

Welcome



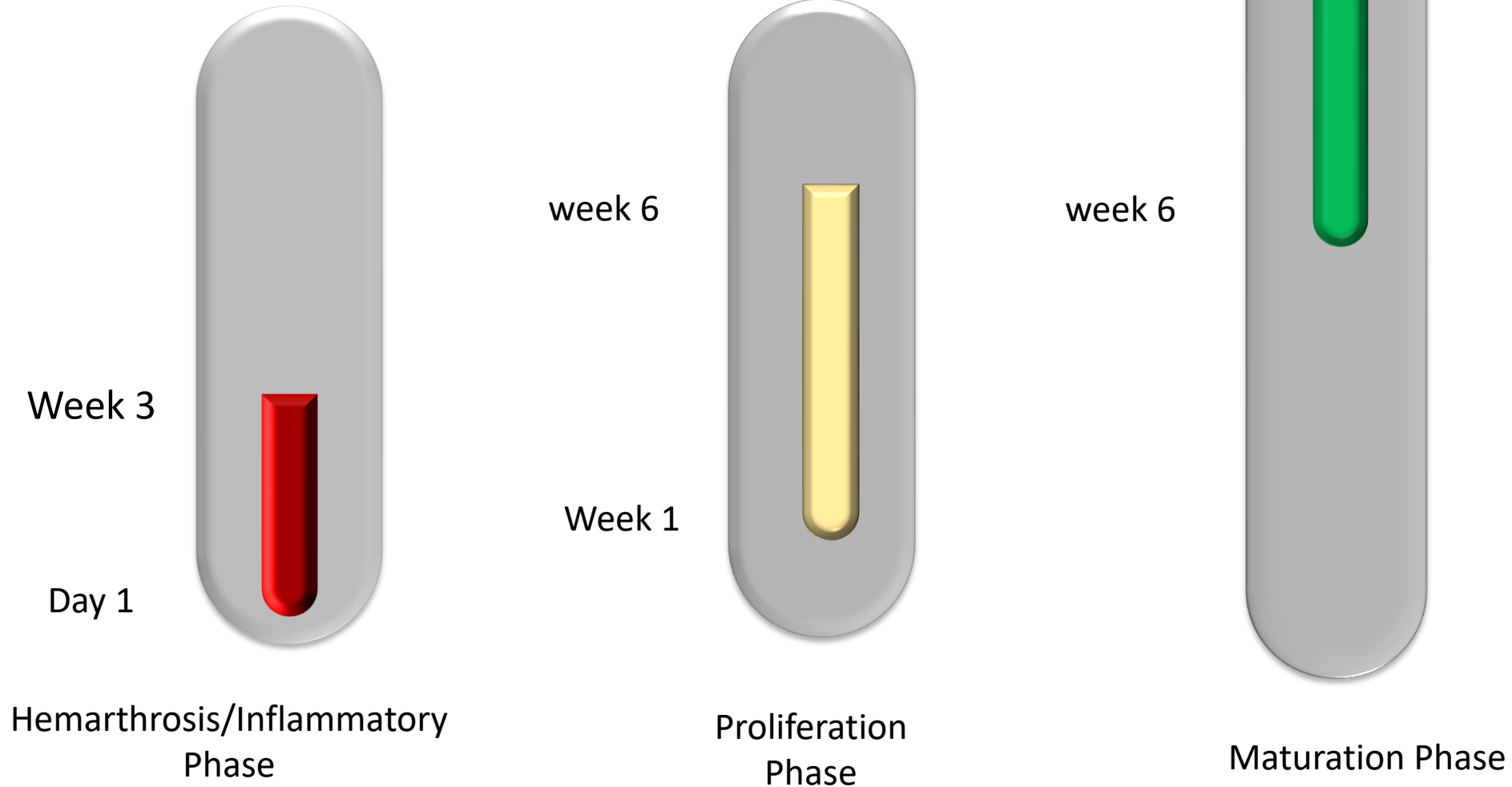
Healing Continuum

You Can't Rush Biology

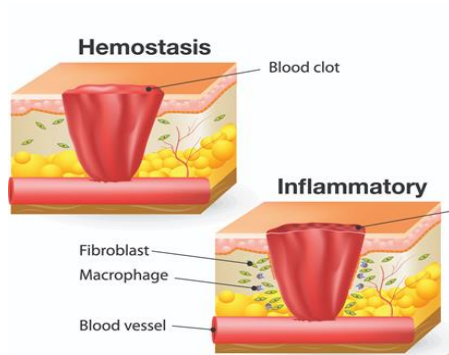


**RESPECT
THE
PROCESS**

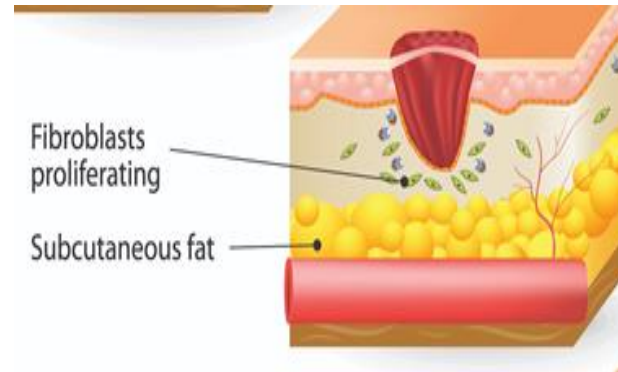
Phases of wound Healing



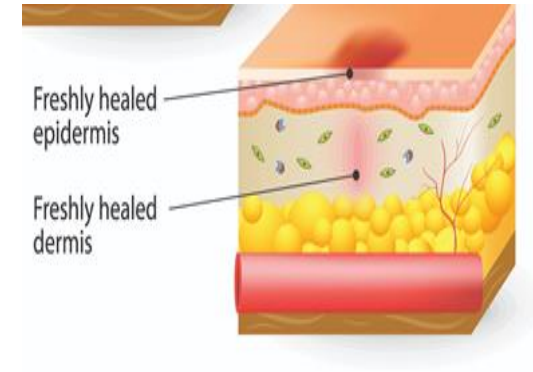
Phases of wound Healing



Hemarthrosis/Inflammatory
Phase

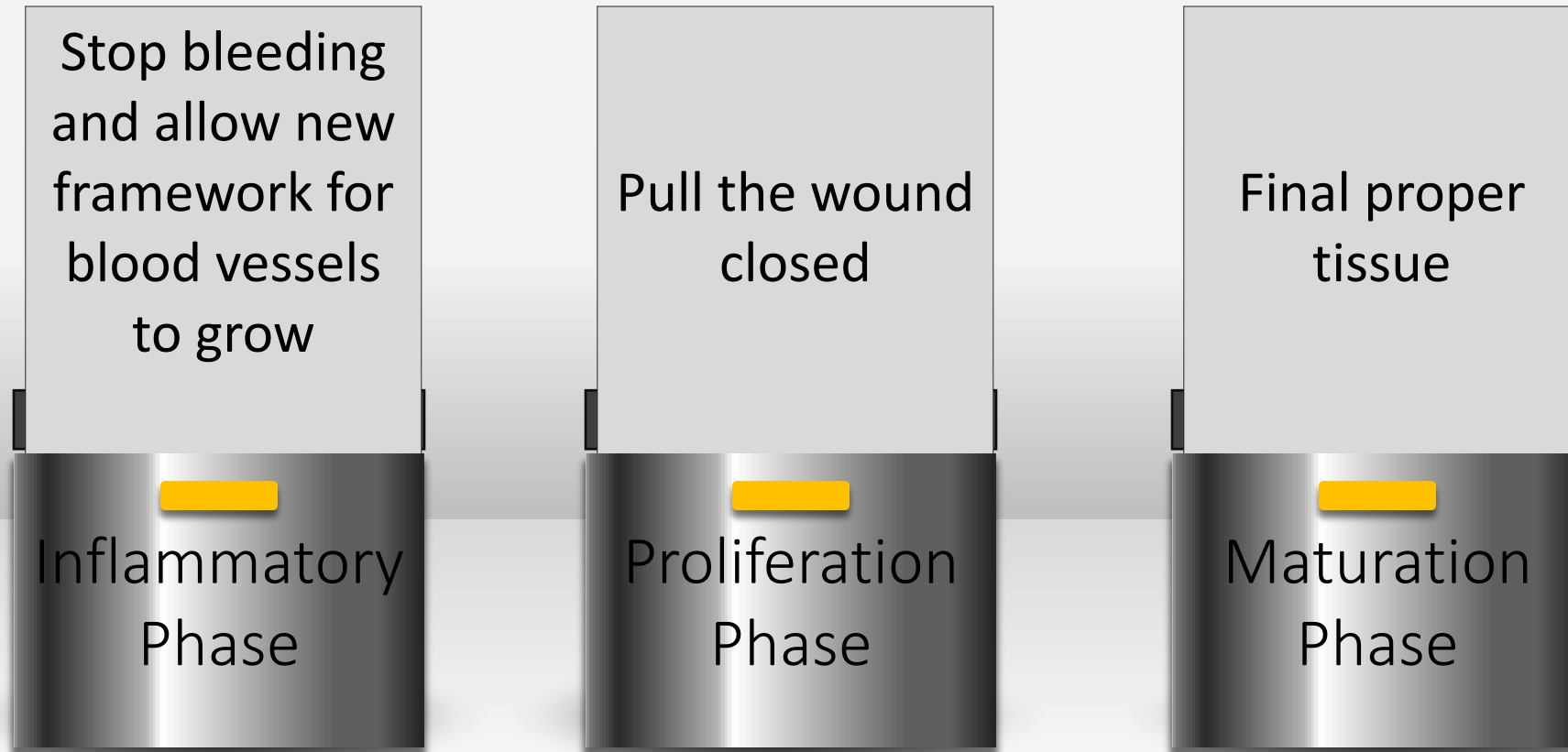


Proliferation Phase



Maturation Phase

Goals for phases of healing



Healing Times

	0-3 days	4-14 days	3-4 wk	5-7 wk	2-3 mo	3-6 mo	6 mo-1 yr	2 yr
