# LOCAL ANESTHESIA V

- In spite of careful patient evaluation, proper tissue preparation, and meticulous technique of administration, local and systemic complications associated with dental anesthesia occasionally develop

- A written note should be entered onto the patient's dental chart with any complication associated with the administration of a local anesthetic

- ***Complications*** (adverse events, sentinel events) are defined as unplanned, unexpected, unintended, and undesirable patient outcomes: death, physical/psychological injury, or any unexpected variation in a process or outcome that demands notice.

- ***Errors*** are deviations from accuracy or correctness, usually, caused by a fault (mistake) for example, carelessness, misjudgment, or forgetfulness.

Complication of local anesthesia

- Local

- Systemic

# LOCAL COMPLICATIONS

- Failure of Local Anaesthesia
- Needle breakage
- Prolonged anesthesia or paresthesia
- Facial nerve paralysis
- Trismus
- Soft tissue injury
- Hematoma
- Pain on injection
- Burning on injection
- Infection
- Edema
- Sloughing of tissues
- Post-anesthetic intraoral lesions
- Blanching
- Visual problem

## 1- Failure of Local Anaesthesia

- Local anaesthesia is not 100% successful in dentistry

- The reasons for failure of a local anesthetic can be classified as:

- Anatomical
- Pathological
- Pharmaceutical/ Pharmacological
- Psychological
- Technical

The first stage in dealing with a failed administration is to **Repeat it**

**A- Anatomical Causes of Failure**

Anatomical causes of failure may be owing to:

1. Bony barriers to diffusion (mandible, zygoma)

How to overcome?

2. Variations in the position of nerves and foramina

How to overcome?

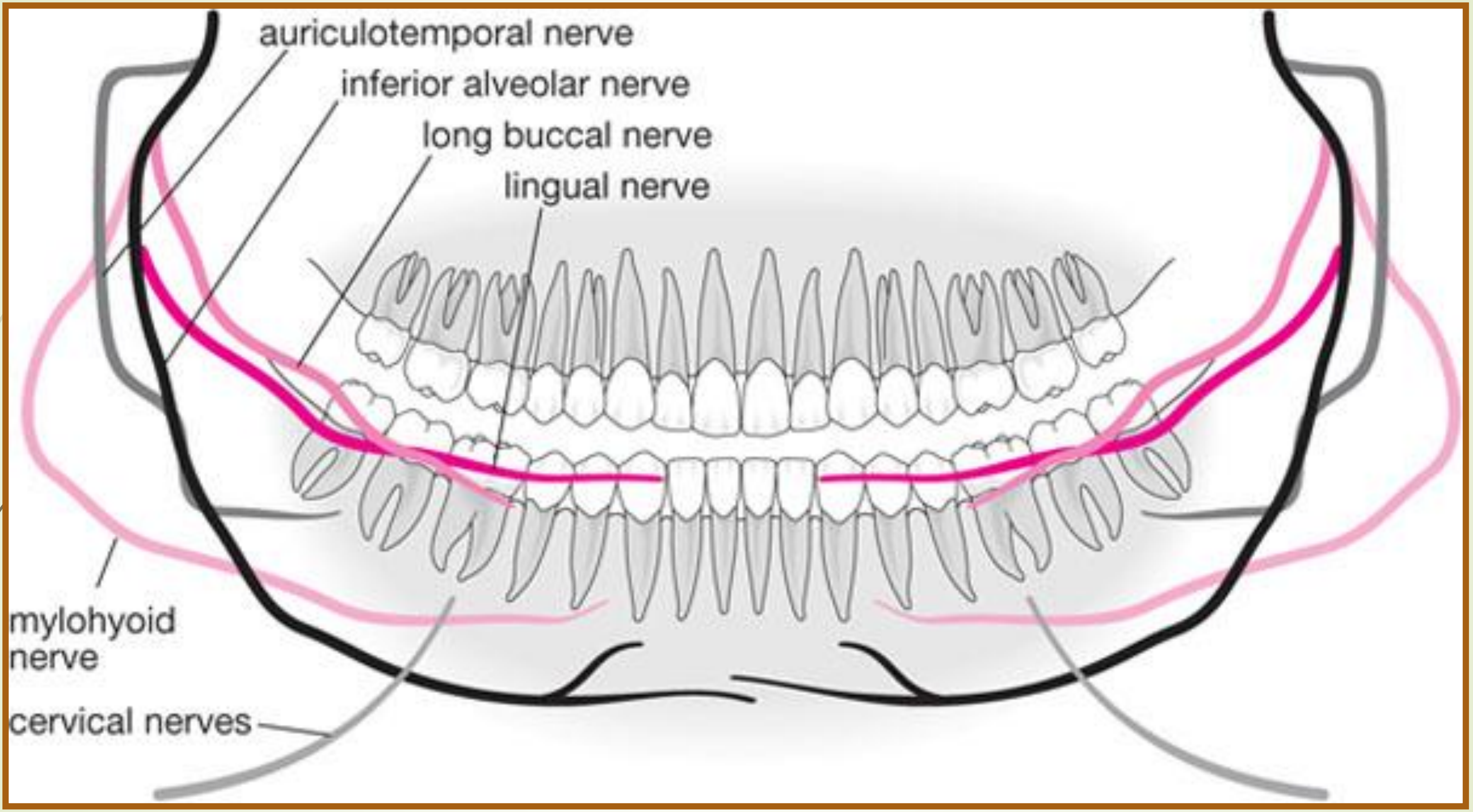
Use a technique to overcome the problem like using Akinosi or Gow-Gates techniques, can overcome the problem of an ectopic mandibular foramen

## 3. Collateral nerve supply

Maxilla: Greater palatine and nasopalatine nerves may contribute fibers to the pulps.

Mandible: Block anaesthesia is less likely to counter collateral supply compared with infiltration methods, which are normally used in the maxilla. additional fibers from the

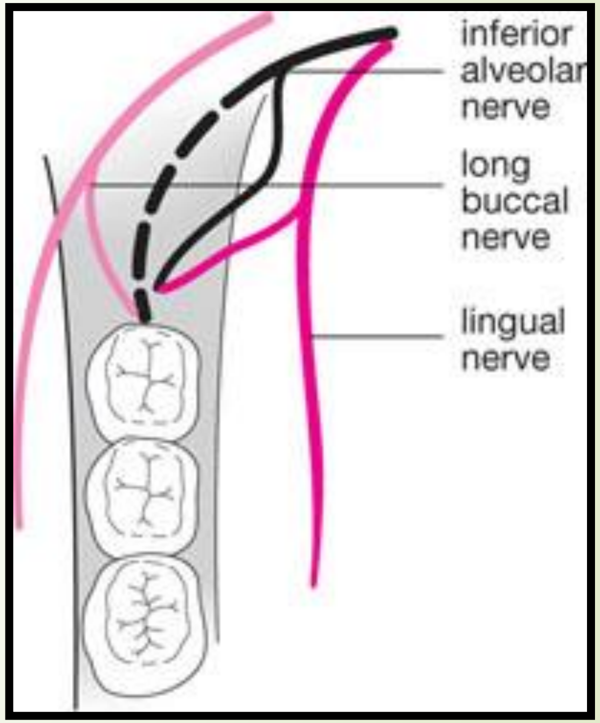
- Ipsilateral inferior alveolar nerve
- Lingual nerve
- Long buccal nerve
- Mylohyoid nerve
- Auriculotemporal nerve
- Cervical nerves


auriculotemporal nerve
inferior alveolar nerve
long buccal nerve
lingual nerve
mylohyoid nerve
cervical nerves

Fibers from the ipsitralateral inferior alveolar nerve

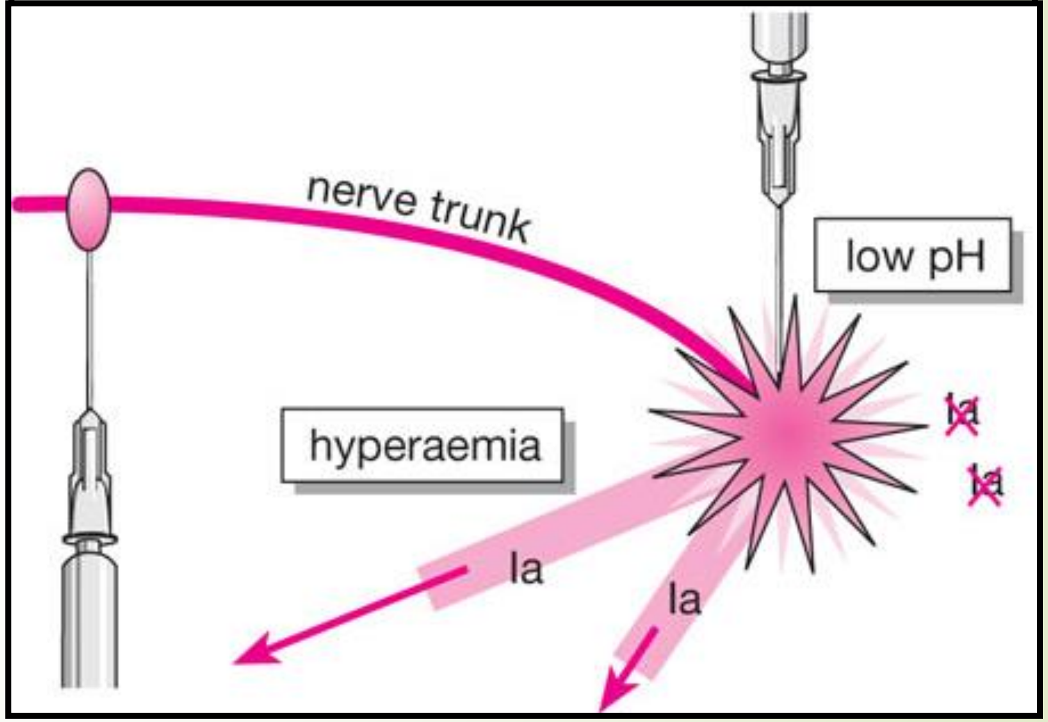
How to overcome?

( High block or distal to lower wisdom)



## B- Pathological

The explanation is that inflamed nerves are hyperalgesic – in other words, they transmit impulses under minimal stimulation.



## C- Pharmaceutical Causes of Failure

Improper storage may decrease efficacy. For example, keeping cartridges at high temperature or in light may lead to loss of activity of epinephrine, which will decrease effectiveness.

- The most likely cause of pharmacological failure is the injection of too small a dose. This may explain why a repeat injection often overcomes failure.

## D- Psychological Causes of Failure

How to overcome?

- Conscious sedation
- Anxiolysis
- Reducing needle phobia
- Producing muscle relaxation
- Overcoming gagging
- Producing analgesia

## E- Technical Causes of Failure

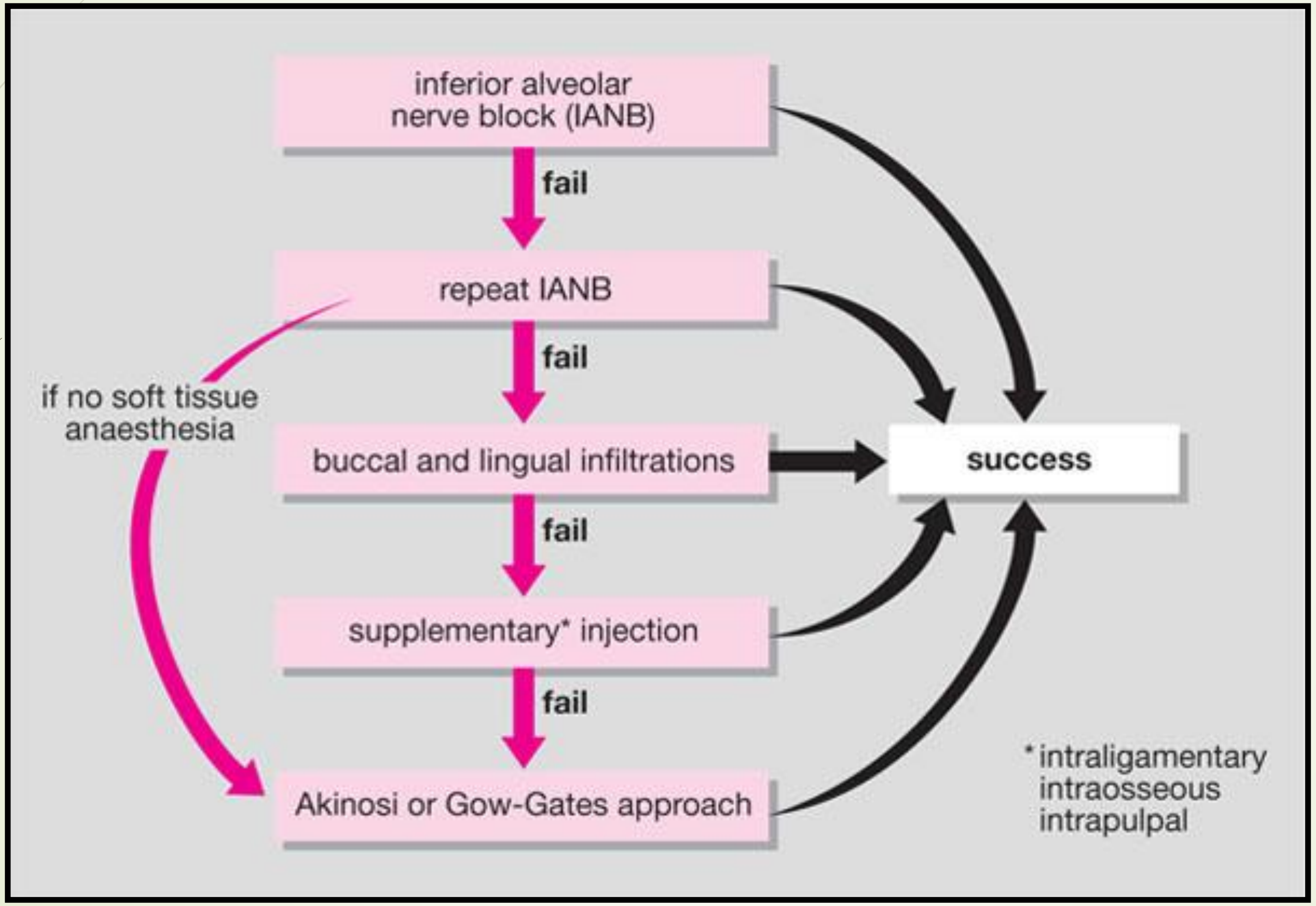
The success of local anaesthesia is technique dependent

How to overcome?

1. Practice more

2. The choice of an appropriate alternative method

# In case of failure of anesthesia in lower molars due to technical reasons

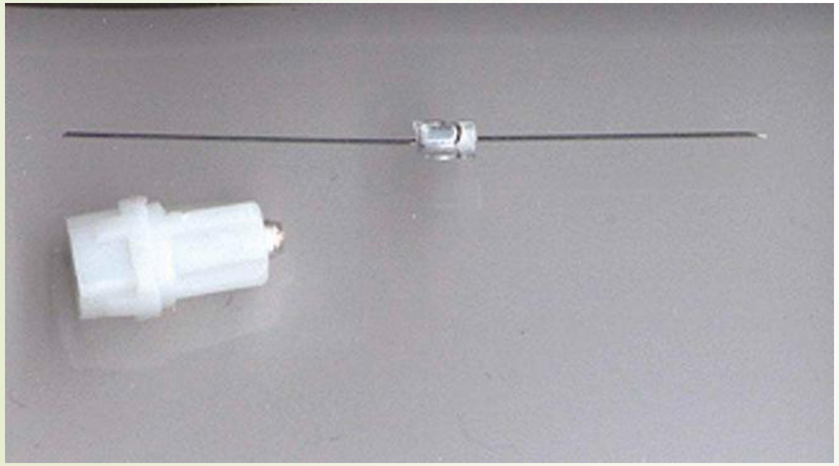


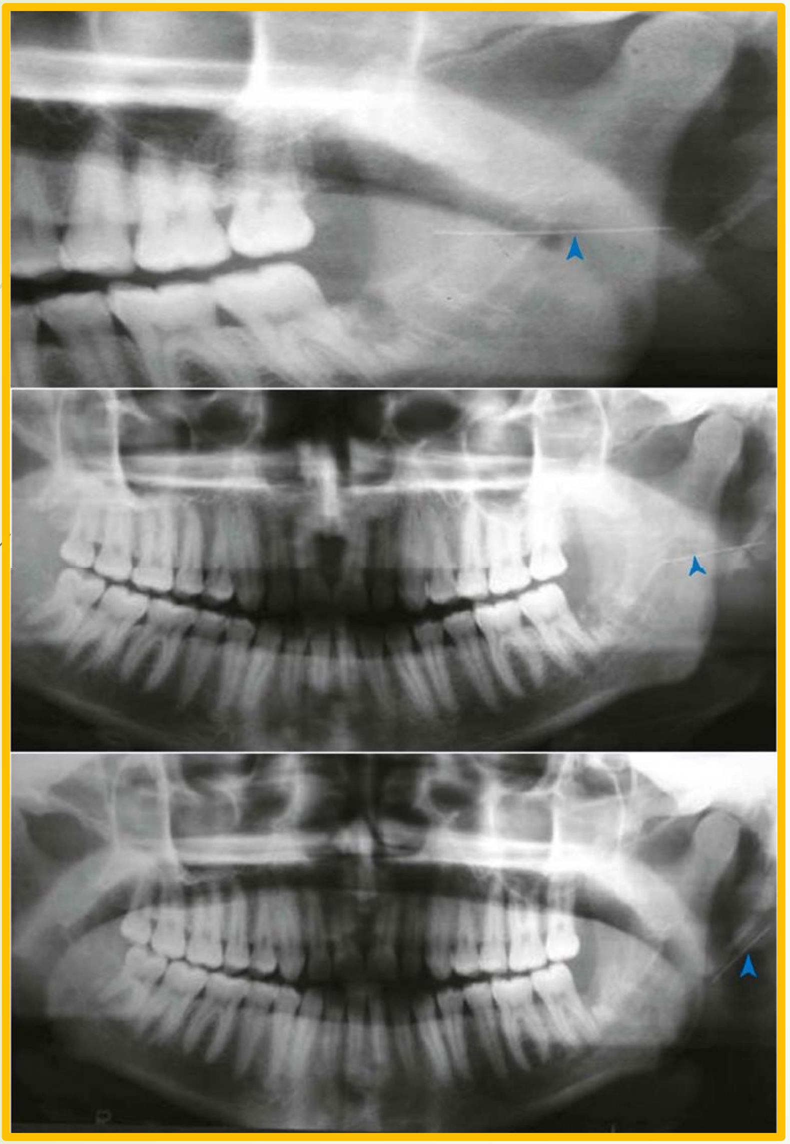
# 2- Needle Breakage

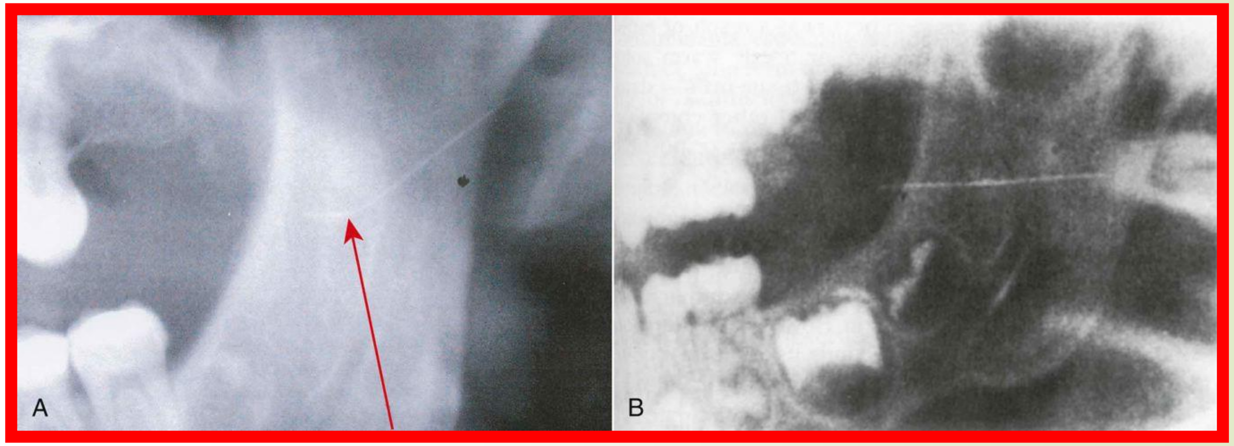
- Since the introduction of non-reusable, stainless steel dental local anesthetic needles, needle breakage has become an extremely rare complication of dental local anesthetic injections.

It happens more in

- Gauge 30
- Short ( till hub)






A
B

# causes

1. Unexpected movement – patient (if patient movement is opposite to path of needle insertion)
2. Multiple used needle
3. Defective manufacture of needles
4. Smaller gauge – more likely to break
5. Intentional bending of needle by the doctor before injection.
6. Forceful contact with bone

# Prevention

1. Not to use short needles for inferior alveolar nerve block in adults or larger children
2. Not to insert the needles till its hub
3. Not to use 30 gauge needles for IAN block in adults or children
4. Not to bend needles when inserting them into soft tissue

- Needle breakage is not a significant problem if the needle can be removed without surgical intervention.

- Ready access by a hemostat

<u>If difficult to grasp then the management</u>

- Immediate referral of the patient to an appropriate specialist (e.g., an oral and maxillofacial surgeon) for evaluation and possible attempted retrieval.
- Conventional management involves locating the retained fragment through panoramic and computed tomographic (CT) scanning.
- A surgeon in the operating theater then removes the retained needle fragment while the patient is under general anesthesia

# 3- PROLONGED ANESTHESIA

- Normal distribution of patient response to drugs allows for the rare individual (e.g., hyperreactor) who may experience prolonged soft tissue anesthesia after local anesthetic administration that persists for many hours longer than expected. This is not a problem.

- When anesthesia persists:: It is a persistent anesthesia or altered sensation well beyond the expected duration of anesthesia for days, weeks, or months, the potential for the development of problems is increased. In addition include hyperesthesia, dysesthesia in which patient experiences both pain and numbness.

A patient's clinical response to this can be profuse and varied, including sensations of numbness, swelling, tingling, and itching. Associated oral dysfunction, including tongue biting, drooling, loss of taste, and speech impediment, may be noted.

## ETIOLOGY:

1. Contamination of the anesthetic solution with alcohol or some other germicidal solution!
2. Needle trauma to nerve tissue.
3. Trauma & swelling of the soft tissue in proximity to the nerve.
4. Hemorrhage into or around the neural sheath is another cause. Bleeding increases pressure on the nerve, leading to paresthesia.
5. All local anesthetics may cause nerve injury (they are neurotoxic in nature). The occurrence of sensory impairment is apparently slightly more frequent following use of articaine and prilocaine.

# MANAGEMENT::

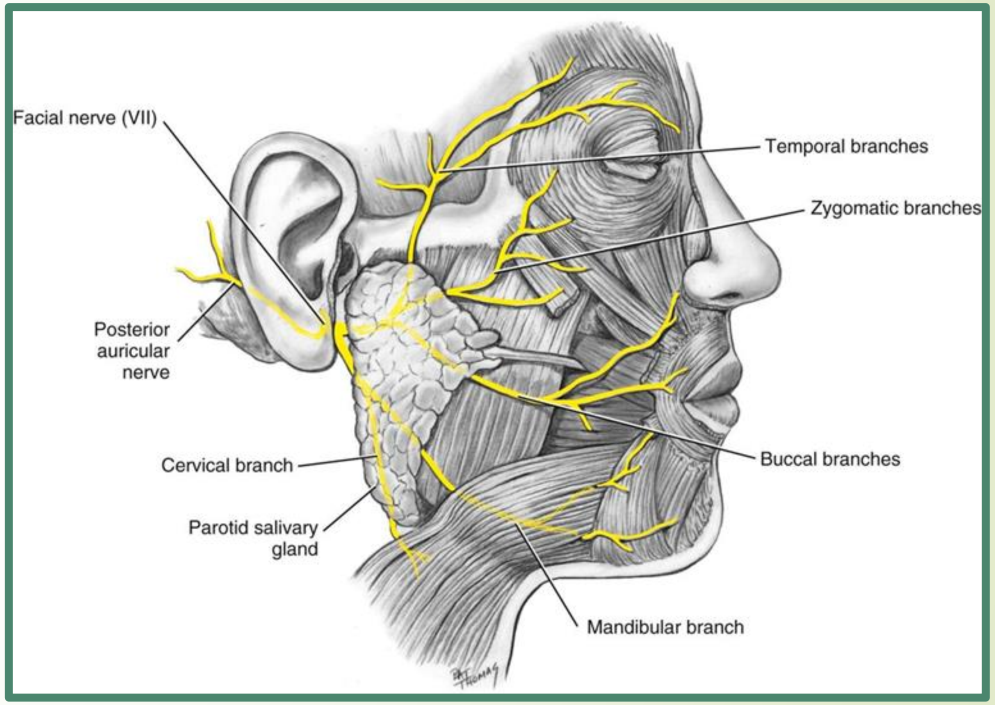
- Most case resolve within 8 weeks
- Reassurance to the patient
- Reschedule the patient for examination every 2 months for as long as the sensory deficit persist.
- Dental treatment may continue , but avoid re-administering LA into region of the previously traumatized nerve & the use alternate LA techniques if possible.

# 4- Facial Nerve Paralysis

- The seventh cranial nerve carries motor impulses to the muscles of facial expression, of the scalp and external ear, and of other structures.

-Paralysis of some of its terminal branches occurs whenever an infraorbital nerve block is administered, or when maxillary canines are infiltrated. Muscle droop is also observed when, occasionally, motor fibers are anesthetized by inadvertent deposition of local anesthetic into their vicinity.

- Generalized facial nerve paralysis may occur when anesthetic is introduced into the deep lobe of the parotid gland, through which terminal portions of the facial nerve extend




## Causes::

Transient facial nerve paralysis is commonly caused by the introduction of local **anesthetic into the capsule of the parotid gland,** which is located at the posterior border of the mandibular ramus, clothed by the medial pterygoid and masseter muscles. Directing the needle posteriorly or inadvertently deflecting it in a posterior direction during an IANB, or over inserting during a Vazirani-Akinosi nerve block, may place the tip of the needle within the body of the parotid gland. If local anesthetic is deposited, transient paralysis can result. The duration of the paralysis is equal to that of the soft tissue anesthesia usually noted for that drug.

## Management::

Within seconds to minutes after deposition of local anesthetic into the parotid gland, the patient senses weakening of the muscles on the affected side of the face. Sensory anesthesia is not present in this situation. Management includes the following:

1. Reassure the patient. Explain that the situation is transient, will last for a few hours, and will resolve without residual effect. Mention that it is produced by the normal action of local anesthetic drugs on the facial nerve, which is a motor nerve to the muscles of facial expression.

2. Contact lenses should be removed until muscular movement returns.

3. An eye patch should be applied to the affected eye until muscle tone returns. If resistance is offered by the patient, advise the patient to manually close the affected eyelid periodically to keep the cornea lubricated.

4. Record the incident on the patient's chart.

5. Although no contraindication is known to re-anesthetizing the patient to achieve mandibular anesthesia, it may be prudent to forego further dental care at this appointment.

# 5- Trismus

Is a prolonged, tetanic spasm of the jaw muscles by which the normal opening of the mouth is restricted

- Normal mouth opening ranges from 35 to 45 mm. Males usually have slightly greater mouth opening than females.
- The average interincisal opening in cases of trismus is about 14 mm.
- In most instances of trismus, the patient reports pain and some difficulty opening his or her mouth on the day after dental treatment.
- Usually it happens with a posterior superior alveolar or, more commonly, an inferior alveolar nerve block was administered.
- - Trismus is not always preventable

## Causes::

1. Trauma to muscles or blood vessels in the infratemporal fossa.

2. Local anesthetic solutions into which alcohol or cold sterilizing solutions have diffused produce irritation of tissues (e.g., muscle).

3. Local anesthetics have been demonstrated to be slightly myotoxic to skeletal muscles.

4. Hemorrhage is another cause of trismus.

5. Low-grade infection after injection can also cause trismus.

6. Multiple needle penetrations. Every needle insertion produces some damage to the tissue through which it passes.

7. Excessive volumes of local anesthetic solution deposited into a restricted area produce distention of tissues, which may lead to post injection trismus.

## Management::

1. Heat therapy: {Heat therapy consists of applying hot, moist towels to the affected area for approximately 20 minutes every hour}

2. Warm saline rinses: {a teaspoon of salt is added to a 12-ounce glass of warm water; the rinse is held in the mouth on the involved side (and spit out) to help relieve the discomfort of trismus}.

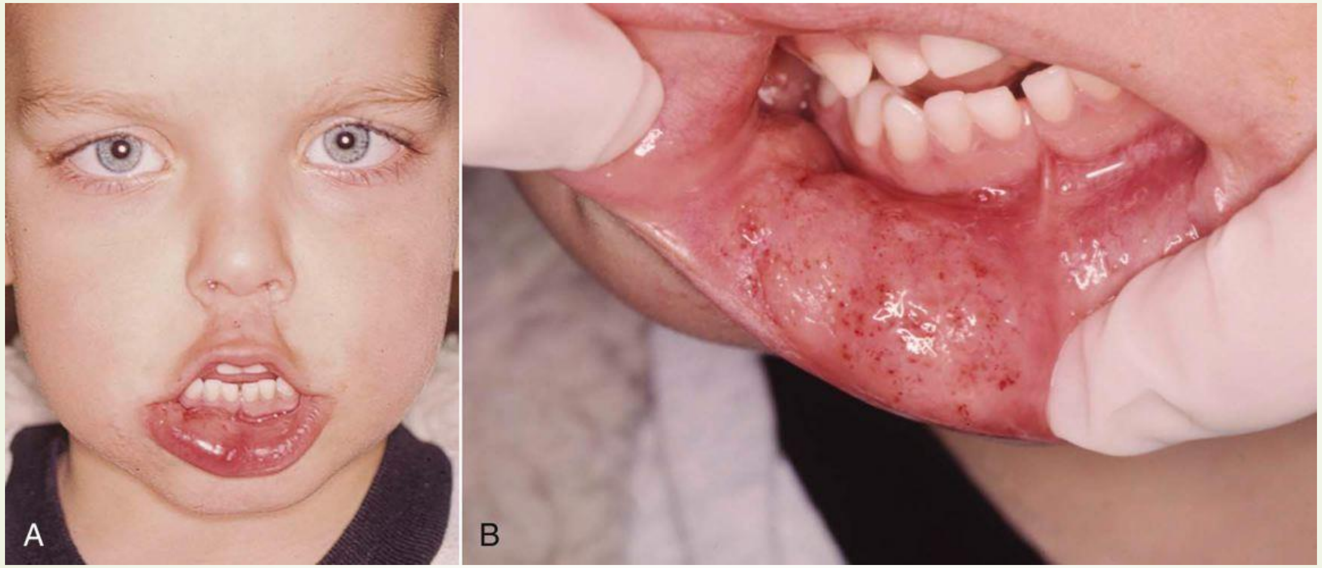
3. analgesics

4. If necessary, muscle relaxants to manage the initial phase of muscle spasm.

5. Physiotherapy. opening and closing the mouth, as well as lateral excursions of the mandible, for 5 minutes every 3 to 4 hours. And chewing gum.

# 6- Soft Tissue Injury

Self-inflicted trauma to the lips and tongue is frequently caused by the patient inadvertently biting or chewing these tissues while still anesthetized




Trauma to anesthetized tissues can lead to swelling and significant pain when the anesthetic effects resolve.

## Cause

- Trauma occurs most frequently in younger children, in mentally or physically disabled children or adults, and in older-old patients; however, it can and does occur in patients of all ages.

- Dental patients receiving local anesthetic during their treatment usually are dismissed from the dental office with residual soft tissue numbness.

## Prevention

1. Warn the patient and the guardian against eating, drinking hot fluids, and biting on the lips or tongue to test for anesthesia.
2. A local anesthetic of appropriate duration should be selected if dental appointments are brief.
3. A cotton roll can be placed between the lips and the teeth if they are still anesthetized at the time of discharge. The cotton roll is secured with dental floss wrapped around the teeth (to prevent inadvertent aspiration of the roll).
4. A self-adherent warning sticker may be used on children

## Management

It is symptomatic:

1. Analgesics for pain, as necessary.
2. Antibiotics, as necessary, in the unlikely situation that infection results.
3. Warm saline rinses to aid in decreasing any swelling that may be present.
4. Petroleum jelly or other lubricant to cover a lip lesion and minimize irritation.

# 7-HAEMATOMA & ECCHYMOSIS

- A hematoma rarely produces significant problems, aside from the resulting "bruise," which may or may not be visible extraorally.
- Possible complications of hematoma include trismus and pain.
- Swelling and discoloration of the region usually subside gradually over 7 to 14 days.

- Hematomas that occur after the inferior alveolar nerve block usually are only visible intraorally, whereas PSA hematomas are visible extra orally.

When the blood effusion during hematoma formation is stopped?

1. The blood effuses from vessels until extravascular exceeds intravascular pressure
2. Or until clotting occurs

Causes:

1. Inadvertent nicking of a blood vessel (artery or vein) during administration of a local anesthetic.

2- Tissue density surrounding the injured vessel is a determining factor. The denser the surrounding tissues (e.g., palate), the less likely a hematoma is to develop, but it is more happen in looser tissue (e.g., infratemporal fossa).

# HAEMATOMA & ECCHYMOSIS

# Prevention

**Hematoma is not always preventable.** Whenever a needle is inserted into tissue, the risk of inadvertent puncturing of a blood vessel is present.

- Knowledge of normal anatomy – proper technique
- The number of needle penetration should be as low as possible.
- Discard defective needles- barbed needles

## Management

- Directly, Apply pressure over the site for a few minute + Ice pack.
- Then ( after 8 hours) hot pack
- Prescribe analgesic, antibiotic, muscle relaxant.
- Time: With or without treatment, a hematoma will be present for 7 to 14 days

## 8- Pain during injection

Pain at the time of injection is mainly due to poor technique and may be caused by the following:

1) **Intraepithelial injection**: This cause epithelial ballooning and is overcome by insertion of the needle into the sub-mucosa.
2) **Sub-periosteal injection**: The discomfort is due to injection into non-compliant tissue.
3) **Too rapid injection rate**: A slow rate of injection reduces discomfort.
4) **Direct contact with nerve trunk**: During block anesthesia; this could occur with experienced operators

5) **Factors related to the solution:**

- **PH**: The presence of Adrenaline increase injection sensation due to the law PH
- **Temperature**: Cold solutions ( less than 15 degree C ) cause pain; should be allowed to reach room temperature before injection or hot one.

7) **A needle can become dull** from multiple injections.

# 9- Burning on Injection

- The primary cause of a mild burning sensation is the pH of the solution being deposited into the soft tissues. The pH of “plain” local anesthetics (i.e., no vasopressor included) is approximately 6.5, whereas solutions that contain a vasopressor are considerably more acidic (around 3.5).

- Rapid injection of local anesthetic, especially in the denser, more adherent tissues of the palate, produces a burning sensation.

- Contamination of local anesthetic cartridges can result when they are stored in alcohol or other sterilizing solutions, leading to diffusion of these solutions into the cartridge.

- Solutions warmed to normal body temperature usually are considered “too hot” by the patient.

# 10- Infection

Infection subsequent to local anesthetic administration in dentistry is an extremely rare occurrence since sterile disposable needles and glass cartridges have been introduced.

Causes

- The major cause of post-injection infection is contamination of the needle before administration of the anesthetic. Contamination of a needle always occurs when the needle touches mucous membrane in the oral cavity.
- Improper technique in the handling of local anesthetic equipment and improper tissue preparation for injection are other possible causes of infection.

# Prevention

1. Use sterile disposable needles.

2. Properly care for and handle needles. Take precautions to avoid contamination of the needle through contact with nonsterile surfaces.

3. Properly care for and handle dental cartridges of local anesthetic.

a. Use a cartridge only once (one patient).

b. Store cartridges aseptically in their original container, covered at all times.

c. Cleanse the diaphragm with a sterile disposable alcohol wipe immediately before use.

4. Properly prepare the tissues before penetration. Dry them and apply topical antiseptic (optional).

## Management::

Low-grade infection, which is rare, is seldom recognized immediately. The patient usually reports post-injection pain and dysfunction 1 or more days after dental care ( and trismus).

- Immediate treatment consists of those procedures used to manage trismus: heat and analgesic if needed, muscle relaxant if needed, and physiotherapy.
- After 3 days if trismus non-resolved…..The patient started on a 7- to 10-day course of antibiotics.

# 11- Edema

Swelling of tissues is not a syndrome, but it is a clinical sign of the presence of some disorder.

## Causes

1. Trauma during injection
2. Infection
3. Allergy: Angioedema is a possible response to ester-type topical anesthetics in an allergic patient
4. Hemorrhage (effusion of blood into soft tissues produces swelling)
5. Injection of irritating solutions (alcohol- or cold sterilizing solution–containing cartridges)

## Management::

The management of edema is predicated on reduction of the swelling as quickly as possible and on the cause of the edema.

- it may be necessary to prescribe analgesics for pain.

- Allergy-induced edema is potentially life threatening. Its degree and location are highly significant. If swelling develops in buccal soft tissues and there is absolutely no airway involvement, treatment consists of intramuscular and oral histamine blocker administration and consultation with an allergist to determine the precise cause of the edema.

## 12- SLOUGHING OF TISSUES

- Prolonged irritation or ischemia of gingival soft tissues may lead to number of unpleasant complications, including:

- epithelial desquamation
- and sterile abscess.

**Causes::**

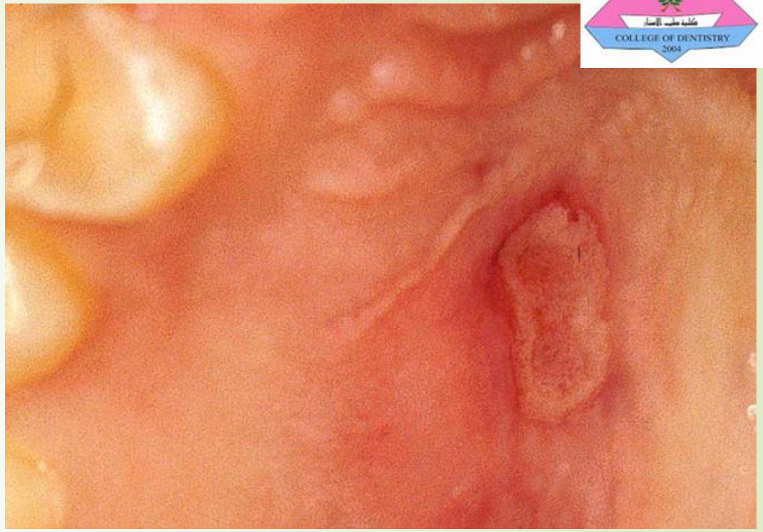
**Epithelial Desquamation**

1. Application of a topical anesthetic to the gingival tissues for a prolonged period.

2. Heightened sensitivity of the tissues to either topical or injectable local anesthetic

**Sterile Abscess**

Secondary to prolonged ischemia resulting from the use of a local anesthetic with vasoconstrictor (usually norepinephrine). Usually develops on the hard palate



# Management::

- No formal management is necessary for epithelial desquamation or sterile abscess.

- Reassure the patient of this fact.

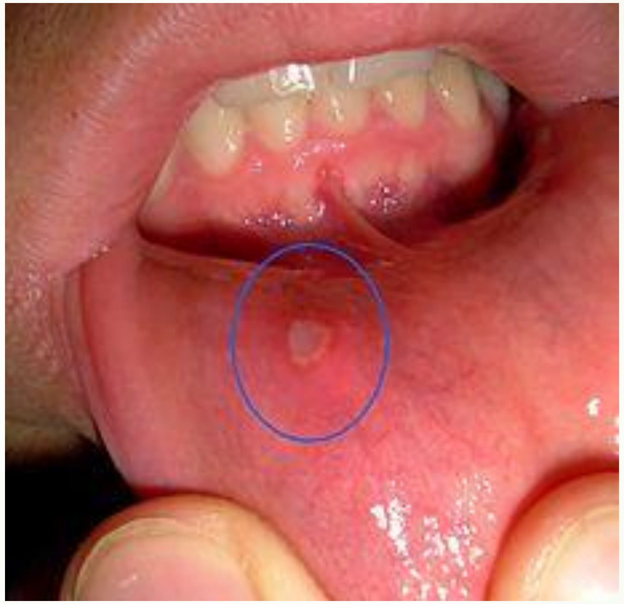
- Management may be symptomatic for pain aspirin or other NSAIDs and topical applied ointment are recommended.

- Epithelial desquamation resolves within a few days the course of a sterile abscess may run 7 to 10 days.

## 13- POST ANESTHETIC INTRAORAL LESIONS

- Patients occasionally report that approximately 2 days after an intraoral injection of local anesthetic, ulcerations developed in their mouth, primarily around the site(s) of the injection(s). The primary initial symptom is pain, usually of a relatively intense nature.

# POST ANESTHETIC INTRAORAL LESIONS::



**Causes::**

- Recurrent aphthous stomatitis or herpes simplex can occur intraorally after a local anesthetic injection or after any trauma to the intraoral tissues.

- Recurrent aphthous stomatitis is more frequently observed than herpes simplex, typically developing on gingival tissues that are not attached to underlying bone, such as the buccal vestibule.

- In spite of much continuing research, the causes remain poorly understood, the ulcers are not preventable, and treatment remains symptomatic.

- Trauma to tissues by a needle, a local anesthetic solution, a cotton swab, or any other instrument (e.g., rubber dam clamp, handpiece) may activate the latent form of the disease process that was present in the tissues before injection.

## Management

Primary management is symptomatic.

- Reassure the patient
- Topical anesthetic solutions (e.g., viscous lidocaine) may be applied as needed to the painful areas.
- Kenalog can provide a degree of pain relief.

# 14- Tissue Blanching

Causes

-Trauma To Blood Vessel By Needle

-I.V. Administration

- Interferance with the autonomic nerve supply of the blood vessels

Prevention

- Use Aspiration Tech.

-Avoid Intraarterial Administration

Management

- Transient Phenomenon

-NO Treatment REQUIRED

# 15- Visual disturbances

i) squint

ii) diplopia

**i) diplopia or double vision**

- infiltrating into the orbit to anesthetic the extrinsic ocular muscles of the yes.
- intaarterial inj.-uncommon vascular patterns-(orbit is supplied either wholly or partly by middle meningeal artery.)
- no management required (resolves within 3 hours, or when effect ends)

**ii)transient squint and double vision**

- paralysis of extrinsic muscles

  la diffused into orbit from pterypalatine ganglion and infratemporal fossa via infraorbital fissure, effecting oculomotor, trochlear, abducens nerve.
- no treatment required

# SYSTEMIC COMPLICATIONS OF LOCAL ANESTHESIA

1- TOXICITY

2- ALLERGY

3- IDIOSYNCRASY

# 1-TOXICITY

- It refers to A drug overdose reaction has been defined as those clinical signs & symptoms that result from an overly high blood level of drug in various target organs and tissues.

- Normally there is constant absorption of the drug from its site of admission into the circulatory system and a steady removal from the blood by the liver.

- Toxicity can be caused by excessive dose of either the local anaesthetic or the vasoconstrictor.

# In which situations we have the LA toxicity?

**Elevated blood levels of LA may result from one or more of the following:**

1. The unbiotransformed drug is too slowly eliminated from the body through the kidneys
2. Too large a total dose is administered or too great concentration
3. Absorption from the injection site is unusually rapid
4. Intravascular administration occurs
5. The **Ester type** of L.A. may produce systemic toxic effects in individuals with atypical forms of *pseudocholinesterase*. Also same reactions to **Amide groups** in patients with *liver disease.*

# **SIGNS & SYMPTOMS**

- L.A. agents are not specific and will affect **impulse transmission** in any excitable tissue especially that associated with the ***central nervous*** and ***cardio-vascular systems .***

# Characteristics of Local anesthetic toxicity

## I - CNS toxicity

1) **Excitation phase:** Tinnitus, confusion, restlessness, perioral numbness or tingling , metallic taste , lightheadness,

2) **Convulsive phase:** Grand-mal clonic-tonic seizure

3) **Depression phase:** CNS depression with drowsiness and unconsciousness

4) **Respiratory depression and apnea**

***-Cocaine - euphoria (unique in its ability to stimulate CNS).***

***-Lidocaine - sedation even at non-toxic doses.***

**- Cardio-vascular toxicity:** → **(bradycardia)**

- Effects on the cardio-vascular system can be due to:

**- Direct action of the L.A. on cardiac tissue and the peripheral vasculature**

**- Indirect action via inhibition of the autonomic nerve fibers that regulate cardiac and peripheral vascular function**

Most local anesthetic agents have a **depressant action on the heart**

- *The most* ***cardiotoxic*** *L.A. is* Bupivacaine

**- Lignocaine** is employed in the treatment of ***cardiac arrhythmias***

The best treatment of toxicity is prevention through:

- Aspiration
- Slow injection
- Dose limitation

## 2-ALLERGY::

True allergy to amide LA is rare, Allergy could due to other contents of LA , Mainly Sodium metabisulfite

- Patients **allergic to bisulfites**
- may be **steroid dependent asthmatic patients**
- **May develop severe bronchospasm**
- Bisulfites NOT used in plain anesthetics

- Allergy is a hypersensitive reaction that occurs through exposure to an antigen.
  - Allergic reactions to the **amide group** are rare;
  - The allergic potential of the **Ester type** has been recognized for some time;

## SYMPTOMS:

1.Rashes

2.Urticaria

3.Mucous membrane congestion

a. Rhinitis

b. Asthmatic symptoms (like laryngeal edema & bronchospasm)

4. Possible hypotension

## PREVENTION:

1. Adequate preanesthetic evaluation must be done.

2. No drug or drugs should be used if the patient gives a history of previous allergic reactions to them.

- Consultation should be considered
- if any doubt exists to allergy to LA
- Medical specialist - Allergist or Immunologist

# 3- IDIOSYNCRASY

# The term idiosyncrasy is defined as <u>any reaction to a local anesthetic or drug that cannot be classified as toxic or allergic.</u>

-Idiosyncrasy have no relation to the pharmacology of the drug and may vary in degree from day, to day even in the same patient.

**<u>The treatment for idiosyncrasy type of emergency:</u>**

- The patients airway must be maintained and adequate oxygenation assured.
- Steps should be taken to evaluate the circulation and support it by positional changes, drugs, or parenteral fluids.
- Precautions may also be exercised to protect the patient from injury to himself as a result of convulsive seizures, loss of consciousness or similar reactions.

# FAINTING

Timing: Fainting may occur before, during or after local anesthetic administration.

Cause: reduction in cranial blood supply. (results of dilation of the splanchnic B.P. & reduced cardiac output).

Clinical signs:

- The patient develops pallor,
- may sweat
- complain of nausea.
- They may experience tingling in the extremities
- lose consciousness.
- The pulse may be rapid in the early stages but then it becomes slow and weak.
- Patient could have convulsion.

Prevention: The chances of fainting can be reduced by dealing with the patient in a confident, calm and reassuring manner. In addition, injections should not be administered with the subject in an upright position. (in order to maintain the blood supply to the brain).

Treatment: place the patient supine. Recovery is rapid after this maneuver. If consciousness is not regained quickly then another cause of unconsciousness due to a medical problem must be suspected and appropriate treatment given.


Spaceline EMCIA SMT

# Conscious Sedation in dentistry::

## Nature of Dental Anxiety::

It is important from the begining to determine the nature of the patient’s anxiety. Some people are anxious of ‘dentistry’ as a whole, while others have a specific anxiety about ‘things in the mouth’ or ‘the dental drill’ or ‘dental injections’ or ‘having a tooth pulled’.

The underlying basis for many of these anxiety-provoking stimuli is frequently the fear of ‘pain’.

Unfortunately, dentistry has always had a close association with pain and the possibility of pain-free dental treatment can be a very difficult concept for anxious patients to accept.

## Definition of Conscious Sedation::

**Conscious sedation is defined as:**

**A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation.**

**The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely.**


## Types of Inhalation Sedation Agents::

### Nitrous Oxide

Nitrous oxide is the only inhalation agent currently in routine use for conscious sedation in dental practice. It was discovered by Joseph Priestly in 1772 and first used as an anesthetic agent for dental exodontia by Horace Wells in 1844.

when Harold Langa pioneered the modern practice of relative analgesia that nitrous oxide came into widespread use as an inhalation sedation agent in dentistry.

**Presentation:** Nitrous oxide is a colorless, faintly sweet-smelling gas with a specific gravity of 1.53. It is stored in light blue cylinders in liquid form at a pressure of 750 pounds per square inch (43.5 bar).

**Sedation:** Nitrous oxide is a good, but mild sedation agent producing both a depressant and euphoriant effect on the CNS. It is also a fairly potent analgesic.

A 50% inhaled concentration of nitrous oxide has been equated to that of parenteral morphine injection at a standard dose (10 mg in a 70 kg adult). It can be used to good effect to facilitate simple dentistry in patients who are averse to local analgesia and it decreases the pain of injections in those who require supplemental local anesthesia.

Nitrous oxide has few side effects in therapeutic use. It causes minor cardio-respiratory depression, and produces no useful amnesia.

## Occupational Hazards of Nitrous Oxide:

The main problems associated with the use of nitrous oxide relate not to the patient but to the staff providing sedation, and the potential hazards relating to chronic exposure. It has been shown that regular exposure of healthcare personnel to high levels of nitrous oxide over long periods of time can cause specific illnesses, the most common effects being hematological disorders and reproductive problems.

It is well known that nitrous oxide causes the oxidation of vitamin B12 and affects the functioning of the enzyme, methionine synthetase required for DNA synthesis. This in turn impairs cellular production and can lead to various health issues.

It should be noted that it is the cumulative effect of the gas that is the major concern and that the effects of the nitrous oxide very much depend on:

1) The pattern of exposure;

2) Tissue sensitivity;

3) Vitamin B12 intake and body stores; and

4) The extent to which methionine synthetase is deactivated.

## Inhalation Sedation in Dentistry

The aims of inhalation sedation are to alleviate fear by producing anxiolysis, to reduce pain by inducing analgesia, and to improve patient co-operation so that dental treatment can be performed. Inhalation sedation embodies a triad of elements:

1) The administration of low to moderate titrated concentrations of nitrous oxide in oxygen to patients who remain conscious.

2) The use of a specifically designed machine with a number of safety features, including the ability to deliver a minimum of 30% oxygen and a fail-safe device that cuts off the delivery of nitrous oxide if the oxygen supply fails.

3) The use of semi-hypnotic suggestion to reassure and encourage the patient throughout the period of sedation and treatment.

## Indications and Contraindications for Inhalation Sedation

### Indications

- Management of dental anxiety (children and adults)
- Management of needle phobia
- Management of gag reflex
- Management of medically compromised patients.

## Contraindications::

Many of the contraindications to inhalation sedation are relative or temporary and include:

- upper respiratory tract infections
- large tonsils or adenoids
- serious respiratory disease
- mouth breathers
- very young children
- moderate to severe learning difficulties
- severe psychiatric disorders
- pregnant women
- patients taking Methotrexate (due to the anti-folate effect of nitrous oxide)
- patient who have had vitreoretinal surgery in the last 3 months
- upper anterior apicectomy

## Advantages and Disadvantages of Inhalation Sedation

### Advantages

- Non-invasive technique with no requirement for venipuncture/cannulation
- Nitrous oxide is relatively inert so that there are no metabolic demands
- The low solubility of nitrous oxide ensures a rapid onset and recovery
- The level of sedation can easily be altered or discontinued
- Little effect on the cardiovascular and respiratory systems
- Some analgesia produced.

### Disadvantages

- The drug is administered continuously via a nose mask close to the operative site
- The mask may be objectionable to the patient
- The level of sedation relies heavily on psychological reassurance
- The technique requires a certain level of compliance in terms of breathing through the nose
- It is not suitable for very young children and patients with severe behavioural problems.

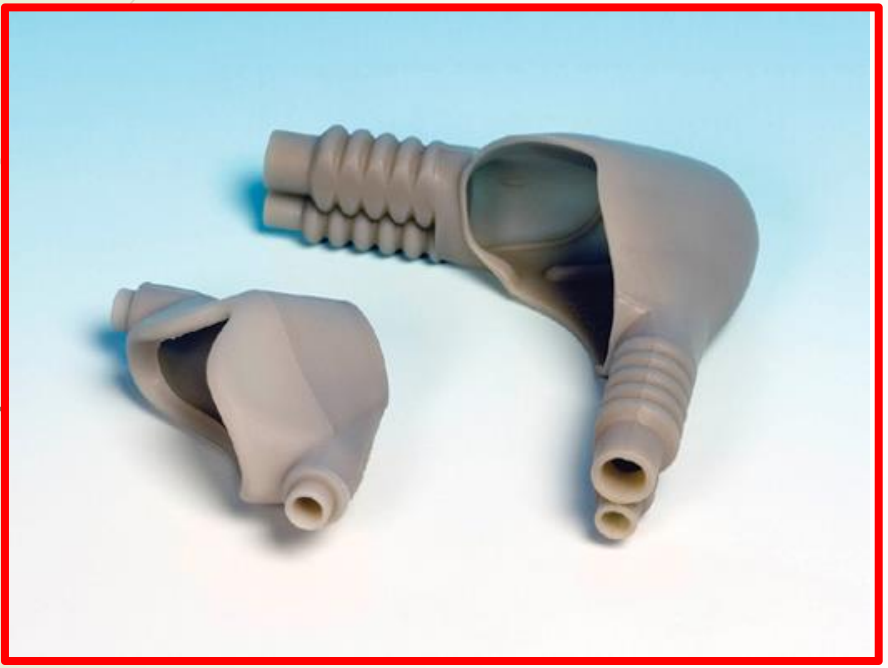
## Equipment for Inhalation Sedation

Machines have been designed specifically for providing inhalation sedation in the dental surgery. They may be either free-standing units or piped gas units. They allow a variable percentage of nitrous oxide and oxygen to be delivered to the patient via a nose mask. The gas flow is continuous but the rate can be individually adjusted to match the patient's minute volume.


1- flow control head, showing nitrous oxide and oxygen flow meters, mixture control dial, flow control knob and oxygen flush button.

B- Piped inhalation sedation system

A- Free-standing inhalation sedation machine.

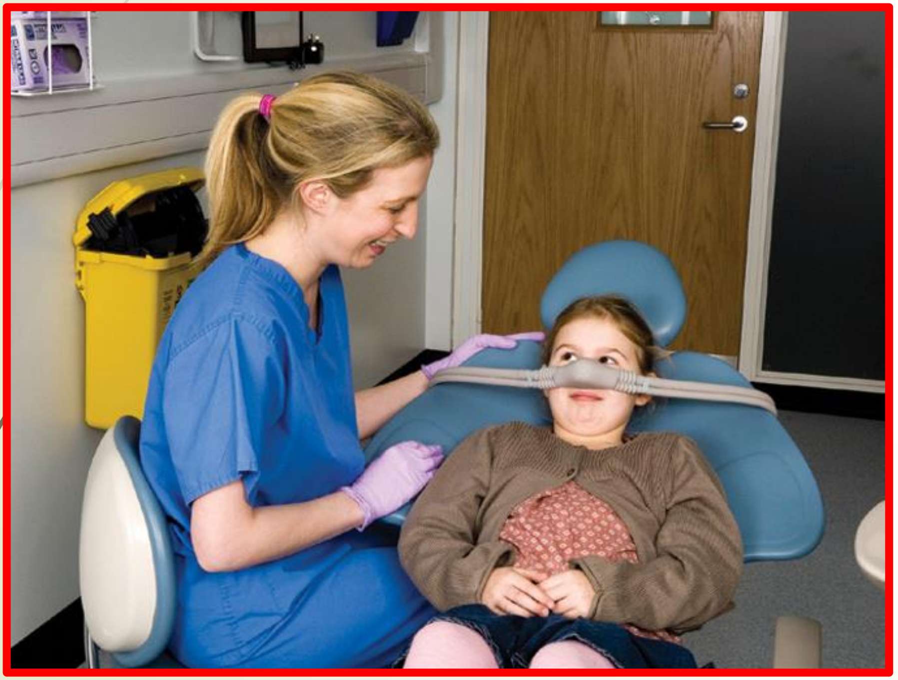


4- Inhalation sedation nose mask, showing the inner and outer units


3- The reservoir bag is situated just below the flow control head

## Patient Management

The patient should then be brought into the surgery by the dental nurse and settled in the dental chair. The procedure for inhalation sedation is explained and the patient is shown the nasal mask .



The nose mask is comfortably positioned on the patient's nose. It is important to check for a good seal around the mask to prevent leakage.

The nose mask is shown to the patient and the procedure explained

## Monitoring

It is essential to monitor the clinical status of the patient throughout the period of nitrous oxide sedation. Clinical monitoring of respiration rate and depth, pulse, colour,

## Recovery

When dental treatment is completed, the nitrous oxide flow is stopped and 100% oxygen is administered for a minimum of three minutes until the patient feels that the sedation has worn off. The aim of this is primarily to prevent 'diffusion hypoxia', a condition that results from the rapid outflow of nitrous oxide across the alveolar membrane when the incoming gas flow is stopped. This can dilute the percentage of alveolar oxygen available for uptake by up to 50%, although the risk of severe, life-threatening diffusion hypoxia is very low. The administration of 100% oxygen counteracts the potential desaturation caused by diffusion hypoxia. Finally, the patient is asked to remove the nasal mask and is slowly brought back to the upright position

## Discharge

After a period of about 10–15 minutes the patient is usually fit to be discharged. The dental clinician should check that the patient is coherent, standing steady and can walk unaided. Children should be discharged into the care of an adult, with written postoperative instructions. Adult patients can be allowed home unaccompanied once the dental clinician has confirmed their fitness to be discharged.

# Oral surgery

# Complications of exodontia

Complications can arise during the procedure of extraction or may manifest themselves sometime following the extraction, so we have immediate complications and post-operative one.

All these complications arise from error in judgment, misuse of instruments, exertion of extensive force or from anatomic causes or factors.

By careful diagnosis and planning of the procedures many complications can be avoided but some of these complications may occur even when utmost, care is exercised, so that the dentist or the oral surgeon should be qualified to deal with each complication successfuly.

So, the possible complications are: -

## 1- Failure to secure anesthesia.

Failure to secure profound or good anesthesia may be due to:-

a- Faulty technique, or Insufficient dosage of anesthesia.

b- Expired anesthesia.

c- The presence of acute infection.

## 2- Failure to remove the tooth with either forceps or elevator.

failure to remove the tooth after applying a reasonable amount of force without movement or yielding of the accused tooth need further clinical and radiological evaluation, because the tooth may be need surgical extraction.

## 3- Fracture (#) of: -

A. Crowns and roots.

B. Alveolar bone.

C. Maxillary tuberosity.

D. Adjacent or apposing tooth. ,

E. Mandible.

## a-Fracture of crowns and roots: -

The most common complication during tooth extraction is fracture of the tooth crown or roots.

The factors that may lead to fracture of crown or roots may be classified into three groups:

1. Factors related to the tooth itself.
2. Factors related to the bone investing that tooth.
3. Factors related to the operator (dentist).

## 1- factors related to the tooth itself

means that the tooth may be badly carious, or heavily filled, brittleness of the tooth due to age, or non-vitality, root canal filled tooth. Also peculiar root or crown formation like dilacerated tooth, geminated tooth, severely curved root, divergent roots, convergent roots, hyper-cementosis, accessory root and complex root shape, malposed tooth, insufficient space for the application of the extraction instrument, internal & external! resorption.

## 2-Factors related to the investing bone

means the surrounding bone might be excessively dense or sclerotic due to localized or systemic causes.

## 3-factors related to the operators

includes improper application of the beaks of the dental forceps or elevator on the tooth to be extracted; like the placement of the beaks of the dental forceps on the crown instead of the root or below the cemento-enamel junction, also the beaks are not parallel to the long axis of the tooth, also the use of wrong type of forceps.

Incorrect application of force during extraction by wrong direction in addition to that the use of twisting or rotational movement when not indicated like the use of twisting movement in extraction of upper $1^{st}$ premolar or upper $1^{st}$ and $2^{nd}$ molar for example.

## b- Alveolar bone fracture: -

Fracture of alveolar bone frequently occurs when extraction is difficult. The fractured bone may be removed with tooth to which it is firmly attached or it may be remain attached to the periosteum or it may be completely detached in the socket or wound.

It is a common complication that especially occurs on labial(buccal) area during extraction of upper canine and upper and lower molar teeth.

This complication might be due to: -

1. The alveolar bone is very thin.
2. Accidental inclusion of the alveolar bone within forceps blades
3. Configuration of the roots.
4. The shape of the alveolus.
5. Pathological or physiological changes in the bone itself like Ankylosis (bony connection between the tooth and bone), the presence of destruction in the alveolar bone due to the presence of discharging sinus.

## c- Maxillary tuberosity fracture: -

Sometime the tuberosity is completely fractured when we try to remove maxillary 3rd or 2nd molar.

Fracture of maxillary tuberosity may lead to a wide opening into the antrum called Oro-antrum communication with irregular tearing in the covering soft tissue lead to profuse bleeding and post- operatively may lead to difficulties in the retention of upper denture.

This complication might occur if the molar tooth to be extracted is isolated and subjected to full force of bite leading to sclerosis of the surrounding bone, or due to downward extension of the maxillary sinus to the nearby edentulous alveolar bone or due to large abnormal size of the maxillary sinus extended to involve the tuberosity; in addition to that, the use of excessive force or wrong positioning of the elevator in the extraction of upper 3rd molars

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## d-Fracture of the adjacent and opposing tooth; -

Adjacent teeth occasionally may be damaged during extraction procedures, this may include loosening or dislocation or fracture of the adjacent teeth.

This misshapes occur mostly due to careless use of the dental forceps or elevator by wrongfully using the adjacent tooth as a fulcrum during the use of elevator or the application of the beaks of dental forceps, also fracture of the crown of adjacent tooth or fracture and dislodgment of its filling.

In addition to that opposing teeth may be chipped or fractured if the tooth being extracted yield suddenly to uncontrolled force of the forceps striking the opposing tooth leads to this complication.

## e-Mandible fracture: -

This is a rare complication, but it might occur almost exclusively with the surgical removal of impacted lower third molar tooth.

A mandibular fracture is usually the result of the application of a force exceeding that needed to remove a tooth and often occurs during the use of dental elevators (winters elevator), but sometimes pathological or physiological changes may lead to weakened mandible like: -

1. Senile atrophy and osteoporosis of the bone.

2. Osteomyelitis e.g. osteoradionecrosis.

3. cystic lesion.

4. Impacted teeth.

5. Tumour, benign or malignant..

So, preoperative clinical and radiographic evaluation is very important to avoid such complication or preventing it.

**4. Dislocation of the tempro-mandibular joint (T.M.J.): -** Exertion of high amount of force during extraction of lower teeth especially posterior teeth may lead to dislocation of the condyle of the mandible and the patient becomes unable to close his/her mouth, especially in patient who had a history of recurrent dislocations in TMJ.

if this dislocation occur it should be reduced immediately by the operator by standing in front of the patient and his thumbs placed intra-orally on the external oblique ridge lateral to the molar teeth and other fingers outside the mouth under the lower border of the mandible, downward pressure with the thumbs and upward pressure with the other fingers may reduce the dislocation, if reduction is delayed it become difficult to reduce it because of muscle spasm and the patient may need general anesthesia to reduce the dislocation, also the patient may complain of traumatic arthritis of the TMJ. Post-operatively due to high pressure applied to the joint during extraction, so supporting the mandible during extraction prevents such complication.

**5. Displacement of a root into the soft tissue and tissue spaces and the maxillary antrum: -**

During extraction especially on use of elevator, a root or piece of root may be dislodged into the soft tissue through a very thin bony plate overlying the socket and disappear buccally or lingually into the soft tissue between periosteum and bone in the vestibule, but sometimes a root or even a tooth may be displaced into the tissue spaces surrounding the jaws e.g. a retained root in the lower molar teeth may be displaced into the sublingual or submandibular space or e.g. upper third molar may displaced into the infratemporal space.

So the extraction with high force without direct vision on the retained root may lead to such complications, also retained root may be displaced into the maxillary antrum during the extraction of upper molar or sometimes premolar teeth especially palatal root of upper molar teeth.

The presence of large antrum or the use of excessive force during extraction or due to pathological conditions like periapical pathology. All these factors may assist or predispose to such complication, so pre-operative radiograph and clinical evaluation may assist in the prevention of such complication.

## 6- Excessive bleeding after extraction: -

At the beginning one must understand that some slight oozing of blood for several hours following tooth extraction is considered normal. But sometime excessive or abnormal bleeding may occur following tooth extraction.

### The causes of excessive bleeding may be due to:-

### A. Local factors

The local causes which are the commonest causes for prolonged bleeding as in usual, due to gross tissue damage, when there is severe bone injury and tearing of the periosteum many vessels are opened also severe gingival lacerations, also damage to large arteries like inferior dental vessel or greater palatine vessels may lead to profuse bleeding, also the presence of Hemangioma (central) and other vascular abnormalities may lead to such complication
Also post-operative infection of the extraction wound causing erosion of the blood vessel leading to secondary haemorrhage, also the working in acutely inflamed area may assist in the prolonged bleeding.

### B. systemic factors

For the systemic causes like systemic haematological disorders like thrombocytopenia, reduction in the clotting factors, anticoagulant drugs, hereditary blood disease like haemophilia, all these factors may lead to severe bleeding; so good history and clinical examination and blood investigation is very important and essential before any extraction especially if the patient gives you a history of bleeding on previous extractions or trauma.

## 7-damage to the surrounding soft tissues.

### a. Damage to the gum or lip.

like laceration of the gum during extraction occurs if the gingival tissue not reflected before extraction so gum adhere to the tooth to be extracted from its socket should be carefully dissected before any further attempts to deliver the tooth are made, also the inclusion of the gum by forceps beaks or by blind application of the forceps may lead to crushing of the soft tissue, also the lower lip may be pressed or crushed between the handles of the forceps and the lower lip on extraction of upper teeth if sufficient care is not taken .

