Cryotherapy

Indexing Metadata/Description

› Device/equipment: Cryotherapy
› Synonyms: Cold therapy; ice pack therapy; ice therapy; cooling; cryokinetics
› Area(s) of specialty: Acute Care, Hand Therapy, Home Health, Neurological Rehabilitation, Orthopedic Rehabilitation, Pediatric Rehabilitation, Sports Rehabilitation

Description/use

- Cryotherapy is a modality used to relieve symptoms associated with inflammation, pain, muscle spasms, and swelling.\(^{34}\)
- In a surgery/radiology context, cryotherapy is a minimally invasive treatment that uses extreme cold to freeze and destroy diseased tissue.\(^{1}\)
- This Clinical Review focuses on therapeutic use of cold
  - Whole body cryotherapy, the exposure of the body to very cold air in temperature-controlled cryochambers, is not included in this review. This treatment has recently gained popularity, particularly among athletes, but is under scrutiny for its safety.\(^{13,14}\) The United States Food and Drug Administration (FDA) does not recognize any medical benefits from cryotherapy chambers, and does not regulate the devices.\(^{12}\)
- In physical therapy, cryotherapy refers to application of mild superficial cooling agents to an area of the body to lower tissue temperature
- Cooling can lower oxygen requirements in the tissue, cause vasoconstriction, and decrease vessel wall permeability.\(^{36}\)
- Commonly used in the acute phase after soft tissue injury in conjunction with rest, ice, compression, and elevation (“RICE”)

› CPT codes: 97010 hot or cold packs (including ice massage)

Reimbursement

- Coverage varies with insurance plans, depending on diagnosis and reason specific treatment is required. There might be limitations, such as number of treatments per condition or per time period
- Cold packs applied in the absence of associated procedures or modalities, or used alone to reduce discomfort, are considered not to require the unique skills of a therapist
- Code 97010 is bundled. It can be bundled with any therapy code. Regardless of whether code 97010 is billed alone or in conjunction with another therapy code, this code is never paid separately. If billed alone, this code will be denied. Reimbursement for code 97010 is included in the reimbursement for the comprehensive therapeutic code

Indications for device/equipment

- Cryotherapy is used in a wide variety of conditions to reduce pain and swelling; to prevent hematoma formation; to reduce inflammation and metabolic activity; and to decrease nerve conduction velocity and muscle spasm.\(^{2}\)Conditions might include
  - acute soft tissue injury
  - subacute and repair phase of soft tissue injury
  - postsurgical swelling and pain
  - exercise-induced muscle damage
• chronic pain
• rheumatoid arthritis flares
• muscle spasm and tightness
• spasticity
• decreased ROM
• myofascial trigger points
• recovery after endurance performance
• precooling prior to physical activity in warm conditions

**Guidelines for use of device/equipment**

› Temperature change and the effects of cooling are related to the time of exposure, the method used to cool the tissue, and the conductivity of the tissue

• 15- to 20-minute applications are commonly reported
• Deeper tissue will require longer exposure to get desired effects
• Because adipose tissue can act as an insulator, obese patients might require longer exposure

– Adipose tissue thickness is commonly measured by skinfold thickness
• Muscular tissue temperature decreases during cryotherapy and continues to decrease even when the modality is removed

• A research group in the United States reported that ice did not decrease muscle perfusion 48 hours after eccentric muscle-damaging exercise that increased blood flow

– Based on a controlled laboratory study involving 18 healthy participants who performed unilateral heel-lowering exercises off a step to induce eccentric muscle damage
– A randomized intervention (cryotherapy, sham or control) was applied to the exercised leg immediately after exercise, and 10, 24, 34, and 48 hours later
  - Cryotherapy was applied with a 750 g bag of crushed ice. A 750 g bag of room temperature candy corn was applied for the sham treatment. For the control group, a towel was placed over the area
  – Perfusion measurements were made using contrast-enhanced ultrasound

– Blood volume and blood flow increased in all conditions at 48 hours after exercise; however, there were no interactions among interventions for microvascular perfusion
  – VAS scores were lower for the cryotherapy group than for the control group
– The researchers concluded that although cryotherapy helped to control pain, it did not decrease muscle blood flow 48 hours after eccentric exercise, and therefore the proposed benefits of the clinical application of ice may need re-examining

