Does cryotherapy reduce the edematous component of acute inflammation? A systematic review

Jenee Henderson, SPT
Carrie Smith, SPT
Advisor: Dr. Tillman

Key Components of Systematic Review Process

- Definition of research question
- Methods for identifying research studies
- Selection of studies for inclusion
- Quality appraisal of included studies
- Extraction of the data
- Synthesis of the data

General knowledge

- All PT settings use cryotherapy
- Ice is the treatment of choice for acute inflammation
- Clinically, ice is not used alone to treat inflammation
- Combinations of RICE are often implemented
- What is actually decreasing the inflammatory reaction?
  - E.g. is it the I, the C, the C and the R, just the R, or E, etc.?

Physiological affects of cold:

- vasoconstriction
- decrease afferent nerve velocity
- decrease cellular metabolism
- decrease vascular permeability
- increase blood, water, and lipid viscosity
- decrease smooth muscle contraction
- decrease mm spasm
- increase sympathetic adrenergic reactions
- reduce skin temp

Clinical Parameters Taught in PT School

Cryotherapy Technique	Temperature	Recommended Duration
Ice Massage	0°C	3 to 10 minutes
Chemical Cold Pack	-12.2°C to –9.4°C	10 to 15 minutes
Ice Pack	0°C	5 to 15 minutes
Ice Towel	0°C	5 to 15 minutes
Ice Bath	13°C to 18°C	10 to 30 minutes

Definition of research question

Does cryotherapy ALONE reduce the edematous component of acute inflammation?

Background

- Five signs of acute inflammation:
  - Heat
  - Edema
  - Redness
  - Pain
  - Loss of function
- Physiologic and cellular processes contributing to local edema:
  - Vasodilation
  - Permiability of microvascular walls
  - Accummulation of exudate in interstitial spaces
  - Increased cellular mediators (neutrophils and macrophages)

Background

- Some research indicates that edema is not being reduced by ice alone
- The use of multiple modalities and treatment in combination have made it difficult to determine whether cold is effective as single modality for edema in acute inflammation

Purpose

- A systematic review will help to determine:
  - effectiveness of cryotherapy on edema
  - parameters for cryotherapy on edematous tissues
  - deficits in this area of research

Database search

Data Source	Search Strategy
Pub Med	"Cryotherapy and edematous tissue" "Cryotherapy and deep tissues" "Cryotherapy and edema" "Ice and wounds and injuries" "Cryotherapy and subcutaneous tissue"
CinAHL	"Cryotherapy and edema" "Ice and edema"
Infotrack	"Edema and cryotherapy"
Medline	"Cryotherapy and edema" "Cryotherapy to treat edema"
Cochrane Database	"Cryotherapy and edema" No relevant articles identified
Reference pages	Relevant references by author discretion

Inclusion criteria

- Controlled study of human and animal subjects
- Published in English
- Refereed journal
- Includes patients recovering from acute soft tissue injury who received one of the various forms of cryotherapy
- Provides comparison of one cryotherapy method with another type of cryotherapy, or with another non-cryotherapy treatment, or with no treatment
- Objectively measures acute swelling in soft tissue

Exclusion criteria

- Studies conducted on non-traumatized tissue without acute swelling
- Studies determining the effects of cryotherapy on subacute edema
- Studies performed on healthy individuals after exercise
- Studies involving cryotherapy in combination with elevation
- Cryotherapy in combination with ROM
- Cryotherapy in combination with compression
- Studies that evaluated the effectiveness of cryotherapy but didn't measure edema outcomes (but rather pain, ROM, optimal rx times and depths)
- Review articles on cryotherapy

Quality appraisal of included studies

- Must identify bias
- Sources used to evaluate articles:
  - Consort statement
    - http://www.cjns.org/consort_checklist.html

Summary of Data Collection

Number of articles ordered	68
Number of articles received	45
Articles that meet criteria and entered into database	8
Literature Reviews on cryotherapy	6
Multiple modality articles	5
Cryotherapy articles that do not measure edema outcomes	4
Background articles related to cryotherapy	16
Articles questionable about meeting criteria	6

Results of Articles

- Articles with Significant Decrease in Edema
- Articles with No Significant Change
- Articles with Significant Increase in Edema


Significant Decrease in Edema


No Significant Change in Edema


Significant Increase in Edema

Discussion

- Why are the experimental procedures similar to each other, but not clinically acceptable cryotherapy protocols?
- Are the objective measures appropriate for measuring edema?
- Are the times of objective measurement appropriate?
- Is ice most effective in combination with RICE?

Results

- Continuous cryotherapy for prolonged time periods is detrimental to contused tissues
  - Hemorrhaging and swelling in deep tissues
- Cryotherapy at extremely low temperatures has negative effects on edema outcomes
- The specific type of outcome measurement may affect the results
- The specific time of measurement/assessment directly affects the results
- Cryotherapy may need to be used in conjunction with RICE for improved long-term edema outcomes

Conclusion

- The question initially asked is relevant, however, research in this specific area is not conclusive, or clinically relevant as originally hypothesized
- The literature in this review does not provide conclusive evidence that cryotherapy alone reduces edema in the acute inflammatory process
- More research needs to be performed using combined modalities in order to achieve evidence based practice

Conclusion

- Should our prescriptions to patients concerning the acute inflammatory process be more specific?
  - E.g. ice on for 20 minutes, off for 1 hour then on again for 20 minutes
  - E.g. ice for 20 minutes while leg is elevated 45 degrees. Keep ankle compressed with ACE bandage while ice is off for 1 hour.

Questions?