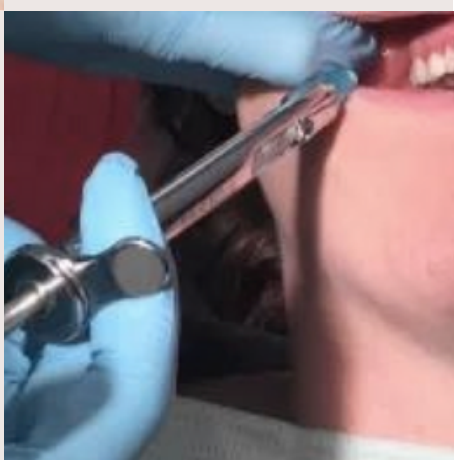
Local Anesthesia: Techniques, Trends and Troubleshooting



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Objectives

Discuss	Discuss indications, relevant anatomy and technique factors of common dental injections
Identify	Identify the physiological and anatomical considerations that may lead to inadequate anesthesia
Apply	Apply critical thinking skills to troubleshooting local anesthetic delivery
Describe	Describe strategies for addressing inadequate local anesthesia during patient care
Identify	Identify alternative delivery techniques
Describe	Describe new trends in the delivery and reversal of local anesthesia

“Dental patients themselves are aware of the difference between local anesthesia administered by the dental hygienist and that administered by the dentist. They frequently comment on the lack of discomfort when the hygienist injects the local anesthetic. Be it a slower rate of administration, great attention to the details of atraumatic injection technique, or greater empathy, it works”

~STANLEY MALAMED

ANATOMICAL CONSIDERATIONS

I Opthalmic (Sensory)

IIncludes tip of nose (nasociliary), eyes (lacrimal) and forehead (frontal)

II Maxillary (Sensory)

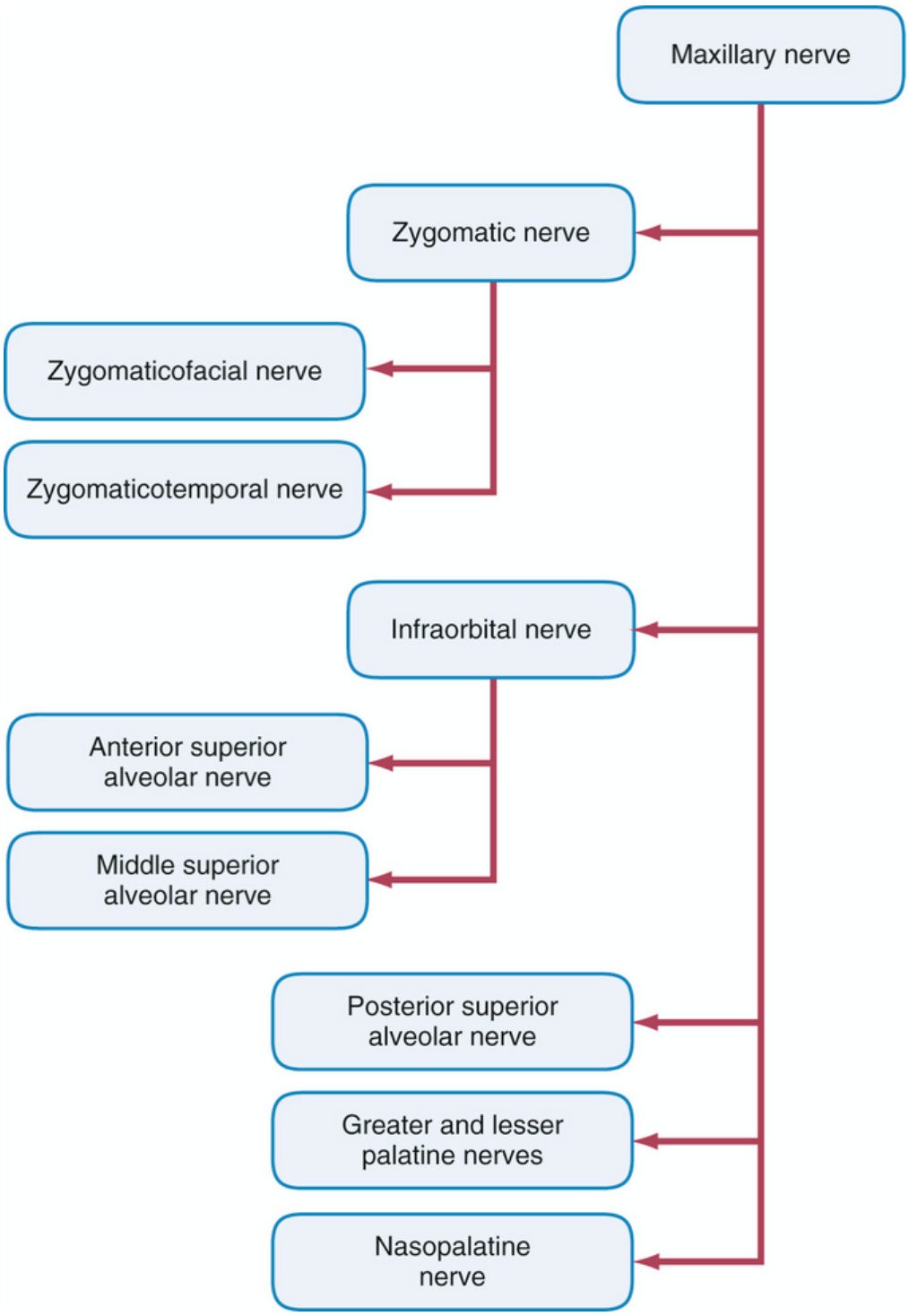
Includes the upper teeth, nose, palate, mouth, cheek and temporal region

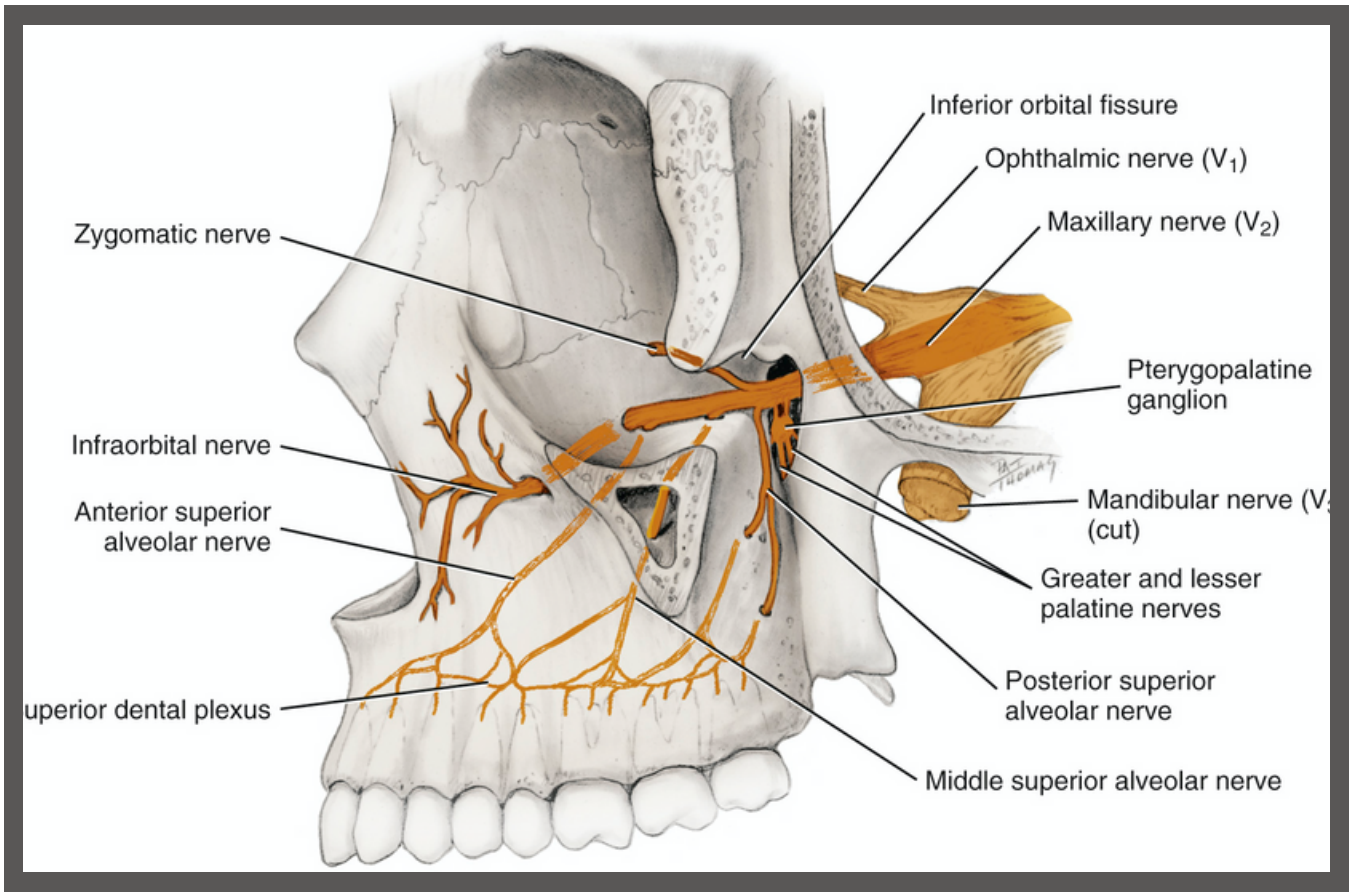
III Mandibular (Sensory and Motor)

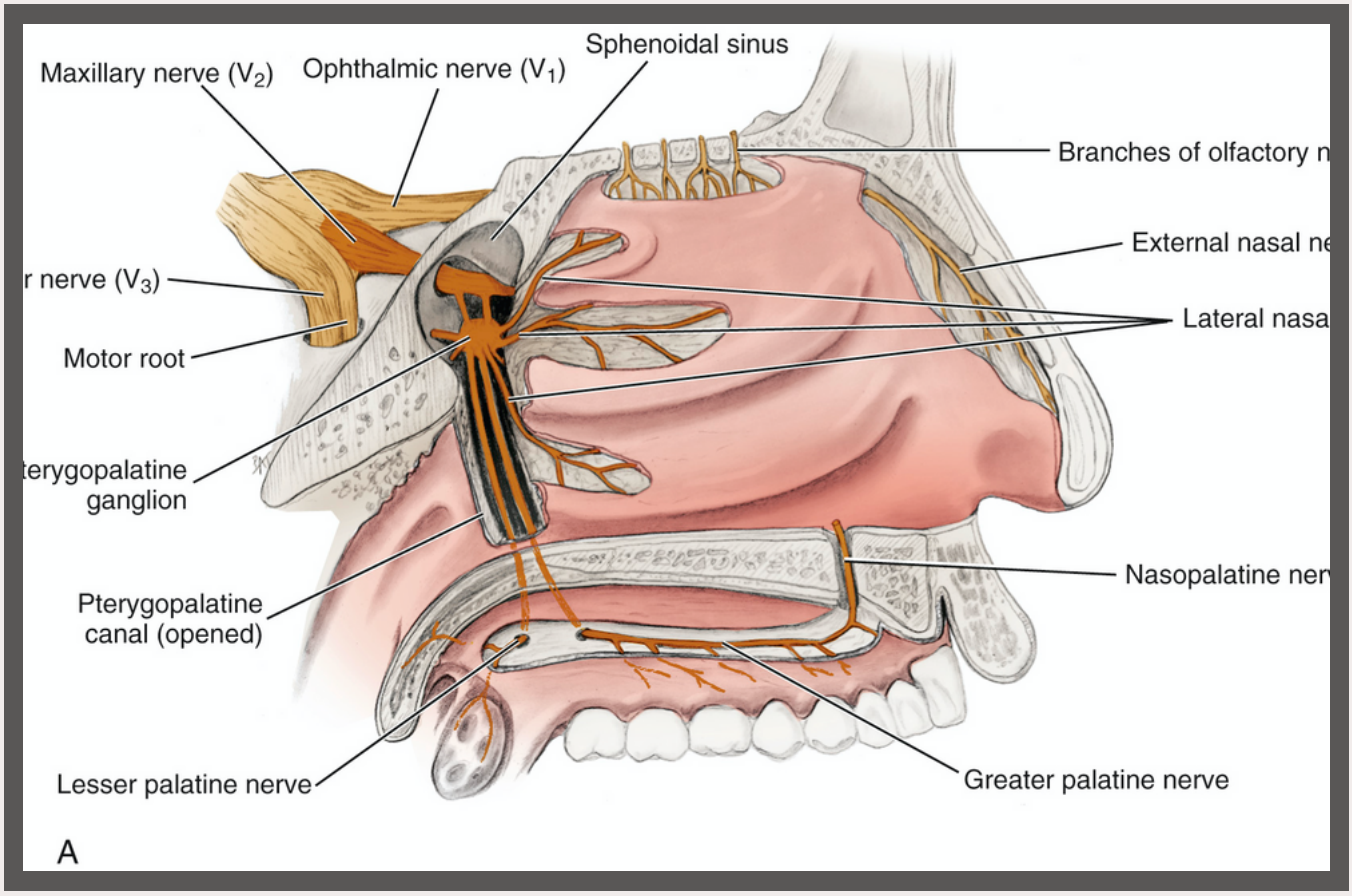
Enters mandible through Mandibular Foramen

