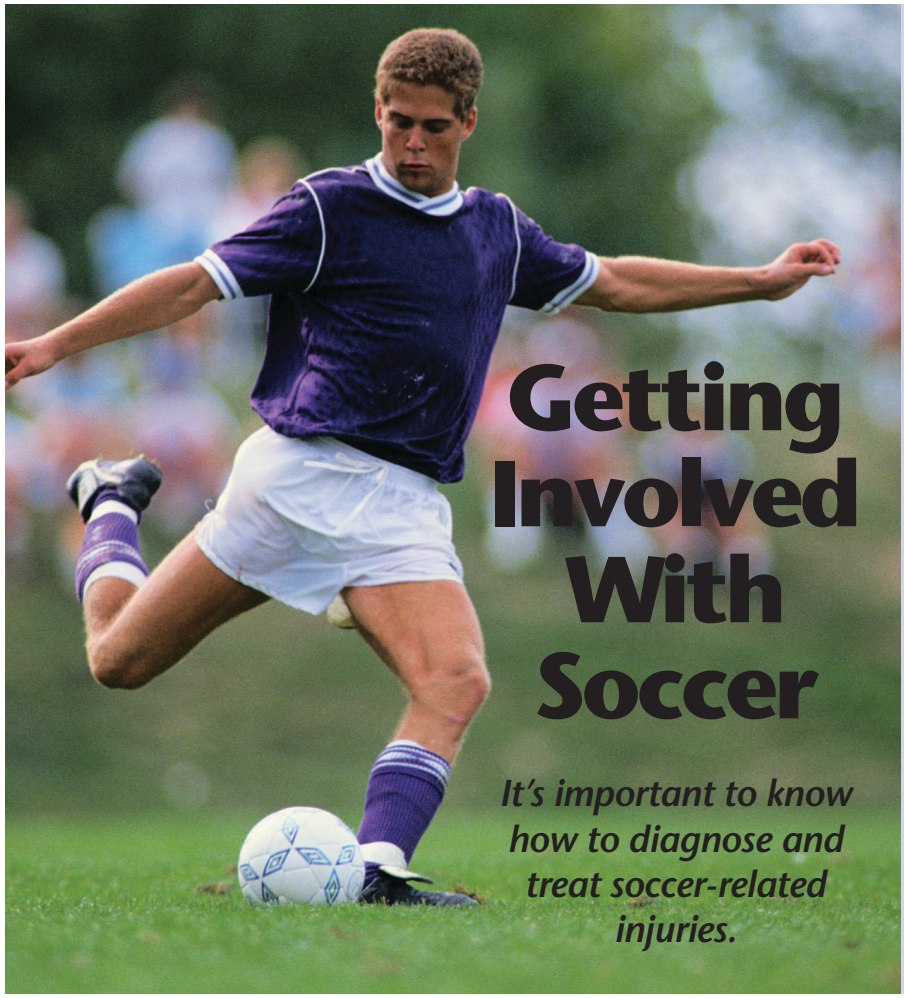
Continuing Medical Education



Getting Involved With Soccer

It's important to know how to diagnose and treat soccer-related injuries.

Objectives

After reading this article the podiatric physician should be able to:

1) Understand the physical demands encountered in the game of soccer

2) Discuss the proper selection of shoe gear with a soccer player

3) Treat an acute ankle sprain and prescribe a rehabilitation program and support devices to prevent reoccurrence in soccer

4) Understand the types and etiologies of shin splints and methods of treatment

5) Recognize, treat and prevent future occurrence of turf toe

6) Recognize and treat calcaneal apophysitis in a young soccer player

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*Following this article, an answer sheet and full set of instructions are provided (p. 138).—**Editor***

By Mark A. Caselli, DPM

The Sport

Soccer is the world's most popular sport. It is estimated that there are over 40 million players in various organized leagues throughout the world.[9] In recent years, soccer has become increasingly popular in the United States, becoming the fastest growing team sport among American youth. Exact statistics on participation are difficult to acquire due to the many municipal recre-

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ational programs, and club teams not affiliated with schools or registered with national organizations. The two largest youth soccer organizations in the United States, the U.S. Youth Soccer Association (USYSA) and the American Youth Soccer Association (AYSO), registered over three million players under age 18 in 1994. The Soccer Industry Council of America estimated that more than six million children under age 12 played on a team in 1990.[18] Soccer has been vigorously promoted for school-age children because it is relatively safe, requires little in the way of special or expensive equipment, is simple to learn, and does not require unique physical characteristics to excel.

