Superficial Heat and Cold

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Therapeutic Cold (Cryotherapy)

Cryotherapy has the primary effect of cooling tissue.[1,7,8] Depending upon the application method and duration of this therapy, the basic physiologic effects include the following[9]:

- Decreased local metabolism
- **Vasoconstriction**
- **Reactive hyperemia**
- **Reduced swelling/edema**[10]
- Decreased hemorrhage
- Reduced muscle efficiency
- **Analgesia secondary to impaired neuromuscular transmission**

Pain reduction associated with the application of cold **relaxes muscle spasm and minimizes upper motor neuron spasticity**. The most common indications and uses for the local application of **therapeutic cold modalities** include the following:

- To **decrease swelling/edema** following trauma - Cooling in water at 8 º C for 30 minutes decreases edema.
- To treat burns
- To **inhibit spasticity** - In spasticity, the muscle must be cooled; this process takes 10 minutes in thin patients and up to 60 minutes in more obese persons.
- **To reduce muscle spasm**
- **To reduce acute inflammatory reaction**
- **To reduce pain**
- To reduce limb metabolism (prior to amputation)
- To produce reactive hyperemia
- To facilitate muscular contraction for various forms of neurogenic weakness and for muscle re-education
- To treat restricted knee flexion due to traumatic lower extremity fractures - This improves the condition to a greater degree than does superficial heat application, even if either is used in combination with passive stretching using mechanical traction.[11]

Immediate **application of ice** or cold packs for superficial burns and for burns on less than 20% of the total body surface area decreases pain, edema, erythema, and blistering. For optimal results in cases of trauma, cold should be applied before significant edema and hemorrhage occur.

The most common methods of **cold application include cold packs, cold immersion, ice massage**, and cooling during exercise (cryokinetics). The treatment known as spray and stretch consists of an application of cryotherapy with a vapocoolant spray, which then is

followed by stretching of the involved muscles. This technique sometimes is used in the management of myofascial pain syndromes, as described by Travell and Simons.[12]

Therapeutic cold is applied for 5-20 minutes, followed by a rest period of 30 minutes. For the treatment of acute sprains/strains and **postoperative care**, application of cold is recommended for the first 24-48 hours.

For the treatment of deeper tissues or for prolonged periods of cold application, physician evaluation/prescription is essential to avoid complications. The most useful local therapeutic cold applications include for the management of edema, muscle spasm, bleeding, and traumatic pain. The vasoconstrictive effect of therapeutic cold is beneficial for reducing posttraumatic swelling and pain, as well as for reducing hemorrhage into soft tissues.

The following are conditions for which local cryotherapy is contraindicated:

- **Hypertension (due to secondary vasoconstriction)**
- **Raynaud's disease**
- **Rheumatoid arthritis**
- **Local limb ischemia**
- **History of vascular impairment, such as frostbite or arteriosclerosis**
- **Cold allergy (cold urticaria)**
- **Paroxysmal cold hemoglobinuria**
- **Cryoglobulinemia or any disease that produces a marked cold pressor response**

Cold packs applied to the abdomen cause increased gastrointestinal motility and gastric acid secretion; therefore, this treatment is contraindicated in patients with known peptic ulcer disease. Interestingly, the application of hot packs to the abdomen produces the opposite effect.

Cold versus Heat Therapy

Modalities for the application of heat and cold can be used effectively in various clinical conditions. Many situations lend themselves to the use of these diverse modalities to take advantage of known biologic effects for managing certain ailments.[13,14,15]

The similarities of these 2 modalities include the following:

- There is a decrease in muscle spasm secondary to musculoskeletal pathology or nerve root irritation.
- Cold effectively decreases the spasticity of upper motor neuron etiology; heat reduces spasticity, but the effects are short-lived and ineffective for muscle re-education.
- Heating and cryotherapeutic modalities cause analgesia.

The following examples illustrate significant differences between the physiologic effects of heat therapy and those of cryotherapy:

- A longer time is necessary for cooled muscle to return to normal temperature. Because the application of heat increases blood flow, a heated muscle returns to normal temperature after a few minutes.
- The application of heat for the relief of muscle spasm is secondary to muscle hyperemia, which decreases muscle spasm – induced ischemia/pain and **interrupts this vicious cycle**.

- Increased tissue metabolism occurs with temperature elevation; metabolism is reduced by cryotherapeutic modalities.
- Heated muscle tissue can sustain a contraction for a shorter period of time; cooling to approximately 27 º C increases the ability of muscle to sustain contraction.
- Blood flow increases with heat and decreases with cold.
- The tendency to bleed increases with heat and decreases with cold.
- The formation of edema is facilitated by heat and is decreased by cooling.
- Immediate cooling of burns is beneficial; however, frostbite is treated by quick warming.
- Joint stiffness decreases with heating but increases with cooling.
- Due to blood pooling, orthostatic hypotension is produced by the application of heat to large parts or all of the body. With cryotherapy, hypotension is decreased secondary to vasoconstriction.

Keywords

superficial heat, superficial cold, heating pads, heating pad, ice pack, gel pack, ice packs, hot pack, heat pack, cold pack, hot packs, cold packs, heat packs, paraffin bath, heat pad, hand paraffin, paraffin baths, paraffin wax bath, cryotherapy, therapy paraffin bath, treatment heat, heat therapy, conduction heat, heat conduction, convection heat, heat convection, convection heat transfer, conversion heat, back heat, pain heat, Fluidotherapy, hydrotherapy, moist air therapy, radiant heat therapy, conductive heading, convective heating