

# ■ Helping to prevent injury

When a runner becomes injured it can be both frustrating and unpredictable. Any training will exert a variety of different stresses and strains on the body which may in turn highlight and then aggravate any underlying weakness. It can be said that runners are only as strong as their weakest link.

By Nina Anderson

**If an athlete** can improve strength and stability the better equipped their body will then be to cope with the stressful demands of training.

A good background of strength and conditioning is imperative and forms the foundation upon which to begin any training. This in itself will serve to help prevent injury. In addition, there are a variety of more unusual strengthening exercises which can incorporate proprioception, eccentric training, and strengthening of the calf, hamstring and gluteus medius. Runners should not wait until they become injured before undertaking this type of strengthening work, but should instead incorporate it into all running schedules as a preventative measure.

## **Proprioception**

This is the name given to the transfer of information concerning position, motion, vibration and pressure from the joints, muscles and tendons. This information is sent in the form of nerve impulses to the brain. It is then processed and the necessary signals are sent to the relevant muscles, joints and tendons which will respond accordingly. For example, in order to enable an individual to walk on a slope, signals would be transmitted to the brain which would in turn lead to commands being sent to the relative muscles, ligaments and tendons. This would allow the person to accommodate the slope without falling over and would take place subconsciously. Although proprioception

occurs in everyday living without conscious awareness, training methods can be implemented in order to improve it (see examples overleaf). This will produce a better neuromuscular reaction which will in turn assist an athlete not only to improve running economy but also decrease the risk of injury. Proprioceptive training is of particular importance post injury as during this period the neural signals will either not have been used (e.g. if a sprained ankle has been non-weight bearing), or impaired due to damage of a joint or ligament. In these cases it is vital to retrain proprioception to work efficiently or risk of further injury will be increased.

## **Eccentric strength training**

When a muscle works eccentrically it is lengthening whilst contracting. For example, to lower a dumbbell to the start position in a bicep curl would work the bicep eccentrically, or to return the weight to its original position on a leg curl machine would work the hamstring eccentrically. The muscle is still contracting at these times. When a muscle works to overcome a resistance or load it undergoes microtears, which in turn stimulate the adaptation of the muscle in order that it can cope with the load next time, (this is called hypertrophy). The purpose of strength training is to induce hypertrophy. Studies have shown that training eccentrically produces significant gains in hypertrophy and muscle strength and should therefore be considered to be extremely beneficial.



## Why is hamstring strength important?

In running it is the action of the hamstring engaging when the front foot strikes which helps to drive the hips forward. It contracts both eccentrically (lengthening) and concentrically (shortening). The hamstring has to work harder at higher speeds and therefore needs to have sufficient strength to cope with an increase in intensity. Hamstring injuries are extremely common and there have been much research undertaken on the subject. Agre's study (1985) suggests that fatigue may alter the neural coordination which may then lead to injury<sup>ii</sup>. Pinniger et al (2000) further suggests that fatigue can bring about biomechanical changes which in turn could lead to hamstring injury<sup>iii</sup>. In short, because the hamstring is an intrinsic part of the running action it makes sense to ensure sufficient effort has been made to enable it to cope with the demands of training and racing.

## Why is calf strength important?

In the running action when the front foot strikes the ground it causes the angle between the shin and the top of the foot to decrease. At this point the Achilles tendon and calf muscle are working eccentrically (lengthening under contraction) to control this movement and prevent the progression of the knee over the foot. As the foot plants on the ground there is a degree of pronation (inward rolling). The calf muscle is intrinsic in controlling this movement.

This is obviously a very simple analysis of this particular phase of the running action but clearly illustrates how necessary it is to incorporate calf strengthening into training.

Studies have shown that eccentric calf strengthening can be beneficial in alleviating the symptoms of Achilles tendonitis and can also play a major role in the prevention of Achilles injury<sup>iv</sup>. Providing the calf with enough strength to cope with the biomechanics of running is a means not only to help prevent injury but also improve running economy which will in turn improve performance.

## Why is strength in the gluteus medius important?

This hip muscle predominately lies underneath the gluteus maximus. In the running action when one leg is lifted the gluteus medius stabilises the pelvis of the unsupported side. Another of its functions is to control the inward rotation of the thigh after the front foot strikes the ground. At this point it has a direct bearing on the alignment of the knee. To strengthen the gluteus medius will improve the biomechanics of the running action and is of particular importance in injury prevention.