The present-day game of soccer developed in England during the 1600's and was officially established there in 1863 as association football, with defined rules and competition. Rugby, Australian football, Gaelic football, and American football all have their roots in the English football of the early 19th century. The British exported association football to Europe and to its colonies around the globe during the mid- and late-1800's. The name "soccer" is derived from the word "association" and is used primarily in the United States to distinguish the game from American football. The Federation International de Football Association (FIFA) is the international governing body of soccer.[12]

Fig. 1: Soccer shoe with stiff synthetic sole plate

Rules

In a regulation soccer game, each team fields 11 players. There are four main positions: goalkeeper, defender, midfielder, and attacker. One player from each team plays the position of goalkeeper, but the distribution of the other players among the other positions can vary.

The game of soccer is characterized by running and jogging interspersed with high-intensity sprints.

The game of soccer is characterized by running and jogging interspersed with high-intensity sprints. Participants can cover up to 10 km during a 90-minute match with 20%-30% of the time spent sprinting.[15] The game consists of rare stoppages in action and few substitutions. In youth, high school, and college games, substitutes may enter the game as often as desired. In the professional game, however, a limited number of substitutes are permitted per contest, usually two or three. Thus, endurance and cardiovascular conditioning are important for players of all ages. Modifications of the game for youth include unlimited substitutions and reducing the length of matches, generally to 60 minutes.

Soccer is unique among team sports in its requirement to use primarily the lower extremities and head to control the ball. With the exception of the goalkeeper, players may use the upper extremities only for throwing the ball in bounds. Soccer is transitional between a contact and non-contact sport, with injuries resulting both directly from collision and indirectly from the tension and torque stresses of running and kicking.[6] The ball may be kicked with either the medial, lateral, or dorsal aspects of the foot, depending on whether the player desires power, con-

Fig. 2: Multistudded soccer shoes are generally preferred

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trol, distance, loft, or some combination of these. Generally, the demands of soccer do not favor any unique morphological attributes such as increased height or weight. Skilled motor coordination, agility, and tactical development are of greater importance.

The Equipment

Compared to other sports, soccer requires very little equipment. A ball of official size and weight and soccer shoes are a must. No other specialized equipment beyond this is mandatory, though some styles of shirts, shorts, socks, and pads serve better than others and are commonly used.

Great care must be exercised in the selection of soccer shoes since each part of the shoe must serve a unique function. Players wear cleated shoes for better traction while running. Cleats give them increased speed and maneuverability. The outsoles of the cleated shoe perform a dual function, providing both support and traction. Since the cleats often do not penetrate fully into the playing surface, a base of support is formed on top of the cleats. This condition is exaggerated on hard dirt. For this reason, cleated shoes should be selected such that the cleats along the shoe edges are positioned as close to the edge as possible. Sections of the sole without cleats will be relatively less supportive, especially in the midfoot-arch area. Shoes with fewer cleats may include internal reinforcement. One method is to add a stiff synthetic or even a metal plate to the shoe to insure adequate support (Fig. 1). This practice has also been used to attempt to reduce the incidence of "turf toe" on synthetic turf fields. The negative side effect of this is a reduction of forefoot flexibility across the metatarsal heads which could result in irritation of the plantar fascia.

The other function of the outsole is to yield adequate traction on a given surface. The two modes in which traction is desirable are along the length of the shoe and in resistance to lateral motion. Traction is not desirable when it resists shoe rotation. Fixing the foot against rotation has been cited as predisposing the knee and ankle to injury. The best method of minimizing rotational fixation is to maximize cleat number and diameter, and minimize cleat height. In general, multi-studded models are preferred by most players (Fig. 2).These can be worn both on grassy fields and on hard ground. For rainy weather, screw-in studs are better because their length can be adjusted. The softer the field and the taller the grass, the longer the studs. The longer screw-in studs should not be used on synthetic turf, as they might get caught in the fibers and cause serious knee and ankle injuries. On synthetic turf, specially designed shoes with short studs are advisable. Since the feet and legs often end up in a tangle during the match, soccer cleats must be no less than 1/2 inch in diameter and may not project more than 3/4 of an inch from the sole.

A unique requirement for soccer footwear is to serve as an impact surface for the ball.

The main function of any shoe upper is to center the foot squarely over the base of support. In order to accomplish this, most soccer shoes have overlays along the lateral edge of the fifth metatarsal head and base to serve as reinforcement, as well as a stiff heel counter to anchor the rearfoot (Fig. 3). A unique requirement for soccer footwear is to serve as an impact surface for the ball. To this end, extra stitching is placed along the medial and lateral sides, which both reinforce the upper and form a ball control surface.[16]

Outdoor technique and tactical exercises should be performed in game shoes. Training shoes, sneakers, or flats should be used for indoor training. Running shoes should be used for endurance training such as running laps. This is especially significant if performed on hard surfaces such as concrete sidewalks, macadam, or indoors to avoid a significant increase in overuse syndromes such as shin splints. Thus each player should have more than one pair of shoes to suit different surfaces, weather conditions, and activities.

