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"X" MARKS THE SPOT:
HANDS-ON TECHNIQUE SIMULATION WORKSHOP FOR LOCAL ANESTHESIA

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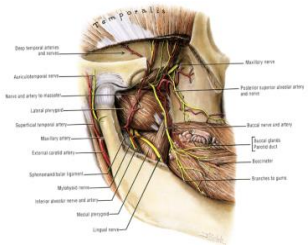
1

Infratemporal Fossa

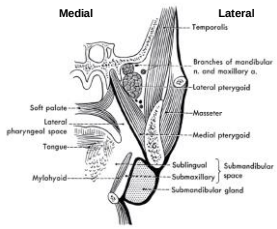
- Contents
  - Muscles of mastication
  - Mandibular division of Trigeminal nerve, V_3
  - Chorda tympani branch of Facial nerve, VII
  - Maxillary artery and vein



Agur & Lee, Grant' s Atlas of Anatomy, 10th Ed, *Lippincott Williams & Wilkins*, 1999

2

The Masticator Space



A Fascial Compartment

Derived from investing layer of deep cervical fascia

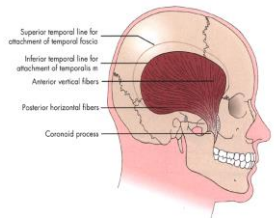
Envelopes mandible and muscles of mastication

Hollinshead, Anatomy for Surgeons, Vol 1, The Head & Neck, 3rd Ed, *Harper & Row*, 1982

3

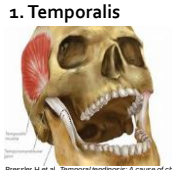
The Muscles of Mastication

Four total: 2 superficial



Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

1. Temporalis

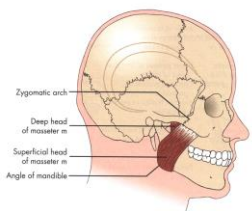


Bressler H et al, *Temporal tendinosis: A cause of chronic orofacial pain*, Current Pain and Headache Reports, 2020

4

The Muscles of Mastication

Four total: 2 superficial



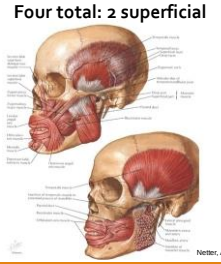
Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

1. Temporalis
2. **Masseter**

5

The Muscles of Mastication

Four total: 2 superficial



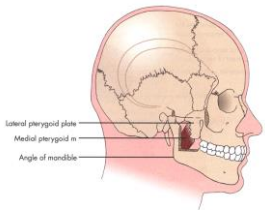
Netter, Atlas of Human Anatomy, 2nd Ed, *Novartis*, 1997

1. **Temporalis**
2. **Masseter**

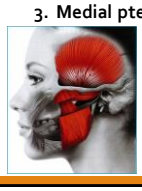
6

The Muscles of Mastication

Four total: 2 superficial; **2 deep**



1. Temporalis
2. Masseter
3. **Medial pterygoid**



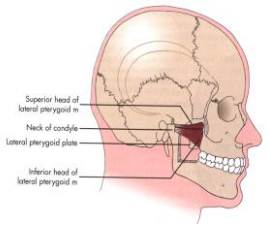
Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

Kristie Gatto, Dental Sleep Practice, Fall 2018

7

The Muscles of Mastication

Four total: 2 superficial; **2 deep**



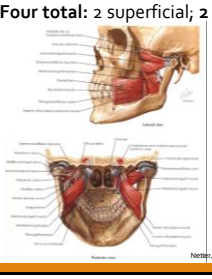
1. Temporalis
2. Masseter
3. Medial pterygoid
4. **Lateral pterygoid**

Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

8

The Muscles of Mastication

Four total: 2 superficial; **2 deep**

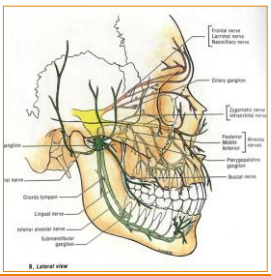


1. Temporalis
2. Masseter
3. **Medial pterygoid**
4. **Lateral pterygoid**

Netter, Atlas of Human Anatomy, 2nd Ed, *Novartis*, 1997

9

Innervation of the Infratemporal Fossa



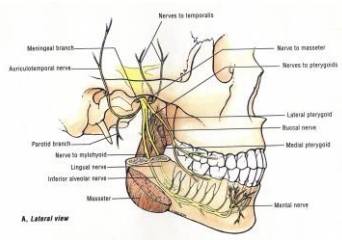
V_3
Mandibular Division of the Trigeminal Nerve

The nerve of the first branchial arch, which gives origin to the maxillary & mandibular arches and the muscles of mastication

Agur, Grant´s Atlas of Anatomy, 9th Ed, *Williams & Wilkins*, 1991

10

V_3: Sensory & Motor Innervation



Motor to the Muscles of Mastication

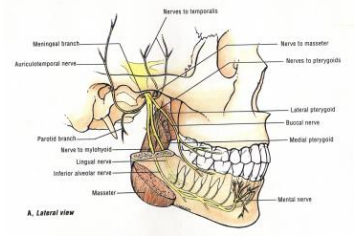
Sensory to all ↓ teeth and oral tissues

Enters through the Foramen Ovale

Agur & Lee, Grant´s Atlas of Anatomy, 10th Ed, *Lippincott Williams & Wilkins*, 1999

11

V_3: Short stem, then splits into 2 divisions

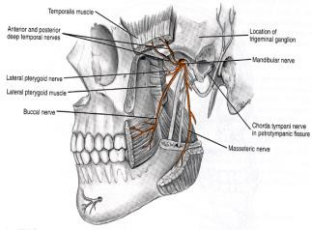


Stem:
1. Medial pterygoid nerve
2. Tensor tympani nerve
3. Tensor palatini nerve
4. Meningeal branch

Agur & Lee, Grant´s Atlas of Anatomy, 10th Ed, *Lippincott Williams & Wilkins*, 1999

12

V_3: Anterior Division



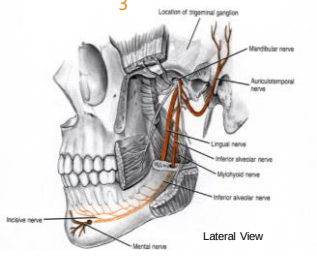
Fehrenbach & Herring, Illustrated Anatomy of the Head & Neck, *Saunders*, 1996

Motor branches:
1. Deep temporal nerves (2)
2. Masseteric nerve
3. Lateral pterygoid nerve

One sensory branch:
Long Buccal nerve

13

V_3: Posterior Division



Lateral View

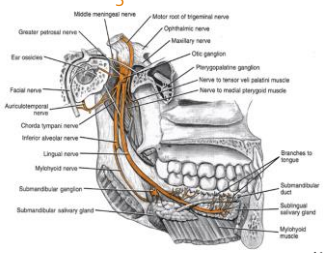
Fehrenbach & Herring, Illustrated Anatomy of the Head & Neck, *Saunders*, 1996

