



Local Anesthesia

Keru Lau
Joanne Li
Olivia Kian

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Chemistry



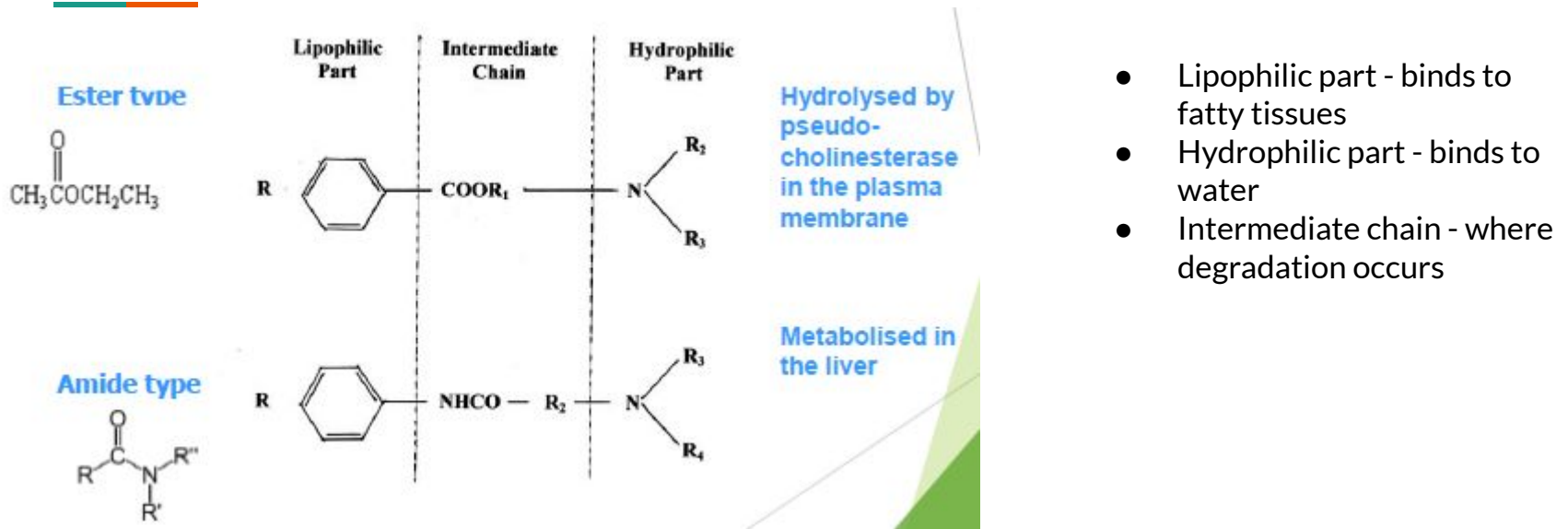
Chemistry of LA

- RN + H⁺ \longleftrightarrow RNH⁺
 - RN is the basic form - diffuses through the nerve sheath
 - RNH⁺ is the cationic form - binds and inhibits sodium channels on nerve membrane (no influx of sodium)

The amount of RN and RNH⁺ is determined by:

- The pH of the LA
- The pKa of the LA
 - pKa is the pH level where there are 50% RN and 50% RNH⁺
- The pH of the injection site
 - Normally, pH of human body is about 7.40. In inflammation, pH is lower.
 - If pt has inflammation in the area that you intend to inject, there is a chance that LA may not work as efficiently