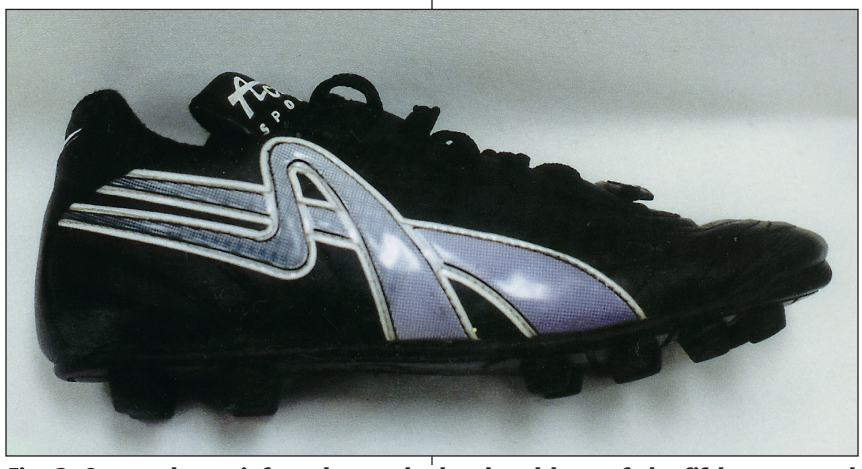

Fig. 3: Soccer shoe reinforced over the head and base of the fifth metatarsal for added support

The Injuries

Studies have revealed that 60% to 80% of all injuries in soccer occur to the lower extremities, over half of these in the foot and ankle.[12] Injuries are far less common in players under age 12, affecting less than 5% of players annually. These injuries are rarely serious and result in little loss of playing time. The incidence and severity of injuries increase dramatically with age, nearly tenfold in high school players.[1] Girls are about twice as likely to be injured as boys in the under 12 age

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group. This difference disappears after adolescence.[2] The most common injuries encountered in soccer appear to be sprains, tendinitis, contusions, strains, fractures and dislocations.

Figs. 4 (above) and 5 (below): Stirrup type ankle orthosis used for ankle sprains

Ankle Sprains

Ankle sprains are the most common injury resulting in time lost in soccer. As in other sports, the most common mechanism for the ankle sprain is an inversion—plantar flexion stress, injuring the anterior talofibular and calcaneofibular ligaments. Treatments for lateral ankle sprains range from early immobilization with compressive dressings to primary repair. Injuries showing no evidence of increased laxity of the ankle, as determined by anterior drawer or inversion stress evaluations, or radiographically by increased talar tilt, can be treated with a program of early return to weight bearing. In the acute setting, the overall goal is to decrease tissue edema and inflammation. Two methods, cryotherapy and compressive dressings, are used for minimizing edema and swelling along with decreasing the inflammatory response. Cryotherapy, with the use of a cold compression boot, can be applied for 20 minutes three times a day. In settings where this device is not available, other forms of cryotherapy such as ice packs or cold whirlpool may be utilized. Cryotherapy has been shown to be effective in yielding early recovery and return to activity after ankle sprains.[8] Compressive dressings that minimize edema consist of elastic bandages that can be reinforced, depending on the extent of the injury, by an external air stirrup splint.

The most common injuries encountered in soccer appear to be sprains, tendinitis, contusions, strains, fractures and dislocations.

Chronic ankle instability and pain in adult soccer players is typically the result of multiple, often minor, injuries sustained over many years. There is, therefore, great interest in preventing ankle injuries in youth. Two methods for the prevention of ankle joint injuries in soccer have been proven to be of value. Coordination training on an ankle disk improves functional stability and postural control, whereas a stirrup-type ankle orthosis provides mechanical support. Both techniques have been shown to reduce the frequency of ankle sprains in soccer players with previous ankle problems. Coordination training on an ankle disk can be included in the rehabilitation of ankle injuries to prevent functional instability. It may also be done prophylactically by players with previous ankle problems in order to break the vicious circle of recurrent sprains and the feeling of giving way.[20,21]

The ankle orthosis is an alternative to taping, and can be used during the rehabilitation period after injury, or when playing on uneven ground. Modern ankle braces prevent inversion and eversion, but

