Periodontal wound healing

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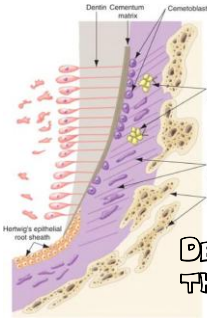
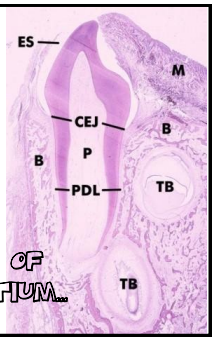
Complex environment…

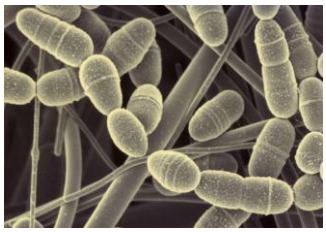
Development of the periodontium…



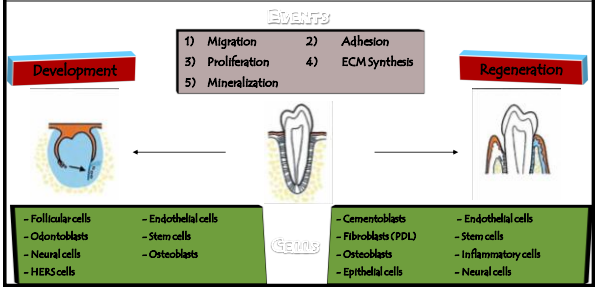


Goals of periodontal therapy

THE ORAL ENVIRONMENT...

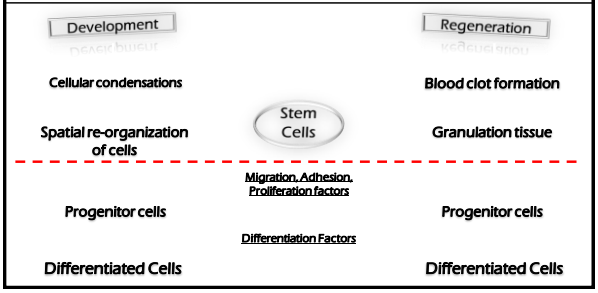


REGENERATION VS. DEVELOPMENT



PERIODONTIUM... DEVELOPMENT

MacNeil & Sommerman, 1999



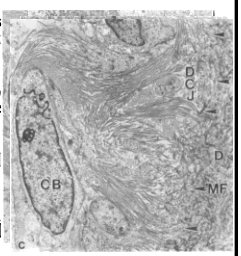
DENTINO-CEMENTAL JUNCTION... FORMATION

Disintegration of HERS, precementoblasts communicate with non-mineralized dentinal matrix

Cementoblasts implant collagen fibers in the pre-dentine & formation of the dentino-cemental junction

Mineralization of the dentine, & dentinal matrix is covered with cementum

Establishment of cementum matrix, mineralization of the dentino-cemental junction



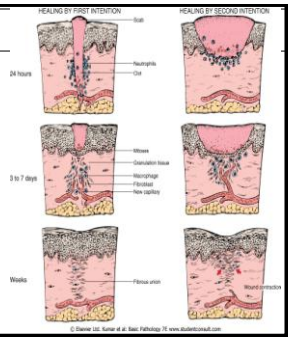
Bosshardt & Selvig, 1997

WOUND HEALING PROCESS

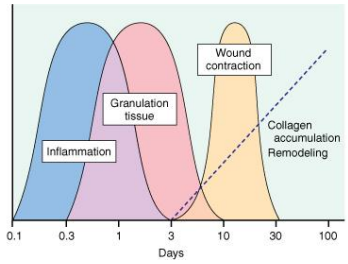
Primary intention

Secondary intention

Tertiary intention



WOUND HEALING PROCESS



WOUND HEALING PROCESS

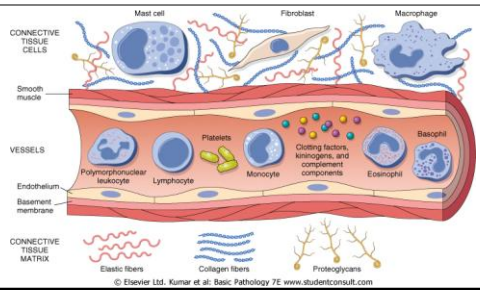
- Trauma / Incision
- Clot formation
- Inflammation
- Granulation tissue formation
- Angiongenesis
- Epithelialization
- Remodeling