• Authors of a similar study compared the effects of cold-water immersion (CWI) with whole-body cryotherapy (WBC) and concluded that CWI greatly improved blood flow and lowered tissue temperatures compared to WBC

› There are several methods and techniques used in the application of cold. They vary in their uses and effectiveness

• Ice packs, cold packs, gel packs
  – Available commercially in various shapes, or homemade with crushed ice, ice cubes, or frozen peas
• Ice massage
  – Ice applied directly to the skin in stroking motion
  – An “ice cup” is generally the medium of choice when performing an ice massage
• Cold-water immersion
  – Reduces the metabolic rate of inflammation
• Cryotherapy devices – e.g., circulating water
  – Ice water is delivered through a hose from a cooler to a bladder
  – Bladder is applied to area of interest
• Cold compression units
  – Combined cryotherapy and compression
• Vapocoolant sprays
  – Applied topically to skin
Contraindications/Precautions to device/equipment

› Contraindications

- **Cryotherapy contraindications**
  - Raynaud’s syndrome
  - Over area of circulatory compromise
  - Over an area of peripheral vascular disease
  - Cold intolerance
  - Cryoglobulinemia
  - Cold urticaria
  - Paroxysmal cold hemoglobinuria
  - Avoid applying cold over superficial nerves

- **Cryotherapy precautions**
  - Hypertension
  - Thermoregulatory disorders
  - Over a superficial peripheral nerve
  - Over an open wound
  - Over an area of poor sensation
  - With individuals with poor cognition
  - In the very young or very old
  - Persons with aversion to cold

- Use of cryotherapy at home is contraindicated in patients with cognitive and/or communication impairments that might impact safety

› Precautions

- Precautions must be used in patients with
  - impaired sensation
  - infected tissues
  - hypertension
  - Reports of the effects on heart rate and blood pressure are variable
    - Vasoconstriction might cause angina pectoris or elevation of blood pressure in susceptible individuals and can exacerbate peripheral vascular disease
  - cardiac failure

- Precaution must be used when applying cryotherapy over/near
  - eyes
  - damaged or at-risk skin

- Prolonged application at very low temperatures can cause serious side effects such as frostbite and nerve injuries
  - Risk of frostbite is reduced by applying a wrap between the ice and skin and by limiting time of application to less than 30–45 minutes
  - Nerve palsy can occur in areas where large nerves are superficial; most frequently peroneal nerve at knee and ulnar nerve at elbow

- Frost nip (chilblain or pernio) can occur after an unprotected area of skin is exposed to mild cold at temperatures of 0–15°C (32–60°F)

- Cold can increase elasticity and decrease viscosity of connective tissue
  - An increase in stiffness of collagen fibers can cause a decrease in muscle flexibility
  - Vigorous exercise immediately following cryotherapy is therefore not recommended

- In a study to quantify the magnitude and persistence of vasoconstriction associated with cryotherapy, researchers in the United States found that cold-induced vasoconstriction can persist long after the cooling ends
  - Four different FDA-approved ice water circulating cryotherapy devices were used. Blood perfusion and skin temperature were measured at multiple sites during baseline, cooling, and rewarming
  - Even while the tissue temperature was returning to baseline, there was a significant and persistent state of vasoconstriction of the local area of cryotherapy treatment
This has implications when considering risk of ischemic injury with cryotherapy

• Authors of a 2014 systematic review addressing the effect of local cooling on immediate functional outcomes in a sport situation reported that the available evidence suggests that athletic performance is adversely affected when athletes return to play immediately after cryotherapy

– Thirty-five studies involving 665 healthy participants were included in the review
– Relevant outcomes included strength, power, vertical jump, endurance, agility, speed, performance accuracy, and dexterity
– Studies used variable cooling protocols with differences in mode of cryotherapy, time, and temperature
– Increases in force output and decreases in upper and lower extremity strength were reported; however, effect sizes were small and clinical relevance was questionable
– The majority of studies reported decreases in performance, as measured by vertical jump, sprint, and agility. Cryotherapy also appeared to decrease hand dexterity and throwing accuracy immediately after intervention

• Use of cryotherapy might increase postural sway and impair proprioception and balance; however, evidence regarding proprioception is inconsistent

– Researchers in the United Kingdom found that 10 minutes of joint cooling did not adversely affect muscle reaction time or muscle amplitude in response to a simulated ankle sprain

