Module 2

# Injury Prevention

## Introduction

Like most athletes, you undoubtedly want to lower your chances of incurring an injury while participating in your favourite sport. Injuries decrease the amount of time you can spend in leisure activities, lower your fitness, downgrade competitive performance, and can lead to long-term health problems.

Sports scientists suggest that injury rates could be reduced by 25% if athletes took appropriate preventative action.

## Overview of the injury prevention module

There are some general rules for injury avoidance that apply to all sports. In this module we look at how you can reduce the chances of developing a sports injury.

- Brian Mackenzie explains how to assess your potential of being sidelined with an injury and the preventative actions you can take to reduce this.
- Raphael Brandon explains how to reduce your chances of injury by eliminating training errors.
- Dr Simon Kemp and Chris Boynes explain how monitoring muscle imbalance can reduce the chances of injury.
- Bruce Tulloh provides some valuable and practical tips to reduce the chances of injury.
- Brian Mackenzie explains how you can use cryotherapy to treat soft tissue injuries.

The articles in this module are applicable to most sports.

## How to avoid injury

### Common misconceptions

Many coaches and athletes believe that males have higher injury rates than females. But male and female athletes have about the same injury rate per hour of training. Among runners it is considered that training speed is the cause of injuries ('speed kills') but research indicates that there is no link between speed and injury risk.

### Don't overdo it

The amount of training you carry out plays a key role in determining your real injury risk. Studies have shown that your best direct injury predictor may be the amount of training you completed last month. Fatigued muscles do a poor job of protecting their associated connective tissues, increasing the risk of damage to bone, cartilage, tendons and ligaments. If you are a runner, the link between training quantity and injury means that the total mileage is an excellent indicator of your injury risk. The more miles you accrue per week, the higher the chances of injury. One recent investigation found a marked upswing in injury risk above 40 miles of running per week.

### The two best predictors of injury

1. If you have been injured before, you are much more likely to get hurt than an athlete who has been injury-free. Regular exercises have a way of uncovering the weak areas of the body. If your knees are put under heavy stress because of your unique biomechanics during exercises, they are likely to hurt when you engage in your sport for a prolonged time. After recovery, if you re-establish your desired training load without modification to your biomechanics, your knees are likely to be injured again.
2. The second predictor of injury is probably the number of consecutive days of training you carry out each week. Scientific studies strongly suggest that reducing the number of consecutive days of training can lower the risk of injury. Recovery time reduces injury rates by giving muscles and connective tissues an opportunity to restore and repair themselves between training.

### Psychological factors

Some studies have shown that athletes who are aggressive, tense and compulsive have a higher risk of injury than their relaxed peers. Tension may make muscles and tendons tauter, increasing the risk that they will be harmed during training.

## Weak muscles

Many injuries are caused by weak muscles, which simply are not ready to handle the specific demands of your sport. This is why people who start a running programme for the first time often do well for a few weeks but then, as they add the mileage on, suddenly develop foot or ankle problems, hamstring soreness or perhaps lower back pain. Their bodies simply are not strong enough to cope with the demands of the increased training load. For this reason, it is always wise to couple resistance training with regular training.

## Muscle imbalance

Screening for muscle imbalances is the current cutting edge of injury prevention. The rationale behind this is that there are detectable and correctable abnormalities of muscle strength and length that are fundamental to the development of almost all musculoskeletal pain and dysfunction. Detection of these abnormalities and correction before injury has occurred should be part of any injury prevention strategy. Assessment of muscle strength and balance and regular sports massage can be beneficial in this strategy.

## Muscle stiffness

Muscle stiffness refers to the ratio between the change in muscle resistance and the change in muscle length. Muscle stiffness is thought to be directly related to muscle injury risk and so it is important to reduce muscle stiffness as part of a warm-up. Research has indicated that only dynamic stretches, slow controlled movements through the full range of motion, decrease muscle stiffness. Static exercises did not decrease muscle stiffness.

This suggests that dynamic stretches are the most appropriate exercises for warming up and not static stretching exercises. Static stretches are perhaps more appropriate for the warm-down as they help to relax the muscles and increase their range of movement.

## Make it specific

Resistance training can fortify muscles and make them less susceptible to damage, especially if the strength-building exercises involve movements that are similar to those associated with the sport. Time should be devoted to developing the muscle groups appropriate to the demands of your sport. If you are a thrower then lots of time should be spent developing muscles at the front of the shoulder. This increases the force with which you can throw, but you must also work systematically on the muscles at the back of the shoulder which control and stabilise the shoulder joint.

