

Ankle Inversion, initial management & proprioceptive rehabilitation



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Ankle injuries are common amongst team sports, runners, dancers and hikers but can also occur when least expected for example, stepping of a curb the wrong way or turning suddenly. The most common movement that injures your ankle is turning it inwards or 'inversion' and the immediate consequence can range from mild pain which settles quickly to severe effusion, bruising, pain and loss of function. It is possible to fracture bones in the foot or ankle when inverting it and therefore x-ray is often indicated.

However, more commonly injured at the ligaments and these can take much longer to repair than broken bone and lead to chronic ankle pain or instability if not managed correctly. The aim of this article is to highlight the immediate action that should be carried out on ankle injury and the principles of rehabilitation in order to reduce the risk of re-injury in the future.

Anatomy

The ankle joint is a complex articulation between the Tibia and fibula with the talus of the foot. This joint allows dorsiflexion (bringing the foot upwards) and

plantar flexion – pointing the foot away from you). A second joint within the ankle called the sub-talar joint is an articulation between the talus (ankle bone) and the calcaneus (heel bone) and allows sideways movement called inversion and eversion. There are several ligaments supporting this joint and restricting movement and providing stability to the joint. The joint is also surrounded by a joint capsule which also provides stability to the joint. There are several muscles that control movement

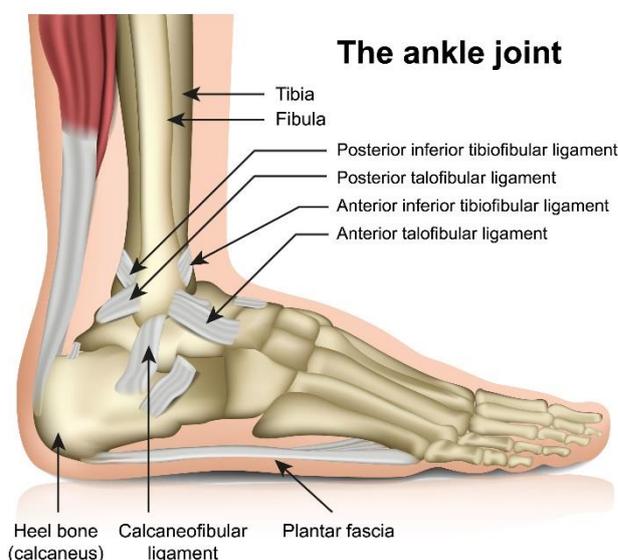


Fig 1: anatomy of the outside of the ankle

at the foot and ankle joint and also contribute to stability of the joint.

Commonly the ankle is injured by a forced inversion movement (rolling inwards on the ankle). This is often accompanied with swelling, pain and loss of movement. This is a protective measure in order to prevent further injury. The first line of treatment is to prevent further damage and to control swelling and pain. This can be achieved by following the POLICED guidelines (box 1). Early physiotherapy may also be indicated in order to regain active range of movement and reduce pain levels and facilitate soft tissue healing. There are several ligaments on the lateral (outer) aspect of the foot and during forced inversion injuries these are placed under a lot of strain. A grade 1 injury is a minor strain and will recover quickly. Grade 2 involves a greater amount of the ligament but it is still intact. This often takes longer to repair. A Grade 3 is a complete rupture of the ligament and may require surgery. The Anterior Talo-Fibular Ligament (ATFL) is often the first ligament to become injured. Other ligaments include the Posterior Talo-Fibular Ligament, Calcaneo-Fibular Ligament and the Calcaneo-Cuboid ligament. Ligament injuries are often accompanied by other soft tissue damage including muscle and nerve tissue.

The repair process

The repair process following injury involves a cascade of events starting from the initial bleeding phase at point of injury and results in the formation of a functional scar. These stages are highlighted in figure 2A: this shows the five staged as separate entities; however, in reality, there is considerable overlap as one stage progresses to the next (Fig 2B).

