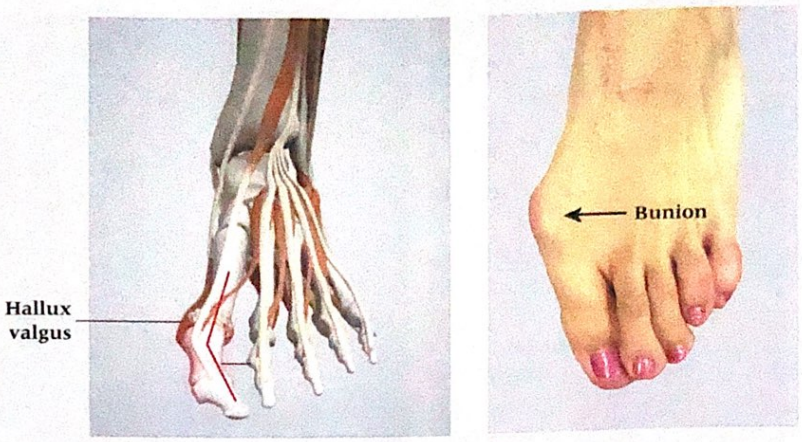


FIGURE 18–29 **(A)** A Hallux valgus deformity often causes the development of a **(B)** bunion.

Management Each bunion has unique characteristics. Early recognition and care can often prevent increased irritation and deformity. Following are some management procedures:

1. Wear correctly fitting shoes with a wide toe box.
2. Wear an appropriate orthotic to correct a structural forefoot varus deformity.
3. Place a felt or sponge rubber doughnut pad over the first and/or fifth metatarsophalangeal joint.
4. Wear a tape splint along with a resilient wedge placed between the great toe and the second toe (see Figure 18–28).
5. Engage in daily foot exercises to strengthen the extensor and flexor muscles. Ultimately, a surgical procedure called a bunionectomy may be necessary to correct the problem.

Sesamoiditis

Etiology Two sesamoid bones lie within the flexors and adductor tendons of the great toe. These sesamoids transmit forces from the ground to the head of the first metatarsal. Sesamoiditis is caused by repetitive hyperextension of the great toe, which eventually results in inflammation. Sesamoiditis is most common in dancing and basketball. It is estimated that 30 percent of sesamoid injuries are sesamoiditis.[55] Fractures of the sesamoids are also common.

Symptoms and signs The patient complains of pain under the great toe, especially during a push-off. There is palpable tenderness under the first metatarsal head.

Management Sesamoiditis is treated with a variety of orthotic devices, including metatarsal pads, arch supports, and, most often, a metatarsal bar (Figure 18–30). Activity should be decreased to allow inflammation to subside.

FIGURE 18–30 Metatarsal bar to treat both sesamoiditis and metatarsalgia.

FIGURE 18–31 A heavy callus often forms under the metatarsal heads in metatarsalgia.

Metatarsalgia

Etiology Although *metatarsalgia* is a general term used to describe pain in the ball of the foot, it is more commonly associated with pain under the second and sometimes the third metatarsal head. A heavy callus often forms in the area of pain (Figure 18–31).[15]

FOCUS 18-1 Focus on Treatment and Rehabilitation

Metatarsal pad support

The purpose of the metatarsal pad is to reestablish the normal relationships of the metatarsal bones. It can be purchased commercially or constructed out of felt or sponge rubber (Figure 18–34).

Materials needed

One roll of 1-inch (2.5 cm) tape, a ⅛-inch (0.3 cm) adhesive felt oval cut to a 2-inch (5 cm) circumference, and tape adherent.

Position of the patient

The patient sits on a table or chair with the plantar surface of the affected foot turned upward.

Position of the athletic trainer

The athletic trainer stands facing the plantar aspect of the patient's foot.

Procedure

1. The circular pad is placed just behind the metatarsal heads.
2. Approximately two or three circular strips of tape are placed loosely around the pad and foot.

One of the causes of metatarsalgia is restricted extensibility of the gastrocnemius-soleus complex. Because of this restriction, the patient shortens the midstance phase of the gait and emphasizes the toe-off phase, causing excessive pressure under the forefoot. This excess pressure over time causes a heavy callus to form in this region. As the forefoot bears weight, normal skin becomes pinched against the inelastic callus and produces pain.[15]

Another cause of metatarsalgia is a fallen metatarsal arch.

Symptoms and signs As the transverse arch becomes flattened and the heads of the second, third, and fourth metatarsal bones become depressed, pain can result. A cavus deformity can also cause metatarsalgia.

Management Management of metatarsalgia usually consists of applying a pad to elevate the depressed metatarsal heads. See *Focus Box 18–1: "Metatarsal Pad Support."* NOTE: The bar is placed behind and not under the metatarsal heads (Figure 18–30). Abnormal callus buildup should be removed by paring or filing. A patient for whom the etiology of metatarsalgia is primarily a gastrocnemius-soleus contracture should perform a regimen of static stretching several times per day. A patient whose metatarsal arch is depressed as a result of weakness should practice a daily regimen of exercise, concentrating on strengthening flexor and intrinsic muscles and stretching the Achilles tendon. A Thomas heel (Figure 18–32), which elevates the medial aspect of the heel from ⅛ to 3/16 inch (0.3 to 0.47 cm) also could prove beneficial.

