



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 3.4  
IJAR 2015; 1(4): 324-327  
www.allresearchjournal.com  
Received: 15-02-2015  
Accepted: 16-03-2015

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## **Cryotherapy – An Inevitable part of Sports Medicine and it's benefits for Sports Injury**

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### **Abstract**

The use of cold therapy in acute sports injuries as well as in the rehabilitation of the injured athlete has become a generally accepted treatment method. Various cooling modalities are used to apply cold to the injured area, e.g. ice packs, ice towels, ice massage, frozen gel packs, ethyl chloride and other vapocoolants, chemical reaction devices and inflatable splints using refrigerant gas. Motor performance is affected by temperature with a critical temperature being around 18°C, above and beneath which muscle performance decreases. There is also a critical temperature for the application of cold with inflammation and oedema increasing at temperatures below 15°C. Precautions should be taken because prolonged application at very low temperatures could have deleterious effects.

**Keywords:** Cryotherapy, reduce pain, sports injuries.

### **1. Introduction**

**Cryotherapy** refers to a variety of cold applications that can be used in multiple ways to effectively treat sports injuries. Each method has its own advantages and disadvantages with some applications for the treatment of acute injuries and some for chronic injuries. Cold application can be used before or after exercise depending on the type of injury. Some types of cryotherapy are also very effective when used in combination with a rehabilitation program. In general, cryotherapy affects the body in a number of ways including reducing blood flow to an injured area (thereby reducing swelling), acting as an analgesic (numbing agent), reducing muscle spasm, and reducing tissue metabolism. Because of its ability to reduce blood flow to an area and reduce pain, cryotherapy is the modality of choice for acute injuries. Acute injuries are injuries that have a known mechanism of injury and usually result in immediate pain. These types of injuries include sprains, strains, subluxations, dislocations, contusions, and fractures.

The most common type of cryotherapy is an ice pack. The most effective ice to use in an ice pack is crushed ice because it conforms comfortably to the contours of the injured area. Crushed ice can also be packed into a thin layer (about one inch thick) placing less weight onto the injured area than a bag filled with cubed ice (can be heavy and result in some discomfort). There is a technique to making an effective ice bag. Although several companies make custom ice bags for use in therapeutic settings, any plastic bag can be utilized to make an ice bag. Scoop the crushed ice into the plastic bag filling the bag about 1/3 of the way with ice.

### **What is Cryotherapy?**

Cryotherapy is a relatively new form of treatment in which the body is briefly exposed to very cold temperatures in order to promote healing and other therapeutic results. Cryotherapy has been shown to decrease inflammation of the body's tissues, muscles and joints. It can also help improve the body's circulation and healing, and also slow down cellular metabolism and reproduction. Cryotherapy can help to reduce pain and muscle spasms in the body as well as reduce the swelling of injuries. Cryotherapy has also been shown to promote faster healing in joint, muscle and tendon injuries.

Cryotherapy is different from cryosurgery in that cryosurgery is used for removing dead or diseased tissues, and involves the focused application of extreme cold to the tissue that is to be removed. This is usually facilitated through the use of liquid nitrogen. Cryosurgery has been used to remove skin tags, warts, moles, etc. and has also been used to treat some forms of cancer.

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## **The History of Cryotherapy**

Using cold as a means of physical treatment is a practice that has been studied and utilized since the age of the ancient Egyptians 4000 years ago, who noted that the application of cold was effective in minimizing the pain of trauma and in decreasing inflammation. The ancient Greeks would regularly bathe themselves in cold water since they found it made them stronger and more vigorous. Hippocrates (460 – 370 BC), an ancient Greek physician who is commonly referred to as the father of western medicine, found that local cold exposure had the ability to reduce swelling, bleeding and pain.

The above findings was later confirmed by French military surgeon Dominique Jean L'Yver, who discovered that exposing injured limbs to cold before amputation would greatly reduce the pain and bleeding during and following the surgery, due to the local loss of sensation and the reduced local flow of blood.

