Suturing Skills

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Objectives

- Describe and review normal wound healing.
- Describe and review wound closure techniques.
- Describe and review the fundamentals of wound preparation including the prevention of infection.
- Discuss & review use of antimicrobial cleaners & oral antibiotic medications for lacerations.
- Describe & review the use of local anesthesia, mechanism of action, dosages, precautions and adverse reactions & demonstrate the use of a local anesthetic.
- Describe and review techniques of basic suturing & simple knot tying.

Wound Healing

Maturation/Remodeling:

- Collagen formation restores strength to the wound
- This process begins within 48 hours of injury and peaks in the first week

Progressive increase in tensile strength

- By 2 weeks the wound acquires 20% of pre-wound strength
- By 5 weeks 50%
- By 10 weeks 80%
- Remodeling and maturation continues for one year or longer

Wound Healing

- Primary intention: Wound edges are re-approximated
  - Examples: well-repaired laceration, well reduced bone fractures
- Secondary intention: Wound is left open to granulate in
  - Examples: tooth extraction sockets, poorly reduced fractures
- Tertiary intention: Delayed Primary Closure: Wound left open to allow healing to begin after debridement of necrotic tissue.
  - Examples: healing by use of tissue grafts.

Wound Healing

- Primary Intention – sutured
- Secondary Intention – granulate
- Tertiary Intention – debride and stage for closure

Wound Preparation

- Do not suture dirty wounds
  - Know the patient's Tetanus Status
- Do not close wound on extremities or trunk over 12 hours
- Do not close wounds on face over 24 hours old
- Bites -should always avoid closure, if possible
  - If mammal, place on antibiotics
  - Augmentin is first line

Wound Preparation

- Normal Saline is the best
  - Solution to pollution is dilution
  - Irrigate with pressure
- Betadine or Hibilclens for the surrounding skin
  - Wound needs to be irrigated with saline.
- Peroxide and alcohol products tend to do more tissue damage.
- Shaving is not recommended

Types of Wound Closure

- 1. Steri Strips
- 2. Tissue Glue
- 3. Staples
- 4. Zip Stitch
- 5. Sutures

Steri-Strips

- 1. Helpful for surface laceration, non-motion area
- 2. Avoid areas prone to getting wet
- 3. Can use sutures or tissue glue
- 4. Can use Benzoin – additional Adhesive
- 5. Elderly – steri-strips first then glue

Tissue Glue

Good Candidate

- Non tension area, facial lacerations
- Superficial
- Non-hair bearing areas
- Not suitable for dog or cat bites
- Examples – Exofin, Dermabond

Tissue Glue Tips

- Key - "Thin to Win"
- Cleanse and dry wound area
- Apply two to three THIN layers
- Avoid oozing into the wound
- Dry between each layer
- Spontaneously Peels in 5-10 days
- No antibiotic ointment (removes glue)

Facial Laceration Considerations

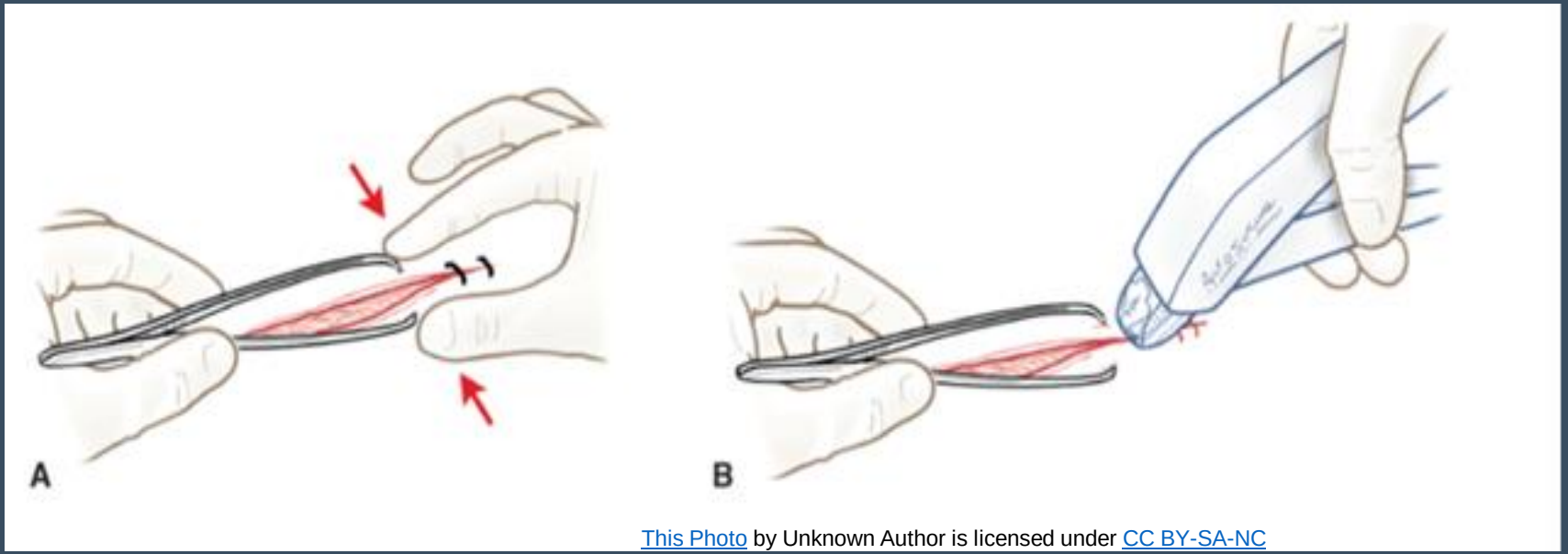
- Moist gauze over eye
- Trendelenburg position
- Antibiotic over lashes
- Avoid using on brow

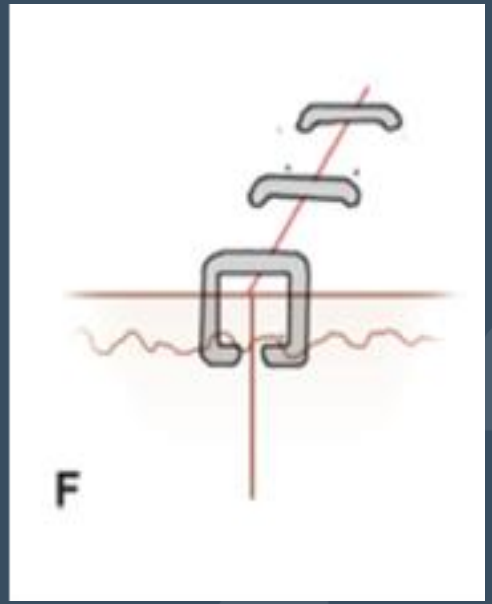
Demonstration of Glue Application

- https://www.youtube.com/watch?v=0n5gOOJdGxU

Staples

- Avoid in hands, feet and face
- Excellent for scalp
- Warn patient about noise

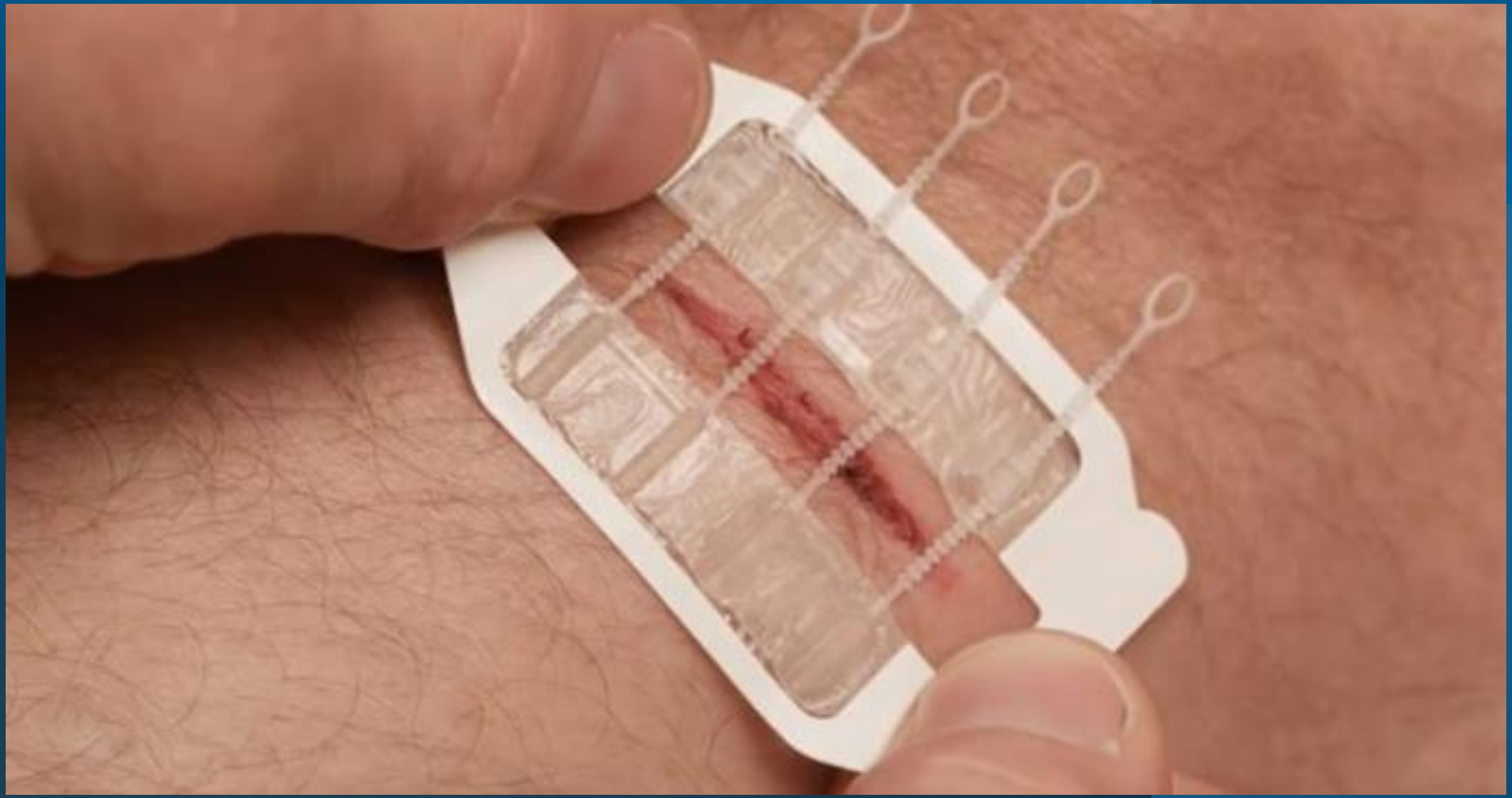




https://www.youtube.com/watch?v=jD18WeritMY

Zip Stich

- •Non-Invasive Skin Closure Replacement for Sutures and Staples
- •Use for cuts less than 4mm in width
- •Clean properly and allowed to dry before application



Demonstration of Zip Stitch

- Treating a wound with ZipStitch - YouTube

Local Anesthetics

Topical Agents

- Limited usefulness (primarily for children)
- Longer time to onset of action

Injectable Agents

- Local infiltration is preferable for surgery on intact skin, large wounds and when immediate anesthetic effect is required
  - Relatively quick onset of action (2-10 minutes) depending on agent
  - Duration of action 30 minutes to 6 hours depending on agent
  - Generally administered as an intradermal or subcutaneous injection blocking pain transmission from the free nerve endings in the epidermis and dermis; intradermal injection is more painful
  - Most injectable agents are weak bases with a pH of 8-9. Any physiologic acid potentially neutralizes the local reducing or eliminating effect or duration of action.