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allow plantar flexion and dorsiflexion of the ankle. The Aircast Sport-Stirrup (Aircast Inc., Summit, NJ) is the original ankle brace. It has molded sides to approximate the ankle. The inner stirrup support system is an adjustable air cell mechanism with two compartments that allow for graduated compression from inferior to superior and prevent slipping of the air cushion from around the malleoli. The air cells are lined with a compressible foam. The straps used to secure the stirrup are wide and comfortable (Figs. 4 and 5). The DarcoGel (Darco International, Inc., Huntington, WV) stirrup brace applies pressure and cold to the ankle with unique gel pack inserts. It is helpful for chronic problems. Full ankle support braces lace up and can be entirely of fabric. The laced canvas ankle brace provides excellent mediolateral support. In the sub acute phase, when swelling has been reduced, the canvas brace fits comfortably inside the shoe (Fig. 6). The Swede-0-1200 ankle orthosis is a lace-up brace with vertical struts on the side for added support and medial lateral stability.[17]

Fig. 6: Laced canvas ankle brace

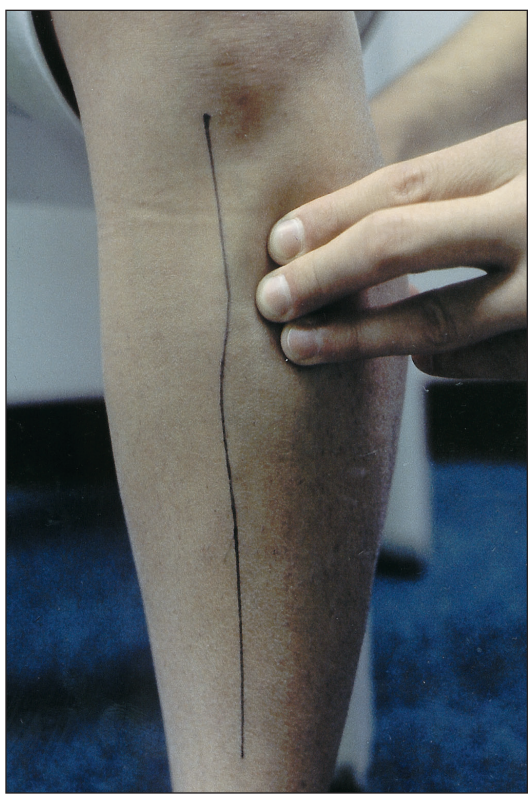

Fig. 7: Pain on palpation of musculature lateral to tibia, indicative of anterior shin splints

Individuals with a cavus foot are more prone to lateral ankle inversion sprains. The rigid forefoot valgus forces the hindfoot into inversion when the athlete bears weight, stressing the lateral ankle.[14] A foot orthosis will ease stress on the ankle by balancing the forefoot and stabilizing the rearfoot. It should be fabricated with a zero degree hindfoot post and extrinsic forefoot valgus tip posting.[19] Athletes with cavus feet and frequent ankle sprains can also be prescribed orthoses with full foot valgus posting.

Whenever a young athlete is evaluated for an ankle sprain, an epiphyseal injury must be considered. Sports-related epiphyseal injuries in children and adolescents have been becoming more prevalent during recent years. In a report of 85 patients with epiphyseal fractures of the lower extremity, 28% were sustained during soccer. The average age of the athletes was 12.6 years. The most frequently seen localizations were in the distal tibial epiphysis, followed by the distal fibula. Of the reported epiphyseal fractures, 30 were Salter-Harris type I injuries, 25 were type II, 8 type III, and 11 were type IV fractures, while 11 were avulsion fractures.[10]

Shin Splints

One of the most common overuse injuries seen in soccer is termed "shin splints." Originally, this term applied to painful conditions of the lower legs including periostitis, stress fractures, chronic compartment syndromes, and periostalgia. Research and discussion in recent years have refined the definition to describe pain of the anteromedial or anterolateral aspect of the distal two-thirds of the tibial shaft due to muscle-tendon inflammation.

Modern ankle braces prevent inversion and eversion, but allow plantar flexion and dorsiflexion of the ankle.

