

Cryotherapy: When, Why and How

Clinical Problem	Signs and Symptoms	Timing	Clinical Objective	Intervention and Mechanism of Action
Pain	<ul style="list-style-type: none"> • Pain 	Acute Phase (First 72 hours after a flare-up or injury)	To reduce pain	Ice <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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): <ul style="list-style-type: none"> • Most effective in controlling inflammation when applied immediately post injury (<48-72 hours)
Edema	<ul style="list-style-type: none"> • No heat • No redness • Pitting edema (indicates presence of dead cells) • Swelling 	72 hours - 7 days	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Promotes movement of extracellular fluid into lymphatic drainage • Promotes circulation, which in turn promotes phagocytosis of dead cells
Swelling: Intraarticular	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> ○ Gentle short-arc ROM ○ Gentle manual compression/traction ○ Grade 1-2 joint mobilizations to create a pressure differential to assist in exchange of fluid intra- and extraarticular
Swelling: Extraarticular	<ul style="list-style-type: none"> • 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 towel)
- 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 urticaria

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