FIGURE 18–32 The Thomas heel extends anteriorly and elevates the medial aspect of the calcaneus ⅛ to 3/16 inch (0.3 to 0.47 cm), which can help provide support to the medial longitudinal arch and relieve pronation and metatarsalgia.

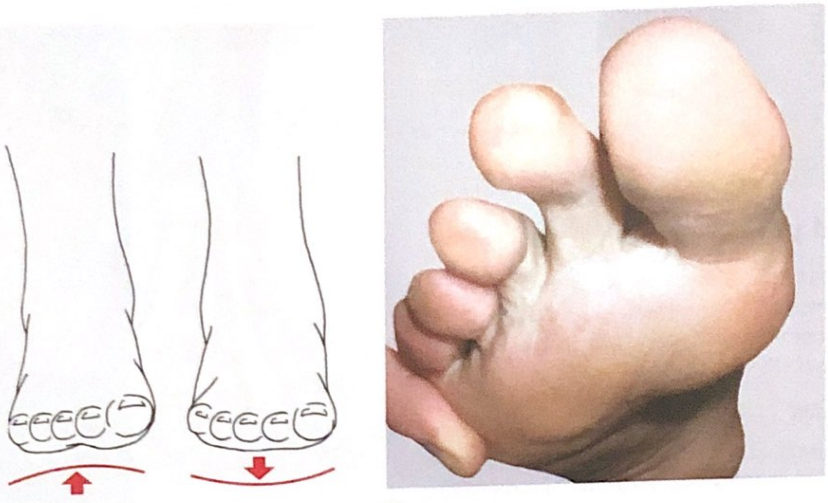
Metatarsal Arch Strain

Etiology The patient who has a fallen metatarsal arch or who has a pes cavus is susceptible to strain.[17] Normally, the heads of the first and fifth metatarsal bones bear slightly more weight than the heads of the second, third, and fourth metatarsal bones. The first metatarsal head bears one-third of the body weight, the fifth bears slightly more than one-sixth, and the second, third, and fourth each bear approximately one-sixth. If the foot tends to pronate excessively or if the intermetatarsal ligaments are weak, allowing the foot to spread abnormally (splayed foot), a fallen metatarsal arch may result (Figure 18–33).

Symptoms and signs The patient has pain or cramping in the metatarsal region. There is **point tenderness** and weakness in the area. Morton's test may produce pain in the metatarsals (see Figure 18–17).

point tenderness Pain produced when an injury site is palpated.

Management Treatment of a metatarsal arch strain usually consists of applying a pad to elevate the depressed metatarsal heads. The pad is placed in the center and just behind the ball of the foot (metatarsal heads) (Figure 18–34).



A B

FIGURE 18–33 (A) Normal and fallen metatarsal arch. (B) Fallen metatarsal arch.

FIGURE 18–34 Metatarsal pad.

Morton's Neuroma

Etiology Recall that a neuroma is a mass that occurs about the nerve sheath of the common plantar nerve at the point at which it divides into the two digital branches to adjacent toes. A neuroma usually occurs between the metatarsal heads and is the most common nerve problem of the lower extremity.[50] A Morton's neuroma is located between the third and fourth metatarsal heads where the nerve is the thickest because it receives branches from both the medial and the lateral plantar nerves (Figure 18–35A).[22]

Irritation increases with the collapse of the transverse arch of the foot, which puts the transverse metatarsal ligaments under stretch and thus compresses the common digital nerve and vessels. Excessive foot pronation can also be a predisposing factor, because more metatarsal shearing forces occur with the prolonged forefoot abduction.

Symptoms and signs The patient complains of a burning paresthesia and severe intermittent pain in the forefoot that is often localized to the third web space and radiating to the toes. The pain is often relieved with non–weight bearing.[31] Hyperextension of the toes on weight bearing, as in squatting, stair climbing, or running, can increase the symptoms. Wearing shoes with a narrow toe box or high heels can increase the symptoms. If there is prolonged nerve irritation, the pain can become constant.[22]

Management A bone scan is often necessary to rule out a metatarsal stress fracture. A teardrop-shaped pad is placed between the heads of the third and fourth metatarsals in an attempt to splay the metatarsals apart during weight bearing, which decreases pressure on the neuroma (Figure 18–35B). Often, this teardrop pad markedly reduces pain, and the patient can continue to play despite this condition. Shoe selection also plays an important role in the treatment of neuromas. Narrow shoes, particularly women's shoes that are pointed in the toe area and certain men's boots, may squeeze the metatarsal heads together and exacerbate the problem. A shoe that is wide in the toe box area should be selected. A straight-laced shoe often provides increased space in the toe box.[66] On rare occasions, surgical excision may be required.

