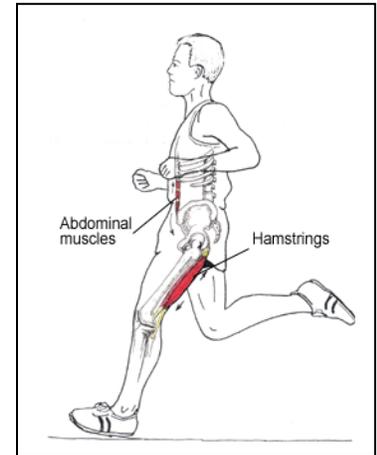


Hamstring Strain

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ANATOMY

There are three muscles in the back of the thigh that are collectively called the hamstrings. They are named biceps femoris, semitendinosus and semimembranosus. The two attachment sites for the hamstrings are the ischial tuberosity (the bony prominence felt under each buttock when sitting), and the back of the knee at the tibia (shin bone). Contraction of the hamstring can cause the knee to flex, bringing the heel toward the buttock. The hamstrings also cause the hip to extend the thigh backwards when the knee is straight. The hamstring muscles provide control to the pelvis when bending forward with the knees straight. When walking or running, the hamstrings function to decelerate the leg and foot as it rapidly moves forward to land on the ground.



INJURY

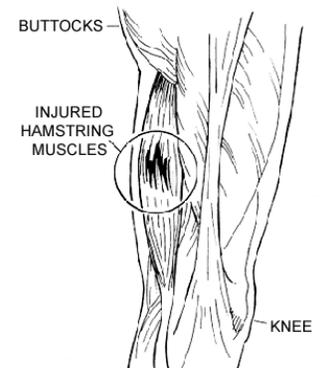
A hamstring strain is an excessive stretch or tearing of muscle fibers and related tissues. Hamstring strains can occur at one of the attachment sites or at any point along the length of the muscle. They are classified as either 1st, 2nd, or 3rd degree, with a grade 3 hamstring strain being the most severe.

A pulled hamstring muscle most commonly presents as a sudden pain in the back of the thigh during fast running or sprinting, when there are great force demands on the muscle. Although hamstring strains often occur while sprinting, they also can occur during jumping and other activities where quick starts and stops are required. High risk sports for hamstring strains are: soccer, football, rugby, baseball, basketball, water skiing and many track and field events. Runners are especially susceptible to chronic hamstring strains due to the repetitive nature of the sport.

Also, when there is an imbalance of the strength of the hamstring muscles with relation to the quadriceps muscles, the risk of hamstring strain is greater.

Severity of Muscle Strains. Muscle strains are graded as mild, moderate and severe. The more severe the strain, the longer the time to recover.

First Degree (Mild). This injury is the most common and usually the most minor. This injury is a 'pulled muscle' with a structural disruption of less than 5 percent. With a first-degree injury, you can expect to be back to sports within 1 to 3 weeks.



Second Degree (Moderate). This injury consists of a more significant, but still incomplete muscle tear. This a partial muscle tear and require 3 to 6 weeks of rest and recovery before you can return to full activity.

Third Degree (Severe). This injury results in complete tearing of the muscle–tendon unit. A third-degree muscle strain can take many weeks or months to fully heal.

TREATMENT

Rest from the activity that caused the muscle strain allows for healing to occur. Immediately following the muscle strain, ice should be applied over the painful area for 20 min. Periodic icing (2-3 times per day) will help to control swelling and reduce pain. Heat should not be applied to the area during the first 7-10 days since this may increase swelling and bleeding within the muscle. An elastic wrap or compressive stocking may be applied to the area to assist with swelling control. If the compressive device causes increased discomfort or "pins and needles" in any part of your leg, it is probably too tight. Lying down periodically with your leg elevated allows gravity to assist with your effort to control the swelling.

Though some experts believe early stretching to be valuable, caution should be taken to avoid aggressive stretching (stretching beyond the point of mild discomfort) which may disrupt healing. **NO** stretching or resistive exercise should be done during the first 3 weeks following injury.

As a general rule of thumb, any activity that elicits pain at or near the injured site may be causing further injury and will only hamper your recovery effort.

A gradual conditioning program, specific to your sport, will prepare the hamstrings for the high demands placed upon them during athletics. Don't forget to incorporate a proper warm-up and stretching session into your conditioning program and athletic competition.

Rehabilitation Program

Exercises outlined in the rehabilitation program are described and illustrated in the back of the handout. The 'time line' that is illustrated in the following rehabilitation program is typical after grade 2 and 3 injuries. After a grade 1 injury, rehabilitation can usually begin at phase three.