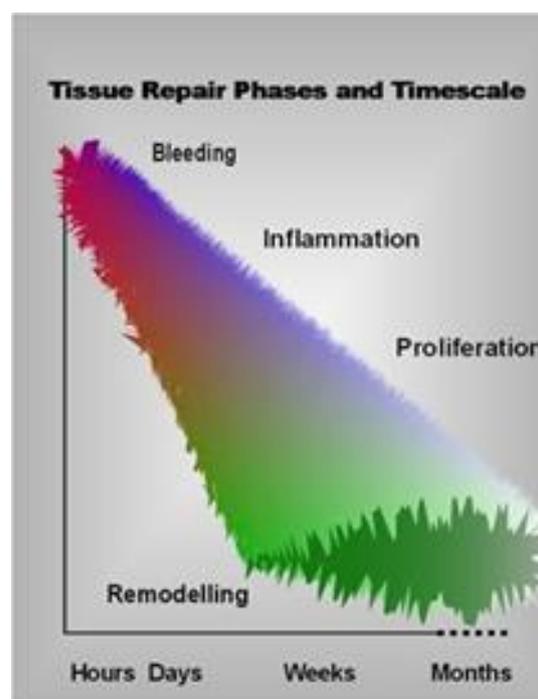
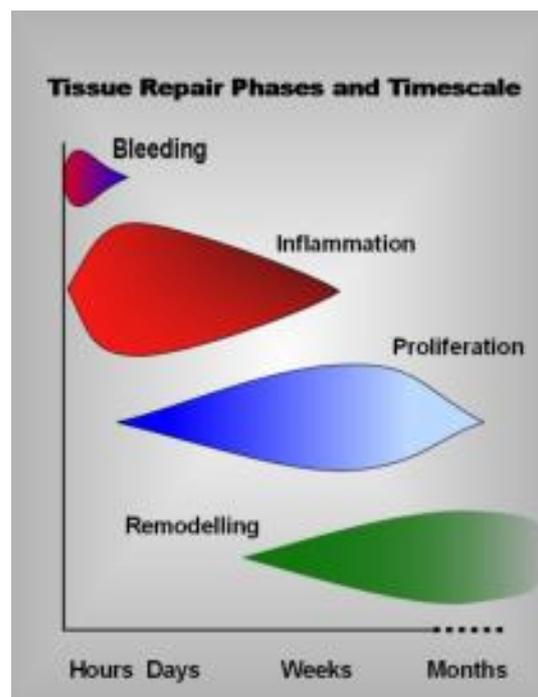


Fig 2A & B: diagram showing the stages of tissue healing (with permission, T. Watson)

The first response to trauma at the ankle is the bleeding phase and can vary in time depending upon the tissue or structures involved. Muscle tissue will bleed greater than ligaments as they have a greater blood supply. The normal time for bleeding at the ankle is between 6 and 8 hours.

Within the first few hours following injury, the inflammatory process will occur. This is an essential component of the repair phase and will raise to its maximum within 2-3 days before gradually settling over the next 2-3 weeks. The cardinal signs of inflammation are swelling at the joint (effusion), heat and redness as well as pain and loss of function. It should be noted at this point that the inflammatory process can also occur as a result of repetitive trauma at a low level such as overuse injuries as well as infection and a wide range of autoimmune disorders. The inflammatory phase is essential and leads naturally to the cascade of events to repair injured tissue.

The next phase, the proliferation phase is the generation of the repair material or scar tissue (collagen). This phase typically starts within 24-48 hrs after the onset of the inflammatory phase but takes longer to reach its peak in activity (usually 2-3 weeks post injury). The proliferation phase will continue for up to 4-6 months where the scar tissue will continuously be developed.

The remodelling phase as it suggests is when the scar tissue undergoes a process whereby it can start to behave similar to that of the injured tissue resulting in an organized, quality and functional scar. This phase is dependant upon the exposure of loading to the scar tissue and therefore places importance upon the continued rehabilitation to a functional level if the possibility of re-injury is to be minimized. The remodelling phase accompanied by end stage rehabilitation is often overlooked and may explain the high levels of re-injury.

These phases of tissue repair cannot be accelerated and any attempts to load the tissue before it is ready may lead to delayed healing. However, physiotherapy

and rehabilitation can influence this process by providing the optimal environment for optimal tissue repair and safe return to pre-injury activity and minimizing the risk of recurrence.

Initial management - POLICE principles

The POLICE guidelines are a great guide to optimize recovery following musculoskeletal injury. If you are unsure of any of the procedures or have other conditions that may be contraindicated, then you are advised to seek medical advice.

Protection

This emphasizes the importance of avoiding further tissue damage. Reduced weight bearing by using crutches maybe appropriate for lower limb damage; avoiding excessive use which may aggravate or make the condition worse.

Optimal Loading

In order to restore function as quickly as possible without compromising the injury, the joint or damaged tissue to be carefully exposed to optimal loading in order to maximize physiological adaptation. This requires consideration of the extent of the damage, tissue type (bone, muscle, ligament or other soft tissue) and the requirements of the person/athlete.

