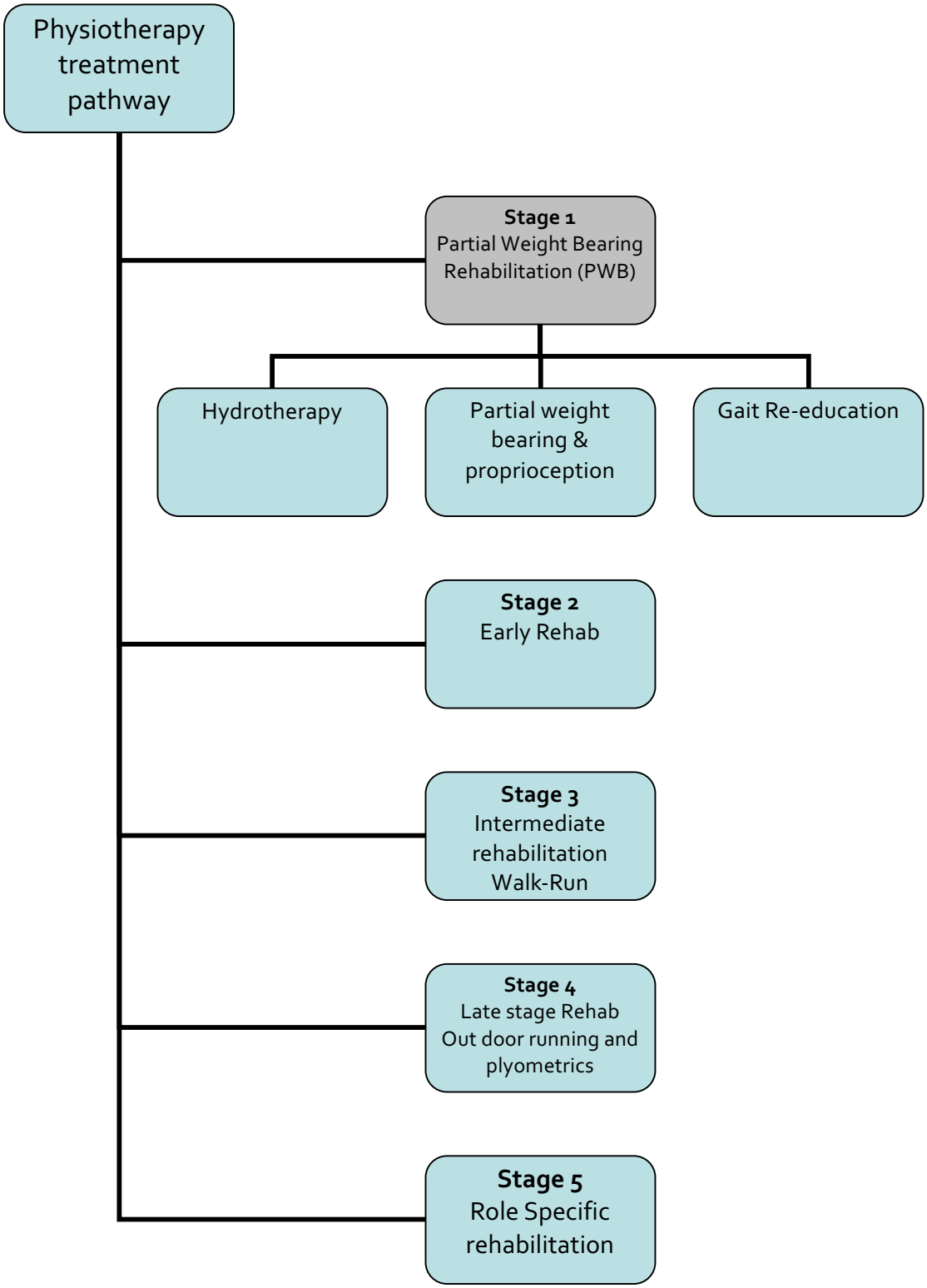
Ankle Rehabilitation



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INTRODUCTION

Anatomy

The ankle joint is a complex articulation between the Tibia and fibular with the talus of the foot. This joint allows dorsi flexion (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 and the calcaneum and allows sideways movement called inversion and eversion (Fig 1c). 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 at the foot and ankle joint and also contribute to stability of the joint.