## Injury prevention tips

- avoid training when you are tired
- increase your consumption of carbohydrate during periods of heavy training
- increases in training should be matched with increases in resting
- any increase in training load should be preceded by an increase in strengthening
- treat even seemingly minor injuries very carefully to prevent them becoming a big problem
- if you experience pain when training, STOP your training session immediately
- never train hard if you are stiff from the previous effort
- pay attention to hydration and nutrition
- use appropriate training surfaces
- check training and competition areas are clear of hazards
- check equipment is appropriate and safe to use
- introduce new activities very gradually
- allow lots of time for warming up and cooling off
- check over training and competition courses beforehand
- train on different surfaces, using the right footwear
- shower and change immediately after the cool-down
- aim for maximum comfort when travelling
- stay away from infectious areas when training or competing very hard
- be extremely fussy about hygiene in hot weather
- monitor daily for signs of fatigue; if in doubt, ease off
- have regular sports massage.

We'll look at some of these in more detail later on.

## Coaches

The key is rapid action when the injury first appears and a lot of psychological support to back up the remedial treatment. Educate yourself and your athletes in the art of cryotherapy (more about this later on). It is when things are not going well that the athlete really needs their coach. It is important for the coach to have an alternative training programme to help the athlete through the injury recovery period.

***Brian Mackenzie***

## Eliminate training errors and reduce your chances of getting hurt

It is well accepted that one major cause of distance running injuries are training errors committed by the athlete concerned. In one study, James and colleagues (1978) were expecting to show that anatomical and biomechanical factors were the most likely causes of running injuries. However, contrary to their hypothesis, they found that some 60% of the injuries in their survey were due to training errors. Other researchers such as Brody (1980) and Clement and colleagues (1981) confirm that training errors are a highly significant, if not the most common, cause of running injury.

If you commit a training error, it does not mean that you are doing the wrong type of training. Instead, training errors are generally associated with high volumes or intensities of training, or any rapid changes in training. This may mean that you are doing the right type of training but just too much of it, or too much training too soon. For example, two common training errors athletes commit are periods of high mileage without easy days in between, and sudden major increases in mileage.

Why training errors cause injury becomes obvious when you think about what happens to your body when you train. During a training run the bones, joints and muscles in the legs and low back are stressed, and this causes damage. Thus a recovery period must follow the training. During the recovery, the damage is repaired. In time, regular training combined with adequate rest results in what is called 'supercompensation'.

With supercompensation, the body responds to the stress by growing stronger. This happens to all the bones, ligaments, tendons and muscles. Once stronger, the bones and joints can handle greater stress, absorb more shock, and the muscles can act more efficiently. However, if you continue with high-mileage training day after day, there is never sufficient recovery. In time, instead of growing stronger, your body becomes permanently weakened and an injury will result.

The same is true if you suddenly increase (>10%) your mileage. Your body is not currently conditioned for the higher levels of stress and so injury results. The bones, ligaments, tendons and muscles are only ever as strong as their current training level. They cannot suddenly develop extra strength as an immediate response to training increases. Supercompensation is a long-term progressive adaptation, not a short-term acute reaction.

Coaches and athletes are well aware that they have to get a positive training effect in muscular strength, anaerobic metabolism and aerobic metabolism. What they too often forget is that positive training effects must also occur in bones, ligaments and tendons if the athlete is to train injury-free.

Avoiding these two common training errors – prolonged high mileage and sudden mileage increases – is a major priority for any athlete. The first step in ironing out these errors is careful planning of training. Athletes must never train on a willy-nilly, do-what-they-feel-like basis. They should always plan every element of their training, including rest days. Then they must ensure that the plan is followed, avoiding extra training just because things happen to be going well.

Many athletes make the mistake of planning their high-quality running sessions, but make up the 'steady runs' element of their training as they go along. This is wrong. For each month, you should plan your training in every detail. Any planned increases in mileage should never be greater than 10% a week. A full rest day is recommended once a week or every other week. Easy days are recommended every three days.

