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Does Cryotherapy Improve Outcomes With Soft Tissue Injury?

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Clinical Question: What is the clinical evidence base for cryotherapy use?

Data Sources: Studies were identified by using a computer-based literature search on a total of 8 databases: MEDLINE, Proquest, ISI Web of Science, Cumulative Index to Nursing and Allied Health (CINAHL) on Ovid, Allied and Complementary Medicine Database (AMED) on Ovid, Cochrane Database of Systematic Reviews, Cochrane Database of Abstracts of Reviews of Effectiveness, and Cochrane Controlled Trials Register (Central). This was supplemented with citation tracking of relevant primary and review articles. Search terms included *surgery*, *orthopaedics*, *sports injury*, *soft tissue injury*, *sprains and strains*, *contusions*, *athletic injury*, *acute*, *compression*, *cryotherapy*, *ice*, *RICE*, and *cold*.

Study Selection: To be included in the review, each study had to fulfill the following conditions: be a randomized, controlled trial of human subjects; be published in English as a full paper; include patients recovering from acute soft tissue or orthopaedic surgical interventions who received cryotherapy in inpatient, outpatient, or home-based treatment, in isolation or in combination with placebo or other therapies; provide comparisons with no treatment, placebo, a different mode or protocol of cryotherapy, or other physiotherapeutic interventions; and have outcome measures that included function (subjective or objective), pain, swelling, or range of motion.

Data Extraction: The study population, interventions, outcomes, follow-up, and reported results of the assessed trials were extracted and tabulated. The primary outcome measures were pain, swelling, and range of motion. Only 2 groups reported adequate data for return to normal function. All eligible articles were rated for methodologic quality using the PEDro scale. The PEDro scale is a checklist that examines the believability (internal validity) and the interpretability of trial quality. The 11-item checklist yields a maximum score of 10 if all criteria are satisfied. The intraclass correlation coefficient and kappa values are similar to those reported for 3 other frequently used quality scales (Chalmers Scale, Jadad Scale, and Maastricht List). Two reviewers graded the articles, a method that has been reported to be more reliable than one evaluator.

Main Results: Specific search criteria identified 55 articles for review, of which 22 were eligible randomized, controlled clinical trials. The articles' scores on the PEDro scale were low, ranging from 1 to 5, with an average score of 3.4. Five studies provided adequate information on the subjects' baseline data, and only 3 studies concealed allocation during subject recruitment. No studies blinded their therapist's administration of therapy, and just 1 study blinded subjects. Only 1 study included an intention-to-treat analysis. The average number of subjects in the studies was 66.7; however, only 1 group undertook a power analysis. The types of injuries varied widely (eg, acute or surgical). No authors investigated subjects with muscle contusions or strains, and only 5 groups studied subjects with acute ligament sprains. The remaining 17 groups examined patients recovering from operative procedures (anterior cruciate ligament repair, knee arthroscopy, lateral retinacular release, total knee and hip arthroplasties, and carpal tunnel release). Additionally, the mode of cryotherapy varied widely, as did the duration and frequency of cryotherapy application. The time period when cryotherapy was applied after injury ranged from immediately after injury to 1 to 3 days postinjury. Adequate information on the actual surface temperature of the cooling device was not provided in the selected studies. Most authors recorded outcome variables over short periods (1 week), with the longest reporting follow-ups of pain, swelling, and range of motion recorded at 4 weeks postinjury. Data in that study were insufficient to calculate effect size. Nine studies did not provide data of the key outcome measures, so individual study effect estimates could not be calculated. A total of 12 treatment comparisons were made. Ice submersion with simultaneous exercises was significantly more effective than heat and contrast therapy plus simultaneous exercises at reducing swelling. Ice was reported to be no different from ice and low-frequency or high-frequency electric stimulation in effect on swelling, pain, and range of motion. Ice alone seemed to be more effective than applying no form of cryotherapy after minor knee surgery in terms of pain, but no differences were reported for range of

motion and girth. Continuous cryotherapy was associated with a significantly greater decrease in pain and wrist circumference after surgery than intermittent cryotherapy. Evidence was marginal that a single simultaneous treatment with ice and compression is no more effective than no cryotherapy after an ankle sprain. The authors reported ice to be no more effective than rehabilitation only with regard to pain, swelling, and range of motion. Ice and compression seemed to be significantly more effective than ice alone in terms of decreasing pain. Additionally, ice, compression, and a placebo injection reduced pain more than a placebo injection alone. Lastly, in 8 studies, there seemed to be little difference in the effectiveness of ice and compression compared with compression alone. Only 2 of the 8 groups reported significant differences in favor of ice and compression.