Includes muscles of mastication (motor) and lower teeth (sensory)

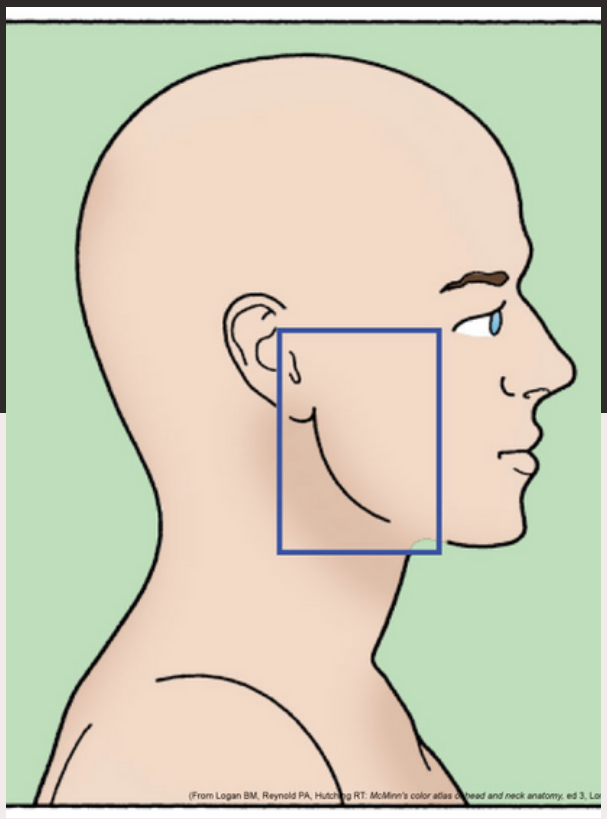
Maxillary Nerve Anatomy




Inferior orbital fissure
Ophthalmic nerve (V_1)
Maxillary nerve (V_2)
Zygomatic nerve
Pterygopalatine ganglion
Infraorbital nerve
Mandibular nerve (V_3) (cut)
Anterior superior alveolar nerve
Greater and lesser palatine nerves
uperior dental plexus
Posterior superior alveolar nerve
Middle superior alveolar nerve

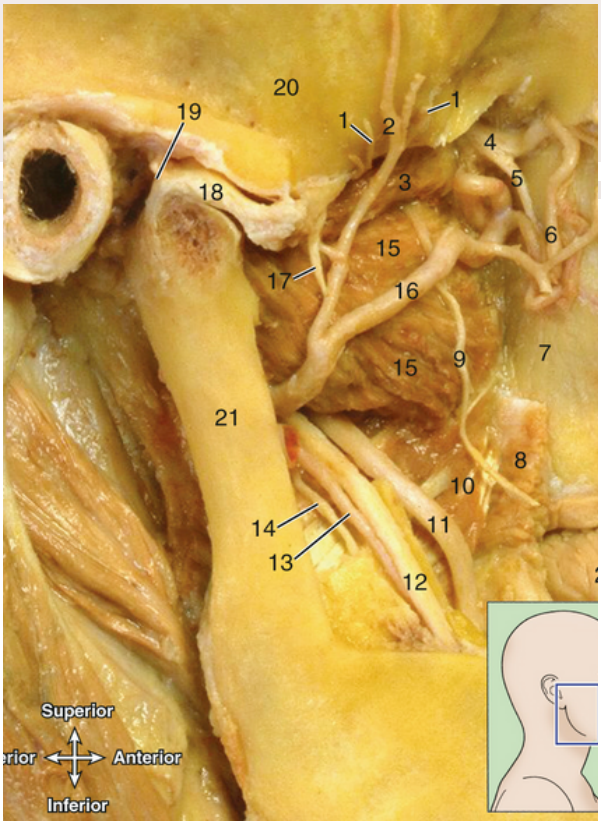

Maxillary nerve (V_2)
Ophthalmic nerve (V_1)
Sphenoidal sinus
Branches of olfactory n
External nasal ne
r nerve (V_3)
Lateral nasa
Motor root
terygopalatine ganglion
Nasopalatine ner
Pterygopalatine canal (opened)
Lesser palatine nerve
Greater palatine nerve
A

Dissection Maxillary Nerve



From Logan BM, Reynold PA, Hutching RT: McMinn's color atlas of head and neck anatomy, ed 4, London, 2010, Elsevier.

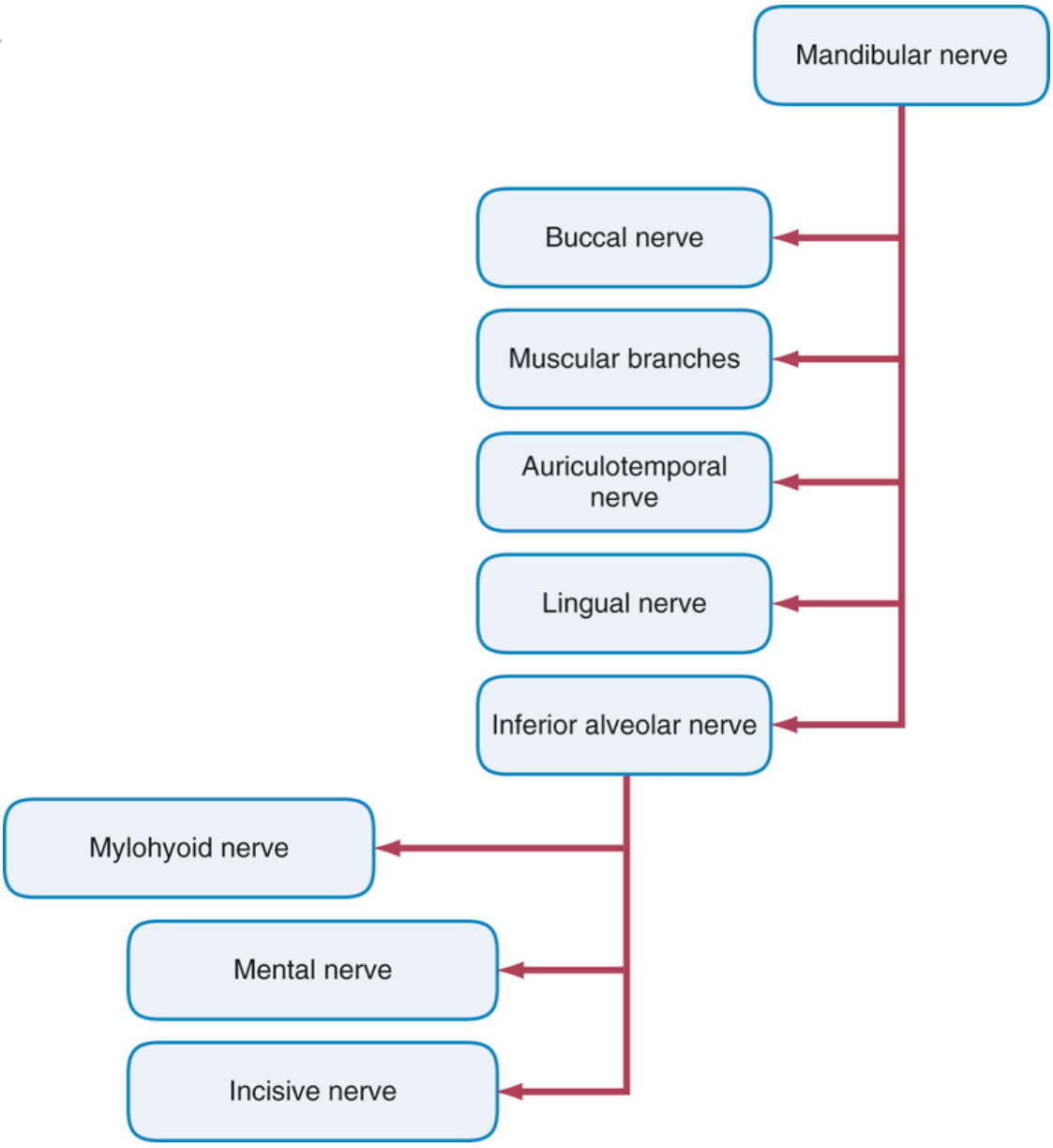
S1, Deep temporal nerve;
2, deep temporal artery;
3, lateral pterygoid muscle;
4, maxillary nerve;
5, posterior superior alveolar nerve;
6, posterior superior alveolar artery;
7, infratemporal surface of maxilla;
8, buccinator muscle;
9, buccal nerve;
10, medial pterygoid muscle;
11, lingual nerve;
12, inferior alveolar nerve;

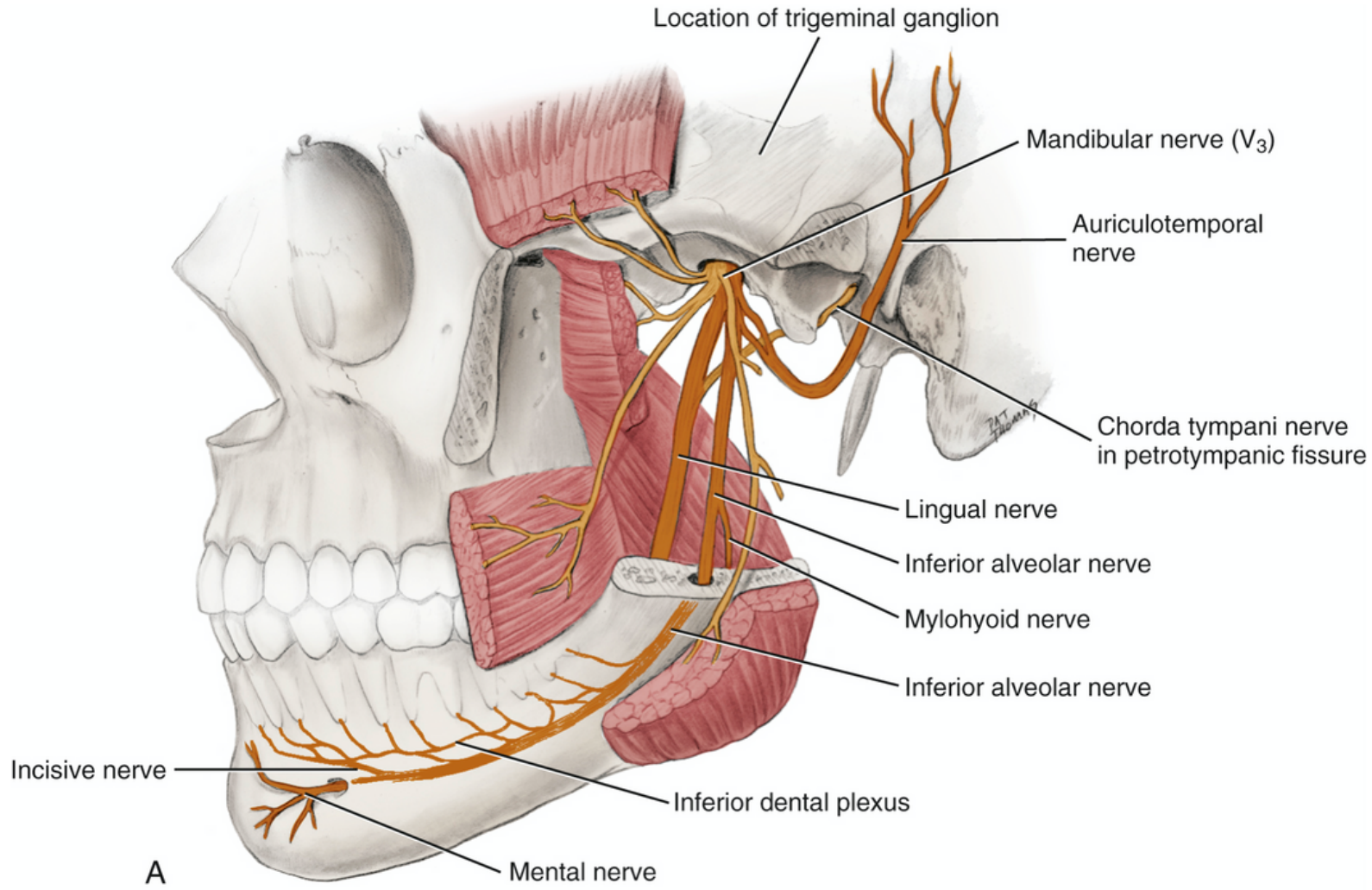


From Logan BM, Reynold PA, Hutching RT: McMinn's color atlas of head and neck anatomy, ed 4, London, 2010, Elsevier.