### b. damage to the tongue and floor of the mouth

Also slipping of elevator during extraction may lead to damage or wounds in the floor of the oral cavity, there are many vital structures in the floor of the oral cavity which might be damage like [sublingual gland , submandibular duct, lingual nerve & tongue]. So the operator should always keep in his mind that supporting of elevator during extraction is very important.

### C. Damage to nerves

occur mostly on surgical extraction of teeth rather than simple extraction but one must always be aware of the risk when operating in the region of the (inferior dental nerve, lingual nerve & mental nerve). Inferior alveolar nerve injury is an uncommon occurrence in extraction of erupted mandibular teeth. In rare cases third molar roots may *encircle the nerve* so that extraction of the tooth will cause nerve injury also curration or improper use of elevators to remove root apices may cause tearing or displace bone fragments so that will be impinging or pressing the nerve in the canal "inferior dental canal" result in *Paraesthesia or anesthesia* of half of lower lip.

The mental branch of the alveolar nerve also may be injured during surgical procedures in the premolar region. The lingual nerve may be damaged during exodontias of the lower molar teeth especially the lower wisdom tooth by trapping the lingual soft tissue in the forceps beaks or by direct trauma from misusing of elevator or by using surgical extraction to remove impacted wisdom tooth.

## 8-post -operative pain:

Post-operative pain and discomfort after extraction due to traumatized hard tissue may be from bruising of bone during instrumentation or from using burs for removal of bone also damage and rough handling of soft tissue during extraction is another cause for postoperative pain.

The most common cause for the moderate to severe continuous pain after extraction is related to a well-known cause called ***dry socket*** *or acute localized alveolar Osteitis.* -The patient presented with continuous moderate to severe pain after 24-72 hours after extraction which may last for 7 to 10 days clinically the patient may presented with empty socket (there is no clot in the socket) , exposed bone or empty socket with some evidence of broken-down blood clot and food debris within it with intense bad odour. The aetiology of this condition is incompletely understood but many predisposing factors exist like infection, trauma, blood supply, site, smoking, sex, vasoconstrictors or systemic factors.

## 9-post- operative swelling:

After extensive surgical interference and exodontias some time may be associated with post-operative swelling, this swelling may be related to one or more of the following causes: (A-Oedema, B-Infection, C-Hematoma.)

### a. Oedema*:*

oedema occurs after surgery as a result of tissue injury *(it is normal response)* when there is great damage to the tissue by using blunt instrument. And rough handling of tissue may Increase the chance of production large oedema.

**So** laceration of tissue during extraction, trauma to the bone or periosteum are some of the most common causes of oedema and in other words *post-operative swelling,* persistent post-extraction swelling or the development of swelling several days after surgery is usually due to infection.

**b. infection**

swelling due to infection can be distinguished from postoperative oedema by the increased skin temperature, greater redness of the overlying tissues, the usual presence of fever and sometime fluctuation is present due to presence of pus. The infection should be always considered a serious complication and need urgent management.

**c. hematoma**

means a collection of blood in the extra-vascular spaces of the tissues. It is rare complication following extraction of the teeth, but sometimes hematoma or ecchymosis (bruising) may develop postoperatively if haemostasis is not developed and persistent bleeding from either the socket or adjacent alveolar bone.

## 10-The creation of an oroantral communication.

On extraction of upper molar teeth and sometimes upper premolars a communication between the oral cavity and maxillary antrum may be created. This communication if not healed or closed after few days a chronic condition occurs called *Oro- antrum fistula*.

Close proximity of the maxillary cheek teeth to the maxillary antrum which are separated only by little amount of bone and sometime even the soft-tissue lining of the maxillary sinus, the presence of periapical infection, the antrum itself may be abnormal in size, misjudgement of the amount of force and its direction used in extraction or the presence of pathological lesions. all these factors may assist in the production of this complication.

to confirm the presence of this complication, the patient is asked to pinch or close the nostrils together and blow air **gently** into the nose, the operator may see blood bubbling, or shooting of air through the communication is heard or a piece of cotton on tweezer may be defected. The *presence of* this complication needs surgical correction by well-trained oral surgeon and surgical unit in which all instruments and qualified staff present.

## 11-Trismus:

Means inability to open the mouth, trismus is one of common complication following extraction of teeth especially the surgical removal of wisdom teeth.

Trismus may be caused by post-operative *oedema, hematoma, inflammation of the soft tissue. Trauma and arthritis* of the temporomandibular joint, it may be related to the use *of inferior dental block* local anesthesia so the management of the trismus depend on diagnosis of the cause of this complication

## 12-syncope(fainting): -

Collapse on the dental chair is a common complication during extraction. The patient may often complain of feeling dizzy, weak & nauseated, and the skin is seen to be pale, cold and sweating, these complains may be accompanied by loss of consciousness, and the patient if not noticed at the beginning of the fainting may shows episode of convulsion.

The primary pathophysiological component of this situation is *cerebral ischemia* secondary to an inability of the heart to supply the brain with an adequate volume of oxygenated blood. In the presence of anxiety, blood flow is increasingly directed toward the skeletal muscles at the expense of other organ systems such as the gastrointestinal tract, in the absence of muscular movement, the increased volume of blood in the skeletal muscle remains there, decreasing venous return to the heart and decreasing the volume of blood available to be pumped by the heart (uphill) to the brain.

A slight decreased in cerebral blood flow is evidenced by the signs and symptoms of vasodepressor syncope (i.e., light headedness, dizziness, tachycardia, palpitation) if this situation continues cerebral blood flow declines still further and the patient loses consciousness.

When the operator notices these signs and symptoms a first aids treatment should be started by lowering the head of the patient by putting him in supine position by lowering the back of the dental chair. Care should be taken to maintain the airway and you have to notice the condition of the patient. if consciousness is not returned within 1-2 minutes otherwise one should consider that something serious like *respiratory arrest* or *cardiac arrest* may happen and the patient need medical emergency.

# GENERAL ANAESTHESIA د. صلاح جاسم

General anesthesia is commonly described as the triad of unconsciousness (loss of awareness), analgesia (pain relieve) and muscle relaxation.

**Induction of general anesthesia** is most frequently done by intravenous agents. Propofol considered as the most widely used induction agent and can be used for maintenance of anesthesia. Other infrequently used intravenous agents include ketamine. Newer agents based on benzodiazepine receptor agonist, etomidate derivatives and fospropofol are still in the experimental stage.

**Inhalational induction** using agents such as non-pungent sevoflurane is useful in children, needle-phobic adults and those in whom a difficult airway is anticipated. These patients will have a higher risk of developing airway obstruction

Another method used in the induction of the General anesthesia is the **Rapid sequence induction** (RSI) is a technique that allows the airway to be rapidly secured. It is used when there is a high risk of regurgitation that may lead to pulmonary aspiration by using a predetermined dose of intravenous an aesthetic agent together with rapidly acting muscle relaxant is used in those with high risk of regurgitation in order to secure the airway quickly. Commonly needed in emergency surgery, it is also a technique of choice in any non-emergency surgery in a patient with delayed emptying of stomach.

However, nowadays the **Total intravenous anesthesia** (TIVA) is becoming popular following the introduction of propofol and ultra-short acting opioid remifentanil due to

1- The lack of a cumulative effect,
2- better hemodynamic stability
3- excellent recovery profile and concerns over the environmental effects of inhalational agents

Total intravenous anesthesia is routinely used in neuro-surgery, in airway laser surgery, during cardiopulmonary bypass and for day-case anesthesia.

**Management of airway during anesthesia**

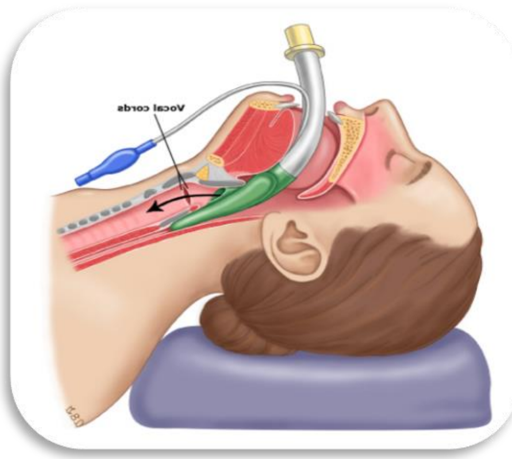
Loss of muscle tone as a result of general anesthesia means that the patient can no longer keep their airway open. Therefore, the patients need their airway maintained for them. The use of muscle relaxants will mean that they will also be unable to breathe for themselves and so will require artificial ventilation.

Different approaches used to manage the airway during anesthesia including

1- Chin lift and jaw thrust: suitable for short term when no aid available
2- Guedel airway: holds tongue forward but does not prevent aspiration
3- Laryngeal mask: easy insertion, reliable airway, allows ventilation
4- Endotracheal intubation: secure and protected airway

Laryngeal mask airway or endotracheal tube is then inserted and the patient is allowed to breathe spontaneously or is ventilated during the procedure. The addition of a cuff to the endotracheal tube facilitates positive pressure ventilation and protects the lungs from aspiration of regurgitated gastric contents.

**Laryngeal mask airway (LMA).** Developed by Dr Archie Brain in the UK, the mask with an inflatable cuff is inserted via the mouth and produces a seal around the glottic opening, providing a very reliable means of maintaining the airway. Its placement is less irritating and less traumatic to a patient's airway than endotracheal intubation. The technique can be easily taught to non-anesthetists and paramedics and can be used as an emergency airway management tool. Several varieties of LMA are available including reinforced, I-gel and an intubating LMA that aids endotracheal intubation.

**Difficult intubation:** Endotracheal intubation is feasible in most patients, but in a certain proportion of patients this may be difficult or impossible; if compounded by inability to ventilate the patient by bag-mask, the consequences can be catastrophic hypoxia. Many devices have been developed to aid intubation if difficulty is anticipated and protocols have been created by specialized societies to deal with such situations. The gold standard for intubation in difficult situations is the use of the fiberoptic intubating bronchoscope, facilitated by topical local anesthetic in awake patients or using general anesthesia. The anesthetist places the endotracheal tube in the trachea by threading the tube over the bronchoscope and so places the tube in the trachea under direct bronchoscopic vision.

## Muscle relaxation and artificial ventilation

Pharmacological blockade of neuromuscular transmission provides relaxation of muscles allowing easy surgical access, but the patient requires artificial ventilation.

Neuromuscular blocking agents are broadly classified into depolarizing and non-depolarizing groups according to their mode of action.

Suxamethonium is the most commonly used depolarizing agent. It binds to the nicotinic acetylcholine receptors resulting in opening of the cation channel leading to depolarization and rapid relaxation of muscles. Despite its adverse effects, such as hyperkalemia, muscle pain, anaphylaxis and potentially lifethreatening malignant hyperthermia, suxamethonium is still widely used because of its quick onset and short duration of action. These properties are useful where rapid endotracheal intubation is necessary to protect the patient's airway or short duration surgery is performed.

## Ventilation during anesthesia

Mechanical ventilation is required when the patient's spontaneous ventilation is inadequate or when the patient is not breathing because of the effects of the anesthetic, analgesic agents or muscle relaxants.

In volume control ventilation, a preset volume is delivered by the machine irrespective of the airway pressure. The pressure generated will be in part dependent on the resistance and compliance of the airway. In laparoscopic surgery requiring the Trendelenburg position (the patient is positioned head down), and in morbidly obese patients and those with lung disease, this may result in excessive pressures being developed, which may lead to barotrauma (pneumothorax).

In pressure control mode, the ventilator generates flow until a preset pressure is reached. The actual tidal volume delivered is variable and depends on airway resistance, intra-abdominal pressure and the degree of relaxation.

**-The End-**

Lec 3

# EXTRACTION OF TEETH (EXODONTIA)

**EXTRACTION OF TEETH (EXODONTIA):-**

Extraction of teeth is the most important part of minor oral surgery and the most common procedures to general dental practitioner(dentist).

**Definition:-**

Exodontia is a painless removal of teeth from their bony alveolar socket with relatively minimal amount of trauma to the investing or surrounding tissues, so that the wound may heal without postoperative problems.

**Basically, we have two methods of extraction:-**

1- Intra-alveolar extraction (forceps extraction).
2- Trans-alveolar extraction (surgical extraction).

In forceps extraction which is enough for extraction in most of cases consist of removing the tooth or root by the use of forceps or elevators or both. While in trans-alveolar extraction we dissect the tooth or root form its bony attachment by rising a flap and removal of some of the bone surrounding the roots, which are then removed by the use of elevators and/or forceps.

**INDICATIONS OF Extraction:-**

There are many indications for tooth extraction, if conservative treatment has either failed or is not indicated, a tooth may have to be extracted. The reasons for extraction of teeth are based on the presence of local pathology, the feasibility of restorative procedure (function of the dentition as a whole and the patient's attitude and education). Although the modern dentistry tries and takes all measures to preserve and maintain teeth in the oral cavity, there are still a variety of general indications for removing teeth.

## Indications of teeth extraction.

### 1-Severe caries:-

This is the most common reason to remove a tooth. Badly carious teeth that are beyond restoration should be removed. Badly carious teeth result in deterioration of the oral hygiene resulted in bad oral hygiene and bad smell in addition to that sharp edges of the carious teeth leads to repeated trauma and ulceration to the mucosa and the tongue, in addition to pain during eating and drinking. Untreated teeth with caries may end with pulpitis, periapical pathology etc...

## 2-Severe periodontal disease:-

Severe and extensive periodontal disease is a common reason for tooth removal, in chronic periodontitis there is excessive bone loss and mobility in the tooth. As a rough guide, loss of about half of the normal alveolar bone or extension of pockets to the bifurcation of the roots of posterior teeth and hypermobility of the teeth means that extraction of the involved tooth is necessary. Patient with advanced periodontitis may complains of mild to severe throbbing pain in case of development of Paradontal abscess.

## 3- pulp pathology:-

For example acute pulpitis or chronic pulpitis, non-treatable pulpal lesion. if endodontic therapy wasn't possible or if the tooth isn’t amenable for endodontic treatment, extraction is indicated.

## 4- Apical pathology:-

Periapical lesions like periapical abscess, periapical granuloma, cyst. If the teeth fail to respond to all conservative treatment to resolve apical pathology due to technical reasons or other causes such teeth are indicated for extraction.

## 5- Orthodontic reasons:-

During the course of orthodontic treatment, tooth or teeth maybe extracted for:-

a) **Therapeutic extraction** e.g. extraction of upper first premolar for treatment of malposed upper canine and extraction of teeth to provide
space for teeth alignment.

b) **Malposed teeth**: teeth which erupted out of the line of arch are difficult to clean and not amenable for orthodontic treatment are indicated for extraction.

c) **Preventive extraction**, means that during mixed dentition period (permanent and deciduous teeth), dental surgeon may extract few deciduous teeth to prevent malocclusion and all these extractions should be done after proper evaluation by specialist orthodontic.

## 6-Prosthetic considerations:-

Extraction of teeth are indicated for:-

1) Providing efficient dental prosthesis.

2) To provide better design for success of partial denture, few teeth maybe extracted.

3) Solitary tooth or non-strategic tooth to enable the patient to have complete denture e.g. full mouth clearance.

## 7- Impacted teeth.:-

Retention of un erupted teeth beyond the normal time of eruption may sometimes be responsible for: -

a) Vague facial pain.
b) Periodontal problems of the adjoining teeth.
c) Tempromandibular joint problems.
d) Bony pathology e.g. cyst (dentisgerous cyst), tumor, pathological fracture.
e) May predispose to anterior teeth crowding
f) Significant infection (pericornoitis) e.g. partially erupted third molar.

## 8-Supernumerary teeth

The teeth maybe impacted or malposed and such teeth may predispose to malocclusion, periodontal disturbances, facial pain, bony pathology (cyst), aesthetic problems and preventing the eruption of adjacent teeth.

## 9- Tooth in the line of fracture of the jaws:- **This tooth maybe extracted if:-**

**a)** It is a source of infection at the site of the fracture.
**b)** The tooth itself is fractured.
**c)** Interfere with fracture reduction.
**d)** Interfere with healing of fracture.

## 10- Teeth in relation with pathological conditions:-

They are indicated for extraction if they are involved in:-
a) Cyst formation.
b) Neoplasm (tumor).
c) Osteomyelitis (Infection of bone).
d) Pyogenic granuloma
And the tooth interfere with complete surgical removal of the lesion the tooth should be extracted.

## 11-Retained roots

Retained roots may remain embedded in the bone without problems for a long period, but sometimes removal of such roots maybe necessary, for example, root maybe at the sub mucosal level producing recurrent ulceration under the denture, sometimes root fragments may be involved in initiation of bony lesions like osteomyelitis, cystic lesion or neoplasm, if such fragments are in close relation to the neurovascular bundle (e.g. inferior dental nerve of the mandible) the patient may complain of facial pain or numbness in the area supplied by that nerve. As a general rule, very small fragments maybe left alone and that patient should be kept under periodic observation, and all other root fragments are indicated for removal.

## 12- prior to irradiation:-(before radiotherapy)

Irradiation is one of the methods of treating oral carcinomas and teeth which cannot be kept in a sound condition should be removed before irradiation, trauma (extraction) with superadded infection will lead to development of osteoradionecrosis of the jaw bone which is unpleasant complication and difficult to be treated.

## 13-Focal sepsis:-

Sometimes teeth or a tooth may appear sound clinically, but on radiographic examination the tooth may appear to be considered as a foci of infection (teeth associated with periapical pathology or periodontal problems), these teeth or tooth should be extracted in certain conditions e.g. heart surgery; heart valve replacement, kidney transplant, eye Surgery.

## 14- Aesthetic:-

Poor aesthetic, severely stained (tetracycline, fluorosis) attrition or hypoplastic (hypoplasia) of enamel or dentine and they cannot be restored may be indicated for extraction.

## Contra-indications of teeth extraction.

In general, the contra-indications are subdivided into ;

1- Local contra-indications.

2- Systemic contra-indications.

## Local contra-indications:- (L.C s)

There are several L.C s to extractions of indicated teeth:-

**1- Acute and uncontrolled infection**:-

Extraction in the presence of acute and uncontrolled infection may lead to spread of infection locally or systemically leading to many complications some of them are dangerous and life threatening (e.g. cavernous sinus thrombosis, mediastinitis, Ludwig's angina)and acute periapical abscess and facial abscess especially in medically compromised patient. In addition to that limitation of mouth opening especially in lower wisdom tooth infection.

**2- Previous radiotherapy:-**

Previous therapeutic radiation in oral and maxillofacial region for treatment of cancer lead to fibrosis and decreased vascularity of the tissue or area of extraction and end with a condition in the bone called osteoradionecrosis.

3- Teeth located within area of tumor:-

Especially in vascular lesion or malignant tumor should not be extracted because extraction may lead to dissemination of the tumor, unhealed socket and postoperative complications, for example, bleeding postoperatively and intraoperative.

## Systemic contra-indications:-

Systemic contra-indications preclude extraction because the patient's systemic health is such that the ability to withstand the surgical work may be compromised. So extraction should be postponed until the severity of the problem has been resolved and maybe arranged after consultation with the physician to perform extraction safely without complications so caution is advised in the following conditions:-

**1- Severe uncontrolled metabolic disease**, e.g. uncontrolled diabetes, end-stage renal disease.

**2- Uncontrolled leukaemia and lymphomas.**

**3- Sever uncontrolled cardiac disease**, e.g. myocardial infarction, unstable angina pectoris, dysrhythmias.

**4- Sever uncontrolled hypertension.**

**5-Pregnancy.**

**6- Bleeding disorder** e.g. haemophilia, platelet disorder, patient on anticoagulants.

**7- Patients who take a variety of medications**e.g. patient on steroid and immunosuppressive drugs, cancer and chemotherapy.

**8- Uncontrolled epilepsy.**

## Pre-extraction evaluation (PEE):-

P.E.E is very valuable and necessary for successful extraction practice. Hurry and inadequate P.E.E of the case may lead to many embarrassing intra-operative problems for the operator, in addition to the postoperative problems to the patient,

**P.E.E include**:-
**1- Clinical preoperative evaluation( POE).**
**2- Radiological evaluation**

## 1-Clinical P.O.E also includes:-

**a) General evaluation.**
**b) Local evaluation.**

**a-General evaluation includes:-**
• General impression of the patient.
• History of general diseases, Nervousness and orientation
• General oral hygiene.
• Gingival inflammation, calculus, neglected mouth.

**b-Local factors evaluation Includes:-**
• **Clinical examination of the accused tooth.**
• **Adjoining structures**.
• **Access to the tooth**. This includes the mouth opening, location of the tooth (e.g. buccally malposed, in standing) may present difficulty in positioning the dental forceps for extraction, so you may remove such a tooth surgically.
• **Tooth mobility**: The mobility of the tooth to be extractedshould be assessed preoperatively, greater than normal mobility is frequently seen with severe periodontal disease, but sometimes it maybe because of the underlying pathology like neoplasm.

• **Condition of the tooth:- e.g**.
**a)** Carious destruction.
**b)** The presence of large restoration.
**c)** Presence or absence of the adjoining teeth.
**d)** Non-vital tooth.
**e)** State of the supporting tissue.
**f)** Shape, position, long axis and size of the crown.
**g)** Attrition.

Good P.O.E resulted from correction of data collected from history, clinical examination, radiographs and laboratory aids in addition to that P.E.E need good knowledge and experience in the basic sciences e.g. anatomy, physiology, pathology.

**In general, P.O.E may help you in:-**

**a)** Determine the method of extraction and type of anaesthesia.

**b)** Reduce the time spend for extraction.

**c)** Reduce the intra and post-operative crisis and complications.

## 2- Radiological evaluation:-

Preoperative clinical assessment maybe supplemented some times by preoperative radiographs, and the positive indications for preoperative radiograph are:-

1) History of difficult or unsuccessful extraction.
2) Crown with extensive caries, large restorations, non-vital tooth when diagnosis is not certain and tooth is malposed.
3) A tooth which is abnormally resistant to forceps extraction.
4) If after clinical examination you decide to remove the tooth surgically.
5) Any tooth which is in close relation to important or vital structures like neurovascular canal, maxillary sinus, mental nerve, nasal cavity.
6) Attrition teeth in elderly patient (maybe associated with hypercementosis).
7) If a tooth is partially erupted or completely unerupted or retained root.
8) Any tooth which has been subjected to trauma, fracture of the root and/or alveolar bone maybe present.
9) An isolated maxillary molar especially if it is unopposed and over erupted. The bony support of such a tooth is often weakened by the presence of maxillary sinus and this may predispose to certain of oro-anrtal communication or fracture of the maxillary tuberosity.
10) Whenever, underlying bony pathology is suspected e.g. cystic lesion, tumor.
11)Any systemic condition which may predispose to dental or alveolar abnormality like:-

**a) Osteitis deformans (Paget's disease)**, in which the roots are hypercementosed andankylosed leading to difficult extraction, infection of the socket.

**b) Cleido-cranial dysostosis**, for pseudo-anodontia (multiple impactions, hooked roots occur, supernumerary teeth).

**c) Patient who have received therapeutic irradiation to the jaw which may have to predispose to osteoradionecrosis.**

**d) Osteopetrosis (marble bone disease)**, which cause extraction very difficult and predispose to chronic osteomyelitis

• **A good radiograph and careful interpretation may give or aid the operator to many factors that may cause difficult extraction, e.g.:-**

1- Abnormal number and shape of roots.
2- An unfavourable root pattern.
3- Caries extending to the root mass.
4- Fracture or resorption of the root.
5- Hypercementosis of roots.
6- Ankylosis (there is no space in periodontal ligament), and sclerosis of the bone.
7- Gemination (the development of two teeth from one bud).
8- Impaction.
9- Bony sclerosis and pathological lesions.

**Also careful interpretation of the radiograph may also reveal or show the possibility of the following complications**:-

1) Involvement of, and damage to inferior dental nerve and mental nerve e.g. on extraction of impacted lowerthird molar
2) The creation of oro-anrtal fistula or or-nasal communication.
3) The retention of intra-bony pathology e.g. cyst.
4) The displacement of root or tooth into maxillary sinus.
5) Fracture of maxillary tuberosity.

*lec 4&5*

# *Exodontia*

## *General Arrangement or considerations for Extraction*

### 1. Light:

Dentist or oral surgeon work in a limited accessible area ( oral cavity ) , then he is going to do his work ( extraction site ) in a relatively inaccessible area in addition to that the shadow of the hand & the instrument he use , so good illumination of the operative field is very important & necessary to perform your work efficiently & safely .

### 2. Position of the operator:

When extracting any tooth in the oral cavity except the right mandibular molars, premolars, canines, the operator stand on the right-hand side of the patient, in other words in front of the patient. For removal of right mandibular teeth (molars, premolars & canines) the operator stands behind the patient in order to achieve the good working position. For left-handed dentists, he should stand behind the patient when extracting lower left teeth.

### 3.Position of the patient:

Correct position of the patient is very important to avoid any Occupational **Postural** problems. The patient is seated comfortably in the dental chair with head rest adjusted to fit the shape of the neck & support of the head. Patients undergoing extraction of maxillary teeth should be positioned where the dental chair back support reclined so that the upper arch lies at an angle of 60 degrees to the floor (inclination of about 60 degrees). For extraction of mandibular teeth, the dental chair should be reclined slightly less (about 30-45 degrees) so that when the patient opens his mouth the occlusal plane parallel to the floor.

## 4.Height of the dental chair:

This is very important. If the site of the operation is either too high too low in relation to the operator he works in mechanical disadvantage & in tiring & uncomfortable position. When maxillary teeth are being extracted the chair should be adjusted so that the site of the operation is levelled at the operators' elbow. During extraction of mandibular teeth the chair height should be adjusted so that the tooth to be extracted about 16cm (6 inches) below the level of the operators elbow. When the operator is standing behind the patient the chair should be lowered sufficiently to enable him to have a clear view of the field of the operation.

## * The dental surgeon should attempt to have: -

1. Quick, efficient, unhurried & methodical approach to his work.
2. Sympathetic encouragement, to gain confidence & cooperation of the patient
3. You have to avoid to increase the misgivings of the patient by displaying instruments.
4. The dressing of operator should be suitable.
5. Try to do your work in a septic environment reduce the chance of contamination by using gloves, mask, trimming of the nails, tied the hair,…etc.

Instruments used in simple uncomplicated teeth extraction includes the followings:

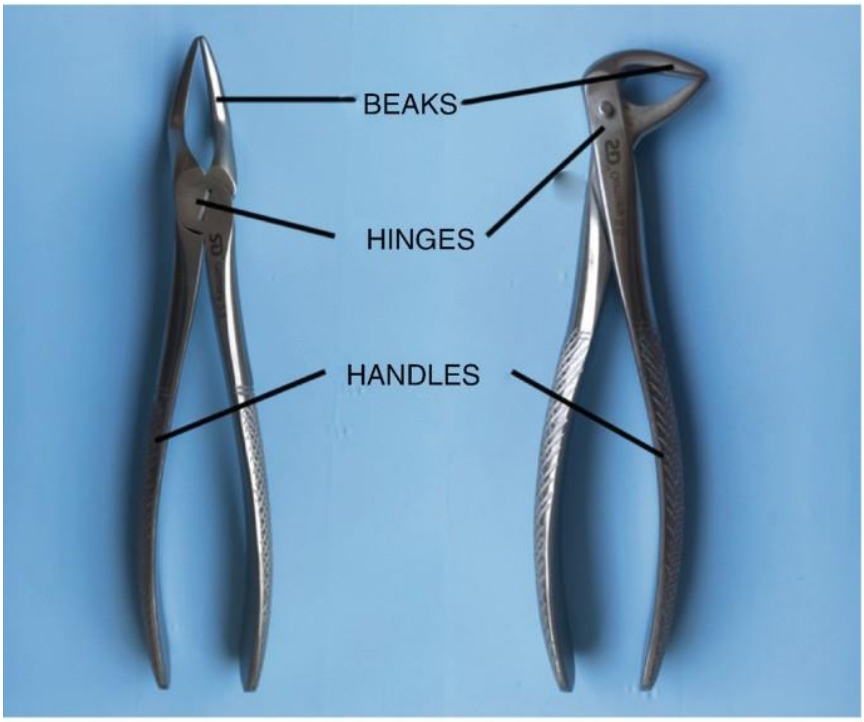
- Diagnostic instruments :(Dental mirror, probe, Tweezer in kidney dish).
- Dental forceps.
- Dental elevators.

The instrument required for extraction are selected, sterilized & placed in a sterile dish at the side of the patient.

**Dental forceps:**

The most widely used instrument employed in extraction of the teeth are dental forceps. Dental forceps are designed in a large number of patterns & configuration which adapt to different teeth & techniques used to extract teeth. It is composed of three parts:-

1. Handle.
2. Hinge joint.
3. Blades (Beaks)






**The more desirable properties & requirements of dental forceps**

1. That must be made of strong metal so that it can resist the forces exerted during extraction movements.

2. It must be constructed of non -corrosive metal so that it can resist rusting during sterilization by boiling water and autoclaving.

3. The handles of forceps should be serrated in order to prevent slippage & good grip during extraction movements. The handles must of such design so that they can give the operator a chance to use maximum leverage force. Also it must be of suitable shape & size so that they can applied to area of extraction without injury to the opposing teeth & surrounding tissues.

4. The blades

The blades ( beaks ) are the source of the greatest variation among forceps . The beaks is designed to adapt to the root of the teeth at the junction of the crown & root & to adapt to the root surface & not to the crown . Also beaks designed for single rooted , two rooted , & three rooted teeth so that the tips of the blades will adapt closely to various root formation decreasing the chance for the root fracture . Other variation is the width of the beaks , some forceps are narrow (fine ) & others are wider ( heavy ) . The edges of the blades is sharp enough so they cut through the periodontal fibres without causing injury to the gingiva . The blades should fit the surface of the extracted tooth . The space between the blades should be enough to accommodate the crown of the extracted tooth without making crushing of the crown . The design of the blades should be suitable to be applied to the surface of the root of the tooth so that the blades are parallel to the long axis of the tooth to be extracted.

5. The hinge joint:

Is that part of the dental forceps which transfers & concentrate the force applied to the handle of the dental forceps & then to the beaks . It is the part which connecting the handle to the beaks . The joint must be

. Bevelled so that it will not cause pinching of the lip or injury to the lip .

. Heavy & strong allow free movement without rocking .

• Lubricated with oil after sterilization to prevent rusting which lead to limitation & difficulty during application of the forceps blade to the tooth to be extracted

# Oral surgery

## TYPES OF DENTAL FORCEPS

## THE FORCEPS FOR UPPER TEETH

1- The upper straight forceps:-

The blades, joint and handle are in one long straight line. We have two types, one with broad blades that is we call heavy blades and this is used for extraction of upper central incisors and upper canines, left and right. The second type of straight forceps has narrow blades or we call it fine blades for extraction of upper lateral incisors (left and right) and upper anterior retained roots.

2- The upper premolar forceps:-

Here we have two bends in the design of the forceps, one where the beaks (blades) bend in relation to the joint of the forceps to apply the forceps parallel to long axis of premolar, the 2nd bend or curvature is of the handle to avoid injury to the lower lip and apposing teeth (mandibular). The upper premolars teeth has either one root or two roots (one buccal and one palatal), so there is no difference in the anatomy of the tooth root of the premolar on the buccal and palatal surface so the two blades of the premolars forceps are mirror image to each other.

3- The upper molar forceps (full crown upper molar forceps):-

Since upper molar teeth have three roots, two buccal and one palatal, the blade of palatal side is round to conform or fit on palatal root, while blades on buccal has pointed tip or projection so it can enter or fit the bifurcation between the two buccal roots (mesial and distal) on the buccal side of the tooth. So we have two forceps; one for the right molars and one for the left molars and these forceps also double bend for the same requirement as mentioned for premolar teeth. The Bayonet forceps, the blades of the forceps are off set to the long axis of the handles, used for extraction of upper 3rd molars right and left. In addition, there is another bayonet with fine curved blades for extraction of upper posterior roots.

## THE FORCEPS OF LOWER TEETH;-

Here we have the long axis of the blades is in right angle to the long axis of the handle so the blades can be applied apical to the cemento-enamel junction (on the root) of the tooth surface parallel to the long axis of the tooth and the handle not to cause injury to the upper lip. The forceps for the lower teeth are:-

**1- Forceps for extraction of lower central and lateral incisors and canine:-**

We have fine blades for extraction of the lower central and lateral incisors and lower anterior retained roots which have fine roots with flattened sides (mesiodistally) and heavy blades used for extraction of canines.

**2- Premolar forceps:-**

Because the bucco-lingual width of the crown in the premolar teeth is larger than that of lower incisors and canines we use forceps with heavy blades but partially away from each other when close to accommodate the crowns of these teeth without crushing for the crown.

**3- Full crown lower molar forceps: -**

Since the lower molar teeth have two roots, one mesial and one distal root so the buccal and lingual blades of the forceps designed with projected tapered tip to fit the bifurcation of these teeth on the buccal and lingual sides, so the buccal and lingual blades are identical so the same forceps can be used on the right and left sides on opposite to that in upper molar teeth. In addition to that we have two Bayonet forceps for lower 3rd molars; one for left side and the other for right side.

## Mechanical principles of extraction:-

The removal of teeth from the alveolar process employs the use of the following mechanical principles:-

**I- Expansion of the bony socket:-**

This is achieved by using the tooth itself as a dilating instrument, and this is the most important factor in forceps extraction, and this principle need:-

1- Sufficient tooth substance be present to be firmly grasped by the forceps.

2- The root pattern of the tooth in such that it is possible to dilate the socket to permit the complete dislocation of the tooth from its socket, e.g. dilacerated, divergent, converge roots.

3- Nature of the bone, elastic bone especially in young patients is maximal and decreased with age, older patients usually have denser, more highly calcified bone that is less likely to provide adequate expansion during extraction of the teeth.

4- Thickness of the bone. Thick bone expansion is less likely to occur by using normal force.

## II- The use of a lever and fulcrum

This is used to force a tooth or root out of the socket along the path of least resistance and the principle is the basic factor governing the use of elevators to extract teeth or roots

## III-The insertion of a wedge or wedges:-

Between the tooth-root and the bony socket wall, thus causing the tooth to rise in its socket and this explains why some conically rooted mandibular premolar and molars sometimes shoot out of their socket when forceps blades are applied to it.

## Physics forceps:

The Physics Forceps uses first-class lever mechanics. One handle of the device is connected to a “bumper,” which acts as a fulcrum during the extraction and stabilizes the beak during wrist movements. The beak of the extractor is positioned most often on the lingual or palatal root of the tooth and into the gingival sulcus The bumper is most often placed on the facial aspect of the dental alveolus, typically at the mucogingival junction. Unlike conventional forceps, only one point of contact is made on the tooth being extracted. No squeezing pressure is applied to the handles or to the tooth. Instead, the handles (once in position) are rotated as one unit for a few degrees, and then the action is stopped for approximately 1 minute. The extraction of a tooth using the Physics Forceps is similar to the removal of a nail from wood using a hammer versus a pair of pliers (Figures below). The handle of the hammer is a lever, and the beaks of the hammer's claw fit under the head of a nail. The hammer's head acts as a fulcrum. A rotational force applied to the hammer handle magnifies the force by the length of the handle, and the nail is elevated from the wood. Unlike a nail in wood with parallel sides and friction along its full length, a tooth is tapered. After being elevated a few millimeters, the periodontal ligament fibers are broken and the tooth may then be easily removed without additional rotational force. This is important to note, since further rotational force on the tooth may fracture the facial plate of bone.

## Elevators:-

Are exo-levers, instrument designed to elevate or luxate the teeth or roots from their bony socket in close or surgical method of extraction to force a tooth or root along the line of withdrawal.

## Line of withdrawal:-

Is the path along which the tooth or root will move out of its socket when minimal force is applied to it, and this line is primarily determined by root pattern (long axis of the tooth).

## Point of application:-

Is the site on the root at which force must be applied to effect delivery, it is determined by the line- of withdrawal. We have buccal point of application, distal point of application, and mesial point of application.

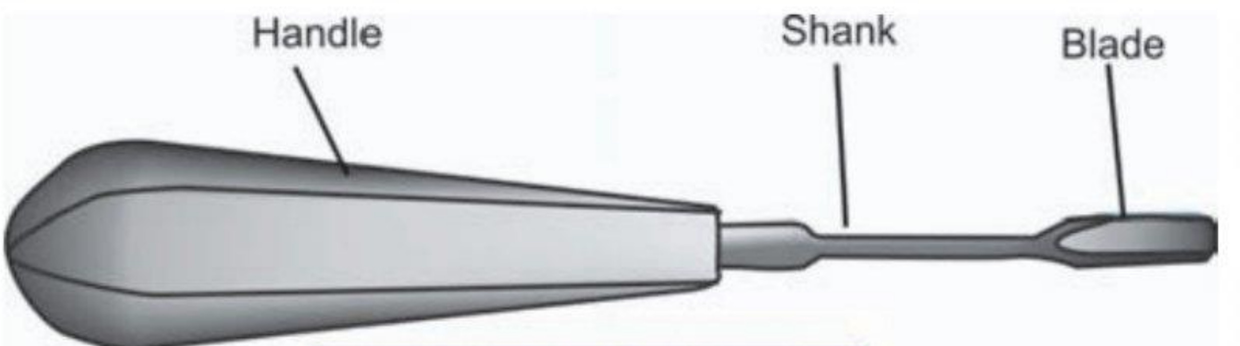
## Parts of elevators:-

All elevators have the following parts:-

**I-Handle:** This maybe a continuation of shank or at right angle to it.

**II- Shank**.

**III- Blade:** This part engages the crown or root and transmit force to the tooth, bone or both. The working side of the blade is either concave or flat.




Parts of a Dental Elevator

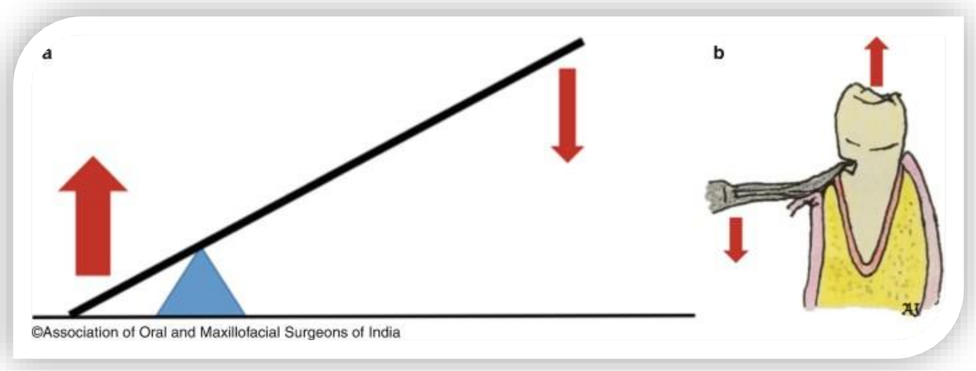
## Mechanical principles of uses of elevators:-

1- Lever principle.

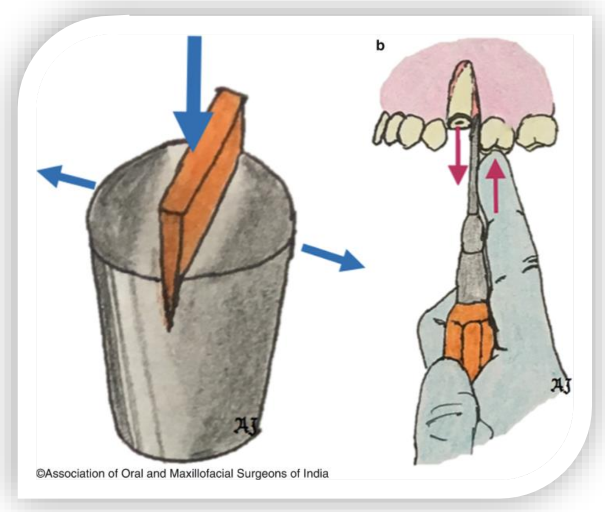
2- Wedge principle.

3- Wheel and axle principle.

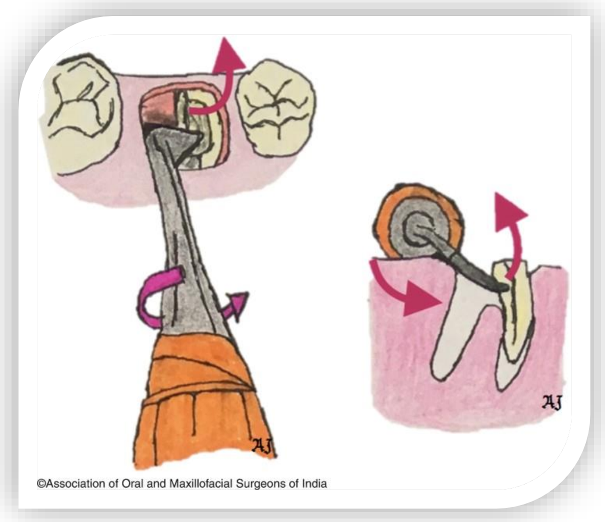
4- Combination of these principles.




Lever principle




Wedge principle.




Wheel and axle principle

## Clinical uses of elevators:-

1- Elevators are used to luxate and remove teeth which cannot be engaged or grasped by the beaks of forceps (e.g. impacted teeth, malposed teeth), also badly carious teeth, teeth with heavy filling.

2- To remove old roots and fractured roots and sectioned roots.

3- To loosen teeth prior to use of forceps.

4- To split teeth which have had grooves cut in them, as in separation of roots.

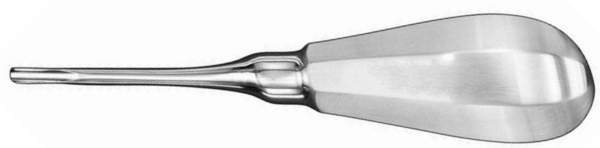
5- To remove small amounts of bone to create point of application for the beaks of forceps, or removal of interseptal bone.

6- Any tooth resisting normal extraction force by extracting forceps.

## Elevators commonly used

### 1-straight elevator

Elevator in which the blade, shank, and the handle are straight. The working blade or end is blind and round, there are many types and sizes of straight elevator.



Straight elevator

**2-Coupland's chisel (elevator)**

It is similar to straight elevator but the working end is sharp and straight cut, used for chiseling of bone to create point of application or to split of teeth. It's of different sizes, size 1, size 2, size 3. Depending on the width of the working end.

**Coupland's chisel (elevator)**

**3-Cryer's elevators:-**

In this type the working blades are sharp, pointed and triangular in shape just like a claw, forming an angle with the shank of the elevators. These are pair instrument mesial and distal (right & left) designed to fit the root surface on mesial and distal surface. It's mostly used for removal of retained root of the lower molar and for elevation for impacted teeth after surgical exposure of the bifurcation of the tooth.

**Cryer's elevators**

**4- Winter's elevator:-**

In which the working end is the same that of Cryer's elevator but the handle is in right angle to the shank so it is called winter's (T -bar) cross-bar handle elevator. Winter's elevators are very powerful and great force maybe applied or generated (sufficient to fracture the mandible) so the use of this elevator should be with great care to avoid fracture of the jaw.

**Winter’s elevator**

**5- Apexo elevators:-**

The working blade is long, the margins are sharp, we have 3 Apexo, 2 angled and 1 straight (mesial, distal, straight). The blade forming an angle with the shank, this elevator is used mainly for removal of apical fragments of root deeply present in the socket of the lower jaw especially morals. We push it between the socket and the root to loosen the fractured tip and remove it from the socket.

**Apexo elevators**

**6-War-wick James elevators:-**

It is a light duty elevator. It's like Cryer's elevator, also we have two angled (mesial and distal) and one straight. The blade is short and the end is rounded and the handle is flattened, it's used for extraction of retained roots, deciduous teeth, anterior lower teeth extraction, and where there is less resistance area. e.g. extraction of upper wisdom tooth.


**War-wick James elevators**

## Guiding principles for use of elevators:-

1-Never use an adjacent tooth as a fulcrum, unless that tooth to be extracted itself in the same visit, and the fulcrum should always be bony one (alveolar bone).

2- An elevator should always be supported to avoid slippage and injury to the patient.

3- Avoid the use of excessive force if the tooth/root is resist luxation, by gentle rotation, then stop, look for the obstruction for elevation and deal with it.

4- The direction of force should be such that the roots are not directed toward major structures such as the maxillary antrum.

5-An elevator should never be used "blindly" in the socket.

6- If an application point is not present, then this should be created by careful removal of bone.

7-Elevators should always be sterile and sharp.

8-- The sharp edges of the working blades are placed between the alveolus and the root surface and gently rotated apically along the long axis of the elevator to luxate or displacing the tooth or root.

## Complications of use of elevators:-

**1- Injury to the soft tissues,** like injury to the tongue, floor of the mouth, soft and hard palate, caused by slipping of elevator during its use

**2- Wrong application of force or excessive force** may lead to fracture of jaw especially the lower jaw at the angle of the mandible, also excessive force may lead to crushing of the alveolar bone and fragmentation

**3- Fracture of maxillary tuberosity** especially in extraction of upper third molars.

**4- Uncontrolled force** may lead to displacement of roots into maxillary sinus, infratemporal fossa, buccal soft tissue, submandibular space or inferior dental canal.

**5- Use of elevator in periapical area of abscessed tooth** may cause spread of infection to the surrounding tissue.

**6- Tip of instrument (working blade) may be fractured** and remain In the socket causing postoperative infection or delay healing, so always check the tip of instrument after use.

### So most problems with elevators arise from:-

a) Miss-judgement of amount of force exerted.

b) Improper positioning of the elevators.

## *INSTRUMENTS FOR BASIC ORAL SURGERY*

These lectures will introduce the basic and main instruments required to perform routine oral surgical procedures, these instruments are used for many purposes including both soft and hard tissues (e.g./ Bone, dental procedures):-

**The main instruments include the followings:-**

1- Instruments to incise the tissues .

2- Instruments for elevating mucoperiosteum.

3- Instruments for controlling hemorrhage .

4- Instruments to grasp tissues.

5- Instruments for removing bone includes:-

a. Rounger forceps ( bone cutter, bone nibbler)

b. Chisel and mallet.

c. Bone file.

d. Burs and hand piece.

e. Instruments to remove soft tissues from bony defects

6-Instruments for suturing mucosa:

a. Needle holder.

b. Needle.

c. Suture material.

d. Scissors.

7- Instruments for retraction of soft tissues.

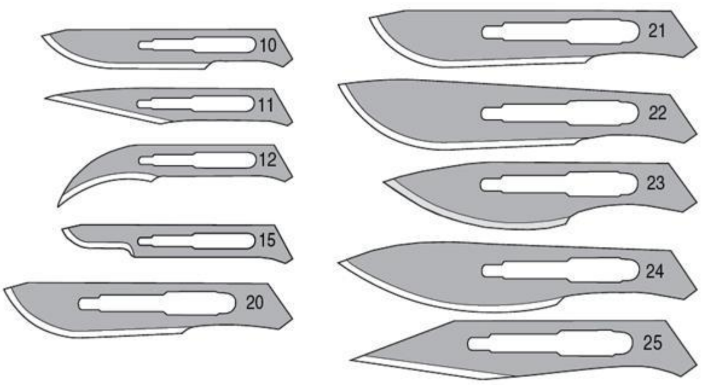
8. Instruments for irrigation and for providing suction.

## *1-Instruments to incise tissues:*

These instruments used to do incision in the soft tissues and this procedure needs scalpel and scalpel handle, the most commonly used handle is number 3 and number 7 . The tip of the scalpel handle is prepared to receive a variety of different scalpel blades that can be inserted into a slotted receiver, the most commonly used scalpel blade for intra oral incisions is number 15 , its relatively small and can be used to make incision around teeth and through mucoperiosteum.

Another scalpel used to make incisions on the skin extra orally is number 10.. Other commonly used blades for intra oral surgery are number 11 and 12. Blade no. 11 mostly used for making stab incision such as for incising abscess , its pointed triangular in shape , the hooked no. 12 blade is useful for mucogingival procedures especially in the posterior area of the oral cavity , for example maxillary tuberosity or posterior aspects of the upper molar region on the buccal or lingual aspects.

Scalpel handle no.3



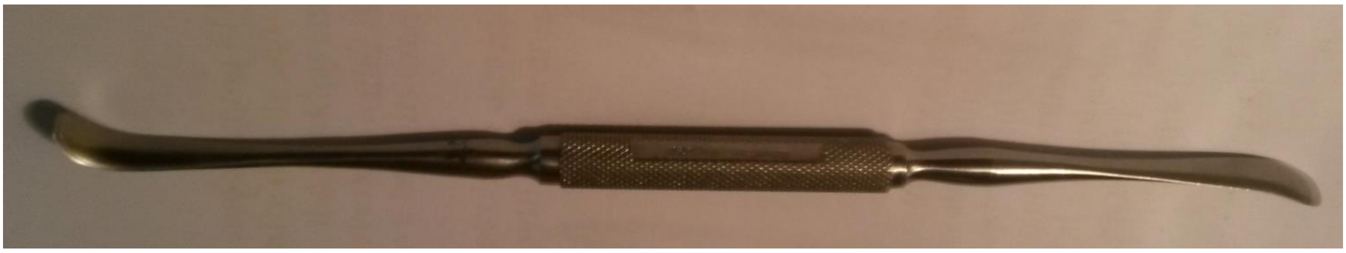

Dental scalpel blades:

**2-Instruments for mucoperiosteum elevation**

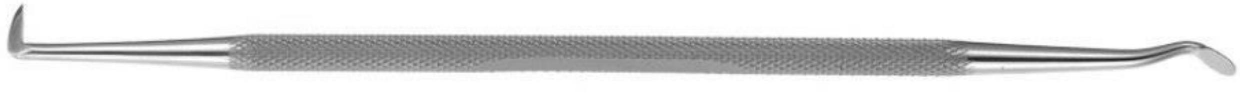
After an incision is made through the mucoperiosteum ( mucosa +sub mucosa+ periosteum=mucoperiosteum.

The mucosa and periosteum should be reflected from the underlying bone with periosteal elevator . The instrument that is mostly used in our department is Howarth periosteal this instrument has a sharp pointed end and a broad flat round end . The broad flat round end is inserted into the incision beneath the cut edge of the periosteum to elevate or strip it off the bone , and the sharp end of the elevator used for detachment of muscle insertion or sometimes to complete the incision done by the blade if there is some resistance for the elevation by the flap, many types and sizes of the periosteal elevators are available like Mitchell trimmer : Mitchell trimmer is useful in separating through the fibers from around the crown of the unerupted teeth and the neck of erupted teeth.

The periosteal elevator can be used to reflect soft tissues by push stroke in which the broad end of the instrument slides underneath the flap separating through the periosteum from the underlying bone and sometimes periosteal elevators are used by a pull stroke or scrap stroke in special locations.



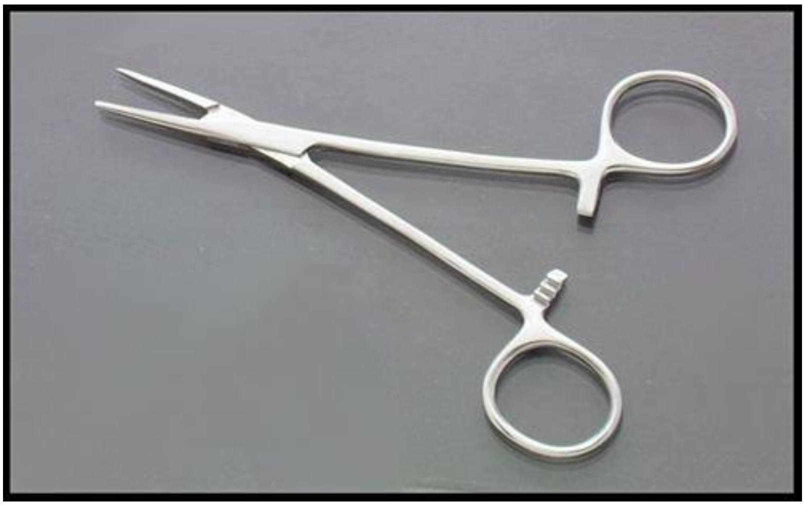
Howarth periosteal elevator:



Mitchell trimmer

## 3-Instruments for controlling hemorrhage:

When incision is made through the tissues , small vessels may be cut leading to bleeding , to control this bleeding we have instruments Which aid in the stoppage of bleeding called haemostat or artery forceps , this comes in a variety of shapes and sizes , it's a delicate instrument which may have straight or curved beaks , this instrument has a locking device assisting in the clamping of the blood vessels In addition to its use as an instrument for controlling bleeding its used in oral surgery to evacuate pus from abscesses by inserting the haemostat inside the abscess after an incision is made , also haemostat may be useful in grasping tissues from the tooth socket and pick up small root tips , pieces of calculus, fragments of amalgam or any other small particles that have been dropped in the mouth or wound area.



Haemostat:

## *4-Instruments used to grasp tissues:*

Here we have :

A-Toothed -tissue forceps.

B- Allis tissue forceps.

These instruments used to hold and stabilize flap during suturing to assist in passing needle through the mucoperiosteal flap , also these instruments, used to hold tissues or grasping tissues in some types of surgical procedures .e.g.\ Taking biopsy. It should be used gently to prevent crushing of the tissues especially in the case of Allis tissue forceps.


Toothed -tissue forceps


Allis tissue forceps

## 5-Instruments for removing bone includes:

A-rounger forceps (bone cutter, bone nibbler)

B-chisel and mallet.

C-surgical burs and hand piece.

D-bone file.

E-instruments used to remove soft tissues from bony defects.

sometimes we need to remove bone to gain access into a lesion like intra-bony cystic lesion, or bony biopsy or to correct an existing bony defect or abnormal bony exostosis or even sometimes to remove a retained root or a sharp bony projection ..etc. So we have many tools and instruments to perform such a duty. the use of any one of these instruments depends on the case and preference of the operator, so we have many modalities to perform bone removal.

### *A- Bone rounger:*

It's also called (bone nibbler) or (bone cutter) it's used to cut bone quickly and efficiently this instrument has sharp blades that are squeezed together by the handles cutting or pinching through the bone , it also has a leaf spring or spring loaded handles to control the opening of the blades, some of these are side cutting others are end cutting.


Bone Cutter (rounger forceps):

End cutting types are used to cut bone in less accessible areas like inside the tooth socket, these instruments are very useful for trimming of sharp bony projections or removing of a thin plate of compact bone during saucerization of bone cavity.

### *B-Chisel and mallet:*

This is another method for removing bone especially when large piece of bone need to be removed, we have many sizes and lengths of chisels ..chisel have a sharp monobeveled working end used to cut bone , bibeveled called ***osteotome*** , may be used for splitting bone or teeth. cutting of bone by chisel need to be used by applying force and by the use of mallet,. A mallet with a nylon cover or facing will exert less shock to the patient, also its less noisy.. Removal of bone using chisel and mallet mostly done under general anesthesia.

Chisel & Mallet:

### *C- Surgical burs and hand piece:*

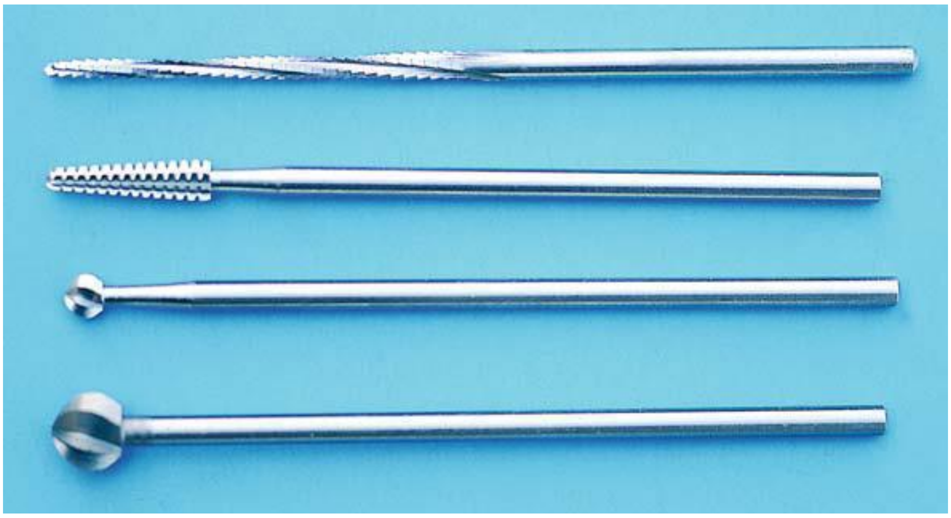
It’s a useful method and commonly used to remove bone by rotary means (hand piece) under local anesthesia, burs are either used to remove bone or to cut a window in the bone , it's also useful in dividing teeth , we have dental steel burs and tungsten carbide burs carbide burs cut bone more efficiently than steel burs, these burs are-either-round or fissure burs...

* large diameter bone burs may be used for removal of wide area of bone or for smoothening of the margins of bony defect, in most cases the use of either size 6 or 8 bone

burs will enable the production of deep narrow slots in the bone, burs can be used with angle or straight hand piece which should have an accepted speed and torque to remove bone efficiently and should always be used with irrigation by distilled water or saline to prevent damage to the bone by heat generation during cutting.

* When large amount of bone needs to be removed, large bur that resembles an acrylic bur is used.

High speed turbine which is used in restorative dentistry must not be used because the air exhausted into the wound may produce tissue emphysema.



Dental surgical burs:

## D- *Bone file:*

This instrument is used for smoothening of bone before suturing of the flap , it's usually double ended instrument with a small and large ends , the working end of the bone file have grooves or slots to work in a ***pull stroke*** only, bone file is not used to remove bone

Dental surgical burs:

its used only for final smoothening ..

Notice that its used in a pull stroke one direction only , if pushing movement is used it will lead to crushing of bone and this should be avoided.

## E-Instruments to remove soft tissues from bony defects:

It is called Curette : it's just like excavator , angled , double ended ,of different sizes, the working end is like a spoon, round -oval in shape, its mostly used to remove soft tissues from a bony cavity like :periapical granuloma or cystic lesion from the bone, it also may be used to remove foreign bodies or small pieces or spicules from the bony socket.


Curette:

## 6-Instruments for suturing:

At the end of the procedure the mucoperiosteal flap must be returned back to its original place or position by sutures, the instruments used to do any suturing may include the followings:

### *A-Needle holder*

the needle holder is an instrument with a locking handle device the handle is long and the beaks are short ,stout for intraoral suturing, a 15 cm handle length needle holder is often recommended the beaks of the needle holder are shorter and stronger than the beaks of the haemostat, the inner surface of the beaks is crosshatched to provide good surface for grasping of the needle and to prevent its rotation or movement during suturing while in haemostat the inner surface has parallel grooves which differentiates it from the needle holder, so haemostat should not be used for suturing but preserved for its original work to control bleeding during surgery.

## *B-Needles:*

Most sutures come fused to needles in a pre-sterilized package, suture needles differ according to the shape of their cross section and their length, there are generally two types:

***1-cutting needle***, have a triangular cross section

***2-taper point,*** which are round or oval in cross section.

According to the shape of the needles, straight needles are only used where tissues or areas of surgery are easily accessible and therefore they are not used in oral cavity because of the limitation of space in oral cavity, so curved needles are mostly used of a length of 21-25 mm or 3/8 or 1/2 (half circle) and this design allows the needle to pass through the limited area of suturing easily, the cutting needle(triangular cross section ) also called *traumatic needle* but it has a good advantage of being able to enter the tissues easily during suturing specially in tout areas like mucoperiosteum of the hard palate (keratinized mucosa) or skin where the tissue is difficult to penetrate the tapered needle is generally used for closing muscle or fascia that are easily penetrated.

### *C-Suture material:*

many types of suture materials are available and could be classified by size , resorb ability ,and whether or not they are monofilament or poly filament .Sutures are made of wide variety of materials and come in several sizes, each designed for a particular purpose

### 1-size

Sutures are available in various sizes that range from one zero (1/0) to (1 l/0) eleven zero, increasing number of zeros means decreasing the suture diameter, the most size used in oral and maxillofacial surgery is size 3/0 and 4/0, the size of the suture usually expressed on the package e.g. 3/0 ,4/0, 2/0....the size 3/0 used most commonly in suturing oral mucosa, which is enough to prevent tearing of the oral mucosa and strong to withstand the tension placed on them intraorally.

### 2.Resorbability:

Sutures may be resorbable or non-resorbable, resorbable sutures are made of materials that the body is capable of easily breaking them down, like catgut sutures and this is used for suturing deep structures like muscles, fascia, so these sutures does not require removal, while non resorbable sutures like black silk sutures, nylon, stainless steel, those need removal of the suture postoperatively.

For the resorbable sutures we have two types. Plain gut and chromic gut, the plain gut is subjected to rapid resorption or digestion by the proteolytic enzymes produced by the inflammatory cells, while the chromic catgut is treated with special chromic salts, to provide resistance for the proteolytic enzymes.

## *D-Scissors:-*

the final instrument necessary for placing sutures are suture scissors ,the suture scissor usually have long handles, short cutting edge or beaks because main purpose is to cut suture during suturing or on the removal of sutures postoperatively, other types of scissors used in oral surgery are called soft tissue scissors or operating scissors: these scissors are used for cutting of tissues and for dissection or undermining of tissues during surgery , we mainly have two types of operating scissors..

***1-***small,sharp,delicate ones used for fine work

2-blunt nosed scissors: used for undermining soft tissues as well as for Blunt tissue scissors.

**notice** that these operating scissors should not be used for cutting sutures or other material because these materials make them blunt ,and it became less effective for cutting tissues.

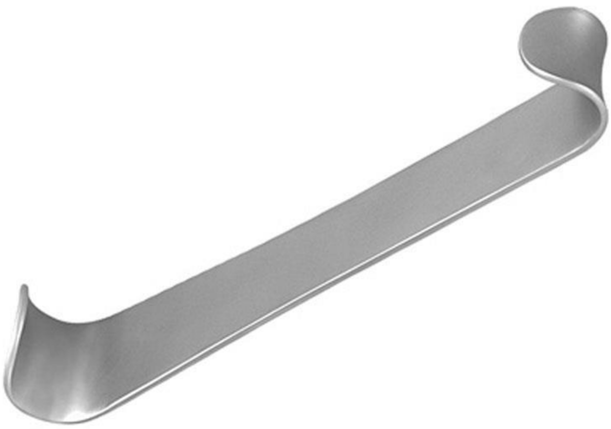
## 7-instruments for retraction of soft tissues:

These instruments may be held by the surgeon or his assistant to help the surgeon to have a clear field or area during his work so that it will provide accessibility to the working field and in addition to that it will help in the protection of surrounding tissues from trauma or injury during surgery.

There are many types and varieties of retractors, that have been designed to retract the cheek, tongue, lips and mucoperiosteal flaps, so we have ..

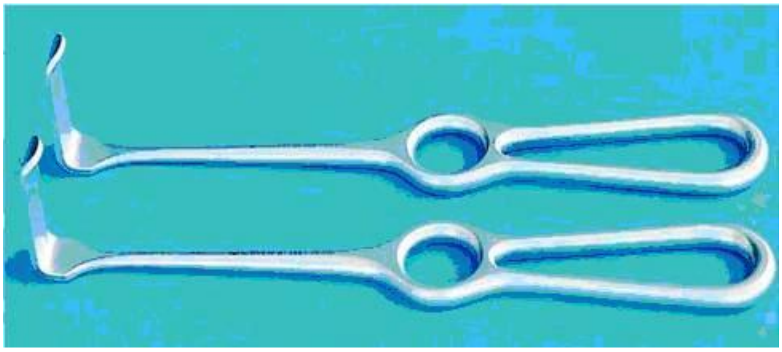
### *A-Cheek retractor:*

from its name its used to retract the cheek, the most popular one is the *kilner retractor,* its double ended with different sizes and widths, and it's held against or at the angle of the mouth, to retract the cheek away from the operative area.



### *B-Mucoperiosteal flap retractor:*

it is used to retract the flap away from the operative area ,to provide good vision for the surgeon and to help protect the flap from trauma ,it should be held against the bone and not on the flap ,there are many retractors of different shapes and designs especially made for flap retraction and even *periosteal elevator (Howarth 's )* may be used as a retractor for the flap ..

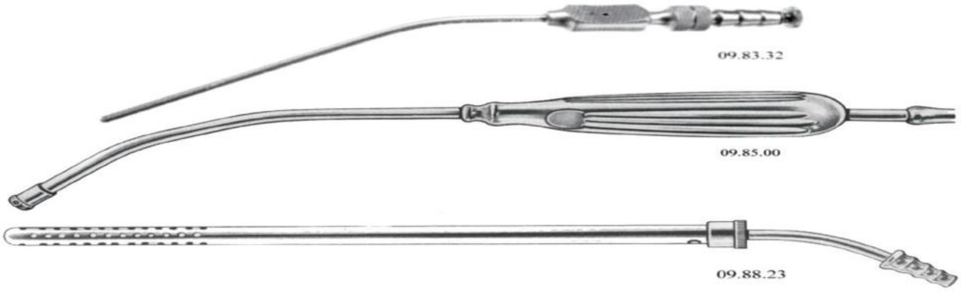


There is also special retractors for the tongue but usually the mouth mirror is the most common instrument used for tongue retraction and lip retraction.