- In an RCT, a total of 54 physically active individuals with no history of ankle injury were randomized to receive wet ice application, cold water immersion, or an untreated control condition for 10 minutes
- Muscle reaction time and muscle amplitude of the peroneus longus and tibialis anterior in response to simulated ankle sprain (incorporating ankle inversion and plantarflexion) were measured
- After cryotherapy there was no change in muscle reaction time or muscle amplitude
- These findings suggest that athletes can safely return to their activity after 10 minutes of ankle joint cooling and that ice can be applied before ankle rehabilitation without adversely affecting dynamic control

– In a small study conducted in Taiwan, researchers found that cryotherapy for chronic ankle instability resulted in reduced proprioception and reduced balance immediately following icing. Researchers recommended that sports trainers/coaches be aware of this phenomenon and educate athletes when they return to the field following ankle cryotherapy

– Results of a study conducted in Brazil indicate that a decrease in the EMG response to ankle inversion occurs in several lower extremity muscles after the use of cold-water immersion of the foot and ankle, with a residual effect that lasts up to 30 minutes

- The EMG responses of the lateral gastrocnemius, tibialis anterior, fibularis longus, rectus femoris, and gluteus medius were recorded following cold-water immersion of the ankle in 35 healthy active participants
- Responses were significantly lower after cold-water immersion compared to pre-immersion for all muscles except the gluteus medius, indicating that after cold-water immersion special care should be taken in activities that require greater neuromuscular control

• Cold application even for short durations might detrimentally affect agility and power

– Researchers in Brazil evaluated the effects of cryotherapy to the calf, ankle, or sole of the foot on ground reaction forces during gait initiation

- Twenty-one volunteers participated
- Gait initiation forces, maximum propulsion impulses, and braking forces were measured through a force platform
- Ice application to the sole of the foot and calf resulted in significant changes in vertical force variables, which returned to their pre-application values 30 minutes after the removal of the ice
- Ice application to the ankle only reduced propulsion impulse
- The authors concluded that caution is necessary when performing activities that require good gait control but that, in general, application of ice to the ankle, sole of the foot, or calf may be safe if removed 30 minutes prior to these activities

Examination

› Contraindications/precautions to examination

• In circumstances in which cryotherapy is being applied as a first-aid treatment in acute injury, elements of this examination should be deferred until later

› History

• History of present illness/injury for which the device is needed
  – Mechanism of injury or etiology of illness: Identify reason for referral
Course of treatment
- Medical management: Medical management will vary depending on the specific underlying condition; document any reported diagnostic tests, therapeutic interventions, complications, and/or hospital stays
- Medications for current illness/injury: Determine what medications have been prescribed and are being taken, and if they are effectively controlling symptoms
- Diagnostic tests completed: Depending on presenting condition, patient might have had diagnostic imaging and/or EMG; review imaging and reports as able
- Home remedies/alternative therapies: Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether they help
- Previous therapy: Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful
- Aggravating/easing factors (and length of time each item is performed before the symptoms come on or are eased)
- Body chart: Use body chart to document location and nature of symptoms
- Nature of symptoms: Document nature of symptoms (e.g., constant vs intermittent, sharp, dull, aching, burning, numbness, tingling)
- Rating of symptoms: Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much)
- Pattern of symptoms: Document changes in symptoms throughout the day and night, if any (a.m., mid-day, p.m., night); also document changes in symptoms due to weather or other external variables
- Sleep disturbance: Document number of wakings/night
- Other symptoms: Document other symptoms the patient is experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician (e.g., dizziness, bowel/bladder/sexual dysfunction, saddle anesthesia)
- Respiratory status: Document if applicable
- Barriers to learning
  - Are there any barriers to learning? Yes___ No___
  - If Yes, describe ________________________

Medical history
- Past medical history
  - Previous history of same/similar diagnosis
  - Comorbid diagnoses: Ask patient about other problems, including diabetes, cancer, heart disease, vascular compromise, peripheral neuropathy, complications of pregnancy, psychiatric disorders, and orthopedic disorders. Specifically ask about any history of Raynaud’s disease, cold urticaria, or cryoglobulinemia
  - Medications previously prescribed: Obtain a comprehensive list of medications prescribed and/or being taken (including OTC drugs)
  - Other symptoms: Ask patient about other symptoms he or she is experiencing

Social/occupational history
- Patient’s goals: Document what the patient hopes to accomplish with therapy and in general
- Vocation/avocation and associated repetitive behaviors, if any: Does the patient participate in recreational or competitive sports? Is the patient employed? What is the nature of the work tasks?
- Functional limitations/assistance with ADLs/adaptive equipment: Include limitations with self-care, home management, work, and community leisure
- Living environment: Document information about the patient’s living situation including stairs, number of floors in home, with whom patient lives (e.g., caregivers, family members). Identify if there are barriers to independence in the home; any modifications necessary?

Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting.) Evaluation procedures should be modified according to the patient’s age, diagnosis, and any unique circumstances; the information listed below is meant to serve as a guide only. Complete a general evaluation as indicated and appropriate. Repeat measures after use of cryotherapy as indicated
- Anthropometric measurements: Circumferential or volumetric measures of swelling
- Arousal, attention, cognition (including memory, problem solving): Complete a cognitive assessment as indicated and appropriate. Is the patient able to inform the provider about sensations being experienced?
- Assistive and adaptive devices: Does the patient utilize any assistive or adaptive devices? Are they appropriate?
• **Balance**: Assess the patient’s balance in sitting and standing as indicated. Use a standardized test such as Berg Balance Test

• **Cardiorespiratory function and endurance**: Assess vital signs as indicated and appropriate, including perceived exertion via the Borg Rating of Perceived Exertion (RPE) Scale

• **Circulation**: Assess for signs of diminished circulation, such as swelling, weak pulses, coldness, changes in skin color, and nonhealing sores

• **Ergonomics/body mechanics**: Assess for faulty body mechanics that might be contributing to the patient’s symptoms

• **Functional mobility**: Assess function as indicated by underlying condition. Use a standardized test such as FIM as indicated

• **Gait/locomotion**: Complete a thorough gait assessment if indicated by reason for referral

• **Joint integrity and mobility**: Assess joint integrity as indicated by symptoms and reason for referral

• **Motor function (motor control/tone/learning)**: Depending on presenting condition, a thorough assessment of motor function, including voluntary movement, coordination, and muscle tone, might be indicated
  – The Modified Ashworth Scale can be used to assess spasticity

• **Muscle strength**: Complete a strength assessment throughout with a particular focus on the area where cryotherapy is to be applied. Manual muscle testing (MMT) might be used except where there is abnormal muscle tone or coordination

• **Observation/inspection/palpation** (including skin assessment)
  – Inspect skin for any signs of irritation or breakdown
  – Assess for swelling
  – Assess for adverse reaction after cryotherapy application

• **Posture**: Assess the patient’s general posture

• **Range of motion**: Complete a ROM and flexibility assessment with a particular focus on the area where cryotherapy is to be applied

• **Reflex testing**: Assess deep tendon reflexes

• **Self-care/activities of daily living (objective testing)**: Complete an ADL assessment as indicated

• **Sensory testing**: Complete a thorough sensory assessment (e.g., light touch, temperature, pinprick) of the area where cryotherapy is to be applied
  – Where applicable, assess proprioception after application of cryotherapy before return to athletic activity

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### Assessment/Plan of Care

› **Contraindications/precautions**
  • See Contraindications/Precautions to device/equipment, above

› **Diagnosis/need for device/equipment**
  • Acute musculoskeletal trauma
    – Acute soft tissue injury
    – Post orthopedic surgery swelling and pain
    – Exercise-induced muscle damage
  • Decreased muscle strength/torque production after acute phase of injury
  • Chronic pain
  • Rheumatoid arthritis
  • Muscle tightness
  • Decreased ROM
  • Endurance performance
    – Recovery after/between endurance performance
    – Precooling prior to endurance performance in hot environmental conditions

› **Prognosis**: Prognosis varies depending on the underlying condition and its severity

› **Referral to other disciplines**: Refer to other disciplines if indicated by underlying condition

› **Treatment summary**
  • See Description, Indications of device/equipment, and Guidelines for use of device/equipment, above
  • General considerations
    – Cooling the extremities generally increases systolic, diastolic, and mean arterial blood pressure as well as oxygen saturation, while also decreasing core body temperatures and pulse rate\(^{(30)}\)
Authors of a study in the United Kingdom of the cooling efficiency of different cryotherapeutic agents found that crushed ice and ice-water immersion provided significantly greater cooling efficiency than gel packs and frozen peas. A repeated measures design was used. Skin surface temperature of the ankle was measured after a 20-minute cryotherapy application. The crushed ice and ice-water immersion had the greatest cooling efficiency and sustained decreased surface temperature post application. Twenty-minute applications caused skin surface temperature to fall within the therapeutic temperature range. Further research is needed to investigate depth of cooling and the relationship between deeper tissue temperature and skin temperature.

