The Best Ways to Treat Hamstring Injuries
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The Hamstring Muscles

Semitendinosus

Semimembranosus

Biceps femoris
(long head)

Biceps femoris
(short head)
Of all the running-related muscle injuries, hamstring strains are the most likely to become chronic. More than two-thirds of runners that strain their hamstrings will suffer re-injury within one year. With stride lengths exceeding 14 feet, sprinters are especially vulnerable to re-injury. Almost always, the hamstring strain occurs just before the lead foot hits the ground, when hamstring tension peaks to resist forward motion of the swinging leg.

Even though the hamstrings consist of four different muscles (Fig. 1), runners almost exclusively injure their outer hamstring muscle, the long head of the biceps femoris. The reason for the higher injury rate in the outer hamstring was a mystery until recently, when researchers from the University of Wisconsin determined that because the biceps femoris muscle attaches lower down the leg, it is under greater strain while the leg is swinging forward (Fig. 2).

In an MRI study evaluating the location of hamstring strains in different athletes, the only runner to injure a hamstring other than the biceps femoris was an older man who severely strained his inner hamstring muscle while performing stretches prior to running, not while running. This is consistent with research showing that dancers almost always injure their inner hamstrings, which are very sensitive to stretch injuries.

As with most injuries, the single best predictor of future injury is prior injury, possibly because the injured muscle heals with less flexibility and/or impaired coordination. Because of the exceptionally high recurrence rate associated with hamstring strains,
rehabilitation of this injury must be comprehensive.

In an **impressive study** evaluating the success of different treatment regimens used in the management of acute hamstring strains, Marc Sherry and Thomas Best prove that compared to a protocol of static stretching and conventional hamstring exercises, an exercise regimen including agility and trunk stabilization exercises produced significantly better short and long-term outcomes (see Table 1 for a summary of these exercises). In contrast to conventional rehabilitation, the agility and stabilization group returned to sport sooner (22 days versus 37 days), and suffered fewer re-injuries during the first two weeks after returning to sport (55 percent of athletes in the conventional rehab group were re-injured, compared to no re-injuries in the progressive agility and trunk stabilization group).

The beneficial effects of the agility and stabilization exercises were even present one year following return to sport, as 70 percent of the athletes treated with conventional stretches and exercises were re-injured, compared to only 7.7 percent of the athletes completing the progressive agility and trunk stabilization program.

Because fatigue increases the potential for hamstring injury while running, I tell runners to briefly stop to stretch their outer hamstring during long runs. The stretch illustrated in figure 3 isolates the biceps femoris and it is typically held for 15 seconds with the knee bent at different angles.

In a **two-year study** evaluating the efficacy of hamstring stretches to prevent injury, scientists demonstrated significantly reduced rates of hamstring strains in Australian Rules football players when the stretches were performed during workouts and competition. This study suggests that occasionally stopping to stretch the outer hamstring during your long runs may lessen the potential for re-injury, especially during the first few months following the initial strain.

A frustrating complaint following hamstring injury is a “toothache-type pain” that occurs near the upper hamstring while sitting and driving long distances. This pain is the result of hypersensitivity in the scar tissue that forms in the strained muscle-tendon junction of the upper biceps femoris muscle (Fig. 1A). Rather than treating the pain with over-the-counter anti-inflammatories, which can interfere with tendon remodeling, a more effective approach to repair the tendon is to perform deep tissue massage directly to the muscle-tendon junction of the upper biceps femoris.

Using electron microscopy, several animal studies have shown that deep tissue
massage stimulates tendon repair. Another important way to repair the upper hamstring tendon is with heavy-load eccentric exercises. The exercises shown in figure 4 isolate the upper portion of the biceps femoris muscle. My favorite is the one illustrated in figure 4C. By tilting slightly to the right, you can really feel the left biceps femoris tense. I recommend 3 sets of 15 repetitions and the resistance in figure 4C can be increased by holding a weight between your arms.

While waiting for a hamstring injury to heal, it is important that runners avoid prolonged wet-vest running in a pool. Although excellent for maintaining aerobic capacity while recovering from stress fractures, pool running fails to adequately stress the hamstrings, since resistance provided by the water forces the quadriceps to pull the lead leg forward (i.e., contract concentrically), while the hamstrings are stressed only while pulling the leg back.

This is in contrast to conventional running, when the hamstrings fire eccentrically when they lengthen to stop forward motion of the lead leg. By failing to strengthen the hamstring eccentrically, pool therapy often results in rapid hamstring re-injury as soon as the runner attempts to run fast. The best way to avoid eccentric hamstring weakness is by performing the exercises illustrated in figure 4 daily.

When you get back to running again, it is important to wear comfortable and lightweight running shoes. Because the weight of the foot has such a long lever arm to the upper hamstring, a heavy running shoe greatly increases strain in the upper hamstring during late swing phase and should therefore be avoided. Heavy motion control running shoes can really be a problem if eccentric hamstring weakness is present.

Lastly, until the hamstring tendons are strong and flexible, you should shorten your stride and increase your cadence while running. As long as you’re not running too fast, it is usually possible to continue running even during the early stages of recovery. By being consistent with a thorough home program, you can usually get back to full-speed training within a few months and your potential for re-injury will be greatly reduced.

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Fig 2

Fig 3
Phase 1.

1. Low-to-moderate-intensity sidestepping, 3 x 1 minute.
2. Low-to-moderate-intensity grapevine stepping (lateral stepping with the trail leg going over the lead leg and then under the lead leg), both directions, 3 x 1 minute.
3. Low-to-moderate-intensity steps forward and backward over a tape line while moving sideways, 2 x 1 minute.
4. Single-leg stand, progressing from eyes open to eyes closed, 4 x 20 seconds.
5. Prone abdominal body bridge (performed by using abdominal and hip muscles to hold the body in a face-down straight-plank position with the elbows and feet as the only point of contact), 4 x 20 seconds.
7. Bide plank. Repeat 4 times, hold 20 seconds on each side.
8. Ice with hamstring in a stretched position for 20 minutes.

Phase 2.

1. Moderate-to-high-intensity sidestepping, 3 x 1 minute.
2. Moderate-to-high-intensity grapevine stepping, 3 x 1 minute single-leg windmill touch, (Figure 4B).
3. Push-up stabilization with trunk rotation (performed by starting at the top of a full push-up, then maintain this position with one hand while rotating the chest toward the side of the hand that is being lifted to point toward the ceiling, pause and return to the starting position), 2 x 15 reps on each side.
4. Feet feel in place (performed by jogging in place with increasing velocity, picking the foot only a few inches off the ground), 4 x 20 seconds.
5. Symptom-free practice without high-speed maneuvers.
6. Ice for 20 minutes if any symptoms of local fatigue or discomfort are present.

Key: Low intensity: a velocity of movement that is less than or near that of normal walking. Moderate intensity: a velocity of movement greater than normal walking but not as great as sprint. High intensity: a velocity of movement similar to sprint activity. Progression criteria: subjects progressed from exercises in Phase 1 to exercises in Phase 2 when they could walk with a normal gait pattern and do a high knee march-in-place without pain.