Keep Them in Stitches: An Introduction To Wound Closure

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Dr. Chris Hemmer
DNP, APRN, ANP, ONP-C, FAANP, FNAON

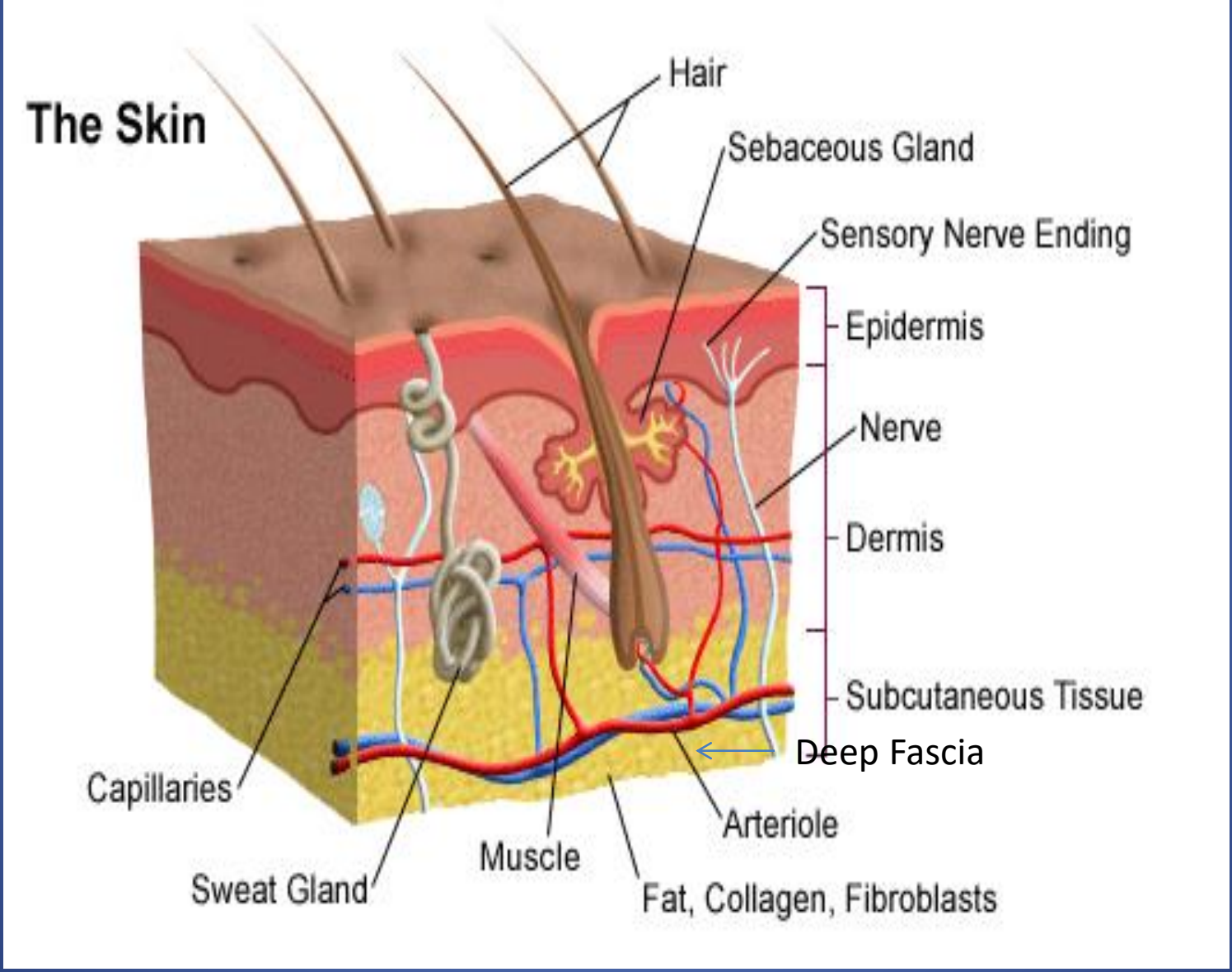
Objectives

Identify	Identify Methods of Wound Closure (steri-strip, adhesive, staples, suture)
Discuss	Discuss Complications in Wound Management
Perform	Perform Simple Suturing Technique

Disclosures

- I have no current financial arrangements with any commercial interest that might have direct interest in the subject matter of this CE activity
- Dr. Christopher Hemmer, 08/2025

The Skin - Review

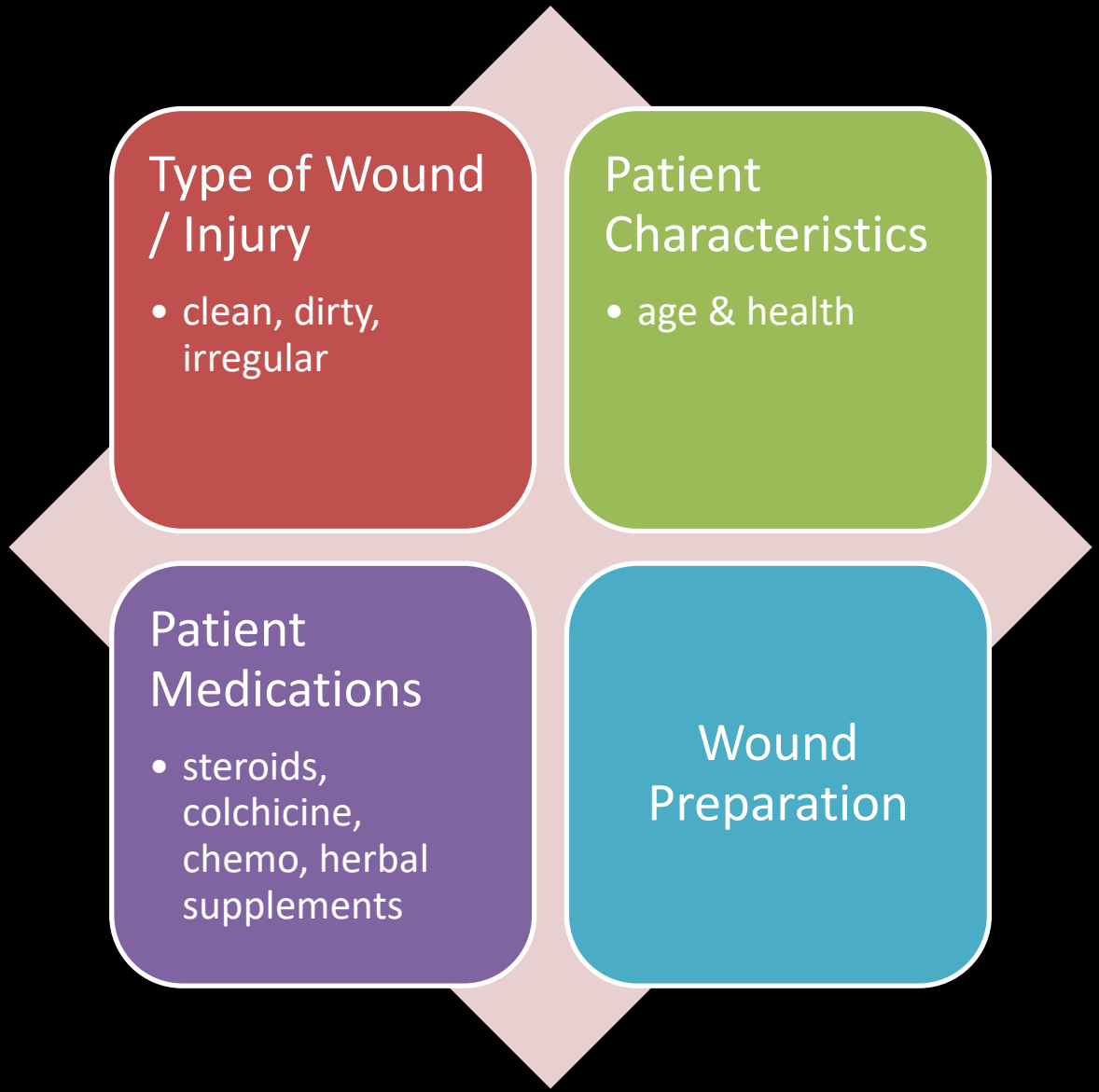


Wound Healing

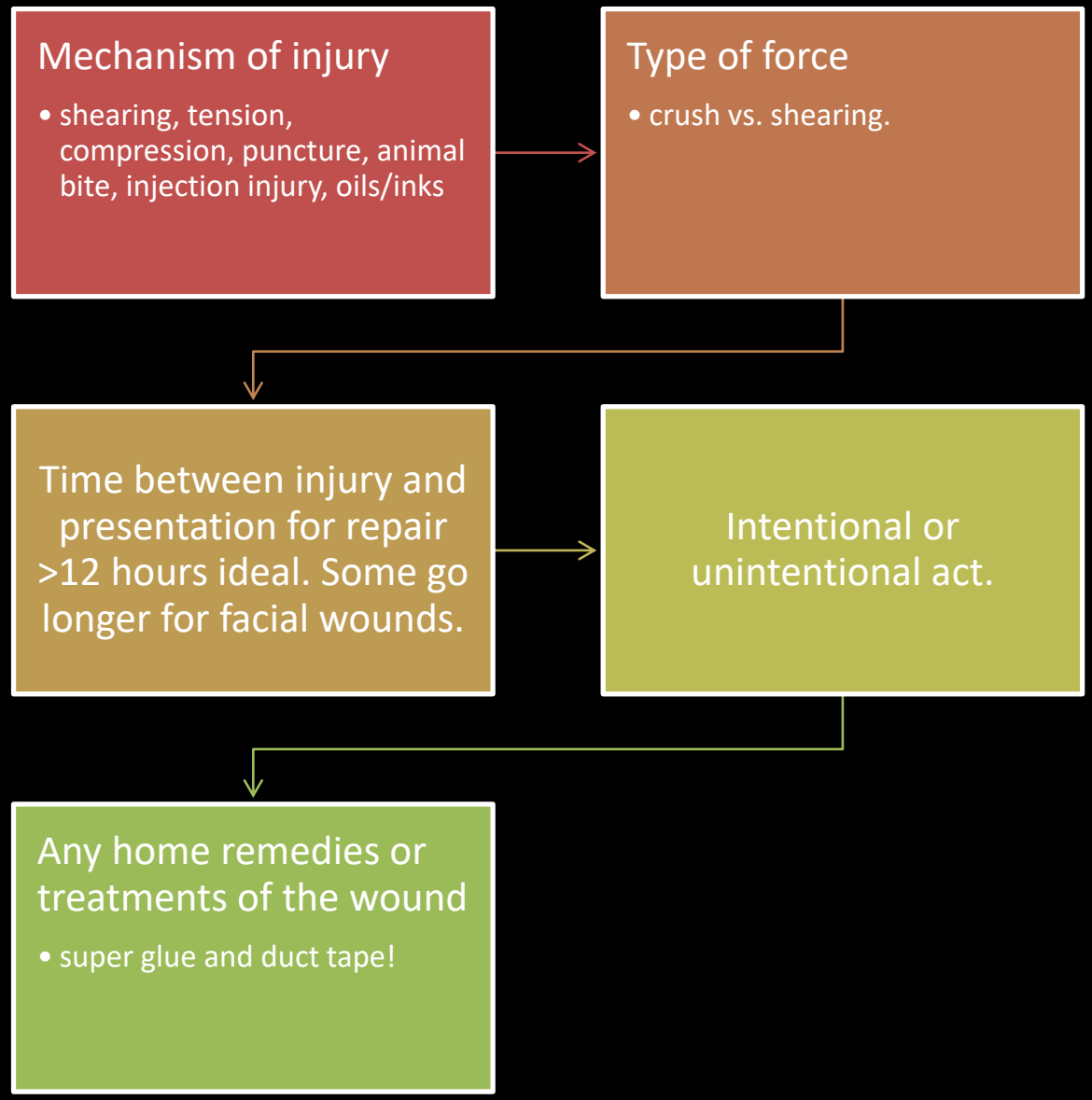
- Primary and Secondary Intention

- Immediate response phase (seconds to hours)
  - Platelet sent to slow bleeding
- Inflammatory phase (hours)
- Epithelialization phase (hours to weeks)
  - Everted – bridging occurs in 18-24 hrs
  - Approximated - 36 hrs
  - Inverted – 72 hrs
- Maturation (Tissue Remodeling) - collagen synthesis phase (days to months)

Factors That Influence Wound Healing



Type of Wound / Injury



Patient Characteristics

- Advanced age
- Malnourished, Poor hygiene
- Alcoholism, DM, PVD
- Uremia , Liver disease, Connective tissue diseases
- Hypoxia
- Anemia
- Multiple trauma

