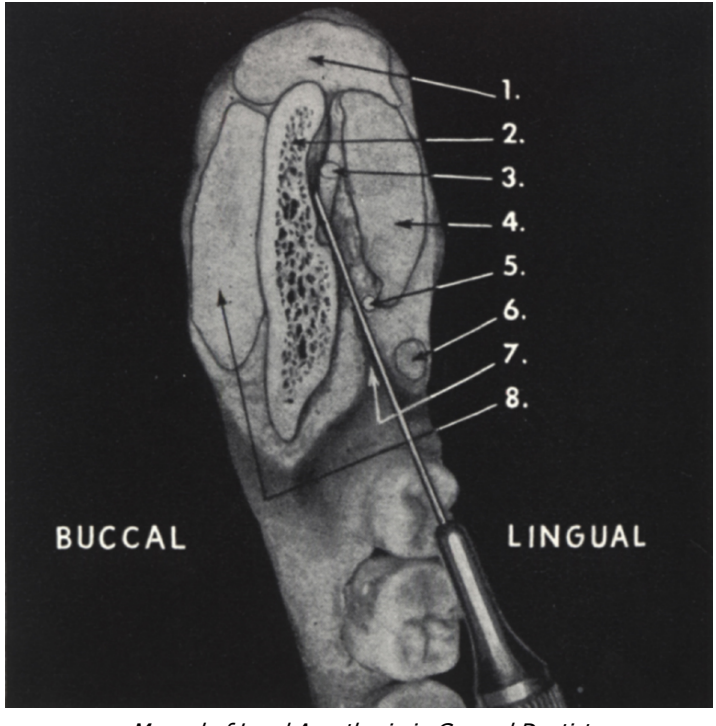
USE ENOUGH ANESTHETIC





MANDIBULAR ANESTHESIA cont.

- Hit bone "too soon"
  - Needle tip too anterior
  - Withdraw slightly, angulate needle tip more posteriorly
  - Re-advance to correct depth (~15 mm)
- No bone
  - Needle tip too posterior
  - Withdraw slightly, angulate needle tip anteriorly
  - Re-advance to correct depth (~15mm)



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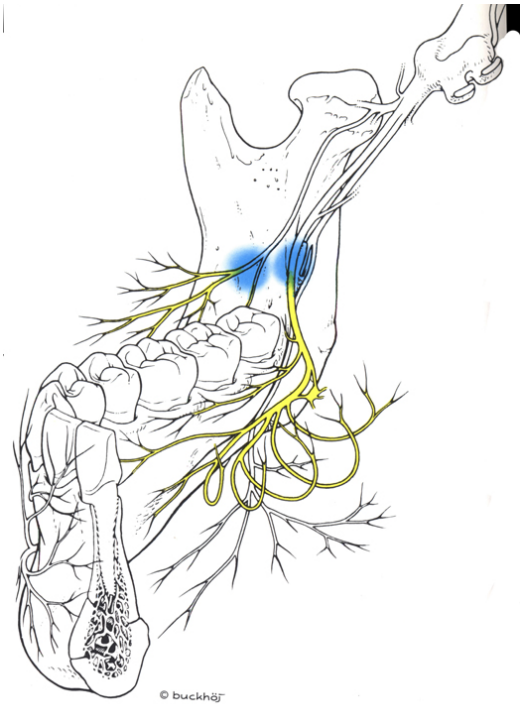
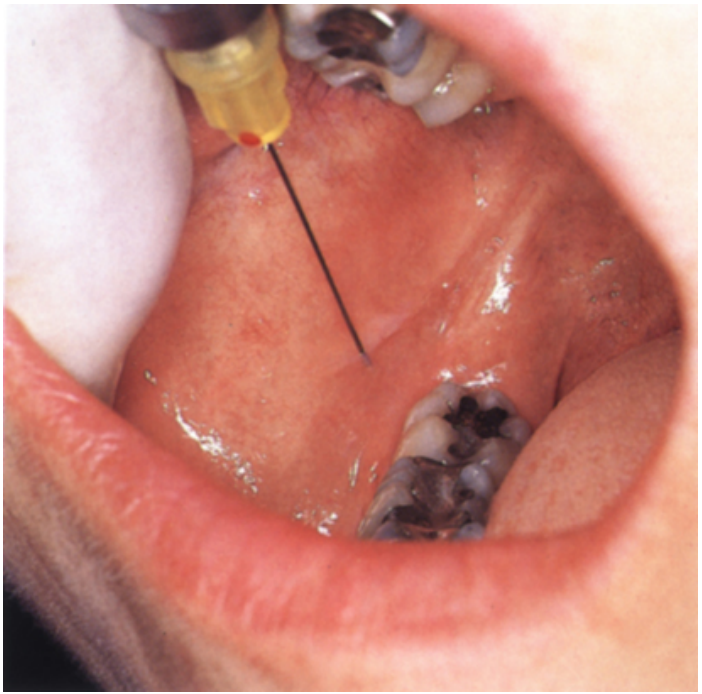
BUCCAL NERVE BLOCK



