WOUND HEALING
PATHOGENESIS
CLASSIFICATION OF ULCERS

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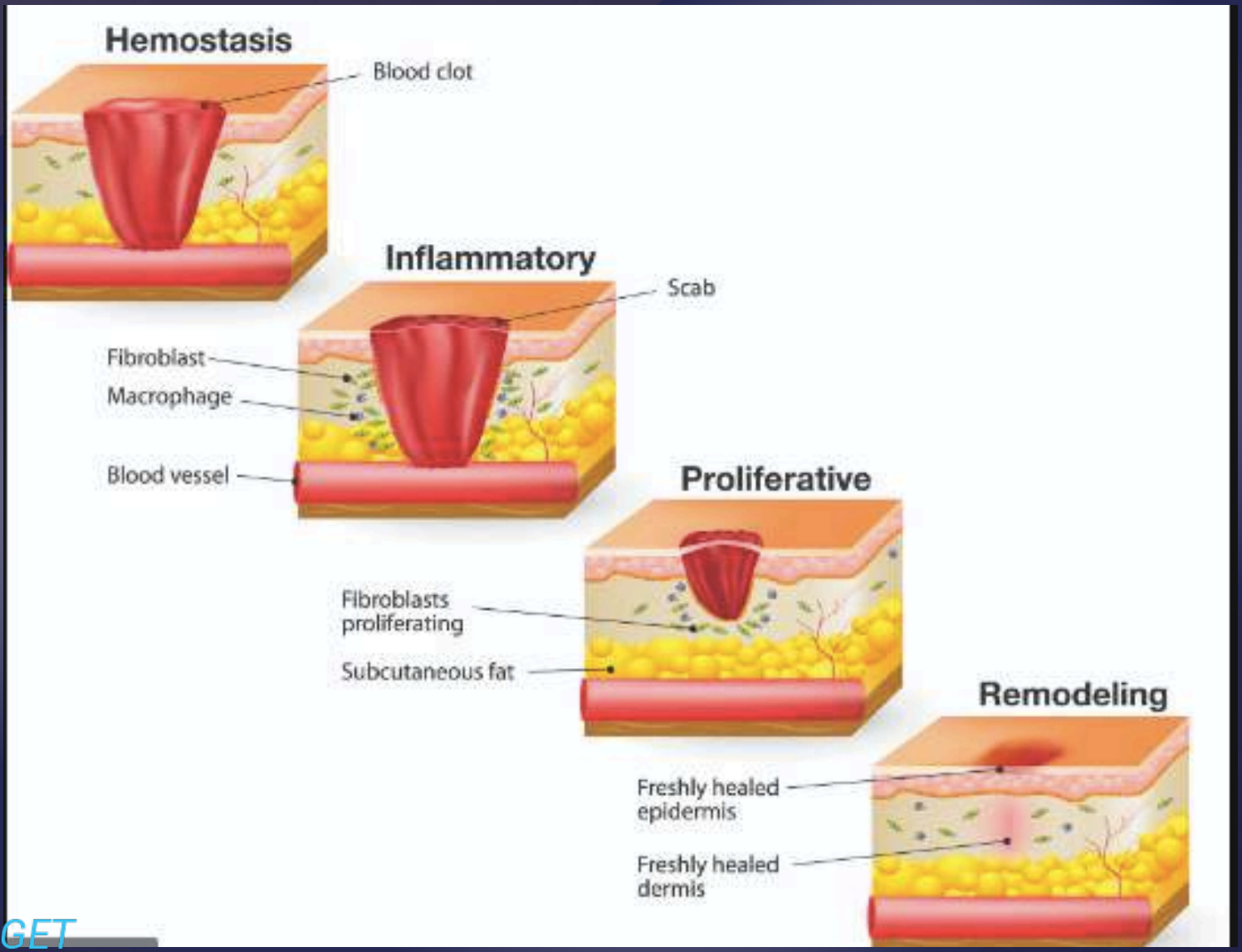
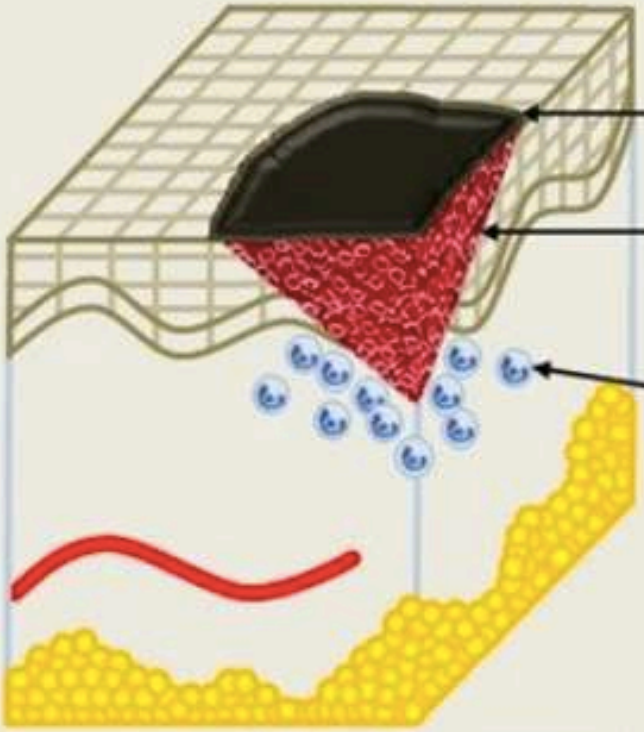
WOUND:

-A break in the continuity of the skin or the mucous membrane. (ulcer)

- Pathogenesis
- Types of healing
- Types of scars





Scab
(Formation of hard coating on the skin)

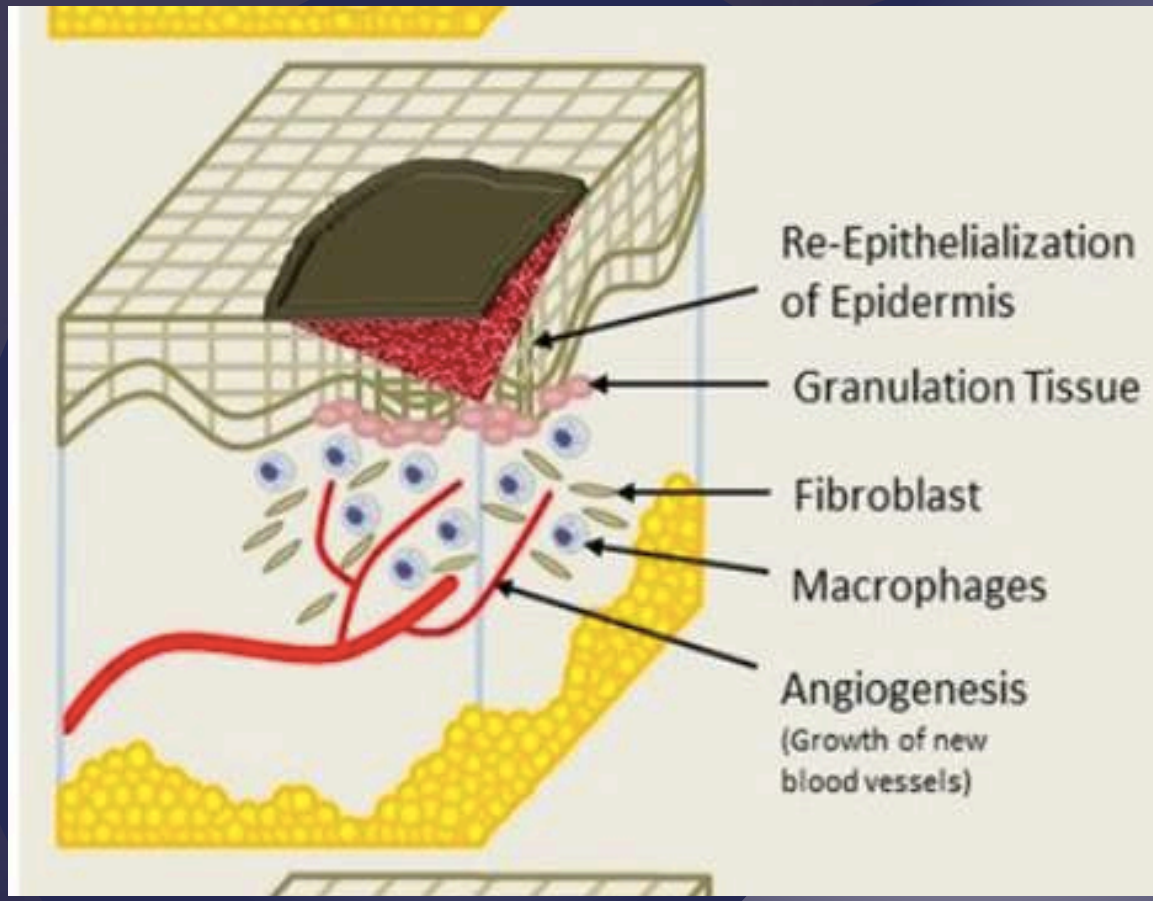
Coagulation
(Formation of blood clots)

