
Problems in Family Practice

Foot Problems in Athletes

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The primary care physician who cares for athletes encounters a variety of foot problems from skin maladies to deformities of the bone. As foot injuries can be totally debilitating, they are of especially great consequence to competitive athletes and must be diligently investigated to reach a proper diagnosis. In most cases the proper use of tape, foam, felt, metatarsal pads, and bars can easily solve what may be a perplexing problem. Occasionally, manufactured orthotic devices may be necessary. In all instances, athletes must be carefully advised on ways to treat and, more important, prevent foot problems.

Foot problems occur with considerable frequency among sports participants. As they are so debilitating, foot injuries often prevent athletes from participation in their sport. Thus, infirmities of the foot are of especially great concern to these patients, and the family physician must be careful not to minimize their seriousness. The goal should

be to return the athlete to activity as quickly and safely as possible.

The current boom in running and jogging has brought an increase in the number of foot injuries seen by the primary care physician. To diagnose such injuries accurately and treat them effectively, the primary care physician must have a good knowledge of foot anatomy and physiology. Unfortunately, few primary care physicians have time to educate themselves in all aspects of foot care.

This article provides the primary care physician with a concise reference on the most common foot problems. Its purpose is to help the physician quickly identify the problem and the potential treatments.

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Anatomy

The normal foot is variable in length, width, and general shape. Aches and pains that occur within it are related to the height and weight of the athlete as well as the athlete's usual normal mobility and conditioning, the type of sport, the intensity of competition, and the level of motivation.¹ The foot contains two main arches formed by the bones and supported directly by ligaments and indirectly by the plantar fascia. A normal degree of motion and elasticity in the arches is necessary for proper foot function. Muscles and a complex array of tendons supply balance for the foot. The longitudinal, or long, arch is made up of two components, the medial and the lateral. The medial component is the more obvious and comprises the calcaneus, the talus, the navicular bone, three cuneiform bones, and the first three metatarsal bones. This arch rests on the head of the first metatarsal and on the calcaneus. The lateral component of the longitudinal arch consists of the calcaneus, the cuboid bone, and the fourth and fifth metatarsal bones. It is supported from behind by the calcaneus and in front by the head of the fourth and fifth metatarsals. The transverse metatarsal arch, formed by the five metatarsal bones, is most prominent at the level of their bases. On standing, there is no arch at the level of the metatarsal heads, all of which bear weight.

The anterior and posterior tibial arteries originate from the popliteal artery. These vessels supply blood to the anterior and posterior portions of the foot through, respectively, the arterial arcade and the digital arteries. Innervation of the foot is provided by the superficial peroneal, saphenous (L3-L4), and sural (S1-S2) nerves.²

Function of the Foot

The function of the foot is to serve as a support for the weight of the body and to act as a lever in raising and propelling the body forward in walking and running. The foot and ankle are focal points to which body weight is transmitted in ambulation, and the feet are well adapted to this function. The

muscles of the leg provide the power, and the heads of the metatarsal bones serve as a fulcrum on which weight is lifted. The joints are capable of the adjustments necessary for fine balance on a variety of terrain. Therefore, the lower extremity is often involved in static deformities not usually seen in other parts of the body.

Etiology of Injury

Injuries of the feet are common in people who run too much, too soon, or on hard surfaces. Injuries are a common result of wearing poorly made or inflexible and inappropriate shoes. When feet are overused, damage to the soft tissue, bone, muscle, and neurological and vascular structures is likely to occur. The foot is also subject to a high incidence of general systemic conditions, such as rheumatoid arthritis and diabetes. Finally, injuries can result from a biomechanical imbalance in the structure of the foot.

In spite of the potential structural and biomechanical problems, the most frequent cause of athletic injury to the foot is mistakes made during training. Such errors include (1) too much mileage, (2) an overly intense workout, (3) an inadequate warm-up, (4) hard running surfaces, and (5) improper footwear.

Foot History

As with all other medical problems, the primary care physician investigating foot problems must obtain a thorough history before performing a physical examination. The following areas in the history should be explored: (1) age; (2) pre-existing trauma including any congenital or musculoskeletal or skeletal disorders that might affect the lumbar spine (spondylolysis, spondylolisthesis), pelvis, or lower extremity; (3) athletic or occupational history or both (in relation to demands on

foot); (4) general health history (previous illnesses or injuries); and (5) pain history. When eliciting a pain history, the following questions should be addressed:

1. When does pain occur?
2. What brings pain on? Does it come at onset, only with activity, or with increase in running and walking distance?
3. How long has the pain been present?
4. What makes the pain better or worse?
5. Is it constant?
6. How severe is the pain?
7. Does it keep the patient awake?
8. What previous treatments have been undertaken?
9. Are improper training methods being used?
10. Has there been a change in training routine?
11. What type of shoes are worn? Does the patient use orthotics or arch supports?
12. What warm-up and stretching routines are performed?