Sensory branches:
1. Auriculotemporal nerve
2. Lingual nerve
3. Inferior alveolar nerve
   - mylohyoid
   - mental
   - incisive

All sensory except mylohyoid nerve

14

V_3: Posterior Division



Fehrenbach & Herring, Illustrated Anatomy of the Head & Neck, *Saunders*, 1996

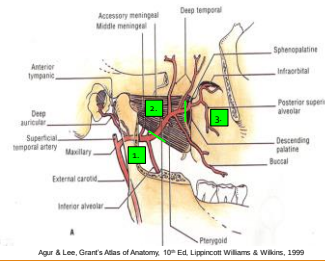
Medial View

Sensory branches:
1. Auriculotemporal nerve
2. Lingual nerve
3. Inferior alveolar nerve
   - mylohyoid
   - mental
   - incisive

All sensory except mylohyoid nerve

15

Blood Supply to the Infratemporal Fossa



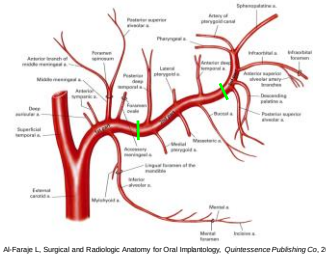
Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, Lippincott Williams & Wilkins, 1999

Maxillary artery:
3 parts

1. Mandibular
2. Pterygoid
3. Pterygopalatine

16

Blood Supply to the Infratemporal Fossa



Al-Faraje L, Surgical and Radiologic Anatomy for Oral Implantology, *Quintessence Publishing Co*, 2013

Maxillary artery
Part 1: Mandibular

1. Deep auricular
2. Anterior tympanic
3. Middle meningeal
4. Accessory middle meningeal
5. Inferior alveolar
   - mylohyoid, mental, & incisive branches

17

Blood Supply to the Infratemporal Fossa

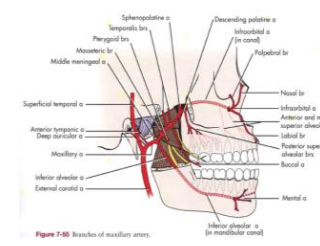


Figure 7-56 Branches of maxillary artery.

Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

Maxillary artery
Part 2: Pterygoid

1. Deep temporal (2)
2. Medial pterygoid
3. Lateral pterygoid
4. Masseteric
5. Buccal
6. Lingual

18

Blood Supply to the Infratemporal Fossa

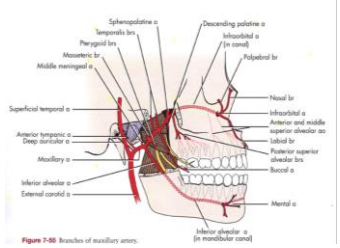


Figure 7-50 Branches of maxillary artery.

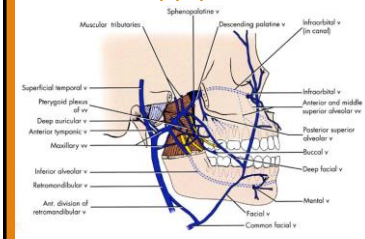
Maxillary artery
Part 3: Pterygopalatine

1. Posterior superior alveolar
2. Infraorbital
3. Artery of pterygoid canal
4. Pharyngeal branch
5. Descending palatine
6. Sphenopalatine

Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

19

Blood Supply to the Infratemporal Fossa



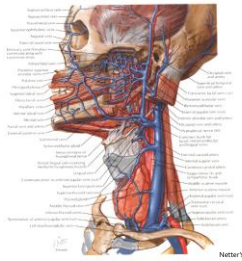
Pterygoid Venous Plexus

Primary drainage to Maxillary vein

Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

20

Blood Supply to the Infratemporal Fossa



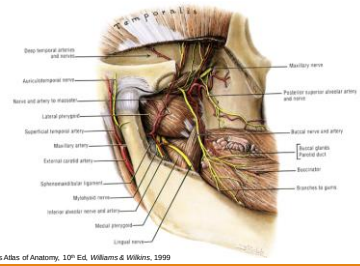
Pterygoid Venous Plexus

Connections to:
1. Cavernous sinus
2. Facial vein
3. Inferior ophthalmic vein
4. Pharyngeal plexus

Netter's Atlas, 4th Ed, *Saunders/Elsevier*, 2006

21

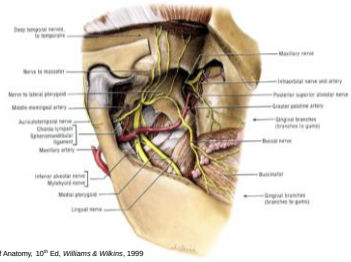
View of infratemporal fossa with mandible resected



Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

22

View of infratemporal fossa fully dissected



Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

23

Infiltration versus Block Injections

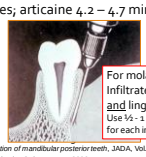
- Advantages of infiltrations
  1. Faster onset
  2. Simple
  3. Safe
  4. Good hemostasis (with vasoconstrictor)
- Disadvantages of infiltrations
  1. Multiple injections for multiple teeth
  2. Shorter duration of anesthesia
     - Especially with children due to their higher metabolic rate

24

Infiltration Anesthesia

- Works well for the maxilla, but for the mandible…
  - Works fairly well for anteriors and bicuspids
  - More variable predictability for molars
  - Greater success using articaine & faster onset
    - Lidocaine 45 – 67%; articaine 75 – 92%
    - Lidocaine 6.1 – 11.1 minutes; articaine 4.2 – 4.7 minutes

Facial



For molars:
Infiltrate both buccally and lingually
Use ½ - 1 cartridge of articaine for each infiltration

Robertson et al, *The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth*, JADA, Vol.138 No. 8, 2007
Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

25

Pharmacology of Anesthetic Agents

- A Practical Armamentarium:
  - From a meta-analysis of 13 clinical trials:
    - Evidence strongly supported articaine's superiority over lidocaine for infiltration anesthesia in both dental arches
    - Evidence was weak for any significant difference between lidocaine and articaine for block anesthesia

Brandt RG et al, *The pulpal anesthetic efficacy of articaine versus lidocaine in dentistry: A meta-analysis*, J Am Dent Assoc, Vol 142(5), May 2011

- Articaine was 4 times more effective, with greater duration, than lidocaine as an infiltration injection when used for teeth diagnosed with irreversible pulpitis in either dental arch

Ashraf H et al, *Efficacy of articaine versus lidocaine in block and infiltration anesthesia administered in teeth with irreversible pulpitis: A prospective, randomized, double-blind study*, JOE, Vol. 39(1), Jan 2013

26

Mandibular Infiltration Anesthesia

- Can mandibular infiltration injections with articaine work for procedures on a single adult tooth WITHOUT a block?

