EDEMA MANAGEMENT

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WHAT WE WILL COVER:
- Different types of Lymphatic Therapies
- Anatomy and physiology
- Manual Edema Mobilization
  - Different types of edema and treatment
  - Basic principles, technique, critical points
- Treatment Adjuncts
  - Compression bandaging
- Evaluation
- Evidence
- Demonstration and Practice

LYMPHATIC THERAPIES

- Types
  - Complete Decongestive Therapy
  - Manual Lymph Drainage
  - Manual Edema Mobilization
- Overall Theory
  - To remove plasma proteins from edematous areas by stimulating the lymphatic system
  - Enables these proteins to leave the interstitial spaces and enter lymphatic structures
  - By ridding the interstitial spaces of these hydrophilic proteins, subacute and chronic edema decreases

COMPLETE DECONGESTIVE THERAPY
- 2 phase non-invasive intervention for lymphedema
  - Benefits
    - Open collateral lymphatic drainage pathways
    - Increased pumping by deep lymphatic pathways
    - Reduction and breakdown of fibrotic tissue
  - Phases
    - Phase I (intensive)
      - Involves MLD, bandaging, use of compression garments
      - 5x/week x 2-4 weeks
    - Phase II (self mgmt- transition to HEP)
      - Pt wears compression garment during day, bandaging at night, exercise, and self MLD

MANUAL LYMPHATIC DRAINAGE
- Specialized manual technique based on physiologic principles of lymph flow and lymph vessel emptying
- Affects lymph system by moving lymph fluid around blocked areas toward collateral vessels, anastomoses, and uninvolved lymph node regions
  - Benefits
    - Increases lymph angiomotoricity (pulse)
    - Increases volume of transported lymph fluid
    - Increasing pressure in lymph collector vessels
    - Improving lymph transport capacity
    - Potentially increasing arterial blood flow
MANUAL EDEMA MOBILIZATION

- A lymphatic stimulation technique used for recalcitrant sub acute or chronic limb/hand edema in the orthopedic population
  - An edema reduction technique
  - Key point:
    - Lymphatic system is intact but temporarily overloaded

ANATOMY AND PHYSIOLOGY

LYMPHATIC SYSTEM

- Scavenger system
  - Removes excess fluid, debris, and other materials from the tissue spaces
- Alternate pathway to the heart
  - For substances too large to be disposed of through the venous system

FUNCTIONS OF LYMPHATIC SYSTEM

- Immune function
  - By protecting the body from disease and infection
    - Via production, maintenance, and distribution of lymphocytes
- Responsible for returning proteins that have accumulated in the interstitial spaces back into the venous system
  - Restoring balance

DEFINITIONS

- Lymph
  - Fluid collected from tissues
  - Flows via lymphatic vessels through lymph nodes and drains into the venous system

- Interstitium
  - The spaces between cells
  - Interstitial fluid is the fluid between cells derived by filtration from the capillaries

FLUID TRANSPORT THROUGH BLOOD CAPILLARIES

- Net capillary filtration pressure is the balance of pressure between:
  - Capillary (hydrostatic) pressure
    - Moves fluid from capillary outward through the membrane
    - Pressure is greater at arterial than venous end
    - Results in fluid filtering out at arterial end and being reabsorbed at venous end of blood capillaries
  - Interstitial fluid pressure
    - Forces fluid inward through the capillary membrane when (+) and outward when (-)
  - Colloid osmotic pressure
    - Pressure created by dissolved proteins causing osmosis of fluid
    - Interstitial fluid colloid osmotic pressure - If high will cause osmosis of fluid outward through the membrane
    - Plasma colloid osmotic pressure - Draws fluid inward through the membrane
**FLUID TRANSPORT THROUGH BLOOD CAPILLARIES**

- When net filtration pressure rises excessively
  - Too much fluid is moved outward into the interstitial spaces for the lymphatics to manage
  - If lymphatic load exceeds the transport capacity, extracellular edema will result

http://lymph.weebly.com/lymphatic-system.html

**MECHANISM OF EDEMA**

- Injury to the inflammatory response changes the permeability of microvessels
  - Allowing plasma proteins to leak into interstitial spaces
  - Too large to permeate the venous system