Neutrophil Granulocytes
(White blood cells)

Inflammatory Phase

After tissue injury, a coagulation cascade is initiated to stop bleeding.

In the presence of infection, the neutrophils increased.



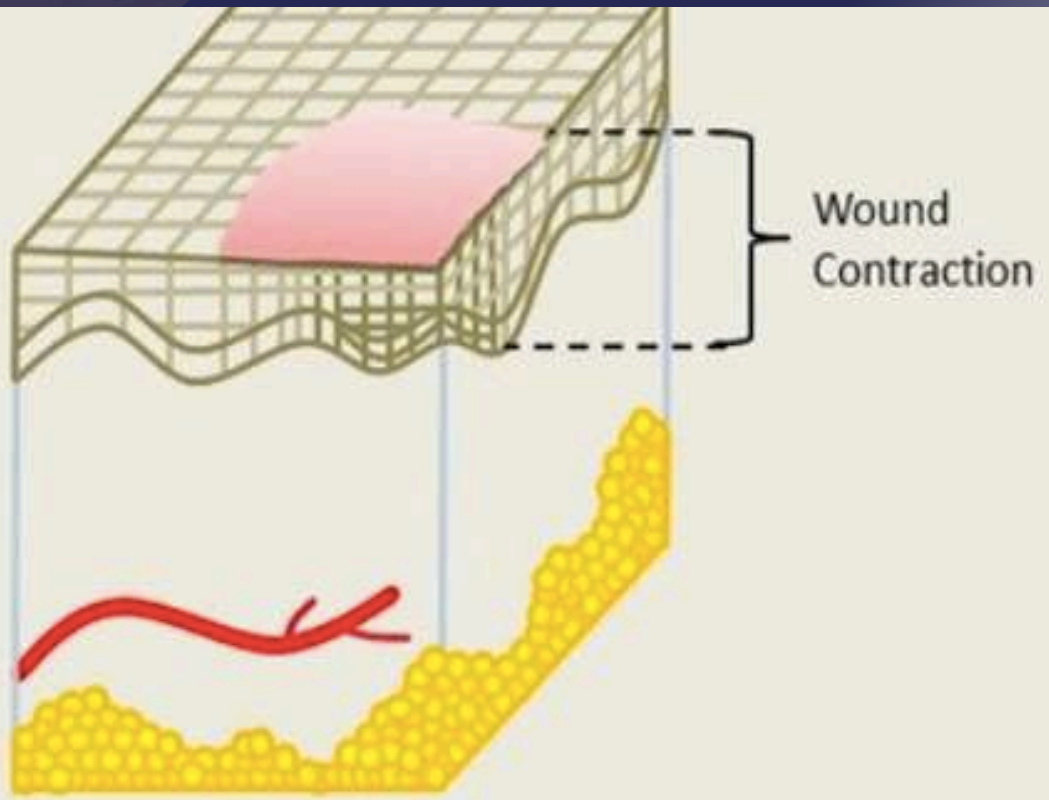
Late-Inflammatory Phase

The macrophages stimulate angiogenesis and re-epithelialization.

Fibroblast activated to deposit excessive amount of collagen for wound repair.

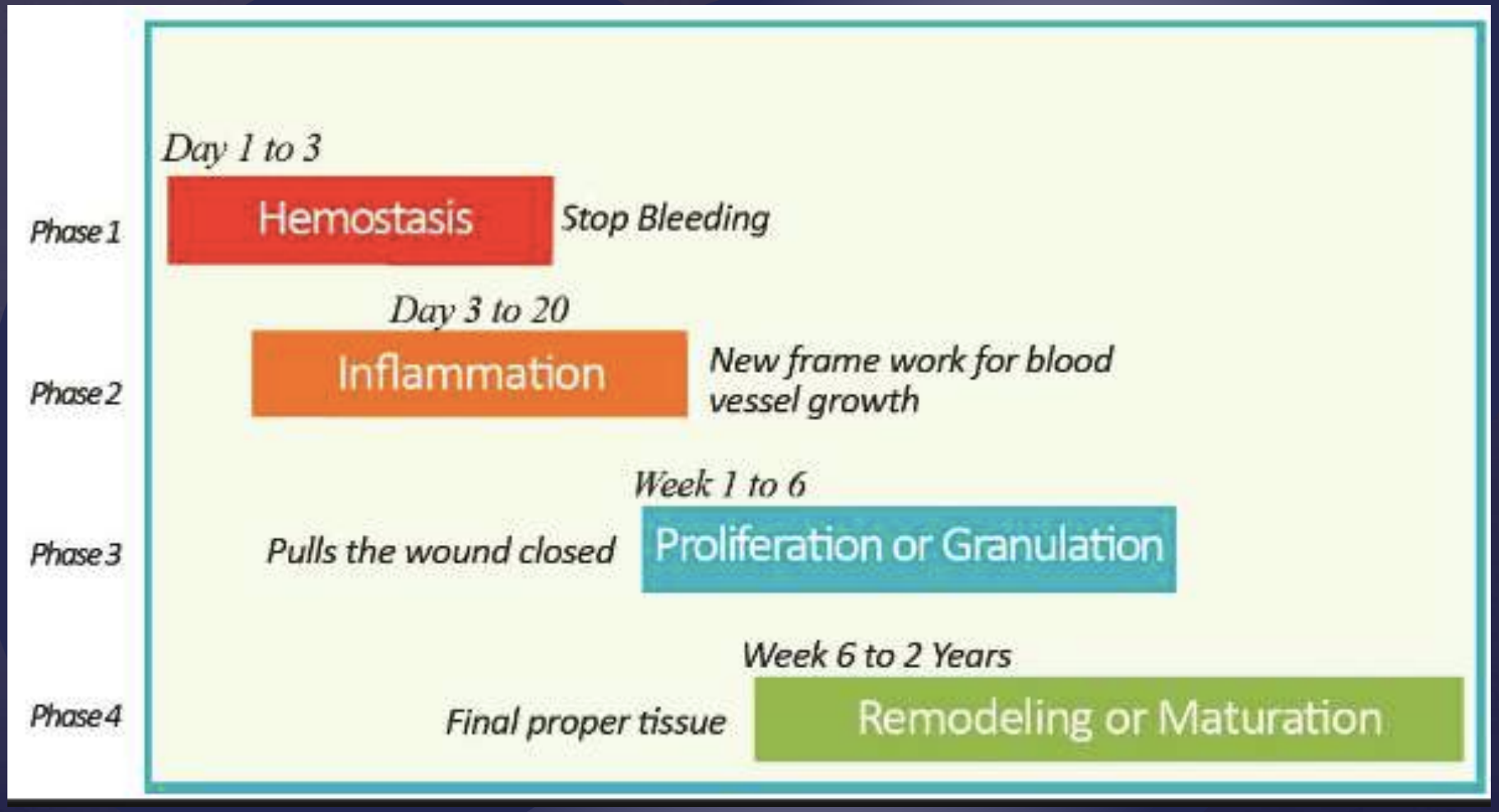
Proliferation Stage

Granulation tissue begins to form and is a loose network of collagen, fibronectin and hyaluronic acid.