YES!

Infiltrate both buccally and lingually

Use ½ - 1 cartridge of articaine for each injection

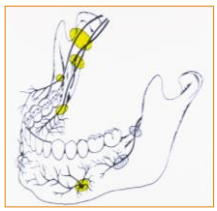
Inject ½ a tooth distal to the tooth you need to work on

Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Medilobe*, 1990

27

Mandibular Anesthesia

- Mandible: Regional nerve blocks
  - Inferior alveolar nerve block
  - Lingual nerve block
  - Long buccal nerve block
  - Mental (& incisive) nerve block
  - Mylohyoid nerve block
- Complete mandibular division nerve blocks
  - Gow-Gates mandibular division block
  - Vazirani – Akinosi mandibular division block

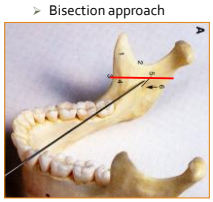


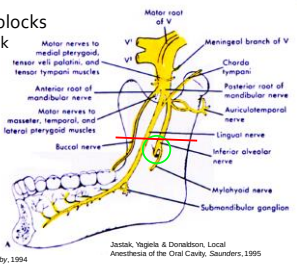
Jastak, Yagiela & Donaldson, Local Anesthesia of the Oral Cavity, *Saunders*, 1995

28

Mandibular Anesthesia

- Mandible: Regional nerve blocks
  - Inferior alveolar nerve block
    - Bisection approach





McMinn, Hutchings & Logan, Color Atlas of Head & Neck Anatomy, 2nd Ed, *Mosby*, 1994

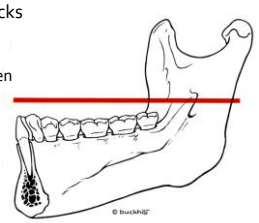
Jastak, Yagiela & Donaldson, Local Anesthesia of the Oral Cavity, *Saunders*, 1995

29

Mandibular Anesthesia

- Mandible: Regional nerve blocks
  - Inferior alveolar nerve block
    - Bisection approach
  - Position of mandibular foramen
    - Below mandibular occlusal plane in 75%
    - Even with occlusal plane in 22.5%

Nicholson ML, *A study of the position of the mandibular foramen in the adult human mandible*, Anat Rec Vol 212, 1985

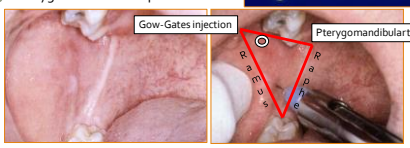


Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Medilobe*, 1990

30

Mandibular Anesthesia

- Inferior alveolar nerve block
  - Intraoral landmarks:
    1. Coronoid notch
    2. Internal oblique ridge
    3. Pterygomandibular raphe

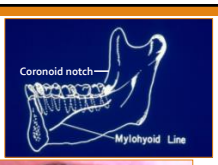


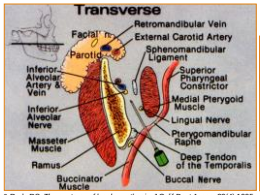
Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

31

Mandibular Anesthesia

- Inferior alveolar nerve block
  - Intraoral landmarks:
    3. Pterygomandibular raphe





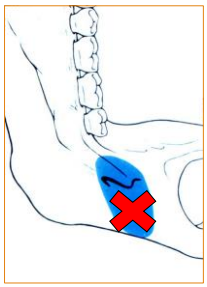
Blanton PL & Roda RS, *The anatomy of local anesthesia*, J Calif Dent Assoc, 23(4),1995 Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Mediglobe*,1990

32

Mandibular Anesthesia

- Inferior alveolar nerve block
  - Bisection technique:
    - Depth 25 – 30 mm
    - Needle Long (short OK in children)
    - Amount 1 – 2 cartridges
    - Comfort level Moderate

After injection, sit patient up?
Not necessary: gravity is not a factor



Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Mediglobe*, 1990

33

Physiology of Anesthetic Agents

- The "right" volume depends on many variables
  - For infiltration injections, ½ to ¾ cartridge is generally ideal for adults; ⅓ for kids

Brunetto et al, *Anesthetic efficacy of 3 volumes of lidocaine with epinephrine in maxillary infiltration anesthesia*, Anesth Prog, Vol 55, 2008

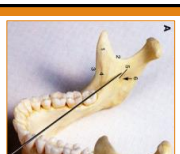
  - For an inferior alveolar nerve block,
    - Less than ½ cartridge tends to be ineffective
    - ¾ – 1 cartridge is ideal for adults; ⅔ for kids
    - An additional cartridge may increase profundity & decrease onset time*

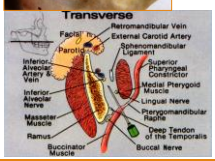
Nusstein et al, *Anesthetic efficacy of different volumes of lidocaine with epinephrine for inferior alveolar nerve blocks*, Gen Dent, Vol 50, 2002
*Kohler BR et al, *Gow-Gates technique: A pilot study for extraction procedures with clinical evaluation and review*, Anesth Prog, Vol. 55, 2008

34

Mandibular Anesthesia

- Inferior alveolar nerve block
  - My concerns
    1. Highly variable success rate
       - 65 – 86% (30 – 97%)
    2. Potential for intravascular injection
       - 3.6 – 22%





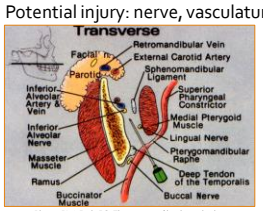
McMinn, Hutchings & Logan, Color Atlas of Head & Neck Anatomy, 2nd Ed, *Mosby*, 1994

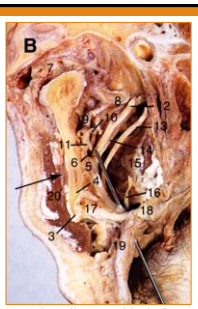
Blanton PL & Roda RS, *The anatomy of local anesthesia*, J Calif Dent Assoc, Vol 23 No 4, April 1995

35

Mandibular Anesthesia

- Inferior alveolar nerve block
  - My concerns
    3. Potential injury: nerve, vasculature





Blanton PL & Roda RS, *The anatomy of local anesthesia*, J Calif Dent Assoc Vol 23 No 4, April 1995

McMinn, Hutchings & Logan, Color Atlas of Head & Neck Anatomy, 2nd Ed, *Mosby*, 1994