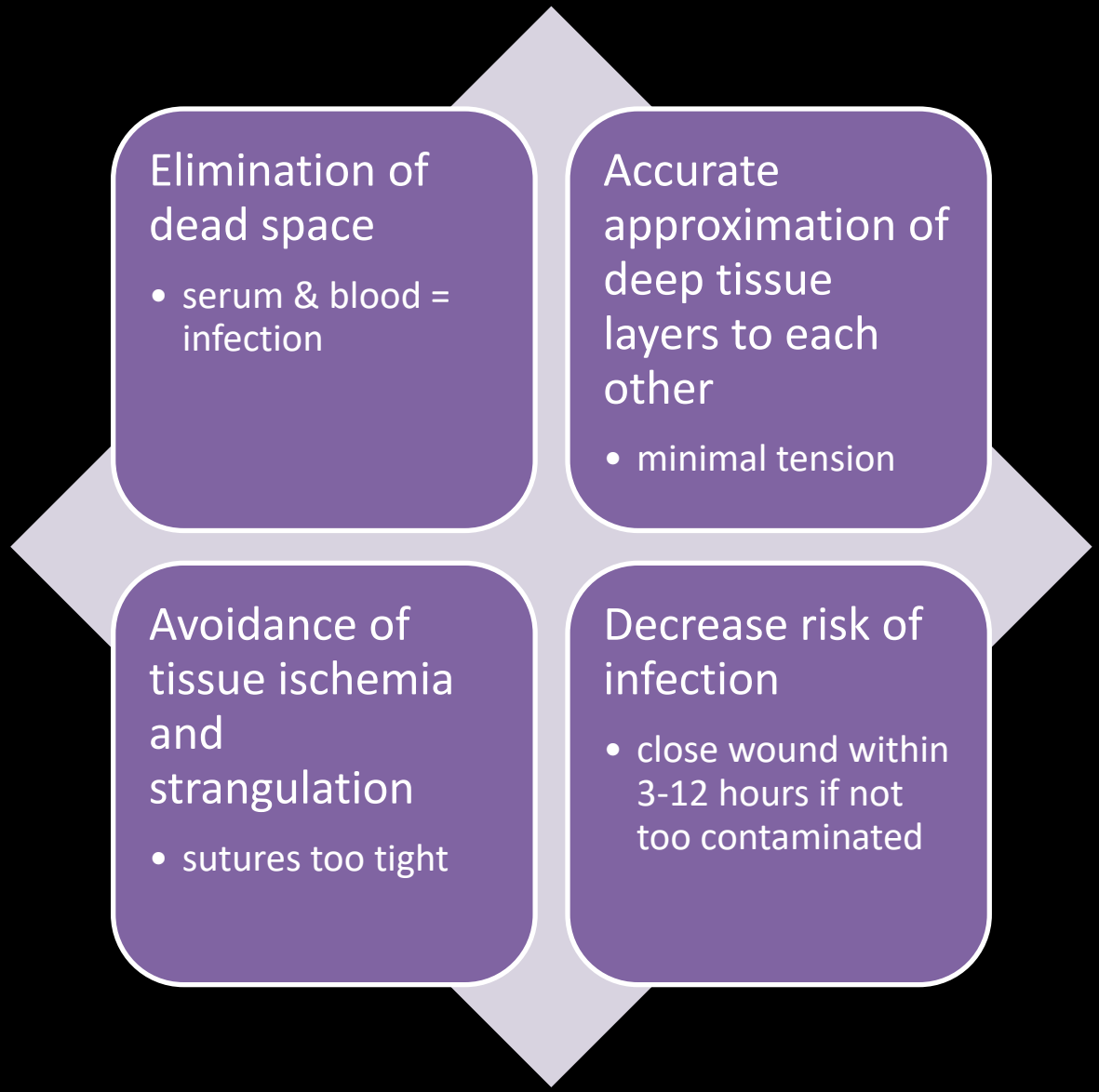
Patient Medications

- Corticosteroids
- NSAIDS
- Colchicines
- Anticoagulants
- Antineoplastic agents

Wound Preparation

Use of tissue-toxic wound prep solutions.	Use of detergent scrub solutions.	Inadequate cleansing and irrigation.	Anesthetics containing epinephrine.
Inadequate hemostasis, wound hematoma.	Reactive suture material.	Excessive suture tension.	Tincture of benzoin.

Goals of Wound Closure



Assessing & Preparing for Wound Closure

Allergies
- anesthetic agents, antibiotics, latex, suture material

Tetanus?

Mechanism of injury
- shearing, tension, compression, puncture, animal bite, injection, ink/oil.

Type of force
- crush vs. shearing.

Time

Intentional or unintentional act

Any home remedies or treatments of the wound

Physical Examination of Wound

Location

Size in cm

Description in **graphic** terms

- "questionable viable flap"
- "multiple ground-in foreign bodies"
- "severely contused wound edges"
- Cosmetic concerns

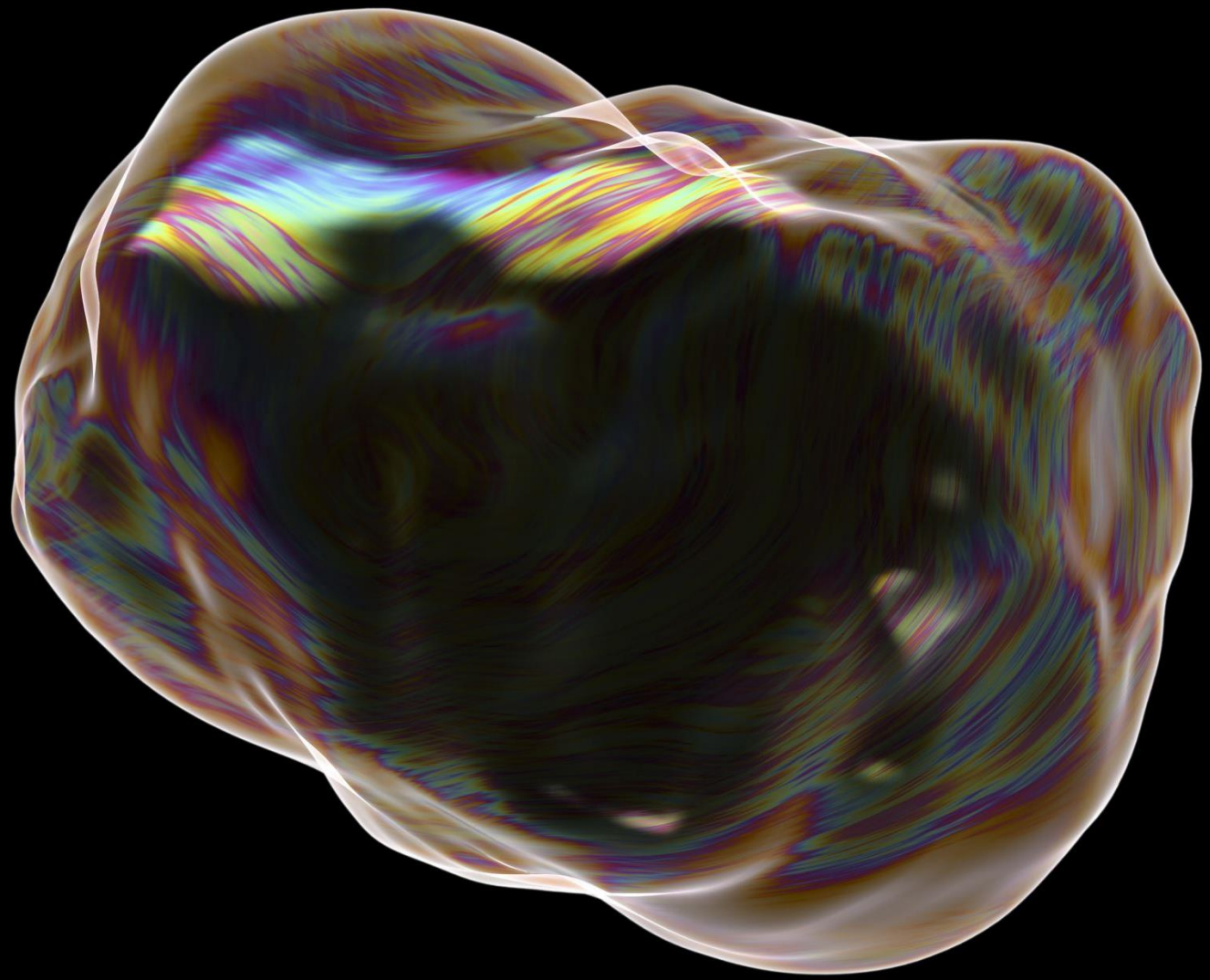
Hemostasis (don't close a bleeding wound) epinephrine or tourniquet – finger tourniquets

No epinephrine to ears, nose, finger, toes, and penis

X-rays

X-Rays

- Failure to dx.
  - A retained foreign body -2nd leading cause of malpractice
- Radiopaque material
  - metal, glass (2mm or larger), gravel
- Detection rate low
  - wood and plastic –ultrasound higher sensitivity 87%, ?CT scan (timing, & smaller sizes)



Flourescence

- Use of fluorescein solution is sometimes used to identify glass foreign body in an outpatient setting
- Use of fluorescent lamp or ophthalmoscope on the fluorescent mode will illuminate the FB
- Rinse thoroughly to remove stain and minimize infection

Wound Preparation

- Sterile technique – standard of care
- Irrigation
  - Large amounts of saline (splash guard)
  - 50-100ml per cm of laceration
  - Betadine on surrounding skin only! No betadine in the wound. No peroxide in the wound.
  - **“Dilution is the solution to pollution”**
- Debridement
  - Remove devitalized tissue (crushed, torn edges)
  - Excision with a surgical blade

Wound Closure

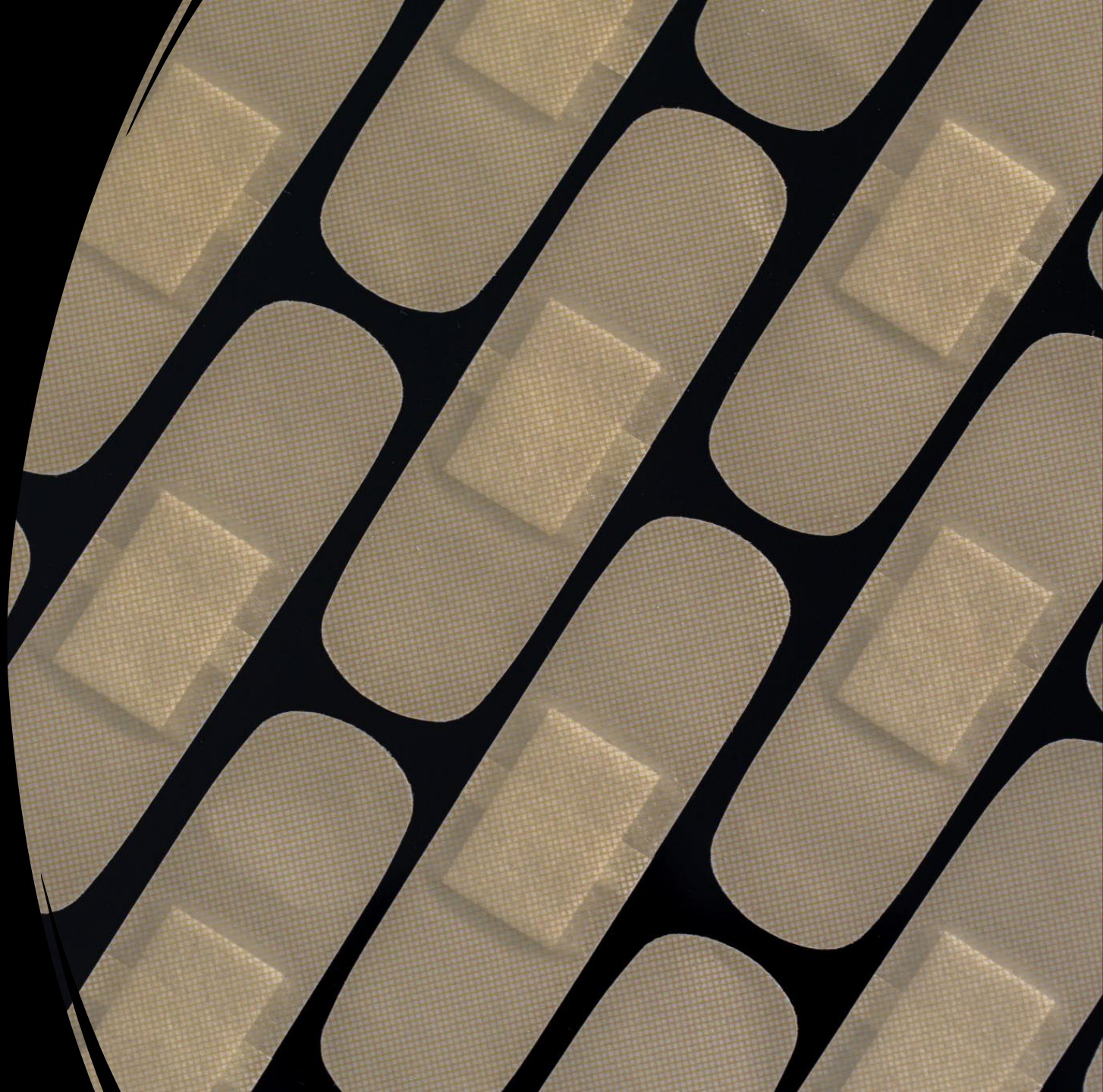
- Goals
  - Obliteration of dead space.
  - Even distribution of tension along suture lines.
  - Maintenance of tensile strength across the wound.
  - Approximation & eversion of the epithelial portion of the closure.

Wound Closure

- Primary
  - Within 12 hours “golden period”; face and scalp 24 hrs
  - Clean wounds without tissue loss
- Secondary
  - Days to weeks
  - “secondary intent” (small partial avulsions, fingertip amputations)
- Tertiary (delayed primary closure) saliva, feces, exudate or >8 hours after injury
  - 3-5 days after injury
  - Daily wound care
  - Same technique as primary closure

Wound Closure Materials

- Adhesive Tape (Steri Strips)
- Tissue Adhesive (Dermabond)
- Staples
- Sutures



Sutures

Size and tensile strength

- 4/0, 5/0, 6/0 will be the most used outside the OR
- Larger the number the SMALLER the suture
- 7/0 is the diameter of the average human hair

Needle Size (Bite)

- Large enough to pass through the tissue. Look at the pictures on the package.
- Cutting or reverse cutting needle (has a triangle on box)

Sutures: Absorbable vs. Non-absorbable

Absorbable

- “gut”, vicryl, chromic
- Breakdown on their own and are not removed
- Layered closure or mucous membranes
  - lip, tongue, genitalia

Non-absorbable

- Can be monofilament or braided
- Silk, Prolene, Ethilon
- Must be removed

Basic Suturing – Anesthesia

Lidocaine

- Dilute lidocaine with sodium bicarbonate 1:10 (1 ml bicarb + 9.0 ml lidocaine)
- shelf life is 7 days
- Max dose 4-5 mg/kg

