

# Hamstring Injuries

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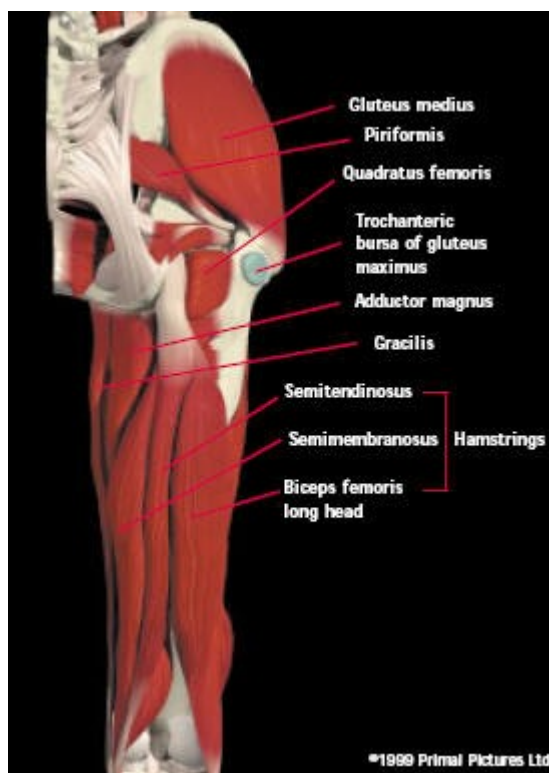
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- Hamstring Prevention Exercises

Hamstring injuries are one of the most prevalent among sprinters, hurdlers, and long jumpers. They also occur in sports involving acceleration and deceleration quickly like football and rugby. Hamstring injuries can occur despite completing stretching and strengthening programmes. Unfortunately once injured the risk of recurrence is high.

### Anatomy

The hamstrings are made up by three muscles, the Biceps Femoris, Semi-tendinosus and Semi-membranosus.



*Illustration 1: Hamstring Muscle Group*

All three share the same origin from the ischial tuberosity. Semi-tendinosus and Semi-membranosus insert onto the medial tibial condyle, Biceps Femoris inserts onto the fibula (the biceps femoris has two origins the second is from the linea aspera).

The hamstrings produce and control movements across two joints (bioarticular). This no doubt, places added loading onto the muscles making them more susceptible to injury. Movements include knee flexion (bending), hip extension (swinging leg backward). They also contribute to rotation around the knee joint and combination movements of rotation and adduction of the hip joint.

### Gait cycle

During running the ground contact time is at a minimum with the muscles having to work at a fast rate to produce and control the movement. Hamstring activity is activated in the second phase of the swing as the hip starts to flex and the knee begins to rapidly extend. At this stage the hamstrings are eccentrically working (lengthening to control movement). As the swing ends just before heel strike the hamstrings begin to contract to prepare for weight bearing. Through the foot strike the hamstrings continue to contract

(shorten).

The hamstrings have an important role in opposing the big quadriceps muscles. The aim is to decelerate the thigh, reacting too late can lead to injury and places extra stress on the hamstrings to contract quicker.

## **Symptoms**

### **A muscle tear**

Usually sudden due to trauma, pain is sharp on the use of the muscle or on stretch of the muscle. There will be an ill-defined ache throughout the posterior thigh at all other times. Walking may show an altered gait usually with a shortened stride on the affected side

*Hamstring injuries are diagnosed as type one or two. Type one is when it happens at speed and can be very limiting at first but rehabilitation progresses quickly. Type two happens through over stretching and can feel good but never quite right, rehabilitation can take a while. The closer the injury to the ischial tuberosity the longer the recovery.*

Bruising maybe present with slight swelling. Knee flexion will be painful, a straight leg raise will be limited. Some discomfort maybe felt during hip extension and at the end of active knee flexion due to using the muscle, when performed passively (someone else moves the limb) these two movements should be pain free until the end range of motion. Resisted knee flexion from a full hamstring stretch will be painful. On severe cases the patient will not be able to lift the leg actively from this position. If the injury is severe then muscle tests should always be done in mid range to prevent further injury. There should be a palpable site of pain (lesion site).

