Hughston Health Alert

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Congenital Malalignment of the Foot

The foot is an amazing part of our anatomy. It is tough and resilient, yet sensitive enough to feel breadcrumbs when walking across the floor. Its primary function is to carry and to transfer the body's weight during walking and running. Anatomically, the 26 bones of the foot are joined and held together by ligaments forming multiple joints that enable the foot to move during the walking cycle. As a result, the foot easily adjusts to uneven surfaces. The foot is poorly adapted to long periods of standing and is less fatigued by walking or running. The functions of weight bearing and weight transfer of the feet work in harmony with the rest of the body, especially the lower extremities. Therefore, the relationship of the foot to the body as a whole, especially the alignment of the hip, knee, and ankle, must be considered during a medical examination for foot problems. Many congenital (present-at-birth) malalignment problems improve with growth; however, some require evaluation, treatment, and, occasionally, surgery.

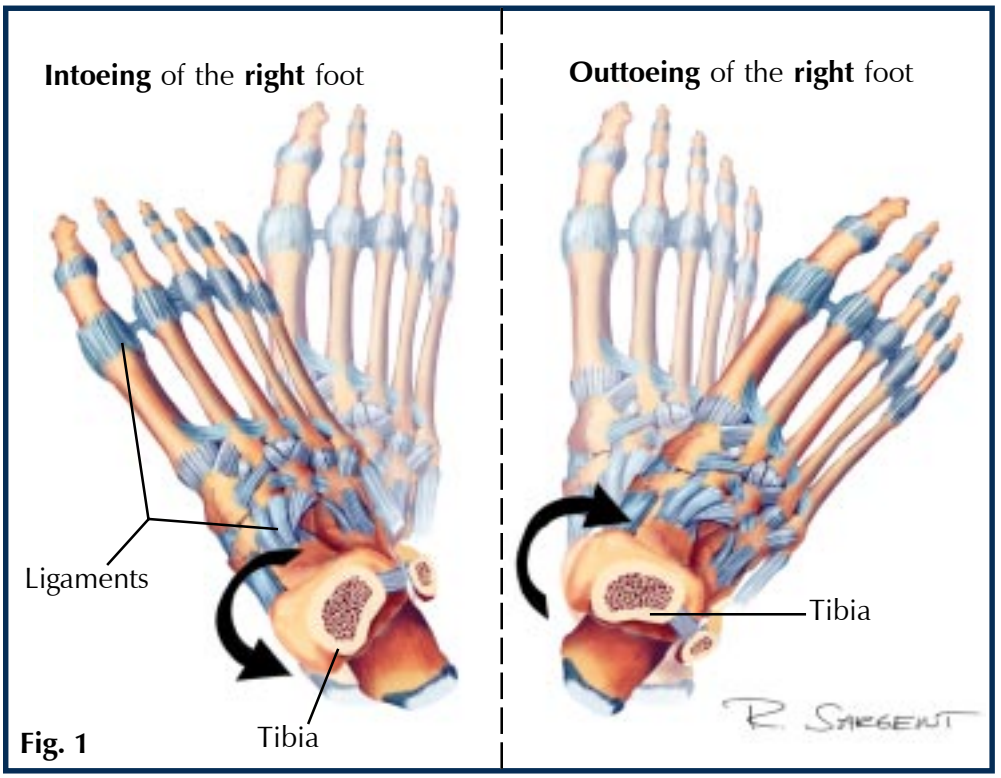

Fig. 1

Intoeing and outtoeing

One congential problem children can have is with their toes turning in or out, called intoeing or outtoeing (Fig. 1). Intoeing or outtoeing can originate from the hips to the midfoot or anywhere in between. Other causes of intoeing or outtoeing are internal tibial torsion and external tibial torsion (the tibias turn toward or away from each other, respectively). Mild cases generally straighten with growth, but sometimes a Denis-Browne night bar is needed when the child begins walking. In severe cases, surgery is required to align the hip, knee, and ankle.