## 8-insrument for irrigation and suction

### A-instrument for suction:

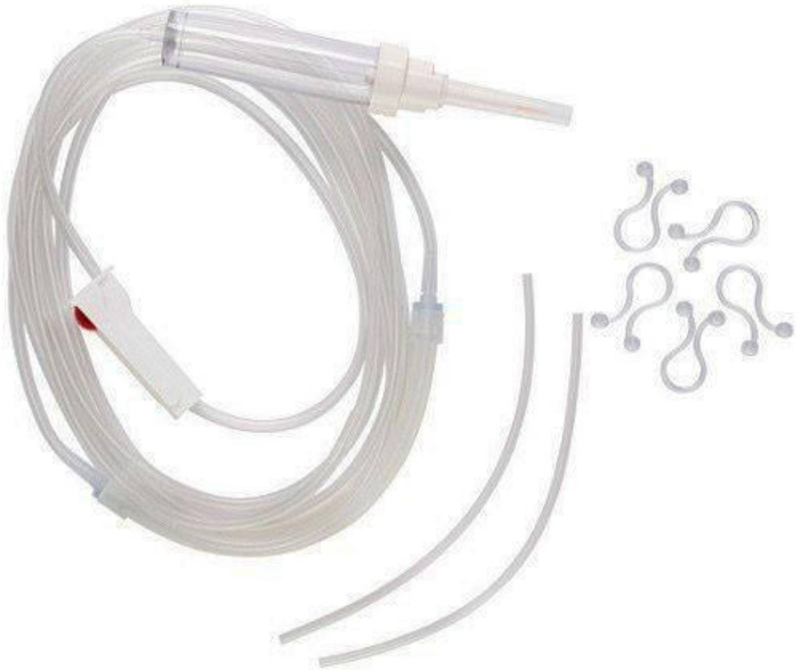
These instruments used to provide good visualization of the operative field by aspirating the blood, saliva and the irrigating solution (e.g. saline, distilled water) used during operation. in oral surgery a fine metal suction tips on vacuum pressure most used to perform such duty. the use of suction also is very important and most be used when we are working under general anesthesia to prevent the possibility of aspiration of blood and other fluids by the patient.



## *B-Instruments for irrigation:*

When we use hand piece and bur to remove bone its necessary to use irrigating solutions like normal saline to cool the bur and prevent bone damage by the heat generated during cutting of bone ,also irrigation will clean the area of surgery from small debris and chips during the surgical procedure and after finishing before suturing the area ,large plastic syringe with blunt 18 gauge needle is used for irrigation purposes ,the needle should be blunt and smooth so that no damage to the vital organs or soft tissues can occur ,the needle also preferable to be angled to have good and efficient direction of the irrigation fluid .

**Irrigation set:**



# *Technique of forceps extraction*

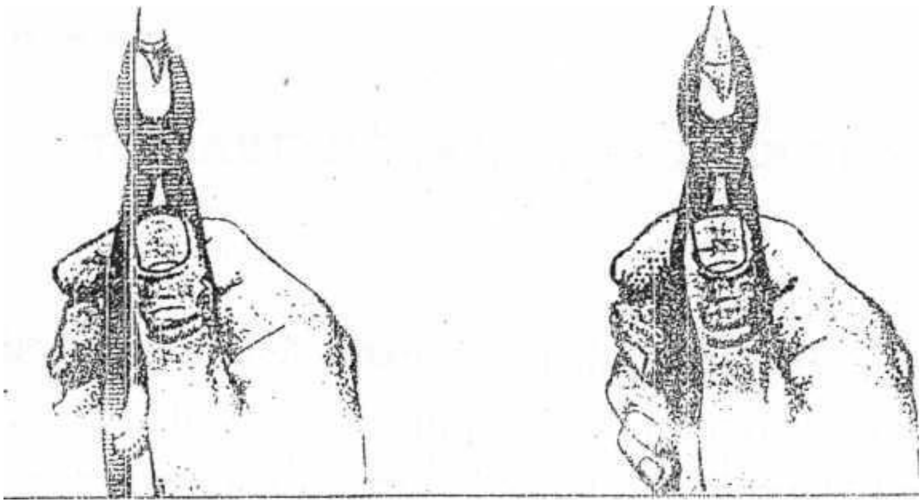
Regardless of the tooth to be extracted in the oral cavity, some common principles are applied to all dental extraction. The general steps in the closed extraction (forceps extraction) procedure are: -

## 1- Soft tissue retraction: -

Before starting the application of the dental forceps, the gingival tissue surrounding the tooth should be reflected with blunt probe or tweezers, the neck of the tooth freed labially and lingually as far as the bony alveolar margin, so that no laceration or tearing of the gingival occur on extraction. So, care should be exercised to avoid application of the beaks over the gingival tissue. Reflection of the gingival tissue allows the surgeon to ensure that profound anesthesia is secured before starting extraction. Also, gingival retraction allows the beaks of forceps to be positioned more apically without interference or impingement of the gingival tissue.

## 2- Handling of the forceps: -

The forceps should be grasped by the palm of the right hand and the thumb finger is placed below the joint. The little finger is placed inside the two handles of the forceps so that it can control the opening and closure of the handle and guide the forceps beaks on the root surface, and when the tooth is grasped the little finger is placed outside the handle.



## 3- Retraction and support (the use of the left hand):

When using the forceps and elevators to luxate and remove teeth. It’s important that the surgeon’s opposite hand play an active role in the procedure. For the right-handed operator (dentist), the left hand has a variety
of functions:

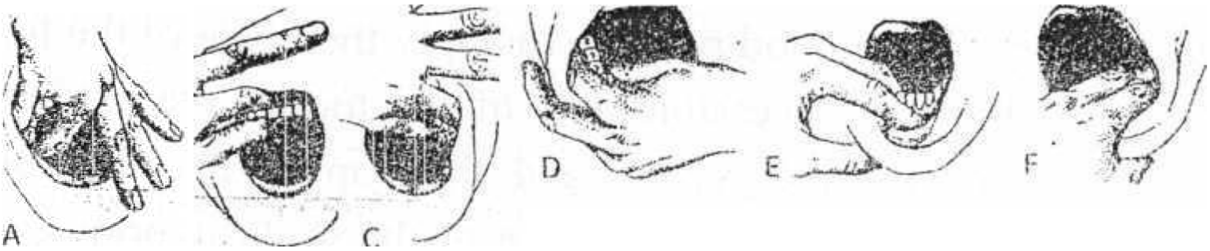
**a)** It’s used to reflect the soft tissues of the cheeks, lips and tongue to provide adequate visualization of the area of surgery.

**b)** It helps to provide protection for the soft tissue structures and protect other teeth from forceps, if they release suddenly from the tooth socket.

**c)** It helps to stabilize the patient’s head during extraction process.

**d)** The opposite hand plays an important role in supporting and stabilizing the lower jaw when mandibular teeth are being extracted to prevent injury and post-operative pain in the tempromandibular joint (T.M.J). And also, to prevent dislocation of the mandible during extraction especially when extraction is performed under general anesthesia

**e)** The opposite hand supports the alveolar process and provide tactile information to the operator concerning the expansion of the alveolar process during luxation process.




## 4- The application of forceps blades to the tooth (tooth grasp):-

After you select the proper forceps for the extraction of particular tooth. The forceps blades are applied on both labial (buccal) and lingual (palatal) surface of the tooth, so that the blades are parallel to the long axis of the tooth to be extracted The blades of the forceps are moved on the tooth surface apically and are allowed to move apically cutting through periodontal and gingival fibers to grasp the tooth root surface below the cemento-enamel junction. The tooth to be extracted is grasped firmly, the blades are not allowed to slide on the surface of the root during extraction movement.

It’s a good practice to apply the blades of the forceps to the less accessible side of the tooth to be extracted first under direct vision and then apply the other blade on opposite side. If one side of the tooth is carious, then the forceps blades applied to the carious side first and extraction movement should be started toward the carious side.

The surface of the beaks of the forceps should lie as close as possible to the surface of the tooth grasped tightly without slipping during extraction

## 5- The displacement of the tooth from its socket: -

This is performed by using the extraction movements.

**The extraction movements are: -**

a- Outward movement (labial or buccal)

b- Inward movement (lingual or palatal)

c- Rotatory movement (rotation movement).

**The purpose of extraction movements is:**

1-Cutting the tooth attachment.

2- Separating the tooth from the wall of the socket.

3- Dilatation of the bony wall of the socket utilizing the resiliency of the living bone.

4- The removal of the tooth from the socket.

When the blades applied to the root surface a firm grip of the root taken by the forceps and buccolingual and lingobuccal movements are made in that order. This pressure should be firm but not crushing, smooth and controlled not jerking. By this movements normally after few lateral movements the tooth is felt to be loosen and begin to rise out of the socket, when this loosening occurs, rotatory or figure 8 movement will help to delivery of the tooth.

**Rotatory movement**:

Can be used as primary movement for extraction of teeth with conical straight roots such as the upper central incisors and lower second premolars, also rotatory movements are useful in completing the removal of teeth previously loosened by other means and this is called secondary rotatory movement. The gross distortion and laceration of the buccal plate and mucosa are happened if excessive lateral movement is done. The final movement by which the tooth is removed from its socket should be always directed outwards, so reducing the trauma to the opposing teeth and preventing slipping of the tooth in the mouth which may be swallowed or aspirated by the patient. If the tooth dose not yield (no movement) after applying a reasonable force, excessive force should not be used, stop and re-evaluate the case clinically and/or radiographically because the tooth may be need surgical extraction.

## Post-operative care of extraction wound: -

**1-** Examine the extracted tooth to be sure that there is no fracture in the roots (retained root), keeping in mind the anatomical variations in number of roots of each tooth, because some teeth have accessory roots.

**2-** Always examine the socket for any loose fragments of bone or roots (pieces of enamel), foreign materials (e.g. calculus, amalgam particles, or pathology (e.g. periapical granuloma, polyp) all these should be removed by using curette or suction tip or tweezer.

**3-** You have to remove or smooth any sharp bone or projections of inter-radicular bone, then apply suture if necessary, e.g. if there is laceration in the soft tissue.

**4-** The expanded bucco-lingual plate should be compressed or squeezed back to their original configuration or shape in order to reduce any distortion of the supporting tissue to re-establish the normal contour before extraction

**5-** Make sure that the socket is full of blood, (to form blood clot)

**6-** Place a properly shaped and size (2X2 Cm) gauze piece over the socket (and never put it into socket) in such a way that the patient close his mouth and it is not visible to gain initial control of hemorrhage. It is important to place the gauze directly over the extraction site in the space occupied by the crown of the extracted tooth and not over the occlusal table of teeth to ensure that the pressure is correctly transmitted over the socket to achieve hemostasis.

## Instructions to the patient:

**1**- Keep biting over the gauze for at least (0.5-1) hours and discharge after that but if haemostasis is not established, you can use another.

**2-** Do not spit during first ***1/2*** hour and use minimal talking and avoid violent exercise or activity to assist the formation of a firm clot in the socket, so rest for the first few hours following extraction are recommended ,avoid insertion of the tongue tip inside the socket which lead to dislodgement of clot or disturb its formation

**3-** use only cold fluid and soft diet for the few postoperative hours and not take solid or hard food for the rest of the day, and chew on the opposite side of extraction.

**4-** in case of continuous bleeding. Place a sterile gauze in place over the wound and keep it in place for an hour, if bleeding not stopped contact your dentist.

**5-** always prescribe the proper analgesic and antibiotic if necessary (e.g. The presence of residual infection, diabetic patient, patient on immunosuppressive drugs, aids...etc.

Forceps handling and left-hand job

# THE ARMAMENTARIUM

The equipment necessary for the administration of local anesthetics includes; the syringe, the needle, and the local anesthetic cartridge.

## 1-The syringe:

It is one of the three essential components of the local anesthetic armamentarium. It is the vehicle whereby the contents of the anesthetic cartridge are delivered through the needle to the patient.

## Parts of the syringe:

The basic design of the syringe (Fig: 1 & 2) consists of a metal barrel and plunger (piston) united by a spring loaded or spring loaded hinge mechanism. At the end of the barrel there is a screw hub by which the needle is attached.

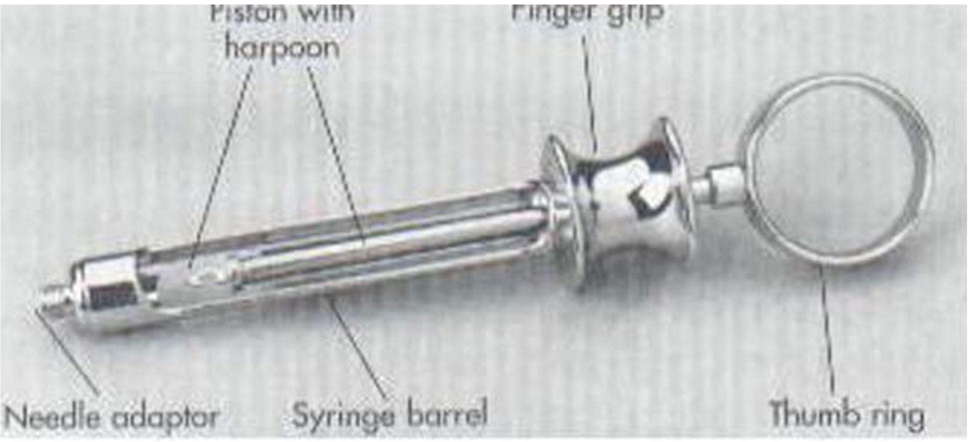



Fig (**1**): Dental syringe (Aspirating type-side loaded cartridge)

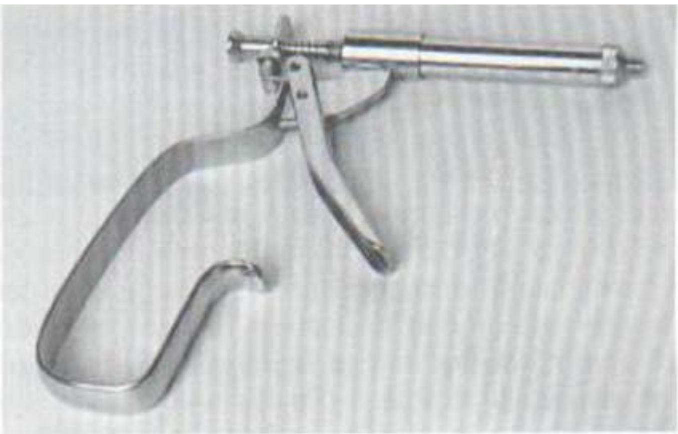
Fig (**2**): dental syringe (top loaded cartridge)

## Types:

1. Aspirating dental syringe: In this type the end of the piston has a device like a hook .this hook will penetrate the thick rubber stopper at the end of the cartridge ( fig:l). The maneuver of aspiration consists of withdrawal of the plunger to create a negative pressure within the cartridge, this maneuver is employed in order to ensure that a blood vessel has not been entered by the needle tip during its insertion into the soft tissues prior to the injection of the anesthetic solution, positive aspiration results in a fine spiral of blood being clearly visible in the solution within the cartridge.

2. Non-aspirating dental syringe: In this type, the piston or the plunger ends in a smooth flat end. A slight amount of aspiration may be achieved with this type by making a small initial injection of solution and then releasing the pressure on the piston, which then rebounds to produce an aspiration effect.

3. Pressure syringe: The original pressure devices (fig:3) using a pistol grip are somewhat larger than the newer ,pen grip devices (fig:4). This type of syringe is specially designed for periodontal ligament injection technique. The main advantages of this type over the conventional type are: (1) a measured dose of anesthetic is given and (2) it overcomes the tissue resistance that is encountered during PDL technique.



Fig(**3**):pressure syringe (origenal design)

Fig(**4**):pressure syringe (new design)

## 2. The needle:

The needle permits the local anesthetic solution to travel from She cartridge into the tissues surrounding She needle dip. Most needles used in dentistry are stainless steel and are disposable." Parts:

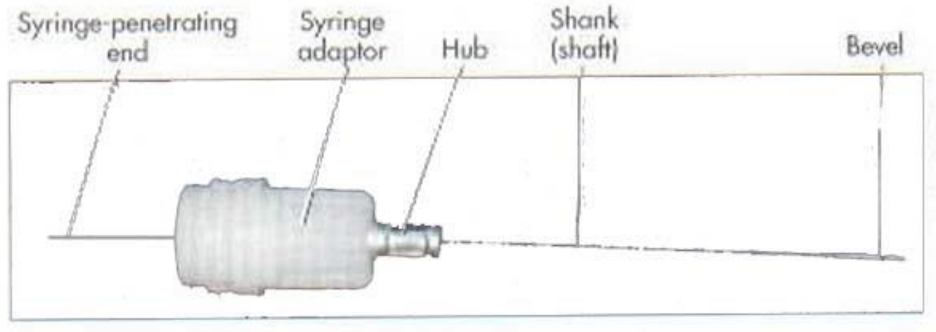
All needles have several components in common, these include;

**1.** 1. The bevel.

**2.** 2- The shank.

**3.** The hub.

**4.** The syringe penetrating end.




Fig(**5**):dental needle

When needles are selected two factors must be considered;

### 1. the gauge:

Gauge refers to the diameter of the lumen in of the needle, the smaller the number, the grater the diameter of the lumen, accordingly 30 -gauge needle has a smaller internal diameter than 25 gauge needle. There is a trend toward the use of smaller diameter needles on the supposition that they are less traumatic the patient than needles with greater diameter. In dentistry, the most commonly used gauge is 25, 27, and 30 gauges.

### 2. The length:

Dental needles are available in two lengths: long (average 32 mm) and short (average 20 mm). Needles should not be inserted into tissues to their hubs unless it is absolutely necessary to prevent needle breakage in the weakest portion of the needle which as she hub. In general, long needles are preferred for all injection technique. Requiring penetration of significant thickness of soft tissue (ex: inferior alveolar block).

## 4.The cartridge (carpule):

The dental cartridge is a glass cylinder containing the local anesthetic solution. It is manufactured to hold either 1.8 ml or 2.2 ml of the local anesthetic solution.

Parts:

It consists of four parts (fig 6):

1. Cylindrical glass tube.
2. Stopper.
3. Aluminum cap.
4. Diaphragm.

**Notes:**

1. The stopper is located at the end of the cartridge that receives the hook of the aspirating syringe.
2. The aluminum cap is located at the opposite end of the cartridge from the stopper, it fits snugly around the neck of the glass cartridge, holding the diaphragm in position.
3. The diaphragm is a latex rubber through which the syringe-Penetrating end of the needle penetrates.

### Clinical problems associated with the dental syringe:

**Leakage during injection:**

Leakage of the anesthetic solution into the patient's mouth during injection will occur if the cartridge and needle are improperly mounted into the syringe. When the needle is properly placed on the syringe after the cartridge is inserted, the needle produces a centric perforation of the diaphragm (fig:l) that tightly seals itself around the needle. When pressure is applied to the plunger during injection, all of the solution will be directed into the lumen of the needle. When reloading a syringe with a second cartridge and the needle already in place, an eccentric ovoid perforation may occur in the diaphragm and with pressure on the plunger, some solution will be directed into the lumen of the needle and some may leak out of the cartridge between the needle and the diaphragm and runs into the patient's mouth.

**Broken cartridge:**

Breakage of cartridge may result from a bent needle at its proximal end (fig 2), which may not perforate the diaphragm of the cartridge; positive pressure on the thumb ring increases intracartridge pressure leading to its breakage. A broken cartridge may also result from a bent hook of an aspirating syringe.

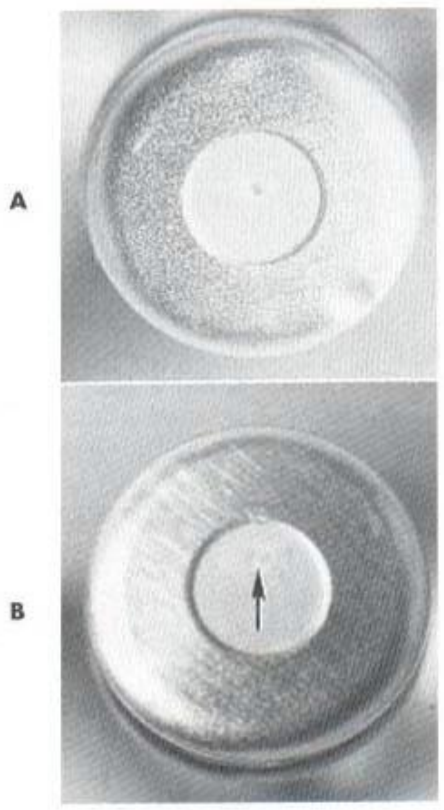



Fig (7): centric and eccentric perforation Fig (8): Bent needle

## Clinical problems associated with the dental needle:

**Pain on insertion:**

This may be avoided by using sharp, new, disposable needles and the application of topical.at the penetration site.

**Breakage:**

In general, bending of the needle during insertion weakens needles, making them more likely to break on subsequent contact with hard tissues, such as bone. Also we should never attempt to fore a needle against resistance since needle are not designed topenetrate hard structure such as bone.

**Pain on withdrawal:**

Pain on withdrawal of the needle from tissue can be produced by fishhook barbs on the tip. This barbs may be produced during the manufacturing process, but, it is more likely that they occur when the needle tip forcefully contact a hard surface such as bone, therefore a needle should never be forced against resistance.

**Injury to the patient or the administrator:**

A major cause of injury is carelessness and inattention by the operator, although sudden unexpected movement by the patient is also a frequent cause. Therefore the needle should be capped until its to be used and should be recapped immediately after withdrawal from the patient's mouth.

## Clinical problems associated with the dental cartridge:

**1-Bubbles in the cartridge:**

A small bubble (fig:3), approximatelyl-2 mm in diameter will frequently be found in the dental cartridge. It is composed of nitrogen gas which was bubbled into the local anesthetic solution during its manufacture to prevent oxygen from being trapped in the cartridge and potentially destroying the vasopressor. A large bubble, which may be present with a plunger that is extruded beyond the rim of the cartridge is the result of the freezing of the anesthetic solution, such cartridge should not be used since sterility of the solution cannot be assured.

**2-Extruded stopper:**

The stopper can be extruded (fig:4) when a cartridge is frozen and the liquid inside expands. In this case the solution can no longer be considered sterile and should not be used for injection. Frozen cartridge can also be identified by the presence of large air bubble (more than 2 mm). An extruded stopper with no bubble is indicative of prolonged storage in a chemical disinfecting solution and diffusion of the solution (through the rubber diaphragm) into the cartridge.

**3-Burning on injection:**

A burning sensation on injection of anesthetic solution may be the result of one of the followings;

**a. Normal response to the PH of the drug:**

The PH of the dental cartridge containing vasopressor is lower (3.3- 4) than that without vasopressor (5.5 - 6); because of this; plain anesthetics have a somewhat more rapid onset of clinical action and more comfortable (less burning on injection). In addition the inclusion of sodium bisulfite as an antioxidant into the anesthetic solution to prevent the biodegradation of the vasopressor by oxygen which might be present in the cartridge during manufacture or which can diffuse through the semi permeable diaphragm after tilling, reacts with the oxygen before the oxygen can destroy the vasopressor,. The sodium bisulfite is oxidized to sodium bisulfate. a chemical with a lower PH. The clinical importance of this point is that increased burning sensation (discomfort) is experienced by the patient on injection of an older (expired) cartridge with vasopressor than with a fresh cartridge.

**b. Cartridge containing sterilizing solution:**

This occurs when the cartridges are stored in a disinfectant solution for a long period so we get diffusion of the disinfecting solution into the cartridge, upon injecting these cartridges we get burning sensation.

**c. Overheated cartridge:**

Local anesthetic solutions injected at room temperature are well tolerated by tissues and patients overheated cartridge produces burning on injection.

**4-Leakage during injection:**

Leakage of the anesthetic solution into the patient's mouth during injection will occur if the cartridge and needle are improperly mounted into the syringe. When the needle is properly placed on the syringe after the cartridge is inserted, the needle produces a centric perforation of the diaphragm that tightly seals itself around the needle. When pressure is applied to the plunger during injection, all of the solution will be directed into the lumen of the needle. When reloading a syringe with a second cartridge and the needle already in place. an eccentric ovoid perforation may occur in the diaphragm and with pressure on (he plunger some solution will be directed into the lumen of the needle and some may leak out of the cartridge between the needle and the diaphragm and runs into the patient's mouth.

**Broken cartridge:**

Breakage of cartridge may result from a bent needle at its proximal end, which may not perforate the diaphragm of the cartridge; positive pressure on the thumb ring increases intra cartridge pressure leading to its breakage. A broken cartridge may also result from a bent hook of an aspirating syringe.

**Notes:**

The following notes should be considered when dealing with the armamentarium:

1. The used dental cartridges and needles must never be used on more than one patient.
2. Needles should be changed after several tissue penetrations in the same patient.
3. Needles should be covered with a protective sheath when not being used to prevent accidental injury with a contaminated needle.
4. The administrator should be aware of the position of the needle tip, whether inside or outside the patient's mouth to minimize the risk of injury to the patient or the operator.
5. Cartridge should be stored at room temperature and should never be used after their expiry date.
6. The drug or drugs contained within the cartridge are listed by their percent concentration. The number of milligrams of the agent can be calculated by multiplying the percent concentration (ex: 2% = 2 gram / 100 ml = 2000 mg/100 ml= 20 mg/ml) by 1.8 or 2.2 (number of milliliters in the cartridge). Thus a 1.8 ml cartridge of a 2% lidocaine contains 36mg lidocaine. This value is important when dealing with plain anesthetic ( without vasoconstrictor) to determine the maximum number of the cartridge that could be given

**Example:**

The maximum dose of 2 % lidocaine (without epinephrine) that could be given to a patient is 300 mg, to calculate the maximum number of the cartridge: 2% means 2 gram / 100 ml = 2000 mg/100 ml = 20 mg/ml 20 mg/ml x 1,8 ml = 36 mg lidocaine inside the single cartridge.

300 mg / 36 mg= 8 cartridge

Preparation of the armamentarium:

Proper care and handling of the local anesthetic armamentarium can prevent or at least minimize the development of complications associated with the needle, syringe, and cartridge.

Steps of the preparation:

1. Remove the sterilized syringe from its container
2. Retract the piston fully prior to attempting to load the cartridge.
3. Insert the cartridge while the piston is fully retracted, into the syringe. Insert the rubber stopper end of the cartridge first
4. Engage the hook; push the piston forward until the hook is firmly engaged in the plunger with gentle firm pressure
5. Attach the needle to the syringe after removal of the plastic cap from the syringe end of the needle.
6. Carefully, remove the plastic protective cap from the opposite end of the needle and expel a few drops of solution to test for proper flow.
7. The syringe is now ready for use.
8. After administration retract the piston and pull the cartridge away from the needle then remove the cartridge from the syringe.

# LOCAL ANAESTHESIA IN ORAL SURGERY

**Definition:-**

Local anesthesia (LA) is defined as a loss of sensation in a circumscribed area of the body caused by a depression of excitation in nerve endings or inhibition of the conduction process in peripheral nerves. An important feature of LA is that it produces this loss of sensation without loss of consciousness, in this point LA differs dramatically from general anesthesia.

**Pain:**- unpleasant physical sensation Experienced following the application of noxious stimuli: Although the supporting tissues of the teeth can them selves give rise to pain most of the nerve endings in the periodontal membrane are proprioceptive.

**Pain threshold:- a** point at which the patient feels discomfort when exposed to painful stimuli. The patient who feels minimal discomfort from painful stimuli is having
high pain threshold.

Many factors influence this response such as fear, apprehension and fatigue, all of which lower the pain threshold.

**Anesthesia:- means** loss or abolition of all modalities of sensation which includes pain and touch

**Analgesia:- means** loss of pain sensation only.

**Paraesthesia:-** means altered sensation (tingling sensation) and this may occur when a damaged nerve is regeneration or when a local anesthesia is either starting to work or its effect is wearing off. the effect of a local anesthetics on nerve fiber has been shown to be dependent on

1-the duration of exposure of local anesthesia

2- Concentration

3- Volume of the solution

**Premedication:-** is the use of drugs to reduce a patient's apprehension prior to operative treatment.

**Sedation techniques:-** involve the administration of a sedative to reduce anxiety in the conscious patient, usually, given by I.V route .

**Relative analgesia:- is a** sedation technique in which the patient remains conscious but mental relaxation is induced by inhalation of a mixture nitrous oxide, oxygen and air. Local anaesthesia used when necessary.

## Classification of nerve fibers:

The fibers of peripheral nerves classified according to the basis of electrophysiological and morphological differences:

**Type A ; fiber:** largest fibers further divided into four groups :-

1) A- alpha (α): responsible for motor action & muscle properioception.

2) A-beta (β): responsible for motor action & muscle properioception.

3) A-gamma (γ): responsible for motor action & muscle properioception.

4) A- delta (δ): responsible for fast sharp pain, temperatures, touch, & pressure

**Type B fibers :** preganglionic responsible for sympathetic activity.

**Type C fibers :** unmyelinated , the most numerous in the peripheral nervous system. Responsible for conduction of dull or burning pain.

Noxious stimuli are transmitted to the CNS by way of Aδ &C fibers. The lightly myelinated Aδ fibers are responsible for conduction of sharp, bright pain while unmyelinated C fibers conduct dull or burning pain.

**Requirements of local anesthetic agents: -**

- It should not be irritating to the tissue to which it is applied
- It should not, cause any permanent alteration of nerve structure
- Its systemic toxicity should by low
- It must be effective regardless of whether it is injected into the tissue or applied locally to mucous membranes.
- The time of onset of anesthesia should be as short as possible
- The duration of action, must be long enough to permit completion of the procedure.
- It should have potency sufficient to give anesthesia without using harmful concentration
- It should be relatively free from producing allergic reactions

- It should be stable in solution and readily undergo biotransformation in the body
- It should either be sterile or be capable of being sterilized by the heat without deterioration.

**Review of the nervous system and impulse generation:-**

The basic structural unit of the nervous system is the neuron (fig: 1) which is able to transmit messages between the central nervous system and all parts of the body, it consists of three parts: cell body axon and dendrites. The dendrites which end in the free nerve endings respond to stimulation produced in the tissue they lie, provoking an impulse that is transmitted centrally along the axon. The axon which is the single nerve

fiber, is a cable like structure composed of neural cytoplasm and covered by thin sheath which is the nerve membrane; in some nerves an insulating lipid rich layer of myelin covers this membrane. Current theories stated that nerve excitability and conduction are both attributable to changes developing within the nerve membrane.

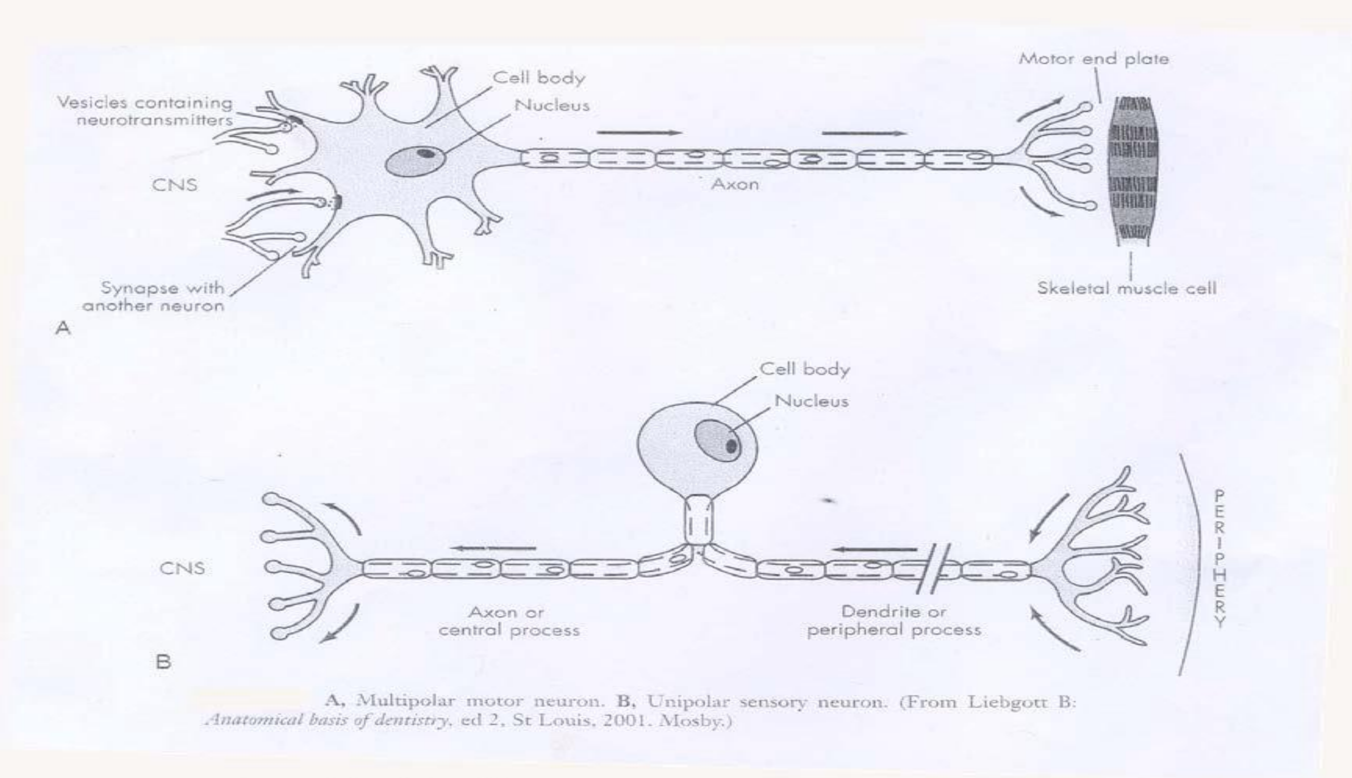



Fig. 1 A.motor neuron. B.sensory neuron.

**Nerve membrane:-**

The nerve membrane consists of two layers of lipid molecules (phospholipids) and associated proteins, lipids and carbohydrates (fig:2). All biologic membranes are organized to (1) block the diffusion of water soluble molecules. (2) be selectively permeable to certain molecules via specialized channels and (3) transduce information by protein receptors responsive to chemical or physical stimulation. Since the nerve membrane exhibits selective permeability, therefore significant differences exist for ions between the intracellular and the extracellular concentrations. Accordingly high concentration of K inside while high concentration of Na and CI outside the nerve membrane.

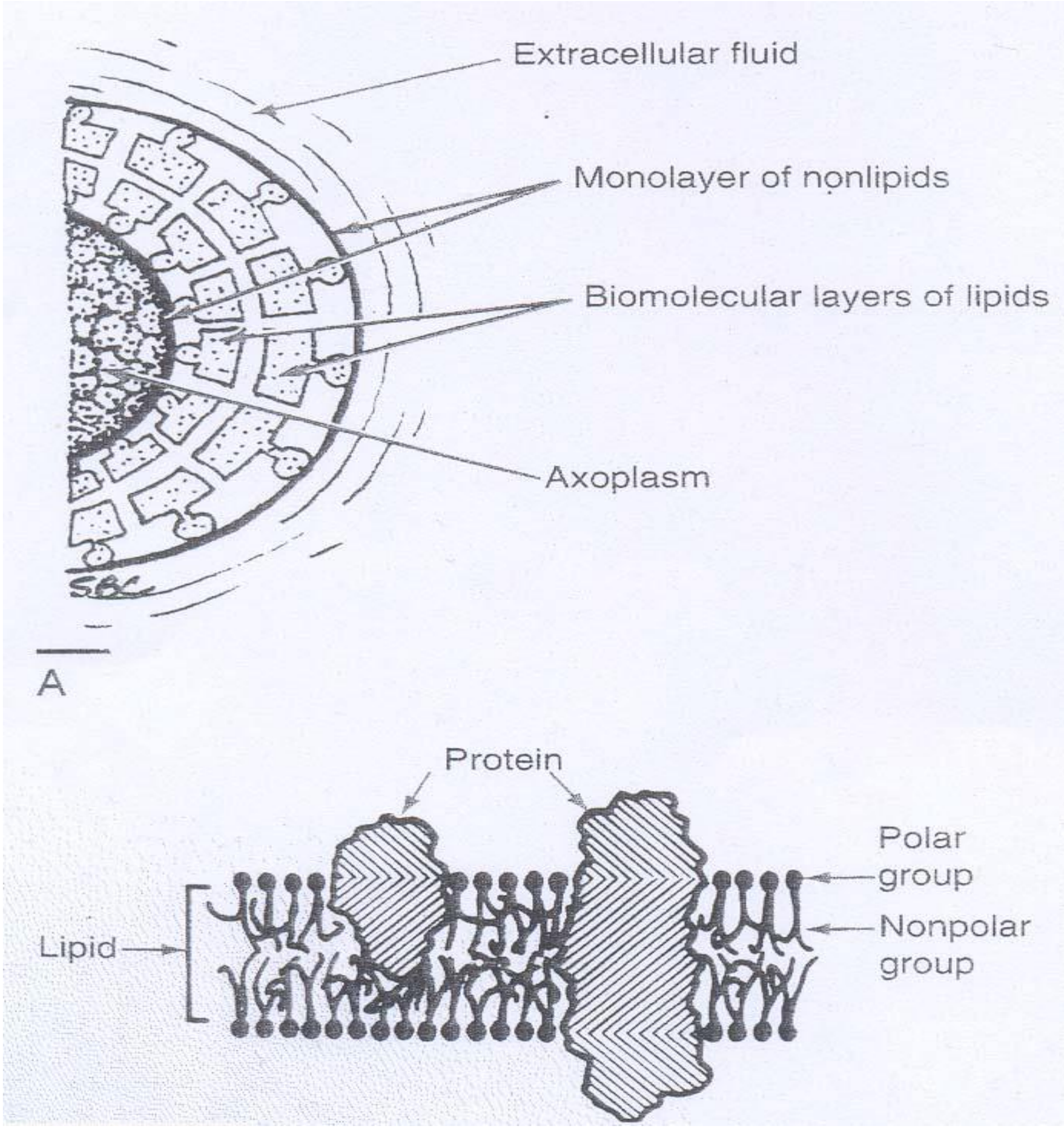



Fig.2 Configuration of the biological membrane.

In some nerves an insulating lipid rich layer of myelin covers this membrane (fig: 3). The outer most layer of myelin consists of the schwann cell cytoplasm and its nucleus. A gap between two adjoining schwann cells and their myelin spirals called node of ranvier at these nodes the nerve membrane is exposed directly to the extracellular
medium.

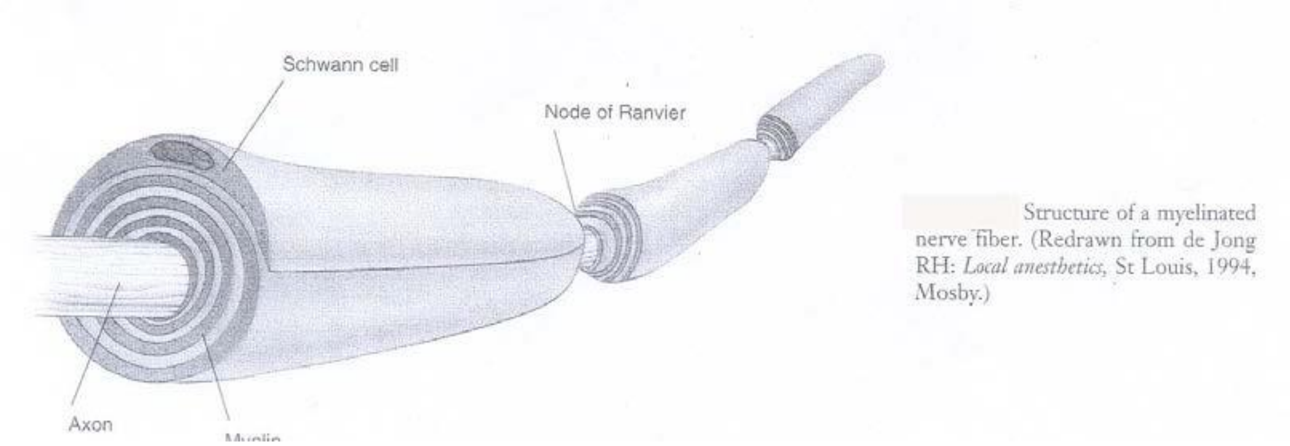



**Fig. 3 The structure of a myelinated nerve fiber.**

**Impulse generation:-**

The function of a nerve is to carry messages form one part of the body to another. These messages in the form of electrical action potentials are called impulses. Impulses are initiated by chemical, thermal, mechanical or electrical stimuli.

**Resting state:-**

(fig 4 step1) In the resting state the nerve membranes possess negative resting potential (-70mv) that comes from different concentrations of ions on either side of the membrane (due to the selective permeability property).

**Depolarization:-**

(Fig 4 step 2) when a stimulus excites a nerve this will lead to an increase in permeability of the membrane to Na ions, the rapid influx of Na ions to the interior of the nerve will cause depolarization of the nerve membrane from the resting level to its firing threshold of approximately (-50) to (-60) mv. The firing threshold is actually the magnitude of the decrease in the negative membrane potential that is required to initiate an action potential (impulse). When firing threshold is reached permeability of the membrane to sodium increases dramatically and at the end of depolarization the electrical potential of the nerve is reversed an electrical potential of + 40 mv exists. This process takes 0.3 millisecond.

**Repolarization:-**

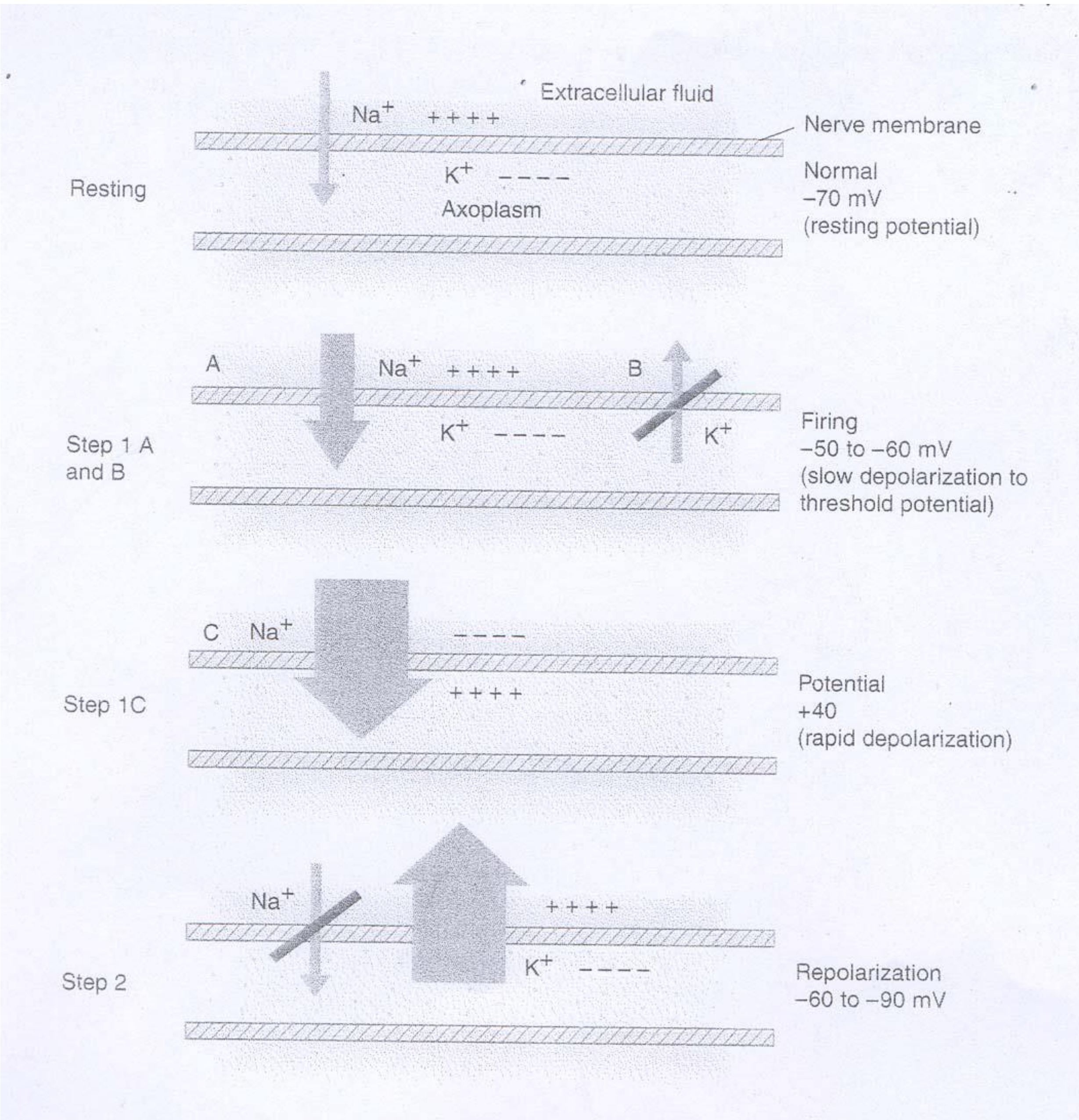
The action potential is terminated when the membrane repolarizes (fig 4 step 3) and this is achieved by increase permeability to K ions, resulting in the efflux of K ions (movement to the outside) leading to membrane repolarization and return to its resting potential (-70mv).This process takes 0.7 milliseconds.

The movement of Na ions to the inside of the nerve during depolarization and the subsequent movement of K ions out of the nerve during repolarization are passive process (not requiring energy) since each ion moves along its concentration gradient. After repolarization when the nerve return to its resting state a slight excess of Na ions exist within the nerve cell and a slight excess of potassium exists extracellularly, accordingly a period of metabolic activity begins called sodium pump leading to the movement of Na to the outside as well as

movement of K to the inside, this pumping mechanism require energy that is coming from oxidative metabolism of adenosine triphosphate (ATP).

Accordingly action potential could be defined as a transient membrane depolarization that result from a brief increase in the permeability of the membrane to sodium and also from delayed increase in the permeability to potassium.

Once an impulse has been initiated it moves along the surface of the axon to the CNS.




*Top*, Resting potential. *Step 1, A* and *B*, Slow depolarization to threshold. *Step 1, C*, Rapid depolarization. *Step 2*, Repolarization.

Fig.4 Steps of the action potential.

**Mechanism of action of local anesthesia:-**

The concept behind the action of L.A. is that it prevents both the generation and the conduction of a never impulse thereby they act like a roadblock between the source of the impulse (ex; surgical incision in the soft tissue) and the brain. The aborted impulse prevented from reaching the brain is not therefore interpreted as pain by the patient.

Many theories have been suggested to explain the mechanism of action of local anesthesia, In general the nerve membrane is the site at which local anesthetic agents exert their pharmacological actions, the most popular theories are:

1. **membrane expansion theory**:- this theory states that local anesthetic molecules diffuse through the nerve membrane producing a general disturbance of the bulk membrane structure expanding some critical regions in the membrane and thus preventing an increase in the permeability to sodium ions, thus inhibiting both conduction and nerve excitation.

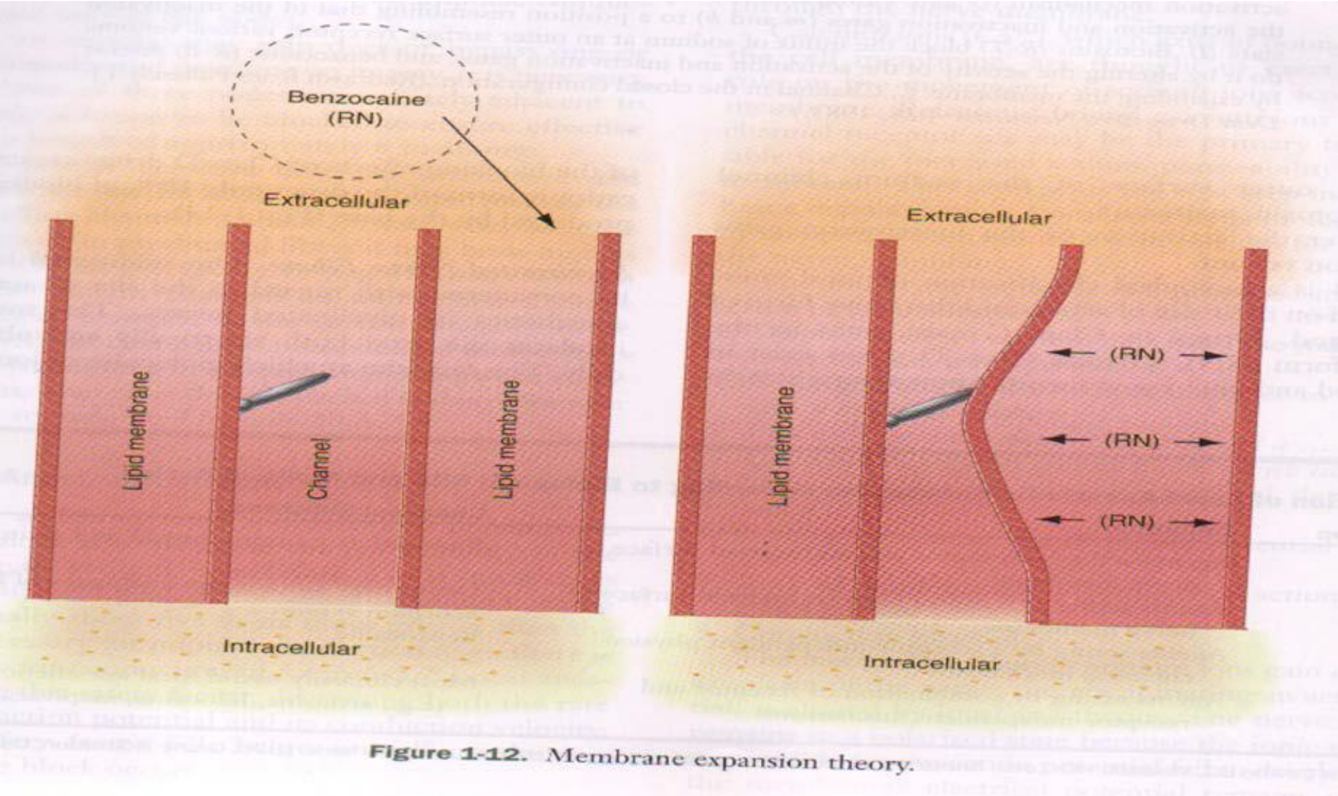



Fig.5 Membrane expansion theory.

2. **specific receptor theory**:- this is most favored one, it proposes that local anesthetics act by binding to specific receptors in the sodium channel (protein channel along the membrane) and the action of the drug is direct not mediated by change in the general properties of the cell membrane. Once the local anesthetic has gained access to these receptors, permeability to Na ions is decreased or eliminated and nerve conduction is interrupted.

***Note*:-**

A peripheral nerve is composed of hundreds to thousands of tightly packed axons (fig: 6) these axons are covered by several layers of fibrous
and elastic tissues in which blood vessels and lymphtics course throughout these layers.\ Individual nerve fibers (axons) are covered with perinurium and separated form each other by the endoneurium. The perineurium then binds these nerve fibers together into bundles called fascicule. The inner most layer of perineurium is the perilemma which represent the main barrier to diffusion of local anesthetic into a nerve. The whole fasciculi are contained within a loose connective tissue called the epineurium which represent 30% to 75% of the total cross section of a nerve.

Local anesthetics are readily able to diffuse through this tissue because of its loose consistency. Nutrient blood vessels and lymphatics traverse the epineurium. These vessels absorb local anesthetic molecules
thus removing them from the nerve.

## Induction of local anesthesia

Following the administration of a L.A into a tissue near a nerve molecules of the L.A will move from on site to anther according to their concentration gradient so it will move from site of deposition toward the nerve (this process termed diffusion).

Fasiculi that are located near the surface of the nerve are termed mantle bundles (fig 6) they are first ones reached by the local anesthetic and they are exposed to a higher concentration of it. These bundles will be blocked completely shortly after the injection of a local anesthetic. Fascisuli that are located near the center of the nerve are called core bundles these bundles are contacted by a local anesthetic only after a much delay and by a lower anesthetic concentration because of the greater distance that the solution must move and the greater number of the barriers it must cross.

As the local anesthetic diffuses into the nerve it becomes increasingly diluted by tissue fluids and is absorbed by capillaries and lymphatics thus the core fibers are exposed to a decreased concentration of local anesthetic a fact that may explain the clinical situation of inadequate pulpal anesthesia developing in the presence of subjective sympotoms of adequate soft tissue anesthesia. Complete block of all nerve fibres in a peripheral nerve requires an adequate volume as well as an adequate concentration of the local anesthetic be deposited.

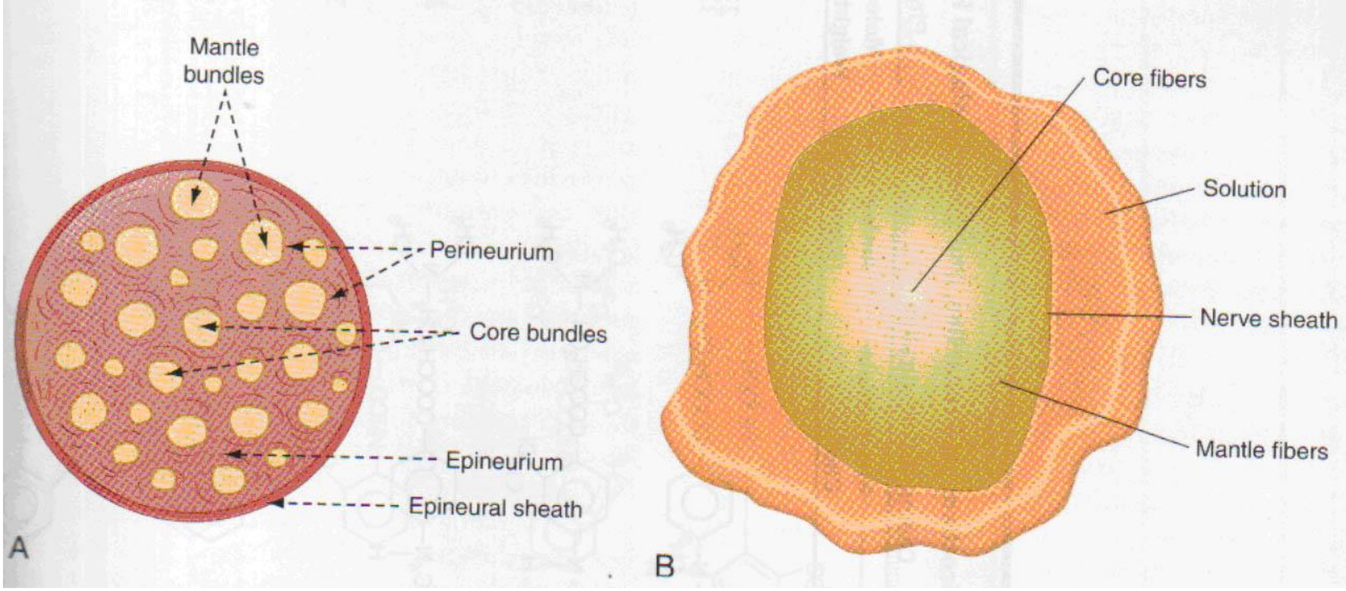



fig. 6 Cross section of a peripheral nerve.

**Lec 11+12**

## Factors affecting local anesthetic action:-

### 1. PH value:-

It is well known that the PH of a local anesthetic solution and the PH of the tissue into which it is injected greatly influences its nerve blocking action. Acidification of the tissue decreases local anesthetic effectiveness inadequate anesthesia results when local anesthetics are injected into inflamed or infected areas since the inflammatory process produces acidic products.

### 2. Lipid solubility:-

Increased lipid solubility of local anesthetics permits the anesthetic to penetrate the nerve membrane (which itself 90% lipid) more easily. This is reflected biologically in an increased potency of the anesthetic. Local anesthetics with greater lipid solubility produce more effective conduction blockade at lower concentrations than less lipid soluble solutions.

### 3. Protein binding:-

The degree of protein binding of the anesthetic molecule is responsible for the duration of local anesthetic activity. Local anesthetics possessing a greater degree of protein binding (ex: bupivacaine) appear to attach more securely to the protein receptor sites and to possess a longer duration of clinical activity.

### 4. Nonnervous tissue diffusibility:-

This will affect on the onset (starting point) of anesthesia, increased diffusibility will decrease time of onset.

### 5. Vasodilator activity:-

Local anesthetic solution with greater vasodilator activity (ex: procaine) will increase blood flow to the area, this will lead to rapid removal of anesthetic molecules from the injection site, decreasing anesthetic potency and duration.

## Reinjection of local anesthesia:-

Sometimes a dental procedure may outlast the duration of action of local anesthetic and a repeated injection of local anesthetic may be required; upon reinjection the following may result:

**1. Recurrence of immediate profound anesthesia:-**

At the time of reinjection, the concentration of local anesthetic in the mantle fibers is less than that in the core fibers. After reinjection, the mantle fibers will again exposed to a concentration gradient directed toward the nerve, the combination of residual local anesthetic in the nerve and the newly deposited supply results in a rapid onset of profound anesthesia with a smaller volume of anesthetic being given.

**2. Difficulty in reachieving profound anesthesia:-**

In this clinical situation a process known as tachyphylaxis occurs tachyphylaxis is defined as an increasing tolerance to a drug that is given repeatedly. It is more likely to develop if nerve function is allowed to return before reinjection (when the patient complains of pain). Although difficult to explain, tachyphylaxis is probably brought about by some or all of the following factors:

1. Edema
2. localized hemorrhage
3. clot formation
4. transudation
5. hypernatremia
6. decreased PH of the tissue

The first four factors isolate the nerve from contact with the local anesthetic solution the fifth hyprnatremia; raises the sodium ion gradient, thus counteracting the decrease in sodium ion conduction brought about by local anesthetic. The last factor is brought about by the first injection of the acidic local anesthetic.

## Duration of anesthesia:-

As the local anesthetic is removed from the nerve the function of the nerve returns, rapidly at first but gradually slowing.

Factors affecting on the duration of anesthesia:-

1. protein binding:- the rate at which an anesthetic is removed from a nerve has an effect on the duration of nerve block. Longer acting local anesthetic (such as bupivacaine and tetracaine) are more firmly bound to the nerve membrane (increased protein binding) than shorter acting drugs (such as procaine and lidocaine) and are therefore released from the receptor sites in the sodium channels more slowly.

2. vascularity of the injection site:- the duration is increased in areas of decreased vascularity.

3. Presence or absence of vasoactive substance:- the addition of a vasopressor into local anesthetic solution decrease the tissue perfusion thus increasing the duration of action.

## Classification of local anesthesia:-

Local anesthetics are calssified as either esters or amides according to their chemical linkages the chemical structure is shown below:

The lipophilic part is the largest portion of the molecule, which is aromatic in structure, while the hydrophilic part is an amino derivative of ethyl alcohol or acetic acid. The chemical structure is completed by an intermediate hydrocarbon chain containing either an ester or an amide linkage. All local anesthetics are amphipathic that is they possess both lipophilic and hydrophilic characteristics generally at opposite ends of the molecule.

**Notes:-**

1. local anesthetics without a hydrophilic part are not suited for injection but are good topical anesthetics (ex: benzocaine)

2. Ester linked local anesthetic (ex: procaine) are readily hydrolyzed in aqueous solution, while amide linked types (ex: lidocaine) relatively resistant to hydrolysis.

3. a greater percentage of an amide linked drug is excreted unchanged in the urine than of an ester linked drug.

**The ester type includes the following:-**

1. procaine
2. chloroprocaine
3. propoxycaine
4. butacaine
5. cocaine
6. benzocaine
7. hexylcaine
8. piperocaine
9. tetracaine

**The amide type include the following:-**

1. lidocaine
2. prilocaine
3. articaine
4. bupivacaine
5. dibucaine
6. etidocaine
7. mepivacaine

## Pharmacokinetic of local anesthetics:-

**Distribution:-**

Once absorbed into the blood local anesthetics are distributed throughout the body to all tissues. The blood level of local anesthetic is influenced by the following factors:-

1. rate at which the drug is absorbed into the cardiovascular system.
2. rate of distribution of the drug from the vacular compartment to the tissue (more rapid in healthy patients than in those who are medically compromised e.g; congestive heart failure patients).
3. elimination of the drug through the metabolic or excretory pathways.

The last two factors act to decrease the blood level of local anesthetic.

**Note:-**

All local anesthetics readily cross the blood brain barrier they also readily cross the placenta and enter the circulatory system of the developing fetus.

## Metabolism (biotransformation):-

### A. Ester local anesthetics:-

Ester local anesthetics are hydrolyzed in the plasma by the enzyme pseudocholinesterase. Procaine undergoes hydrolysis to para – aminobenzoic acid which is excreted unchanged in the urine. Allergic reactions that occur in response to ester drugs are usually not related to the parent compound (e.g; procaine) but rather to para aminobenzoic acid which is a major metabolic product of ester local anesthetic. Peoples having atypical form of pseudocholinesterase get inability to hydrolyze ester local anesthetics and other chemically related drugs thus get prolongation of higher blood levels of the local anesthetic and an increased potential for toxicity.

### B. amide local anesthetics:-

The metabolism of the amide local anesthetics is more complex than that of the esters the primary site of biotransformation of amide drugs is the liver. The metabolic products of certain local anesthetics are capable of producing significant clinical activity if permitted to accumulate in the blood (due to renal or cardiac failure and during periods of prolonged drug administration). A clinical example is the production of methemoglobinemia in patients receiving large doses of prilocaine or articaine these drugs cannot produce methemoglobinemia but their metabolic products induce the formation of methemoglobin which is responsible for methemoglobinmia another example is the sedative effect occasionally observed following lidocaine administration. Lidocaine dose not produce sedation but some of its metabolic products are currently
thought to be responsible for this clinical action.

### Excretion:

The kidneys are the primary organ for both the local anesthetics and its metabolites. A percentage of a given dose of local anesthetic drug will be excreted unchanged in the urine and this varies according to the drug.

Esters appear in only very small concentration as a parent in the urine; this is because they are hydrolyzed almost completely in the plasma. Amides are usually present in the urine as the parent compound in a greater percentage than are esters, because of their more complex process of biotransformation. Patients with significant renal impairment may be unable to eliminate the local anesthetic compound or its metabolites from
the blood, resulting in slightly elevated blood levels and an increase potential for toxicity. This may occur with either the esters or the amides drugs. Thus patients with a significant renal disease may represent a relative contraindication to the administration of local anesthetics.

**Constituents of local anesthetic solution:**

1. local anesthetic agent (esters or amides type)
2. Vasoconstrictor agent. (will be discussed later)
3. Reducing agent: vasoconstrictors in local anesthetic solution are unstable and may oxidize, especially on prolonged exposure to sunlight. This will lead to brown discoloration of the solution and this is an indication that the solution should be discarded. In an attempt to overcome this problem a small quantity of sodium bisulphite, which compete for the available oxygen, is included in the solution. Since this substance is more readily oxidized than adrenaline or nor adrenaline it protects their stability.
4. Preservative: the sterility of local anesthetic solution is maintained by the inclusion of a small amount of preservative. Some preservatives such as methyl paraben have been shown to produce allergic reaction in sensitized subjects.
5. Fungicide: in the past some solutions tended to become cloudy due to the proliferation of minute fungi, now a small quantity of thymole is added to serve as a fungicide and prevent this occurrence.
6. Vehicle: the anesthetic agent and the additives mentioned above are dissolved in modified ringer’s solution. This isotonic vehicle minimizes discomfort during injection.

## The role of vasoconstrictors in local anesthetic solution:

All injectable local anesthetics posses some degree of vasodilating activity. The degree of vasodilating varies from one type to other and may vary according to the site of injection and individual patient response. After local anesthetic injection into tissue, blood vessels dilate in the area, resulting in an increased blood flow to the site. This increase in perfusion leads to the following leads to the following reactions:

1. Increased rate of absorption of the local anesthetic into the cardiovascular system, which in turn removes it from the injection site.
2. Increased plasma level of the local anesthetic, with an increased risk of local anesthetic toxicity.
3. Decreased duration of action and decreased depth of anesthesia because it diffuses away from the injection site more rapidly.
4. Increased bleeding at the site of injection due to increased perfusion.

Vasoconstrictors are drugs that constrict blood vessels thereby control tissue perfusion. They are added to local anesthetic solutions to oppose the vasodilating actions of local anesthetics. They are important additions to local anesthetic solution for the following reasons:

1. By vasconstricting blood vessels, vascoconstrictors decrease blood flow (perfusion) to the site of injection.
2. Absorption of the local anesthetic into the cardiovascular system is slowed, resulting in lower anesthetic blood levels.
3. The lower local anesthetic blood levels decrease the risk of local anesthetic toxicity.
4. Higher volumes of the local anesthetic agent remain in and around the nerve for longer periods, thereby increasing the duration of action of local anesthetics.
5. Vasconstrictors decrease bleeding at the site of injection and are useful when increased bleeding is anticipated (ex: during a surgical procedure).

Note: the vascoconstrictors used with local anesthetic are chemically identical or quite similar to the sympathetic nervous system mediators (epinephrine and nor epinephrine).

## *Dilution of vasoconstrictors*

The dilution of vasoconstrictor is commonly referred to as ratio (1 to 1000, written 1: 1000). This 1:1000 mean that there is I gm (1000 mg) of anesthetic drug contained in 1000 ml of solution. Therefore a 1:1000 dilution contains 1000 mg in 1000 ml or 1.0 mg/ml of solution. Accordingly 1:10000 dilutions contain 1000 mg in 10000ml or 0.1 mg/ml of solution. & 1:100 000 dilution contain l000mg in 100 000 ml or 0.01 mg/ml of solution.

***The mg/ml value of the various vasoconstrictors are :***

***Type mg/ml dilution***

Adrenalin 0.02 1:50 000

Adrenalin 0.0125 1:80 000

Adrenalin 0.01 1:100 000

Adrenalin 0.005 1:200 000

Levonorde frin 0.05 1:20 000

Noradrenalin 0.033 1:30 000

## *Types of the vasoconstrictors* :-

1- ***Epinephrine (adrenaline) :-***

***Sources: it is cither synthetic or obtained from adrenal medulla of animals.***

## *Mode of action:-*

**It** acts directly on both alpha α & beta β receptors

Systemic action:

**1- *Cardiovascular system***

It causes increased systolic & diastolic B.P.

It causes increased heart rate & strength of contraction.

It causes increased stroke volume &cardiac out put.

It causes increased myocardial 02 consumption.

On blood vessel it cause vasoconstriction *&* so frequently used a lone as a vasoconstrictor for hemostasis during surgical procedures.

***2-Respiratory system:-***

Epinephrine is a potent dilator of the smooth muscle of the bronchiole; it is the drug of choice for management of acute asthma.

***3- Central nervous system (CNS)***

In the usual therapeutic dosage epinephrine is not a potent CNS stimulant. CNS stimulation occurs when an excessive dosage is given.

*Availability in dentistry*

Epinephrine is the most potent & widely used vasoconstrictor in dentistry. It is available in 1:50 000, 1:80 000, 1:100 000, 1:200 000 dilution.