**EDEMA**

- Can only occur if the lymphatic system has failed
- By Definition
  - Accumulation of excess fluid in the intercellular spaces in the body

**LYMPHATIC TISSUE DRAINAGE SYSTEM**

- 3 levels of structures
  - Lymphatic capillaries
  - Collector lymphatics
  - Nodes

**LYMPHATIC CAPILLARIES**

- Beginning of the lymphatic system
- Found in the dermis at the dermal-epidermal junction forming a flat 2-dimensional continuous network over the entire body
  - Except the CNS and cornea

http://www.nature.com/uri/journal/1/4/1/fig_suburi1258_F2.html
LYMPHATIC CAPILLARIES

- Consists of single layer of overlapping endothelial cells that have connector filaments anchoring them to surrounding CT
  - Forms flap like junctions that open when local interstitial pressure changes
  - When open, fluid flows in changing internal pressure from low to high, causing junctions to close
  - Enables vessels to stay open even under high tissue pressure
  - Fluid is unable to flow out

LYMPH PRECOLLECTORS AND COLLECTORS

- Lymphatic loads are reabsorbed by the lymph capillaries and flow into larger lymph vessels called precollectors which drain into collectors
  - Collectors have valves spaced every 6-20 mm
  - Prevent the backflow of lymph

LYMPH NODES

- Propulsion directs the lymph fluid into regional and central lymph nodes to be filtered
  - Nodes consist of a complex of sinuses that perform immunologic functions
  - Ultimately empties into the venous system

TRUNK LYMPHOTOMES

- Divided into 4 lymphatic quadrants (drainage territories)
  - L and R Upper Quadrant- Thoracic Lymphotomes
    - Extend from anterior midline to vertebral column on L and R sides of upper trunk
    - Lymph drains from superficial to deeper vessels that connect to nodes
  - Lymphotomes are watershed areas where normal drainage is away from the watershed toward the nodes
  - There are superficial collateral vessels across watershed areas
  - With lymph congestion they provide alternative pathway to uncongested lymph vessels
  - L and R Lower Quadrant- Abdominal Lymphotomes

DRAINAGE AREAS FOR LYMPHATIC DUCT

- UE drain mainly into axillary nodes
- Lymph from R thoracic lymphotome, RUE and R side of head drain into trunks that empty into R Lymphatic Duct
  - Duct empties into R Subclavian Vein and into the Superior Vena Cava of the heart
**DRAINAGE AREAS FOR THORACIC DUCT**

- Both LE, both abdominal lymphotomes, L thoracic lymphotome and L side of head drain into the Thoracic Duct
  - Largest lymphatic vessel in the body extending from L2 to T4
  - Thoracic Duct empties into the venous system at the juncture of the Subclavian and Jugular Veins

**MANUAL EDEMA MOBILIZATION**

A lymphatic stimulation technique used for recalcitrant sub acute or chronic limb/ hand edema in the orthopedic population

**Basic Premise**
- Diaphragmatic breathing, light skin-traction massage, and exercise help stimulate the lymphatic system
  - By changing interstitial pressure which enables the proteins to leave the interstitial spaces and enter lymphatic structures
  - By ridding the interstitial spaces of these proteins the edema decreases

**Key point:**
- Lymphatic system is intact but temporarily overloaded

**DIFFERENCES**

<table>
<thead>
<tr>
<th>Manual Edema Mobilization</th>
<th>Manual Lymphatic Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed for orthopedic patients with subacute and chronic edema</td>
<td>Originally intended for individuals with lymphedema</td>
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<tr>
<td>Lymphatic system is intact</td>
<td>Insufficient Lymphatic System</td>
</tr>
<tr>
<td>Temporarily overloaded</td>
<td>High plasma protein edema associated with mechanical obstruction</td>
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<tr>
<td>Treatment are shorter and typically involve moving less fluid</td>
<td>Treatments are longer and more involved</td>
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<td>Large amounts of fluid may need to be rerouted throughout the body</td>
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**CRITICAL POINTS**