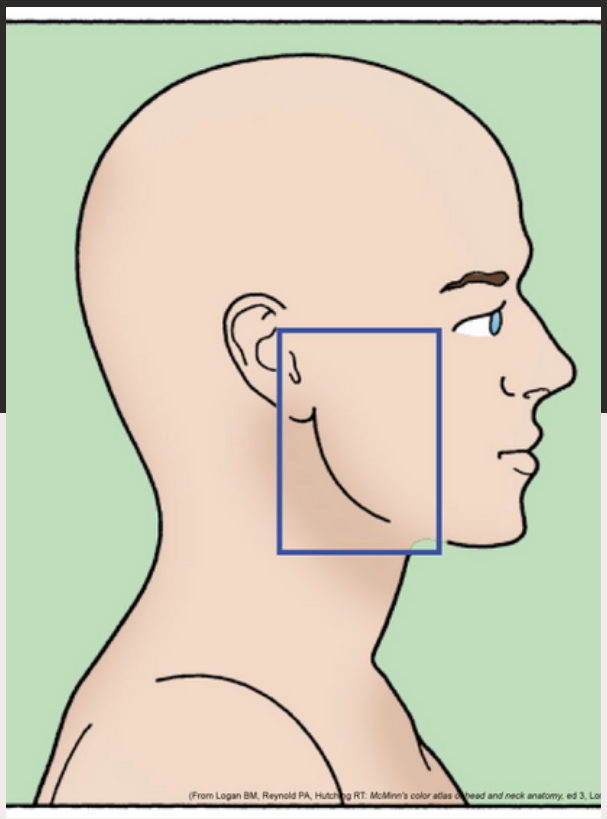
13, inferior alveolar artery;
14, mylohyoid nerve;
15, lateral pterygoid muscle;
16, maxillary artery;
17, masseteric nerve;
18, joint disc of the temporomandibular joint and mandibular condyle;
19, joint capsule;
20, temporal bone;
21, mandibular ramus;
22, tongue.

Mandibular Nerve Anatomy



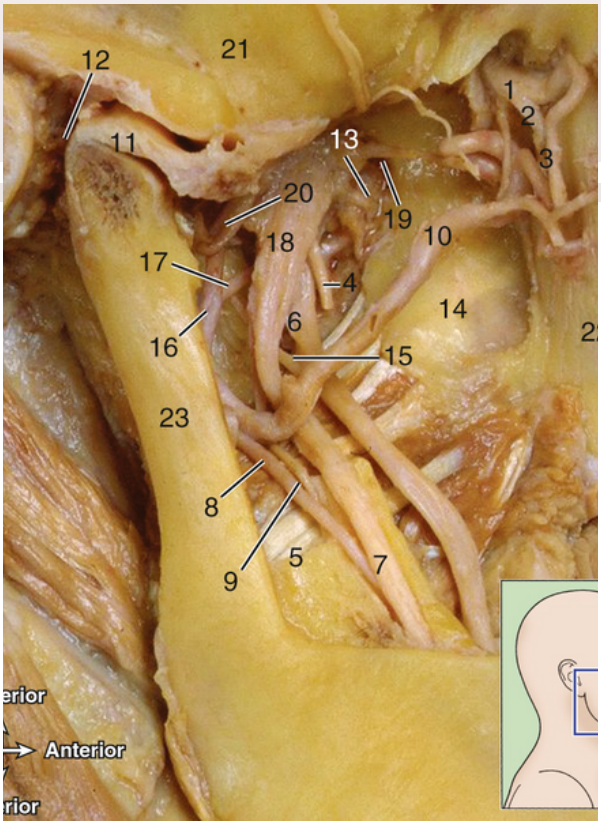

Location of trigeminal ganglion
Mandibular nerve (V_3)
Auriculotemporal nerve
Chorda tympani nerve in petrotympanic fissure
Lingual nerve
Inferior alveolar nerve
Mylohyoid nerve
Inferior alveolar nerve
Incisive nerve
Inferior dental plexus
Mental nerve
A

Dissection Mandible



From Logan BM, Reynold PA, Hutching RT: McMinn's color atlas of head and neck anatomy, ed 4, London, 2010, Elsevier.

1, Maxillary nerve;
2, posterior superior alveolar nerve;
3, posterior superior alveolar artery;
4, buccal nerve;
5, medial pterygoid muscle;
6, lingual nerve; 7, inferior alveolar nerve;
8, inferior alveolar artery;
9, mylohyoid nerve;
10, maxillary artery;
11, joint disc of temporomandibular joint and mandibular condyle;
12, joint capsule;
13, medial pterygoid nerve; (continued)



From Logan BM, Reynold PA, Hutching RT: McMinn's color atlas of head and neck anatomy, ed 4, London, 2010, Elsevier.

14, lateral pterygoid plate;
15, chorda tympani nerve;
16, middle meningeal artery;
17, accessory meningeal artery;
18, mandibular nerve;
19, lateral pterygoid nerve;
20, auriculotemporal nerve;
21, temporal bone;
22, maxilla;
23, mandibular ramus;
24, tongue.

Common Dental Injections

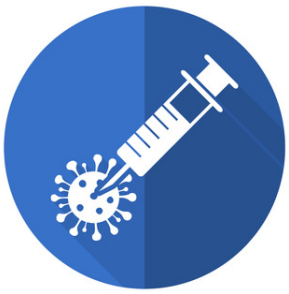
Indications

Anatomical Considerations

Technique Factors

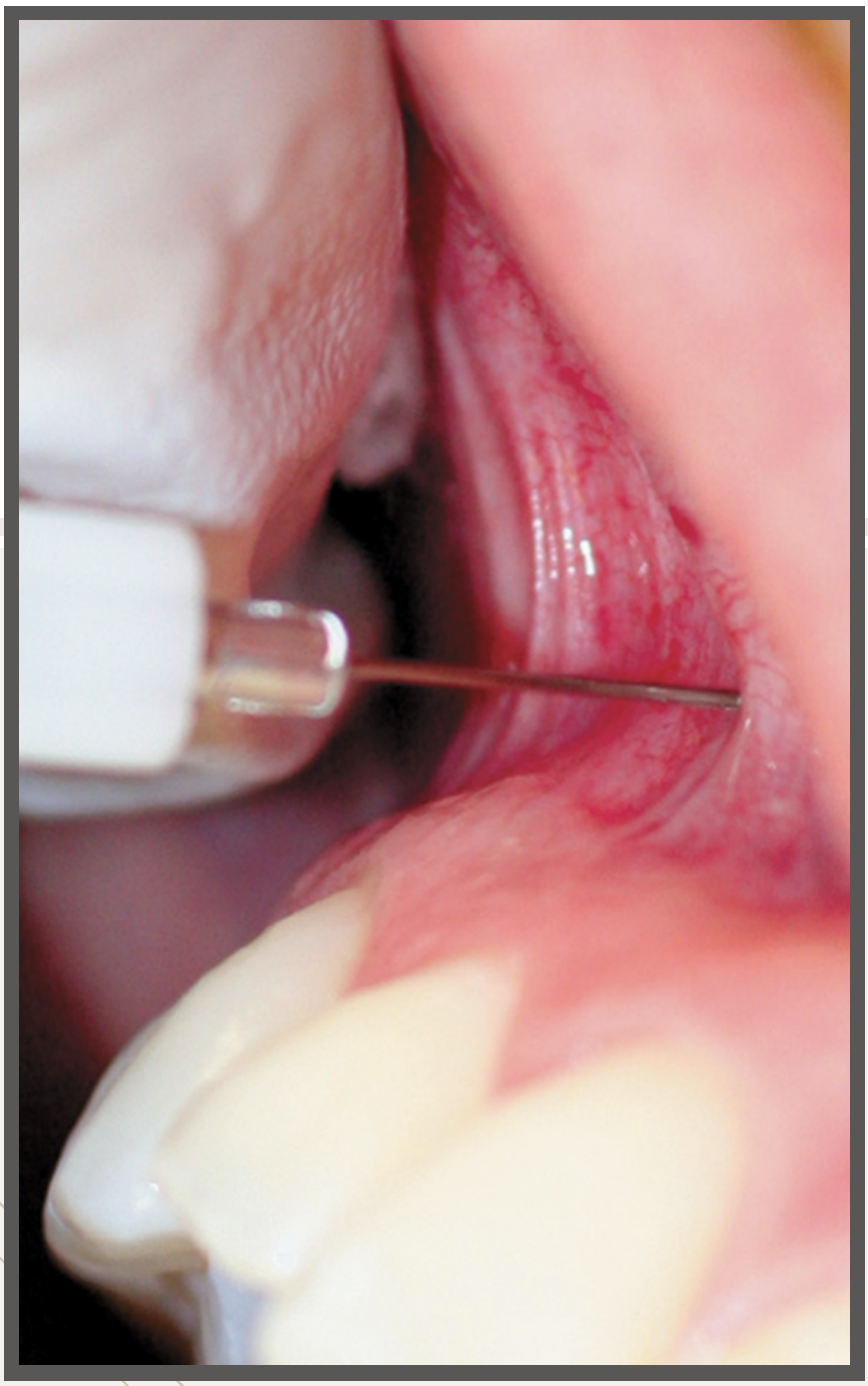






NOTES:

Anterior Superior Alveolar



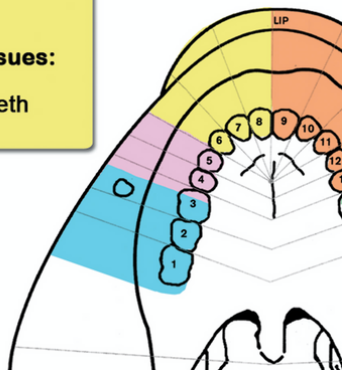
ASA

Teeth anesthetized:

canine, lateral, central

Periodontium/Soft tissues:

facial to affected teeth



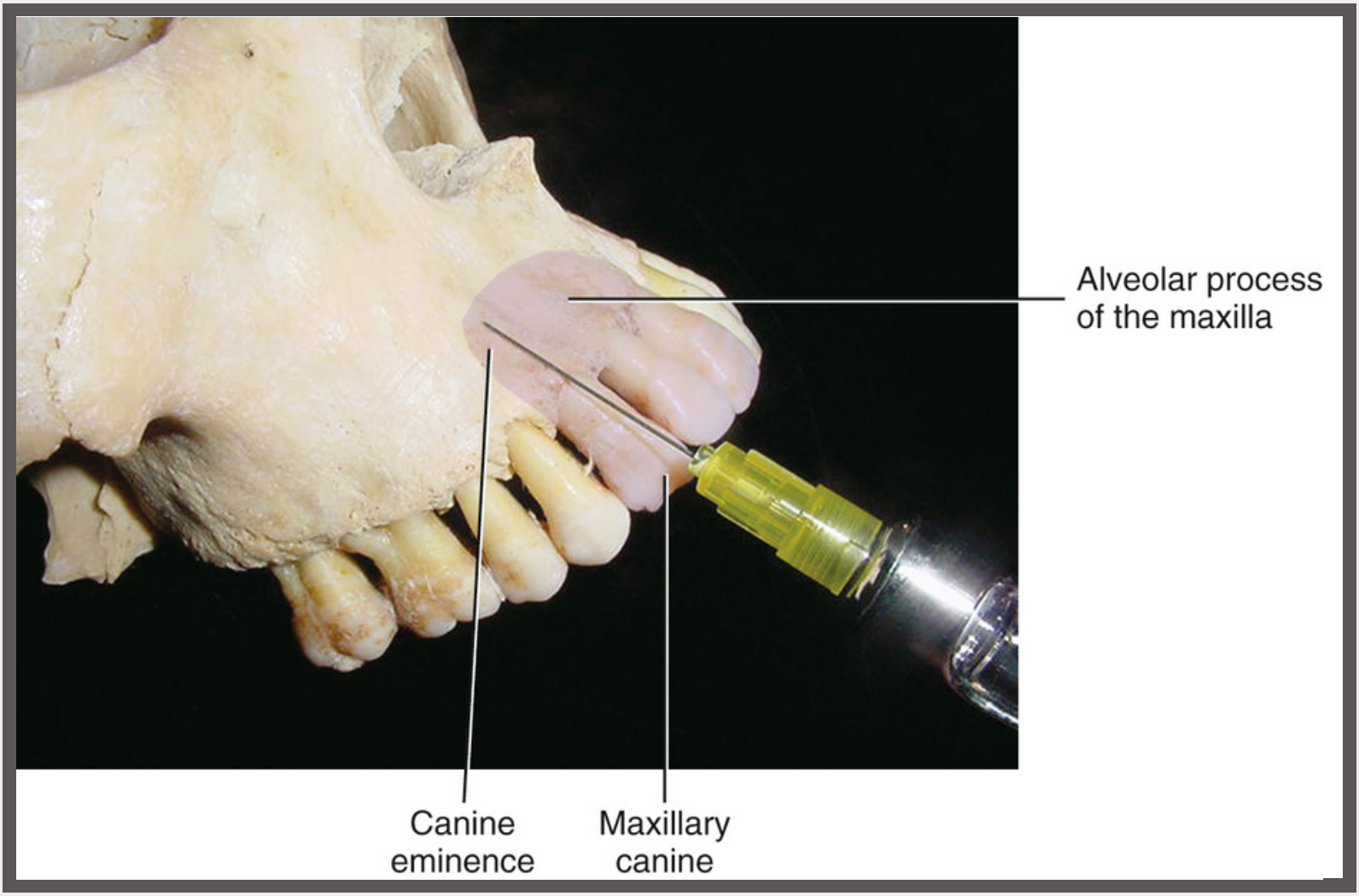
Penetration Site: Height of the mucobuccal fold anterior to the canine eminence in the canine fossa.

Deposition Site: above the canine eminence. Contact with bone should be avoided.

