

Basic & Advanced Wound Closure Techniques

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Wound Management - General Principles

Phases of Wound Healing

Phase 1 - Coagulation & Inflammation

Days 1 to 5

Tensile strength of wound ~5% of normal skin

Phase 2 - Proliferation

Days 5 to 14

Phase 3 - Remodeling

Day 14 to complete healing

Tensile strength 15-20% at 3 weeks & 60% at 4 months

Continues to increase up to 1 year (70-90% of original)

- Anesthesia

- Lidocaine

- Max dose 5-7mg/kg
 - Duration ~60 mins

- Epinephrine

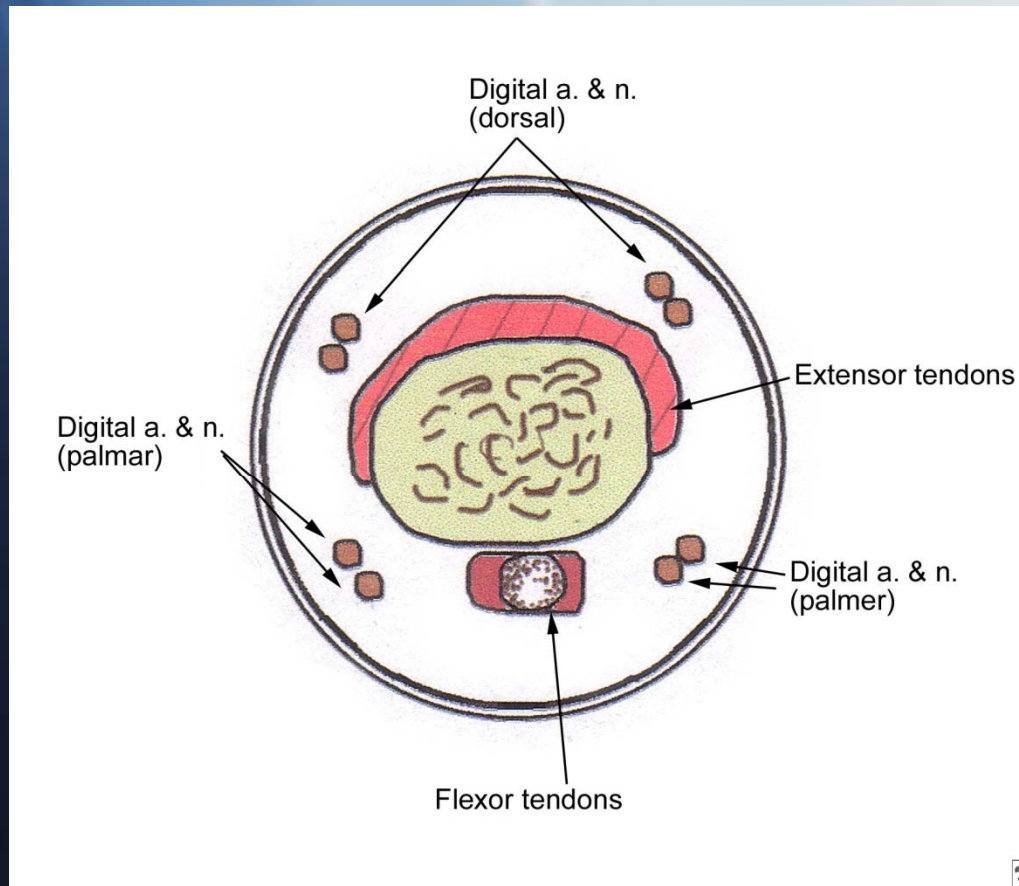
- Prolongs duration, promotes hemostasis and reduces systemic absorption
 - Avoid with Fingers, Nose, Penis, Toes (and Ears)
 - Increases incidence of infection
 - Avoid with contaminated wounds

- Topical

- LET gel - lidocaine/epinephrine/tetracaine
 - Avoid with end artery and contaminated