Bowlegs and knock-knees

When we are born, we are usually bowlegged. At around 2 years of age, the legs straighten, and then at about

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2-1/2 to 4 years, there is progression toward knock-knees. During that period of time, the feet adapt as the alignment of the legs changes during growth. For the most part, bowlegs and knock-knees will straighten with growth; if they don't, however, evaluation and treatment are essential.

Blount's disease (growth abnormality in the tibia, which is the inner and larger bone in the lower leg), rickets (abnormal development in growing bones, sometimes due to poor absorption of calcium and phosphorus), and injury to the growth areas of the bones can be associated with bowlegs and should be ruled out by a physician. Severe knock-knees (the knees may actually "knock" together) can be caused by uneven growth of the tibia. Surgery can correct this problem while the bones are still growing. Putting surgical staples into the inner area of the growth plate of the tibia slows growth, while the outer area of the growth plate continues growing. Over time, this evens the growth of the tibia and straightens the leg.

Metacarpus adductus

Metacarpus adductus may look like intoeing, but it is actually the curving in of the forepart of the foot. For children 3 to 6 months of age, treatment consists of a series of casts placed on the affected foot or feet and changed every two weeks for two to three months, followed by corrective shoes.

Clubfoot

Clubfoot is rarely seen in an adult born in the Western Hemisphere because it is apparent at birth and usually treated early in life. Clubfoot is a deformity in which the foot turns in with the sole facing the other foot instead of the ground (Fig. 2). An orthopaedist applies adhesive strapping or plaster casts to the leg and foot after the ligaments are stretched and held in proper alignment. Initially, the casts are changed twice a week because the baby grows so fast there is a danger of the cast becoming too tight and cutting off blood flow. As growth slows, the changing of the casts slows also. If casts fail to correct the problem, then pins can be placed surgically to correctly align the foot. After the pins are inserted, the foot is placed in a cast for six weeks. After the pins and cast are removed, a short cast is placed on the leg for 2 to 2-1/2 months, followed by the nightly use of a Denis-Browne night bar to correct any intoeing or outtoeing.

Fig. 2 **Clubfoot**

A clubfoot is inwardly rotated toward the big toe and has a slight downward tilt.

The flat foot and high arch

Two common problems involving the forefoot are flat feet and an extremely high arch. Flat feet can be a result of incomplete formation of the joints of the hind part of the foot, which then cause flattening of the longitudinal (from toe to heel) arch. This condition is usually corrected with a surgical procedure on the hind part of the foot to reestablish the arch. There are also individuals who are born with a flat-foot deformity that results from incorrectly aligned joints in the mid-portion of the foot. These misaligned joints can cause pain, which is treated with orthotics such as arch supports. In rare cases, surgical reconstruction may be required to correct the problem.

Uneven leg lengths can pose a problem with the feet, as well as with the hips and knees. For instance, unequal leg lengths cause the foot on the longer leg to assume a flat-foot posture in an effort to decrease the height of the foot, whereas the foot on the short leg turns inward with a high-arched position to lengthen the extremity. Excessive external rotation (the hips turning out from the midline of the body) predisposes a person to a flat-foot deformity, whereas excessive internal rotation (the hips turning toward the midline) predisposes one to a foot with a relatively high arch. When the discrepancy is mild, a heel lift is recommended; for more severe cases, however, surgery may be required.

Evaluation of foot deformities must be considered in relationship to the body as a whole, with a thorough history and examination of the lower extremities. Congenital malalignment problems often improve with growth; those that don't, however, require evaluation, treatment, and possibly surgery to achieve proper alignment. The good news is that most congenital malalignment problems have a solution, whether it is provided by nature or by an orthopaedist.

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Commonly Prescribed Orthoses for the Lower Limb

The word "orthosis" is derived from the Greek word "ortho," which means “to make straight.” Orthoses (plural for orthosis) do “straighten” bones, but they also prevent deformities, enhance walking, assist with daily activities, alleviate pain, protect limbs, promote osteogenesis (bone growth), and strengthen the limbs and spine. An orthosis is an externally applied mechanical appliance or an apparatus that provides control, correction, and support of a limb. A brace (one type of orthotic) can either resist or assist motion to control a deformity, and often weight can be added or shifted to provide corrective measures. Orthoses are used to correct malalignments and deformities of the lower limbs, upper limbs, and spine. Perhaps the most widely recognized orthoses are those for the lower limbs, especially those pertaining to the foot, such as shoe inserts.

