

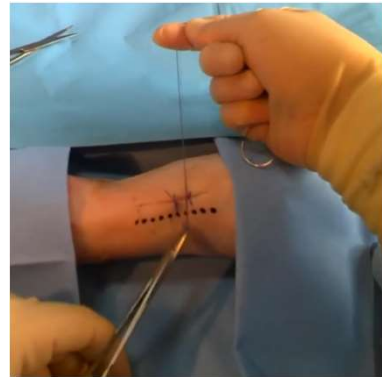
Suturing Techniques and Wound Care
AAPA 2020
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No financial disclosures



Learning Objectives

- ▶ Identify several aspects of wound healing theory
- ▶ Discuss superficial wound management
- ▶ Describe local anesthesia administration
- ▶ Select appropriate sutures and needles
- ▶ Discuss proper follow-up wound care mgt.



Wound Healing Concepts

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



Common Patient Factors

- ▶ Age
- ▶ Blood supply to the area
- ▶ Nutritional status
- ▶ Tissue quality
- ▶ Revision/infection
- ▶ Compliance
- ▶ Weight
- ▶ Dehydration
- ▶ Chronic disease
- ▶ Immune response
- ▶ 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 phagocytosed and removed, and factors are released that cause the migration and division of cells involved in the proliferative phase.
- ▶ (3) **Proliferative**: angiogenesis, 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.



Critical Wound Healing Period

Tissue

Skin

5-7 days

Mucosa

5-7 days

Subcutaneous

7-14 days

Peritoneum

7-14 days

Fascia

14 - 28 days

Wound Evaluation

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



Wound Preparation:

Superficial 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

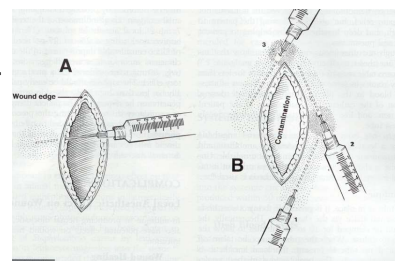
- ▶ X-ray for possibility of retained glass.
- ▶ If glass fragments are present, the wound needs exploration.

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

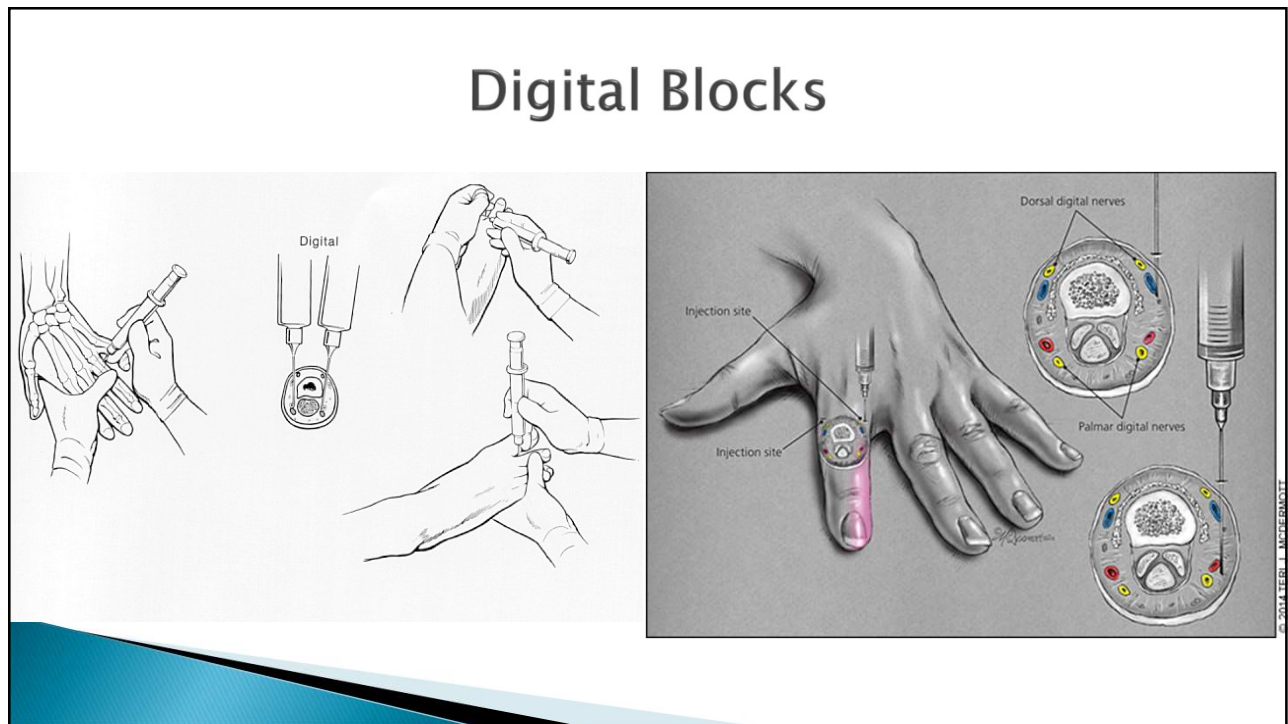
- ▶ Clean area and prep
- ▶ Use 27 gauge needle to make wheal at the proximal angle of lesion
- ▶ Using wheal infiltrate the first two sides of the square using long 22 or 25 gauge needle
- ▶ At the distal aspect of the subdermal infiltration puncture the skin and complete the skin



