Evidence Based Practice

Cold and Heat Therapy

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2008 EATA Meeting at Valley Forge
Show Me the Evidence!
What is Evidence-Based Practice?

Best Research

Clinical Experience

Patient Values

2008 EATA Meeting at Valley Forge
Evidence-Based Practice

Where are we today?

Lots of theories
Testimonials
Education & manufacturer driven
Uninjured human subjects
Animal Models
Some RCT’s

Where do we want to go?

Large Scale Randomized Clinical Trials that examine our treatments and determine our clinical practice
Get Involved!
Top Ten Things an Athletic Trainer Says

1. Put some ice on it
If so, which treatments are most effective?
How can we optimize our treatments?
The most common clinical practice in sports medicine

- “Put some ice on it”
- Does ice reduce swelling after an ankle sprain?
- Does it hasten recovery?
Systematic Review of Cryotherapy on Return to Play

- 83 relevant clinical trials
- 79 were excluded because they did not include return to play as an outcome
- 4 reviewed studies
  - 2 had a positive RX effect
  - 1 had a positive effect but attributed it to compression
  - 1 showed no difference

All had PEDro Scores of 3 or 4 (1-10)

Hubbard et al  JAT 39(1) 88-94
1. Eligibility criteria were specified
2. Subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)
3. Allocation was concealed
4. The groups were similar at baseline regarding the most important prognostic indicators
5. There was blinding of all subjects
6. There was blinding of all therapists who administered the therapy
7. There was blinding of all assessors who measured at least one key outcome
8. Measurements of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups
9. All subjects for whom outcome measurements were available received the treatment or control condition as allocated, or where this was not the case, data for at least one key outcome were analyzed by “intention to treat”
10. The results of between-group statistical comparisons are reported for at least one key outcome
11. The study provides both point measurements and measurements of variability for at least one key outcome
Physiotherapy Evidence Database (PEDro)

**PEDro Score**

- **0-2**: Weak
- **3-4**: Most Cold and Heat Studies
- **5-6**: Goal of future Studies
- **6-8**: Studies
- **9-10**: Strong

**Goal of future Studies**
The use of ice in the treatment of acute soft-tissue injury: a *systematic review* of randomized controlled trials

- There was marginal evidence that ice plus exercise is most effective, after ankle sprain and postsurgery.
- There was little evidence to suggest that the addition of ice to compression had any significant effect, but this was restricted to treatment of hospital inpatients.
- Few studies assessed the effectiveness of ice on closed soft-tissue injury, and there was no evidence of an optimal mode or duration of treatment.

Compared 20 minutes ice pack to intermittent (10 minutes 10 minutes off) ice packs

The intermittent protocol reduced pain on activity one week after injury

No other statistical difference in terms function, swelling and pain at rest

Statistical significance vs. clinical significance
Compared Heat and cold on acute ankle sprains

Concluded that cold worked better than heat

No Controls

Did cold make it better or did heat make it worse?????
Comparison of cold, heat and contrast therapy on ankle swelling

- Subacute Ankle Sprains
- 1 Treatment per day
- Measurement error was greater than treatment effect
- No Control Group

All Three Interventions Increased Limb Volume!
Cold had the smallest increase and was deemed most effective

Cote et al. Phys Ther 1988, 68(7) 1072-6
High Voltage Pulsed Current (HVPC)

- Long touted by clinicians as an effective tool in managing pain and edema and thereby hastening recovery
- No evidence that it hastens recovery!!
Ice and high voltage pulsed stimulation in treatment of acute lateral ankle sprains

30 subjects who sustained a grade I or II Ankle Sprain

ATC treat within minutes of the injury

ICE for 30 minutes

ICE + HVPS for 30 minutes

ICE followed by HVPS

Most swelling has already occurred

One 30 Minute Treatment per day

Did not measure function

No treatment effect but a tendency toward decreased pain, edema, and an increase in ankle dorsiflexion

Michlovitz et al, JOSPT 1988;9,301-304
Ice and high voltage pulsed stimulation in treatment of acute lateral ankle sprains

No treatment effect but a tendency toward decreased pain, edema, and an increase in ankle dorsiflexion

PEDro Score

Michlovitz et al, JOSPT 1988;9,301-304
Does cryotherapy and e-stim have an added effect?

