

## Cryotherapy Protocols

Kim Christensen, DC, DACRB, CCSP, CSCS

For years, especially in sports, chiropractors have known the positive benefits of cryotherapy and ice. The most recent survey of the National Board of Chiropractic Examiners lists 92.6 percent of all chiropractors polled to be users of ice pack/cryotherapy as a non-adjustive technique.<sup>1</sup> On the other hand, traditional medicine has for some reason been reluctant to abandon its long-held faith in heat therapy for initial-stage injuries, despite the research compiled to the contrary over the past two decades. It is still possible to find oneself in a hospital emergency room with an acute injury, and being told, "Go home and put some heat on it."

There is no doubt that ice is the appropriate protocol for Phase 1 (acute inflammatory) injuries. We also need to be aware however that cryotherapy may be counterproductive to the recovery process, if ice is applied without regard for duration of use based upon location of the injury.

At the moment of injury, many individual fibers in the affected muscles, tendons and ligaments are contracted, stretched or torn. The body realizes something is wrong and responds by rushing blood to the area. After substantial blood has arrived via vasodilation, the area becomes swollen and inflamed. As long as the injured area is unattended the inflammation will remain. This time period can be one hour, one day, one week or six weeks, depending on what action, if any, has been taken to reduce the blood flow to the area and eliminate the blood that has already pooled.

During the acute inflammatory phase of recovery, examination findings include varying levels of:

- pain
- swelling
- heat
- redness

It is inappropriate during the acute phase to worsen or aggravate any of the four primary signs and/or symptoms. Thus, early heat treatments are contraindicated during Phase 1 management. Kalenak et al. documented the following physiological responses to early heat treatments:<sup>2</sup>

- increase in underlying hemorrhage
- increased pain
- increased swelling
- increased heat
- increased redness

Cryotherapy becomes an initial therapy of choice during Phase 1 to decrease blood flow, and thus control the resulting inflammation. Various forms of cooling devices are available to accomplish this. McMaster evaluated the abilities of common forms of cryotherapy to decrease intramuscular temperatures (see Table 1).<sup>3</sup>

Table 1. Cryotherapy Decreasing Temperatures<sup>3</sup>

Temperature Decrease (°C)

Minutes	15	30	45	60
Ice	3.4	6.9	9.2	11.3
Gel	1.8	4.4	6.5	8.4
Chemical	1.6	2.9	3.0	3.5

Table 1 demonstrates that ice decreased intramuscular temperatures more quickly than gels or chemicals. In approximately 15-30 minutes ice decreases connective tissue temperature by 3-7°C. Pappenheimer et al. revealed there is a decreased blood flow as blood temperature decreases from 40-25°C.<sup>4</sup> As blood temperatures continue to decrease below 25°C, however, blood flow is increased. The result is that initial cryotherapy causes blood vessels to constrict, but continued cryotherapy (decreasing temperatures below 25°C) results in blood vessels dilating.

Barcroft indicates that resting muscle is between 32-36°C, and after approximately 30 minutes of cooling the minimal temperature would be 25°C.<sup>5</sup> Thus, the important principle to be remembered from this phenomenon of cold vasodilation is that there is an optimum temperature in terms of decreasing blood flow, and that excessive cryotherapy may be counterproductive due to cold vasodilation, resulting in increased hemorrhage and inflammatory response. This could cause increased pain.

Waylonis demonstrated that the temperature in all tissue is not uniform.<sup>6</sup> Table 2 demonstrates that 10 minutes of ice decreases the most superficial tissue temperature to the greatest degree.