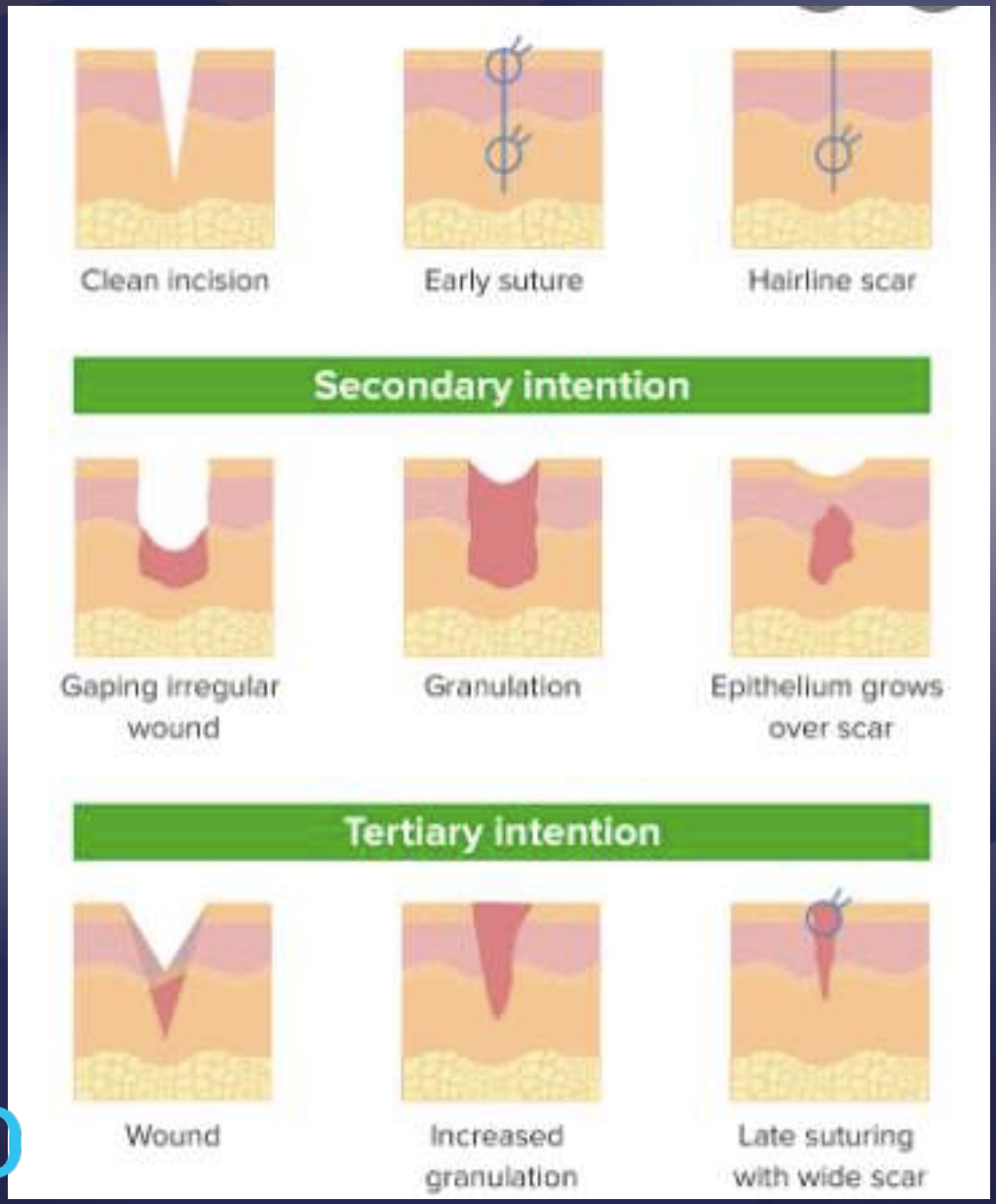


Maturation Phase

Further collagen deposition and cross linking of extracellular matrix will occur therefore the scar tissue gains tensile strength.



PRIMARY INTENTION



Late wound healing events

Collagen synthesis

- 3-5 days post injury
- Primarily by fibroblasts
- Maximum synthesis rate 2-4 weeks
- Declines after 4 weeks
- Type 1 collagen most common (80-90% of skin collagen)
- Type 3- seen in early phases of wound healing

Hypertrophic Scar

Distinguishing features

- Appear as red raised scar tissue
- Scarring does not extend beyond boundary of original wound
- Nodular structures containing α-SMA-producing myofibroblasts
- Promote scar contractures
- Can regress with time