Lidocaine w/Epinephrine

- Highly vascular areas

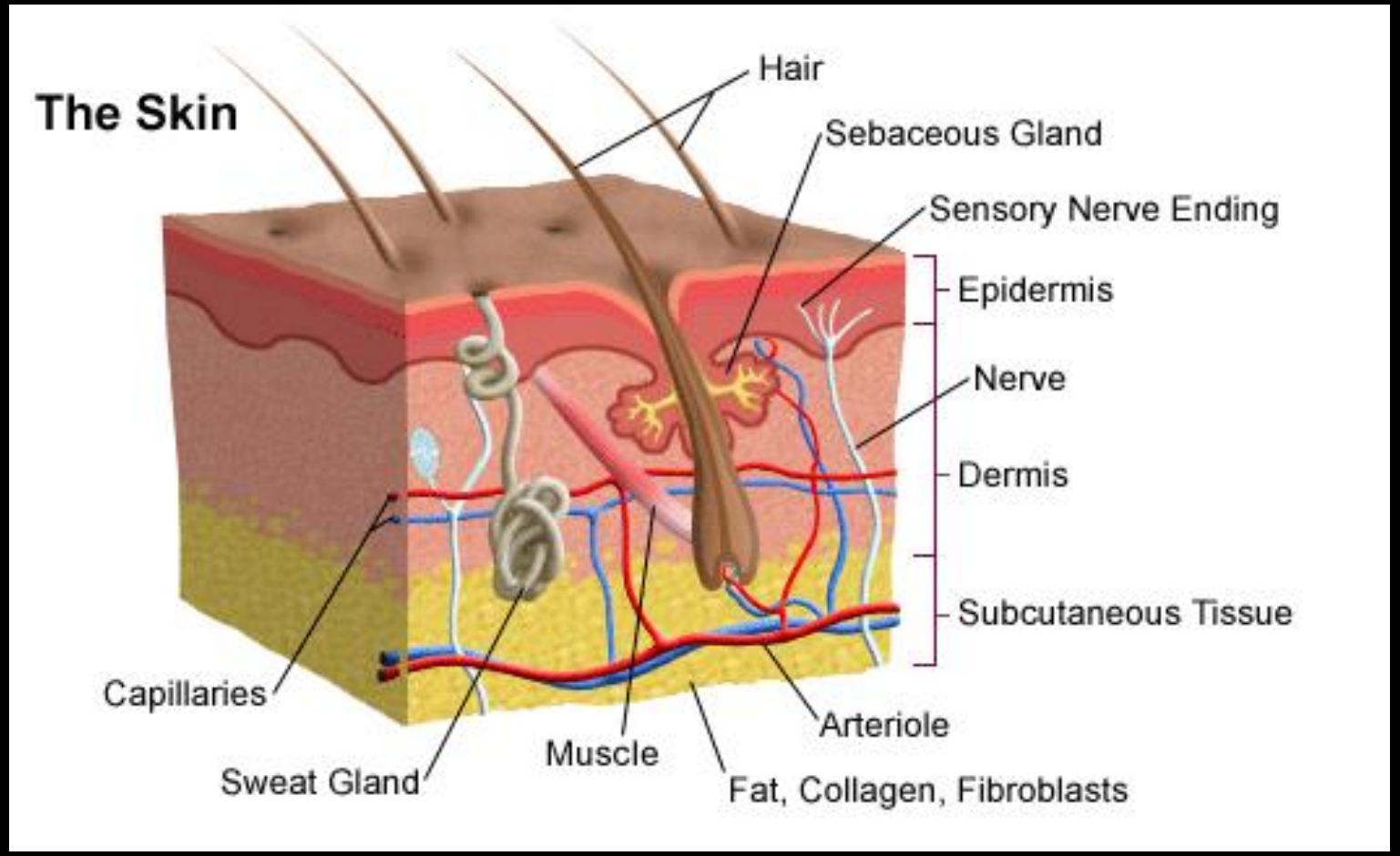
Bupivacaine

- 4x duration of lidocaine
- Max dose 2-3 mg/kg

Topical - typically used prior to injection in pediatrics

Direct Wound Infiltration

Inject immediately beneath the dermis at the junction of the superficial fascia



Direct Wound Infiltration

- Inject slowly.
- Inject into subcutaneous plane instead of intradermal plane.
- In clean wounds, insert needle thru the wound edges.
- In contaminated wounds, infiltrate the skin.
- Small needle 27g or 30g.

Digital Block

- Equipment
- Sterile drape & gloves
- Betadine
- 10cc syringe with 25-gauge needle, 1 ½ inch
- 1% lidocaine (no epinephrine)/Sodium bicarbonate
- Informed consent

Digital Block Procedure

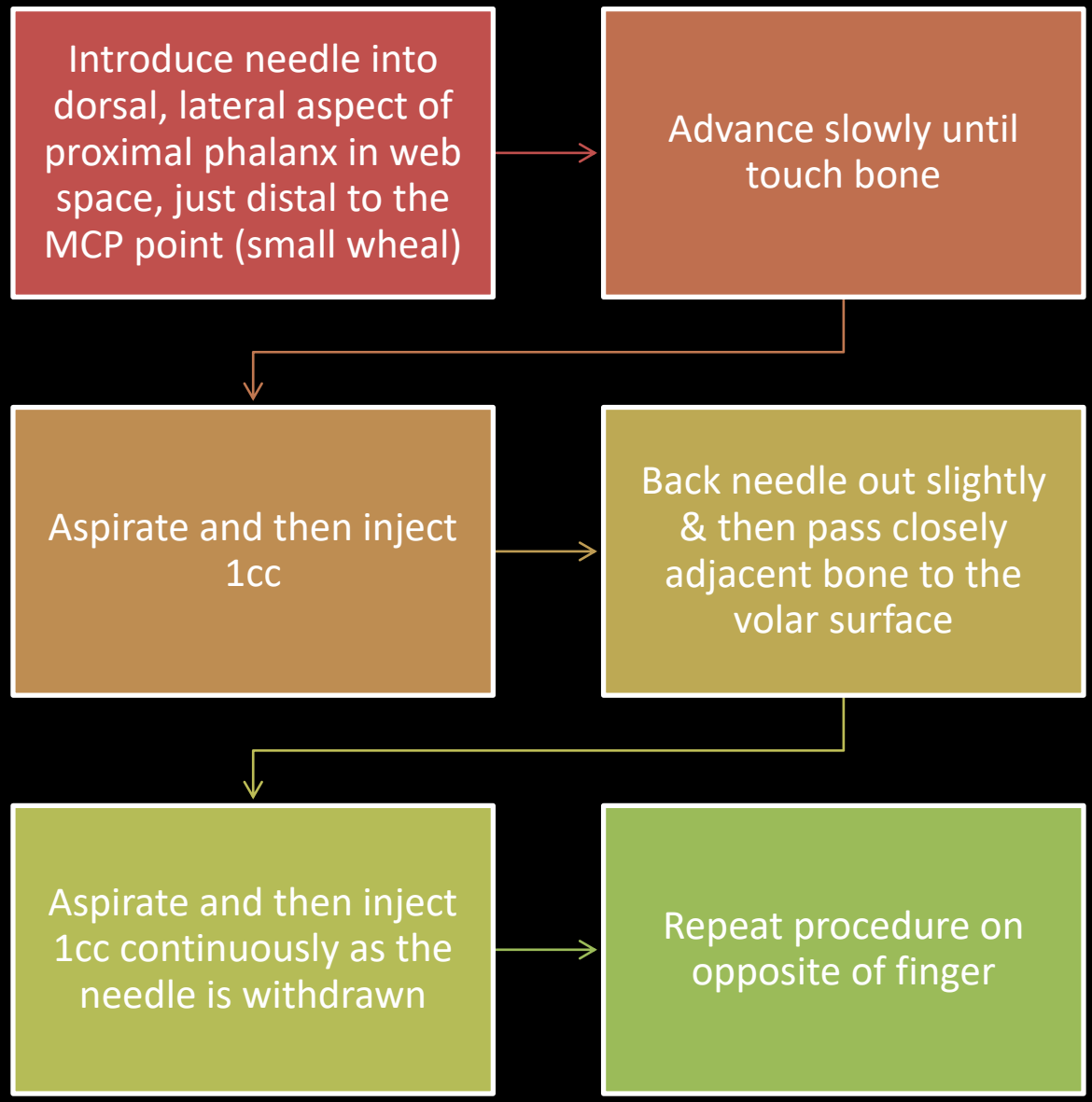


Figure A: Mary Albury-Noyes

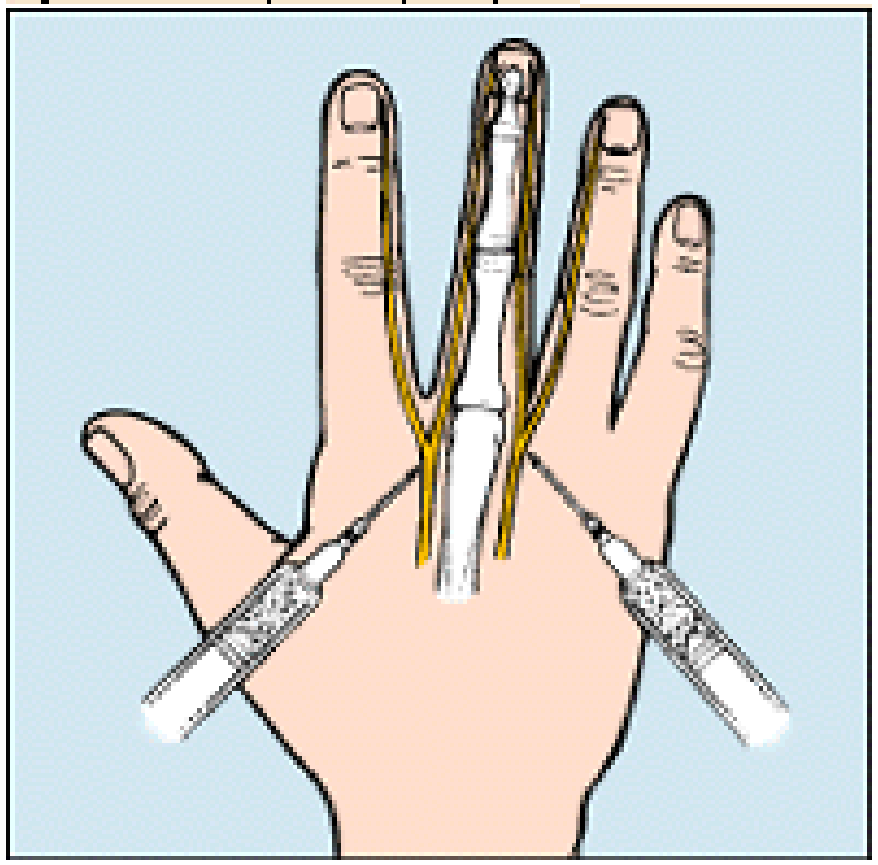
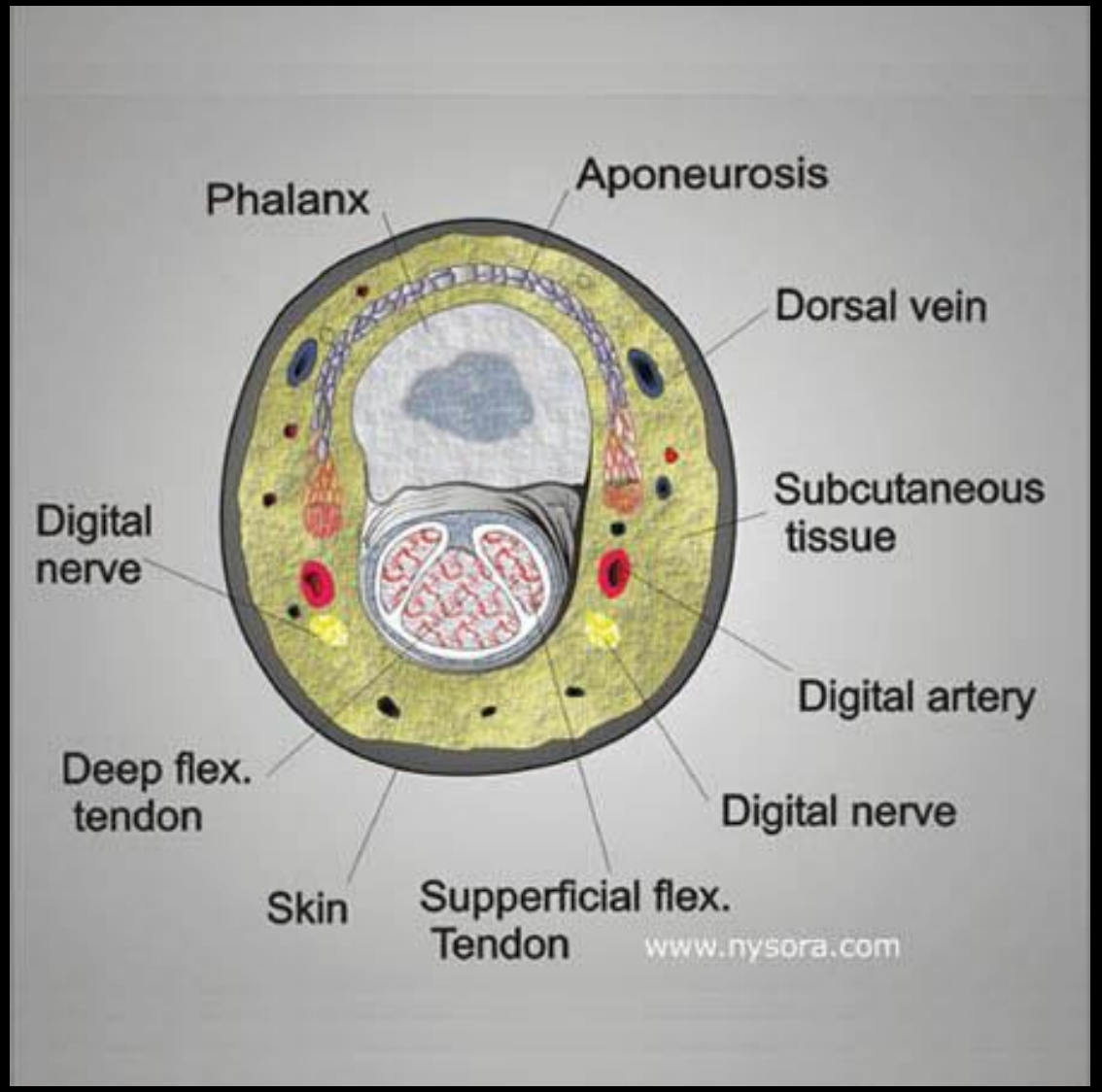
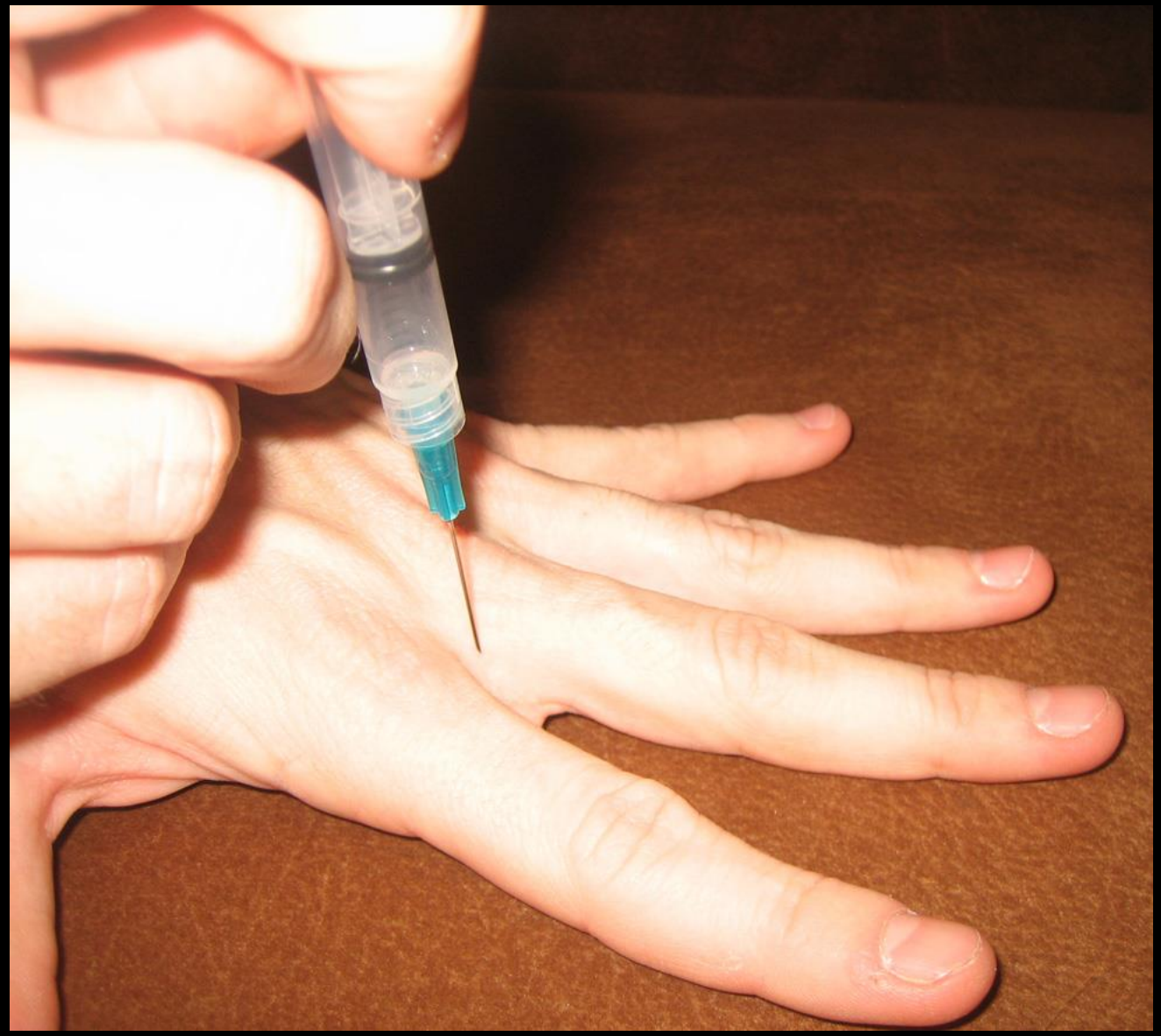


