

HEALING, HEAT, ICE & TAPE

THE HEALING PROCESS

The initial response to injury is inflammation. This is a necessary pre-requisite to optimal healing. Attempts to stem the inflammatory response may hinder your recovery. This section will explain what is going on within your injury and highlight practical ways to optimize healing. Before exploring the initial events of injury, it is helpful to understand the basic concept of tissue fluid formation in healthy tissue.

Tissue fluid formation

Tissue fluid bathes every one of our cells allowing the delivery of oxygen and glucose (as well as other essential matter) and assists in the removal of waste products such as carbon dioxide between the cells and blood. It is mainly water with few dissolved substances. It has very few proteins as these are too large to fit through the capillary walls. Movement of these substances from the blood into the tissue fluid happens through pressure filtration.

Oxygenated blood arrives at the arteriole end of the capillary bed under pressure which is higher in the capillaries than in the tissue, therefore fluid is forced out through the capillary walls into the tissue. As the fluid leaves the capillary's, the hydrostatic pressure gradually decreases (as a result of reduced fluid) At the venule end, the blood has become deoxygenated because the oxygen has been delivered to the tissue. The fluid needs to get back into the blood otherwise the tissue would just constantly swell with fluid. Recall that the large proteins cannot fit through the capillary walls and therefore there is a higher concentration of these in the blood. Therefore, water is drawn back into

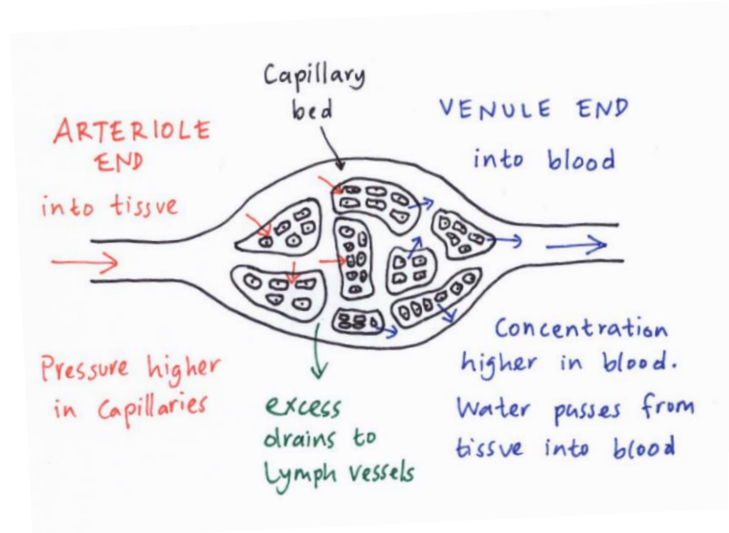


Fig 8: Tissue fluid formation

the blood by a process called osmosis to reduce the concentration. This process is further explained in [diagram 4](#). Osmosis is not enough to get all the lost fluid back into the capillaries, so any excess tissue fluid is drained away by the lymphatic system.

What happens when we get injured?

The first stage in these events is inflammation and is characterized by heat, redness, pain, swelling and loss of ROM.

INFLAMMATION:

Damaged blood vessels (capillaries) within the injured tissue that would normally supply the area with oxygen and nutrients become disrupted and can no longer supply the area with these vital substances. Subsequently, the damaged area leads to increased cell death. In response to this, several processes are initiated:

- Blood vessels near to the injured site increase in size (vasodilate) which increased blood flow to this area resulting in increased temperature and redness.
- These blood vessels also increase their permeability meaning that proteins within the blood are forced out of the capillaries and into the interstitial space. This increases the osmotic pressure within the interstitial space and forms swelling.
- Damaged cells and capillaries also release chemicals and these bind with free nerve endings within the tissue and are responsible for the sensation of pain.

The inflammatory response will reach its peak within days and is vital not only in protecting the joint from further damage but also in cascading the repair process.

INITIAL TREATMENT AFTER INJURY

It is very important that you seek advice from a healthcare professional. However, the following is a guide to help optimal recovery. Firstly, it is worth noting that we cannot speed up the biological healing process. However, if you overload the tissue, it is possible to hinder this process.

1. PROTECT

Unload or restrict movement for 1 – 3 days. This reduces the risk of aggravating the injury. However, movement and weight-bearing will be encouraged as soon as possible (depending upon the type of injury) to minimize the adverse effects of reduced activity.

2. ELEVATE

Elevate the injured limb to higher than the heart. This promotes tissue fluid flow out of the injured area. (Although there is low evidence for this, there is a low risk to benefit ratio.

3. AVOID ANTI-INFLAMMATORY MEDICATION

This may negatively affect long term tissue healing. The inflammatory process is a pre-requisite of the tissue healing process which may be hindered by the use of medication.

4. AVOID ICE

Ice is mostly for pain relief and has minimal or no effect on the healing process.

Ice may potentially disrupt inflammation, and new capillary growth which will delay the repair process.