Physical Examination of the Foot

After a thorough history is taken, the physical examination should be performed. This examination will localize the site of the disease or injury and will determine whether there are any anatomical or biomechanical abnormalities that may be causing a problem.

Physical examination of the foot can be divided into two major parts. The first part is passive and geared toward detecting any deformities that may be contributing to foot injury. Also, a superficial examination of the foot is conducted to detect cutaneous maladies. All areas to be examined should have no coverings and be readily visible while the following nine procedures are performed.

1. Observe the gait and carriage of the patient, noting any limp.
2. Examine the patient in a standing position, looking for spinal and pelvic abnormalities, eg, lordosis, scoliosis, or malalignments.
3. Check the lower extremities, looking for a genu valgum or varum, tibia varus, internal or external tibial torsion, ankle varus or valgus, medial

or lateral directing patella, patella alta, or pronated or cavus feet.

4. Have the patient lie down, and measure leg length, including the umbilicus to lower pole of the medial malleolus, and the anterior superior iliac spine to the medial malleolus.

5. Have the patient sit, and check the dorsalis pedis and posterior tibialis pulses.

6. Check skin for peeling, redness, corns, and calluses.

7. Check the plantar and dorsum of the foot for exostoses, ganglions, and deformities such as hallux valgus, metatarsus adductus, dorsal bunions, and subtalar varus and valgus position.

8. Check heels for plantar fasciitis and the Achilles insertion for bursa, "pump bumps," friction problems, and tendinitis.

9. Check shoes. A worn forefoot is usually seen in "toe runners"; wear on the outside heel and sole indicates a supinated foot. Patients with hyperpronated feet show wear on the medial forefoot and lateral heel.³

The second portion of the physical examination is more active in nature. During this phase the physician should examine the patient's range of motion (active and passive) and also the first metatarsophalangeal joint, which is commonly involved in foot injuries.

Several quick tests can help determine whether there is any gross restriction in a patient's active range of ankle and foot motion. To test plantar flexion and toe motion, ask the patient to walk on his toes; to test dorsiflexion, instruct the patient to walk on his heels. To test inversion, have the patient walk on the lateral borders of his feet; to test eversion, instruct the patient to walk on the medial borders of his feet. Although these tests can indicate functional abnormality, they are not precise evaluative measures of separate motion. If the patient is unable to perform any of these procedures, however, the physician should conduct passive testing to determine the cause of the athlete's limited range of motion.

Dorsiflexion and plantar flexion take place between the talus and the tibia and fibula within the ankle mortise. A line drawn between the midpoints of the medial and lateral malleoli approximates the axis of ankle joint motion.

To test the range of ankle motion, instruct the patient to sit on the edge of the examining table and to dangle his leg. Stabilize the subtalar joint by

holding the calcaneus. Then, invert the forefoot to lock it into the hindfoot. While gripping the forefoot, push the foot as one unit into dorsiflexion (approximately 20 degrees is within normal range) and plantar flexion (approximately 50 degrees is within normal range).⁴

Restricted ankle movement may be caused by extra-articular swelling (edema secondary to sprain or cardiac failure). Intra-articular swelling also reduces ankle motion, as does a fusion of the ankle joint or a contracted joint capsule.

Subtalar inversion and subtalar eversion serve to adjust the foot to function on uneven surfaces. To test inversion and eversion, have the patient remain seated on the edge of the examining table and stabilize his tibia by holding it around the distal end. Then grip the calcaneus and alternately invert and evert the heel (5 degrees in each direction is within normal range). A patient who has subtalar arthritis may complain of pain during this motion.⁴

The motions of forefoot adduction and abduction take place primarily at the metatarsal joint (the talonavicular and calcaneocuboid joints). To test these motions, hold the patient's foot at the calcaneus with one hand to stabilize the heel in the neutral position and move the forefoot medially (20 degrees is within normal range) and laterally (10 degrees is within normal range) with the free hand. The range of motion is difficult to measure accurately, but it can be felt.