Tendon								
Tendinitis								
Rupture								
Muscle								
Exercise induced								
Grade I								
Grade II								
Grade III								
Ligament								
Grade I								
Grade II								
Grade III								
Lig. graft								
Bone								

FIGURE 3-1 Tissue-healing time line.

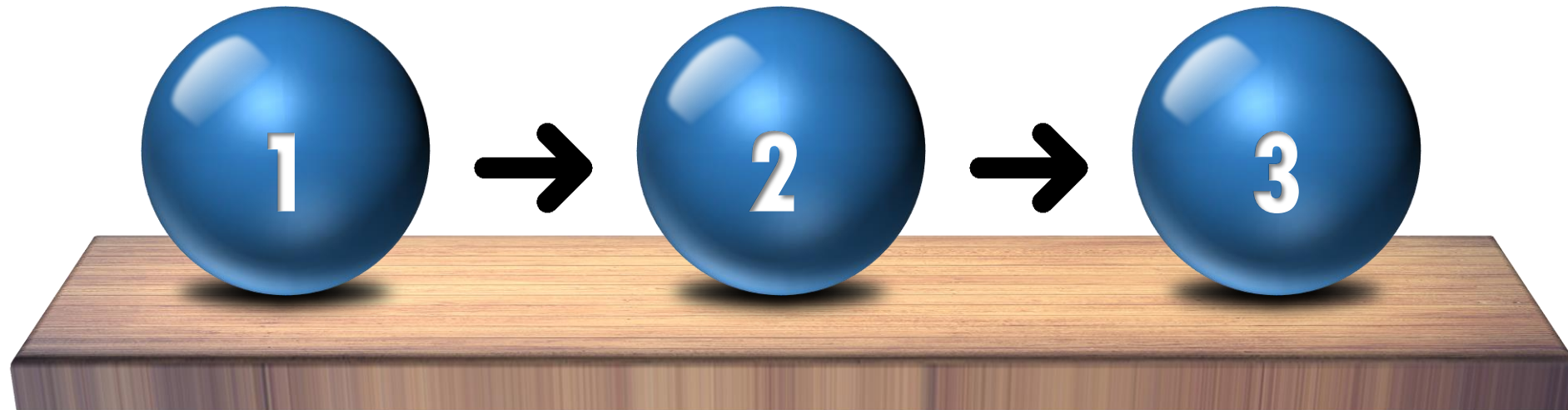
Criteria-Based Progression

- The Concept that recovery is NOT based simply on the passage of time, but rather based on the achievement of measurable objective milestones.