Local Anesthetics

Amides

- Lidocaine(most commonly used agent)
- Mepivacaine
- Bupivacaine/Marcaine

Esters

- Procaine/Novocaine
- Tetracaine
- Cocaine
- Benzocaine

Local Anesthetics

Lidocaine

Onset fast, 2-5 min

- Max does 5mg/Kg
- Max with epi 7mg/Kg
- Allergy rare
- Toxicity: dizziness, tinnitus, metal taste, seizure coma, ↓BP,↓HR death

Bupivicaine

- Onset slower 5-10 min
- Max does 2mg/Kg
- Max with epi 3mg/kg
- IV injection can cause refractory asystole.

Local Anesthetic

- Lidocaine causes a blockade of voltage-gated sodium channels
- This will interfere with the neural depolarization and transmission of impulses along axons

Local Anesthetic Injection

Reduce pain of injection

- Inject through wound edges not directly into skin
- Injected slowly to reduce pressure
- Can buffer 10cc of local with 1 cc of $NaHCO_3$ (Sodium Bicarbonate)

Dosage of Lidocaine

Lidocaine 1%

- 4.5mg/kg
- 30 ml for adult (70 kg)

Lidocaine with epinephrine 1%

- 7 mg/kg
- 50 ml for adult (70 kg)

	Dorsal Web Space	Transthecal	Volar Subcutaneous
Also known as…	Traditional Finger Block	Flexor Tendon Sheath Block	Tumescent Block
Use for	Fingers or Toes	Fingers only	Fingers only
Success rate (%)	60-92	94-100	89
Volume of anesthetic (assuming 1% lidocaine)	1-3mL per aspect (2-6mL total)	1.5-3mL	2-3mL
Onset of action (min)	3.9-4.5	2.8-7.2	1.6-3.3
Advantages	Enhanced anesthesia to dorsal digit and nail bed	Single injection only, reduced risk of neuromuscular injury or compression	Single injection only, easier to perform, patient preferred (less procedure related pain)
Disadvantages	Two injections, increased rate of incomplete anesthesia, Higher potential for direct nerve injury	Potential increased risk of post-procedural pain 2/2 tendon sheath puncture/injection	Reduced dorsal anesthesia compared to other blocks

https://journalfeed.org/article-a-day/2022/lets-get-digital-how-to-do-five-digital-blocks/

The Web Block

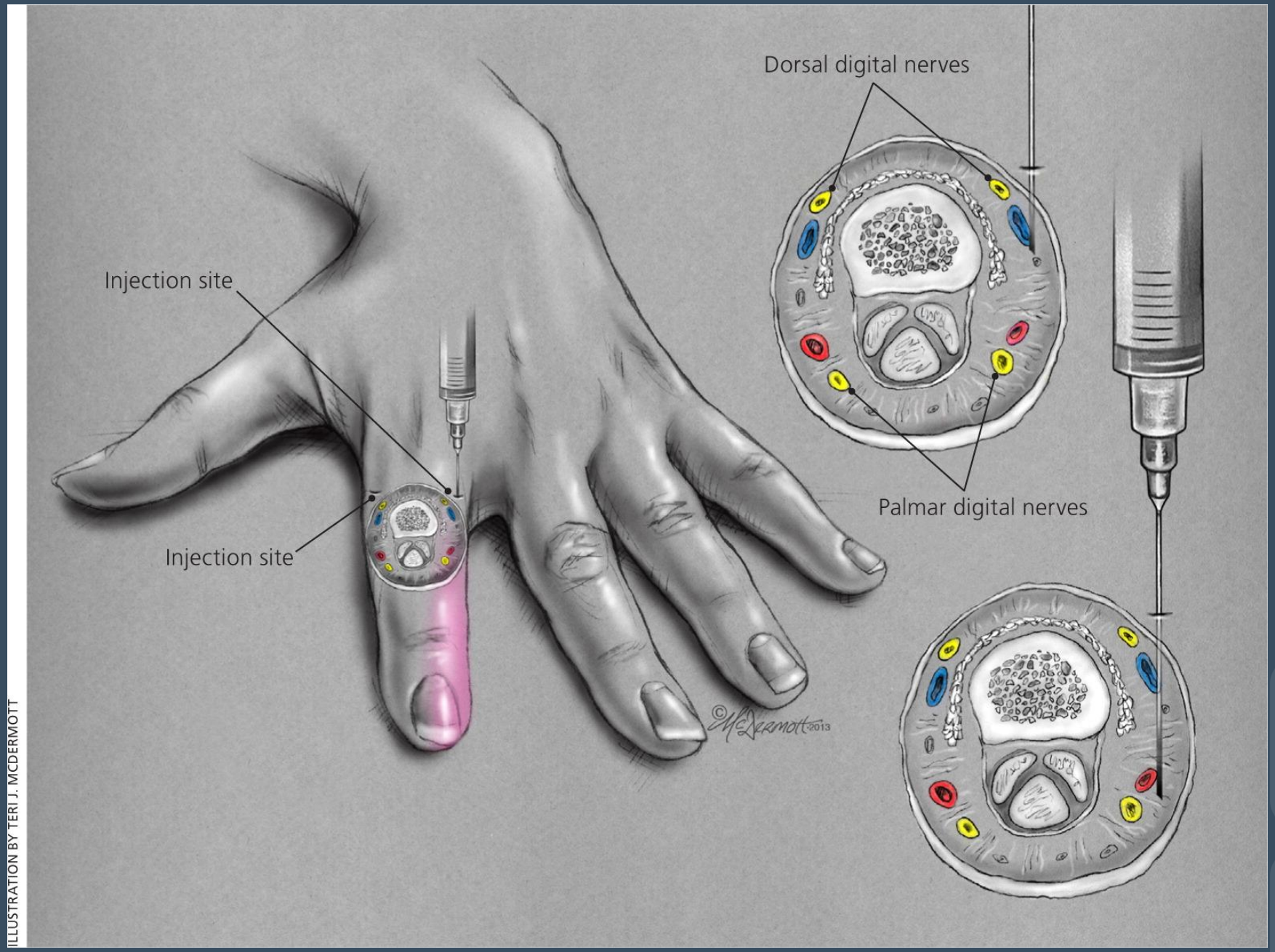
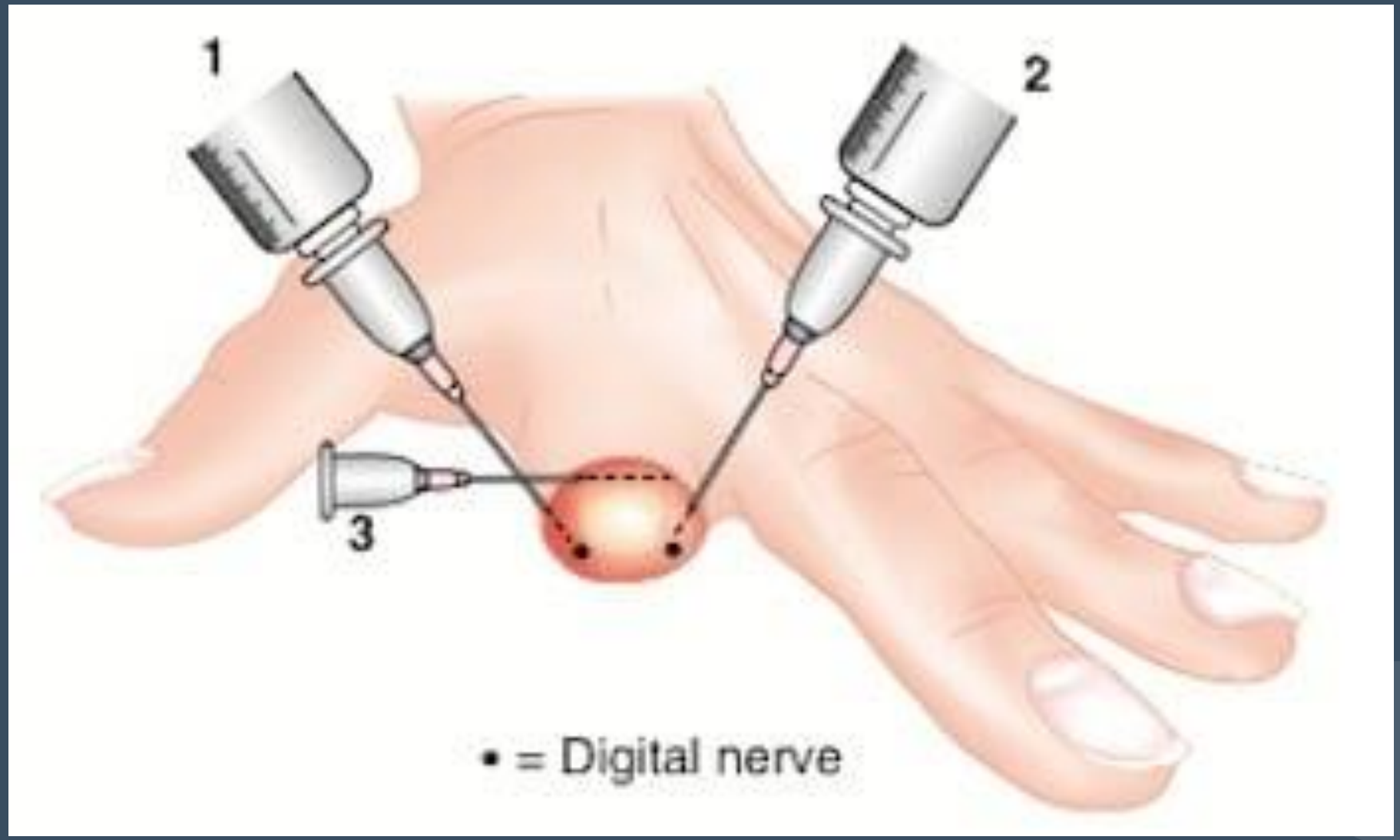


ILLUSTRATION BY TERI J. MCDERMOTT

3-Sided digital block



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Volar Subcutaneous Block Technique

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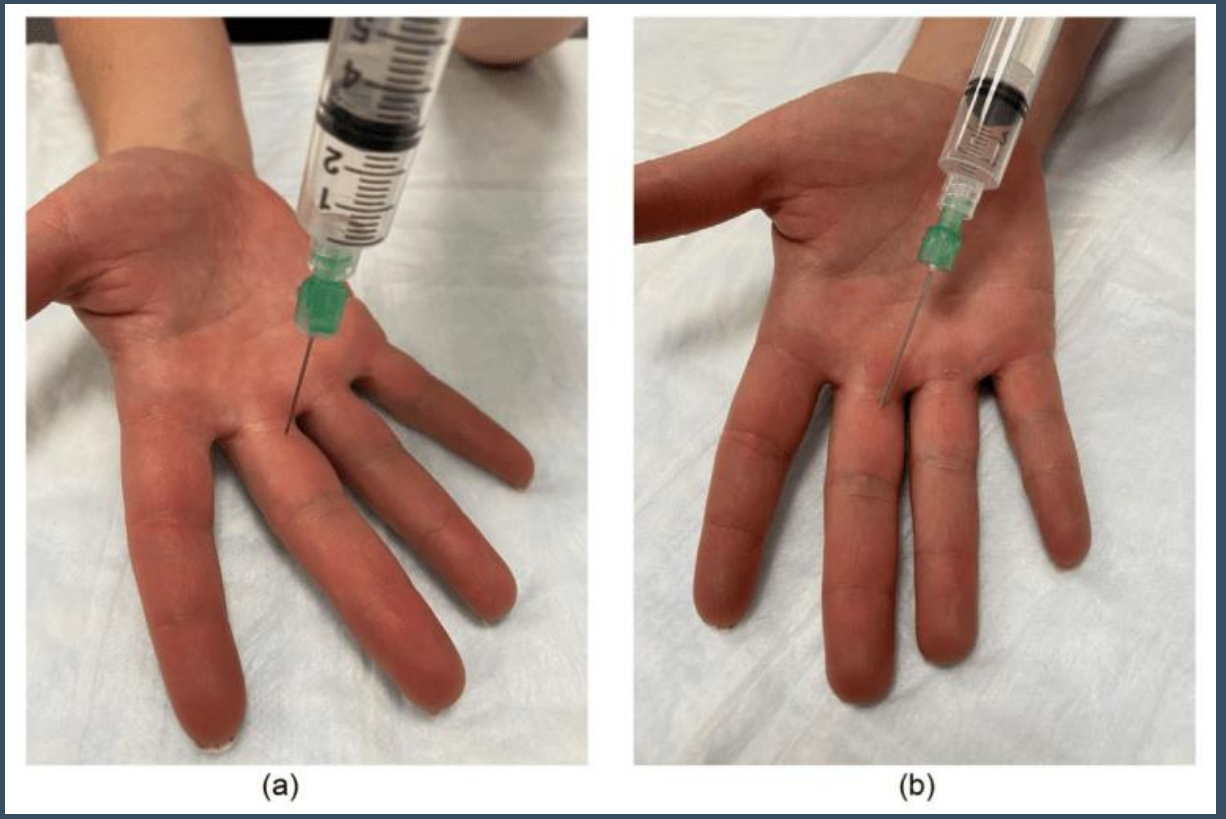
Transthecal Block Technique