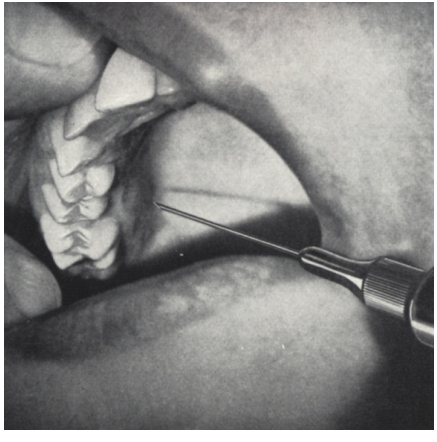


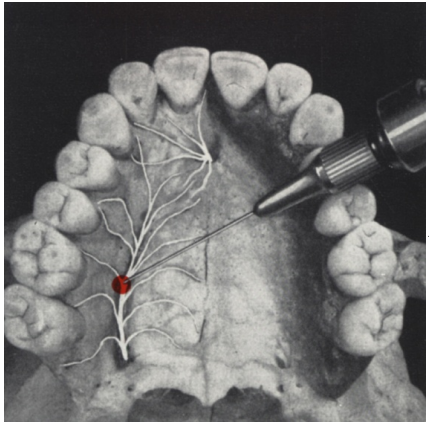
Accessory Innervation > ⅓ to ½ of Time

PALATAL TISSUE ANESTHESIA

THIS BLOCK IS PAINFUL, AND CARE SHOULD BE TAKEN TO PREPARE THE CHILD ADEQUATELY!

1. For distraction apply pressure with a cotton-tipped applicator to the site that is to receive the needle.
2. Insert needle with bevel oriented parallel to the bone immediately adjacent to the applicator.
3. Proceed to depth at which the bevel of the needle is adjacent to the periosteum and Aspirate.
4. Inject the bolus of anesthetic very slowly.
5. Remove needle and apply pressure to the area with 2 x 2 gaze for hemostasis.





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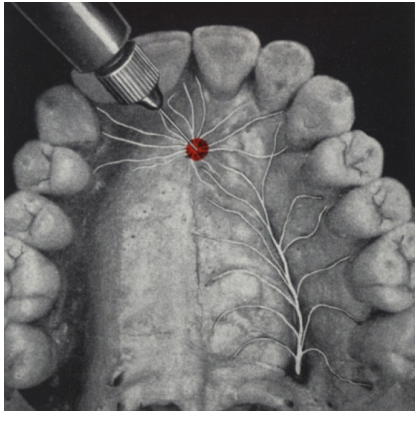
NASAL PALATINE BLOCK



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1. Same technique described for palatal tissue anesthesia.
2. The needle is inserted to the left or right side of the papilla.
3. You will note blanching of tissue at the injection site.

PALATAL ANESTHESIA ALTERNATIVE

- Alternative – Supraperiosteal injection on the facial combined with interdental injection, which includes the lingual tissues, is usually quite adequate and avoids unnecessary pain associated with the palatal injections.
- The interdental injection should follow the buccal infiltration by about 3-5 minutes to minimize the pain associated of the second injection
- Insert needle horizontally into the buccal papilla just above the interdental septum
- Local anesthetic is injected as the needle is advanced toward the palatal side. This should cause blanching of the soft tissue on the palate
- 27 gauge short or 30 gauge extra-short or short
- 0.2 to 0.5 ml of anesthetic