Figure A. For a dorsal metacarpal block, the needle is introduced in the dorsal web space on each side of the metacarpo-phalangeal joint.

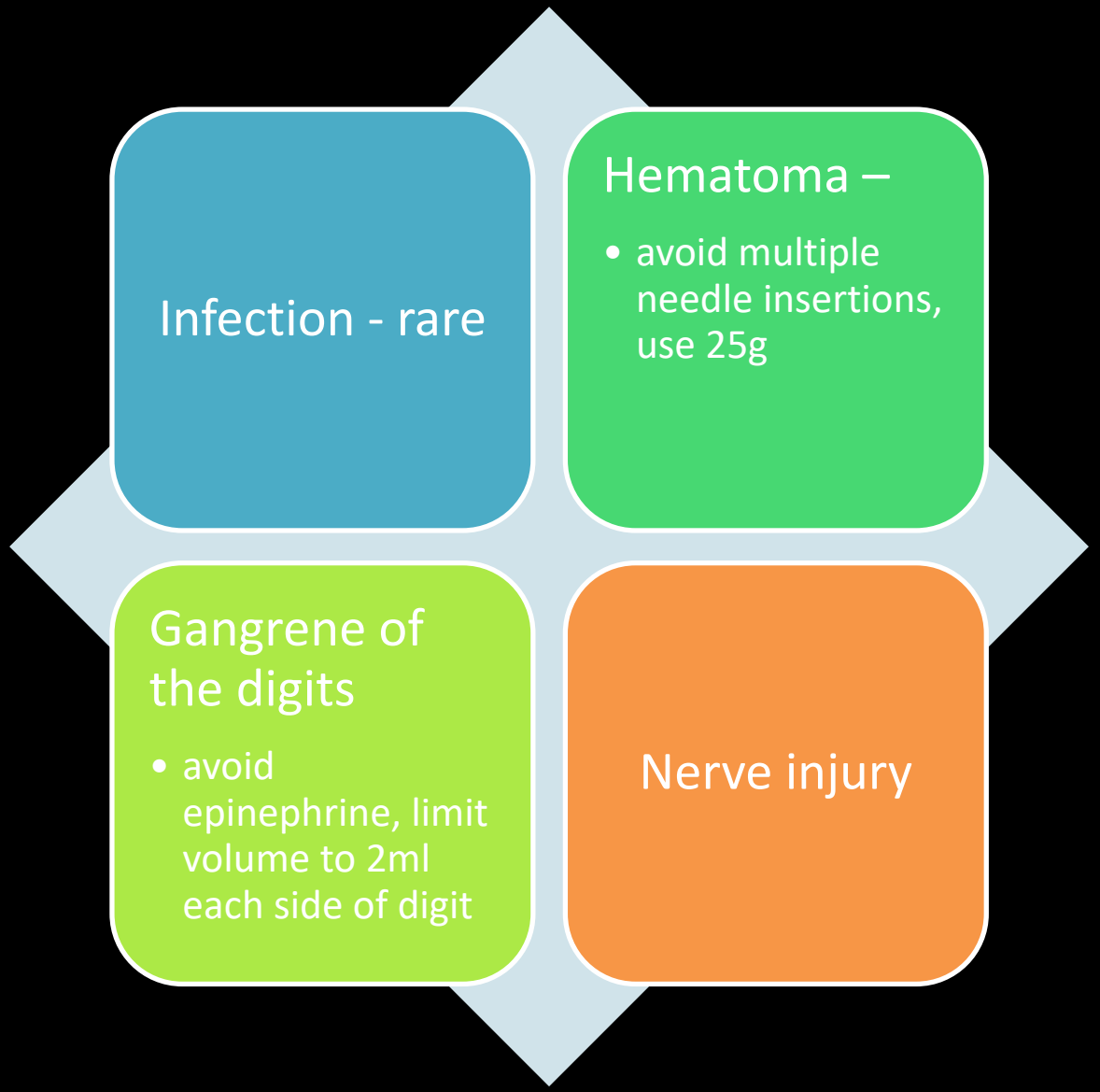




Digital block video

https://youtu.be/skS8aPRgFZA

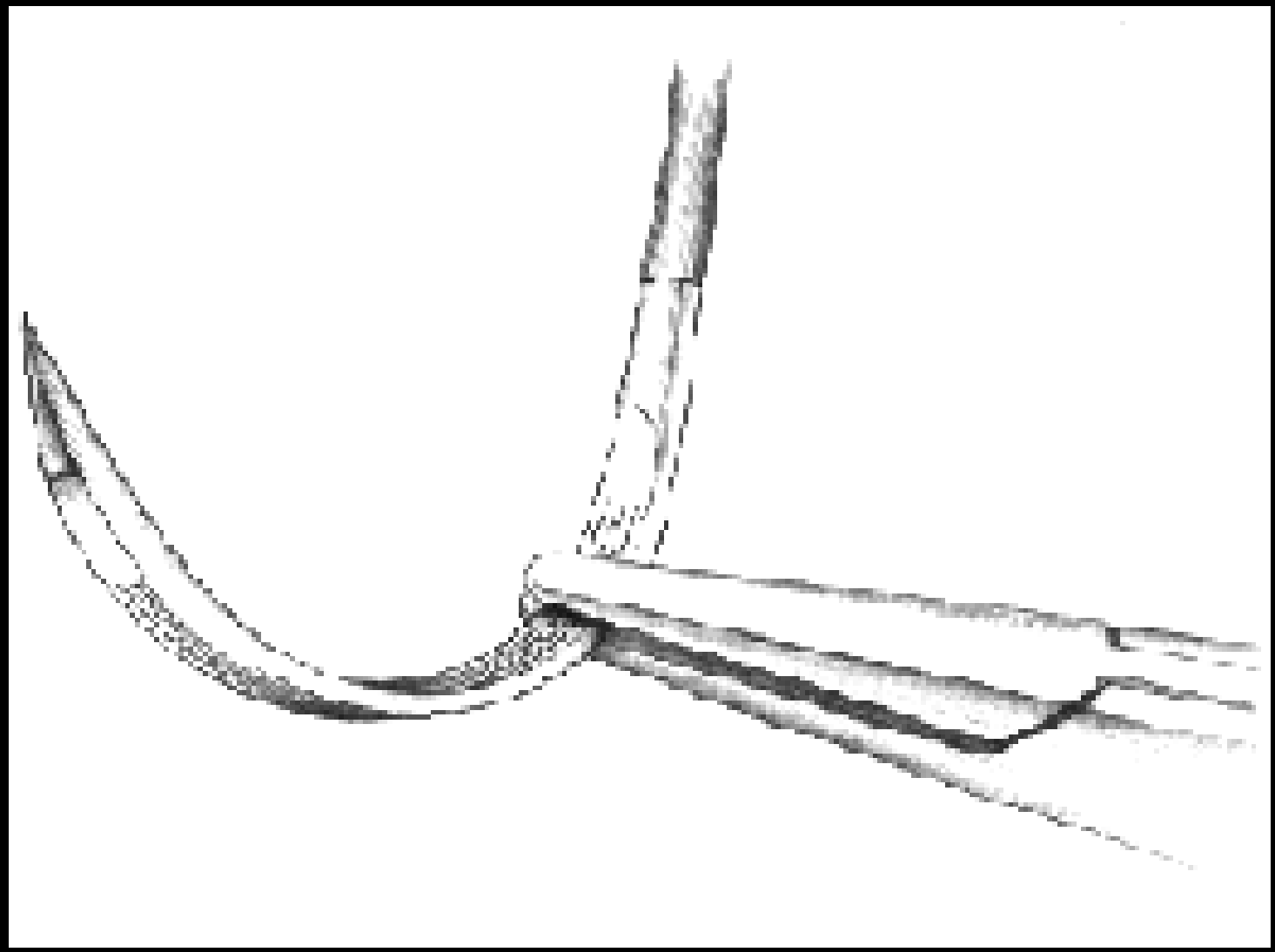
Complications of a Digital Block



What comes in my kit??

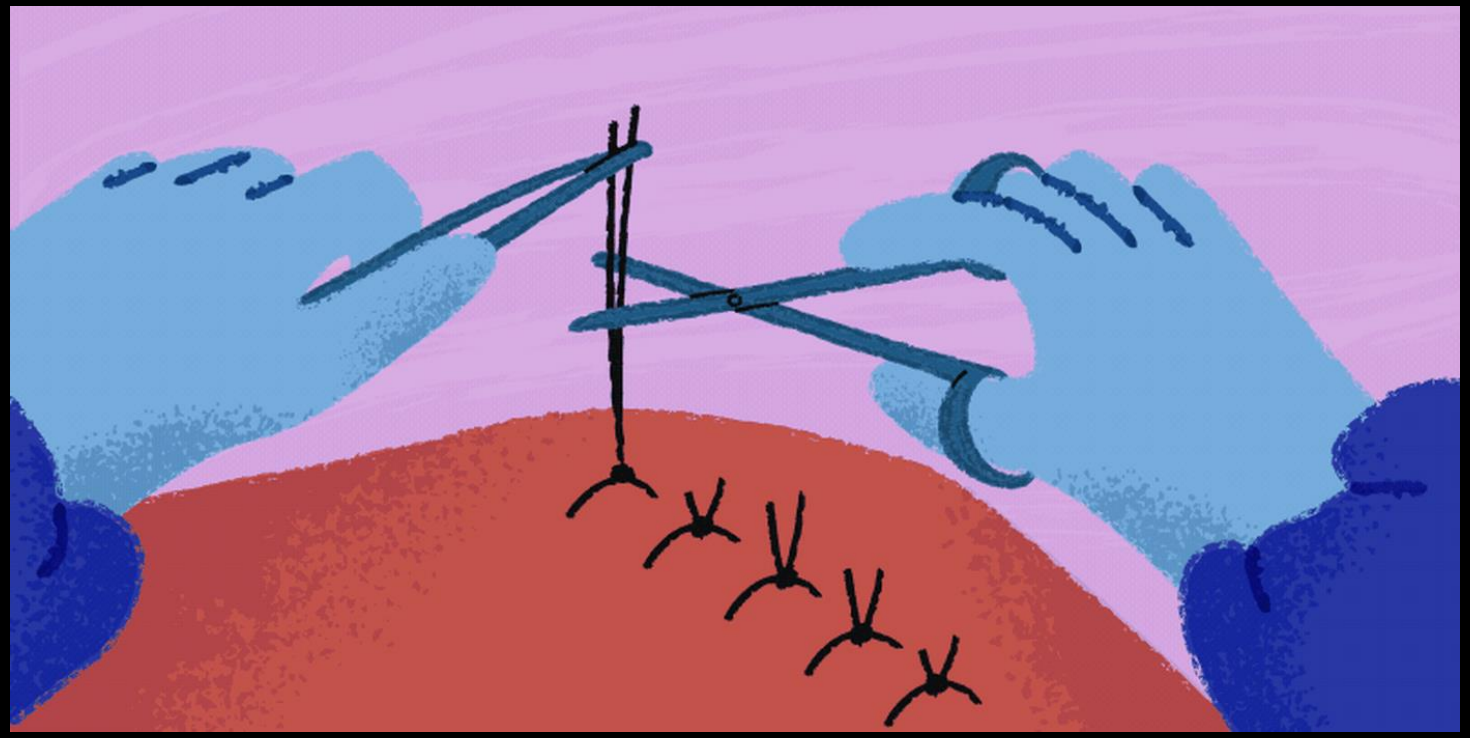
- https://youtu.be/66iNbapx17g

- Needle Driver
- As a rule, the needle should be grasped at its center or perhaps 50-60% back from the pointed end.
- The needle should be grasped 1-2 mm from the tip of the needle holder.