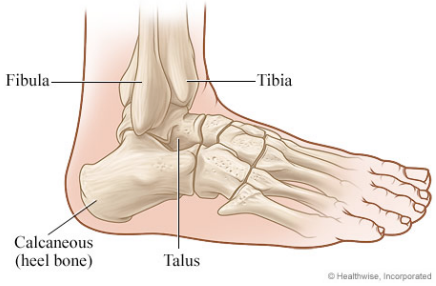


Fig 1a Anatomy of the ankle

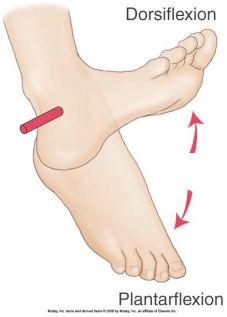


Fig 1b

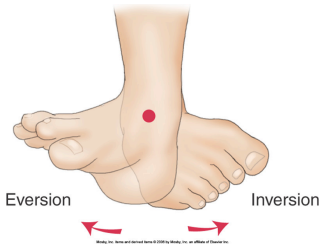
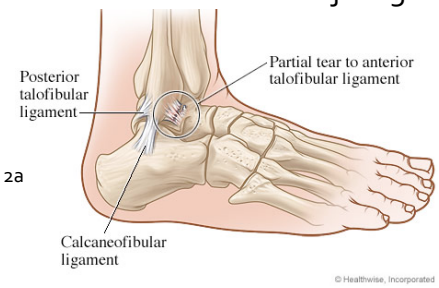
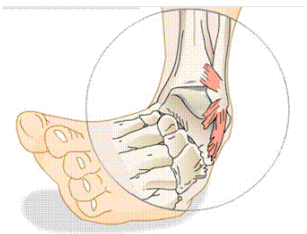


Fig 1c

Commonly the ankle is injured by a forced inversion movement (rolling over on the ankle). This is often accompanied with swelling, pain and loss of movement (bleeding – inflammatory phase, see below). 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 aspect of the foot and during forced inversion injuries 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. Below are the major ligaments in the lateral aspect of the foot:



2a



2b

Fig 2a: Anterior Talo Fibular Ligament (ATFL) partial tear (Grade 2) & **b**: Inversion injury

What's going on in my ankle? Soft Tissue Repair and Healing

Introduction

The inflammatory and repair processes are no longer simple events to describe in the light of the ever increasing knowledge in this field. This review is only a brief resume of the salient tissue repair, particularly concerning the soft tissues (Ligament, muscle and tendons and to an extent – bone). Tissue healing (or tissue repair) refers to the body's replacement of destroyed tissue by living tissue and comprises two essential components - Regeneration and Repair. The differentiation between the two is based on the resultant tissue. In REGENERATION, specialised tissues are replaced by the proliferation of surrounding undamaged specialised cells. In REPAIR, lost tissue is replaced by granulation tissue which matures to form scar tissue. This review concentrates on the events and processes associated with the repair process. Probably the most straightforward way to describe the healing process is to divide it up into broad stages which are not mutually exclusive and overlap considerably. These stages are: (1) BLEEDING, (2) INFLAMMATION, (3) PROLIFERATION and (4) REMODELLING.

A brief overview of each phase is presented here. Figure 3 refers to a general arrangement of the phases.