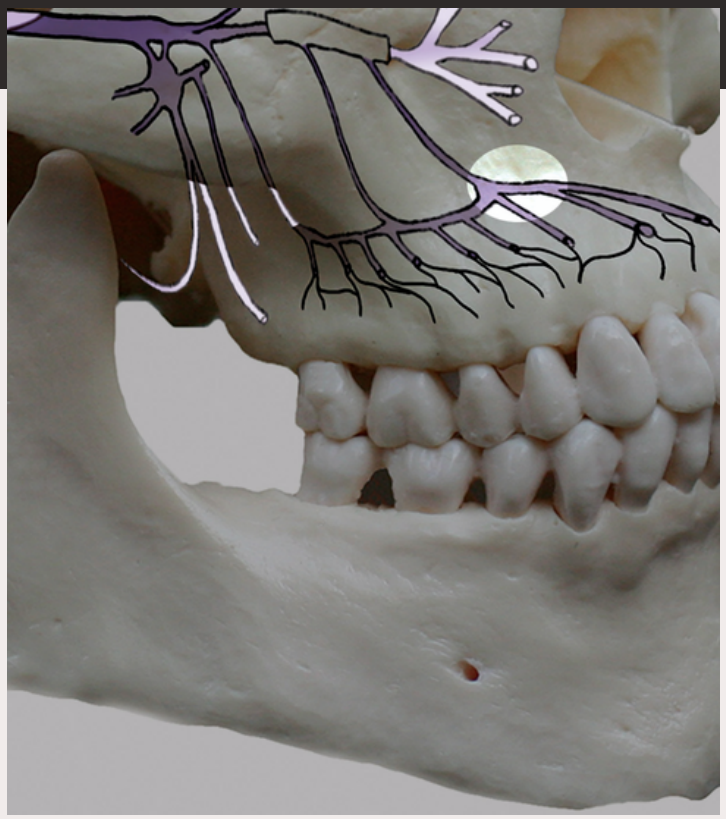
Procedure: Depth of injection is 3-6mm. ½ cartridge is deposited

Common Causes of Injection Failure: depositing solution too far from the target, inadequate volumes of solution, inflammation or infection at the site.

Anterior Superior Alveolar Block



Troubleshooting



- Anterior cross-innervation from contralateral ASA innervation
  - Infiltrate over same side central incisor
  - Contralateral ASA nerve block
  - P-ASA nerve block
- Unusually dense anterior maxilla
- Short vertical height of maxilla
- Boney protrusions

NOTES:

Middle Superior Alveolar

MSA

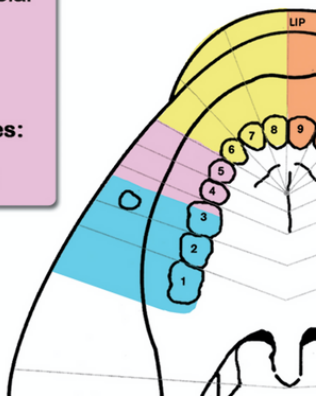
Teeth anesthetized:

maxillary premolars and mesiobuccal root of first molar*

* For most people

Periodontium/Soft tissues:

facial to affected teeth



Penetration Site: Height of the mucobuccal fold over the maxillary second premolar. *Malamed suggests between the two premolars.

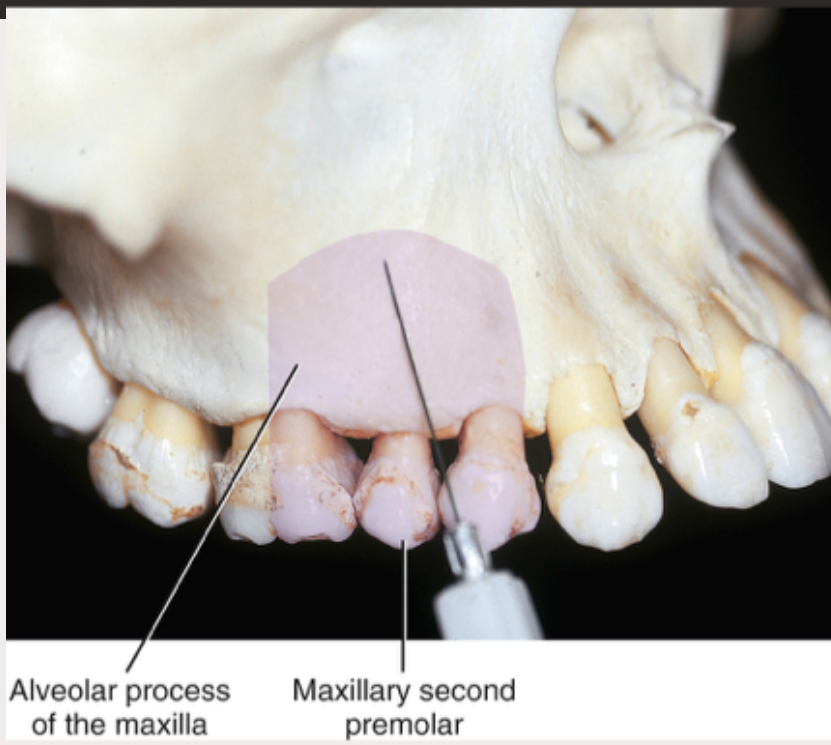
Deposition Site: Well above the apex of the second premolar. Several clinicians approach the deposition site between the apices of the two premolars.

Procedure: Depth of injection is 5-8mm. ½-2/3 cartridge is deposited.

Common Causes of Injection Failure: Depositing solution too far from the target, inadequate volumes of solution, inflammation or infection at the sitemmation or infection at the site.

Troubleshooting

- Middle superior alveolar nerves are missing in 50-72% of the population.
- Posterior deflection of needle during injection may move deposition site away from MSA nerve.
- Some clinicians inject between the apices of the two premolars.



NOTES:

Posterior Superior Alveolar

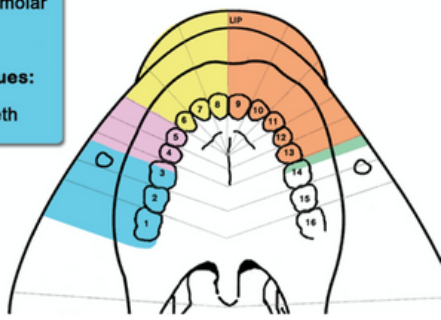
PSA

Teeth anesthetized:

maxillary molars except mesiobuccal root of first molar

Periodontium/Soft tissues:

buccal to affected teeth

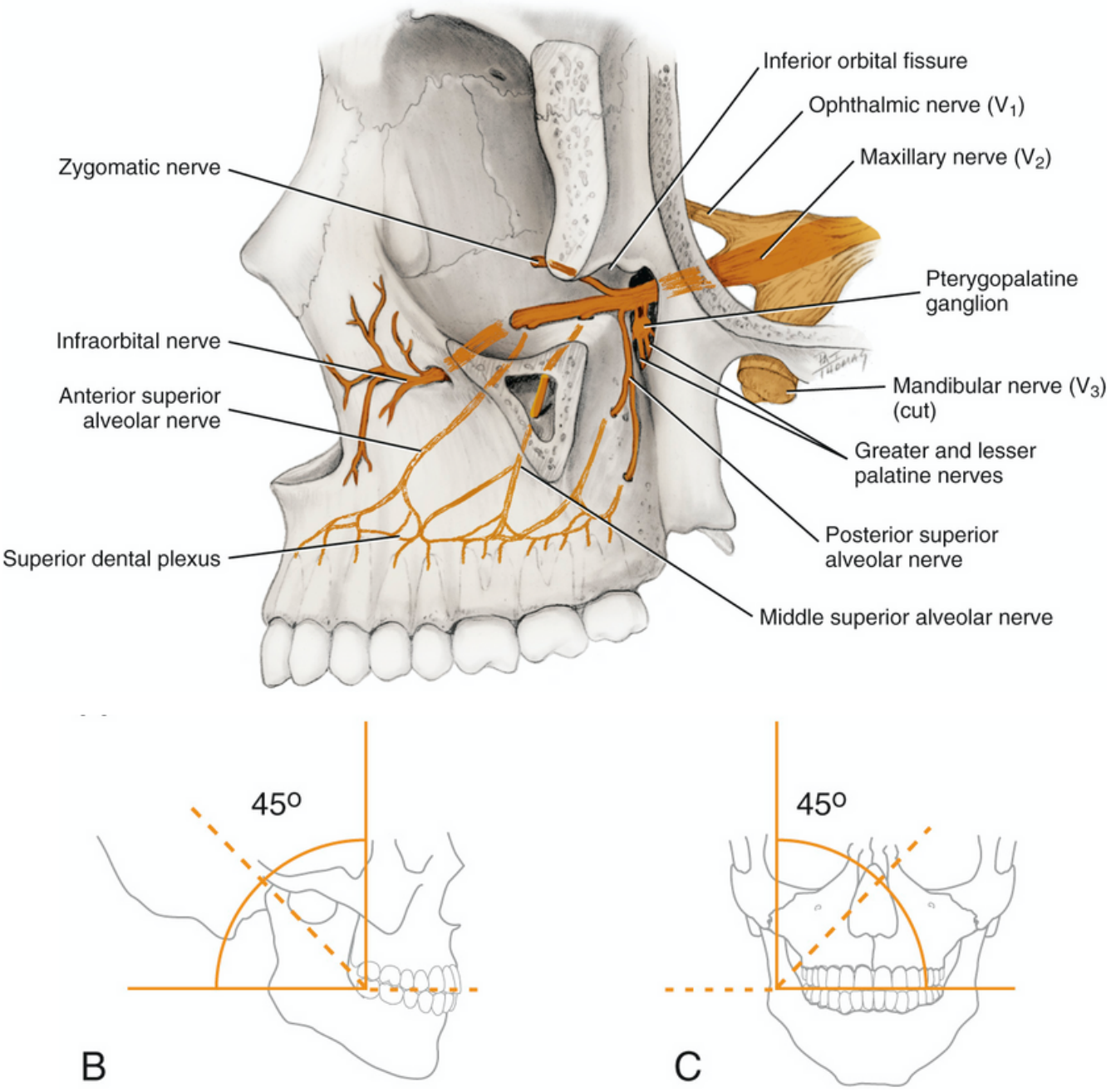


Penetration Site: Height of the mucobuccal fold posterior to the zygomatic process of the maxilla and generally superior to the distobuccal root of the second molar.

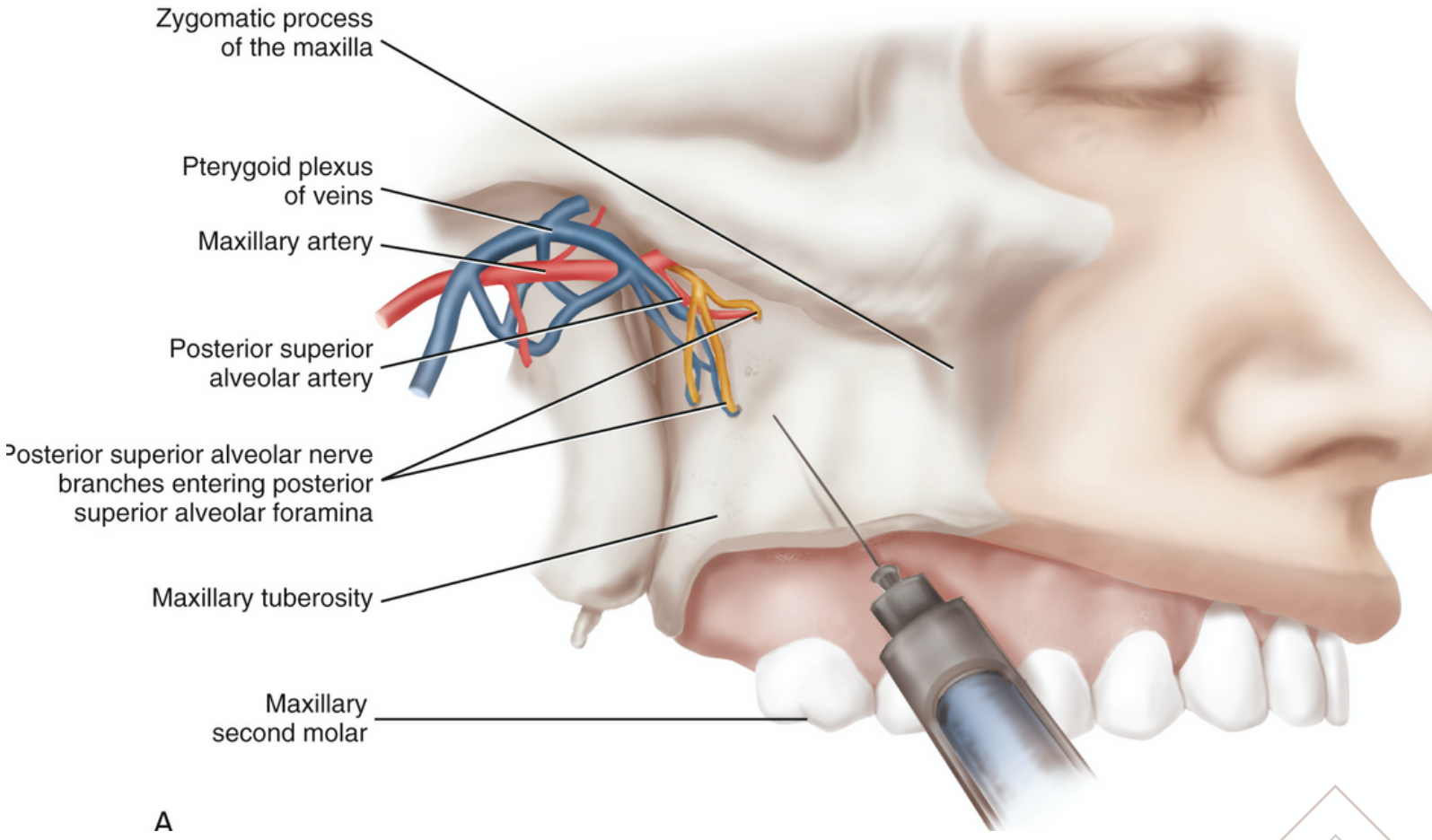
Deposition Site: adjacent to the foramina for the PSA nerve branches on the posterior surface of the maxilla