## Slow and steady does it

The crucial underlying principle in correct planning is for slow and steady progression. The starting point is to work out what level of mileage you can currently train at without becoming injured. Then you must plan a slow progression over a period of months up to the mileage level you would like to be training at. As well as being the correct practice for injury prevention, this long, slow progression of training is also the key to improved performance. Commonsense says that an athlete who attempts an 80-miles-a-week regime but regularly takes weeks off through injury will not be as fit as the athlete who starts on 40 miles a week, slowly builds up 60 and continues injury-free.

Prolonged high mileage and sudden increases in mileage are not the only kinds of training errors. In fact, just about any rapid change in any aspect of training could be classed as a training error and likely to cause injury.

A sudden addition of high-intensity training is another common training error. This could be the situation when, say, you have spent months on steady mileage training and then decide to include fast anaerobic interval sessions. The same principle applies. The body has not yet been trained to cope with running at a fast pace, with the higher muscle forces and impact forces that result from increased speed. The muscles tire quickly and so extra strain is placed on the bones and joints. The result is injury.

Again, slow and planned progressions are the way to avoid this training error. A good way to start with higher-intensity sessions is with a fartlek workout once a week (this involves including fast sessions in your run when you feel like it, taking easy sections for recovery). After a few weeks of fartlek runs you can then add an interval session at 3K pace. For example, start with an eight to 10 x 400m with 60 seconds' recovery, building up to 25 x 400m. Once you can cope with this pace, you can attempt faster-paced sessions to train the anaerobic system.

Another example of a training error is a sudden change in running surface. Hard surfaces, such as roads, require high-impact forces to be absorbed. Obviously you must be able to cope with this. However, at the same time hard surfaces are true and do not dampen the propulsive forces. Conversely, soft off-road terrains attenuate impact forces, thus lessening the need to absorb shock, but dampen the propulsive forces. This means you may have to change your neuromuscular coordination to adapt.

If you train regularly on hard surfaces and then switch to training on soft surfaces, or you do a one-off cross-country race, problems may occur due to the different stress on the muscles. If you regularly train on soft terrain and then switch to hard surfaces, you will suffer because you cannot cope with the high impact forces.

Artificial surfaces also have unique properties that you must be used to coping with. If athletes are to train or race on different surfaces, they must plan in advance the switch in surface and build up the training on the new surface slowly.

## Compounding the problem

The worst kinds of training errors are compound rapid changes. The classic compound change that runners make is to spend all winter doing steady running on the road in trainers and then switch to fast training on the track, in spikes, for the summer season. Here there are three variables that have suddenly been changed: the intensity of the running sessions, the surface and the shoe. With spikes there is lower heel lift and less support. This means there is greater dorsiflexion and potentially more pronation. This will place greater stress on the muscles in the lower leg.

This change in biomechanics caused by the shoes, along with the higher impact forces from the fast speeds and different muscle recruitment required for the spongy nature of the track, is often too much for the athlete and injury will result. However, if you include some speed training on the track, in spikes, throughout the whole training year, you will dramatically reduce injury risks in the spring when you want to increase intensities for track racing. As long as you are used to, and can cope with, a variety of surfaces or shoes, that is fine. Remember, it is rapid changes that have to be eliminated, not necessarily variety.

The training errors I have mentioned are typical of those committed by distance runners – but not just by them. Coaches and athletes of all events and sports must realise that prolonged high-intensity training, prolonged high volumes of training or any kind of rapid change in any aspect of training should be seen as a training error. This is a vital principle to understand. It should be followed in any training programme or potential improvement will only be curtailed by injury.

Clearly, then, it is very important for injury prevention to avoid training errors.

With careful planning and slow progressions, athletes should be able to avoid the kinds of errors I have discussed.

But a word of warning: because elite performance requires high mileage and high-intensity training, athletes are still at risk simply from hard training. Some may be able to withstand it while others may need to reduce their training to remain injury-free. Only then will they reap the benefits of uninterrupted training. To underline the point, here is a telling comment from Derek Clayton, the former world-class marathon runner:

'If I had my competitive career to run over again, I would change some of my attitudes to injuries. I would show them more respect. Because, after all, injuries were not some unknown barrier I was trying to break through. Injuries were simply my body telling me that something wrong was happening.'