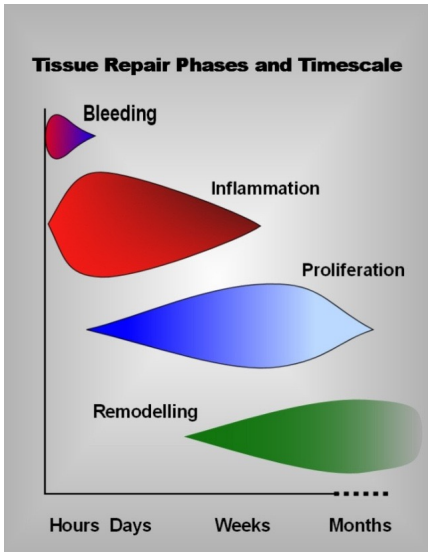


Fig 3a: General arrangement of phases

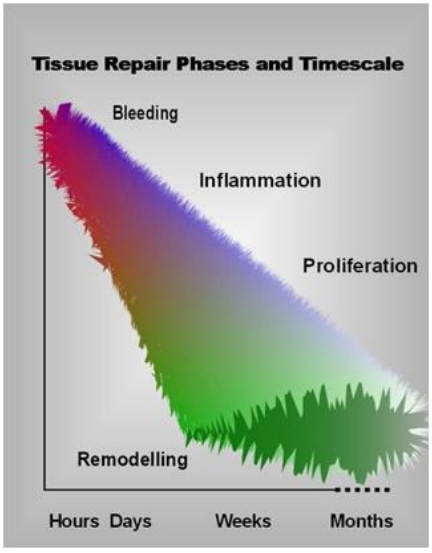


Fig 3b: Showing the overlap of each phase of healing

BLEEDING PHASE

This is a relatively short lived phase, and will occur following injury, trauma or other similar insult. Clearly if there has been no overt injury, this will be of little or no importance, but following soft tissue injury, there will have been some bleeding. The normal time for bleeding to stop will vary with the nature of the injury and the nature of the tissue in question. The more vascular tissues (e.g. muscle) will bleed for longer and there will be a greater escape of blood into the tissues. Other tissues (e.g. ligament) will bleed less (both in terms of duration and volume). It is normally cited that the interval between injury and end of bleeding is a matter of a few hours (4-6 hours is often quoted) though this of course is the average duration after the average injury in the average patient. Some tissues may continue to bleed for a significantly longer period, albeit at a significantly reduced rate. Figure 3a(above) is a gross representation of the key phases of the tissue repair process. The phases identified are shown as separate entities, though in reality, they

are interlinked in a very deliberate way. There are events associated with one phase that act as stimulants for the following phase. Figure 3b (above) indicates the integrated reality of repair rather than the 'convenient' separate phase model.

INFLAMMATORY PHASE:

The inflammatory phase is an essential component of the tissue repair process and is best regarded in this way rather than as an 'inappropriate reaction' to injury. There are, of course, numerous other initiators of the inflammatory process (e.g. repetitive minor trauma such as overuse injuries and mechanical irritation such as altered biomechanics), though for the purpose of this handout, the traumatic injury model will be adopted. The inflammatory phase has a rapid onset (few hours at most) and swiftly increases in magnitude to its maximal reaction (1-3 days) before gradually resolving (over the next couple of weeks). It can result in several outcomes but in terms of tissue repair, it is normal and essential. The onset and resolution are swifter in more vascular tissues and slower in the relatively poorly vascularised tissues. The alternative initiators of the inflammatory events include mechanical irritation, repeated minor trauma, excessive heating and cooling plus others that may be less significant in therapy such as infection and a wide range of autoimmune disorders. The inflammatory events are essentially the same whichever 'route' is relevant for the initiation.

PROLIFERATION PHASE:

The proliferative phase essentially involves the generation of the repair material, which for the majority of musculoskeletal injuries, involves the production of scar (collagen) material. The proliferative phase has a rapid onset (24-48 hours) but takes considerably longer to reach its peak reactivity, which is usually between 2-3 weeks post injury (the more vascular the tissue, the shorter the time taken to reach peak proliferative production).

This peak in activity does not represent the time at which scar production (repair) is complete, but the time phase during which the bulk of the scar material is formed. The production of a final product (a high quality and functional scar) is not achieved until later in the overall repair process. In general terms it is usually considered that proliferation runs from the first day or two post injury through to its peak at 2-3 weeks and decreases thereafter through to a matter of several months (typically 4-6) post trauma.

REMODELLING PHASE:

The remodelling phase is an often overlooked phase of repair in terms of its importance, especially in the context of therapy and rehabilitation. It is neither swift nor highly reactive, but does result in an organised, quality and functional scar which is capable of behaving in a similar way to the parent tissue (that which it is repairing). The remodelling phase has been widely quoted as starting at around the same time as the peak of the proliferative phase (2-3 weeks post injury), but more recent evidence would support the proposal that the remodelling phase actually starts rather earlier than this, and it would be reasonable to consider the start point to be in the first week.

The final outcome of these combined events is that the damaged tissue will be repaired with a scar which is not a 'like for like' replacement of the original, but does provide a functional, long term' mend' which is capable of enabling quality recovery from injury. For most patients, this is a process that will occur without the need for drugs, therapy or other intervention. It is designed to happen, and for those patients in whom problems are realised, or in whom that magnitude of the damage is sufficient, some 'help' may be required in order to facilitate the process. It would be difficult to argue that therapy is 'essential' in some sense.