36

Mandibular Anesthesia

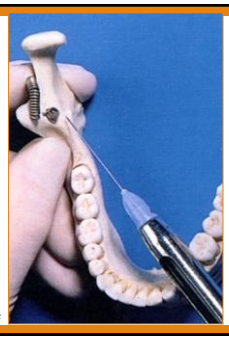
- Inferior alveolar nerve block
  - Bisection technique:
    - Unfortunately, most of the mandibular anatomy varies widely
      - Wide flaring mandible
      - Wide flaring ramus
      - Long (A – P) ramus
      - Bulky muscles or buccal fat pad
      - Class III occlusion
      - Missing molars/edentulous
      - Age/children
    - Except one feature, not so much

Prado FB et al, *Morphological changes in the position of the mandibular foramen in dentate and edentate Brazilian subjects*, Clinical Anatomy, Vol 23, 2010

37

Mandibular Anesthesia

- Inferior alveolar nerve block
  - Alternative technique:
    IA "Walk-In" technique
    1. Deliberately contact bone anterior to mandibular foramen, feel depth

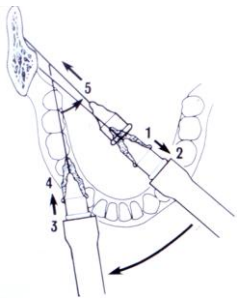


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

38

Mandibular Anesthesia

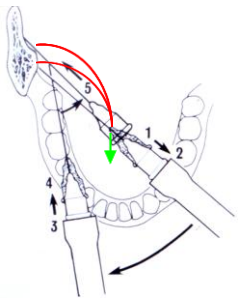
- Inferior alveolar nerve block
  - IA "Walk-In" technique
    1. Deliberately contact bone anterior to mandibular foramen, feel depth
    2. Withdraw 2 – 3 mm, pivot from tip of the needle to the ipsilateral side
    3. Insert 2 – 3 mm posteriorly, pivot back to contralateral side, contact bone again, feel depth
    4. Repeat 1 – 2 times



39

Mandibular Anesthesia

- Inferior alveolar nerve block
  - IA "Walk-In" technique
    1. Penetrate tissue, then put posterior pressure on the syringe to produce strong needle deflection
    2. Deliberately contact bone anterior to mandibular foramen, feel depth
    3. Withdraw 2 – 3 mm, pivot from tip of the needle to the ipsilateral side
    4. Insert 2 – 3 mm posteriorly, pivot back to contralateral side, contact bone again, feel depth
    5. Repeat 1 – 2 times



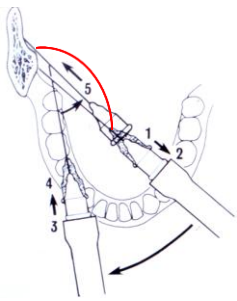
40

Mandibular Anesthesia

- Inferior alveolar nerve block
  - IA "Walk-In" technique

When you reach the same injection depth without contacting bone,

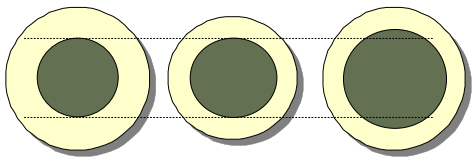
Stop
Aspirate
Inject



41

Needles

- For block injections: Gauge: 25 or 27
  Length: long is recommended



Standard | Thin Walled Design | Thin Walled, Increased Bore Design

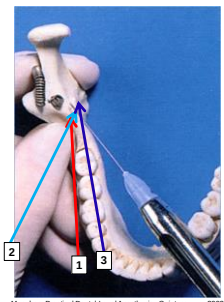
42

Mandibular Anesthesia

- Inferior alveolar nerve block
  - Indirect IA technique: bisection technique = Direct technique

1. Contact bone anterior to mandibular foramen
2. Redirect to medial
3. "Hook" around lingula, insert slighty

Stop
Aspirate
Inject

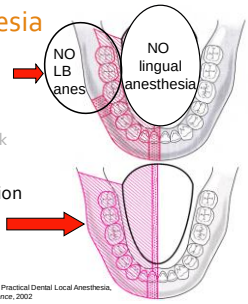


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

43

Mandibular Anesthesia

- Mandible: Regional blocks
  - Inferior alveolar nerve block
  - Lingual nerve block
  - Long buccal nerve block
  - Mental (& incisive) nerve block
  - Mylohyoid nerve block
- Complete mandibular division nerve blocks
  - Gow-Gates
  - Vazirani – Akinosi

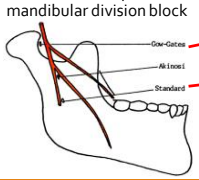


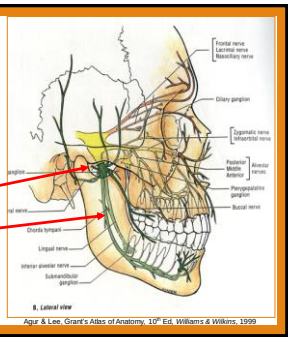
Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

44

Mandibular Anesthesia

- Mandible: Nerve blocks
  - Inferior alveolar regional "mandibular" block
  - Gow-Gates complete mandibular division block





Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

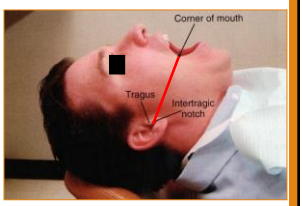
45

Mandibular Anesthesia

- Gow-Gates mandibular division block
  - Landmarks

1. Alpha plane: from intertragic notch of the ear to corner of the mouth, and across to the opposite corner of the mouth

Anterior – posterior orientation

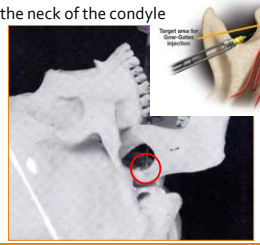


Malamed, Handbook of Local Anesthesia, 3rd Ed, *Mosby Year Book*, 1990

46

Mandibular Anesthesia

- Gow-Gates mandibular division block
  - Target: Contact bone at the neck of the condyle



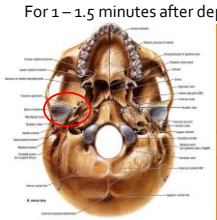
47

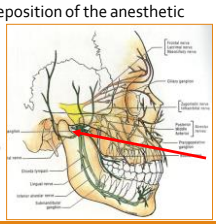
Mandibular Anesthesia

- Gow-Gates mandibular division block

The mouth must be open wide!

For 1 – 1.5 minutes after deposition of the anesthetic





Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

48

Mandibular Anesthesia

- Gow-Gates mandibular division block
  - The mouth must be open wide!
  - Establish the alpha plane
  - Modification:
    Finger behind the neck of the condyle

49

Mandibular Anesthesia

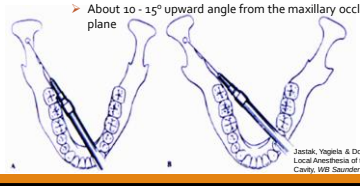
- Gow-Gates mandibular division block
  - The mouth must be open wide!
  - Point of insertion: Maxillary vestibule off the distal-buccal cusp of the second molar or slightly behind

    ...but at what angle?