## **Cryotherapy for Chronic Injuries**

One of the more effective cryotherapy methods to reduce pain and swelling in chronic injuries is ice massage. Ice massage is the use of a frozen cup of water to gently massage the tissue while receiving the benefit of an analgesic. The injured area is gently massaged with the overlapping strokes moving from distal to proximal (towards the heart). Ice cups can either be purchased (plastic reusable ice cups) or made at home using Styrofoam cups. To make an ice cup at home, fill a Styrofoam cup with water (leaving an inch at the top) and place the cup in the freezer. When the water has frozen, remove the cup, peel off the top of the Styrofoam cup, and melt any sharp edges of ice by rubbing the ice cup against the palm.

Ice massage is effective to reduce pain in small areas. One injury that is commonly treated with ice massage is shin splints. The painful area is gently massaged with overlapping motions for 5 – 10 minutes prior to activity and 20 minutes after activity.

## **Cryotherapy (Cold Therapy) for Pain Management**

Cryotherapy literally means cold therapy. The pain-relieving benefits of snow and ice were first written about by the Greek physician Hippocrates thousands of years ago. When you press a bag of frozen peas on a swollen ankle or knee, you are treating your pain with a modern (although basic) version of cryotherapy.

Cryotherapy can be applied in various ways, including ice packs, coolant sprays, ice massage, and whirlpools, or ice baths. When used to treat injuries at home, cryotherapy refers to cold therapy with ice or gel packs that are usually kept in the freezer until needed. These remain one of the simplest, time-tested remedies for managing pain and swelling.

## **How does Cryotherapy Work?**

Cryotherapy works by lowering the skin temperature of the body very rapidly and for a short period of time usually for just a couple of minutes, and no more than 4 minutes. This is accomplished by spraying the body with a fine mist of safe, non-toxic nitrogen. (Nitrogen actually makes up 80% of our natural atmosphere.) The recipient steps into a cryotherapeutic chamber about the size of a spray-tan booth and receives the treatment while standing up.

This dramatic, but brief reduction in the body's temperature causes the release of a sudden burst of adrenaline, giving an immediate boost to the body's immune system. This immune

system improvement can last for days or even weeks after the treatment. There is also a shorter term release of endorphins, the body's natural painkiller. This changed physiology within the body can result in accelerated healing and promote increased well being in all of the body's organs, cells and systems.

## **What are the Benefits of Cryotherapy?**

The reported benefits of cryotherapy include improved circulation, better metabolism, detoxification of the skin, liver and lymph systems, accelerated healing, cellular and tissue repair, and improved immune function. Cryotherapy can promote faster muscle regeneration from injuries and quicker recuperation from fatigue. All of these healing benefits are possible, and cryotherapy is a relatively safe and noninvasive procedure. Cryotherapy is increasingly being offered in clinics and spa-like facilities all around the world, and professional athletes are starting to take notice.

In addition to these health benefits, cryotherapy can also help reduce the pain, signs and symptoms of arthritis, tendonitis, fibromyalgia, migraines and psoriasis. It can also promote increased endurance, speed and strength, result in better skin tone, a reduction in cellulite, less insomnia and better sleep, lower stress levels and lower levels of anxiety and depression.

## **What is the Cost of Cryotherapy?**

A cryotherapy treatment is affordable, costing about as much as a massage. The average cost of cryotherapy treatment is about \$50 to \$100 per session. Benefits can be experienced from even one or two sessions, but often people choose to sign up for packages of up to ten sessions. Cryotherapy treatments can be administered as often as the patient chooses, and in some cases, multiple treatments are administered in one day.

## **Use of Ice**

When applying ice never apply directly onto the skin as this may result in ice burns to the skin, instead wrap the ice in a damp cloth (a dry cloth will not transmit cold effectively). There is ongoing debate over how long to apply ice. Current research suggests that during the first 24-48 hours after injury ice should be applied for 10 minutes and repeated every 2 hours. If the ice pack is left on for more than 10 minutes, a reflex reaction occurs (Hunting effect) where the blood vessels dilate and blood is again pumped into the injured area, causing further bleeding and swelling.