Structure of LA

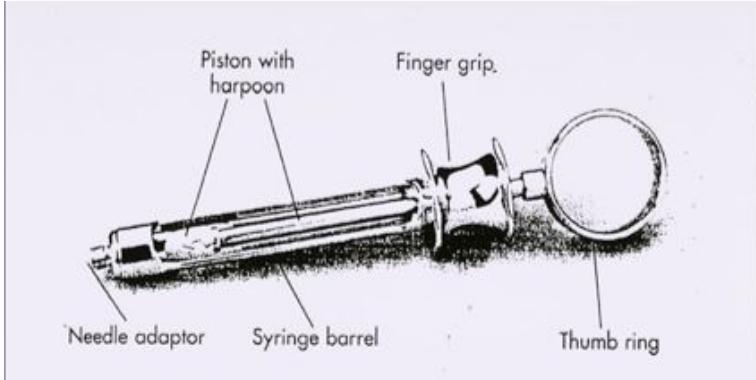


Amide LAs are more commonly used due to reduced risk of allergic reactions



Syringe components

Syringe components

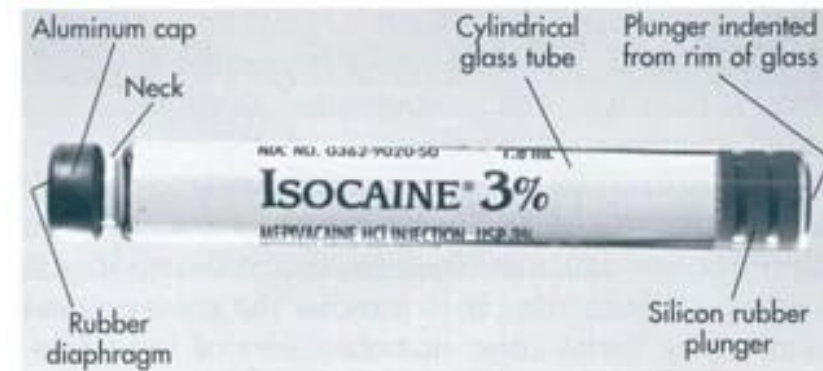


- Blocks - Long needle (40mm)
- Infiltrations - Short needle (25 mm)
- Needle gauge - 27 usually
 - The bigger the gauge the narrower the hole in the needle

Anonymous Q1

Components of the Needle

- The Bevel
- The Shank
- The Hub
- The Syringe Penetrating End



LA components

Components of LA



Component	Function
Vasoconstrictor	Reduces bleeding, reduces blood flow, increases duration of anaesthesia, reduce vascular absorption of LA
Methylparaben	Antibacterial preservative
Bisulphite	Antioxidant - prevents oxidation of LA. Decreases pH.
Distilled water	Alter volume to obtain an injectable amount
Sodium chloride	Makes solution more isotonic
Sodium hydroxide	Increases pH to counteract Bisulphite
Nitrogen gas	Space filler, inert so does not react with the vasoconstrictor



Contraindications for LA with adrenaline

- Pt allergic to components in the LA
 - a. Unlikely to be allergic to the LA agent itself, usually is due to other components such as bisulfites (asthma)
- Uncontrolled hyperthyroidism, Pts on non-selective beta blockers = reflex bradycardia > low BP > life threatening
- Pts on Tricyclic antidepressants = may enhance systemic effects of adrenaline
- Pts on monoamine oxidase inhibitors (MAOI) = MAOIs prevent degradation of vasoconstrictors > hypertensive crisis
- Articaine is generally contraindicated for blocks - deemed to have higher possibility of nerve damage

LA Types



Types of LA

Types use in ADH

- **Lignospan special** - 2% xylocaine with 1 : 80 000 adrenalin, *Topical Ziagel 5% Xylocaine*
 - **Scandonest Plain** - 3% mepivacaine with no vasoconstrictor
 - **Septanest** - 4% articaine with 1 : 100 000 adrenalin
-
- Important to understand the contraindications and indications of each
 - Justify the choice of LA
 - Label the name of the LA in full & amount to be used
 - Approx. duration

Practice Exam Style Q1

LA Techniques



LA Techniques

1. Infiltrations (Supraperiosteal)
 2. Inferior alveolar nerve block
 3. Other techniques
- Step by step process of the procedures
 - Troubleshoot for blocks
 - Nerves and tissues anaesthetised

