

## CUMBERLAND FOOT AND ANKLE CENTERS

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#### **Running Foot Injuries - Describing plantar fasciitis is easy: It's simply an inflammation of the fascia on the bottom of the foot. Getting rid of plantar fasciitis is hard**

Cases of plantar fasciitis can linger for months at a time, with pain increasing and decreasing in an unpredictable pattern. Often, plantar fasciitis discomfort may nearly disappear for several weeks, only to re-emerge full-blown after a single workout. About 10 per cent of individuals who see a doctor for plantar fasciitis have the problem for more than a year.

The plantar fascia is actually a thick, fibrous band of connective tissue which originates at the heel bone and runs along the bottom of the foot in a fan-like manner, attaching to the base of each of the toes. A rather tough, resilient structure, the plantar fascia takes on a number of critical functions during running and walking. It stabilizes the metatarsal joints (the joints associated with the long bones of the foot) during impact with the ground, acts as a shock absorber for the entire leg, and helps to lift the longitudinal arch of the foot to prepare it for the 'take-off' phase of the gait cycle.

Although the fascia is invested with countless sturdy 'cables' of connective tissue called collagen fibres, it is certainly not immune to injury. In fact, about 5 to 10 per cent of all running injuries are inflammations of the fascia, an incidence rate which in the United States would produce about a million cases of plantar fasciitis per year, just among runners and joggers. Basketball players, tennis players, volleyballers, step-aerobics participants, and dancers are also prone to plantar problems, as are non-athletic people who spend a lot of time on their feet or suddenly become active after a long period of lethargy. A recent study found that over 50 per cent of people who suffer from plantar fasciitis are on their feet nearly all day, and many cases of plantar fasciitis seem to occur in 'sofa spuds' shortly after they've made their first trip around their garden with a lawn mower in the spring.

#### **The 'red zone of tautness'**

Why does the fascia flare up? Although it is a fairly rugged structure, the plantar fascia is not very receptive to stretching, and yet stretching occurs in the fascia nearly every time the foot hits the ground. Studies indicate that the fascia can unkink itself to no more than 102 per cent of its normal length without suffering at least some tearing, but the force equal to almost three times body weight which passes through the foot with each step forces the fascia to come close to this 'red zone of tautness' 90 times per foot per minute during the act of running ('Anatomy and Biomechanics of the Hindfoot,' Clinical Orthopaedics, vol. 177, pp. 9-15, 1983). So, it's not surprising that plantar fasciitis occurs fairly frequently, nor is it a surprise that the damage - and pain - often tend to occur near the heel, where stress on the connective tissue fibres is greatest, and where the fascia itself is the thinnest (it tends to broaden out as it reaches toward the toes).

The heel locus for trouble is one reason why plantar fasciitis is often associated with 'heel spurs'. Those 'spurs' are simply wads of calcium deposited at the site where the fascia suffers most damage. The heel agitations also explain why the clinical manifestation of plantar fasciitis is usually strong discomfort at the bottom of the heel bone. More specifically, the person suffering from plantar fasciitis will often feel a pinpoint, knife-like pain at the 'medial tubercle' of the calcaneus (heel bone), which happens to be the exact location of the origin of the inside part of the plantar fascia. Swelling may occur just in front of the heel bone, and pain can radiate along the whole longitudinal arch of the foot.

#### **Fatties suffer**

Why are some people troubled by plantar fasciitis, while others remain relatively pf-free? Research suggests that pf is often associated with a change in activity (like a sudden increase in the volume or intensity of training or a simple expansion of the total time you spend on your feet). Using worn-out shoes, especially while running on pavement or hard ground, also seems to increase the risk. Individuals with flat feet are said to be at higher risk for plantar fasciitis, and - somewhat paradoxically - so are people with high arches. A sudden increase in hill training may

also spark a bout of pf, and pregnancy and pf go together like hand and glove.

Gaining weight or being obese is also a strong risk factor for plantar fasciitis. A recent study determined that 77 per cent of its sample of 411 plantar fasciitis (heel spurs) patients were overweight. Another study found that 23 per cent of overweight women had plantar fasciitis (heel spurs) compared to 8 per cent of the normal body-weight group. The additional body mass simply places increased stress on the plantar fascia.