The cooling effectiveness of different types of ice used in ice packs was evaluated in a repeated measures study conducted in the United States. Ice packs were made of polyethylene bags filled with cubed ice, crushed ice, or cubed ice plus water (“wetted ice”). Cutaneous and intramuscular temperature was measured. Wetted ice was more effective than cubed ice and crushed ice in lowering surface temperature during treatment and maintaining the lower temperature during recovery. Wetted ice and cubed ice were more effective than crushed ice in lowering intramuscular temperature and maintaining the lower temperature.

Although the wetted ice bag is currently the clinical gold standard for decreasing intramuscular temperature, researchers in the United States reported in 2016 that salted cubed ice bags were as effective as wetted bags at decreasing intramuscular temperature at 2 cm subadipose, and suggested that salted ice bags may be more clinically practical.

Based on a repeated measures study that involved 24 healthy participants, ice bags made of wetted ice (2,000 mL ice and 300 mL water), salted crushed ice, and salted cubed ice were applied to the posterior gastrocnemius for 30 minutes. The presence of water in the ice bags provides better contact with the skin. When salt is applied to ice, the ice begins to melt and the substance’s freezing point is lowered, with the resulting water staying in liquid form at lower than freezing temperatures. Cutaneous and intramuscular temperatures of nondominant gastrocnemius were measured at baseline, immediately after treatment, and during a 45-minute rewarming period.

• Acute soft tissue injury: Cryotherapy is widely practiced in the treatment of acute soft tissue injuries; however, there is insufficient evidence that it improves the clinical outcomes of soft tissue injury. Therapeutic benefits of cryotherapy are enhanced by simultaneous application of compression.

• Exercise-induced muscle damage: Cryotherapy is a commonly used treatment believed to reduce symptoms of exercise-induced muscle damage. Results of studies evaluating the effects of cryotherapy are conflicting, and protocols vary. Authors of a 2016 systematic review and meta-analysis found that the available evidence suggests that cold-water immersion can be slightly better than passive recovery in the management of muscle soreness, and that there is a dose-response relationship. Nine RCTs that compared cold-water immersion to passive recovery were included. Meta-analysis indicated that cold-water immersion is more effective than passive recovery in terms of immediate and delayed effects. Water temperature between 11 and 15°C for 11–15 minutes provides the best results for both immediate and delayed effects.

Researchers in Japan found that regular post-exercise cold applications to muscles might attenuate muscular and vascular adaptations to resistance training. Fourteen subjects performed wrist-flexion resistance training for 6 weeks. Training included 5 sets of 8 wrist flexion exercises at 70–80% repetition max, 3 times per week. Seven participants immersed their experimental forearms in cold water (10°C) for 20 minutes after the exercises, and 7 did not. Measurements taken before and after the training period included wrist flexor thickness, brachial diameter, maximal muscle strength, and local muscle endurance.
Wrist flexor thickness of the experimental arms increased in both groups, but the increase was significantly less in the cooled group compared to the noncooled group.

Maximal muscle strength and brachial artery diameter did not increase in the cooled group, but did increase in the noncooled group.

Local muscle endurance increased in both groups, but the increase was lower in the cooled group than the noncooled group.

Postoperative

The efficacy and safety of using cryotherapy devices in the postoperative setting were evaluated in a small study conducted in the United States of healthy individuals. Three different cryotherapy devices were applied over different amounts of layering. Skin temperature was recorded every 15 minutes for 180 minutes. Safe and effective temperature range was achieved with all devices when applied over one layer of Jones compression dressing. Effective temperature range was not achieved over two layers of Jones compression dressing. Efficacy and safety were less predictable when devices were applied over thinner, standard surgical dressings.

Researchers in the United States also found that short-term application of cryotherapy post total knee arthroplasty (TKA) did not significantly decrease pain nor did it improve patient satisfaction with pain management. Based on an RCT with crossover that involved 29 patients post TKA, two sequential episodes of pain requiring analgesic administration were studied in each patient, one with a 30-minute cryotherapy application and one without, in random order. The benefit of short-term cryotherapy for pain relief post TKA was found to be questionable.