Phase one - The first week after injury

- Rest from painful activities
- Ice 20 minutes, three times a day
- Compression wrap or neoprene sleeve

Phase two – the second and third week after injury

- Ice once a day, 20 minutes, after exercises
- Start active ROM exercises, 1-2 times a day, 10 to 20 repetitions
 - Quad sets
 - Heel slides (towel assist if painful)
 - Toe raises
 - Standing hamstring curls
 - Standing or prone SLR hip extension
 - Stationary bicycle, 10 minutes, no resistance, if pain free
 - **NO stretching**

Phase three – the 4th, 5th and 6th week after injury

Begin gentle strengthening, 1 time a day, 5 days a week, 15 to 30 repetitions

- Start 1lb ankle weight.
- Standing hamstring curls, add one pound a week to 5 pounds
- Standing or prone SLR hip extension, PRE one pound a week to 5 pounds
- Stationary cycle, add 1 minute per session up to 30 to 40 minutes
- Slow treadmill walking, pain free, start 5 minutes and add one minute per session to 20 minutes or start “Return to Walk\Run Program” (see below).
- Gentle pain-free stretching, two times a day (see stretching illustrations and instructions in the back of the handout).

Phase four – 7 to 12 weeks after injury

- Start gradual hamstring and quadriceps strength training, maintaining a 4:3 Hamstring: Quadriceps ratio, 3 times a week.
- Follow ‘Strength Training for the Knee’ supplement and Principles of Progressive Resistance exercise.
- Stationary cycle
- Gentle hamstring stretching
- Start “Return to Full Speed Running Program if able to jog 1 mile pain-free.

Phase five – from 12 weeks onward

- Continue above program
- Start return to sports training

Return to Walk/Run program

General Instructions

1. Walking/jogging should be done no more than every other day.
2. The program should be performed step by step. Do not advance your program until you can successfully complete the initial step. Let pain and swelling be your guide. If the activity creates pain, swelling, or causes you to limp, go back to the previous step.
3. Before starting the program and after completion of the program, allow 15 minutes to perform warm-up and gentle stretching exercises.
4. Cool down by gently stretching all muscle groups
5. Ice for 20 minutes after cool down stretching.

Phase 1:

- Day #1 Walk 1/4 mile -- easy pace (1/2 speed)
Day #2 Walk 1/4 mile -- (3/4 speed)
Day #3 Walk 1/4 mile -- full speed - briskly

Phase 2:

- Day #1 Walk 1/2 mile -- easy pace (1/2 speed)
Day #2 Walk 1/2 mile - (3/4 speed)
Day #3 Walk 1/2 mile -- full speed - briskly

Phase 3:

- Day #1 Walk 3/4 mile -- (3/4 speed)
Day #2 Walk 3/4 mile -- (full speed — briskly)
Day #3 Walk 1 mile -- (comfortable pace: $\frac{3}{4}$ to full speed)

Phase 4:

- Day #1 Jog $\frac{1}{4}$ mile, Walk $\frac{3}{4}$ mile, comfortable pace
Day #2 Jog $\frac{1}{2}$ mile, Walk $\frac{1}{2}$ mile, comfortable pace
Day #3 Jog $\frac{3}{4}$ mile, Walk $\frac{1}{4}$ mile, comfortable pace

Phase 5:

- Day #1 Jog $\frac{3}{4}$ mile, Walk $\frac{1}{4}$ mile, comfortable pace
Day #2 Jog 1 mile
Day #3 Jog 1 mile

You can continue to increase distance by $\frac{1}{4}$ mile per session until you reach your desired distance. When you have reached your training distance without causing any pain or swelling, and have a normal running form, you can gradually start to increase your running speed or progress to the “Return to sprint program”.

Return to sprint program

Warm-up, Stretch and Ice

Be careful to be sure that you warm-up well and stretch lightly before workouts, and stretch well again after workouts. Generally, you should do some walking, cycling or jogging so that you break a sweat before starting the running program. You should **then** stretch **before** beginning the running drills. After completing the running drills, gently stretch all muscle groups as you cool down. Apply ice for 20 minutes after that

The criteria to progress

Do not progress to the next step in the progression until the present step is pain free.

Frequency: every other day or 3 to 4 times a week.

- DAY 1 Run ½ speed 100 yards, 10 repetitions
2 No Run
3 Repeat Day 1
4 No Run
5 Repeat Day 1
6 Run ¾ speed 100 yards, 10 repetitions
7 No Run
8 Repeat Day 6
9 No Run
10 Repeat Day 8
11 No Run
12 Run ½ speed, 100 yards, 3 repetitions
Run ¾ speed, 100 yards, 3 repetitions
Run full-speed, 50 yards, 4 repetitions
13 No Run
14 -42 Continue workout from Day 12, adding one 50 yard run each workout until you can do (10) 50 yard full speed runs. This progression should take a minimum of 24 days (3 weeks, 3 days), but may take longer if pain or swelling occurs. Do not progress to the next step in the progression until the present step is pain free, without swelling.