### References

Brody, DM (1980), 'Running Injuries', *Clin Symp*, 32(4), pp1-36

Clement, DB, Taunton, JE, Smart, GW, and Nicol, KL (1981), 'A survey of overuse running injuries', *Phy Sp Med*, 9(5), pp47-58

James, SL, Bates, BT, and Osternig, LR (1978), 'Injuries to runners: A study of entrants to a 10K race', *Am J Sp Med*, 6, pp40-50

Taunton, JE (1993), 'Training errors', in *Sports Injuries: Basic Principles of prevention and care.* in Renstrom PAFH (Ed), London: Blackwell

***Raphael Brandon***

## Why detecting muscle imbalance is an essential part of an injury prevention strategy

Screening athletes prior to competition and training is increasingly being undertaken as part of a comprehensive injury prevention strategy. Coaches, trainers and athletes need to have a working understanding of risk management strategies to reduce injury risk. Clearly not all injuries are preventable. Rugby footballers will sustain impact injuries no matter how well conditioned and protected they are, but the risk of injury can be minimised.

Injuries can be classified in many ways but perhaps the most helpful classification divides them into acute and overuse types. Acute injuries happen suddenly and may be direct (resulting from collisions with opponents, the ground or playing equipment) or indirect (for example, sudden muscle pulls). Overuse injuries result from repetitive micro-damage to the body from sporting activity that

exceeds the body's ability to repair such damage (stress fractures, Achilles tendinosis, 'shin splints' etc).

Acute indirect and overuse injuries are theoretically preventable. By reducing the risk of sustaining such injuries we will be able to maximise the ability to sustain a training load, reduce time out of competition and training and hence enhance performance.

## Injury prevention strategies

These in the main are well known and include:

- an adequate warm-up and warm-down
- appropriate training loads
- appropriate surfaces to train on
- the use of person-specific equipment (matching running shoes to foot type, appropriately set-up bicycles etc)
- adequate recovery times
- attention to hydration and nutrition.

Pre-participation screening is increasingly being added to the above list, especially in the elite sport arena.

## Pre-participation screening

This is commonplace in the USA, where in excess of 6m adolescent athletes each year are screened to detect any condition that may limit participation or may predispose to injury. The impetus for these programmes is provided by the need for colleges and high schools to meet insurance or legal requirements. Such screening principally looks for conditions that would disqualify an athlete from competition and consequently the focus is on recognising undiagnosed and serious medical problems.

Heart conditions such as hypertrophic obstructive cardiomyopathy and aortic stenosis are specifically looked for in athletes with a history of dizziness or faintness during exercise. Marfans syndrome, a disorder of connective tissue that may lead to a rupture of the thoracic aorta and sudden death during exercise, is typically only seen in tall athletes and basketballers are specifically screened for this condition.

The musculoskeletal element of the screening typically focuses on specific joints such as the knee, ankle and shoulder and aims to detect current injury and deficits resulting from previous injury. The focus of these examinations is the joint itself rather than the surrounding muscles and the examiner assesses the range of joint movement, the presence of excess fluid in the joint and the integrity of the supporting ligaments. Such screening does not usually specifically look for muscle imbalance.

## Muscle imbalance screening

Screening for muscle imbalances is the current cutting edge of pre-participation screening. The rationale behind such an approach is that there are detectable and correctable abnormalities of muscle strength and length that are fundamental to the development of almost all musculoskeletal pain and dysfunction. Detection of these abnormalities and correction before injury has occurred should be part of any injury prevention strategy and a similar approach will ensure that injuries, once sustained, will not recur.

## Muscle imbalance – basic principles

The relationship between the tone or strength and length of the muscles around a joint is known as muscle balance. When examining an athlete we need to assess stationary and dynamic strength and length. Muscles can be divided into two types, mobilisers and stabilisers. These two groups of muscles have quite different characteristics. The mobilisers are found close to the body's surface and tend to cross two joints. They are typically made up of fast-twitch fibres that produce power but lack endurance. With time and use they tend to tighten and shorten. Stabilisers, by contrast, are situated deeper, invariably only cross one joint and are made up of slow-twitch fibres for endurance. They tend to become weak and long with time.

Functionally the stabilisers assist postural holding and work against gravity. The mobilisers assist rapid or ballistic movement and produce high force. While initially both groups of muscles work in a complementary fashion to stabilise and move, over time the mobilisers can inhibit the action of the stabilisers and begin to move and attempt to stabilise on their own. This inhibition of the stabilisers and preferential recruitment of the mobilisers is central to the development of 'imbalance' and is the essence of what we want to detect and if possible reverse.

