Pediatric surgical stomatology

Features of local anesthesia by operative measures in maxillofacial area in children

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Background

- **Local anesthesia** is any technique to render part of the body insensitive to pain without affecting consciousness. It allows patients to undergo surgical and dental procedures with reduced pain and distress. In many situations, such as cesarean section, it is safer and therefore superior to general anesthesia. It is also used for relief of non-surgical pain and to enable diagnosis of the cause of some chronic pain conditions. Anesthetists sometimes combine both general and local anesthesia techniques.
- The following terms are often used interchangeably:

  - Local anesthesia, in a strict sense, is anesthesia of a small part of the body such as a tooth or an area of skin.

  - Regional anesthesia is aimed at anesthetizing a larger part of the body such as a leg or arm.

  - Conduction anesthesia is a comprehensive term which encompasses a great variety of local and regional anesthetic techniques.

Background

- It is generally agreed that one of the most important aspects of child behavior guidance is the control of pain. If children experience pain during surgical procedures, their future as dental patients may be damaged. Therefore it is important at each visit to reduce discomfort to a minimum and to control painful situations.

Techniques

- Local anesthetic can block almost every nerve between the peripheral nerve endings and the central nervous system. The most peripheral technique is topical anesthesia to the skin or other body surface. Small and large peripheral nerves can be anesthetized individually (peripheral nerve block) or in anatomic nerve bundles (plexus anesthesia).
- Injection of local anesthetics is often painful. A number of methods can be used to decrease this pain including buffering of the solution with bicarb and warming.

Techniques

- **Surface anesthesia** - application of local anesthetic spray, solution or cream to the skin or a mucous membrane. The effect is short lasting and is limited to the area of contact.
- **Infiltration anesthesia** - injection of local anesthetic into the tissue to be anesthetized. Surface and infiltration anesthesia are collectively topical anesthesia.
- **Field block** - subcutaneous injection of a local anesthetic in an area bordering on the field to be anesthetized.
- **Peripheral nerve block** - injection of local anesthetic in the vicinity of a peripheral nerve to anesthetize that nerve's area of innervation.
- **Plexus anesthesia** - injection of local anesthetic in the vicinity of a nerve plexus, often inside a tissue compartment that limits the diffusion of the drug away from the intended site of action. The anesthetic effect extends to the innervation areas of several or all nerves stemming from the plexus.

Local anesthetics

- Dental local anesthetics fall into two groups: amides and esters. The names are derived from the type of chemical link between the two ends (aromatic and base) of the local anesthetic molecule.

Local anesthetics

Articaine 4% (Septocaine) with epinephrine 1:100,000

Adult total dose ranges for submucosal injection

- Infiltrative administration: 0.5-2.5 mL (20-100 mg)
- Nerve block: 0.5-3.4 mL (20-136 mg)
- Oral surgery: 1-5.1 mL (40-204 mg)
- Not to exceed 7 mg/kg (0.175 mL/kg)
- Decrease dose in pediatric patients (>4 y), elderly patients, or those with hepatic impairment; use in children younger than 4 y not recommended

Local anesthetics

Lidocaine 2% (Xylocaine) with epinephrine 1:100,000 (or 1:50,000 when greater depth and hemostasis are required)

- Maxillary and mandibular area for oral surgery
- Adult total dose range for submucosal injection: 1-5 mL (20-100 mg)
- Children younger than 10 years: 0.9-1 mL (18-20 mg)
- Maximum dose for adult and pediatric patients

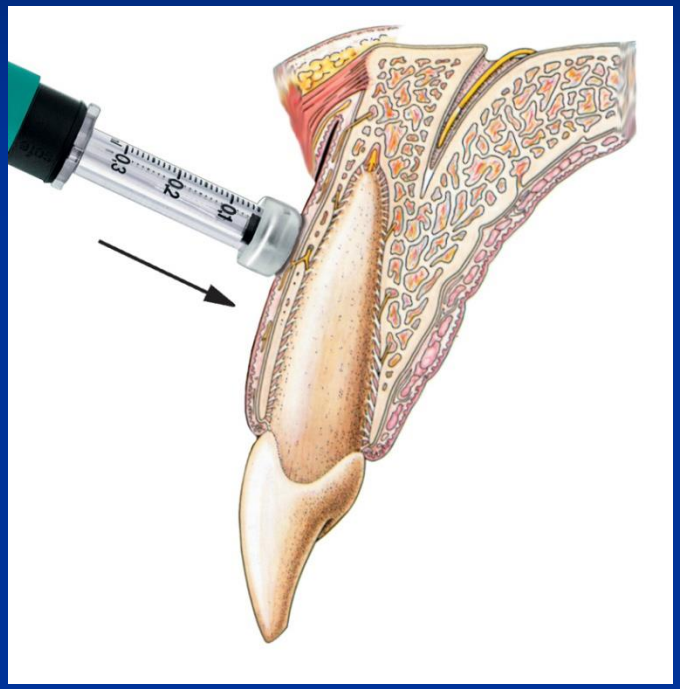
  - Not to exceed 7 mg/kg (with epinephrine)
  - Not to exceed 4.5 mg/kg (without epinephrine)

Local anesthetics

Bupivacaine 0.5% (Sensorcaine)

- Maxillary and mandibular area for oral surgery
- Adult total dose range is 1.8 mL to a maximum of 18 mL (9-90 mg)
- Not to exceed 18 mL (90 mg) per dental sitting
- Reduce dose in pediatric or elderly patients, those with cardiac disease, those who are debilitated, or those with hepatic impairment