Snyder-Mackler et al. Clinical Commentary; Current Concepts for Anterior Cruciate Ligament Reconstruction: A Criterion-Based Rehabilitation Progression. J Orthop Sports Phys Ther. 2012;42:601-614

Inflammatory Phase



Hemarthrosis

0-3 days

Inflammatory Phase

3-20 days

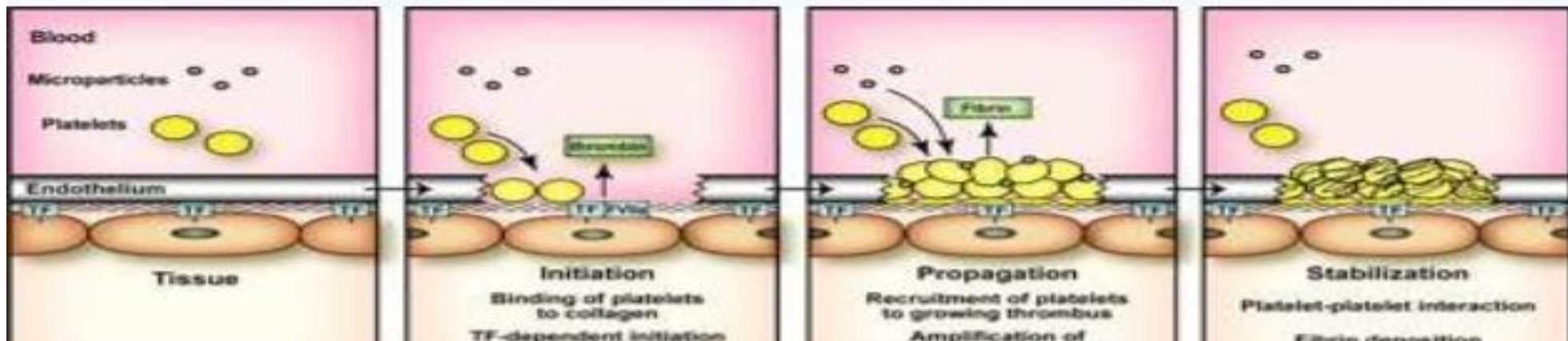
Goal

- Stop bleeding
- Produce a clean wound for tissue restoration