## Typical imbalance patterns

Groin injuries are the bane of athletes and therapists alike. Accounting for 5% of all sports injuries, they are often of the overuse type and typically the athlete will have had pain for a considerable period of time. The 'holy trinity' of chronic groin injuries are the sports hernia (disruption to the inguinal canal without an apparent hernia), osteitis pubis (inflammation or degeneration of the pubic symphysis) and chronic adductor tendinosis (degeneration or wear at the origin of the adductor tendons of the inner thigh). Athletes may develop one, two or all three of the above. All of these conditions are thought to be caused by repetitive shearing forces acting across the pubic symphysis (the joint at the front of the pelvis where the two pubic bones meet). What the unfortunate sufferers often have in common is poor pelvic stability where they are unable to stabilise the lower abdomen and pelvis while performing the twisting and turning movements needed for their sport. When this group is examined for muscle imbalances we invariably find that their mobilisers, the hamstrings, adductors,

hip flexors and abdominal recti, have become shortened and their principal stabilisers, the transversus abdominis and posterior glutei mediae, have become long, weak and inhibited. The mobilisers are attempting to stabilise as well as mobilise and perform neither role particularly well.

Similar imbalances in the shoulder are seen in overhead athletes where the stabilising group of muscles, principally the lower trapezius and serratus anterior (which stabilise the scapula or shoulder blade) are long and weak, the rotator cuff is weak and as a consequence we find increased translation or movement at the glenohumeral joint leading to pain and dysfunction.

### Screening

Assessing muscle length is not overly difficult as there are standard tests. Assessing strength is more taxing. One needs the athlete (and assessor) to be able to isolate the action of individual muscles. Most strength testing to date has concentrated on mobilisers rather than stabilisers because the former are easier to isolate. The assessor needs to develop a protocol whereby both groups are assessed. This is carried out statically and dynamically.

### Injury prevention

This process is typified by three elements that runs concurrently. One lengthens the shortened mobilisers at the same time as training the stabilisers to work again, initially statically and then dynamically. In the groin this would typically involve shortening and stabilising the transversus abdominis, multifidus and gluteals and lengthening the TFL/ITB, rectus femoris, psoas and invariably the hamstrings.

***Dr Simon Kemp and Chris Boynes***

## Here are 10 practical guidelines that will help an athlete avoid getting injured

A man's greatest strength is often his greatest weakness, and this is particularly noticeable among full-time sportsmen and women. The compulsive streak in their character, which drives them to practise hour after hour, day after day, is their worst enemy when it comes to handling injuries. The only way around this is to put 'avoidance of injury' high on the list of priorities. When I am making out a training plan I always start with the objectives such things as improving aerobic fitness, practising changes of pace or maintaining flexibility. Including 'avoidance of injury' in this list brings it into the reckoning when planning a week's training. These are my guidelines, some of which we've already briefly touched upon:

1. never train hard when stiff from the previous effort
2. introduce new activities very gradually

3. allow lots of time for warming up and cooling off
4. check over training and competition courses beforehand
5. train on different surfaces, using the right footwear
6. shower and change immediately after the cool-down
7. aim for the maximum comfort when travelling
8. stay away from infectious areas when training or competing very hard
9. be extremely fussy about hygiene in hot weather
10. monitor the athlete daily for signs of fatigue. If in doubt, ease off

### Never train hard when stiff

This seems obvious but it is seen all too often at the beginning of a season or in a training camp. Some people turn up very fit and set a fast pace in training and the others suffer for it the next day. But instead of waiting for the stiffness to go, they try to go on training as hard as the day before. The result is that running is awkward, movements are not coordinated and injuries are more likely.

### Introduce new activities gradually

Ideally, one would never introduce anything new at all, but there has to be a first time for everything and there are bound to be changes of emphasis, eg the switch from indoor to outdoor training or from grass to a synthetic surface. The solution is to start switching well before it is necessary. In switching from cross-country running to the synthetic track, for example, one might include a bit of running on the track whenever the opportunity arises, even if it is only three or four laps and a few strides. The first track session of the year would only be half a normal session and it would be done mostly in trainers. The following week one might do most of one session on the track but only part of it in spikes, and for the next two weeks one increases the proportion done in spikes. After a month, we might be running three times a week on the track, with other sessions being done mostly on grass.