Local vs. regional

- Less distortion w regional
- Transthecal (palmar) digital nerve block
 - Uses the flexor tendon sheath for infusion of anesthesia
 - A single injection of 2-3 mL of 1 or 2% epi-free lidocaine through the flexor tendons at the base of the digit
 - Inadequate for thumb and the dorsal aspect of the third digit's proximal phalanx b/c of incomplete anesthesia



- Skin & Wound Preparation

- Skin Cleansing

- Hair Removal

- Eyebrows should never be shaved
 - Plaster hair down if possible

- Wound Irrigation

- Removes contaminants, reduces infection, improves visualization

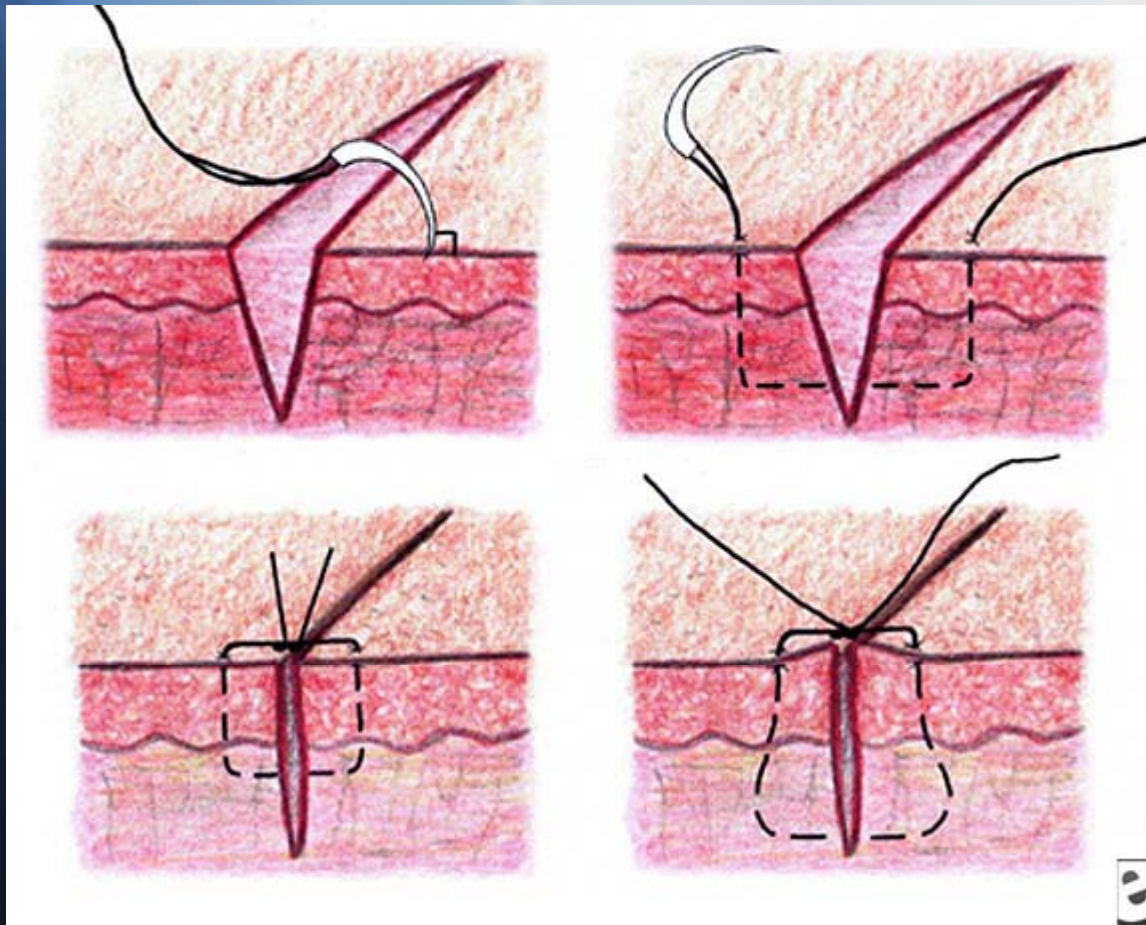
- Wound Debridement

- Wound Excision

- Wound Undermining

- Approximately double the width of the gap
 - Do not undermine contaminated tissue
 - Never on palms, soles or face