Procedure: Depth of injection is 16mm for most adults; 10-14mm on children and small adults. Deposit ½ to a full cartridge of solution.
Common Causes of Injection Failure: depositing solution too far from the target, inadequate volumes of solution, inflammation or infection at the site

Posterior Superior Alveolar Nerve

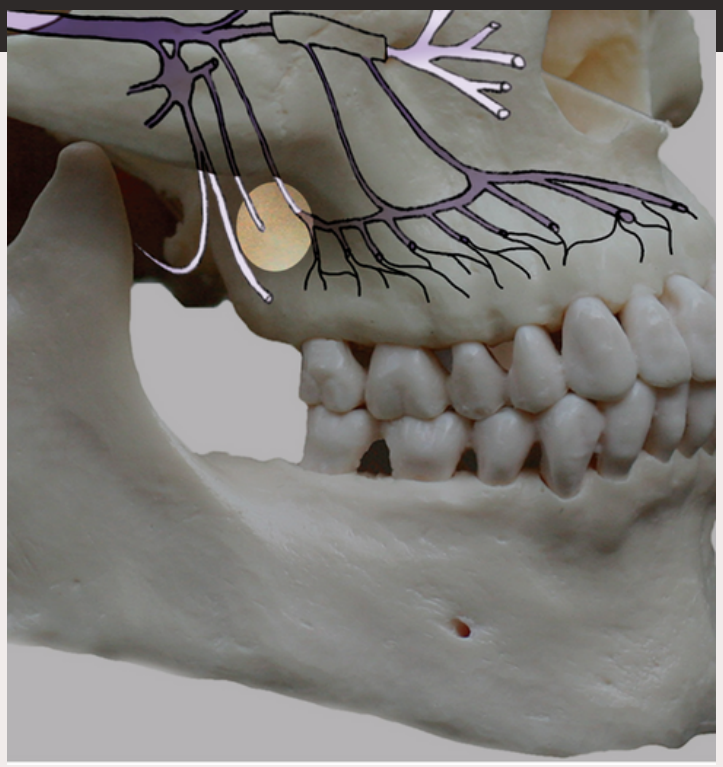


Posterior Superior Alveolar Block



Troubleshooting

- When third molars are present, the penetration site is adjusted posteriorly to the distobuccal root of the maxillary third molar
-
- Using a long needle may create overinsertion
-
- Studies show that fibers from the greater palatine nerve may also provide accessory innervation
    - Greater palatine nerve block will anesthetize atypical branches
- Studies show that articaine provides more effective diffusion to palatal roots

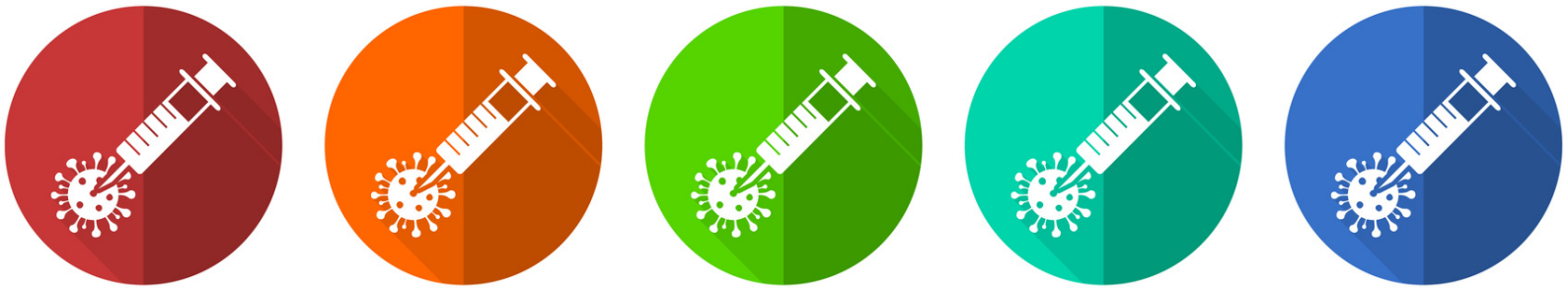


Complication: Hematoma

- Insertion of the needle too far distally may lead to a temporarily unesthetic hematoma.
- Penetration sites near the alveolar ridge rather than into the more forgiving site at the mucobuccal fold increases risk for contact with bone and subsequent tearing of the PSA artery or vessels within the pterygoid plexus of veins.
    - Boney resistance may also indicate too great of an angle toward the midline

Management of Hematomas

- Apply pressure and ice to permit clotting
- Instruct patient to apply ice over the next 6 hours, avoid anticoagulant pain relievers
- Inform patient of future discoloration



NOTES:

InfraOrbital

IO

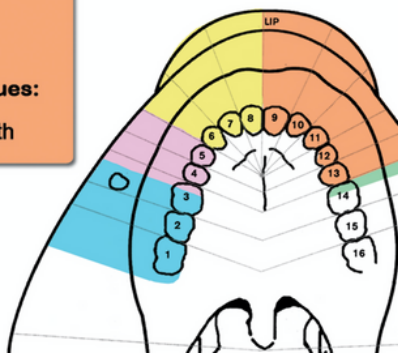
Teeth anesthetized:

premolars, canine,

lateral, central

Periodontium/Soft tissues:

facial to affected teeth

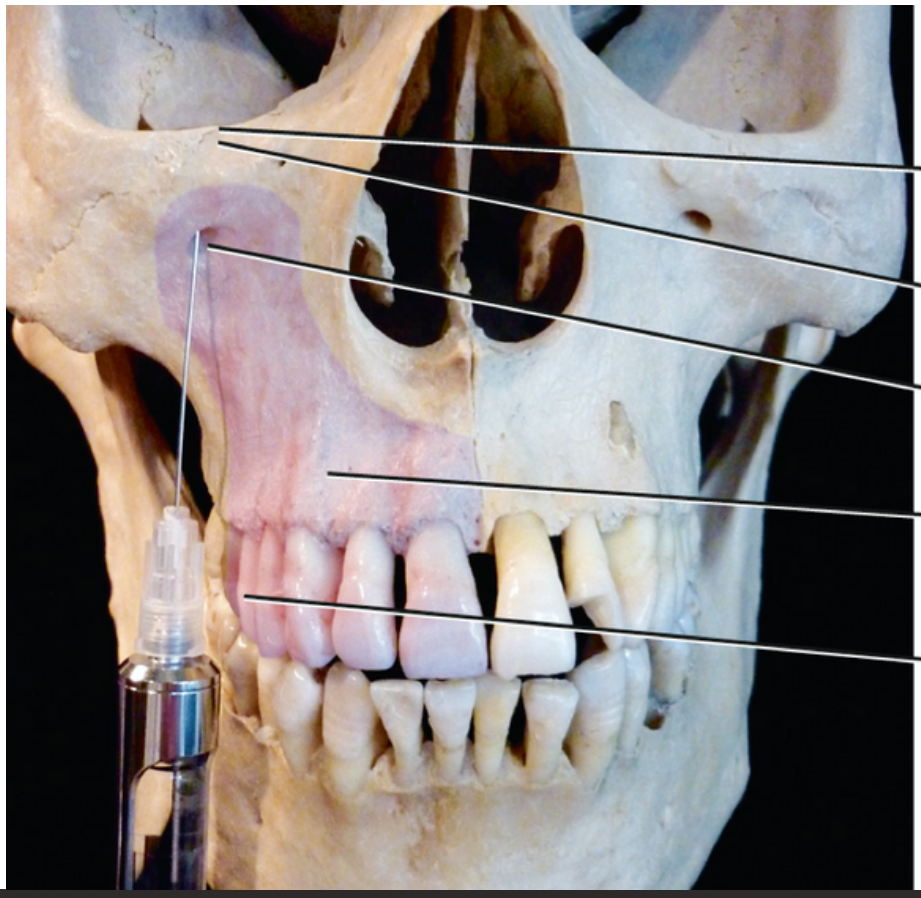


Penetration Site: Height of the mucobuccal fold in direct vertical alignment with the infraorbital notch and subsequently the infraorbital foramen. Anatomy is assessed utilizing palpation techniques.

Deposition Site: Superficial to the infraorbital foramen, directly below the infraorbital notch.

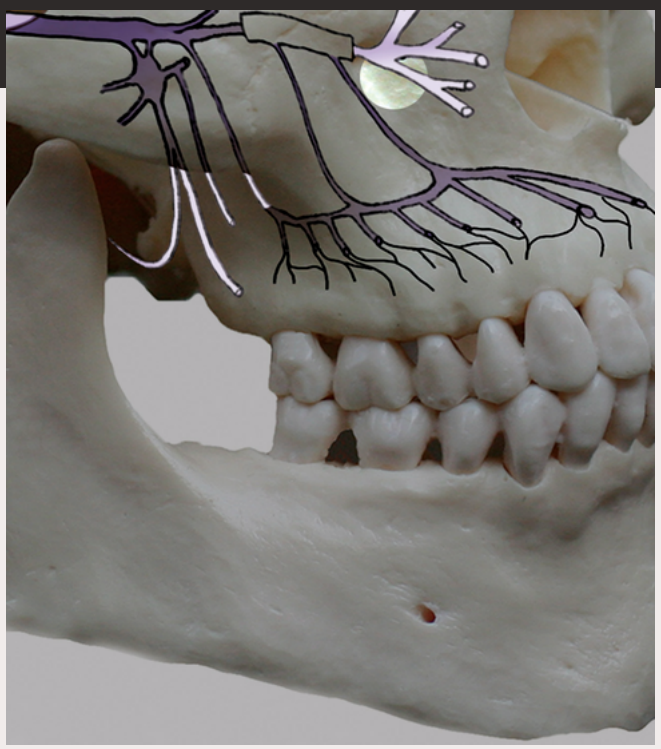
Procedure: Contact with bone is controversial but ensures contact with the infraorbital ridge. ½ a cartridge is deposited. Finger pressure is applied extraorally for 1-2 minutes

Common Causes of Injection Failure: depositing solution too far from the target, inadequate volumes of solution, inflammation or infection at the site



Troubleshooting

- Assumption of penetration site at the height of the mucobuccal fold over the first premolar
- Unsuccessful evaluation/visualization and palpation techniques in assessing the location of the foramen.
- Pressure not applied or not applied for appropriate amount of time
- Foramen is too small



Greater Palatine

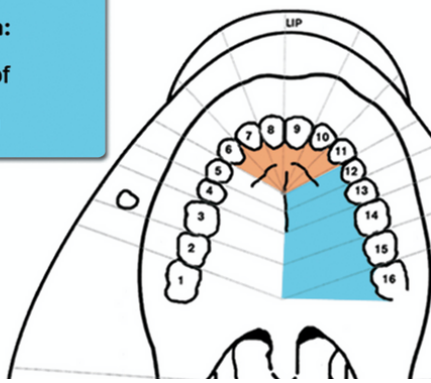
GP

Teeth anesthetized:

none

Periodontium:

palatal tissues of posterior teeth



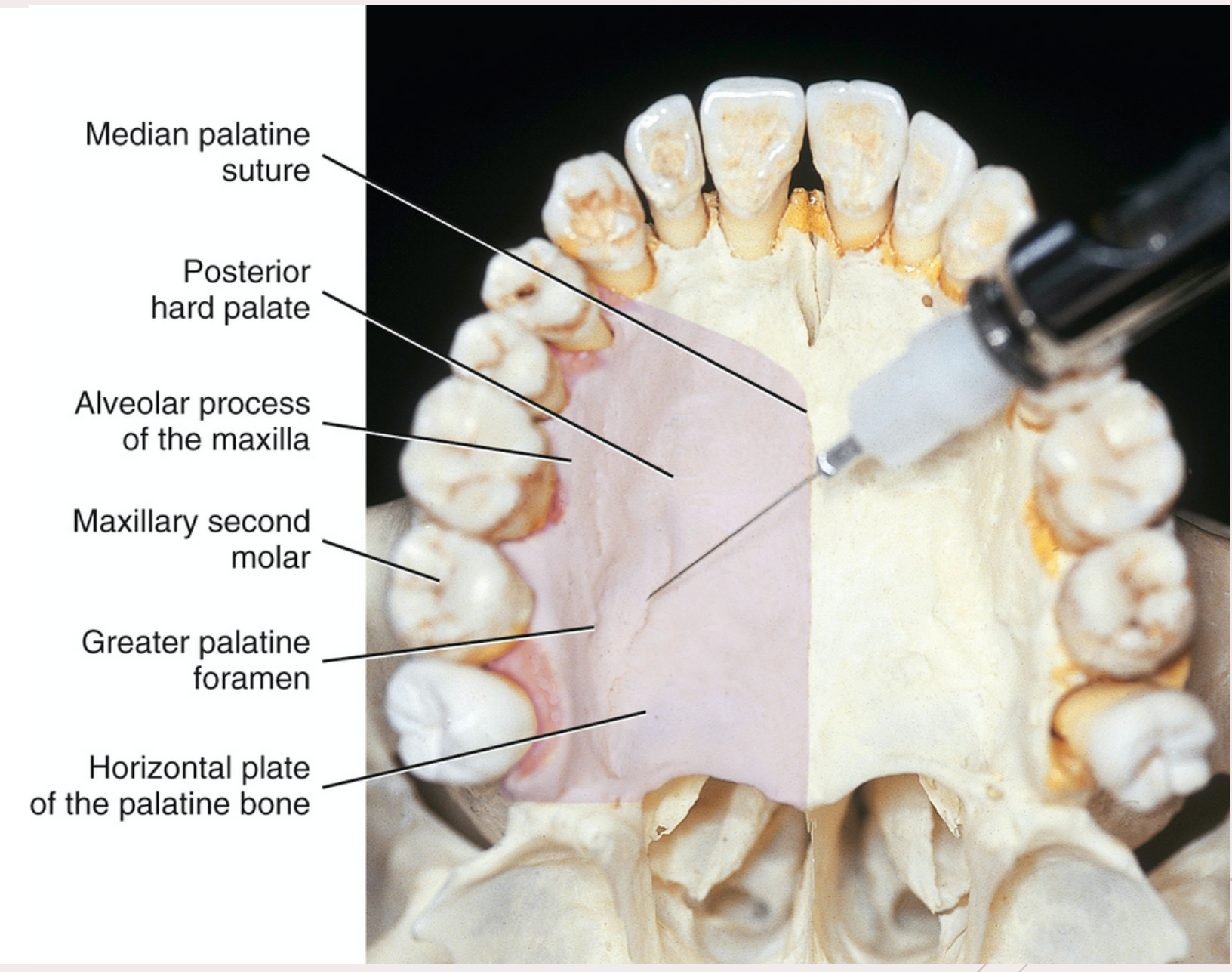
Penetration Site: Palatal soft tissues slightly anterior to the greater palatine foramen at the anterior border of the depression.