The most commonly prescribed orthoses for the lower extremity are the various types of ankle-foot orthoses, foot orthoses, and knee orthoses. These devices control, assist, or resist motion and are categorized by the joints and regions they control. They are often custom fabricated or custom fitted by making a cast of the patient’s lower extremity or by taking measurements of the area.

Fig. 1

Fig. 2

The **ankle-foot orthosis** is widely used for various neuromuscular (nerve and muscle) disorders and to achieve a functional outcome after injury or surgery (Fig. 1). Ankle-foot orthoses eliminate foot-to-ground placement problems that affect heel contact and foot clearance. Ankle-foot orthoses also restore foot stability during the stance and the swing phases of walking and compensate for quadriceps (thigh muscle) weakness to prevent knee buckling. Ankle-foot orthoses are usually fabricated out of thermoplastic or metal. The design and material of an ankle-foot orthosis depend on the type of disorder and the desired functional outcome.

A **foot orthosis** (Fig. 2) is used to align and support the foot; to prevent, correct, or accommodate foot deformities; and to improve overall function of the foot. During walking, the normal foot changes from a supple, shock-absorbing structure to a rigid lever for push off. A flat foot that is supple and does not invert and become rigid does not effectively form a rigid lever for push off. Just the opposite occurs with a cavus, or high-arched, foot. A cavus foot is rigid and lacks shock absorption. During walking, the high-arched foot remains locked and fails to become supple for a comfortable stance. Flexible and rigid (unbending) shoe inserts can be purchased over the counter. Many people who suffer with foot problems try a store-bought insert first; then if the problem is not resolved, they seek the advice of their health care professional for a custom-made insert.

Knee orthoses are designed to control ligament deficiencies around the knee and are often custom made. For example, a knee orthosis for a patient with an injured anterior cruciate ligament resists abnormal forward translation of the tibia (large lower leg bone) on the femur (thigh bone). This is most often achieved through a control system that prevents hyperextension (extreme/excessive extension) of the knee (Fig. 3).

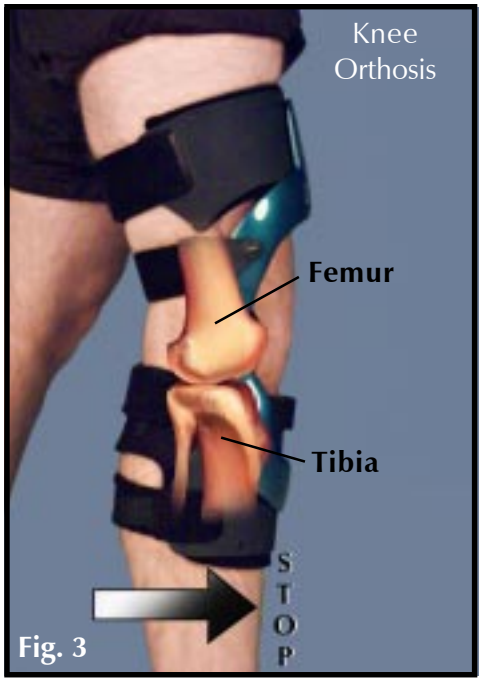

Fig. 3

For osteoarthritis of the knee, similar orthoses are used, but they work on a different biomechanical principle. In osteoarthritis, the joint space between the femur and tibia is reduced due to degeneration and inflammation, resulting in chronic pain in the knee. Osteoarthritis of the knee occurs more often in the medial (inner aspect) compartment than in the lateral (outer aspect) compartment. During normal walking, the knee joint is subjected to a varus (inward bending) force, which shifts the joint load to the medial compartment. To reduce this load in the patient with osteoarthritis, the orthosis applies a valgus (outward bending) correction using three-point pressure, which ultimately shifts the load to the lateral compartment of the knee.

