Edema & Scar Management

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Edema Management

- Water (and fluids) – a force to be reckoned with!

Edema

- Fluid accumulation in intercellular spaces
- First/most obvious reaction to hand injury
- Capillary permeability increases
- Imbalance occurs across capillary membrane

Edema

- Liquid/fluid
- Pitting edema
- Brawny/fibrotic

“Edema is scar in evolution”
– George Omer

Acute Consequences of Edema

- Pain
- Restricts motion
- Decreases function
- Increases WOF (work of flexion)
- May compress nerve
- Decreases nutrition/inhibits wound healing
- Leads to contracture (“position of injury”)

[Arakahran C, 1999]

Chronic Consequences of Edema

- Intrinsic fibrosis/shortening
- Scar/adhesions
- Decreased ROM
- Decreased tendon glide
- Fibrosis palmar fascia
- Joint contracture – capsular thickening/tightness
Assessment

- Edema may not be visually detected
- 30% interstitial fluid volume increase before detection
- Volumeter
  - Standardized tool
  - Reliable within 1% ([Waylett-Rendall & Seibly])
- Dominant hand (R) 3.43% larger ([VanVelze et al])
- Follow standardized procedure

Assessment

- Figure-of-eight method
  - High intra-rated reliability
- Truncated circumferential method

Edema & Stages of Wound Healing

- Inflammatory
  - Liquid
  - Soft
  - Easy to mobilize
  - Mostly water/dissolved electrolytes ([Villeco 2012])

Inflammatory Phase Continued

- Treatment
  - Elevation
  - Compression
  - Active motion (as allowed)
  - Cold
- Contraindications
  - Excessive exercise
  - Increased clot formation
  - Increased inflammation
  - Heat
  - Increased vasodilation
  - Increased membrane permeability
  - Increased capillary infiltration
  - Increased arterial blood supply

Fibroplasia

- Edema more viscous
  - Increased protein content
  - Fibrosis
  - Tissue thickening
  - Fibrin deposited
  - Tissue shorten
  - Adhesions form
  - Tissues become less elastic
  - More swelling = more dense fibrous tissue

Fibroplasia Continued

- Treatment
  - Continue with previous treatment
  - May need to add lymphatic massage
  - Active motion
  - Tendon gliding
  - Splinting
  - Compression
  - Kinesiotape
  - Heat
Maturation Phase
- Edema
  - Hard
  - Thick
  - Brawny
- Treatment
  - Add foam chips to regimen
  - Manage scar

Therapeutic Techniques
- Elevation
  - Enhances venous & lymphatic flow
  - Decreases hydrostatic pressure in blood vessels
    (Villeco 2011)
- Treatment
  - Add foam chips to regimen
  - Manage scar

Compressive Dressings
- Provide counter pressure to muscles
- Compensate for elastic insufficiency of tissues
- Increase efficiency of circulation (Zuther EZ 2009)
- Inflammatory phase
  - Limits space for swelling
  - Fibroplasia phase
    - Decreases blood flow
    - Local hypoxia
    - Decreases fibroblast synthesis (slows scar)
  - Maturation phase
    - Maintains gain

Treatment Options
- Compressive stockinets
- Self-adherent wraps
- Finger sleeves
- Pressure garments
- Short stretch bandages
- Foam or chip bags

Cold
- Helpful during inflammatory stage
- Vasoconstriction
- Reduces metabolic rate
- Reduces arterial blood flow
- Decreases membrane permeability (Deal et al 2002)
- Performs better than contrast baths (Cote DJ et al 1988)
- 10 minute applications safest and most effective (MacAuley 2000)

Cold Contraindications
- Raynaud’s disease
- Arterial compromise/repair
- Circulatory compromise
- Use with caution when decreased circulation
**Exercise**
- Active motion
- Muscle pumping
- Proximal to stimulate lymphatic flow
- Adduction/abduction (intrinsics)
  - Deep v. palmar system
  - MP ext/flex (intrinsics)
- Fist (external compression superficial palmar/dorsal v. system)
- Differential tendon gliding
- Prevents adhesions (stretches intrinsics)

**Simple Lymphatic Drainage**
- Increases lymphatic flow
- Supported by evidence (Priganc VW 2008)
- Several techniques exist
- Excessive pressure can be harmful
- Start proximal to injury
- Know your skill level

**Contraindications**
- Untreated cancer
- DVT
- Pulmonary embolism
- Untreated infection
- Renal failure

**Kinesiotaping**
- Theory
  - Elastic adhesive lifts fascia/skin
- Application
- Evidence is scarce (Ristow O et al 2013)

**Physical Agents**
- High Volt Pulsed Stimulation
  - Mixed research results
  - Positive animal model (Snyder 2010)
- Intermittent Pneumatic Compression
  - Treatment parameter vary (Pilch et al 2009)
  - Rarely used for orthopedic conditions
- Ultrasound
  - Evidence scarce for treating edema
- Low-level laser therapy
  - Evidence scarce for treating edema
  - Treatment parameters/instrumentation vary

**Scar Management**
- Scar tissue is normal
- Dense fibrous connective tissue
- Forms over and around scar
- Repairs damaged tissue
- Part of fibroplastic and remodeling wound phases
  - (Bayat, et al 2003)
Normal Scar