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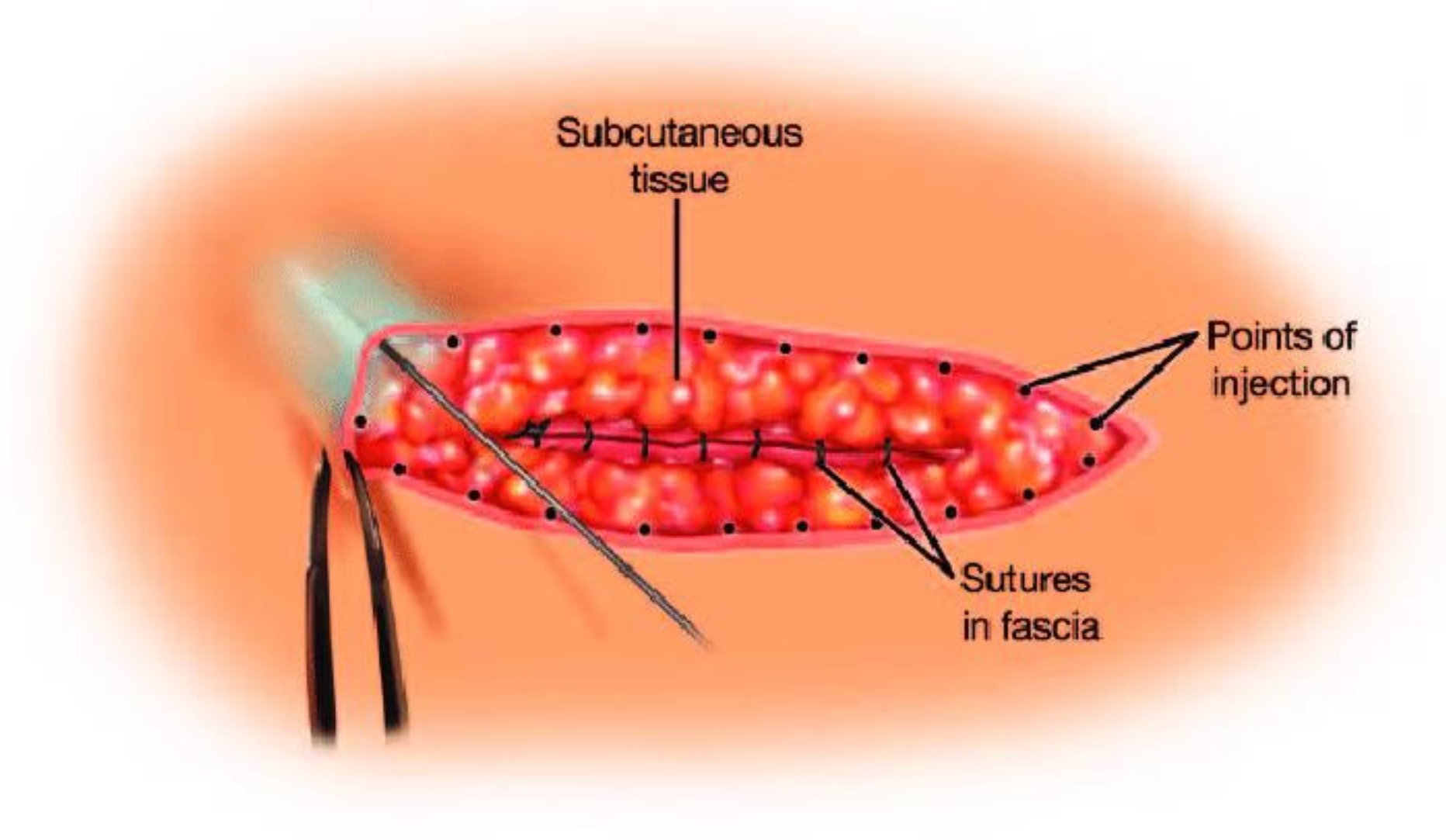

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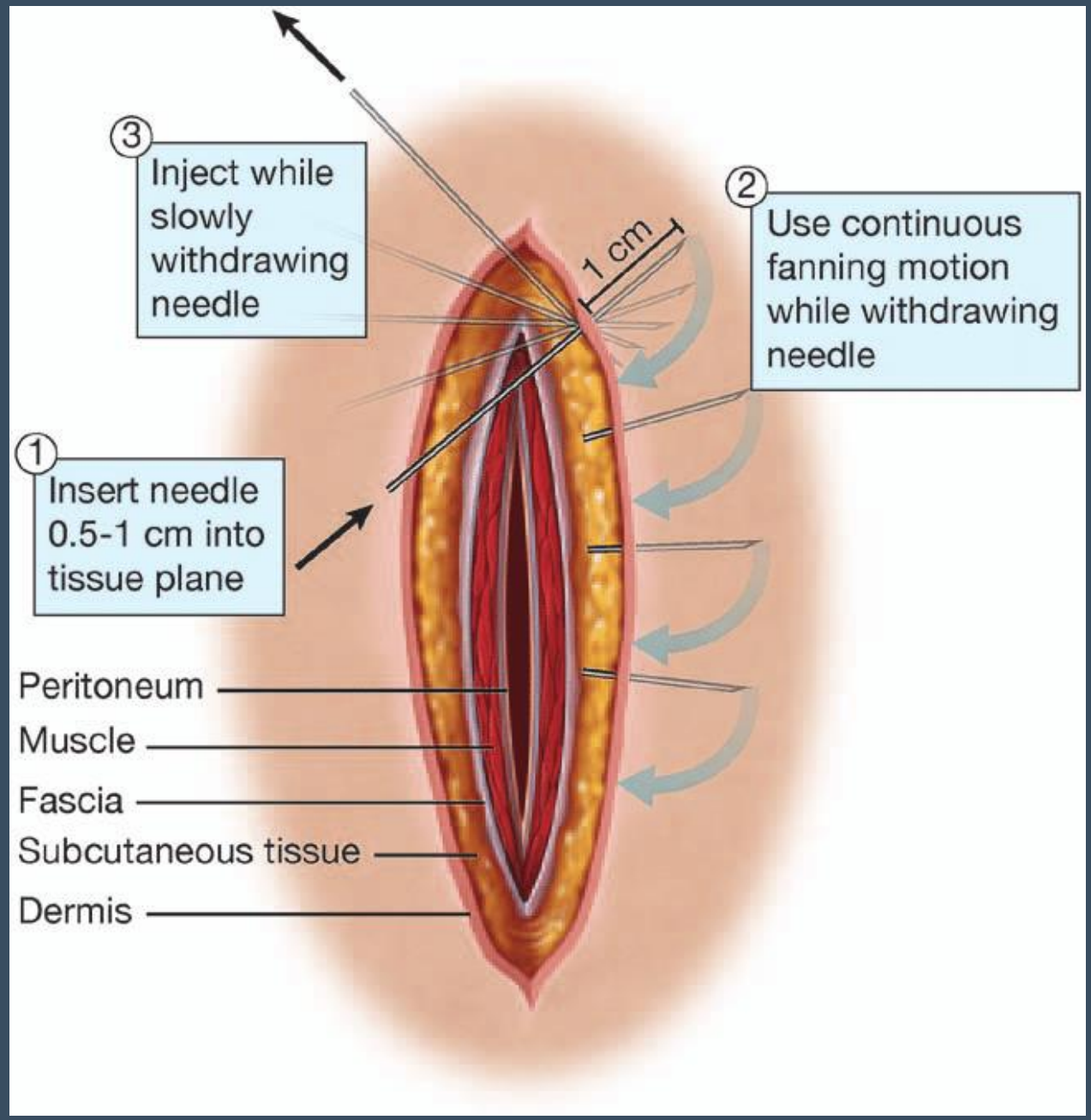


https://www.researchgate.net/figure/infiltration-with-moving-needle-technique-to-optimize-distribution-of-the-local_fig4_312421850

Suture Material

- Criteria
  - Tensile strength
  - Holds knot well
  - Easy handling
  - Low tissue reactivity
  - Ability to resist bacterial infection

Suture Materials

- Absorbable
  - Lose tensile strength within 60 days
  - Do not need removal
- Non-Absorbable
  - Maintain tensile strength
  - Need removal

Synthetic Absorbable

- Monofilament
  - Polydioxanone (PDS)
    - 50% tensile strength =30+ days
    - Sites: need for prolonged strength
  - Poliglecaprone 25 (Monocryl)
    - High tensile strength deminishes over 14 days
    - Sites: subcuticular
- Braided
  - Polyglycan 910 (Vicryl)
    - Braided synthetic polymer
    - 50% tensile strength for 30 days
    - Used subcutaneous

Natural Absorable

- Plain Gut
  - Derived from small intestine of sheep
  - Loses 50% tensile strength in 7 days
  - Sites:mucosal surfaces
- Chromic Gut
  - Treated with chromic acid to delay absorption
  - Loses 50% tensile strength in 10-14 days
  - Sites: Episiotomy

Synthetic Non-Absorbable

- Monofilament
  - Polypropylene (Prolene)
    - Maintains tensile strength
    - Minimal tissue adherance
  - Nylon (Ethilon)
    - Gradual loss of tensile strength
    - Holds knot well
- Braided
  - Polyester (Ethibond)
    - Gradual loss of strength over time
    - Minimal tissue reaction

Natural Non-absobable

- Braided
  - Silk
    - Non-reactive
    - Maintains tensile strength
    - Holds knot well

Suture Needles

Taper

- Used most commonly on internal structures
  - Bowel
  - Mucosa
  - Vessels

Cutting

- Used most commonly on skin.