WOUND HEALING PROCESS... CLOT FORMATION

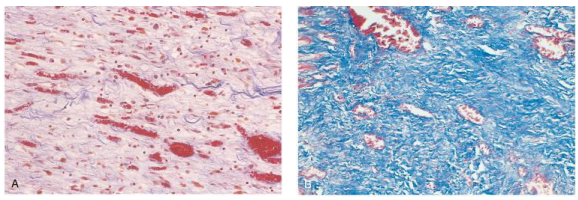
Function
- Tissue protection
- Matrix for cell migration

Blood clot is a reservoir for cytokines & growth factors, important mediators for wound healing and tissue repair/regeneration

WOUND HEALING PROCESS... INFLAMMATION

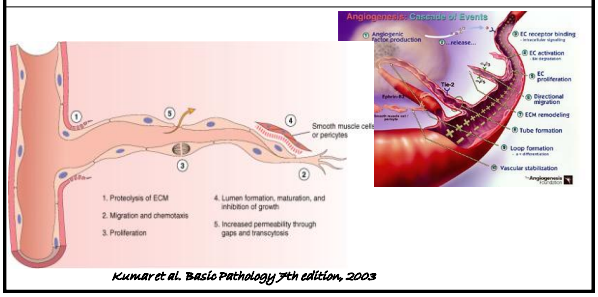


WOUND HEALING PROCESS... GRANULATION



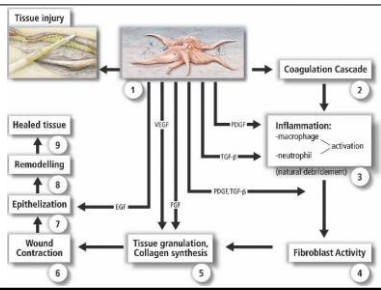
Kumar et al. Basic Pathology 7th edition, 2003

WOUND HEALING PROCESS... ANGIOGENESIS



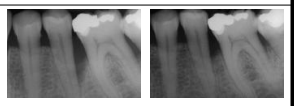
Kumar et al. Basic Pathology 7th edition, 2003

WOUND HEALING PROCESS



WOUND HEALING... RESULTS

Repair vs. Regeneration



Crucial factors

I. Availability of needed cells
II. Presence or absence of cues & signals necessary for recruitment & stimulation of available cells