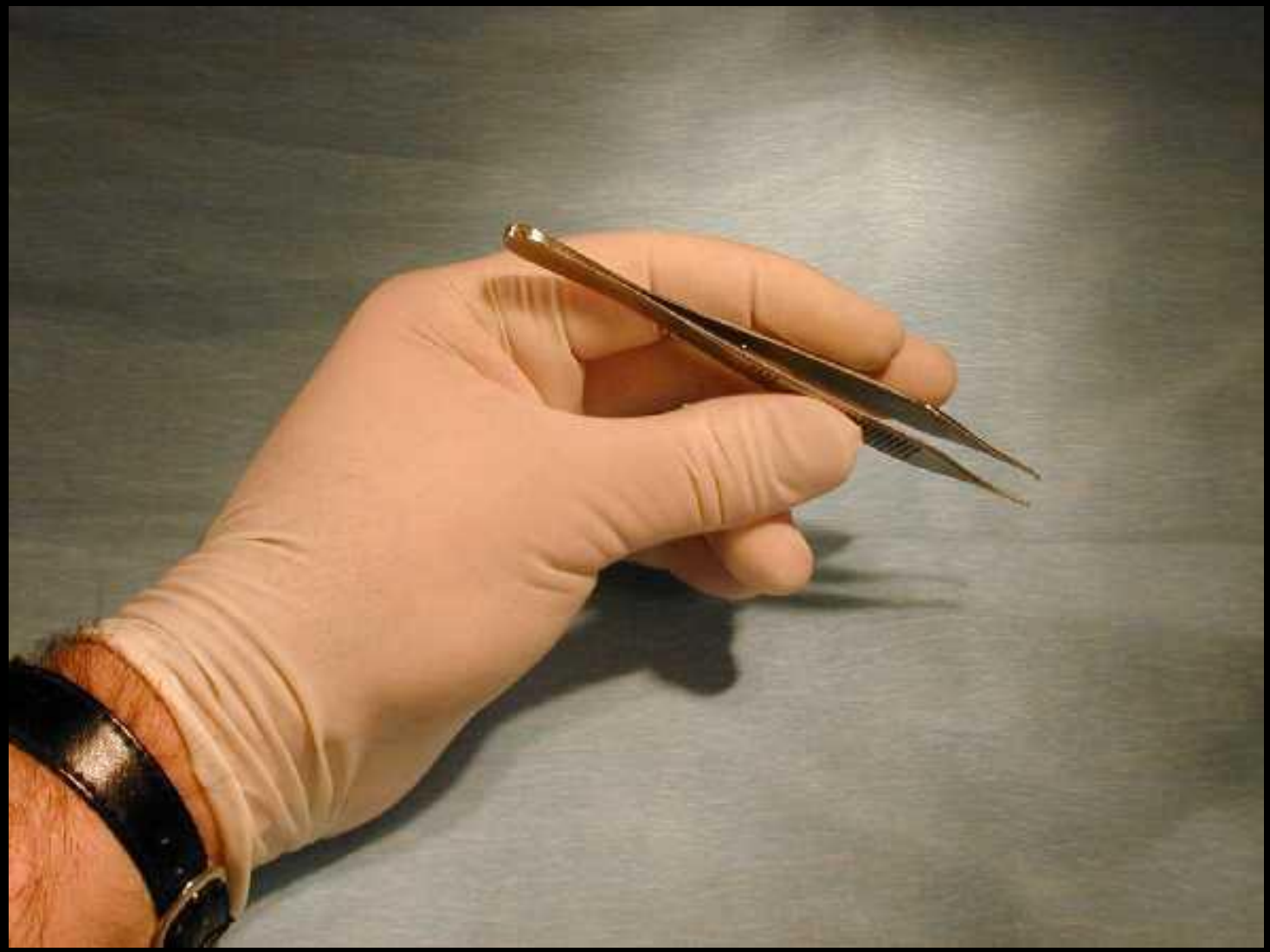
Preparing to suture

- https://youtu.be/lZexLr6inwo



Addison Forceps

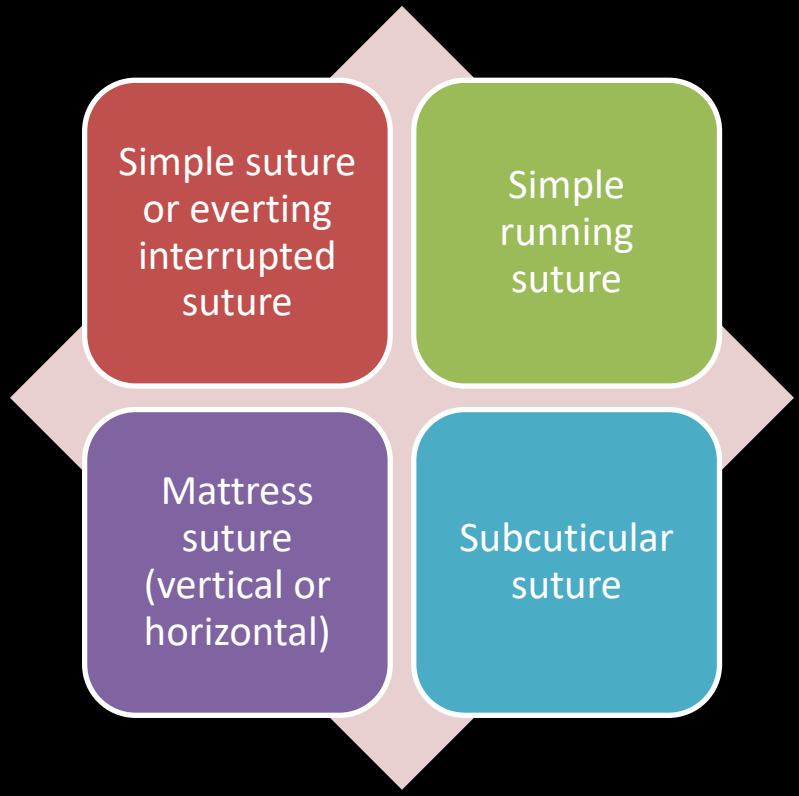
- Small toothed forceps, such as the Addison forceps shown here, should be used to grasp the skin edges during suturing.
- Forceps with teeth provide a secure grasp with minimal pressure, thereby avoiding crushing of the skin edge.
- The forceps should be held in the first three fingers as one would hold a pen.



Anesthesia

- https://youtu.be/OoWD9cAiS0U

Suturing Techniques



Videos

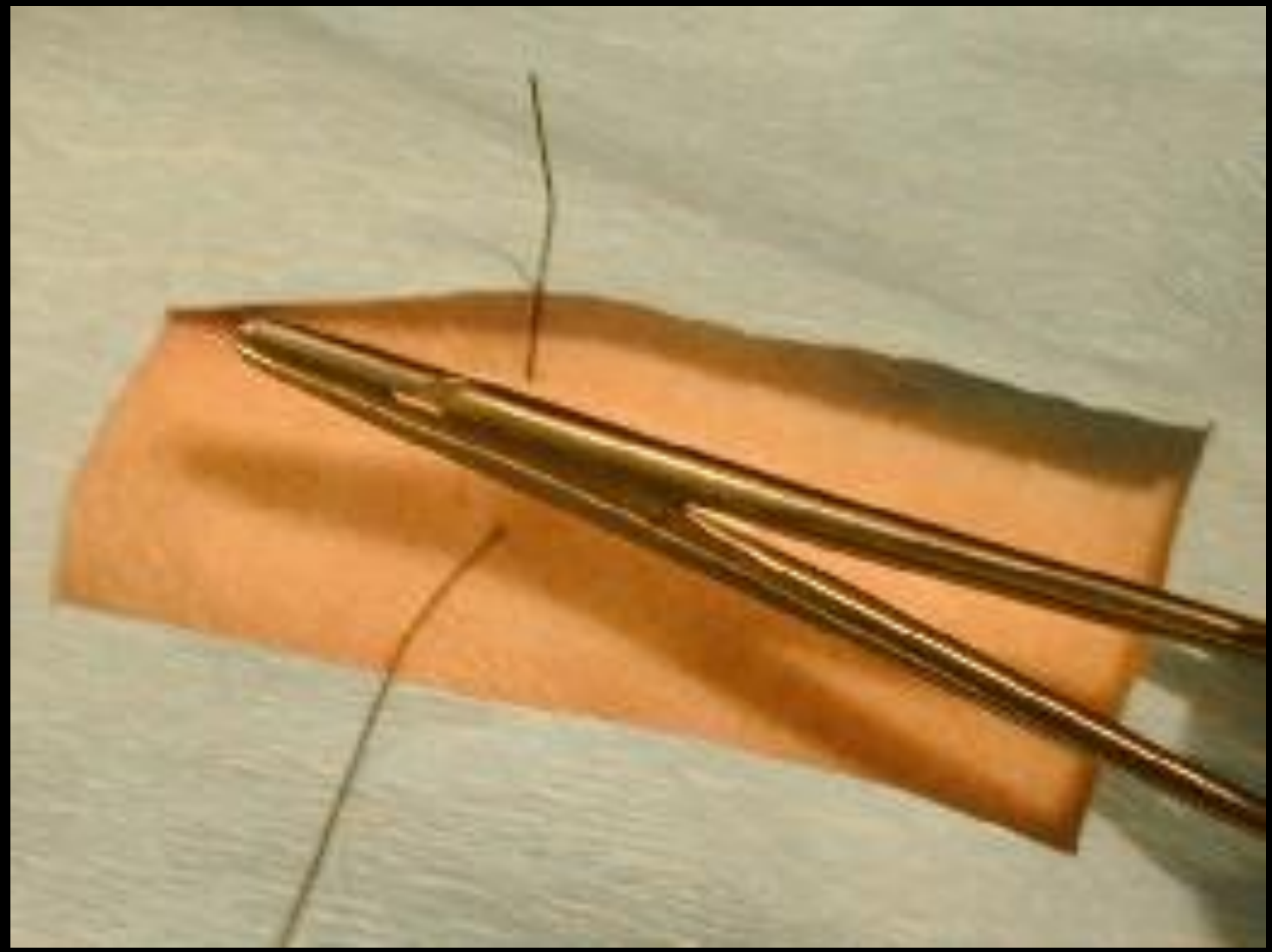
Simple Interrupted Sutures:

https://youtu.be/LYc3tTChj5Q

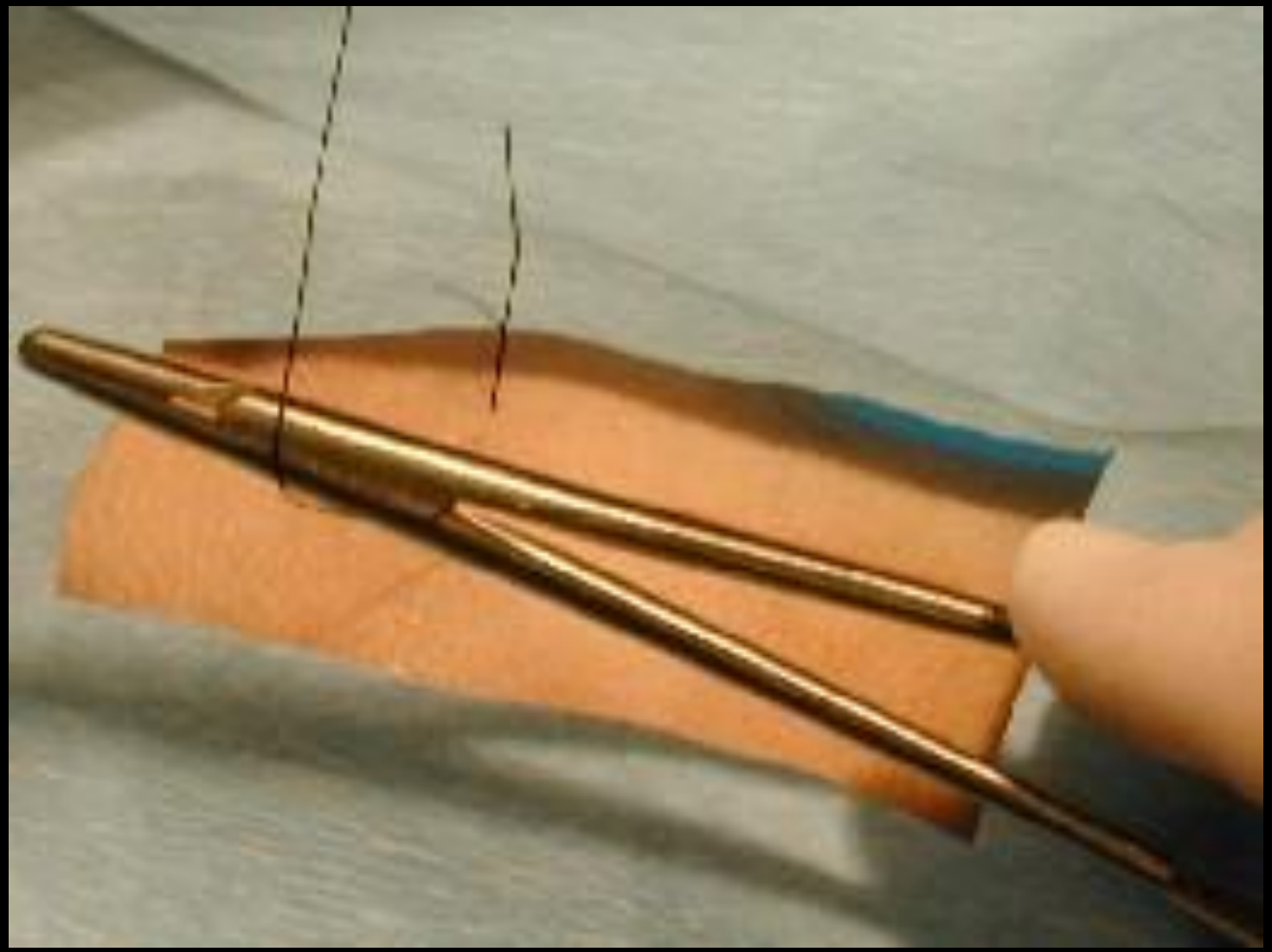
Second suture:

https://youtu.be/OH4Bkv2t1zo

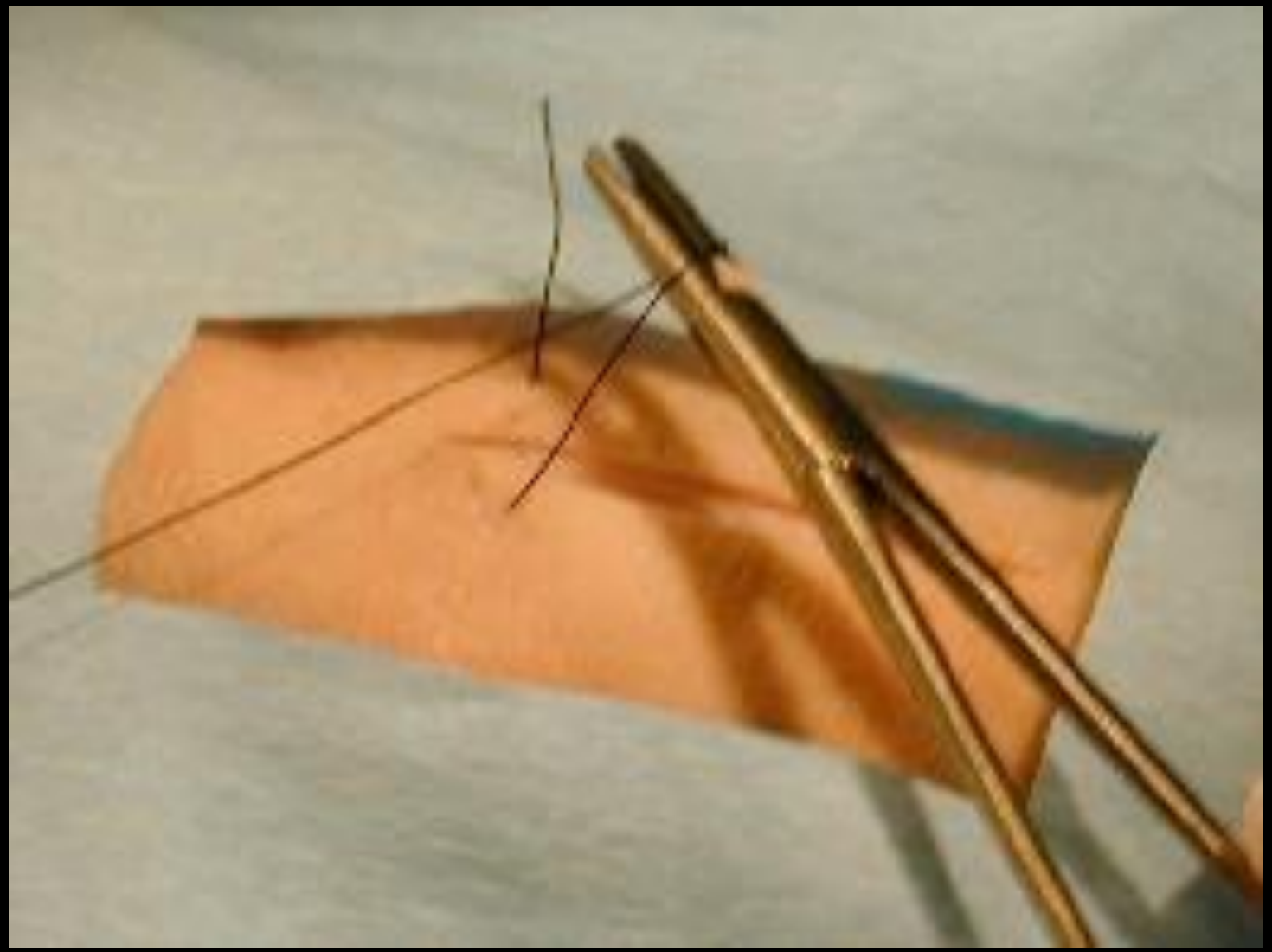
- The suture material is drawn through the skin, leaving 2-3 cm protruding from the far skin surface.
- The forceps are then dropped or "palmed" so the left hand can grasp the long end in preparation for an instrument tie.
- Note that the needle holder is positioned between the strands over the wound.



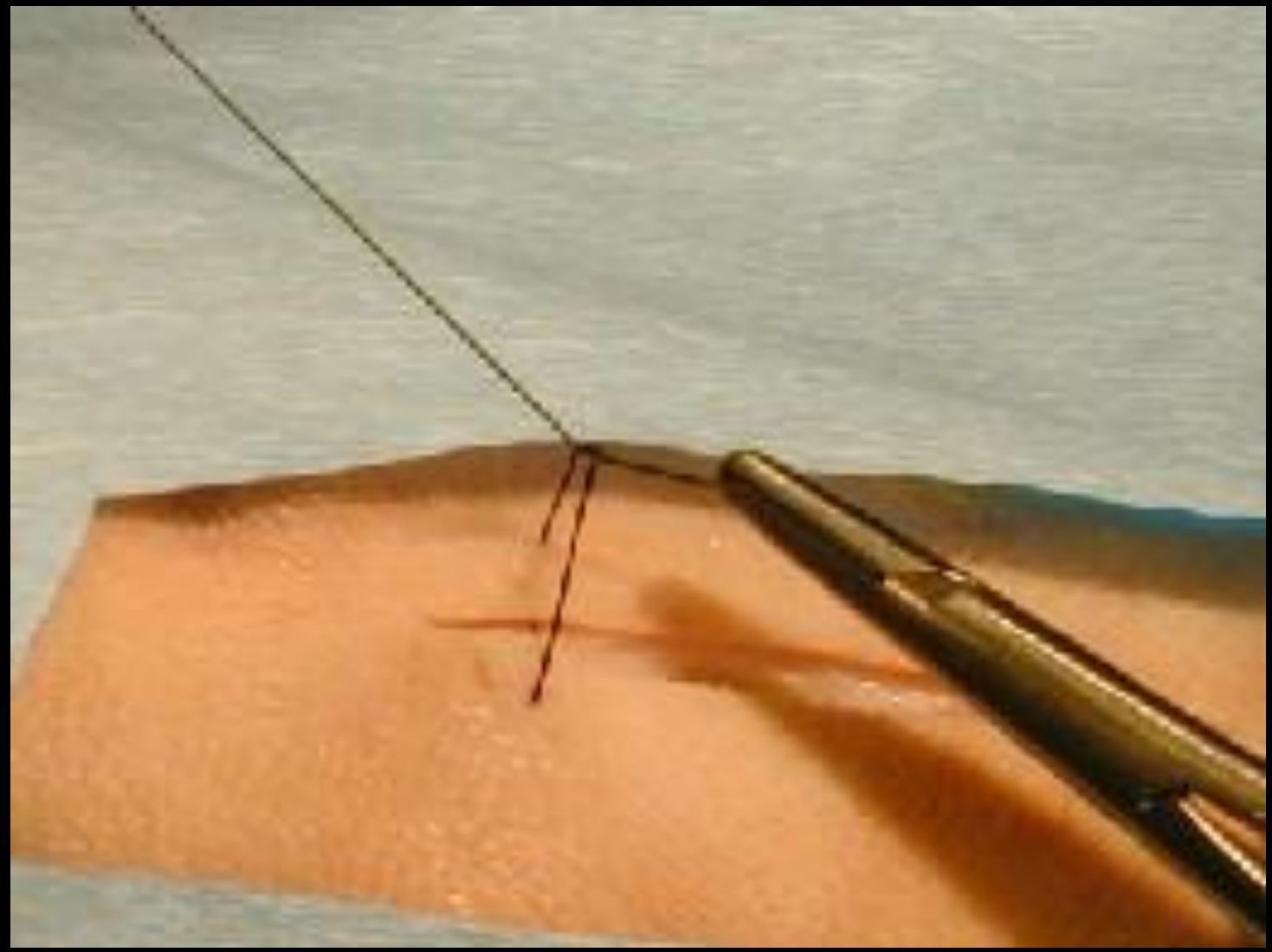
- The long strand is being wrapped around the needle holder to form the loop for the first throw of a square knot.
- You will loop twice for the first throw.



- The needle holder is then rotated away from the clinician to grasp the short end of the suture.

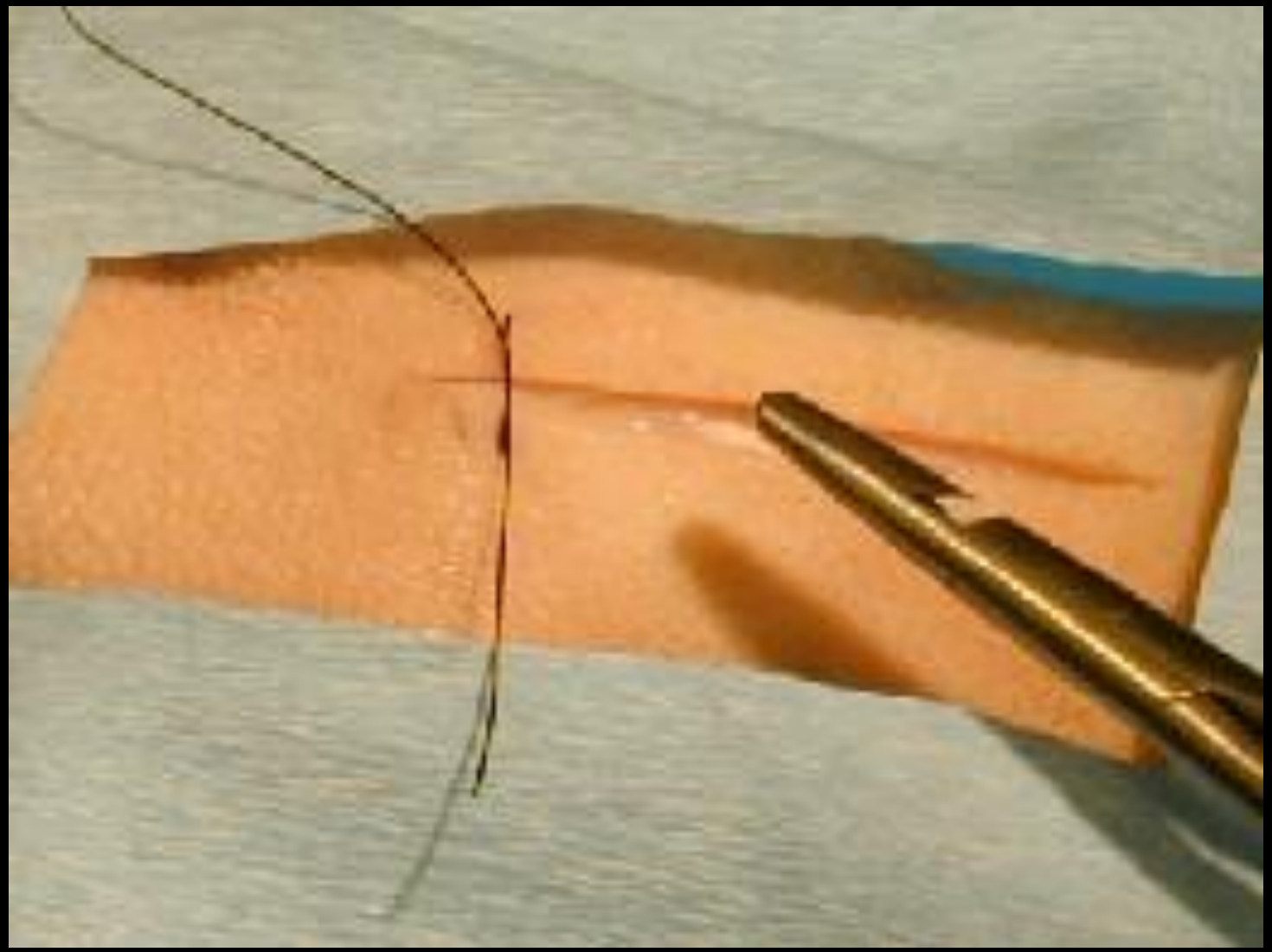


- The short end is grasped and drawn back through the loop toward the clinician.