## *Maximum dosage:*

*/- for pain control*

The least concentrated solution that produces effective pain control should be used.

## *For normal healthy patient*

The max dose is 0.2 mg per appointment &this means:

10 ml of a 1:50 000 dilution (5 cartridge).

20 ml of a 1:100 000 dilution (11 cartridge).

40 ml of a 1:200 000 dilution (22 cartridge).

for patient with clinically significant cardiovascular dis. The max dose 0.04 mg per appointment, that means:

2 ml of a 1:50 000 (I cartridge).

4 ml of a 1:100 000 (2 cartridge).

8 ml of a 1:200 000 (4 cartridge ).

## *2- For hemostasis:-*

Epinephrine containing LA solution is used via infiltration in to the site of operation to prevent or minimize bleeding during surgical procedures.

***For normal healthy patient*** the 1:50 000 dilution of epinephrine is more effective in hemostasis than less concentrated 1:100 000 ,or 1:200 000.

***For patient with cardiovascular dis.***The dilution of 1:100 000 is considered the best.

**2-*Nor epinephrine (noradrenalin)***

Sources: either synthetic or obtained from adrenal medulla of animals.

Mode of action:

The mode of action is almost exclusively on alpha receptors. It also stimulates beta (β) receptors in the heart. Nor epinephrine is one fourth as potent as epinephrine.

Systemic action:

1 - Cardiovascular system(C.V.S)

It causes increased systolic B.P..

It causes decreased heart rate.

It causes no changes or slightly decrease cardiac out put.

It causes increased stroke volume.

It causes increased peripheral resistance.

On the blood vessel through alpha receptor stimulation, it produce constriction of cutaneous blood vessels & this wi l l lead to increased peripheral resistance.

2- Respiratory system

Nor epinephrine does not relax smooth muscle as do epinephrine & it is not cl i n i cal l y effective in the management of bronchospasm.

3- CN*S*

In the usual therapeutic dosage nor epinephrine is not potent CNS stimulant .CNS stimulating action predominate when an excessive dosage is given

**Availabi l i ty in dentistry:**

Some times, nor epinephrine is used with LA as vasoconstrictor in a l :30000 dilution. Max doses: Nor epinephrine should be used for pain control only but not for hemostasis. For normal healthy patient: 0.34 mg per appointment, that mean 10 ml of a 1:30 000

For patient with clinically significant cardiovascular dis. 0.14 mg per appointment, that means 4ml of a 1:30000.

***Levonordefrin (Neo-cobefrin):***

It is synthetic substance.

It acts through direct alpha receptor stimulation with some B beta activity. It produce less cardiac &CNS stimulation than epinephrine does. It is mainly used with mepivacaine in a 1:2() 000 dilution. The max dose for all patients should be 1 mg per appointment that mean 20 ml of a 1:20 000 dilution (11 cartridge).

***Felypressin (octapressin):***

Sources: it is the analogue of the ant diuretic hormone vasopressin .it is a non sympathomimetics drug & is categorized as vasoconstrictor.

Mode of action:

It acts as direct stimulant of vascular smooth muscle. It s action appear to be more pronounced on the venous than the arteriolar microcirculation.

***Systemic action:***

Heart: no direct effects

Blood vessel: In high doses. Felypressin -induced constriction of cutaneous
blood vessel &may produce facial pallor.

CNS: no effect

Uterus: it has both antidiuretic & oxytocic actions, the latter contraindicating it s uses in pregnant patient.

***Clinical application:***

It is used as vasoconstrictor to decrease the absorption as well as to increase the duration of the anesthesia .it is not recommended for use when hemostasis is required because of their predominant effect on the venous rather than the arterial circulation. Availability in dentistry:

It is used in a dilution of 0.03 iu/ml with3% prilocaine (it means international unit) . Max doses It is 0.27 IU, that means: 9ml of 0.03 iu/ml.

## ***Calculation of the dose of local anesthetics in dentistry (Using lidocaine as an example)***

As any other drug, LA has a max safe dose. The dose is calculated in mg per kg of body weight (mg/kg body wt) .

The amount of LA agent (e.g. lidocaine) that is present in the cartridge is

wr i t t en on the cartridge by it s percent conc.

The number of milligram of the agent in the cartridge therefore can be calculated by.

* multiplying the percent cone, (ex 2% - 2gm/100ml=2000 mg/100 ml=20 mg/ml) by 1.8 or 2.2 (number of milliliters in the cartridge). Thus 1.8 ml cartridge of 2% lidocaine contains 36 mg lidocaine.

Example:-

The maximum safe dose of lidocaine is 4.5 mg/kg body weight per appointment .this means that maximum dose of 2% lidocaine (withoutepinephrine )that could be given to 70 kg patient about 300 mg per

appointment (4.5*70=315 mg ).

To calculate the max number of cartridge:

2% means 2 gm /100 ml - 2000 mg/100 ml

20 mg /ml * 1.8 = 36 mg lidocaine inside the single cartridge.

300 mg / 36 mg =8 cartridges.

This calculation is considering that the local anesthesia is plain (i.e. with out a vasoconstrictor) .

We should remember that the max dose of the vasoconstrictor is 0.2 mg per appointment for adult healthy patient. And 0.04 mg per appointment for patient with clinically significant cardiovascular dis, & should be considered when calculating the max number of cartridge that are allowed to be given to the patient per appointment & according to the type & cone. of the vasoconstrictor.

***Type Pulpal Soft tissue anesthesia***

Lidocaine 2% 5-10 min. 60 min

Prilocaine 4% 5-10 min 90 min

Mepivacaine 3% 20-40 min 120 min

Lidocaine 2% 60 min 180-240 min

Epinephrine!: 100 000

Prilocaine4 %( block) 60 min 120 min

Bupivacaine 0.5% > 90 min 240-540 min

Dis = disease. IM = intramuscular.

Ex ^example. I V= intravascular injection.

I n j injection. SC= subcutaneous injection.

Max=maximum. LA= local anesthesia.

BP= blood pressure. CVA =cerebro vascular accident.

CNS= central nervous system. CVS= cardiovascular system.

# LOCAL ANESTHESIA III

Six nerve blocks are described : Two of these—involving the mental and buccal nerves— provide regional anesthesia to soft tissues only and have exceedingly high success rates. In both instances, the nerve anesthetized lies directly beneath the soft tissues, not encased in bone.

The four remaining blocks— inferior alveolar, incisive, Gow-Gates mandibular, and Vazirani-Akinosi (closed-mouth) mandibular—provide regional anesthesia to the pulps of some or all of the mandibular teeth in a quadrant.

Three other injections of importance in mandibular anesthesia—periodontal ligament, intraosseous, and intraseptal—are described in . Although these supplemental techniques can be used successfully in the maxilla or the mandible, their greatest utility lies in the mandible, because in the mandible, they can provide pulpal anesthesia of a single tooth without providing the accompanying lingual and facial soft tissue anesthesia that occurs with other mandibular nerve block techniques.

# TECHNIQUES FOR MANDIBULAR ANAESTHESIA

Infiltration may be considered as first-choice injections depends on:

- The age of the patient
- The tooth of interest

## 1. Age of the patient

- Mandibular infiltration is successful in cases where the patient has a full primary dentition.

- Once a mixed dentition develops, it is a general rule of teaching that the mandibular cortical plate of bone has thickened to the degree that infiltration might not be effective, leading to the recommendation that "mandibular block" techniques should now be employed

- The technique is similar to that described for maxillary buccal infiltrations as the approach is from the buccal side.
- In the lower jaw the area of penetration is made taut by pulling the tissues laterally and inferiorly rather than superiorly.
- The point of penetration is in the depth of the buccal sulcus and the technique is identical to maxillary buccal infiltration.
- A 30-gauge needle is used and 1 mL of solution deposited over 30 seconds.

## 2. Tooth of interest::

- In adults, infiltration anaesthesia is the first choice for pulpal anaesthesia of the lower incisor teeth.

1. Thin and porous buccal plate
2. contralateral inferior alveolar nerve

- Pulpal anaesthesia is best achieved by depositing solution both buccally and lingually in the apical region of the tooth involved.
- A volume of at least 0.5 mL at each site is recommended.
- The buccal injection is as described above. The lingual infiltration is performed in the reflected mucosa in the apical region of the tooth of interest.
- The onset of anaesthesia may take longer than a maxillary buccal infiltration. It may be 8 to 10 minutes before pulpal anaesthesia is of sufficient depth to allow pain-free operative procedures on the tooth.

# 2- Regional block methods in the mandible

- Most dental treatment on the adult dentition that requires anaesthesia is performed using regional block methods.
- As is the case with the maxilla, there are extra oral approaches to the mandibular nerve. These are not recommended in dental practice.

- Regional block methods used in the mandible include:

• Inferior alveolar and lingual nerve block

• Gow-Gates block

• Akinosi-Vazirani block

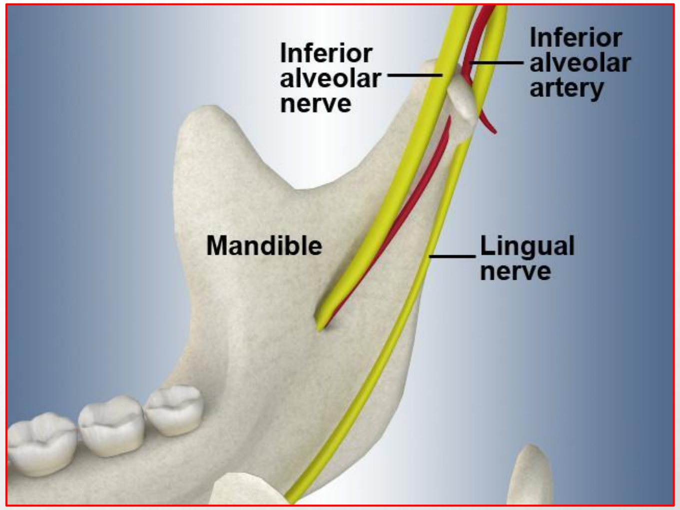
• long buccal nerve block

• Mylohyoid nerve block

• Incisive and mental nerve block

# A- The inferior alveolar and lingual nerve block

- Is the second most frequently used (after infiltration)
- The aim of the injection is to deposit local anesthetic solution close to the mandibular foramen on the medial aspect of the mandibular ramus thus blocking transmission in the inferior alveolar nerve at the point of entry into the bone.

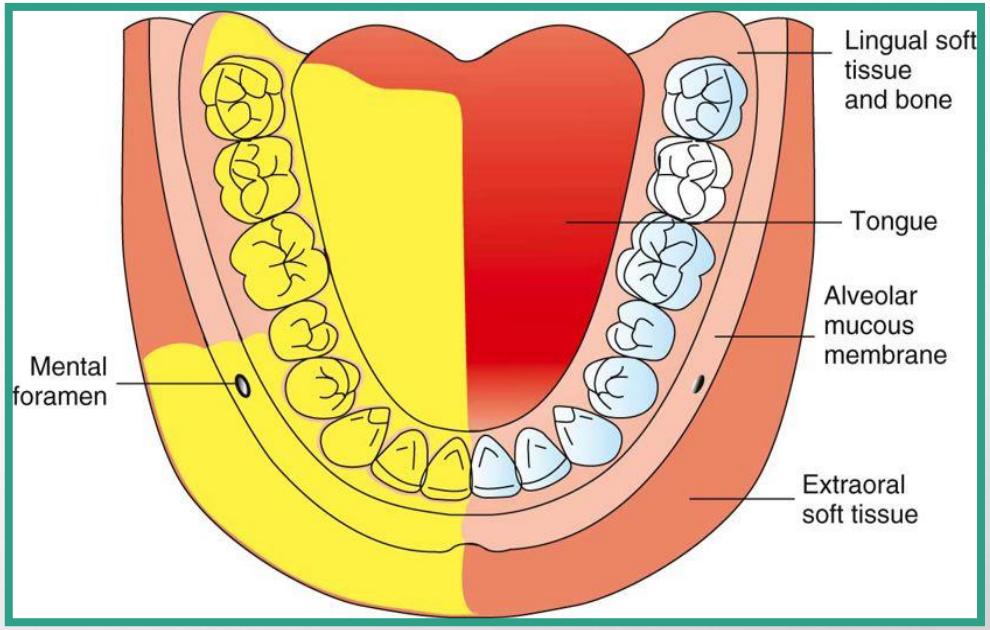



- Positive aspiration (10% to 15%, highest of all intraoral injection techniques)


Osseous landmarks for inferior alveolar nerve block. 1, Lingula; 2, distal border of ramus; 3, coronoid notch; 4, coronoid process; 5, sigmoid (mandibular) notch; 6, neck of condyle; 7, head of condyle.

## Nerves Anesthetized

1. Inferior alveolar, a branch of the posterior division of the mandibular division of the trigeminal nerve (V3)
2. Incisive
3. Mental
4. Lingual (commonly)




## Areas Anesthetized

1. Mandibular teeth to the midline
2. Body of the mandible, inferior portion of the ramus
3. Buccal mucoperiosteum, mucous membrane anterior to the mental foramen (mental nerve)
4. Anterior two thirds of the tongue and floor of the oral cavity (lingual nerve)
5. Lingual soft tissues and periosteum (lingual nerve)

- Administration of bilateral IANBs is rarely indicated in dental treatments other than bilateral mandibular surgeries. They produce considerable discomfort, primarily from the lingual soft tissue anesthesia, which usually persists for several hours after injection. The patient feels unable to swallow and, because of the absence of all sensation, is more likely to self-injure the anesthetized soft tissues.

- Two excellent alternatives to bilateral IANBs are bilateral incisive nerve blocks (where lingual soft tissue anesthesia is not necessary) and unilateral inferior alveolar blocks on the side that has the greater number of teeth requiring restoration or that requires the greater degree of lingual intervention, combined with an incisive nerve block on the opposite side.

- The success rate of the inferior alveolar nerve block is considerably lower than that of most other nerve blocks.

- Difficulty with the traditional Halsted approach (IANB) is the absence of consistent intraoral landmarks.

- **Failure rates for the IANB are commonly high, ranging from 31% and 41% in mandibular second and first molars to 42%, 38%, and 46% in second and first premolars and canines, respectively, and 81% in lateral incisors.**

- The central core theory best explains this problem.

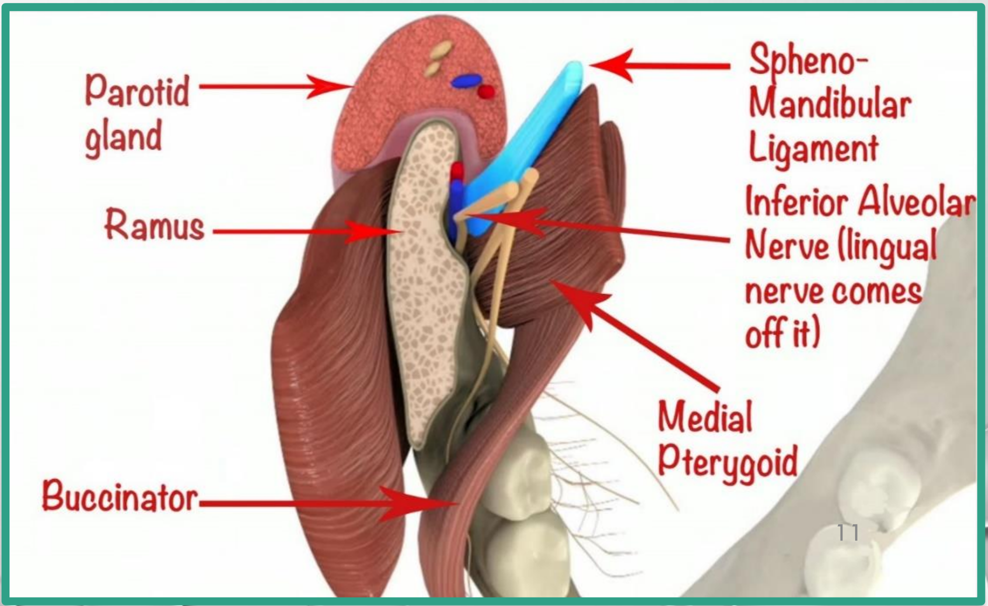
Nerves on the outside of the nerve bundle supply the molar teeth, while nerves on the inside (core fibers) supply incisor teeth. Therefore the local anesthetic solution deposited near the IAN may diffuse and block the outermost fibers but not those located more centrally, leading to incomplete mandibular anesthesia.

# A- The direct technique

- This method is also known as the Halstead approach and relies on simple anatomical landmarks. The aim is to deposit the local anesthetic in the pterygo-mandibular space.

Target area: Inferior alveolar nerve as it passes downward toward the mandibular foramen but before it enters into the foramen

- This anatomical space is bordered posteriorly by the parotid gland, laterally by the ramus of the mandible, medially and inferiorly by the medial pterygoid muscle, superiorly by the lateral pterygoid muscle and anteriorly by the buccinators muscle.



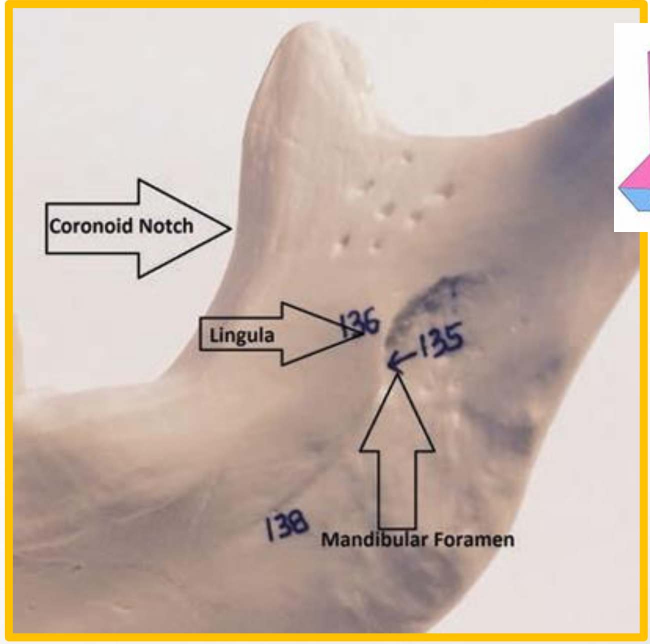
- The position of the foramen is variable. It should be noted that the mandibular foramen is usually apparent on dental panoramic radiographs and if one of these is available it should be consulted. Information regarding the height (in relation to the teeth) and anteroposterior position of the foramen will be obtained from the radiograph.

# Landmarks ::

a. Coronoid notch (greatest concavity on the anterior border of the ramus)

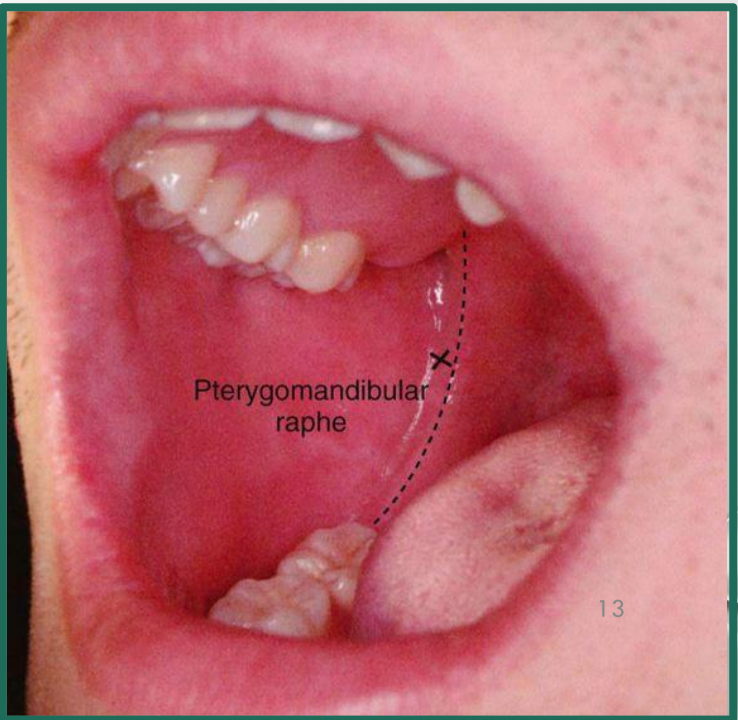
b. Pterygo-mandibular raphe (vertical portion)

c. Occlusal plane of the mandibular posterior teeth




**Orientation of the needle bevel:** Less critical than with other nerve blocks, because the needle approaches the inferior alveolar nerve at roughly a right angle

The posterior border of the mandibular ramus can be approximated intraorally by using the pterygomandibular raphe as it turns superiorly toward the maxilla.



# Three parameters must be considered during administration of IANB:

(1) The height of the injection

(2) The anteroposterior placement of the needle (which helps to locate a precise needle entry point)

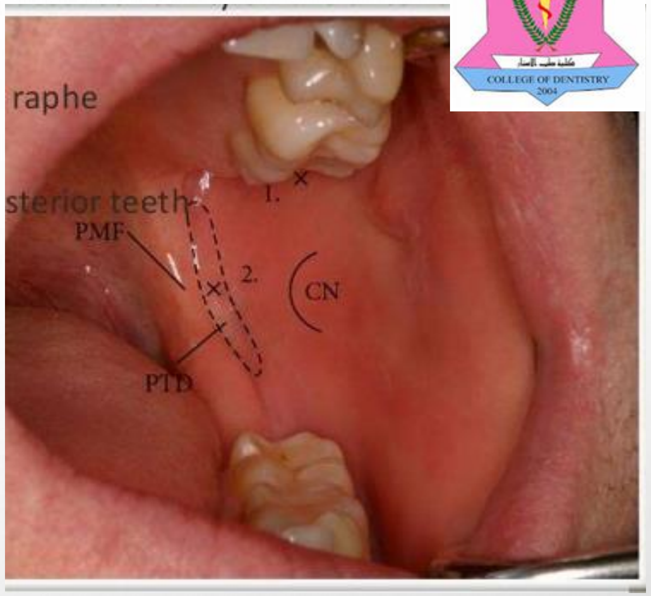
(3) The depth of penetration (which determines the location of the inferior alveolar nerve).

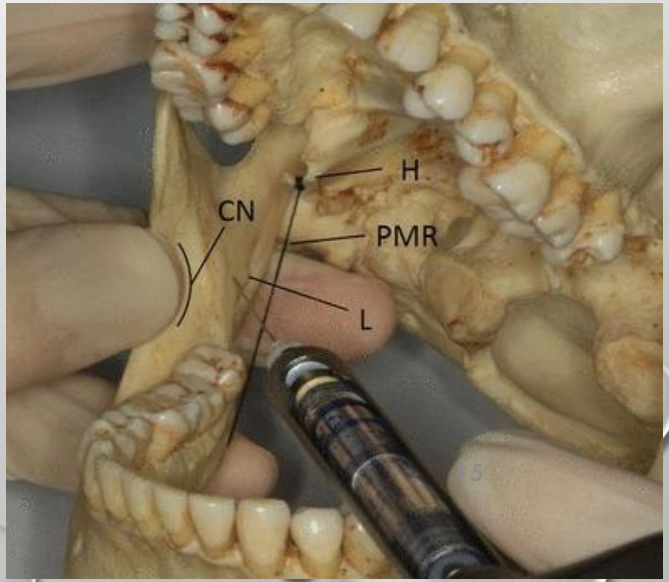
**(1) <u>Height of injection</u>:**

- Place the index finger or the thumb of your left hand in the coronoid notch.

- An <u>imaginary line</u> extends posteriorly from the fingertip in the coronoid notch to the <u>deepest part of the pterygo-mandibular raphe</u> (as it turns vertically upward toward the maxilla), determining the height of injection.

- <u>This imaginary line should be parallel to the occlusal plane of the mandibular molar teeth. In most patients, this line lies 6 to 10 mm above the occlusal plane).</u>



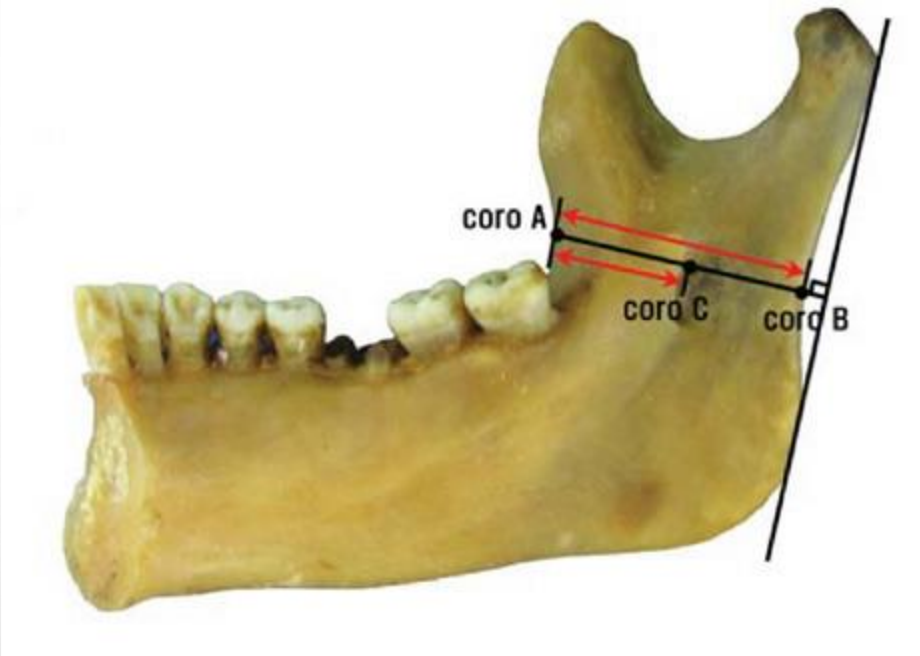
Anteroposterior site of injection: Needle penetration occurs at the intersection of two points.

(a) Point 1 falls along the horizontal line from the coronoid notch to the deepest part of the pterygo-mandibular raphe as it ascends vertically toward the palate as just described.

(b) Point 2 is on a vertical line through point 1 about three fourths of the distance from the anterior border of the ramus. This determines the anteroposterior site of the injection.

(3) Penetration depth: In the third parameter of the IANB, bone should be contacted.

Slowly advance the needle until you can feel it meet bony resistance. (usually 20-25 mm)

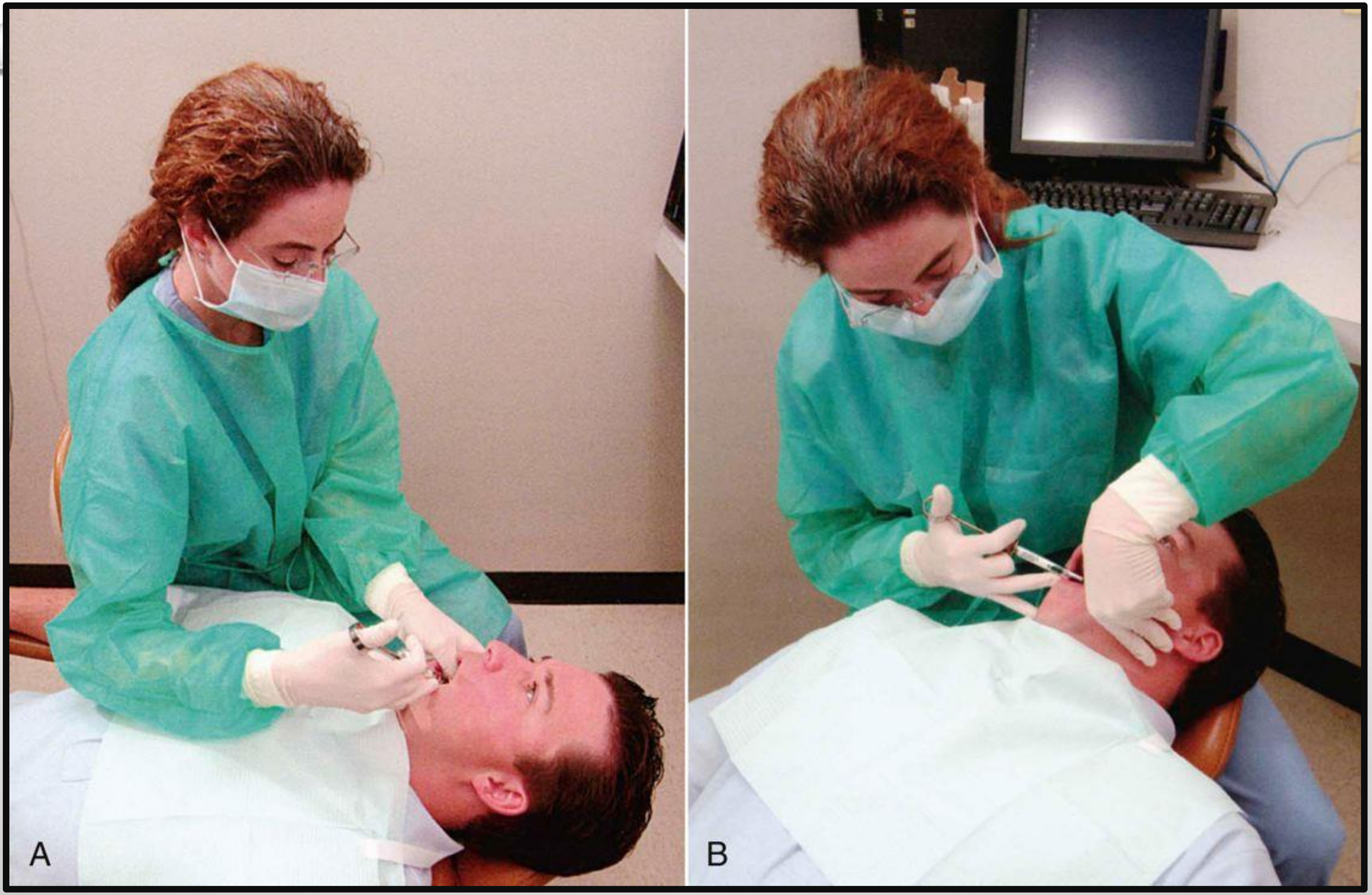


-The finger on the coronoid notch is used to pull the tissues laterally, stretching them over the injection site

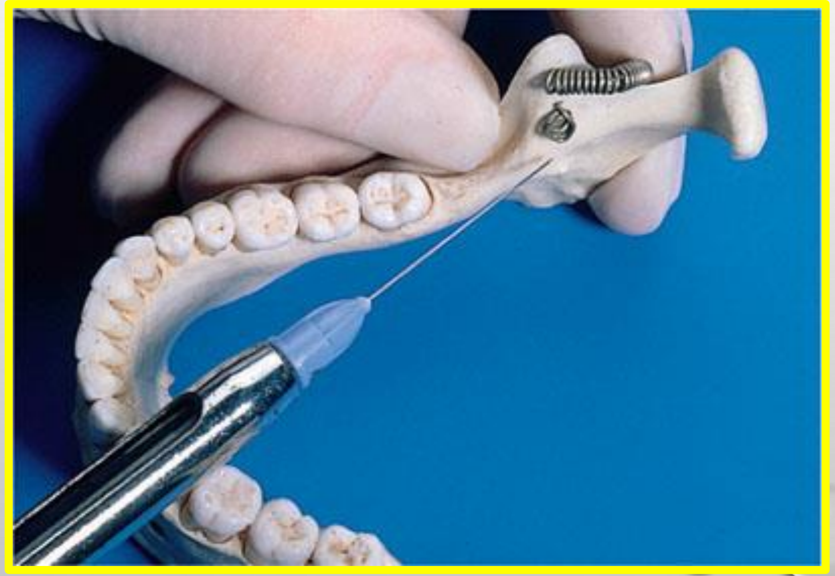
- In adults A 25-gauge long needle is preferred; a 27-gauge and should be long is acceptable. This is due to the depth of penetration that may be required.

- The patient’s mouth is opened wide

- The ramus is held between the operator’s thumb and index finger.
- The index or middle finger is placed extraorally on the posterior aspect of the ramus at the same height as the thumb. In the adult mandible the mandibular foramen is often approximately halfway between the operator’s thumb and index finger about halfway up the thumbnail.
- The syringe is introduced across the premolars of the opposite side aiming to enter mucosa at the level of halfway up the operator’s thumbnail.




Position of the administrator for a :
**(A)** Right and **(B)** left inferior alveolar nerve block.



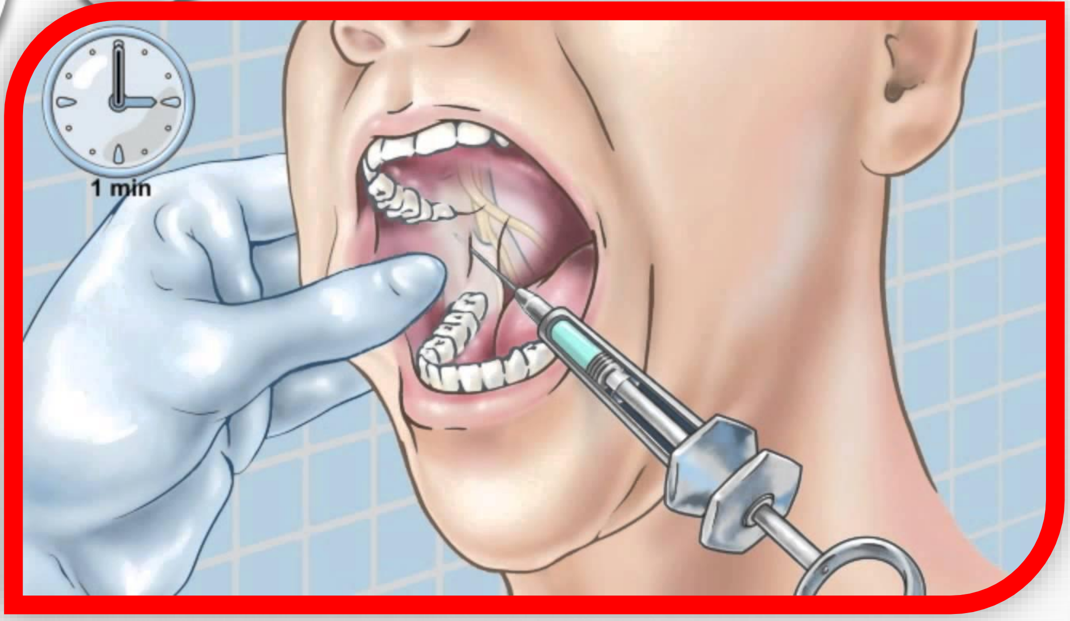
**Inferior alveolar nerve block: The depth of penetration is 20 to 25 mm (two thirds to three fourths the length of a long needle).**

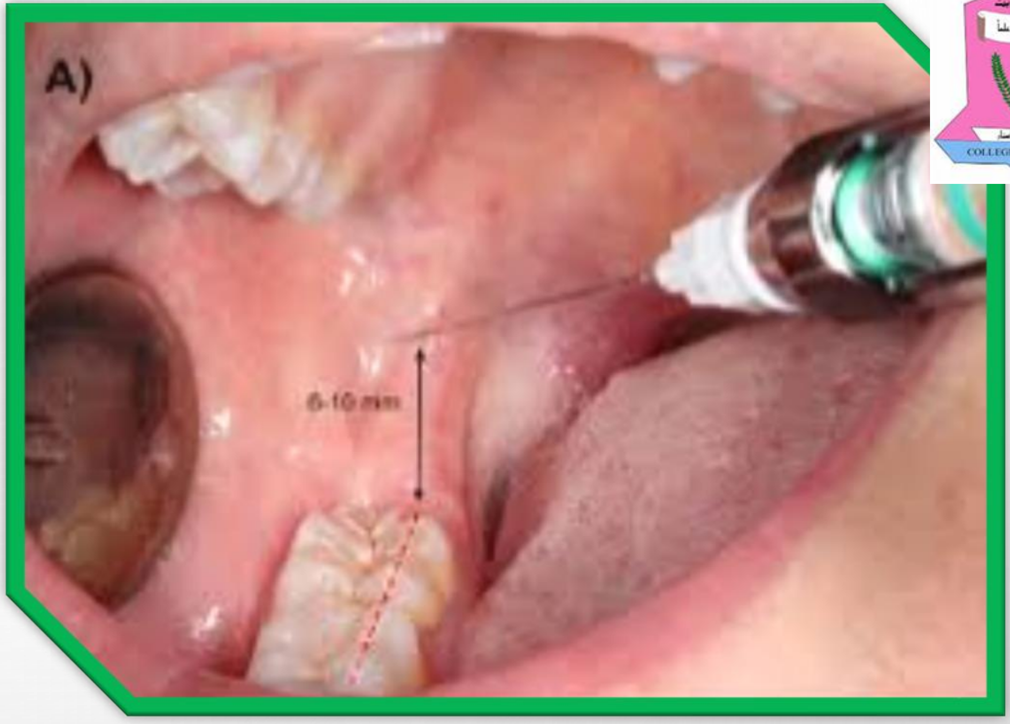
The point of entry is midway between the internal oblique ridge (which was palpated by the thumb) and the pterygomandibular raphe (which is visualized). The needle is advanced through tissue until bony contact is made. In adults this normally occurs between 20 and 25 mm of penetration.

When the needle has contacted bone in the correct position it is withdrawn slightly, aspiration performed and 1.5 mL of solution deposited slowly (over a minimum of 60 seconds). Aspiration is important.

**This injection anaesthetizes the inferior alveolar nerve and may block transmission in the lingual nerve.**

When lingual nerve anaesthesia is definitely required a modification to the technique is added. Following injection at the original site the needle is withdrawn halfway through mucosa, aspiration performed and solution deposited at this point. The injection continues as the needle is completely withdrawn, stopping just as the needle exits mucosa to prevent local anesthetic spilling into the mouth.



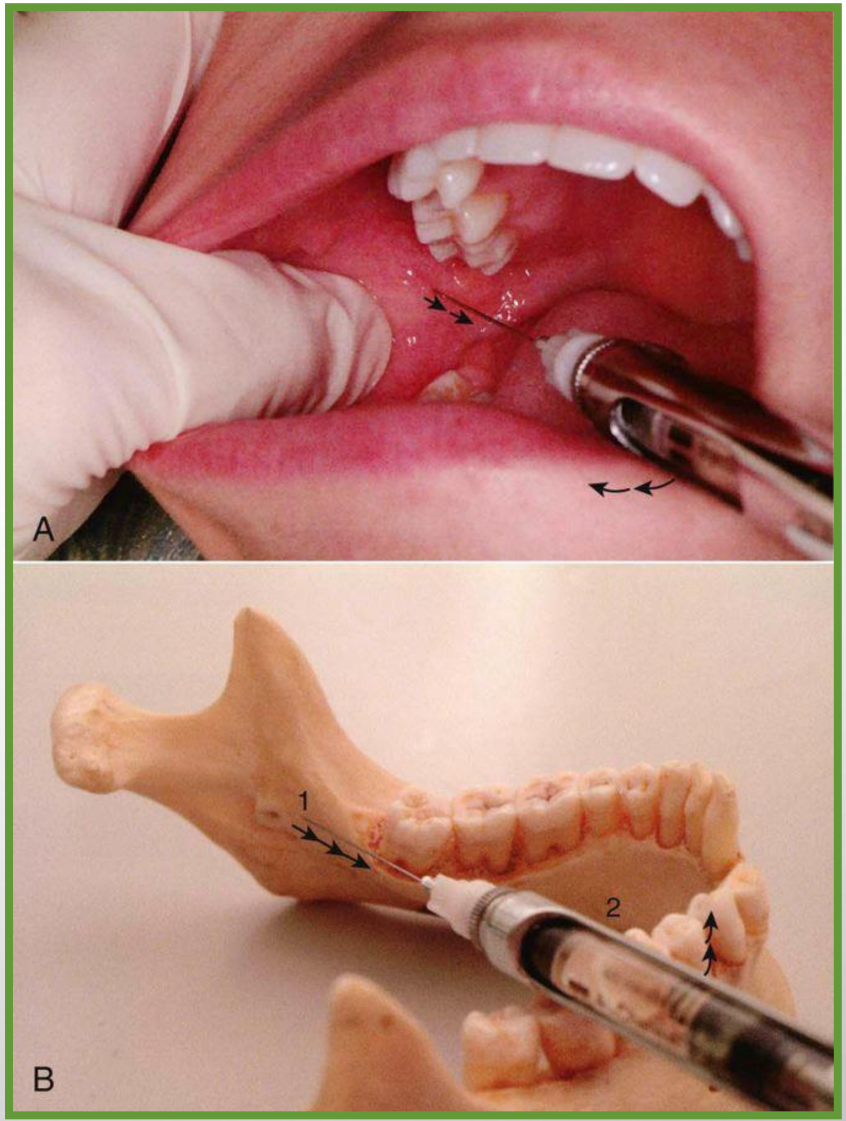




Note the placement of the syringe barrel at the corner of the mouth, usually corresponding to the premolars. The needle tip gently touches the most distal end of the pterygomandibular raphe.

If bony contact is made too soon then the area contacted is probably the internal oblique ridge of the mandible. Deposition of solution here will not anaesthetize the inferior alveolar nerve.

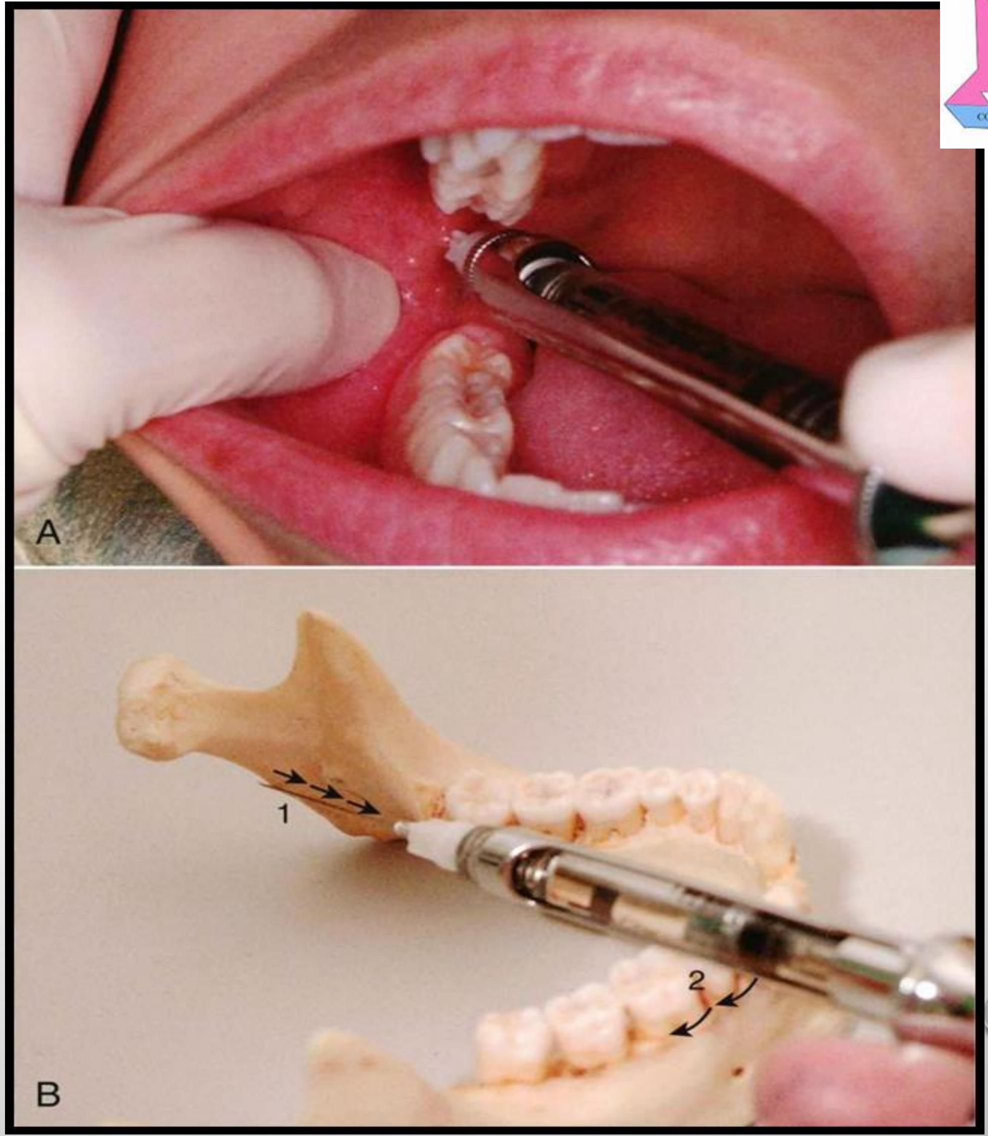
If bone is not palpated then it is possible that the needle is placed too far posteriorly. This can result in the needle entering the parotid gland. Injection into this gland can produce loss of transmission in the motor fibers of the facial nerve (this is a temporary but embarrassing problem).

**A,** The needle is located too far anteriorly (laterally) on the ramus. **B,** To correct: Withdraw it slightly from the tissues (1) and bring the syringe barrel anteriorly toward the lateral incisor or canine (2); reinsert to proper depth.



كلية طب الأسنان جامعة تكريت

**A,** Over- insertion with no contact of bone.
The needle is usually posterior (medial) to the ramus.
**B,** To correct: Withdraw it slightly from the tissues (1) and reposition the syringe barrel over the premolars (2); reinsert.



## 2. The indirect technique

- This modification of the inferior alveolar nerve block is useful in overcoming the problem of contacting bone too soon with the direct method.

- As with the direct technique the patient has the mouth wide open and the operator holds the patient's mandible in the manner described above. This time the needle is introduced *across the occlusal plane of the mandibular teeth on the same side as the injection.* The needle penetrates the same point in the mucosa as described above. After the needle has been inserted about a centimeter the syringe is swung across to the premolars of the opposite side and the injection then continues as described above for the direct method. As this method involves more movement of the syringe than the direct technique, the latter method is preferred as first choice.

# Problems with inferior alveolar nerve block anaesthesia

**The inferior alveolar nerve block is not successful in 100% of cases**

1. Poor technique.

2. An ectopic mandibular foramen. This foramen is not in the same position in every patient (and therefore the standard anatomical landmarks will not apply in every case).

The position varies with age. In young patients the foramen may be below the occlusal plane, in adults it is usually above this level.

3. Bending of the needle during administration. Dental local anesthetic needles are not rigid structures and may be deflected during advancement through tissues. Thus the needle may not reach the intended target area.

4. Accessory nerve supply. The inferior alveolar nerve block may not provide satisfactory anaesthesia owing to the fact that nerves other than the inferior alveolar can provide innervation to the pulps of mandibular teeth.

# Accessory nerve supply

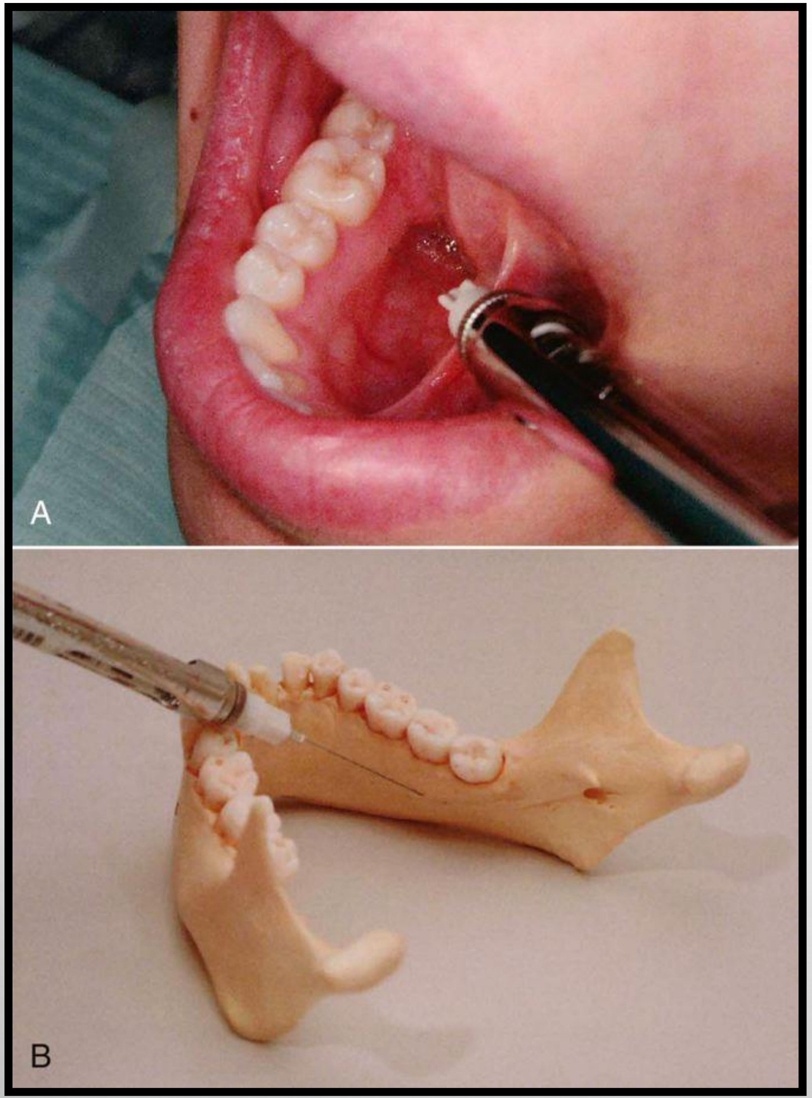
(1) lingual nerve

(2) long buccal nerve

(3) mylohyoid nerve

(4) auriculotemporal nerve

(5) upper cervical nerves




**A,** Retract the tongue to gain access to, and increase the visibility of, the lingual border of the mandible. **B,** Direct the needle tip below the apical region of the tooth immediately posterior to the tooth in question.

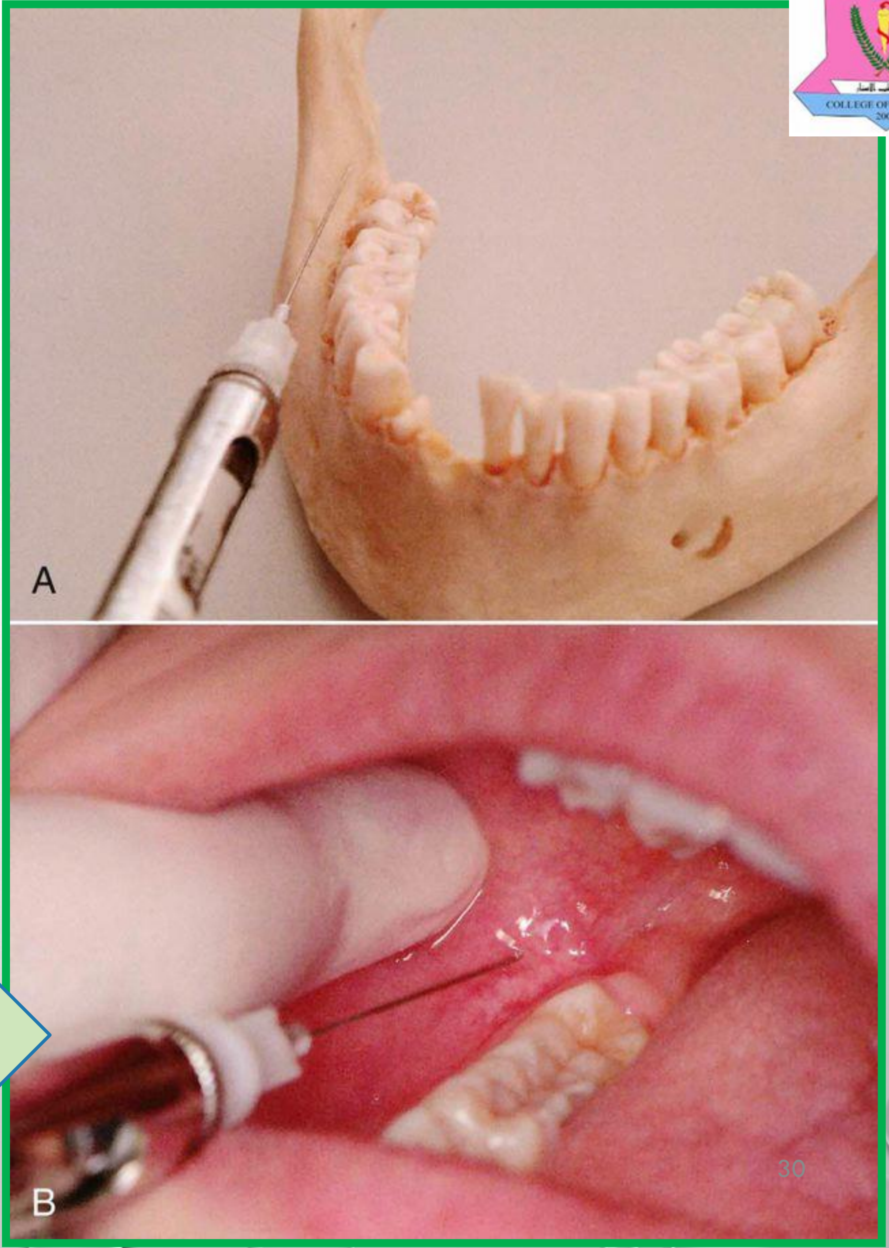
# Long buccal nerve anaesthesia

Area of insertion: Mucous membrane distal and buccal to the most distal molar tooth in the arch

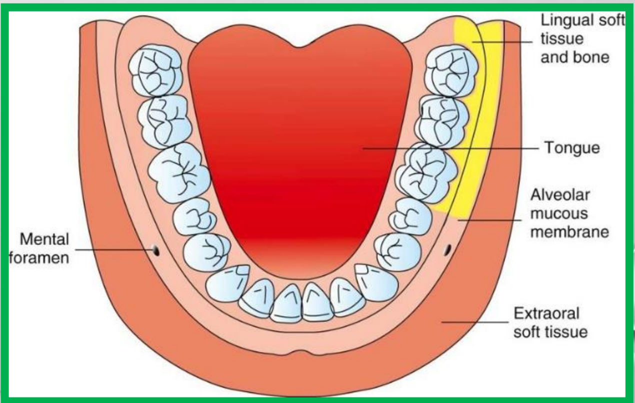
Target area: Buccal nerve as it passes over the anterior border of the ramus

The depth of penetration is seldom more than 2 to 4 mm, and usually only 1 or 2 mm

Syringe alignment. **A,** Parallel to the occlusal plane on the side of injection but buccal to it. **B,** Distal and buccal to the last molar.



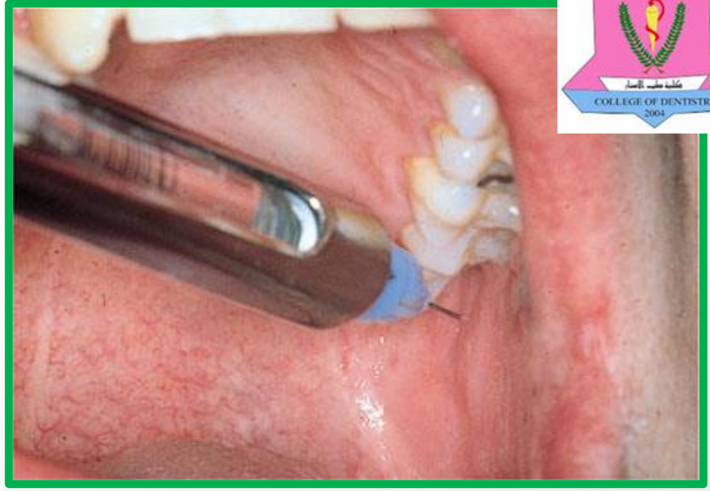
- The long buccal nerve may be anaesthetized at various points along its length.
- This may be performed in a zone from the depth of the mandibular buccal sulcus to the occlusal plane level in the buccal mucosa.
- A true long buccal block can be performed by depositing solution at the anterior aspect of the mandibular ramus.
- The coronoid notch is palpated and the needle is inserted at this point until bony contact is made. The needle is withdrawn slightly, aspiration performed and 0.3- 0.5 mL of solution injected slowly.
- In some patients an anastomosis exists between the long buccal nerve and the inferior alveolar nerve and the former nerve may send accessory supply to the pulps of the teeth via retro molar foramina.



## B- Gow-Gates mandibular nerve block

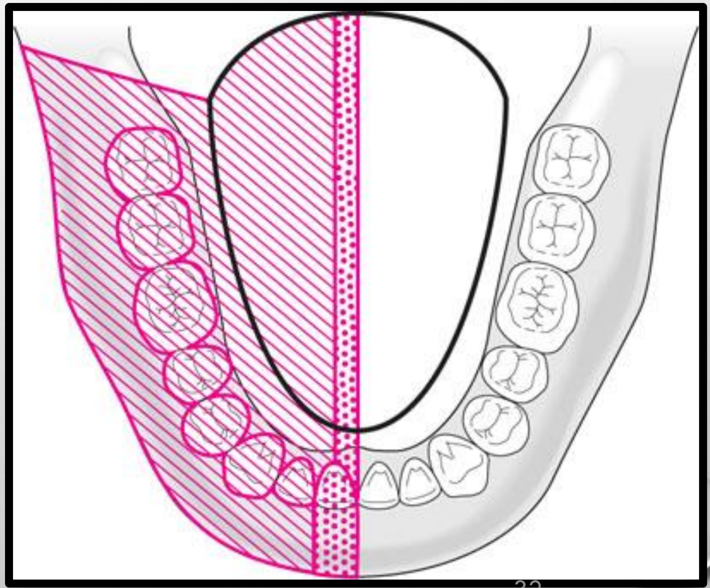
- This method is one of the "high" methods of anaesthetizing the inferior alveolar nerve.

- The advantage of this method is that it can block transmission in many accessory supplies to the dental pulps including that provided by the lingual, long buccal, mylohyoid and auriculotemporal nerves.



- The aim is to deposit solution at the mandibular condyle.

- There is evidence that this technique is more successful than the conventional inferior alveolar nerve block and that there is less likelihood of intravascular injection.

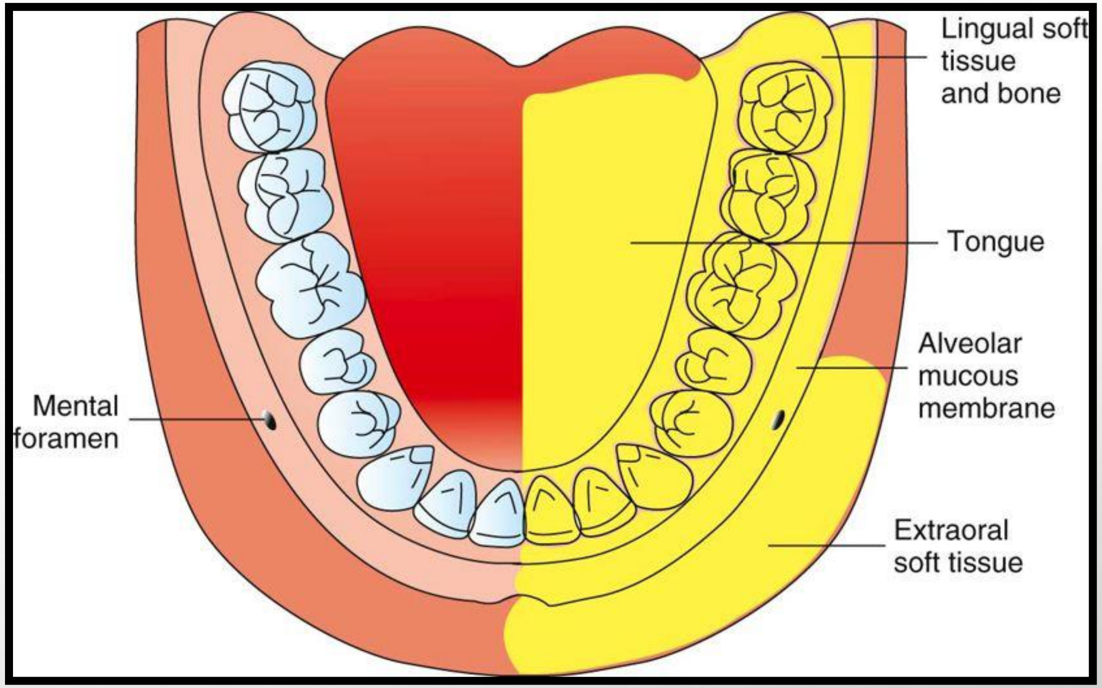


## Nerves Anesthetized

1. Inferior alveolar
2. Mental
3. Incisive
4. Lingual
5. Mylohyoid
6. Auriculotemporal
7. Buccal (in 75% of patients)

## Areas Anesthetized

1. Mandibular teeth to the midline
2. Buccal mucoperiosteum and mucous membranes on the side of injection
3. Anterior two thirds of the tongue and floor of the oral cavity
4. Lingual soft tissues and periosteum
5. Body of the mandible, inferior portion of the ramus
6. Skin over the zygoma, posterior portion of the cheek, and temporal regions



## The technique

1- Patient's mouth opened wide.

2- The syringe is introduced into the mouth parallel to a plane running from the angle of the mouth to the inter-tragal notch of the ear

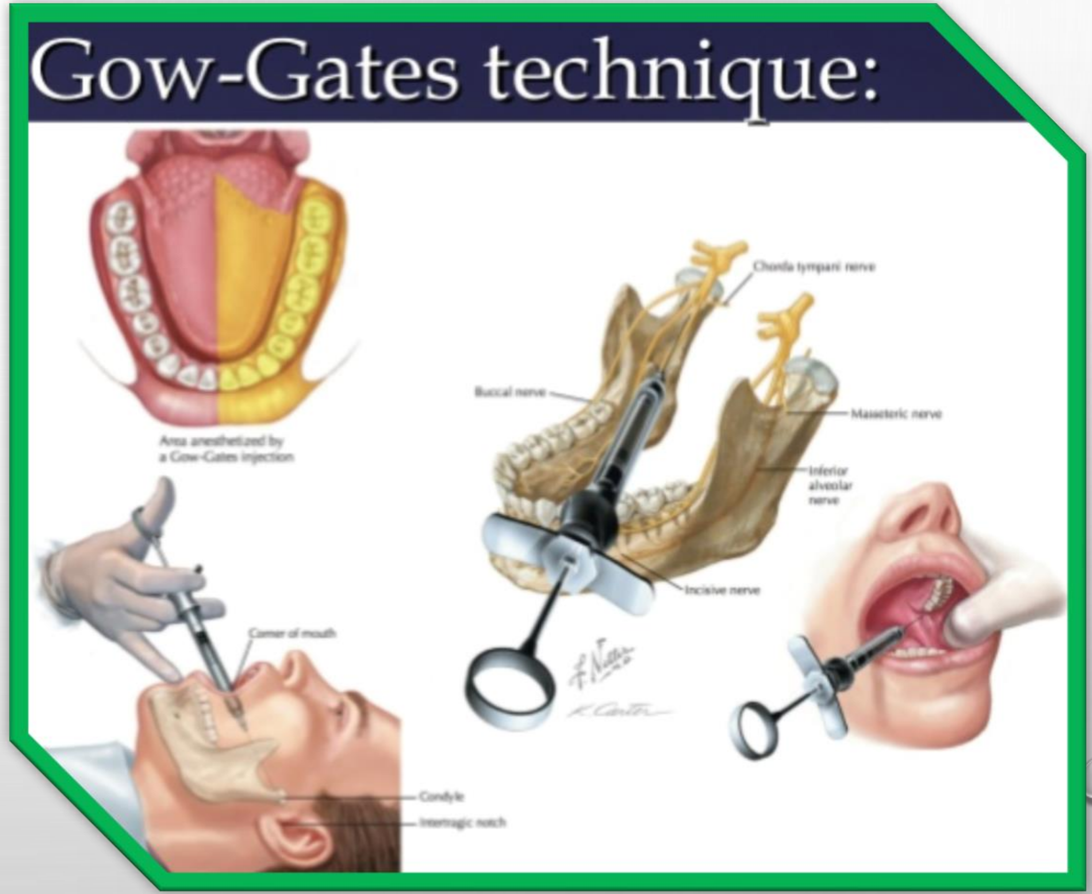
3- Across the opposite maxillary canine. The syringe is then directed across the palatal cusps of the maxillary second molar on the side receiving the injection and enters the mucosa at a point much higher than that penetrated during the standard Halstead approach.

