

Suturing Techniques and Wound Care

AAPA

Nashville Tn

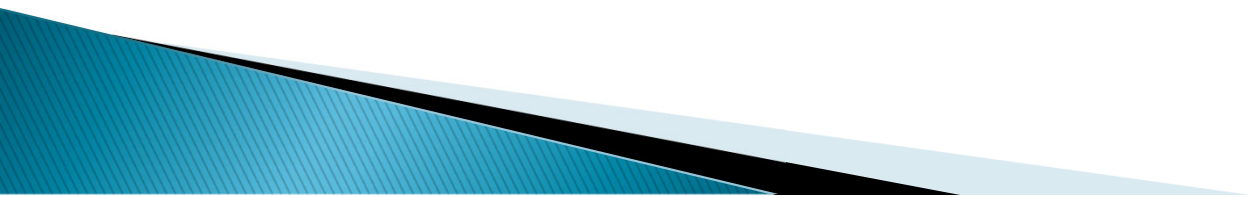
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No financial disclosures

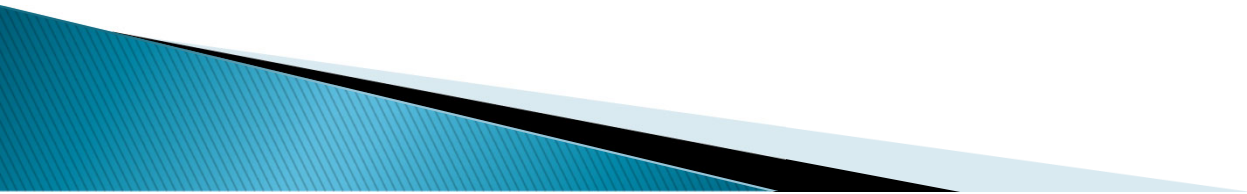


# Questions

- 1 Which of the following takes the longest time to heal?
    - a. Skin
    - b. Fascia
    - c. Mucosa
    - d. Peritoneum
- 

2 You must close all layers when repairing a wound?

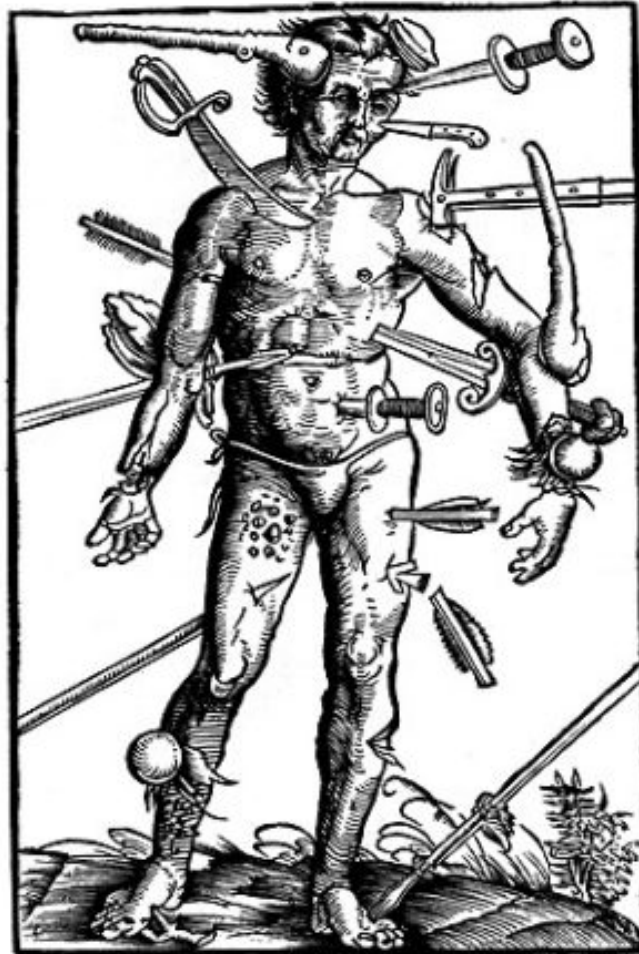
- a. True
- b. False



Which of the following local anesthetics provide the longest effect?

- a. Novocaine?
- b. Marcaine
- c. Lidocaine
- d. Carbocaine

# Wounds

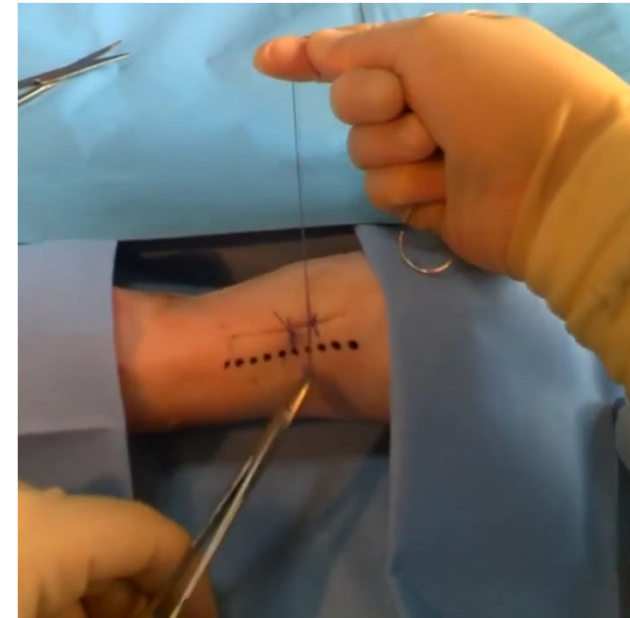




"That's it. Keep your finger on there until I have this knot tied."

# Learning Objectives

- ▶ Understand Suturing principles
- ▶ Describe wound healing principles
- ▶ Comprehend suturing terms, suture types, and commonly used suture techniques
- ▶ Name of commonly used suture needles
- ▶ Understand anesthetic and anesthetic techniques






# Wound Healing Concepts

- ▶ Wound classification
- ▶ Mechanism of injury
- ▶ Tetanus/antibiotics/local anesthetics
- ▶ Surgical principles and wound prep
- ▶ Suture/needle/stitch choice
- ▶ Management/care/follow-up



# Healing factors

- ▶ Patient's:
    - Age
    - Vascular supply to tissue
    - Nutritional status
  - ▶ Tissue character
  - ▶ Prior injury
  - ▶ Treatment compliance
  - ▶ Excess adipose tissue
  - ▶ Chronic disease
  - ▶ Prior radiation therapy
- 

# Model of Wound Healing

- ▶ (1) **Hemostasis**: within minutes post-injury, platelets aggregate at the injury site to form a fibrin clot.
- ▶ (2) **Inflammatory**: bacteria and debris are removed, and factors are released that cause the migration and division of cells involved in the proliferative phase.
- ▶ (3) **Proliferative**: collagen deposition, granulation tissue formation, epithelialization, and wound contraction
- ▶ (4) **Remodeling**: collagen is remodeled and realigned along tension lines and cells that are no longer needed are removed by apoptosis.



# Tissue healing timeline

Skin

5–7 Days

Mucosa

7–14 days

Subcutaneous

7– 14 days

Peritoneum

7–14 days

Fascia

14–28 days

# Wound Evaluation

- ▶ When did the injury occur
  - How long ago
- ▶ How did the injury occur
- ▶ Size of wound
- ▶ Depth of wound
- ▶ Vessel/Tendon/nerve involvement



# Wound Preparation:

## Superficial Skin Wounds

- ▶ Clean with saline, aqueous chlorhexidine or betadine.


## Deep Wounds

- ▶ Require exploration–anesthetized to assist with thorough cleaning
- ▶ Removed foreign bodies.
- ▶ Thorough irrigation with saline under pressure (with a 19 Ga needle on a 10–20 ml syringe)

## Ragged Wounds

- ▶ May have to trim tissue. May have to ellipse the wound

## Glass Injuries

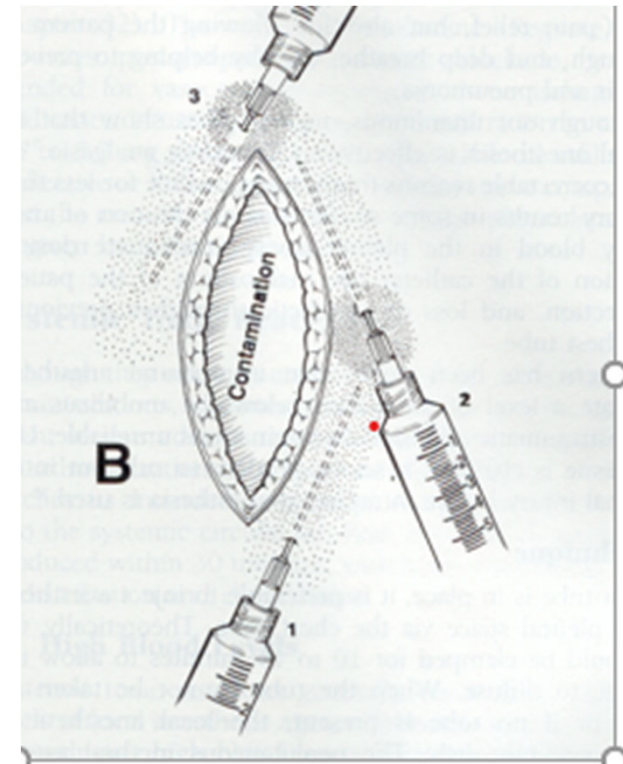
- ▶ X–ray for possibility of retained glass.
  - ▶ If glass fragments are present, the wound needs exploration.
- 