Activities involving running, both sprinting and long-distance, commonly lead to shin splints. Risk factors include weakness of anterior or posterior leg muscles as well as poorly designed soccer shoes. Shoes providing inadequate support, such as those with flexible midsoles and no midsole cleats, or poor cushioning are often to blame. Training errors such as playing on hard surfaces or doing distance running in cleated shoes are also contributing factors. Skeletal malalignment problems such as tibia vara, subtalar or forefoot varus, tight heel

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cords, forefoot supinatus, or hypermobile, pronated feet can also lead to shin splints.[4,11]

Anterior Shin Splints

There are three variations of shin splints that affect the anterior compartment of the leg. The first type is an anterior tibial muscle shin splint secondary to a sagittal plane muscle imbalance, most commonly a tight posterior muscle group (gastrocnemius or soleus). The anterior tibial muscle, which accounts for approximately 80 percent of the dorsiflexory power of the foot, is forced to work harder in gait as it pulls up on the foot to get the needed ankle dorsiflexion that it lacks. Manual muscle testing produces pain at the origin of the anterior tibialis muscle on active dorsiflexion of the foot against the examiner's resistance. The patient may complain of numbness or tingling of the foot or toes due to the peripheral nerve irritation. This can be considered the earlier stage of a compartment syndrome (Fig. 7).

Treatment will initially include a heel lift to decrease the adverse effects of the equinus deformity (Fig 8). The patient must be instructed in proper stretching techniques for the posterior muscle group. By reducing the ankle equinus through stretching, one can reduce the need for the heel lift.

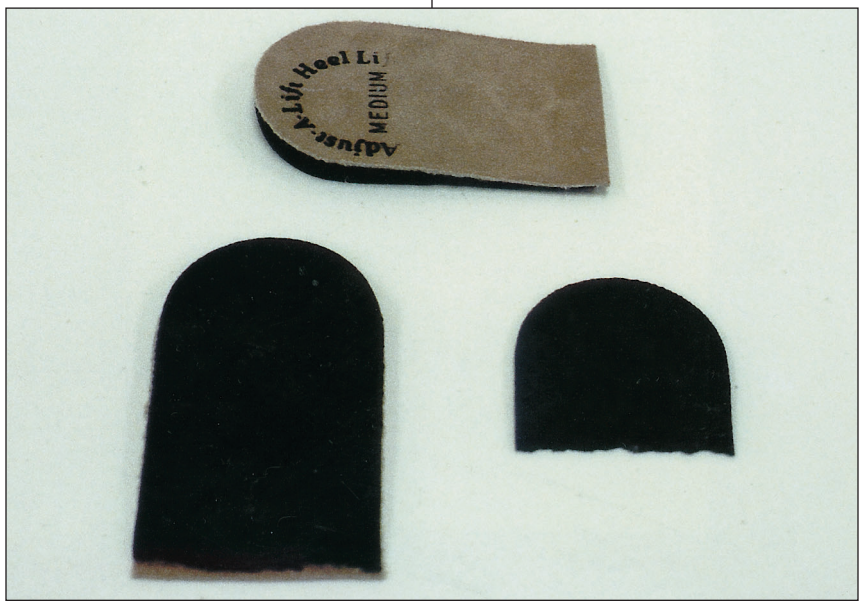

Fig. 8: Adjust-A-Lift (Warwick Enterprises, Grinnell, IA) heel lifts can easily be modified to various heights

Fig. 9: Custom foot orthoses providing both reduction of excessive pronation and increased shock absorption

There are three variations of shin splints that affect the anterior compartment of the leg.

The next type of shin splint affecting the anterior tibial muscle is the result of a functional shortening of the muscle. The origin of the anterior tibial muscle becomes closer to its insertion as the amount of forefoot varus or supinatus increases. This type of deformity is found in a foot that is markedly pronated with maximal internal tibial rotation. Thus, the more varus or supinatus present in the forefoot, the greater the shortening. Manual muscle testing produces pain at the origin of the anterior tibial muscle on active plantarflexion of the foot.

Treatment of this deformity will include stretching of the tightened anterior tibial muscle. Foot orthoses should be used to decrease the effects of foot pronation and varus or supinatus deformity of the forefoot.

The last anterior shin splint is of the peroneus tertius type. This is also caused by a sagittal plane muscle imbalance. In response to an equinus of the posterior muscle group of the leg, the peroneus tertius acts to evert the foot to get extra ground clearance while running. Manual muscle testing produces pain of the peroneus tertius on active dorsiflexion and eversion of the foot against the examiner's resistance.

The treatment of the etiology (posterior muscle group equinus) is of primary importance. Therefore, stretching exercises should be performed for the gastrocnemius or soleus muscles. Again, a heel lift would be indicated to initially decrease the equinus effects on the leg

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until the posterior muscles are adequately stretched.

Medial Shin Splints

Three shin splints will affect the posterior compartment muscles of the leg, producing medial-posterior leg pain. The most common (accounting for 13 percent of the injuries to the lower extremity) is the posterior tibial shin splint, also referred to as medial tibial stress syndrome. The other types of medial shin splints are flexor hallucis longus and flexor digitorum longus shin splints.