If you have heel pain at the front and bottom of your heel, especially when you first wake up in the morning, it's quite likely that you have pf. If it is indeed pf, putting about an inch of folded paper under your heel or stretching out your calf muscles will usually help diminish the pain. However, other problems sometimes mimic pf discomfort; X-rays and a bone scan can help rule out the possibility of stress fracture, and a nerve study (using electrodes) can eliminate tarsal tunnel syndrome. A bit of arthritis in the heel may resemble pf, but blood tests can help make the diagnosis (there is no blood test for pf, but there is for arthritis). Your doctor may want to perform an MRI to confirm the presence of plantar fasciitis.

The traditional remedies for plantar fasciitis are - at best - quite weak. Stretching the calf muscles is often recommended, as are massage, decreasing one's training, losing weight, purchasing better-fitting shoes (with a raised heel and arch support), using special insoles, relying on thick heel pads, icing the sore heel, and gulping down prescription-type doses of ibuprofen.

The trouble with most of these nostrums (e. g., stretching the calf muscles, getting a massage, cutting back on training, hitting the non-steroidal anti-inflammatories, and icing) is that they don't really address what's going on. Stretching out the calf area is often a step in the right direction (tight calf muscles put extra strain on the plantar fascia), but there are many other strengthening and stretching routines which work more effectively (we'll describe them later). In addition, you can refrain from training, employ ice packs, and wash down dozens of ibuprofen caps over a period of many months, but when you get back into full-fledged training again, pf is very likely to recur with full fury. As is the case with any injury, you have to understand why plantar fasciitis cropped up before you can really rehab yourself and make the impairment a distant memory. You also need to increase the strength and resiliency of the plantar fascia and the other muscles and connective tissues of the foot - and stabilize and strengthen the entire leg - before you can expect to stay away from plantar fasciitis in the future. The exercises outlined below do just that.

### **Exercises to recover from and prevent plantar fasciitis**

Our pf routines are divided into two types - those that emphasize stretching and those that stress strengthening:

#### **I. Stretching Routines**

##### **A. The Rotational Hamstring Stretch**

To carry out this stretch, stand with your weight on your left foot and place your right heel on a table or bench at or near waist height. Face straight forward with your upper body and keep both legs nearly straight. As you stand with your right heel on the table and your left foot on the ground, rotate your left foot outward (to the left) approximately 45 degrees, keeping your body weight on the full surface of your left foot (both heel and toes are in contact with the ground). You are now ready to begin the stretch.

Lean forward with your navel and shoulders until you feel a steady tension (stretch) in the hamstring of your right leg. Don't increase the stretch to the point of pain or severe discomfort, but do maintain an extensive stretch in your right hamstring while simultaneously rotating your right knee in a clockwise - and then counter-clockwise - direction for 20 repetitions. As you move the right leg in the clockwise and counter-clockwise directions, stay relaxed and keep your movements slow and under control.

After the 20 reps, remove your right leg from the table and rest for a moment.

Then, lift your right leg up on to the table and repeat this clockwise and counter-clockwise stretch of the right hamstring, but this time keep the left (support) foot rotated inward (to the right) approximately 10 degrees as you carry out the appropriate movements. Perform 20 repetitions

(clockwise and counter-clockwise) before resting.

Finally, repeat this entire sequence of stretches, but this time have the right foot in support and the left foot on the table for the repetitions (do 20 clockwise and counter-clockwise reps with the left foot on the table and the right (support) foot turned out 45 degrees, and 20 more reps with the right foot turned in).

