Phases of Wound Healing

- Substrate Phase (0-2 days)
- Proliferative Phase (3-30 days)
- Maturation Phase (30 days-years)
SUBSTRATE PHASE

(aka inflammatory, lag, exudative phase)

- involves platelets, PMNs, and macrophages
  - platelet secrete inflammatory factors (ECM proteins, cytokines, growth factors)
  - vasoconstriction followed by vasodilation
  - PMN around for 48 hours - cleanse wound
  - macrophages after 48 hours - phagocytose bacteria and damaged tissue
PROLIFERATIVE PHASE

- only begins when wound is covered by epithelium
- angiogenesis
- production of collagen in the wound (fibroblasts predominate)
MATURATION PHASE

- Remodeling
- 1 month - 1 year
- tensile strength of wound increases
Types of Healing

- **Primary healing** (healing by first intention)
  - closed by direct approximation of the epithelial wound edges

- **Secondary healing**
  - The process whereby an open wound closes by new tissue formation with subsequent wound contraction and re-epithelialization.

- **Tertiary healing**
  - The process whereby a wound is temporarily left open to be closed at a later day (4-7 days) using a primary closure technique.
HOW DO SKIN GRAFTS TAKE?

- **Plasmatic imbibition**
  - Initially, the skin grafts passively absorbs the nutrients in the wound bed by diffusion

- **Inosculation**
  - By day 3, the cut ends of the vessels on the underside of the dermis begin to form connections with those of the wound bed

- **Angiogenesis**
  - By day 5, new blood vessels grow into the graft and the graft becomes vascularized
PLASMATIC IMBIBITION

- After the skin graft has been placed, it needs nourishment
- Imbibition is the passive absorption of nutrients into the grafts
- Grafts often become edematous
- Soon after, capillaries of the wound bed join with those of the graft
INOSCULATION

- the re-establishment of blood supply in the graft appears to depend on the ingrowth of host vessels into the graft dermis, thus establishing new endothelial channels.

- earliest stereomicroscopic evidence of a beginning blood circulation, as characterised by oscillatory or sluggish movements, in the graft vessels at 48 hours.

- the grafts appear completely revascularised between the 4th and 5th day after transplantation (Angiogenesis).
BRIDGING

- Some areas of the graft may survive lying over nonvascularized area as nearby collateral circulation supply nearby vessels
- Full thickness bridge better than STSG due to the subdermal plexus aid to bridging
Epidermal Hyperplasia

- In first 2 weeks
- Can increase 7-8 fold
- Occurs as a result of:
  - the swelling of epidermal cells
  - migration towards the surface
  - Mitosis within the epidermis
Dermal fibroblast Hyperplasia

- Fibrocyte population in skin grafts decreases POD# 1-3
- Fibrocytes remain only beneath the epidermis and just above host bed
- After day 3, fibroblasts work their way up the graft
- Day 7-8, marked hyperplasia of these cells as the graft
- Fibroblasts generate collagen
MATURATION

- Graft contraction
- Dermal collagen turnover
- Dermal-epidermal specificity
- Sebaceous glands, hair follicles, sweat glands
Wound Contraction

- produce serious functional and cosmetic problems depending on location and severity
- Contraction probably begins shortly after initial wounding and progresses slowly for 6-18 months following skin grafting
- the myofibroblast in the wound bed is believed to be responsible
Regeneration & Reinnervation

- Epithelial appendages need to regenerate after grafting; hair more likely to grow in FTSG
- Sweat glands and sebaceous glands initially degenerate following grafting
- Sweat gland regeneration is dependent on reinnervation of the skin graft with recipient bed sympathetic nerve fibers.
- Reinnervation of the graft occurs from the recipient bed and the periphery along the empty neurolemmal sheaths of the graft.
- Sensibility returns to the periphery of the graft and proceeds centrally (starts month 1 but takes years)
GRAFT FAILURE

- Inadequate Graft Bed
  - Tissue w/ out blood supply
  - Damaged tissue: crush/burn/radiation
  - Regional arterial/venous malfunction
  - Systemic disease: RA, sepsis
  - Wound fibrinolysin

- Hematoma
- Movement
- Infection
- Technical errors
References

- Plastic and Reconstructive Surgery Essentials for Medical Students
- www.wikipedia.com
Questions?

THANK YOU!