Ice will have an analgesic effect on the injured part by limiting the pain and swelling, muscle spasm may also be reduced. Whilst this has obvious benefits, be cautious about reducing the pain, as this may mask the seriousness of the injury. During the first 24 to 72 hours after an injury be sure to avoid any form of heat at the injury site (e.g. heat lamps, heat creams, spa's, Jacuzzi's and sauna's), avoid movement and do not massage the injured area as these will increase the bleeding, swelling and pain.

After the initial healing period of up to 72 hours (depending on the severity of the injury), ice massage may be incorporated into treatments. By applying stroking movements with an ice pack, the blood vessels will dilate and constrict alternately bringing an increased supply of blood and nutrients to the area, and so increasing the rate of healing. This may be done for more than 10 minutes to increase circulation.

### Contraindications of using ice

- ✚ Check a person's general sensitivity to ice - some people find the application of cold immediately painful
- ✚ Do not use ice on injuries in the chest region as in some instances this may cause a reaction in the muscles, bringing about angina pain, possibly from the constriction of coronary arteries
- ✚ Always check skin sensitivity before applying ice - if a person cannot feel touch before applying ice it may indicate other problems such as nerve impingement. In such instances ice would only serve to mask this and complicate the problem
- ✚ Do not apply cold to someone with high blood pressure as vasoconstriction will increase the pressure within the vessels.

### Using cryotherapy

Cryotherapy is the "I" component of R.I.C.E. (Rest, ice, compression, and elevation), a treatment recommended for the home care of many injuries, particularly ones caused by sports.

Cryotherapy for pain relief may be used for:

- Runner's knee
- Tendonitis
- Sprains
- Arthritis pain
- Pain and swelling after a hip or knee replacement
- To treat pain or swelling under a cast or a splint
- Lower back pain

Studies have shown the benefits of applying ice:

- It lowers your skin temperature.
- It reduces the nerve activity.
- It reduces pain and swelling.

Experts believe that cryotherapy can reduce swelling, which is tied to pain. It may also reduce sensitivity to pain. Cryotherapy may be particularly effective when you are managing pain with swelling, especially around a joint or tendon.

### How to apply cold therapy

Putting ice or frozen items directly on your skin could ease pain, but it also can damage your skin. It's best to wrap the cold object in a towel to protect your skin from the direct cold, especially if you are using gel packs from the freezer.

Apply the ice or gel pack for brief periods – about 10 to 20 minutes – several times a day. Check your skin frequently for sensation while using cryotherapy. This will help make sure you aren't damaging the tissues.

You might need to combine cryotherapy with other approaches to pain management:

- **Rest.** Take a break from activities that can make your pain worse.
- **Compression.** Applying pressure to the area can help control swelling and pain. This also stabilizes the area so that you do not further injure yourself.
- **Elevation.** Put your feet up – or whatever body part is in pain.
- **Pain medication.** Over-the-counter products can help ease discomfort.
- **Rehabilitation exercises.** Depending on where your injury is, you might want to try stretching and strengthening exercises that can support the area.

Stop applying ice if you lose feeling in the skin where you are applying it. If cryotherapy does not help your pain go

away, contact your doctor. Also, you may want to avoid cryotherapy if you have certain medical conditions like diabetes that affect how well you can sense tissue damage.

What should you do when you suffer a musculoskeletal injury, such as a sprained wrist or a strained back? Most people are advised to rest, apply ice and compression, and temporarily, elevate the injury site if possible (not so easy with a back strain). This technique, known as RICE (Rest, Ice, Compression, Elevation), is widely used in sports medicine today.