Loading will increase tensile strength of the injured tissue, promote collagen reorganization, increase tendon stiffness and promote nerve tissue firing patterns and should be performed as soon as the damaged tissue allows to promote effective healing. Initially it may be inappropriate to increase the magnitude of the load (i.e. increasing resistance and repetition) as the damaged tissue may not be ready yet. However, varying the rate and direction of load may promote adaptation whilst protecting the damaged

tissue from excessive stress. In addition, this will allow tissues to adapt to multidirectional stresses resulting in a stronger repair later on.

Ice

Ice has two main effects. Firstly, it reduces tissue metabolism by constricting blood vessels. This slows down and prevents further swelling within the joint or muscle tissue allowing early range of movement (ROM) exercises. Secondly, ice can reduce painful nerve signals going to the brain which can reduce the sensation of pain and also muscle spasms.

There is limited evidence suggesting the optimal dosage of ice and this can also vary depending on the body part. Reviews suggest 10 minutes of ice combined with 10 minutes without ice are most effective (Brukner & Khan, 2006, p130). However, you should use your judgement and be aware that prolonged ice can cause ice burns and neural damage such as loss of sensation. It is advised that you wrap the ice in a damp towel before applying to the skin.

There are contraindications to applying ice such as previous cold weather injuries, circulatory dysfunction and diabetes.

Compression

Compression bandages or garments serve to prevent further swelling during the inflammatory phase. Elasticated bandages or tubi-grip are ideal as they provide a comfortable compressive force without increased pain or restriction of blood vessels. Start your wrapping below the injury and move upwards overlapping the bandage by half each turn. The bandage will also provide minimal protection from excessive movements.

Elevation

Elevation will prevent swelling by increasing venous return to the systemic

circulation, and reducing hydrostatic pressure thereby reducing swelling/oedema and facilitating waste removal from the site of injury. Ensure that the lower limb is above the level of the pelvis.

Proprioception

The term “proprioception” is derived from the latin word *proprius* meaning “one’s own” and the word *perception*. Therefore, proprioception refers to how the body perceives and maintains itself in space. Specialized receptors (called “proprioceptors” within the joints ligaments, tendon and muscle tissue provide feedback to the central nervous system (Brain and spinal cord) which provides information concerning joint position, motion, vibration and pressure.

When we get injured, disruption to the proprioceptors may lead to altered or inadequate information being passed to the central nervous system. This may lead to reduced postural control, reduced strength and altered muscle reaction time in response to external stimuli such as running on uneven ground.

Up to 40% of ankle injuries result in re-injury even though they appear pain free and mechanically stable. This maybe as a result of incomplete proprioceptive retraining.

There are several muscles that act to stabilize the foot and ankle during posture and dynamic exercises. Proprioceptive rehabilitation of these muscles involves balance exercises, joint position re-training, strength training, plyometric and agility exercises before sports specific rehabilitation.

Proprioceptive rehabilitation has shown to significantly increase the recovery pathway of ankle injuries and reduce the likelihood of re-injury and is therefore an extremely

important part of your recovery from ankle injury.

Try this...

Stand in a safe place with no obstacles around. Place your hands on your hips and close your eyes. Now lift one foot of the floor and have someone time 20 seconds. Count how many times you make any balance errors such as:

- Accidentally put your foot down
- Open your eyes
- Take your hands off your hips.
- Shuffle your foot on the floor
- Lean in any direction

This test is called the Balance Error Scoring System and can be used to monitor postural stability and balance as you progress through rehabilitation.

Aim to maintain good balance with no errors over the 20 seconds period. Ensure you have adequate space or something to support you should you require it.

Video: [The Balance Error Score System & Proprioceptive rehabilitation](#)

There are many other factors to be considered when you invert your ankle. Neural damage (indicative of altered sensation or reduced power to the ankle and foot) or even osteochondral lesions where the articulating cartilage becomes damaged can all increase complexity to the presentation. If you have inverted your ankle and it is not responding to initial management, then I recommend seeking advice from your G.P. or physio. There are many exercises you can do to maintain ankle; flexibility, strength and proprioception which will help you recover from injury but will also reduce your chances of primary or recurrent ankle injury in the future. Have a look at the [ankle rehab video](#) and follow me on FB for more information and top tips to help you TRAIN SMARTER!



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