Suture Sizes

- Sizes 2 thru 11-0
  - Largest diameter is #2
  - Smallest diameter is 11-0
  - Most common sizes 3-0 and 4-0
    - Extremities, scalp, chest back
  - 5-0 and 6-0
    - Hands, face

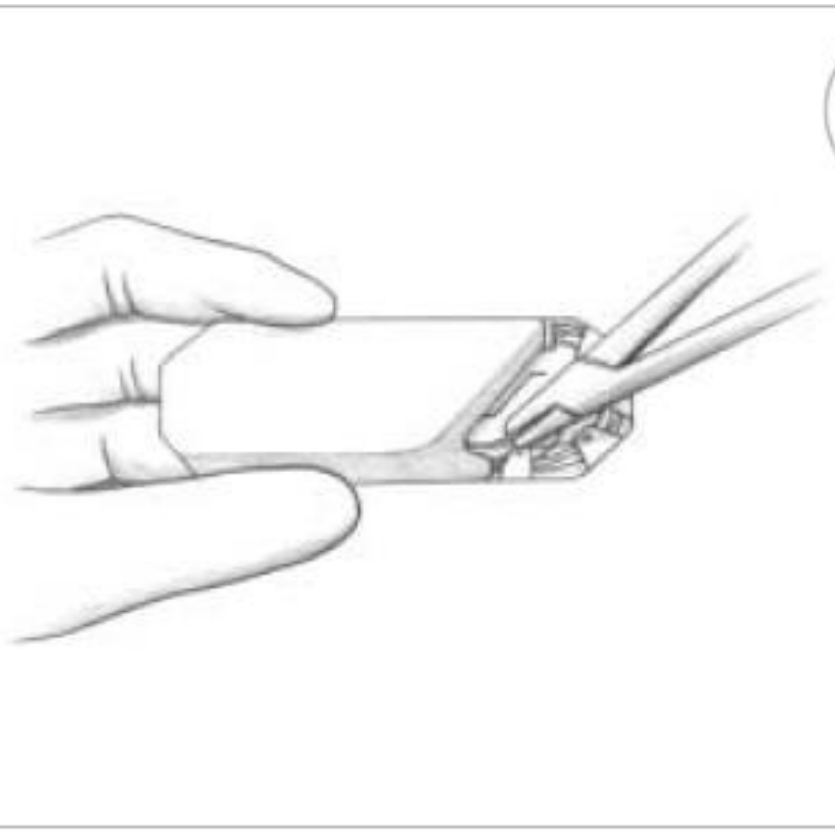


FIGURE 2

METHOD FOR PREPARING ONE-STEP RELAY PACKAGE SUTURES

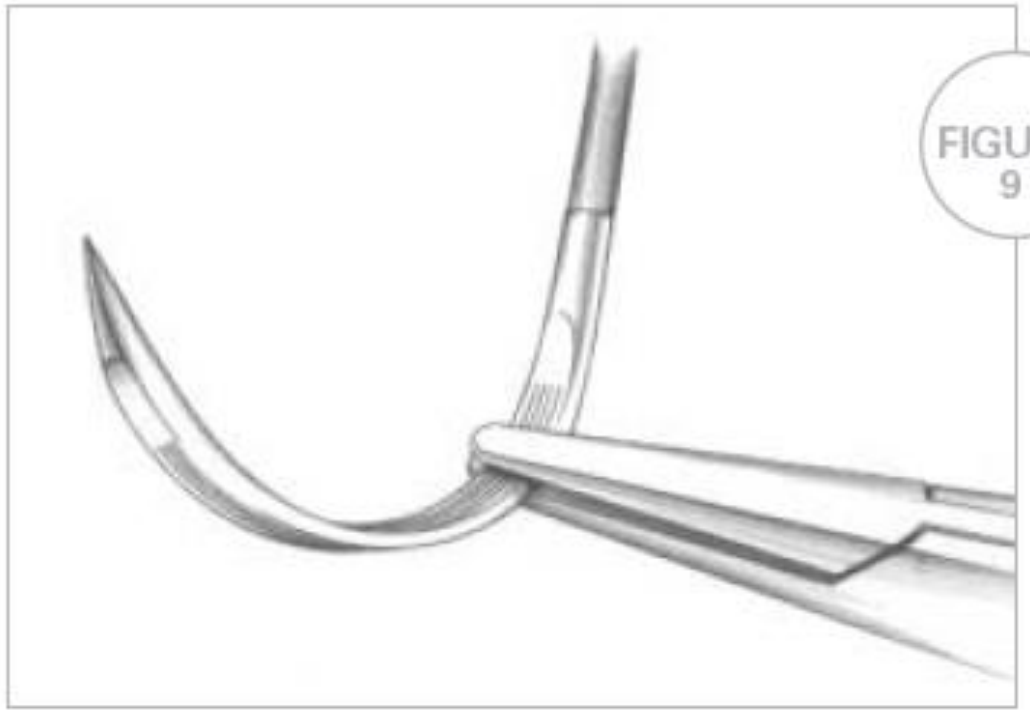
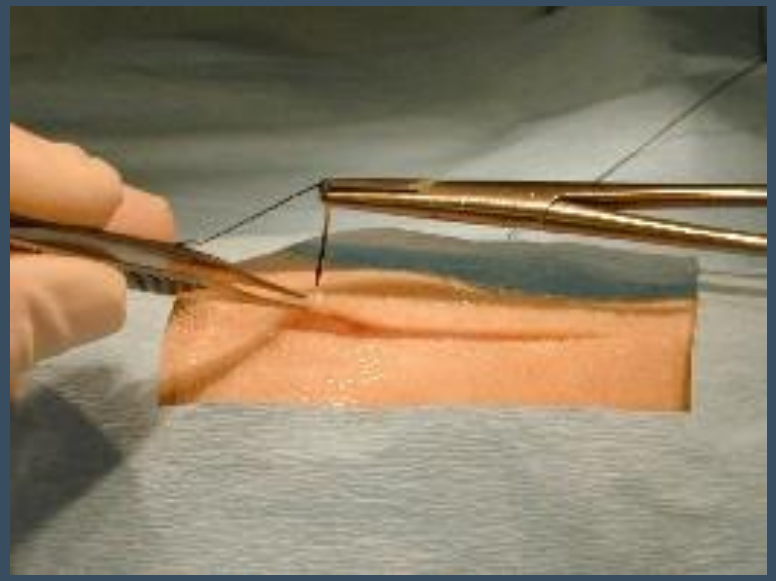


FIGURE 9

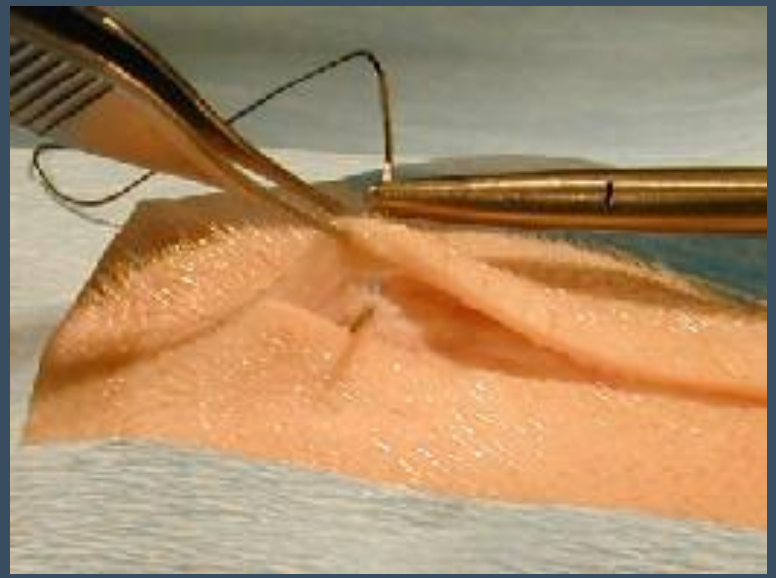
ARMING A NEEDLE-HOLDER PROPERLY

Grasp the needle one-third to one-half of the distance from the swaged end to the point.

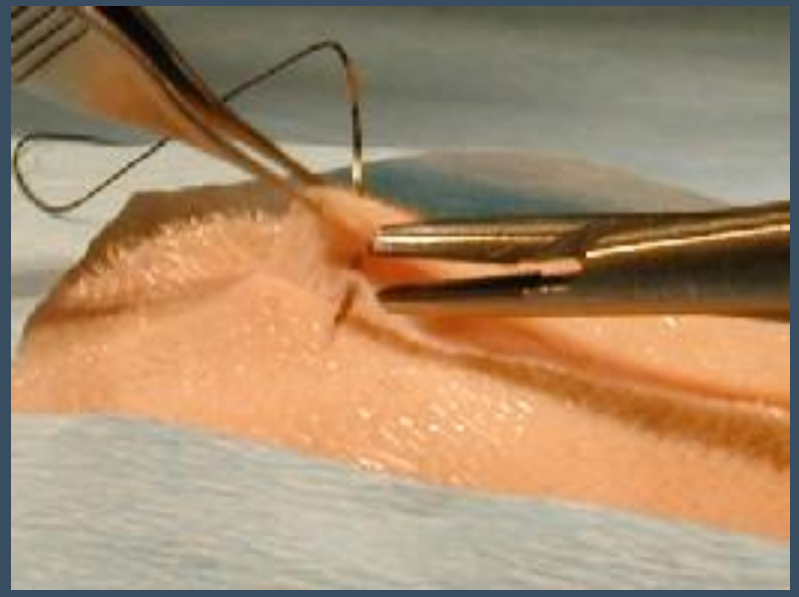
Simple Interrupted Stitch



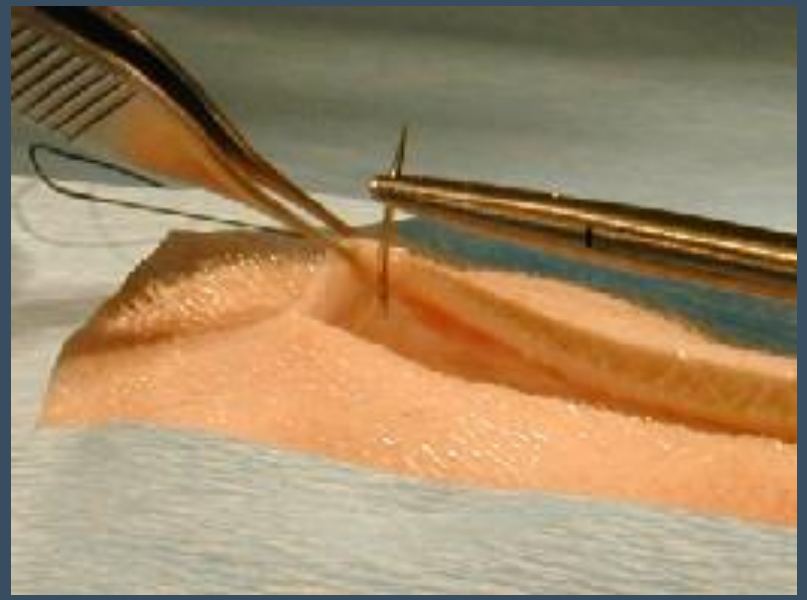
- Grasp the skin edge with the forceps and slightly **evert the skin edge**
- Then pronate the needle-holder so that the needle will **pierce the skin at 90º**
- Ensure the trailing suture material is out of the way to avoid tangling



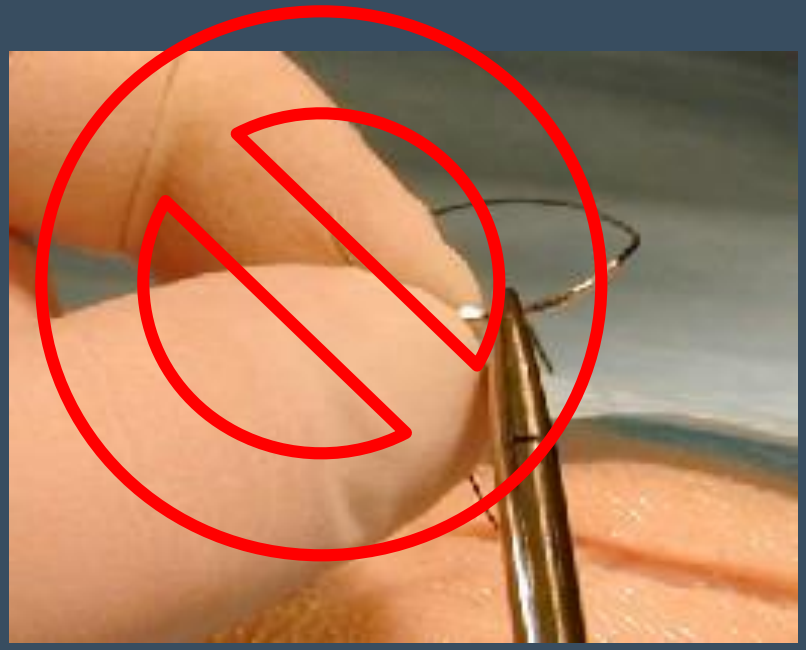
- Drive the needle through the full thickness of the skin by supinating the needle-holder
- Keeping the shaft of the needle perpendicular to the skin allows **the curvature of the needle to traverse the skin** as atraumatically as possible