Simple Suture



Close Dead Space

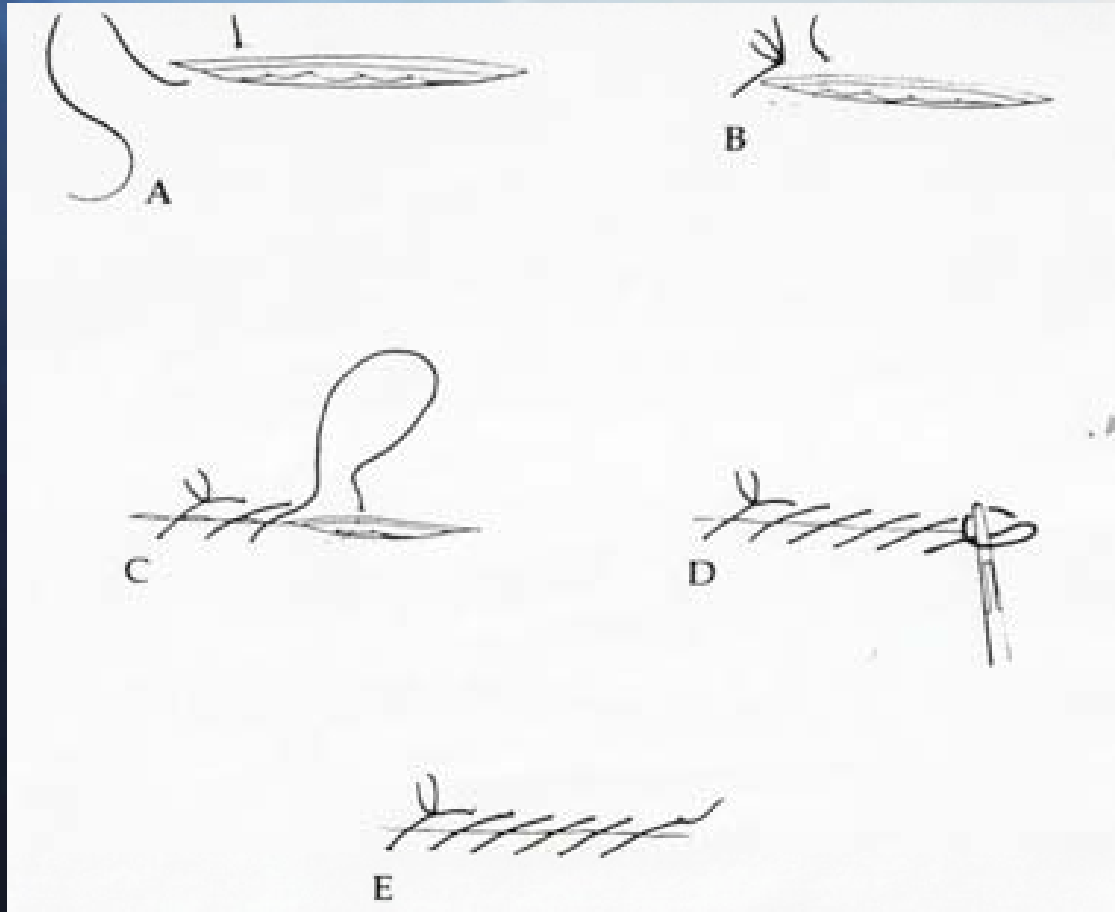
Loosely Approximated

Alignment

Equal Depth

Slight Eversion