Infiltrations

- Labial and buccal infiltrations
- Palatal infiltrations

Contraindications

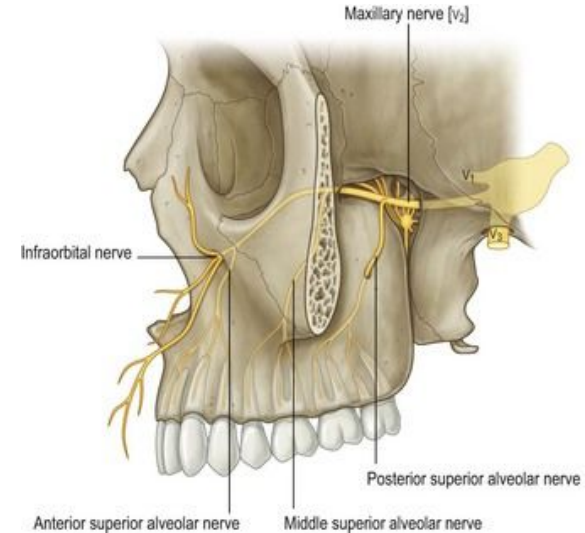
- Posterior aspect of the mandible - bone is too thick -> not suitable for infiltrations

Tissue Anaesthetised

- Pulp and root area of the tooth, buccal periosteum, connective tissue and mucous membrane (buccal only)

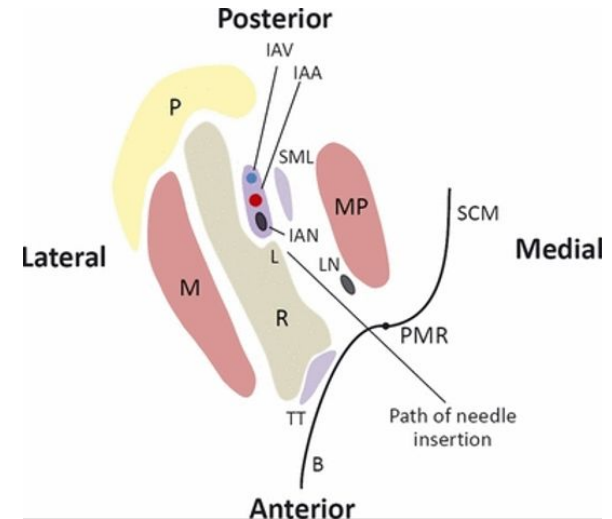
Anatomical Landmarks

- Mucobuccal fold determines the height at which the needle should be inserted (indicates where the apex of the tooth should be)
- Crown of the tooth injection should be performed adjacent to the tooth needing to be anaesthetised



Anatomy of an IANB

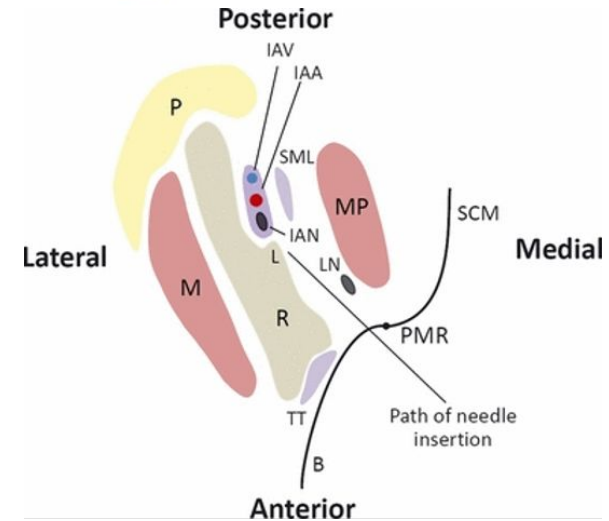
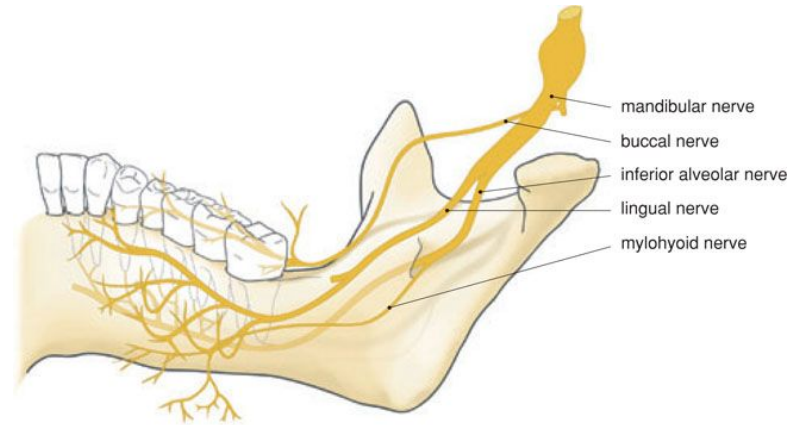
- Aiming for the **pterygomandibular space** – contains the IAN, artery and vein as well as the lingual nerve,
nerve to mylohyoid and sphenomandibular ligament
 - Want to anesthetise the IAN before it enters the
mandibular canal
 - Deposit LA solution superior to the lingula
- Boundaries are:
 - Laterally by the medial surface of the mandibular ramus
 - Medially by the medial pterygoid muscle
 - Posteriorly by the parotid gland
 - Anteriorly by the pterygomandibular raphe
 - Superiorly by the lateral pterygoid muscle