INJEX. Needle-free injections for infiltration anaesthesia



- The fear of needle injections has been widespread since the development of the conventional syringe in 1853. Experienced dentists are well aware of the different problems associated with the conventional needle syringe: Delay until onset of anaesthesia, painful injections, feelings of fear and anxiety exhibited by patients, tissue damage, and unpleasant numbness of soft tissue, risk of injury with restless or fearful patients…
- INJEX Pharma now offers a solution for previous local anaesthesia problems:

  a needle-free injection system.
- The INJEX System uses an injection ampoule with a micro orifice of only ø 0.18 mm through which the anaesthetic is administered under dosed pressure to the submucosa – virtually painless and exactly where it is needed

INJEX. Needle-free injections for infiltration anaesthesia

- Areas of application:The ampoule has to be placed on the attached gingiva at an angle of 90°directly above the tooth to be anaesthetised. This defines a determined area of application (anaesthesia is possible with the following teeth1: 15-25, 33-43, all teeth of the primary dentition 55-85)

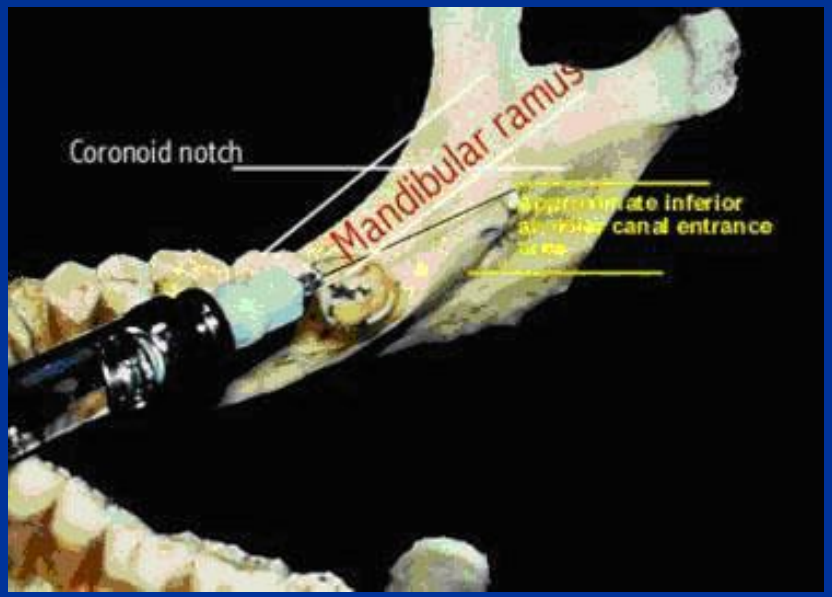
INJEX. Needle-free injections for infiltration anaesthesia

- Children are especially difficult dental patients because they are so very much afraid and cannot understand the purpose of the treatment. Experienced dentists are able to use INJEX to administer anaesthetic to all deciduous teeth. The shorter onset time also reduces the treatment-induced stress for children. Since only 0.3 ml of local anaesthetic is administered, the maximum dose is hardly ever used. Even very young children can be treated with INJEX who are especially pleased with the needle-free injection. The stress for accompanying parents is also reduced significantly due to the shorter treatment time. Small children are frequently less willing to cooperate with the dentist. This is where INJEX reduces the stress of administering a local anaesthetic due to the lower risk of injury.Patients usually continue to request anaesthesia with this system the next time they visit their dentist.