Principally involved with the toe-off phase of gait, the first metatarsophalangeal joint is crucial to normal ambulation. To test it, stabilize the patient's foot and move his great toe through flexion and extension at the metatarsophalangeal joint. Normal motion of the first metatarsophalangeal joint measures 45 degrees flexion and 70 to 90 degrees extension. Normal toe-off requires a minimum of 35 degrees to 40 degrees of extension.⁴

Clinical Problems of the Foot

Tables 1 through 6 illustrate the important features of foot problems common among sports participants. These problems are broken down into

Table 1. Skin, Subcutaneous Tissue, and Nail Problems in the Foot

Type	Precipitating Cause	Symptoms	Diagnosis	Treatment
Athlete's foot ⁵	Trichophyton rubrum, mentagrophytes, or Epidermophyton floccosum	White macerated scaly areas between toes. Dryness, scaling, and fissuring of the sole, or deep-seated blisters on plantar surfaces and contiguous areas of the skin	Scrape skin and transfer to microscopic slide with one or two drops of 15% KOH. Heat and look for hyphae	Clotrimazole solution 1% locally, miconazole cream. If severe, griseofulvin 250 to 500 mg daily for 4 to 6 wk or ketoconazole 200 mg daily for 10 days
Erythrasma ⁶	Corynebacterium minutissimum	Confluent lesions with red-dish-brown scaly patches causing itching without inflammation between toes	Pink fluorescence under Wood's light	Oral erythromycin, adult 250 mg twice a day; child 30 to 50 mg/kg/d for 1 wk. Topical sodium fusidate twice a day for 10 days

Table 1. Skin, Subcutaneous Tissue, and Nail Problems in the Foot (Continued)

Type	Precipitating Cause	Symptoms	Diagnosis	Treatment
Contact dermatitis	Shoes with secondary skin irritants, ill-fitting shoes, lining irregularity, allergy to chemicals used in shoe manufacture	Affects the dorsal aspect of the great toe or dorsal aspect of the foot. Rash, itching, and sometimes lichenification	Positive patch test reaction with shoe material or erythema to vesiculation	Burow's solution of 1:10 or 1:20, 3 to 4 times daily; if weeping, a steroid cream
Eczema ⁷ (dyshidrosis) (atopic dermatitis)	Unknown	Vesiculation, lichenification, scaling, fissuring pruritis	Consider when KOH preparation fungus and patch testing are negative; usually seen on side of digits and soles	Burow's solution as above, topical steroids after area is dry
Blisters ⁸	Rapid shearing force causing split in mid- to lower malpighian layer of epidermis	Pain, tenderness, irritability	Bullae filled with clear fluid	Drain fluid from bullae, leaving roof of bullae and applying colloidin or benzoin
Callosities	Localized thickening of dermis, secondary to abnormal pressure	Pain, especially if over pressure area or under pressure area	Usually under first or fifth metatarsal head, medial border of great toe, and under abnormal bony prominence	If symptomatic, softening and trimming callus will give temporary relief; anatomical correction of biomechanical defects can in some cases be accomplished with orthotic shoe inserts, low-heeled shoe with adequate width, metatarsal bars, relief pads; rarely surgical correction to relieve bony prominence
Runner's toe ⁹	Pressure on the nail by the end of the shoe, or ridge in the shoe causing elevation of the nail	Black toenails, usually second toe but possibly first and third toe	Toenail becomes black after activity	Drilling hole in nail to release hematoma or no treatment
Plantar ¹⁰ fasciitis (heel spur syndrome)	Overuse syndrome; inflammatory reaction at insertion of the long plantar ligament into the calcaneus	Pain with the first few steps in the morning; pain at outset of workout, decreasing during running, and recurring at finish or later	Cavus or pronated foot; increased eversion of the heel and forefoot varus; point tenderness at the attachment of plantar fascia to heel	Taping the heel; heel pads, cups, rest, ice, steroid injections, stretching

