

## EXAMINATION OF THE SPINE AND EXTREMITIES: THE FOOT

Regardless of your specific activity level, the design, structure, and functional abilities of your feet can get you going in the right direction or slow you down considerably. And even though proper functioning of the foot is essential for walking, running, jumping, and landing; understanding the foot and its proper design and function is often overlooked.

### **ANATOMY:**

Comprised of 26 bones, dozens of tendons, and numerous ligaments, the foot truly is a masterful design of structure, stability, and force distribution. With every step, force is absorbed and transmitted through the three distinct regions of the foot and across four separate arches.

#### Rearfoot:

- Responsible for initial stability and shock absorption
- Comprised of the talus and calcaneus bones

#### Midfoot:

- Provides essential medial and lateral stability
- Adaptable to a variety of surfaces
- Comprised of the navicular, cuboid, and the 1st, 2nd, and 3rd cuneiform bones



#### Forefoot:

- Provides for propulsion and stability
- Maximizes lift off for gait swing and repositioning
- Comprised of 5 metatarsal bones, 22 phalangeal bones, and 2 sesamoid bones

## Physiology

For a basic physiological understanding of gait mechanics and force transmission in the foot, the act of walking is basically divided into two distinct phases:

### **Stance/Support Phase:**

Comprised of the time between heel strike and toe off, the stance/support phase of gait is separated into two primary functions:

**Shock Absorption:** As the foot makes initial contact with the ground, the ground transmits force simultaneously into the foot. Proper foot mechanics at this stage is therefore solely focused on the efficient dispersal of these ground reaction forces. With success, force is dissipated through a vast network of cartilage, muscles, tendons, ligaments, and bone. Without success, force is isolated into a specific structure or structures and, with repetition, eventually overloads and injures/damages the tissue involved.

**Push-Off:** Immediately after the act of force dissipation comes the act of propulsion. Upon full weight bearing the midfoot transitions from a structure that is malleable and movable to one that is rigid and firm. This rigid and locked position of the midfoot provides for the leverage necessary for the foot to now propel forward through the toes.

### **Swing/Recovery Phase:**

Much like it sounds, the purpose of the swing/recovery phase is to unlock the midfoot and reposition the entire foot in order to receive the next heel strike. However, with injury, the simple act of repositioning the foot can become a debilitating challenge. If not addressed, limitation in the swing/recovery phase can easily cause increased stress on the knee, hip, and spine.

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## Common Injuries

### **Sever's Disease:**

A force-dissipation injury, specifically in young, physically-active individuals, occurring where the Achilles tendon inserts into the calcaneus. Pain occurs at the posterior superior aspect of the heel as a result of consistent jumping and running activities. Although padding, heel supports, and gentle stretching of the calf musculature may help, the most effective treatment for this condition is rest.

### **Calcaneal Contusion:**

A true blunt force trauma injury, a calcaneal contusion can occur from one intense blow or as the result of repetitive lesser blows. Either way, with the lateral plantar nerve and its branches in the immediate area, this injury is often much more debilitating than other bruises. In fact, treatment for this condition often requires anti-inflammatory medication and non-weight bearing for a period of days.

### **Jones Fracture:**

A fracture to the proximal end of the 5th metatarsal, this injury is very routinely seen in patients who are involved in repetitive weight-bearing and jumping-type activities like basketball and running. Although this injury can occur due to a forceful landing or perhaps by being stepped on, this injury usually occurs as a result of repetitive microtrauma to the bone over time. Either way, chronic pain in this area of the foot should always be examined further as mismanagement of a Jones fracture almost always involves a surgical repair.

### **Turf Toe:**

As a forced hyperextension injury of the great toe, a turf toe injury overstresses and tears the joint capsule and the tendons of the flexor hallucis longus and the flexor hallucis brevis. Although appearing minor in nature, this condition is extremely painful and exceedingly difficult to manage without a significant period of rest, reduced weight bearing, anti-inflammatory meds, and protective splinting/taping upon returning to activity.

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## Injury Prevention

### **Ground Reaction Forces:**

As previously described, a primary function of the foot is shock absorption. As a result, cushioning shoes and athletic footwear are absolutely vital to injury prevention. As a shoe wears out, or if the footwear is ineffective at dissipating force, (i.e. dance slipper, sprinter's cleat, soccer cleats, etc...) the foot is then subjected to an increase load of ground reaction forces. Over time stress fractures and strains will usually result.

### **Matching the Correct Foot with the Correct Shoe:**

In our January 2011 edition of Sports Medicine Monthly, we described distinct foot types, shoe design, and how to match the two of them together. Just as selecting the proper shoe will ease the workload and demand on your foot, selecting the wrong shoe will increase it. Our January 2011 Newsletter, Injury Prevention for the Track Athlete, along with all of our past newsletters, are available on our website free of charge.

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### **Progressive Demand:**

The number one cause of injury in athletics is overuse. Although the bones, tendons, ligaments, etc... are specifically designed to increase in durability, density, and tensile load strength, they cannot do such without rest.



So, what are the common signs of overtraining, overuse, and not enough rest and recovery time?

- Chronic soreness
- Chronic fatigue
- Greater susceptibility to illness
- Soreness/Pain that requires long-term or increasing medication use

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