# Common Injectable Local Anesthetics

Generic Name (trade name)	Drug Class	Available Concentration	Maximum Allowable Adult Doses	Average Onset Time	Average Duration Time
Procaine (Novocain)	Ester	0.5%, 1%, 2% solutions	1000mg (10-15mg/kg)	1-5 minutes	30-60 minutes
Lidocaine (Xylocaine)	Amide	0.5%, 1%, 2% solutions	Without epi: 300mg (4.5mg/kg)	.05-30 minutes, varies by route given	30 minutes to 3.5 hours
Mepivacaine (Carbocaine)	Amide	1%, 2% solutions	400mg (4.5mg/kg)	1-10 minutes	1-3 hours
Bupivacaine (Marcaine)	Amide	0.25%, 0.5% solutions	Without epi: 175mg With epi: 225mg	2-30 minutes	8-16 hours


# Field Blocks

- ▶ Clean area and prep
- ▶ Use 27-gauge needle to make wheal at the proximal angle of lesion
- ▶ Using wheal infiltrate the first two sides of the square using long 22- or 25-gauge needle
- ▶ At the distal aspect of the subdermal infiltration puncture the skin and complete the skin

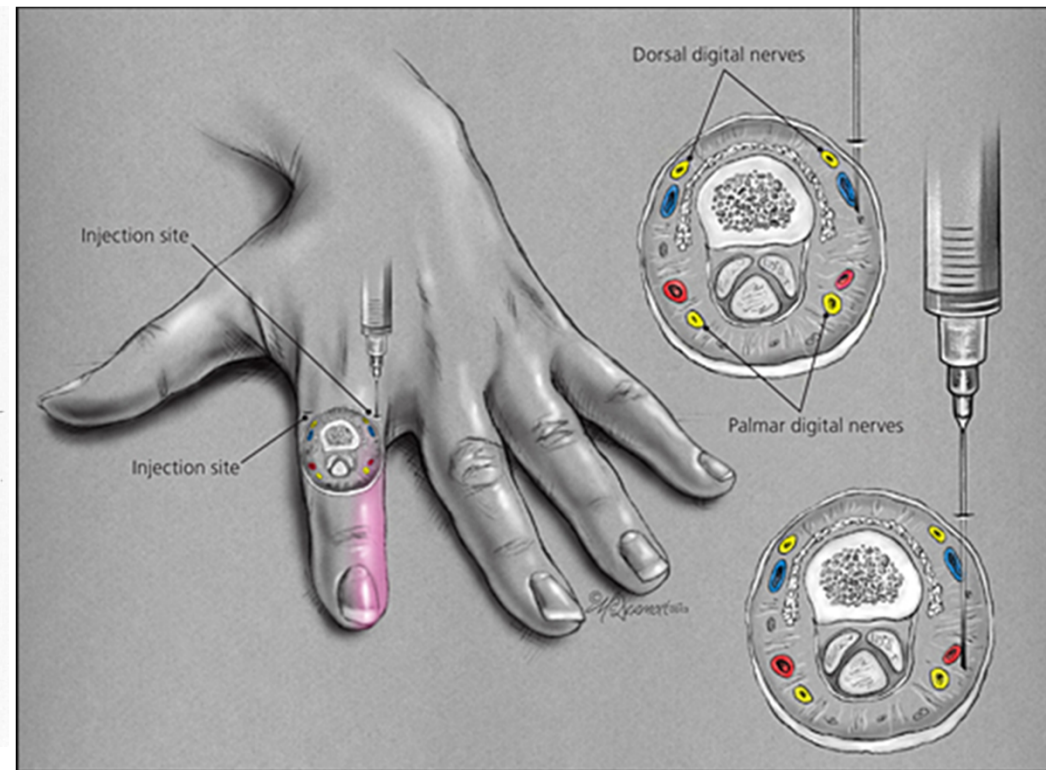
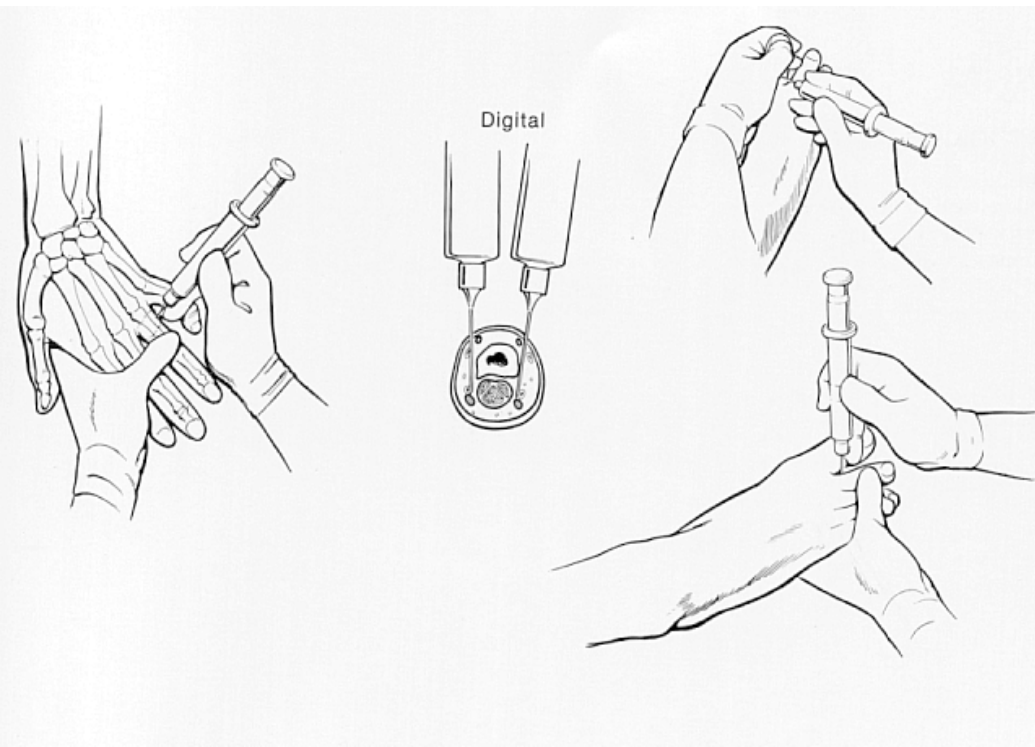




# Digital Block--finger

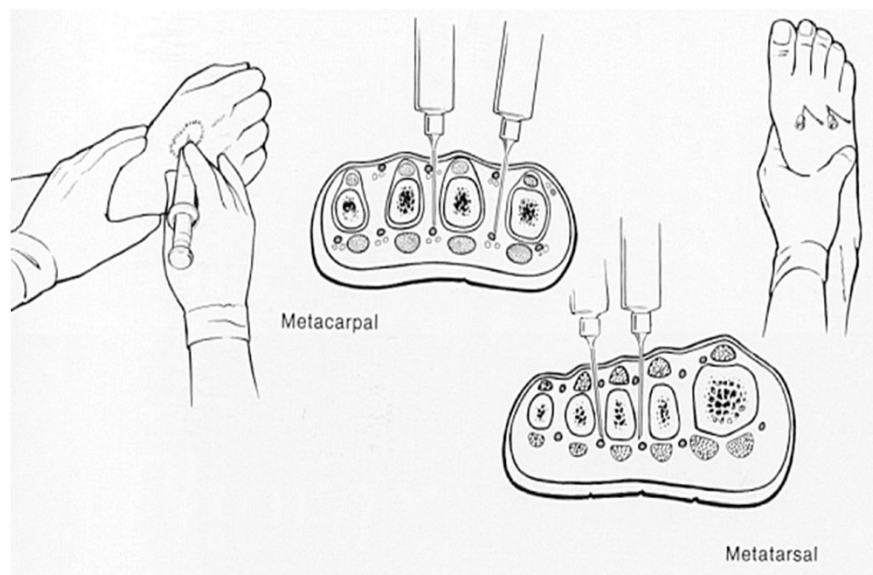
- ▶ Anatomy--fingers are supplied with nerves at 2,5,7,10 o'clock position
  - ▶ With a 23- or 25-gauge needle inject 3 ml slowly around the circumference of finger at the base of anesthesia
  - ▶ Note--mechanical compression of the vascular supply may occur with large volume of local
  - ▶ Use caution when using Epinephrine in any digital block
- 