INJEX. Needle-free injections for infiltration anaesthesia

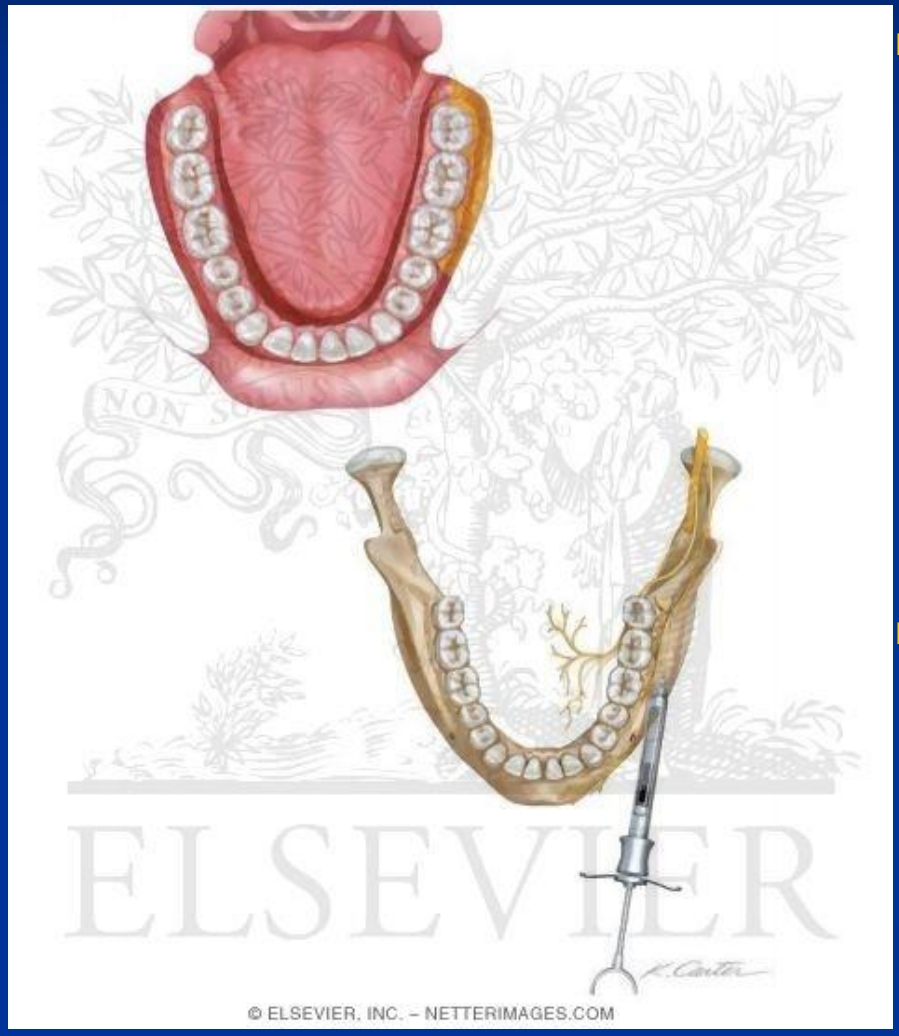
- Contrary to conventional local injection methods, infiltration anaesthesia with INJEX delivers the local anaesthetic submucously down to the periosteum . This leads to a more rapid diffusion and resorption and a quicker rise to the effective concentrations. The result is a significantly quicker rise to a pain-eliminating level. Studies have shown effects in just a few seconds (1to 90 s) after administering the anaesthetic. The therapeutic effective window with a reliable and safe elimination of pain extends in comparison with conventional injections. A shorter duration of soft tissue numbness is observed as a positive side effect, which pleases patients additionally. Sufficient anaesthesia is achieved with comparably low doses. This is especially important with children who have a lower dose limit. The total required amount of local anaesthesia is even further reduced due to the extended effective window and the targeted anaesthetising of the individual tooth. Consequently, reduced doses are necessary to anaesthetise patients in general.
- **Areas of application**: Fillings, extractions, cleaning, and smaller periodontal procedures are possible with the teeth listed above after anaesthetising the individual tooth. INJEX thus offers the option of needle-free anaesthesia for numerous routine dental procedures and interventions performed at the dentist's office. Patients are less afraid of dental procedures and trust their dentist more.

Local anesthesia by conventional injection: Inferior Alveolar Nerve Block



- The supraperiostal injection technique may sometimes be useful in anesthetizing primary incisors, but it is not as reliable for complete anesthesia of the mandibular primary or permanent molars.
- **The mandibular foramen is situated at a level lower than the occlusal plane of the primary teeth of the pediatric parient**. Therefore the injection mast be made slightly lower and more posteriorly than for an adult parient.
- The depth of insertion averages about 15 mm but will vary with the size of the mandible and its changing proportions depending on the age of the patient. Appoximately 1 ml of the solution should be deposited around the inferior alveolar nerve.

Local anesthesia by conventional injection: Lingual and Long Buccal Nerve Block



- One can block the lingual nerve by brynging the syringe to the opposite side with the injection of a small quantity of the solution as the needle is withdrawn. If small amounts of anesthetic are injected during insertion and withdrawal of the needle for the inferior alveolar nerve block, the lingual nerve will invariably be anesthetized as well.
- For the removal of mandibular permanent molars it is necessary to anesthetize the long buccal nerve. A small quantity of the solution may be deposited in the mucobuccal fold at a point distal and buccal to the indicated tooth.

Local anesthesia by conventional injection: Mandibular Conduction Anesthesia (Gow-Gates Mandibular Block Technique)

- This approach uses external anatomic landmarks to align the needle so that anesthetic solution is deposited at the base of the neck of the mandibular condyle.
- This technique is a nerve block prosedure that anesthetizes virtually the entire disturbation of the fifth cranial nerve in the mandibular area, including the inferior alveolar, lingual, buccal, mental, incisive, auriculotemporal, and mylohyoid nerves.
- The external landmarks to help align the needle for this injection are the tragus of the ear and the corner of the mouth. The needle is inserted just medial to the tendon of the temporal muscle and considerable superior to the insertion point for conventional mandibular block anesthesia. The needle is also inclined upward and parallel to a line from the corner of the patient's mouth to the lower border of the tragus (intertragic notch).

Gow-Gates Mandibular Block Technique

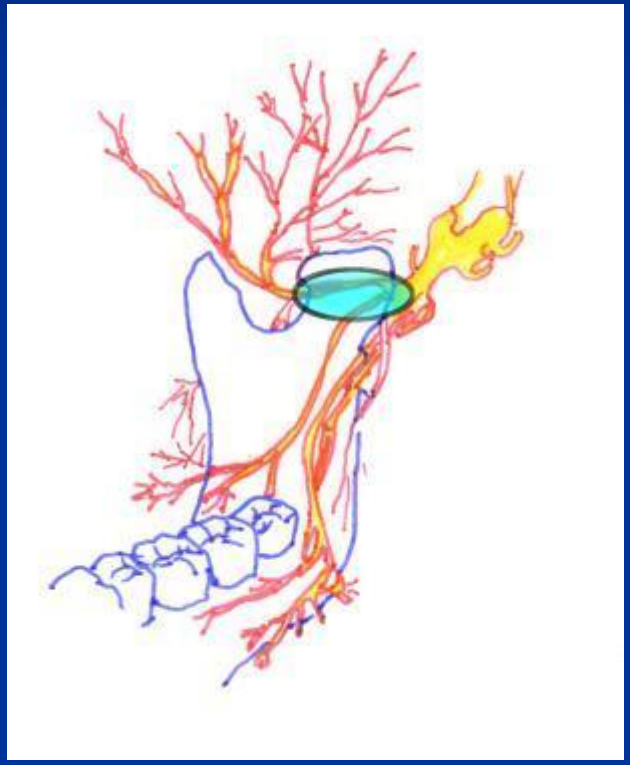
The Gow-Gates has a number of advantages over it's more traditional alternative.