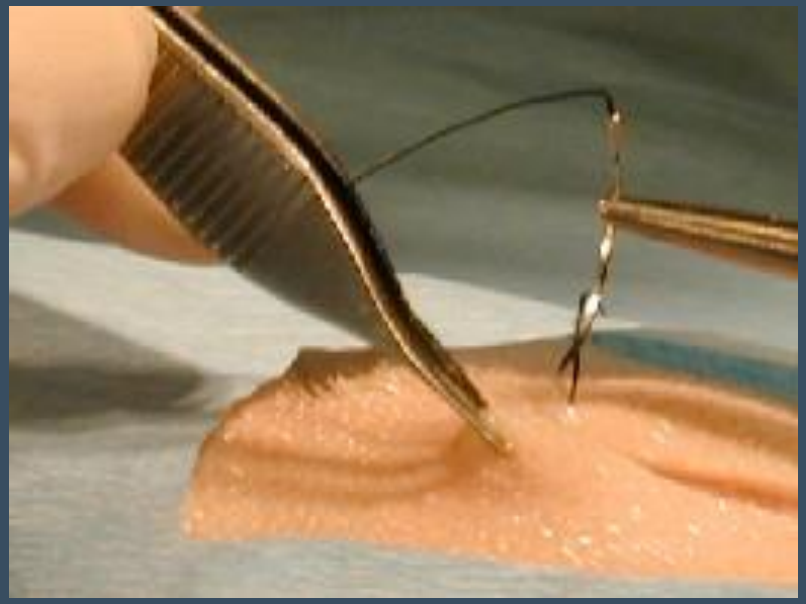
- Release the needle and pronate the needle-holder
- Regrasp the needle proximal to its pointed end
- Maintain tension with the forceps to prevent the needle from retracting



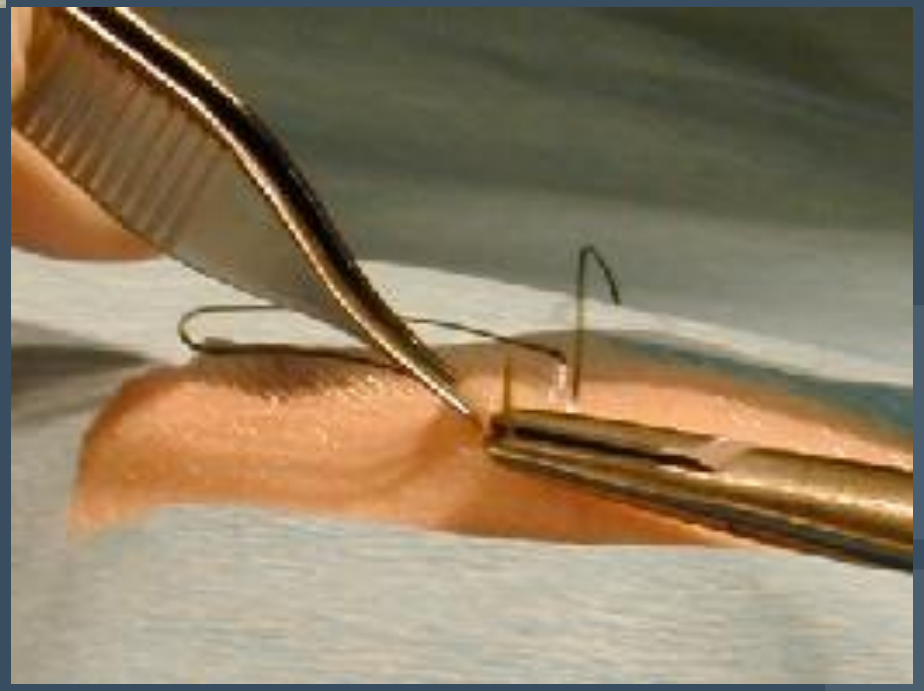
- Again, supinate the needle-holder to rotate the needle upwards and through the tissue

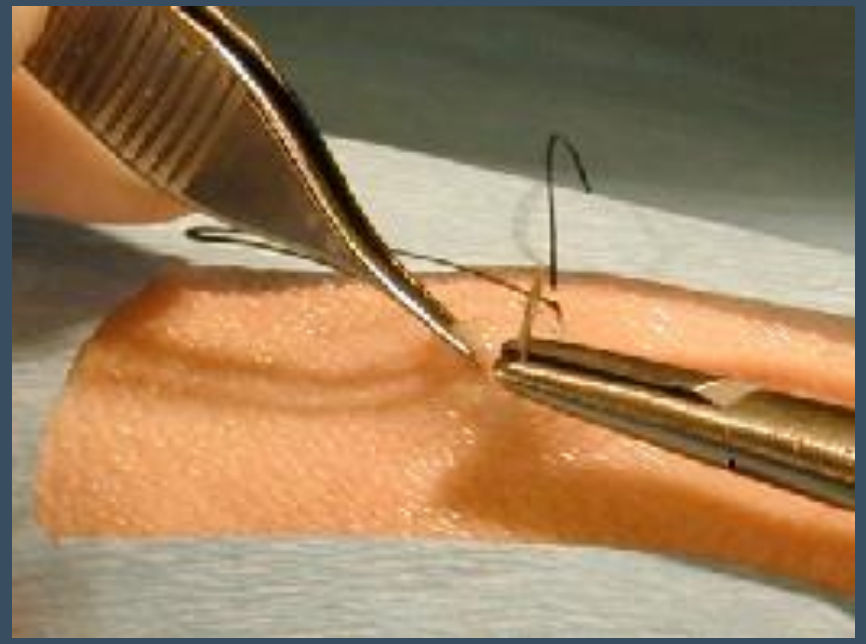


- Regrasp the needle with the forceps in order to rearm the needle-holder

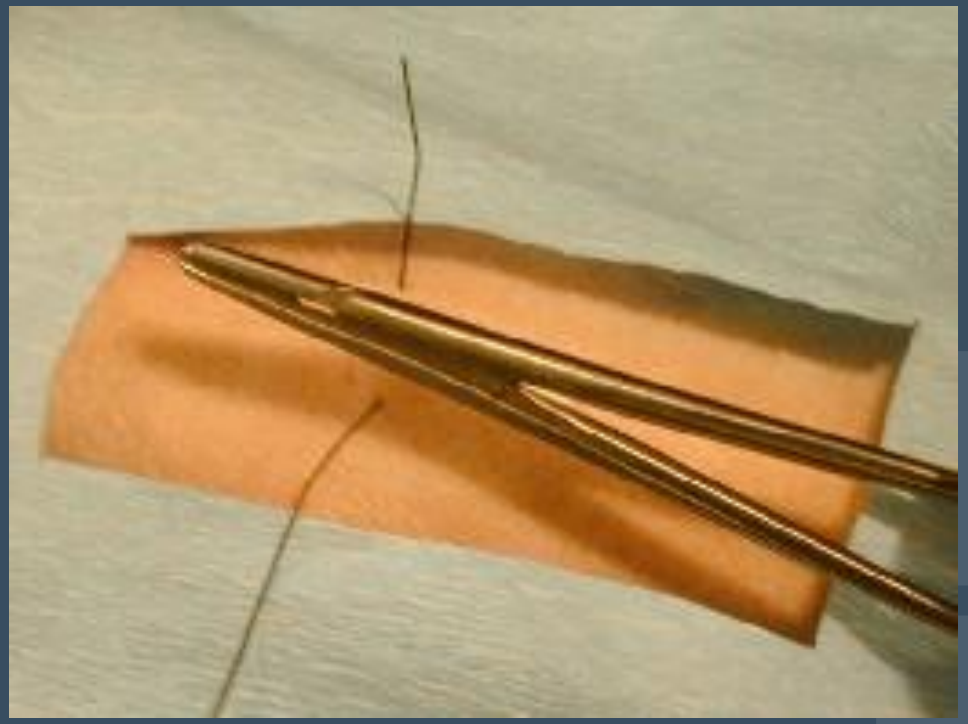


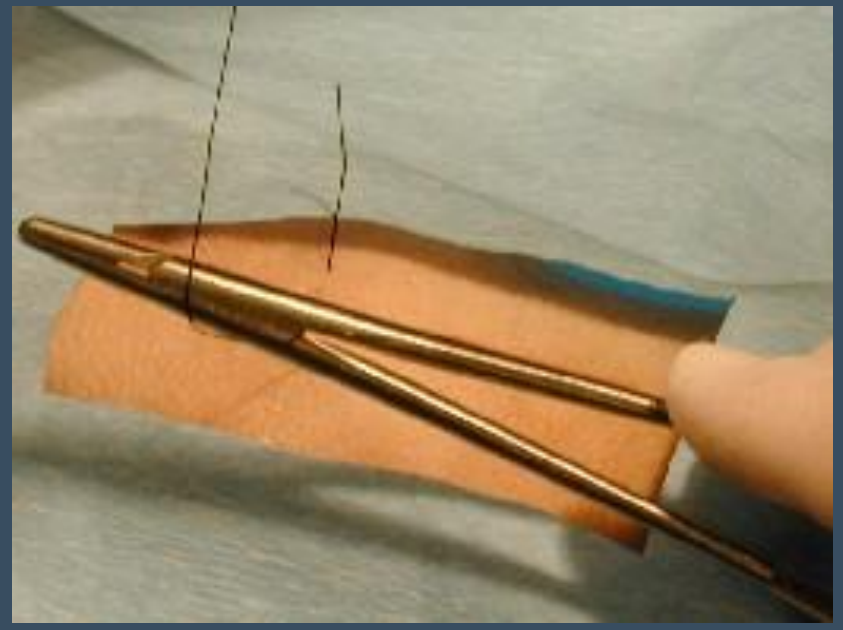
- Grasp and slightly evert the opposing skin edge with the forceps
- Repeat the needle drive process



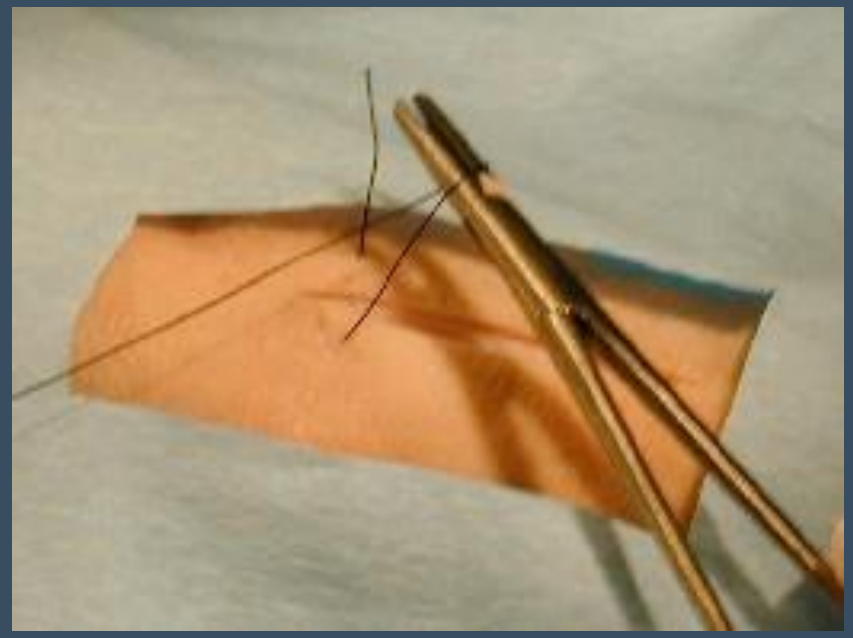


- Pull the suture material through the skin until 2-3 cm is left protruding
- Discard the forceps and use your free hand to grasp the long material end in preparation for an instrument tie
- Place the needle-holder between the strands