Deposition Site: Anterior to the opening of the anterior palatine foramen.

Procedure: Advance 4-10mm until gentle contact with bone. Deposit ¼ of a cartridge.

Common Causes of Injection Failure: Inadequate depth of penetration and inadequate volumes of solution deposited. Others include inflammation or infection present, inadequate diffusion of solution and overlapping innervation by the nasopalatine nerve.

Greater Palatine Block



Troubleshooting

- Pediatric patients may have a greater palatine foramen located posterior to all erupted teeth. If so, consider palatal infiltrations or a maxillary nerve block.

NOTES:

Nasopalatine

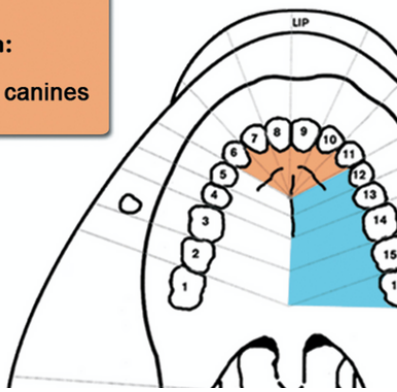
NP

Teeth anesthetized:

none

Periodontium:

palatal to incisors and canines



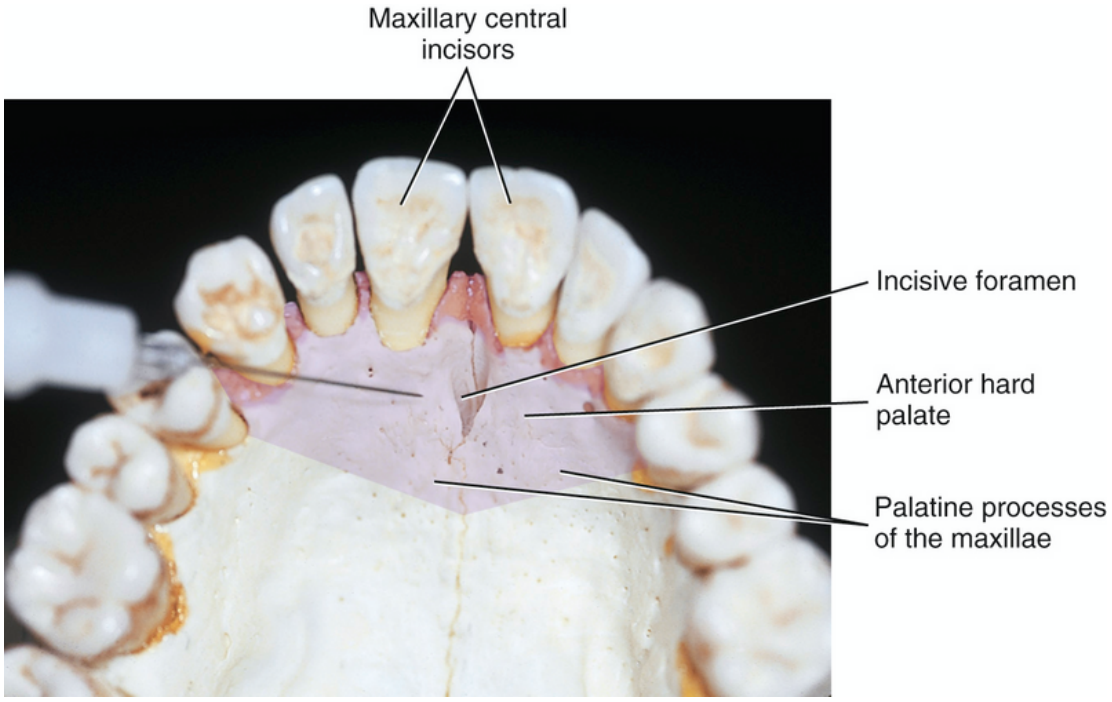
Penetration Site: Palatal mucosa lateral to the widest anteroposterior dimension of the incisive papilla

Deposition Site: At the center of the incisive canal

Procedure: Insert 4-7mm; contact the opposite wall of the foramen. Deposit ¼ of a cartridge.

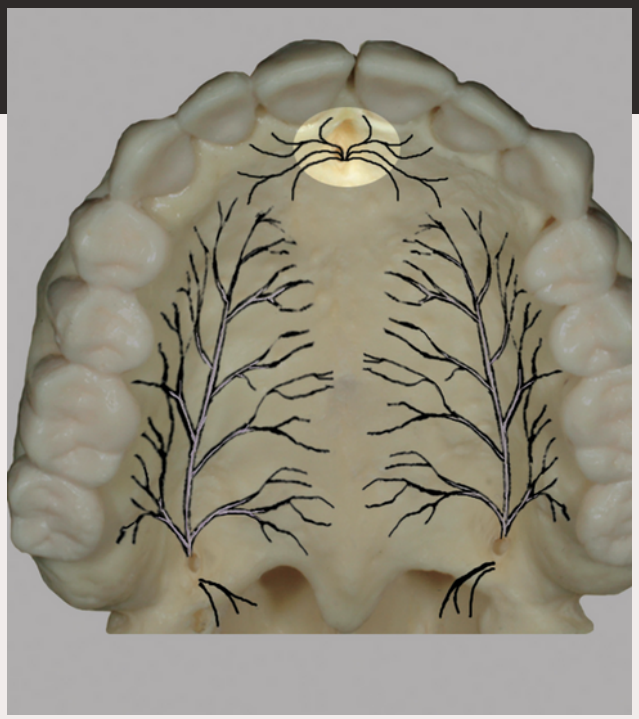
Common Causes of Injection Failure: Inadequate depth of penetration and inadequate volumes of solution deposited. Others include inflammation or infection present, inadequate diffusion of solution and overlapping innervation by the greater palatine nerve.

Nasopalatine Block



Troubleshooting

- Evaluate angulation of the syringe and depth of penetration as well as volumes of solution deposited
- The nasopalatine injection may result in unilateral anesthesia if the opposite wall of the canal is not contacted.

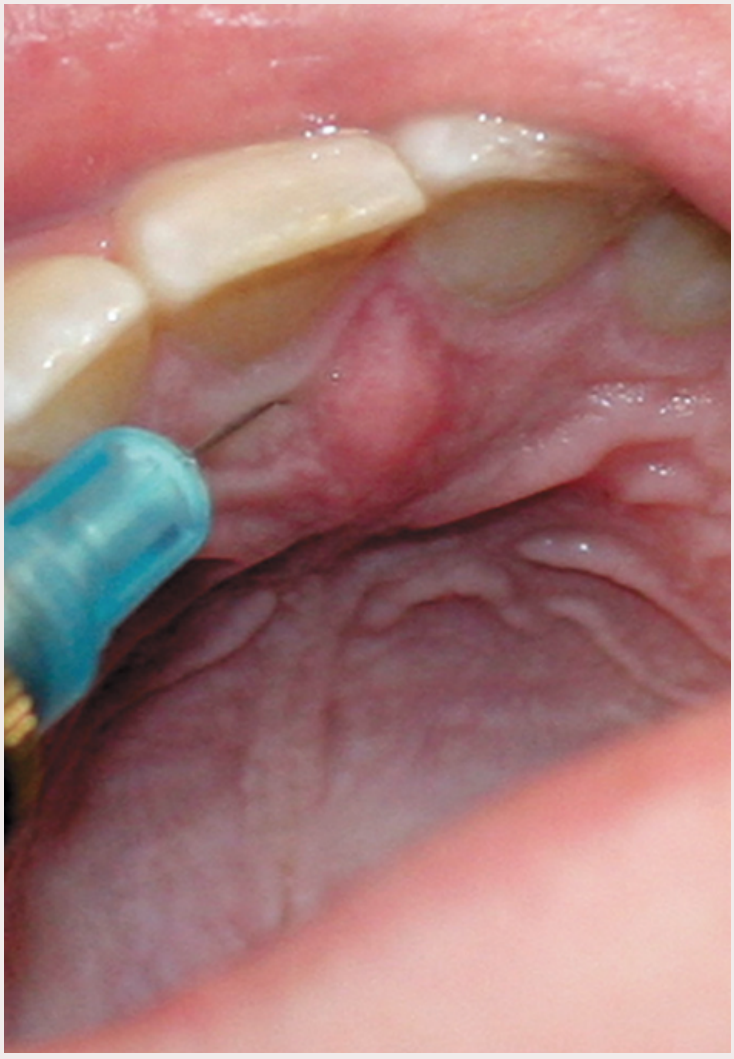


Multiple Penetrations Technique

Labial Frenum

Interdental papilla between the maxillary central incisors

Nasopalatine area

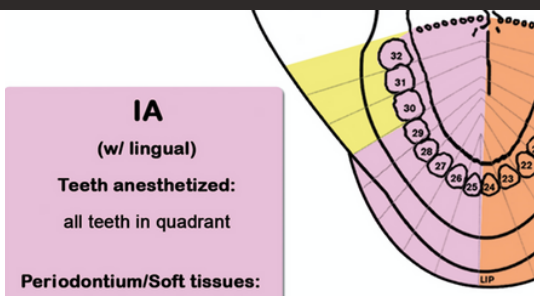


Palatal Blanching

- Administering a 4% drug: suggest reducing the total volume administered to half that of what is typically recommended
    - Potential for paresthesia; evidence is unclear
    - Slow deposition rate is encouraged by Bassett and DiMarco (1 cart over 6 mins)
- Excessive blanching is more commonly observed with higher concentrations of epinephrine (1:50,000)

NOTES:

Inferior Alveolar



IA

(w/ lingual)

Teeth anesthetized:

all teeth in quadrant

Periodontium/Soft tissues:

all periodontium, buccal mucosa premolars to midline, floor of mouth and ½ tongue in quadrant