Table 2. Nerve Problems in the Foot

Type	Precipitating Cause	Symptoms	Diagnosis	Treatment
Tarsal ^{11,12} tunnel syndrome	Entrapment of the posterior tibial nerve passing behind the medial malleolus and osseofibrous tunnel; the nerve divides to supply the heel and medial and lateral portions of the sole of the foot	Burning pain in the sole of the foot from the toes to the heel; in advanced cases decreased sensation in the sole, arch, and heel	Positive Tinel's sign; positive nerve conduction and electromyographic studies	Treatment conservative—elevation, heat, ice, medial heel wedge, arch support. Steroid injection locally, ie, 40 mg prednisolone, 1 mL 2% lidocaine. Padding over bony prominences; if conservative measures fail, surgical compression
Medial plantar ¹³ neuropathia (jogger's foot)	Fibromuscular tunnel for the nerve is formed by the adductor hallucis muscle; foot eversion stretches the nerve against tunnel	Burning heel pain	Deficient sensation on medial aspect of sole with tenderness at entrapment point	NSAID,* nerve blocks; arch supports; change in running posture
Peroneal ¹⁴ neuropathy	Degeneration and weakness of the anterior tibial and peroneal muscle	Numbness and paresthesia, usually found over the anterior lateral aspect of the leg and dorsum of the foot	May have foot drop along with sensory loss and paresthesia	NSAID,* nerve blocks; arch supports; change in running posture
Morton's ¹⁵ neuroma	Irritation and thickening of plantar digital nerve between the third and fourth toe; possibly entrapment syndrome	Sharp excruciating pain, lateral aspect of the foot; radiates into the third and fourth toe and may radiate to dorsum of foot and ankle region	Point tenderness usually between the third and fourth toe; rarely a small nodule is palpated; may also occur between the second and third toe	Metatarsal pads, bars, steroids; surgical excision

*NSAID—Nonsteroidal anti-inflammatory drug

Table 3. Ligament Problems in the Foot

Type	Precipitating Cause	Symptoms	Diagnosis	Treatment
Foot sprain ¹⁶ (acute traumatic)	Overstretching of ligaments by forcing of involved joint through wider range of motion than normal	Pain and tenderness in the region of the longitudinal arch	History and pain in the region of the longitudinal arch	Ice, elevation, strapping
Static sprain ¹⁷	Weakness of muscles supporting longitudinal arch; arches are inadequate secondary to malposition and loss of strength; stress of weight bearing falls on the tarsal ligaments	Dull ache over ball of foot; fatigue and aching of feet; tight feeling and swelling of the feet by the end of the day	Pain along plantar ligament from the calcaneal attachment to the attachment near the metatarsal	Relief of weight bearing; use of arches; change of shoes; improvement of foot position; reconstructive exercises
Sprain of "spring ligament" ¹⁸	Running on uneven surfaces with soft shoes	Pain in the area of the calcaneal navicular ligament	Tenderness over medial anterior aspect of foot	Felt insoles; isometric intrinsic foot exercises, inversion, eversion, abduction, adduction, dorsiflexion, plantar flexion
Turf toe (toe sprain) ¹⁹	Playing on artificial surfaces; toe jammed inside of shoe and falls into hyperextension with ligament sprain followed by cartilage bruising, stretching, and tearing of joint capsule	Pain and swelling at the metacarpal phalangeal joint	Tenderness on flexion and extension of big toe	Ice; taping to next toe; stiff, solid shoe to inhibit motion
Flat feet ²⁰	Dynamic instability caused by soft tissue, bony abnormalities, and laxity of ligaments; trauma, systemic disease, or arthritis	Postural fatigue in arch and pain on walking or running for prolonged period of time	Pain is of medial longitudinal foot strain or metatarsal pain	Ranges from shoe modification with wedges, to orthoses, either soft or hard; surgery sometimes necessary

Table 4. Bursa Problems in the Foot

Type	Precipitating Cause	Symptoms	Diagnosis	Treatment
Retrocalcaneal ²¹ bursa	Irritation by shoe to the bursa, anterior to the Achilles tendon at the attachment to the calcaneus	Tenderness with palpation	Bogginess and tenderness at the attachment of the Achilles tendon to the calcaneus	Weight bearing minimized for as long as necessary; elevation of heel 1/2"; ice or heat; NSAID* or corticosteroid injections
Plantar bursa	Irritation of the bursa between the calcaneus and the skin of the heel on the plantar surface	Tenderness with palpation	Bogginess and tenderness	Removal of irritating cause
Metatarsal bursa	Irritation of bursa between the skin and medial sesamoid, adjoining the first metatarsal head with development of hard callus	Tenderness with palpation	Bogginess and tenderness	Removal of irritating cause
"Pump bump"	Inflammatory reaction to poorly padded heel counter that irritates a pre-existing enlargement of the calcaneus	Pain over bony prominence lateral to the attachment of the Achilles tendon	Tender, slightly red nodule just lateral to the calcaneal attachment of Achilles tendon	Aspirin, ice, exercise, warm soaks, proper fit in shoes
Tailor's bunion	Irritation by shoe	Pain over lateral aspect of fifth metatarsal head	Tenderness over the lateral fifth metatarsal head	Stretching to enlarge shoes; rarely surgery
*NSAID—Nonsteroidal anti-inflammatory drug				