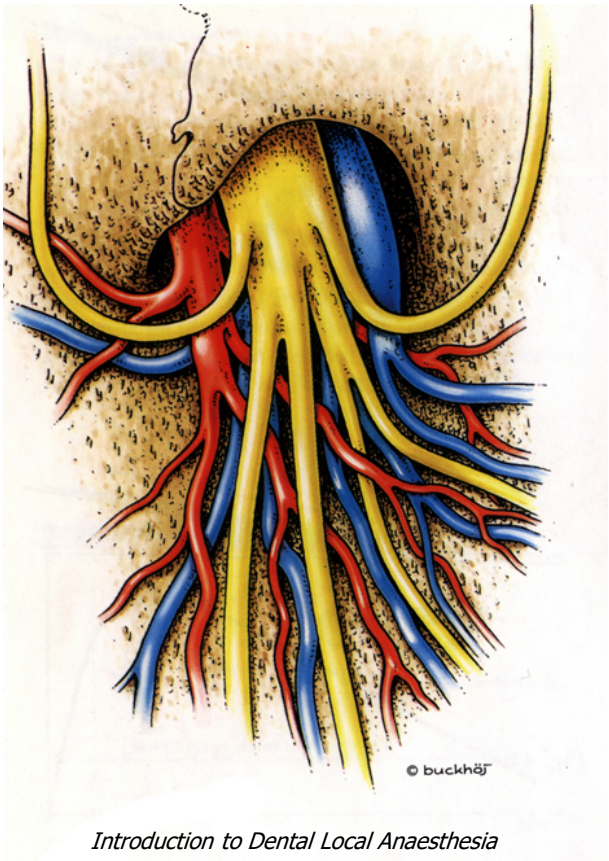
PERIODONTAL LIGAMENT INJECTION

- The needle is placed in the gingival sulcus, and advanced along the root surface until resistance is met.
- Then approximately 0.2 mL of anesthetic is deposited into the periodontal ligament.
- Pressure is necessary (by the injection) to express the anesthetic solution.

ADVANTAGES OF PERIODONTAL LIGAMENT ANESTHESIA

1. It provides reliable pain control rapidly and easily.
2. It provides pulpal anesthesia for 30 to 45 minutes.
3. It is no more uncomfortable than other local anesthesia techniques.
4. It is completely painless if used adjunctively.
5. It requires very small quantities of anesthetic solution.
6. It does not require aspiration before injection.
7. It may be performed without removal of the rubber dam.
8. It may be useful in patients with bleeding disorders that contraindicate use of other injections.
9. It may be useful in young or disabled patients in whom the possibility of postoperative trauma to the lips or tongue is a concern.

AVOID INSERTING NEEDLES INTO FORAMENS



RECORDKEEPING

- Documentation must include the type and dosage of local anesthetic, including vasoconstrictors. For example:
  - 34 mg lido with 0.017 mg epi
  - 34 mg lido with 1:100,000 epi
- Documentation may include the type of injection(s) given (Infiltration, block, intraosseous), needle selection, and patient's reaction to the injection.
- In patients for whom the maximum dosage of local anesthetic may be a concern, the weight should be documented preoperatively.
- If the local anesthetic was administered in conjunction with sedative drugs, the doses of all agents must be noted on a time-based record.
- Documentation should include that post-injection instructions were reviewed with the patient and parent.

LOCAL ANESTHESIA

- Armamentarium
- Drugs
- Techniques
- **COMPLICATIONS**

COMPLICATIONS

- **Anesthetic toxic ►Inject slowly, aspirate, check max dosage, use vasoconstrictor**
- **Syncope**
- **Post anesthesia soft tissue masticatory trauma**
- **Local anesthesia and infection**
- **Hematoma**
- **Paresthesia**

SYNCOPE

- Most common reaction (psychogenic)
  - 76% of medical emergencies in the dental office are related to stress and anxiety
- To avoid syncope
  - Give injections with the patient lying supine, then **slowly** sit the patient upright

MANAGEMENT OF SYNCOPE

- Lay patient supine with legs above head
- Maintain airway; may administer O_2
- Loosen tight collar; keep patient warm
- Monitor pulse, blood pressure & breathing
- Calmly reassure the patient and parent

POST ANESTHESIA MASTICATORY TRAUMA

- Most common post-op complication for local anesthesia in children.
- ALWAYS GIVE POST OPERATIVE INSTRUCTIONS TO THE PATIENT AND PARENT AND WRITE IT IN THE PROGRESS NOTE IN THE PATIENT'S CHART!
- Consider using OraVerse (phentolamine mesylate)[47%-67% reduction in time of soft tissue paresthesia]. Only kids > 6 years old.

