

## COLD AND HOT THERAPY

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Therapy type	Indications	Methods of application	Responses to treatment
Cold	<ul style="list-style-type: none"> <li>• Acute injury (first 24-48 hours)</li> <li>• Pain reduction</li> </ul>	<ul style="list-style-type: none"> <li>• Ice water immersion</li> <li>• Ice surface application</li> <li>• Cold packs</li> </ul>	<ul style="list-style-type: none"> <li>• Restricts blood flow</li> <li>• Reduces metabolism</li> <li>• Reduces activity of inflammatory enzymes</li> <li>• Reduces pain</li> </ul>
Heat	<ul style="list-style-type: none"> <li>• Chronic injury (after 72 hours)</li> <li>• Enhance tissue stretching</li> <li>• Enhance healing response</li> </ul>	<ul style="list-style-type: none"> <li>• Warm water from hose</li> <li>• Hot packs</li> <li>• Leg sweat</li> <li>• Therapeutic ultrasound</li> </ul>	<ul style="list-style-type: none"> <li>• Increases blood flow</li> <li>• Increases metabolism</li> <li>• Increases activity of tissue enzymes</li> <li>• Relaxes muscle spasm</li> <li>• Reduces pain</li> <li>• Increased tissue extensibility</li> </ul>

One of the most accessible and time-tested methods of physical treatment is thermal therapy. Heat or cold may be administered to horses using many modalities and can range from simply applying water from a garden hose to deep-heating ultrasound therapy.

**Cold Therapy-** The major physiologic benefits of cold therapy are decreased local circulation, decreased pain, and reduced tissue swelling.<sup>1,2</sup> These benefits are most effective very early in the period following injury or surgery. The primary effect of local cold application is to constrict blood vessels and reduce tissue temperature. Reduced blood flow will reduce edema, hemorrhage, and extravasation of inflammatory cells. Cold reduces tissue metabolism and may inhibit the effect of inflammatory mediators and slow enzyme systems. Cyclical rebound vasodilatation is another response to cold therapy. Following a minimum of 15 minutes of cold therapy that results in tissue temperatures that range from 10° to 15° C, cycles of vasoconstriction and vasodilatation occur. Vasodilatation associated with cold therapy may help further resolve tissue edema. Analgesia follows cold therapy.

Cold therapy is indicated in acute musculoskeletal injuries and following surgical procedures to reduce edema, slow the inflammatory response and reduce pain. It is particularly effective during the first 24 to 48 hours after injury or surgery. Cold immersion of the distal limbs is also effective in reducing severity of laminitis by decreasing the activity of laminar matrix metalloproteinase (MMP) and causing laminar vasoconstriction when applied during the developmental phase.

Cold may be applied by ice water immersion, application of ice packs or cold packs, and ice water-charged circulating bandages or boots. The most beneficial therapeutic effects of cold

occur at tissue temperatures between 15° and 19° C (59° to 66° F).<sup>1</sup> Average time of cold application is 20 to 30 minutes. Treatments are best repeated every 2 to 4 hours during the first 24 to 48 hours of injury or surgery if the goal is to reduce tissue inflammation. Direct contact of ice water with the skin is the most effective method of cold therapy. Buckets or turbulator boots may be used depending on the site. If immersion therapy is used immediately following surgery, the wound must be protected with a water impervious barrier. Ice may be placed in a plastic bag or water may be frozen in a paper cup and applied to the site. To prevent laminitis, continuous cold therapy is applied to the distal limbs using plastic bags filled with ice, ice water immersion or commercial cold therapy boots. A recent study identified a simple way to effectively cool the distal limb using a bag-within-a bag technique. Empty 5L fluid bags are secured on the limbs and filled with ice. This technique effectively reduces tissue temperatures for a prolonged period of time and is very easy to apply. Ice water immersion of the equine digit for 30 minutes resulted in significant decreases in laminar temperatures. Vascular perfusion decreased, but not significantly.<sup>3</sup> When comparison of laminar and venous temperatures was made between ice water immersion in vinyl boots, ice water slurry in plastic bags and application of malleable cold packs, ice water immersion and the slurry in bags were comparable in reducing measured temperatures while cold packs did not substantially reduce temperatures.<sup>3</sup>

A new system of cold packs and boots has been recognized to reduce hoof surface temperatures sufficiently to prevent and treat laminitis.<sup>4</sup> Reusable cold packs were attached to the foot and pastern for eight hours with changes to freshly frozen packs every 2 hours (Cold Capsule Technology; Ice Horse, MacKinnon Products, Sonoma, CA, USA). These packs use new technology to maintain colder temperatures for longer periods of time compared to packs previously used by this company. Hoof wall surface temperatures were significantly decreased to a median 11° C. The minimum temperature reached with this system was 6.8° C at 68 minutes after initial cold pack application.<sup>4</sup>

Boots connected to a cold source that circulate fluid through them are also very effective at cooling tissue. Systems are available with a variety of boot configurations for different portions of the limb, making effective cold therapy logistically very simple. Some of the systems also provide compression and may be used for cold and heat therapy.