5. COMPRESS

External mechanical compression such as tubigrip and taping may limit swelling

6. EDUCATION

Understand your injury and adopt an active role in healing including optimal loading and training other body parts whilst recovering.

AFTER THE FIRST FEW DAYS OF INJURY:

1. LOAD

Normal activities should resume as soon as symptoms allow.

Early mechanical stress will promote the repair process.

Loading without causing pain will build tissue tolerance and capacity of tendons, muscle and ligaments.

2. BE OPTIMISTIC BUT STAY REALISTIC

The brain plays a huge role in recovery. Psychological barriers include:

Catastrophising, depression and fear.

3. DO CARDIOVASCULAR TRAINING

Perform CV work without aggravating your injury. This is a motivation booster and increases blood flow to the injured structures and reduces the need for pain medication.

4. PERFORM EARLY REHAB

Use pain as a guide to progress rehab to restore mobility, strength and proprioception early after an injury.

You will notice that ice has not been discussed here. This is because recent evidence suggests that ice does not contribute to the healing process and may even hinder the cascade of events leading to healing. It is, however, useful as an analgesic (i.e. to reduce the sensation of pain and muscle spasm see guidance on its application before applying ice therapy). Robust evidence for duration and frequency of ice therapy is very limited and can vary depending upon the stage of injury and the body part that is injured.

You should take advice from your physio before applying ice.

Methods of applying ice:

- **Ice packs** are the most common method of cryotherapy. It was discovered that wetted ice is better to lower surface temperature during treatment and maintaining the lower temperature during recovery.
- Game ready or cold compress for up to 20-30 minutes every 2 hours immediately after injury
- 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.
- Ice Spray: A cooling effect can also be produced by spraying ice for a similar effect.
- Ice Massage: slow strokes in circular motion for 5-10 mins.

Cautions:

- Skin burn
- Cooling can temporarily Inhibit muscle function
- Be cautious with weight bearing after icing a lower extremity
- Cooling can temporarily Inhibit muscle function with potential for increased risk of injury/re-injury

Contraindications:

- CRPS, haemoglobinuria, cryoglobulinemia,
- Peripheral vascular disease
- Impaired circulation: Raynaud's disease
- Urticaria
- Hypersensitivity to cold
- Skin anaesthesia

HEAT

By increasing the temperature of the skin/soft tissue, the blood flow increases by vasodilatation. The metabolic rate and the tissue extensibility will also increase. Heat increases oxygen uptake and accelerates tissue healing, it also increases the activity of destructive enzymes, such as collagenase, and increases the catabolic rate.

Deep heating is thought to lessen nerve sensitivity, increase blood flow, increase tissue metabolism, decrease muscle spindle sensitivity to stretch (causing muscle relaxation) and increase flexibility.

Always use a recommended heat pack.

Heat therapy is not suitable on skin that has reduced sensitivity or unable to differentiate between hot and cold sensations.

Always rest the heat on the body part. Do not rest your body part on the heat source as this may restrict blood flow.

TAPE

Taping is commonly used as an adjunct or temporary technique with the aims of:

- relieve your pain
- improve joint stability
- enhance athlete confidence
- reduce injury recurrence
- prevent injury
- reduce strain on injured or vulnerable tissues
- correct faulty biomechanics
- inhibit muscle action
- facilitate muscle action
- enhance proprioception
- compress in the presence of swelling or lymphatic drainage

In some cases, mild to moderate skin reactions can occur. These include redness, itchiness, hives swelling. Immediately remove tape if any skin reaction occurs and consult your doctor if symptoms are severe or do not improve within two days.

Do NOT apply tape if you have skin allergy to tape or adhesive materials.

Throughout the reactive phase of recovery, it is important to observe and respect what is going on within the tissues. An understanding of the inflammatory process outlined above will help you to select a load appropriate for your condition. It is important to understand that we cannot speed the healing process up but if we load too early, it is possible to slow this process down. However, this has to balance with optimal loading in order to promote recovery without delay. Clinical signs of your readiness to progress onto the rehabilitation phase include pain free or near pain free activities of daily living (walking, sleeping, etc) and control of the inflammatory response. Your rehabilitation will then be aimed at facilitating the proliferation response – building new tissue and adaptation to increased load.

Exercise goals during the Reactive phase focus on optimizing load with the aims:

- to stimulate repair
- regaining optimal movement control
- avoid unwanted movement compensations (joint stability)
- Regain muscle balance
- Maintain core stability
- Maintain function in uninjured tissue
- Cardiovascular conditioning.
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Fig. 9 demonstrates a progressive sequence of training outcomes leading to a resilient body. As you can see, speed and power is based upon an assumption of a good level of strength. Manipulation of the training intensity and training volume will lead to different training outcomes. Before we can earn the right to increase load towards a strength base, we need to ensure optimal mobility, stability and control. Ideally, this should be performed through functional movements. The following pages discuss these concepts and give an understanding of how this will progress towards a more resilient physique.