Cryotherapy and Intermittent Pneumatic Compression for Soft Tissue Trauma

Susan G. Capps, PhD • Biological Engineering Solutions and Brook Mayberry, DVM, PhD • Equine Medical Associates, Inc.

SOFT TISSUE trauma initiates an inflammatory response that increases the local tissue temperature. Characteristics of inflammation include increased blood flow, edema accumulation, and passage of leukocytes into the tissue spaces. Leukocytes play a central role in removal of infectious agents and tissue debris, but they can also be responsible for cellular injury and necrosis. Protection, rest, ice, compression, and elevation (PRICE) therapy is a widely-accepted approach to treatment of soft tissue trauma, which modifies the inflammatory response. Research findings have confirmed the benefits of cryotherapy and static external compression, but the use of intermittent pneumatic compression (IPC) is a relatively new treatment for soft tissue trauma. This report discusses the potential value of combining cryotherapy with IPC for facilitation of the healing process.

**Cryotherapy**

Cryotherapy has long been recognized as a beneficial posttrauma treatment modality, which provides a short-term analgesic effect, reduces metabolic activity, and decreases cellular oxygen demand (Table 1). A marked reduction in local metabolic enzymatic activity and a profound local vasoconstriction occur in response to cold application. The analgesic effect of cryotherapy has been attributed to a combination of decreased production of pain mediators and slower propagation of neural pain signals. Metabolism may be decreased by more than 50%, which facilitates oxygen diffusion into the injured tissues. Joint range of motion is improved through suppression of excitatory muscle spindle afference.

Leukocytes play a central role in the inflammatory response to soft tissue injury. The application of cryotherapy has been found to decrease the number of leukocytes that adhere to the endothelial surface of a capillary, which results in less leukocyte migration into the tissues. In vivo research findings suggest that cryotherapy reduces posttrauma endothelial dysfunction, which ultimately reduces the intensity of the inflammatory response.

**Intermittent Pneumatic Compression**

The utilization of IPC has been shown to be effective for prevention of edema formation, increasing blood flow, and stimulation of...
Although static compression is an effective therapy for edema reduction, the intermittent compression optimizes lymphatic drainage.15,16 IPC can accelerate recovery from either intense exertion or injury, especially when the athlete is incapable of generating rhythmic muscle contractions. Improved lymphatic function accelerates healing through removal of edema from injured soft tissues.15-19

Enhanced Blood Flow
IPC has also been shown to enhance the blood flow of the treated area through stimulation of endothelial cell production of nitric oxide. IPC increases the velocity of blood flow and creates shear stress on the walls of blood vessels, which is the probable physiologic mechanism for enhanced nitric oxide production.3 Increased nitric oxide production also inhibits platelet aggregation and neutrophil adherence, both of which play important roles in the creation of secondary hypoxic injury. Nitric oxide is also a neurotransmitter that can influence vascular tone, thereby increasing blood flow.

Cryotherapy With Static Compression
The separate benefits of cryotherapy and external compression appear to be amplified when the two therapeutic modalities are used in combination.
External compression helps to restore normal physiologic processes within damaged tissue and it increases the depth of temperature reduction achieved by the application of cold to the body surface. Both the rate and magnitude of tissue cooling are increased by combined therapy, as compared to the effect of cold application without compression. A greater magnitude of compression is associated with a shorter amount of time for a given level of tissue temperature reduction.

**Conclusion**

The literature contains evidence that the inflammatory response in injured soft tissue is modified in a manner that promotes healing through the combined application of cryotherapy and compression. The therapeutic effect of cryotherapy is enhanced by the use of either static external compression or intermittent pneumatic compression. Further research is needed to compare the different modes of compression application in conjunction with cryotherapy.

**References**


---

*Susan Capps* is with Biological Engineering Solutions in Warsaw, Indiana.

*Brook Mayberry* is with Equine Medical Associates in Emond, Oklahoma.