Injuries to the Toes

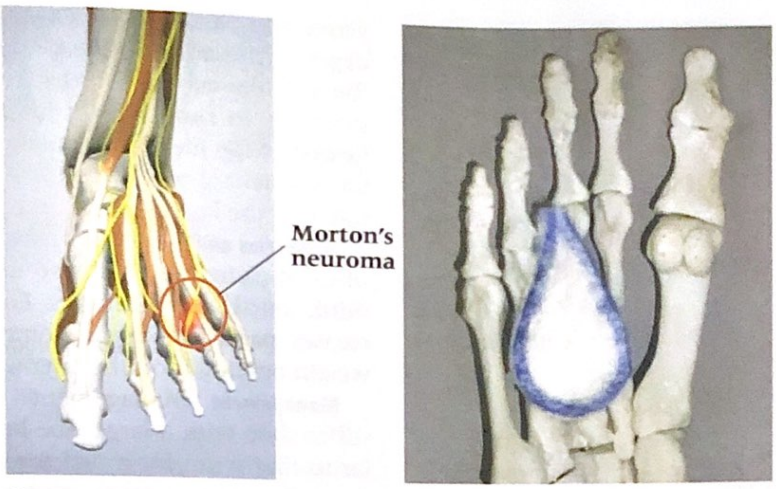
Sprained Toes

Etiology Sprains of the phalangeal joints of the toes are caused most often by kicking some nonyielding object. Sprains result from a considerable force applied in such a manner as to extend the joint beyond its

18–8 Clinical Application Exercise

A football player who commonly plays on artificial turf complains of pain in his right great toe.

? What type of injury frequently occurs to the great toe of an athlete who plays on artificial turf?



A B

FIGURE 18–35 **(A)** A Morton's neuroma between the third and fourth metatarsal heads can be treated using **(B)** a teardrop placed on the plantar surface of the foot as shown.

normal range of motion (jamming it) or to impart a twisting motion to the toe, thereby twisting and tearing the ligaments and joint capsule.

Symptoms and signs Pain is immediate and intense but is generally short lived. There is immediate swelling with discoloration appearing during the first or second day. Stiffness and residual pain may last for several weeks.

Management RICE must be applied immediately to minimize swelling. Casting or splinting of the small toes is difficult. Thus, buddy taping the injured toe to the adjacent toes is an effective technique of immobilization. The patient may begin weight bearing as soon as tolerated and may not need to be on crutches at all.

Fractures and dislocations of the foot phalanges can be caused by kicking an object, stubbing a toe, or being stepped on.

Great Toe Hyperextension (Turf Toe)

Etiology A hyperextension of the great toe results in a sprain of the metatarsophalangeal joint, either from a single trauma or from repetitive overuse (Figure 18–36).[5] Typically, this injury occurs on unyielding synthetic turf, although it can occur on grass also. Many of these injuries occur because sports shoes made for use on artificial turf often are more flexible and allow more dorsiflexion of the great toe.

Symptoms and signs There is significant pain and swelling in and around the metatarsophalangeal joint of the great toe. Pain is exacerbated when the patient tries to push off the foot in walking and certainly in running and jumping.[16]

Management Some shoe companies have addressed this problem by adding steel or other materials to the forefoot of their turf shoes to stiffen them.[40] Flat insoles that have thin sheets of steel under the forefoot

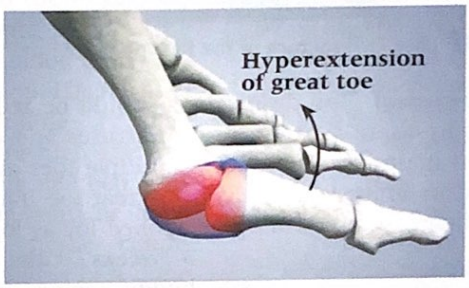


FIGURE 18–36 A turf toe is a sprain of the metatarsophalangeal joint resulting from hyperextension of the great toe.

are also available. When commercially made products are not available, a thin, flat piece of thermoplastic (e.g., Orthoplast) may be placed under the shoe insole or may be molded to the foot. Taping the toe to prevent dorsiflexion may be done separately or with one of the shoe-stiffening suggestions (see Figure 8–27). Modalities of choice include ice and ultrasound. One of the major ingredients in any treatment for this injury is rest. The patient should be discouraged from returning to activity until the toe is pain free.

Fractures and Dislocations of the Phalanges

Etiology Fractures of the phalanges (Figure 18–37) usually occur by kicking an object, stubbing a toe, or being stepped on. Dislocations of the phalanges are less common than fractures. If one occurs, it is most likely to be a dorsal dislocation of the middle phalanx proximal joint. The mechanism of injury is the same as for fractures. Frequently, fractures and dislocations accompany one another.[2]

Symptoms and signs There is immediate, intense pain, which is increased when the toes are moved. In the case of a dislocation, deformity will be obvious. Swelling of the joint occurs rapidly, and there is subsequent discoloration in the area of injury.

FIGURE 18–37 Fracture of the fifth phalanx.