### Warming up and cooling down

In the British climate this is particularly necessary. Warm muscles stretch much better than cold muscles. Ligaments and tendons are much more likely to tear when the muscles are cold and inflexible.

The warm-up procedure helps in several other ways, too, both physically in diverting the blood flow from non-essential areas to working muscles, and mentally, in focusing the athlete on the approaching event.

I would recommend at least 15 minutes and up to 30 minutes of warm-up before hard training starts. In ball games this can often be done with a ball, carrying out various skill routines, but in all cases it should start with five to 10 minutes of gentle movement, gradually increasing in pace, followed by five to 10 minutes of

stretching, still in warm clothing. After that, one moves to fast strides and eventually to short sprints, then stays warm and loose until the start. A sprinter might well take 45 minutes to warm up for a 10-second burst of energy. During the cool-down period, which should last for 10 to 15 minutes after a competition or a hard training session, the body temperature returns to normal and the fatigue products are flushed out of the muscles, which reduces the chances of stiffness the next day.

### Check the course beforehand

In cross-country and road running there may be unexpected traps for the unwary, potholes in the road, sudden ups or downs, all of which could cause trouble if you are not prepared for them, and of course this is closely linked to the next rule.

### Wear the right shoes

Wearing shoes which are too light or flimsy or which are unevenly worn are two very common causes of injury. If you turn up expecting a soft course and find that it is frozen hard, you could be in a lot of trouble. I once arrived for a so-called cross-country race in Madrid to find that it was 90% road. Luckily I had brought my road racing shoes, but my colleague, who had only spikes, had to run the race in dance shoes strapped on with pink ribbon! (I won, but he came second.) At a higher level, Liz McColgan threw away a chance of winning the world cross-country title in Boston because she had not checked out the length of spikes necessary on the snow-covered course.

Perhaps the commonest cause of all injuries is training too much on hard surfaces. Running fast on roads causes a lot of impact shock. I recommend getting off the road at least one day in three.

### Shower and change after training

This reduces the likelihood of stiffening up and your chances of catching a cold. Ideally, a hard session or a race should always be followed by a massage if you want to recover quickly.

### Travel in comfort

This sounds a bit sissy, but it is not at all uncommon for athletes to stay wedged into a minibus or a train, sitting awkwardly for several hours before an important event. I recommend that you get up, walk around and stretch once every hour while travelling, if possible. Apart from the muscles, the more you can keep down the stress, the better you will perform. It is best to get to the venue the day before the event for anything big, and if you have to deal with major changes in climate and/or time zones it is best to get there a week beforehand.

### Avoid infection

After hard sessions, the immune system is definitely vulnerable. Athletes in hard training are particularly susceptible before a big event. They should stay away from crowded rooms, schools, and people with bad colds.

### Be fussy about hygiene

All too often people in training camps or in games villages pick up stomach bugs just before the big event, and the reason is often evident from the sloppy conditions in which they live, with food left around, dirty clothing, people sharing cups and glasses. Athletes, like most young people, have a sense of invulnerability, which is positively dangerous.

### Monitor fatigue

In hindsight it is usually possible to trace the cause of an illness or injury, and there is usually a point where the athletes should have eased off but did not. It is a vital part of the coach's job to tell the athlete when to stop and the athlete must play their part by being aware of the early signs of overtiredness. A raised resting pulse is a sure sign.

### Attitude to injury

However careful you are, injuries can occur, particularly in the stress of competition, and illness can be picked up, often when the athlete is really fit.

The first thing is damage limitation. The usual course of events is as follows:

1. The athlete feels a little pain during training and ignores it.
2. The pain recurs, and may even be felt after training, but is not bad enough to prevent training.
3. The pain is now bad enough to interfere with normal training, but the athlete can still compete, if they rest.
4. The pain is so bad that the athlete can neither train nor compete.

The time to report the injury and start treatment is at stage one. The procedure should be to switch right away from any exercise that makes the injury more painful and to get diagnosis immediately, certainly not later than the next day. At the same time, coach and athlete should work out what forms of exercise are possible, and redesign the programme so that the athlete is at least doing something to maintain cardiovascular fitness, constant body weight and muscle strength. It is as important to maintain their morale and confidence as it is to maintain their fitness, but in these days of leisure centres, gyms, static bikes and aqua joggers it is always possible to find some suitable exercise.

