Reasons to think twice before icing an injury - and what to do instead
by Rebecca Dietzel and Jennifer Denys

Big News!

It's not very often that rehabilitation items hit the news, but in case you haven't heard, ice is on trial. It's all over the internet, in prominent newspapers, and featured in Macleans: According to a wide body of research, icing is *harming* rather than helping our healing. Dr. Gabe Mirkin, who coined the well known term RICE (Rest, Ice, Compression, Elevation) has come out publicly stating that his recommendations about ice have been incorrect. This is big news for the whole world of sports, dance, rehabilitation, first aid, self-care, and the like. In this document, we will introduce you to the latest research and explain why it points us in a different direction, *away* from the ice bag. We will explain how ice interferes with the healing process and present a new strategy for dealing with injury, one that is supported by the research.

Healing 101

In order to understand why the advice about ice is drastically changing, we need to first help you understand the healing process. When you get injured or strain yourself during a heavy workout, your body immediately activates the first stage of healing. This is called inflammation. The job of inflammation is to mobilize and transport the clean-up crew that will clear away the damaged tissue. Inflammation also brings various agents of your immune system to the injured area to deal with the damage. After inflammation has done its job, your body can continue with the rest of the healing process: building replacement tissue, helping it mature, and finally integrating it into the existing tissue. So inflammation is not the enemy that many people believe it to be. It is essential for healing. In fact, some of the inflammatory compounds active in the initial clean-up stage of healing play a role in the processes of tissue rebuilding that follow.[1,2]

Inflammation becomes a problem when it goes on too long, thus getting in the way of the tissue rebuilding process, or is too high in its intensity. When our level of inflammation matches the degree of the damage, we get optimal healing.

During inflammation, the body increases circulation to the injured area, which is why we also see swelling with injury. Remember that inflammation is a means of delivering powerful agents to the injury site to begin the healing process. There are very purposeful ingredients in that swelling. Without them, the rest of the healing goes substantially slower and less effectively.

While it is not necessary to understand all of the complex physiology and biochemistry of this process, it will be helpful to know a few things about one of these powerful ingredients: the macrophages. These are specialized white blood cells. Each macrophage acts like a mini "pac-man" to clean up the debris of the injury. Macrophages are more than just a clean-up crew, however. They also release a very important protein: insulin-like growth factor 1 (IGF-1).[3] The job of IGF-1 is to signal the overall healing to proceed at its fastest possible rate. Without IGF-1, all the other ingredients in the swelling end up disorganized, confused, and moving slowly. IGF-1 is the critical agent to organize "the team" to operate at its maximum effectiveness.[4]

To help you fully understand how ice interferes with the healing process, there is one more detail to discuss: the transport systems used by the body. The various agents of inflammation travel around in your bloodstream in an extensive network of blood vessels. When macrophages and other members of the team arrive at the site of injury, the blood vessel becomes "leaky" by opening small gaps between cells, giving the inflammation team a way to exit the circulatory system. We see swelling or puffiness around the injury because of the fluid that exited the system in this way. After the macrophages and the rest of the team have done their work, they need a way to get out of the tissue. For their exit, they use a completely different network called the lymphatic system. You can think of the lymphatic system as a network of tubes that runs alongside the arteries and veins. The lymphatic vessels have many entry points into the tissues that can pick up excess fluid and debris from the injured tissue. Eventually the lymphatic vessels deliver everything to the heart, where it can be dealt with by being delivered to your liver or kidneys via your circulatory system. In summary, the circulatory system is the delivery system; the lymphatic system is the removal system.

Ice is NOT Nice!

Now you're ready to understand the big deal about how ice interferes with all of this.

1. Ice constricts the blood vessels, resulting in distinctly fewer macrophages getting to the site of injury. This means much less efficient clean up of the injury debris, because the macrophages (and the rest of the team) can't get to the injury site. To make matters worse, this ice-induced constriction of blood vessels persists hours after the ice has been removed from the body.[5] Even after the iced area returns to normal body temperature, blood vessels remain constricted, which can lead to cellular damage, nerve damage and even tissue death.
2. Ice prevents the macrophages that *do* arrive from releasing their IGF-1.[6] This means you don't have adequate signalling for organizing the healing process to proceed at its optimal rate.
3. The lymphatic system is collecting a mixture of fluid and cellular debris as a result of the injury, meaning there is a viscous substance moving through the lymphatic vessels. The science of fluid dynamics tells us that decreasing the temperature of a thick fluid slows its rate of movement. So ice slows the rate of lymphatic drainage from the injured tissue.
4. Ice makes the lymphatic vessels "leaky," allowing fluid to move back into the injured tissue.[7] This problem is compounded by the fact that, as fluid leaks out of the lymphatic vessels, what remains in the vessels is now more dense and moving more slowly.

These are important points to consider, because one argument presented *for* the use of ice is to decrease swelling. However, it is the lymphatic vessels that actually clear swelling, and these vessels are leaking their contents back into the injured tissues due to ice. Add the slowed movement of the contents of the lymphatic vessels to this picture, and you can easily see that it is a myth that ice reduces swelling. While ice may slow the rate at which swelling

develops (by constricting blood vessels), it comes at the cost of also restricting delivery of healing agents to the site.