### **Hamstring Tendinopathy**

This can occur due to overuse over a period of time. It will occur either at the origin (buttock) or insertion (back of the knee) sites. it can also predispose the athlete to a hamstring tear. Initially an ache will occur at the end or towards the end of an activity. If the athlete continues it may turn into a more of a burning sensation. A tightness or pulling feeling may occur during weight bearing activities. A straight leg raise may show discomfort, all active movements will usually be pain free. Resisted knee flexion will cause pain, it may need to be tested several times to co-inside with the nature of the injury. For insertion injuries rotations of the knee may help in differentiating between the hamstrings. Resisted hip extension may cause discomfort for upper hamstring problems. The affected tendon will be painful on palpation.

Also test the calf muscles when pain is felt at the back of the knee.

Other injuries to look out for;

- Referred pain
- Ischial bursitis
- Adductor Magnus strains
- Avulsion of the hamstring from the ischial tuberosity (adolescents 14-18yrs)

### **Predisposing factors**

Successful management of hamstring injuries means highlighting a number of factors that may have contributed to the cause of injury.

- Decreased hamstring strength, or the surrounding muscles

If the loading on the muscle is too high the muscle will fail. This may be the hamstring itself working against the quads. The ratio of quads strength to hamstring strength is 60:40 (the hamstring should have at least 65% strength of the quads i.e. quads max lift 80kg the hamstrings maximum lift should be 52kg) if there is a weakness in the hamstrings they will not be able to rapidly decelerate the thigh. It maybe the quads which are too strong placing added load onto the hamstrings.

Also during isometric contractions of the hip the hamstrings produce less than 50% of the moment. If either the Gluteus Maximus or Adductor Magnus are deficient then there will be increased load on the hamstrings.

Placing of the foot relative to the centre of mass will affect the moment that the hamstrings must produce. The foot strike should be as close to the line of gravity as possible, the further the foot is placed in front the greater the load on the hamstring (over striding).

**Tip 1:** It may be difficult to prevent over striding especially for a footballer straining to get to the ball. Training at speed and in game like situations will increase adaptation of the muscles fibers to higher tensile forces.

**Tip 2:** Athletes who over stride or have a forward lean can use running drills to improve posture.

Core stability may also be helpful if weakness is present.

- Reduced flexibility

Flexibility of the hamstrings DOES NOT predict the incidence of strain. However once injured flexibility is reduced (protection mechanism and scar tissue maturation) and maybe a factor for ongoing problems. Flexibility of the surrounding structures should be looked at. A tight Psoas muscle can cause a forward tilt of the pelvis (causes a curved lower back). During the late swing in the gait cycle this can add extra load onto the hamstrings.

- Inadequate warm-up
- Increases in training happening to quickly
- time since previous injury
- referred pain

Referred pain from the back may cause altered recruitment of motor units. It is not uncommon for hamstring strains to occur following back pain.

- hamstring fatigue

Hamstring injuries are most commonly seen in the last quarter of a game.

- Poor posture/running technique

### **Clinic Treatments**

Initially the therapist would use ice and ultrasound to aid in the healing of the tissues.

After 72 hours the therapist can start to bring in light massage and passive movements to keep the muscle length. After a few weeks the treatments can be more aggressive and start working the muscles harder, deep tissue massage would be used with PNF stretching. It is vital to keep appointments close to make the treatments effective and to progress rehabilitation accordingly.

In the next stage the therapist can start to bring in running drills, trampet, wobble board and gym ball. For high performance athletes this is the time to start working closely with the coach especially as the athlete enters sport specific stage..

**Tip 3;** You don't want to isolate a team player when injured. in the early stages it maybe unavoidable but get them back in to working with the team whether at the side lines or joining in with the warm-up.

**Tip 4;** Upper body and core exercises can still be completed as long as they do not effect the injury. For a tennis player it can be a good opportunity to work on rotator cuff and wrist strength as it is usually neglected.