1. All edema is not the same
2. Stimulation of the lymphatic system is necessary to decrease sub acute and chronic edema (high-protein edema)
3. The initial lymphatic system is superficial, fine, and fragile
4. Diaphragmatic breathing, light massage, and exercise help stimulate the lymphatic system

**LYMPHEDEMA**

- High plasma protein edema associated with a mechanical obstruction or insufficiency of the lymphatic system
  - Lymphatic system is unable to clear the interstitial tissues
  - Most distinguishing feature is resultant high content plasma proteins in the interstitial fluid
  - Over time can lead to fibrosis
  - MEM is contraindicated


[Image: http://www.agoracosmopolitan.com]
**STROKE EDEMA**

- Simple pitting edema
  - Perpetuated by the loss of motor function (muscle pump)
  - Eventually can become gel-like and then fibrotic

**EDEMA FROM KIDNEY OR LIVER DISEASE**

- Caused by decreased plasma proteins in the interstitium
  - Pitting edema
  - MEM is contraindicated

**EDEMA FROM CARDIAC CONDITIONS**

- Increased venous and capillary pressures
  - Bilateral pitting edema around ankles/feet
  - MEM is contraindicated

**NOT ALL EDEMA IS THE SAME**

- Pitting
  - Leaves depression with palpation

- Brawny
  - Immobile, hard to palpate
  - Non-pitting edema

- Fusiform or Periarticular

**INFLAMMATORY EDEMA**

- Acute (0-72 hours)
  - Inflammatory phase of wound healing
  - Initial flooding of damaged tissue area with electrolytes and water
  - Edema is liquid, soft, and easy to mobilize
  - These low-protein substances readily diffuse by osmosis back into the venous system
  - Good response to elevation
    - Elevation decreases hydrostatic pressure, reducing the flow of fluid into the interstitium

**INFLAMMATORY EDEMA TREATMENT**

- Rest
  - Immobilization, when possible, should occur in the intrinsic–plus position
  - Early active motion when appropriate

- Ice
  - Avoid heat modalities that may increase bleeding

- Compression

- Elevation
  - Decreases hydrostatic pressure, reducing the flow of fluid into the interstitium
**SUBACUTE EDEMA**
- Characterized by excess plasma proteins
- Lymphatic transport is compromised
- Fibroblastic phase of wound healing
  - Edema is more viscous from the elevated protein content
  - Fibroblasts are activated by the proteins trapped in the interstitium and produce collagenous tissue
    - Exudate causes fibrosis/thickening of tissues with subsequent shortening of ligamentous & tendinous structures
- Persistent edema, immobilization, and poor positioning will lead to a stiff hand
  - To decrease—lymphatics must be specifically stimulated
    - Active muscle pumping
    - MEM

**SUBACUTE EDEMA-TREATMENT**
- Lymphatics must be specifically stimulated
  - AROM/Tendon Gliding
    - Active muscle pumping is single most important stimulus for increasing lymphatic flow
  - Exercise stimulates the superficial lymphatics by altering tissue pressure (allowing fluid to flow into the lymphatic system) and stimulates the deeper lymphatics which aids in propelling the lymph through the deeper vessels
  - Lymphangions have a higher rate of contraction or “pumping” during exercise

**CHRONIC EDEMA**
- Maturation phase of wound healing
- Persistent edema leads to fibrosis with elevated protein count
- Edema becomes hard, thick, and brawny as the result of connective tissue infiltration and fibrosis
  - Can be reversed with MEM

**CHRONIC EDEMA TREATMENT**
- Lymphatics must be specifically stimulated
  - Techniques to increase tissue hydrostatic pressure
    - Compression garments
      - Isotoner gloves, Cohan wraps, Elastomull wraps
    - Lymphatic Therapies
      - Massage
        - Creates a locally negative pressure gradient, draining the lymphatic system distally
    - Other
      - Kinesiotape, Chip bags