The Good News: There are safe and effective ways to control the total volume of swelling without disrupting this important healing chemistry. We'll discuss those shortly.

What about ice for post-workout soreness?

Ice is also applied not in response to an injury, but as a means to decrease muscle soreness after an intense workout. The most widely accepted theory of the reason for post-workout soreness is that physical training results in micro-damage to muscles. This is, in fact, how we strengthen muscles: we challenge them enough to produce micro-damage and the ensuing muscle repair results in a stronger muscle. This means that soreness can be an indication that the muscle requires healing, which requires inflammation! To ice a muscle after a workout is to decrease the healing process of inflammation, just the opposite of what we want.

There is another factor to consider when applying ice following a workout. If you have worked a muscle hard enough to produce micro-damage, you have also decreased or depleted its glycogen stores. Glycogen is the storage form of glucose, which your muscles use for energy. Ice decreases the ability of your muscles to replenish glycogen stores, even if you eat or drink a recovery food or beverage after your workout.[8]

Does ice have any other effects that are potentially harmful?

We've outlined how ice decreases inflammation, thereby slowing the healing process. The research also shows that ice affects physical performance due to its effects on muscles, joints, and the nervous system.

Overall there is a decrease in a muscle's ability to function optimally after icing. Studies show numerous reasons why this is the case, including:

- increased muscle stiffness[9,10,11]
- decreased isometric strength[12]
- decreased concentric and eccentric strength[13,14]
- decreased maximal dynamic strength[12]
- decreased motor nerve conduction[15]

Joints are affected by ice as well, showing a decrease in range of motion[16] and proprioception, as well as increased stiffness.[17]

Given all these effects, it should come as no surprise that overall measures of physical performance decline after icing. Studies show loss of speed and decreased height in jumping[18] as well as decreased manual dexterity and decreased throwing accuracy.[14]

Considering that ice results in losses of strength, flexibility, and the ability of our nerves to conduct signals to our muscles, it makes sense that we'd see a decline in overall performance of movement following ice use.

Is there anything redeeming about ice?

Across all of the research, the only common thread of benefit about ice is that it is a natural pain reliever. It's just that the stakes are high when you ice something painful that also desperately needs the inflammation team to get to the site ASAP. Before you consider ice for pain relief, remember that there are other means to address pain that won't interfere with the overall healing process. These include: ginger root, deep breathing, white willow bark tincture, and topical menthol application.[19]

In terms of pain relief, there is a time allotment for ice application that won't interfere with the healing process:[20]

Ice for Pain Control = Minimal Ice

➔ 5 minutes maximum for ice ON, 20 minutes ice OFF, 5 minutes maximum ice ON

This can be repeated *once only* if needed for pain relief, which means a maximum of 2 cycles. To ice for a second cycle, you need to wait 20 minutes before starting with your 5 minutes ice ON again. You can ice for less than 5 minutes, but do not ice longer and do not ice again.

What we recommend instead of ice:

One thing we've observed in our work with injured people is that people who are calm recover more quickly than those who are anxious. Numerous studies show the effects of stress, fear, and anxiety on our physiology and biochemistry. We actually increase the inflammatory process beyond the helpful healing range when we feel stressed. This means that if you are panicked, worried, and frantic when an injury first happens, you are revving up your nervous system into an alarmed state. Your alarmed nervous system will cause the initial swelling response to be extremely dramatic as if you are confirming to your nervous system that this injury is "the worst ever," even though the actual damage may be quite mild.

For this reason, we've taken the latest research and summarized it in the acronym BE CALM. Indeed, if you remember nothing else, remembering to BE CALM (and helping injured friends to BE CALM) will allow your body to engage in its incredible healing processes at just the right intensity for the situation. We are excited to unveil this to you.

There are 2 versions of BE CALM. One is for soft tissue injuries, the other for bone injuries. Let's start with the soft tissue version. The "E" will tell you if you need to move on to the version for bone injury.

B E C A L M for Soft Tissue Injuries

B = BREATHE

Calm deep breathing is your most powerful way to calm yourself and your nervous system. With each breath, move your lower ribs slowly in and out. Aim for a slow and long inhale and exhale with each breath cycle. Let your mind focus on the air moving in an out, not on the 1001 possible worries that will only rev up your already alarmed nervous system.

E = EVALUATE

Once you're calm, you want to sort out if you're dealing with a soft tissue or a bone injury. This stage is very important, as there are certain things you just shouldn't do if it's a bone injury. Whenever possible, seek the help of a qualified person like a physio, teacher, or trainer for this stage. If you're on your own or helping a friend, here are some things to look for that suggest the need for immediate medical attention:

1) Are you unwilling to move the body part?

   If so, suspect a fracture and proceed with BE CALM for Bones.

2) Are you unable to bear weight? (This is more than just pain with weight-bearing, but a serious unwillingness/inability to bear weight.)