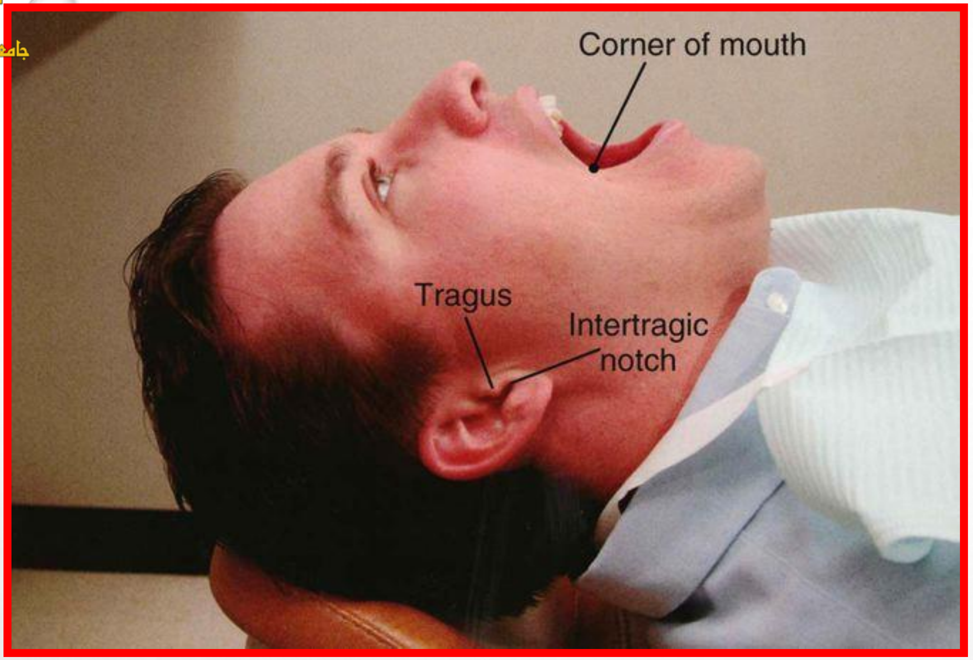
4- The needle is advanced through mucosa until bony contact is made on the condyle, withdrawn slightly and after aspiration the contents of the cartridge are deposited. The average depth of soft tissue penetration to bone is 25 mm

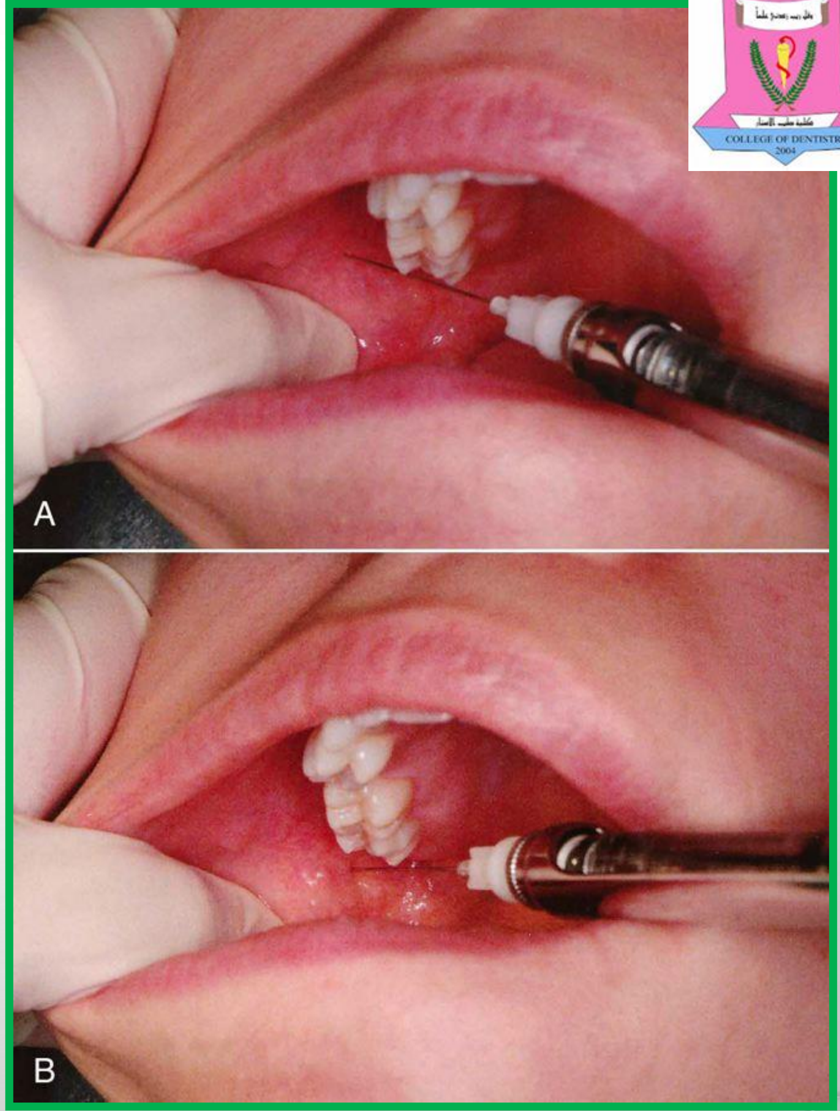
5- The patient maintains the mouth in the open position for a few minutes.

When initially described it was recommended that 3 mL of solution was used and thus a second injection may be required. experience with the GGMNB shows that 1.8 mL is usually adequate to provide clinically acceptable anesthesia in virtually all cases.


Inferior Alveolar
The Gow-Gates nerve block targets these mandibular nerve branches.


Gow-Gates technique:
Area anesthetized by
a Gow-Gates injection
Chorda tympani nerve
Buccal nerve
Masseteric nerve
Inferior
alveolar
nerve
Incisive nerve
Corner of mouth
Condyle
Intertragic notch

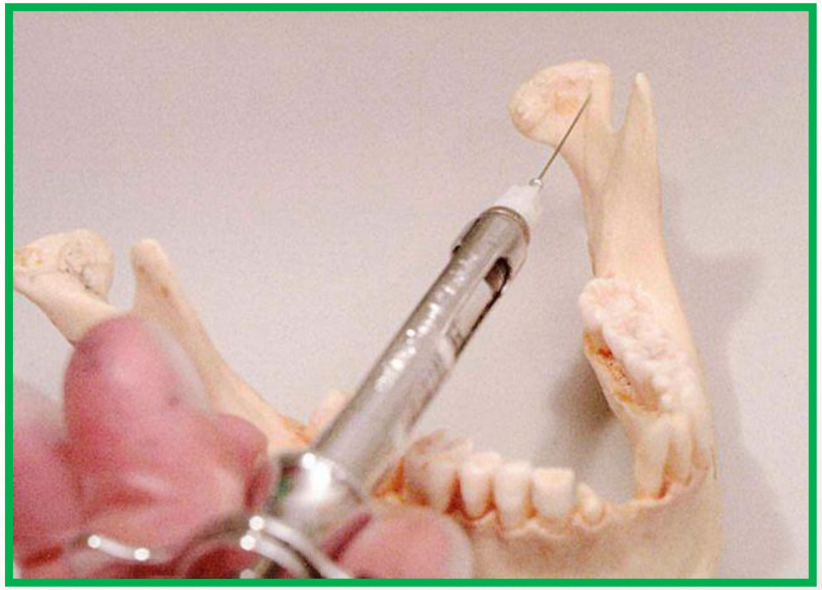


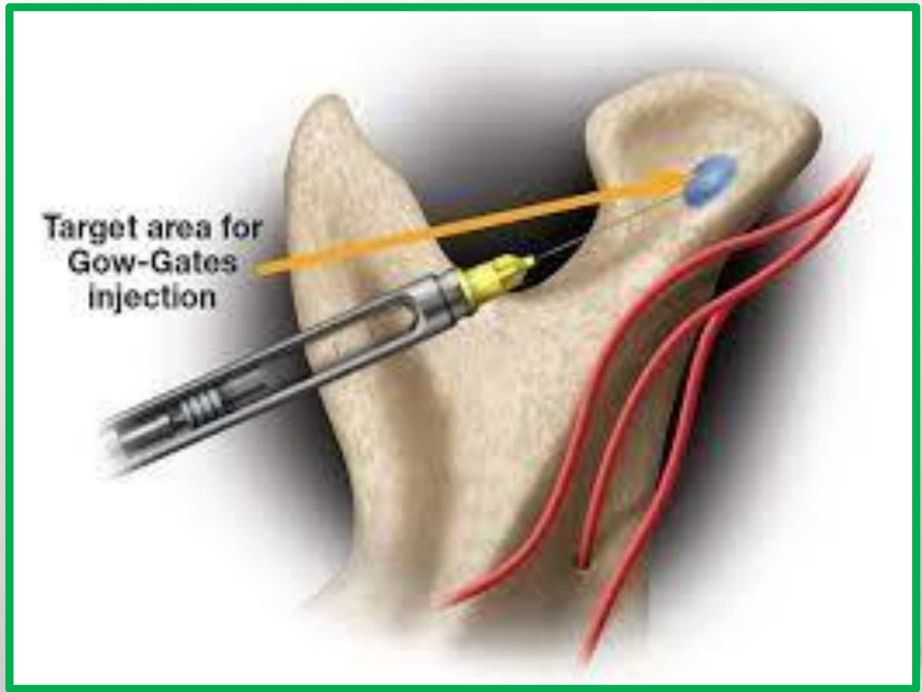



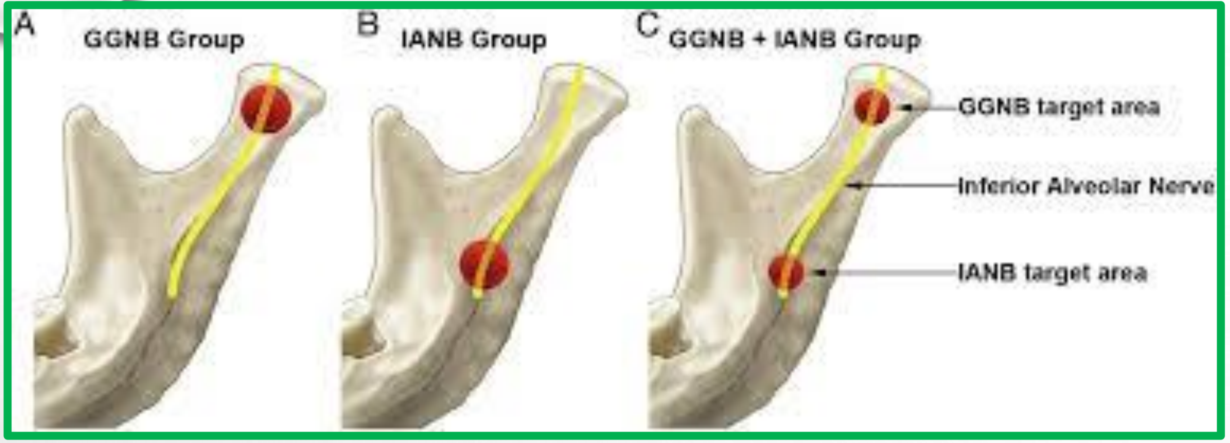

Intraoral landmarks for a Gow-Gates mandibular block. The tip of the needle is placed just below the mesiolingual cusp of the maxillary second molar **(A)** and is moved to a point just distal to the molar **(B)**, maintaining the height established in the preceding step. This is the insertion point for the Gow-Gates mandibular nerve block.

**Area of insertion:** Mucous membrane on the mesial of the mandibular ramus, on a line from the intertragic notch to the corner of the mouth, just distal to the maxillary second molar

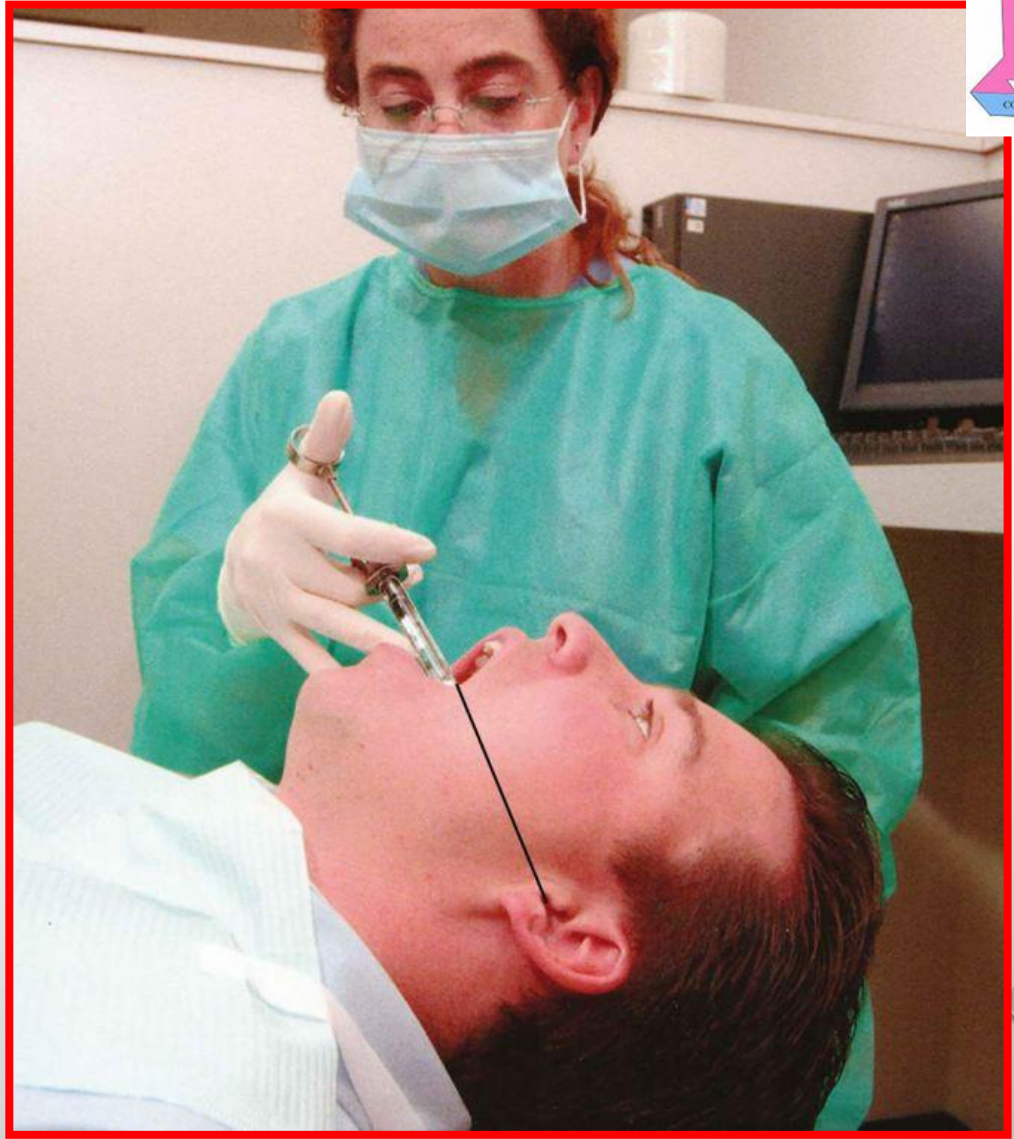
**Target area:** Lateral side of the condylar neck, just below the insertion of the lateral pterygoid muscle








The barrel of the syringe and the needle are held parallel to a line connecting the corner of the mouth and the intertragic notch.

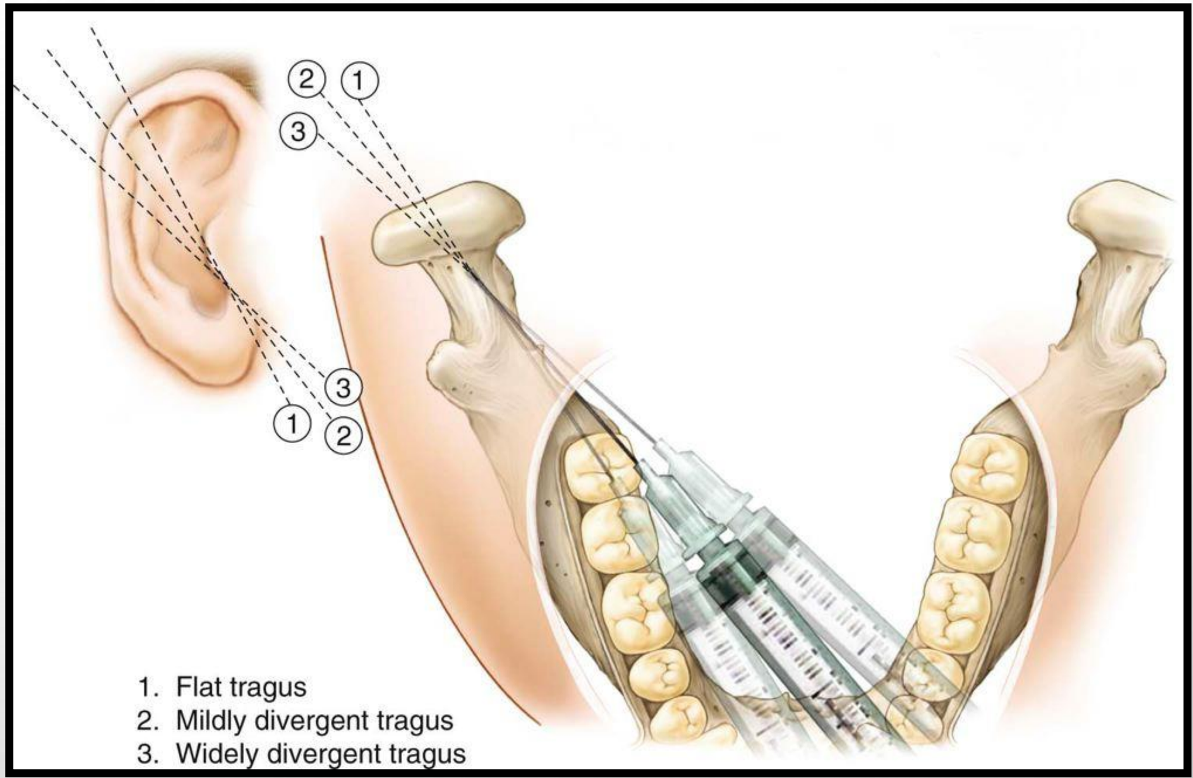


Once the patient closes even slightly, two negatives occur:

(1) The thickness of soft tissue increases

(2) The condyle moves in a distal direction.

Both of these make it more difficult to locate the condylar neck with the needle.



- The Gow-Gates technique is a true mandibular nerve block because it provides sensory anesthesia to virtually the entire distribution of V3. The inferior alveolar, lingual, mylohyoid, mental, incisive, auriculotemporal, and buccal nerves all are blocked in the Gow-Gates injection.

- Significant advantages of the Gow-Gates technique over IANB include its

1. higher success rate
2. its lower incidence of positive aspiration (approximately 2% vs. 10% to 15% with the IANB),
3. and the absence of problems with accessory sensory innervation to the mandibular teeth.

- The time to onset of anesthesia is somewhat longer (5 minutes) than with an IANB (3 to 5 minutes), primarily because of the size of the nerve trunk being anesthetized and the distance of the nerve trunk from the deposition site (approximately 5 to 10 mm).

## Complications::

1- Hematoma (<2% incidence of positive aspiration)

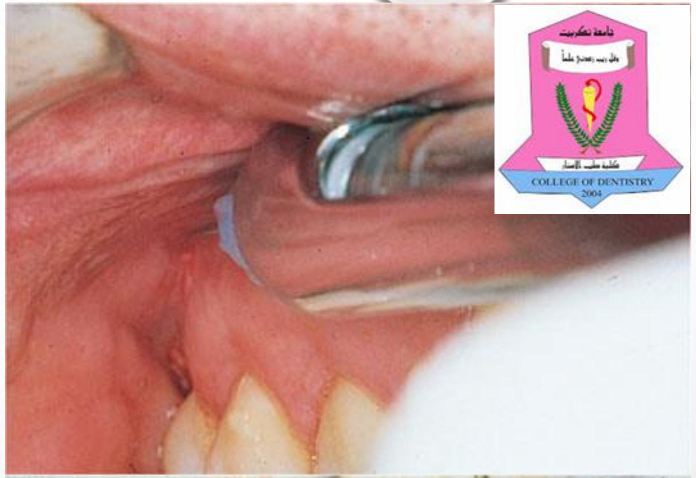
2 - Trismus (extremely rare)

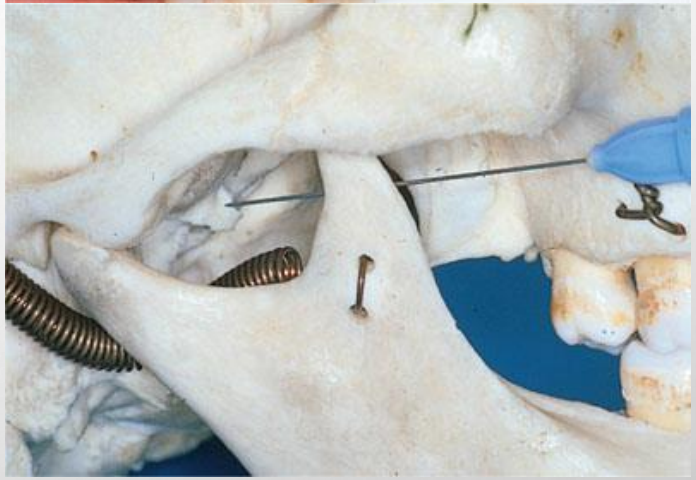
3 - Temporary paralysis of cranial nerves III, IV, and VI. In a case of cranial nerve paralysis after a right Gow-Gates mandibular block, diplopia, right-sided blepharoptosis, and complete paralysis of the right eye persisted for 20 minutes after the injection. This has occurred after the accidental rapid intravenous administration of local anesthetic.

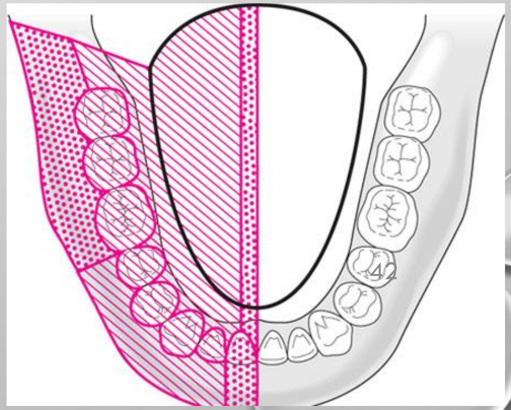
The recommendations of Dr. Gow-Gates include placing the needle on the lateral side of the anterior surface of the condyle, aspirating carefully, and depositing slowly. If bone is not contacted, anesthetic solution should not be administered.

# Akinosi-Vazirani block: (Closed-Mouth Mandibular Block)

- This is another “high” block. It is often referred to as the “Akinosi” technique.
- As was the case with the Gow-Gates technique, it may anaesthetize accessory supply to the dental pulps from the lingual, long buccal and mylohyoid nerves.
- It has no bony end-point. So the depth of soft tissue penetration is somewhat arbitrary.
- Akinosi recommended a penetration depth of 25 mm in the average-sized adult, measuring from the maxillary tuberosity.
- is administered with the patient’s mouth closed.
- It can achieve anaesthesia of the inferior alveolar nerve in cases where access to the normal approach is difficult due to trismus or because of a large or uncontrollable tongue.
- Lower aspiration rate (<10%) than with the inferior alveolar nerve block

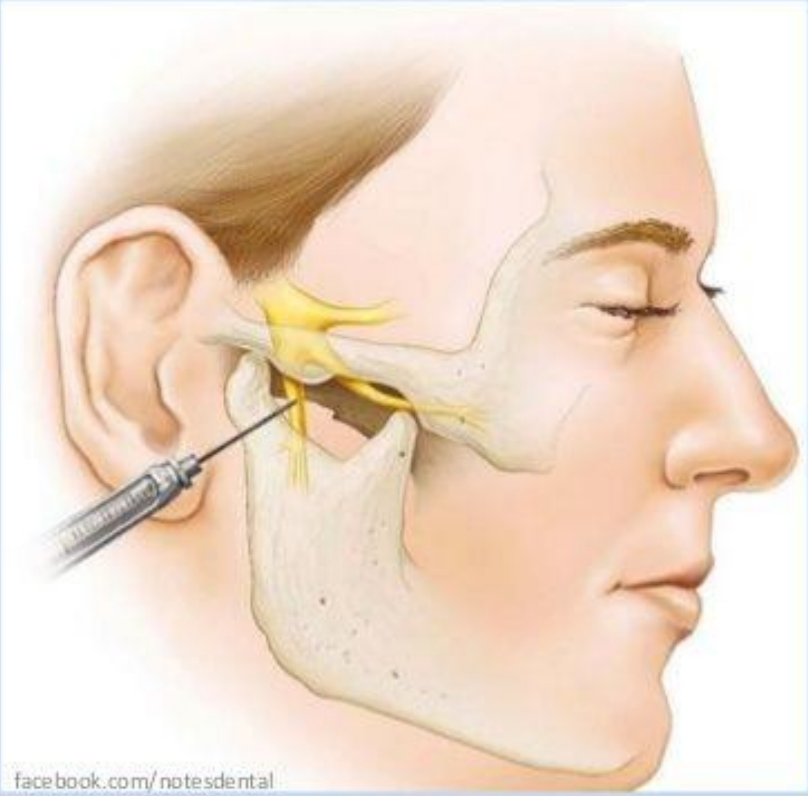




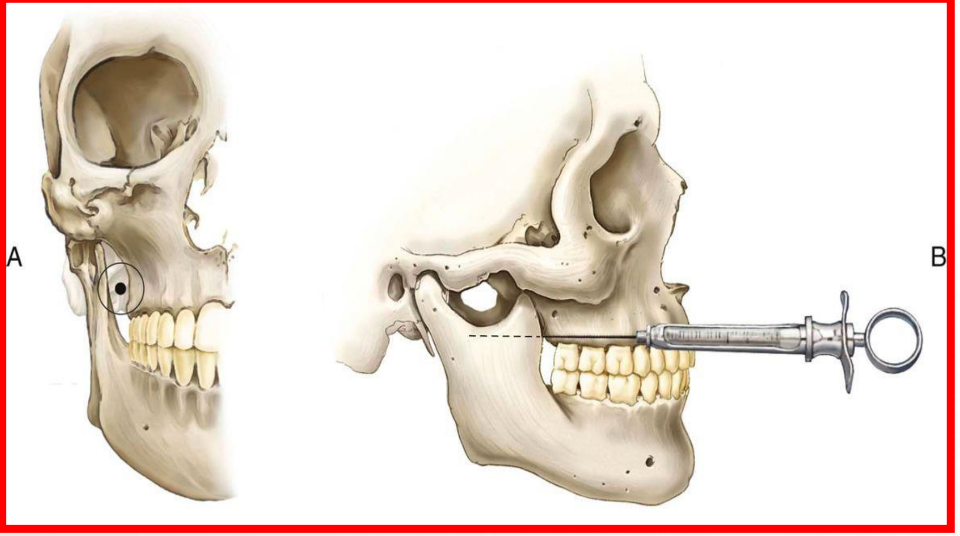


# Vazirani-Akinosi Closed-Mouth Mandibular Block

- Also known as tuberosity technique
- primary indication remains those situations where **limited mandibular opening.**
- **Nerves Anesthetized**
  - Inferior alveolar
  - Incisive
  - Mental
  - Lingual
  - Mylohyoid




Extraoral mandibular block using lateral approach through the sigmoid notch.




**A,** Area of needle insertion for a Vazirani-Akinosi block. **B,**
Hold the syringe and needle at the height of the mucogingival junction above the maxillary third molar.

**Area of insertion**: Soft tissue overlying the medial (lingual) border of the mandibular ramus directly adjacent to the maxillary tuberosity at the height of the mucogingival junction adjacent to the maxillary third molar

**Target area:** Soft tissue on the medial (lingual) border of the ramus in the region of the inferior alveolar, lingual, and mylohyoid nerves as they run inferiorly from the foramen ovale toward the mandibular foramen (the height of injection with the Vazirani-Akinosi being below that of the GGMNB but above that of the IANB)

# The **Technique** is as follows::

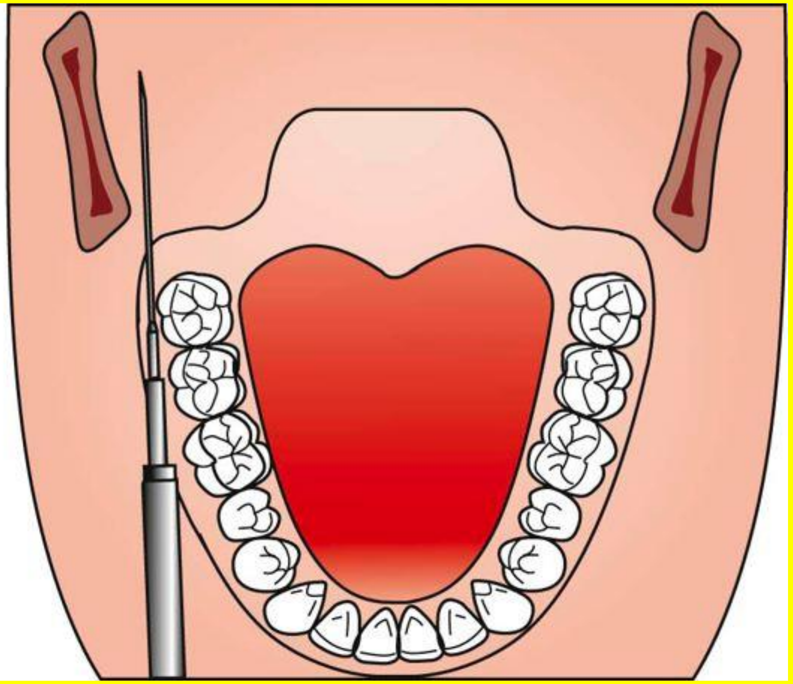
1- Place your left index finger or thumb on the coronoid notch, reflecting the tissues on the medial aspect of the ramus laterally. Reflecting the soft tissues aids in visualization of the injection site and decreases trauma during needle insertion.

2- Ask the patient to occlude gently with the cheeks and muscles of mastication relaxed.

3- Reflect the soft tissues on the medial border of the ramus laterally.

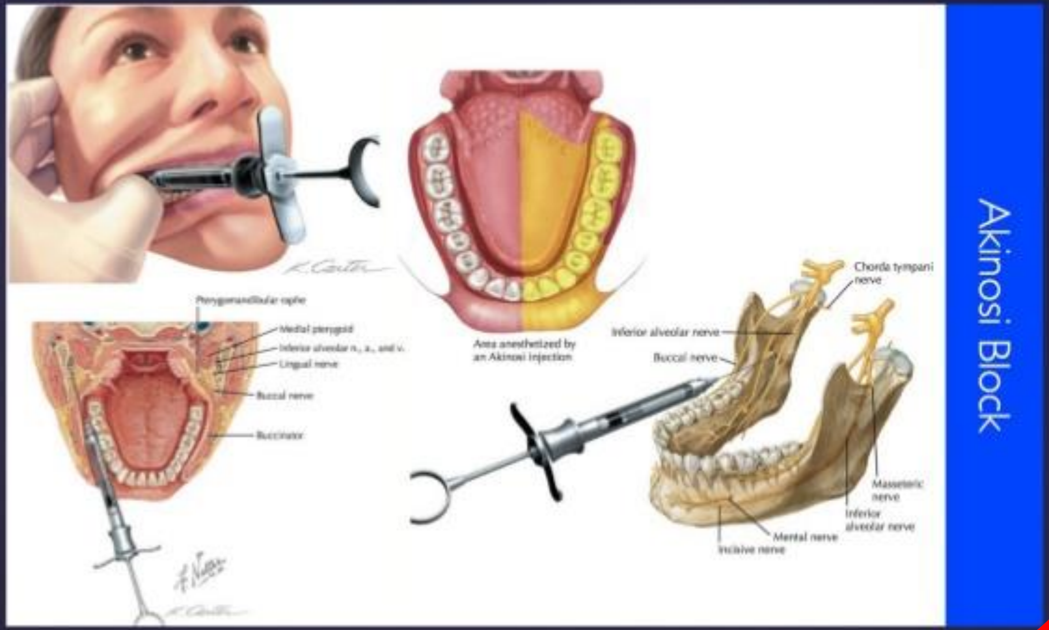
4- The barrel of the syringe is held parallel to the maxillary occlusal plane, with the needle at the level of the mucogingival junction of the maxillary third (or second) molar

5- Advance the needle 25 mm into tissue (for an average-sized adult). This distance is measured from the maxillary tuberosity. The tip of the needle should lie in the mid-portion of the pterygomandibular space, close to the branches of V3

- Vazirani-Akinosi closed-mouth mandibular nerve block. Barrel of syringe is held parallel to maxillary occlusal plane with the needle at the level of the mucogingival junction of the second or third maxillary molar.
- Advance the needle posteriorly into tissues on the medial side of the mandibular ramus.

# Vazirani- Akinosi closed mouth technique:




- Orientation of the bevel (bevel orientation in the closed-mouth mandibular block is very important): The bevel must be oriented away from the bone of the mandibular ramus.

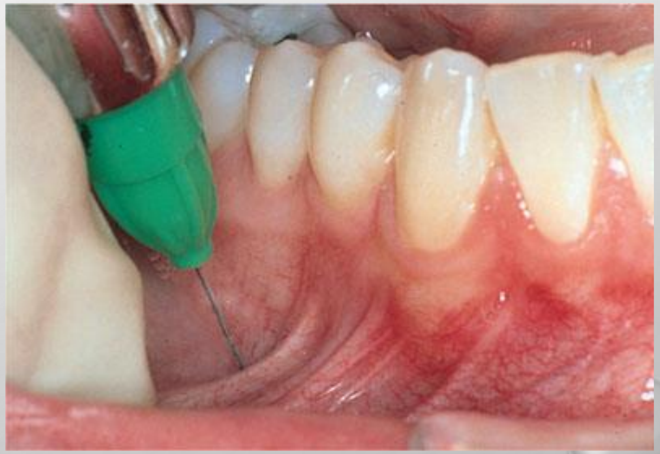
- Deposit 1.5 to 1.8 mL of anesthetic solution in approximately 60 seconds.

- Motor nerve paralysis develops as quickly as or more quickly than sensory anesthesia. The patient with trismus begins to notice increased ability to open the jaws shortly after the deposition of anesthetic.

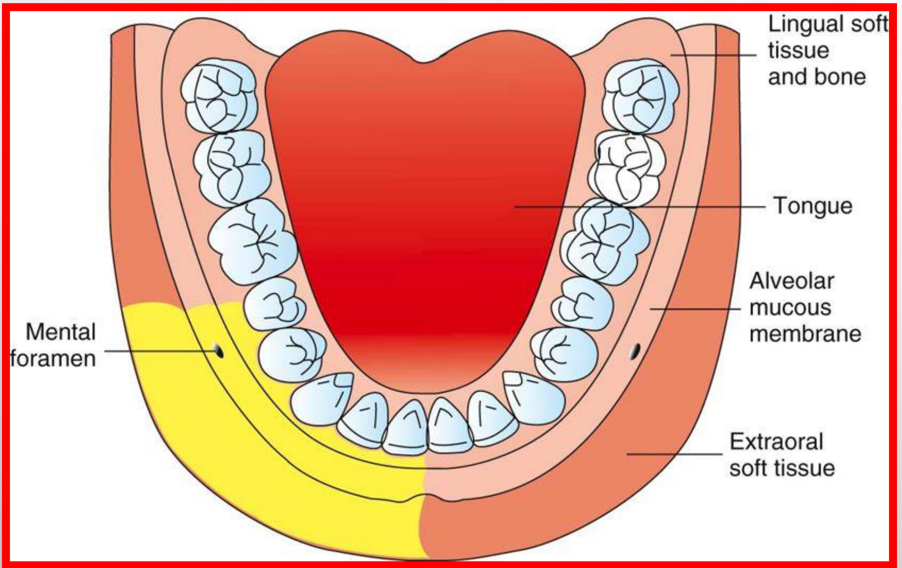
# Akinosi-Vazirani block

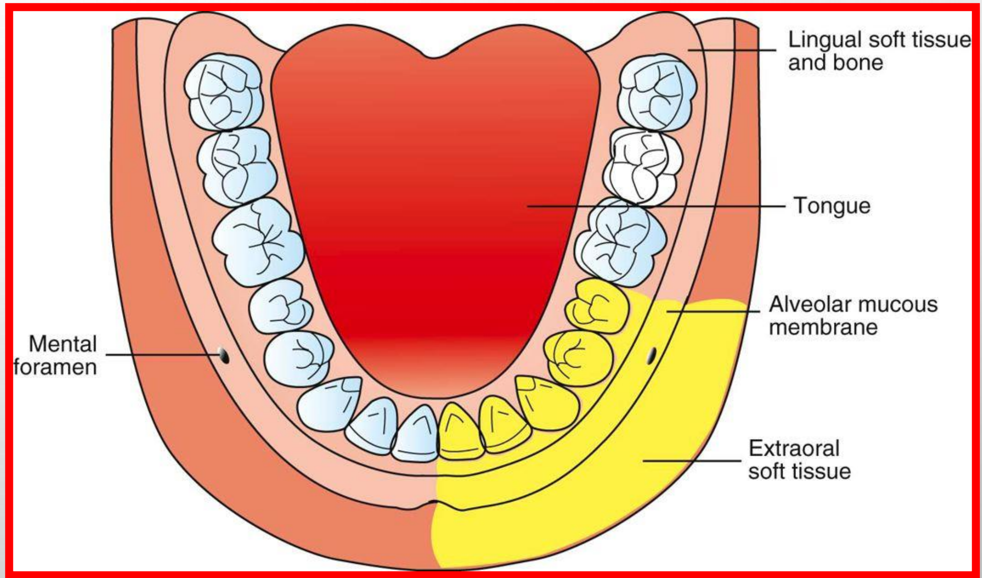
# Incisive and mental nerve block::

- involves depositing local anesthetic solution at the mental foramen. The hope is that sufficient solution will enter the foramen to block transmission in the incisive nerve to anaesthetise the premolar and anterior mandibular teeth.
- As is the case with the mandibular foramen, the mental foramen is not in a constant position although it can be visualized in periapical radiographs. Unfortunately, it is not always apparent on panoramic radiographs.
- This injection is useful in providing soft tissue anaesthesia, as the mental nerve is readily accessible in the soft tissues.
- The amount entering the foramen to anaesthetize the incisive branch must vary. The patient has the mouth partly open and the needle is inserted through reflected mucosa aiming for bone in the region between the premolar apices

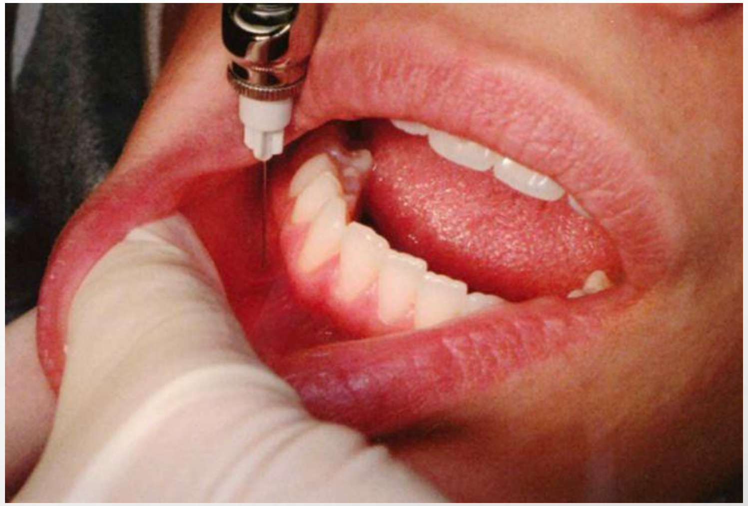


- Once bone is contacted!!!! the needle is withdrawn slightly, aspiration performed and 1.5 mL of solution deposited slowly. Massaging the tissues following injection may encourage entry of solution into the mental foramen.



Positive Aspiration 5.7%



Area of insertion: Mucobuccal fold at or just anterior to the mental foramen.

Target area: Mental nerve as it exits the mental foramen (usually located between the apices of the first and second premolars)

- The mental foramen usually is found around the apex of the second premolar. However, it may be found anterior or posterior to this site.

- Advance the needle slowly until the foramen is reached. The depth of penetration is 5 to 6 mm. For the mental nerve block to be successful, there is <u>no need to enter the mental foramen or to contact bone.</u>

**- For Incissive n.** Advance the needle slowly until the mental foramen is reached. The depth of penetration is 5 to 6 mm. There is no need to enter the mental foramen for the incisive nerve block to be successful.

# Supplementary anesthesia

Methods of anaesthesia other than infiltration and regional block methods that are used in dentistry

- Topical anaesthesia
- Jet injection
- Intrapapillary anaesthesia
- Intraosseous anaesthesia
- Intraligamentary anaesthesia
- Intraseptal anaesthesia
- Intrapulpal anaesthesia
- Transcutaneous electronic nerve stimulation.

## 1- Topical Anesthesia

Topical anesthetics may achieve beneficial effects prior to needle penetration. Such effects may be psychological or pharmacological.

Factors that influence the pharmacological efficacy of topical anesthetics include:

- The agent employed
- Duration of application
- Site of application

The transfer of the anesthetic through the mucosa is concentration dependent

## The agent

Different delivery vehicles are used to administer topical anesthetics. These include:

- aerosols
- ointments
- gels
- pastes
- powders!
- solutions!

## Site

The effectiveness of topical anaesthesia varies in different parts of the mouth.

best

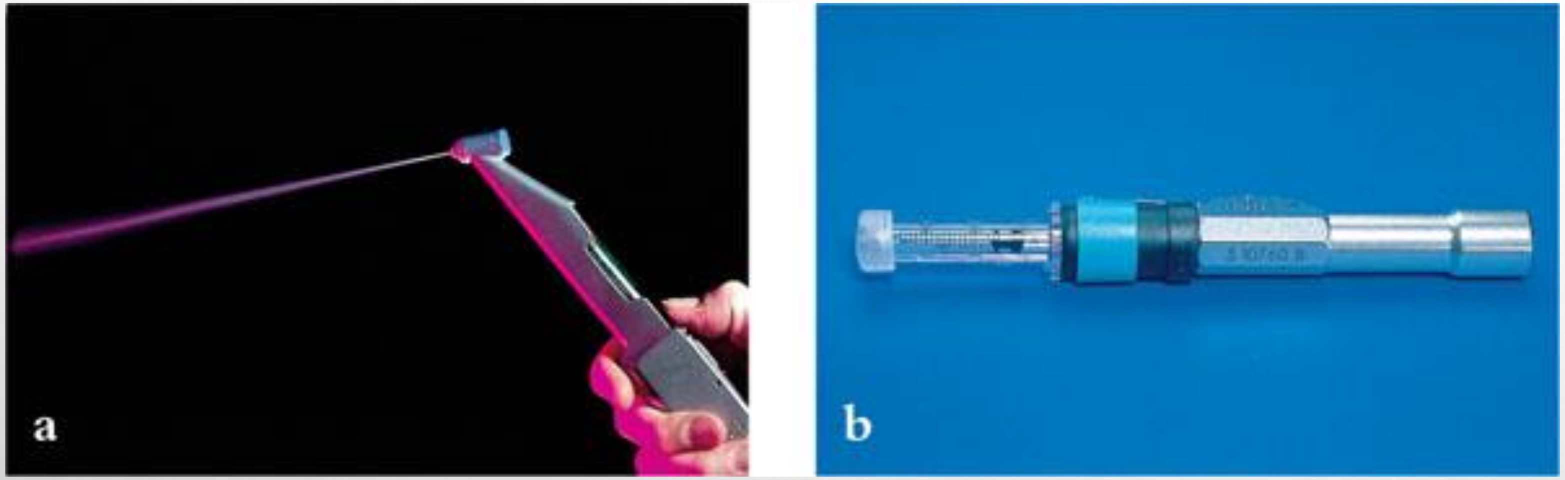
1. Mandibular buccal fold
2. Maxillary buccal fold
3. Palatal mucosa

@@@ Uses in infiltration vs regional block?

some reductions in the response of dental pulps to electrical stimulation have been reported following application of topical anaesthesia to the overlying mucosa !!!

# 2- JET INJECTION

Jet injection works by forcing anesthetic through mucosa under pressure




Some devices accept dental local anesthetic cartridges; with others the solution has to be drawn up into a reservoir in the injector.

## Effectiveness

- The technique has been shown to provide enough anaesthesia in some cases to allow extraction of teeth.
- On the other hand it is not 100% effective in reducing injection discomfort of needle penetration after surface anaesthesia with jet injection.
- The efficacy is dependent upon the concentration of local anesthetic used.

## Disadvantages

1. Occasionally hematoma formation at the site of use.
2. Spillage of anesthetic solution into the mouth tastes unpleasant.

# 3- Intra-papillary Anaesthesia

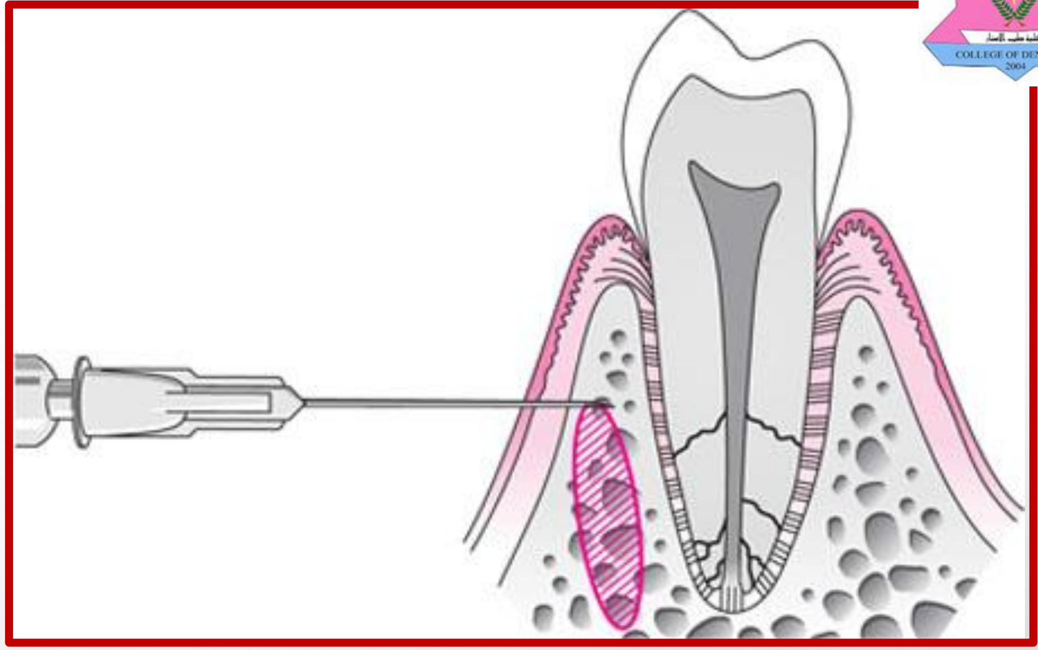
1. Localized anaesthesia and hemorrhage control during periodontal surgery.
2. Palatal anaesthesia following buccal infiltration.

It is particularly useful in children

The needle is inserted at the buccal aspect of the papilla; a site about 2 mm apical to the tip of the papilla is ideal

the needle parallel to the occlusal plane and solution injected slowly. Blanching of the papilla indicates successful deposition.

# 4- Intraosseous Anaesthesia



- Deposition of anesthetic solution directly into the cancellous space

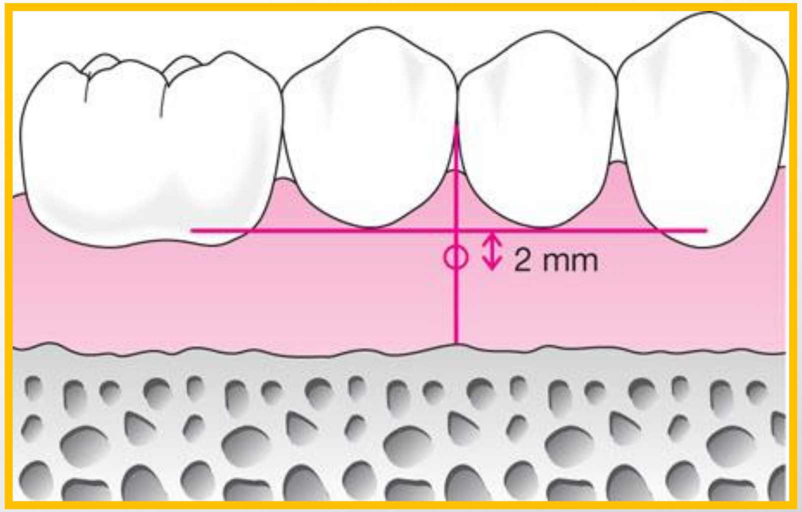
- Technique may be performed with conventional dental local anesthetic delivery systems. however, the introduction of specialized equipment has made this method easier to carry out.

1- The point of penetration is identified

2- It should lie in attached gingiva and is determined by imagining two lines perpendicular to one another.

3- The horizontal line passes along the buccal gingival margins of the teeth. The vertical line bisects the distal interdental papilla of the tooth that is being anaesthetized.

4- The site of perforation is 2 mm apical to the intersection of these lines.



- The area of perforation is infiltrated with 0.2 mL of local anesthetic.

- The perforator is used one minute later when gingival anaesthesia has occurred. When using the specialized equipment the perforator is advanced through the anaesthetized gingiva and bone using a slow speed hand piece

- Following removal of the perforator, the short (6 mm) 27-gauge needle is inserted through the perforation into the cancellous space

- About 1 mL of solution is delivered slowly (over a two-minute period)
- 0.5 if single or 2 teeth, 1.8 if multiple teeth to be treated

The technique should be avoided in cases of

1. Active periodontal disease
2. Limited attached gingiva
3. Little inter-radicular bone.

## Duration and spread of anaesthesia

The onset of intraosseous anaesthesia is rapid, ranging from 10 to 120 seconds. The success falls off rapidly over an hour and the decline in anaesthesia seems to be more rapid with anterior teeth.

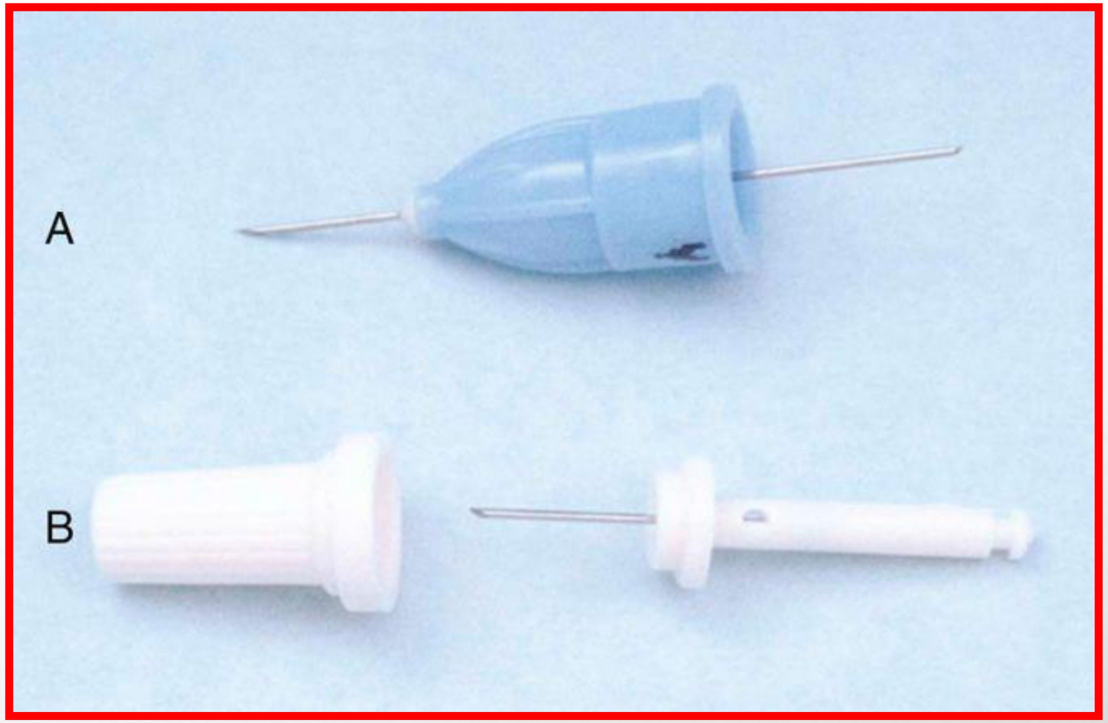
## Advantages of intraosseous anaesthesia

- a smaller dose is required
- a smaller area of soft tissue anaesthesia is produced
- the method aids in overcoming failure of conventional techniques.

## Disadvantages of intraosseous anesthesia

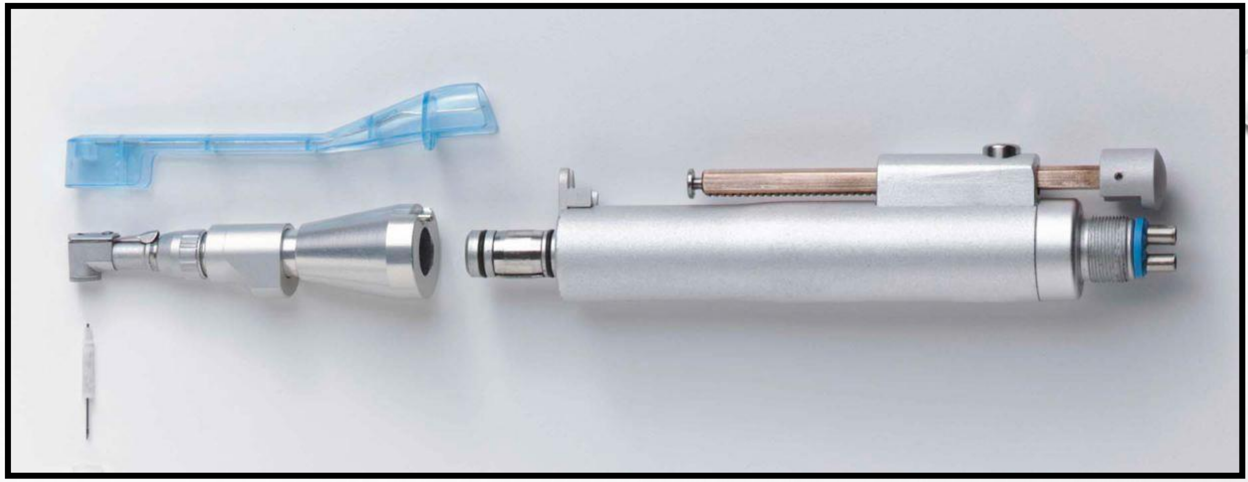
- Technically more difficult than infiltration anaesthesia
- Specialized equipment may be required
- Systemic effects may be increased
- Post-injection discomfort may be produced
- Teeth may be damaged.

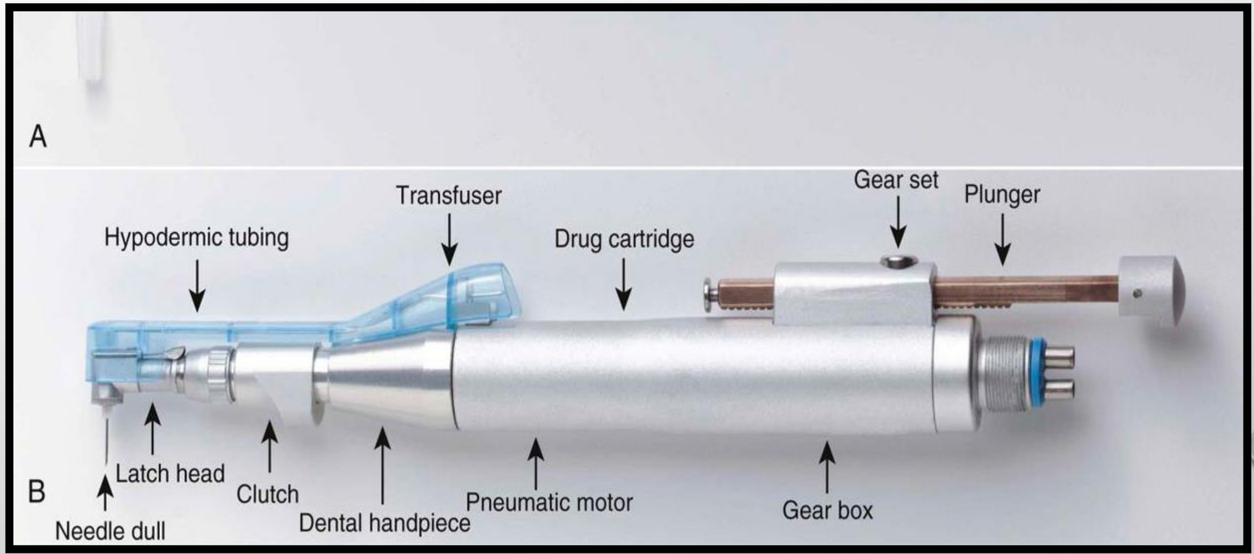
Originally, IO anesthesia necessitated the use of a half-round bur to provide entry into inter-septal bone that had been surgically exposed. Once the hole had been made, a needle would be inserted into this hole and local anesthetic deposited.

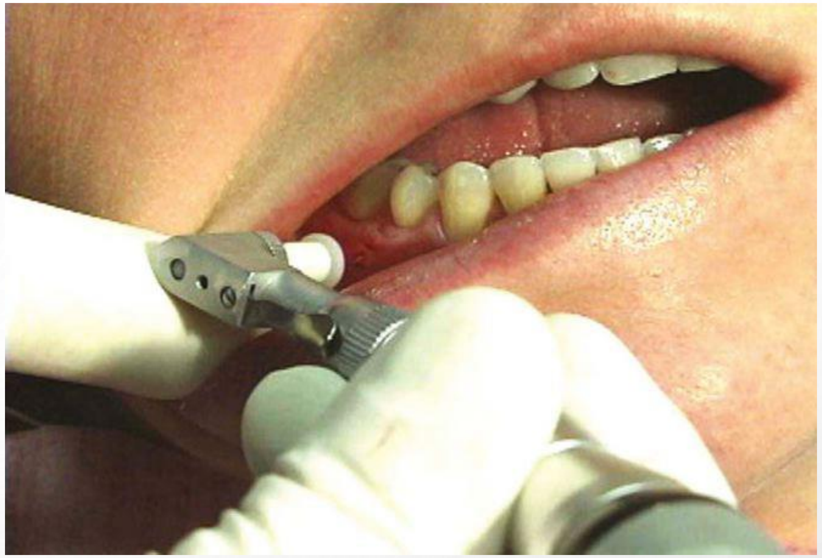


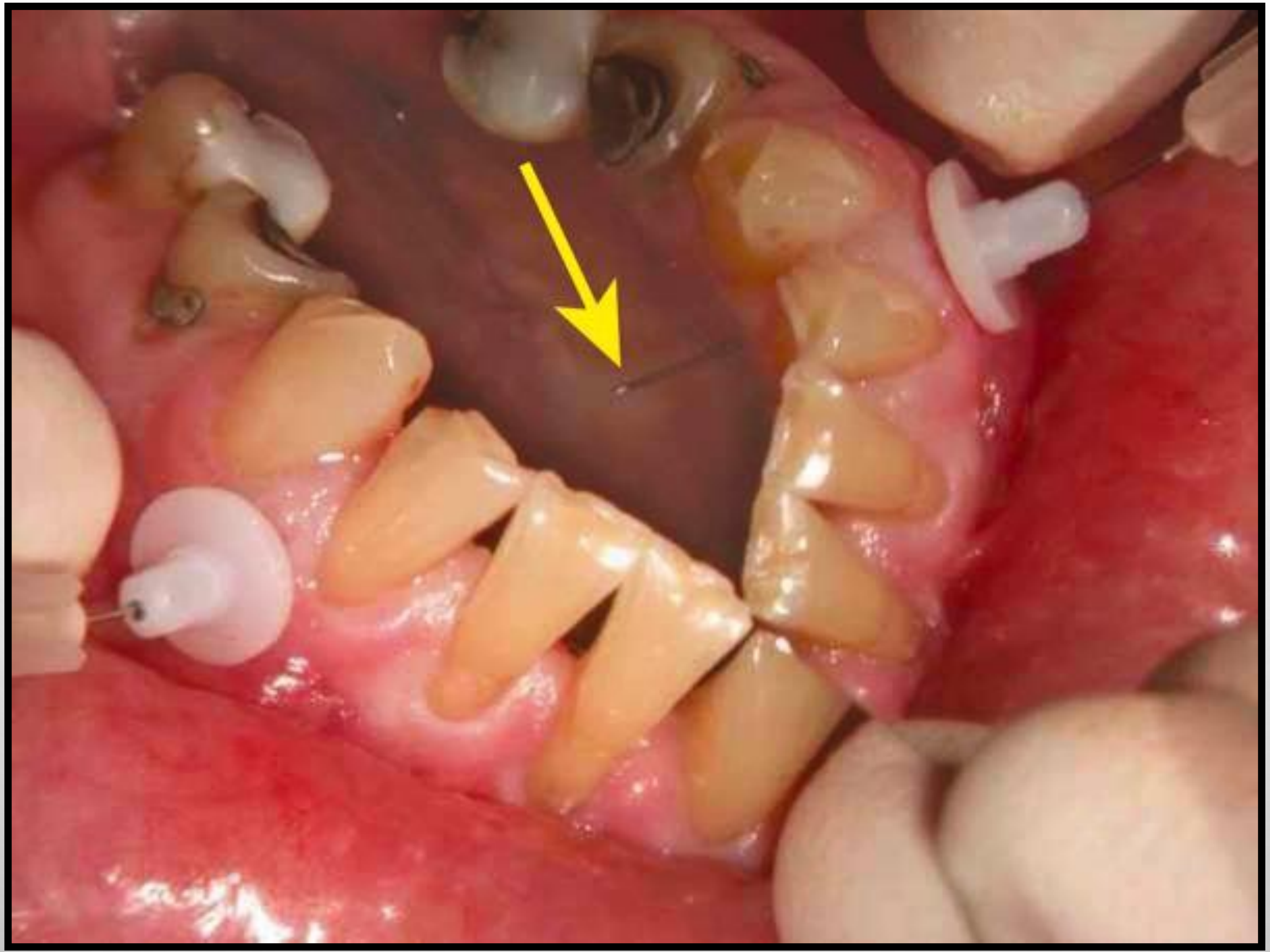

- The Stabident System consists of two parts: a perforator—a burr that perforates the cortical plate of bone with a conventional slow-speed contra-angle handpiece—and an 8-mm long, 27-gauge needle that is inserted into this predrilled hole for anesthetic administration

The IntraFlow HTP Anesthesia Delivery System, which was recently introduced, combines the two steps of x-tip into one



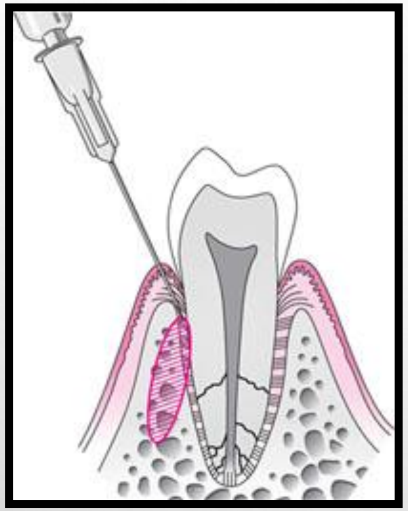


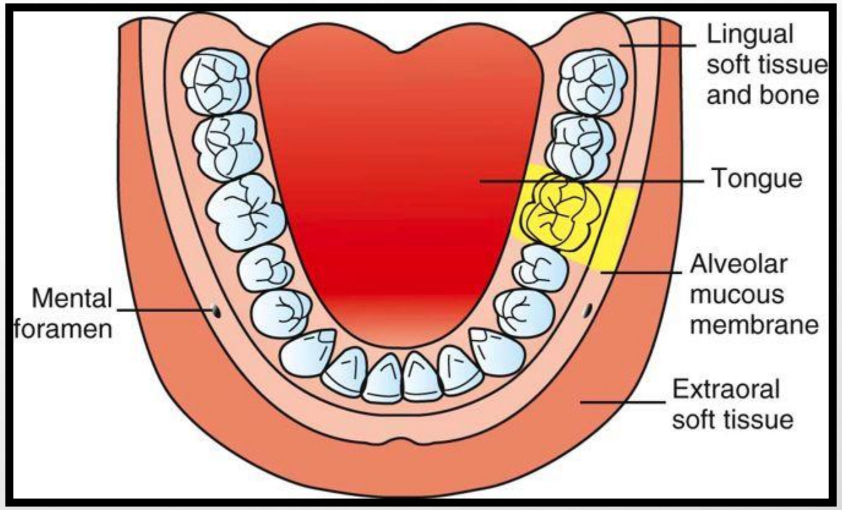




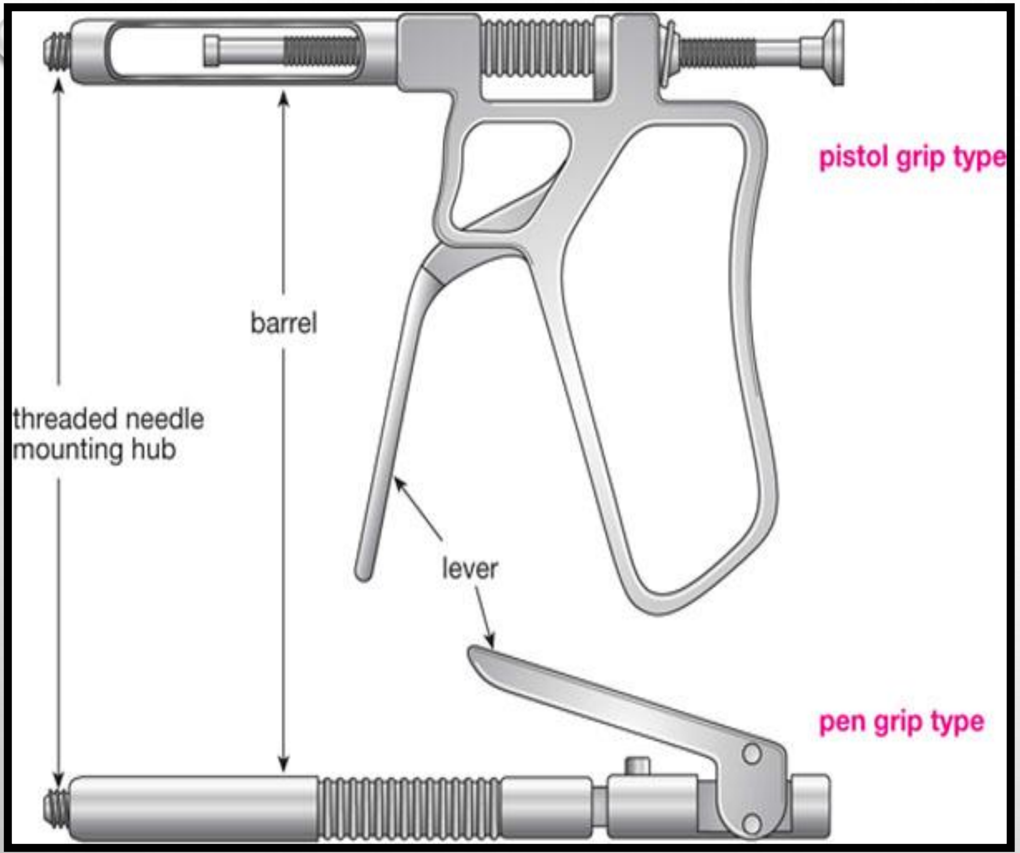
# 5- Intra-ligamentary (Periodontal Ligament) Anaesthesia

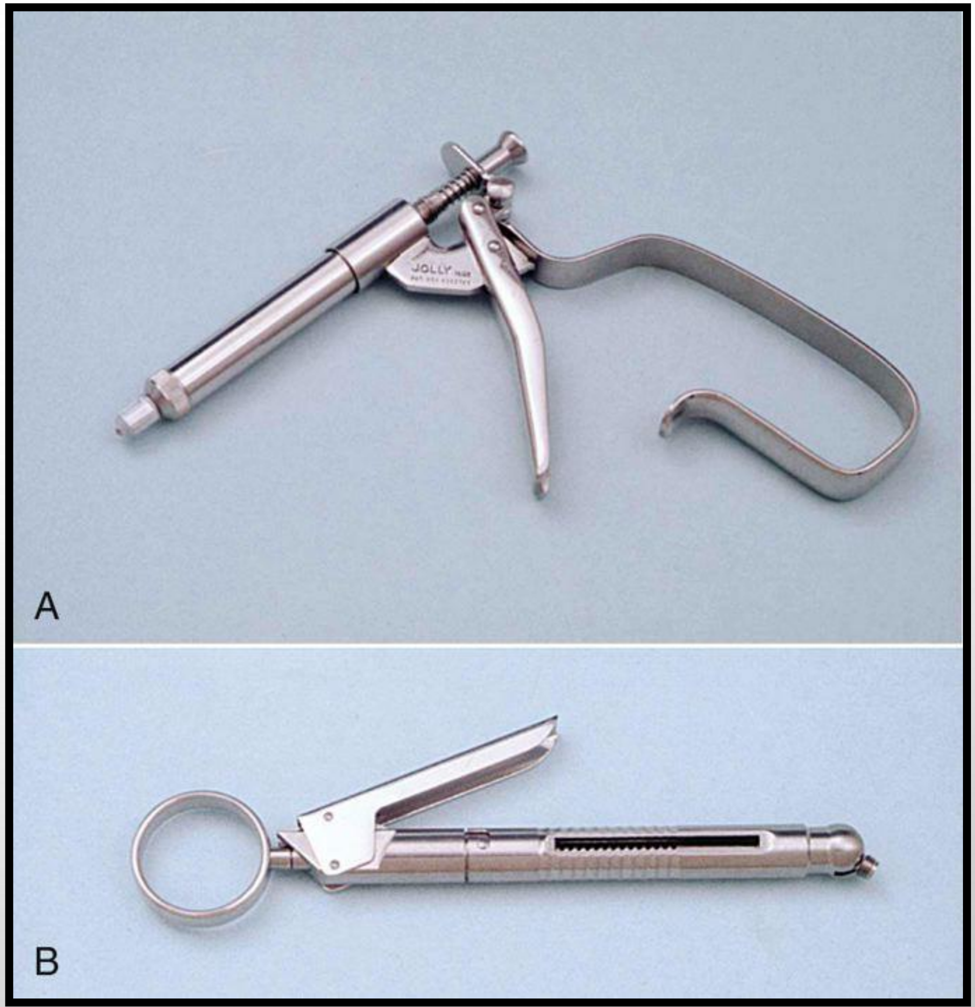
- Solution injected via the periodontal ligament reaches the pulpal nerve supply by entering the cancellous bone via perforations in the socket wall, not by travelling down the length of the ligament






- Potential benefit of the PDL injection lies in the fact that it provides pulpal and soft tissue anesthesia in a localized area (one tooth) of the mandible without producing extensive soft tissue (e.g., tongue and lower lip) anesthesia as well.


pistol grip type
barrel
threaded needle
mounting hub
lever
pen grip type


A
B

## Duration and spread of intra-ligamentary anaesthesia

The duration of intraligamentary anaesthesia between individuals is marked. The duration of reliable pulpal anaesthesia is around 15 minutes for single-rooted teeth and rather less for molars. Intra-ligamentary anaesthesia is not a single-tooth anesthetic. Spread of anaesthesia to adjacent teeth occurs with both specialized and conventional syringes but appears to happen more frequently with the former type.