Management Toe dislocations should be reduced by a physician. Casting of toe fractures and dislocations is unnecessary unless multiple toes are involved or unless the injury is a great toe fracture, in which case a cast may be applied for as long as 3 weeks. Otherwise, buddy taping of the injured toe to adjacent toes usually provides sufficient support.

18–9 Clinical Application Exercise

While roughhousing in the locker room, an athlete inadvertently kicks a locker and injures his right great toe.

? What should the athletic trainer be concerned with in this type of injury mechanism?

Hallux Rigidus

Etiology Hallux rigidus is a painful condition caused by the proliferation of bony spurs on the dorsal aspect of the first metatarsophalangeal joint, resulting in impingement and a loss of both active and passive dorsiflexion.[40] Hallux rigidus is a degenerative arthritic process, resulting in changes to the articular cartilage of the metatarsal head and in synovitis. In running and jumping activities, dorsiflexion of the metatarsophalangeal joint in the great toe is essential and, if restricted, causes the foot to roll onto the lateral border to compensate.

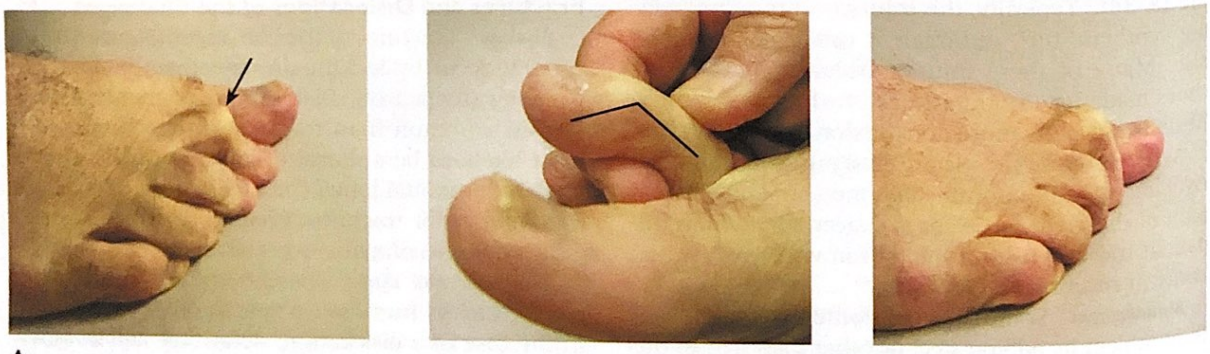
Symptoms and signs The great toe is unable to dorsiflex, causing the patient to toe-off on the second, third, fourth, and fifth toes. Forced dorsiflexion increases pain. Walking becomes awkward because weight bearing is on the lateral aspect of the foot.

Management Management usually includes a stiffer shoe with a larger toe box. An orthosis similar to that worn for a turf toe may also be helpful. Antiinflammatory medication may help reduce the inflammatory response. An osteotomy (surgically removing a piece of bone) to remove the mechanical obstruction to dorsiflexion may allow the patient to return to a normal level of function.[40]

Hammertoe, Mallet Toe, and Claw Toe

Etiology Deformities of the smaller toes can be either fixed or flexible. A hammertoe is a flexible deformity that becomes fixed. It is caused by a flexion contracture at the proximal interphylangeal (PIP) joint (Figure 18–38A). A mallet toe is caused by a flexion contracture at the distal interphylangeal (DIP) joint involving the flexor digitorum longus tendon (Figure 18–38B). It also eventually becomes a fixed deformity in which a callus develops dorsally over the DIP joint or on the tip of the toe. In a claw toe, a flexion contracture develops at the DIP joint, but there is also a hyperextension at the metatarsophylangeal (MP) joint (Figure 18–38C). A callus develops over the PIP joint and under the metatarsal head. Deformities of the lesser toes may be congenital, but more often the conditions are caused by wearing shoes that are too short over a long period of time, thus cramping the toes.[47]

Symptoms and signs In all three conditions the MP, PIP, and/or DIP joints can become fixed. There may be blistering, swelling, pain, callus formation, and occasionally infection.



A B C

FIGURE 18–38 (A) Hammertoe. (B) Mallet toe. (C) Claw toes (all four toes).

FIGURE 18–39 Overlapping toes.

FIGURE 18–40 A subungual hematoma is blood accumulating under the nail.

Management Conservative treatment involves relieving pressure over the toes by wearing footwear with more room for the toes. The use of padding and protective taping (see Figure 8–28) can help prevent irritation. Shaving the calluses may also help reduce skin irritation. Once the deformities become fixed, it is likely that surgical procedures that involve straightening the toes and then maintaining positioning by using K-wire (Kirshner wire) inserted longitudinally through the phalanges into the metatarsals will be necessary.[47]

Overlapping Toes

Etiology Overlapping of the toes (Figure 18–39) may be congenital or may be brought about by improperly fitting footwear, particularly shoes that are too narrow.