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

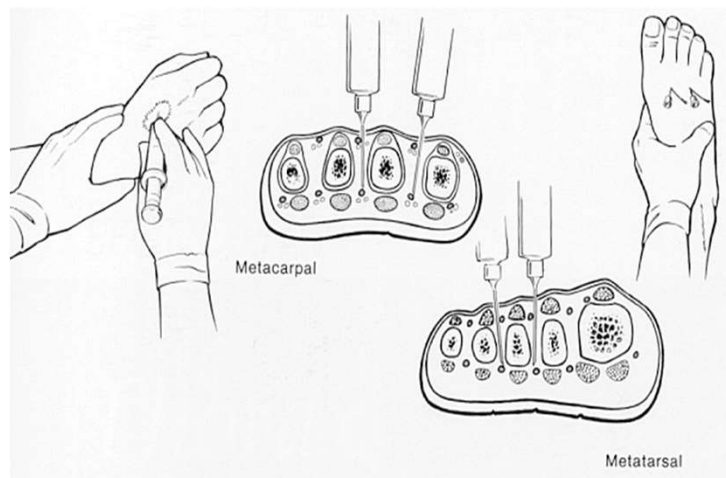
Digital Blocks



Digital Block--toes

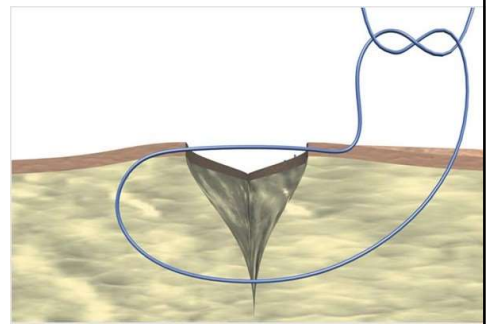
- ▶ Same as the as the digital block of the hand except need to use longer needle-1 1/2 to 2 inch needle
- ▶ Requires 5 to 8 ml of local injected between the metatarsal, most near the sole of the foot

Foot Digital block



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/Animal
- ▶ Tendon, nerve, or vessel involvement
- ▶ Wound more than 12 hours old (body) and 24 hrs (face)

Basic Suturing Principles

- ▶ Be precise– not careless,
- ▶ 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
- ▶ 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

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.
- ▶ Contaminated area--avoid multifilament sutures which may lead to infection.

Suture Selection

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



Suture Sizes

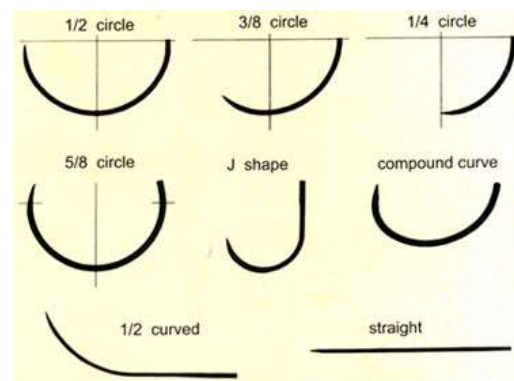
- ▶ 10-0 is the smallest
- ▶ 5 is the largest
- ▶ 10-0, 9-0, 8-0..... 0, 1, 2

Smaller ←-----→Larger

....."3-0"... "2-0"... "1-0"... "0"... "1"... "2"... "3".....