**CRITICAL POINTS**
1. Stimulation of the lymphatic system is necessary to decrease sub acute and chronic edema (high-protein edema)
   - Theory
     - MEM removes the plasma proteins from edematous area by stimulating the lymphatic system
     - Enables the proteins to leave the interstitial spaces and enter lymphatic structures
     - By ridding the interstitial spaces of these proteins the edema decreases
CRITICAL POINTS
3. The initial lymphatic system is superficial, fine, and fragile
   • Firm compression may collapse the system

4. Diaphragmatic breathing, light massage, and exercise help stimulate the lymphatic system
   • By changing interstitial pressure and causing increased lymphatic protein absorption

BASIC PRINCIPLES
- Work from proximal to distal and then distal to proximal
- Direction of strokes must follow direction of lymph flow
  • Towards heart
- Intensity of strokes is very light
  • Too much pressure can collapse the lymph vessels
- Each stroke has a working and a resting phase
  • Strokes are slow and rhythmic
  • At least 1 second is needed during the working phase and 5-10 repetitions in each area
- Requires time to complete
  • 15-30 minutes

TECHNIQUE
- Diaphragmatic Breathing
  • Thoracic duct is the largest lymphatic structure (L2-T4) and one of the deepest
  • Diaphragmatic breathing changes pressure in duct
  • The pressure change creates a vacuum pulling lymph from peripheral structures centrally

- Exercise
  • General AROM BUE as diagnosis permits
  • Rationale
    • Active muscle pumping is single most important stimulus for increasing lymphatic flow
    • Exercise stimulates the superficial lymphatics by altering tissue pressure (allowing fluid to flow into the lymphatic system) and stimulates the deeper lymphatics which aids in propelling the lymph through the deeper vessels
    • Lymphangions have a higher rate of contraction or "pumping" during exercise

- Light skin-traction massage
  • So light that no blanching or indentation of skin occurs
  • Firm enough to move skin (not slide across)
  • Rhythmical
  • Forms a "U" shape on the skin with the opening of the U towards the heart in direction of lymphatic flow
  • Clearing U followed by Flowing U
    • Clearing U: work proximal to distal within 1 segment to clear lymphatic system within that segment
    • Flowing U: performed after clearing U: performed distal to proximal
TECHNIQUE

- Pump point stimulation
  - In the extremities there are areas of concentrated lymphatic nodes
  - PPS refers to simultaneously massaging 2 areas of concentrated lymphatic structures
  - The underlying concept is based on the theory that massage creates a locally negative pressure gradient, draining the lymphatic system distally

- Home program
  - Diaphragmatic Breathing
  - AROM exercises
  - Light skin-traction massage

SCARS

- Edema will have to be rerouted around scars and incisions
  - It cannot go through scars
- Goal is to reroute congested lymph around areas of tissue damage into adjacent functioning lymph capillaries
- Begin clear and flow massage proximal to the incision or scar
- Then the therapist creates a vacuum drawing the congested lymph around the scar by having her proximal hand form U’s near where the lymph is to be directed toward a node and the other hand is proximal to the edematous area performing flowing U’s toward the proximal hand

CONTRAINDICATIONS

- Malignancy
- Infection
- Do not use over an inflamed area
  - Stay proximal to area
- Thrombosis/blood clot/hematoma
- CHF, severe cardiac problems, Renal failure/kidney disease, Liver disease, Pulmonary problems
  - Due to potential to overload already failing system
  - These are low protein edemas- MEM treats high protein edema
- Active Cancer
  - Do not want to spread
- Primary Lymphedema (congenital) or Secondary lymphedema (post mastectomy edema)
  - Require knowledge how to reroute lymph to other parts of body

PRECAUTIONS

- Can increase the feeling of morning sickness in 1st trimester pregnancy
- Can alter blood sugar in diabetics
- Can decrease blood pressure in pts having low blood pressure