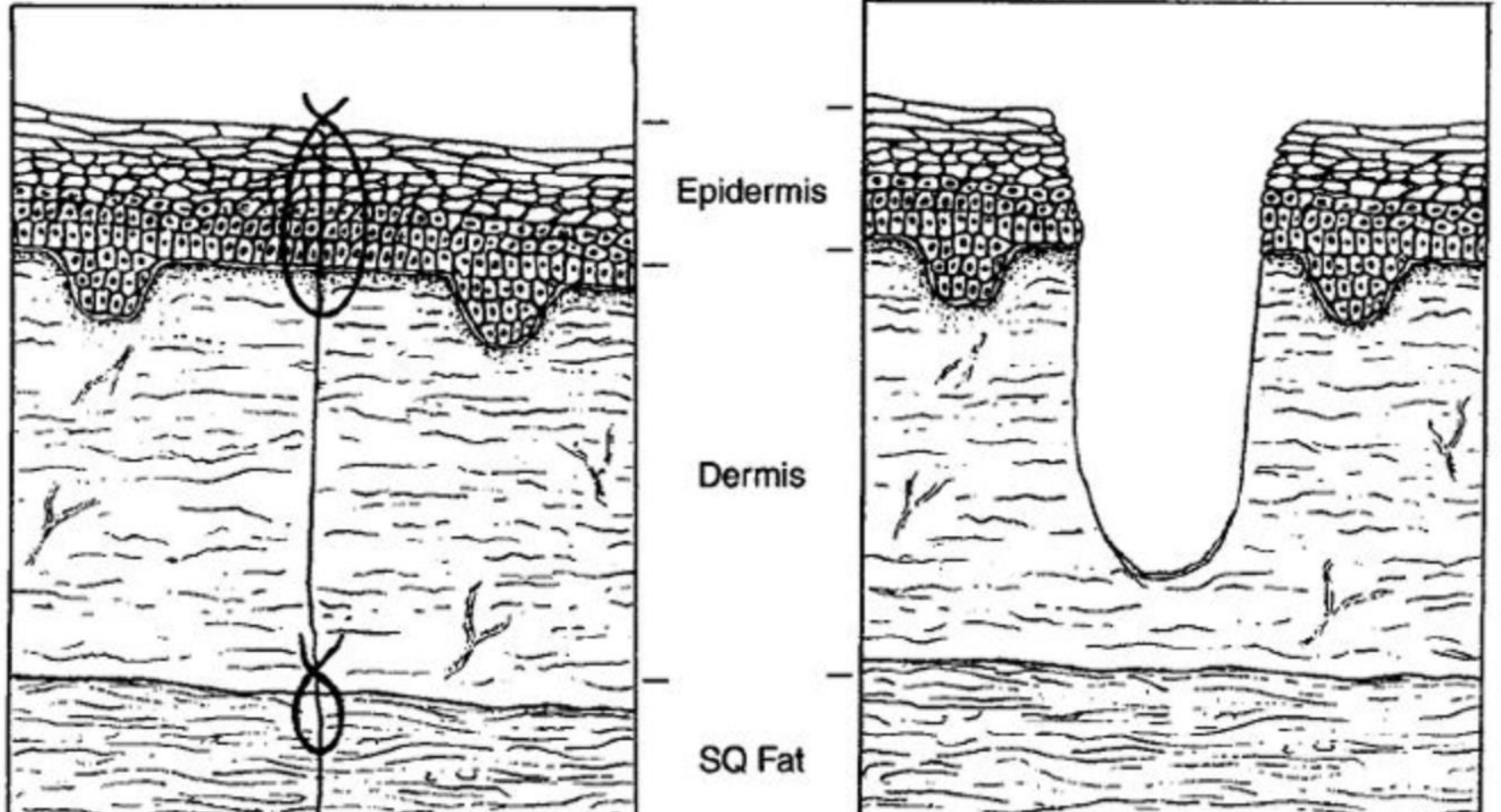


Coagulation cascade to attain hemostasis

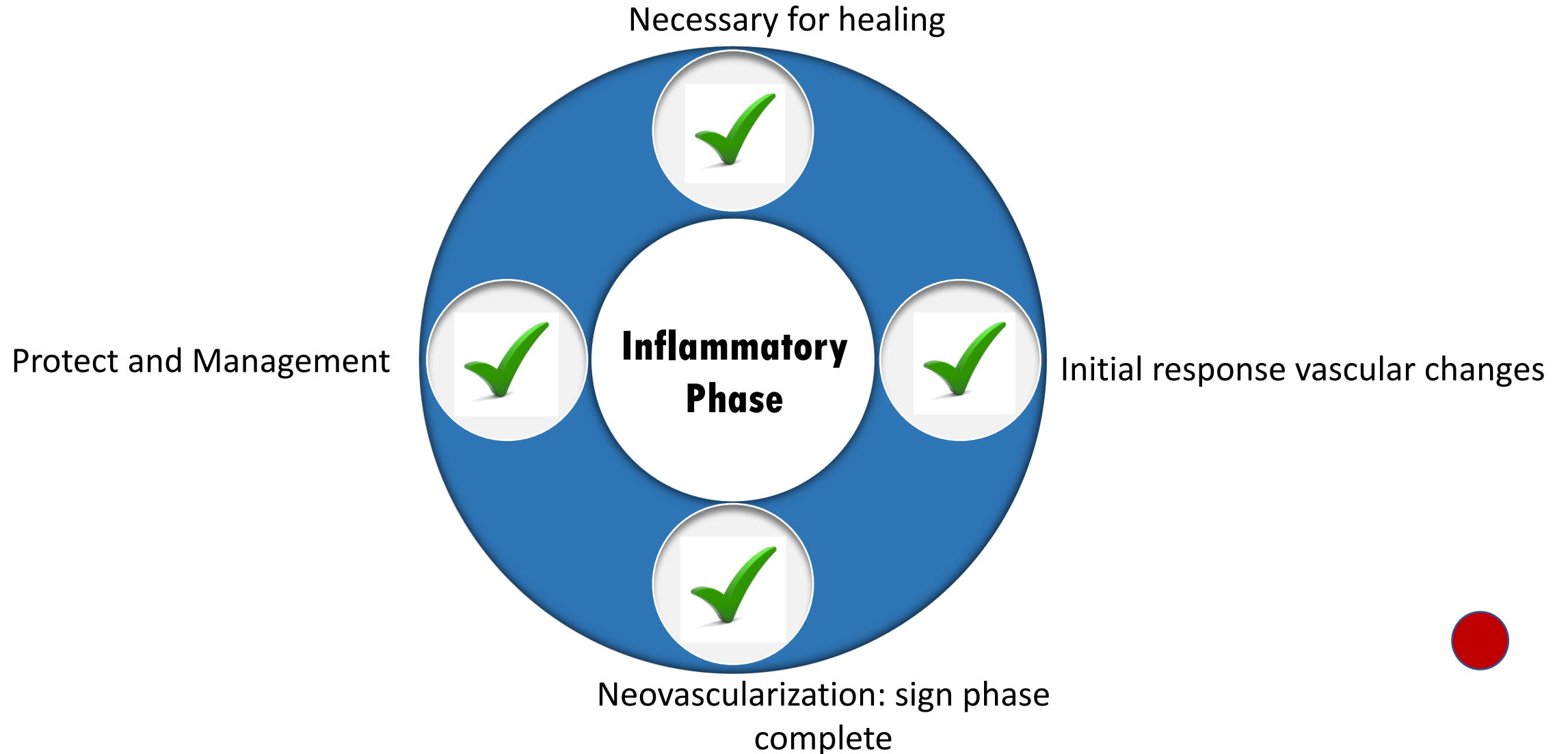
- These events stabilize hemostasis, begins production of chemoattractants and initiate the process of wound decontamination.
- This result in formation of a coagulum.



Primary versus Secondary Intention Healing



Inflammatory phase keys:



Drainage POD 1-4

Initially: bloody



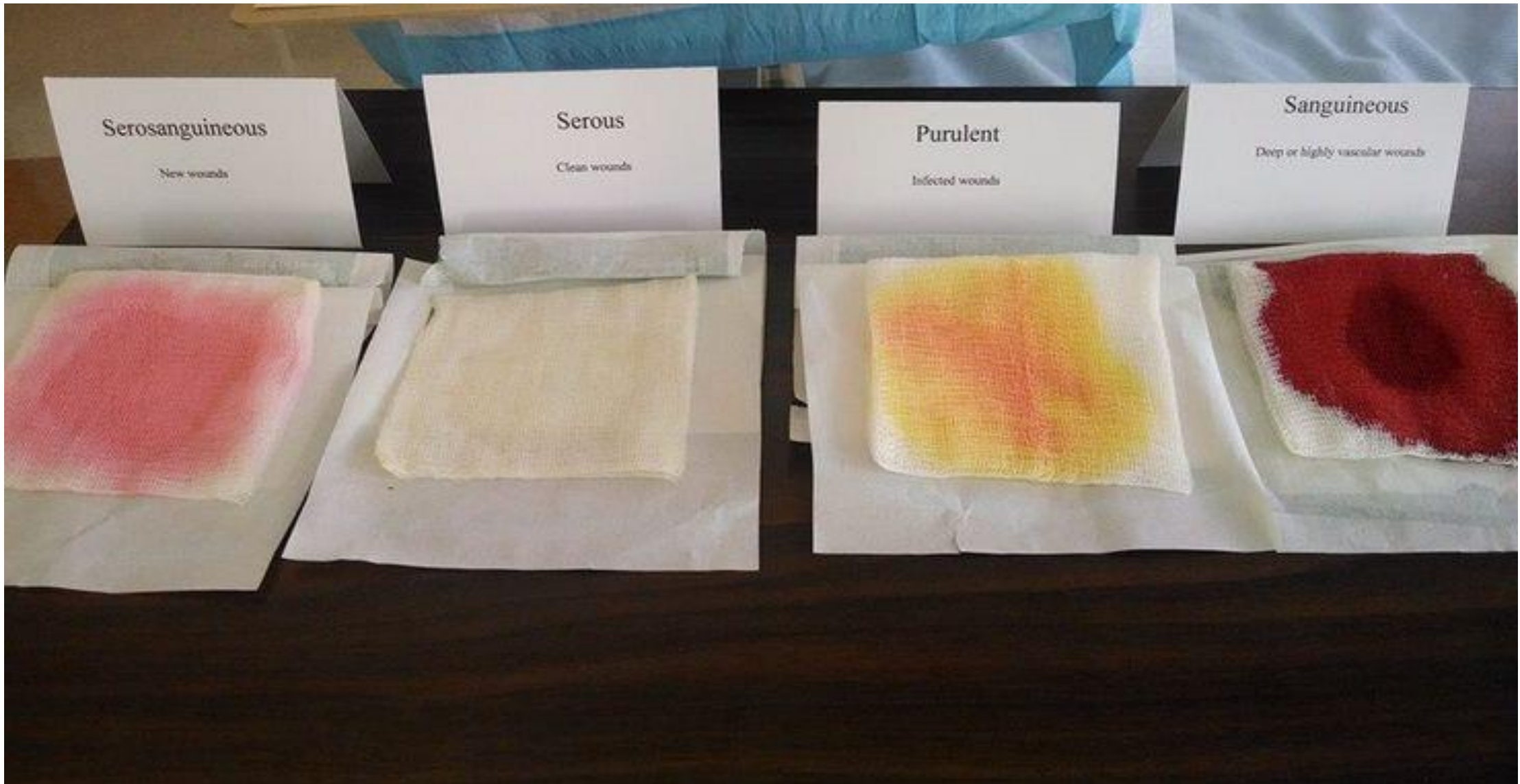
Days 2-4
serosanguineous
(serum and blood)