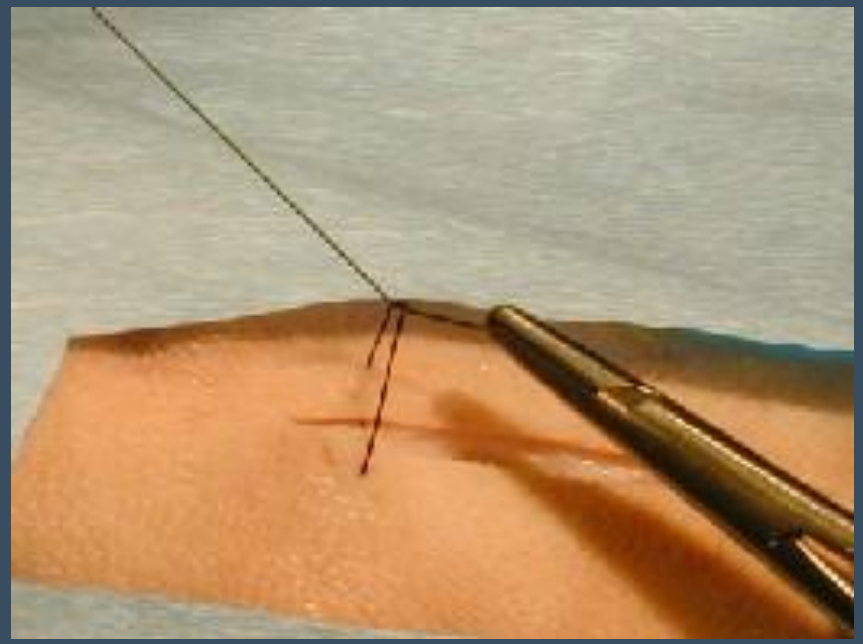




- Wrap the long strand around the needle-holder to form the loop for the first throw of a square knot

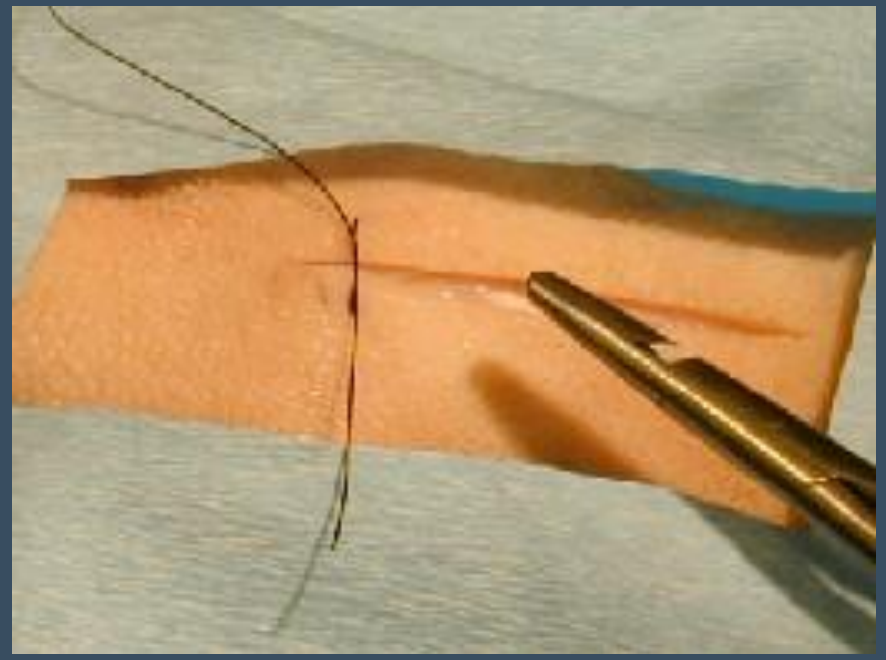


- Rotate the needle-holder away yourself and grasp the short end of the suture

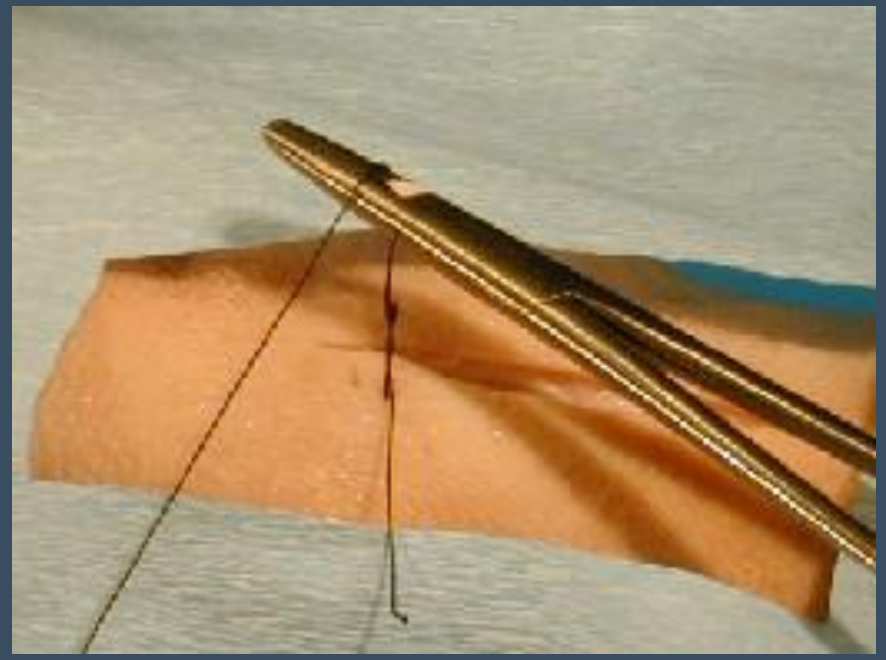


- Draw the short end back through the loop towards yourself

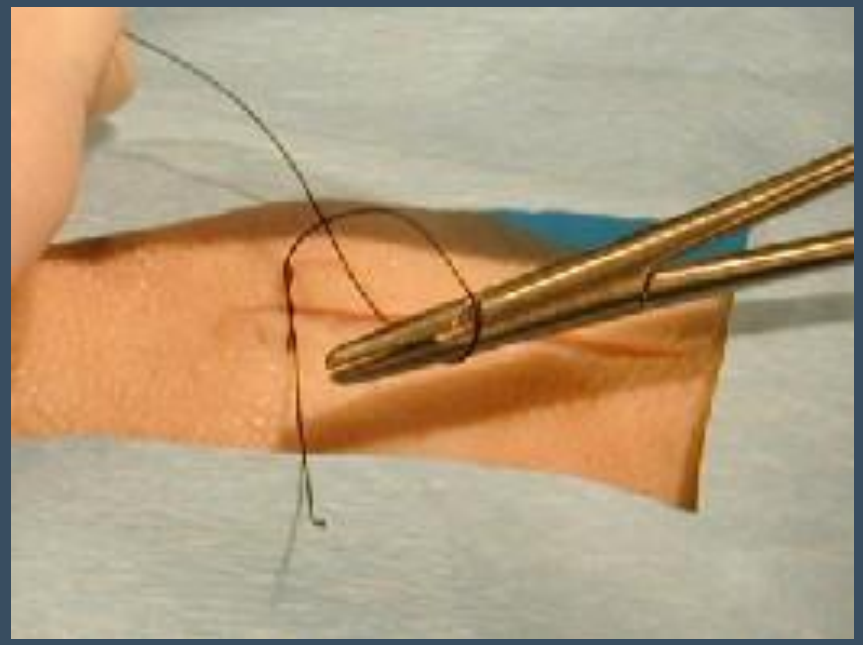
- Tighten the first throw



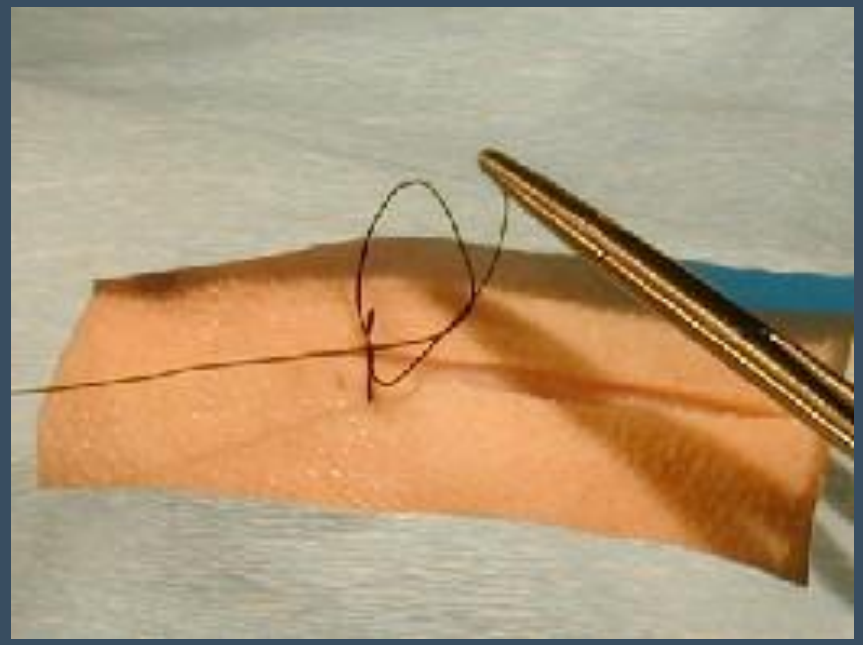
- Tighten just enough to approximate the skin edges but not enough to strangulate the tissue



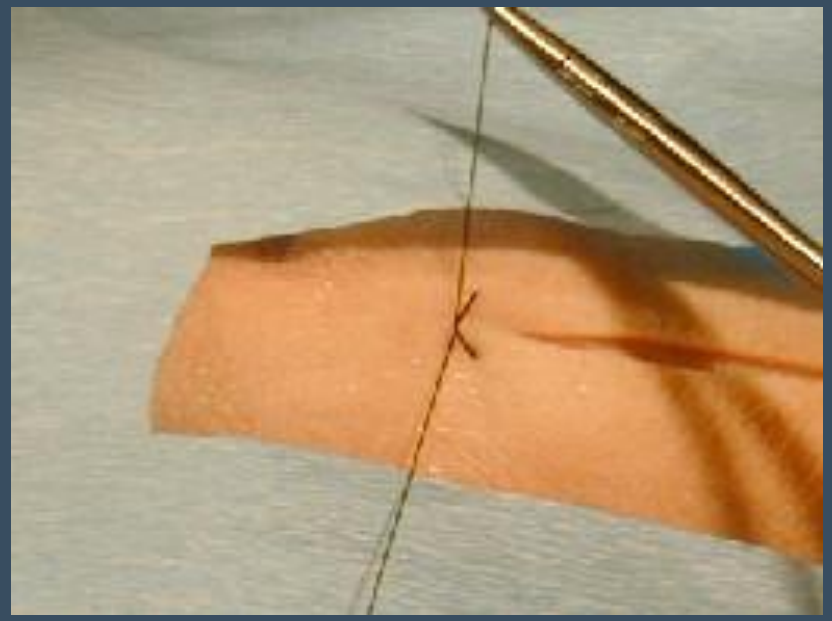
- To begin the second throw of the square knot, again wrap the long strand around the needle-holder