Running Sutures

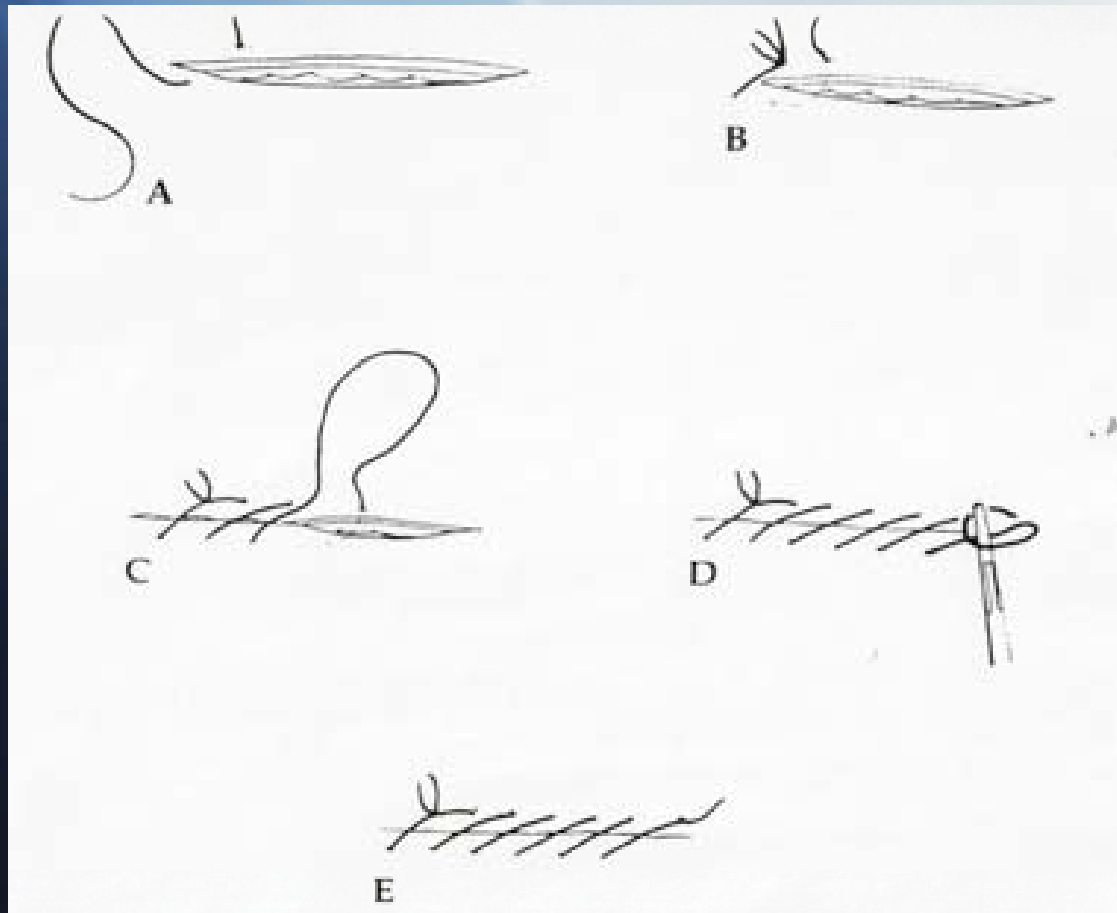


Rapid

Holds in two planes

Not with contaminated
wounds