In a single-blinded RCT, researchers in China found cryotherapy to be effective in relieving pain and reducing analgesic consumption for patients post elbow arthrolysis. Fifty-nine patients who received elbow arthrolysis were randomly assigned to a cryotherapy plus standard care group or to a control group receiving standard care only. VAS scores were significantly lower in the cryotherapy group during the first 7 postoperative days, both at rest and in motion.

Authors of an RCT conducted in the United States found that application of cryoneurolysis can be an effective treatment option in reducing pain and improving symptoms in patients with knee pain due to osteoarthritis. One hundred eighty patients participated in this study, with 121 individuals being placed in the experimental group and 59 in the control group. Cryoneurolysis was applied to the inferior branch of the saphenous nerve (IPBSN) for 30 days while the control group received a sham treatment. Results after 30 days showed significant improvements in the Western Ontario McMaster Osteoarthritis Index (WOMAC) compared to the sham group. Results were effective for at least 150 days after treatment.

Muscle function: The analgesic effect of cryotherapy allows a patient to perform therapeutic exercises that would otherwise be painful. Evidence suggests that the beneficial effects of cryokinetics (the use of cryotherapy in conjunction with exercise) might be partially due to disinhibition of the musculature surrounding the injured joint.

Authors of a study conducted in Italy suggest that use of partial body cryotherapy (PBC) before a training session or sport competition can increase isometric strength of the hand. Two hundred healthy adults were randomized to either the PBC group (n = 100) or control group (n = 100). Prior to the experiment, hand grip strength was taken. Individuals in the experimental group performed 150-second sessions of PBC with temperatures ranging between –130° C and –160° C. The control group stayed in a neutral temperature room ranging from 22.0 ± 0.5° C. Immediately after the session, the handgrip strength of participants in both groups was retested. After a single session of PBC there were significant improvements in handgrip strength in the experimental group compared to the control group.

Muscle tone: Use of cryotherapy to reduce tone in spastic muscles is sometimes recommended for patients with neurological disorders such as stroke or traumatic brain injury.

Endurance performance/exercise-induced hyperthermia: Cold-water immersion has also been investigated as a cooling intervention before physical activity (i.e., precooling).
Authors of a 2015 meta-analysis investigating the optimal procedures for cold-water immersion for exertional heat stroke concluded that prompt, vigorous cold-water immersion should be encouraged for treating exercise-induced hyperthermia whenever possible, using cold-water temperature of approximately 10°C and maximizing body surface contact (whole-body immersion).  

- Nineteen studies were included
- Results demonstrated that cold-water immersion had a significant effect. Cold-water immersion cooled individuals twice as fast as passive recovery
- Immersion duration of 10 minutes, immersing torso and limbs, was most effective. There is insufficient evidence of effectiveness of immersing just forearms and hands for rapid cooling

A combination of internal and external body-cooling techniques might enhance repeated athletic performance in heat more than individual cooling methods do.  

- Based on an RCT conducted in Australia
- Twelve repeated sprint cyclists were randomized to 1 of 4 experimental conditions: a cooling jacket, ingestion of an ice slushy, combination of cooling jacket and ice slushy, or control
- All of the cooling techniques improved performance in comparison to the controls. In comparison to the individual cooling techniques, enhancement of sprint performance was greater with the combination of internal and external body cooling techniques

- Cold-pack therapy can be utilized in a noninvasive manner that can significantly reduce post-burn pruritus in patients who have had a burn injury.

- Authors of a 2018 RCT have found that application of an icepack along the perineum for 10 minutes can provide pain relief for up to 1 hour 45 minutes to 2 hours in women after spontaneous vaginal birth.

- Authors of an RCT in 2018 conducted in Iran have found that ice pack application can significantly reduce pain during the active phase of labor without any significant side effects, suggesting that ice modality be recommended for labor pain relief.

- Ninety primiparous women participated in this RCT
- Ice pack was applied to the sacral area for 10 minutes and was repeated every 30 minutes during the beginning and second stages of labor

- Authors of a systematic review on the effects of cold pack application on postoperative turbinate and/or septal bleeding found no benefits in terms of managing pain.