### To take an example:

I had a case where a runner was tripped and fell, tearing some fibres just below the kneecap, three weeks before the Olympic trials. After icing it (more about cryotherapy in a moment) and protecting it for the first two days, he started on daily physiotherapy, and massaged the area before each session to stimulate blood flow. He could not cycle with it but he could walk, do some circuit training and swim front crawl. After three days of this he progressed to walking and jogging on grass, then to long uphill jogs, trying to avoid limping. Running uphill on grass means there is very little stress but the heart is working quite hard. By the 10th day he was doing long slow training; by the 14th day he was able to train hard, but still mainly uphill on grass. In the third week he was able to do part of the session on the track and at the end of the week he went into the trials with no knee problem at all and finished second, qualifying for the Olympic team.

The key is rapid action when the injury first appears and a lot of psychological support to back up the remedial treatment. It is when things are not going well that the athlete really needs their coach.

***Bruce Tulloh***

## Cryotherapy to the rescue

Cryotherapy is the use of cooling as a means of treating injuries, and may be used in different ways on both acute and chronic injuries. Much research has been carried out on the effects of cooling on damaged soft tissues, and although the benefits are now widely accepted there are varying opinions on how long the application should be to gain maximum benefit. Meanwhile there are still many athletes who believe a long soak in a hot bath after an injury is the best remedy to ease the pain.

### The body's reaction to an injury

In many instances, no matter how small the injury, tissues will either have been stretched or have received an impact causing blood vessels to be torn or damaged. The extent of bleeding will depend on the vascularity of the tissues involved, and may also be increased if the injury occurs during exercise. Blood will flow out until the vessels are restricted (vasoconstriction), so preventing further blood leaking into the tissues. It is important to stop bleeding into tissues as the blood will act as an irritant, increase inflammation, and must be cleared from the tissues before the healing process can properly commence.

Cells starved of nourishment from the blood due to injury will soon die. These dying cells stimulate the release of histamine, causing the blood vessels to dilate and thereby bringing increased blood supply and extra nutrients to help repair and rebuild the damaged tissues. During this phase of increased but slower and

more viscous blood supply, the capillary walls become much more permeable and quantities of protein and inflammatory substances are pushed into the area, causing swelling. Various reactions continue at a rapid rate, all of which contribute to the healing process.

Muscle spasm may also occur, causing the muscle to contract either voluntarily or involuntarily, helping prevent further movement. However, this may have adverse effects by further restricting blood flow and also placing more pressure on nerve endings, leading to increased pain.

## RICE

By applying ice or cooling immediately after an injury involving damage to soft tissues, the level of swelling and amount of blood allowed to leak out may be substantially limited. This will also be assisted by compression, elevation and rest, hence 'ICER' – or more commonly 'RICE'.

**Ice** – Apply ice for up to 10 minutes as soon after the injury as possible, do not wait for the swelling to start. This may be repeated every two hours during the first two days after injury. It is important not to keep the ice on any longer than 10 minutes as the body then reacts by increasing blood flow to warm the area and therefore exacerbating the swelling. Do not apply ice directly to the skin. Use a wet flannel.

**Compression** – After ice, apply a compression bandage to help minimise the swelling to the tissues.

**Elevation** – Elevate the injured part to help limit blood flow and prevent use of muscles to injured part.

**Rest** the injured part as much as possible to allow the healing of damaged tissues.

Failure to do this means that the period of recovery from injury may be considerably extended while the swelling and removal of dead tissue and blood cells is dealt with. If severe and not properly managed, these may create long-term problems for the athlete.

## Use of ice

When applying ice, never do so directly onto the skin as this may result in ice burns to the skin. Wrap the ice in a damp cloth (a dry cloth will not transmit cold effectively). There is an on-going debate over how long to apply ice, and current research suggests that during the acute phase (ie the first 24 to 48 hours after injury), 10 minutes is the maximum time needed and may be adjusted downwards according to the depth of tissues it is being applied to. Application for the appropriate time must be repeated every two hours during the acute phase. Once only after injury is not enough!

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. While this has obvious benefits, be cautious about reducing the pain, as this may also mask the seriousness of the injury.

After an 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.

## Contra-indications 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, this 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.

## Education

It is important to educate anyone managing injuries, including athletes themselves, on at least the basic use of ice on soft tissue injuries. Early treatment is essential.

***Brian Mackenzie***