The body has an intricately complex and balanced mechanism through which these events are

controlled. It is possible however, that in cases of inhibited response, delayed reactions or repeated trauma, therapeutic intervention is of value. It would also be difficult to argue that there was any need to change the process of tissue repair. If there's an efficient (usually) system through which tissue repair is initiated and controlled, why would there be any reason to change it? The more logical approach would be to facilitate or promote the normality of tissue repair, and thereby enhance the sequence of events that take the tissues from their injured to their 'normal' state.

If the tissue repair process is slowed, stalled or in any way delayed, encouraging the 'normal' sequence is the best evidenced way forward. This can be achieved with the same essential techniques as those used for a 'normally' progressing repair sequence, though it may take a 'stronger' or more' intense' therapy to initiate a tissue response.

The mechanism through which therapy can be effective throughout the repair sequence is becoming better understood, though as a general comment, these effects appear to be achieved by' stimulating' rather than 'changing' the events.

Protect - light duties chit and crutches if required.

Optimal Loading - Apply weight to a level that is comfortable

Ice - Game Ready – see Physio. Or fresh ice – not frozen peas!

Compress - Apply bandage up to knee level

Elevate - Raise your foot higher than your knee when at rest

Drugs - Take paracetamol as required (Follow instructions by Doctor or on the packet).

Box 1: POLICED Protocol

EXERCISE REHABILITATION

During the proliferative and remodelling phase, you should be aiming to achieve full range of movement (ROM) at the ankle joint. This may require physiotherapy and exercises. During this phase you should be fully weight bearing although you may still require strapping or tape. As well as ROM you will now begin strength and proprioceptive rehabilitation.

Proprioception rehabilitation

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 ligamants, 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.
In acute and overuse soft tissue injuries, long term changes in proprioception and control at the joint causing disruption to the proprioceptors which may lead to altered or inadequate information being passed to the central nervous system. Ultimately this leads 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 poor proprioceptive retraining. Additionally, it has been observed that there is a delay in Peroneus longus -a muscle responsible for eversion of the foot – (see fig. 4) reaction time in response to sudden inversion forces.

Proprioceptive rehabilitation involves balance exercises, plyometric exercises, agility exercises and then 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 individual programme. In order to make your rehabilitation programme progressive, 5 levels have been identified.

Stage 1: Partial weight bearing
Stage 2: Early rehabilitation (Phase 1 & 2)
Stage 3: Intermediate rehabilitation
Stage 4: Advanced rehabilitation
Stage 5: Specific rehabilitation

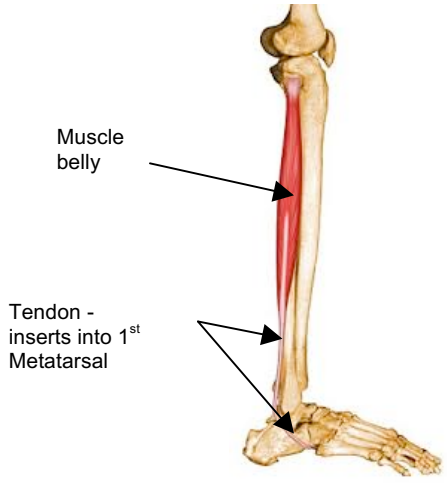


Fig 4: Peroneus Longus muscle and tendon

Stage 1
Partial Weight-bearing Rehabilitation

Aims:

- Protect from further injury
- Control swelling
- Reduce pain
- Facilitate soft tissue healing
- Education regarding condition, management plan and prognosis

Exercises:

- Walking with support (Crutches) ensure correct heel toe movement.
- Seated with feet on rocker board, forwards / backwards rocking for 2 minutes pain-free, first with both legs then with one leg.
- Two leg and single leg bridging (when appropriate) Fig 5a and b.
- Hydrotherapy – Gait re-education programme in water Progress these exercises on dry land as soon as possible. Initially you may require crutches or Alter G (see ERI).

Criteria for progression to level 2:

- ✓ Full weight-bearing without assistance.