# Digital Blocks--fingers



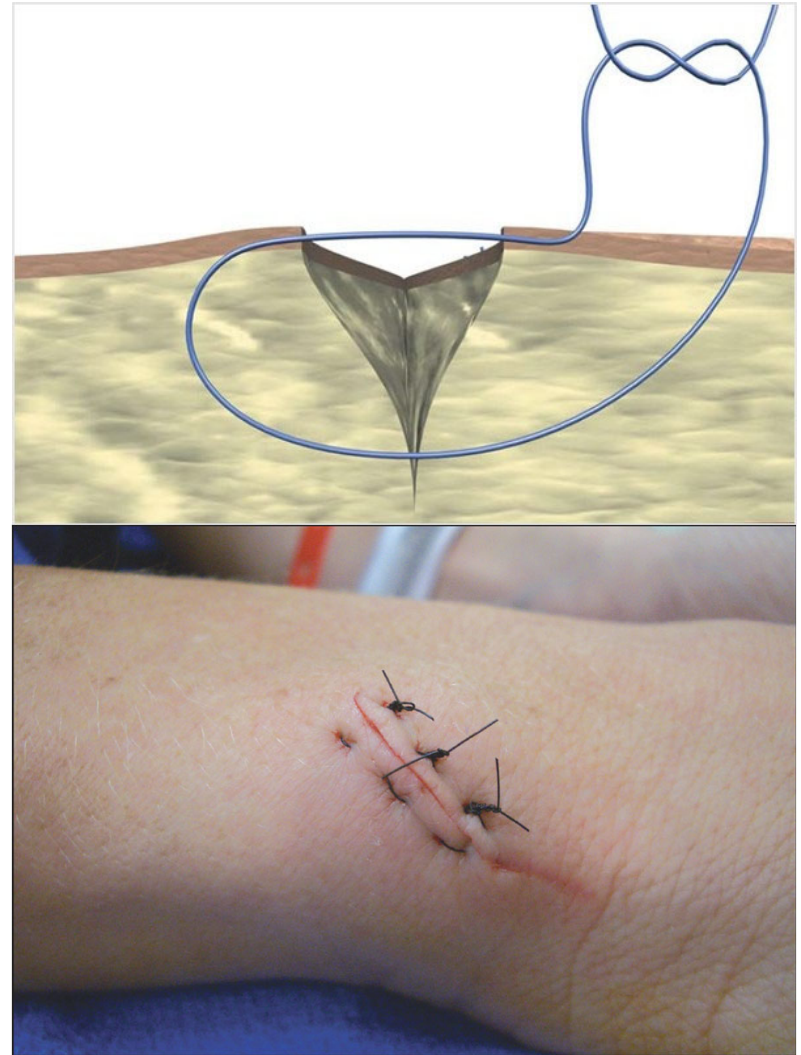
# Digital Block--toes

- ▶ Same as the as the digital block of the hand except need to use longer needle–1 ½ to 2–inch needle
- ▶ Requires 5 to 8 ml of local injected between the metatarsal, most near the sole of the foot




# Why do we suture???


- ▶ Approximate wound edges
- ▶ Restoration of natural anatomic contours
- ▶ To eliminate dead space
- ▶ Minimize skin tension
- ▶ Promotes wound healing
- ▶ Affords a better cosmetic results




# Contraindications to Suturing

- ▶ Signs of gross infection
  - ▶ Puncture wounds
  - ▶ Bites– Human/Cat
  - ▶ Tendon, nerve, or vessel involvement
  - ▶ Injury occurring more than 12 hours on the torso or 24 hours of the face
- 

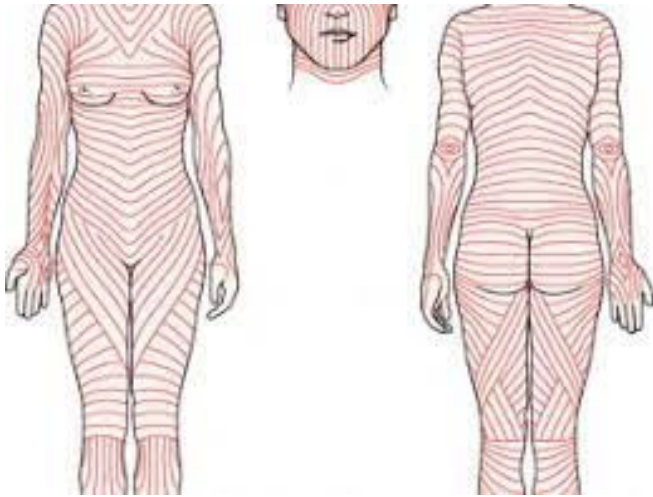
# Basic Suturing Principles

- ▶ Be precise
  - ▶ Take your time
  - ▶ Use good lighting
  - ▶ Repair all layers–Muscle, fascia, dermis, skin
  - ▶ Evert skin edges
  - ▶ Approximate–not strangulate tissue edges
- 

# Principles Cont..

- ▶ Always suture Right to left, or towards you
    - If Left handed–suture left to right
    - There are a couple of exceptions
      - Vertical and Horizontal mattress sutures
  - ▶ Handle tissue gently
  - ▶ Follow the needle arch– let the needle work for you
  - ▶ Tie secure, flat knots
  - ▶ Keep the number of suture to minimum
  - ▶ Know your limitation and know when to defer
- 


# Langer's lines





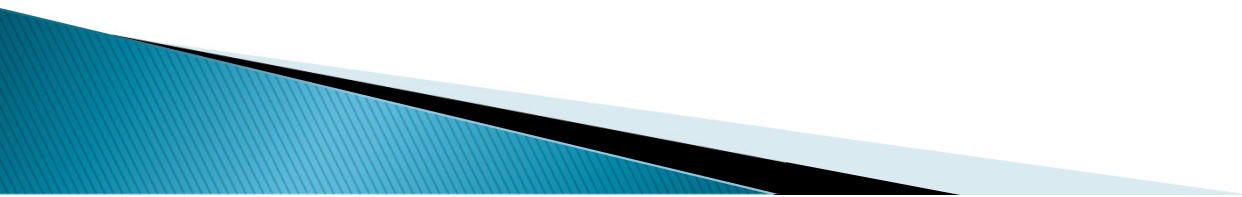
# Classification of Suture

Absorbable  
Non-absorbable  
Multifilament  
Monofilament



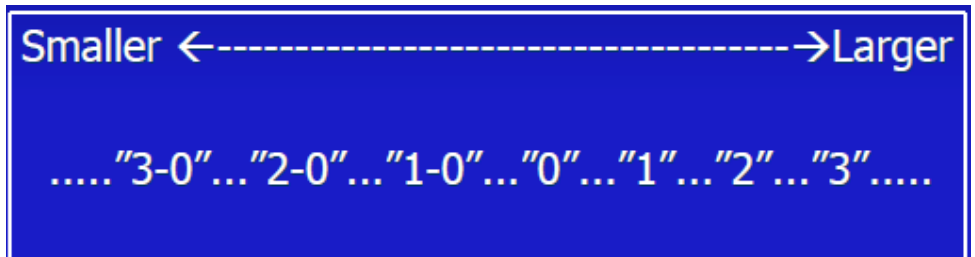
# Suture Selection

- ▶ Close slow healing tissues with non-absorbable sutures or long lasting absorbable.
- ▶ Close fast healing tissues with absorbable suture—face, scalp
- ▶ Contaminated area—avoid multifilament sutures which may lead to infection.



# Suture Sizes

- ▶ 10-0 is the smallest
- ▶ 5 is the largest
- ▶ 10-0, 9-0, 8-0..... 0, 1, 2...5



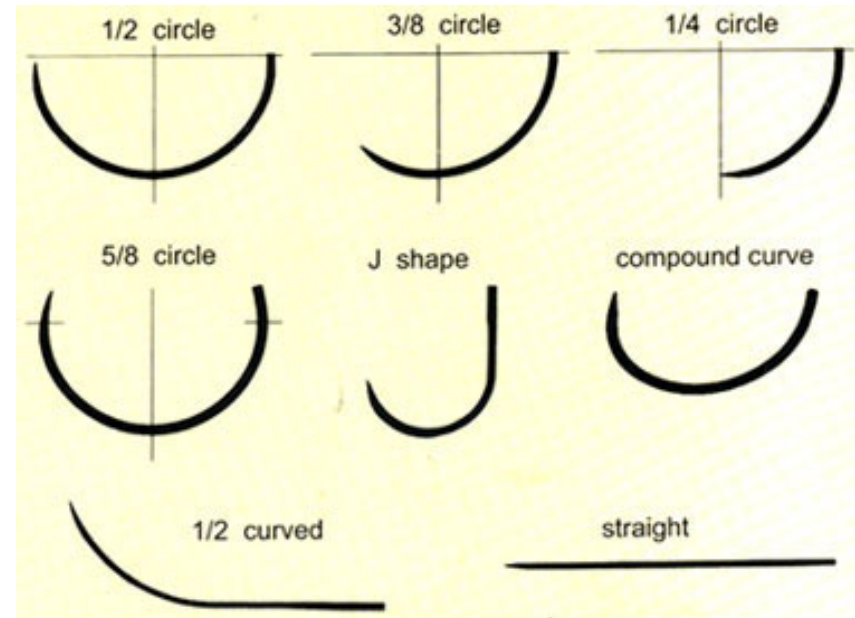
# Suture Selection

- ▶ Cosmetic surgery use the smallest appropriate suture.
- ▶ Avoid using skin staples alone—suture underlying tissue if possible
- ▶ Use subcuticular if possible.