Posterior tibial shin splints classically produce pain 12 cm proximal to the medial malleolus. The pain may be elicited by manual muscle testing. Pain is experienced by active adduction and plantarflexion of the foot when resisted by the examiner. Excessive foot pronation at heel contact and midstance stretch the posterior tibial tendon, resulting in the shin splint symptoms.

As with most tibial shin splint syndromes, a stress fracture must be ruled out.

Initially, an inversion ankle strapping to prevent foot pronation (in conjunction with a supportive arch padding) may be used to decrease the shin splint symptoms. Eventual orthotic therapy is recommended to decrease the effects of excessive heel eversion (Fig. 9). More effective rearfoot cushioning (by way of shock attenuating insoles) may decrease the shock that travels up the leg at heel strike. Heel lifts may be used concomitantly with stretching exercises of the tightened posterior group muscles.

Playing on a hard surface in flexible shoes predisposes to turf toe.

Flexor hallucis longus shin splints produce pain resembling posterior tibial shin splints. However, on manual muscle testing, the pain is produced on active plantarflexion of the hallux (at distal interphalangeal joint) when resisted by the examiner. An etiology for this shin splint is foot pronation at midstance and propulsion. As the tibia internally rotates maximally, the origin is stretched far from its insertion as with the pronated foot.

Orthotic therapy with forefoot varus posting is indicated to decrease the foot pronation and internal tibial rotation at midstance and propulsion.

The pain associated with flexor digitorum longus shin splints is found in the proximal medial third of the leg. The etiology of this condition is overuse due to forced resisted dorsiflexion at propulsion. Manual muscle testing elicits pain on active plantarflexion of the digits (at the distal interphalangeal joints) when resisted by the examiner.

Treatment consists of stretching and strengthening of the toe flexors. Metatarsal pads can be used to reduce cramping of the digits. Orthoses, with or without metatarsal pads, are beneficial in decreasing foot pronation. Increasing the rigidity in the sole of the shoe is helpful in preventing hyperextension of the digits at propulsion.[5]

Initial treatment in acute cases

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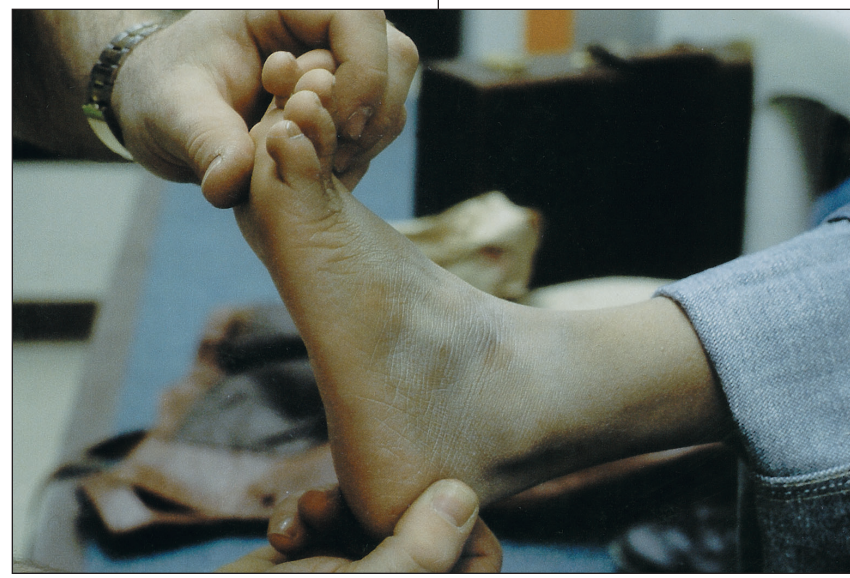

Fig. 10: Pain on palpation of the outer margins of the heel in a patient with calcaneal apophysitis