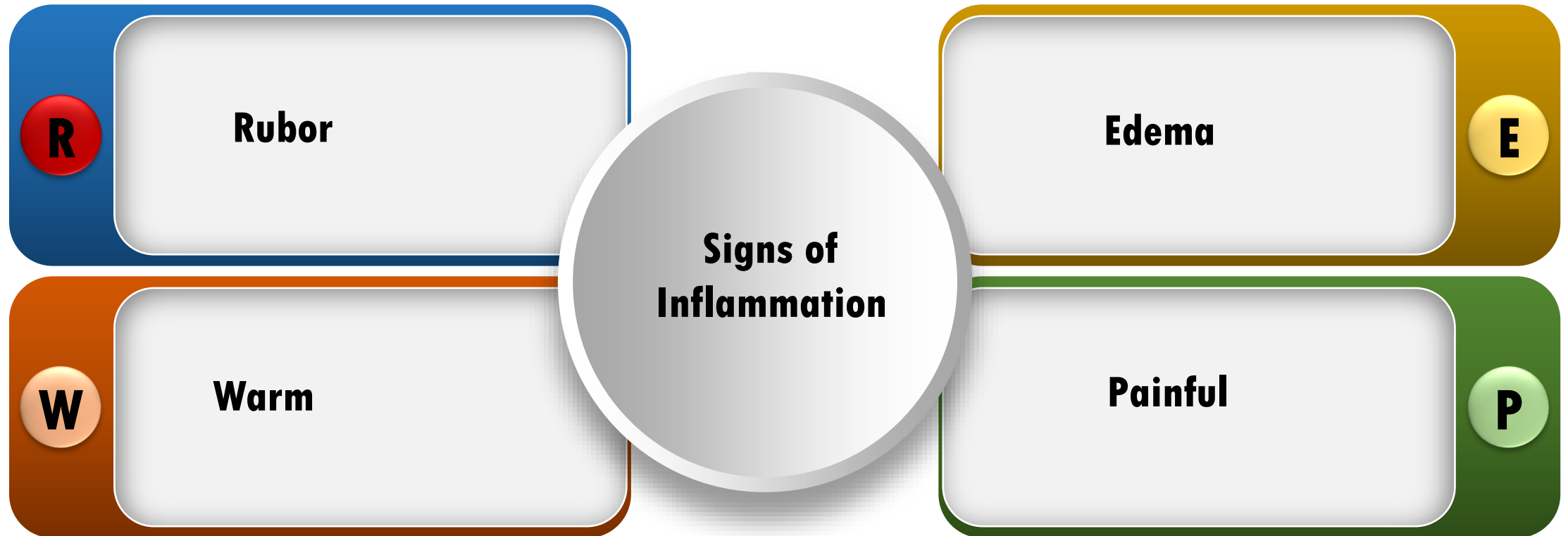
Day 4 minimal:
serous



Types of Wound Drainage



Signs of Inflammation



Signs of Inflammation



Factors Effecting Healing



Loss of strength and proprioception

Focus of Rehab

Set up the environment for repair

Control swelling

Rest (immobilization) is critical for first 1-2 days

LE: NWB 24 hrs,,gradual increase in wt bearing

Days 2-3, start pain free AROM



Fibroblastic Phase



Day 7 through 6 weeks

Fibroblasts synthesize scar tissue, 15% of normal strength

Type 3 collagen

Cellular matrix is random



Fibroblastic Phase



Goals

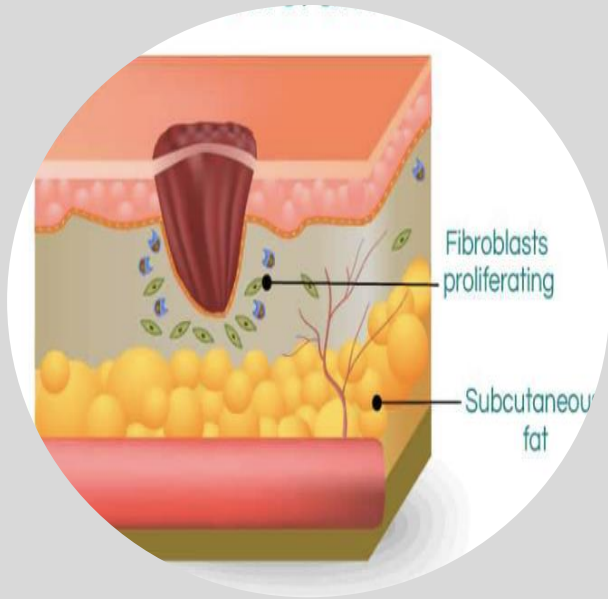
- Fill in the wound
- Restore skin integrity

Process

- Angiogenesis
- Collagen Synthesis
- Contraction of the wound

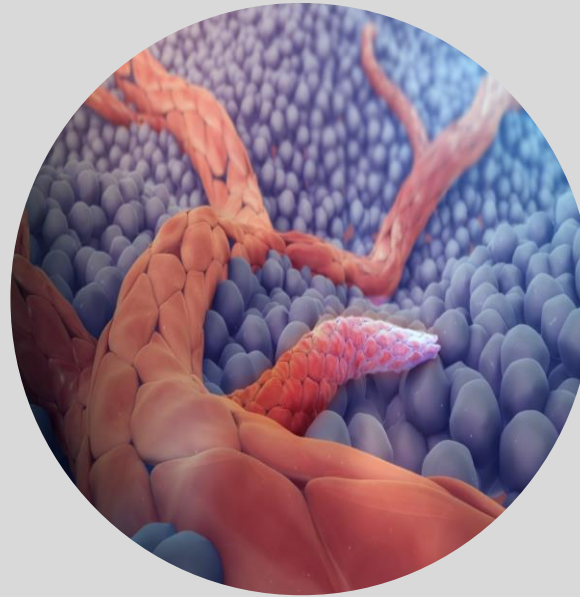


Healing Process



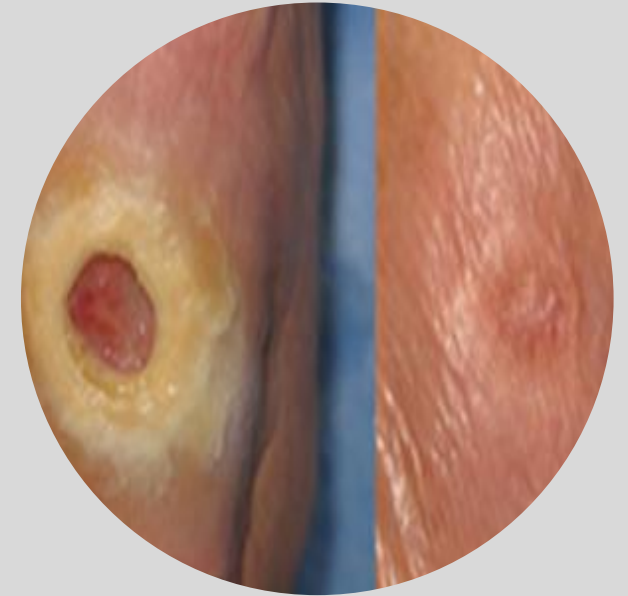
Contraction

Myofibroblasts connect to skin margins and pull the epithelial layer inward. Changes the wound shape and decreases the open area



Angiogenesis

Formation of new blood vessels, granulation tissue will be red and bumpy



Epithelization

Continues from reaction phase, cells travel to the area to close the wound





“INFLAMMATION IS LIKE A FLASH FLOOD”





“SCAR TISSUE IS LEFT IN IT’S WAKE”



Cement Analogy



Assessment (POD 5-9)



Healing Ridge



Feels like a roll of
quarters



If not: formed by day 5-9
think infection of
dehiscence



Focus of Rehab

- Once inflammatory response has subsided, repair begins-could be as early as 3-7 days post injury
- Swelling should be stopped completely but tissue may still be tender
- The goal is to start exercises to maintain levels of cardiovascular fitness, restore full ROM, increase strength and restore neuromuscular control





Clinical Pearl

- Stress must be applied in the proper “dosage”
 - Intensity
 - Volume
 - Frequency

Snake Venom can kill or heal





Persistent inflammatory response can result in extended fibroplasia and excessive fibrogenesis

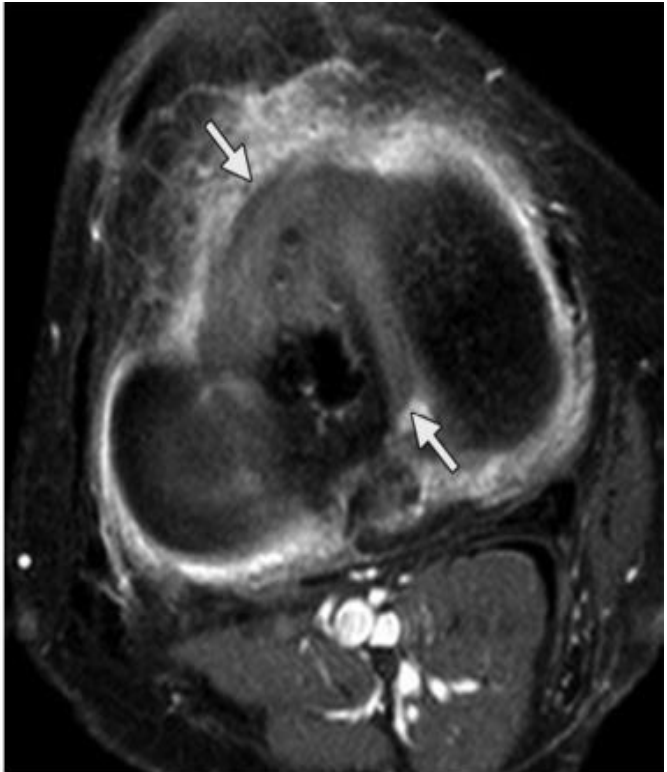
**Clinical
Moment**



Arthrofibrosis



a.