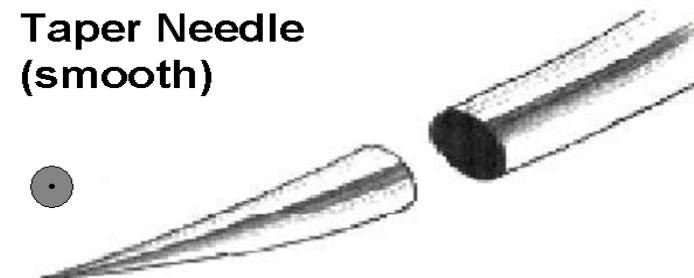
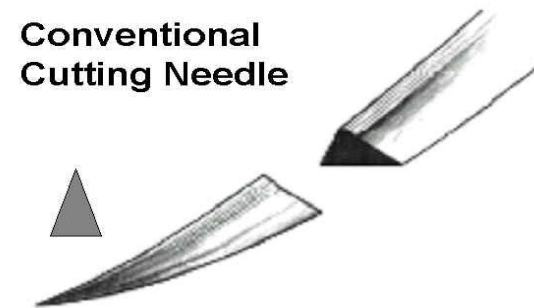
# Needle types

- ▶ Cutting
- ▶ Taper



# Needles

- ▶ Curved
- ▶ Cutting -usual for skin
- ▶ Tapered-subcutaneous



# Suture and Usage

Anatomical Wound Location	Tissue Layer to be Sutured	Suture Material Recommendation	Suture Technique
Face and Neck	Skin	6-0 PAFG, Nylon, Polypropylene	Simple
	Dermis	6-0, 5-0 Vicryl, PDS	Inverted
	Muscle	4-0, 5-0 Vicryl, PDS	Simple
	Perichondrium	6-0 Vicryl	Simple
Mouth	Tongue	4-0, 5-0 Vicryl, Chromic Gut	Simple; Inverted
	Mucosa	Same as above	Simple; Inverted
Scalp	Skin	4-0 Nylon, Polypropylene	Simple
	Dermis	4-0 Vicryl, PDS	Inverted
	Muscle, Galea	3-0, 4-0 Vicryl, PDS	Simple

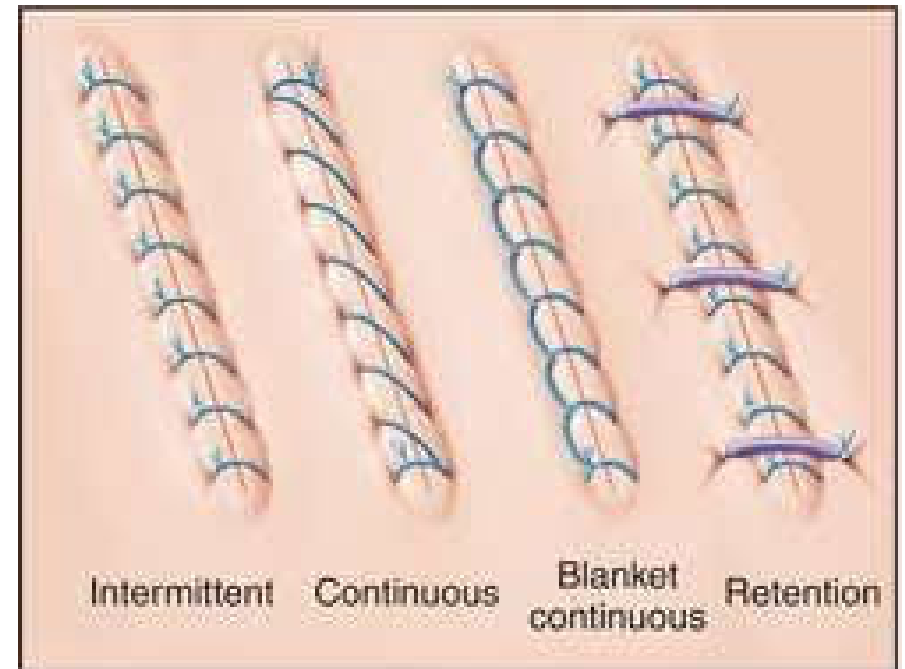
# Suture and Usage

Anatomical Wound Location	Tissue Layer to be Sutured	Suture Material Recommendation	Suture Technique
Arms and Legs (except hands and feet)	Skin	4-0, 5-0 Nylon, Polypropylene	Simple; Mattress
	Dermis	4-0, 5-0 Vicryl, PDS	Inverted
	Fascia	3-0, 4-0 Vicryl, PDS	Simple
Hands	Skin	5-0 Nylon, Polypropylene	Simple
	Nail bed	6-0 Vicryl	Simple
	Dermis	5-0 Vicryl, Nothing in Fingers	Inverted
Feet	Skin (Dorsum)	4-0, 5-0 Nylon, Polypropylene	Simple; Mattress
	(Plantar)	4-0, 5-0 Nylon, Polypropylene	Simple
	Nailbed	6-0 Vicryl	Simple
	Dermis	5-1 Vicryl; Nothing in Nailbed	Inverted

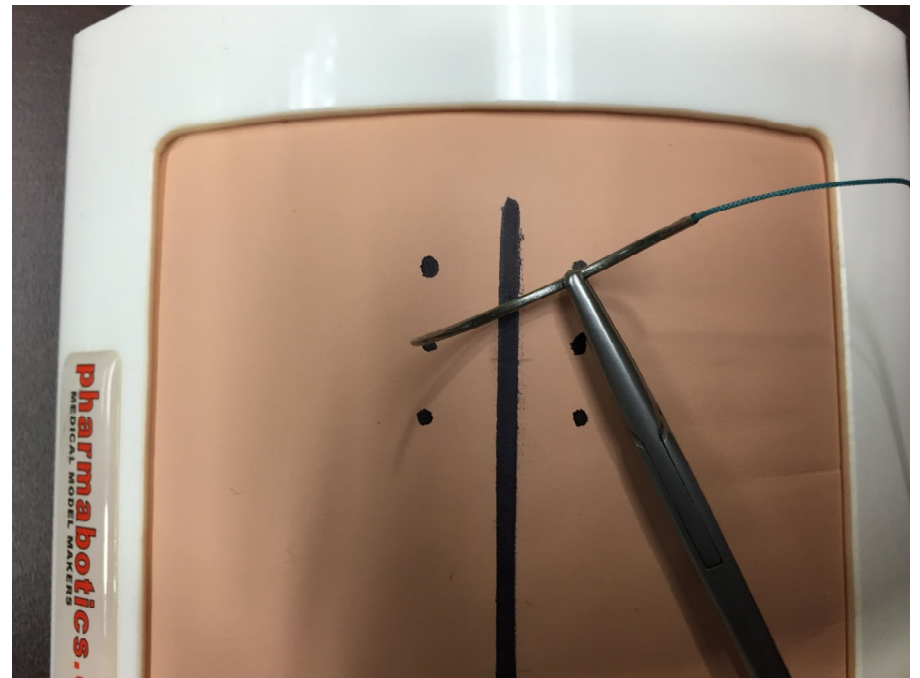
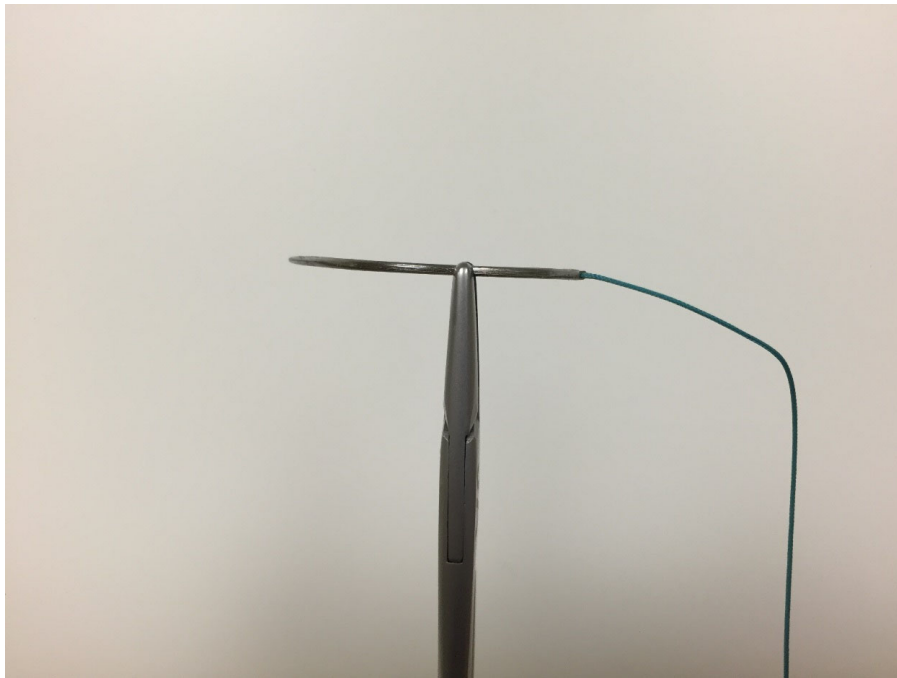