Needle types

- ▶ Cutting
- ▶ Taper



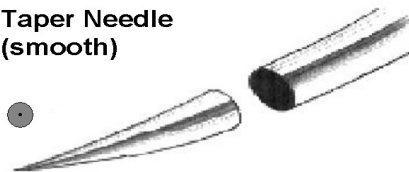
Needles

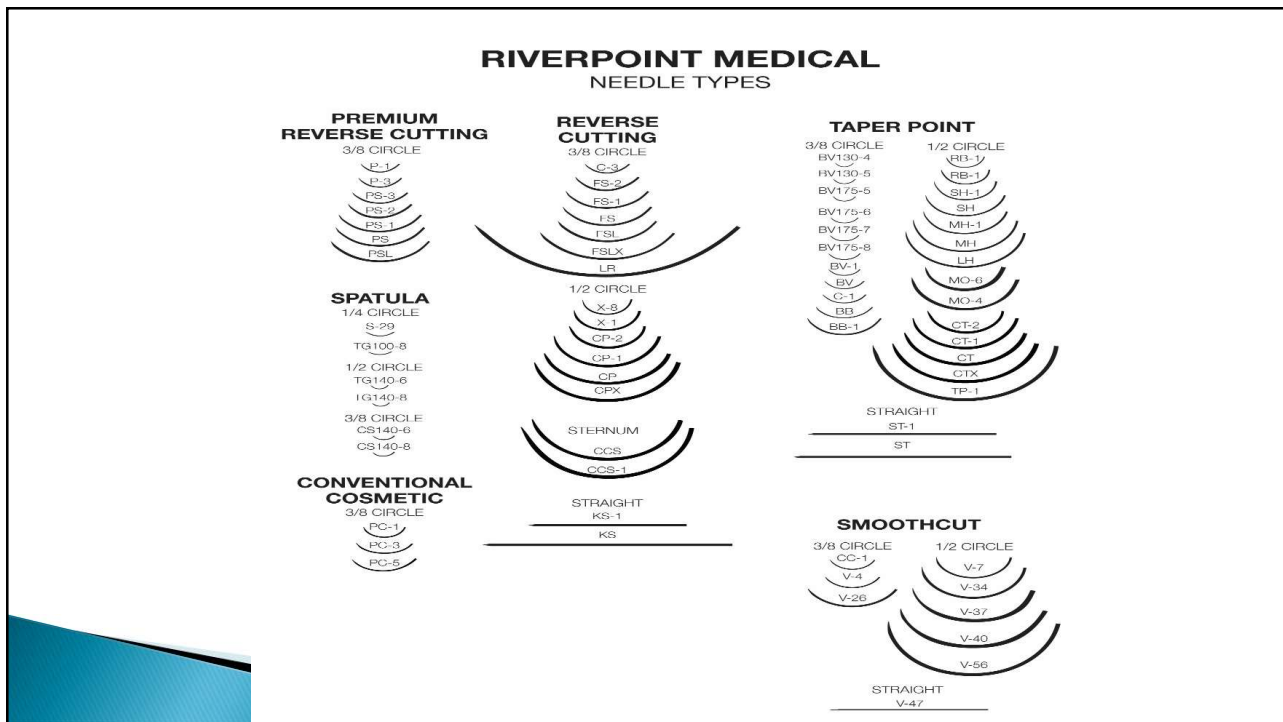
- ▶ **Curved**
- ▶ Cutting -usual for skin
- ▶ Tapered-subcutaneous

Conventional
Cutting Needle



Taper Needle
(smooth)





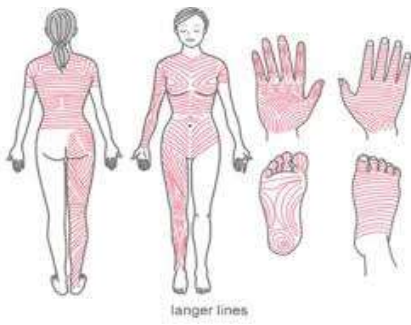
Suture and Usage

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

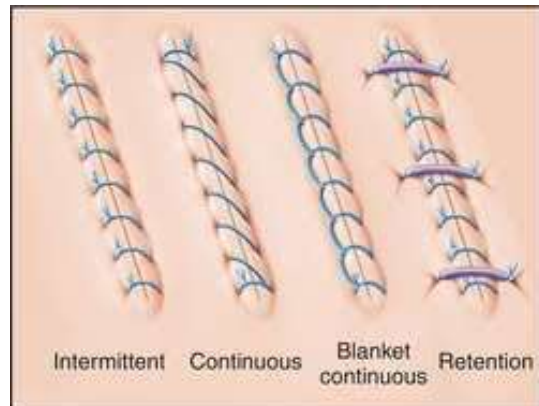
Anatomical Wound Location	Tissue Layer to be Sutured	Suture Material Recommendation	Suture Technique
Arms and Legs (except hands and feet)	Skin	4-0, 5-0 Nylon, Polypropylene	Simple; Mattress
	Dermis	4-0, 5-0 Vicryl, PDS	Inverted
	Fascia	3-0, 4-0 Vicryl, PDS	Simple
Hands	Skin	5-0 Nylon, Polypropylene	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