Table 5. Tendon Problems of the Foot

Type	Precipitating Cause	Symptom	Diagnosis	Treatment
Ganglion	Cystic mass that emerges from tendon sheaths or joint capsules; pathogenesis not definitely known	Slow growing; occasional discomfort in adjacent joint and tendons after overuse or strain	Tense or fluctuant swelling; rounded, nontender and not fixed to skin; may regress or disappear spontaneously	Surgical excision offers best chance of cure; reassurance; aspiration with steroid instillation, though same needle may rarely be useful
Tenosynovitis ²²	Commonly occurs with overuse; irritation between the tendons and surrounding tissue with loss of smooth gliding	Pain on motion of tendon under tension; crepitation on motion	Tenderness in involved area; pain on extension or flexion	Rest, strapping, arch supports, shoe wedging; must <i>not</i> be injected with steroids
Hammertoes	Fixed flexion deformity of interphalangeal joint secondary to primary muscle imbalance	Pain on plantar aspect of tip of toe and callus over dorsal aspect of proximal interphalangeal joint	Dorsiflexion of the metatarsophalangeal joint and plantar-flexion contracture of the proximal interphalangeal joint on roentgenograph	Manipulation and splinting of affected toe; metatarsal bar or pad elevating metatarsal heads; arthrodesis of proximal interphalangeal joint
Achilles ²³ tendinitis	Running on heels; shoes with rigid soles or inadequately padded heel wedge; tight hamstring and calf muscles with cavus foot	Painful inflammation about the Achilles tendon with or without swelling; burning pain appears early in jogging, gets less severe during running, and worsens after the run	4 to 5 cm proximal to insertion of tendon into the calcaneus; may have crepitus swelling and tender nodule	Rest; ice; exercise; NSAID*; reduce mileage, avoid hills and banked roads; flexible sole on running shoe; well-molded Achilles pad, heel lift; stretching exercises
*NSAID—Nonsteroidal anti-inflammatory drug				

Table 6. Bone and Epiphysis Problems in the Foot

Type	Precipitating Cause	Symptom	Diagnosis	Treatment
Metatarsalgia	Collapse of the transverse arch	Pain beneath metatarsal heads in front portion of foot; dull ache, cramping, and burning pain over the medial metatarsal heads	Localized tenderness underneath metatarsal heads; if asked to push toes into floor, may be unable to lift metatarsal heads from surface	Arch supports behind metatarsal heads; intrinsic muscle exercises; metatarsal bar
Morton's foot ²⁴⁻²⁵	Weight distribution problem secondary to structural instability characterized by short, hypermobile first metatarsal and posteriorly located sesamoid bone	Plantar aponeurosis strain with pain	Short great toe; abnormally thickened callus under the second or third metatarsal head	Arch supports; metatarsal pad behind region of callus
Stress fractures ²⁶⁻²⁷	Gradual development of a fault in bone caused by many repetitions of a force that if applied only once would cause no damage	Vague ache in mid-portion of foot, worsens with continued activity	Tenderness in region of second and third metatarsal shaft; occasional swelling, x-ray film normal if taken prior to 10 to 21 days. Bone scan with ⁸⁵ Sr with ⁹⁹ Tc if x-ray film not definitive	Remove stress; metatarsal pads; occasionally cast; allow 3 to 6 weeks for healing
Cavus feet mild to moderate (not severe)	Inherited tendency or secondary to high heels or excessive use of leg muscles (dancers); may be secondary to neurological disease, eg, intrinsic denervation of foot from posterior tibial nerve entrapment	Early fatigue with exercise; pain in heel under metatarsal pads or plantar fascia	Heavy callus under heel and ball of foot may cause chronic plantar fasciitis; high arch, clawtoes, and varus heel	Mild—orthotics to ensure proper foot function and flexibility, exercise. Surgical intervention in cases of hammertoe deformities and/or severe plantar calluses.
Freiberg's ²⁸⁻²⁹ disease	Avascular necrosis of metatarsal head; believed to be a disturbance of circulation resulting in localized ischemic necrosis; may be secondary to trauma	Pain on weight bearing; thickening and tenderness usually over the head of the second metatarsal bone	X-ray film shows absorption in deformation with thickening of the distal portion of affected bone	Anterior arch pad in the early stages; if continues to be painful, remodeling of the deformed metatarsal head by surgery followed by anterior arch support