Performing an IANB

Key Intraoral Landmarks

- Coronoid Notch (greatest concavity of the anterior border of the ramus) defines the approximate vertical height of the injection (approximately 10mm above the occlusal plane of the lower molars)
- Pterygomandibular Raphe attaches above to the pterygoid hamulus and below to the posterior edge of the mylohyoid line
 - o IAN, needle passes on the lateral side of the pterygomandibular raphe into the pterygotemporal depression determines the entry point
- Barrel of the syringe is lined up with the lower second premolars on the contralateral side (angle of insertion)





IANB Step by Step

Generally (need more specifics - tailor to scenario eg. LHS/RHS + pt case):

- Prepare tissue -> eg. dry area, topical
- Identify appropriate insertion point and angulation
- Insert the needle slowly approx $\frac{2}{3}$ to $\frac{3}{4}$ of the length of the needle -> contact should be made at this stage
 - If not: trouble shoot
- Aspirate, inject the $\frac{3}{4}$ of the solution
- If you want to anesthetized lingual nerve
 - Withdraw needle halfway -> change angulation -> aspiration -> inject remaining $\frac{1}{4}$ of the solution
- Safe disposal of needle

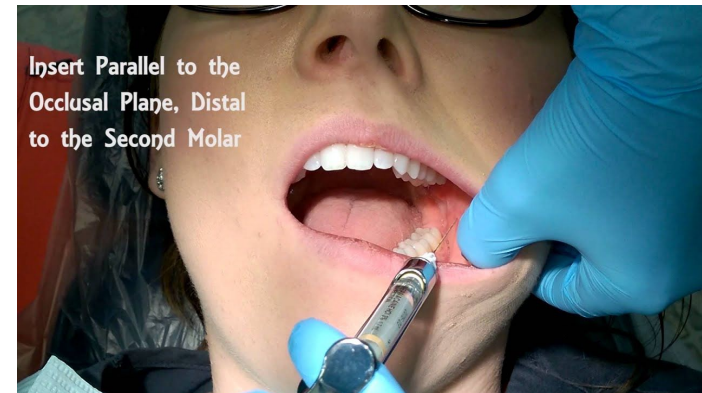
Lingual and Long Buccal Block

Lingual Block

- Often done with the IANB, swing the barrel of syringe towards the midline (canines) and withdraw approx. $\frac{1}{3}$ of the needle, aspirate and deposit remaining $\frac{1}{4}$ of the solution