Langer's lines



Suturing Techniques

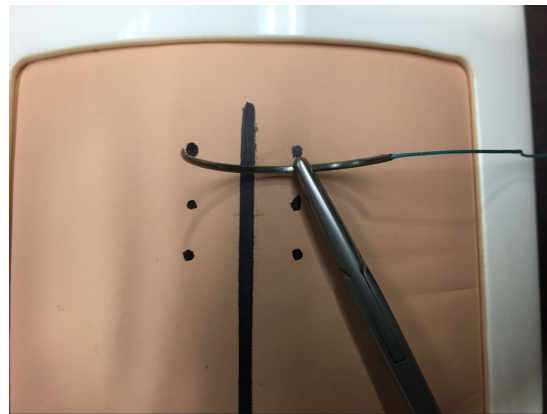
- ▶ Interrupted Suture
 - Simple
 - Horizontal Mattress
 - Vertical Mattress
- ▶ Continuous Suture
 - Simple
 - Horizontal
 - Vertical
 - Locked running
- ▶ Subcuticular Suture
- ▶ Subcutaneous (Buried knot)
- ▶ Modified
 - Simple with interrupted vertical mattress



Needle position-Incorrect

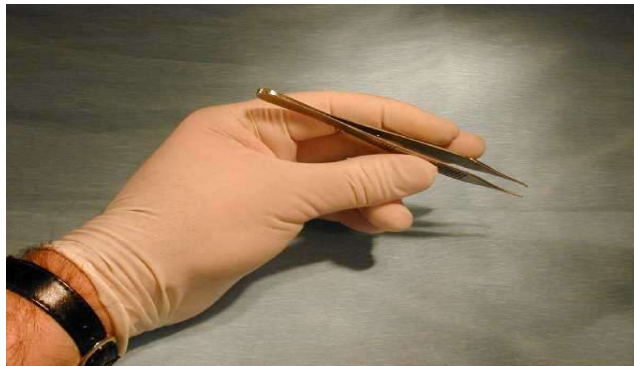


Needle position-Correct



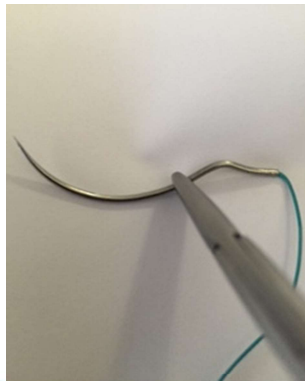
Forceps

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

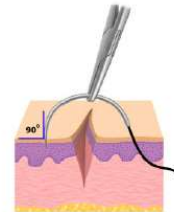


Suturing

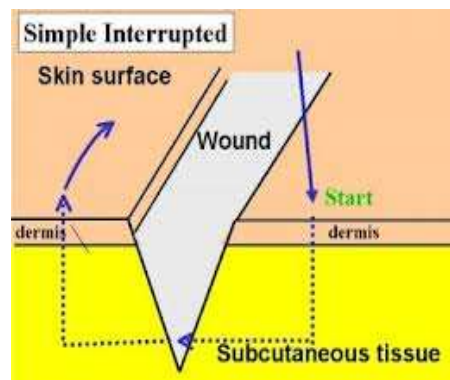
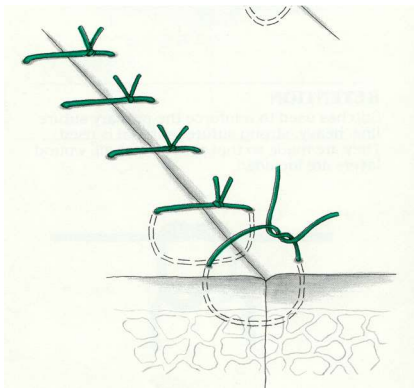
- ▶ The needle enters the skin approximately $\frac{1}{4}$ inch from wound edge at 90 degrees