Strength Training for the Knee

This section is to help you with a program rebuild the strength of the knee muscles after injury to the hamstring muscles. It is intended as a guideline to help you organize a structured approach to strengthen the knee muscles.

Precautions When Exercising:

- Avoid pain at the hamstring strain site
- Avoid pain and/or crepitus (grinding) at the patella (kneecap)
- Build up resistance and repetitions gradually
- Perform exercises slowly avoiding quick direction change and impact loading
- Exercise frequency should be 2 to 3 times a week for strength building
- Be consistent and regular with the exercise schedule

Before Starting Your Workout

- Warm-up prior to exercising by stationary cycling, elliptical machine or treadmill walking uphill
- You are “warmed –up” when you have started sweating
- Gently stretch all muscle groups next (see attachment for recommended stretches)
- Do exercises involving multiple muscle groups first and individual muscle groups last
- Do aerobic workouts *after* strength workouts
- Cool-down by stretching after finishing exercise

Progressive Resistance Exercise (PRE) Principle

- To build muscle strength and size, the amount of resistance used must be gradually increased.
- The exercises should be specific to the target muscles
- The amount of resistance should be measurable and gradually increased over a longer period of time
- To avoid excess overload and injury, the weight or resistance must be gradually increased in increments of 5 to 10 %
- Resistance can be increased gradually every 10 to 14 days when following a regular and consistent program
- Adequate rest and muscle recovery between workout is necessary to maximize the benefit of the exercise
- If the PRE principle is followed too strictly, the weights potentially will go higher and higher.
- At a certain point, the joints and muscles will become overloaded and injury will occur.
- This eventuality can be avoided by refraining from using excessive weight during strength training.

Knee Muscle Strength Ratio

- When there is an imbalance of muscle strength at the knee between the hamstring muscles and the quadriceps muscle, the risk of hamstring strain is greater in running and sprinting sports.
- The ideal ratio of strength between the hamstrings and quadriceps is 4:3, or Q:H=4:3.
- The strength ratio of Q:H is difficult to measure without testing equipment.
- In most cases, the hamstring muscles cannot be 'too strong'.
- You can make sure that you have an optimal Q:H ratio by doing an equal amount of exercise sets and repetitions for quadriceps (Leg press, squat, single leg progression and knee extension machine) and Hamstrings (Hamstring curl machine, roman chair).
- Follow the PRE principles to build strength maximally when using the hamstring curl machine

Basic Knee Strengthening Program after Hamstring Muscle Strain

- Frequency: 2 to 3 Times per week
- Sets: 3 for leg press, squat, knee extension and step-up
6 for hamstring curl machine and roman chair
- Repetitions per set: 10-15
- Emphasis is to build muscle strength using BOTH legs
- Progress according to the PRE principle

Basic Program Exercises- see illustrations at the back of the handout.

- Leg Press
- Hamstring Curl * (*= important hamstring exercise)
- Knee extension machine (short-arc 30 degrees)
- Roman Chair *
- Chair Squat (hold dumbbells for resistance) or barbell squat
- Calf Raises
- Hip Abductor/Adductor machine
- Step Up/Down (see attachment for single-leg progression)

If you do not have access to gym equipment, the following exercises can be substituted using ankle weights (see illustrations and instructions attached):

- Straight leg raise
- Short-arc lift
- Side lying abduction
- Standing hamstring curl
- Toe raises

In General, the Basic Knee Strengthening Program is good for most people who are active recreationally, but who do not participate in running and jumping sports. For people who will participate in running and jumping sports, the following Advanced Knee Strengthening Program can be used to develop a higher level of knee strength.

Advanced Knee Strengthening Program after Hamstring Muscle Strain

- Frequency: 2 to 3 Times per week
- Sets: 3 for leg press, squat, knee extension, step-up and single leg alternates
6 for hamstring curl machine and roman chair
- Repetitions per set: 10
- Emphasis is to continue to build muscle strength using both legs and progress to Advanced Exercises using the Single leg.
- Advanced Single leg exercises are integrated with the exercises from the Basic Knee Strengthening Program.

The following single leg drills are integrated into the workout on an alternating basis:

- Single Leg Wall Slide
- Single Leg Squat (see attachment for progression of single leg drills)

So that the Advanced Knee Strengthening Program would be as follows:

- Leg Press
- Hamstring Curl
- Knee extension machine (short-arc 30 degrees)
- Roman Chair
- Chair Squat (hold dumbbells for resistance or barbells)
- Calf Raises
- Step up/down
- Alternate workouts with single leg wall slide and single leg squat
- When starting the new single leg drills, start with 3 sets of 5, and add one repetition per set, per workout until you can do 3 sets of 10.
- When 3 sets of 10 are easy and pain free, then you can hold dumbbells to increase resistance and strength.