50

Mandibular Anesthesia

- Gow-Gates mandibular division block
  - Angle (medial – lateral angulation) = Beta plane
    - Varies with width and flare of mandible and ramus
    - Aim for your extraoral finger behind the condylar neck
      - About 10 - 15° upward angle from the maxillary occlusal plane



Jastak, Yagiela & Donaldson, Local Anesthesia of the Oral Cavity, *WB Saunders Co*, 1995

51

Mandibular Anesthesia

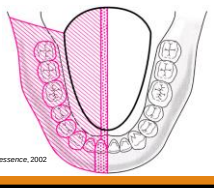
- Gow-Gates mandibular division block
  - The mouth must be open wide!
  - Point of insertion: Maxillary vestibule off the distal-buccal cusp of the second molar or slightly behind
  - Aim for your finger behind the neck of the condyle (angle ~10 – 15° up)

Malamed, Handbook of Local Anesthesia, 5th Ed, *Elsevier Mosby*, 2004

52

Mandibular Anesthesia

- Gow-Gates mandibular division block
  - Depth 25 – 28 mm (contact bone)
  - Needle Long
  - Amount 1 – 2 cartridges
  - Comfort level Moderate to high
  - **Keep mouth open for 1 to 1.5 minutes after deposition of the anesthetic (Use a bite block)**



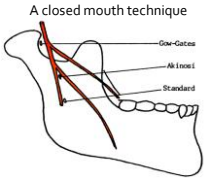
Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

53

Mandibular Anesthesia

- Complete mandibular division nerve block
  - Vazirani – Akinosi mandibular division block

    A closed mouth technique

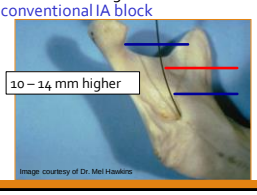


Wolfe SH, The Wolfe nerve block: *A modified high mandibular nerve block*, Dentistry Today, June/July 1992

54

Vazirani – Akinosi

- Complete mandibular division nerve block
  - A closed mouth technique delivered at a higher level than the conventional IA block

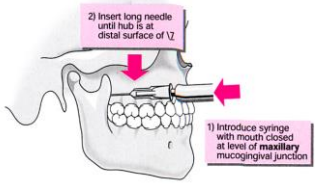


Wolfe SH, The Wolfe nerve block: *A modified high mandibular nerve block*, Dentistry Today, June/July 1992

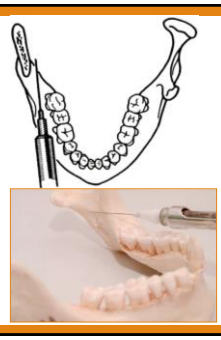
55

Mandibular Anesthesia

- Vazirani – Akinosi mandibular division block
  - A closed mouth technique



Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

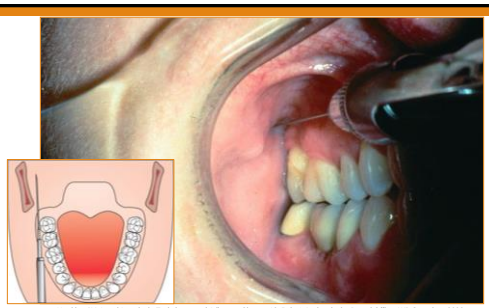


56

Vazirani – Akinosi Quadrant Block

Have the patient slide their lower jaw towards the injection side

57



Hawkins JM, Local Anesthetic Techniques and Adjuncts, Chapter 13: Pain & Anxiety in the Dental Office, *WB Saunders*, 2002
Malamed, Handbook of Local Anesthesia, 6th Ed, *Elsevier Mosby*, 2013

58

Mandibular Anesthesia

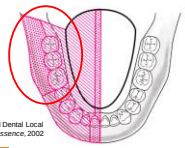
- Vazirani – Akinosi mandibular division block
  - Depth 25 – 30 mm (no bone contact)
  - Needle Long
  - Amount 1 – 2 cartridges
  - Comfort level Moderate

Injection site visibility difficult with mouth closed

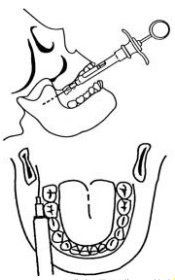
59

Mandibular Anesthesia

- Vazirani – Akinosi mandibular division block
  - Modifications
    1. Mouth slightly open
    2. Use bent needle
  - Area of anesthesia



Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002



Wolfe SH, *The Wolfe nerve block: A modified high mandibular nerve block*, Dentistry Today, June/July 1992

60

Mandibular Anesthesia

- Comparison of mandibular division nerve block techniques
  - Conventional (Halstead) regional technique
  - Advantages:
    - Most familiar and most widely used
    - Good success rate (65 – 86%+)
  - Disadvantages:
    - Higher success rates associated with increased incidence of positive aspiration
    - Moderate incidence of trismus and/or paresthesia
    - **Multiple injections required for anesthesia of inferior alveolar, lingual, long buccal, and mylohyoid nerves**

61

Mandibular Anesthesia

- Comparison of mandibular division nerve block techniques
  - Gow-Gates technique
  - Advantages:
    - Very high success rate (90 – 100%)
    - Extremely low incidence of positive aspirations
    - **Significantly reduced incidence of trismus and/or paresthesia**
    - **Single injection for anesthesia of inferior alveolar, lingual, long buccal, and mylohyoid nerves**
  - Disadvantages:
    - Technically a more difficult technique to master
    - Slower onset of anesthesia
    - ~~Possible increased patient discomfort~~ – **Use a bite block!**

62

Mandibular Anesthesia

- Comparison of mandibular division nerve block techniques
  - Vazirani – Akinosi technique
  - Advantages:
    - Moderate to high success rate (76 – 93%)
    - Extremely low incidence of positive aspirations
    - Significantly reduced incidence of trismus and/or paresthesia
    - Potential single injection for anesthesia of inferior alveolar, lingual, long buccal, and mylohyoid nerves
    - Less threatening to apprehensive patients (closed mouth)
    - Ability to anesthetize both sensory and motor nerve branches uniquely useful for patients with severe trismus
  - Disadvantages:
    - **Increased potential for operator error** due to no bone contact
    - **Higher incidence of unexpected and unusual side effects**
    - Not completely reliable technique to achieve anesthesia of long buccal nerve

63

Troubleshooting Mandibular Anesthesia

- The "Hot" Tooth / "Hot" Gum
- First, give a block injection
  - The Gow-Gates mandibular division block has a significantly higher success rate than all other techniques

Gow-Gates	52%
Vazirani – Akinosi	41%
Conventional IA	36%
Buccal-plus-lingual infiltration	27%