### **Rehabilitation Considerations**

When designing a programme it must take into consideration the;

- site of injury (belly, origin or insertion)
- severity
- which muscle
- how long since the injury occurred
- any other injuries present

Rehabilitation should also be specific to the athletes sport and position played.

It's Important to remember the stages of healing

- acute phase (1-5 days)
- Sub-acute phase (5 days to 2 weeks)
- Remodelling phase (1-6 weeks)
- Functional phase (2 weeks to 6 months)
- return to sport

A minor hamstring injury may take only 3 weeks to get back into full return but many will cut this time and have a recurrence. Each recurrence will take longer than the one before. Be patient and get through the full rehab programme. A more serious injury will take longer.

### **Rehabilitation**

In the early stages PRICE is always used. For the purpose of this article I will briefly take you through the rehab process for a grade 2 mid belly injury that happened 72 hours ago. You must remember the rehab must be specific to the athletes needs (sport, position) this is achieved in the functional phase.

Stage 1

At 72 hours the injury should have settled a little and active flexion and extension within inner and mid range can start

1. Seated hamstring curl
2. Standing hamstring curl
3. Prone hamstring curl

To start from a comfortable range a rope or towel maybe used to achieve the start position. Or you can use the non-injured leg to help you and apply the isometric pressure or help the injured side to achieve the ranges of motion. You can also bring in isometric holds (contraction without movement) for the prone hamstring curl using the other leg as resistance, hold each pain free position for 5 seconds repeat 10 times.

Other exercises include

1. Leg press
2. Dumbbell half squat
3. Dumbbell Romanian deadlift

All should be within pain free range 4-6 sets of 12-15 reps, build up from min to max slowly. For the active movements start with slow movements and increase speed gradually throughout the weeks.

Ice should still be used after all exercise and throughout the day to decrease pain and reduce inflammation. Some articles state not to do any stretching for the first 14 days but light outer range stretching is fine as long as its within the pain free range. Its important to achieve full range of motion as quickly as possible.

Endurance can be kept going with low impact step machine 1-10mins, cycle 1-10mins, and light walking progressing to jogging (400m).

To advance your programme you must be able to perform a full active stretch of the hamstrings. (Give 2-4wks to reach this stage). You need a full range, pain free sub maximal resisted contraction and a pain free isometric contraction all ranges. You should be able to jog 400m+ pain free.

## Stage 2

Start to bring in pendular swinging movements with the leg, start off with a small range of motion and slow speeds. At the end you should be bringing in sport specific movements like kicking for football or the running leg action for most sports, don't forget sideways, rotational and diagonal movements.

The active movements are now progressed to include weights. 6 sets of 8 reps. Start to bring in eccentric hamstring (gym ball leg curl) exercise 5 reps. These strength exercises should be done every other day.

**Tip 5:** Write a diary of each session recording how you felt at the beginning, middle and end as well as the progress of each exercise pain level, the weight used and reps/sets completed.

Endurance exercises should be increased and a hamstring running programme can be

introduced. A hamstring running programme is marking out 100m, put a cone at 30m and 60m as well. Start with a slow acceleration walking to jogging when you reach the first cone you should be at the fastest speed you feel comfortable at. When you reach the second cone you have until the last cone to reduce your speed nice and slowly. Progression is made by shortening the acceleration and deceleration distances.

We can get more functional now bringing in movements that are required from the sport the athlete competes in. For racket sports hitting shots without the sprints can be done working on technique (very easy serving). Footballers can start to bring in gentle ball skills.

### **Stage 3**

All of Stage 2 should be achieved and pain free. Its now time to bring in full functional exercises. Plyometrics, acceleration, decelerations, changing directions (if needed). Multi-directional running. Start to bring in full game skills and tactics slowly in a controlled game.

To get into full game situations a fitness test should be done to assess the injury site, the player, the position played and the sport. A runner may get back quicker than a footballer who is required to move in different directions at different speeds. Don't forget the length of time the player or athlete is expected to play for. A good time frame is 3 months.

Pro-Am Sports Injury Clinic shows you some Hamstring Injury Prevention Exercises on this video link <http://youtu.be/jRySBPVCaXs>

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