Below are some examples of exercise that focus on the **gluteus medius, hamstrings, calf and proprioception**:-

### Gluteus Medius Wall Squat



**Function - strengthens gluteus medius**  
Stand with side of body next to wall, feet straight forward and slightly wider than hip width apart (may need to adjust once in position); bend outside leg so line of knee is in line with foot and on glancing down just obscures foot from view. Raise leg next

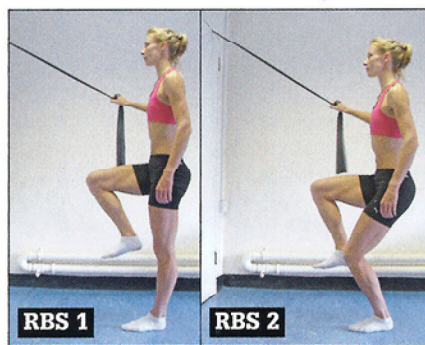
to wall to approximately 90 degrees and press same knee against wall. Continue to press knee into wall and hold for duration of exercise. Repeat on other side

#### NOTES:-

- Begin by trying to hold position for 30 seconds and ensure action of pressing hip into wall is continued throughout hold
- Progress exercise until it can be held for 3 to 4 minutes each side

### Resistance Band Squat

**Function - strengthens gluteus medius and trains proprioception (more so if performed in bare feet, though trainers can be worn). Works core muscles isometrically (without movement)**



Tie a knot into a resistance band and put knotted end into top of door (as in photo RBS 1). The exercise should be performed in the opposite position to the way door opens.

**RBS 1 - Starting Position:** stand facing door approximately one metre away, lift one leg with toes turned up, raised leg heel should be behind line of raised leg knee. Corresponding hand holds resistance band under tension, this arm should be bent at 90 degrees at the elbow. Line of band, hand and forearm should form a continuous straight line as should line of shoulder and upper arm, the only bend is

at elbow. Maintain this upper body position throughout exercise

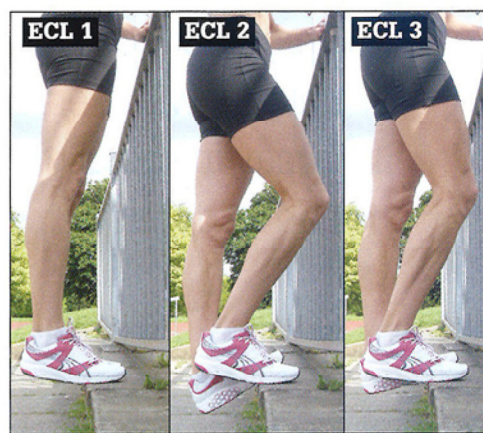
**RBS 2 -** squat on supporting leg with control whilst still keeping tension on resistance band. Maintain balance. Return to starting position. Repeat

#### NOTES:-

- Only raise leg as high as hip flexor flexibility will allow
- Body should remain tall throughout, eyeline forward
- An example of sets and repetitions may be 3 x 10 on each side

### Eccentric Calf Lower

**Function - strengthens calf muscle eccentrically**



**ECL 1 - Starting Position:** stand on edge of step, feet shoulder width apart, three quarters of foot hangs over edge and is parallel to ground below. Hold rail with light grip for support, stomach tight and eyeline forward throughout exercise

**ECL 2 -** Transfer body weight to left foot (so right foot is just resting on step), lower left heel down with control, right leg bends at knee

**ECL 3 -** After full motion (as in ECL 2) transfer all body weight through bent right leg; push through right leg so that left leg is returned to starting position. Ideally left leg (having just worked eccentrically) should not be engaged in its return to the start position. The return is controlled through right leg. Repeat again for specific number of repetitions

#### NOTES:-

- To be performed in a controlled manner
- An example of sets and repetitions might be 3 x 20 on each side. As this requires good coordination it is advisable to perform one set of 20 first on one side then the other
- This can be progressed by adding a weight (either in back pack or holding dumbbell)



## Guidelines

- Wearing trainers which have been properly fitted is essential in preventing injury. It is important to purchase them at a specialist running shop where the staff will have the expertise to provide shoes specific to individual needs.
- Training should always incorporate gradual progression - do not do too much too soon
- It is essential to ensure strength and flexibility through the full range of movement which may be undertaken.