Why is this stretch valuable? Tight hamstring muscles (which cross both the knee and hip joints on the back of the leg) can lead to limited extension and exaggerated flexion of the knee during the running stride (they tend to pull the lower part of the leg backward). This over-flexion at the knee actually increases the amount of dorsiflexion at the ankle during the landing phase of the running stride (remember that the entire leg functions as a kinetic chain; change one thing, in this case hamstring flexibility, and that change will 'ripple' right down the leg to the ankle joint). Increased flexion of the ankle creates an inordinate amount of stress on the Achilles tendon (the Achilles tendon's 'job' during running is to control dorsiflexion of the ankle), which in turn pulls on the heel bone (calcaneus) and plantar fascia. The rotational hamstring stretch ensures that hamstring flexibility is developed in the transverse (rotatory) plane as well as the sagittal plane. The hamstrings undergo movement stresses in both of these planes during the running motion and therefore must have flexibility in both planes to avoid overstressing the plantar fasciae.

#### B. The Tri-Plane Achilles Stretch

To carry out this stretching manoeuvre, stand with your feet hip-width apart and your left foot in a somewhat forward position compared to your right foot (it should be about six to 10 inches ahead). Shift most of your weight forward onto your left leg and bend your left knee while keeping your left foot flat on the ground. Your right foot should make contact with the ground only with the toes. You are now ready to begin the stretch.

Move your left knee slowly and deliberately to the left. As you do so, also attempt to 'point' the knee in a somewhat lateral direction. You should be able to feel this side-to-side and rotational action at the knee creating a rotational action in your left Achilles tendon. Bring the knee back to a straight-ahead position, and then move it toward the right. As you move the left knee to the right, again rotate the knee somewhat, this time to the right, creating more rotation at the Achilles tendon. When you bring the left knee back to the straight-ahead position, you have completed one rep (you should perform 20 total repetitions). Make sure that you keep most of your weight on the left leg while performing this exercise.

Repeat the entire action described above for 20 reps, but this time with your right leg bearing your body weight and doing the side-to-side and rotational movements.

What is the value of this stretch? The Achilles tendon (also known as the heel cord) inserts directly into the heel bone on the back of the foot. The plantar fascia is attached to the heel bone on the underside (sole) of the foot. During the running stride each component of the body's support system (hip, thigh, lower leg and foot) is responsible for controlling and dissipating a portion of the impact force associated with landing. Insufficient flexibility in the Achilles tendon during the landing phase can lead to overstress of the plantar fascia, since the plantar fascia must then do more than its fair share of the work as the body moves over the foot while the foot is on the ground (a tight Achilles tendon tends to 'throw' the foot forward onto the plantar fascia as impact is made with the ground, magnifying the stress on the plantar fascia). The frontal-plane and rotational movement of the knee during the tri-plane Achilles stretch forces the Achilles tendon to undergo rotation, and this rotational component of the stretch ensures that Achilles flexibility is developed in the transverse (rotatory) plane as well as the sagittal plane. The Achilles tendons, like the hamstrings, undergo movement stresses in both of these planes during running.

#### C. The Rotational Plantar Fascia Stretch

Stand barefoot, with your feet hip-width apart and with your left foot in a slightly forward position - two to three inches ahead of your right foot. The bottoms of the toes of your left foot should be in contact with a wall in front of you (the wall should be creating a forced dorsiflexion of the toes, so that the sole of the left foot is on the ground but the toes are on the wall), and your left knee should be bent slightly. Keep your weight evenly distributed between your right and left foot to start the exercise (see note below). You are now ready to begin the stretch.

Slowly rotate your left foot to the inside (pronation) so that most of the weight is supported by the 'big-toe side' of the foot. Then, slowly rotate your left foot to the outside (supination), shifting the weight to the 'little-toe side' of your foot. Repeat this overall movement for a total of 15 repetitions.

Next, simply repeat the above sequence with your right foot.

Note: As you become more comfortable with this exercise, gradually shift more of your weight forward onto the forward, 'stretched' foot and ankle. This shift in weight will increase the intensity of the stretch.