- Unlike the mandibular block, the path the needle traverses during a Gow Gates block contains much less muscle tissue than is traversed by the needle in a standard mandibular block, and thus there is little release of bradykinins which are the chemicals which cause the aching that patients feel when receiving a mandibular block. Furthermore, the tissue through which the needle passes contains no nerve receptors, and thus there is little direct pain during the injection. It is not uncommon for patients to remark that they felt nothing during the injection.

- The area where the Gow-Gates is delivered is less vascularized than the area adjacent to the location of injection in a standard mandibular block. Studies indicate that there is an 89-90% lower likelihood of giving an intra-vascular injection using this technique. In addition, because of the lower vascularization in the area, the anesthesia is less rapidly absorbed into adjacent blood vessels prolonging the presence of the anesthesia in the area, which means that mepivicaine without vasoconstrictor may be used to greater and longer lasting effect using the Gow-Gates. Some users of this technique recommend that no vasoconstrictor be used at all.

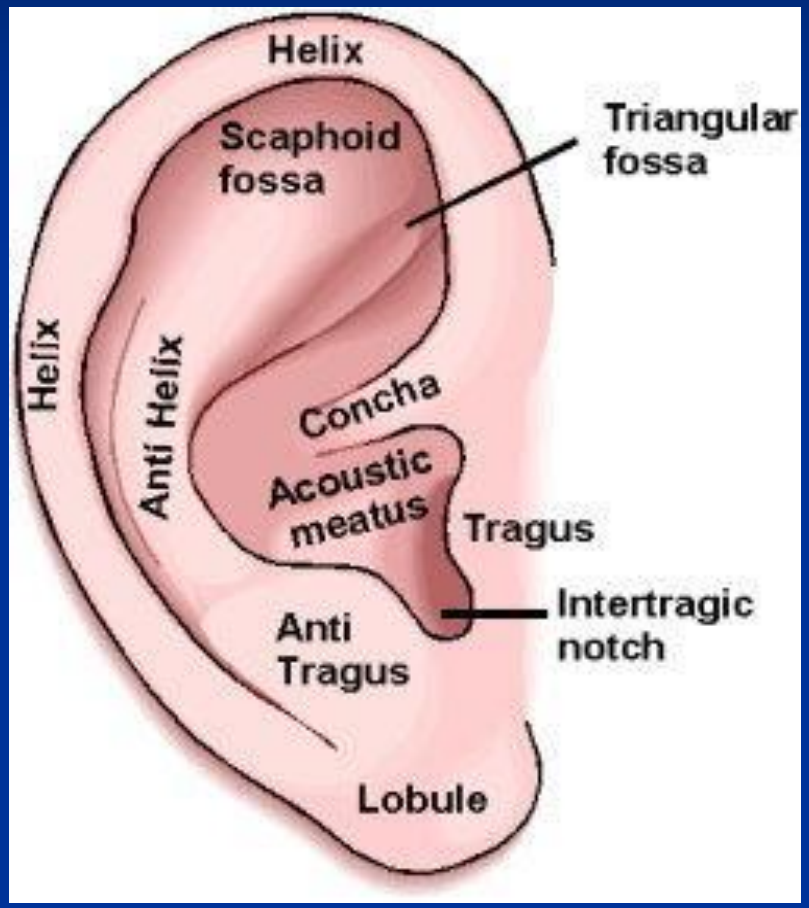
- Finally, the Gow-Gates anesthetizes the nerve trunk before it splits into its three main branches; the lingual branch, the buccal branch and the alveolar branch. Thus the Gow Gates delivers three shots in one. A single shot does the work of three separate injections.

Gow-Gates Mandibular Block Technique



- The image above shows the medial aspect of the right condyle and the relative position of the nerve trunk. The shaded oval indicates the area of the condyle where the tip of the needle should be placed. Note the proximity of the nerve trunk with respect to the general target.

Gow-Gates Mandibular Block Technique



- In the image of the ear above, the little prominence in the front is called the tragus. The tragus is a useful landmark since it lies just distal to the temporomandibular joint. The little notch just below it is called the intertragal notch. Both of these landmarks are easily identified, and, more importantly felt with the finger. The intertragal notch is the landmark that is used as the "aiming point" of the needle when giving the Gow-Gates injection.