COMMON MISTAKES

- Not starting MEM at uninvolved axilla and clear/flow across chest
CASE EXAMPLE
- 56 yo Rhd Engineer
- Injured at work while in Puerto Rico
- 3 weeks 3 days s/p repair partial laceration extensor tendon L RF
- Edema measured using tape measure
  - Figure of 8 measurement
  - Edema
  - Pre tx 44.1 cm
  - Post tx 42.9

TREATMENT ADJUNCTS
- CHIP BAGS
  - Made from small pieces of varied-density foam
  - Provide light stimulating compression
  - Retain body heat
  - Provide further tissue softening
  - Provide significant local pressure and are especially helpful for brawny areas
    - Extremity should be wrapped from distal to proximal to assist with lymphatic and venous drainage

- FOAM PADDING
  - Place bandaging on stretch and flatten foam
  - When the limb slowly decongests, the foam expands
    - Ensures that the bandaging steadily applies firm pressure to the limb, while continuing to allow the limb to decongest

CASE EXAMPLE
- 73 yo male presented 10 days s/p R radial head replacement
- Treatment: MLD followed by Compression wrapping

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ELASTOMULL
- Elastic gauze bandage
- Park et al (2016) evaluated the effect of a modified hand compression bandage in pts with post-burn hand edema and concluded:
  - It was effective in pts with post-burn hand edema
    - Improving MCP jt ROM, hand circumference, & skin thickness
    - Will be clinically useful for the treatment of patients with post-hand burn edema
KINESIOTAPE

- When applied to the skin over an inflamed area, the stretch in the tape gently lifts the skin.
  - Creates an area of negative pressure, allowing both blood vessels and lymphatic vessels to dilate, draining the area.
  - Improved blood flow enhances delivery of oxygen and nutrients to the injured tissues, accelerating the healing process.

COMPRESSION BANDAGING MATERIALS

- Tubular bandage
  - Tricofix or 100% cotton
- Padding material
  - Cotton or synthetic (Artiflex)
- Foam
  - Velfoam, gray foam (1/4 or 1/2 inch), high-density (Komprex)
- Elastic gauze bandages (Transelast)
- Short-stretch bandages (Comprilan/Rosidal)

EVALUATION

RELIEF TECHNIQUES TO MEASURE EDEMA

- Volumeter
  - Standardized
  - Reliable within 10 ml if successive measures are performed by the same examiner
  - Use of "cool" (68°F; 20°C) versus "tepid" (95°F; 35°C) water does not appear to alter hand volume
  - Truncated surface measures
    - Derived by dividing the arm into cones, determining the volume of each cone, and summing these to determine total arm volume
    - Figure of 8 measurement
      - Valid and reliable
      - Uses 4 landmarks to provide 1 cumulative number in centimeters as a measure of edema

VOLUMETER

- Evaluates hand mass via water displacement
- Standardized Testing Procedure
  - Enhances reliability (Farrell et al. 2003)
    - Valid and Reliable within 10 ml if successive measures are performed by the same examiner (Waylett- Rendall, 1993)
    - Water should be room temperature (68-95°F)
    - Use of "cool" (68°F; 20°C) versus "tepid" (95°F; 35°C) water does not appear to alter hand volume (King 1993)
    - Warm water has been shown to increase volume in asymptomatic hands so avoid hot temperatures (Walsh, 1984; King 1993)
    - May be performed sitting or standing (Stern, 1991)
    - Use same position for subsequent measures
    - Initially measure both hands for comparison
    - Subsequent measurements compare injured itself
    - Changes in hand size may be due to reasons other than edema