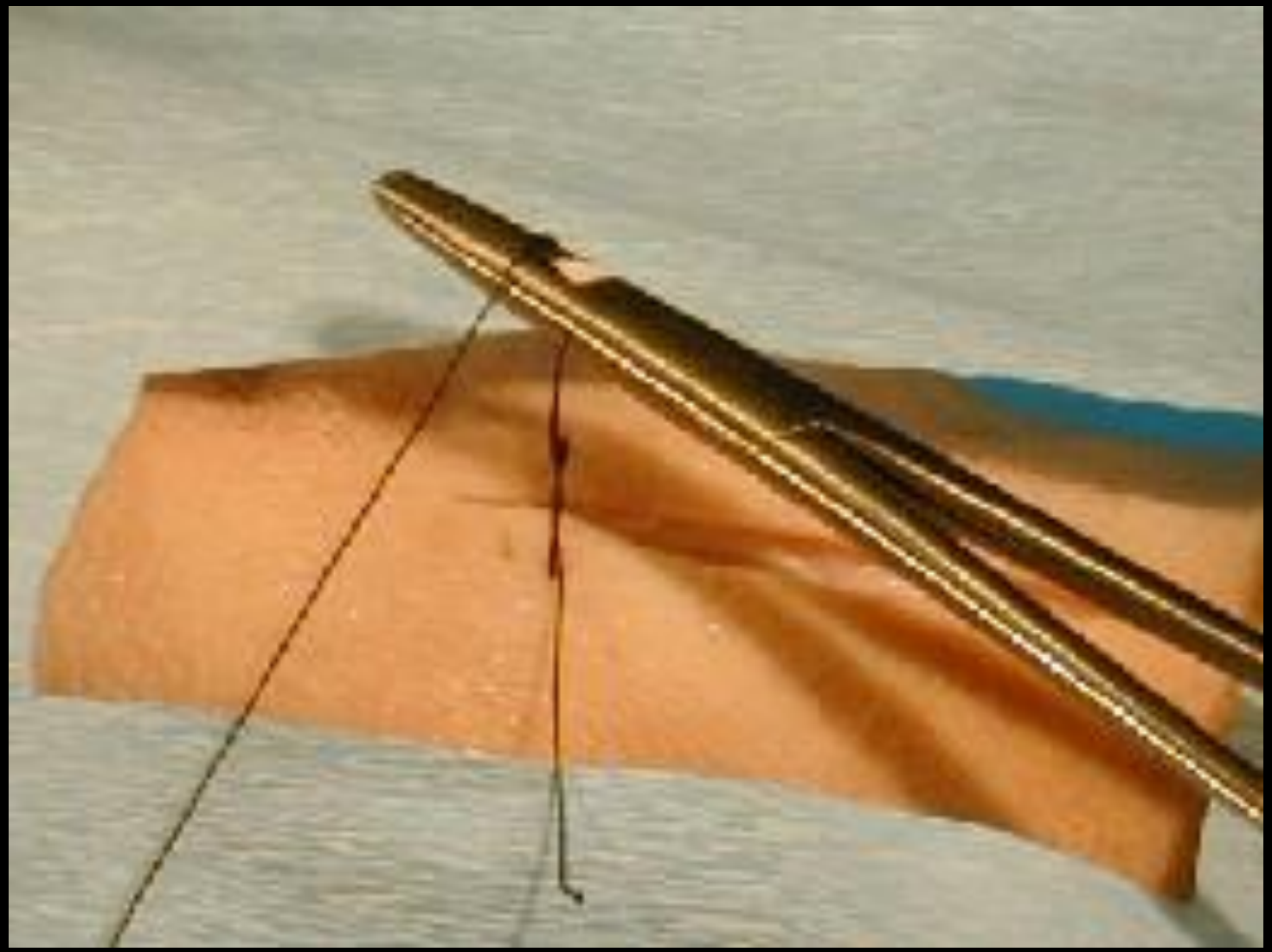


- The throw is tightened…

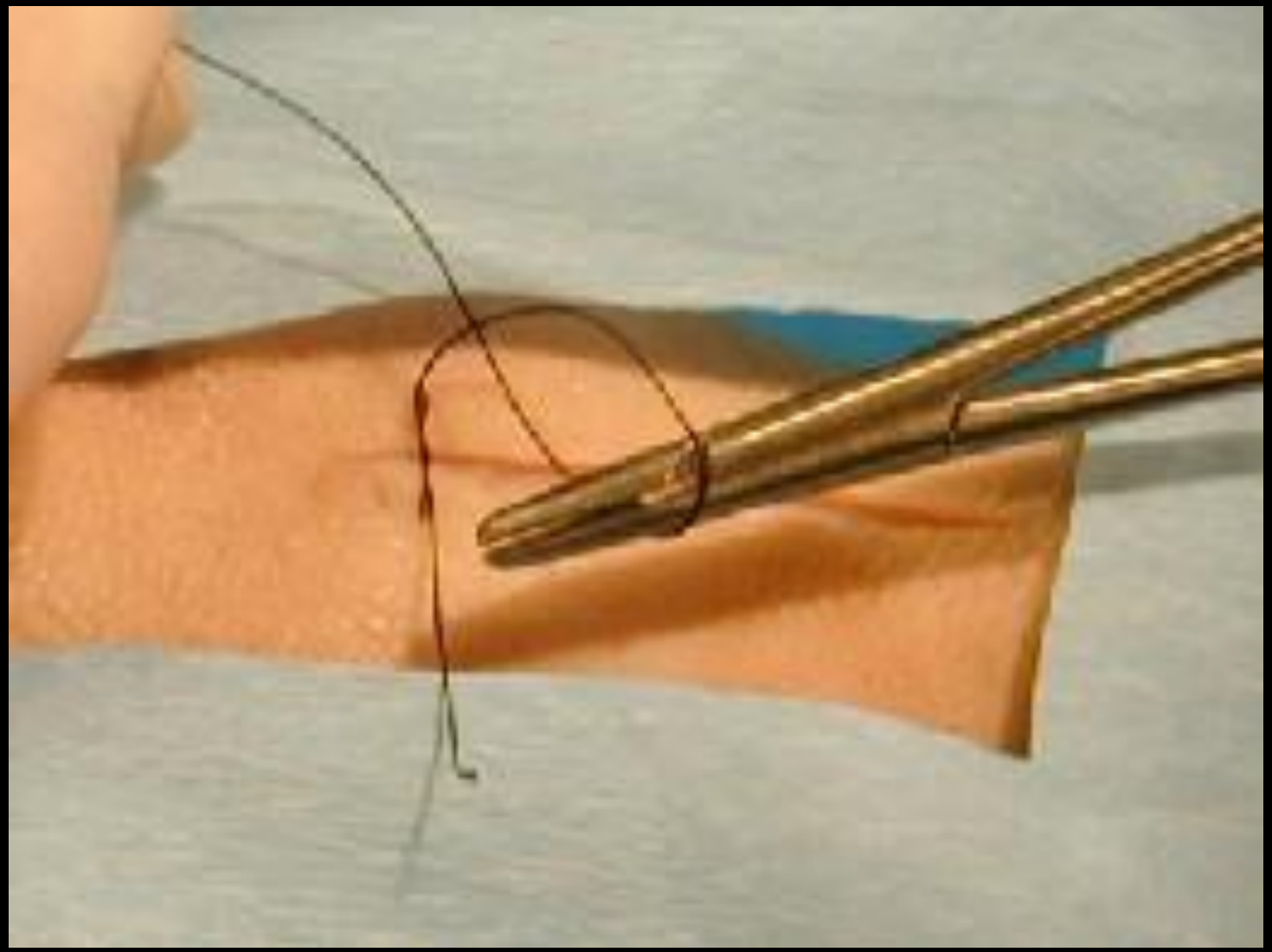
- ... creating a flat throw which will be tightened just enough to approximate the skin edges.
- Remember: approximate; do not strangulate.



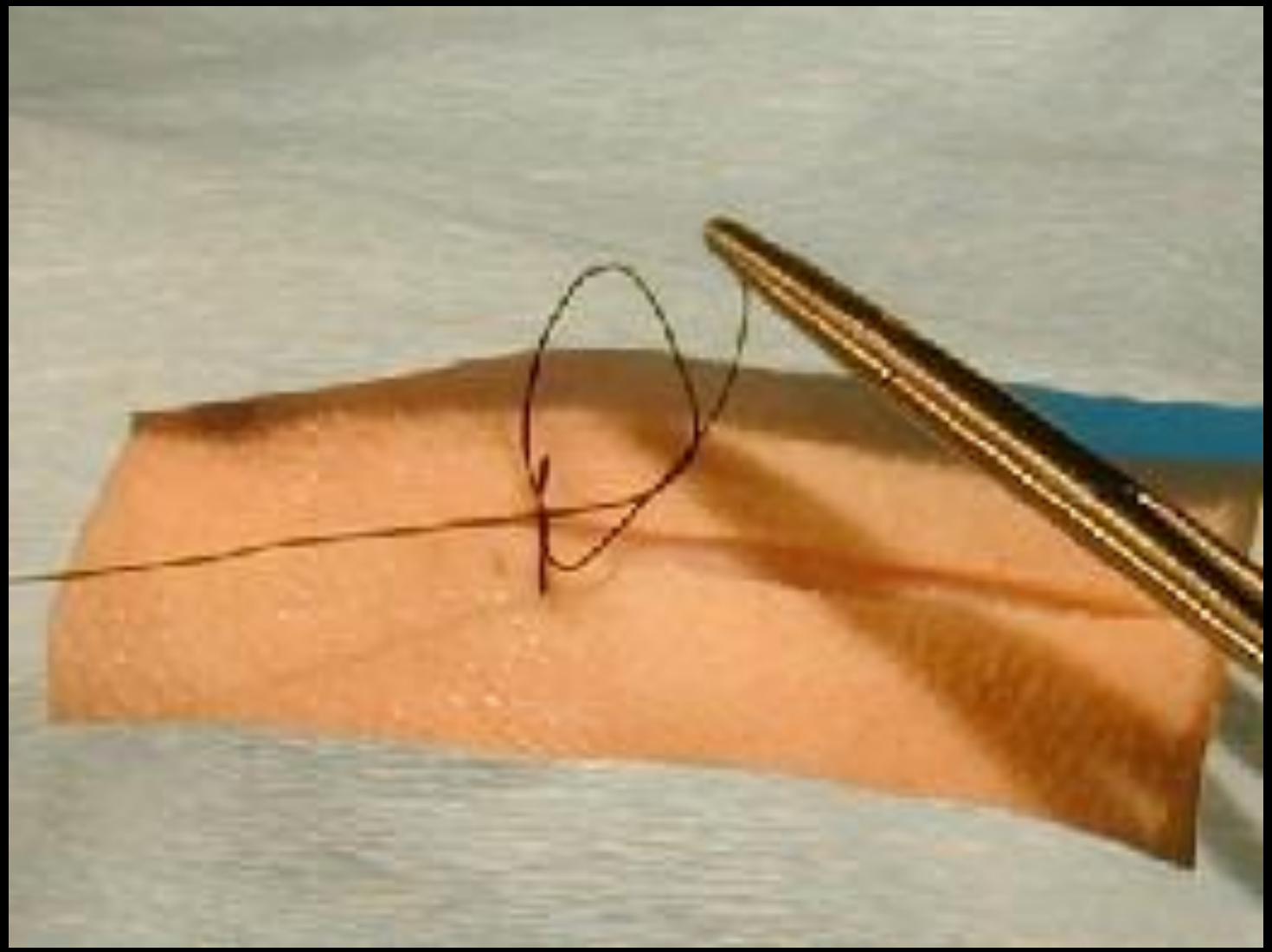
- The second throw of the square knot is initiated with the needle holder pointed to the left as the long strand is wrapped around it by bringing the long strand toward the clinician.



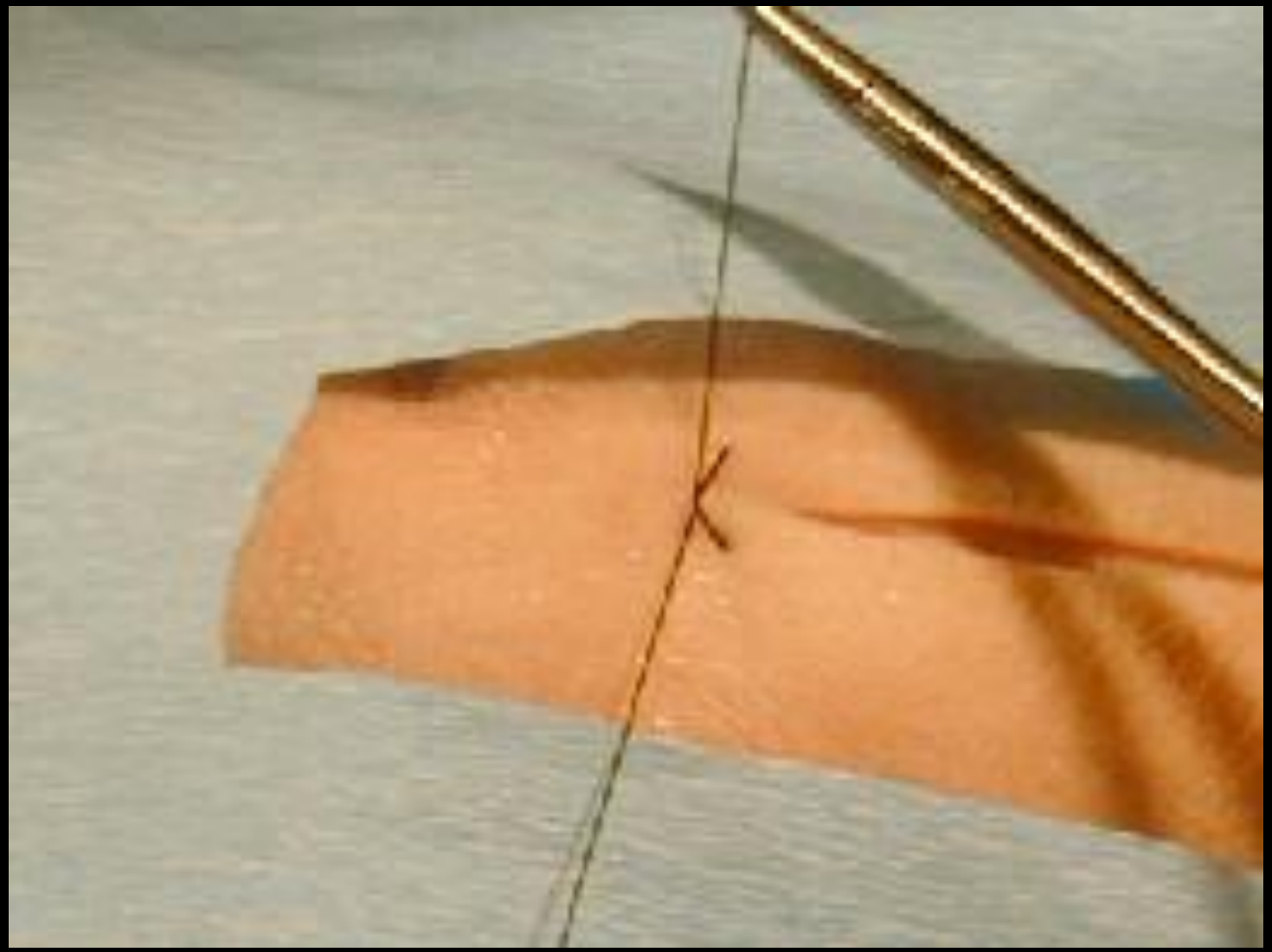
- The needle holder is then rotated toward the clinician to retrieve the short end...



- ... and the short end is drawn through the loop that has been created, pulling it away from the clinician.



- The second throw is then brought down and tightened securely against the first throw.