Lie on your back on a mat. Bend your knees so your feet are flat on the floor. Hands should be palm down on the mat. Keeping your head on the mat and looking at the ceiling, slowly raise your bottom so that it is clear of the floor. Slowly lower back to the floor.
Repeat 3 x10 times

<u>Progression 1:</u> perform as for exercise above, but once into 'bridge' position straighten uninjured knee out so toes are pointing towards the ceiling. Bend the knee and replace the foot onto the mat before lowering pelvis back onto the mat.
Repeat 3 x10 repetitions for each leg

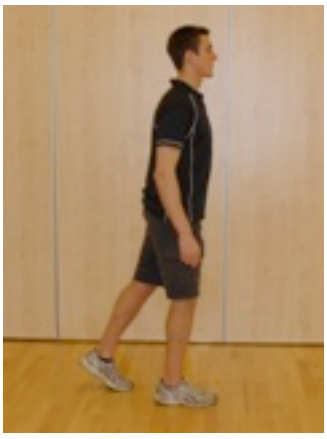
<u>Progression 2:</u> Perform this exercise with the sole of your injured foot placed on a physioball.

Fig 5 a & b Gluteal strengthening and proprioception

Partial weight bearing - Gait re-education

Perform these exercises in water until you are able to perform them on dry land.

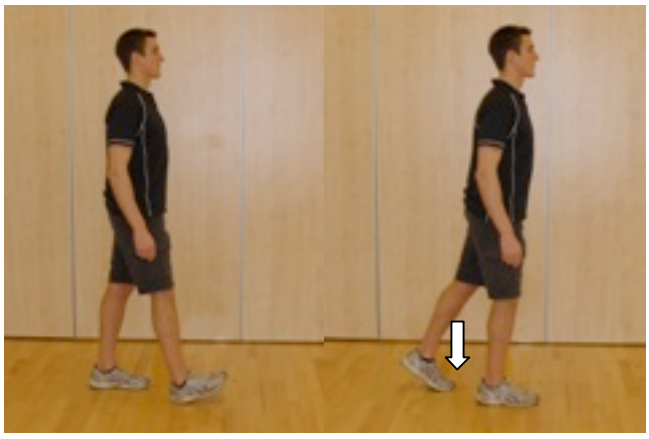
Rock Walking

The heel of the involved leg is placed slightly in front of the toes of the uninvolved limb. The body is rocked forwards and backwards transferring the weight through each leg in turn. After a set number of rocks, take 2 paces forwards in the same rhythm and repeat the rocking. Typically perform this exercise to the following phase: 'Rock forwards, rock back, rock forwards, rock back, step, step, step, rock back'.

Repeat 10metres x 5

Tidal Walking



A variation on Rock Walking. The uninvolved limb is forward and bearing the full weight with the involved limb to the rear with the heel raised. The patient presses backwards onto the toes of the back foot enough to feel the pressure (see arrow) but not enough to press the heel to the floor. After a set number of presses take 2 paces forwards and repeat the whole cycle.

Repeat 10 metres x 5

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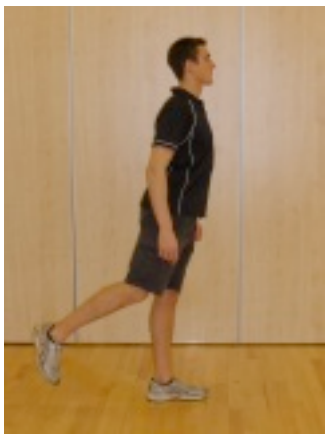
Swing walking




Walk forward on to the uninvolved limb then swing the involved limb forwards, backwards and forwards again to set down the heel in front of the uninvolved limb. One pace is then taken forwards before repeating the cycle.

Repeat 10metres x 5

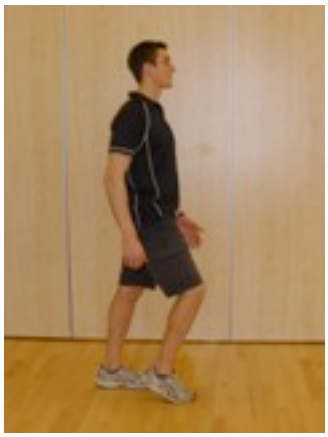
Strength walking high knee

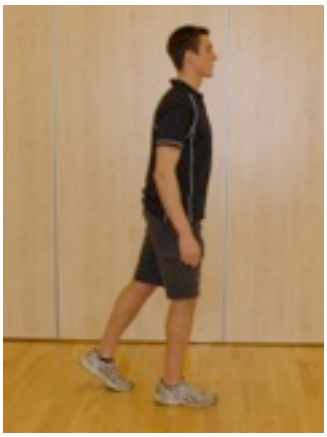

Perform slow controlled High knee walking with a 3 second pause in the high knee position. Place the hands on the hips to assist with feed back regarding pelvic positioning, i.e., flat and level.