   If so, suspect a fracture and proceed with BE CALM for Bones.

3) Is the pain coming from a sharply painful, very specific spot on a bone (in other words, can you point to the pain with one finger)?

   If so, suspect a fracture and proceed with BE CALM for Bones.

4) Have you suffered any loss of consciousness, even momentary, or are you bleeding?

   If either is the case, or if you suspect a head or spinal cord injury, seek emergency medical care.

If your answer to all the above is "NO," you can continue with BE CALM for Soft Tissues:

C = COMPRESSION

You would not compress a fracture which is why "E – Evaluate" is so important. For compression, use an elastic tensor bandage and gently wrap the affected area. If your compression crosses a joint (as with a sprain), place the joint as close to the joint's *neutral* position as possible. This neutral position is to help send as many normal signals from the affected body part to the nervous system as possible. It is also important not to block your circulation by making tight circles with the elastic bandage. Choose diagonals like a figure 8 instead.

A = ABLE ACTIONS

Slowly and carefully move your injured body part to ascertain which movement(s) you can do in a pain-free manner. These are your "able actions." Practice your able actions slowly for one minute every hour. *Pain-free* is the key here. Don't worry if the pain-free range is a very small one. The important thing is to slowly and carefully move in ways that do not hurt.

As for walking, if you can walk with minimal pain and without a limp, you may walk calmly and carefully. Otherwise, use supports like crutches or a cane to achieve pain-free mobility.

L = ELEVATION (Yes, we *do* know that elevation starts with E. We used creative license here. If you want to be perfectly correct with the acronym, use ***LIFT***.)

You can use gravity to help your body naturally limit swelling by simply elevating the injured body part above the level of your heart. The best way to do this is to lie down on your back and raise the affected area by resting it on a chair, a stack of pillows, or even on a pile of clothes. Anything you have close by that is soft will do.

M = ***MINIMAL ICE***

If the pain is so intense that you are finding it hard to "BE CALM", go back to the B in BE CALM and BREATHE. Deep slow breathing with a focus on a long exhale can decrease pain. If you feel like you need to do something more to help with pain, use the "minimal ice" rule to naturally help calm the pain. As written previously , this is:

- ➔ 5 minutes maximum for ice ON, 20 minutes ice OFF, 5 minutes maximum ice ON

Remember that this is a strategy for responding to an injury. It is NOT a full treatment plan. Prioritize seeing a physiotherapist after 48 hours (or within 48 hours if injury is severe) for further treatment.

Now, if your **E – Evaluate** made you suspect a possible fracture, here is the BE CALM for Bones:

B E C A L M for Bones

B = *Breathe* and E = *Evaluate*, as outlined earlier

C = *CRUTCHES*

Crutches will help you avoid putting weight on an injured hip, knee, ankle or foot. Aside from keeping weight off your lower limb, you also need to immobilize the affected part until you can see a doctor. The most important thing is to stop moving the part. A splint is very helpful in this regard. For upper body injuries, a sling is also a good strategy for immobilizing the injured body part.

A = *ARRANGE X-ray*

You will need to get an x-ray as soon as possible. You can either go to the emergency room or see your doctor as soon as possible. Getting an image of the fracture is the best way to determine how to proceed with treatment.

L = ELEVATION

Same as for soft tissue, but only if it is physically possible to do so. The location and severity of the fracture will determine if this is possible.

M = *MINIMAL ICE*

As with the guideline for soft tissue: in partnership with your breathing, minimal ice may be used for pain control if absolutely needed.

What about using heat?

Let's go back to the big picture. Your body is engaging in the process of inflammation in response to injury. The response begins with changes in circulation that deliver the macrophages and other agents to the injured tissues. We want the inflammatory process to proceed at the rate appropriate to the level of injury.

Applying heat will direct too much circulation to the injured area, thereby disrupting the inflammatory process and taking it beyond the level appropriate for healing. In addition, if the injury resulted in broken blood vessels (which you may or may not see as bruising), heat will be even more problematic. It will drive blood directly out of the broken vessels, flooding the surrounding tissues and giving your body even more work to do to in addressing the injury.

For these reasons, we want to avoid using heat in the first 48 hours. After that time, heat might be helpful, depending on the severity and nature of the injury. Bottom line: Don't use heat if bruising is present, swelling is present, or if the injury is severe.

For mild injuries, re-evaluate after 48 hours to decide if heat might be helpful. Practice the BE CALM recommendations to decrease your pain and swelling. Do not apply heat if swelling is still present. If the swelling has abated, you can apply heat for 5 minutes and assess your results. If heat increases your pain or brings back the swelling, your body is telling you not to use it.

What comes next?

BE CALM is a strategy for maximizing the healing capacity of your body. What follows it depends on the severity of your injury. For something like a mild ankle sprain or a pulled hamstring, you will likely notice improvement within the first 48 hours due to proportionate levels of inflammation engaging the healing process. For injuries of a more severe nature, be sure to follow up with the appropriate healthcare practitioner for guidance in creating a program that will bring you fully back to a state of balance and strength.

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