All with 4% articaine with 1:100,000 epinephrine

- No technique was fully acceptable by itself

Aggarwal V et al. *Comparative evaluation of anesthetic efficacy of Gow-Gates mandibular conduction anesthesia, Vazirani-Akinosi technique, buccal-plus-lingual infiltrations, and conventional inferior alveolar nerve anesthesia in patients with irreversible pulpitis.* O Surg O Med O Path O Radio Endo, Vol. 109 No. 2, Feb. 2010

64

Troubleshooting Mandibular Anesthesia

- The "Hot" Tooth / "Hot" Gum
- First, give a block injection
  - For the inferior alveolar nerve block injection, a recent systematic review and meta-analysis showed success rates for 1 cartridge:

articaine	73%
prilocaine	57%
mepivacaine*	55%
bupivacaine	53%
lidocaine	12%

Increasing the volume of anesthetic from 1 cartridge to 2 substantially improved the success rate for all anesthetics

*3% plain or 2% with vasoconstrictor

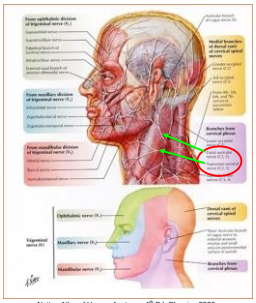
de Geus JL et al, *Different anesthetics on the efficacy of inferior alveolar nerve block in patients with irreversible pulpitis: A network systematic review and meta-analysis*, J Am Dent Assoc, Vol. 151 No. 2, February 2020

65

Troubleshooting

- Innervation of mandibular teeth, particularly molars, from the cervical plexus
  - Great auricular nerve
  - Transverse cervical nerve

Ella B et al. *Transverse cervical and great auricular nerve distribution in the mandibular area: A study in human cadavers*, Clin Anat, Vol 28 No 1, January 2014



Netter, *Atlas of Human Anatomy*, 4th Ed, *Elsevier*, 2006

66

Troubleshooting Mandibular Anesthesia

- Is it possible that innervation to mandibular teeth, particularly molars, comes from the cervical plexus?
  - The great auricular nerve and/or the transverse cervical nerve reached the mandible in 60% of 250 cadavers
  - Anastomoses between the cervical plexus and trigeminal nerves were observed in 15% of 250 cadavers
    - With the auriculotemporal nerve was most common
    - With the mental nerve was less common
  - **The likelihood of innervation from the cervical plexus reaching mandibular teeth is small, but can occur**

Ella B et al, *Transverse cervical and great auricular nerve distribution in the mandibular area: A study in human cadavers*, Clin Anat, Vol 28 No 1, January 2014

67

Troubleshooting Mandibular Anesthesia

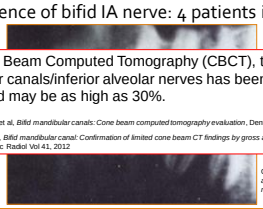
- The likelihood of innervation from the cervical plexus reaching mandibular teeth is small, but can occur
- Solution: a buccal &/or lingual infiltration with articaine below the apices of the teeth is likely to block any innervation coming up from the neck

68

Troubleshooting Mandibular Anesthesia

- Repeated failure to achieve adequate anesthesia
- Take a panoramic radiograph

Incidence of bifid IA nerve: 4 patients in 5,000 films



With Cone Beam Computed Tomography (CBCT), the incidence of bifid mandibular canals/inferior alveolar nerves has been found to be at least 15.6%, and may be as high as 30%.

Kuribayashi A et al, *Bifid mandibular canals: Cone beam computed tomography evaluation*, Dentomaxillfac Radiol 39(4), 2010

Fukami K et al, *Bifid mandibular canal: Confirmation of limited cone beam CT findings by gross anatomical and histological investigations*, Dentomaxillofac Radiol Vol 41, 2012

Grover PS & Lorton L, *Bifid mandibular nerve as a possible cause of inadequate anesthesia in the mandible*, Journ O Maxillofac Surg Vol 179, 1983

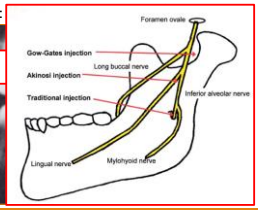
69

Troubleshooting Mandibular Anesthesia

- Repeated failure to achieve adequate anesthesia
- Take a panoramic radiograph

Incidence of bifid IA nerve:

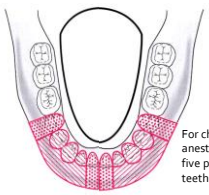
Solution: Use the Gow-Gates technique



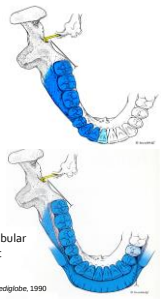
70

Mandibular Anesthesia

- Mental (& incisive) nerve block



For children, anesthetizes the five primary mandibular teeth in a quadrant

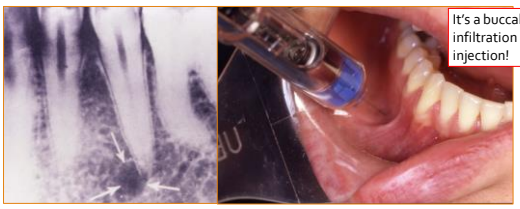


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002
Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Medglobe*, 1990

71

Mandibular Anesthesia

- Mental (& incisive) nerve block



It's a buccal infiltration injection!

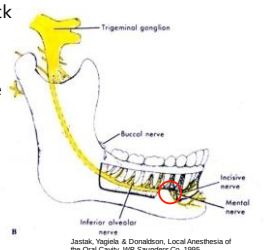
Malamed, Handbook of Local Anesthesia, 5th Ed, *Elsevier Mosby*, 2004

72

Mandibular Anesthesia

- Mental (& incisive) nerve block
  - Depth 3 – 6 mm
  - Needle Short
  - Amount 1/3 -1/2 cartridge of articaine
  - Comfort level High

After injection, massage site

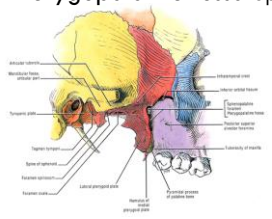


Jastak, Yagiela & Donaldson, Local Anesthesia of the Oral Cavity, *WB Saunders Co*, 1995

73

The Masticator Space/Infratemporal Fossa

Pterygopalatine fossa opens into the medial wall



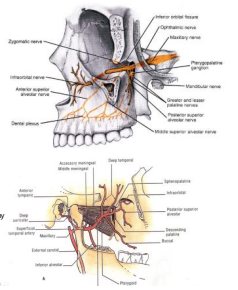
- Boundaries
  - A gap between the maxilla anteriorly and the lateral pterygoid plate of the sphenoid bone posteriorly
  - Laterally: an opening, the **pterygomaxillary fissure,** into the infratemporal fossa
  - Medially: the palatine bone & sphenopalatine foramen

Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

74

Pterygopalatine Fossa

- Contents
  - Maxillary division of Trigeminal nerve, V_2
  - Pterygopalatine ganglion
  - Terminus of maxillary artery
    - Distributed out with the branches of V_2