# Suturing Techniques

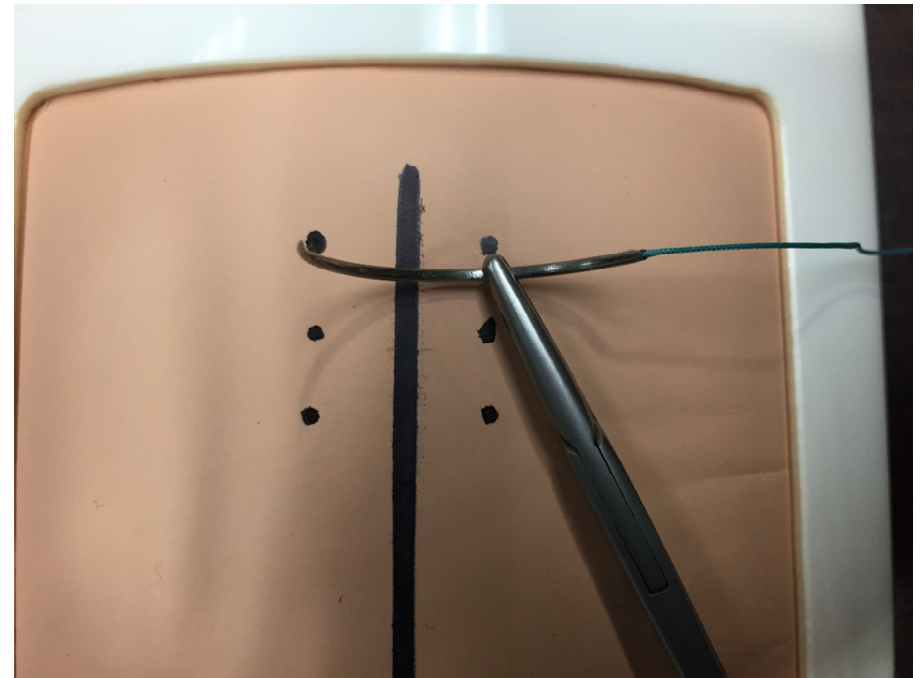
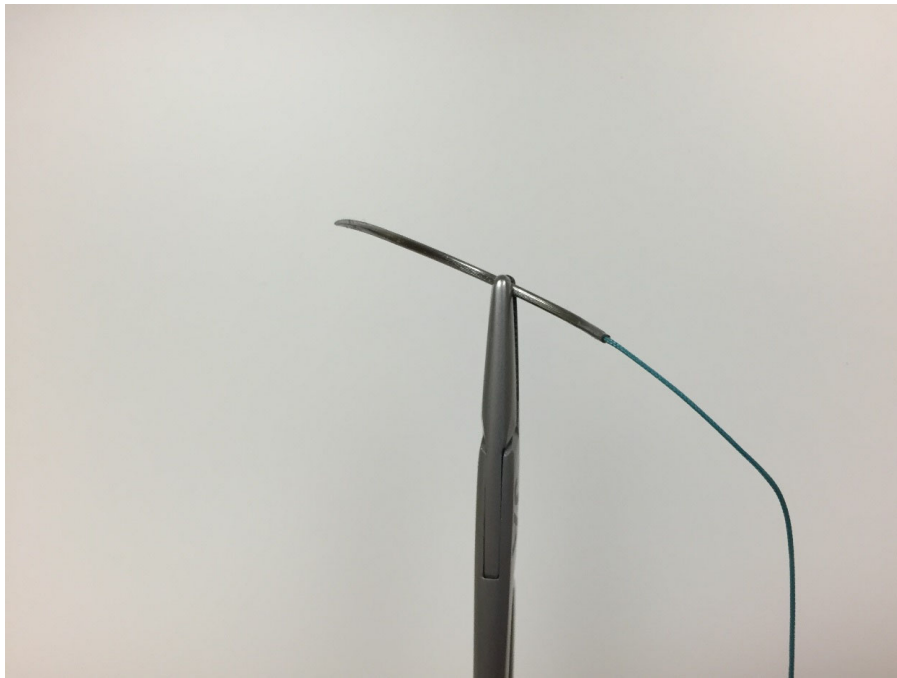
- ▶ Interrupted Suture
  - Simple
  - Horizontal Mattress
  - Vertical Mattress
- ▶ Continuous Suture
  - Simple
  - Horizontal
  - Vertical
  - Locked running
- ▶ Subcuticular Suture
- ▶ Subcutaneous (Buried knot)
- ▶ Modified
  - Simple with interrupted vertical mattress



# Needle position-Incorrect

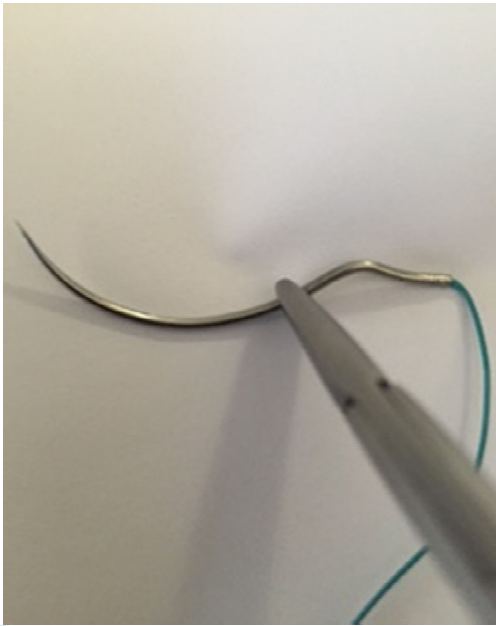


# Needle position-Correct

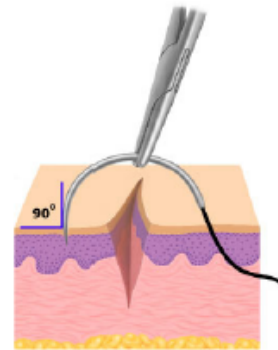


# Suturing

- ▶ The needle enters the skin approximately  $\frac{1}{4}$  inch from wound edge at 90 degrees

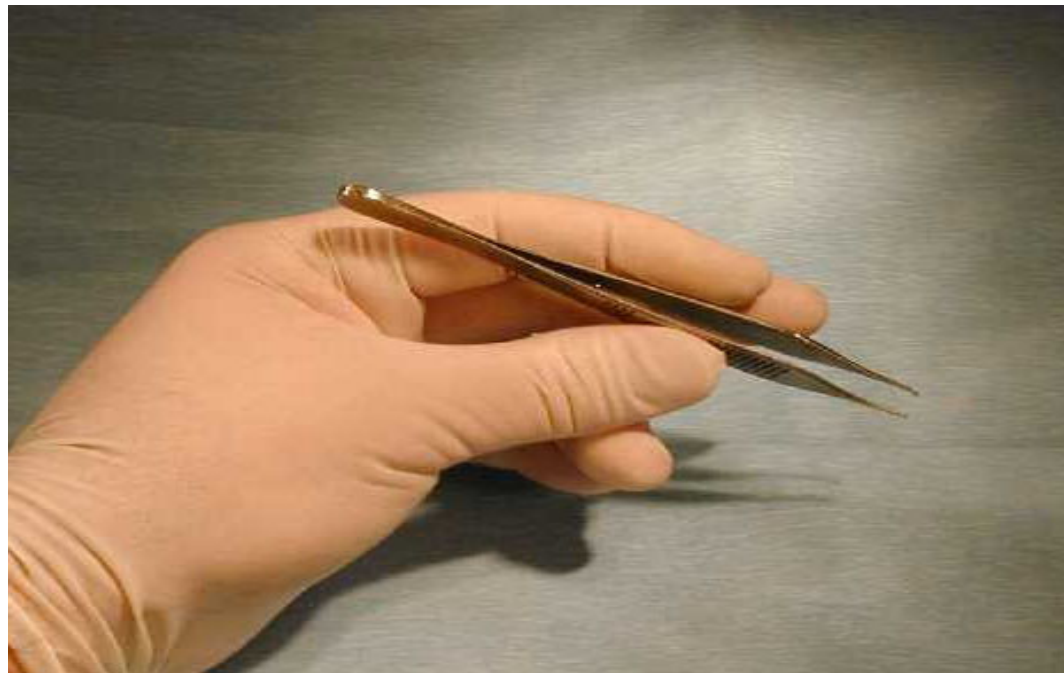


Wound eversion 1 (up to date)