There are lots of methods for applying cold and compression to the injured. "Low-tech" cryotherapy treatments include ice packs, ice towels, ice massage, gel packs or ice-filled buckets. While these may work OK, they are much less effective at reducing the pain and swelling of a sports injury as compared to cryotherapy systems that simultaneously deliver both cold and compression therapy through wraps specially designed for a specific injury area, such as the back, wrist, knee or ankle.

### There is lots of scientific evidence available to explain how cryotherapy systems help to reduce pain and swelling. Here are a few key medical facts:

- ❖ **Cold therapy reduces pain.** This is because cold effects on the soft tissues, due to a combination of decreased production of pain mediators and slower spread of nerve pain signals. Nerve cells in the chilled area cause nearby blood vessels to constrict (scientifically known as vasoconstriction), leading to a reduction of blood flow to the injured site; this acts to moderate pain. While passive cryotherapy systems will help with pain relief, using a system that deploys active cold treatment will draw more heat away from the injury site, leading to more efficient temperature reduction and better pain reduction.
- ❖ **Cryotherapy controls swelling.** Following an injury, your body immediately triggers an inflammatory response - this means increased blood flow, edema build-up, and movement of leukocytes (white blood cells) to the soft tissue injury site.. However, they also can cause cellular injury and necrosis and promote swelling.
- ❖ **Cryotherapy systems are safe and non-invasive.** Many studies have concluded that cold therapy is effective and harmless and has minimal complications. The main concern is keeping the temperature within a specific range, so that very low temperature treatments are avoided. Too-cold therapy can cause serious tissue side-effects, such as frostbite and nerve damage.
- ❖ **Less pain means less time on pain MEDs.** For sure, there are situations when a musculoskeletal injury is painful enough that you really need to take pain medication. But sometimes, pain pills can cause drowsiness, fuzzy thinking and slow down your recovery. It's been discovered that active cold and compression therapy can help people to reduce or even eliminate the use of pain MEDs, which helps them get their life back faster.
- ❖ **Active cold and compression therapy delivers more benefits.** Professional athletes and 'weekend warriors' alike have found a system that delivers both cold and compression treatment directly to the injury site, without using messy ice packs or inefficient ace wraps. The combination of cold and compression is the best way to reduce pain, control swelling, and minimize or eliminate

the use of pain medications so therapy proceeds faster.

### What are the Possible Side effects of Cryotherapy?

Overall the cryotherapy process and treatments are considered very safe. The cryotherapy process has been described as “brisk but tolerable.” Some recipients of the treatment have compared it to the way it feels to stand briefly inside of a walk-in freezer. Since the process causes the body to release a surge of endorphins, the main “side effect” of cryotherapy is feeling good. This increase in positive feelings and mood can last from several days to several weeks.

For the cryotherapy treatment occurs inside of a chamber, there is the possibility that those persons who have issues with claustrophobia might feel uncomfortable during the process. However, since the treatment is so brief (just a couple of minutes), this is very rarely an issue. Other rare but possible side effects of cryotherapy are changes to the skin color and pigmentation, and nerve damage to nerves that lie close to the surface of the skin.

### Conclusion

Most clinical studies report that the use of cryotherapy has a positive effect on pain reduction and on the recovery of various injuries. When the physiological processes produced by cryotherapy are examined in experimental situations, some of these reactions differ from expectations. Skin, subcutaneous, intramuscular and joint temperature changes depend on application method, initial temperature and application time. Intramuscular temperature continues to drop after the cooling modality has been removed. Results of various studies are consistent on the effects on neuromuscular and pain processes. Results of studies on cold and blood flow vary considerably, however it appears that blood flow increases with superficial cold application and decreases when cold is applied to large skin surface areas.

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### Related References

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### Related Pages

The following Sports Coach pages provide additional information on this topic:

1. Articles on Injury Prevention
2. Books on Sports Injuries
3. Cryotherapy
4. Hot and Cold Contrast Baths
5. Injury Prevention
6. Muscle Balance
7. Muscle Cramp
8. Over Training
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