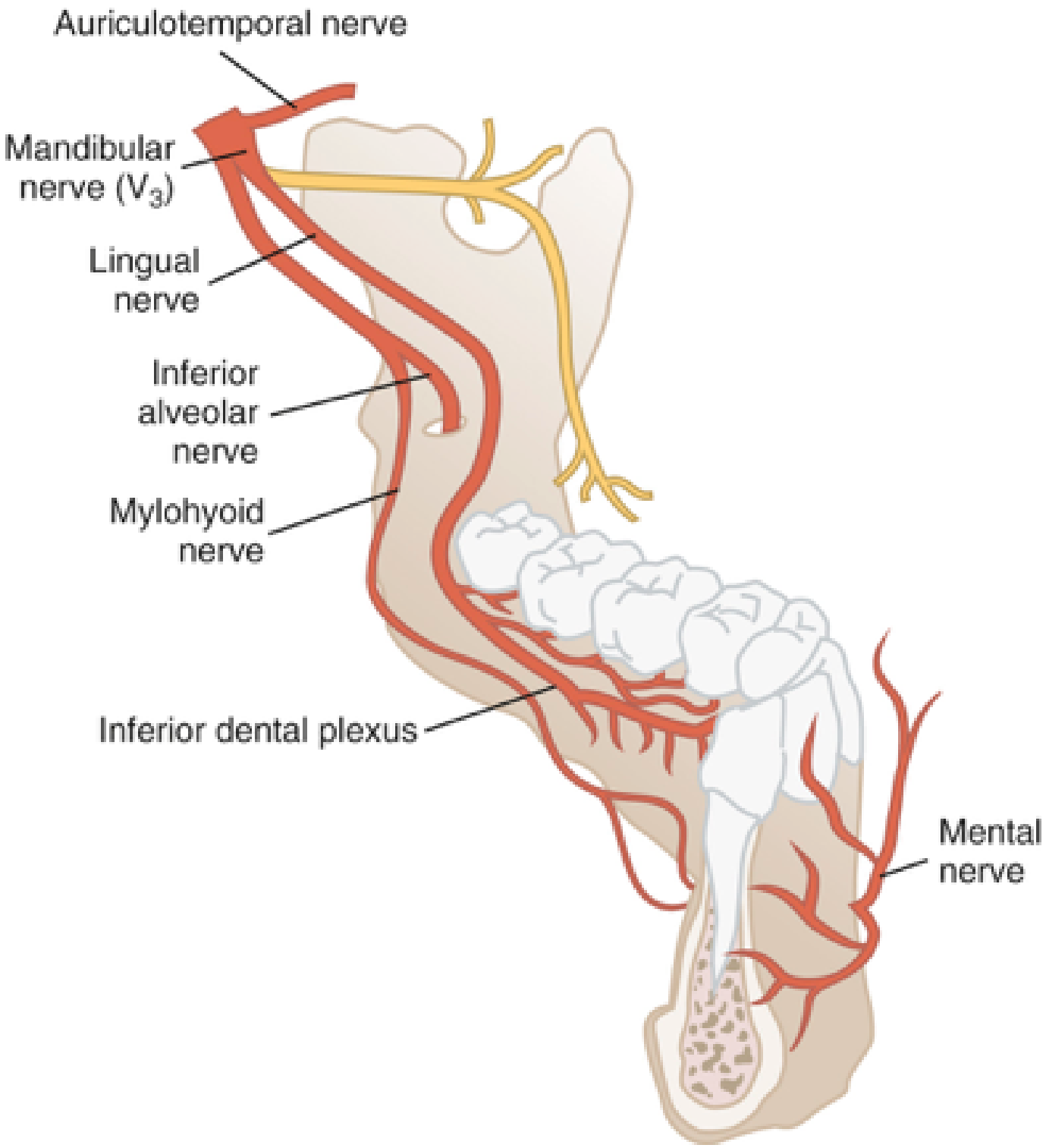
Penetration Site: Lateral to the pterygomandibular raphe at the height (2-3mm superior) of the coronoid notch and medial to the internal oblique ridge.

Deposition Site: 1mm lateral to the medial aspect of the ramus and above the mandibular foramen.

Procedure: Deposition at about 2/3-3/4 of a long needle, until boney resistance is met. Deposit ¾ of a cartridge *budget for Lingual and Buccal.

Common Causes of Injection Failure: Published failure of the inferior alveolar block is among the highest failure rates in history.

Malamed states inadequate anesthesia rates are 31-81%, the most common error being depositing solution too far away from the foramen.


Auriculotemporal nerve
Mandibular nerve (V_3)
Lingual nerve
Inferior alveolar nerve
Mylohyoid nerve
Inferior dental plexus
Mental nerve

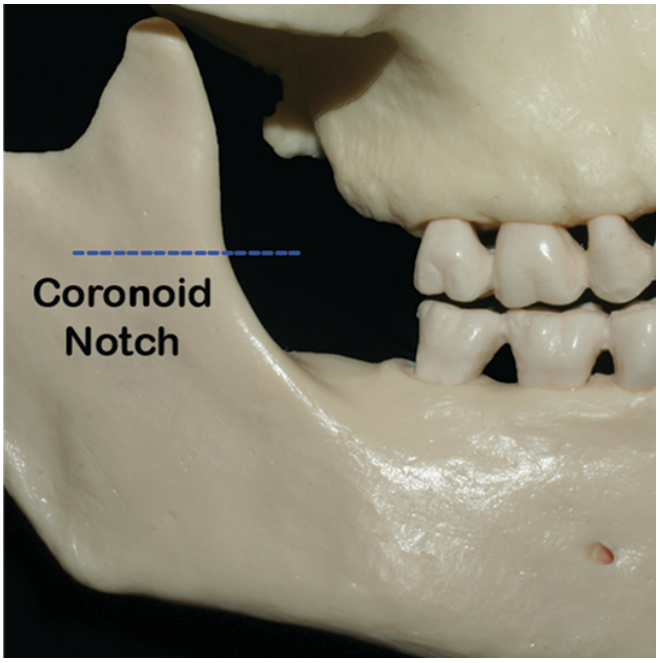
Technique

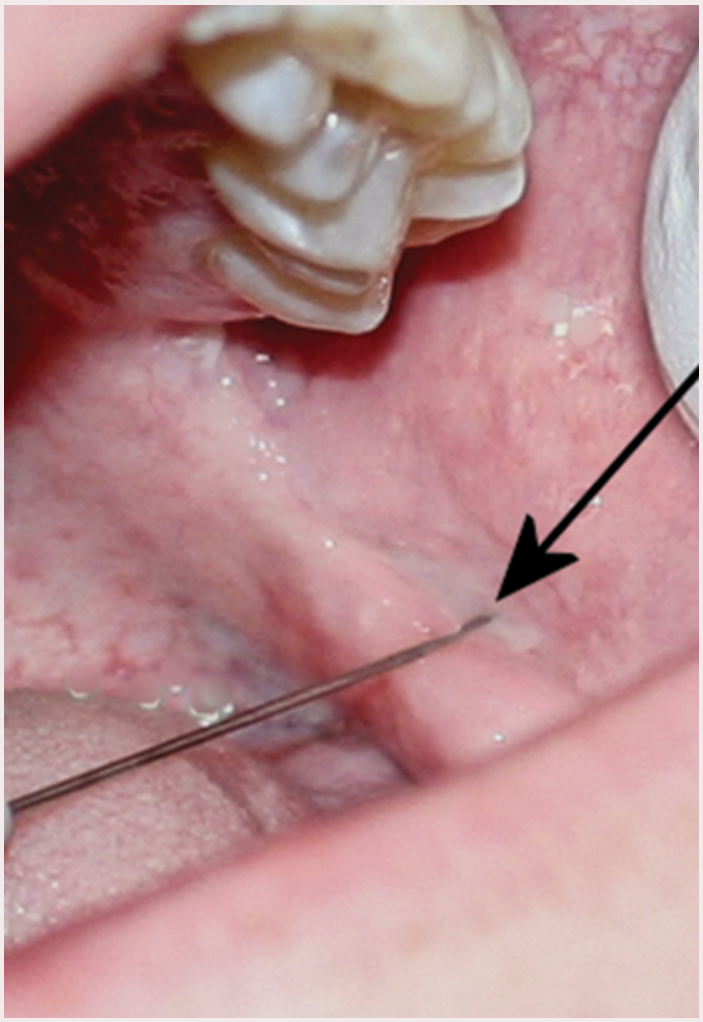
Palpate for the coronoid notch by sliding up the internal oblique ridge (the greatest concavity on the anterior border of the ramus indicates 6-10mm superior to the mandibular occlusal plane)

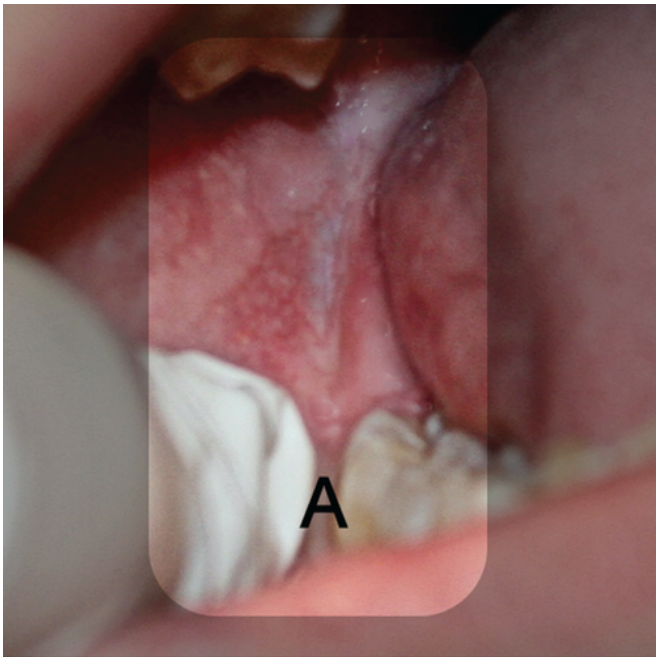
Retract mucosa on the anterior border of the ramus at the coronoid notch indicating proximity to the penetration site

Penetrate lateral to the pterygomandibular raphe (connective tissue) while syringe barrel remains parallel to and above the occlusal plane in the labial commisure of the contralateral side.

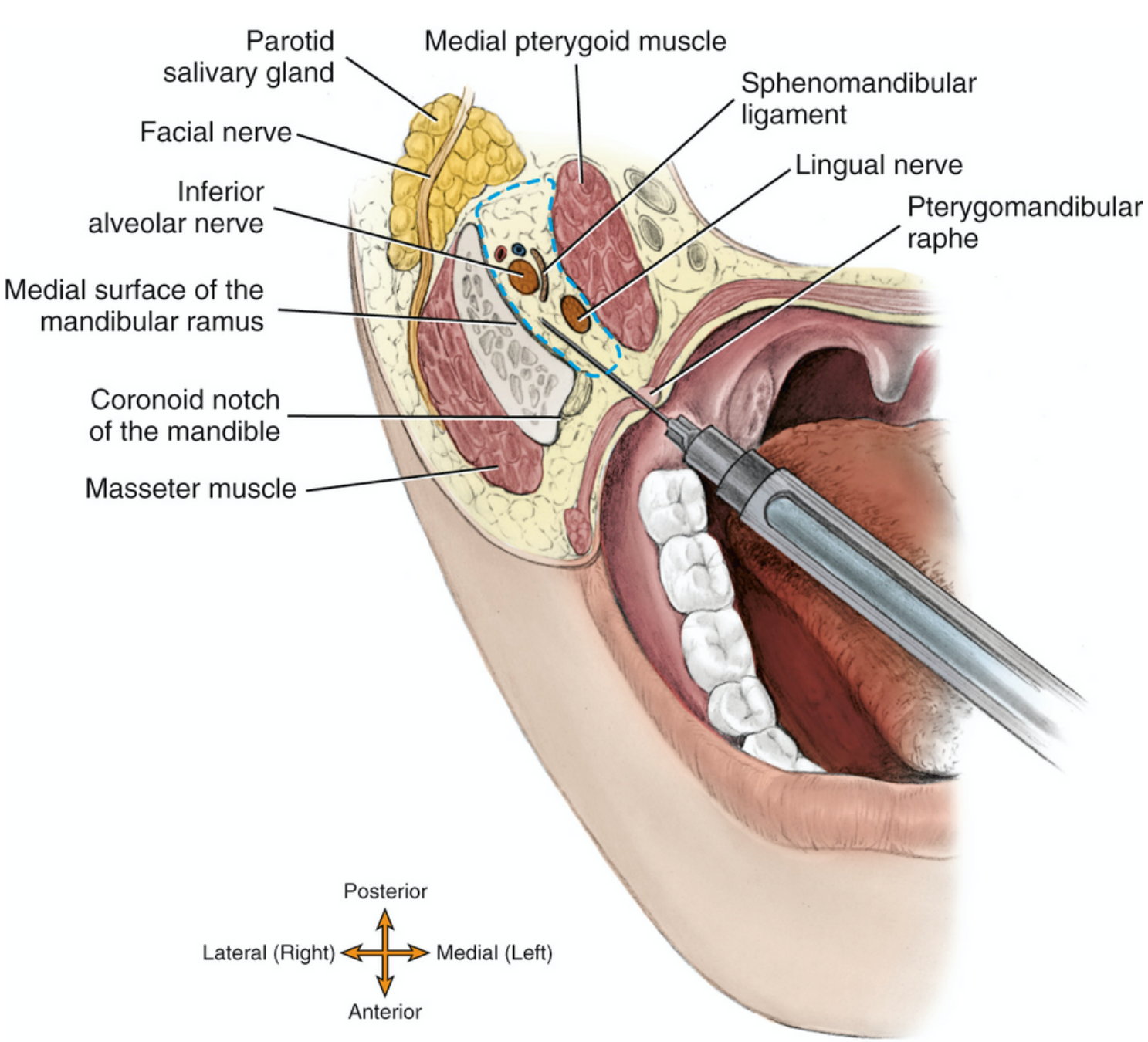
Contact with bone indicates a point superior to the mandibular foramen