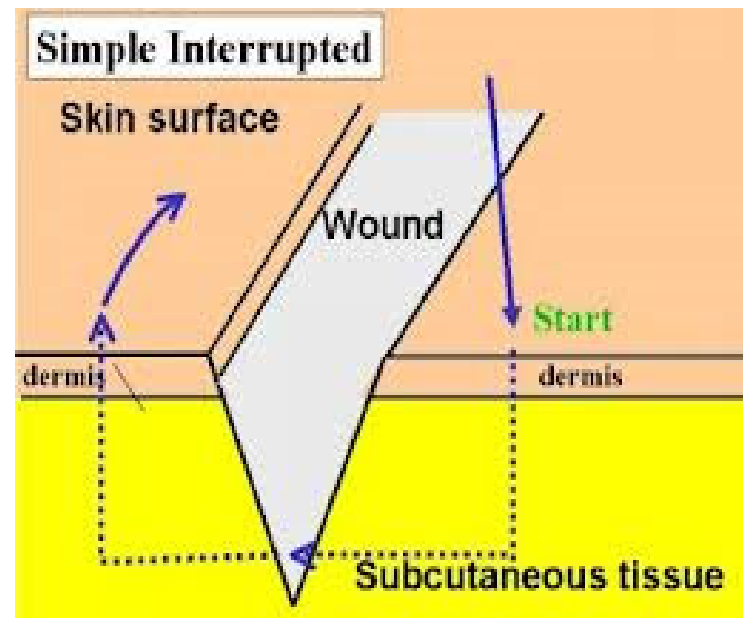
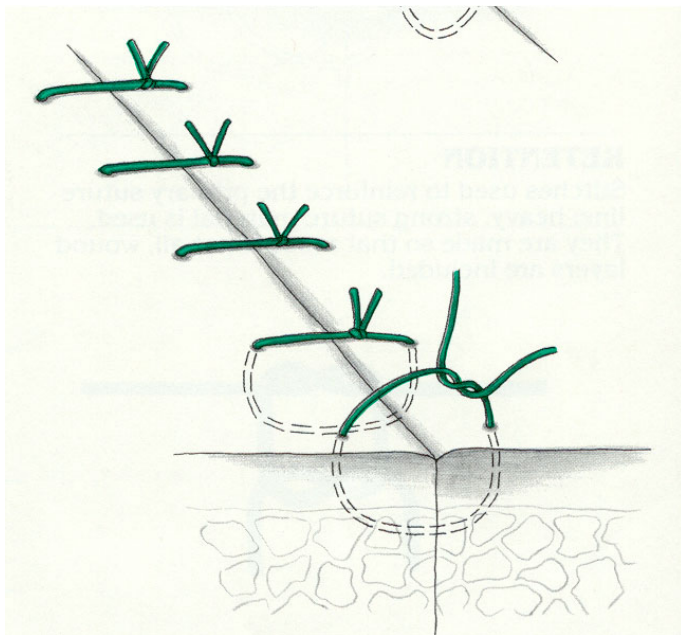


# Forceps

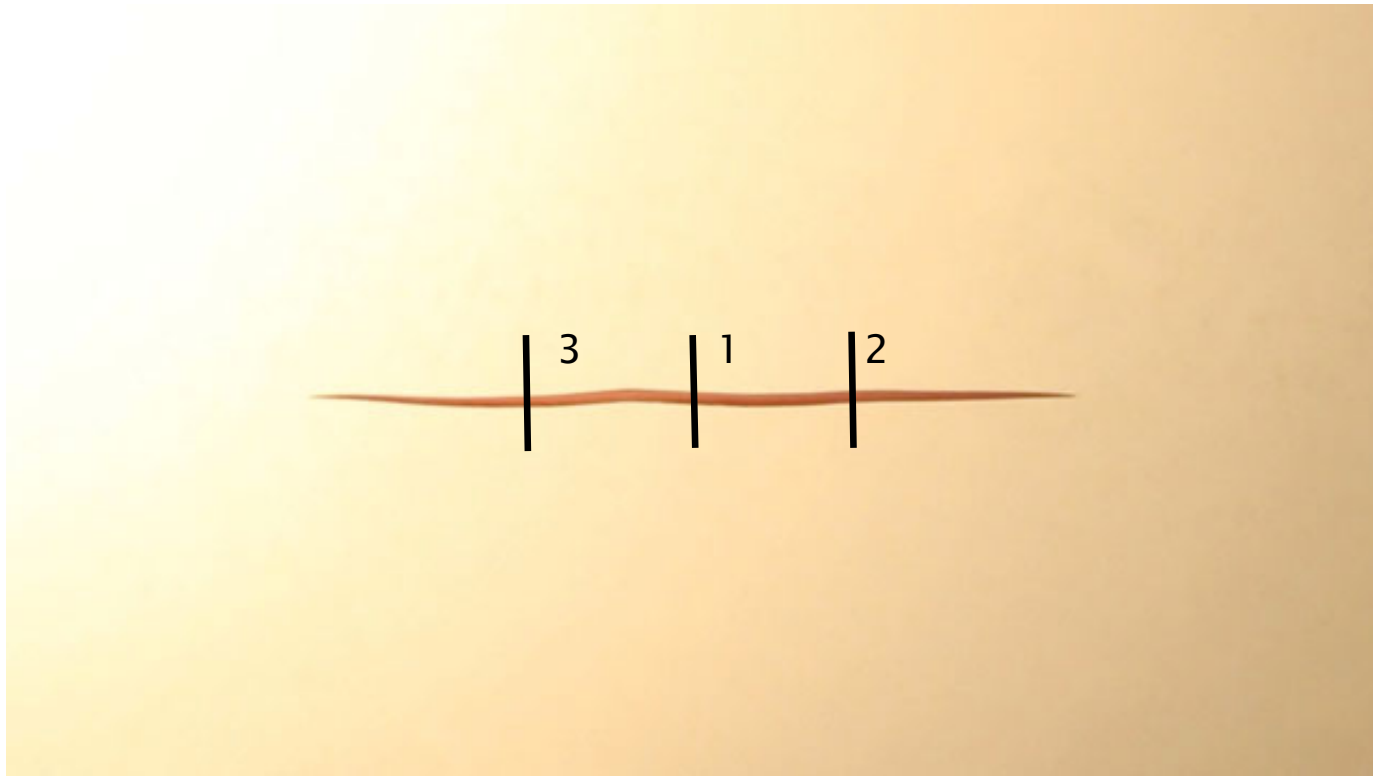
- ▶ Grasp forceps between thumb and index finger. Hold like a pen.



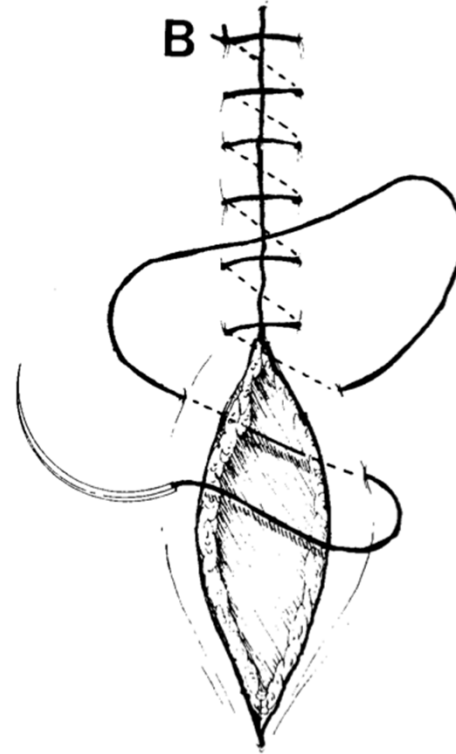
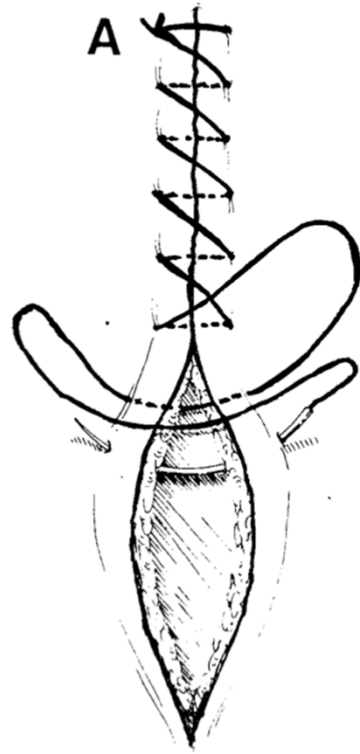
# Simple Suture