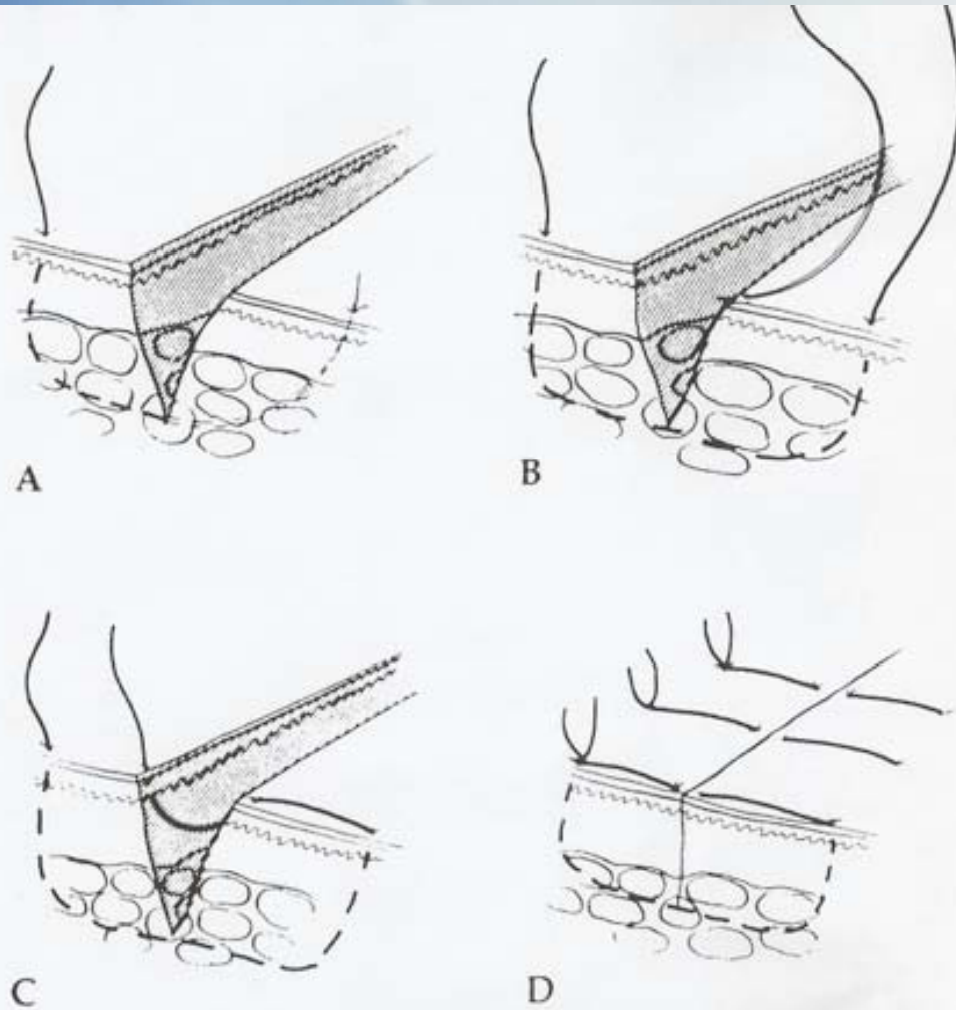
Running Locked



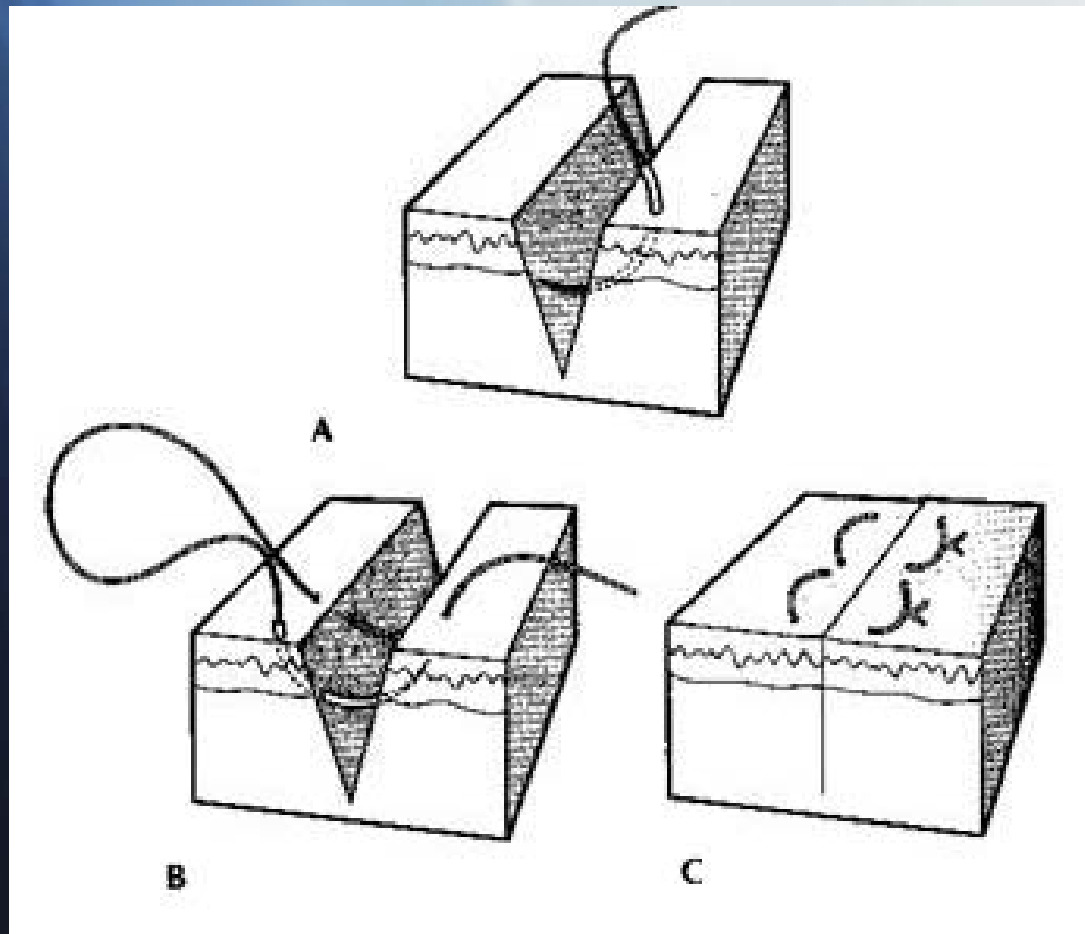
Great for scalp lacerations b/c of good hemostasis