An orthosis should be prescribed by a health care professional who understands the patient's current physical condition and recognizes how an orthotic device can help to improve the condition. The health care provider will consider the condition of the affected area, the patient's overall health, the cost of the orthosis versus surgical intervention, and the patient's willingness to be compliant with the orthosis. Working with an orthotist (a professional who has been trained in the fabrication, fitting, and use of orthotics), the physician can prescribe the best possible device to meet both the needs and lifestyle of the patient.

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Fitness Performance Evaluations for Adults

All adults, regardless of age, should exercise for a healthier life. You may ask, "How do I know if I am ready to start an exercise program?" Some relatively simple tests will help you to determine your current physical fitness level. These tests measure aerobic fitness, muscular fitness, flexibility, and body composition—the four components of physical fitness. Before you attempt any of these physical fitness tests, you should first complete the Physical Activity Readiness Questionnaire (PAR-Q) which can be found at **www.csep.ca/publicationsmain.html**. The PAR-Q is useful in the early detection of potentially serious health conditions. If you answer "yes" to any of the questions on the PAR-Q, consult your physician before you begin any exercise program or fitness tests.

If you answer "no" to all the PAR-Q questions, then you can test your physical fitness level. You can begin with the one-mile walking test that is designed to measure your aerobic fitness. Before starting, warm up for a few minutes by walking slowly, followed by gentle stretching of the thigh and calf muscles. When ready, start a stopwatch and begin walking one mile as quickly as you can. As soon as you finish, stop your time and count your pulse (you can find it at the base of your thumb or just below your jaw in the groove on either side of your windpipe) for 30 seconds, then double it to get your heart rate per minute. Generally, for men and women of all ages, a walking time of 20-22 minutes and a heart rate of 200 beats per minute indicates a poor score. An average score for this test is a walking time of 16 minutes and a heart rate of 160 beats per minute.

Muscular fitness is measured by the push-up test. Men use the standard push-up position, and women use a modified push-up with their knees on the ground. The object is to complete as many push-ups as you can without resting. A low score for men is performing fewer than 10 push-ups and for women, fewer than 5. An average score for men is between 10 and 20 push-ups, and for women, between 5 and 15 push-ups.

The sit-and-reach test measures your flexibility. For this test, secure a yardstick to the floor by placing a 12-inch piece of tape across it at the 15-inch mark. Position yourself on the floor with the yardstick between your legs (zero mark toward you) and the soles of your feet even with the 15-inch tape mark. Lean forward, reaching as far as possible, and hold the position for two seconds. Note the distance reached by your fingertips. An average score is greater than 7 inches for men and greater than 10 inches for women.

Finally, you can evaluate your body composition by calculating your waist-to-hip ratio. Use a measuring tape to determine the circumference of your hips at the widest part of your buttocks, and measure your waist at the smallest circumference, just above the belly button. Divide your waist measurement by your hip measurement. A score of 1.0 or greater puts both men and women in a high-risk category for health problems such as heart disease. A waist-to-hip ratio of 0.7 or lower for men and women indicates a low-risk category for health problems.

The American College of Sports Medicine recommends reassessing your fitness level after completing 6 weeks of exercise. By then, you should show some improvement and be on your way to a healthier life.

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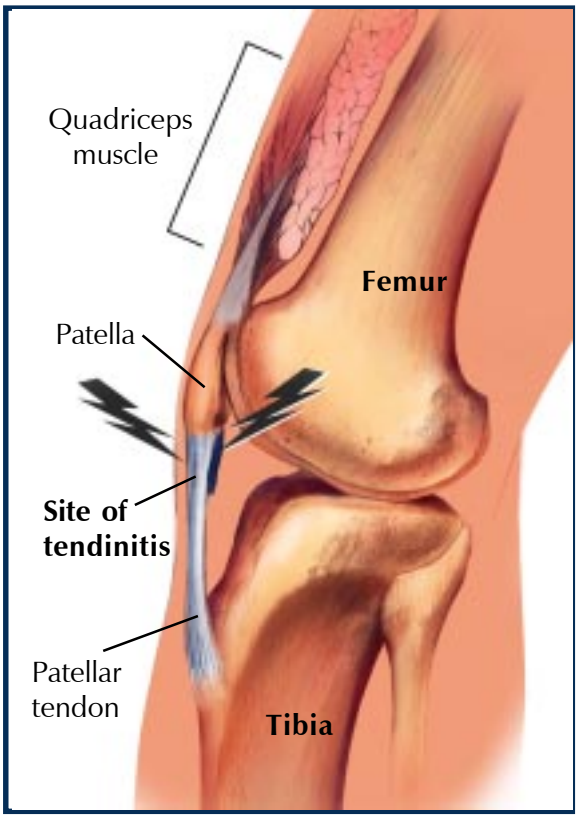
Jumper's Knee