What is the value of this stretch? The plantar fascia runs the length of the foot from the heel bone (calcaneus) to the toes. During a running stride, the plantar fascia undergoes a rather sudden lengthening and then shortening during the landing phase - much like a rubber band that is suddenly stretched and then allowed to shorten. This 'elastic' event requires the plantar fascia to be sufficiently supple and strong to handle such stress without breaking down. Insufficient elasticity in the plantar fascia combined with the tendency to over-pronate (which puts extra stretch on the plantar fascia) is a nearly foolproof formula for pf problems. This plantar fascia stretch utilizes both rotational and sagittal (front-to-back) stretching in order to develop flexibility in both the transverse and sagittal planes - the primary planes in which the structures of the foot and lower leg function during running. Regular use of this stretch helps the plantar fascia better withstand the key twisting and lengthening forces which are placed on it.

## **II. Strengthening Exercises for the Plantar Fascia**

### **A. Toe Walking with Opposite-Ankle Dorsiflexion**

Barefoot, stand as tall as you can on your toes. Balance for a moment and then begin walking forward with slow, small steps (take one step every one to two seconds, with each step being about 10 to 12 inches in length). As you do this, maintain a tall, balanced posture. Be sure to dorsiflex the ankle and toes of the free (moving-ahead) leg upward as high as you can with each step, while maintaining your balance on the toes and ball of the support foot. Walk a distance of 20 metres for a total of three sets, with a short break in between sets.

Why is this exercise valuable? The muscles of the feet require good strength to control the forces associated with landing on the ground during the running stride. This toe-walking exercise helps to develop the eccentric (support) strength and mobility in the muscles of the foot and calf, as well as the plantar fascia and Achilles tendon (eccentric strength means hardness as these structures are being stretched out). The exercise also works the foot and ankle through a broad range of motion, especially for the foot which is bearing weight on the ball and toes while the ankle is extended (is in plantar flexion). The exercise also improves balance and stability, which are critical factors for runners hoping to improve their efficiency of movement.

### **B. Toe Grasping**

To perform this exercise, stand barefoot with your feet hip-width apart. In an alternating pattern, curl the toes of your right foot and then your left foot down and under, as though you are grasping something with the toes of each foot. Repeat this action (right foot, left foot, right foot, etc.) for a total 50 repetitions with each foot. Rest for a moment, and then complete two more sets. Try pulling yourself across the floor (smooth surfaces work best) for a distance of three to six feet as you become more skilled at this exercise.

What is the value of toe grasping? Toe grasping develops strength, coordination and flexibility in the muscles of the foot that run parallel to the plantar fascia and help support the longitudinal arch of the foot. This exercise also strengthens selected stabilizing muscles of the calf and shin. Your range of motion during the 'grasping' action will improve over time, as will the range of motion of the entire foot.

Overall, your strategy should be to strengthen the plantar fascia and related structures in your feet and legs, as well as improve their flexibility in all planes of motion. By doing so, you will take stress off your plantar fasciae and be less prone to fasciitis. Please bear in mind, though, that if you currently have a tough case of pf, you will need to start slowly with the exercises to avoid aggravating your condition. If the exercises themselves produce pain, stop immediately!

### **Final points**

1. If your friendly neighbourhood surgeon says you have heel spurs which need to be removed, beware! It's important to remember that heel spurs themselves do not usually cause heel pain. In a recent study, it was determined that about 21 per cent of the adult population has at least one heel spur (!), yet few of these individuals reported actual heel pain.

2. In forthcoming issue, we'll tackle the question of whether custom orthotics are good for pf and various other running injuries. In the meantime, bear in mind that prescribing orthotics for pf is like saying that the key problem which produces pf is always in the feet. This is certainly not true: as we mentioned earlier, tight hamstrings can cause pf, and prescribing orthotics for taut hamstrings is nonsense! You've got to think of your plantar fascia as being part of an interactive chain of muscles and connective tissues which runs from your hip down through your toes. If you want to stay away from pf, the whole system must be taken into account - and worked on. In addition, even if your pf problem is truly the result of 'weak feet', does it make more sense to install appliances under your feet and forget about correcting the weakness - or work diligently on overall foot (and leg) strength?!

3. Always remember that icing, anti-inflammatories, reduced training, massage, etc. are temporary palliatives for pf. They do not cure the problem. The only true plantar-fasciitis elixir is an increase in the overall resiliency and strength of your legs and feet - so that plantar fasciitis just can't come back.