The Healing Process and Guidelines for Using Therapeutic Modalities

Chapter II

Why do Athletic Trainers use modalities???

- As an Adjunct to Therapeutic Exercises
- Facilitate Healing Process

Phases of Healing
- Inflammatory – Response Phase
- Fibroblastic – Repair Phase
- Maturation – Remodeling Phase

Inflammatory – Response Phase
- When damage occurs down to the cellular level a change in metabolism and a release of materials start this phase.
- It occurs immediately.
- Defensive mechanism by which the body attempts to control the side effects of injury and return the tissue to its normal state. (Starkey, 1993)

Inflammation
- Contribution to the healing process
  - Defends body against alien substances
  - Disposes of dead and dying tissues
  - Promotes regeneration of normal tissue
- Detrimental effects
  - Edema
  - Decreased oxygen
  - Chemical spillage
    - Irritant to surrounding tissues
    - Results in inflammation in surrounding tissues

Cardinal Signs of Inflammation
- Increased Temperature
- Redness
- Swelling
- Pain
- Loss of Function *
Cellular Response to Inflammation

- Leukocytes, Phagocytes, and Exudate migrate from the blood to the injured area to:
  - Protect injured area
  - Dispose of Bi-products through Phagocytosis

Phagocyte: “Eating” Cell

Vascular Response to Inflammation

- Vascular Spasm causes Immediate Vasoonstirction
  - Lasts Five to Ten minutes
  - Allows local anemia
    - Platelet plug
    - Coagulation
  - Allows local hyperemia
    - Causes fluid seepage (swelling)
    - Growth of fibrous tissue
    - Supplies area with leukocytes

Chemical Mediators

- Histamine
  - Released from Mast cells
  - Causes vasodilation
  - Increases cellular permeability
    - Allows swelling and separation of endothelial cells

- Leucotaxin
  - Causes Margination of Leukocytes
  - Increases local cellular permeability

Chemical Mediators (Con’t)

- Necrosin- responsible for phagocytic activity
- Bradykinin- increases capillary permeability and pain (especially in presence of prostaglandins)
- Prostaglandins- most cause vasodilation and pain.
  (target for anti-inflammatories)
- Heparin- anti-coagulant

Function of Platelets

- Obstruct local lymphatic drainage
- Localize injury response
- Adhere to collagen
- Creates sticky matrix with Leukocytes to form a plug

Clot Formation

- Begins 12 hours after injury and is completed by 48 hours
- Due to release of thromboplastin (a protein molecule)
  - prothrombin to thrombin
  - fibrinogen to fibrin
Clot Formation (Con’t)
- Fibrin - A sticky substance that shuts off blood supply
- Results of these events:
  - Allows injured area to wall off
  - Promotes healing process
  - Prepares for the next phase of healing

Chronic Inflammation
- Injury not eliminated
- Failure to return to normal physiologic state
- Leukocytes are replaced with
  - Macrophage
  - Lymphocytes
  - Plasma cells

Chronic Inflammation (Con’t)
- Where are these cells located?
  - Highly vascularized areas
  - Highly innervated areas
  - Loose connective tissue

Why does chronic inflammation occur?
- Unknown!!
- Thought to be related to overuse or overload of tissues with cumulative microtrauma
- No specific time frame

Fibroblastic – Repair Phase
- Allows for scar formation - Fibroplasia
- Lasts 4-6 weeks
- Repair of injured tissue occurs
- Growth of endothelial capillary buds into the wound due to decrease in oxygen
- Increase in Nutrients
- Formation of Granulation Tissue
  - Contains fibroblasts, collagen, and capillaries
  - Fills in the “gaps”

Extra-cellular Matrix Formation
- Collagen, Elastin, and Ground Substance
- Day 6 or 7 Collagen deposited randomly to begin scar formation.
- Increase in tensile strength leads to decrease in fibroblasts
- Normal sequence allows for minimal scar tissue
Maturation – Remodeling Phase

- LONG TERM PROCESS!!!
- Collagen continues remodeling according to the stress that is placed upon it. (SAID principle)
- Realignment of tissues will give greatest efficiency
- Scar tissue is rarely as strong as uninjured tissues.

Factors that Impede Healing

- Extent of Injury
- Microtears
- Macrotears
- Edema
- Hemorrhage
- Poor Vascular Supply
- Separation of Tissue
- Muscle Spasm
  - Causes traction on tissue
- Atrophy
- Corticosteroids
  - Inhibits healing process
- Keloids and Hypertrophic scars
- Infection
- Humidity, Climate, and Oxygen Tension
- Health, Age, and Nutrition

Putting it all Together

- Inflammatory-Response Phase
  - Protects the area from further injury and sets the stage for healing
- Fibroplastic-Repair Phase
  - Begin scar formation
- Maturation-Remodeling Phase
  - Strengthens and remodels scar tissue overtime.

Now What?

- Determine which modalities can provide the best environment for healing.
- Figure out when’s the most appropriate time to use them!!

QUESTIONS????