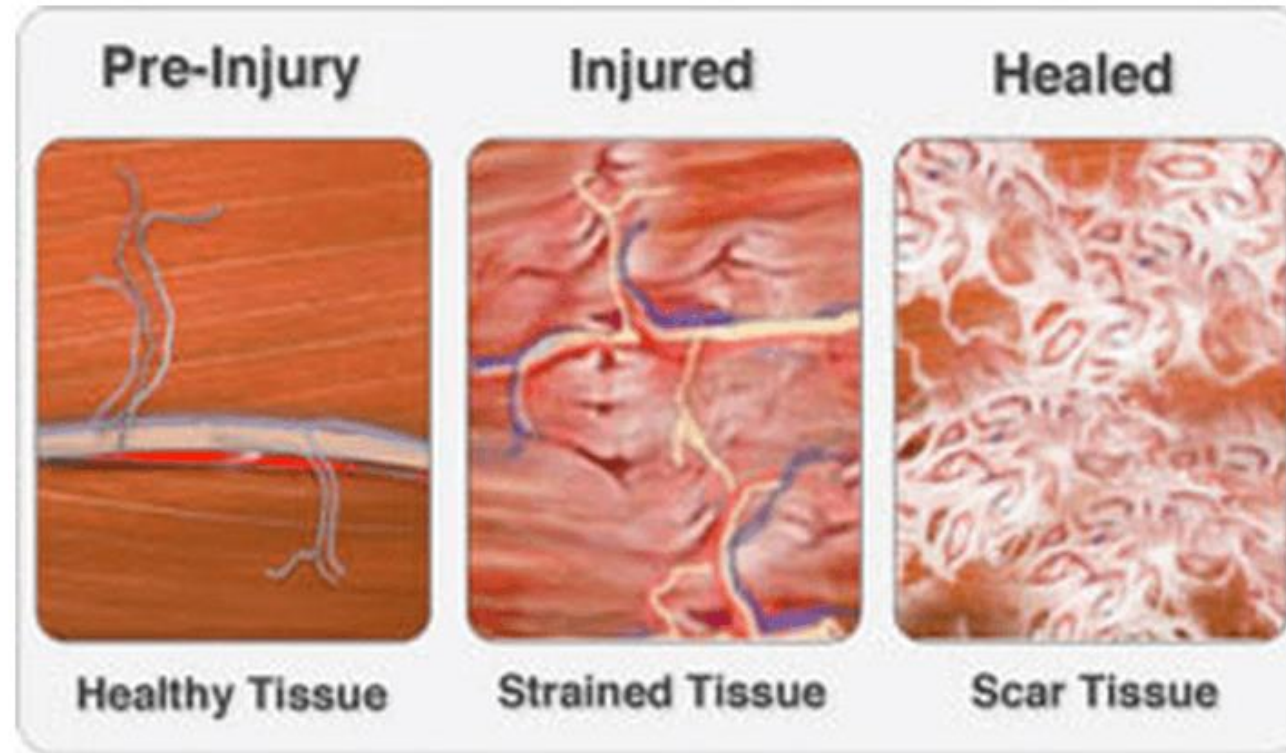
b.