Symptoms and signs At times, the condition indicates an outward projection of the great toe articulation or a drop in the longitudinal or metatarsal arch.

Management As in the case of hammertoes, surgery is the only cure, but some therapeutic modalities, such as a whirlpool bath, can assist in alleviating inflammation. Taping may prevent some of the contractural tension within the sport shoe.

Blood under the Toenail (Subungual Hematoma)

Etiology Blood can accumulate under a toenail as a result of the toe being stepped on, dropping an object on the toe, or kicking another object. Repetitive shearing forces on toenails, as may occur in the shoe of a long-distance runner, may also cause bleeding into the nail bed. In any case, blood that accumulates in a confined space underneath the nail is likely to produce extreme pain and can ultimately cause loss of the nail (Figure 18–40).

Symptoms and signs Bleeding into the nail bed may be either immediate or slow, producing considerable pain. The area under the toenail assumes a bluish-purple color and gentle pressure on the nail greatly exacerbates pain.

Management An ice pack should be applied immediately, and the foot should be elevated to decrease bleeding. Within the next 12 to 24 hours, the pressure of the blood under the nail should be released by drilling a small hole through the nail into the nail bed. This drilling must be done under sterile conditions and is best done by either a physician or an athletic trainer. It is not uncommon to have to drill the nail a second time because more blood is likely to accumulate.

18–10 Clinical Application Exercise

A professional male soccer player is complaining about pain in the toes. Upon inspection, the athletic trainer observes that the second and third toes are heavily callused on the dorsal surface and on palpation realizes that the toes are stuck in a flexed, or clawlike, position.

? What is this condition, and what steps can be taken to correct this problem?

FOOT REHABILITATION

It is critical that the athletic trainer incorporate appropriate rehabilitation techniques in to the management of foot injuries. The foot is the base of support for the entire kinetic chain. Thus, injuries to the foot can affect the biomechanics of not only the foot but also the ankle, knee, hip, and spine.

General Body Conditioning

Rehabilitation techniques for managing injuries to the lower extremity in general and to the foot in particular often require that the patient be non–weight bearing for some period of time. Even if weight bearing is allowed, the injured athlete will not be able to maintain his or her level of fitness by engaging in running activities. Thus, it becomes necessary to substitute alternative conditioning activities, such as running in a pool or working on an upper-extremity ergometer (Figure 18–41).[31] The patient should certainly continue to engage in strengthening and flexibility exercises as allowed by the constraints of the injury.

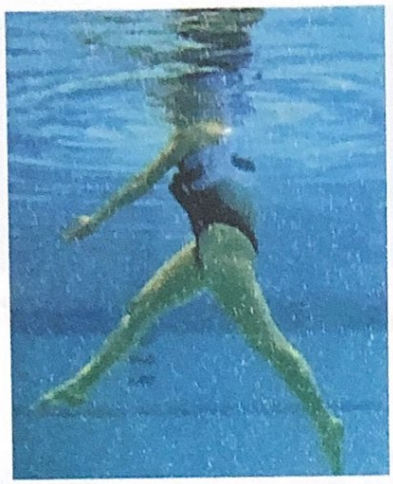


FIGURE 18–41 Pool exercises are useful in maintaining fitness while non-weight bearing.

Weight Bearing

If the patient is unable to walk without a limp, non–weight-bearing or limited weight-bearing crutch walking might be employed. Using incorrect gait mechanics certainly affects other joints within the kinetic chain, causing unnecessary pain, and tends to do more harm than good. Progressing to full weight bearing as soon as it is tolerated is generally recommended.

Joint Mobilization

Manual joint mobilization techniques are useful in maintaining or normalizing joint motions (Figure 18–42). The following joint mobilization techniques can be used in the foot:

- Anterior/posterior calcaneocuboid glides are used for increasing adduction and abduction. The calcaneus should be stabilized while the cuboid is mobilized.
- Anterior/posterior cuboidmetatarsal glides are done with one hand stabilizing the cuboid and the other gliding the base of the fifth metatarsal. These glides are used for increasing mobility of the fifth metatarsal.
- Anterior/posterior tarsometatarsal glides decrease hypomobility of the metatarsals.
- Anterior/posterior talonavicular glides also increase adduction and abduction. One hand stabilizes the talus while the other mobilizes the navicular bone.
- With anterior/posterior metatarsophalangeal glides, the anterior glides increase extension and the posterior glides increase flexion. Mobilizations are accomplished by isolating individual segments.

Flexibility

Maintaining normal flexibility is critical in the foot. Restoring full range of motion following various injuries to the phalanges is particularly important. It is also critical to engage in stretching activities in the case of plantar fasciitis (Figure 18–43). Stretching the gastrocnemius-soleus complex is also important for a number of injuries (see Figure 19–39).

18–11 Clinical Application Exercise

A tennis player complains of pain in the ball of the right foot. Inspection reveals a heavy callus formation under the second metatarsal head. This condition produces a metatarsalgia.

? What is the probable cause of this condition?

Muscular Strength

Strength exercises for the foot can be done using a variety of resistance methods, including rubber tubing, towel exercises, and manual resistance.