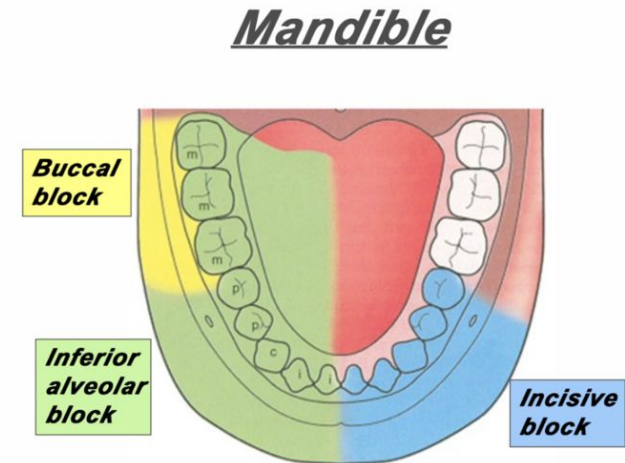
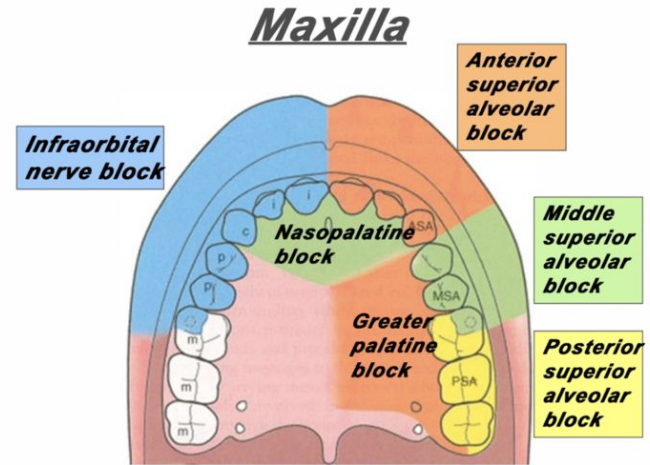
Long Buccal Block

- Anesthetise the buccal soft tissues of the mandibular molars
- Not always done in conjunction with an IANB



Other Techniques

- Mental block
- Maxillary block
- Nasopalatine block
- Intra-periodontal
- Intra-pulpal
- Intra-osseous



Failures (IANB)

Failure of IANB



How to test for anesthesia:

Starting with the non-anaesthetised side check for PDL anaesthesia using the back of the handle of a mirror & a percussion test, check soft tissue anaesthesia with gentle pressure with the tip of tweezers.

Repeat for the anaesthetised tissues.

Ask the patient if the anaesthetised side feels different & how it feels.

Failure of an IANB may be due to poor operator technique or anatomical variation:

- If the ipsilateral (same side as injection) chin/lip & teeth are not anaesthetised-> incorrect IANB technique
- If there is soft tissue anaesthesia of the chin/lips but not the teeth-> more likely to be anatomical variation

Patient factors

Accessory innervation	Accessory innervation of certain oral structures may mean that standard LA techniques are insufficient. E.g., nerve to mylohyoid may provide a sensory function to mandibular teeth.
Cross over	May be a crossover of nerves between the L/R side; common with the anterior teeth with accessory foramina.
Bifid mandibular nerve	Presence of a secondary branch of the inferior alveolar nerve, which may bifurcate before it enters the foramen. Normal IANB technique may be insufficient in blocking conduction from both branches.
Anatomical variations	Anatomical variation in the shape, width and size of the mandible & other variations e.g., sphenomandibular ligament obstructing the lingula & mandibular foramen.
Anxiety	Patients are more likely to experience pain due to a lowered pain threshold.
Pathology	Inflammation: If there is inflammation or pathology within the area, there will be a decreased pH of the tissues within the surrounding area. This would alter the chemical equilibrium of the LA in solution and will shift the equation to produce more RNH^+ which cannot diffuse properly ->it cannot cross into the nerve membrane.

Operator factors

Poor technique	<ul style="list-style-type: none">● Height too low: Pt. not opening wide enough or jaw closes during the administration of anaesthesia● Lack of stretching the cheek: leads to not being able to locate the pterygotemporal depression● Injection too posteriorly: needle does not hit bone, if LA is injected the facial nerve may be anaesthetised● Injection too medially: resistance from the medial pterygoid muscle● Electric shock: in the right area but contacted the IAN
Insufficient volume	<ul style="list-style-type: none">● Inadequate volume of LA administered
Timing	<ul style="list-style-type: none">● Inserting too quickly may result in ballooning of the tissue.● Not waiting long enough for the LA to set in. Can sometimes take >5-10 min. Pulpal anaesthesia may take longer due to dense covering of apex of tooth (and thus impaired diffusion).<ul style="list-style-type: none">○ Infiltration: ~3mins to set in○ IANB: ~3-5mins to set in
Intravenous injection	<ul style="list-style-type: none">● Ensure a negative aspiration prior to injection● May cause a haematoma
Equipment failure	<ul style="list-style-type: none">● E.g., needle breakage, expired LA