Table 6. Bone and Epiphysis Problems in the Foot (Continued)

Type	Precipitating Cause	Symptom	Diagnosis	Treatment
Köhler's disease (avascular necrosis of the navicular bone)	Possibly ischemic; degenerative changes sometimes precipitated by trauma	Local discomfort around the navicular bone	Tenderness and slight thickening over the navicular bone; x-ray films reveal small, dense bone with irregular outline	Protection of the bone from excessive trauma; supportive longitudinal arch and restriction of activity; occasionally casting
Sever's ³⁰ disease (calcaneal apophysitis)	Probably due to low-grade inflammatory reaction to the posterior calcaneal epiphysis or traction of the Achilles tendon	Seen in boys aged 9 to 14 years; pain and swelling usually secondary to chronic pressure	X-ray films reveal the epiphysis to be irregular or segmented with areas of increased density and sometimes may show the same changes without symptoms	Relieve strain and pressure; raise heel of the shoe
Cuboid ³¹ syndrome	The peroneus longus pulls the lateral aspect of the cuboid bone dorsally, which allows the medial aspect of the cuboid bone to move into a more plantar position and resultant locking	Pain located along the lateral side of the foot or over the fourth and fifth metatarsal on the dorsal aspect of the cuboid bone or the calcaneal cuboid	Pain and tenderness by direct palpation of the peroneal groove; pain in the cuboid bone during walking	Manipulation to re-establish proper alignment of the calcaneal cuboid joint by simultaneously moving the medial aspect of the cuboid dorsally and laterally
Symptomatic ³² accessory navicular bone	Secondary to inflammation that occurs from direct repeated trauma to the bone	Acute or chronic pain on medial surface of foot	Usually palpable protuberance with swelling and redness where pain localized	Arch support, heel wedge; soaks; strapping; cast; NSAID*; possibly surgery
Osteochondritis ³³ dessicans of heel	Uncertain, but probably secondary to injury causing avulsion of small fragments of bone between calcaneus and tendon	Posterior heel pain	Appearance of defect in calcaneus on x-ray film, separated fragment causes reactive density of the calcaneus	Relieve pain; heel raised, heel cup; heat; rest; orthotics; NSAID*; surgery

*NSAID—Nonsteroidal anti-inflammatory drug

the following categories: skin, subcutaneous tissue, and nails; nerves; ligaments; bursa; tendons; and bones and epiphysis. All of these problems are easily handled by the knowledgeable family physician. Within each category specific injuries are cited, indicating precipitating causes, symptoms, diagnoses, and treatments. The precipitating causes are examples of the specific situations that produce each type of foot problem. The symptoms help the physician identify the proper "locale" of the problem. The diagnoses refer to typical findings of the history or physical examination and whether x-ray examination or laboratory tests are recommended. Finally, recommendations are made for various treatment options.

Prevention of Foot Injuries

Because athletic activity places much stress on the foot, athletes are very prone to foot injuries. Such injuries may be prevented by following certain guidelines for proper foot care:

1. Many injuries are caused by improper running surfaces. Thus, a change in running routine may be necessary. Such a change may include avoiding hills, reducing speed, and checking running shoes.

2. If jogging causes foot disturbances, rest or reduce mileage. Do not try to "run through" pain.

3. If minor pain develops, use ice massage and gentle stretching, making sure not to stretch through pain. When applying ice, wait until the skin turns red and then do gentle stretching exercises.

4. When done slowly and gently, stretching exercises ease, and also prevent, many injuries. These exercises should be done before, after, and if possible, during workouts to maintain flexibility.

5. If a biomechanical imbalance does not respond to routine changes, orthotic devices may be necessary.

6. When a runner with a foot problem becomes asymptomatic after an injury, he should gradually return to activity. For the first three days he should slowly run one-quarter mile, rest on the fourth day, increase mileage to one-half mile for three days, and rest on the fourth day. This pattern should be continued until three miles a day is reached. At this time the runner may return to former training mileage and speed.³⁴

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