Cold Salt Water Emersion- Exercising in water with higher solute concentrations has been reported to have anti-inflammatory, osmotic and analgesic effects.<sup>5</sup> Horses diagnosed with distal limb injuries stood in hypertonic (20g/l sodium chloride, 30g/l magnesium sulfate) cold water baths for 10 minutes, 3 days a week for 4 weeks.<sup>6</sup> These horses demonstrated both clinical and ultrasonographic healing of digital flexor tendon and suspensory ligament lesions.<sup>6</sup> Visual improvements in the degree of soft tissue swelling were also demonstrated within 8 days of the initiation of hypertonic cold water therapy.<sup>6</sup> In horses, tendonitis and desmitis monitored ultrasonographically demonstrated reduced peritendinous and periligamentous edema, decreased inflammatory infiltration, and improved collagen fiber alignment after the four weeks of hypertonic cold water therapy.<sup>6</sup> The added mineral components in water provide an increased osmotic effect, which reduces soft tissue inflammation and swelling, decreases pain, and ultimately improves joint range of motion. These osmotic effects and the cold water can help manage soft tissue changes associated with musculoskeletal injury, wounds, lymphangitis, and cellulitis in horses.

**Heat Therapy-** The major physiologic benefits of heat therapy are increased local circulation, muscle relaxation (and therefore, reduction of muscle spasms and associated pain), and increased tissue extensibility.<sup>1,2</sup> Increasing local blood flow mobilizes tissue metabolites, increases tissue oxygenation and the metabolic rate of cells and enzyme systems. In general, metabolic rate increases 2 to 3 times for a tissue temperature increase of 10° C.<sup>1</sup> These

responses to heat therapy are especially beneficial for wound healing. Increased blood flow and vascular permeability may promote resorption of edema, which is a common reason for heat application in horses. Heat application also decreases pain. Soft tissues may be stretched more effectively when they are warm. Heat decreases tissue viscosity and increases tissue elasticity. Low-load, prolonged stretching of tissues heated between 40° to 45° C (104° to 113° F) results in increased extensibility of tendons, joint capsules, and muscles.<sup>1,2</sup> For example, heating the flexor structures of foals with contracted limbs will result in more elongation of the affected tendons.

Heat is best applied after acute inflammation has subsided. It is useful for reducing muscle spasms and pain that is often a result of musculoskeletal injuries. Heat therapy can be used to increase joint and tendon mobility, particularly by their application before active stretching. Heat may benefit recovery of localized soft tissue injuries by accelerating the healing response.

Superficial heat is most commonly applied using hot packs and hydrotherapy. These modalities provide heat penetration to approximately 1 cm below the level of the skin. The most profound physiologic effects of heat occur when tissue temperatures are raised to 40° to 45° C (104° to 113° F).<sup>1,2</sup> Tissue temperatures above 45° C may result in pain and tissue damage. For deeper tissues, such as tendon or muscle, 15 to 30 minutes is required to elevate tissue temperature to the therapeutic range. When using heat sources warmer than 45° C, the source must be wrapped in several layers of moist towels before application. Heat from these sources is usually applied for 20 to 30 minutes. Warm water is probably the most accessible method of heat therapy. Methods of application include the use of a hose, wet towels, water immersion in a bucket, turbulator boot, and circulating treatment system. A rule-of-thumb is that water as hot as your hand can comfortably stand has a temperature of 38° to 41° C (101° to 105° F). However, tissue heated by water at this temperature may only reach the lowest tissue therapeutic range. Therefore, the target temperature should be above this level, but as mentioned earlier, horses will commonly experience discomfort with water 45° C and warmer.

Heat may be used to relax tight muscles in the back before exercise. Simply using a thick fleece blanket or exercise rug can be used to relax muscle spasm and prepare the back for stretching exercises or riding.

**Contrast Heat/Cold-** Efforts have been made to use thermal contrast modalities to improve tissue oxygenation and local circulation to improve healing of injuries and speed recovery from exercise. A study in humans, where lower legs had contrast baths where 4 minutes of hot immersion followed by 1 minute of cold immersion was continued for a total of 30 minutes (6 hot/cold cycles). Compared to controls, tissue hemodynamics and oxygenation in the lower leg muscles increased following contrast therapy (Shadgan, et al. J Athl Train 2018; 53(8):782-787).

The use of magnetic blankets to increase blood flow has been another treatment method used to treat muscle stiffness and soreness. However, a study of a static magnetic field blanket on back muscle blood flow, skin temperature, mechanical nociceptive threshold or behavior in normal horses failed to find any changes following a 60 minute treatment.<sup>7</sup>

## REFERENCES

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### Cold compression therapy