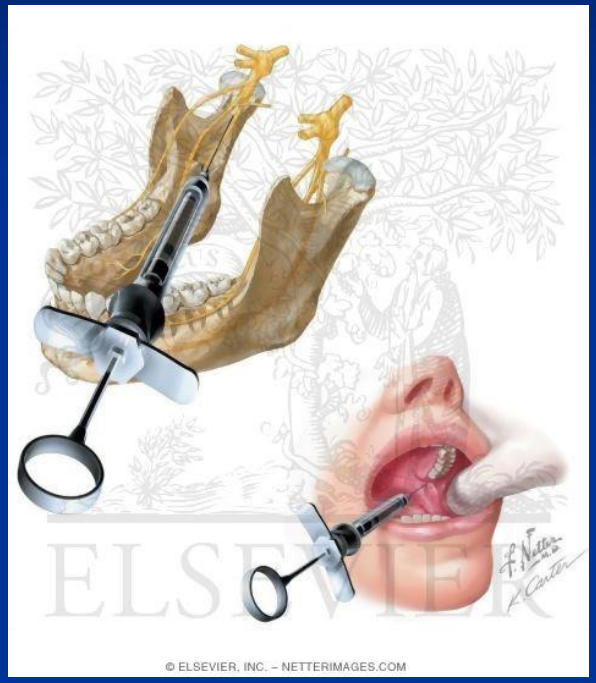
Gow-Gates Mandibular Block Technique

- This intra-oral image shows the entry point of the needle. The patient's mouth must be WIDE open so that the condyle is fully translated over the articular eminence. The entry point of the needle is high and about a quarter inch distal to the distal palatal cusp of the second molar.

Gow-Gates Mandibular Block Technique

- With the patient lying fully reclined in the chair, have the patient open his/her mouth as wide as possible. This technique is not possible if the patient is not able to open wide enough to allow the condyles to translate fully over the articular eminences.
- Place your thumb in the patient's mouth retracting the cheek. The thumb should be relatively close to the site of the entry point of the needle noted in the image above.
- Place the middle finger of the same hand over the intertragal notch. This landmark is easily felt with the finger. Thus the hand is held in a "C" with the thumb inside the mouth retracting the cheek and the middle finger outside the mouth placed firmly over the intertragal notch.

Gow-Gates Mandibular Block Technique



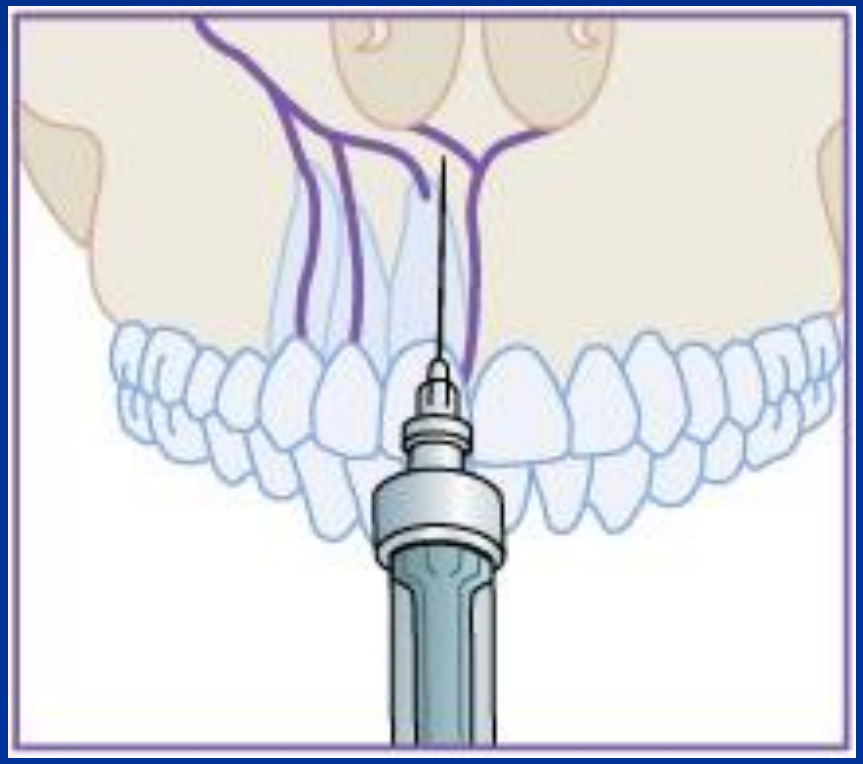
- Using a long 27 gauge needle, and holding the handle of the syringe at about the level of the lower premolars, allow the needle to enter the buccal mucosa just distal and apical to the tuberosity.
- Now aim the tip of the needle toward the the intertragal notch. This is fairly easy because you can feel the notch under your middle finger, so in effect, you are simply aiming for your finger! Keeping the middle finger in this position, and using it as the aiming point makes giving the Gow-Gates block easy and predictable.
- Proceed until the needle hits bone. The needle will enter about two-thirds to three-quarters of its length before hitting bone. If the needle does not hit bone, then you have missed the target and should withdraw and try again, aiming slightly laterally, or medially. It should be noted that this technique seems to produce very few misses. In any case, multiple tries do not lead to post operative pain since the needle has penetrated little or no muscle. Once you become familliar with the technique, missing the target becomes a rare event.
- Once the needle hits bone, aspirate and then inject the entire carpule slowly.
- After withdrawing the needle, ask the patient to remain open wide for about one minute after the shot.

Clinical evaluation of the Gow-Gates block in children

(A.Yamada and J.T.Jasstak // Anesth Prog.1981 Jul-Aug, (28,4);106-109.