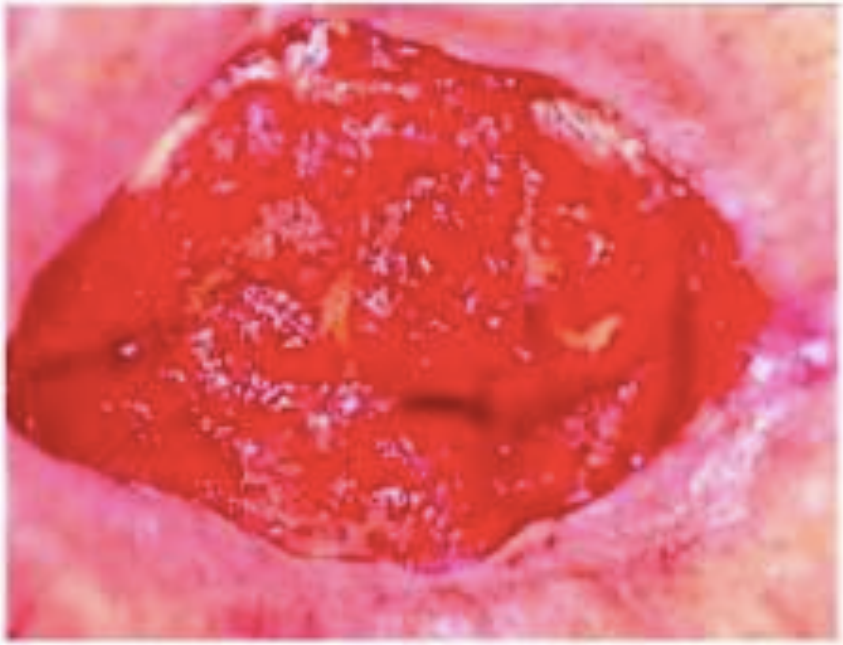
Keloid

Distinguishing features

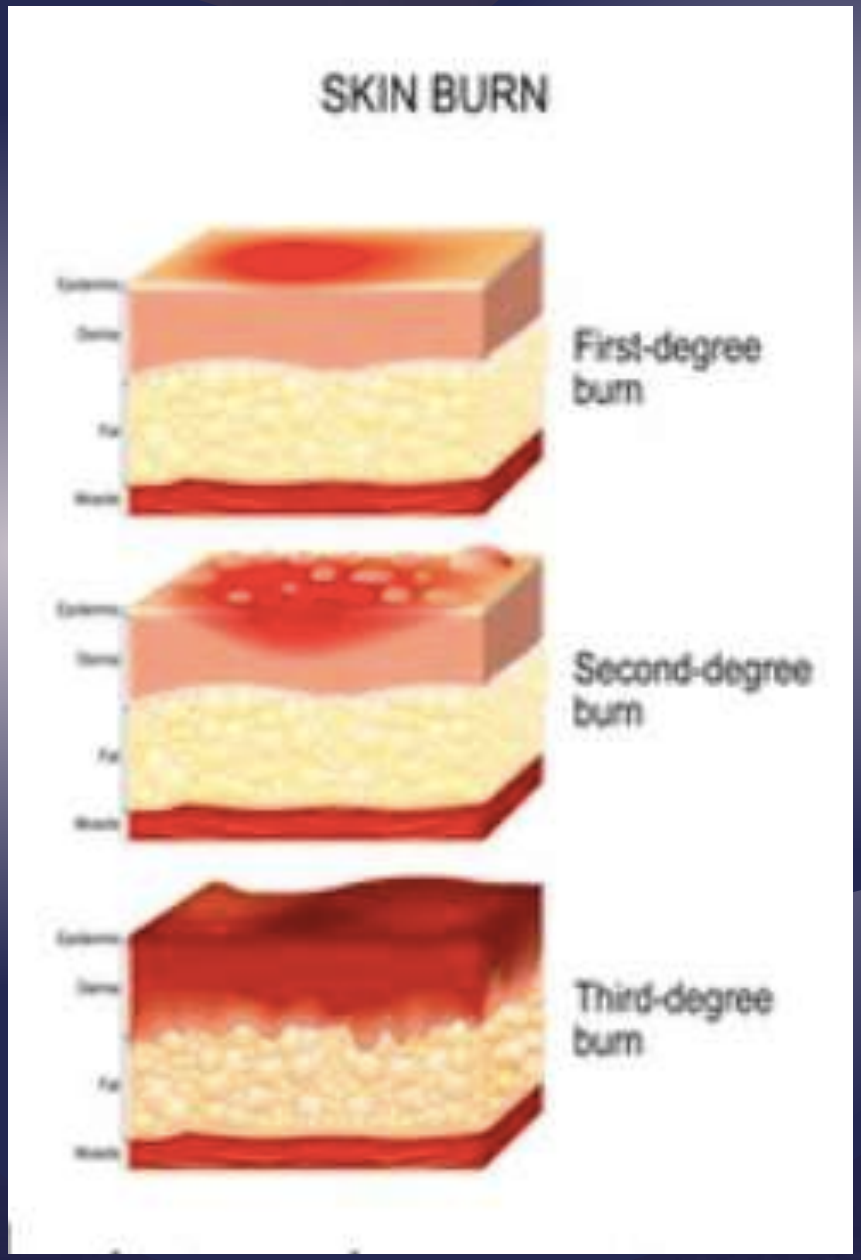
- Often appear as shiny rounded protuberances, color ranges from pink to purple
- Scarring extends beyond boundaries of original wound
- Rarely nodular, no α-SMA producing myofibroblasts
- Do not promote scar contractures
- Do not regress with time

GRANULATION TISSUE: good or bad??

- Beefy red in appearance
- Perfused with capillary loops
- Needed for epithelialization to occur