## Technique

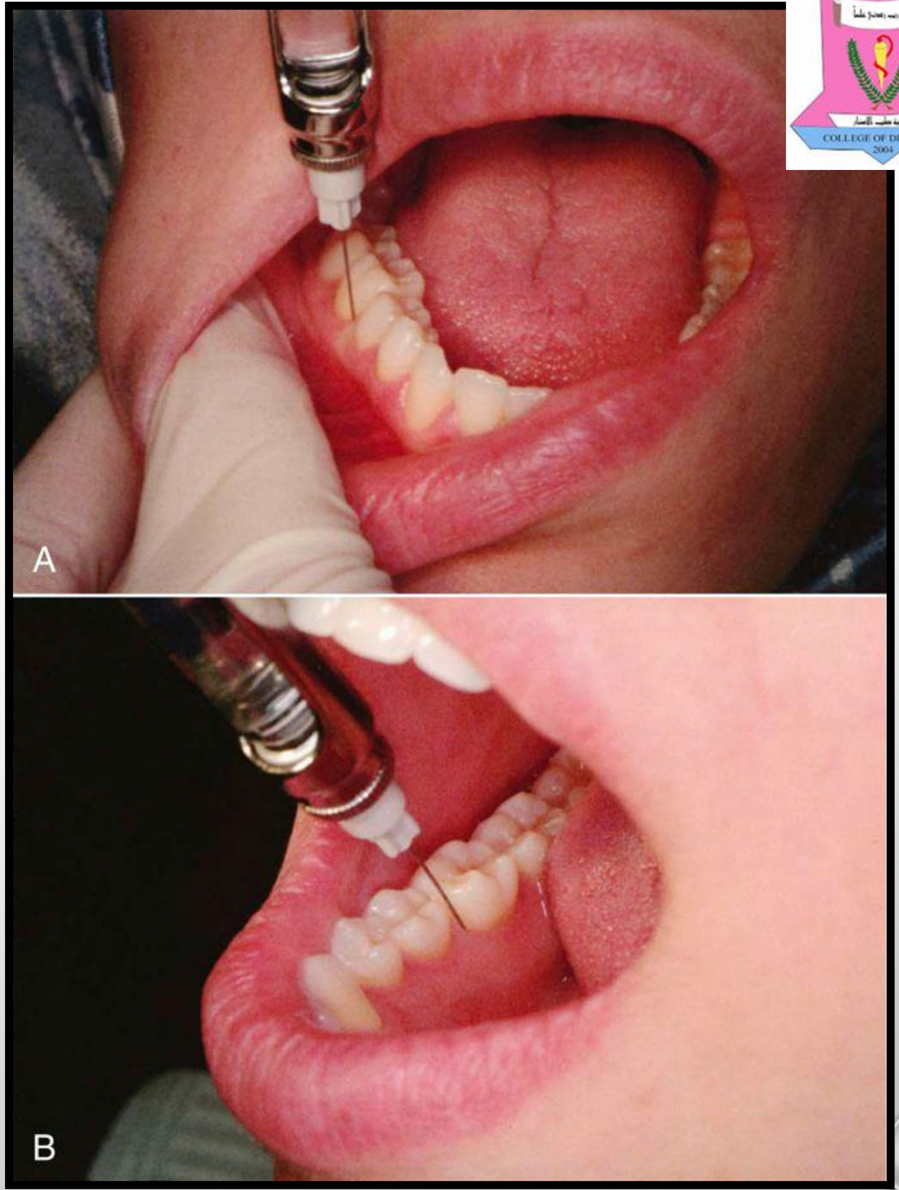
- It is recommended that the site of penetration is swabbed with an antiseptic solution.
- Although the injection can be performed using either conventional or specialized syringes, it is easier with an intraligamentary syringe.??
- A 30-gauge needle is recommended. The needle is inserted at the mesio-buccal aspect of the root(s) at 30 degrees to the long axis of the tooth. The needle is advanced to maximum penetration until it is wedged between the tooth and the alveolar crest. Progression deep into the periodontal ligament is not usually possible.
- Once the needle is correctly positioned, the solution is injected under backpressure. It is recommended that 0.2 mL of solution is deposited into the periodontium of each root.
- When using the specialized syringes the needle should remain in position for about 10 seconds following depression of the lever to allow escape of solution from the cartridge.

There are two important indicators of success of the injection:

(1) Significant resistance to the deposition of local anesthetic solution

(2) Ischemia of the soft tissues adjacent to the injection site. (This is noted with all local anesthetic solutions but is more prominent with vasoconstrictor-containing local anesthetics.)

- If the tooth is multi-rooted, remove the needle and repeat the procedure on the other root(s).



## Advantages of intraligamentary anaesthesia

- smaller dose required
- rapid onset of anaesthesia
- the method aids in overcoming failure of conventional techniques
- only a small area of soft tissue is anaesthetized
- it is useful in the mandible for patients with bleeding diatheses. (avoid reginal block)
- Its use as a possible aid in the diagnosis (e.g., localization) of mandibular pain

## Disadvantages of intraligamentary anaesthesia

- the production of a bacteraemia
- increased systemic effects
- peri- and postinjection discomfort can occur
- damage to dental and periodontal tissues can be caused
- damage to equipment may be produced.

**Contraindications to the PDL injection:**

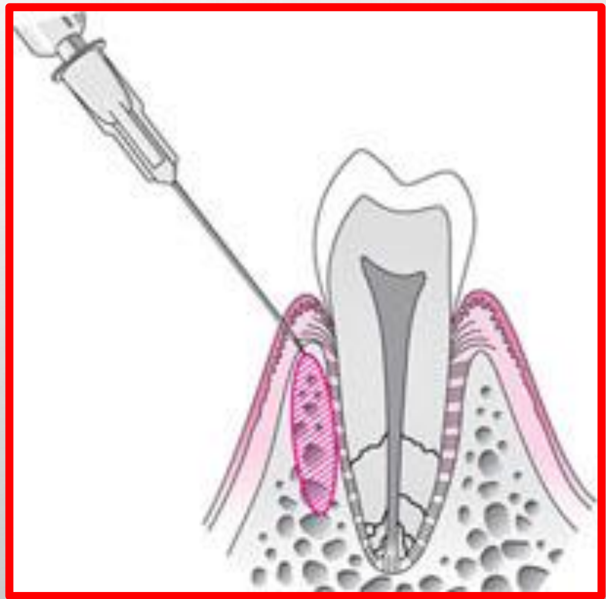
infection or severe inflammation at the injection site and the presence of primary teeth ?

# 6- Intraseptal Anaesthesia

a hybrid of intraligamentary and intraosseous anaesthesia.

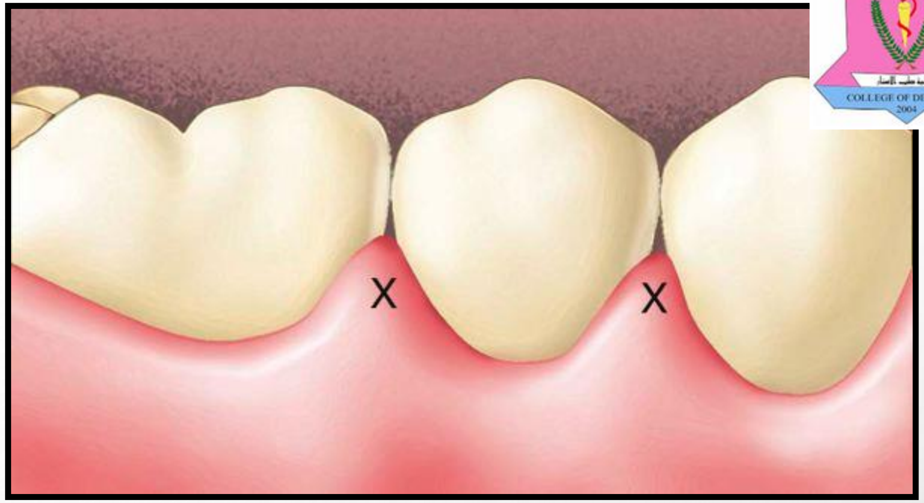
effect identical to intraligamentary injection

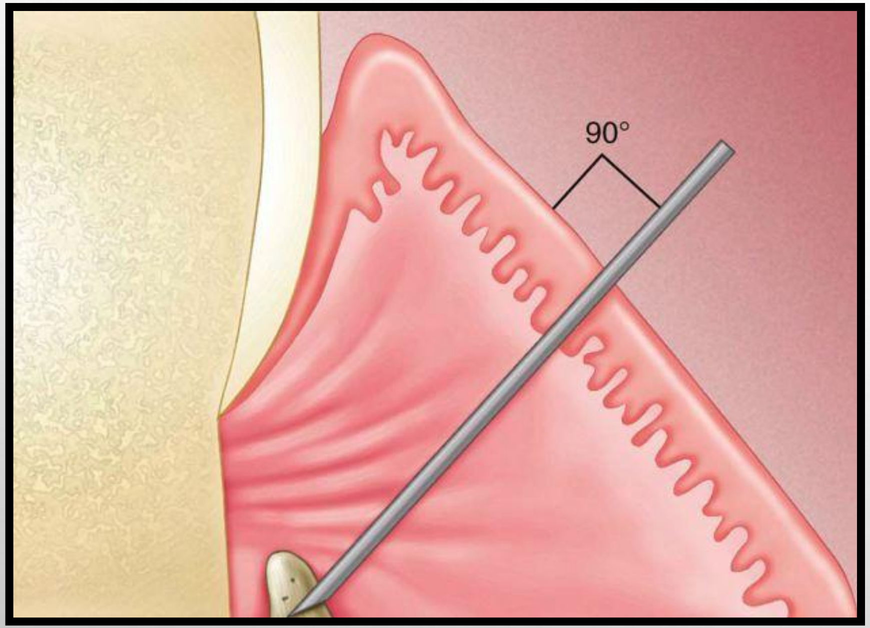
A short 27-gauge needle is inserted into the buccal interdental papilla, injecting while it is directed toward the bone



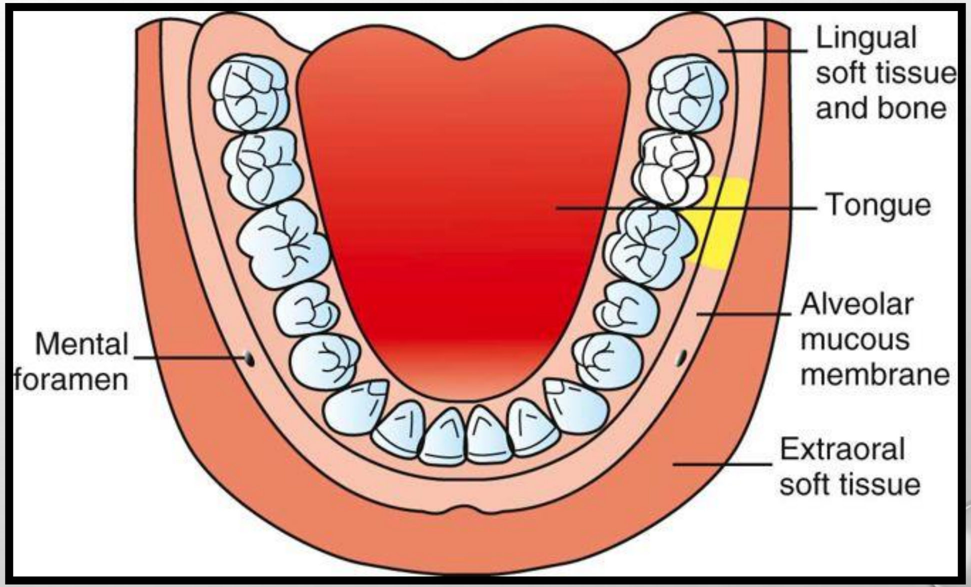
- Once bone is contacted the needle is advanced into the bone and 0.2 mL of solution injected.
- The technique may be used instead of the intraligamentary method if the periodontal condition is poor.

<u>**Area of insertion & Target area:**</u> both are the center of the interdental papilla adjacent to the tooth to be treated




Bevel facing the apex of the tooth



# 7- Intra-pulpal Anaesthesia

## Technique

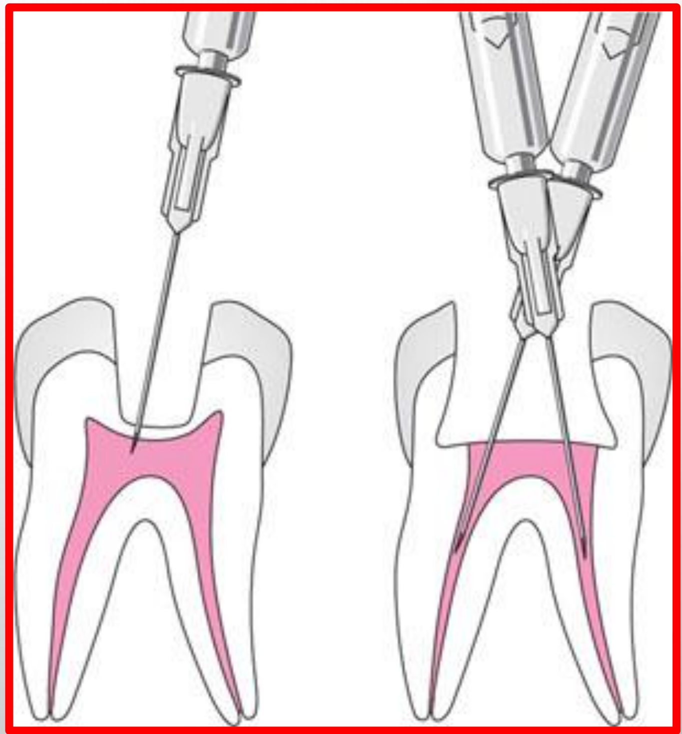
- This method of anaesthesia relies on deposition of solution directly into the pulp canals.

- Usually it will be administered following the injection of an anesthetic solution by another route.

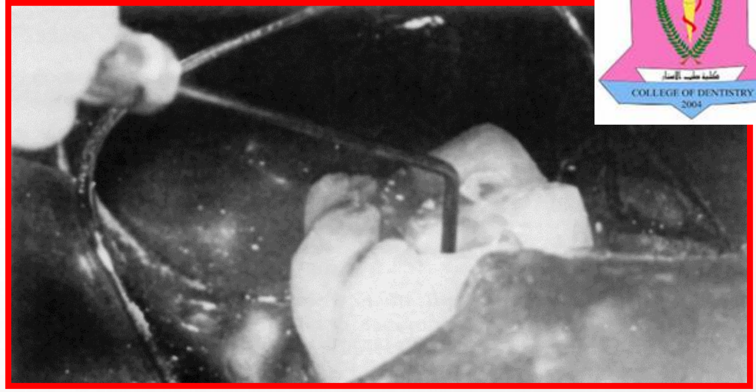
- It is essential that the solution is injected into the pulp under pressure.

- Fit is tight either by opening by small round bur into the chamber or if not can done by inserting the needle deep in the canal.

- Around 0.2 mL of solution is injected.



The intrapulpal injection provides pain control through both the pharmacologic action of the local anesthetic and applied pressure. This technique may be used once the pulp chamber is exposed surgically or pathologically.



**Indication**

When pain control is necessary for pulpal extirpation or other endodontic treatment in the absence of adequate anesthesia from other techniques.

Ideally, wedge the needle firmly into the pulp chamber or root canal.

Instrumentation may begin approximately 30 seconds after the injection is given

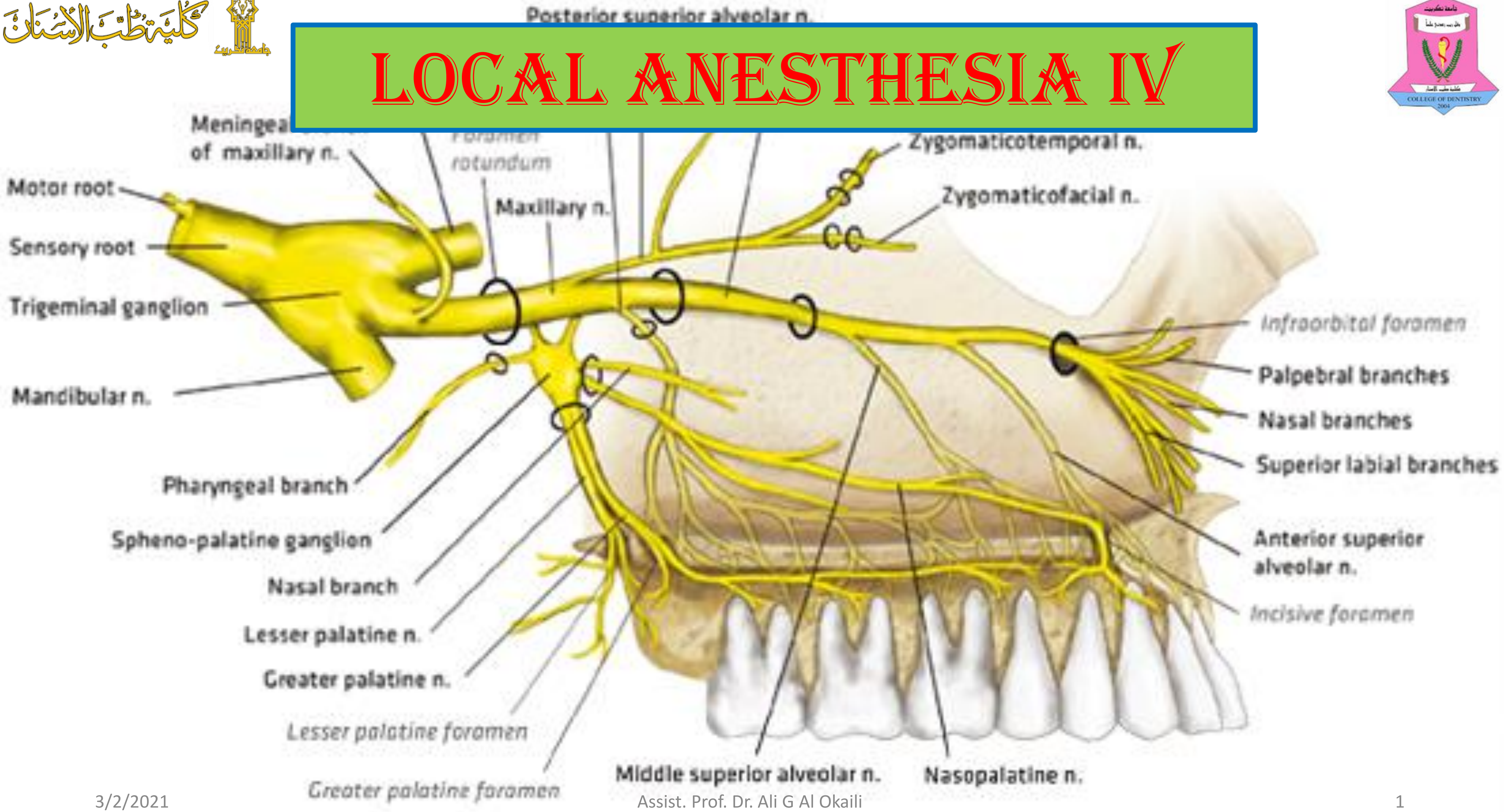
## Advantages of intrapulpal anaesthesia

- success is independent of the solution
- the method aids in overcoming failed conventional methods
- single tooth anaesthesia may be obtained
- there are minimal systemic effects.

## Disadvantages of intrapulpal anaesthesia

- discomfort may be produced
- application of the method is limited.

# LOCAL ANESTHESIA IV



Patients Rate A Dentist “Who Does Not Hurt” And One Who Can “Give Painless Injections” As Meeting The Second And First Most Important Criteria Used In Evaluating Dentists

**An atraumatic injection has two components: a technical aspect and a communicative aspect**

# Important tips for painless & safe anesthesia

1. Disposable needles are sharp on first insertion. However, with each succeeding penetration, their sharpness diminishes. By the third or fourth penetration, the operator can feel an increase in tissue resistance to needle penetration. Clinically, this is evidenced by increased pain on penetration and increased post-anesthetic tissue discomfort. Therefore it is recommended that stainless steel disposable needles be changed after every three or four tissue penetrations.

2. Topical anesthetics produce anesthesia of the outermost 2 or 3 mm of mucous membrane; this tissue is quite sensitive. Ideally the topical anesthetic should remain in contact with the tissue for 2 minutes to ensure effectiveness. A minimum application time of 1 minute is recommended.

3. Determine whether to warm the anesthetic cartridge or syringe

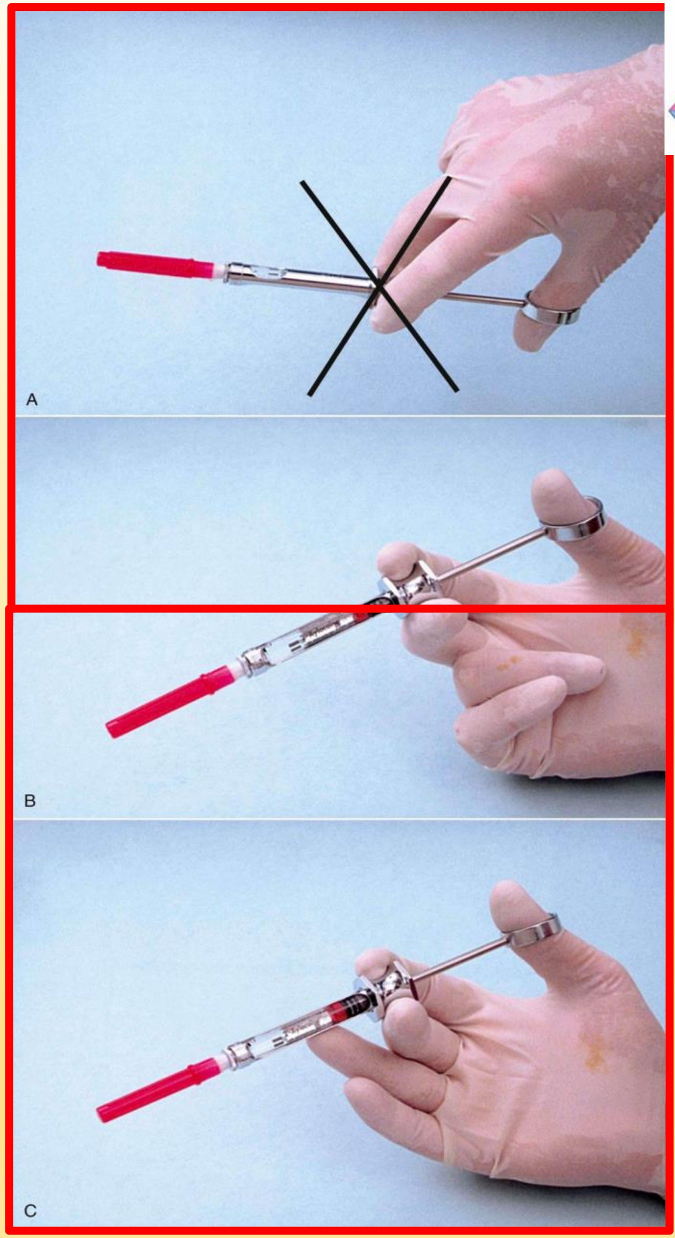
4. Use words that prevent stress! word *freeze !*

5. Establish a firm hand rest  Hand positions for injections

**A. Palm down:** poor control over the syringe; not recommended.

**B. Palm up:** better control over the syringe because it is supported by the wrist; recommended.

**C. Palm up and finger support:** greatest stabilization; highly recommended.



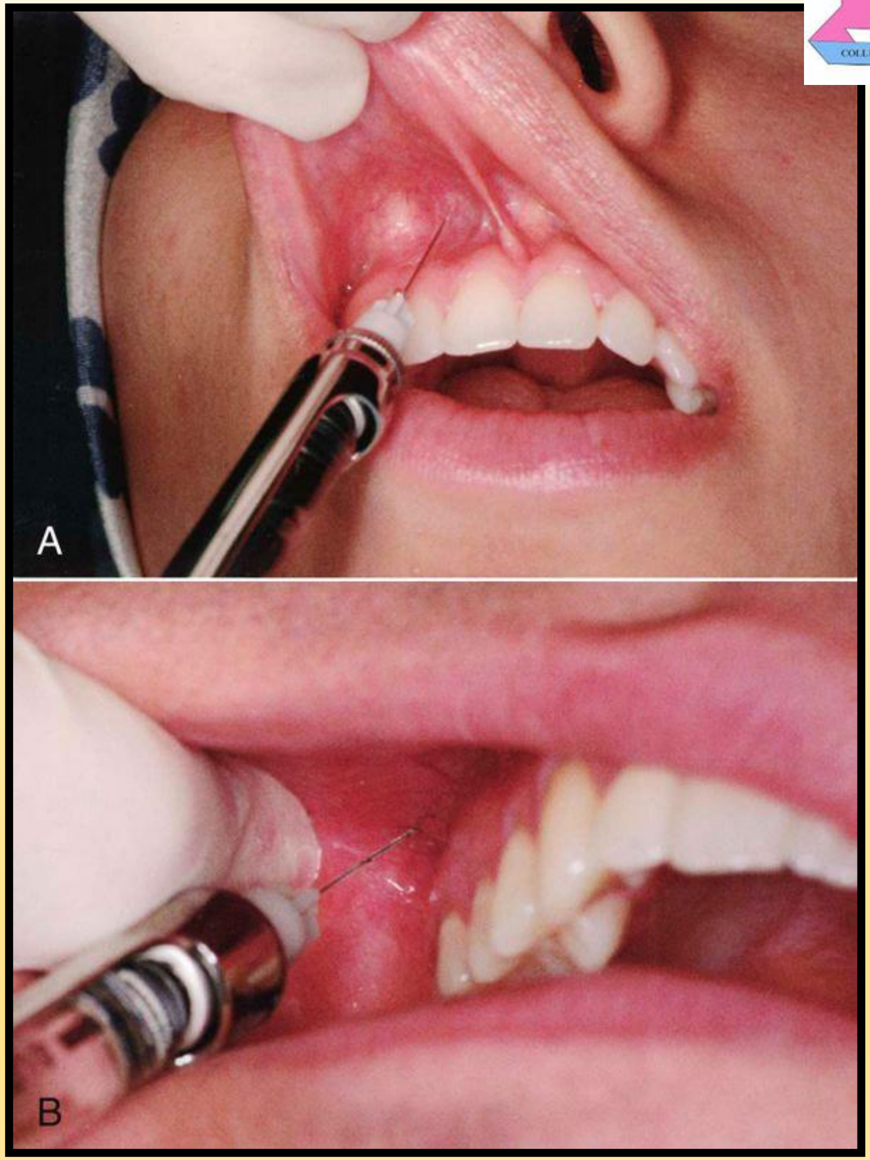
# Important tips for painless & safe anesthesia



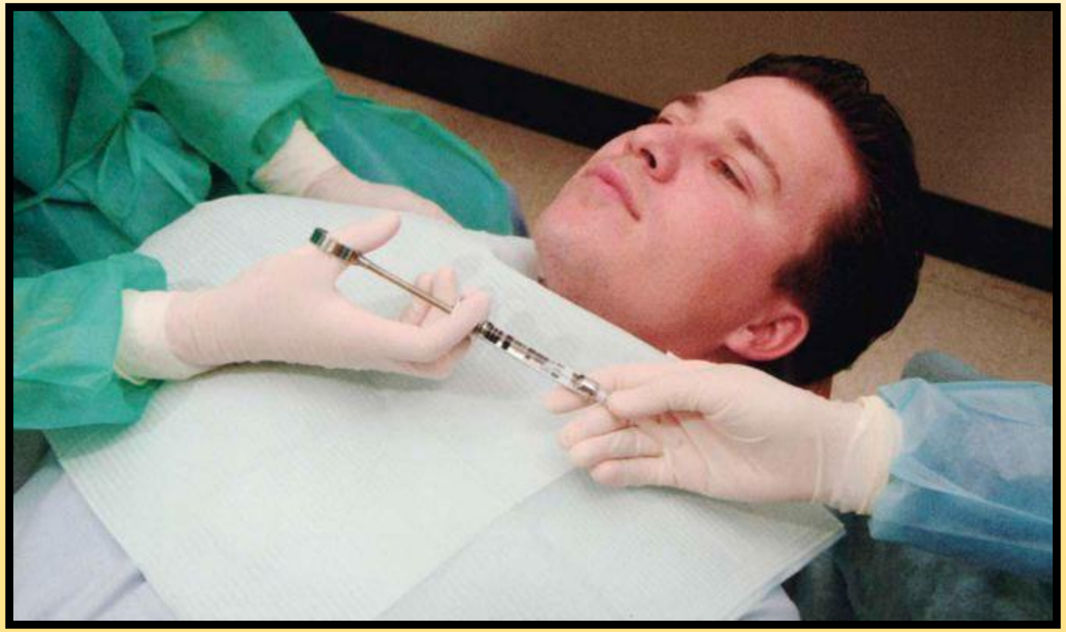
Persons with long fingers can use finger rests on the patient's face for many injections; those with shorter fingers may need elbow rests

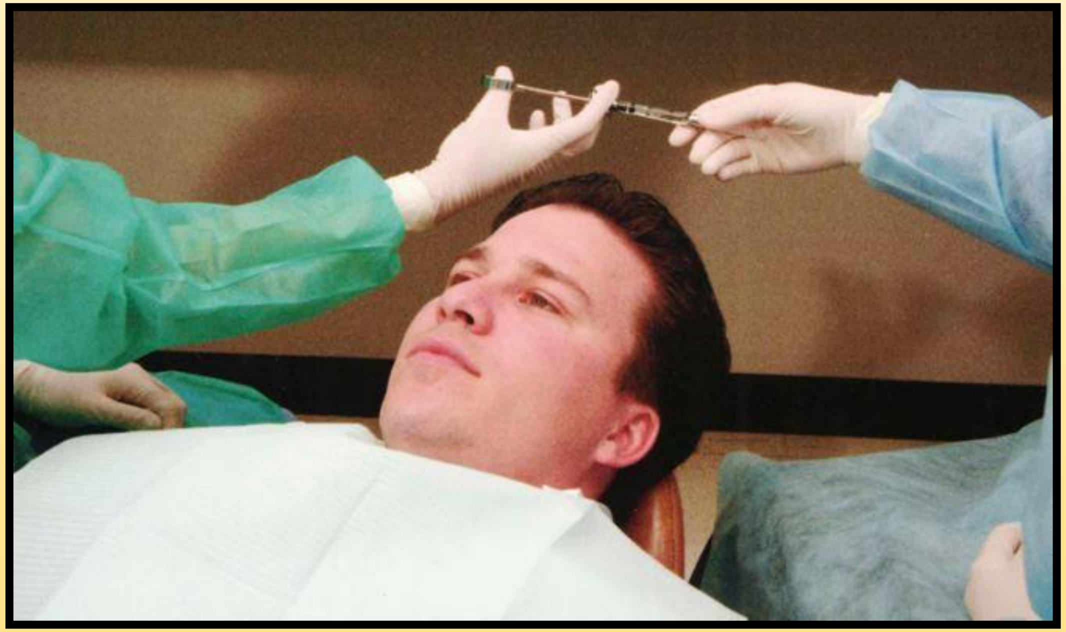
# Important tips for painless & safe anesthesia

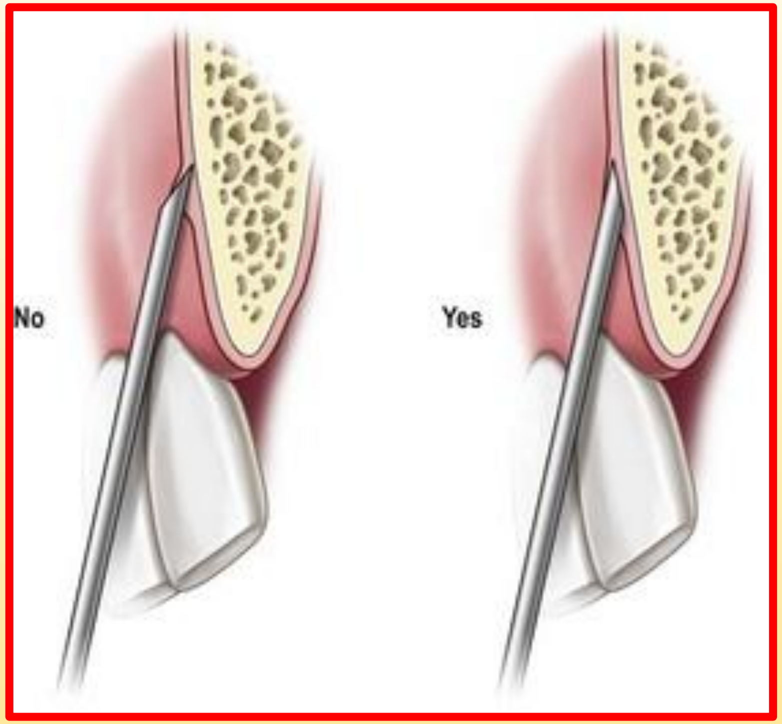
6. Make the tissue taut. The tissues at the site of needle penetration should be stretched before insertion of the needle



# 7. Keep the syringe out of the patient's line of sight





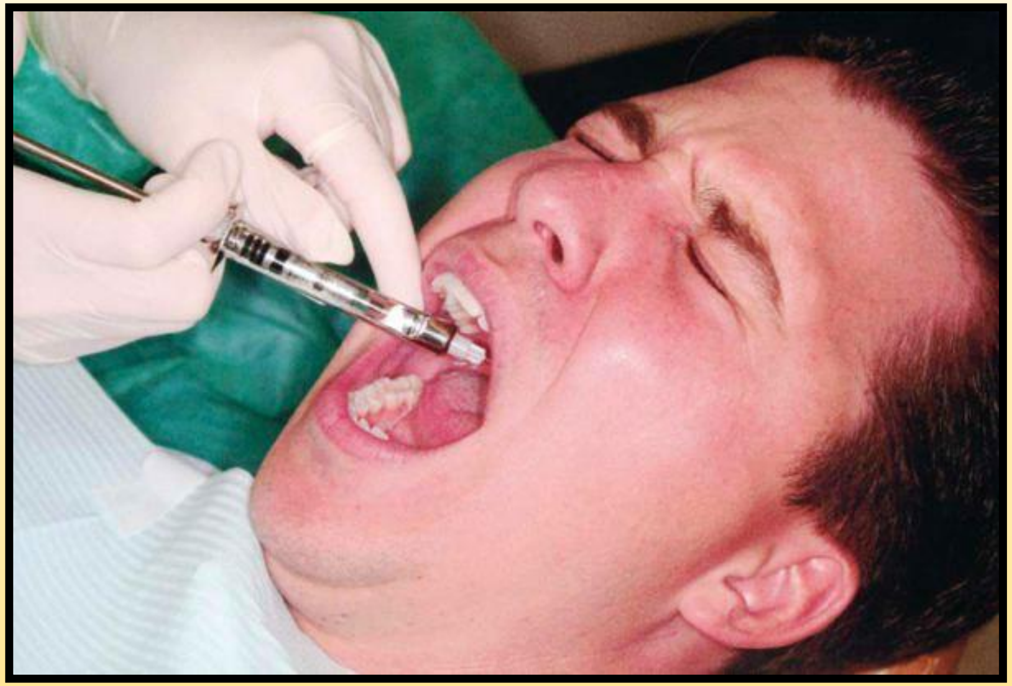



8. Insert the needle into the mucosa. With the needle bevel properly oriented. as a general rule, the bevel of the needle should be oriented toward bone

9. Watch and communicate with the patient : During the injection, the patient should be watched and communicated with; the patient's face should be observed for evidence of discomfort during needle penetration.

Signs such as furrowing of the brow or forehead and blinking of the eyes may indicate discomfort.

More frequently, no change will be noticed in the patient's facial expression at this time (indicating a painless, or atraumatic, needle insertion).



Patients who are apprehensive about injections of local anesthetics are likely to react to any sensation as though it were painful

10. During the aspiration test. Adequate stabilization is mandatory. Beginners have a tendency to pull the syringe out of the tissues while attempting to aspirate.

A slight reddish discoloration at the diaphragm end of the cartridge on aspiration usually indicates venous penetration. Reposition the needle, re-aspirate, and, if negative, deposit the solution.

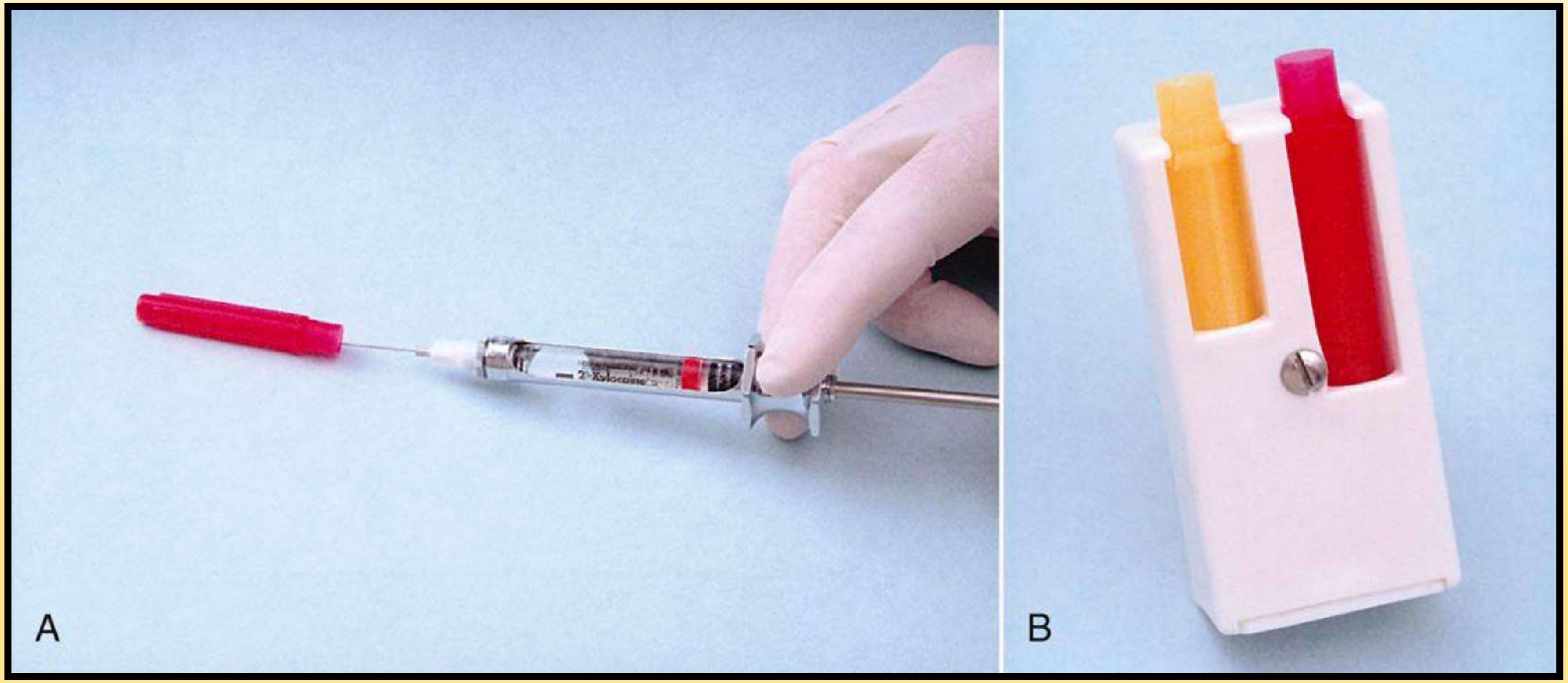
Bright red blood rapidly filling the cartridge usually indicates arterial penetration.

A major factor determining whether aspiration can be performed reliably is the gauge of the needle. Larger-gauge needles (e.g., 25) are <u>recommended more often</u> than smaller-gauge needles (e.g, 27, 30) whenever a greater risk of positive aspiration exists.

11. Slowly deposit the local anesthetic solution. Slow injection prevents the solution from tearing the tissue into which it is deposited. Rapid injection results in immediate discomfort (for a few seconds) followed by prolonged soreness (days) when the numbness provided by the local anesthetic dissipates later.

Slow injection is defined ideally as the deposition of 1 mL of local anesthetic solution in not less than 60 seconds. Therefore a full 1.8 mL cartridge requires approximately 2 minutes to be deposited.

12. "Scoop" technique for recapping contaminated local anesthetic needle. **B,** Plastic needle cap holder.



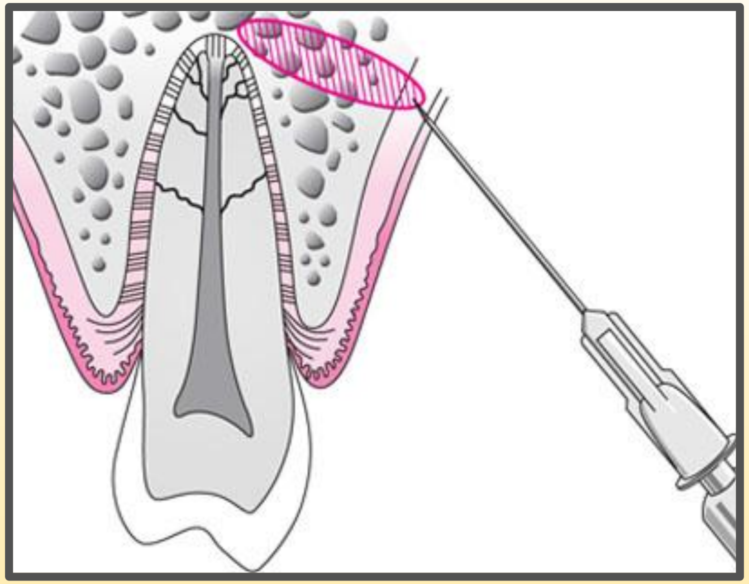
13. Position of the patient on the dental chair: Ideally the patient should be fully supine to aid cranial blood flow and prevent fainting. Some patients may be uncomfortable or feel vulnerable in this position. A compromise is to tilt the chair back at least thirty degrees to the vertical.

# TECHNIQUES FOR MAXILLARY ANAESTHESIA

1. Infiltration,
2. Regional block,
3. supplementary: like Intraligamentary, Intra-osseous and Intrapulpal anesthesia.

The primary method is infiltration anaesthesia.

# 1- A- Buccal Infiltration Anaesthesia



- The term infiltration has been in common usage in dentistry to define an injection in which the local anesthetic solution is deposited at or above the apex of the tooth to be treated. Really, this technique is a field block

- Solution deposited at the buccal side of the maxillary alveolus can infiltrate through to the pulps of the teeth to produce dental anaesthesia.

- Cortical plate on the buccal side of the maxilla is thin.
- Hold the syringe parallel with the long axis of the tooth Advance the needle until its bevel is at or above the apical region of the tooth In most instances, the depth of penetration is only a few millimeters

- The operator pulls the cheek or lip in a superior direction to stretch the tissues and the needle is inserted through the taut tissues of the buccal fold. This stretching of the lip or cheek may be performed by holding the tissues between the operator’s fingers or by retraction with a mirror.

The former method affords more control; the latter reduces the chances of needle-stick injury. The choice is personal.

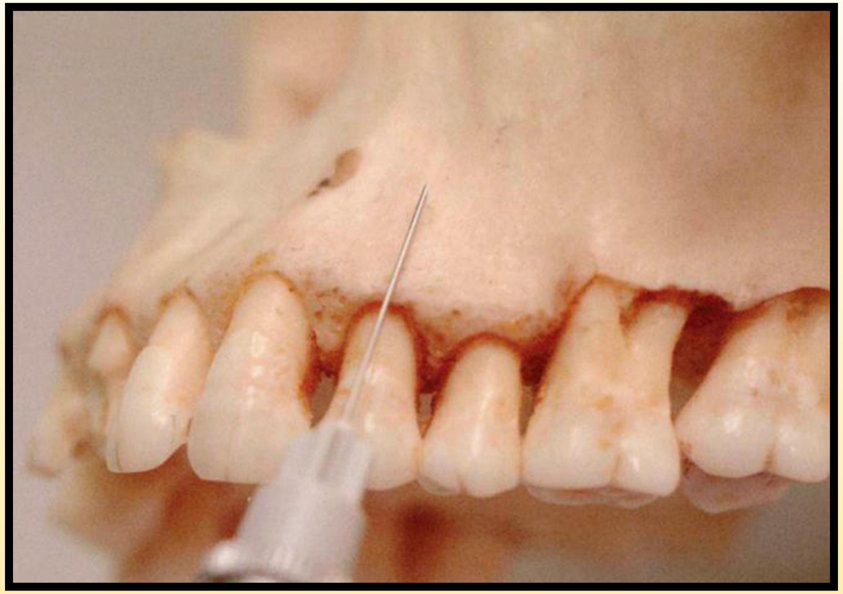
# Technique

A- The syringe is fitted with a 27 or 30 gauge needle. Usually a 20–25 mm-long needle is employed (short needle).

B- Area of insertion: height of the mucobuccal fold above the apex of the tooth being anesthetized. Target area: apical region of the tooth to be anesthetized

C- Access to this region is easiest when the patient has the mouth only partly open (specially in the posterior region).

d- Prior to injection this area should be cleaned with a gauze swab (could be disinfected also) and a topical anesthetic may be applied. deposit approximately 0.6 mL – 1 mL slowly over 20 seconds.



The needle must be inserted into a plane deeper than the epithelium. Injecting into the epithelium produces a distinct blister. This produces discomfort and, if noted, the needle is advanced to a deeper level. The needle is directed towards the bone, aiming for the apical area of the tooth in question.

Bone does not need to be contacted. If bone is touched the needle should be withdrawn slightly so that the point is not subperiosteal.

An injection underneath the periosteum is painful at the time and in the post anesthetic stage.

# ADVANTAGES OF INFILTRATION ANAESTHESIA ARE:

1. Simple technique which is easy to master
2. When successful, anesthetizes all nerve endings in the area of deposition independent of the nerve source.
3. Avoid damage to nerve trunks
4. Reduce chance of intravascular injection
5. Provide hemostasis where it is required

The disadvantages are:

1. only effective in obtaining pulpal anaesthesia when diffusion through cortical bone occurs

2. localized infection may be spread if an inflamed area is infiltrated

3. only a limited zone of anaesthesia per injection

The efficacy of infiltration anaesthesia is dependent upon::

1. **The volume of anesthetic**
2. **Concentration of the local anesthetic solution**
3. **The presence of a vasoconstrictor**

## Problems with buccal infiltration anaesthesia

# Buccal infiltrations may fail if there is collateral supply to the pulp from the greater palatine or nasopalatine nerves. This is overcome by supplementing the injection with one of the palatal techniques.

# Another reason for failure may be due to a thick cortical plate reducing the spread of solution through bone. This may occur in the region of the zygomatic buttress causing failure of anaesthesia in upper first molars. This is overcome by infiltrating mesially and distally to the buttress or by using the regional block methods described.

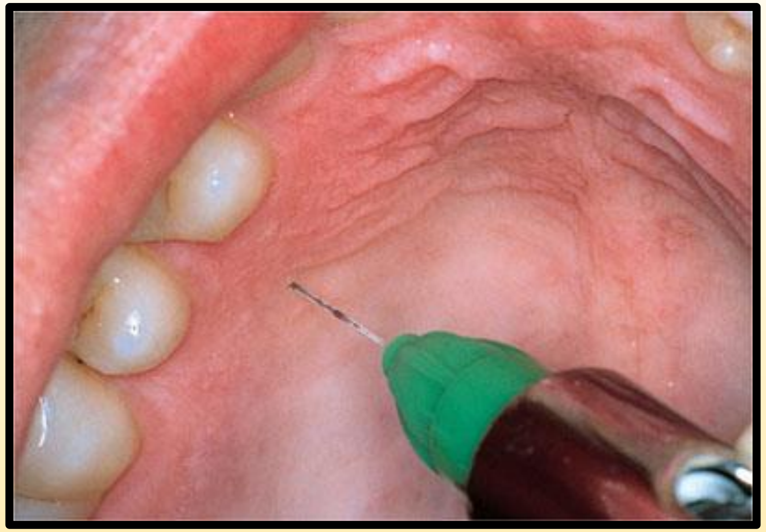
# If there is localized infection at the site of an infiltration it is unwise to inject at this zone.

Using one of the regional block methods described.

## 1- B- Palatal Infiltration::

- When working on the tissues distal to the canine the palatal soft tissue can be anaesthetized by infiltration or regional block anaesthesia. Infiltration of around 0.2 mL of solution into the palatal mucosa just distal to the tooth of interest will anaesthetize the palatal mucosa and periodontium anterior to the point of infiltration up to the canine region.

- The exception is the upper third molar when the solution should be deposited at the anterior aspect of the tooth. This is because the greater palatine foramen lies anterior to the third molar tooth and the nerve supplying this region travels in a posterior direction.



The point of infiltration is in the fleshiest part of the palate around 5 to 15 mm from the gingival margin.

-Palatal injections can be uncomfortable owing to the poor compliance of the tissue

# 2- Regional Block Methods::

The advantages of regional block techniques are:

1. They produce widespread anaesthesia from one injection
2. the anesthetic can be deposited away from infected areas.

The disadvantages of block injections are:

1. Technically more difficult than infiltration anaesthesia
2. Do not anaesthetize nerve endings from different trunks (for example, in the mid-line where crossover may occur).
3. May cause deep hemorrhage in patients with bleeding diathesis
4. Although rare, the potential for direct injury to a nerve trunk is possible.
5. Increased risk of intravascular injection compared to infiltration anesthesia.

Regional block anaesthesia may be used in the maxilla

1. If infiltration methods are ineffective ( presence of abscess)
2. To avoid multiple injections when a large area of anaesthesia is needed.

Intraoral approaches: It is possible to approach the maxillary nerve and some of its branches from extraoral approaches but these are not recommended in dental practice.

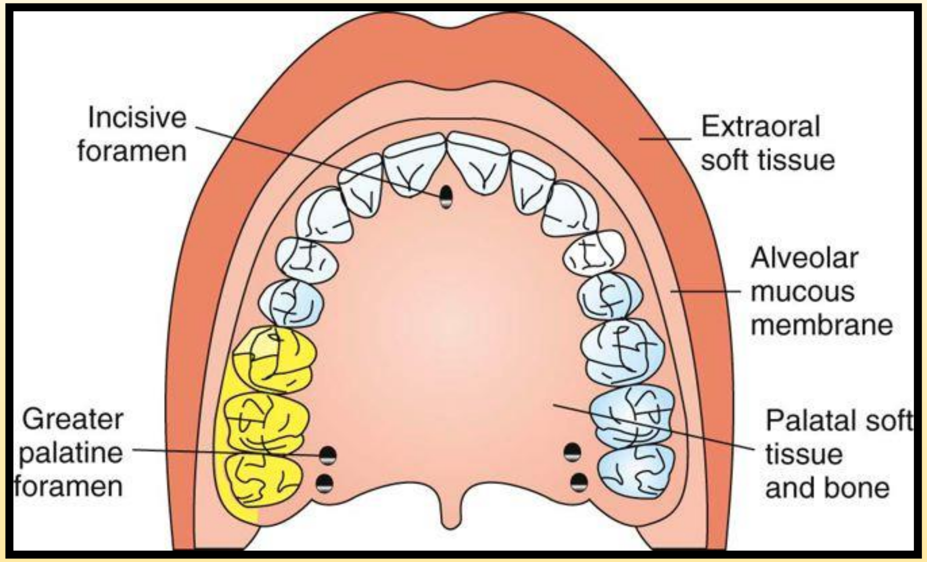
## Regional block methods useful in the maxilla include:

- Posterior superior alveolar nerve block
- Middle superior alveolar nerve block
- Anterior superior alveolar nerve block
- Infra orbital nerve block
- Anterior middle superior alveolar nerve block
- Greater palatine nerve block
- Nasopalatine (long sphenopalatine nerve) block
- Maxillary nerve block.

# 2- A- Posterior superior alveolar nerve block (PSA)

Areas Anesthetized

1. Pulps of the maxillary third, second, and first molars (entire tooth = 72%; mesiobuccal root of the maxillary first molar not anesthetized = 28%)
2. Buccal periodontium and bone overlying these teeth




- High success rate (>95%)

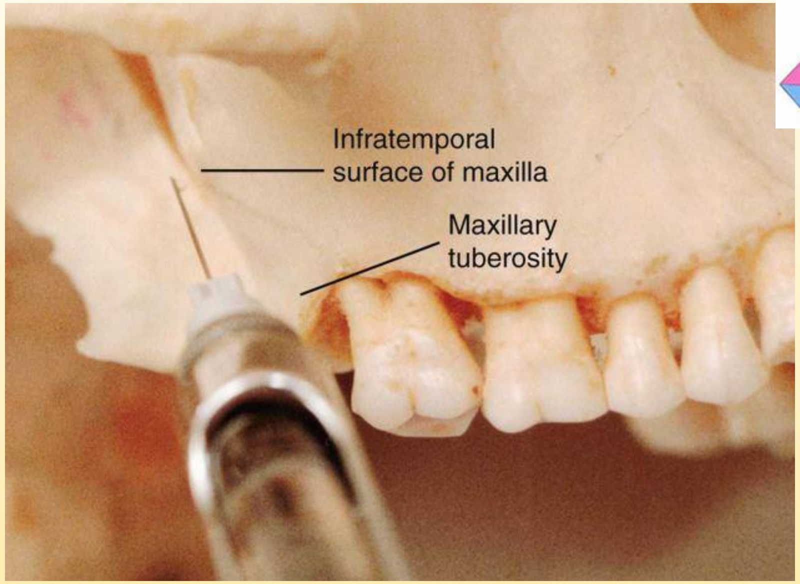
- Technique somewhat arbitrary: no bony landmarks during insertion

- The depth of needle penetration should be checked: over insertion (too deep) increases the risk of hematoma; too shallow might still provide adequate anesthesia.

# Technique

Area of insertion: height of the mucobuccal fold above the maxillary second molar

Target area: PSA nerve—posterior, superior, and medial to the posterior border of the maxilla




Partially open the patient's mouth, pulling the mandible to the side of injection.

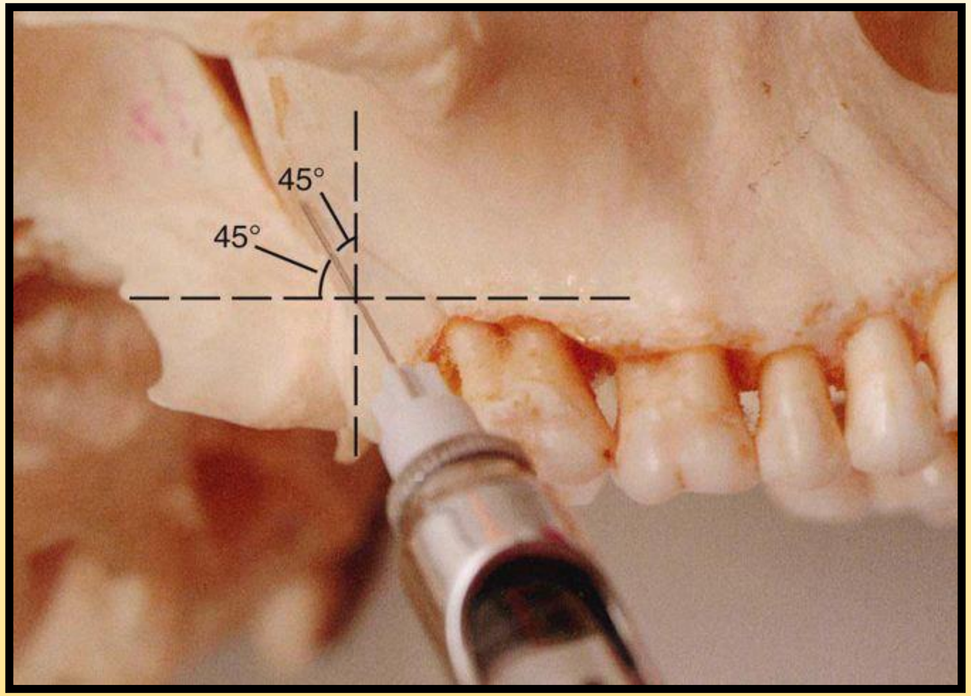
Insert the needle into the height of the mucobuccal fold over the second molar

Advance the needle slowly in an upward, inward, and backward direction

(1) Upward: superiorly at a 45-degree angle to the occlusal plane

(2) Inward: medially toward the midline at a 45-degree angle to the occlusal plane

(3) Backward: posteriorly at a 45-degree angle to the long axis of the second molar

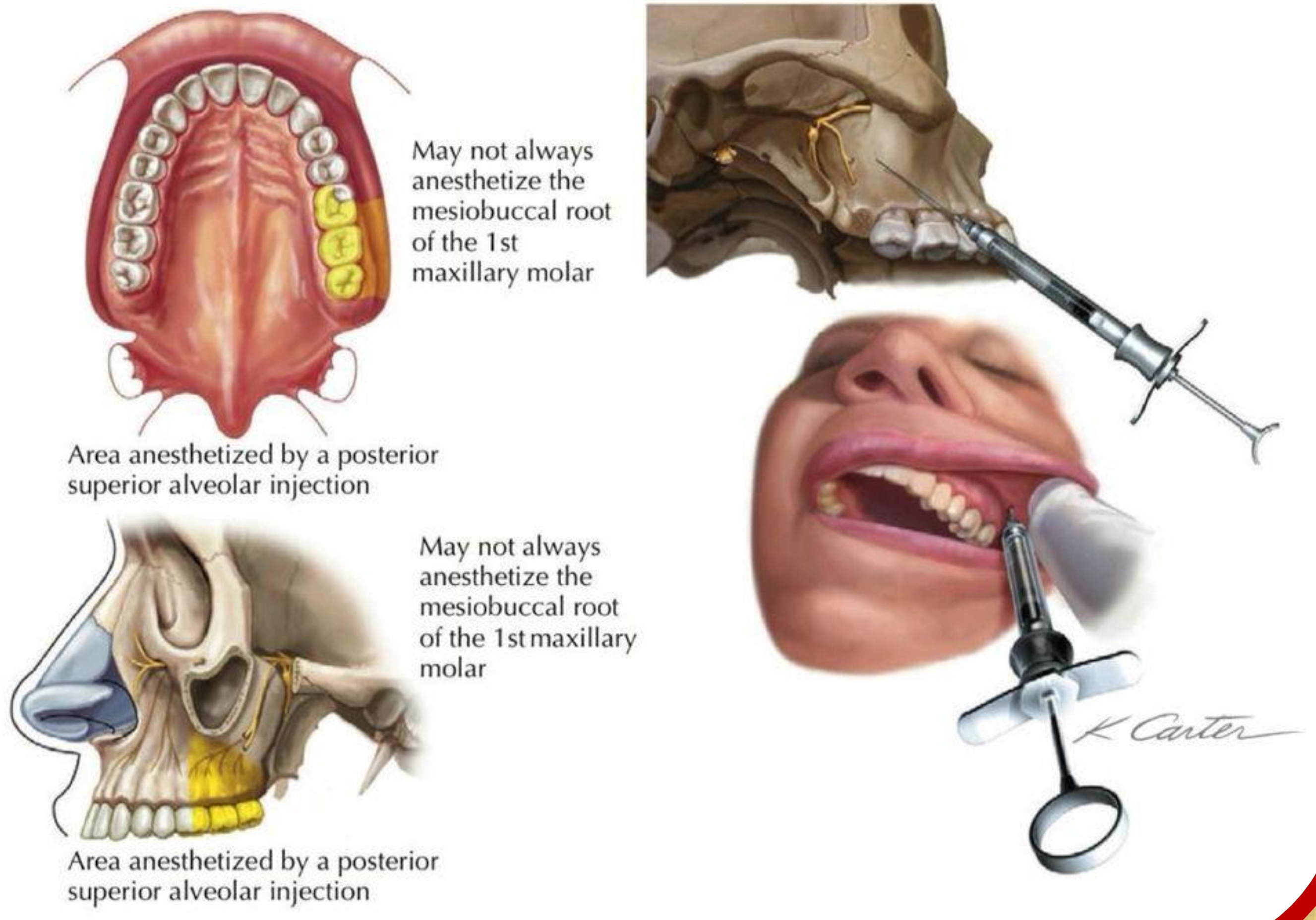


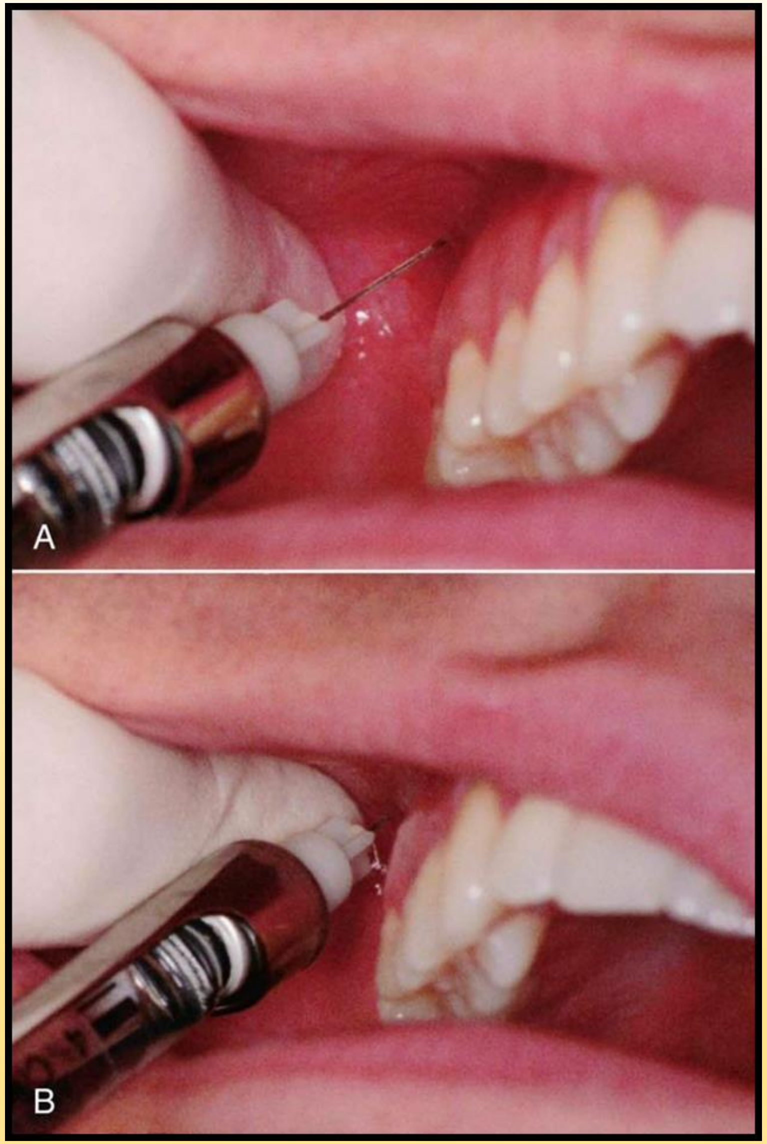
In an adult of normal size, penetration to a depth of 16 mm places the needle tip in the immediate vicinity of the foramina through which the PSA nerves enter the posterior surface of the maxilla. When a long needle is used (average length, 32 mm), it is inserted half its length into the tissue. With a short needle (average length, 20 mm), approximately 4 mm should remain visible.

