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## **Acute Muscle Strains of the Thigh in Athletes**

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### **Overview**

A muscle strain is typically a muscle tear or “pull”, and is a common injury among young athletes. It is very common in the thigh, and can occur in any of the three major muscle groups in the thigh. In the back of the thigh, the hamstring muscles help flex or bend the knee. The quadriceps muscles are located on the front of the thigh and they help to extend or straighten the knee. The adductor or groin muscles are on the inside of the upper thigh and help to pull the legs together. The hamstring and quadriceps muscles cross two joints, the hip and the knee. Muscles like this that cross two joints are put under increased strain and, because of that, the hamstring and “quad” muscles are very commonly strained or injured.

### **Anatomy**

The quadriceps muscles run down the front of the thigh, and consist of four muscles: the medialis, intermedius, lateralis, and biceps femoris. Some attach on the front of the pelvis, while others attach on the top of the thigh (femur) bone. They continue down the leg and form a common tendon (the quad tendon), which attaches to the top part of the shin (tibia) bone in an area called the tibial tuberosity (figure 1).

The hamstring muscles run down the back of the thigh. There are three major hamstring muscles: the semitendinosus, semimembranosus, and the biceps femoris. They attach near the buttocks on a bone in the pelvis called the ischial tuberosity and continue down the back of the leg across both the hip and then the knee joints, to attach on the back of the tibia (shin) and fibula bones (figure 2).

The adductor or groin muscles attach on the front part of the pelvis in the midline where the two halves of the pelvic bones joint together. They extend down the leg and attach about half way down the thigh (femur) bone.

### **Muscle Tears**

A muscle strain is essentially a tearing of the muscle. It is graded according to its severity into three grades. A grade I strain is a mild stretch or small tear and heals quickly; a grade II strain is a partial tear (part of the muscle stays normal, part of it tears); a grade III strain is the worst and represents a complete tear of the muscle. As muscles approach the bone where they attach, they turn into a tough connective tissue called a tendon. It is at this spot where the muscle turns into tendon (called the muscle-tendon



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junction) where most muscle strains occur. Less commonly, a tendon can tear away from where it attaches to the bone, and this is called an avulsion injury.

### Causes

Muscle overload is the most common reason for a muscle strain. This happens when the muscle is loaded or stretched beyond its limits. The job of a muscle is to shorten or contract, thereby causing a joint to move in a particular direction. Most muscle strains occur when a contracted or shortened muscle is asked to slowly *lengthen*. This may sound contradictory, but is a common occurrence.

As an example, when a person walks down a step, the knee of the lead leg is relatively straight when it contacts the lower step. The quad muscle is the front of the leg contracts to keep the knee in this straightened position. As the body weight of the person is slowly lowered down the step, the knee slowly bends to accept the weight of the body, and the quad muscle slowly *lengthens* itself in a controlled way to gently lower the body down to the next step. This controlled *lengthening* of a contracted muscle is called an eccentric contraction, and is the most demanding activity required of a muscle. It is also the time when the muscle is most vulnerable to injury or tearing.

### Risk Factors

There are several factors that make it more likely to suffer a muscle strain.

Muscle Tightness: A tight muscle is less able to slowly lengthen itself, making it vulnerable to a muscle strain. This is why a daily stretching program is helpful.

Muscle Imbalance: Muscles on opposite sides of a bone must work together to smoothly move a joint. In the case of the thigh, the quad and hamstring muscles must work together to move the knee joint. When one muscle is significantly stronger than its counterpart, this imbalance can lead to one muscle over-powering or stretching the opposite muscle, causing a strain. In the case of the thigh, the quad muscle is typically stronger than the hamstring muscle, but an excessive imbalance between the two can lead to a muscle strain.

Muscle Fatigue/Poor Conditioning: If a muscle is weak, it will often fatigue faster and be less able to cope with the stress of exercise. A fatigued muscle is more prone to a stretch injury.

Choice of Activity: Anyone can get a muscle strain, but sports or activities that require sudden, strong bursts of energy like sprinting or changing directions are at higher risk. Sports such as soccer, basketball, and football as well as sprinters and dancers are particularly prone to muscle injuries.

Growth Spurts: Muscle strains commonly occur in growing adolescents. As a child's bones grow, they may grow faster than the muscles and tendons. This causes the muscles