The following are exercises commonly used in strengthening the muscles involved in foot motion:

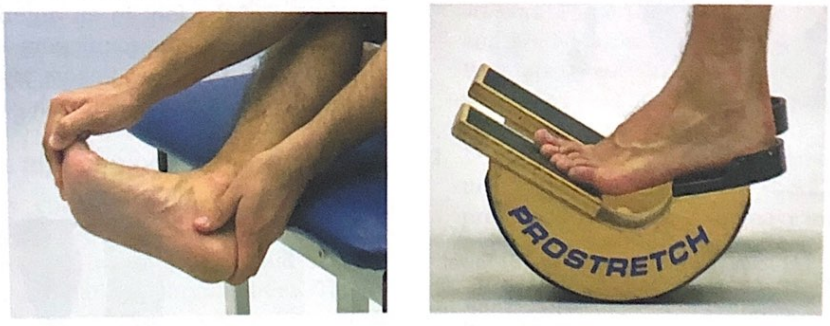
- Writing the alphabet. With the toes pointed, the athlete writes the complete alphabet in the air three times.
- Picking up objects. The patient picks up small objects, such as marbles, with the toes and places them in a container.
- Ankle circumduction. The ankle is circumducted in as extreme a range of motion as possible (10 circles in one direction and 10 circles in the other).
- Gripping and spreading the toes. Gripping and spreading is repeated for up to 10 repetitions (Figure 18–44).
- Towel gathering. A towel is extended in front of the feet. The heels are firmly planted on the floor, with the forefoot on the end of the towel. The patient then attempts to pull the towel, with the feet, without lifting the heels from the floor. As execution becomes easier, a weight can be placed at the other end of the towel for added resistance. Each exercise should be performed 10 times (Figure 18–45A). This exercise can also be used for exercising the foot in abduction and adduction.

18–12 Clinical Application Exercise

A police officer who stands on his feet many hours a day complains of severe intermittent pain in the region between the third and fourth toes of the left foot. Inspection reveals that the pain radiates from the base to the tip of the toes. There is numbness of the skin between the toes.

? What is this condition, and how should it be conservatively managed?

FIGURE 18–42 **(A)** Anterior/posterior calcaneocuboid glides. **(B)** Anterior/posterior cuboid-metatarsal glides. **(C)** Anterior/posterior tarsometatarsal glides. **(D)** Anterior/posterior talonavicular glides. **(E)** Anterior/posterior metatarsophalangeal glides. (S = stabilize, G = glide).



A B

FIGURE 18–43 Plantar fascia stretches. **(A)** Manual. **(B)** Prostretch.

- Towel scoop. A towel is folded in half and placed sideways on the floor. The patient places the heel firmly on the floor and the forefoot on the end of the towel. To ensure the greatest stability of the exercising foot, it is backed up with the other foot. Without lifting the heel from the floor, the athlete scoops the towel forward with the forefoot. Again, a weight resistance can be added to the end of the towel. The exercise should be repeated up to 10 times (Figure 18–45B).

A B

FIGURE 18–44 (A) Gripping and (B) spreading of the toes can be an excellent rehabilitation exercise for the injured foot.

A

B

FIGURE 18–45 (A) Towel gathering exercise. (B) Towel scoop exercise.

Neuromuscular Control

Reestablishing neuromuscular control following foot injury is a critical component of the rehabilitative process and should not be overlooked. Although maintaining neuromuscular control while weight bearing may appear to be a rather simple motor skill for uninjured patients, neuromuscular control is compromised when injuries occur. Muscular weakness, proprioceptive deficits, and range of motion deficits may challenge a patient's ability to maintain a center of gravity within the body's base of support, causing the patient to lose balance. Neuromuscular control in the foot is the single most important element dictating movement strategies within the closed kinetic chain. The capability of adjusting and adapting to changing surfaces while creating a stable base of support is perhaps the most important function of the foot in weight bearing.[31]

Neuromuscular control is a highly integrative, dynamic process involving multiple neurological pathways. Neuromuscular control relative to joint position sense, proprioception, and kinesthesia is essential to all performance but is particularly important to those activities that require weight bearing. Current rehabilitation protocols are therefore focusing more on closed kinetic chain exercises and neuromuscular control.

Exercises for reestablishing neuromuscular control in the foot should expose the injured patient to a variety of walking, running, and hopping exercises involving directional changes performed on varying surfaces. Balance board or wobble exercises can be useful to establish a dynamic base of support (Figure 18–46).

Exercise sandals can be incorporated into rehabilitation as a closed kinetic chain functional exercise that places increased proprioceptive demands on the patient.[6] The exercise sandals are wooden sandals with a rubber hemisphere located centrally on the plantar surface (Figure 18–47A). The patient can progress into the exercise sandals once he or she demonstrates proficiency in a barefoot single-leg stance. Prior to using the exercise sandals, the patient is instructed in the "short-foot concept"—a shortening of the foot in an anterior/posterior direction while the long toe flexors are relaxed, thus activating the short toe flexors and foot intrinsics (Figure 18–48). Clinically, the short foot appears to

FIGURE 18–46 BAPS board exercises.

