WOUND HEALING

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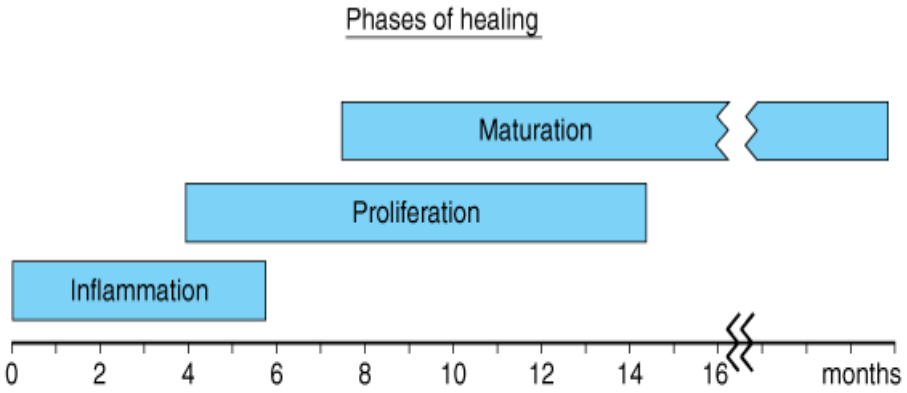
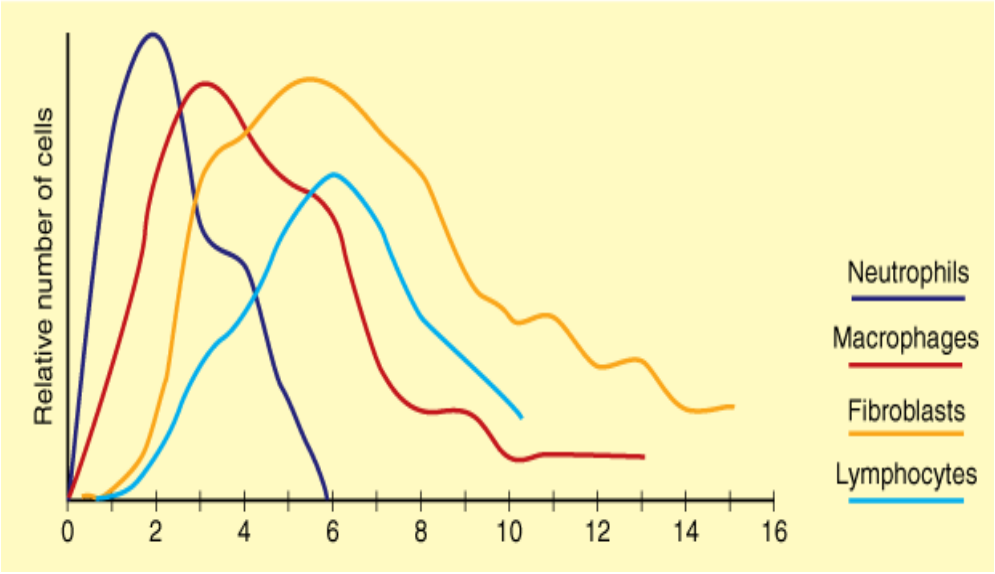
HISTORY

- Egyptians. 3000BC. Differentiated clean/infected wounds
- 1650 BC: 48 different types of wounds described
- 1550 BC. Use of honey/ lint/ grease
- Greece: differentiated acute/ chronic wounds
- 1850: Joseph Lister. Used phenol; antiseptic

Phases of wound healing

- Hemostasis and inflamation
- Proliferation
- Maturation and remodelling





Hemostasis and inflamation

- Damage to tissues and blood vessels
- Exposure of sub-endothelial collagen
- Platelet aggregation/degranulation
- Activation of complement and coagulation
- Increased vascular permiability
- Increased arterial vasodilation
- Entry of neutrophills, macrophages, lymphocytes
- Production of cytokines and growth factors

Cytokines

- Interleukin 1, interleukin 6, tumor necrosis factor alpha

Growth factors

- TGF-b, ILGF, EGF, VEGF, PDGF

FUNCTION OF CYTOKINES/ GROWTH FACTORS

- Modulate Cell recruitment
- Modulate matrix synthesis and breakdown
- Modulate angiogenesis

Cells involved

Platelets:

- PDGF, TGF-BETA, PAF, fibronectin,
- Hemostasis. Platelet plug. Chemotaxis. Cell recruitment

Neutrophils:

- TNF-ALPHA. Collagenases. Oxygen radicals
- Phagocytosis, debridement, collagen synthesis, angiogenesis, cell recruitment

Lymphocytes:

Modulate transition to proliferative phase

macrophages

Table 9-1 Macrophage Activities during Wound Healing	
Activity	**Mediators**
Phagocytosis	Reactive oxygen species
	Nitric oxide
Débridement	Collagenase, elastase
Cell recruitment and activation	Growth factors: PDGF, TGFβ, EGF, IGF
	Cytokines: TNF-α, IL-1, IL-6
	Fibronectin
Matrix synthesis	Growth factors: TGFβ, EGF, PDGF
	Cytokines: TNF-α, IL-1, IFN-γ
	Enzymes: arginase, collagenase
	Prostaglandins
	Nitric oxide
Angiogenesis	Growth factors: FGF, VEGF
	Cytokines: TNF-α
	Nitric oxide