Table 2. 10 Minutes of Cryotherapy<sup>6</sup>

Depth (cm)	(oC) Temp Before	Temp Decrease	
Skin	33.9		6.4
Subcutaneous	32.5		5.8

0.5	33.6		6.0
-----	------	--	-----

1.0	35.3		6.0
-----	------	--	-----

2.0	36.7		3.6
-----	------	--	-----

4.0	37.0		1.7
-----	------	--	-----

8.0	37.2		1.2
-----	------	--	-----

Based upon the above data, a cryotherapy protocol during the acute inflammatory phase would be - according to the Chiropractic Rehabilitation Association (CRA) Standards Manual:<sup>7</sup>

*Acute Inflammation*

1. Length of application: 10-20 min. max.

A. 10 minutes: cervical spine, elbow, wrist, hand, shin, ankle, foot B. 15 minutes: thoracic spine, shoulder, knee C. 20 minutes: lumbar spine, pelvis, thigh 2. Frequency of application A. Minimum: 2-4 times per day B. Maximum: hourly 3. Procedure A. Ice massage of the injury site, pushing gently in a peripheral direction. B. Compression wrap application between ice applications with elevation.

A gentle ice massage is the procedure of choice on an hourly basis during the acute phase. This procedure has the effect of pushing the exudate into the lymphatics.

Both Waylonis and Benson indicate that within 4-5 minutes of ice therapy there is a "sensory fiber analgesia."<sup>6,8</sup> This is due to the fact that sensory fibers are blocked sooner than motor fibers. For pain control, Millar indicates that cryotherapy gives relief comparable to local anesthesia.<sup>9</sup> The protocol would be as follows:

1. Length of application: 4-5 minutes maximum
2. Frequency of application: every 30 minutes
3. Procedure: Compression with elevation

The importance of utilizing cryotherapy appropriately and timely in the acute inflammatory phase has been demonstrated in recent literature.<sup>10,11</sup> Comparisons of recovery time were made between cryotherapy performed within 24 and after 48 hours. These results were compared with that of heat treatments. Table 3 clearly shows the importance of early ice treatment.

Table 3. Ice vs. Heat Recovery Time<sup>11</sup>

*Cryotherapy/Heat*

Within 24 hrs		After 48 hrs		Heat	
Grade 2-3	6 days		11 days		15 days
Grade 3	13 days		30 days		33 days

*Early cryotherapy performed on a Grade 2-3 injury results in recovery in approximately six days, compared with 11 days if applied after 48 hours. In a Grade 3 injury the recovery is within 13 days as compared to 30 days. Failure to timely prescribe cryotherapy results in delayed recovery. This alone could make the difference whether an athlete can return to his/her sport within the same season. Occupational injuries treated in a timely fashion would result in minimal time loss. Employers who are concerned with lost work time as a result of a direct or indirect soft tissue injury should employ utilization of cryotherapy immediately upon injury. Additionally, employees should be taught that it is counterproductive to use heat during the acute phase, as this may result in increased time lost from work. Table 3 demonstrates that early heat treatments result in lengthier recovery times.*

*References*

1. National Board of Chiropractic Examiners. *Job Analysis of Chiropractic*. Greeley, CO: NBCE Publications, 1993. 78.
2. Kalenak A et al. *Athletic injuries: heat vs. cold*. *Am Fam Physician* 1975; 12:131-134.

3. *McMaster WC. Am J Sports Med 1977; 5:124-126.*
4. *Pappenheimer et al. Am J Physiol 1948; 155:458.*
5. *Barcroft, Edholm. J Physiol 1943; 102:5-20.*
6. *Waylonis GW. The physiologic effects of ice massage. Arch Phys Med Rehab 1967; 48:37-42.*
7. *CRA. Chiropractic Rehabilitation Standards Manual. Chiropractic Rehabilitation Association, 1989.*
8. *Benson TB, Copp EP. The effect of therapeutic forms of heat and ice on the pain threshold of the normal shoulder. Rheum Rehab 1974; 13:101-104.*
9. *Millar AP. Med Sci Sports 1976; 8:39-42.*
10. *Foreman, Croft. Whiplash Injuries. 1988.*
11. *Hocutt JE. Cryotherapy. Am Fam Physician 1981; 23:141-144.*  
*Kim Christensen, DC, DACRB, CCSP*  
*Ridgefield, Washington*

NOVEMBER 1996