VOLUMETER

ASHT RECOMMENDED TESTING PROCEDURE

1. Place the volumeter on the same level surface for each test
2. Fill volumeter with tepid water (91.7 to 95°F) to the point of overflow
3. Dry the collection beaker and place it below the spout
4. Ask the patient to remove any jewelry
5. Instruct the patient to keep the hand as vertical as possible and avoid contact with the sides of the volumeter while slowly immersing the hand into the volumeter to avoid spillage over the rim
6. The palm of the hand should face the patient (forearm mid-position) and the thumb should face the spout
7. The patient is asked to stop when the third web space makes contact with the dowel in the volumeter and to wait until water stops spilling from the spout
8. The water can then be measured in a graduated cylinder in milliliters or weighed. If the overflow is >500 ml, it will be necessary to pour the contents from the overflow beaker into the graduated cylinder twice and add the sums together
9. Record the results and repeat procedure on the opposite arm
VOLUMETER AND EXERCISE
- McGough and Zurwasky (1991) found that resistive exercise increased volume in asymptomatic hands (N=20)
  - Females 3.6 % increases immediately s/p exercise
  - Males 5.2 % increases
  - Both declined at 10 min s/p ex to 2.4% (women) and 5% (men)
- Changes in edema need to be greater than 10 ml to be clinically significant
- Changes pre and post would need to be greater than 25 ml to account for expected increase in hand volume with exercise

TRUNCATED SURFACE MEASURES
- Derived by dividing the arm into cones, determining the volume of each cone, and summing these to determine total arm volume
  - Measures may be taken every 4 or 10 cm
- Commercial computer programs are available to automate the computations once the landmarks and circumferences are determined
  - Useful for pts with large arms, diffuse edema, or those with pins, fixators, or open wounds
- High correlations between water displacement and truncated formulas have been well documented (Karges, 2003)
  - Measures are not interchangeable

FIGURE OF 8 MEASUREMENT
- Uses 4 landmarks to provide 1 cumulative number in centimeters as a measure of edema
  - Valid and reliable
    - In sample of individuals w no recent hand injury/surgery (Pellecchia 2003)
    - Excellent reliability and concurrent validity compared with water volumetry (Maihafer 2003)
    - High intra-rater reliability in hand pts (sensitive to differences in injured/uninjured hands (Lewis et al, 2014)
  - Valid and Reliable in Burn population (Dewey et al., 2007)
  - Valid and Reliable in conditions affecting the Hand (Leard et al., 2004)
- Factors that may compromise test results
  - Irregular, improper, or inconsistent placement of tape
  - Tester not well trained in method
  - Different testers using incorrect hand, wrist position

ASHT RECOMMENDED TESTING PROCEDURE
- Pt sits with arm abducted/externally rotated 90°, elbow flexed 90°, wrist neutral, fingers adducted/extended, and thumb abducted in plane of the hand. The examiner uses a measuring tape per instructions by Maihafer et al (2003)
  1. Begin on the radial/palmar side of the wrist, aligning the distal edge of the measuring tape with the distal wrist crease
  2. Wrap the tape measure in an ulnar direction across the wrist, staying proximal to the distal wrist crease until passing over the tendon of the FCU

CIRCUMFERENTIAL MEASUREMENTS
- No standardized procedure/ Not rec'd for routine use
  - Due to variable placement of tape and tension applied
  - Goal: No tension
  - Reliability of circumferential measurements is better when anatomical landmarks, and consistent tension are used, and when measurements are taken at the same time of day (Lewis 2010; Taylor 2006)
- May be necessary
  - When open wounds are present
  - When edema is isolated to 1 joint
  - Volumeter is not sensitive enough changes
ASHT RECOMMENDED TESTING PROCEDURE
- Using a flexible tape measure or finger circumference gauge, measure around the affected body part, being sure to utilize bony landmarks and document exact landmarks used for measurement
  - A force gauge may be used to measure the amount of force applied for more objective measure
  - The tape measure should not indent skin or validity of measurement will be affected
  - Reliability is improved by using the same for subsequent measurements and bony landmarks

EVIDENCE
Knygsand-Roenhoej (2011) investigated effects of a modified MEM approach (n=14) and compared it with traditional edema techniques (n=15) in patients with subacute edema following DR fracture
- Elevation, compression, functional training
- Level I Evidence
- Found that neither treatment was superior
  - No significant changes were observed in edema reduction, AROM, pain, or ADL at 6 and 9 weeks
- BUT- Modified MEM resulted in fewer sessions to decrease edema. Significant improvement was observed in ADL performance after 3 weeks in the MEM group