Proliferative stage

- Lasts from day 4- 12
- Fibroblasts: collagen and glycosaminoglycans
- Endothelial cells: neo vessels

cellular/ rough endoplasmic recticulum

- MRNA ⟶ AMINO ACIDS ⟶ PROTOCOLLAGEN
- PROTOCOLLAGEN ⟶ PROCOLLAGEN

extracellular

- PROCOLLAGEN ⟶ COLLAGEN

GLYCOSYLATION-HYDROXYLATION of PROTOCOLLAGEN

- Of proline and lysine molecules.
- Requires oxygen and iron as co-factors
- Vitamin c as electron donor
- Alpha keto glutarate as co-substrate

GLYCOSAMINOGLYCANS

Dermatan/ chondroitin sulphate proteoglycans

Forms lattice with collagen

Maturation/re-modelling

- Lasts weeks to months
- Metallo-proteases: collagen breakdown
- Balance of collagen synthesis and breakdown
- Cross-linking of collagen fibrils
- From collagen type 3 to type 1
- Strength is never the same

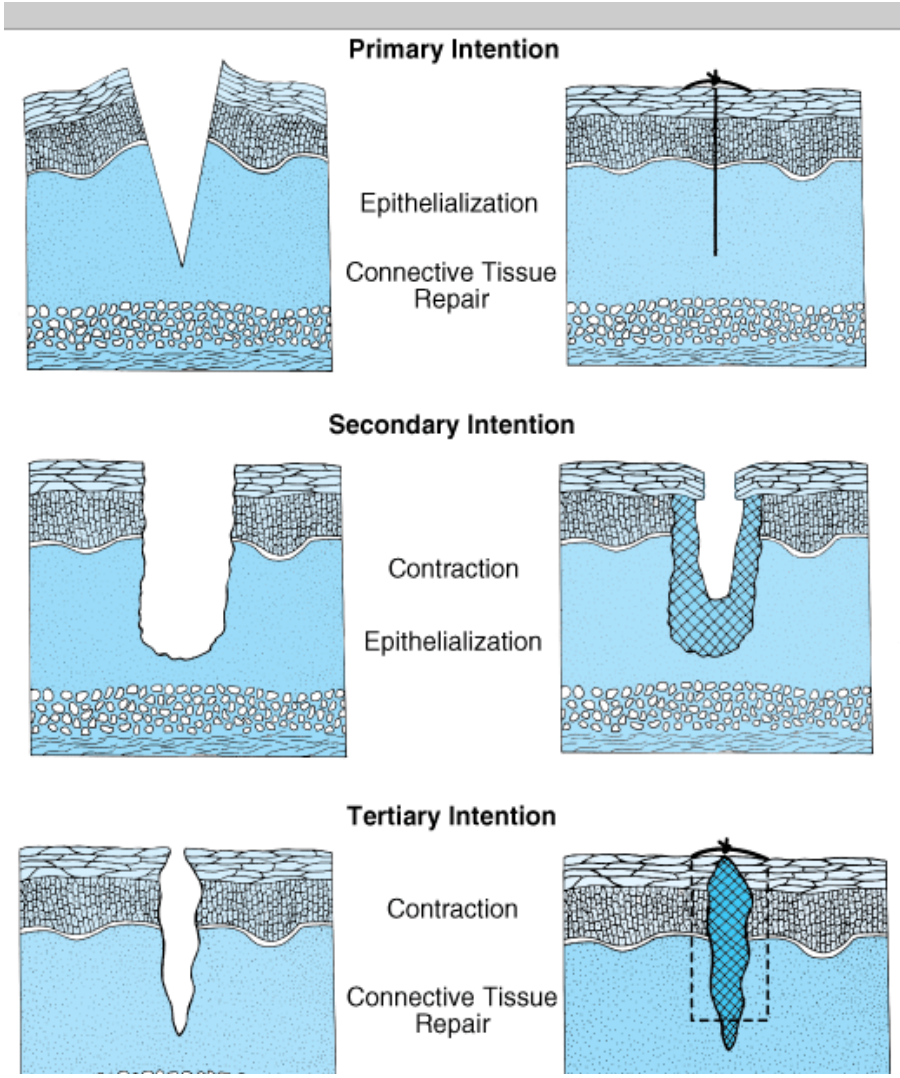
Wound contraction: myofibroblasts

Types of wound healing

- Primary intention
- Secondary intention
- Tertiary intension

Types of wounds

- Acute wound
- Chronic wound



Factors affecting wound healing

Local

- Foreign bodies
- Irradiation
- Infection
- Oedema
- Mechanical stress

Systemic

- Immunosuppresion
- Anaemia
- Metabolic factors e.g. diabetes
- Malnutrition
- Age
- smoking

Chronic wounds

- Diabetic wound
- Arterial ischemic wound
- Venous ulcer
- Decubitus Pressure ulcers

Ecxessive healing

- Keloids
- Hypertrophic scars
- adhesions

Wound treatment

- Surgical debridement
- Dressing
- Primary wound closure
- Skin grafting
- Skin substitutes

Dressing materials

- Gauze
- Hydrocolloids
- Alginates
- Hydrofibre
- Negative pressure dressing