Pearls

Use instruments not fingers

Take equal “bites” for both sides

- **Evert the wound edges**

Each suture strand is passed thru the skin only once

Scalp / trunk 4-0

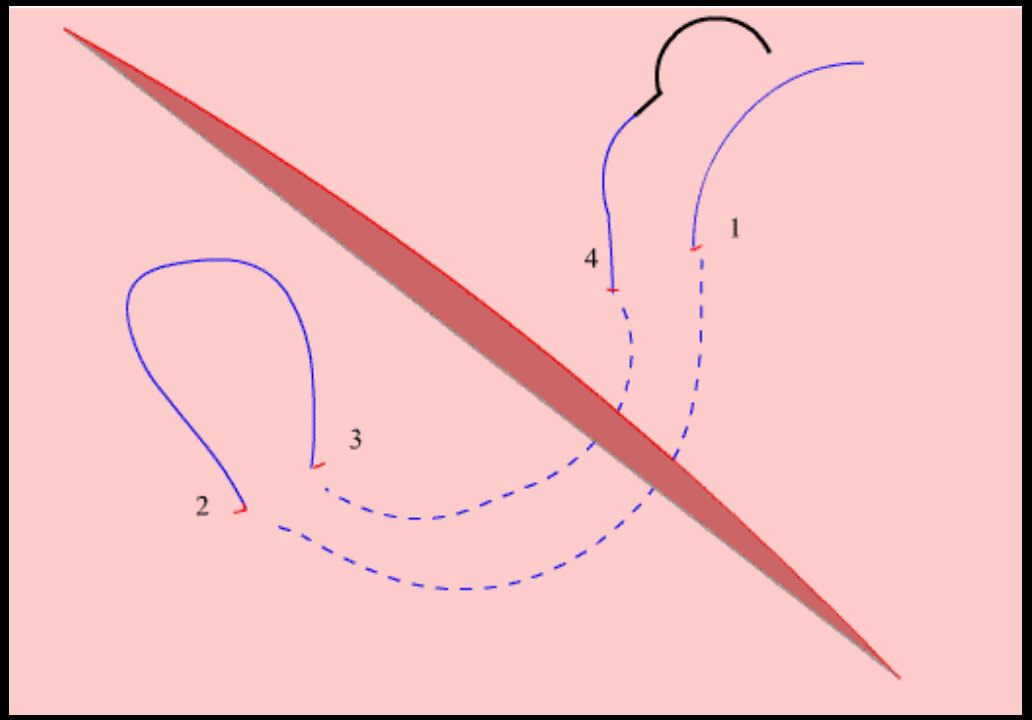
Face 6-0

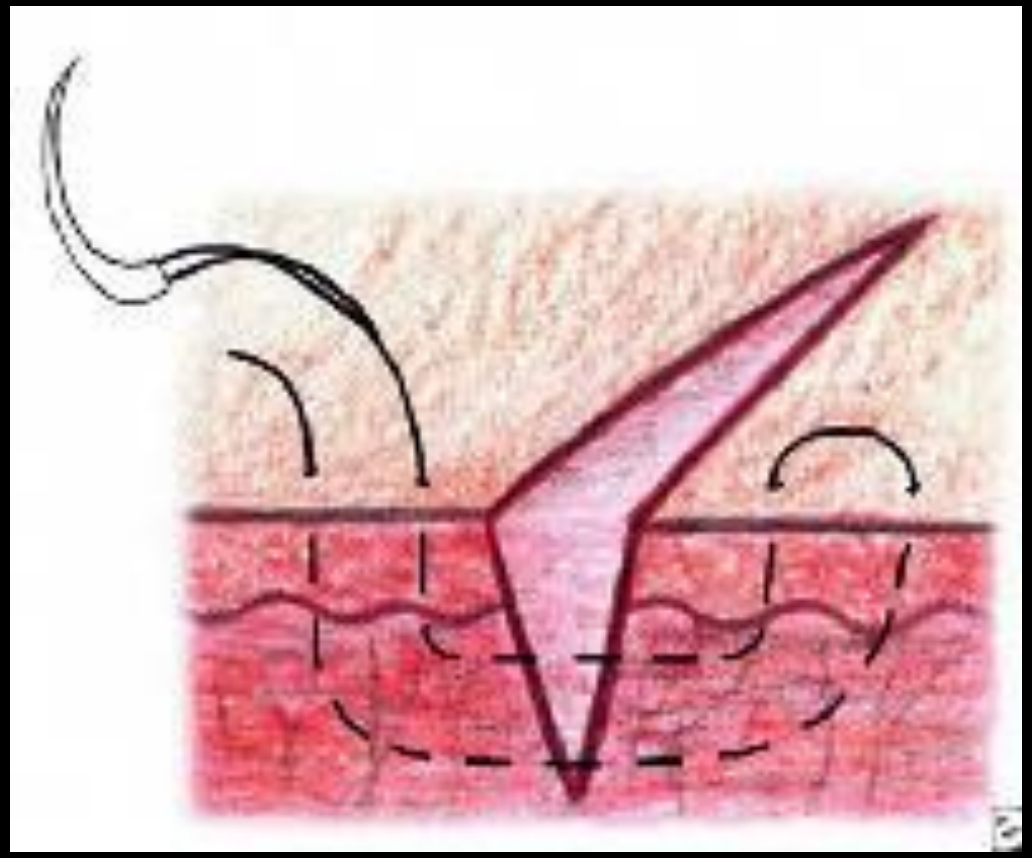
Extremities

- Over joints 3-0 to 4-0
- Hand 5-0

Vertical Mattress suture

- https://youtu.be/Jd2477Nt8eg


4
1
3
2

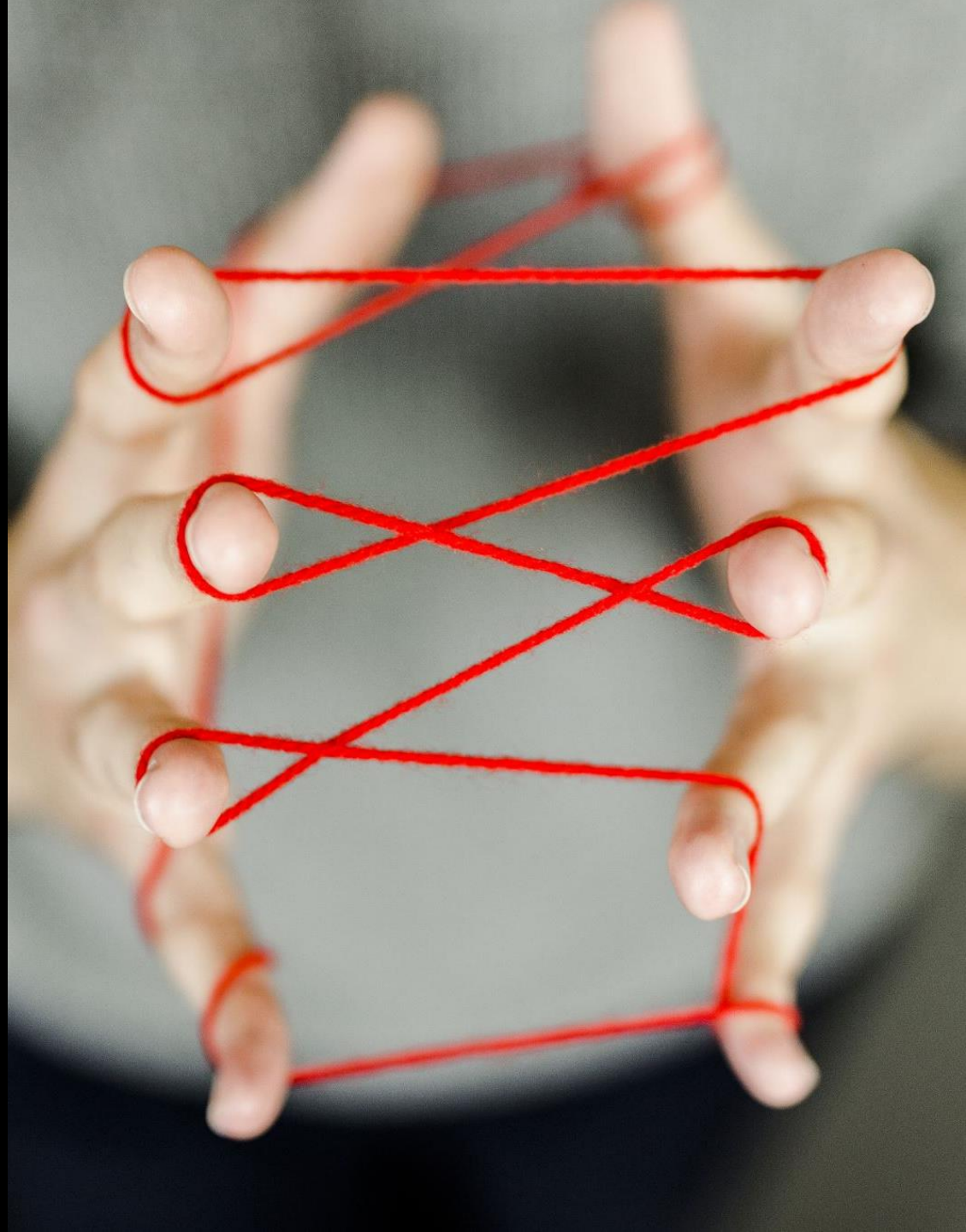


Vertical Mattress

- Maximizes wound eversion
- Reduces dead space
- Combine deep and percutaneous sutures
- Minimizes tension across the wound
- Placing each stitch precisely & taking symmetric bite

Disadvantage

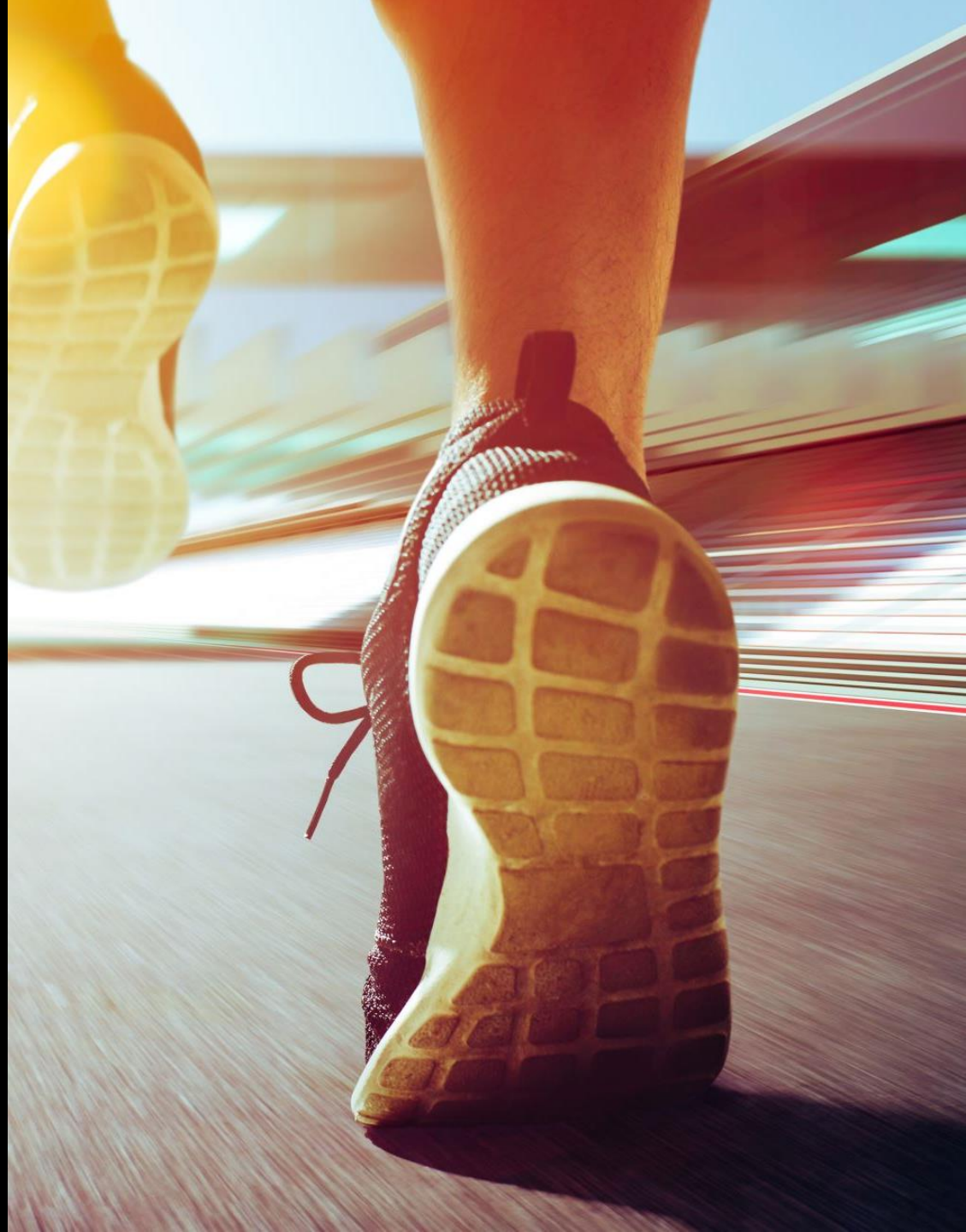
- Cross hatching
  - due to increased tension across the wound and 4 entry and exit points



Running Suture

- Advantages:
- Fast

- Disadvantage:
- Difficult to control eversion
- If one suture breaks the whole construct is weakened



Running Suture Video

- https://youtu.be/n8KDmORIW2o

Skin Staples

- Advantage:
- Fast, strong, low risk infection
- Not much experience needed

- Disadvantage:
- Not as cosmetic
- Nickle allergy

- Most common in scalp lacerations

Staples video

- https://youtu.be/GSv_xQG0apE

Dressing and Splinting

- Area should be cleansed with normal saline
- Antibiotic ointment (? efficacy) for 3-5 days
- Dressing - cover for 24-48 hours and be non-occlusive
- Tension wounds should be splinted for 1-2 weeks

Oral Antibiotics

- Wounds >8-12 hrs old, especially on the hands and lower extremities
- Crushing injuries (compression) mechanism, devitalization, or extensive revisions
- Contaminated wounds
- Violation of the ear or nose cartilage
- Involvement of a joint space, tendon, bone
- Mammalian bites
- Valvular diseases or immunosuppression

Tetanus Prophylaxis

Tetanus Wound Management

Vaccination History	Clean, minor wounds		All other wounds	
	Td	TIG	Td	TIG
Unknown or <3 doses	Yes	No	Yes	Yes
3+ doses	No*	No	No**	No

* Yes, if >10 years since last dose
** Yes, if >5 years since last dose

Documentation

- H & P
  - careful attention to neuromuscular and motor function
- Must document that all wounds were explored
- Type of anesthesia
- Type of wound repair
- Size and number of sutures
- Nature of the wound irrigation
- After care instructions
- Foreign bodies and wound contamination

After Care

All wounds will heal with a scar

Daily cleansing

Signs & symptoms of infection

Suture removal

- Face: 4-5 days
- Scalp 6-8 days
- Extremities and digits: 8-10 days
- Chest and abdomen 8- 10 days

Sunscreen to scar for at least 6 – 12 months

Referral Guidelines

- When in doubt, refer it out!
- Deep wound on face
- Inside the mouth
- Around the eyes
- Into the joint
- Ligament or tendon guidelines
- Fingertip with tissue loss
- You’re not comfortable!

Resources / References

- Simple Interrupted Sutures:
- https://youtu.be/LYc3tTChj5Q
- Running Sutures:
- https://youtu.be/n8KDmORIW2o
- Deep Suture Repair: https://www.youtube.com/watch?v=oEBgmhTCll0
- Skin Staples:
- https://youtu.be/GSv_xQG0apE

Principles of Office Anesthesia Part 1- American Family Physician www.aafp.org/afp/20020701/91.html.

Principles of Office Anesthesia Part 2- American Family Physician www.aafp.org/afp/20020701/99.html.

QUESTIONS