BURN

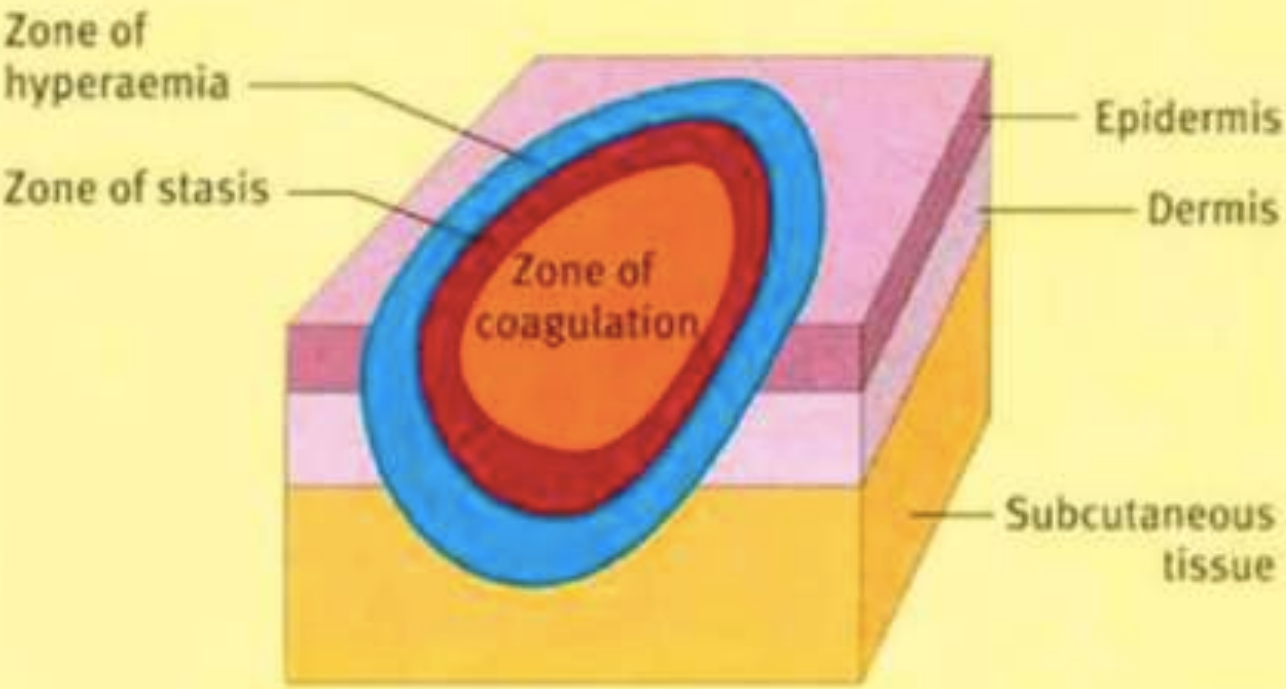


BURN

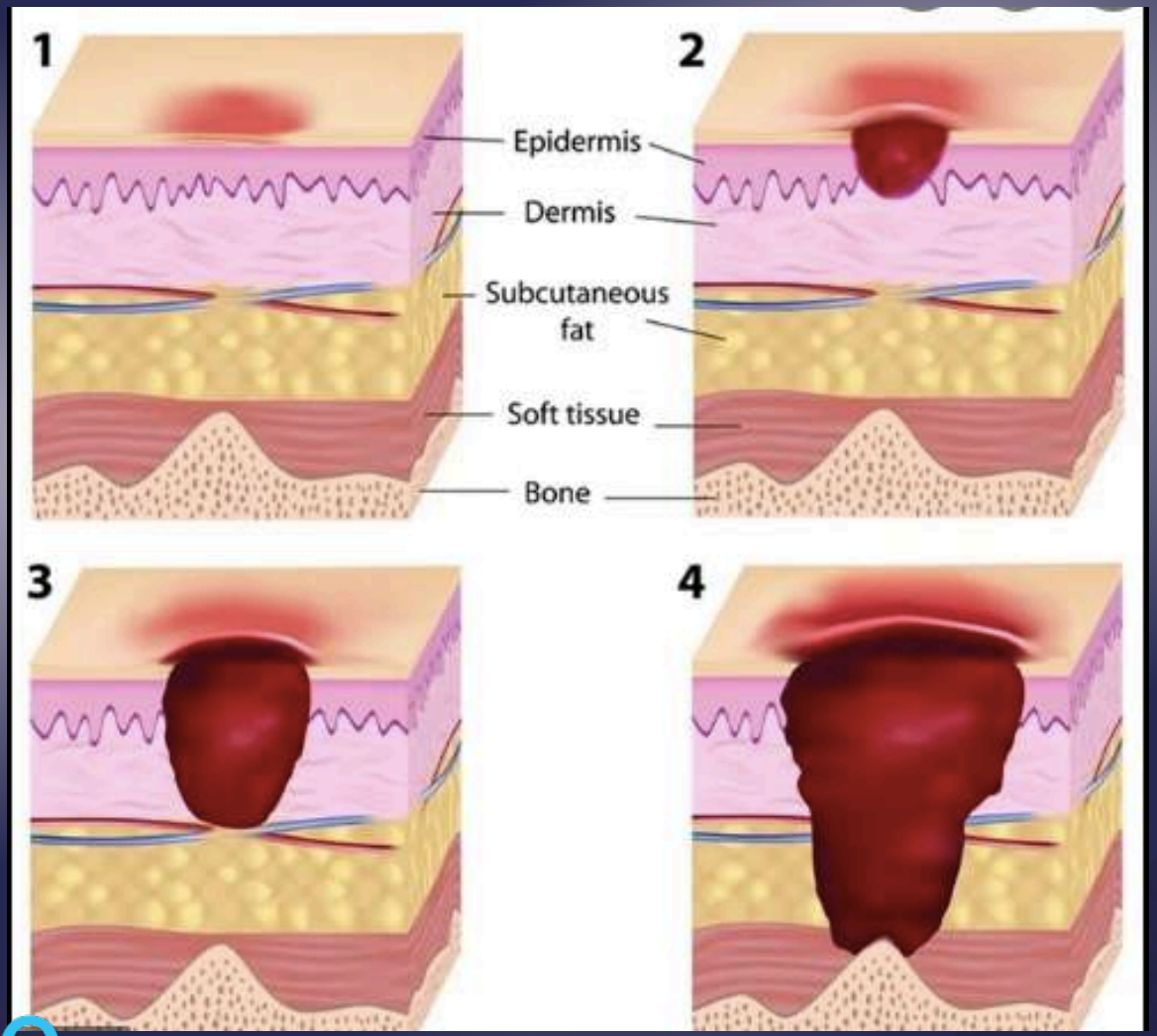
To identify the degree of burns :

DEGREE	EXTENT	COLOUR	BLISTERS	PAIN/SENSATION	HAIR/GLANDS
First	Epidermis	Pinkish Blanching +	NO	YES	YES
Second Superficial	" and papillary dermis	Pinkish Blanching +	YES	YES	YES
Second Deep	Full dermis	Pale-Pink peeling Blanching -	NO/ Late	Decreased	MAYBE SEEN
Third	Subcutaneous tissue	Pale Thrombosed veins	NO	Decreased	NO
Fourth	Muscle/tendon/bone	Black, charred	NO	NO	NO

Schematic representation of Jackson's burn model



PRESSURE SORES



GRADES

The degree of pressure sores varies and are graded depending on their severity

- Grade I – reddening of the skin
- Grade II – blister and abrasion
- Grade III – full skin loss in which depth of the ulcer is obscured by slough
- Grade IV – the sore now exposes bone and tendon

BRADEN SCORE:

- Sensory perception
- Nutrition
- Moisture
- Activity
- Mobility
- Friction and shear

MANAGEMENT:

- Mobilisation
- Nutrition
- Alpha bed
- VAC
- Debridement
- Flaps

VASCULAR ULCERS

Lower Limb Ulcers

Arterial

Sites of trauma Pressure areas (e.g. heel)	Site
• Hypertension • Diabetes • Smoking • Hyperlipidaemia • Family history	Risk factors
• Severe pain • Limb may be cold and have reduced/ absent pulses	Clinical features
Well-defined and regular Punched out	Border
Deep, sloughing (green) or necrotic (black)	Base
History of intermittent claudication or critical limb ischemia	Associated features
Ankle Brachial Pressure Index (ABPI) to quantify extent of peripheral vascular disease	Investigation

	Venous
Site	Most commonly found in gaiter region
Risk factors	• Increasing age • Varicose veins • Venous thromboembolism • Pregnancy • Obesity
Clinical features	• Can be painful, particularly towards end of the day • On examination, may have varicose veins with ankle/ leg oedema
Border	Shallow with irregular borders
Base	Pink, granulating
Associated features	Signs of venous insufficiency e.g. varicose eczema, lipodermatosclerosis
Investigation	Duplex ultrasound to confirm diagnosis. ABPI to assess any arterial component and suitability of compression therapy

NEUROPATHIC ULCER

DIABETIC, weight bearing areas, callous, iceberg phenomenon

WOUND MANAGEMENT

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DEBRIDEMENT :

"Removal of dead(necrotic) and infected tissue to help in wound healing."

- It is essential to do thorough **debridement** before proceeding for any advanced dressings/ VAC or even closure/cover.

- Usage of various dressing materials without debridment can cause further damage by trapping the infected tissue underneath and leading to further necrosis and even local or systemic manifestations.

VAC:
- Vacuum Assisted Closure

NPWT:
- Negative Pressure Wound Therapy

PRINCIPLE:
The application of negative pressue to a debrided, healing surface leads to :