Patellar tendinitis, also known as jumper's knee, is a relatively common inflammatory condition that causes pain in the anterior (front) aspect of the knee. The extensor mechanism (Fig.), which includes the quadriceps muscle and patellar tendon, connects the patella (kneecap) to the femur (thighbone) and the tibia (shin). Patellar tendinitis begins as inflammation of the patellar tendon where it attaches to the patella. It can also progress by tearing or degeneration of the tendon.

Jumper's knee is an overuse injury that results from repetitive overloading of the extensor mechanism of the knee. Microtears to the patellar tendon often exceed the body's ability to heal the area unless the aggravating activity is stopped for a period of time. Jumper's knee occurs in many types of athletes but is most common in sports such as basketball, volleyball, or soccer, which require explosive jumping movements. **Eccentric loading**, which is contraction of the muscle while it is lengthening, occurs when landing from a jump or decelerating. In fact, knee loads up to 7 times body weight occur in a soccer player during kicking and between 9 and 11 times body weight occur in volleyball players during landing. These eccentric loads are thought to be the primary cause of overload in jumper's knee.

Patients with jumper's knee have pain in the area of the patellar tendon, usually near its attachment to the patella. It typically starts as a dull ache but can gradually increase over a period of time. Initially, the soreness is usually felt following a game or workout, but as the condition worsens, one may feel stiffness, grinding, and swelling in the knee. From a diagnostic standpoint, the symptoms can be divided into 4 stages. In stage 1, pain occurs only after activity. The condition does not seem to bother the person before or during the activity. In stage 2, pain is present at the beginning of an activity, seems to dissipate after warming up for a while, and then reappears after the activity. In this stage, the athlete's play is not usually affected. In stage 3, pain occurs during and after activity, affecting performance. In stage 4, the tendon ruptures, causing a chronic weakness of the tendon.



Most patients with jumper's knee, especially those with stage 1 and 2 symptoms, can be treated effectively with nonoperative measures. As with any tendinitis, resting the injured area until the symptoms have subsided is very important. The RICE regimen (rest, ice, compression, elevation) can also help alleviate soreness. Nonsteroidal anti-inflammatory medication, such as aspirin or ibuprofen, and ice massage after activity can help control the swelling and inflammation. Strengthening the quadriceps helps to balance the forces across the patella and take pressure off the patellar tendon. Also, hamstring stretching is extremely important to take pressure off the anterior structures of the knee. Once the inflammation is controlled, the patient with mild to moderate jumper's knee can begin an exercise program focusing on eccentric strengthening exercises. Neoprene sleeves or braces similar to the ones worn by tennis players with tennis elbow can help decrease or disperse the forces on the patella.

The outcome of treatment in patients with jumper's knee is usually very good, especially for those patients in stage 1 and 2, Sometimes in stage 3, the nature of the injury and how it will respond to nonoperative treatment are a little more unpredictable. Even so, few of these patients go on to require surgical intervention. Surgery is reserved for patients who experience debilitating pain for 6 to 12 months despite close adherence to their doctor's instructions. Patients with stage 4 disease who have suffered a complete tendon rupture also need surgery. The overall goal of surgery is to remove the damaged tissue from the tendon and stimulate blood flow to promote healing.