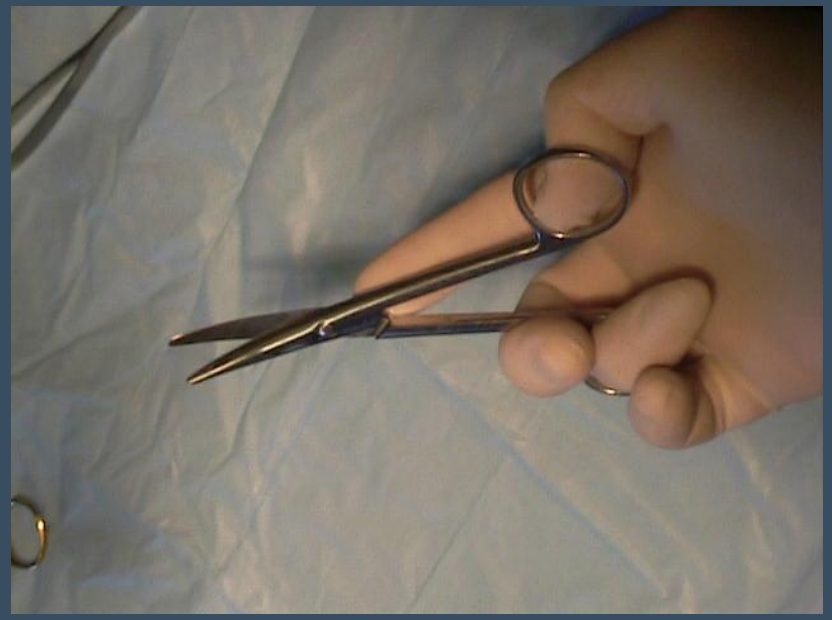
- Rotate the needle-holder towards yourself to retrieve the short end



- Grasp the short end and draw it through the loop

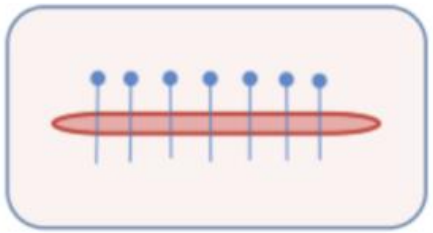
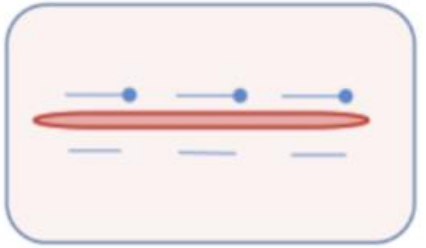
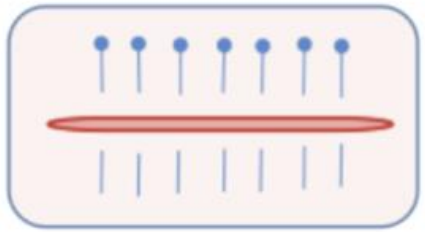
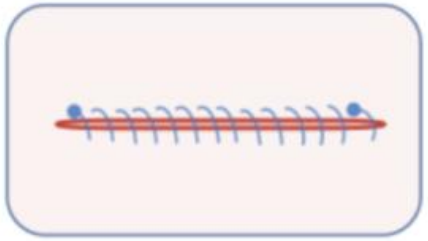


- Tighten the second throw securely against the first
- Ensure the knot is to one side of the wound to avoid involvement in the clot

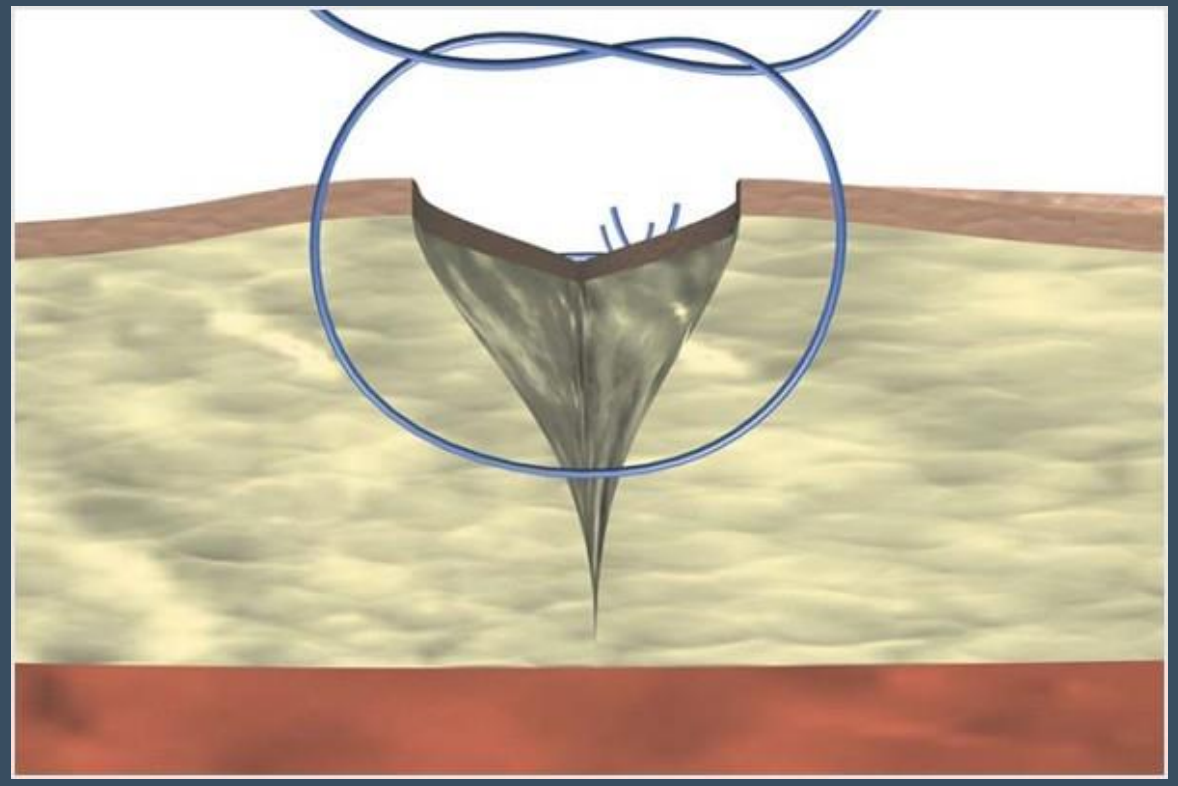


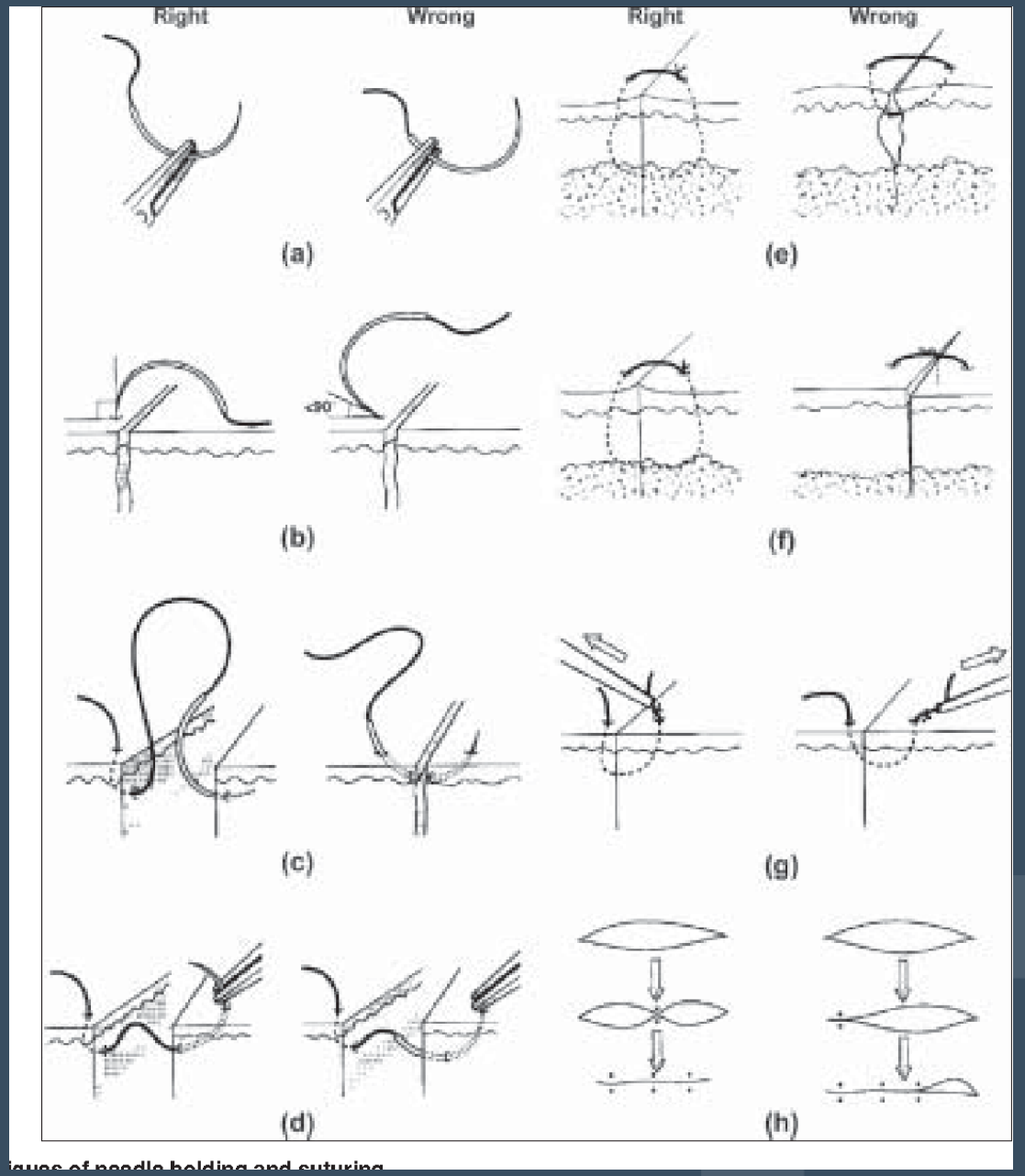
- In one hand hold the scissors as shown
- With the other hand maintain tension on the suture material
- Slide the tips of the scissors down the strands to the point where they will be cut
- Cut the suture material leaving 5mm tails (important for removal of external non-absorbable sutures)