A

B

FIGURE 18–47 Exercise sandals are used to increase muscle activation and neuromuscular control in the foot. (OPTP Minneapolis)

enhance the longitudinal and transverse arches of the foot. Once the patient can perform the short-foot concept in the sandals, he or she progresses to walking in place and forward walking with short steps (see Figure 18–47B). The exercise sandals are excellent for increasing muscle activation in the foot and lower leg.[6]

Foot Orthotics and Taping

Throughout this chapter, references have been made to taping techniques and to the use of orthotics as means of providing additional support or correcting biomechanical abnormalities. Taping techniques are thoroughly discussed in Chapter 8, and the use of orthotics was discussed briefly earlier in this chapter. This section expands on the discussion of orthotic use relative to the various injuries described in this chapter.

The use of orthotics to correct foot deformities is a common practice by athletic trainers.[38] The normal foot functions most efficiently when no deformities are present that predispose it to injury or exacerbate existing injuries. Orthotics are used to

A

B

FIGURE 18–48 Short-foot concept. **(A)** Foot relaxed. **(B)** Intrinsic muscles contracted, shortening and elevating the arch.

control abnormal compensatory movements of the foot by "bringing the floor up to meet the foot."[30]

The foot functions most efficiently in a neutral position. By providing support so that the foot does not have to move abnormally, an orthotic should help prevent compensatory problems.[18] For problems that have already occurred, the orthotic provides a platform of support so that soft tissues can heal properly without undue stress (see Figure 7–26).[59]

Basically, there are three types of orthotics:[31]

1. Pads and flexible felt supports, referred to as *soft orthotics*. These soft inserts are readily fabricated and are advocated for mild overuse syndromes. Pads are particularly useful in shoes, such as spikes and ski boots, that are too narrow to hold orthotics.
2. *Semirigid orthotics* made of flexible thermoplastics, rubber, or leather.[44] These orthotics are prescribed for athletes who have increased symptoms. These orthotics are molded from a neutral cast. They are well tolerated by patients whose sports require speed or jumping.[21]
3. Functional, or *rigid, orthotics* are made from hard plastic and require neutral casting.[24] These orthotics allow control for most overuse symptoms.

Many athletic trainers make a neutral mold, put it in a box, mail it to an orthotic laboratory, and several weeks later receive an orthotic in the mail. Others like to construct the entire orthotic from start to finish, which requires a more skilled technician than does the mail-in method.[24]

FOCUS 18-2 Focus on Treatment and Rehabilitation

Functional progression for the foot

- Non–weight bearing
- Partial weight bearing
- Full weight bearing
- Walking
  - Normal
  - Heel
  - Toe
  - Side step/shuffle slides
- Jogging
  - Straightaways on track
  - Walk turns
  - Jog complete oval of track
- Short sprints
- Acceleration/deceleration sprints
- Carioca
- Hopping
  - Two feet
  - One foot
  - Alternate
- Cutting, jumping, hopping on command

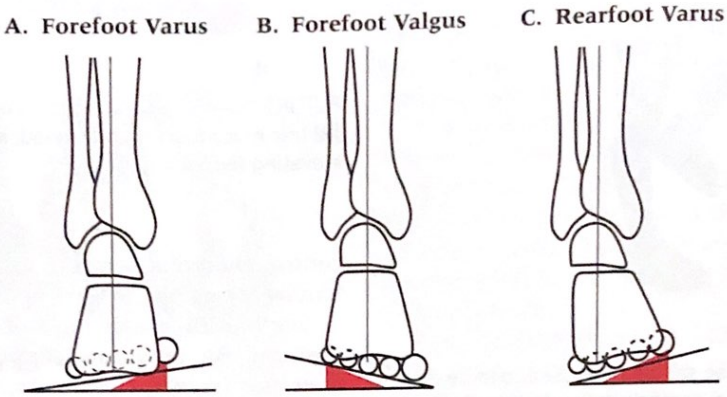


FIGURE 18–49 **(A)** Medial wedge for forefoot varus. **(B)** Lateral wedge for forefoot valgus. **(C)** Medial wedge for rearfoot varus.

Orthotics for Correcting Excessive Pronation and Supination To correct a structural forefoot varus deformity in which the foot excessively pronates, the orthotic should be the rigid type and should have a medial wedge under the head of the first metatarsal (Figure 18–49A).[26] It is also advisable to add a small wedge under the medial calcaneus to make the orthotic more comfortable.

Conversely, to correct a structural forefoot valgus deformity in which the foot excessively supinates, the orthotic should be semirigid and have a lateral wedge under the head of the fifth metatarsal (Figure 18–49B). Again, adding a small wedge under the lateral calcaneus will make the orthotic more comfortable.