# Rule of Halves

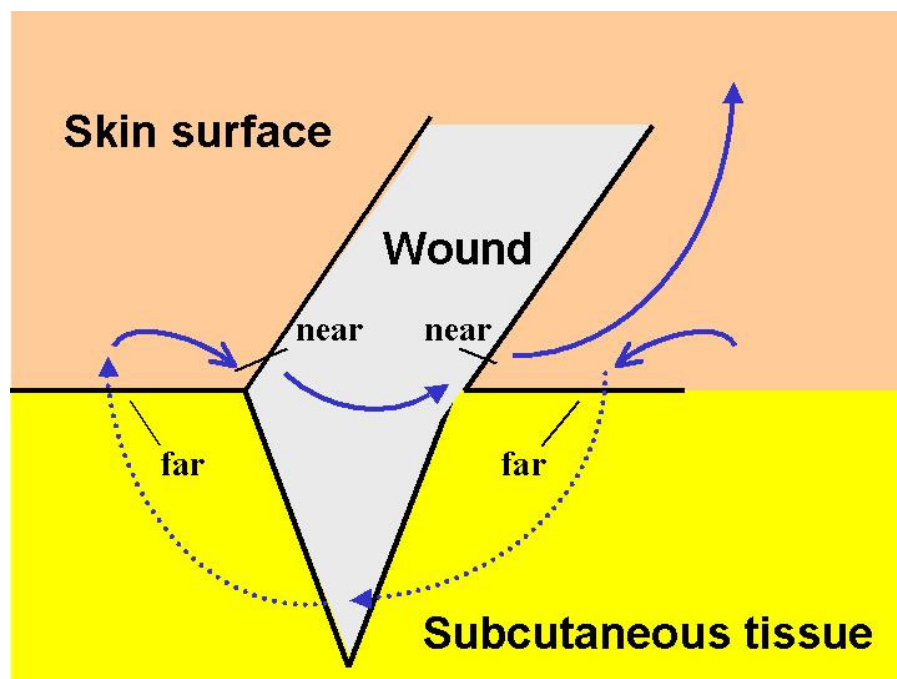


# Simple continuous

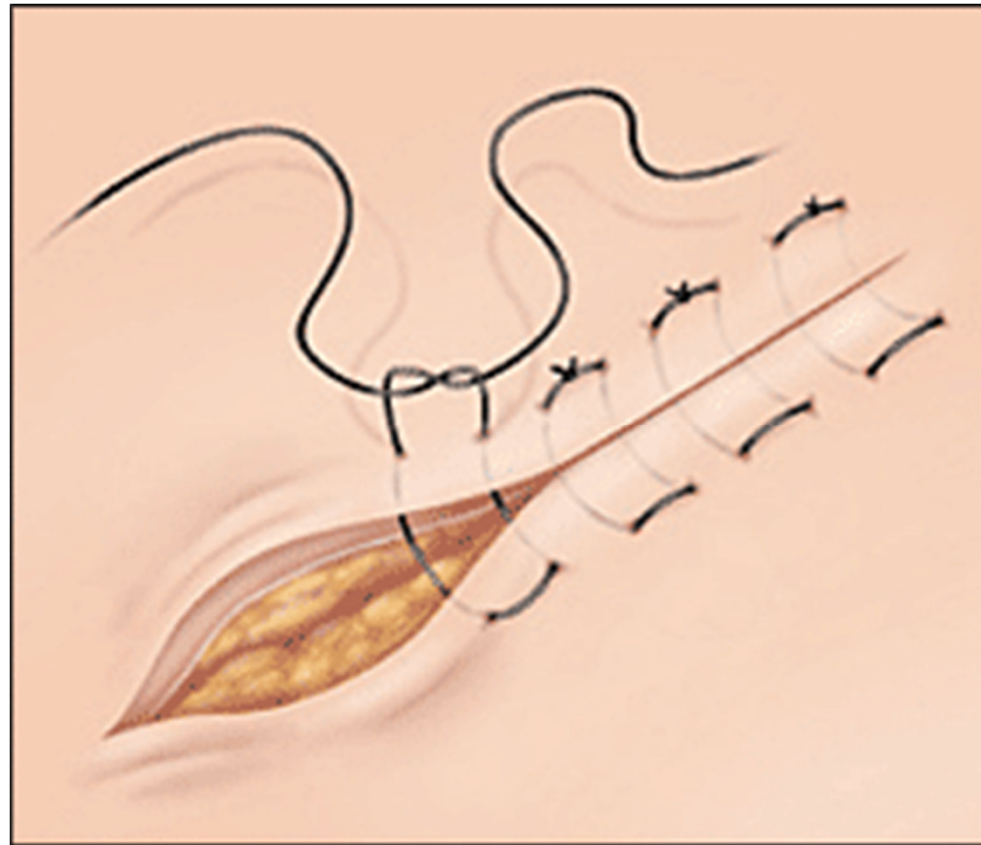




# Vertical Mattress

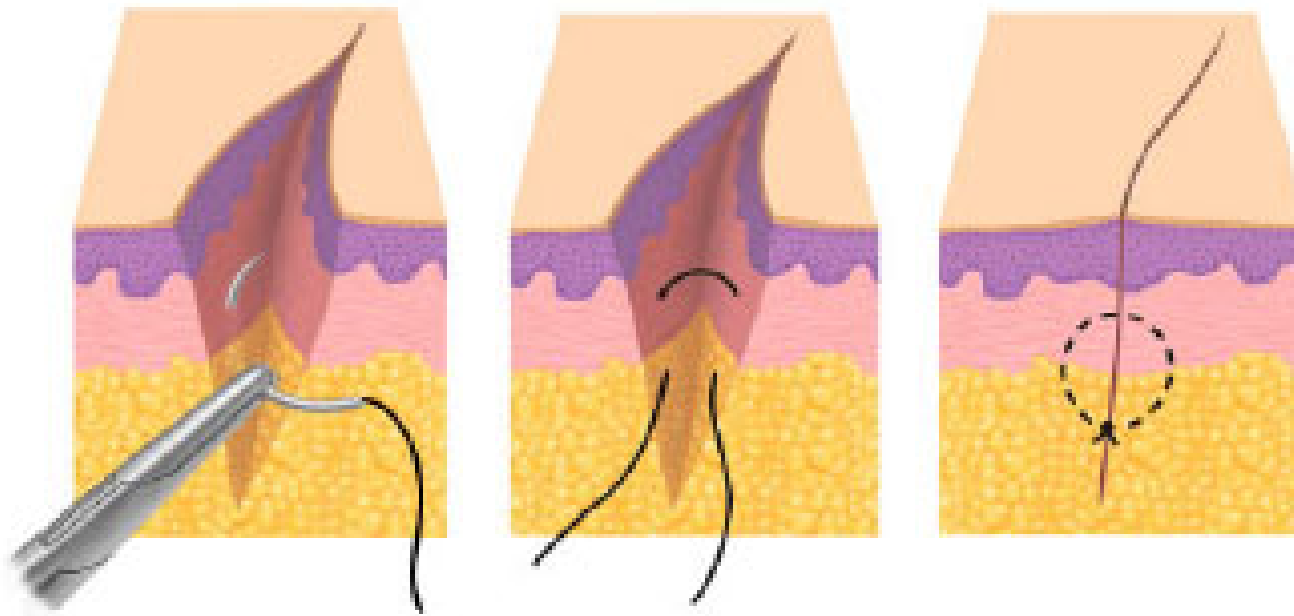


# Horizontal Mattress

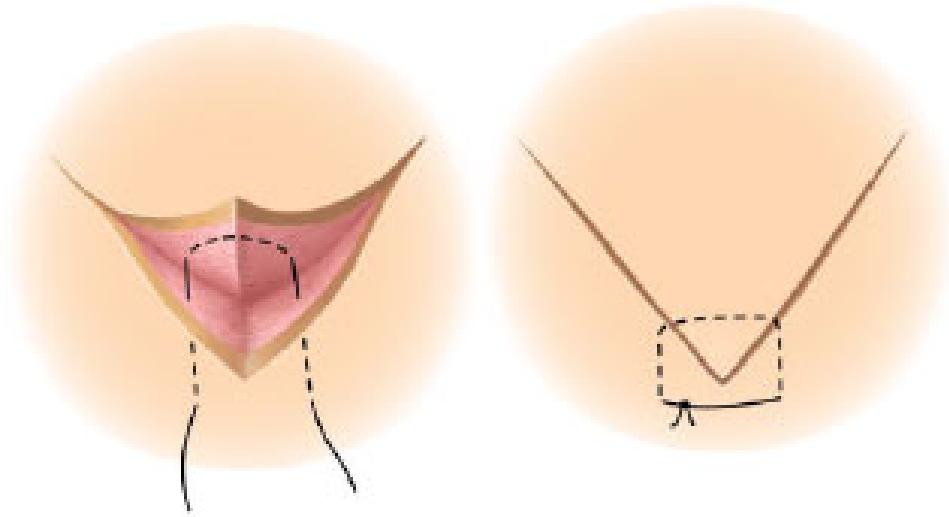


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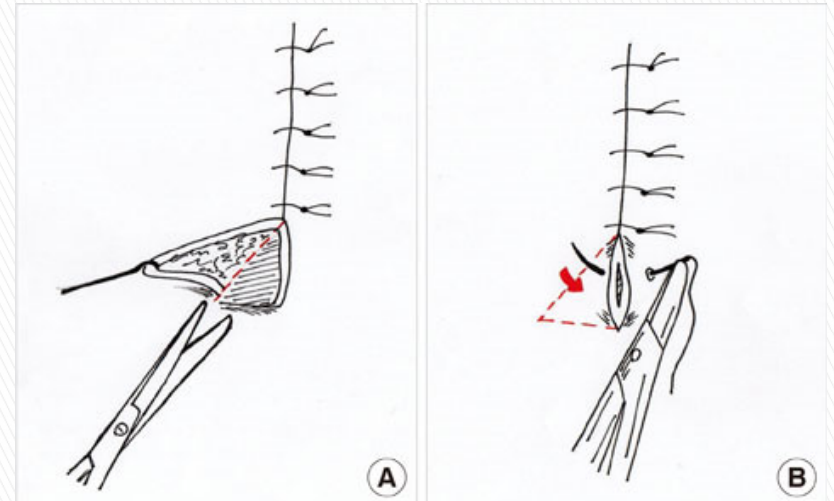
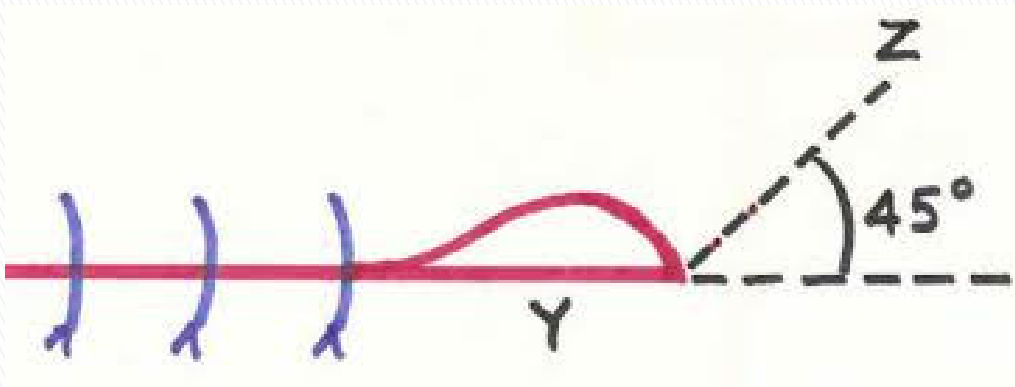
# Technique for Sub-Dermal Suture