Vertical Mattress

Ensure wound
eversion
Higher risk of
local ischemia



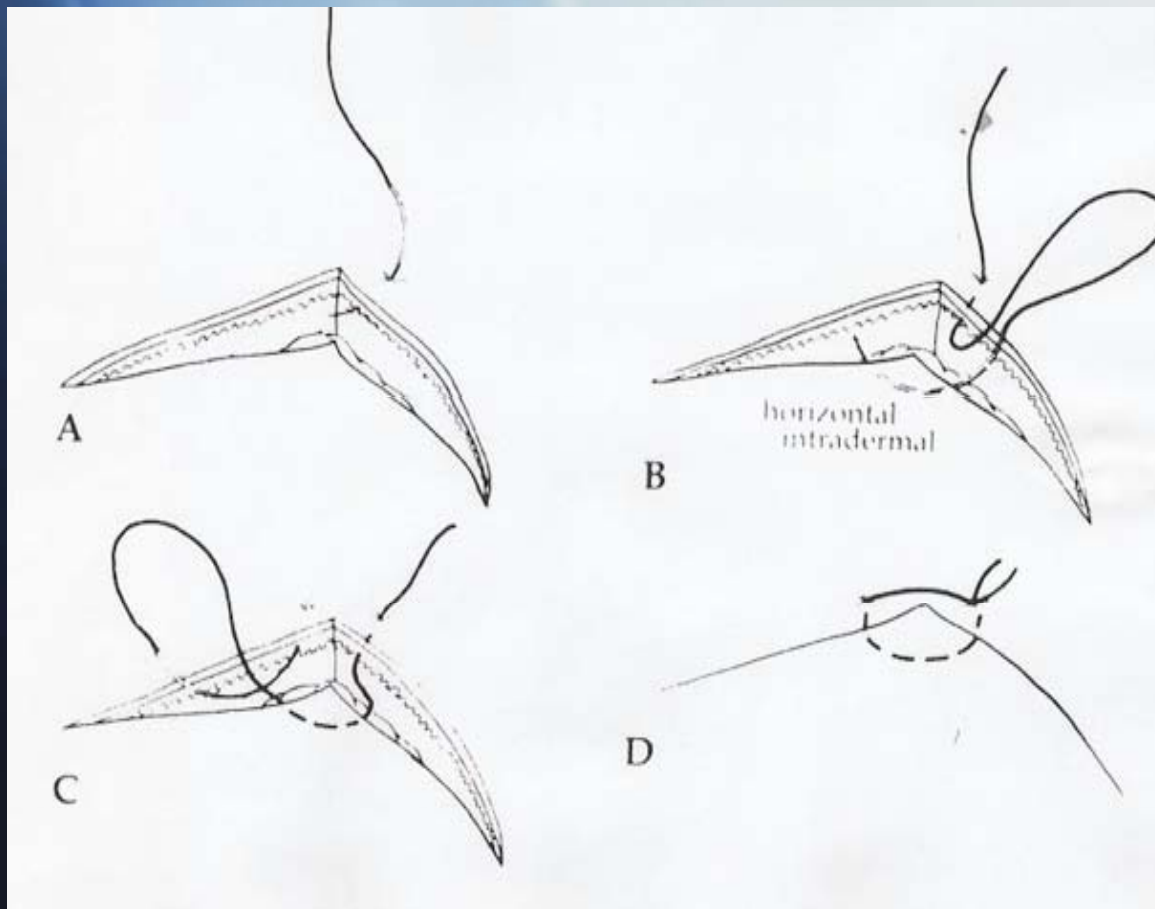
Horizontal Mattress