Maximizing quadriceps and hamstring muscle strength and flexibility is the best way to prevent knee injury. Preseason conditioning should concentrate on a gradual increase in repetitive eccentric quadriceps contraction so the tendon can begin to withstand repetitive loading. These measures will help to prevent this inflammatory process. As always, the best treatment is prevention.

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Knee Taping

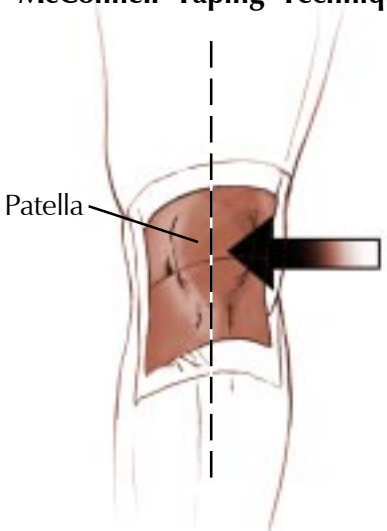
Patella, or kneecap, pain is very common in both athletic and sedentary people. Many factors can cause anterior knee pain (pain in the front of the knee), such as tightness of the muscles and tendons (structures that attach muscle to bone) around the kneecap, weakness of the leg muscles, and abnormal movement of the kneecap while bending and straightening the knee. Typically, physical therapy that includes stretching and strengthening is prescribed for patients with this type of pain. Along with these exercises, bracing or knee taping may be prescribed. One method of taping the kneecap was developed by Jenny McConnell, a physical therapist in Australia, who found that moving or repositioning the kneecap into better alignment often reduces pain (Fig.).

When should the knee be taped?

During an evaluation called "tracking," the patient bends and straightens the knee while the health care professional determines if the patella is moving along the correct path and is positioned correctly in front of the knee. Additionally, the patient is asked to perform common activities, such as squatting and walking up and down stairs, to determine if the kneecap pain can be reproduced. Abnormal positioning or tracking may indicate that tight tissues on the outside of the thigh are pulling the kneecap toward the outside of the knee, in which case taping may help to realign the kneecap.

One of the great benefits of knee taping is that it is a fairly simple procedure that can be taught to the patient. Within 15 to 20 minutes, the physical therapist or athletic trainer can teach the patient the taping technique. Another benefit is that knee taping usually provides immediate relief. The patient knows right away if the symptoms are reduced by the application of the tape. Several taping techniques are available, so different combinations can be tried to relieve pain.

McConnell Taping Technique



The tape holds the **realigned** patella in place to reduce pain.

Taping often helps to relieve the patient's discomfort and allow him or her to exercise with greater intensity.[1,2] However, taping is not the cure; it's the exercise that provides a lasting benefit. In most cases, the kneecap is taped every day for 2 weeks. Then the patient is gradually weaned off by taping every other day or for only specific activities such as sports or work. The patient should not become dependent on the taping and should only use this procedure for temporary pain relief.

There are two types of tape that are applied to the patient's knee. The first tape applied is a white protective tape (Cover-Roll®), which is meant to provide a firm surface for the more adhesive brown tape. The adhesive brown tape should not be applied directly to the skin. The white tape best adheres to a smoothly shaven and non-oiled skin surface. If the skin becomes irritated from the tape, the patient should remove the tape and treat the skin with topical ointment, such as hydrocortisone cream.

Knee taping reduces pain during exercise while the exercise strengthens the muscles and tendons that stabilize the kneecap. Taping the knee is meant as a temporary solution to knee pain and should never replace the exercise that corrects the cause of the pain.

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How to Manage Shin Splints

What are shin splints?

The term "shin splints" has been widely used as a catch-all term referring to a collection of different conditions that cause leg pain. The term **medial tibial stress syndrome (MTSS)** better defines the injury and separates it from injuries such as stress fractures or compartment syndrome. MTSS is caused by chronic strain, overuse, and microtrauma of the soleus (calf) muscle at its origin on the shinbone (posteromedial tibia) or deep inflammation of the periosteum, which is the connective tissue that covers the bone, of the tibia beneath the posterior tibialis muscle (Fig.). MTSS usually occurs in unconditioned people who begin a new running or jumping activity or conditioned runners who change or increase their speed or distance or change their type of shoe or running terrain. MTSS also affects individuals who have flat feet because the mechanics of the foot increase stress on the soleus muscle.