Repeat 10 metres x 5

Progression: Place an ankle weight around the ankle of the involved limb.

Toe off walking

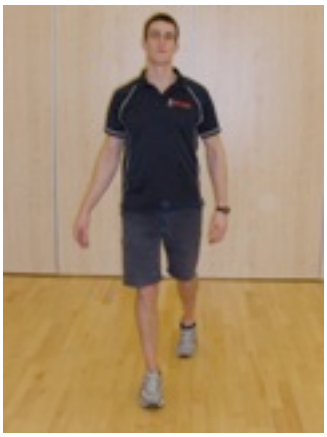




The toe of the involved (non-weight bearing) foot in front, is set down instead of the heel. The exercise is a quick transference of body weight bringing the uninvolved limb forward. In doing so the forward heel being forced down as the knee is braced back to support the body weight. Repeat this cycle.

Repeat 10 metres x 5

Strength walking Abduction

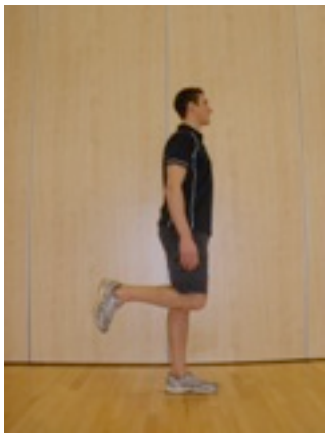


Perform slow walking and on each cycle lift the leg out to the side with 3 second pause in the abducted position change legs on each cycle. Place the hands on the hips to assist with feed back regarding pelvic positioning, i.e., flat and level and keep an upright posture.

Repeat 10metres x 5

Progression: Place an ankle weight around the ankle of the involved limb.

Strength walking hamstring curl

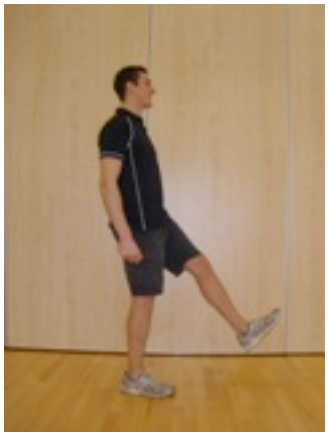
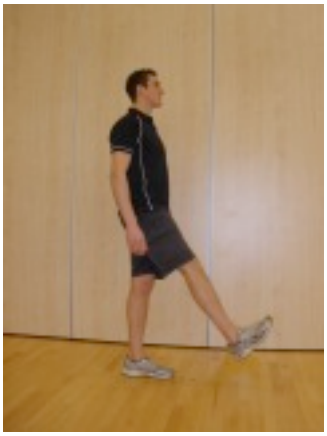



Perform slow controlled hamstring curl walking with a 3 second pause in the hamstring curl position. Place the hands on the hips to assist with feed back regarding pelvic positioning, i.e., flat and level.

Repeat 10metres x 5

Progression: Place an ankle weight around the ankle of the involved limb.

Strength walking quads brace

Perform slow controlled quads brace walking with a 3 second pause in the quads brace position. Place the hands on the hips to assist with feed back regarding pelvic positioning, i.e., flat and level.

Repeat 10 metres x 5

Progression: Place an ankle weight around the ankle of the involved limb.

See physiotherapist for progression to stage 2 – (Early rehabilitation)

Check list

Stage 1:

- ✓ Do you understand the nature of your condition?
- ✓ Do you understand the POLICED protocol?
- ✓ Do you have a previous cold weather injury?
- ✓ Do you understand your Individual programme (IP) at this stage?
- ✓ Do you have a strategy to maintain cardiovascular fitness?
- ✓ Have you completed the LEFS assessment?
- ✓ Do you have your next Physio appointment?

NOTES:

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