- Positive Aspiration Approximately 3.1%.

- Slowly, over 30 to 60 seconds, deposit 0.9 to 1.8 mL of anesthetic solution.
- The PSA injection is normally atraumatic because of the large tissue space available to accommodate the anesthetic solution and the fact that bone is not touched.

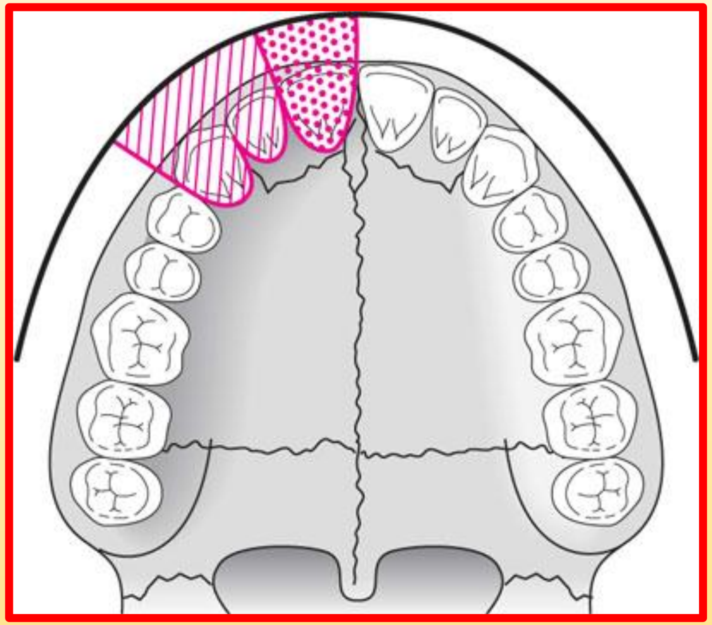
# Posterior Superior Alveolar Nerve Block



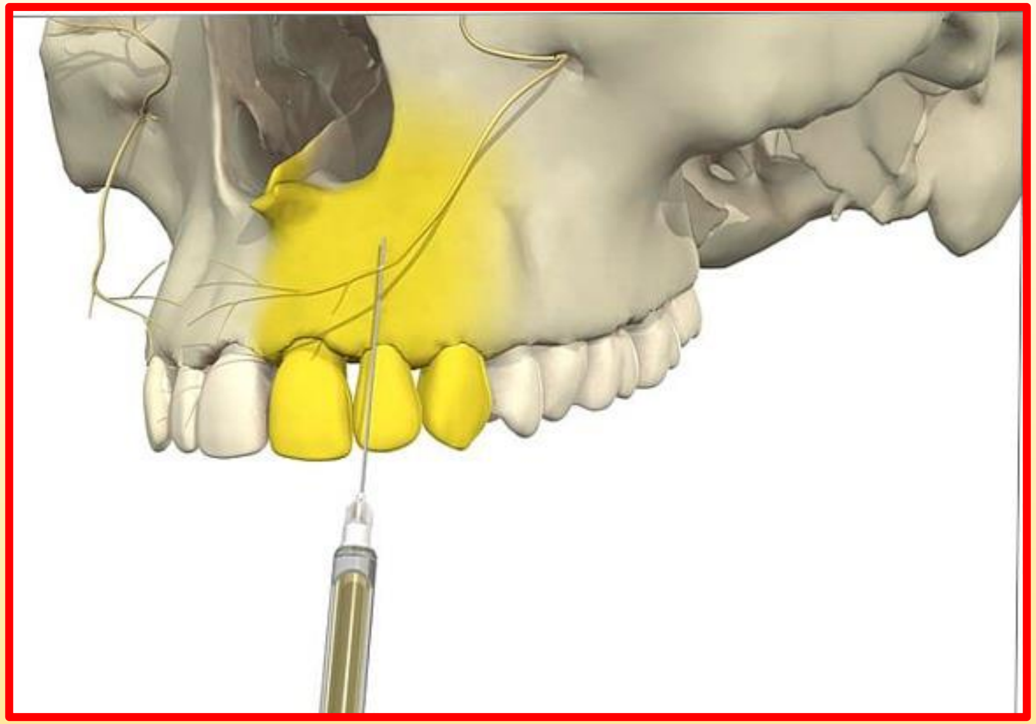



# 2-b- Anterior superior alveolar nerve block

- The anterior superior alveolar nerve supplies the canine and upper incisor teeth. There is some crossover at the midline from the contralateral supply.
- **The anterior superior alveolar nerve may be blocked in isolation or by the infraorbital nerve block.**
- The block of ASA nerve in isolation is performed by introducing the needle into the buccal sulcus in the maxillary canine region and advancing the needle towards the canine apex.
- The needle is maintained in a supra-periosteal position and following aspiration 1.5 mL of solution is deposited.



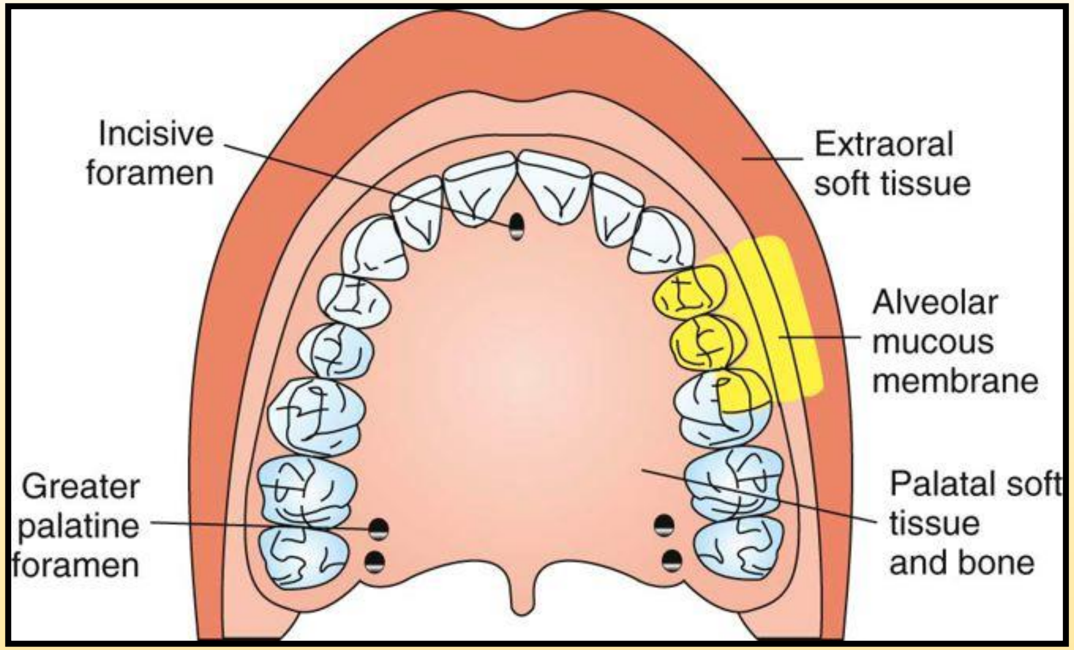
# Anterior superior alveolar nerve block



## 2-c- Middle superior alveolar nerve block (MSA)

- The middle superior alveolar nerve (when present in 28%) provides innervation to the premolar pulps as well as the mesiobuccal pulp of the maxillary first permanent molar tooth.
- When the ASA nerve block fails to provide pulpal anesthesia distal to the maxillary canine, the MSA block is indicated.
- The success rate of the MSA nerve block is high.
- Inserting the needle in the buccal sulcus in the second premolar region.

-The needle is advanced to a supra-periosteal position close to the apex of the second premolar tooth and inject 0.9 to 1.2 mL (one half to two thirds cartridge) of solution (approximately 30 to 40 seconds).

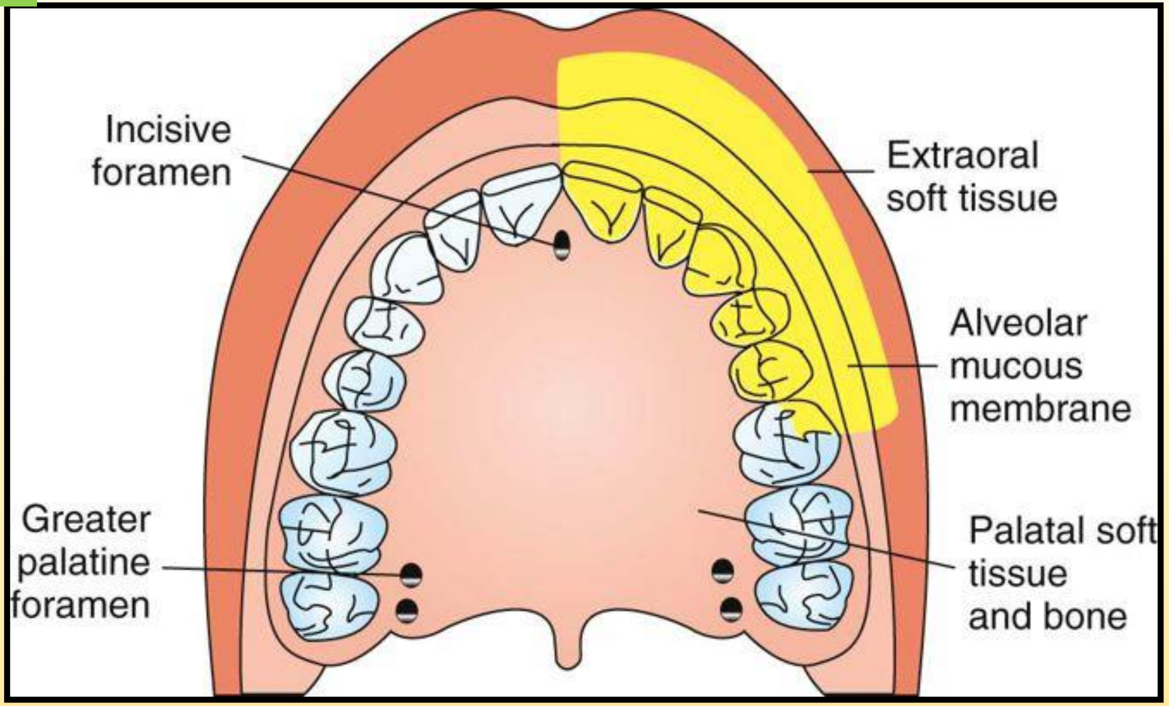



Area anesthetized

Target area: maxillary bone above the apex of the maxillary second premolar

Positive Aspiration is Negligible (<3%).

# 3- Infraorbital nerve block




## Nerves Anesthetized

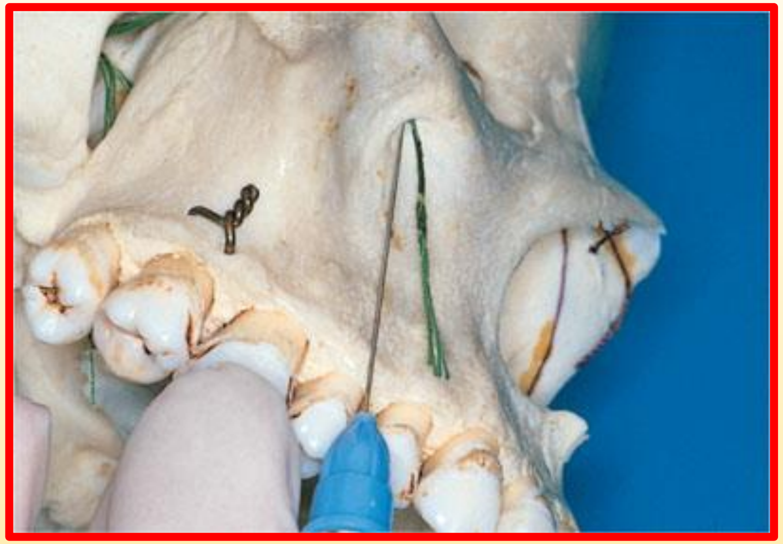
1. Anterior superior alveolar
2. Middle superior alveolar
3. Infraorbital nerve
    a. Inferior palpebral
    b. Lateral nasal
    c. Superior labial

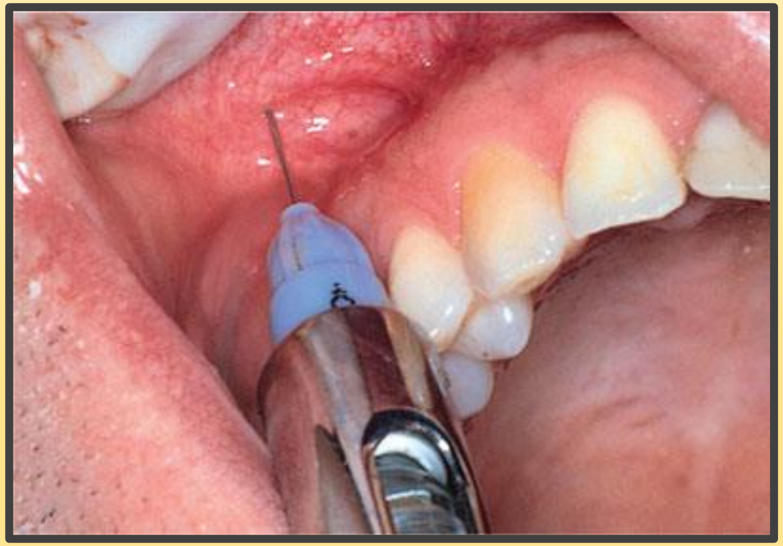
## Areas Anesthetized

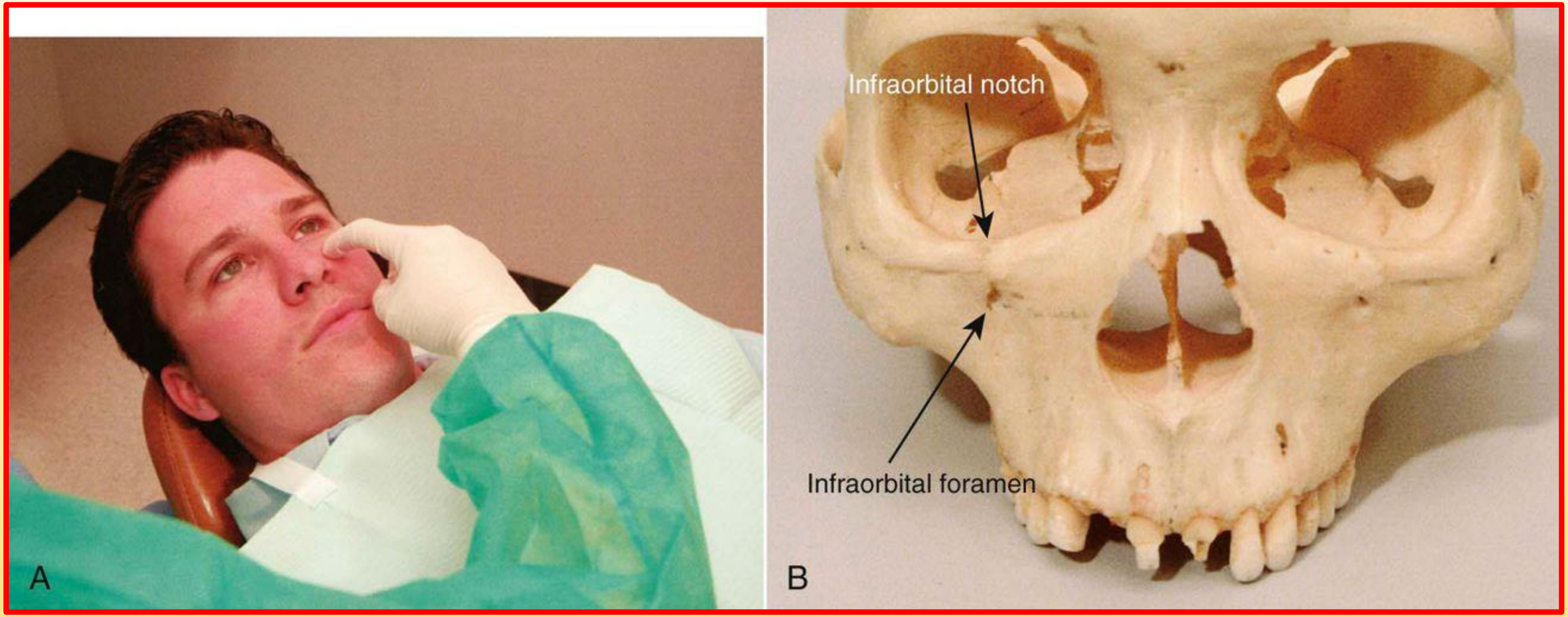
1. Pulps of the maxillary central incisor through the canine on the injected side
2. In about 72% of patients, pulps of the maxillary premolars and mesiobuccal root of the first molar !!!
3. Buccal (labial) periodontium and bone of these same teeth
4. Lower eyelid, lateral aspect of the nose, upper lip

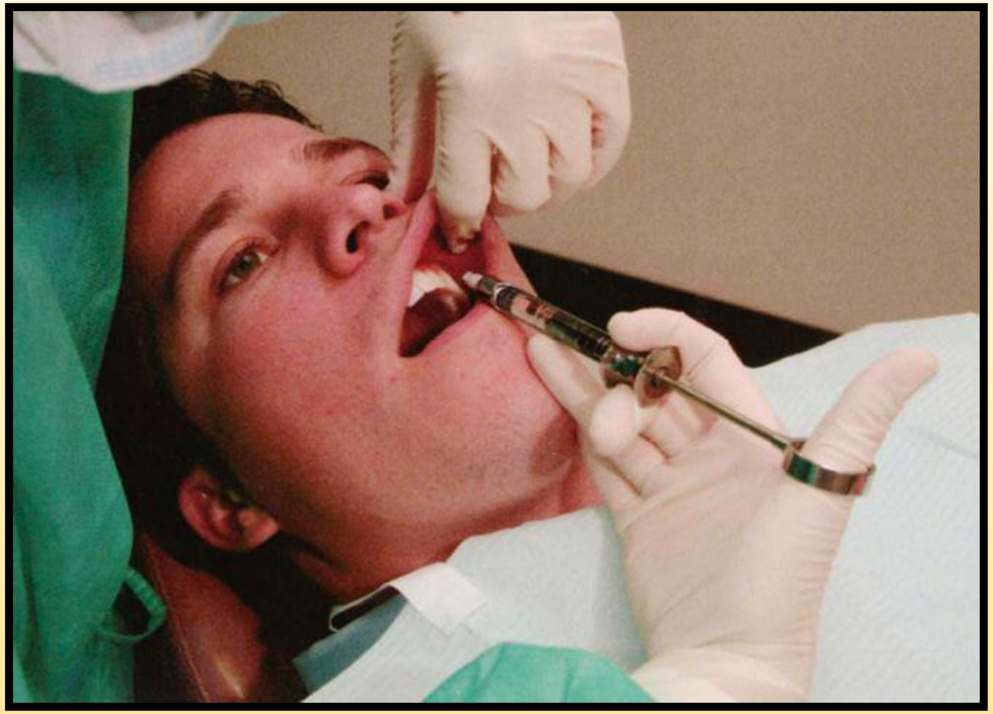
## The intraoral approach is as follows:

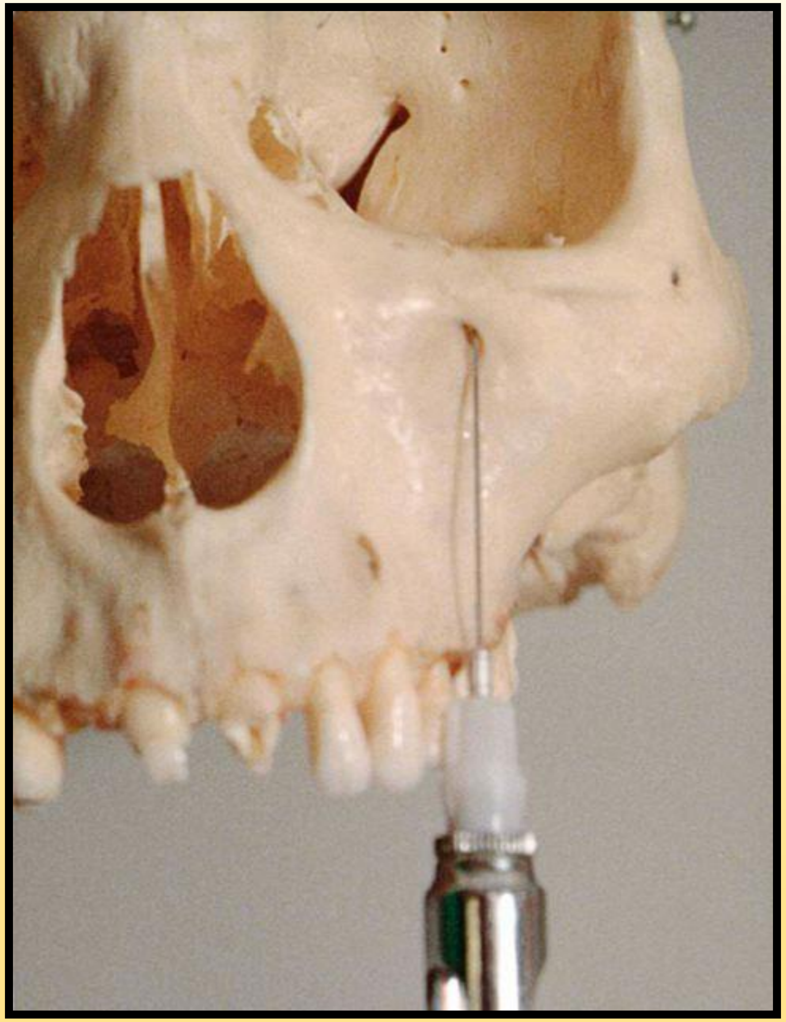
- The patient has the mouth open slightly and the tissues are retracted laterally.
- A long (35 mm) needle should be used.
- The needle pierces the height of the buccal sulcus in the mid premolar region. It is advanced superiorly parallel to the premolar roots until bony contact is made in the region of the infraorbital foramen that is being palpated extra-orally by the index finger. The needle is then withdrawn slightly to a supra-periosteal position.
- Aspiration is performed and Slowly deposit 0.9 to 1.2 mL (over 30 to 40 seconds).






A
Infraorbital notch
Infraorbital foramen
B

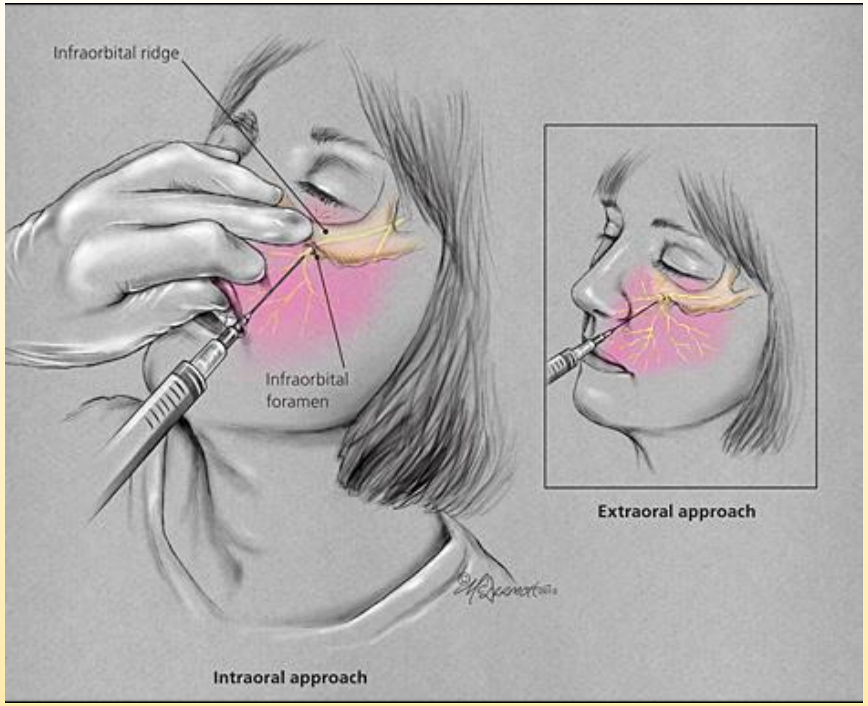




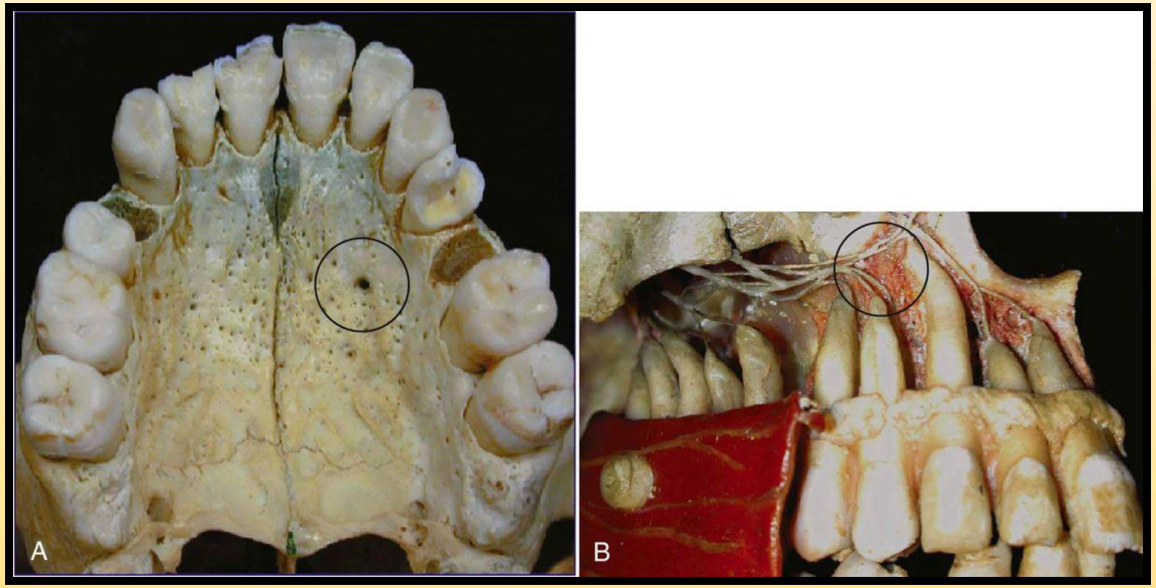
Position the needle tip during injection with the bevel facing into the infraorbital foramen and the needle tip touching the roof of the foramen

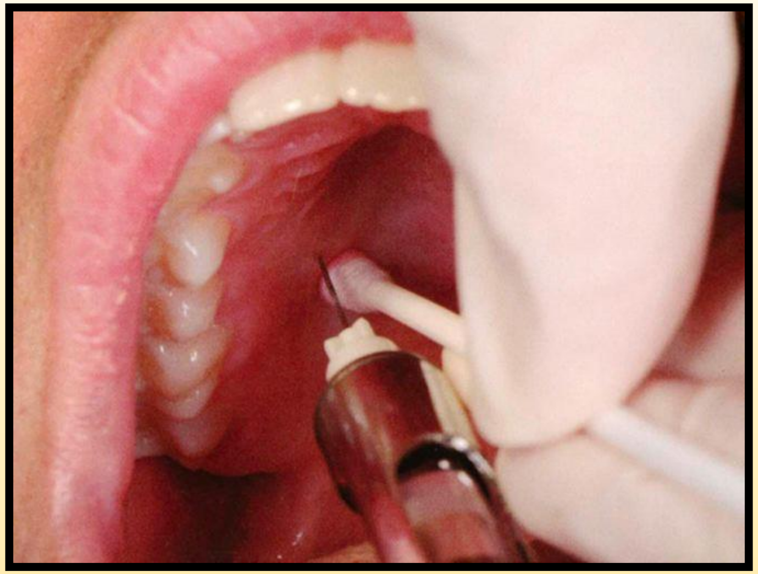
Positive Aspiration 0.7%.

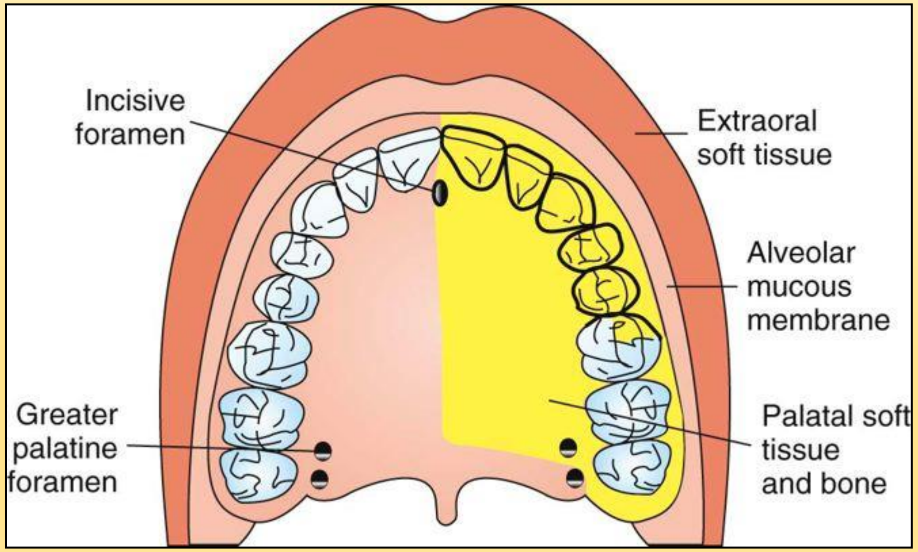
- Maintain firm pressure with finger over the injection site both during and for at least 1 minute after the injection (to increase the diffusion of local anesthetic solution into the infraorbital foramen).




# 4- Anterior Middle Superior Alveolar Nerve Block





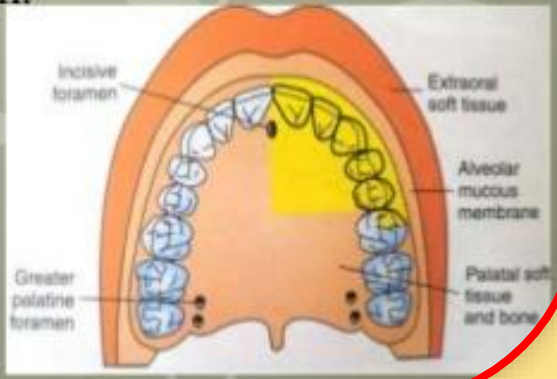
# ANTERIOR MIDDLE SUPERIOR ALVEOLAR NERVE BLOCK

Nerves anaesthetized –

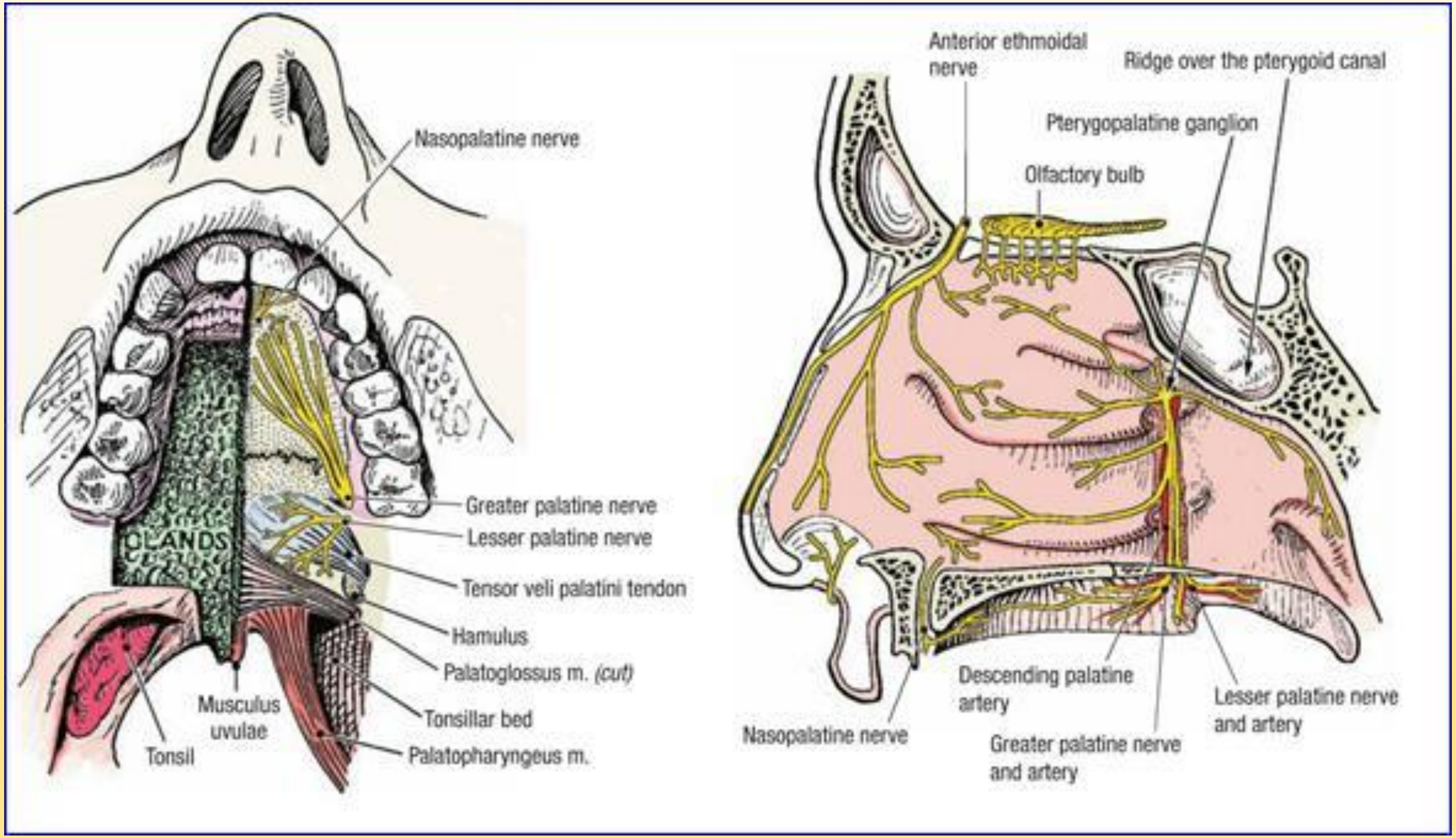
- Anterior superior nerve
- Superior alveolar nerve, when present Sub neural dental nerve plexus of the anterior and middle superior alveolar nerves.

Areas anaesthetized –

- Pulpal anaesthesia of the max. Incisors, canines, and premolars.
- Buccal attached gingival of the same teeth.
- Attached palatal tissues from midline to free gingival margin on the associated teeth.



# 5- Greater palatine nerve block



# it is possible to anaesthetize the palatal tissues by infiltration or by regional block methods.

# The greater palatine nerve block anaesthetizes the soft tissues of the hard palate from third molar to canine region.

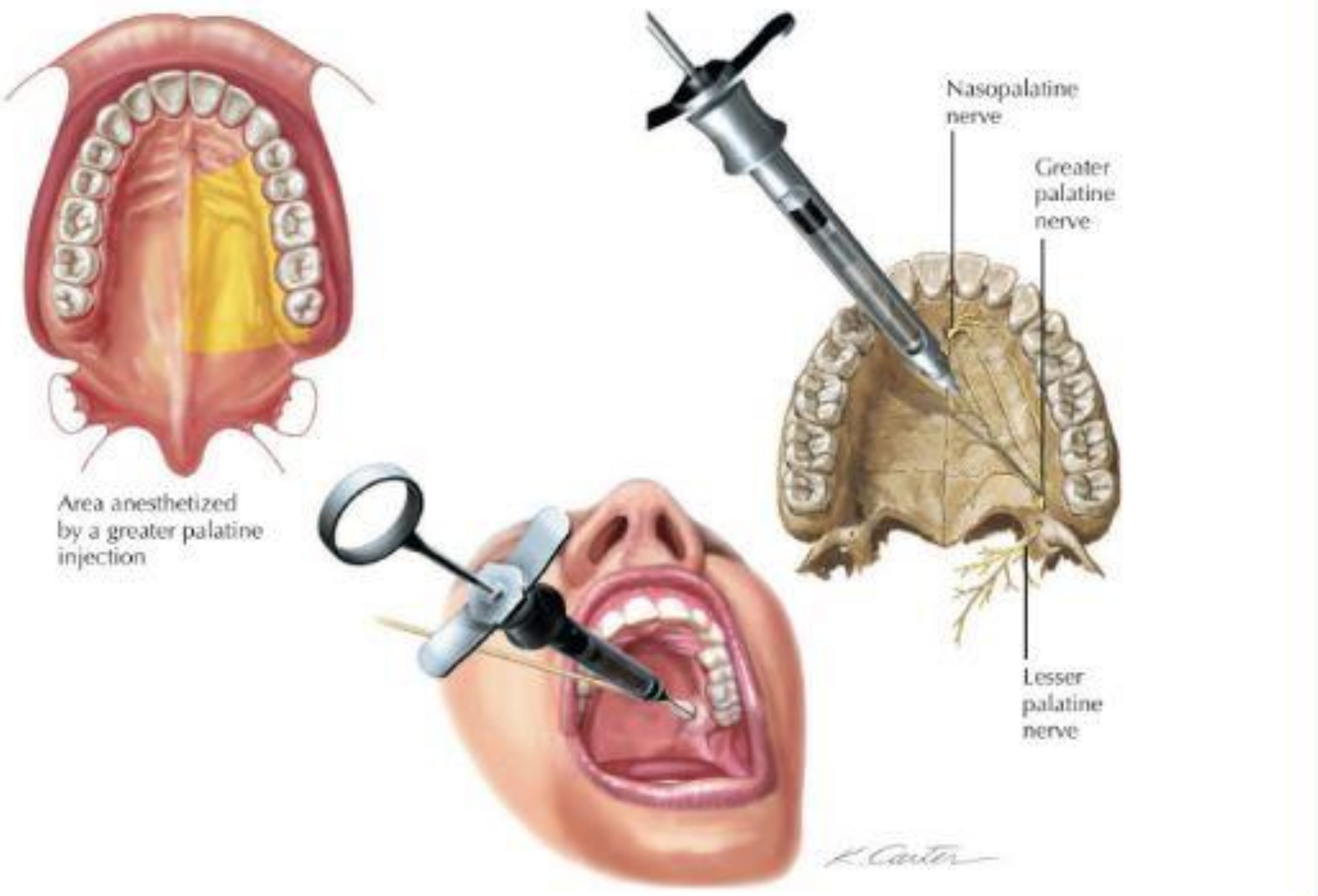
#The greater palatine foramen is located palatal to the distal aspect of the upper second molar tooth. The use of a ball-ended instrument such as an amalgam condenser is useful in locating the site of this foramen.

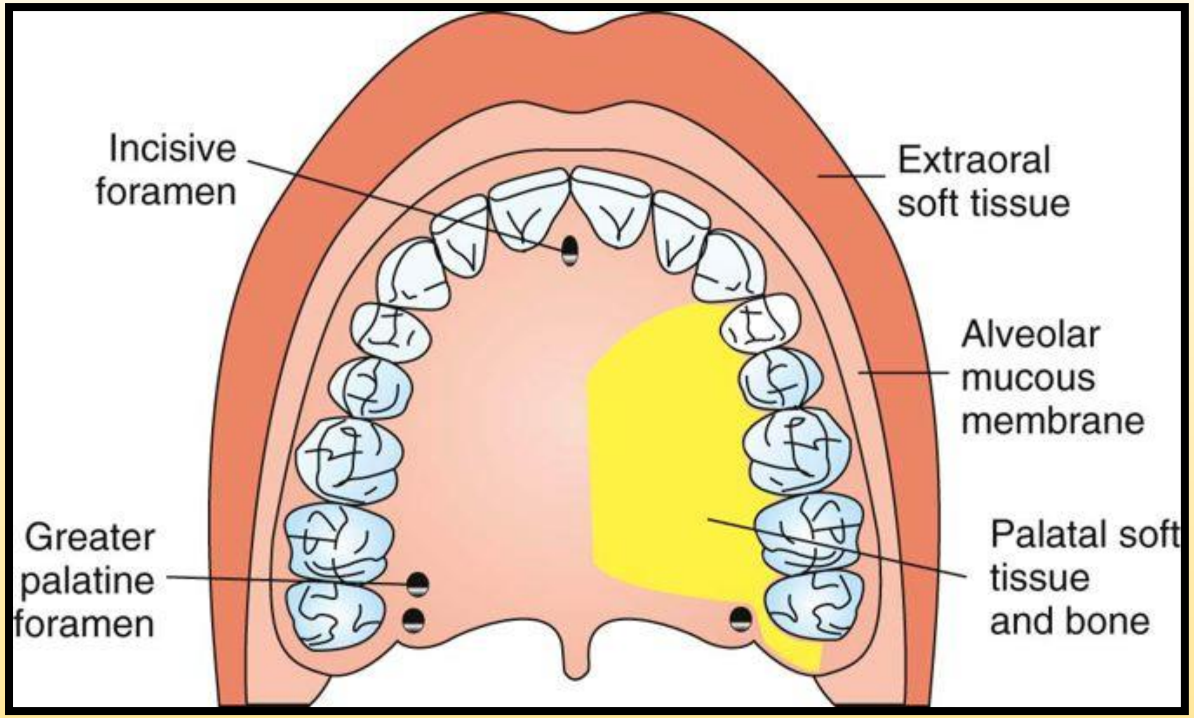
#The needle is inserted only a few millimeters and aspiration performed.

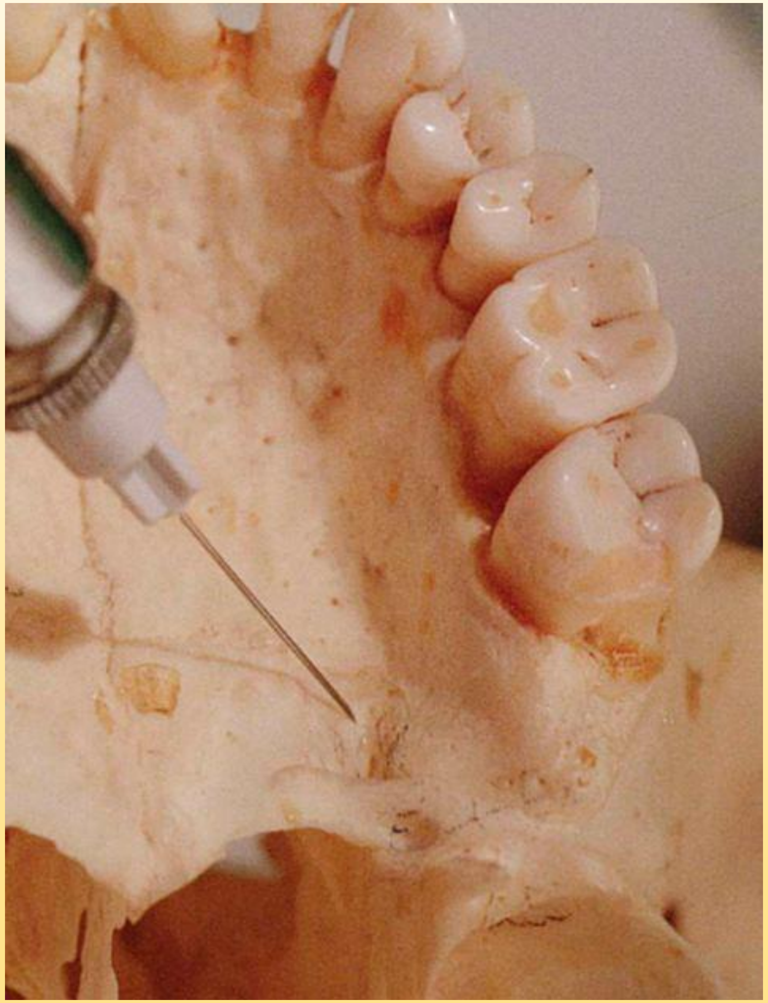
# slowly deposit (30 second minimum). Very little anesthetic solution is required to obtain a greater palatine nerve block. Around 0.2-0.6 mL is sufficient.

# Positive Aspiration Less than 1%.

# Greater Palatine Nerve Block





advance the syringe from the opposite side of the mouth at a right angle to the target area

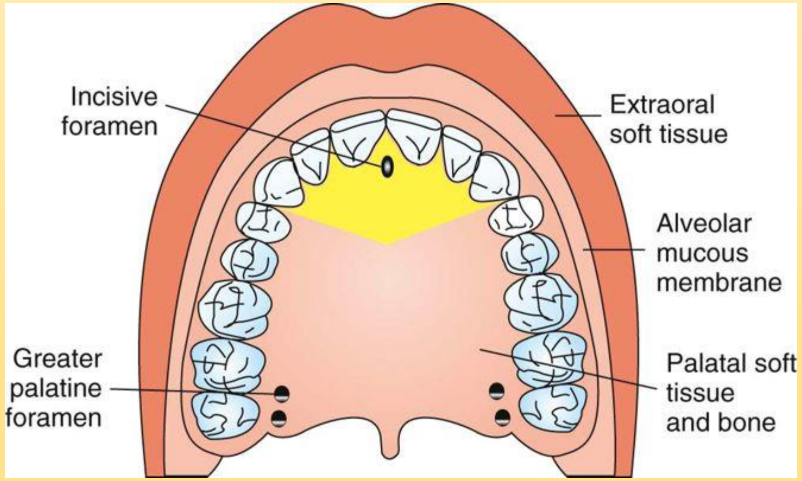
## 6- Nasopalatine (long sphenopalatine nerve) block

# This injection anaesthetizes the soft tissues and bone of the anterior hard palate adjacent to the six anterior teeth. In the canine region some fibers from the greater palatine nerve may provide an accessory supply.

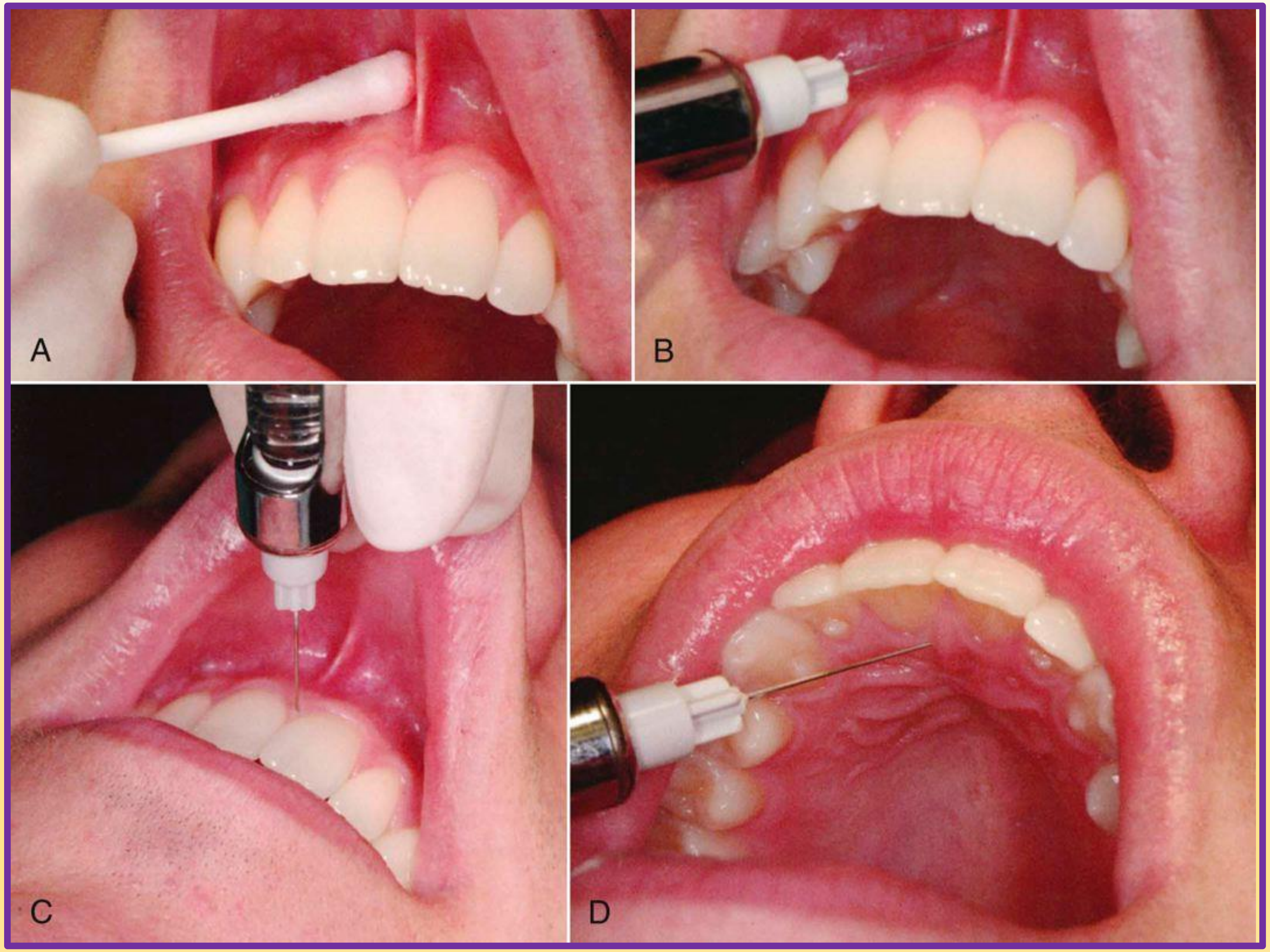
# During the injection the patient has the mouth wide open. The needle is inserted at one side of the incisive papilla. Penetration of only a few millimeters is required; aspiration is performed and less than 0.2 mL of solution deposited.

# In order to reduce the discomfort of this injection the incisive papilla may be approached via previously anaesthetized buccal tissues by chasing the anesthetic through the central incisor interdental papilla.

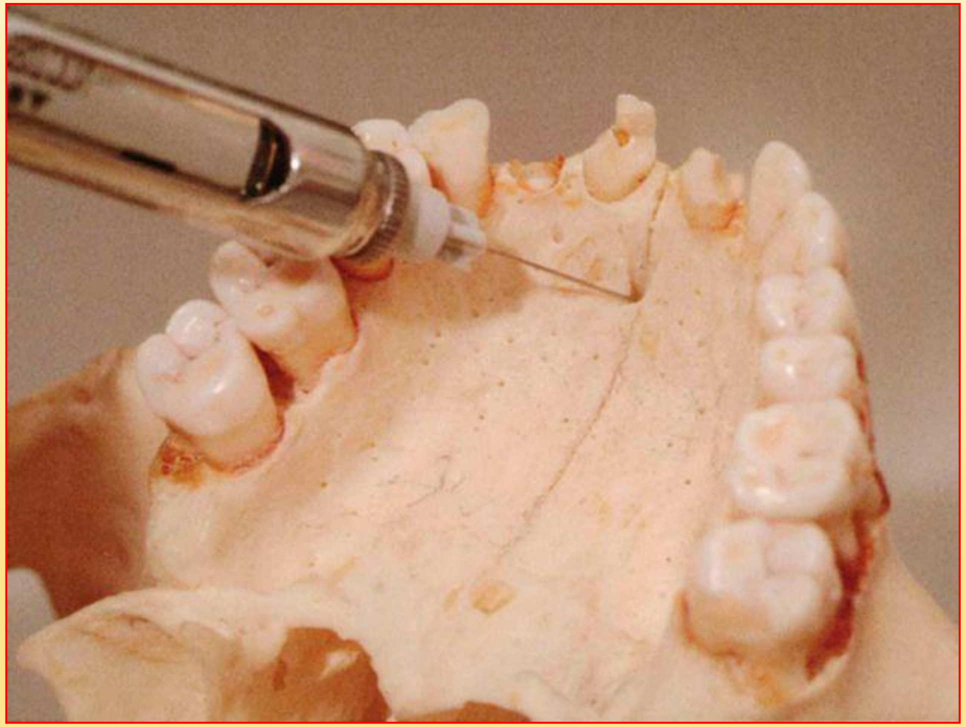
# Positive aspiration= Less than 1%.

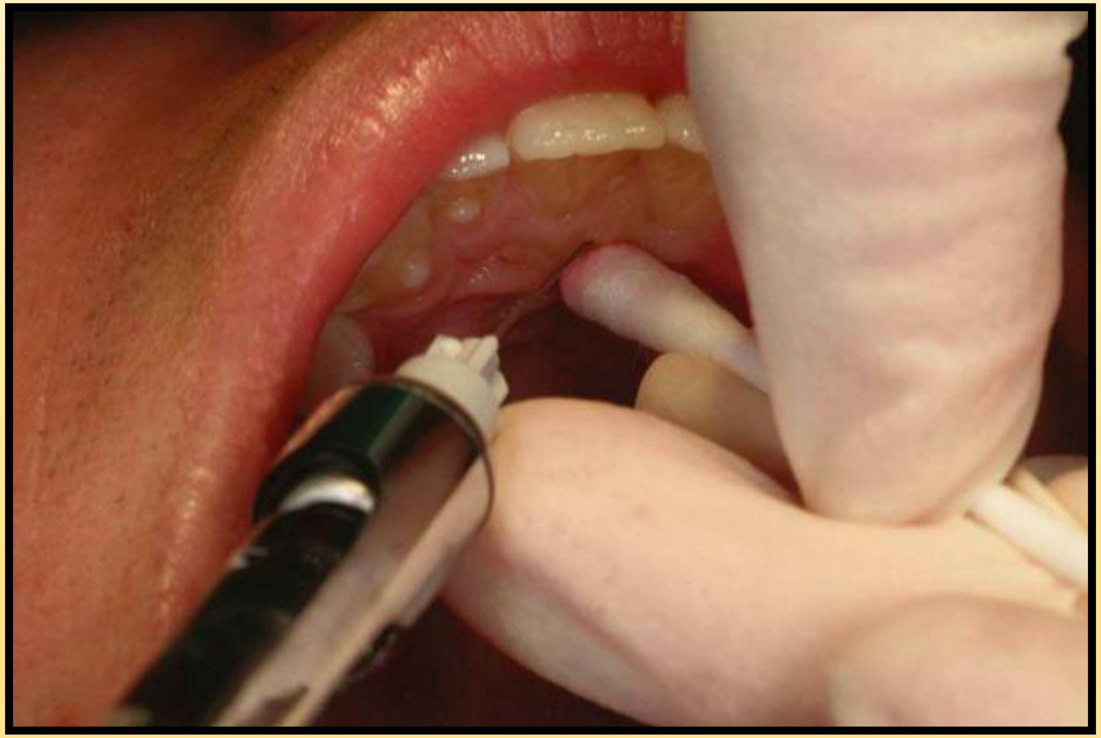


# Three needle punctures technique?



Target area: incisive foramen, beneath the incisive papilla



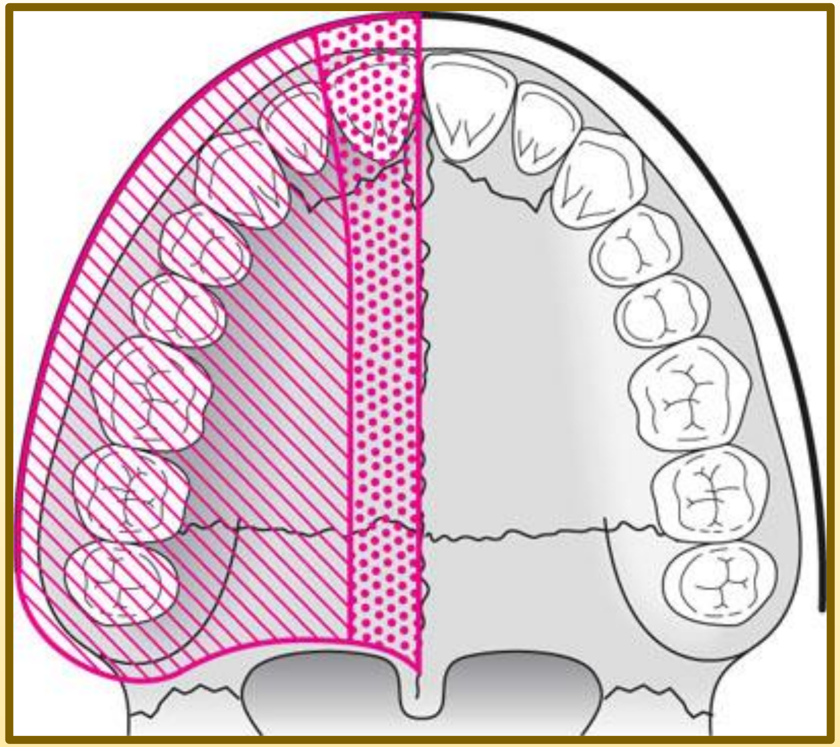


## Maxillary nerve block

- There are two approaches to the maxillary nerve block – namely, the tuberosity approach and the greater palatine canal approach.

- **Tuberosity approach** is similar to the posterior superior alveolar nerve block, the greater palatine canal approach gains access to the maxillary nerve trunk via the greater palatine canal.

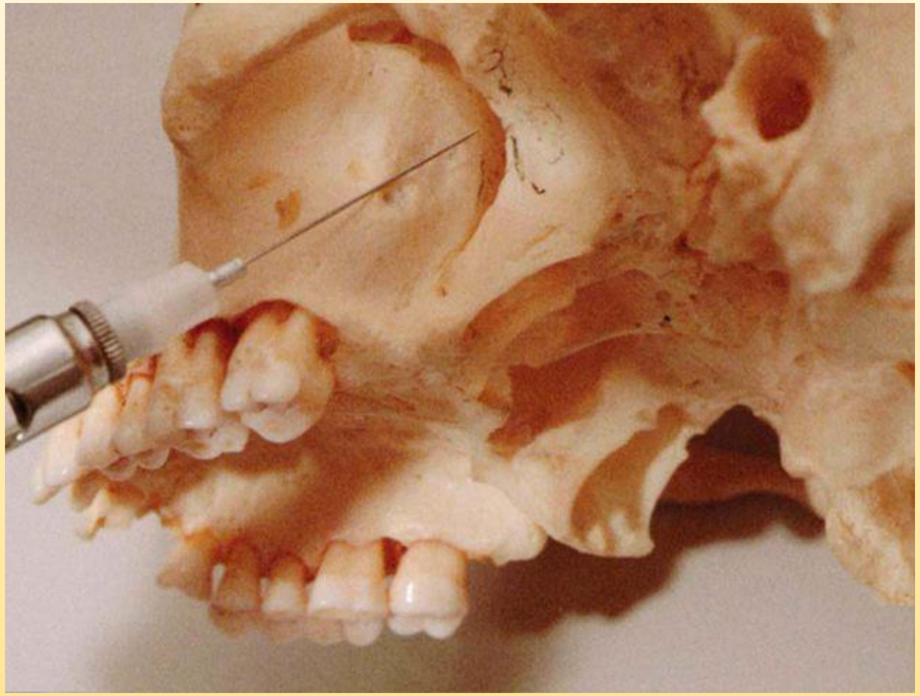
- Deposition of local anesthetic solution around the trunk of the maxillary nerve will provide anaesthesia of one-half of the upper jaw, including all of the teeth and the buccal and palatal mucosa .



Major difficulties with the greater palatine canal approach involve locating the canal and negotiating it successfully. The major difficulty in the high-tuberosity approach is the higher incidence of hematoma.

# A- Tuberosity approach

- A long (35 mm) needle must be used. The approach is identical to the posterior superior alveolar nerve block. However, the needle is inserted to a much greater depth – namely, 30 mm.



- At this point the needle is in the vicinity of the maxillary nerve within the pterygopalatine fossa.
- This end point is superior and medial to the point of injection during the posterior superior alveolar nerve block.
- Following aspiration, Slowly (more than 60 seconds) deposit 1.8 mL

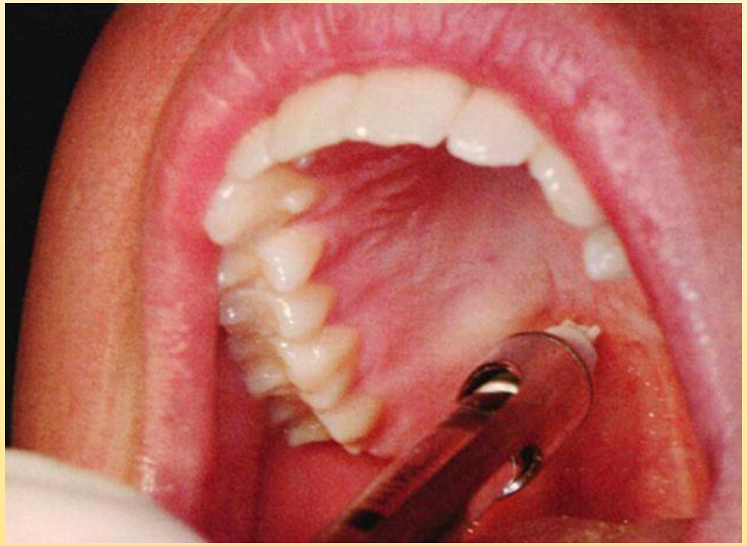
# B- Greater palatine canal approach

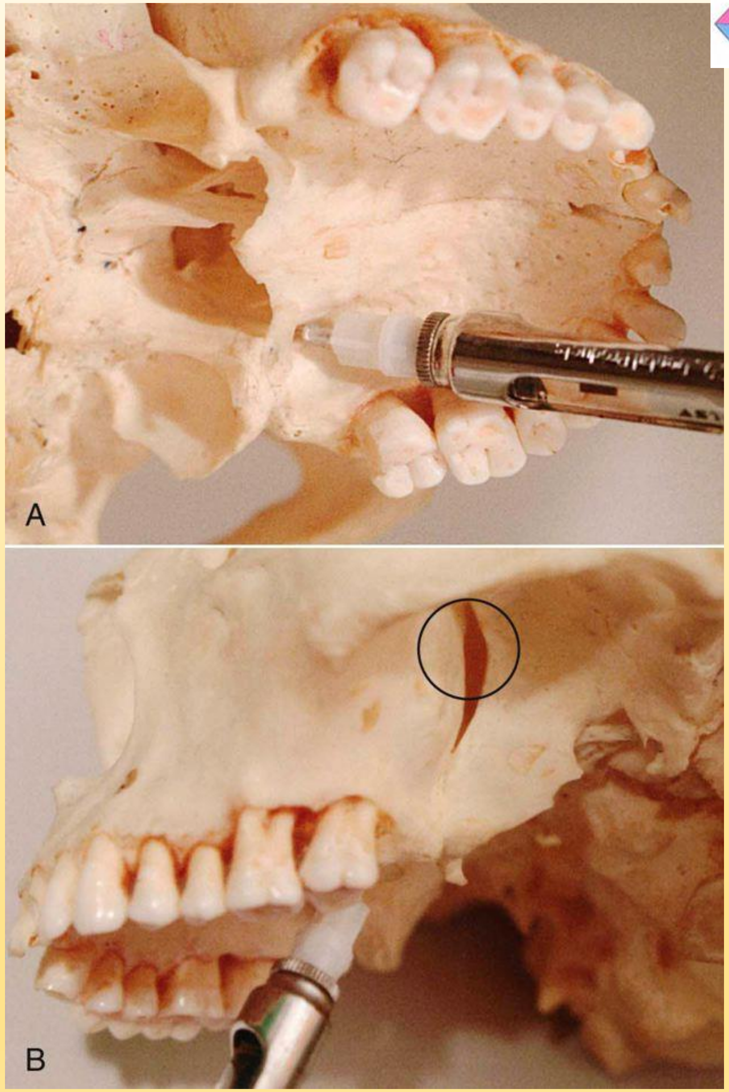
- Target area: the maxillary nerve as it passes through the pterygopalatine fossa; the needle passes through the greater palatine canal to reach the pterygopalatine fossa

- The patient has the mouth open wide and the greater palatine foramen is approached from the opposite side.
The needle is advanced into the canal superiorly and posteriorly at an angle of 45°. The needle is advanced very slowly along the canal to a depth of 30 mm and slowly deposit 1.8 mL of solution over a minimum of 1 minute.

- If bony obstructions are encountered, the needle should not be advanced forcibly. It is better to withdraw slightly and advance again at a different angle. If an insurmountable barrier is encountered then this approach should be abandoned.
- Bleeding at the needle exit point can occur with this injection. Firm pressure at the site for a few minutes will arrest any hemorrhage.

- Continue to deposit small volumes of anesthetic throughout the procedure.






- Approximately 5% to 15% of greater palatine canals have bony obstructions that prevent passage of the needle

# Oral Surgery

3rd Grade
Dr. Ali Mohammed

## Medical Emergencies During Dental Treatment

Patients with medical conditions sometimes require modifications of their perioperative care when oral surgery is planned. This lecture discusses those considerations for the major categories of health problems.

### Cardiovascular Problems

1. **Ischemic Heart Diseases.**
   - **Angina Pectoris:**

     It is a progressive narrowing or spasm (or both) of one or more of the coronary arteries. narrowing of myocardial arteries is one of the most common health problems that dentists encounter. This condition occurs primarily in men older than age 40 years and is also prevalent in postmenopausal women.

     This condition leads to a mismatch between myocardial oxygen demand and the ability of the coronary arteries to suppl oxygen carrying blood. Myocardial oxygen demand can be increased, for example, by exertion or anxiety, the attack occurs because there is insufficient oxygen supply that meet the demand by the myocardium.