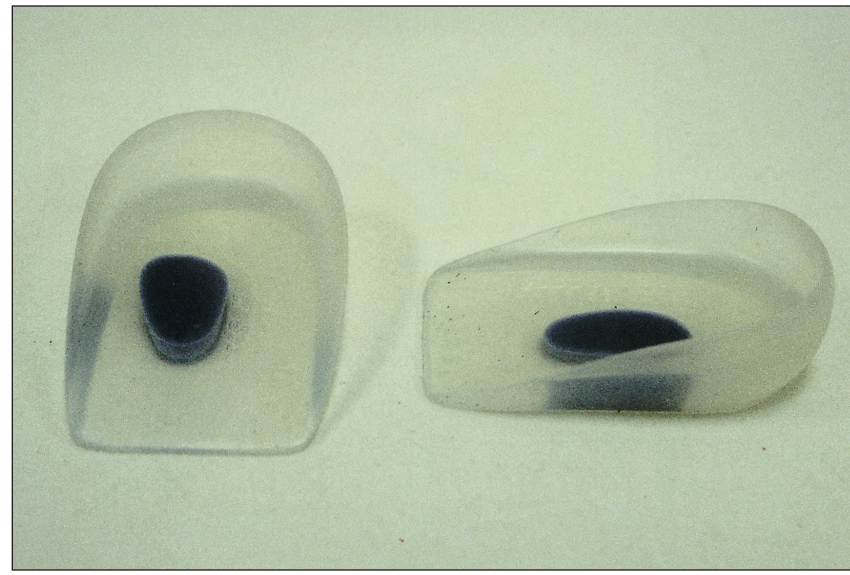

Fig. 11: ViscoSpot (Bauerfeind USA, Inc., Kennesaw, GA) viscoelastic heel cushions are ideal for the treatment of calcaneal apophysitis

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should include RICE (rest, ice, compression, elevation) and NSAID's as needed with relative rest being the most important intervention. For chronic conditions, physical therapy with emphasis on anterior and posterior muscle groups—such as resistive dorsiflexion, heel raises, and stretching—often are helpful. Modification of the exercise regimen should be considered.

Turf Toe

Turf toe, a condition common to both football and soccer, is the result of repetitive extreme hyperextension (dorsiflexion) of the first metatarsophalangeal joint resulting in damage to the plantar capsule of this joint and the adjacent sesamoid bones. Often an osteochondral injury occurs on the dorsal surface of the joint, which may include a fleck of cartilage being shorn from the bone. Playing on a hard surface in flexible shoes predisposes to this condition, which is characterized by pain on forced dorsiflexion of the great toe, and stiffness. Treatment includes applying a spica taping, utilizing tape around the first metatarsophalangeal joint to limit motion as well as a sesamoid pad if indicated by the presence of sesamoid pain. The player should also be switched to a stiffer shoe to further prevent excessive motion of the painful joint.[3]

Calcaneal Apophysitis

Calcaneal apophysitis (Sever's Disease) is a common cause of heel pain in the 8 to 13 year old soccer player. It presents as inflammation of the open calcaneal growth plate with pain over the posterior calcaneus extending from inferior to the insertion site of the Achilles tendon to the inferior weight bearing surface, both medially and laterally (Fig. 10). Soft tissue swelling and induration may be present. The condition is thought to occur due to traction on the apophysis of the calcaneus by both the Achilles tendon and the plantar fascia, as well as direct impact stress to the heel. Risk factors include tight heel cords, forefoot and rearfoot varus, and pronation. The lack of shock absorption as well as the relative flat heel afforded by soccer cleats probably accounts for the increased incidence of calcaneal apophysitis in this athletic group. Treatment is primarily symptomatic, including a program of lower extremity stretching, cushioning posterior heel wedges 1/4 to 3/8 inch in height, and foot orthoses if needed to control excessive pronation (Fig. 11).[13]

Prevention of Injuries

Although not all injuries are preventable, there are four major etiological factors contributing to soccer injuries which, if addressed, can greatly reduce the chances of injuries occurring. These include 1) player factors consisting of joint instability, muscle tightness, lack of training, and inadequate rehabilitation after a previous injury; 2) equipment factors, including faulty or improper footwear for soccer use, improper design of soccer cleats, and the improper use of screw-in cleats; 3) playing surface factors, including the size and surface quality of the soccer field or practice area; and 4) soccer rules including the acceptance of the referee's judgment, and respect of rules by players, since many of the traumatic game injuries are caused by foul play.[7] ■

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EXAMINATION

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See answer sheet on page 139.

1) In a regulation soccer game each team fields how many players?
- A) Six
- B) Nine
- C) Eleven
- D) Twelve

2) Soccer shoes with fewer cleats should include what type of modification?
- A) High toe box
- B) Stiff sole reinforcement
- C) Rigid heel counter
- D) Soft upper material

3) For soft, wet fields and tall grass, the best type of studs to use are:
- A) Short and flat
- B) Long screw-in
- C) One inch rubber
- D) Curved metal

4) A common injury associated with running laps on hard surfaces while wearing soccer cleats is:
- A) Shin splints
- B) Chondromalacia patella
- C) Anterior impingement syndrome
- D) Turf toe

5) Ankle sprains showing no evidence of increased laxity of the ankle should be treated with:
- A) Four weeks non-weight bearing immobilization
- B) An early return to weight bearing program
- C) Alternating heat and cold treatments
- D) Extended bed rest

6) Chronic ankle instability in adult soccer players is often the result of:
- A) Improper treatment of ankle sprains
- B) Multiple fractured ankles
- C) Missed osteochondral injury
- D) Multiple minor ankle sprains