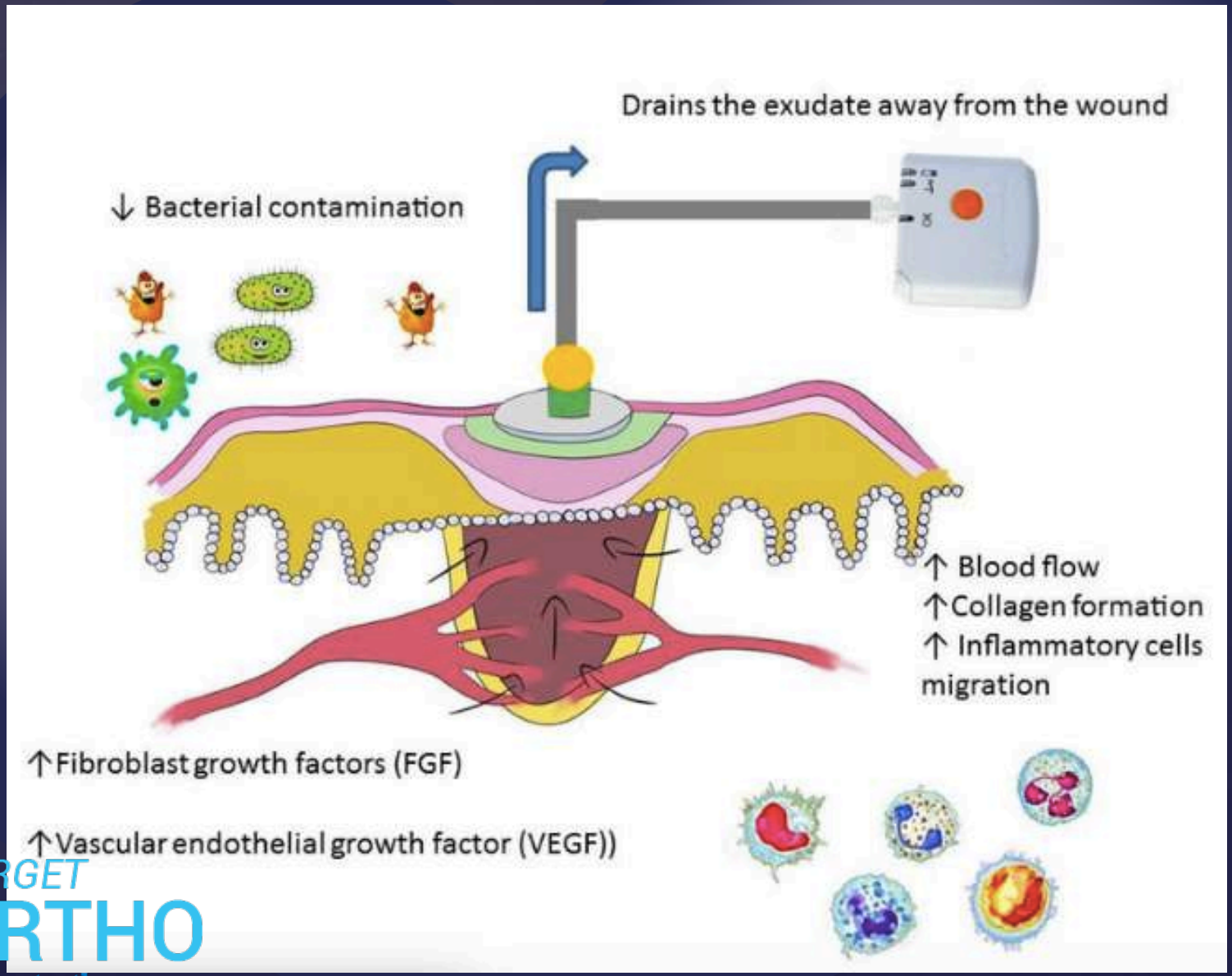
- Angiogenesis

- Wound contraction

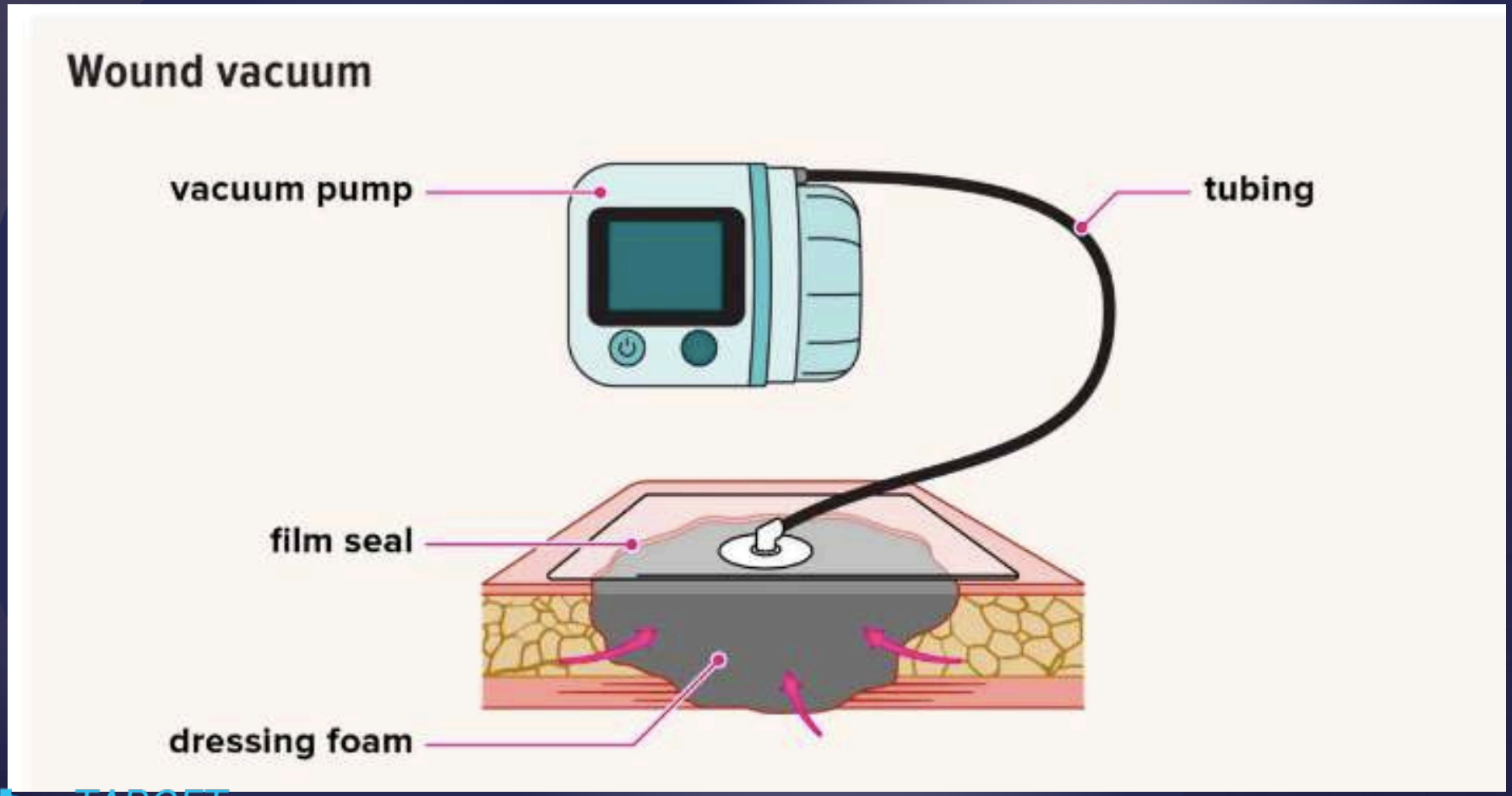
- Granulation tissue formation

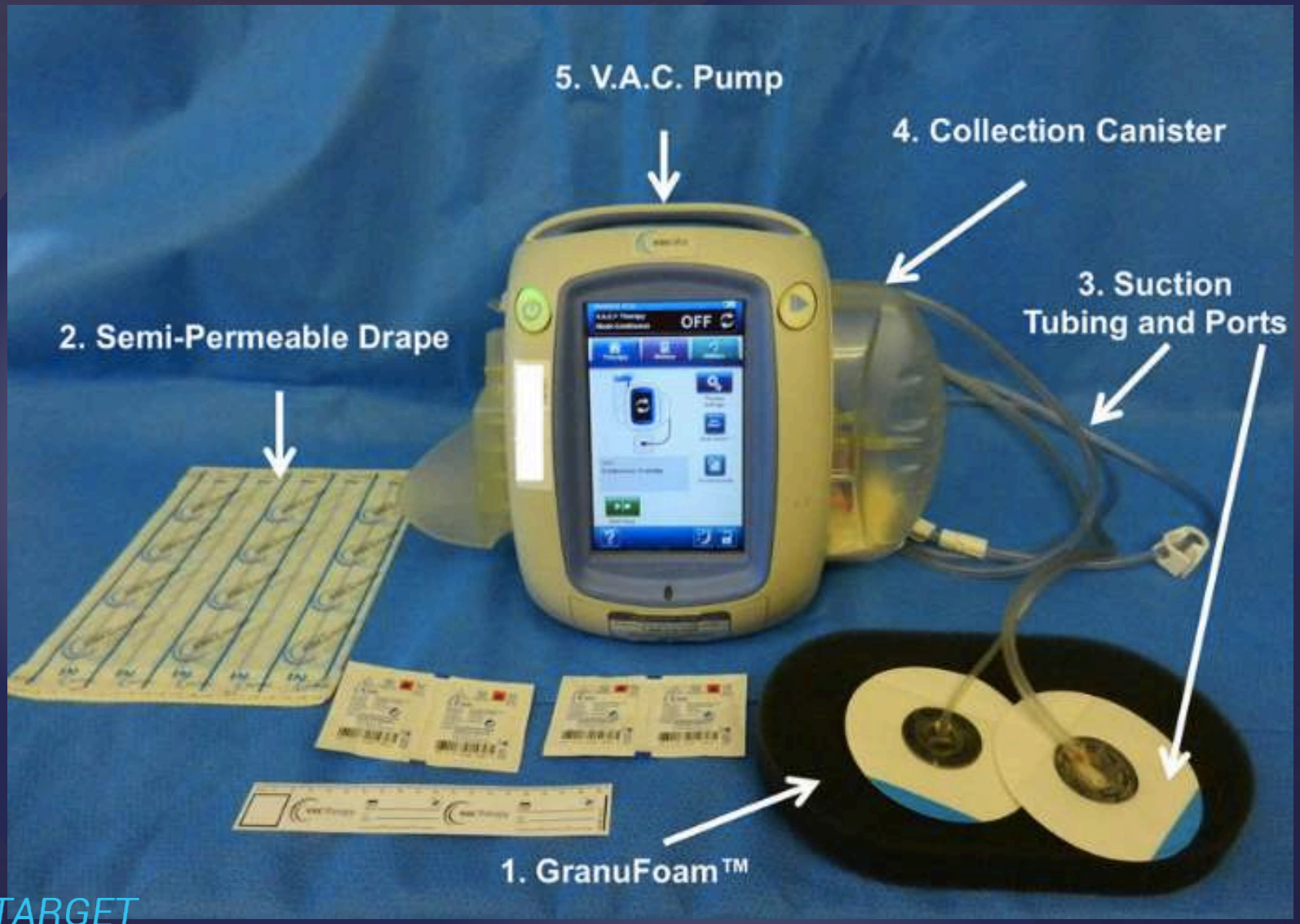
- Reduced bacterial load

MECHANISM OF ACTION

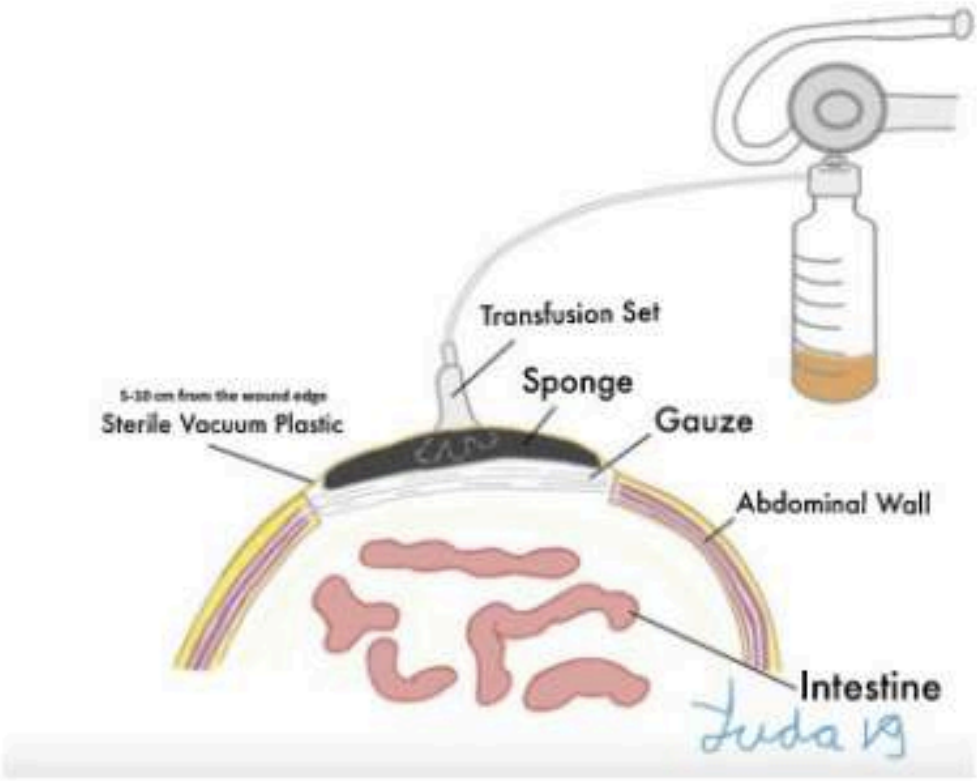


EQUIPEMENT





VAC & WALL SUCTION



SETTNGS:

- Continuous or intermittent
- 50 to 125 mmHg. (negative)

- Intermittent mode consists of a cycle of 5 min on and 2 min off phase.

- Intermittent mode and low pressure is used for chronic painful wounds or in case of abdomen.

POINTS TO REMEMBER:

- To debride thoroughly before VAC application
- To apply paraffin mesh (bactigras) over wound to avoid foam intergration into the wound
- To change VAC dressing every 3 days
- To consider debridment again in case of murky collection in canister and fever
- ABSOLUTE CONTRAINDICATION : Acute bleeding surface, slipped ligature!

USAGE:

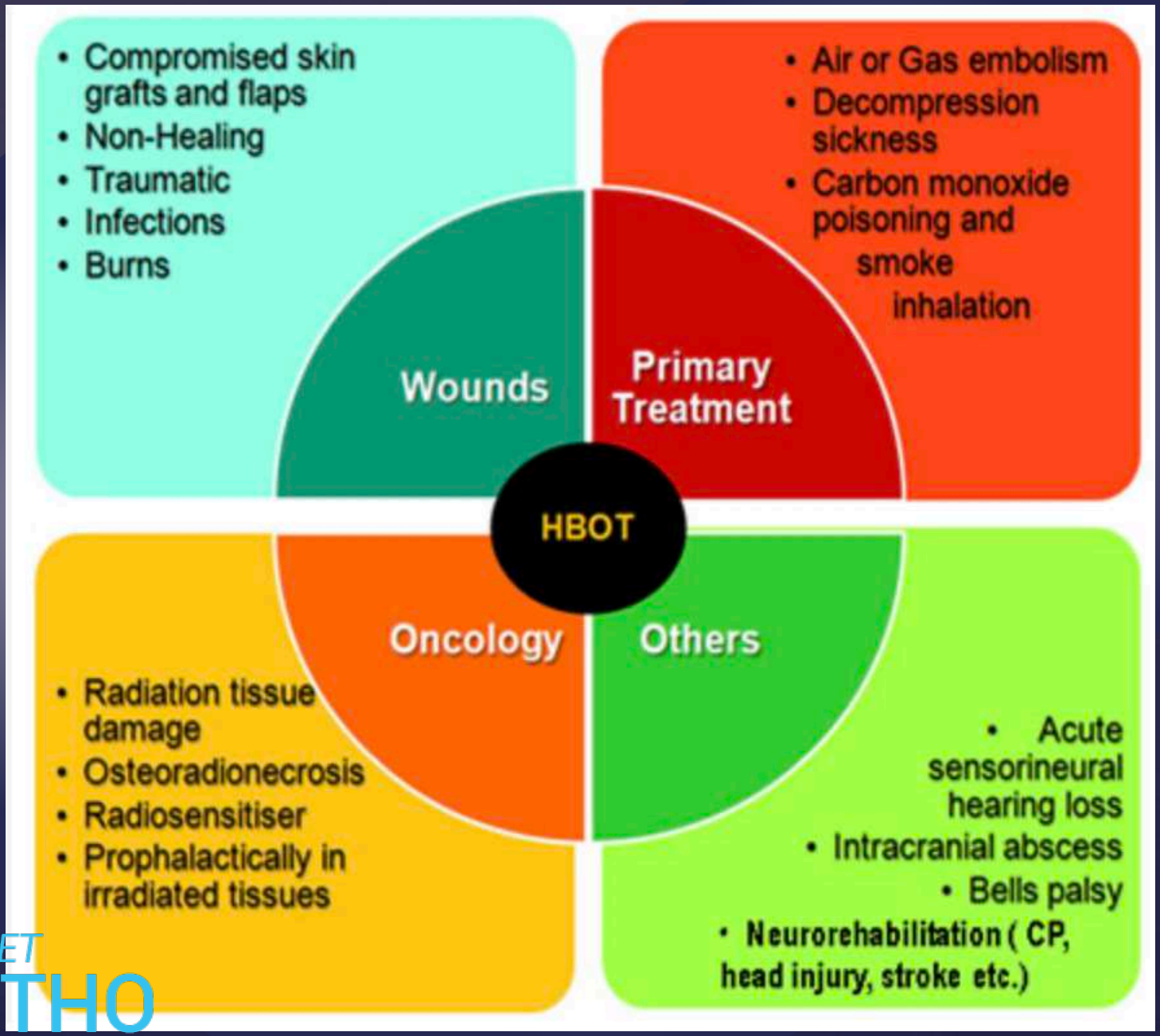
- Pressure sores
- Exposed bony surfaces
- Chronic ulcers
- Diabetic foot
- Abdomen wounds
- Delayed flap closure

HYPERBARIC OXYGEN THERAPY

WHAT IS HBOT

- Hyperbaric oxygen therapy (HBOT) entails breathing pure oxygen in a room/enclosure with high pressure
- The HBOT chamber has three times the normal air pressure so that the lungs take in more oxygen
- This oxygen-rich blood circulating in the body can help fight bacterial infection or produce growth factors and stem cells to accelerate healing

- HBOT helps patients with serious infections, bubbles of air in blood vessels and wounds that won't heal as a result of diabetes or radiation injury



THERAPY:

- 2 or 3 ATA
- 60–90 min each session
- 3 to 5 sessions for acute conditions
- 50–60 sessions for radiation illnesses.

- ABSOLUTE C.I : Impending Pneumothorax
- Side effect : Barotrauma to ear

ANTISEPTIC SOLUTIONS:

- Betadiene : 10% Povidone Iodine solution
  : 5% Ointment

- Savlon : Chlorhexidine + cetrimide

- Dettol : Chlorxylenol

- EUSOL : Edinburgh University Solution
  1.25gm Boric Acid
  1.25gm bleaching powder
  100ml NS

SILVER DRESSINGS :

- Silver nitrate cream/gel (silverex) (staining)

- Ionised colloidal silver gel (Megaheal)

- Ionised silver foam dressing (Mepilex Ag)

WHY silver?

- Broad spectrum antimicrobial
- Alters MMP in wounds
- Reduced frequency of dressing

SPECIAL DRESSING MATERIALS:

SILVER FOAM

SILICON/FOAM DRESSING

SKIN SUBSTITUTES

- Burns
- SSG donor sites
- Chronic ulcers

- Dressing/ treatment

- Xenogenic
- Allogenic
- Combined

COLLAGEN:

- Bovine/ porcine

- Dry sheet (applied directly)

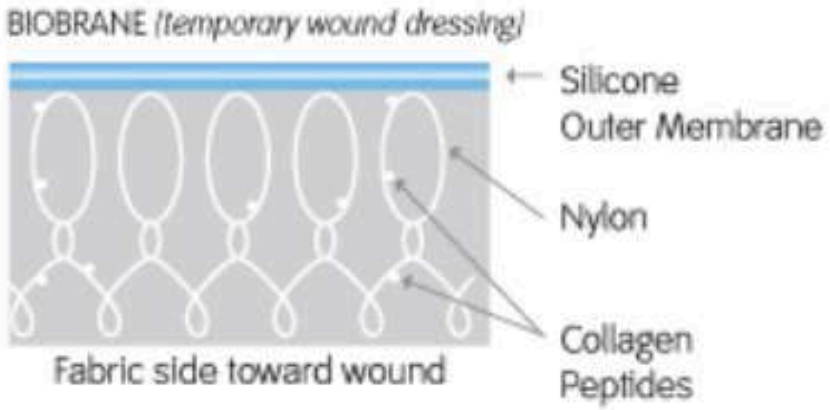
- Wet sheet (applied after rinsing in NS due to alcohol solvent)

- Granules (for ulcers)
- Gel (for cavities)

- Temporary dressing till healing occurs by epithelailisation

ACELLULAR DERMAL MATRIX
(ALLODERM)

BIOBRANE

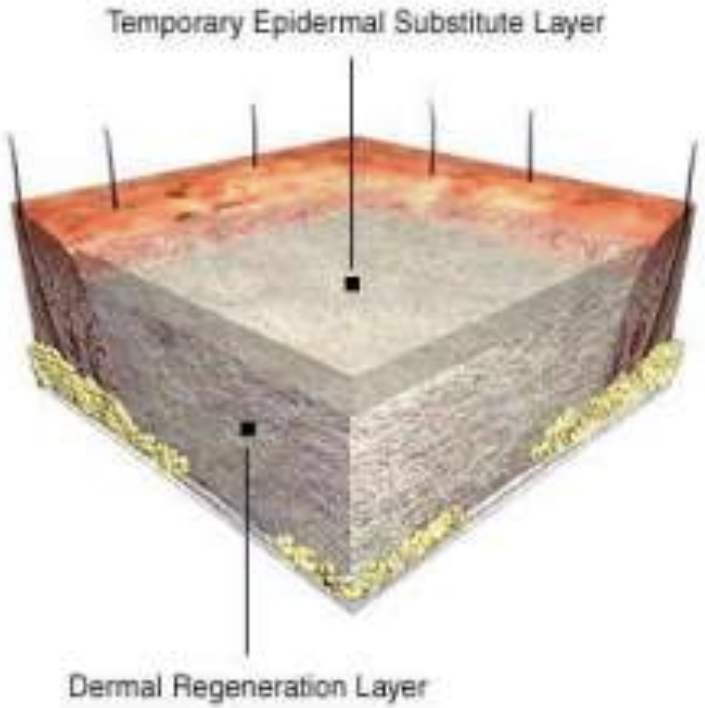


Reduces water vapour loss

- The silicone outer layer acts like a protective epidermal barrier and reduces the water loss from the wound which is essential to avoid wound desiccation
- Allows some water vapour permeability which is beneficial in preventing excess fluid accumulation

Reduces pain

INTEGRA
(permanent dermal matrix)



CADAVERIC SKIN GRAFT

- Allograft
- Cadaver skin grafts
- Temporary subsitute
- 60 to 70% burns
- Skin bank
- Problems with infection, sepsis

THANK YOU!

Linkedin – Dr.Priyanka Sharma

Instagram – drps_plastics

Youtube – DrPS