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<tr>
<th>Problem</th>
<th>Goal</th>
<th>Intervention</th>
<th>Expected Progression</th>
<th>Home Program</th>
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<tbody>
<tr>
<td>Acute soft tissue injury</td>
<td>Reduce pain, swelling, and inflammation</td>
<td><strong>Physical agents and mechanical modalities</strong></td>
<td>10–20 minutes every 2 hours for first 48–72 hours</td>
<td>Decrease or discontinue after 72 hours or when pain and swelling subside</td>
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<td></td>
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<td>Application of cryotherapy. Most commonly, ice packs in setting of injury – in conjunction with rest, compression, elevation</td>
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<tr>
<td>Subacute or repair phase of soft tissue injury</td>
<td>Enable active exercise of muscles around soft tissue injury</td>
<td><strong>Physical agents and mechanical modalities</strong></td>
<td>Apply cold prior to active exercise throughout repair phase</td>
<td>Continue with cold application even after pain subsides, to obtain stronger contractions</td>
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<td></td>
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<td>Various cryotherapy modes followed by active therapeutic exercise</td>
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<tr>
<td>Condition</td>
<td>Intervention</td>
<td>Description</td>
<td>Desired Outcomes/Outcome Measures</td>
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<tr>
<td>Muscle spasm</td>
<td>Interrupt pain-spasm-pain cycle</td>
<td><strong>Physical agents and mechanical modalities</strong>&lt;br&gt;15–20 minutes of selected cryotherapy application over entire muscle</td>
<td>Spasm reduction might continue after cold removed&lt;br&gt;As needed</td>
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<tr>
<td>Decreased ROM</td>
<td>Increase ROM</td>
<td><strong>Physical agents and mechanical modalities</strong>&lt;br&gt;Application of cryotherapy around joint or over tight muscle, followed by active or passive stretching</td>
<td>Progression variable depending on condition&lt;br&gt;Variable depending on condition and results</td>
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<tr>
<td>Rheumatoid arthritis flare</td>
<td>Decrease active joint temperature to decrease inflammation and repress lysosomal activity</td>
<td><strong>Physical agents and mechanical modalities</strong>&lt;br&gt;Application of selected cryotherapy for 20 minutes every 2 hours</td>
<td>Continue until disease activity and pain in joint subsides&lt;br&gt;Rest and exercise as indicated by disease activity. Resume cryotherapy with disease flare-ups</td>
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<td>Hyperthermia</td>
<td>Decrease core body temperature&lt;sup&gt;24&lt;/sup&gt;</td>
<td><strong>Physical agents and mechanical modalities</strong>&lt;br&gt;Complete body immersion in cold water</td>
<td>Severe hyperthermia is a medical emergency that requires treatment in a medical facility (i.e., if patient is confused, unconscious, or body temperature &gt; 40°C)&lt;br&gt;N/A</td>
<td></td>
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<tr>
<td>Submaximal athletic performance – cardiovascular and muscular endurance and muscle strength</td>
<td>Enhanced athletic performance</td>
<td><strong>Physical agents and mechanical modalities</strong>&lt;br&gt;Precooling with cooling garments, complete immersion in cold water, ingestion of icy drinks</td>
<td>N/A&lt;br&gt;N/A</td>
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**Desired Outcomes/Outcome Measures**

› Reduced pain, swelling, and inflammation<sup>2</sup>
  • VAS, circumferential measurements
› Enabled active exercise of muscles around soft-tissue injury
  • Maximal voluntary contraction (e.g., 1 RM), central activation ratio (CAR), MMT, RPE, timed performance tests
› Interrupted pain-spasm-pain cycle
› Decreased neurogenic tone, spasticity
  • Modified Ashworth Scale
› Increased ROM
  • Goniometry
References


16. Train PK, Bleakley CM, Mitchell ACS. Muscle reaction time during a simulated lateral ankle sprain after wet-ice application or cold-water immersion. J Athl Training. 2015;50(7):697-703. doi:10.4085/1062-6050-50.4.05. (R)


Coding Matrix

References are rated using the following codes, listed in order of strength:

- **M**: Published meta-analysis
- **SR**: Published systematic or integrative literature review
- **RCT**: Published research (randomized controlled trial)
- **R**: Published research (not randomized controlled trial)
- **C**: Case histories, case studies
- **G**: Published guidelines
- **P**: Published literature reviews
- **PP**: Policies, procedures, protocols
- **X**: Practice exemplars, stories, opinions
- **GI**: General or background information/texts/reports
- **U**: Unpublished research, reviews, poster presentations or other such materials
- **CP**: Conference proceedings, abstracts, presentation

Patient Education

- Decreased core body temperature
- Temperature