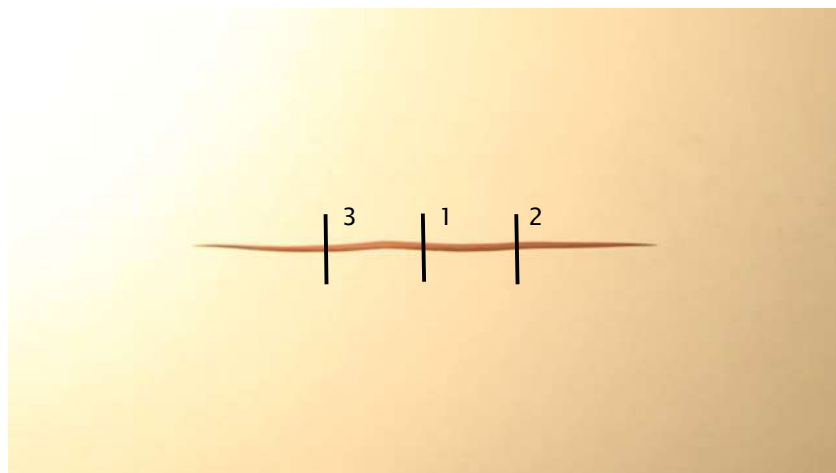
Wound eversion 1 (up to date)



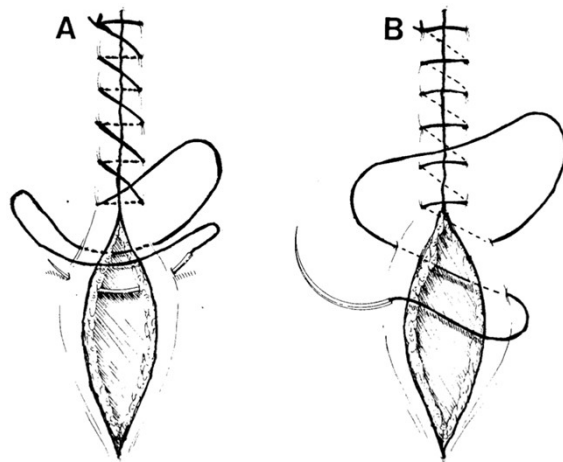
Simple Suture



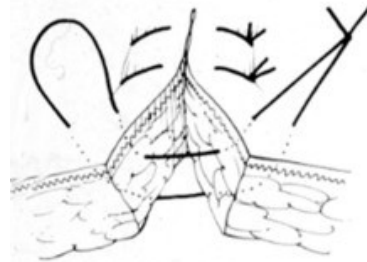
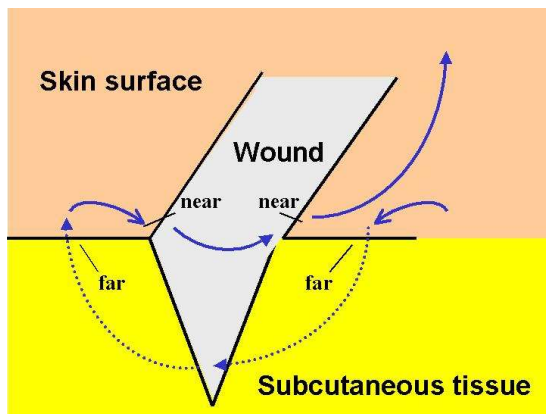
Rule of Halves



