## Cryotherapy: When, Why and How

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| **Pain**         | • Pain             | Acute Phase (First 72 hours after a flare-up or injury) | To reduce pain | ice  
• Slows nerve conduction of pain message  
• More effective and appropriate for acute rather than chronic pain  
• Should NOT be used if suspected or confirmed Complex Regional Pain Syndrome (CRPS) |
| **Inflammation** | • Heat  
• Redness  
• Swelling  
• Pain  
• Reduced function | Acute Phase (First 72 hours after a flare-up or injury) | To limit the extent of the inflammatory reaction | ice  
• Decreases metabolic rate, and thus required blood flow, of the cells which were not originally involved in the injury; thereby controls the extent of the inflammatory reaction  
• Temporary vasoconstriction of superficial blood vessels only  
• The use of contrast baths to stimulate vasoconstriction and vasodilation is effective primarily in areas of arteriovenous anastomoses (ears, fingers, toes)  

**Combination of rest, cooling, compression and elevation (RICE):**  
• Most effective in controlling inflammation when applied immediately post injury (<48-72 hours) |
| **Edema**        | • No heat  
• No redness  
• Pitting edema (indicates presence of dead cells)  
• Swelling | 72 hours - 7 days | To assist in phagocytosis of the dead cell material  
To control extraarticular swelling  
To quickly resolve intraarticular swelling | **Combination of eliciting muscle pump (active gentle muscle contractions), soft tissue massage, elevation and compression:**  
• Promotes movement of extracellular fluid into lymphatic drainage  
• Promotes circulation, which in turn promotes phagocytosis of dead cells |
| **Swelling: Intraarticular** | • No heat  
• No redness  
• Possible pain and reduced muscle function/muscle atrophy (muscles surrounding the joint are typically inhibited by intraarticular swelling) | After 7-10 days | To enhance exchange of fluid from intra- to extraarticular | **ROM/Joint mobilization:**  
• Movement of fluid into and out of a joint does not occur primarily through blood vessels but rather through the bone-cartilage interface and through the synovial membrane; this occurs during movement of the joint  
• Movement of the joint increases nutrition to the cartilage  
• Intraarticular swelling  
  o Gentle short-arc ROM  
  o Gentle manual compression/traction  
  o Grade 1-2 joint mobilizations to create a pressure differential to assist in exchange of fluid intra- and extraarticular |
| **Swelling: Extraarticular** | • No heat  
• No redness  
• An increase in tissue girth but no pitting edema | After 7-10 days | To assist in resolution of swelling, normalization of movement and return of function (including strengthening) | **Combination of eliciting muscle pump (active gentle muscle contractions), soft tissue massage, elevation and compression**  
(See next page for dosage guidelines) |
**Key Considerations**

Inflammation, edema and swelling are NOT synonymous terms

- Each symptom is associated with a different phase in the ‘continuum of resolving inflammation’
- The specific clinical problem and the desired mechanism of action should guide the selection of the intervention

**Is there an optimal ‘dosage of cryotherapy’?**

There is no optimal dosage that is ideal for all body locations. Consider the nature of the tissue when icing:

- The duration of icing for a small area with minimal fat and muscle, such as a finger, would be significantly less (~3-5 minutes) than that for a larger area and deeper tissue such as at the hip (~20 minutes)
- Intermittent icing (e.g., 10 minutes on: 10 minutes off) may be more effective for management of acute inflammation than icing for 20 consecutive minutes

**Type/duration of cooling dependent upon the goal**

- Cooling to reduce pain will likely require less intense (ice pack) and shorter durations (5 minutes)
- Cooling to reduce metabolism of uninjured cells will likely require more intense cooling (ice bath or ice chips in a wet towel) for longer durations (10-15 minutes)
- The hierarchy of the efficiency of cooling from most to least: ice-water immersion, crushed ice, frozen peas and gel pack

**Possible Risks/Undesirable Effects**

- **Inhibit muscle function**
  - Cooling can temporarily Inhibit muscle function with potential for increased risk of injury/re-injury
  - Be cautious when having patients weight bear/undertake complex exercise after icing a lower extremity
- **Ice burn**
  - Elderly patients with impaired sensation and/or circulation will be more vulnerable to an ice-burn, therefore consider using less intense icing techniques (e.g., moderately cold ice pack wrapped in an insulating layer(s) of toweling)
  - Younger patients with intact sensation and circulation may benefit most from direct immersion of the limb in cold water then progressively adding ice cubes
  - Cold gel packs stored in a freezer have a surface temperature below 0°C (32°F) and thus an insulating layer should be used between the cold pack and the patient’s skin
- **Cryotherapy-induced nerve injuries**
  - Most common when cold is applied in combination with compression
  - Check capillary refill during application of ice combined with compression therapy to ensure adequate blood flow
- **Generalized cooling and decrease in core temperature**
  - Shivering and piloerection are signs of decrease in core temperature which may compromise patient safety (especially in the elderly and those with fever)
  - The application of therapeutic cryotherapy should produce only local effects
- **Reduced ROM**
  - Ice may contribute to shortening of collagen fibers in connective tissue
  - After gaining ROM by warming, stretching and then strengthening in the newest part of the ROM, it is likely counterproductive to cool the tissue in a shortened position
  - If one wishes to cool the tissue post stretch and exercise, it is best to do so with the tissue in a lengthened position
  - In patients with significantly restricted ROM due to scar tissue, it may be preferable not to use ice
- **Be aware of conditions in which icing is contraindicated**
  - E.g., CRPS, hemoglobinuria, cryoglobulinemia, Raynaud’s disease and cold uticaria

**References**


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