Common complications

Complication	Cause	Signs & Symptoms	Management
Trismus	Trauma to muscles or blood vessels due to direct damage or haemorrhage. LA can be myotoxic to skeletal tissue.	May present as a prolonged spasm of jaw muscles with difficulty opening the mouth, pain on opening.	<ul style="list-style-type: none"> ● Reassure pt. + explain that it should resolve in 1-2 wks. ● Heat therapy (warm moist towel for ~20mins/hr) ● Warm saline rinses (1 tsp salt in a cup of warm water) ● Analgesics (NSAIDs as per instructions on packaging, check MHx for contraindications) ● Soft diet ● Jaw exercises, consider referral to physiotherapist ● Avoid further dental treatment until the area has fully healed ● Review in 7-14 days, consider referral to OMFS
Facial nerve paralysis	Needle too posterior, LA administered in the parotid gland.	May exist unilaterally (face lopsided, inability to close one eye) or through the drooping of eyelid and upper lip/corner of mouth.	<ul style="list-style-type: none"> ● Reassure pt that it is temporary ● Advise pt to not rub eyes ● Cover the affected eye with eye patch (to prevent damage + prevent it from drying out) ● Keep under observation until pt. can blink ● No driving back home - If not recovered after 12hrs -> med review (Therapeutic Guidelines Fig. 13.54)
Hematoma	Puncture of a blood vessel	Localised swelling, intra/extra oral bruising, possible trismus.	<ul style="list-style-type: none"> ● Apply localised pressure for ~2mins to stop bleeding ● Record in dental record & advise pt. regarding risk of trismus. Discolouration should resolve in 7-21 days. ● Ice may be applied to the region immediately on recognition of a developing hematoma. Consider analgesics. ● Do not apply heat to the area for at least 4 to 6 hours after the incident (may increase the size of the hematoma). Apply moist heat the next day to promote resorption of blood elements. (Malamed, 2020)

Complication	Cause	Signs & Symptoms	Management
Soft tissue injury	Often self-inflicted trauma.	Localised soft tissue trauma with pain and swelling.	<ul style="list-style-type: none"> • Adequate post op. • Analgesics for pain as necessary. • Antibiotics as necessary (in the unlikely case of an infection) • Warm saline rinse. • Petroleum jelly to cover lip lesions & reduce irritation. (Malamed, 2020)
Pain or burning on injection	Pain: <ul style="list-style-type: none"> • Periosteal stripping • Injecting LA too fast Burning: <ul style="list-style-type: none"> • Due to pH of the solution • Rapid injection of LA into dense tissues • Cold LA 	Pain or burning on injection.	Because most instances of burning on injection are transient and do not lead to prolonged tissue involvement, formal treatment is usually not indicated. (Malamed, 2020)
Sloughing of tissues	Prolonged irritation due to application of topical LA for a prolonged period or heightened sensitivity of the tissues to LA causes epithelial desquamation. Sterile abscess-> prolonged ischemia resulting from the use of LA with a vasoconstrictor (usually on hard palate).	Possible pain. Epithelial desquamation or sterile abscess.	No formal management. May recommend analgesics and a topical ointment to minimise irritation to the area. Epithelial desquamation resolves in a few days, sterile abscess may run 7-10 days. (Malamed, 2020)

