Interosseous Muscle Strains

These Small, But Important Muscles Keep Us Walking

By Ben E. Benjamin

When clients have a sharp pain between two or more metatarsals in the dorsal anterior foot, they are likely suffering from an interosseous muscle strain. The pain can be felt not only in the dorsal but also the plantar surface of the foot, or, in some cases, straight through the foot. These four muscles, which are engaged each time you take a step, help to stabilize the front part of the foot and prevent the toes from spreading apart when you walk. They don't seem that important to us until they start to hurt.

In the acute phase of the injury, the pain can be so severe that many people will have difficulty even bearing their full weight on the injured foot.

The interosseous muscles stabilize the foot while walking or running. They abduct and help flex and stabilize the toes and feet, although abduction is less important in the mid-foot than stabilization. They also control the direction of the toes during vigorous activity, allowing the long and short flexors to perform their actions. The interosseous muscles contribute to maintaining the stability of the anterior metatarsal arch of the foot, as well as the medial and lateral longitudinal arches, due to the position of the joints between the metatarsal bones and the phalanges.

Let's look at the anatomy in more detail, especially the relationship between the interosseous muscles and the metatarsal bones of the foot.

ANATOMY OF THE INTEROSSEOUS MUSCLES

The four interosseous muscles are situated between the five long metatarsal bones of the mid-foot. They are bipenniform (feather-shaped) muscles, arranged on each side of a tendon. Each interosseous muscle has two heads and originates

from the proximal half of the sides of adjacent metatarsal bones. The two heads of the muscle form a central tendon, which passes deep to the transverse metatarsal ligament. The first tendon is inserted into the medial side of the second toe; the other three are inserted into the lateral sides of the second, third, and fourth toes.

HOW AND WHY INTEROSSEOUS MUSCLES GET INJURED

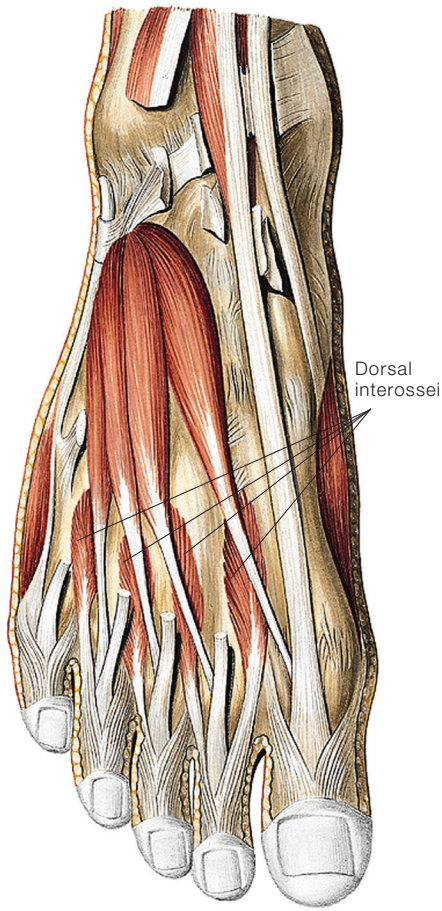
No unusual activity is needed to strain the interosseous muscles. Strains of these small, but important muscles are fairly common and can be caused by being on your feet for longer periods of time than the body can sustain. Such strains are frequently noticed when you first step out of bed in the morning and are walking barefoot. A sharp pain is felt with each step. This may follow a day of heavy exertion, but not necessarily. The pain is lessened, or even eliminated, by wearing shoes because the shoe stabilizes the front of the foot. However, in severe cases, the pain may persist during walking, with or without shoes. This knife-like pain is usually felt between the bones of the second, third, and fourth toes on the dorsal surface of the foot, and in some cases, on the plantar surface as well. In mild cases, the pain may last for a few weeks then disappear for a short while, only to return once again with increased activity. In the acute phase of the injury, the pain can be so severe that many people will have difficulty even bearing their full weight on the injured foot.

In this injury, multiple small muscle tears occur as a result of frequent fatigue in the leg. The muscles of the leg tire and the brunt of the body's weight falls on these very weak and small muscles between the toes. They often tear in several places at once, more commonly on the dorsal foot, as mentioned earlier. When they heal, matted scarring usually develops. This scar tissue can then re-tear under prolonged exertion. Additional symptoms of interosseous muscle strains are swelling, tenderness, and bruising on the dorsal and/or sometimes the plantar aspect of the foot. Slight pressure on the muscle is often painful. All of these symptoms may limit the range of motion of the injured foot.

There are various scenarios and causes for this kind of injury: a crush injury that often results from dropping a heavy object directly onto the foot, which causes immediate severe soft-tissue damage and pain; an injury due to a fall from a great height, or even a fall off a curb which causes a twisting of the foot; and a slow onset of an interosseous strain injury from excessive standing, especially when on a hard surface like concrete, or from participating in continuous running sports that have few breaks. These activities bring on fatigue of the muscles of the legs and feet and may lead to this type of injury.

Those who wear shoes that are excessively tight or wear very high heels that place unnatural pressure on the forefoot "plant the seeds" of an interosseous muscle injury.