If not, which is more effective

Does either modality provide a “clinical effect”

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Cool-Water Immersion and High-Voltage Electric Stimulation Curb Edema Formation in Rats

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Objective: Although cryotherapy and high-voltage electric stimulation, both alone and in combination, are commonly applied to curb acute edema, little evidence from randomized controlled studies supports these procedures. Our purpose was to examine the effects of cool-water immersion (CWI) at 12.9°C (55°F), cathodal high-voltage pulsed current (CHVPC) at 120 pulses per second and 90% of visible motor threshold, and the combination of CWI and CHVPC (CWI + CHVPC) on edema formation after impact injury to the hind limbs of rats.

Design and Setting: Both feet of 34 rats were traumatized after hind-limb volumes were determined. Animals were randomly assigned to 1 of 3 groups: CWI (n = 10), CHVPC (n = 10), or CWI + CHVPC (n = 14). One randomly selected hind limb of each rat was exposed to four 30-minute treatments, interspersed with four 30-minute rest periods beginning immediately after posttraumatic limb volumes were determined. Contralateral limbs served as controls. Limbs remained dependent during all treatments, rest periods, and volumetric measurements.

Subjects: We used 34 anesthetized Zucker Lean rats in this study.

Measurements: We measured limb volumes immediately before and after trauma and after each of 4 treatment and rest periods.

Results: Volumes of treated limbs of all 3 experimental groups were smaller (P < .05) than those of untreated limbs. No treatment was more effective than another.

Conclusions: Cool-water immersion, cathodal high-voltage electric stimulation, and simultaneous application of these treatments were effective in curbing edema after blunt injury. Combining CWI and CHVPC was not more effective than either CWI or CHVPC alone.

Key Words: cryotherapy, electrotherapy, swelling, animal model
What effect does initial treatment have on acute edema formation?

CHVPC → Decrease in Capillary Permeability

+ 

Cryotherapy → Decreases Metabolic Activity

Greater = RX Effect?

Acute Trauma Management
Results
Cryotherapy + HVPC had no added treatment effect.
“Staircase Effect”

Limb Volumes

Trauma 0 30 60 90 120

RX

REST

Control Limbs

Continuous RX

Time
Effects of Cool-Water Immersion and High-Voltage Electric Stimulation for 3 Continuous Hours on Acute Edema in Rats

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Objective: Cool-water immersion (CWI) at 12.8°C (55°F), cathodal high-voltage pulsed current (CHVPC) at 120 pulses per second and 95% of visible motor threshold, or the combination of CWI and CHVPC, applied 30 minutes on, 30 minutes off for 4 hours, are known to curb edema formation after blunt trauma to the hind limbs of rats. Our purpose was to examine the effects of extending treatment times to 3 continuous hours after blunt trauma to the hind limbs of rats.

Design and Setting: A randomized, parallel-groups design of 22 subjects was used. Volumes of traumatized limbs, randomly assigned to CWI (n = 7), CHVPC (n = 8), or CWI followed by CHVPC (n = 7) were compared with those of injured but untreated limbs with analysis of variance.

Subjects: Twenty-two anesthetized Zucker lean rats (mass = 203 ± 27 g).

Measurements: We measured limb volumes immediately before and after trauma and every 30 minutes over the 4-hour experiment.

Results: Volumes of treated limbs of all 3 experimental groups were smaller than those of untreated limbs (P < .05). No treatment was more effective than another.

Conclusions: Exposure to either 3 hours of CWI or CHVPC or to 1 hour of CWI followed by 2 hours of CHVPC effectively curbed edema after blunt injury. These results suggest that these common treatments are effective only during application and hint that application should be maintained throughout the period during which edema is forming.