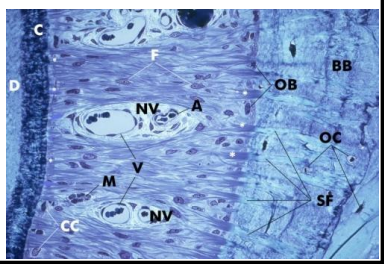
PERIODONTAL WOUND HEALING

Epithelial cells

Fibroblasts

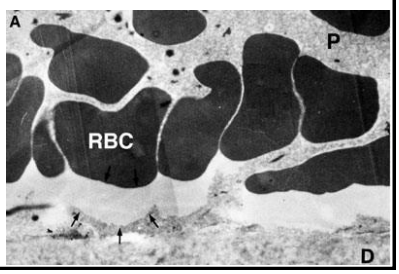
Osteoblasts

Cementoblasts



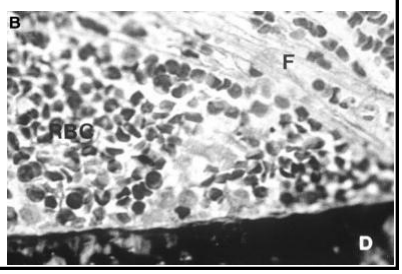
PERIODONTAL WOUND HEALING... MINUTES

Blood clot formation



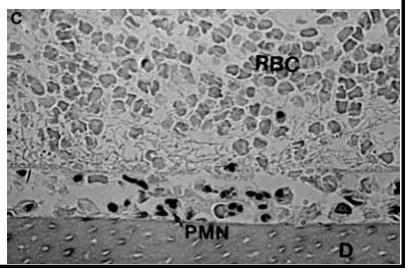
PERIODONTAL WOUND HEALING... 1 HOUR

Neutrophils infiltrate the clot



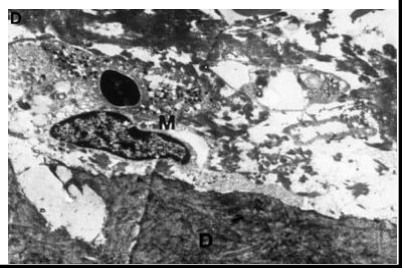
PERIODONTAL WOUND HEALING... 6 HOURS

- Neutrophils line root surface
- Wound decontamination



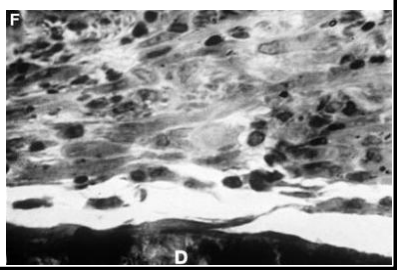
PERIODONTAL WOUND HEALING... 3 DAYS

- Late inflammatory phase
- ↑ Macrophage influx
- Wound debridement
- Release of GF
- Granulation tissue



PERIODONTAL WOUND HEALING... 7 DAYS

- Granulation tissue replaced
- Cell-rich newly-formed tissue
- Maturation phase
- Remodeling of newly-formed tissue
- Functional adaptation

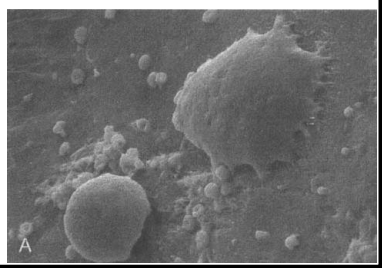


PERIODONTAL WOUND HEALING... MATURATION

- Collagen bundles parallel to root surface (collagen adhesion)
- Cementoblast differentiation
- Resorptive activity (Osteoclasts & Odontoclasts)
- Ankylosis