Conclusions: Based on the available evidence, cryotherapy seems to be effective in decreasing pain. In comparison with other rehabilitation techniques, the efficacy of cryotherapy has been questioned. The exact effect of cryotherapy on more frequently treated acute injuries (eg, muscle strains and contusions) has not been fully elucidated. Additionally, the low methodologic quality of the available evidence is of concern. Many more high-quality studies are required to create evidence-based guidelines on the use of cryotherapy. These must focus on developing modes, durations, and frequencies of ice application that will optimize outcomes after injury.

DISCUSSION

The effects of ice have been demonstrated in numerous animal models and human studies. Ice reduces tissue temperature, blood flow, pain, and metabolism. However, and possibly more important, is the question, ''Does ice application improve the treatment outcomes?'' Does treatment facilitate achievement of goals related to functional limitations and sudden transient disability after injury or surgery? Bleakley et al[1] reported that cold seemed to be more effective in limiting swelling and decreasing pain in the short term (immediately after application to 1 week postinjury). However, the long-term effects of cryotherapy and the effect on the tissue repair are not known. Only 1 group examined the effect of cryotherapy at 4 weeks postinjury. Additionally, evidence is limited that cryotherapy hastens return to participation.

Currently, only 4 groups have examined the effect of cryotherapy on return to participation.[2–5] The 4 groups addressed return to sport or work after ankle sprain and scored 2–4 on the PEDro scale (maximum = 10 points). Cryotherapy was applied immediately after injury. Two of the four reports suggested that cryotherapy speeds return to full activity. However, the results of the outcome measures were not fully documented. A confounding factor of compression as part of the treatment prevents interpretation of the effects of cryotherapy in one of the articles.[4] Therefore, whether cryotherapy facilitates return to participation is still unclear.

Ice does not seem to be more effective than compression after surgery. Only 2 of the 8 groups reported significant differences in favor of ice and compression. However, in all 8 studies, postsurgical dressings or socks were used to separate the injured area of the body and the cooling agent. Such barriers may have mitigated the cooling effect of the cold compress. Further research comparing ice with compression is required in subjects with acute injuries.

Currently, no authors have assessed the efficacy of ice in the treatment of muscle contusions or strains. Considering that most injuries are muscle strains and contusions, this is a large void in the literature. Most cryotherapy studies have focused on postsurgical anterior cruciate ligament repairs and knee and hip replacements. The results of these studies cannot be generalized to muscle strains and contusions.

The Bleakley et al[1] study has several limitations. In the 12 treatment comparisons made by Bleakley et al,[1] only 1 or 2 articles were examined in some instances. It is difficult to generalize results based on only 1 or 2 studies. Additionally, the authors did not separate cryotherapy for acute immediate care from that for rehabilitation. The goals for each may be different and a potential reason for the lack of efficacy of cryotherapy.

Based on this review by Bleakley et al[1] and a similar review by Hubbard et al,[6] the methodologic quality of clinical trials of cryotherapy is poor. Most of the studies were conducted years ago. Additionally, with cryotherapy research, it is not possible to blind subjects to the exposure to cold and thus score 10 on the PEDro scale. However, scores higher then 5 should be achieved. Assessing the quality of the randomized, controlled clinical trials is important because of evidence that low-quality studies provide biased estimates of treatment effectiveness.[7] Despite the general acceptance of cryotherapy as an effective intervention, evidence on which to base these conclusions is limited. Only with strong randomized, controlled clinical trials will we know the true efficacy of cryotherapy.

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