7) Which one of the following devices should be used to reduce functional instability after an ankle sprain and help prevent recurrence?
- A) Compression dressing
- B) Stirrup ankle orthosis
- C) Ankle disk
- D) Foot orthoses

8) The most important characteristic of a modern sports ankle brace is that:
- A) It provides compression to reduce swelling
- B) It reduces the degree of ankle dorsiflexion and plantar flexion
- C) It eliminates all ankle motion during play
- D) It prevents ankle inversion and eversion

9) Which one of the following foot orthosis modifications can be used to reduce ankle sprains in an athlete with a cavus foot type?
- A) Forefoot valgus posting
- B) Deep heel cup
- C) Long medial flange
- D) Heel lift

10) An epiphyseal injury must be considered whenever a young athlete is evaluated for an ankle sprain. The most common location for this type of injury is:
- A) Proximal fibula
- B) Distal fibula
- C) Distal tibia
- D) First metatarsal

11) The properties of a soccer shoe that might lead to shin splints include all of the following except:
- A) Flexible midsole
- B) Poor cushioning
- C) Built-in arch support
- D) Flat insole

12) Overuse of the tibialis anterior muscle leading to anterior shin splints is the result of which of the following two conditions?
- A) Tight posterior muscle group and functional shortening of the tibialis anterior
- B) Weak posterior muscles and weak tibialis anterior
- C) Weak posterior muscles and strong tibialis anterior
- D) Tight posterior muscle group and functional lengthening of the tibialis posterior

13) Which treatment regimen is best for treating the effects of a tight posterior muscle group?
- A) Muscle strengthening and a heel lift
- B) Muscle stretching and a heel lift
- C) Muscle stretching and no heel lift
- D) Muscle strengthening and no heel lift

14) Shin splints due to a functional shortening of the tibialis anterior muscle is best treated by stretching and:
- A) Foot orthoses with no posting
- B) Foot orthoses with forefoot varus posting
- C) Foot orthoses with forefoot valgus tip posting
- D) Foot orthoses with full foot valgus posting

Continued on page 138

Continuing Medical Education

EXAMINATION

(cont'd)

15) Which one of the following treatments would not be recommended for the treatment of posterior tibial shin splints?
- A) Inversion ankle strapping
- B) Arch padding
- C) Foot orthoses
- D) Flexible soled cleats

16) Pain produced on active plantar flexion against resistance of the hallux is indicative of which one of the following shin splints?
- A) Extensor hallucis longus
- B) Flexor hallucis longus
- C) Flexor hallucis brevis
- D) Flexor digitorum longus

17) Metatarsal pads alone or incorporated in a foot orthosis are valuable in the treatment of which type of shin splint condition?
- A) Flexor digitorum longus
- B) Flexor hallucis longus
- C) Posterior tibial
- D) All types of medial shin splints

18) Which one of the following represents the best method of preventing turf toe?
- A) Shoe with high toebox
- B) Rigid soled cleats
- C) Foot orthoses with forefoot varus posting
- D) Heel lift in shoes

19) Calcaneal apophysitis presents as inflammation of the open calcaneal growth plate. It is most likely the result of all of the following except:
- A) Tight heel cord
- B) Traction from the plantar fascia
- C) Tight tibialis anterior
- D) Hard heel strike

20) In addition to decreasing activities, the best initial treatment for calcaneal apophysitis is:
- A) Soccer shoes with screw-in adjustable cleats
- B) Custom foot orthoses
- C) Cushioning heel wedges
- D) Running on softer surfaces

See answer sheet on page 139.

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ENROLLMENT FORM & ANSWER SHEET (cont'd)

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Soccer
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2.	**A**	**B**	**C**	**D**	**12.**	**A**	**B**	**C**	**D**
3.	**A**	**B**	**C**	**D**	**13.**	**A**	**B**	**C**	**D**
4.	**A**	**B**	**C**	**D**	**14.**	**A**	**B**	**C**	**D**
5.	**A**	**B**	**C**	**D**	**15.**	**A**	**B**	**C**	**D**
6.	**A**	**B**	**C**	**D**	**16.**	**A**	**B**	**C**	**D**
7.	**A**	**B**	**C**	**D**	**17.**	**A**	**B**	**C**	**D**
8.	**A**	**B**	**C**	**D**	**18.**	**A**	**B**	**C**	**D**
9.	**A**	**B**	**C**	**D**	**19.**	**A**	**B**	**C**	**D**
10.	**A**	**B**	**C**	**D**	**20.**	**A**	**B**	**C**	**D**

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