MANAGEMENT OF SOFT TISSUE TRAUMA

- Usually no antibiotics needed, unless wound becomes infected
- Keep wound clean
- Mild saltwater rinse or alcohol-free chlorhexidine
- Hydration
- Bland, soft diet
- Ice chips or popsicles
- Ice packs to face if patient has swelling
- Counsel parent on what to expect in terms of course of healing

BILATERAL MANDIBULAR BLOCKS

Quote from AAPD Reference Manual 2020-2021 – Page 321

The use of bilateral mandibular blocks does not increase the risk of soft tissue trauma when compared to unilateral mandibular blocks or ipsilateral maxillary infiltration…there is no research demonstrating a relationship between reduction in soft tissue trauma and the use of shorter acting local anesthetics.

LOCAL ANESTHESIA AND INFECTION

- **Local anesthesia and infection – local anesthetics are not usually effective in areas of infection.**
  - **Alternatives include: anesthetizing at a site away from the infection (nerve block), using intraligament or intrapulpal injections (OUCH!), give antibiotics to decrease infection and have patient return in 3-5 days.**

LOCAL ANESTHETIC INJECTION INTO AN AREA OF INFECTION

Quote from AAPD Reference Manual 2020-2021 – Page 318

If a local anesthetic is injected into an area of infection, its onset will be delayed or even prevented. The inflammatory process in an area of infection lowers the pH of the extracellular tissue, inhibiting anesthetic action as little of the active free base form of the anesthetic is allowed to cross into the nerve sheath to prevent conduction of nerve impulses.

HEMATOMA

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

HEMATOMA
Arterial vs. Venous

- Fast
- Red
- Warm

- Slow
- Blue
- Normal

- <u>Management</u>
- 1. Initial ice pack and pressure
- 2. Analgesics/anti-inflammatories (usually not needed)
- 3. Rest

PARESTHESIA

Quote from AAPD Reference Manual 2020-2021 – Page 320

Paresthesia is persistent anesthesia beyond the expected duration. Trauma to the nerve can result in paresthesia and, among other etiologies, can be caused by the needle during the injection….Paresthesia has been reported to be more common with four percent solutions such as articaine and prilocaine compared to those of lower concentration.

TABLE 17.4 **Incidences of Paresthesia Reported to the Adverse Event Reporting System From 1997 to 2008**

Anesthetic	Incidence
Mepivacaine	1 in 623,112,900
Lidocaine	1 in 181,076,673
Bupivacaine	1 in 124,286,050
Overall	1 in 13,800,970
Articaine	1 in 4,159,848
Prilocaine	1 in 2,070,678
Being struck by lightning (annual risk)	1 in 328,000 to 1 in 700,000

Data derived and modified from Garisto GA, Gaffen AS, Lawrence HP, et al. Occurrence of paresthesia after dental local anesthetic administration in the United States. *J Am Dent Assoc*. 2010;141:836–844.

- As with all procedures under consideration for use by a doctor, as well as with any drugs being considered for administration, the doctor must weigh the benefit to be gained from use of the drug or therapeutic procedure against the risks involved in its use. Only when, in the mind of the treating doctor, the benefit to be gained clearly outweighs its risk should the drug or the procedure be used. (REF #4, pg 314)

SUMMARY

- Know your technique well
- Administer appropriate volumes
- Use LA with vasopressor
- Do not insert needle to its hub
- ALWAYS aspirate repeatedly
- Never use 30-gauge needle for blocks

References

1. Evers, H, Haegerstam, G: *Introduction to Dental Local Anaesthesia,* Fribourg 1, Switzerland, Mediglobe SA, 1990.
2. *Best Practices: Use of Local Anesthesia for Pediatric Dental Patients*, The American Academy of Pediatric Dentistry Reference Manual, 2020-2021:318-323.
3. Cook-Waite Laboratories, Inc: *Manual of Local Anesthesia in General Dentistry, 2nd ed.* New York, 1947.
4. Malamed, S: *Handbook of Local Anesthesia, 7th ed*. St. Louis, Elsevier, 2020.

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