Foot injuries are fairly common among athletes. It is important to remember that some seeming interosseous muscle injuries could actually be fractures of one of the



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metatarsal bones of the mid-foot. Therefore, before working on an interosseous muscle strain, have the client consult their physician to rule out the possibility of a fracture.

Mid-foot injuries involving fractures or dislocations of the bones often include soft-tissue injuries to both the interosseous muscles and the ligaments, and may continue to cause pain after the fractured bone(s) has healed.

Interosseous muscle injuries, or mid-foot sprains, are often challenging for health professionals to assess or diagnose. The rate of missed or delayed diagnoses is approximately 24 percent. It's worth mentioning that certain medical illnesses may contribute to these missed or delayed diagnoses. For example, diabetes patients suffering from peripheral neuropathy, or those with Raynaud's disease, may have a higher threshold for pain and could be unaware of the high level of pain caused by a mid-foot sprain. Timely assessment and proper treatment greatly improve the chance of successful healing and reduce the odds for adhesive scar tissue formation and other complications. If a person can't walk properly, their gait becomes distorted and injuries to the knee, hip, and lower back may soon follow.

Interosseous muscle injuries are often brought on by a sprain to the Lisfranc ligament, a large and strong interosseous ligament that attaches the first cuneiform bone to the second metatarsal bone. When this powerful stabilizer of the medial mid-foot is sprained and can't do its job, the interosseous muscles will try to take over and may also become strained in the process. Another problem is that a neuroma (an inflamed nerve) in the foot may also cause confusion during the assessment process. What appears to be a neuroma may, in fact, be a severely strained interosseous muscle.

Mid-foot sprains can occur at all ages, even in children as young as 3 or 4 years old, but they are much more common in people who participate in sports or recreational activities like ballet, baseball, basketball, football, hockey, mountain biking, soccer, and windsurfing. Football players, as well as the elderly, are found to have a high incidence of these mid-foot sprains.

INJURY VERIFICATION

Metatarsal Compression Test

To test for an interosseous strain, clasp your hands underneath the ball of the foot with the heels of your hands on the medial and lateral aspects of the foot and slowly exert pressure on both sides of the metatarsals by squeezing the heels of your hands together (Image 1). If the person has this injury, the squeezing will reproduce the pain.

Palpation Testing

Now place your thumb or index finger between the metatarsal bones on the interosseous muscles (Image 2). Apply pressure laterally and move the tip of your finger anteriorly and posteriorly while maintaining firm pressure on the edge of the metatarsal bone. Do this in several places along the bone in the area of the client's pain. This is painful when interosseous strain is present.

TREATMENT CHOICES

Self-Treatment

To treat yourself, wrap athletic trainer's tape securely around the metatarsal region of your foot to help stabilize it. Be sure the tape doesn't bind too much during walking. Elevate your legs for five minutes once or twice a day by lying flat on the floor, bending your legs at the knees, and positioning the lower leg up on the seat of a chair. Two or three weeks of rest are often effective if the strain is not too severe. You should not walk barefoot at any time during the rehabilitation period since that places more stress on these injured muscles. If the pain recurs, adhesive scar tissue has formed and treatment is necessary. Flex and extend your toes many times throughout the day and practice the exercises described below under Exercise

Therapy. Once the pain has subsided, a gradual return to activity is recommended while wearing shoes with good support.

Myofascial Therapy

The fascia of the foot is inextricably connected to the muscles, the tendons, and the ligaments throughout the foot and ankle. If you are trained in myofascial work, begin by working the fascia on the dorsal foot up to the knee, then work the fascia on the plantar surface of the foot up the calf. There may be major or minor fascial components, depending on the nature of the injury.

Friction Therapy

Beginning at the distal end of the muscle, apply a friction motion pressing laterally while frictioning in an anterior to posterior direction (Image 2). Move to different segments of the muscle as it attaches to the metatarsal bone wherever you have found tenderness with mild pressure. Be sure to work on both sides of the muscle where it attaches to the metatarsal bones between each of the toes that are affected.

Exercise Therapy

Once there is no pain during walking, exercises for the feet and toes can begin. You will need a few simple supplies, including a small towel approximately 24 by 15 inches, and 1-, 2-, and 3-pound weights. Place the towel on a wood or tile floor so that the long end is facing away from you and place a 1-pound weight at the far end of the towel. Now place your heels on the ground and your toes on the near edge of the towel. Using only the toes, gradually pull the towel toward you one pull at a time. (You might want to dampen the towel to make this a bit easier at first.) When the towel can be easily pulled in all the way, place a 2-pound weight near the end and repeat, working your way up to 4 or 5 pounds.


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Then place the towel sideways in front of you and place the weight at one end. Now, with one foot, move the towel by inverting the foot with the heel on the ground and the forefoot on the towel. Then reverse the direction and evert the foot. In these two exercises, you are combining the muscles that control the toes with the muscles of the lower leg.

SUMMARY

Injuries to the interosseous muscles of the forefoot are fairly common and make walking painful. Recovery of full function is possible with accurate assessment, skillfully applied treatment, and exercise therapy. **m&b**

Editor's note: Massage & Bodywork *is dedicated to educating readers within the scope of practice for massage therapy. Essential Skills is based on author Ben E. Benjamin's years of experience and education. The column is meant to add to readers' knowledge, not to dictate their treatment protocols.*

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