- Matures over time (6 months to 5 years)
- Flattens
- Softens
- Assumes more normal pigmentation

Problematic Scars

- Hypertrophic
  Abundance of scar tissue confined to original wound site
  (Peacock, Madden, Trier 1970)

Keloid

- A raised scar extending beyond borders of original wound

Classification of Scars

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Classification of Scars

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Secondary effects of scar

- Contractures
  - Across joints or skin creases
  - Occurs when scar is immature
  - Can be hypertrophic
  - Limits ROM & function

- Adhesions
  - One wound-one scar concept
  - Moving parts may be glued together
  - (Brand and Hollister, 1999)
Limitations
- Decreased range of motion
- Decreased function

Sensory Issues
- Pain
- Itching
- Decreased sensation

Cosmetic Changes
- Hands
- Face

Assessment of Scars
- Objective-qualitative measurements
  - Size
  - Color
  - Pliability
  - Temperature
- Subjective-observer dependent
- Appearance

Assessment of Scars
- No overall valid and reliable non-invasive objective assessment tool of cutaneous scar characteristics
  (Perry et al 2010)

Scar Management
- Massage
- Orthotics
- Exercise
- Silicone gel/sheeting/Elastomer
- Tape
- Pressure
Scar Massage

- Standard in scar management
- Reduces pain/itching/anxiety (Field et al 2000)
- Anecdotally effective – evidence is weak (Amo et al 2014)
- Ongoing randomized clinical trial, University of British Columbia, post operative scar massage in women with cancer. https://clinicaltrials.gov/identifier NCT00275344

Massage is thought to:

- Proliferative phase
  - Prevent adhesions
  - Have a role in collagen synthesis (Silverberg et al 1996)
- Remodeling phase
  - Aid in mobilization/realignment of collagen tissue (mechanical stress)
  (Grigsby, DeLinde, and Knothe 2002)

Contraindications

- Open wounds
- Infection
- Fragility of wound/scar
- Pain
- Inflammation
  (Roques C 2002)

Massage Techniques

- Longitudinal (along scar)
- Horizontal (across scar)
- Circular
- Transfriction
- Scar retraction
- Little evidence to support use of vitamin E
  (Aliyeh 2006)

Orthotics

- Prevent or correct contractures
- Concept of low load, prolonged stress
- Tissue modification/elongation
- Effective for correction of joint contractures
- Effective for lengthening muscle/tendon tightness
- Evidence in scarce specifically for scar management

Exercise

- Helps to counteract contraction associated with scar
- Places stretch on scar
- Prevents soft tissue shortening
- Differential gliding of structures
- Evidence for specific scar effects scarce
Silicone Gel/Sheeting

- Used since 1980’s
- “Gold standard” (S. Monstrey et al 2014)
- Mechanism (?) (Arno et al 2014)
  - Occlusion
  - Hydration
- Appears to flatten, soften, and increase pliability of new scars (Gold 1994)

Elastomer

- Conforms to scar
- Can be used as an insert

Use

- Begin 2 weeks after wound healing
- Use at least 2 months
- Sheetling for small areas
- Wash daily to prevent rashes and infection

Contraindications

- Open wounds
- Fragile scar
- Complications
  - Rash
  - Skin breakdown

Tape

- Paper tape
- Kinesiotape

Paper tape

- Use at 2 weeks
- Use at least three months
- May use 4-7 days
- Ok to get wet
- Evidence supports use through:
  - Controlling scar tension
  - Eliminating stretching forces
  - Preventing hypertrophic scarring
  (Atkinson et al 2005)
**Kinesiotape**
- Used on healed wounds
- Theory
- Application
- Evidence is scarce
  (Karwacinska et al. 2012)

**Pressure Therapy**
- Reduces collagen synthesis
- Decreases blood, oxygen, nutrients to scar
- Decreases MMP-28
- Increases PGE2 (activates collagenase)
  (Reno et al. 2001)
- Used since 1970’s (Shriners Institute for Burn Care, Texas)
- Evidence mainly empirical
  (Jones L 2005)

**Use**
- Hypertrophic, keloid scars
- Burns
- Edema management
- Suggested use
  - 24 hours per day
  - 20-40 mmHg (lower is better)
  - Begin when wound epithelializes
- Up to 24 months
- Difficult to use in concave areas (palm)
  - May combine with inserts
- Patient compliance may be an issue (40%)
  (MacIntyre L, Baird M 2006)

**Physical Agents**
- Ultrasound
- Iontophoresis
- Low level laser therapy (LLLT)

**Ultrasound**
- Widely used (approx. 70% by PTs)
  (Wong, Schumann et al. 2007)
- Evidence supports use to increase healing
- May aid collagen reorganization
- Tissue temperatures elevated prior to exercise/massage
- Little current evidence to support role in
  scar management
- More study needed

**Iontophoresis**
- Evidence for scar management scarce
- More study needed
Low Level Laser Therapy (LLLT)

- Available in US since 2002
- Emerging technology
- Needs more research
  - Efficiency
  - Safety
  - Dosage
  - Type/timing
  - Scar reoccurrence

(Khatri, Mahoney, McCartney 2011)

More studies needed!

Thank you!