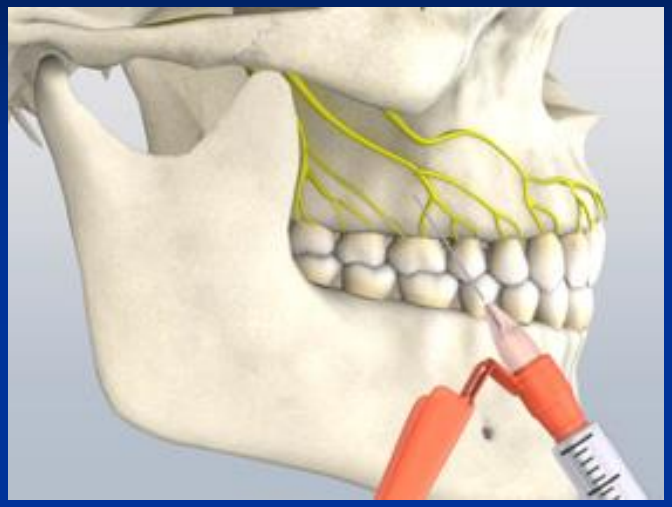
- A Gow-Gates mandibular nerve block injection was given to eleven children and the results were compared with eleven pedodontic patients who had conventional mandibular nerve block injections.
- The Gow-Gates group exhibited clinically excellent anesthesia in all instances. In the conventional group, complete mandibular anesthesia was achieved in eight patients, usable anesthesia in one patient, and two of the patients required supplemental injections to complete treatment.
- The rate of positive pain responses on insertion and/or injection was much smaller in the Gow-Gates group than in the conventional group.

Anesthetizing maxillary primary and permanent incisors and canines (subperiosteal technique)



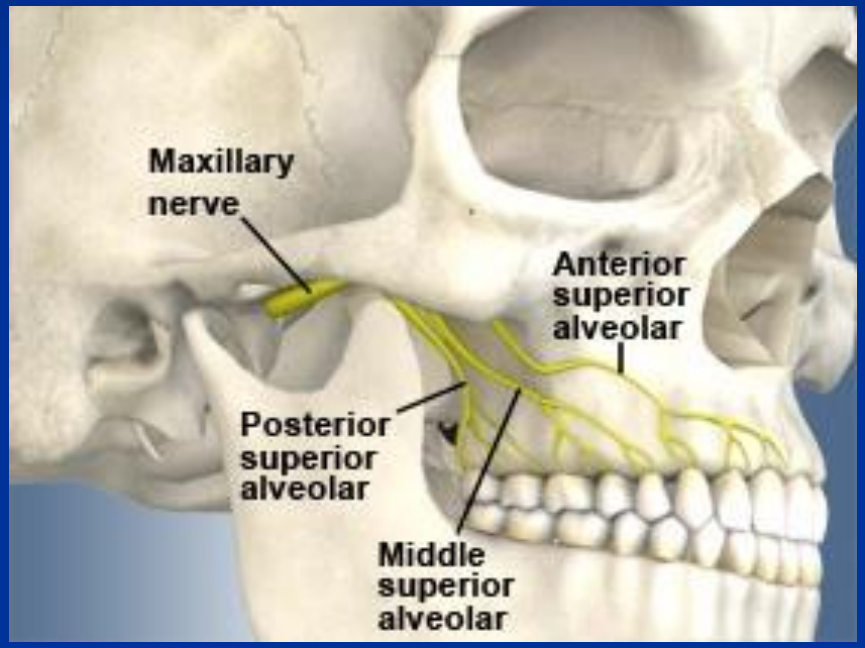
- The injection should be made closer to the gingival margin than in the patient with permanent teeth, and the solution should be deposited close to the bone. After the needle tip has penetrated the soft tissue at the mucobuccal fold, it needs little advancement before the solution is deposited (2 mm at most) because the apices of the maxillary primary anterior teeth are essentially at the level of the mucobuccal fold.

Anesthetizing maxillary primary molars and premolars



- The bone overlying the first primary molar is thin, and this tooth can be adequately anesthetized by injection of anesthetic solution opposite the apices of the roots. However, the thick zygomatic process overlies the buccal roots of the second primary and first permanent molars in the primary and early mixed dentition. This thickness of bone renders the supraperiosteal injection at the apices of the roots of the second primary molar much less effective; the injection should be supplemented with a second injection superior to the maxillary tuberosity area to block the posterior superior alveolar nerve as has been traditionally taught for permanent molars
- To anesthetize the maxillary first or second premolar, a single injection is made at the mucobuccal fold to allow the solution to be deposited slightly above the apex of the tooth.

