Intermittent Compression

Chapter 14

Body's Response to Injury?
- Tearing of tissue
- Immediate vasoconstriction (5-10 minutes)
- Vasodilation (24-48 hours)
- Release of Chemical mediators
- Clot Formation (12-48 hours)

Where does the Lymphatic system fit?

Lymphatic System
- Purpose?
  - Picks up plasma and plasma proteins and returns them to blood circulation
  - Acts as a safety valve for fluid overload
  - Maintains homeostasis - removes waste
  - Cleanses interstitial space - blocks infection through lymph nodes

Lymphatic System
- Structure
  - Closed vascular system
  - Endothelial lined tubes
  - Runs parallel with arterial and nervous systems
  - Anchored and supported by fibrils
  - Concentrated on the medial side of the limbs
  - Fluid passes through one or more lymph nodes as it moves centrally up the system
  - Deep and superficial collecting systems in extremities
    - Deep branches: bony and fascial layers
    - Superficial branches:
      - Very superficial: no valves
      - Underneath Dermis in subcutaneous tissue

Lymphatic Structure
Lymphatic System

- **Function**
  - Pressure on fibrils forces endothelial cells to gap at their junctions and allow fluid, waste, proteins, extracellular particles, and cells into the lymphatic channels.
  - Constantly pushed and pulled open depending on activity in the area.
- **Once substances enter channels they become lymph.**
- **Muscle activity, elevated positions, respirations, and blood vessel pulsation aid in movement of lymph.**

How Lymph flow works

Drainage Areas

- Two very unequal drainage areas.
- Do not cross invisible line.
- Structures within each carry lymph to its destination within the circulatory system.

Injury Edema

- Following injury accumulation of extracellular fluid and proteins accumulate in interstitial spaces.
- Two types:
  - Pitting Edema
  - Lymphedema

Formation of Pitting Edema

- Formed by plasma, plasma proteins, and cellular debris moving into interstitial space.
- Vasodilation occurs allowing more fluid to pool.
- Local blood flow slows down.
- Pressure within blood vessels increases.
- Permeability of vessels increase due to separation of endothelial cells.
- Inflammatory exudate is formed due to increase in osmotic pressure.
- Formation of exudate occurs too quickly to maintain equilibrium and pitting edema is formed.

Formation of Pitting Edema

- The fluid takes on a gel-like appearance and blocks the free flowing of fluid.
- When pressure is applied the fluid is pushed out of the intercellular space and it slowly moves back.
Formation of Lymphedema

- Interstitial fluid continues to increase
- This causes lymph to flow
- When edema causes overflow of lymph capillaries, entry pores are ineffective

Why is this bad???

- Secondary Hypoxic/Enzymatic Injury
- Physical Separation of torn tissue
- Pain
- Restricted ROM
- Increases recovery time
- Infection
- Atrophy
- Contractures
- Interstitial fibrosis
- RSD

How can we treat edema?

- Good First Aid - RICE, E-stim, Gentle ROM
- Gravity
- Rythmic Internal Compression - muscle contraction
- External Pressure - massage, compression wraps, intermittent compression devices
- Early weight-bearing activities

Intermittent Compression

- Can be used immediately post-injury once fractures and other contraindications are ruled out
- Three parameters to be concerned with:
  - Inflation pressure
  - On/Off Time
  - Total Treatment time

Inflation Pressures

- Loosely correlated with BP and patient comfort
- Pressure equal to or lower than the diastolic portion of the patients blood pressure is used in most treatment protocols.
- Ranges in pressure:
  - Upper extremity: 30-60 mmHg
  - Lower extremity: 40-80 mmHg

On/Off Sequence

- Not research based
- Practitioner left to his/her own judgment
- It is suggested that lymphatic massage is reached with shorter on/off times and hydrostatic pressure vehicles are reached with longer on/off times
- Some examples: 30s/30s, 1m/2m, 2m/1m, 4m/1m
Total Treatment Time
- Little Research but is convenience based
- Primary Lymphedema: 3-4 hour treatment
- Marked decrease in lymph volume reduction after 30 minutes
- More treatment times per day also help with decrease in total volume.

Application Procedure
- Position patient comfortably
- Check contraindications
- Choose appropriate sized sleeve
- Connect air tube from machine to the sleeve
- Adjust parameters as needed to patient’s comfort:
  - Inflation Pressure
  - On/Off Time
  - Total Tx Time

Variations
- Compression with E-stim
- Compression with Ice
- Compression with Elevation
- Sequential Compression

Indications
- Lymphedema
- Traumatic Edema
- Chronic Edema
- Wound Healing following surgery

Contraindications
- Deep Vein Thrombosis
- Local superficial infection
- Congestive heart failure
- Acute pulmonary edema
- Displaced Fractures