Ensure wound
eversion

Higher risk of
local ischemia

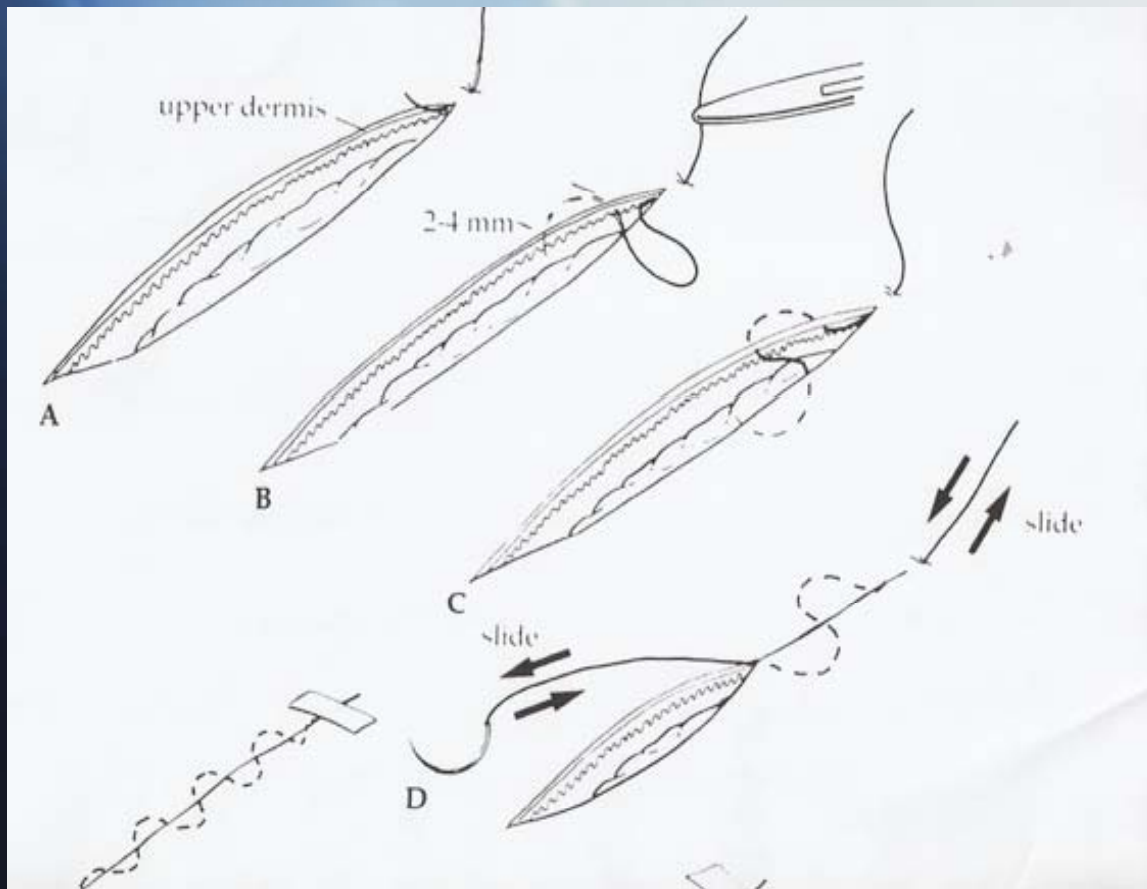
Half-buried Mattress (Apex)