Suture Technique

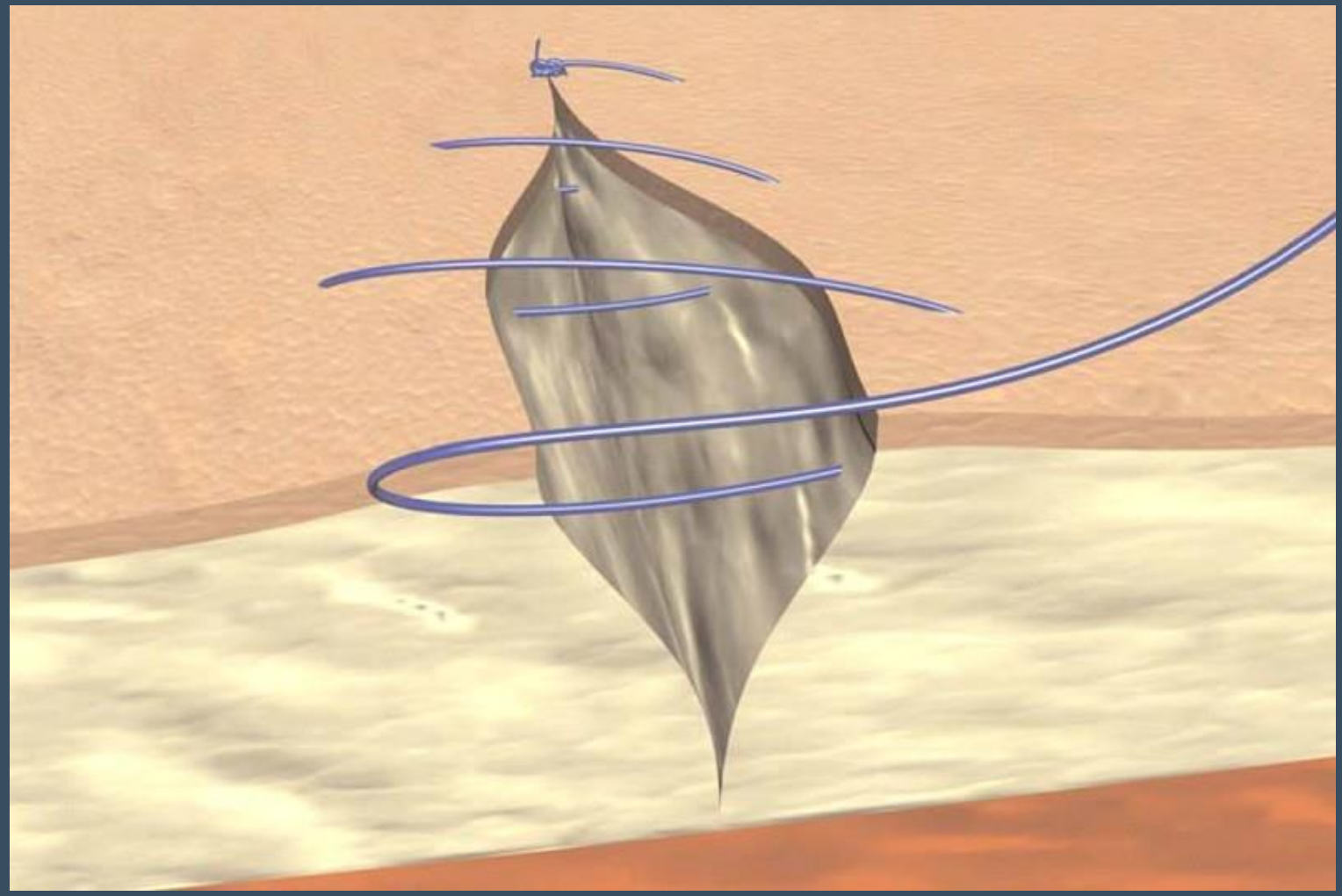
Technique	Indication	Diagram
Simple Interrupted	Go-to method of repair	
Horizontal Mattress	To repair high tension lacerations	
Vertical Mattress	To repair deep, gaping lacerations without using separate deep sutures	
Running	To quickly repair non-tensile lacerations	

Simple Interrupted

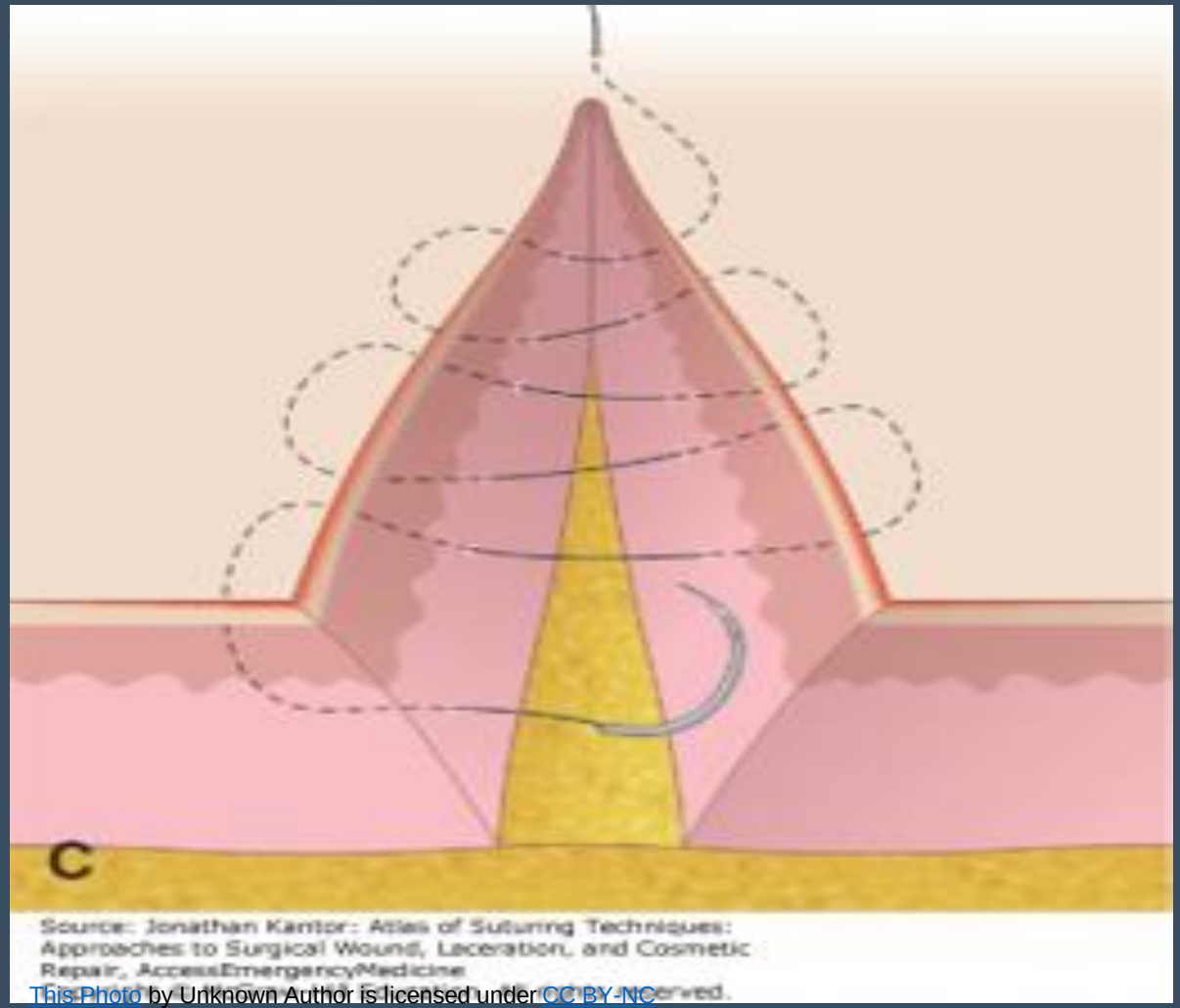




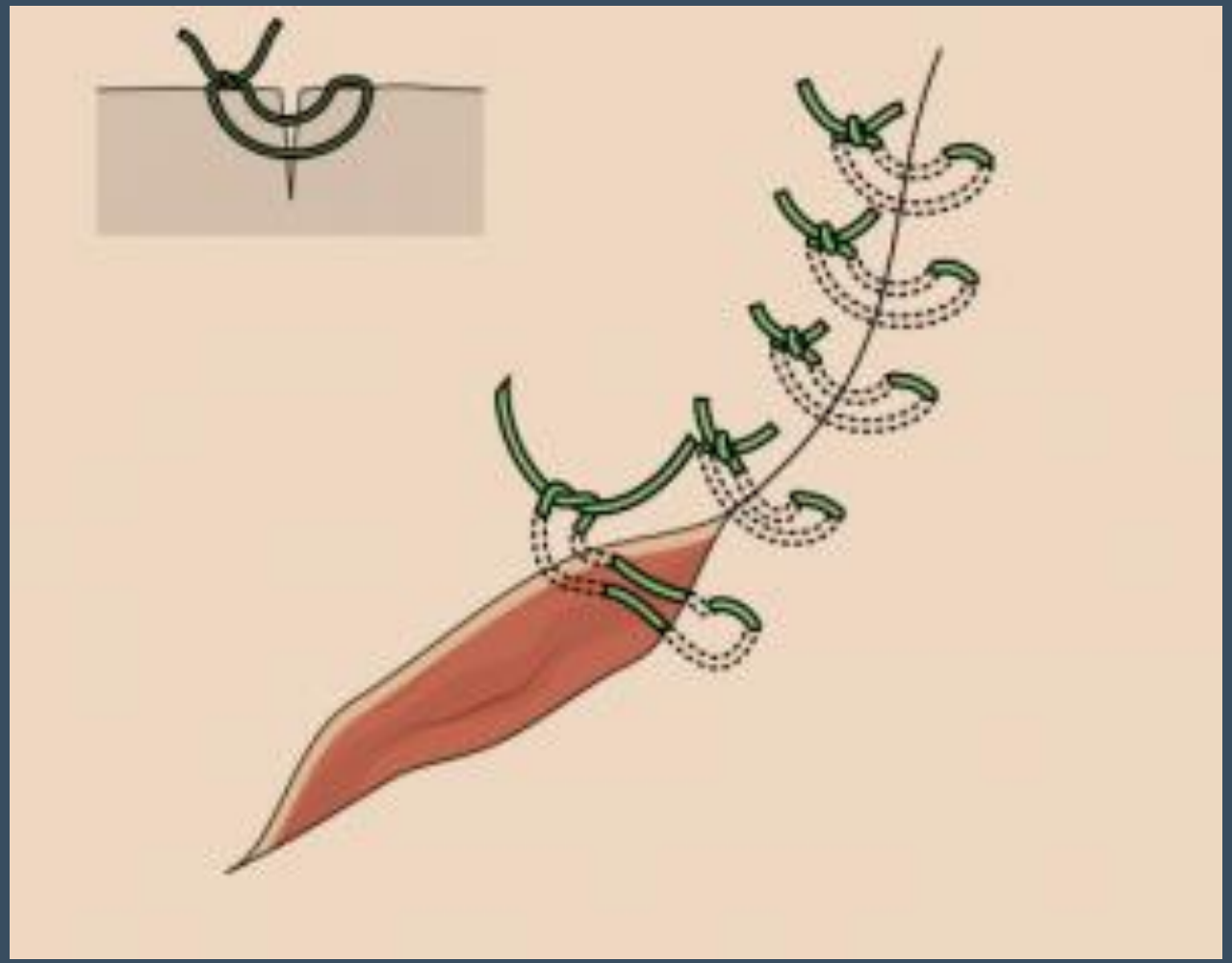
Simple Running



Running Subcuticular



Vertical Mattress



Suture Removal

- Sutures should be removed:
  - Face: 5 - 7 days
  - Scalp: 7-10 days
  - Trunk: 7-10 days
  - Limb: 7-10 days
  - Foot: 10-14 days
- Steps involved in removal:
  - Reassure patient that the procedure is not painful
  - Cleanse the skin
  - Grasp one of the suture ‘tails’ with forceps and elevate
  - Slip the tip of the scissors under the suture and cut close to the skin edge (to minimize the length of contaminated suture pulled through the wound)
  - Remove knotted suture
  - Reinforce the wound Steri-Strips if required

Contraindications to Suturing

- Redness
- Edema of the wound margins
- Infection
- Fever
- Puncture wounds
- Animal bites
- Tendon, nerve, or vessel involvement
- Wound more than 12 hours old (body) and 24 hrs (face)

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

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Questions ?

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