MTSS or stress fracture?

A patient with MTSS has pain at the inner portion of the tibia in the middle of the lower leg and in the surrounding soft tissue (Fig.). A patient with a stress fracture feels pain around the upper outside portion of the tibia. With MTSS, pain usually disappears once the activity that causes the pain is reduced or stopped. With a stress fracture, however, the patient usually experiences pain that does not go away with rest. The pain often persists with walking and increases when walking up steps or during similar moderate activity. The patient often complains of pain at night. A "one-leg hop test" is a functional test often used to distinguish between MTSS and a stress fracture. A patient with MTSS can hop at least 10 times on the affected leg; however, a patient with a stress fracture cannot hop without severe pain.

An x-ray sometimes show chronic cases of MTSS, where there is a mild thickening or an uneven edge at the end of the tibia in the back. X-rays are also often taken to rule out a stress fracture. However, x-rays may not show a fracture line or a healing stress fracture until several weeks after injury, so a bone scan, computed tomography (CT) scan or magnetic resonance imaging (MRI) scan may be used instead.

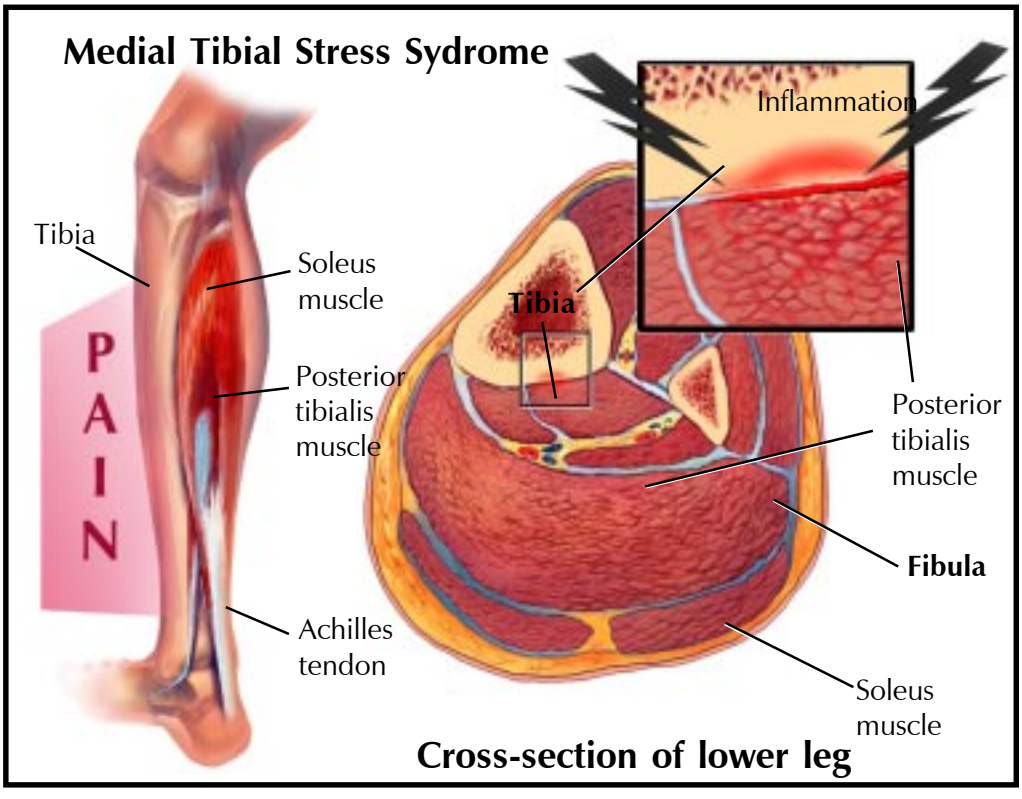
How to treat MTSS

To relieve the pain caused by MTSS, ice massage and Achilles tendon stretching are performed 3 to 4 times a day. Nonsteroidal anti-inflammatories such as aspirin are recommended to relieve inflammation and pain. Gentle stretching of the leg muscles that includes the calf, heel cord, and hamstring is essential before and after exercising to treat MTSS. Any anatomic foot variation, such as a pronated (a foot with a low arch) flat foot, should be corrected with a semirigid foot orthosis (shoe insert). Runners should use a running shoe that provides shock absorption and has a firm heel support. Gentle flexibility and strengthening exercises for the muscles involved should also be added to the workout.