Key Words: cryotherapy, electrotherapy, swelling, inflammation, treatment time, animal model
Effects of Continuous Treatment on Edema Formation

“Golden Minute” for Acute Management

Change in Limb Volume (mL/Kg)

Minutes

JAT 2003, 38(4) 225-229
How can we optimize our treatments?

Pain & Edema

Max

Exercise

Min

Untreated

Intermittent

Continuous

Injury

Return to Play

Acute Trauma Management
Is Amount of Time Treated Related to RX Effect?

- Inflammation: 100%
- Cont. HVPC: 85%
- HVPC: 1%
- Elevation: 17%
- Compression: 96%
- Cryotherapy: 6%

Minutes per day expressed as %
Effects of electrical stimulation on pain, edema and return to play following ankle sprains in college and professional athletes

A Multi-Center Clinical Trial

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Effects of HVPC on acute lateral ankle sprains in collegiate and professional football players. Mendel et al. In Review.
Effects of HVPC on Return to Play Following Ankle Sprains

- Clinical trials often give unexpected results
- Time of Intervention
- Does stim retard inhibit healing?

- Prospective
- Double Blind
- Credible Placebo

PEDro Score

- 0 Weak
- 10 Strong

9-10
Application of Continuous HVPC in Athletes

Acute Trauma Management
Extended Treatment using HVPC
BEST PRACTICES:
THE TAKE HOME MESSAGE

- Limited evidence that RICE and E-Stim hasten recovery
- Apply RICE+ other interventions ASAP
- Consider Extended Treatment Times and reapply at frequent time intervals (more is sometimes BETTER)
- Supervised Rehab supplemented by home therapy
Thermotherapy

- Application of superficial and deep heat to improve treatment outcomes
Cochrane Review of Superficial Heat and Cold

- Acute and subacute low back pain
- Heat wrap therapy reduced pain after 5 days
- One trial of 90 participants with acute low back pain found that a heated blanket significantly decreased pain
- One trial of 100 participants with a mix of acute and subacute low back pain examined the additional effects of adding exercise to heat wrap and found that it reduced pain after 7 days

French et al Spine 2006, 31 (9), pp. 998-1006
Philadelphia Panel
Evidence-Based Clinical Practice Guidelines

- Low Back: ADL’s + Exercise
- Knee: TENS + Exercise
- Shoulder: US for calcific Tendon lesions
- Neck: Exercise

Thermotherapy is ineffective or no studies to evaluate
Effects of heat wraps on skin and muscle temperatures

ThermaCare

↑ temp at 2 cm depth with less sensation of heat

J& J Back Plaster

↑ temp at skin and greater sensation of heat

ABC Warme-Pflaster

You Decide

Trowbridge JOSPT, 2004,34(9) 549-558
Heat Wraps in the prevention and early treatment of low back DOMS

2 RCT’s

Prevention
- Heat Wrap
- Control
- Pain Intensity ↓47% at 24 hours for heat wrap group
- Self Reported disability and function decreased 53% & 45% for heat wrap group

Treatment
- Heat Wrap
- Cold
- Pain relief was ↑138% at 24 hours for Heat Wraps
- No differences in self-reported function or disability

Subjects with non-specific low back pain

Do heat wraps worn overnight affect pain, stiffness and ROM?

Heat Wrap worn overnight  Control

Overnight use of heatwrap therapy provided effective pain relief throughout the next day, reduced muscle stiffness and disability, and improved trunk flexibility. Positive effects were sustained more than 48 hours after treatments were completed.


35 randomized clinical trials that examined US in soft tissue injuries

10 had acceptable methods and included treatment and control groups

2 reported positive outcomes (carpal tunnel syndrome & calcific tendonitis of the shoulder)

8 reported no treatment effect

little evidence that active therapeutic ultrasound is more effective than placebo in promoting soft tissue healing.
BEST PRACTICES: THE TAKE HOME MESSAGE

- Limited evidence that thermotherapy hastens recovery
- Moderate evidence that continuous heat therapy decreases pain and improves function in non-specific back pathology
- Are these results transferable to other conditions that athletic trainers manage?
Thanks for the Invitation

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