To correct a structural rearfoot varus deformity, the orthotic should be semirigid and have a wedge under the medial calcaneus and a small wedge under the head of the first metatarsal (Figure 18–49C).[57]

Functional Progressions

Patients engage in functional progressions following injury to the foot in order to gradually regain the ability to walk, jog, run, change directions, and hop.[42] *Focus Box 18–2:* "Functional progression for the foot" details an appropriate functional progression for an injury to the foot.

SUMMARY

- The function of the foot is critical in running, jumping, and changing direction, and the complex nature of the anatomical structures of this body part makes recognition and management of foot injuries a major challenge to the athletic trainer.
- Many chronic and overuse injuries to the lower extremity can be related to faulty biomechanics of the foot because the foot is the part of the kinetic chain that is in direct contact with the ground.

- Essential movements that occur in the foot include pronation and supination, dorsiflexion and plantar flexion, adduction and abduction, and inversion and eversion.
- Foot injuries can best be prevented by selecting appropriate footwear, by correcting biomechanical structural deformities through the use of appropriate orthotics, and by paying attention to appropriate foot hygiene and care.
- Assessment of an injury to the foot includes a history and a palpation of soft-tissue and bony structures. In addition, observation should include a check for existing structural deformities, including forefoot varus, which might cause excessive pronation; forefoot valgus, which causes excessive supination; and rearfoot varus, which contributes to excessive pronation.
- Injuries to the foot can be classified into three categories: injuries to the tarsal region; injuries to the metatarsal region, including the arches; and injuries to the toes.
- A patient engaging in rehabilitation of an injury to the foot should maintain general body conditioning and should engage in exercises designed to regain essential joint mobility, strength, flexibility, and neuromuscular control through a series of functional progressions that gradually increase stress to the injured structures.
- The use of orthotics and taping techniques can be essential in treating many foot injuries.

WEB SITES

American College of Foot and Ankle Surgeons: www.acfas.org
Podiatric physicians and surgeons provide information on topics related to foot health.

Dr. Pribut's Running Injuries Page: www.drpribut.com/sports/spsport.html
This page lists common running injuries of the foot, ankle, knee, and hip.

Medline Plus: Foot & Ankle Disorders: www.nlm.nih.gov/medlineplus/footinjuriesanddisorders.html
This site can be a resource for many athletes related to foot injuries.

Premiere Medical Search Engine: http://www.medscape.com/
This site allows the reader to enter any medical condition and will search the Internet to find relevant articles.

Wheeless' Textbook of Orthopaedics: www.wheelessonline.com
This Web page is great for injuries, anatomy, and X-rays.

SOLUTIONS TO CLINICAL APPLICATION EXERCISES

18–1 A forefoot valgus deformity can cause excessive or prolonged supination. This condition may limit the ability of the foot and lower extremity to absorb ground reaction forces, resulting in injury. These injuries include inversion ankle sprains, tibial stress syndrome, peroneal tendinitis, iliotibial band friction syndrome, and trochanteric bursitis. The athlete can use an orthotic to correct this biomechanical problem or wear proper footwear with extra cushioning and flexibility.

18–2 Sever's disease is a traction injury to the apophysis of the calcaneal tubercle where the Achilles tendon attaches. The circulation becomes disrupted, resulting in a degeneration of the epiphyseal region.

18–3 It is likely that this athlete has a forefoot varus. To correct a structural forefoot varus deformity where the foot excessively pronates, the orthotic should be the rigid type and should have a medial wedge under the head of the first metatarsal. It is also advisable to add a small wedge under the medial calcaneus to make the orthotic more comfortable. The athletic trainer should also recommend that this patient purchase a board-lasted shoe with a medial heel wedge and a firm heel counter.

18–4 This condition is characteristic of a plantar fascial strain. It should be managed symptomatically. A doughnut placed over the epicondyle region, a heel lift, and a shoe with a stiff shank may relieve some pain. The patient should stretch the plantar muscles and gastrocnemius and perform arch exercises. Application of LowDye taping for pronation can also relieve pain.

18–5 A lateral sprain can produce an avulsion fracture of the proximal head of the fifth metatarsal bone.

18–6 Management of this stress fracture usually consists of 3 or 4 days' partial weight bearing followed by 2 weeks of rest. Return to running should be very gradual. An orthotic that corrects excessive pronation can help take stress off the second metatarsal.

18–7 This condition is a bunion, or hallux valgus deformity. It is associated with wearing dance shoes that are too pointed, narrow, or short. It may begin with an inflamed bursa over the metatarsophalangeal joint. It can be associated with a depressed transverse arch or a pronated foot.

18–8 A sprain of the first metatarsophalangeal joint (turf toe) stems from hyperextension, usually because of the unyielding surface of artificial turf. This injury is a tear of the joint capsule from the metatarsal head.

18–9 Kicking the locker with the great toe could cause a fracture of the proximal or distal phalanx. This injury may develop swelling, discoloration, and point tenderness.

18–10 This condition could be either hammertoes, mallet toes, or claw toes. It is likely that this condition developed from years of wearing shoes that were too tight or small. The athletic trainer could try padding the toes and recommend