Used for tips
and margins of
flaps

Greater risk of
mismatch of
height &
length

Sub-cuticular



Skin suture marks
avoided

Difficult to achieve
accurate edge
approximation

- Time of Injury
 - Few studies to determine max time to closure
 - Bacteria count increases dramatically >3-6hrs
 - Face & Scalp - 12 to 24 hours (>48hrs)
 - Other areas - 6 to 12 hours
 - Not heavily contaminated
 - Not in high-risk area (hand or foot)

- Characteristics of Tetnus-Prone Wounds

Clinical Feature	Tetnus-Prone	Non-tetnus-prone
Contaminants	Present	Absent
Devitalized tissue	Present	Absent
Infection	Present	Absent
Ischemic	Present	Absent
Mechanism	Burn,crush,bullet	Sharp & smooth
Wound age	> 6 hours	<6 hours
Wound depth	> 1 cm	< 1 cm
Wound type	Abrasion, avulsion, crush, irregular, stellate	Linear or straight

Tetanus Prophylaxis

Immunization Hx	Tetanus-prone	Non-tetanus-prone
Hx of adsorbed Td	Td & TIG	Td & TIG
Unknown or <3 doses	Td, TIG & complete series	Td & complete series
Fully Immunized, >5y & <10y	Td	None needed
Fully Immunized, <5 years	None needed	None needed
Fully Immunized, >10 years	Td & TIG	Td

Td, tetanus and diphtheria toxoids; TIG, tetanus immune globin.

■ Discharge Instructions

- High risk wounds should be reevaluated in 24hr
 - Bites, hand wounds, heavily contaminated and wounds requiring prophylactic Abx
- One in ten persons develops a wound infection
- RTC if signs of infection develop
 - Wound becomes red or has discharge, streaks develop or patient develops a fever

■ Suture Removal

Location	Days	Location	Days
Face	3-5	Neck	3-4
Arm	7-10	Hand	10-14
Chest	7-10	Back	10-14
Buttocks	10-14	Legs	8-10
Foot	10-14	Joints	10-14

Depends on location, amount of tension and healing time of tissue

Scar Formation

6 to 12 months required to form a mature scar

Adequate immobilization is essential

Of wound not entire anatomic part

Hypertrophic Scar

Thick and raised scar within original boundaries

Keloid

Exceeds the boundaries of initial injury

References

- Emergency Management of Skin and Soft Tissue Wounds.

Ernest N Kaplan MD

Vincent R Hentz MD