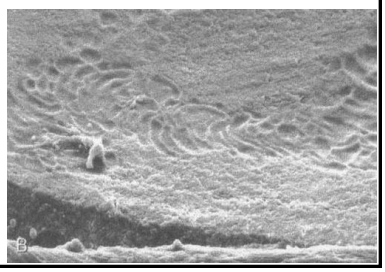
PERIODONTAL WOUND HEALING... CONNECTIVE TISSUE REATTACHMENT

Giant cell adherence to root surface



PERIODONTAL WOUND HEALING... CONNECTIVE TISSUE REATTACHMENT

Superficial resorption of the root surface

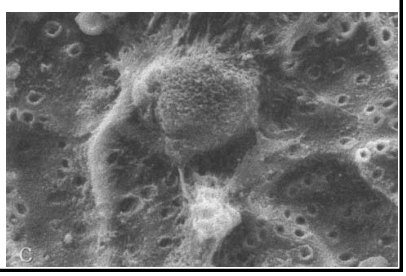


PERIODONTAL WOUND HEALING... CONNECTIVE TISSUE REATTACHMENT

Howship's lacunae

Exposure of dentinal tubules

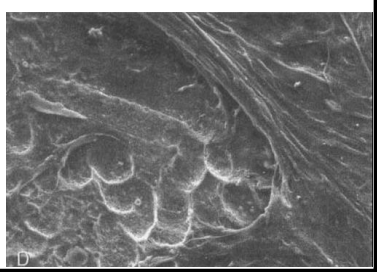
Denudation of dentinal matrix



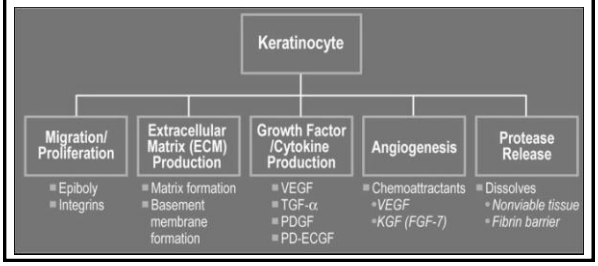
PERIODONTAL WOUND HEALING... CONNECTIVE TISSUE REATTACHMENT

Biologically altered root surface

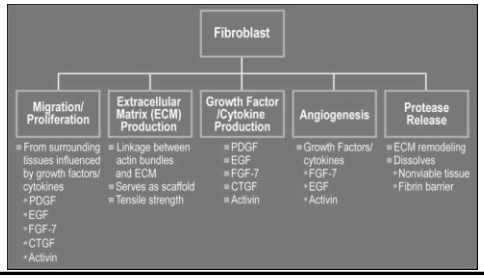
Collagen fiber attachment



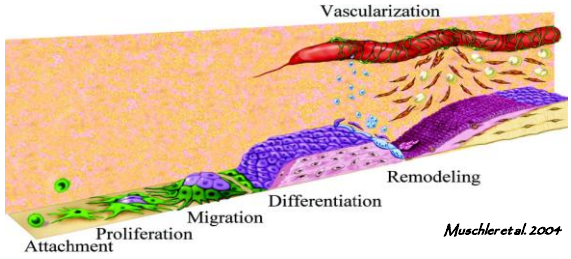
PERIODONTAL WOUND HEALING… ROLE OF KERATINOCYTES



PERIODONTAL WOUND HEALING… ROLE OF FIBROBLASTS



PERIODONTAL WOUND HEALING… BONE HEALING

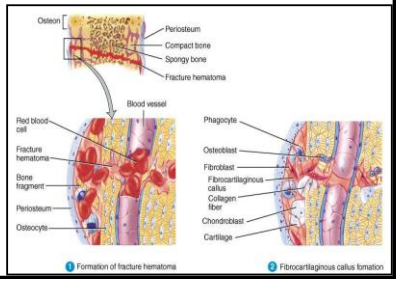


PERIODONTAL WOUND HEALING… BONE HEALING

D1 Blood clot

D3 Inflammation

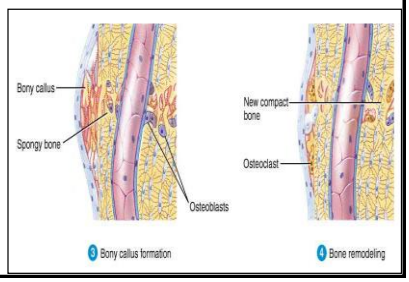
W1 Soft callus (granulation, ECM)



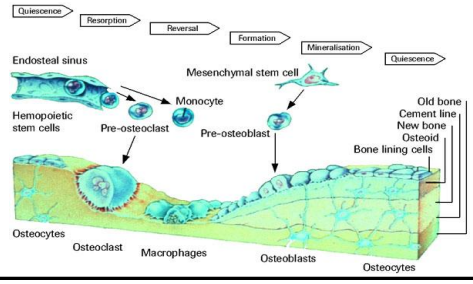
PERIODONTAL WOUND HEALING... BONE HEALING

W3-6 Woven bone

W8+ Remodeling



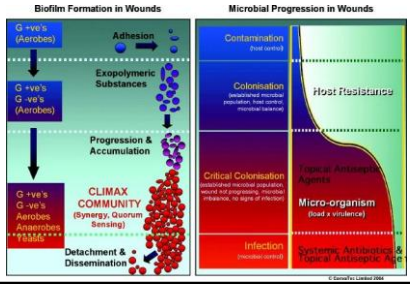
PERIODONTAL WOUND HEALING... BONE REMODELING



FACTORS AFFECTING PERIODONTAL WOUND HEALING

- Bacterial contamination
- Innate wound-healing potential
- Local site characteristics
- Surgical procedure/technique
- Initial wound stability