Anesthetizing maxillary permanent molars

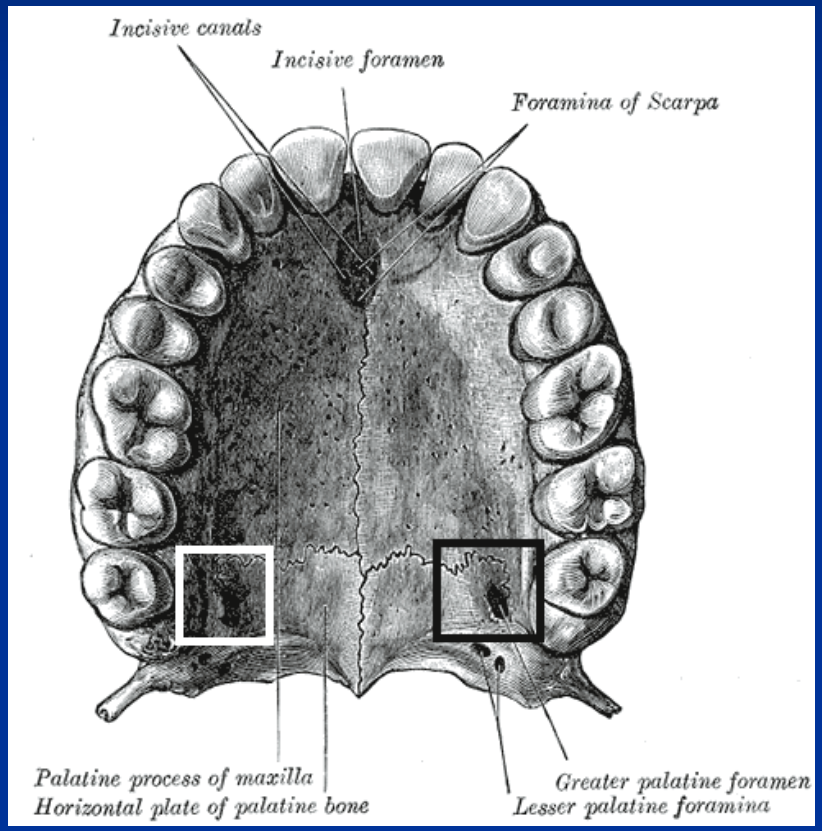


- The puncture point is in the mucobuccal fold above and distal to the distobuccal root of the first permanent molar. If the second molar has erupted, the injection should be made above the second molar. The needle is advanced upward and distally, depositing the solution over the apices of the teeth. The needle is inserted for a distance approximately 2 cm in a posterior and upward direction; it should be positioned close to the bone,with the bevel toward the bone.

Anesthetising the palatal tissues
Nasopalatine Nerve Block

- If the needle is carried into the chanel, it is possible to anesthetize the six anterior teeth completely. However, this technique is painful and is not routinely used before operative procedures. The part of insertion of the needle is alongside the incisive papilla, just posterior to the central incisors. The needle is directed upward into the incisive canal. Discomfort associated with the injection can be reduced when the anesthetic solution is deposited in advance of the needle.

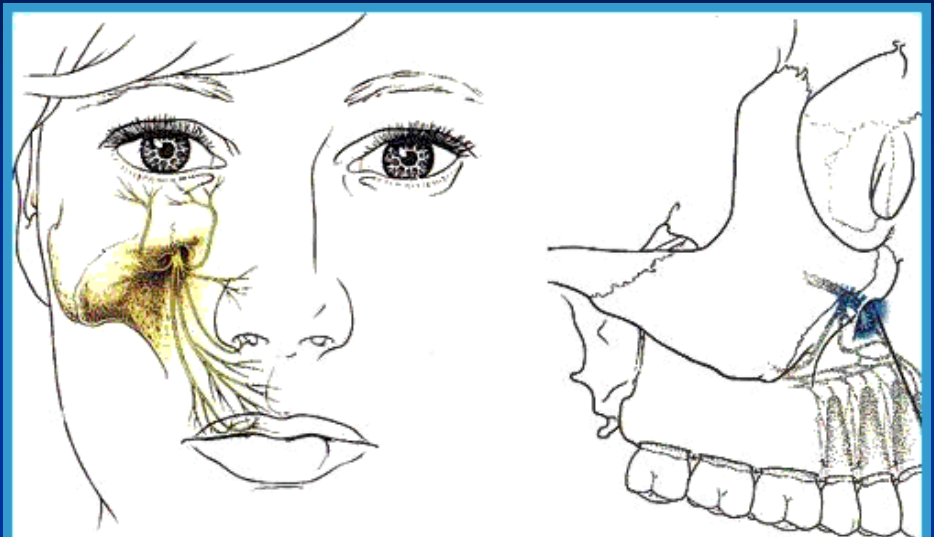
Anesthetising the palatal tissues
Greater (Anterior) Palatine Nerve Block



- Before the injection is made, it is helpful to bisect an imaginary line drawn from the gingival border of the most posterior molar that has erupted to the midline. Approaching from the opposite side of the mouth, the dentist makes the injection along this imaginary line and distal to the last tooth. In the child with only the primary dentition erupted, the injection should be made approximately 10 mm posterior to the distal surface of the second primary molar. It is not necessary to enter the greater palatine foramen.

Supplemental injection techniques:

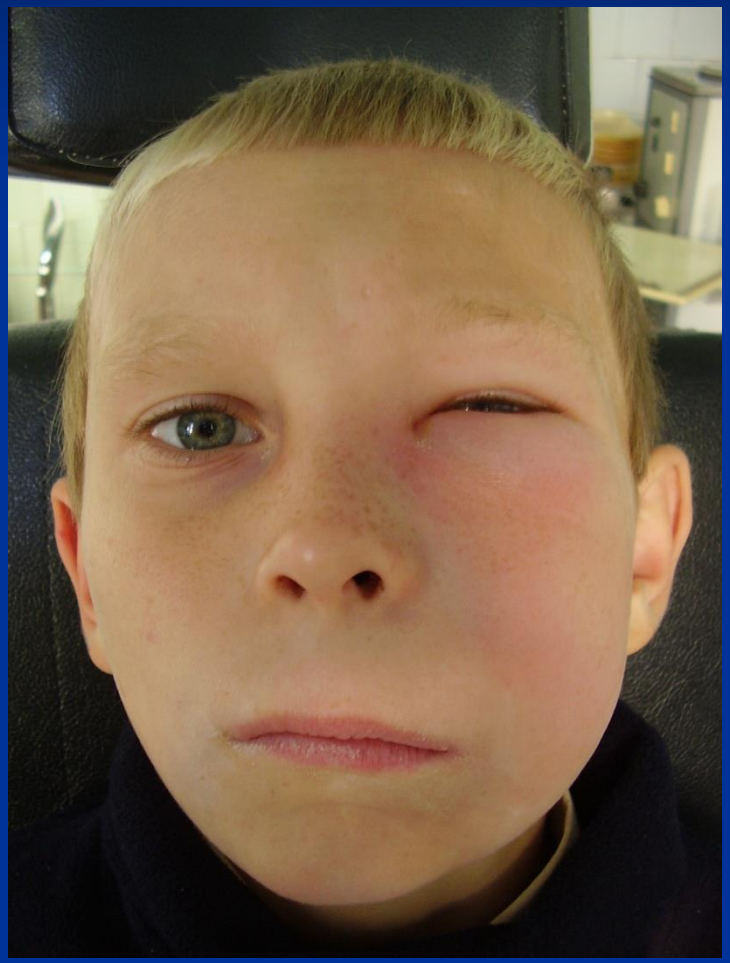
Infraorbital Nerve Block



Area anesthetized: Lower eyelid, lateral aspect of the nose and upper lip.

- The infraorbital nerve block anesthetize the branches of the anterior and middle superior alveolar nerves. It also affects innervation of the soft tissue below the eye, half of the nose, and the oral musculature of the upper lip on the injected side of the face.
- This leaves the child with a feeling of numbness above the mouth similar to that below the mouth when an inferior alveolar is blocked.

Supplemental injection techniques:
Infraorbital Nerve Block



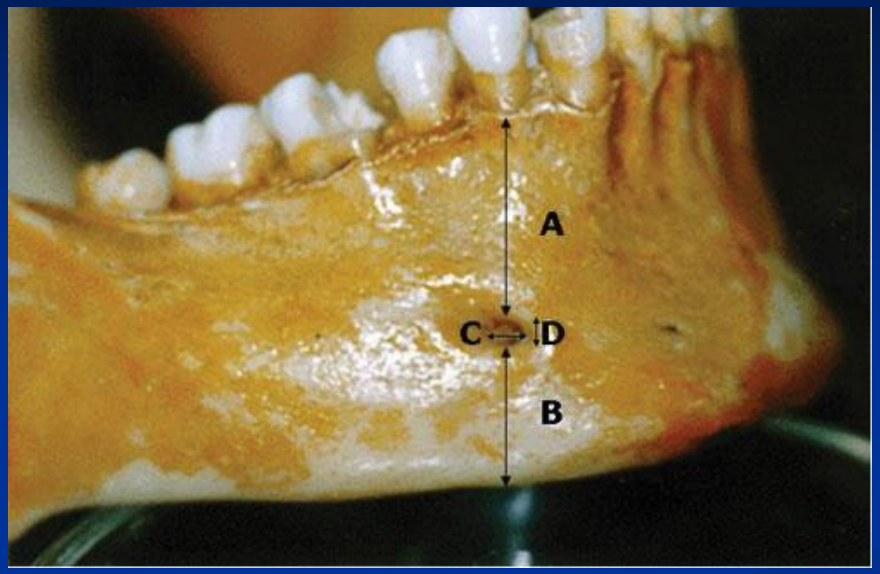
- The infraorbital block technique is preffered for removal of impacted teeth (especially canines or first premolars) or large cysts, when moderate inflammation or infection contraindicates the supraperiosteal injection site, or when longer duration or a greater area of anesthesia is needed.

Supplemental injection techniques:
Infraorbital Nerve Block

Intraoral approach

- Obtain informed consent.
- Apply cotton-tipped applicator soaked with topical anesthetic to the mucosa opposite the upper second bicuspid (premolar tooth) for 1 minute.
- To palpate the infraorbital foramen, have the patient look straight ahead and imagine a line drawn vertically (sagittally) from the pupil down toward the inferior border of the infraorbital ridge.
- Keep the palpating finger in place over the inferior border on the infraorbital rim for the remaining steps.
- Retract the cheek and introduce the needle into the mucosa opposite the upper canine approximately 0.5 cm from the buccal surface.
- Keep the needle parallel with the long axis of the upper canine until it is palpated near the foramen. (The approximate depth is 1.5-2.5 cm.) If the needle is extended too far superiorly and posteriorly, the orbit may be entered.
- Once the needle is positioned properly, aspirate to ensure that the needle is not within a vessel.
- Inject 2-3 mL of anesthetic solution adjacent to the foramen.
- Take care not to inject into the foramen (which may result in swelling of the lower eyelid) by keeping the palpating finger firmly on the inferior orbital rim.

Supplemental injection techniques:
Mental Nerve Block



- The mental nerve block would make it possible to perform routine operative procedures on all primary teeth without discomfort to the patient.
- The mental nerve block is no more comfortable for the patient, and the technique puts the syringe in clear view of the patient, whereas the inferior alveolar nerve block may be performed with the syringe out of the child's direct vision.

Intraosseous and Interseptal Injection

- Intraosseous injection techniques (of which the interseptal injection is one type) require the deposition of local anesthetic solution in the porous alveolar bone. A small, reinforced intraosseous needle may be used to penetrate the cortical plate more easily. This procedure is not particularly difficult in children because they have less dense cortical bone than adults.
- When the latter is contraindicated by injection in the periodontal ligament space

Complications after a local anesthetic

- **Anesthetic toxicity**. The young children are more likely to experience toxic reactions because of their lower body weight and are also often sedated with pharmacologic agents before the treatment.
- **Trauma of Soft Tissue.** Parents of children who receive local anesthesia in the dental office should be warned that the soft tissue in the area will be without sensation for a period of 1 hour or more.