Inferior Alveolar Block



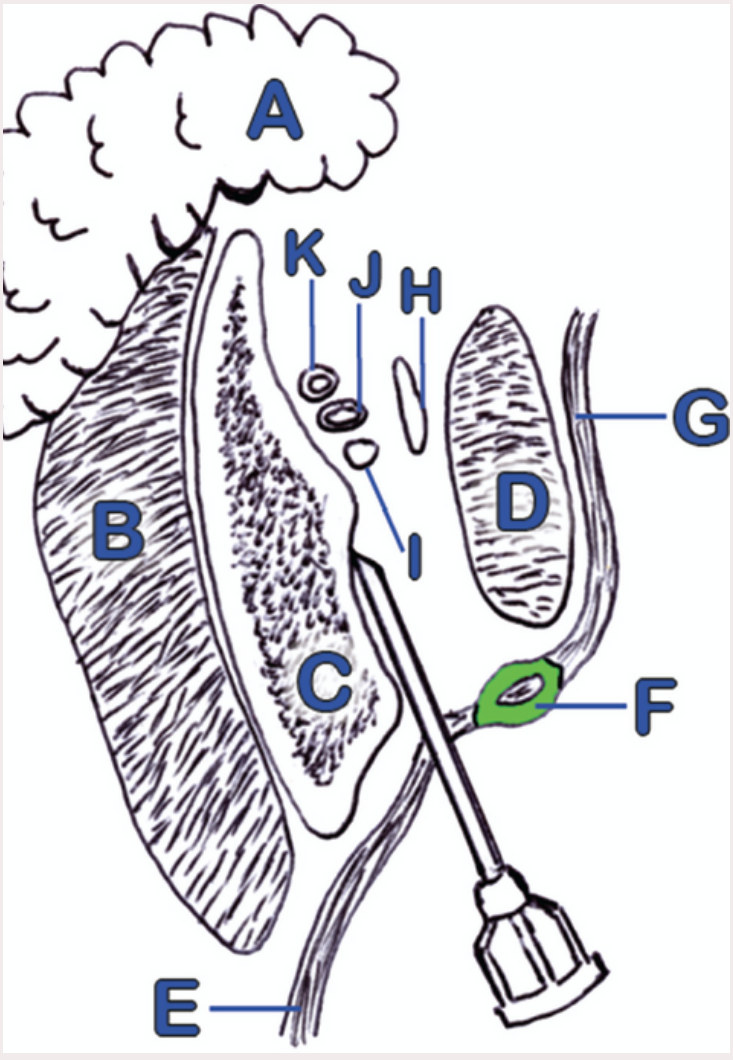
Premature Bony Contact

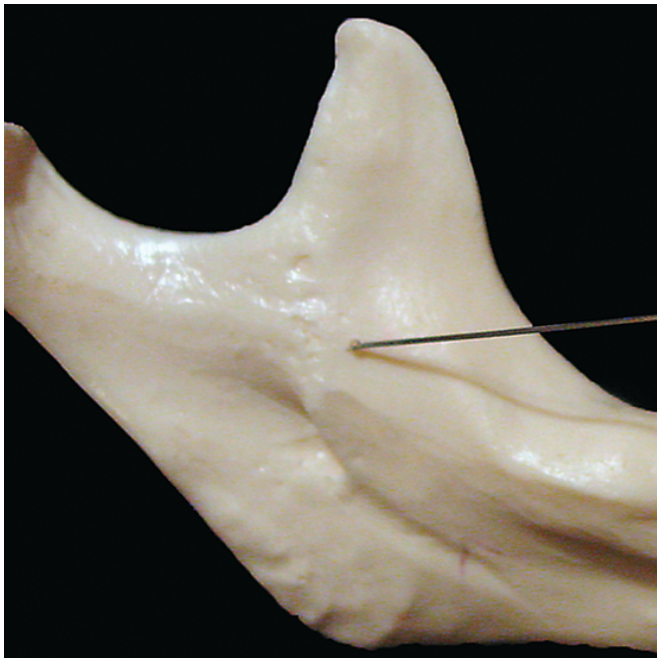
PIf boney resistance is met immediately after penetration, it is probable that the penetration was too low or too lateral to the raphe.

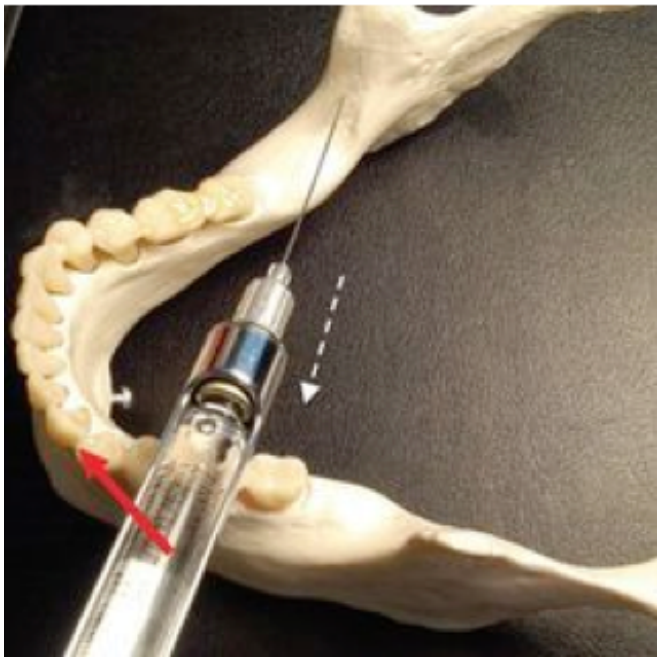
Correction: reinsertion at a higher and more medial point along the raphe.

Aberrant lingula is probable.

Patient will experience lack of anesthesia except at injection site by the minimum depth of needle penetration.





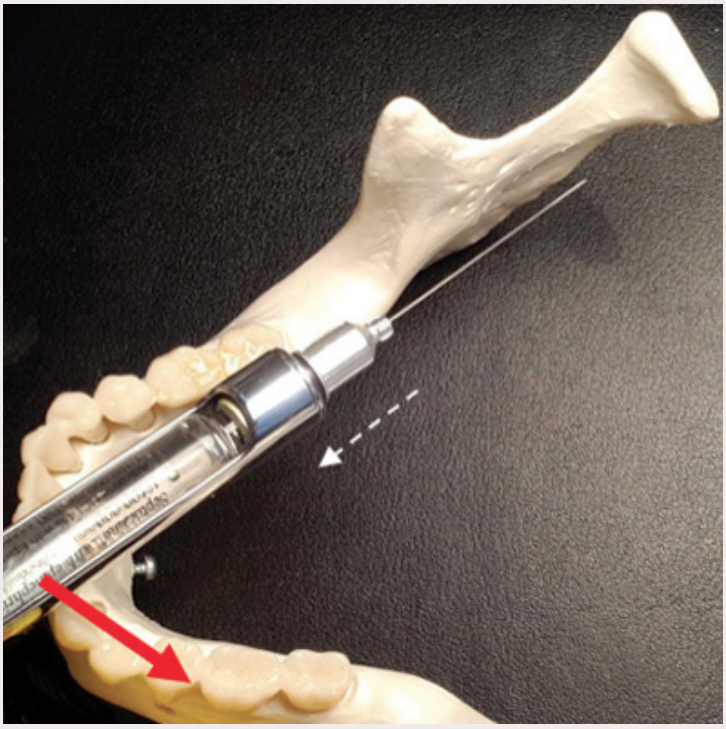


Overinsertion/ No Contact with Bone

If bone is not contacted, the needle tip is too far posterior (medial)

Correction: withdraw slightly and reposition barrel more posteriorly over the contralateral mandibular molars until bone is contacted.

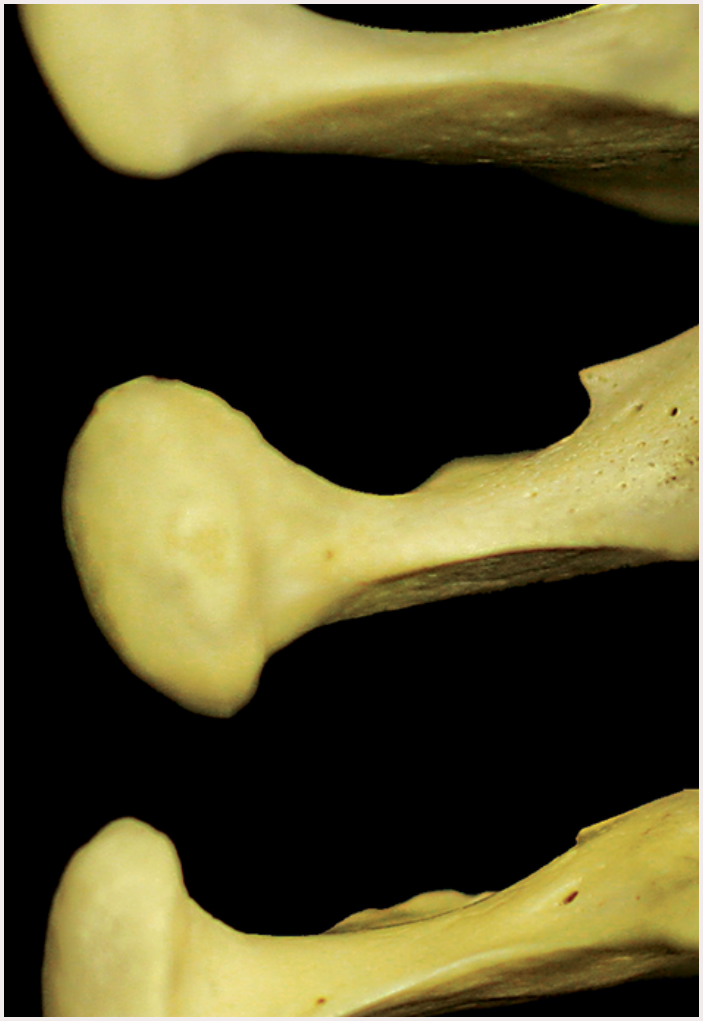
Safety: do not deposit if bone is not contacted. The needle tip may be resting within the parotid gland near the facial nerve (CN VII) and transient blockade/paralysis of the facial nerve may develop.



Anatomical Variances of the Ramus

Premature contact can be related to prominence of the medial surface of the ramus at the internal oblique ridge

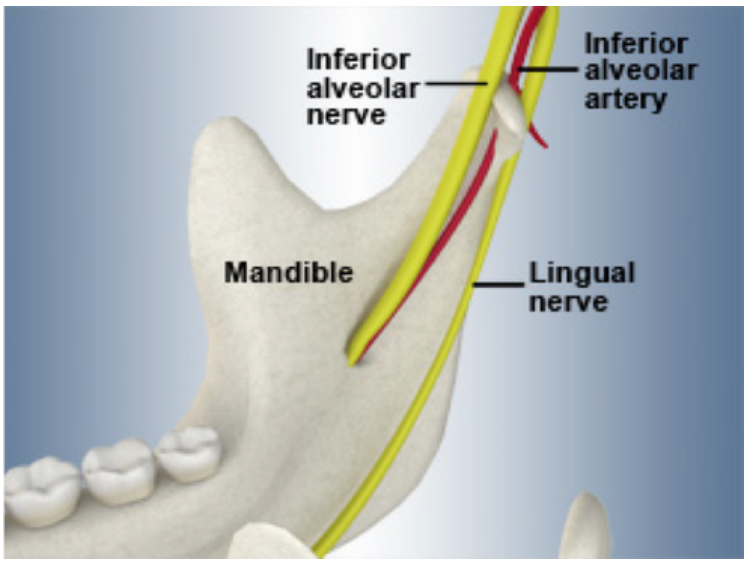
Flare of the ramus may impact angulations. Insertion angulations may need to be adjusted to reach optimum deposition site.



Variation of the Mandibular Foramen

- In approximately 14% of the population, the Mandibular Foramen is located above the Coronoid Notch
    - Research demonstrates the Mandibular Foramen can be 6-19mm above the occlusal table
- Research concludes variable locations in regards to the antero-posterior location of the Mandibular Foramen across the ramus.

Anatomical Insight

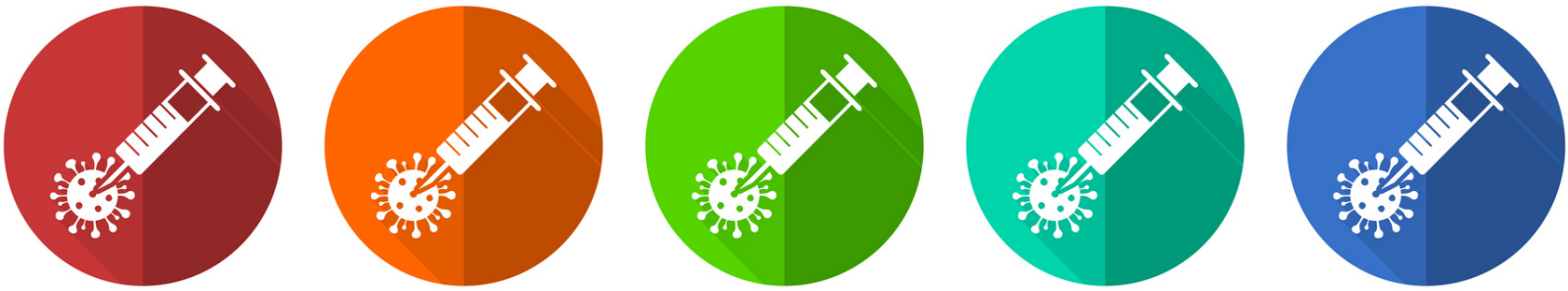


- The inferior alveolar nerve travels within the pterygomandibular space where it exits the mandible through the mandibular foramen, the central opening on the internal surface of the ramus.
- In some cases, there are two nerves present, creating bifid inferior alveolar nerves and is detected by the presence of a double mandibular canal

Complication: Transient Facial Paralysis

- One complication with an IA block is transient facial paralysis if the facial nerve is mistakenly anesthetized.
- This can occur because of an incorrect administration of anesthetic into the deeper parotid salivary gland (carrying the seventh cranial or facial nerve) because the mandibular bone was not contacted.

Fehrenbach MJ, et al: Mosby's dental dictionary, ed 3, St Louis, 2014, Elsevier.



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