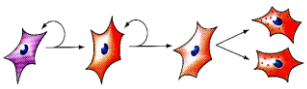
..... BACTERIAL CONTAMINATION

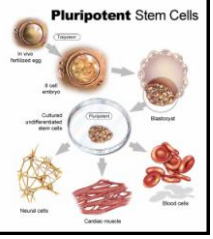


..... INNATE WOUND-HEALING POTENTIAL

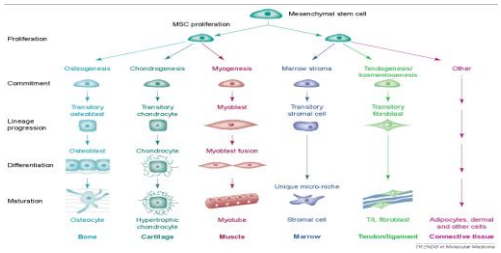
Mesenchymal cells:

- Undifferentiated cells
- High proliferation rate over long time
- Can differentiate into different cell types
- Asymmetrical mitosis



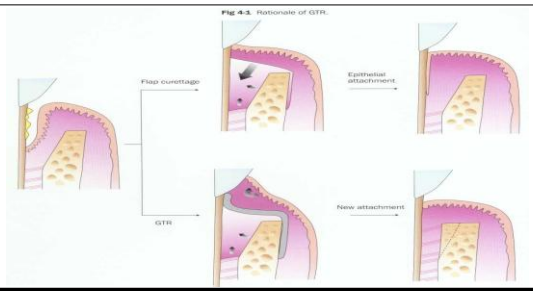


..... INNATE WOUND-HEALING POTENTIAL

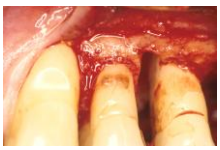


Caplan & Bruder, 2001

..... INNATE WOUND-HEALING POTENTIAL



..... LOCAL SITE CHARACTERISTICS



..... SURGICAL PROCEDURE/TECHNIQUE




..... INITIAL WOUND STABILITY



COMPLICATIONS OF PERIODONTAL WOUND HEALING

Microbiota

Multiple, specialized cell types

Multiple specialized junctional complexes

Avascular tooth surface

Stromal – cellular interactions

REQUIRED STEPS FOR IDEAL PERIODONTAL WOUND HEALING

Elimination of infected, degraded, & necrotic tissues

Availability of populations of progenitor cells

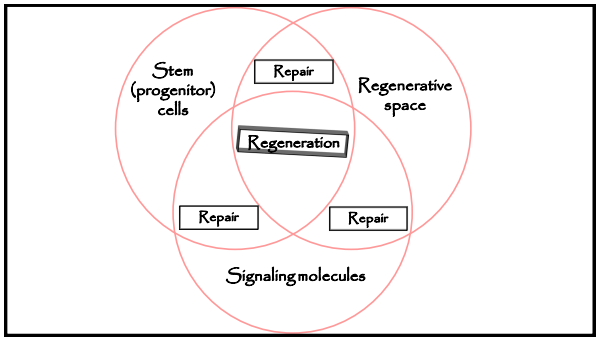
Proliferation & differentiation of progenitor cells in response to soluble & ECM factors

Migration of progenitor & specialized cells to healing site

Establishment of a reservoir of progenitor cells in the healing site

Newly formed tissues & ECM must be stably integrated, & undergo remodeling

Repopulating cells should be capable of synthesizing appropriate growth & signaling factors to restore dynamic tissue homeostasis



Power does not corrupt men.

FOOLS, however, if they get into a position of power, corrupt power.

George Bernard Shaw