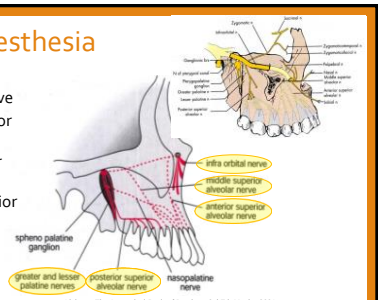
Fehrenbach & Herring, Illustrated Anatomy of the Head & Neck, Saunders, 1996

Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

75

Maxillary Anesthesia

- Maxilla: Nerves
  - Infraorbital nerve
  - Anterior superior alveolar nerve
  - Middle superior alveolar nerve
  - Posterior superior alveolar nerve



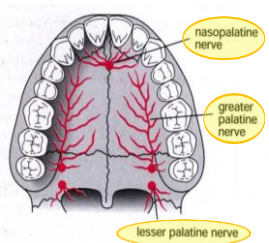
Liebgott, The Anatomical Basis of Dentistry, 2nd Ed, *Mosby*, 2001

Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

76

Maxillary Anesthesia

- Maxilla: Nerves
  - Infraorbital nerve
  - Anterior superior alveolar nerve
  - Middle superior alveolar nerve
  - Posterior superior alveolar nerv
  - Greater palatine nerve
  - Lesser palatine nerve
  - Nasopalatine nerve



Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

77

Maxillary Anesthesia

- Two basic types of injections
  1. Infiltrations
  2. Blocks

- Infiltrations
  - Work well throughout maxilla
  - Greater success using articaine
    - Faster onset and longer duration
    - Frequent palatal anesthesia with buccal infiltration
      - 82.7% success with articaine versus 1.3% with lidocaine*

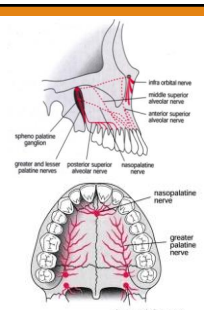
Costa DG et al, *Onset and duration periods of articaine and lidocaine on maxillary infiltration*, Quintessence Int, 36(3), 2005

* Gholami M et al, *The efficacy of 4% articaine versus 2% lidocaine in inducing palatal anesthesia for tooth extraction in different maxillary regions*, Journ Oral Maxillofac Surg, Vol. 79, 2021

78

Maxillary Anesthesia

- Maxillary regional blocks:
  - Anterior & middle superior alveolar nerve block
    - Infraorbital nerve block
    - AMSA palatal block
    - ASA palatal block
  - Posterior superior alveolar nerve block
  - Nasopalatine nerve block
  - Greater palatine nerve block
- Complete maxillary division block

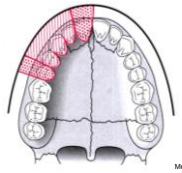


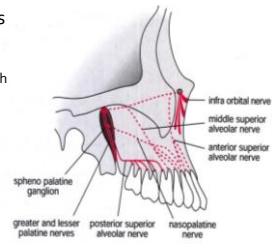
Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

79

Maxillary Anesthesia

- Maxilla: Regional nerve blocks
  - Anterior & middle superior alveolar nerve block
    - Infraorbital nerve block approach





Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

80

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve block
  - Infraorbital nerve block approach

Delivered at the infraorbital foramen

Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Medglobe*, 1990

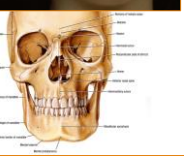
81

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve block
  - Infraorbital nerve block approach

Delivered at the infraorbital foramen

Palpate the inferior orbital rim



Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Lippincott Williams & Wilkins*, 1999

82

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve block
  - Infraorbital nerve block approach

Delivered at the infraorbital foramen

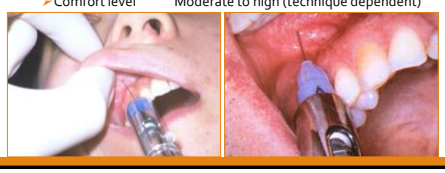
Palpate the inferior orbital rim

Drop 10 mm below lowest point

83

Maxillary Anesthesia

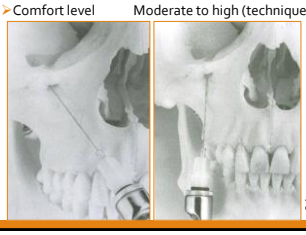
- Anterior & middle superior alveolar nerve block
  - Infraorbital nerve block approach
    - Depth — 3 – 15 mm
    - Needle — Short
    - Amount — 1/3 - 1/2 cartridge
    - Comfort level — Moderate to high (technique dependent)



84

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve blocks
  - Infraorbital approach
    - Comfort level Moderate to high (technique dependent)



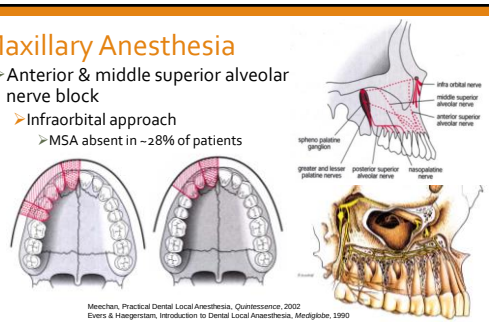
Note: You do NOT need to get the needle tip into the foramen

Jastak, Yagiela & Donaldson, Local Anesthesia of the Oral Cavity, *WB Saunders Co*, 1995

85

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve block
  - Infraorbital approach
    - MSA absent in ~28% of patients

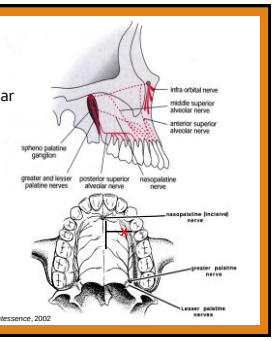


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002
Evers & Haegerstam, Introduction to Dental Local Anaesthesia, *Medglobe*, 1990

86

Maxillary Anesthesia

- Maxilla: Nerve blocks
  - Anterior & middle superior alveolar nerve block
    - The AMSA palatal approach (P-AMSA injection)



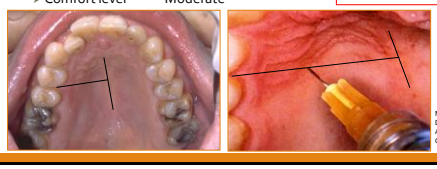
Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

87

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve blocks
  - The AMSA palatal approach (P-AMSA injection)
    - Depth 2 – 4 mm
    - Needle Short
    - Amount ≤1/4 cartridge of articaine
    - Comfort level Moderate

You can give a buccal infiltration of articaine first, however, that will anesthetize the lip

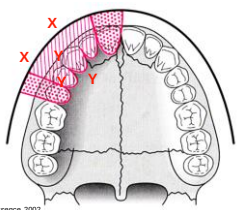


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

88

Maxillary Anesthesia

- Anterior & middle superior alveolar nerve block
  - The AMSA palatal approach vs. infraorbital approach
    - Advantages
      1. Buccal and palatal anesthesia of bicuspids and incisors
      2. No lip anesthesia
      3. More reliable anesthesia of middle superior alveolar nerve/ bicuspids
    - Disadvantages
      1. Shorter duration
      2. **A palatal injection**



Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

89

Maxillary Anesthesia

Learn to give comfortable **palatal** injections!