# Half Buried Horizontal Mattress for Corner Flap (up to date)



# Dog Ear Repair



# Lips

- First suture at vermilion border.
- Sutures: skin – 4/0, 5/0, Ethilon/Prolene
- Mucosa and muscle – 4/0, 5/0 Vicryl
- Inner lip–Sutures rarely needed



# Scalp

- Control excessive Bleeding with pressure at wound margin.
- It is not usually necessary to shave any/much hair.
- Close in 2 layers:
  - GALEA 3/0–5/0 Chromic Cat Gut (CCG) or PDS (absorbable)
  - SCALP 4/0–5/0 Nylon
  - Staples



# Forehead

- Debride if necessary
- Do not shave eyebrow
- Sutures 5/0, 6/0 Nylon
- Vicryl absorbable sutures
- Superficial wound ( $\pm$  steri-strips/dermabond)





# Cheek

- Check for fractures (zygomatic arch Fx, blow out of orbit)
- Should consult OMFS if fractured
- involvement of facial nerve and muscle.
- Ophthalmology if excessive swelling of the eyelid
- Close as like forehead closure



# Eyelids

- If lid involvement, then refer to Ophthalmology
- Tarsal plate injury– refer Ophthalmology
- May need plastic referral for aesthetics
- Sutured without tension.
  - 5/0,6/0 Vicryl or Fast Plain Gut absorbable sutures
  - May use Dermabond–be careful to not get in eye



# Limbs

- May need immobilization of joint
- Upper Limbs: 4/0, 5/0 Nylon. Deep sutures 4/0 PDS.

# Trunk

- Subcutaneous layer: 3/0, 4/0 Vicryl or PDS.
- Skin: 4/0, 5/0 Nylon.



# Digits & Hand

- Small lacerations of fingertips with skin loss are very common.
  - Areas of skin loss up to 1 cm<sup>2</sup> are treated with dressings and heal with good return of sensation.
  - May need Plastic surgeon referral.
- Partial-amputation/crush injury (Finger)
  - Need to assess the integrity of the nail bed
  - Nail bed damage—refer to Plastic surgery for repair.
  - X-ray for distal fracture
- Palm:
  - Be careful in assessing wound especially in very young children as deeper structures (eg nerves and tendons) may be involved. If in doubt consult Plastics.



## Palate

- Beware: Examine posterior pharynx for injury. May need to consult with OMFS.
- Rare to suture only if gaping widely, extending through posterior free margin or continuing to bleed.

## Tongue

- Most lacerations do not require suturing.
- IF laceration is large, extending through the free edge, full thickness or associated with ongoing bleeding, Plastics opinion is necessary.

## Ear

- If full thickness involving cartilage, needs Plastic opinion.



# Lip Laceration repair



# Body art/Piercing

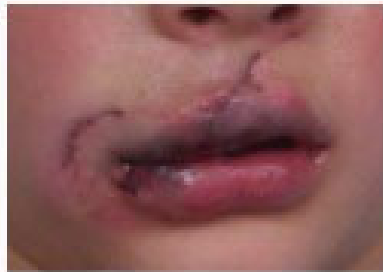
- ▶ Try to repair injury not disrupting the body art



# Lip Laceration repair



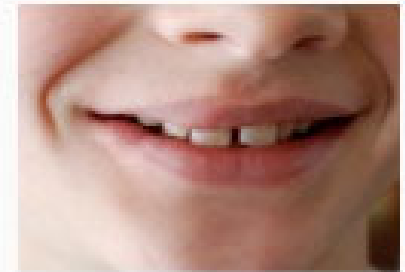
Initial



Post-Op



3 Weeks



1 Year



# Hand laceration repair



Initial



10 Days




5 Weeks


What would you do with this?????




# Antibiotics

- Simple lacerations—none needed
  - Most important decontamination of the wound
  - Bites and wounds with extensive tissue damage, or massive contamination—antibiotic needed
  - Recommended antibiotics  
Augmentin 875mg BID for 10 days  
If PCN allergy: Flagyl 500 TID and Doxycycline 100 BID for 10 days
- 

# Suture Removal

- ▶ Average time frame is 7 – 10 days
    - FACE: 3 – 5 d
    - NECK: 5 – 7 d
    - SCALP: 7 – 10 days
    - UPPER EXTREMITY and TRUNK: 10 – 14 days
    - LOWER EXTREMITY: 10–14 days
    - SOLES, PALMS, BACK OR OVER JOINTS: 10–14 days
  - ▶ Any suture gross signs of infections should be removed immediately.
- 

# When to Refer:

- ▶ Wound type is above your skill to repair
  - ▶ Hand and feet with penetrating injury
  - ▶ Eye, Lip or ear with full thickness injury
  - ▶ Injury with nerve, large artery (you cannot gain control of bleeding) or bone fractures
  - ▶ Crushing injury of an extremity
  - ▶ Severely contaminated wound
  - ▶ Cosmetic repair uncertainties
- 

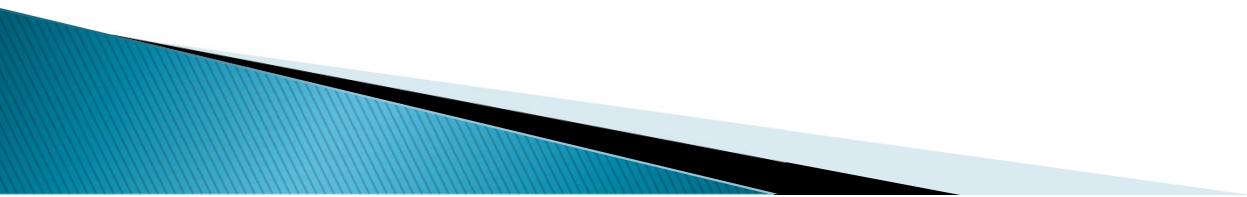


"It's a new technique for training interns:  
suture by numbers."

# Questions

- 1 Which of the following takes the longest time to heal?
  - a. Skin
  - b. Fascia
  - c. Mucosa
  - d. Peritoneum

- 2 You must close all layer when repairing a wound?
- a. True
  - b. False



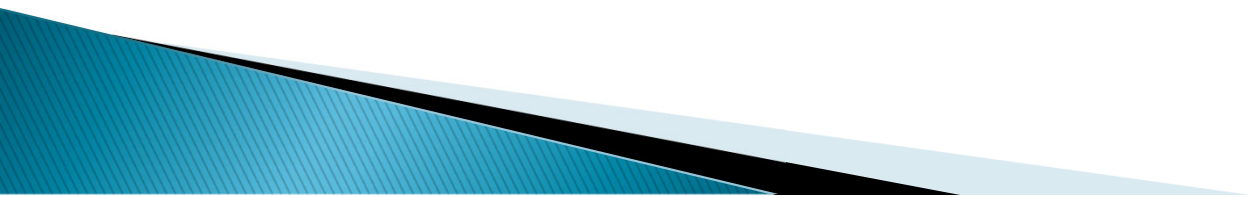


Which of the following local anesthetics provide the longest effect?

- a. Novocaine?
- b. Marcaine
- c. Lidocaine
- d. Carbocaine



Questions?????



# References

- ▶ Cartoon Stock one of 3, slide 3, 58
- ▶ American Family Physician Essentials of Skin Laceration Repair, [Oct 15, 2008 Issue](#) Slide 30
- ▶ Wayne LaMorte, M.D. Boston University Slide 36,39, 40
- ▶ [Veterinary Medicine 835](#) with [Anderson/blackford](#) at [University of Tennessee – Knoxville](#) Slide 40
- ▶ Essential of Skin laceration repair, Randall T. Frosch MD, University of Michigan Medical School, slide 41
- ▶ Nova Plastic Surgery web site, slide 54
- ▶ Closing the Gap–Wound Closure fro the emergency practitioners–Christopher Gascon, slide 43, 53
- ▶ Crashingpatient.com slide 43
- ▶ Chen E et al. Primary Closure of Mammalian Bites. Acad EM 2000; 7(2): 157–162. Slide 53,54
- ▶ NYSORA:Digital Nerve block <https://www.nysora.com/digital-nerve-block>