EVIDENCE
Priganc and Ito (2008) examined the efficacy of MEM on decreasing edema and pain and increasing ROM using a single-subject, A-B design study.
- In 4/5 subjects a decrease in edema between baseline and treatment/intervention phases was found statistically significant
- Differences between baseline and treatment/intervention phases for pain and ROM were not statistically significant despite qualitative reports of improvements after treatment
- Provides statistical support for use of MEM in decreasing subacute and chronic edema

EVIDENCE LEVEL 2 B
Miller et al (2017) performed a SR to examine the evidence of effectiveness of treatments for sub-acute hand edema
- 10 studies; 16 edema interventions
- Due to heterogeneity of pt characteristics, interventions, and outcomes assessed, it was not possible to pool the results from all studies
- Found low to moderate evidence “with limited confidence” in the effect estimate to support the use of MEM in conjunction with standard therapy to reduce problematic hand edema
- CONCLUSION:
  - High quality RCT are needed to assess effectiveness of therapy interventions on hand volume for subacute hand edema
  - MEM should be considered in conjunction with conventional therapies (massage, elevation, exercise, and compression) in cases of excessive edema or when the edema is unresponsive to conventional treatment alone
  - MEM is not advocated as a routine intervention

EVIDENCE DIAPHRAGMATIC BREATHING
- Some studies that suggest that active muscle contraction rather than passive tendon stretch more efficiently enhances local diaphragmatic lymph flow
  - Synchronous contraction of diaphragmatic skeletal muscle fibers recruited at every inspiratory act dramatically enhances lymph propulsion
- Moseley et al explored the benefits of gentle arm exercise combined with deep breathing for secondary arm lymphedema in 38 women
  - Found statistically significant reductions in edema directly after performing the regime (52 mls, 5.8%), at 30 minutes (50 mls, 5.3%), at 24 hours (46 mls, 4.3%), at 1 week, (33 mls, 3.5%), and at 1 month (101 mls, 9.0%).
  - Reported arm heaviness and tightness were also statistically significantly decreased
Leduc et al (1998, 1990) found that the combination of multilayered bandages on the forearm combined with exercise increased protein absorption by lymphatic capillaries.

Kurz (1997) demonstrated that the flow of lymph within the vessel is best between 22-41°C. Sharply slows down or stops below and above those temps.

Bandaging can influence protein absorption by providing light compression and perhaps by providing a buildup of body heat that is within the mid range of ideal temp to mobilize lymph.

Gustafson (2016) investigated the effectiveness of compression bandaging from the finger to the axilla in reducing poststroke edema in the upper limb using a single-case study (N=5).

Part 2 of a 3 part research study. Part 1 investigated the difference between the use of low-stretch and high-stretch bandaging of the hand and found that both types were effective in reducing post stroke edema but the edema shifted to the forearm and returned to the hand upon removal of bandages. Part 3 explored the efficacy of compression gloves in maintaining benefits gained from compression bandaging in the stroke-affected upper limb (N=4). Found that compression gloves had mixed benefits in managing reductions in edema.

SR by Morris et al (2013) of 9 RCTs concluded that there is insufficient evidence to support the use of Kinesiotape over other modalities in clinical practice.

In a randomized experimental design, Bell and Muller evaluated efficacy of Kinesiotape in reducing edema in 17 hemiplegics.

- Found that while Kinesiotape did not result in a stat. significant reduction in edema, large and medium effect sizes were seen for edema reduction at the MCP and wrist joints.
- 2 randomized controlled pilot studies compared 2 groups: 1 treated with CDT and bandaging and 1 treated with CDT and Kinesiotape.
- Both studies report comparable effect measured by circumference, higher quality of life, lower cost, and improved acceptance with longer wearing times, less difficulty in usage, and increased comfort and convenience.
- 2 other studies found that kinesiotape was not an effective method of reducing lymphoedema in women after breast cancer treatment.

What Can We Do Better?

Thank You