The key treatment for MTSS is rest from the activity that causes the pain. Once the pain has subsided, less stressful exercise can begin. For example, for the first week, biking and swimming can be substituted for running. Then the patient can start training again at about half the previous level of intensity (half the distance or pace). The exercise intensity should be gradually increased to the desired level over 3 to 6 weeks. Recurrence of pain is a signal that the level of activity has been resumed too fast.

Active individuals who have recurring MTSS need not stop exercising or running. They should first correct predisposing factors, such as wearing worn-out shoes, running on hard surfaces and pavement, or increasing training too quickly. If the pain does not subside with these changes and a reduction of activity, then a visit to their orthopaedist is warranted. Rarely, if the symptoms do not respond with long periods of rest, a patient may undergo surgery to release the soleus attachment to the tibia. Usually after surgery, the patient may walk as tolerated, and activity is gradually increased over the following 3 months.

MTSS can be painful but is usually easily resolved. If you experience pain in your shin, thoroughly stretch before exercising, reduce your activity level, and check your shoe wear. If you run on a hard surface, find softer ground. Remember, exercising should be fun, not a painful experience.



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Further Reading:
Perrin DH. The Injured Athlete. 3rd ed. Philadelphia, PA: Lippincott-Raven; 1999:423-424.

What is a Corticosteroid Epidural Injection?

A corticosteroid epidural is a back injection that reduces inflammation and gives long-term relief of back and leg pain. The advantage of back injections over oral nonsteroidal anti-inflammatory medication, such as ibuprofen, is the ability to place the medicine directly where it is needed.

Typically, the only discomfort you feel during the procedure is the initial injection given to numb the skin and soft tissues before the epidural injection. You remain awake while the physician injects a preparation that contains anesthetic (numbing medicine) and then corticosteroid (anti-inflammatory) medication into the space surrounding the spinal cord and spinal nerves (epidural space). The procedure is done under x-ray guidance to ensure proper placement of the needle. The epidural injection usually takes only a few minutes and is done as an outpatient procedure.

Pain relief is often immediate because of the anesthesia used during the procedure. However, this initial response wears off, and, after a few hours, the back or leg pain may return. The corticosteroid usually begins to take effect in three to five days. If only partial relief is gained from the injection, it can be repeated. Often a second injection improves the pain relief further. However, if pain is not reduced with the first injection, there is little reason to try another one.

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The *Hughston Health Alert* is a quarterly publication of the Hughston Sports Medicine Foundation, Inc. The Foundation's mission is to help people of all ages attain the highest possible standards of musculoskeletal health, fitness, and athletic prowess. Information in the *Hughston Health Alert* reflects the experience and training of physicians at The Hughston Clinic, P.C., of physical therapists and athletic trainers at Rehabilitation Services of Columbus, Inc., of physicians who trained as residents and fellows under the auspices of the Hughston Sports Medicine Foundation, Inc., and of research scientists and other professional staff at the Foundation. The information in the Hughston Health Alert is intended to supplement the advice of your personal physician and should not be relied on for the treatment of an individual's specific medical problems.

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Suggested readings and classic references for articles contained in this issue can be found at
www.hughston.com

Health Hint

Acetaminophen (ah-set"ah-me'no-fen), such as Tylenol or Tempra, is an effective non-prescription medication often used for low back pain. Unlike aspirin, acetaminophen does not reduce inflammation; it relieves pain by working centrally (in the brain) to switch off the perception of pain. Acetaminophen is frequently recommended because it has few side affects and is safe for infants, children, and teens.

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