Rarer complications


Complication	Cause	Signs & Symptoms	Management
Prolonged anaesthesia or paraesthesia	Trauma to a nerve or injection of LA contaminated by alcohol or sterilizing solution.	Persistent anaesthesia for days, weeks, months.	<ul style="list-style-type: none"> ● Reassure the pt. that most cases resolve within 8 wks without treatment. ● Schedule follow up appt. For examination + note findings in dental records & refer to OMFS for second opinion. ● Reschedule pt. For exam every 2 months until paraesthesia resolves. (Malamed, 2020)
Ocular complications	Accidental intra-arterial injection of a vasoconstrictor -> spasm of the ophthalmic artery and related blood vessels. OR diffusion through myofascial spaces, bony openings.	May include unilateral blindness, double vision.	<ul style="list-style-type: none"> ● Pt must be taken to an emergency department urgently ● If the Pt is unconscious -> basic CPR (Therapeutic Guidelines Fig. 13.58) ● Consultation with an ophthalmologist (Malamed, 2020)
Overdose	Intravascular injection, administration of too large a dose, rapid absorption of LA from the site of administration, inability to biotransform the drug normally, inability to excrete the drug normally.	CNS excitation followed by depression. Excitation causes: restlessness, confusion, giddiness, headache, convulsions Depression can affect: respiratory and CVS and may lead to loss of reflexes and loss of consciousness	<ul style="list-style-type: none"> ● Emergency management with DRSABCD (see Malamed for specifics in different cases) ● Prevention via knowledge of max and recommended doses of LA.

Complication	Cause	Signs & Symptoms	Management
Allergy	Allergy to the LA agent is rare. Allergies are usually to preservatives in LA (e.g, bisulphite), latex (e.g., from the latex plunger).	Wide spectrum of s/s including: itching, urticaria, loss of consciousness, anaphylaxis.	<ul style="list-style-type: none"> • Thorough Medical History prior to LA. • Follow DRSABCD, administer adrenaline if anaphylaxis occurred + 000. If patient can't breathe-> administer emergency airway. • Contact GP.
Needle breakage	<ul style="list-style-type: none"> • Use of incorrect needle length • Needle insertion up to the hub • Excessive force or bending of needle 	Needle stuck in soft tissue.	Remove with haemostat forceps if possible. Immediately refer to specialist (OMFS)- may require 3D tomographic scan and surgical removal.

Other complications not covered may involve: oedema, heart palpitations, breakage of a glass cartridge and unilateral numbness of the arm and neck, etc.




Anonymous Questions



1. why is it bad to bend the needle, consequences?

- Increase risk of needle breakage
 - Best case scenario you can retrieve the needle sticking out of the tissue with hemostat
 - Worst case scenario - needle fragment left in tissue > need immediate referral



2. are the steps for infiltrations the same as IANB but just different location?

Not exactly


- Selection of Equipment
- Intraoral Landmarks
- Contacting with Bone or not (length of needle in soft tissues)
- Aspiration

Note: Buccal vs palatal infiltration



3. what happens if you inject into the pterygomandibular raphe

- LA failure
- The raphe is a band of connective tissue which separates the buccinator and superior constrictor muscles and serves as a partial origin for each. The raphe extends from the hamulus of the medial pterygoid plate (superiorly) to the posterior end of the mylohyoid line of the mandible (inferiorly).



4. what happens if you hit bone too early, or too late?

- In either cases don't inject solution
- Never inject if your needle is too far in, more than $\frac{2}{3}$ rds (ie. making contact with bone too late/not making contact with bone at all) -> why?
- LA will be ineffective if contact with bone is made too early
- Readjust if you make contact with bone too early/late -> how should I adjust for each type?

Exam Style Questions



Question 1

The pt requires a tooth extraction of the 26. Justify the LA procedure(s) and type of LA used. State which nerves and tissues will be anaesthetised.

what are the different techniques for routine direct restorative procedure, deep periodontal scaling, tooth extraction, root canal treatment



Question 2

What post op instructions should be given following LA?

Inform patient:

- approximate length of time for anaesthesia to wear off – can vary dependent per above info (eg, 1.5-3/4hrs)
- describe sensation of anaesthesia wearing off and then all sensation returning
- if patient needs to eat for med reasons or a child – ensure you provide information re, eating/drinking eg body temp or cooler food and to eat on the non-affected side
- take care not to bite the inside of your lip or cheek
- to contact clinic if persistent anaesthesia (eg, more than 24 hr period).
- Also inform clinic if experience any concerns related to the anaesthesia

NB: if during the LA procedure there has been any technical difficulties experienced that may lead to haematoma, potential for trismus then the patient must be informed and a record made.

(Post op instructions for LA document- under clinic session learning guides)