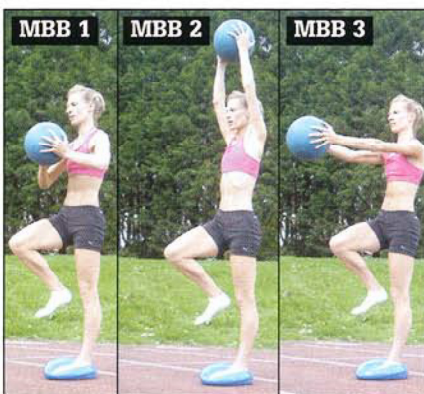
*Muscle tightness may lead to extra tension in other areas e.g. a tight quadricep muscle may produce a symptom of knee pain*

- When a muscle is weak others may be recruited to compensate which could in turn lead to injury. It is important to ascertain the cause of the problem and not merely treat the symptom. The cause may not be obvious as it is not necessarily directly linked to the area of pain
- A sports practitioner who can provide a diagnostic evaluation of biomechanics is extremely helpful. After this analysis further treatment and specific physiotherapy can be undertaken. This can often be key to help prevent a recurrence

*This article is intended as a guide only and it is recommended that if you suffer from any pain or potential injury you should seek the advice from a sports physiotherapist and/or your GP.*

## Medicine Ball Balance

**Function** – strengthens calf muscle and gluteus, trains proprioception, isometric work of core muscles



**MBB 1 - Starting Position:** stand on one leg on wobble cushion, other leg raised with toes turned up, raised leg heel

should be behind line of raised leg knee. Hold medicine ball to chest

**MBB 2** – In controlled manner raise medicine ball above head

**MBB3** – In controlled manner lower medicine ball with straight arms forward until it is opposite chest, return to starting position

### NOTES:-

- Begin with low number of repetitions and try to increase on a weekly basis
- This can be progressed by increasing weight of medicine ball

## One Leg Catch

**Function** – strengthens gluteus, trains proprioception, isometric work of core muscles



**OLC 1** – Two people stand opposite each other. One has medicine ball, the other stands on one leg, raised leg positioned as in MBB1

**OLC 2** – Throw medicine ball

**OLC 3** – Catch ball with arms outstretched, throw ball back. Catcher's raised leg remains lifted for entire set of repetitions

### NOTES:-

- This can be progressed by altering weight of medicine ball and increasing effort of thrower. With lighter ball, throws can be multi-directional which will force catcher to work harder to stabilise
- Suggestions of repetitions may be 3 x 10 on each leg

## Standing Eccentric Hamstring

**Function** – strengthens hamstring eccentrically, trains proprioception, isometric work of core muscles



**SEH 1 - Starting Position:** stand tall with stomach muscles engaged, raise one foot off ground with toes turned up  
**SEH 2** – Raise lifted leg behind body and lower trunk, keep stomach muscles engaged. Try to keep a straight line from top of head to heel of lifted foot. Return to starting position. Repeat. Do not allow working leg to touch ground in between repetitions

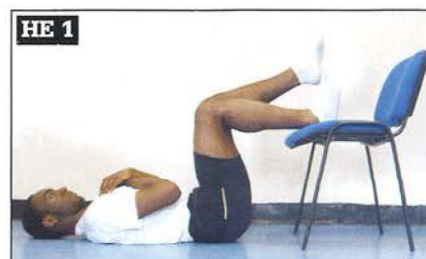
### NOTES:-

- Raising and lowering of leg should be performed in a controlled manner.
- This may be progressed by holding a weight or medicine ball (SEH 3)
- This exercise can be performed in bare feet to improve proprioceptive response
- It should feel like the leg is leading the way for the body to follow and not the other way around
- A suggestion of repetitions may be 3 x 5 on each leg

## Hamstring Exercise

**Function** – strengthens hamstring

**HE 1** – Lie on back, arms across chest, one leg resting on chair and bent at 90 degrees, toes turned up, other leg held above rested leg





**HE 2** - In controlled manner press heel into chair and raise hips to form a straight line from shoulder through to working knee, lower to position HE 1 then repeat

#### NOTES:-

- This may be progressed by moving hips further away from chair. A further progression would be for heel to be rested on an unstable surface e.g. medicine or stability ball
- A suggestion of repetitions would be 3 x 8 - 10 on each side progressing to 3x15