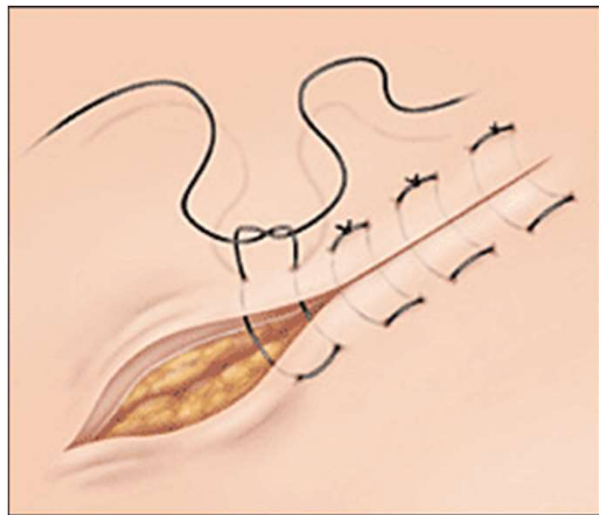
Simple continuous



Vertical Mattress

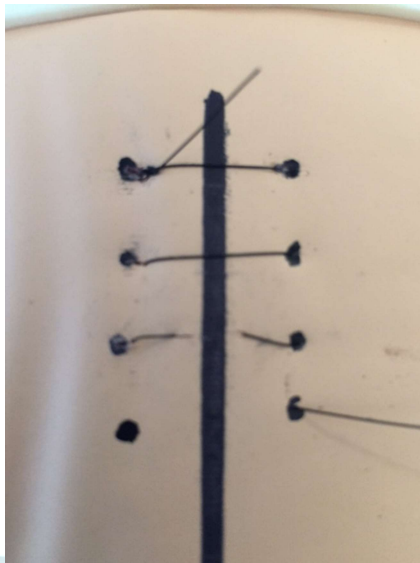


Horizontal Mattress

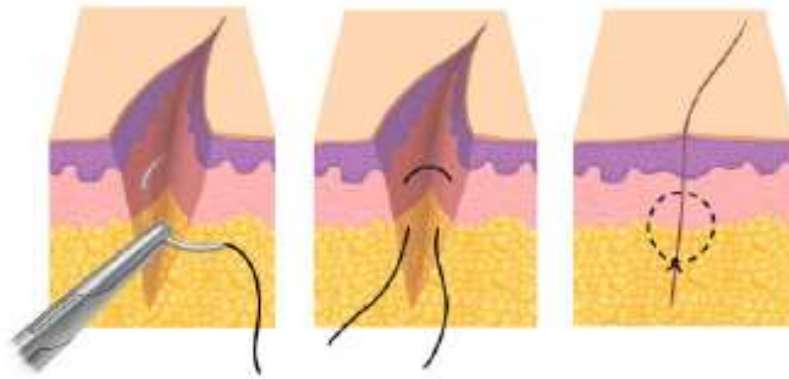


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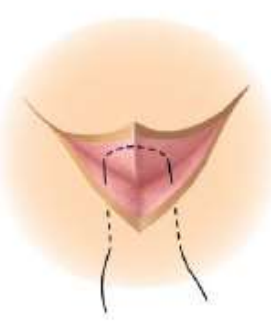
Simple continuous with vertical mattress



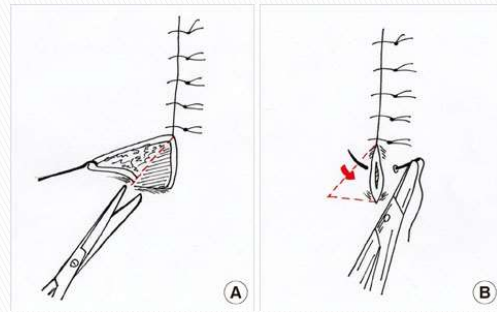
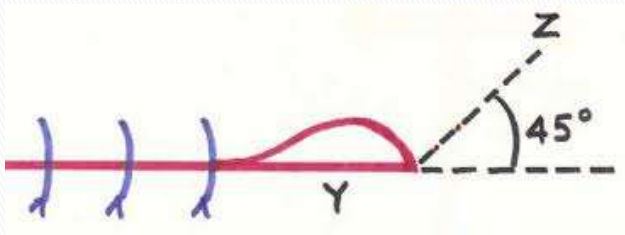
Technique for Sub-Dermal Suture



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



Dog Ear Repair



Demonstration video of suturing techniques

▶ https://www.youtube.com/watch?v=TFwFMav_cpE

One handed Surgical tying

▶ <https://www.youtube.com/watch?v=uFJbTbjeU4Y>

Two handed tie—Surgeon knot

▶ <https://www.youtube.com/watch?v=Gu8e0nArRuY>

Two handed tying

▶ <https://www.youtube.com/watch?v=cMr3DjBcAmY>

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)
- 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 cm² 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



Consent for use of this photo generously provided by Christopher Gascon

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:

- ▶ Deep wounds of hands or feet, or unknown depth of penetration
- ▶ Full thickness lacerations of eyelids, lips or ears
- ▶ Injuries involving nerves, larger arteries, bones, joints or tendons
- ▶ Crush injuries
- ▶ Markedly contaminated wounds requiring drainage
- ▶ Concern about Cosmetics

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
- ▶ **Michael Zenn M.D. Human tissue lab**, Duke University slide 44
- ▶ **Dr. Omedary**, from Youtube Slide 45, 46, 47
- ▶ **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> slide 11,13,15

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