Maturation Phase



Maturation Phase



✓ Normal Function
+
✓ No Pain

↓ Function
+
↑ Pain

↓ Function
+
↑ Risk of Re-Injury

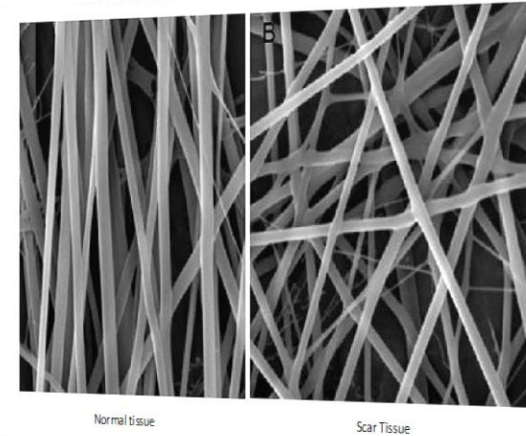
POD Week 6 through 2 years



GOAL: Increase tensile strength of the scar tissue

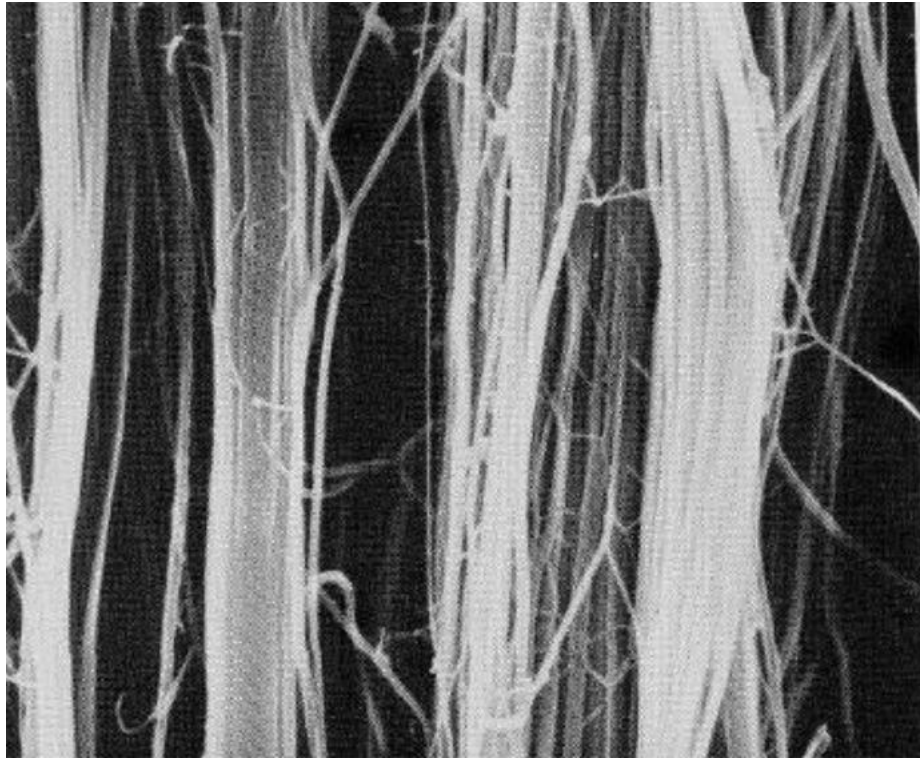


Tissue strength by the end of this phase

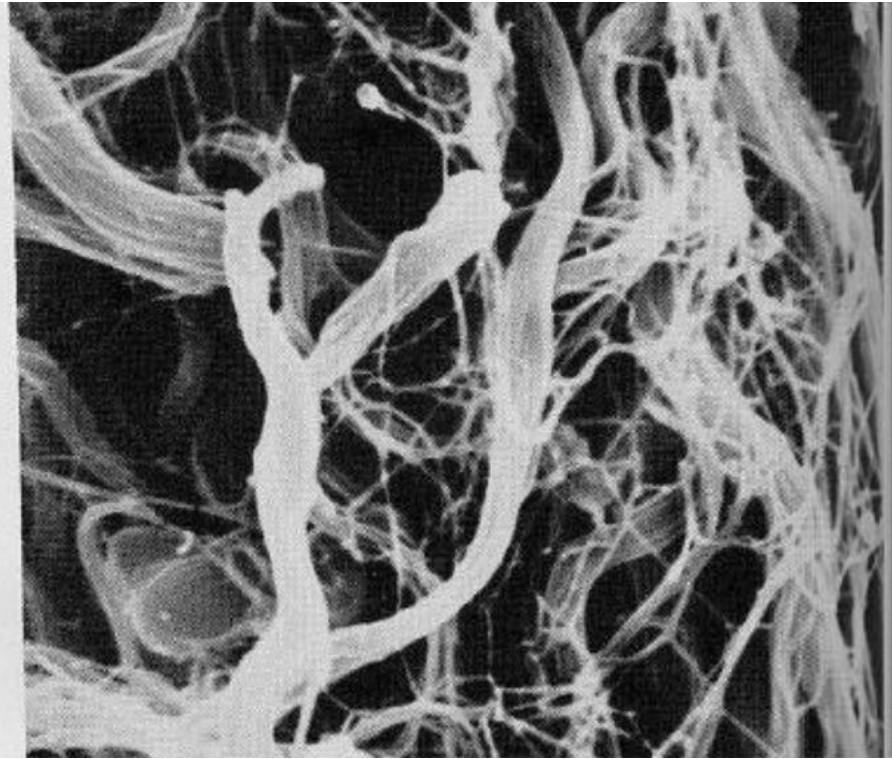


Normal cross linking vs adhesions





Normal



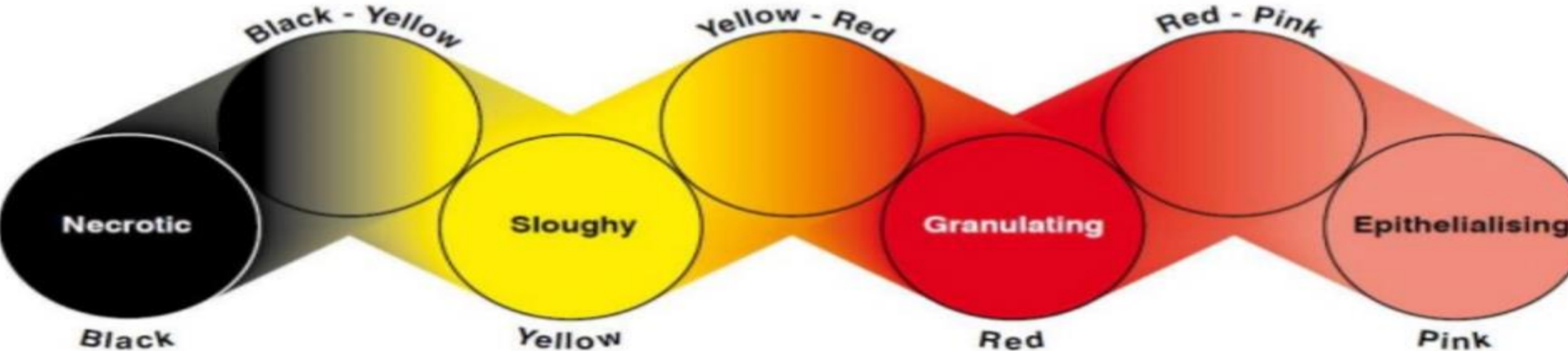
Disorganized tissue

Wolff's law states :

Soft tissue and bone will respond to physical demands placed on them causing them to remodel along the tensile lines of force.



Colors of Wound



Colors of the Wound



Red



Yellow



Mixed



Black

Infection Masqueraders



Allergy to surgical tape



Surgical Granuloma



Spitting Suture



Contact Dermatitis

Wound Dehiscence

When to Refer

- Marked increase in bloody drainage post-op
- Increased drainage after POD #4
- No healing ridge by POD #9
- Wound dehiscence
- Signs of Infection
 - Fever
 - Induration
 - Erythema
 - Edema/swelling
 - Purulent (pus) drainage



Thank You!!!