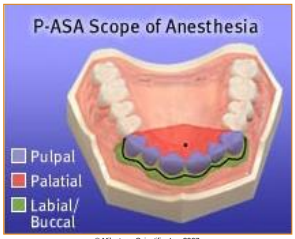
- Techniques to minimize the discomfort of all injections
  1. Topical anesthesia
  2. Pressure distraction/analgesia
  3. Slow injection with small volumes
  4. Buccal infiltrations or mid-palatal sulcus pdl injections with articaine
  5. **Explain all that you do to minimize the discomfort**

Crump B et al, *Prospective study on pdl anesthesia as an aide to decrease palatal infiltration pain*, Anesth Prog Vol 69 No 1, April 2022

90

Maxillary Anesthesia

- Maxilla: Regional blocks
  - The ASA palatal approach (P-ASA injection)
    - To bilaterally anesthetize:
      - Incisor pulps
      - Buccal tissue
      - Anterior palatal tissue



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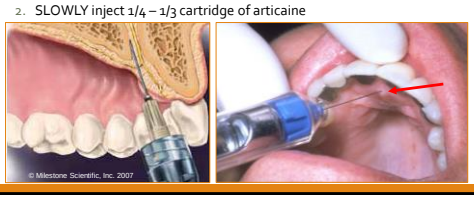
91

Maxillary Anesthesia

- Bilateral anterior superior alveolar nerve block
  - The ASA palatal approach (P-ASA injection)
    1. Inject from side of incisive papilla initially, then gently shift to vertical orientation as enter incisive canal
    2. SLOWLY inject 1/4 – 1/3 cartridge of articaine



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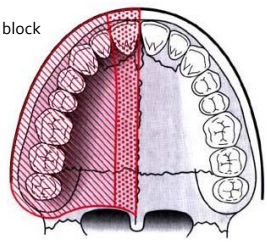
92

Maxillary Anesthesia

- Maxilla: Nerve blocks
  - Complete maxillary division block
    - With 2 injections
    - With 1 cartridge
    - Two approaches
      - PSA (lateral) approach
      - Greater palatine canal (medial) approach

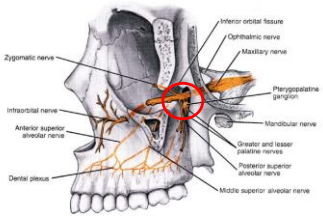


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

93

Pterygopalatine Fossa

- Contents
  - Maxillary division of Trigeminal nerve, V_2
  - Passes across the top of the fossa



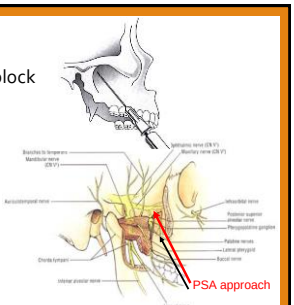
Fehrenbach & Herring, Illustrated Anatomy of the Head & Neck, *WB Saunders Co*, 1996

94

Maxillary Anesthesia

- Complete maxillary division block
  - PSA (lateral) approach

Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

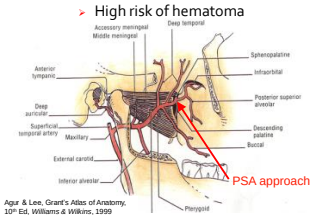


Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

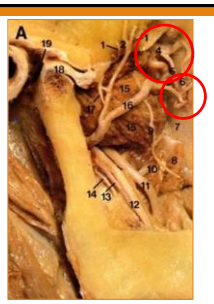
95

Maxillary Anesthesia

- Complete maxillary division block
  - PSA (lateral) approach
    - High risk of hematoma



Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

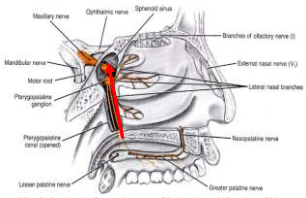


McMinn, Hutchings & Logan, Color Atlas of Head & Neck Anatomy, 2nd Ed, *Mosby*, 1994

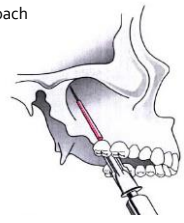
96

Maxillary Anesthesia

- Complete maxillary division block
  - Greater palatine canal (medial) approach



Fehrenbach & Herring, Illustrated Anatomy of the Head & Neck, *Saunders*, 1996



Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

97

Maxillary Anesthesia

- Greater palatine canal (medial) approach
  1. Give greater palatine block injection
  2. Re-palpate the greater palatine foramen
  3. With a single penetration, gently probe for the foramen

98

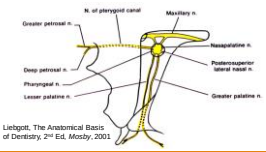
Maxillary Anesthesia

- Greater palatine canal (medial) approach
  3. With a single penetration, gently probe for the foramen
  4. Passively insert needle up canal
  5. Deposit the entire cartridge of anesthetic

99

Maxillary Anesthesia

- Complete maxillary division block
  - Greater palatine (medial) approach
    - Depth — Varies, ~15 mm
    - Needle — Long
    - Amount — 1 cartridge
    - Comfort level — Moderate



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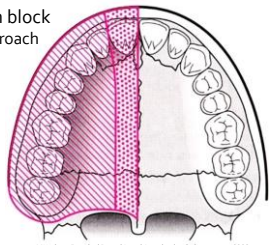
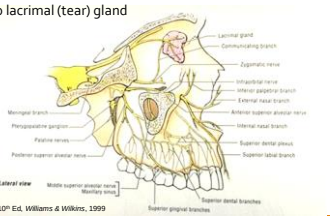


Meechan, Practical Dental Local Anesthesia, *Quintessence*, 2002

100

Maxillary Anesthesia

- Complete maxillary division block
  - With either approach, may anesthetize zygomatic branch of V_2
    - Innervation to lacrimal (tear) gland



Agur & Lee, Grant's Atlas of Anatomy, 10th Ed, *Williams & Wilkins*, 1999

101

Keys to Success

- Anesthetic failures happen
- The "Three Strikes Rule"
  - 3 attempts at anesthesia, then stop
- It's not about "fault"
  - It's not the patient's fault
  - It's not your fault
  - Failures happen

Reschedule the patient!

102