#### Sports Massage



Ruth Staff, a Sports Massage Therapist says 'Many people think of sports massage as a post race treatment or a means to alleviate some symptoms of injury but it can be extremely useful for many reasons. It can:-

- **Help to prevent injuries**
- **Relieve muscle tension and stiffness**
- **Improve joint flexibility and range of movement**
- **Speed up recovery post exercise**

Athletes who are looking to improve performance and increase their competitive edge do so by training. No matter which sport, the aim is nearly always to increase the intensity of training and thereby subject the body to gradual and controlled overuse. It is this overuse that may often create problems and



An easy way to massage the plantar fascia is to gently roll a golf ball under the arch of the foot for a few minutes.

## Update of Case Study Shân Hughes (Age - 52)



**weight**  
**% fat**

#### Initial

110.2kg  
47.50%

#### After 30 weeks

106.6kg  
45%

Shân's training has progressed significantly and she can now run continuously for over 45 minutes. She combines this up with running at a higher intensity for short periods, cross training and conditioning. Shân says 'I actually can't believe I am running for over 40 minutes, especially when I think back to when I first started and could only manage 1 minute



*The Hydro Active Women's Challenge is one of the UK's premier 5k women's road running events. It takes place simultaneously in 3 London, Liverpool and Birmingham and attracts all level of abilities. [www.womenschallenge.co.uk](http://www.womenschallenge.co.uk)*

of continuous running, I feel as if I have come such a long way.' Having decided to compete in the Hydro Active Women's Challenge in Hyde Park on Sunday 16th September, she has teamed up with Polar and now trains with the RS400sd heart rate monitor. Shân was concerned about the distance she was covering in her training runs and wanted to feel more confident for the race itself. The monitor she is now using has a foot pod which enables the running distance to be calculated. Shân says, 'I'm a bit of a technophobe but I can't believe how easy this is to use. The sport zones mean I can keep track of how hard I'm working in my shorter interval sessions, and I do find looking at the amount of calories I've burnt quite satisfying. I know exactly how far I'm going on each run, so hopefully by September I will have a good idea of how long it's going to take me to run the 5k.'



You can follow Shân's programme at [www.ninaanderson.com/publications.shtml](http://www.ninaanderson.com/publications.shtml)



**Ice can help to reduce inflammation and may be used post-training as a preventative measure. A simple and economical method of icing is to freeze water in a polystyrene cup, tear off the top then turn cup upside down and apply. This can then be re-frozen.**

imbalances in the soft tissues. If these are ignored and allowed to become chronic, they will not only hinder the athlete's rate of improvement, but also in many cases their performance may well suffer and ultimately they may be susceptible to development of more serious conditions. Using regular massage as a means to help prevent injuries is extremely beneficial.'

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#### NEXT ISSUE

**In the next issue Nina discusses the importance of nutrition in relation to training**

## References

- Farthing JP and Chilibeck PD (2003) The effect of eccentric training at different velocities on muscle hypertrophy. *Eur J Appl Physiol*. 89(6):570-7.
- Vikne, H, et al (2006) Muscular performance after concentric and eccentric exercise in trained men. *Medicine and Science in Sports and Exercise*. 38 (10): 1770-1781
- Agre, J (1985) Hamstring injuries. *Sports Medicine* 2:21-33.
- Pinniger GJ, Steele JR, and Groeller H (2000) Does fatigue induced by repeated dynamic efforts affect hamstring muscle function? *Medicine and Science in Sports and Exercise* 32:647-653
- Ohlberg L, Lorentzon R, Alfredsson H (2004) Eccentric training in patients with chronic Achilles tendinosis: normalised tendon structure and decreased thickness at follow up. *Br J Sports Med*. Feb;38(1):8-12
- Alfredsson, H, Lorentzon R (2000) Chronic Achilles tendinosis: recommendations for treatment and prevention. *Sports Med*. Feb;29 (2):135-46



Nina has a passion for athletics and fitness. She started jogging at the relatively late age of 25, and only stepped on to the track for the first time four years later. Now, at the age of 35, she is a

competitive athlete (400m and 800m). As an athletics coach she specialises in technical drills, strength and conditioning, and designing individual running programmes. Together with this, Nina works as a Fitness Mentor with a very wide range of clients. [www.ninaanderson.com](http://www.ninaanderson.com)