**Signs & Symptoms:**

a) Heavy pressure or squeezing sensation in the patient's substernal region that can radiate into the left shoulder and arm and even into the mandibular region.
b) Intense sense of being unable to breathe adequately.
c) Nausea.
d) Sweating.
e) Bradycardia.

Once the decision is made to perform elective oral surgery, the patient with a history of angina should be prepared for surgery, and the patient's myocardial oxygen demand should be lowered or prevented from rising. The increased oxygen demand during oral surgery is primarily the result of patient anxiety; thus, an anxiety-reduction protocol should be used as mentioned below.

**General Anxiety-Reduction Protocol**

***Before Appointment***

• Hypnotic agent to promote sleep on night before surgery (optional)
•Sedative agent to decrease anxiety on morning of surgery (optional)
•Morning appointment and schedule so that reception room time is minimized

***During Appointment***

***Nonpharmacologic Means of Anxiety Control***

• Frequent verbal reassurances
•Distracting conversation
• No surprises (clinician warns patient before doing anything that could cause anxiety)
•No unnecessary noise
•Surgical instruments out of patient's sight
•Relaxing background music

***Pharmacologic Means of Anxiety Control***

• Local anesthetics of sufficient intensity and duration
• Nitrous oxide
•Intravenous anxiolytics.

**Management of patient with history of Angina Pectoris:**

1. Consult the patient's physician.
2. Use an anxiety-reduction protocol.
3. Have nitroglycerin tablets (sublingual) or spray readily available. Use nitroglycerin premedication, if indicated.
4. Ensure profound local anesthesia (best reducer of anxiety) before starting surgery.
5. Consider the use of nitrous oxide sedation.
6. Monitor vital signs closely.
7. Consider possible limitation of amount of epinephrine used (0.04 mg maximum)(4ml of LA with 1:100,000 epinephrine).
8. Maintain verbal contact with patient throughout the procedure to monitor status.

- **Myocardial Infarction (MI):**

MI occurs when ischemia (resulting from an oxygen demand-supply mismatch) is not relieved and causes myocardial cellular dysfunction and death.

MI usually occurs when an area of coronary artery narrowing has a clot form that blocks all or most blood flow. The infarcted area of myocardium becomes nonfunctional and eventually necrotic and is surrounded by an area of usually reversibly ischemic myocardium that is prone to serve as a nidus for dysrhythmias.

In general, it is recommended that elective major surgical procedures be deferred until at least 6 months after an infarction.

### Management of Patient with a History of Myocardial Infarction

1. Consult the patient's primary care physician.
2. Check with the physician if invasive dental care is needed before 6 months since the myocardial infarction.
3. Check whether the patient is using anticoagulants (including aspirin).
4. Use an anxiety-reduction protocol.
5. Have nitroglycerin available; use it prophylactically if the physician advises.
6. Administer supplemental oxygen (optional).
7. Provide profound local anesthesia.
8. Consider nitrous oxide administration.
9. Monitor vital signs, and maintain verbal contact with the patient.
10. Consider possible limitation of epinephrine use to 0.04 mg.
11. Consider referral to an oral-maxillofacial surgeon.

### 2. Cerebrovascular Accident (Stroke)

Patients who have had a cerebrovascular accident (CVA) are always susceptible to further neurovascular accidents. These patients are often prescribed anticoagulants or antiplatelet medication depending on the cause of the CVA; if they are hypertensive, they are given blood pressure–lowering agents. CVAs are typically a result of an embolus from a history of atrial fibrillation, a thrombus due to a hypercoagulable state, or stenotic vessels.

In the case of a patient having an embolic or thrombotic stroke, the patient is likely taking an anticoagulant as opposed to an ischemic stroke secondary to stenotic vessels, in which case the patient would be taking an antiplatelet medication. If such a patient requires surgery, clearance by the patient's physician is desirable, as is a delay until significant hypertensive tendencies have been controlled. The patient's baseline neurologic status should be assessed and documented preoperatively.

The patient should be treated by a nonpharmacologic anxiety reduction protocol and have vital signs carefully monitored during surgery. If pharmacologic sedation is necessary, low concentrations of nitrous oxide can be used. Techniques to manage patients taking anticoagulants are discussed later in this lecture.

**3. Congestive Heart Failure (Hypertrophic Cardiomyopathy)**

CHF (HCM) occurs when a diseased myocardium is unable to deliver the cardiac output demanded by the body or when excessive demands are placed on a normal myocardium.

The heart begins to have an increased end-diastolic volume that, in the case of the normal myocardium, increases contractility through the Frank-Starling mechanism (FOR YOUR INFORMATION (FYI) The Frank-Starling mechanism is an intrinsic cardiac autoregulatory mechanism that represents the relationship between stroke volume and end-diastolic volume. The law states that the stroke volume of the heart increases in response to an increase in the volume of blood in the ventricles before contraction (the end-diastolic volume), when all other factors remain constant. As a larger volume of blood flows into the ventricle, the blood stretches cardiac muscle, leading to an increase in the force of contraction. This mechanism ensures that stroke volume changes in proportion to the change in end-diastolic volume). However, as the normal or diseased myocardium further dilates, it becomes a less efficient pump, causing blood to back up into the pulmonary, hepatic, and mesenteric vascular beds. This eventually leads to pulmonary edema, hepatic dysfunction, and compromised intestinal nutrient absorption. The lowered cardiac output causes generalized weakness, and impaired renal clearance of excess fluid leads to vascular overload.

**Sings & Symptoms:**

a) Orthopnea: shortness of breath in supine position.
b) Paroxysmal nocturnal dyspnea: similar to orthopnea. The patient has respiratory difficulty 1 or 2 hours after lying down.
c) Lower extremity edema: which usually appears as a swelling of the foot, the ankle, or both, is caused by an increase in interstitial fluid. The edema is detected by pressing a finger into the swollen area for a few seconds; and the indentation in the soft tissue is left after the finger is removed.
d) Weight gain.
e) Dyspnea on exertion.

### Management of the Patient with Congestive Heart Failure

1. Defer treatment until heart function has been medically improved and the patient's physician believes treatment is possible.
2. Use an anxiety-reduction protocol.
3. Consider possible administration of supplemental oxygen.
4. Avoid using the supine position.
5. Consider referral to an oral-maxillofacial surgeon.

## Pulmonary Problems

### 1. Asthma

True asthma involves the episodic narrowing of inflamed small airways, which produces wheezing and dyspnea as a result of chemical, infectious, immunologic, or emotional stimulation or a combination of these. Patients with asthma should be questioned about precipitating factors, frequency and severity of attacks, medications used, and response to medications. The severity of attacks can often be gauged by the need for emergency room visits and hospital admissions.

### Management of the Patient with Asthma

1. Defer dental treatment until the asthma is well controlled and the patient has no signs of a respiratory tract infection.
2. Listen to the chest with a stethoscope to detect any wheezing before major oral surgical procedures or sedation.
3. Use an anxiety-reduction protocol, including nitrous oxide, but avoid the use of respiratory depressants.
4. Consult the patient's physician about possible preoperative use of cromolyn sodium.
5. If the patient is or has been chronically taking corticosteroids, provide prophylaxis for adrenal insufficiency.
6. Keep a bronchodilator-containing inhaler easily accessible.
7. Avoid the use of NSAIDs in susceptible patients.

FYI: - Cromolyn is a synthetic compound that is used to prevent some allergic reactions. It is traditionally described as a mast cell stabilizer and is commonly marketed as the sodium salt sodium cromoglicate or cromolyn sodium. This drug prevents the release of inflammatory chemicals such as histamine from mast cells. It is available in multiple forms such as nasal spray, nebulizer solution for aerosol administration to treat asthma.

### 2. Chronic Obstructive Pulmonary Disease (COPD)

In the past, the terms emphysema and bronchitis were used to describe clinical manifestations of COPD, but COPD has been recognized to be a spectrum of pathologic pulmonary problems. It is usually caused by long-term exposure to pulmonary irritants such as tobacco smoke that cause metaplasia of pulmonary airway tissue. Airways are inflamed and disrupted, lost their elastic properties, and become obstructed because of mucosal edema, excessive secretions, and bronchospasm, producing the clinical manifestations of COPD.

**Sings & Symptoms:**

1. dyspnea during mild to moderate exertion.
2. chronic cough that produces large amounts of thick secretions.
3. frequent respiratory tract infections.
4. barrel shaped chests.
5. they may purse their lips to breathe.
6. Have audible wheezing during breathing.
7. Patients may develop associated pulmonary hypertension and eventual right-sided heart failure.

### Management of Patient With COPD

1. Defer treatment until lung function has improved and treatment is possible.
2. Listen to the chest bilaterally with stethoscope to determine adequacy of breath sounds.
3. Use an anxiety-reduction protocol, but avoid the use of respiratory depressants.
4. If the patient requires chronic oxygen supplementation, continue at the prescribed flow rate. If the patient does not require supplemental oxygen therapy, consult his/her physician before administering oxygen.
5. If the patient chronically receives corticosteroid therapy, manage the patient for adrenal insufficiency.
6. Avoid placing the patient in the supine position until you are confident that the patient can tolerate it.
7. Keep a bronchodilator-containing inhaler accessible.
8. Closely monitor respiratory rate and heart rate.
9. Schedule afternoon appointments to allow for clearance of secretions.

## Renal Problems

### 1. Rental Failure

Patients with chronic renal failure require periodic renal dialysis. Elective oral surgery is best undertaken the day after a dialysis treatment has been performed. This allows the heparin used during dialysis to disappear and the patient to be in the best physiologic status with respect to intravascular volume and metabolic byproducts.

### Management of Patient with Renal Insufficiency and Patient Receiving Hemodialysis

1. Avoid the use of drugs that depend on renal metabolism or excretion. Modify the dose if such drugs are necessary. Do not use an atrioventricular shunt for giving drugs or for taking blood specimens.
2. Avoid the use of nephrotoxic drugs such as nonsteroidal anti-inflammatory drugs.
3. Defer dental care until the day after dialysis has been given.
4. Consult the patient's physician about the use of prophylactic antibiotics.
5. Monitor blood pressure and heart rate.
6. Look for signs of secondary hyperparathyroidism.
7. Consider screening for hepatitis B virus before dental treatment. Take the necessary precautions if unable to screen for hepatitis.

### 2. Renal Transplantation and Transplantation of Other Organs

The patient requiring surgery after renal or other major organ transplantation is usually receiving a variety of drugs to preserve the function of the transplanted tissue. These patients receive corticosteroids and may need supplemental corticosteroids in the perioperative period.

Most of these patients also receive immunosuppressive agents that may cause otherwise self-limiting infections to become severe.

Therefore, a more aggressive use of antibiotics and early hospitalization for infections are warranted. The patient's primary care physician should be consulted about the need for prophylactic antibiotics. Cyclosporine A, an immunosuppressive drug administered after organ transplantation, may cause gingival hyperplasia. The dentist performing oral surgery should recognize this so as not to wrongly attribute gingival hyperplasia entirely to hygiene problems. Patients who have received renal transplants occasionally have problems with severe hypertension.

### Management of Patient with Renal Transplant

1. Defer treatment until the patient's primary care physician or transplant surgeon clears the patient for dental care.
2. Avoid the use of nephrotoxic drugs.
3. Consider the use of supplemental corticosteroids.
4. Monitor blood pressure.
5. Consider screening for hepatitis B virus before dental care. take necessary precautions if unable to screen for hepatitis.
6. Watch for presence of cyclosporine-A–induced gingival hyperplasia. emphasize the importance of oral hygiene.
7. Consider use of prophylactic antibiotics, particularly in patients taking immunosuppressive agents.

### 3. Hypertension

According to the American Heart Association hypertension is a chronic elevation of blood pressure. when blood pressure consistently ranges from 130-139 systolic or 80-89 mm Hg diastolic, as illustrated in the table below:

## Blood Pressure Categories

American Heart Association.

| BLOOD PRESSURE CATEGORY | SYSTOLIC mm Hg (upper number) | | DIASTOLIC mm Hg (lower number) |
|---|---|---|---|
| NORMAL | LESS THAN 120 | and | LESS THAN 80 |
| ELEVATED | 120-129 | and | LESS THAN 80 |
| HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1 | 130-139 | or | 80-89 |
| HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2 | 140 OR HIGHER | or | 90 OR HIGHER |
| HYPERTENSIVE CRISIS (consult your doctor immediately) | HIGHER THAN 180 | and/or | HIGHER THAN 120 |

### Management of Patient with Hypertension

**Mild to Moderate Hypertension (Systolic >140 mm Hg; Diastolic >90 mm Hg)**

1. Recommend that the patient seek the primary care physician's guidance for medical therapy of hypertension. It is not necessary to defer needed dental care.
2. Monitor the patient's blood pressure at each visit and whenever administration of epinephrine-containing local anesthetic surpasses 0.04 mg during a single visit.
3. Use an anxiety-reduction protocol.
4. Avoid rapid posture changes in patients taking drugs that cause vasodilation.
5. Avoid administration of sodium-containing intravenous solutions.

**Severe Hypertension (Systolic >200 mm Hg; Diastolic >110 mm Hg)**

1. Defer elective dental treatment until the hypertension is better controlled.

2. Consider referral to an oral-maxillofacial surgeon for emergent problems.

## Hepatic Disorders

The patient with severe liver damage resulting from infectious disease, ethanol abuse, or vascular or biliary congestion requires special consideration before oral surgery is performed. An alteration of dose or avoidance of drugs that require hepatic metabolism may be necessary.
The production of nearly all coagulation factors, therefore obtaining an international normalized ratio [INR] which is in a healthy person is typically between 0.8 and 1.2, prothrombin time [PT] (normally 11-13.5 sec.) or partial thromboplastin time [PTT] (normally 25-35 sec.) may be useful before surgery in patients with more severe liver disease who are undergoing surgery with the potential for heavy blood loss. Portal hypertension caused by liver disease may also cause hypersplenism and the sequestering of platelets, causing a relative thrombocytopenia. Thrombopoietin is also produced in the liver, and decreased production of thrombopoietin may result in a true thrombocytopenia. Finding a prolonged bleeding time or low platelet count reveals this problem. Patients with severe liver dysfunction may require hospitalization for dental surgery because their decreased ability to metabolize the nitrogen in swallowed blood may cause encephalopathy. Finally, unless documented otherwise, a patient with liver disease of unknown origin should be presumed to carry the hepatitis virus.

FYI: - Encephalopathy is a general term used to describe a disease that affects the function or structure of the brain. It can have many different causes, including infections, liver failure, kidney failure, lack of oxygen or blood flow to the brain, and exposure to toxins. Symptoms of encephalopathy can vary depending on the underlying cause and may include confusion, memory loss, personality changes, seizures, and loss of consciousness.

## Endocrine Disorders

### 1. Diabetes Mellitus

Diabetes mellitus is caused by an underproduction of insulin, a resistance of insulin receptors in end organs to the effects of insulin, or both. Diabetes is commonly divided into insulin-dependent (type 1) and non-insulin-dependent (type 2) diabetes.

Type 1 diabetes usually begins during childhood or adolescence. The major problem in this form of diabetes is an underproduction of insulin, which results in the inability of the patient to use glucose properly.

Patients with type 2 diabetes usually produce insulin but in insufficient amounts because of decreased insulin activity, insulin receptor resistance, or both. This form of diabetes typically begins in adulthood, is exacerbated by obesity, and does not usually require insulin therapy.

Hypoglycemia should be avoided in patients undergoing oral surgery since it can lead to coma while hyperglycemia rarely lead to ketoacidosis in patient with type 2 diabetes, therefore, any Signs of hypoglycemia—hypotension, hunger, drowsiness, nausea, diaphoresis, tachycardia, or mood change—occur, an oral or IV supply of glucose should be administered.

Persons with well-controlled diabetes are no more susceptible to infections than are persons without diabetes, but they have more difficulty containing infections. This is caused by altered leukocyte function or by other factors that affect the ability of the body to control an infection. Difficulty in containing infections is more significant in persons with poorly controlled diabetes. Therefore, elective oral surgery should be deferred in patients with poorly controlled diabetes until control is accomplished.

### Insulin-Dependent (Type 1) Diabetes

1. Defer surgery until the diabetes is well controlled; consult the patient's physician.
2. Schedule an early-morning appointment; avoid lengthy appointments.
3. Use an anxiety-reduction protocol, but avoid deep sedation techniques in outpatients.
4. Monitor pulse, respiration, and blood pressure before, during, and after surgery.
5. Maintain verbal contact with the patient during surgery.
6. If the patient must not eat or drink before oral surgery and will have difficulty eating after surgery, instruct him or her not to take the usual dose of regular insulin; start intravenous administration of a 5% dextrose in water drip at 150 mL/h.
7. If allowed, have the patient eat a normal breakfast before surgery and take the usual dose of regular insulin.
8. Advise patients not to resume normal insulin doses until they are able to return to usual level of caloric intake and activity level.
9. Consult the physician if any questions concerning modification of the insulin regimen arises.
10. Watch for signs of hypoglycemia.
11. Treat infections aggressively.

### Non–Insulin-Dependent (Type 2) Diabetes

1. Defer surgery until the diabetes is well controlled.
2. Schedule an early-morning appointment; avoid lengthy appointments.
3. Use an anxiety-reduction protocol.
4. Monitor pulse, respiration, and blood pressure before, during, and after surgery.
5. Maintain verbal contact with the patient during surgery.

6. If the patient must not eat or drink before oral surgery and will have difficulty eating after surgery, instruct him or her to skip any oral hypoglycemic medications that day.
7. If the patient can eat before and after surgery, instruct him or her to eat a normal breakfast and to take the usual dose of hypoglycemic agent.
8. Watch for signs of hypoglycemia.
9. Treat infections aggressively.

**2. Adrenal Insufficiency**

Diseases of the adrenal cortex may cause adrenal insufficiency. Symptoms of primary adrenal insufficiency include weakness, weight loss, fatigue, and hyperpigmentation of skin and mucous membranes. However, the most common cause of adrenal insufficiency is chronic therapeutic corticosteroid administration (secondary adrenal insufficiency).

Often, patients who regularly take corticosteroids have moon facies (moon-shaped face), buffalo (back) humps, and thin, translucent skin. Their inability to increase endogenous corticosteroid levels in response to physiologic stress may cause them to become hypotensive, syncopal, nauseated, and feverish during complex, prolonged surgery, which is consistent with an adrenal crisis.

### Management of Patient With Adrenal Suppression Who Requires Major Oral Surgery

**If the patient is currently taking corticosteroids:**

1. Use an anxiety-reduction protocol.
2. Monitor pulse and blood pressure before, during, and after surgery.
3. Instruct the patient to double the usual daily dose on the day before, day of, and day after surgery.

4. On the second postsurgical day, advise the patient to return to a usual steroid dose.

**If the patient is not currently taking steroids but has received at least 20 mg of hydrocortisone (cortisol or equivalent) for more than 2 weeks within the past year:**

1. Use an anxiety-reduction protocol.
2. Monitor pulse and blood pressure before, during, and after surgery.
3. Instruct the patient to take 60 mg of hydrocortisone (or equivalent) the day before and the morning of surgery (or the dentist should administer 60 mg of hydrocortisone or equivalent intramuscularly or intravenously before complex surgery).
4. On the first 2 postsurgical days, the dose should be dropped to 40 mg and dropped to 20 mg for 3 days thereafter. The clinician can cease administration of supplemental steroids 6 days after surgery.

# Oral Surgery

3rd Grade
Dr. Ali Mohammed

## Medical Emergencies During Dental Treatment

Patients with medical conditions sometimes require modifications of their perioperative care when oral surgery is planned. This lecture discusses those considerations for the major categories of health problems.

### Cardiovascular Problems

1. **Ischemic Heart Diseases.**
   - **Angina Pectoris:**

     It is a progressive narrowing or spasm (or both) of one or more of the coronary arteries. narrowing of myocardial arteries is one of the most common health problems that dentists encounter. This condition occurs primarily in men older than age 40 years and is also prevalent in postmenopausal women.

     This condition leads to a mismatch between myocardial oxygen demand and the ability of the coronary arteries to suppl oxygen carrying blood. Myocardial oxygen demand can be increased, for example, by exertion or anxiety, the attack occurs because there is insufficient oxygen supply that meet the demand by the myocardium.

**Signs & Symptoms:**

a) Heavy pressure or squeezing sensation in the patient's substernal region that can radiate into the left shoulder and arm and even into the mandibular region.
b) Intense sense of being unable to breathe adequately.
c) Nausea.
d) Sweating.
e) Bradycardia.

Once the decision is made to perform elective oral surgery, the patient with a history of angina should be prepared for surgery, and the patient's myocardial oxygen demand should be lowered or prevented from rising. The increased oxygen demand during oral surgery is primarily the result of patient anxiety; thus, an anxiety-reduction protocol should be used as mentioned below.

**General Anxiety-Reduction Protocol**

***Before Appointment***

• Hypnotic agent to promote sleep on night before surgery (optional)

•Sedative agent to decrease anxiety on morning of surgery (optional)

•Morning appointment and schedule so that reception room time is minimized

***During Appointment***

***Nonpharmacologic Means of Anxiety Control***

• Frequent verbal reassurances

•Distracting conversation

• No surprises (clinician warns patient before doing anything that could cause anxiety)

•No unnecessary noise

•Surgical instruments out of patient's sight

•Relaxing background music

***Pharmacologic Means of Anxiety Control***

• Local anesthetics of sufficient intensity and duration
• Nitrous oxide
•Intravenous anxiolytics.

**Management of patient with history of Angina Pectoris:**

1. Consult the patient's physician.
2. Use an anxiety-reduction protocol.
3. Have nitroglycerin tablets (sublingual) or spray readily available. Use nitroglycerin premedication, if indicated.
4. Ensure profound local anesthesia (best reducer of anxiety) before starting surgery.
5. Consider the use of nitrous oxide sedation.
6. Monitor vital signs closely.
7. Consider possible limitation of amount of epinephrine used (0.04 mg maximum)(4ml of LA with 1:100,000 epinephrine).
8. Maintain verbal contact with patient throughout the procedure to monitor status.

- **Myocardial Infarction (MI):**

MI occurs when ischemia (resulting from an oxygen demand-supply mismatch) is not relieved and causes myocardial cellular dysfunction and death.

MI usually occurs when an area of coronary artery narrowing has a clot form that blocks all or most blood flow. The infarcted area of myocardium becomes nonfunctional and eventually necrotic and is surrounded by an area of usually reversibly ischemic myocardium that is prone to serve as a nidus for dysrhythmias.

In general, it is recommended that elective major surgical procedures be deferred until at least 6 months after an infarction.

### Management of Patient with a History of Myocardial Infarction

1. Consult the patient's primary care physician.
2. Check with the physician if invasive dental care is needed before 6 months since the myocardial infarction.
3. Check whether the patient is using anticoagulants (including aspirin).
4. Use an anxiety-reduction protocol.
5. Have nitroglycerin available; use it prophylactically if the physician advises.
6. Administer supplemental oxygen (optional).
7. Provide profound local anesthesia.
8. Consider nitrous oxide administration.
9. Monitor vital signs, and maintain verbal contact with the patient.
10. Consider possible limitation of epinephrine use to 0.04 mg.
11. Consider referral to an oral-maxillofacial surgeon.

### 2. Cerebrovascular Accident (Stroke)

Patients who have had a cerebrovascular accident (CVA) are always susceptible to further neurovascular accidents. These patients are often prescribed anticoagulants or antiplatelet medication depending on the cause of the CVA; if they are hypertensive, they are given blood pressure–lowering agents. CVAs are typically a result of an embolus from a history of atrial fibrillation, a thrombus due to a hypercoagulable state, or stenotic vessels.

In the case of a patient having an embolic or thrombotic stroke, the patient is likely taking an anticoagulant as opposed to an ischemic stroke secondary to stenotic vessels, in which case the patient would be taking an antiplatelet medication. If such a patient requires surgery, clearance by the patient's physician is desirable, as is a delay until significant hypertensive tendencies have been controlled. The patient's baseline neurologic status should be assessed and documented preoperatively.

The patient should be treated by a nonpharmacologic anxiety reduction protocol and have vital signs carefully monitored during surgery. If pharmacologic sedation is necessary, low concentrations of nitrous oxide can be used. Techniques to manage patients taking anticoagulants are discussed later in this lecture.

### 3. Congestive Heart Failure (Hypertrophic Cardiomyopathy)

CHF (HCM) occurs when a diseased myocardium is unable to deliver the cardiac output demanded by the body or when excessive demands are placed on a normal myocardium.

The heart begins to have an increased end-diastolic volume that, in the case of the normal myocardium, increases contractility through the Frank-Starling mechanism (FOR YOUR INFORMATION (FYI) The Frank-Starling mechanism is an intrinsic cardiac autoregulatory mechanism that represents the relationship between stroke volume and end-diastolic volume. The law states that the stroke volume of the heart increases in response to an increase in the volume of blood in the ventricles before contraction (the end-diastolic volume), when all other factors remain constant. As a larger volume of blood flows into the ventricle, the blood stretches cardiac muscle, leading to an increase in the force of contraction. This mechanism ensures that stroke volume changes in proportion to the change in end-diastolic volume). However, as the normal or diseased myocardium further dilates, it becomes a less efficient pump, causing blood to back up into the pulmonary, hepatic, and mesenteric vascular beds. This eventually leads to pulmonary edema, hepatic dysfunction, and compromised intestinal nutrient absorption. The lowered cardiac output causes generalized weakness, and impaired renal clearance of excess fluid leads to vascular overload.

**Sings & Symptoms:**

a) Orthopnea: shortness of breath in supine position.
b) Paroxysmal nocturnal dyspnea: similar to orthopnea. The patient has respiratory difficulty 1 or 2 hours after lying down.
c) Lower extremity edema: which usually appears as a swelling of the foot, the ankle, or both, is caused by an increase in interstitial fluid. The edema is detected by pressing a finger into the swollen area for a few seconds; and the indentation in the soft tissue is left after the finger is removed.
d) Weight gain.
e) Dyspnea on exertion.

### Management of the Patient with Congestive Heart Failure

1. Defer treatment until heart function has been medically improved and the patient's physician believes treatment is possible.
2. Use an anxiety-reduction protocol.
3. Consider possible administration of supplemental oxygen.
4. Avoid using the supine position.
5. Consider referral to an oral-maxillofacial surgeon.

## Pulmonary Problems

### 1. Asthma

True asthma involves the episodic narrowing of inflamed small airways, which produces wheezing and dyspnea as a result of chemical, infectious, immunologic, or emotional stimulation or a combination of these. Patients with asthma should be questioned about precipitating factors, frequency and severity of attacks, medications used, and response to medications. The severity of attacks can often be gauged by the need for emergency room visits and hospital admissions.

### Management of the Patient with Asthma

1. Defer dental treatment until the asthma is well controlled and the patient has no signs of a respiratory tract infection.
2. Listen to the chest with a stethoscope to detect any wheezing before major oral surgical procedures or sedation.
3. Use an anxiety-reduction protocol, including nitrous oxide, but avoid the use of respiratory depressants.
4. Consult the patient's physician about possible preoperative use of cromolyn sodium.
5. If the patient is or has been chronically taking corticosteroids, provide prophylaxis for adrenal insufficiency.
6. Keep a bronchodilator-containing inhaler easily accessible.
7. Avoid the use of NSAIDs in susceptible patients.

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### 2. Chronic Obstructive Pulmonary Disease (COPD)

In the past, the terms emphysema and bronchitis were used to describe clinical manifestations of COPD, but COPD has been recognized to be a spectrum of pathologic pulmonary problems. It is usually caused by long-term exposure to pulmonary irritants such as tobacco smoke that cause metaplasia of pulmonary airway tissue. Airways are inflamed and disrupted, lost their elastic properties, and become obstructed because of mucosal edema, excessive secretions, and bronchospasm, producing the clinical manifestations of COPD.

**Sings & Symptoms:**

1. dyspnea during mild to moderate exertion.
2. chronic cough that produces large amounts of thick secretions.
3. frequent respiratory tract infections.
4. barrel shaped chests.
5. they may purse their lips to breathe.
6. Have audible wheezing during breathing.
7. Patients may develop associated pulmonary hypertension and eventual right-sided heart failure.

## Management of Patient With COPD

1. Defer treatment until lung function has improved and treatment is possible.
2. Listen to the chest bilaterally with stethoscope to determine adequacy of breath sounds.
3. Use an anxiety-reduction protocol, but avoid the use of respiratory depressants.
4. If the patient requires chronic oxygen supplementation, continue at the prescribed flow rate. If the patient does not require supplemental oxygen therapy, consult his/her physician before administering oxygen.
5. If the patient chronically receives corticosteroid therapy, manage the patient for adrenal insufficiency.
6. Avoid placing the patient in the supine position until you are confident that the patient can tolerate it.
7. Keep a bronchodilator-containing inhaler accessible.
8. Closely monitor respiratory rate and heart rate.
9. Schedule afternoon appointments to allow for clearance of secretions.

## Renal Problems

### 1. Rental Failure

Patients with chronic renal failure require periodic renal dialysis. Elective oral surgery is best undertaken the day after a dialysis treatment has been performed. This allows the heparin used during dialysis to disappear and the patient to be in the best physiologic status with respect to intravascular volume and metabolic byproducts.

### Management of Patient with Renal Insufficiency and Patient Receiving Hemodialysis

1. Avoid the use of drugs that depend on renal metabolism or excretion. Modify the dose if such drugs are necessary. Do not use an atrioventricular shunt for giving drugs or for taking blood specimens.
2. Avoid the use of nephrotoxic drugs such as nonsteroidal anti-inflammatory drugs.
3. Defer dental care until the day after dialysis has been given.
4. Consult the patient's physician about the use of prophylactic antibiotics.
5. Monitor blood pressure and heart rate.
6. Look for signs of secondary hyperparathyroidism.
7. Consider screening for hepatitis B virus before dental treatment. Take the necessary precautions if unable to screen for hepatitis.

### 2. Renal Transplantation and Transplantation of Other Organs

The patient requiring surgery after renal or other major organ transplantation is usually receiving a variety of drugs to preserve the function of the transplanted tissue. These patients receive corticosteroids and may need supplemental corticosteroids in the perioperative period.

Most of these patients also receive immunosuppressive agents that may cause otherwise self-limiting infections to become severe.
Therefore, a more aggressive use of antibiotics and early hospitalization for infections are warranted. The patient's primary care physician should be consulted about the need for prophylactic antibiotics. Cyclosporine A, an immunosuppressive drug administered after organ transplantation, may cause gingival hyperplasia. The dentist performing oral surgery should recognize this so as not to wrongly attribute gingival hyperplasia entirely to hygiene problems. Patients who have received renal transplants occasionally have problems with severe hypertension.

### Management of Patient with Renal Transplant

1. Defer treatment until the patient's primary care physician or transplant surgeon clears the patient for dental care.
2. Avoid the use of nephrotoxic drugs.
3. Consider the use of supplemental corticosteroids.
4. Monitor blood pressure.
5. Consider screening for hepatitis B virus before dental care. take necessary precautions if unable to screen for hepatitis.
6. Watch for presence of cyclosporine-A–induced gingival hyperplasia. emphasize the importance of oral hygiene.
7. Consider use of prophylactic antibiotics, particularly in patients taking immunosuppressive agents.

### 3. Hypertension

According to the American Heart Association hypertension is a chronic elevation of blood pressure. when blood pressure consistently ranges from 130-139 systolic or 80-89 mm Hg diastolic, as illustrated in the table below:

## Blood Pressure Categories

American Heart Association.

| BLOOD PRESSURE CATEGORY | SYSTOLIC mm Hg (upper number) | | DIASTOLIC mm Hg (lower number) |
|---|---|---|---|
| NORMAL | LESS THAN 120 | and | LESS THAN 80 |
| ELEVATED | 120-129 | and | LESS THAN 80 |
| HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1 | 130-139 | or | 80-89 |
| HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2 | 140 OR HIGHER | or | 90 OR HIGHER |
| HYPERTENSIVE CRISIS (consult your doctor immediately) | HIGHER THAN 180 | and/or | HIGHER THAN 120 |

### Management of Patient with Hypertension

**Mild to Moderate Hypertension (Systolic >140 mm Hg; Diastolic >90 mm Hg)**

1. Recommend that the patient seek the primary care physician’s guidance for medical therapy of hypertension. It is not necessary to defer needed dental care.
2. Monitor the patient’s blood pressure at each visit and whenever administration of epinephrine-containing local anesthetic surpasses 0.04 mg during a single visit.
3. Use an anxiety-reduction protocol.
4. Avoid rapid posture changes in patients taking drugs that cause vasodilation.
5. Avoid administration of sodium-containing intravenous solutions.

**Severe Hypertension (Systolic >200 mm Hg; Diastolic >110 mm Hg)**

1. Defer elective dental treatment until the hypertension is better controlled.

2. Consider referral to an oral-maxillofacial surgeon for emergent problems.

## Hepatic Disorders

The patient with severe liver damage resulting from infectious disease, ethanol abuse, or vascular or biliary congestion requires special consideration before oral surgery is performed. An alteration of dose or avoidance of drugs that require hepatic metabolism may be necessary. The production of nearly all coagulation factors, therefore obtaining an international normalized ratio [INR] which is in a healthy person is typically between 0.8 and 1.2, prothrombin time [PT] (normally 11-13.5 sec.) or partial thromboplastin time [PTT] (normally 25-35 sec.) may be useful before surgery in patients with more severe liver disease who are undergoing surgery with the potential for heavy blood loss. Portal hypertension caused by liver disease may also cause hypersplenism and the sequestering of platelets, causing a relative thrombocytopenia. Thrombopoietin is also produced in the liver, and decreased production of thrombopoietin may result in a true thrombocytopenia. Finding a prolonged bleeding time or low platelet count reveals this problem. Patients with severe liver dysfunction may require hospitalization for dental surgery because their decreased ability to metabolize the nitrogen in swallowed blood may cause encephalopathy. Finally, unless documented otherwise, a patient with liver disease of unknown origin should be presumed to carry the hepatitis virus.

FYI: - Encephalopathy is a general term used to describe a disease that affects the function or structure of the brain. It can have many different causes, including infections, liver failure, kidney failure, lack of oxygen or blood flow to the brain, and exposure to toxins. Symptoms of encephalopathy can vary depending on the underlying cause and may include confusion, memory loss, personality changes, seizures, and loss of consciousness.

## Endocrine Disorders

### 1. Diabetes Mellitus

Diabetes mellitus is caused by an underproduction of insulin, a resistance of insulin receptors in end organs to the effects of insulin, or both. Diabetes is commonly divided into insulin-dependent (type 1) and non-insulin-dependent (type 2) diabetes.

Type 1 diabetes usually begins during childhood or adolescence. The major problem in this form of diabetes is an underproduction of insulin, which results in the inability of the patient to use glucose properly.

Patients with type 2 diabetes usually produce insulin but in insufficient amounts because of decreased insulin activity, insulin receptor resistance, or both. This form of diabetes typically begins in adulthood, is exacerbated by obesity, and does not usually require insulin therapy.

Hypoglycemia should be avoided in patients undergoing oral surgery since it can lead to coma while hyperglycemia rarely lead to ketoacidosis in patient with type 2 diabetes, therefore, any Signs of hypoglycemia—hypotension, hunger, drowsiness, nausea, diaphoresis, tachycardia, or mood change—occur, an oral or IV supply of glucose should be administered.

Persons with well-controlled diabetes are no more susceptible to infections than are persons without diabetes, but they have more difficulty containing infections. This is caused by altered leukocyte function or by other factors that affect the ability of the body to control an infection. Difficulty in containing infections is more significant in persons with poorly controlled diabetes. Therefore, elective oral surgery should be deferred in patients with poorly controlled diabetes until control is accomplished.

## Insulin-Dependent (Type 1) Diabetes

1. Defer surgery until the diabetes is well controlled; consult the patient's physician.
2. Schedule an early-morning appointment; avoid lengthy appointments.
3. Use an anxiety-reduction protocol, but avoid deep sedation techniques in outpatients.
4. Monitor pulse, respiration, and blood pressure before, during, and after surgery.
5. Maintain verbal contact with the patient during surgery.
6. If the patient must not eat or drink before oral surgery and will have difficulty eating after surgery, instruct him or her not to take the usual dose of regular insulin; start intravenous administration of a 5% dextrose in water drip at 150 mL/h.
7. If allowed, have the patient eat a normal breakfast before surgery and take the usual dose of regular insulin.
8. Advise patients not to resume normal insulin doses until they are able to return to usual level of caloric intake and activity level.
9. Consult the physician if any questions concerning modification of the insulin regimen arises.
10. Watch for signs of hypoglycemia.
11. Treat infections aggressively.

## Non–Insulin-Dependent (Type 2) Diabetes

1. Defer surgery until the diabetes is well controlled.
2. Schedule an early-morning appointment; avoid lengthy appointments.
3. Use an anxiety-reduction protocol.
4. Monitor pulse, respiration, and blood pressure before, during, and after surgery.
5. Maintain verbal contact with the patient during surgery.

6. If the patient must not eat or drink before oral surgery and will have difficulty eating after surgery, instruct him or her to skip any oral hypoglycemic medications that day.
7. If the patient can eat before and after surgery, instruct him or her to eat a normal breakfast and to take the usual dose of hypoglycemic agent.
8. Watch for signs of hypoglycemia.
9. Treat infections aggressively.

**2. Adrenal Insufficiency**

Diseases of the adrenal cortex may cause adrenal insufficiency. Symptoms of primary adrenal insufficiency include weakness, weight loss, fatigue, and hyperpigmentation of skin and mucous membranes. However, the most common cause of adrenal insufficiency is chronic therapeutic corticosteroid administration (secondary adrenal insufficiency).

Often, patients who regularly take corticosteroids have moon facies (moon-shaped face), buffalo (back) humps, and thin, translucent skin. Their inability to increase endogenous corticosteroid levels in response to physiologic stress may cause them to become hypotensive, syncopal, nauseated, and feverish during complex, prolonged surgery, which is consistent with an adrenal crisis.

### Management of Patient With Adrenal Suppression Who Requires Major Oral Surgery

**If the patient is currently taking corticosteroids:**

1. Use an anxiety-reduction protocol.
2. Monitor pulse and blood pressure before, during, and after surgery.
3. Instruct the patient to double the usual daily dose on the day before, day of, and day after surgery.

4. On the second postsurgical day, advise the patient to return to a usual steroid dose.

**If the patient is not currently taking steroids but has received at least 20 mg of hydrocortisone (cortisol or equivalent) for more than 2 weeks within the past year:**

1. Use an anxiety-reduction protocol.
2. Monitor pulse and blood pressure before, during, and after surgery.
3. Instruct the patient to take 60 mg of hydrocortisone (or equivalent) the day before and the morning of surgery (or the dentist should administer 60 mg of hydrocortisone or equivalent intramuscularly or intravenously before complex surgery).
4. On the first 2 postsurgical days, the dose should be dropped to 40 mg and dropped to 20 mg for 3 days thereafter. The clinician can cease administration of supplemental steroids 6 days after surgery.

# Articaine

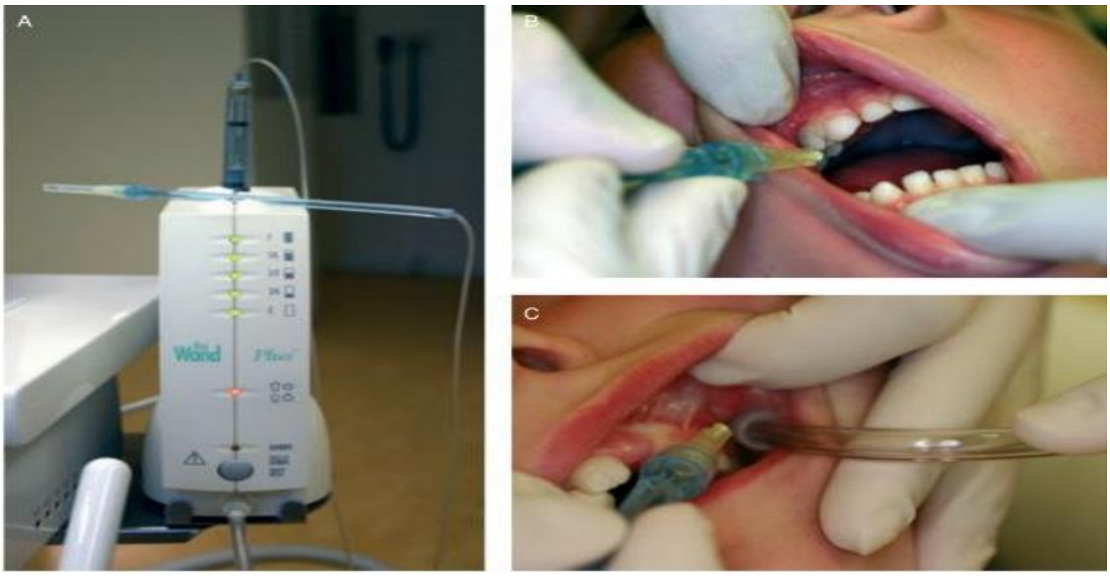
Articaine 2% with adrenalin 1 200000 was. firstly used in 1998 for dental and for ophthalmic areas. Articaine has both amide and ester linkages so the biotransformation of it occurs in both the plasma by pseudocholinestrase enzyme and in the liver, so the plasma level and risk of toxicity falls rapidly, because of that Articaine can be used in higher concentration 4% compared to 2% lidocaine in dental practise.

Property of Articaine is its ability to defuse through soft and hard tissues more reliable than other local anaesthetic agent so it can be used in upper teeth just in buccal injection that diffuse to palatal side and eliminate the need for palatal injection, or used in lower posterior teeth by infiltration technique instead of inferior alveolar nerve block. Compared with lidocaine, Articaine is faster in onset, more efficient and has low degree of toxicity.

## Microprocessor controlled anesthesia

This apparatus is especially suited to those patient having anxiety and fear of dental syringe such as children and mentally retarded patient.

It composed of sterile and disposable hand piece in which standard local anesthetic cartridge can be inserted. It works by foot switch, the motor pump unite ensure that the pressure and the flowrate of the injected fluid remain low.



# Buffering of local anesthesia

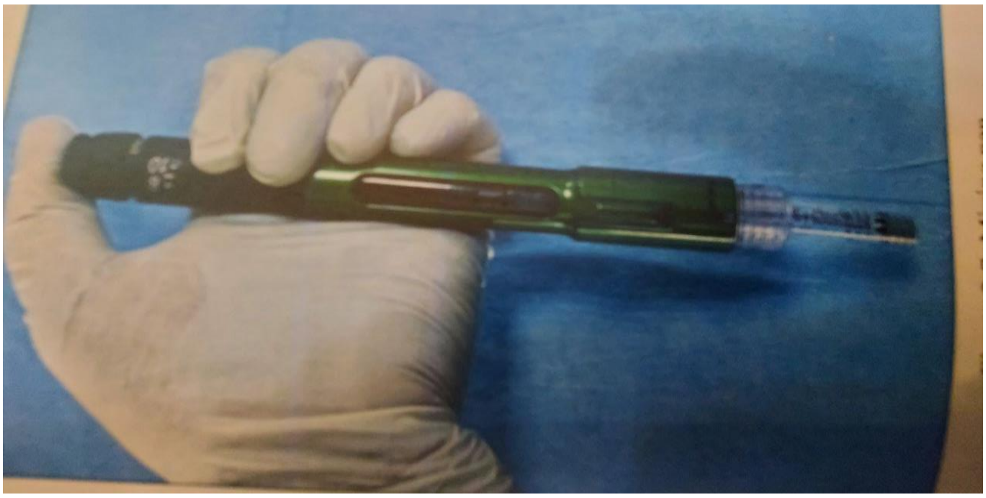
The majority of local anesthetic agents are acidic (PH 3.5 – 5) because the manufacturers supply the solution as hydrochloride salt to improve the solubility, stability and shelf life. The adding of vasoconstrictor will increase the acidity of the solution so decrease the PH of the solution which lead to some complications such as discomfort, burning sensation and increase the onset time buffering is done by adding sodium bicarbonate to local Anesthetic solution for alkalinisation (increase PH) to decrease pain , burning sensation and improve the onset time.

alkalinisation of local anesthesia should be made fresh as soon as possible because the precipitation increase with time and lead to decrease the efficacy of local anesthesia.

## Buffering technique

1- Hand mixing technique by using tiny syringe such as insulin syringe and vial of sodium bicarbonate. a desired amount of local anesthesia solution is remove from the dental cartridge by insulin syringe and replaced by the same ratio of sodium bicarbonate.

2 - mixing system such as on pharma mixing system (pen).



د.صلاح جاسم

# Sedation technique for dentistry

Traditionally dentistry has been carried out under local anesthesia. However, sedation is required for:

1. Uncooperative children,

2. Adult patients with simple genuine fear and phobia of dental treatment,

3. Medically compromised patients (cardiovascular disease, asthma, chronic epilepsy, spasticity, Parkinsonism)

4. Those having persisting fainting attacks or gagging.

As for general anesthesia, only patients who satisfy ASA I and II criteria should be considered for sedation. Since the early work of Langa with nitrous oxide and Jorgenson using intravenous agents, a variety of sedative techniques for dentistry have been described. Patients can remain fully conscious or can almost become anesthetized, when different techniques of deep sedation or ultralight anesthesia are used.

## Definitions

### Premedication

Premedication is given preoperatively to produce narcosis and the latent period may range from 15 to more than 30 minutes. Oral, rectal, and intramuscular techniques of sedation are referred to as premedication.

### Conscious Sedation

It is a state of mind obtained by IV administration of combination of anxiolytics, sedatives and hypnotics and/or analgesics that render the patient relaxed, yet allows the patient to communicate, maintain patent airway and ventilate adequately

### Deep Sedation

Deep sedation is a depressed level of consciousness with some blunting of protective reflexes, although it remains possible to arouse the patient. The ideal sedative medication for use during dental practice would provide for an easily titratable level of sleepiness (sedation), predictable amnesia and decreased anxiety (anxiolysis), while providing for a rapid recovery with minimal side effects.

The term sedation is used to describe techniques in which clinical actions develop more rapidly and this term is commonly applied to inhalational and intravenous techniques.

## Sedation Techniques

## 1. Intravenous Sedation

The first generally accepted intravenous (IV) sedation regime was devised by Professor Jorgenson of California, who advocated the use of diluted solution of pentobarbitone, pethidine and hyoscine by slow IV injection in the management of mentally handicapped patients. This technique while effective, often produces quite deep levels of sedation with prolonged recovery. This was followed by the use of small incremental doses of methohexitone (Brevital) after an initial loading dose of the same drug to produce ultralight anesthesia. With this technique patient's comfort was obtained at the expense of the integrity of the respiratory and cardiovascular systems—a potentially dangerous situation.

For many years **diazepam** was the IV agent of choice, but concerns about active metabolites and recirculation leading to prolonged recovery and pain on injection with venous sequelae have led to it being superseded by **midazolam**, which is more potent and shorter-acting.

**Midazolam** is an excellent anxiolytic with a powerful anterograde amnesic effect. It must be titrated very carefully and slowly until the patient reaches a sedation 'endpoint', characterized by a delayed response to questions and commands and some slurring of speech. Verbal contact must be maintained. For most patients, this will require 0.07 to 0.14 mg/kg which will provide useful sedation for about 45 minutes. Midazolam has no analgesic properties and local anesthetic injections will be required for painful procedures. In sedative doses, midazolam causes minimal cardiovascular depression, but respiratory depression can be marked. Patients must be monitored carefully and use of pulse oximetry to monitor oxygen saturation is highly recommended. Oxygen should be administered via nasal cannulae at 1 to 2 liters per minute (LPM) to prevent hypoxia. Patients must fulfil set criteria for recovery before being discharged. Patients must be accompanied home by a responsible adult. Ideally, the sedative agent should be given in the morning and the patient may resume normal activities on the following day.

Flumazenil, is a specific benzodiazepine antagonist available to treat any inadvertent overdose of benzodiazepines.

**Advantages of Intravenous Sedation**

1. Highly effective technique
2. Rapid onset of action
3. Titration is possible
4. Patent vein is a safety factor
5. Control of salivary secretions possible
6. Nausea and vomiting less common

7. Gag reflex diminished

8. Motor disturbances (epilepsy, cerebral palsy) diminished.

**Disadvantages of Intravenous Sedation**

1. Venepuncture is necessary.

2. Venepuncture complications (infiltration, hematoma, thrombophlebitis) may occur.

3. More intensive monitoring required.

4. Delayed recovery.

5. Escort needed.

Since IV sedation techniques may produce major depression of cardiorespiratory parameters, it is not to be administered to the patient by any person, except those who have had training in anaesthesiology.

**Drugs Commonly Available for IV Sedation**

1 Sedative, hypnotics and antianxiety drugs

a. Benzodiazepines—diazepam, midazolam

b. Barbiturates—methohexitone

2. Nonbarbiturate hypnotics

a. Propofol

b. Ketamine

c. Innovar (droperidol and fentanyl combination)

3. Antihistaminics—promethazine

4. Narcotic agonists—pethidine, pentazocine, fentanyl.

## 2.Inhalational Sedation

In 1966, Langa popularized the descriptive term relative analgesia for painful dental surgery. The term originates from the concept that the first stage of anesthesia in Guedel‘s classification might be subdivided into three planes; the first two were relative analgesia and the last was complete analgesia.

## Nitrous Oxide Sedation

Nitrous oxide is an odourless and colourless gas that is not irritating to airways. It is toxic to humans if given in very high concentrations, but, when properly mixed with pure oxygen and given appropriately, it can be an extremely potent analgesic and anxiolytic. This makes it useful when providing oral surgery as well as for patients who primarily fear local anesthetic injections.

Nitrous oxide concentrations of 6 to 25 percent, 26 to 45 percent and 46 to 55 percent correspond to the three planes. In the first plane, there is moderate sedation and some analgesia (moderate analgesia), in the second plane the sedation is described as dissociation and there is a greater element of analgesia (dissociative analgesia) and in the third there is total analgesia (analgesic anesthesia), preceding to loss of consciousness.

Nitrous oxide concentrations of 66 to 80 percent, give light anesthesia, where there is complete analgesia and amnesia and it is not possible to communicate with the patient. The term relative analgesia, however, is misleading because for complete dental work, relative analgesia is not necessary.

Langa believed that the nitrous oxide concentration (20 to 30%) should be sufficient in most patients to carry out treatment without local anesthesia, but the more recent view is that control of pain should be obtained essentially by local anesthesia and any analgesic effect of the nitrous oxide serves only to remedy minor deficiencies in the local block. Accordingly, a better descriptive term is ‘inhalational sedation’ if nitrous oxide is used in this way.

**Indications**

1. Uncooperative children of reasoning age.
2. Mildly apprehensive adult patients.
3. Medically compromised patients.
4. Patients with gagging problem.

**Cardiovascular diseases:** In patients with angina pectoris, congestive cardiac failure, severe cardiac dysrhythmias, myocardial infarction and high blood pressure inhalational sedation have been employed with great success, because nitrous oxide has analgesic, amnesic and sedative properties, helping the patient to relax and thus reducing the work load of the myocardium and providing the patient and myocardium with the oxygen enriched gas mixture.

**Asthma:** Any type of stress in these patients is a potential cause of an acute exacerbation of asthma and thus the use of inhalational sedation is frequently warranted in these patients.

**Epilepsy:** Nitrous oxide is not an epileptogenic agent and therefore may be employed in patients with a history of chronic seizure activity as long as hypoxia is avoided.

**Hepatic dysfunction:** Nitrous oxide does not undergo biotransformation and therefore be used without additional risk and with a high probability of success in a patient with hepatic dysfunction.

**Gagging:** Gagging is a potential problem during many dental procedures. Nitrous oxide sedation has proved to be a highly effective method of eliminating or at least minimizing severe gagging especially during short procedures.

**Contraindications:**

1. Patients with extreme anxiety.

2. Nasal obstruction, sinus problem, common cold, habitual mouth breathing.

3. Upper respiratory tract infections.

4. Patients with serious psychiatric disorders.

5. Chronic obstructive pulmonary disease (COPD). These patients have chronically elevated carbon dioxide blood levels, and the stimulus for breathing in these patients is a lowered blood oxygen content. Oxygen enriched mixture of gases with inhalational sedation technique, raises the oxygen saturation of the blood and removes the stimulus for involuntary breathing leading to respiratory apnoea in the patients.

6. First trimester of pregnancy.

**Advantages**

1. Easy to administer.

2. Onset of action is rapid.

3. Nitrous oxide has bland, pleasant, non-irritating odour.

4. Rapid uptake and elimination of nitrous oxide ensures that no hangover effect is experienced.

5. Recovery is fast.

6. Titration is possible.

7. There is a wide margin of safety.

8. There is cardio-respiratory stability.

9. Nausea and vomiting–uncommon.

10. Reflex integrity is maintained.

11. No preparation of patient is required.

12. No need for any escort

**Disadvantages**

1. Equipment is expensive.

2. In the absence of scavenging system, exposure to nitrous oxide may cause occupational hazards to dental and nursing staff. The abortion rate is higher in practicing female dental assistants, when this technique is used. Methods that aid in minimizing exposure of the office personnel to nitrous oxide levels are as follows:

a. Testing the equipment for leaks.

b. Venting of waste gases outside the building.

c. Use of scavenging nasal hoods.

d. Use of airsweep (portable electric fan).

e. Minimizing conversation with patient (avoid mouth breathing).

f. Monitoring of air with infrared (IR) nitrous oxide analyzer to prove the effectiveness of the control measures, at least 2 to 3 times in a year. Reasonable concentration of nitrous oxide appears to be approximately 50 parts per million (ppm).

## General Protocol for Using Nitrous Oxide

Nitrous oxide-oxygen sedation will always begin and end with the patient receiving 100 percent oxygen. The patient should be advised to avoid a heavy meal prior to the use of nitrous oxide-oxygen sedation. The patient is requested to void if necessary, prior to treatment. If the patient is wearing contact lenses, they should be removed as gas leak around the bridge of the nose may produce drying of the eyes. Review baseline vital signs prior to sedation. During sedation keep verbal communication with the patient and monitor vital signs and oxygen saturation using pulse oxymeter and ECG.

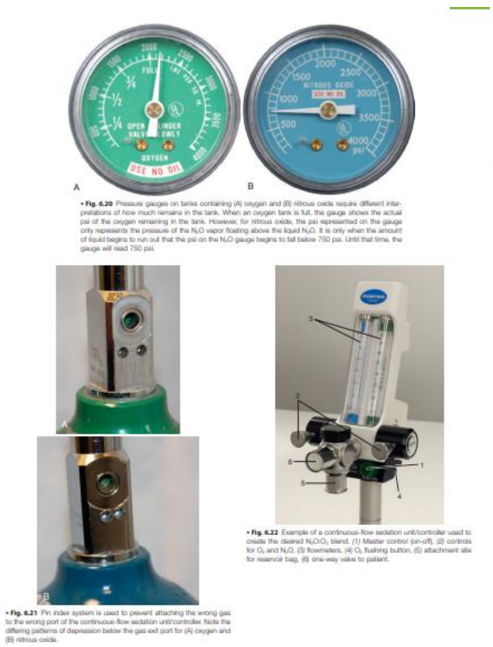
The general protocol for administering nitrous oxide in the dental setting begins with giving the patient 100% oxygen. While this is being done, the clinician should check for proper mask adaptation to the patient's face as well as allow the patient a few minutes to become accustomed to the mask and thus able to tolerate the mask.

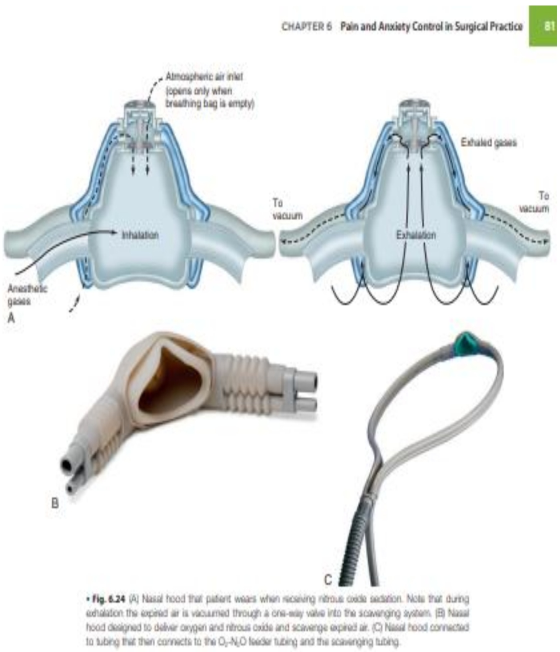
After a few minutes of pre oxygenation, the amount of nitrous oxide (N2O)/oxygen (O2) flows should be adjusted to deliver a 20%/80% N2O:O2 mix. For the vast majority of patients this will not produce any effect; nonetheless, after 2 minutes at this level the patient should be queried as to whether they are beginning to sense any changes in mood or other sensations. If they are not, the gas mix should be changed to 30%:70% N2O:O2. Again, after 2 minutes at this level the patient should be queried as to whether they are beginning to sense any changes in mood or other sensations. If they are, they should be asked if the feelings are good or bad. If bad, the percentage of N2O should be lowered to 25%, and after 2 minutes the patient should be asked if they still feel any effect and whether it is positive or negative. If negative, it may be that the patient cannot tolerate even low levels of N2O and the attempt at inhalation sedation is then ended. However, if the patient feels no effect at 30% N2O or some positive effects, the clinician should raise the N2O percentage to 35%. Again, after 2 minutes the patients should be asked whether they can now feel some effects or if they previously felt some positive effects, whether or not the effects became more positive. If they became more positive and the patient is feeling relaxed, the practitioner can proceed with local anesthesia and the surgery. If the patient feels that the previously positive effects are not as positive as at 30%, the doctor can lower the N2O concentration to 32% or 33% to try to fine-tune the sedative effects. Titration of the gas mixture should continue until the patient feels relaxed and is enjoying the experience. Once a good level is reached, clinical care can move forward. Note that some patients who have regular experience being in mind-altering states may desire higher doses of N2O, but it is important to make sure their mask fits properly and that they are breathing in and out of their nose.

The clinician must use their judgment as to how high a concentration of N2O to provide in such circumstances. Generally, levels of N2O above 50% should be avoided, and when levels above 40% are in use, monitor the patient's mood since in some circumstances patients may suddenly become disoriented or even combative. In addition, for longer procedures the dentist should regularly check that the patient is still relaxed and feeling good. Patients can begin to find the nitrous oxide effects less comfortable and need a break from the sedation. Fortunately, once the patient begins to breathe 100% oxygen or room air, the effects of the N2O rapidly dissipate. This also occurs once the need for sedation ends and the patient is placed on 100% oxygen for about 5 minutes to recover.

**Clinical Indicators of Oversedation**

1. Patient uncomfortable.
2. Persistent closing of mouth.
3. Spontaneous mouth breathing.
4. Patient responds sluggishly to command.
5. Patient becomes uncooperative.
6. Patient laughs, cries, or feels giddy.
7. Patient has uncoordinated movements.
8. Patient talks incoherently





Examples of inhalation sedation control units4 (A) Nasal hood that patient wears when receiving nitrous oxide sedation. Note that during exhalation the expired air is vacuumed through a one-way valve into the scavenging system. (B) Nasal hood designed to deliver oxygen and nitrous oxide and scavenge expired air. (C) Nasal hood connected to tubing that then connects to the O2-N2O feeder tubing and the scavenging tubing.

# Sterilization, Disinfection, and Asepsis in Implantology

**AHMED FADHEL IBRAHEEM**

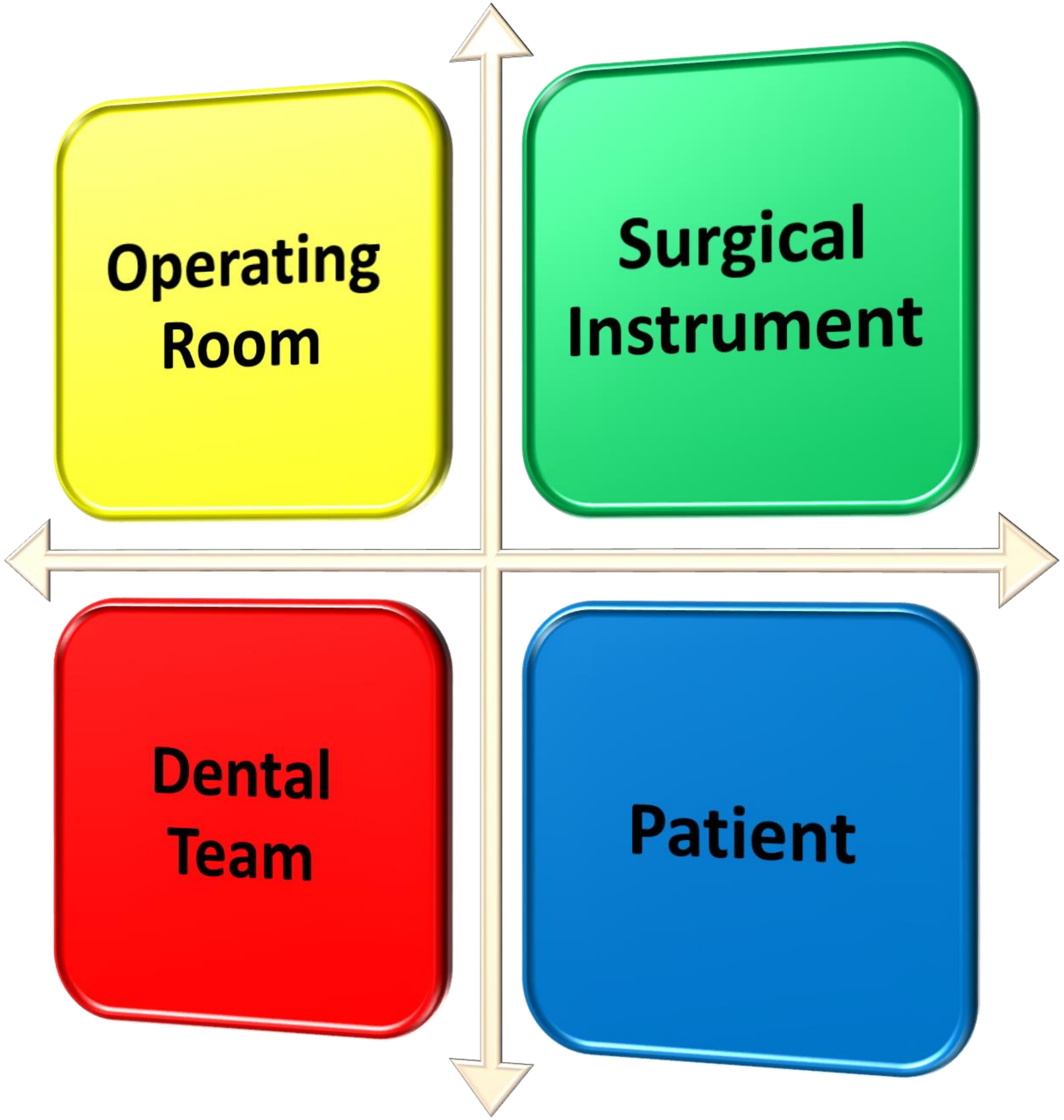
**B.D.S.,FIBMS**

Sterilization

# Vs.

Disinfection

# How to Prepare Your Clinic for A Surgical Procedures?


Operating Room
Surgical Instrument
Dental Team
Patient

# What is Operating room ????

**It a Clean A Septic Room where we do Surgeries**

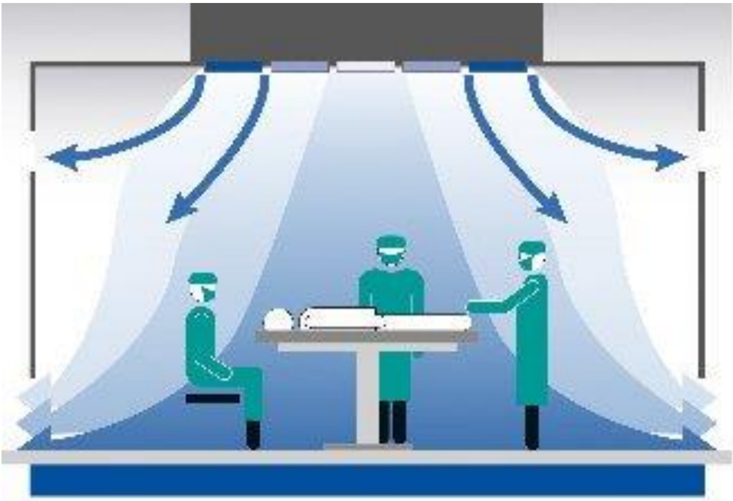
# Cleaning and Asepticity

- Most postoperative wound infections are caused by seeding of endogenous bacteria; however, exogenous bacteria also have been frequently implicated.

floor of the operating room should have a homogenous surface free of grooves and fissures.

# Operating Room Ventilation

- Studies have shown that airborne bacteria account for 98% of the bacteria found in wounds postoperatively



- researchers suggest that directing air away from the wound rather than toward it is perhaps an even more important consideration

# Surgical Instrument Care

- The Centers for Disease Control and Prevention (CDC) has proposed three categories of infection control related to surgical instruments.These categories are **Critical**, **Semicritical**, and **Noncritical**.

- Critical items are defined as those that penetrate soft tissue, contact bone, or enter into or contact the bloodstream or other normally sterile tissue( periodontal scalers, scalpel blades, and surgical burs). These items should be sterilized by heat.


11.5
SD-30-S,L

- Semicritical items are defined as those items that contact mucous membranes or non-intact skin ( mouth mirror, amalgam condenser, and reusable impression trays)

- These items should be sterilized by heat unless heat sensitive; if so, high-level disinfection can be used.


- Noncritical items are defined as those that contact intact skin (radiograph head/cone, blood pressure cuff, and facebow).
- For these items, cleaning is adequate unless the item is visibly soiled, and cleaning should be followed by disinfection.

# Dental Team

# Surgical Scrubbing


LACALUT
aktiv


LACALUT
aktiv


LACALUT
aktiv

# Surgical clothing

# Patient Preparation

The  aim is to reduce the number of pathogens at the surgical site.

# Preparation of the Surgical Field

# Pathway to success