

Musculoskeletal Problems and Orthotic Support

Mark Charrette, DC

Normal biomechanics of the foot and ankle include moving from supination to pronation and back during the gait cycle. This transition is necessary for proper shock absorption at heel strike, stability when the foot is flat and leverage for an efficient toe-off. The most common problem that interferes with effective foot biomechanics is excessive pronation. Since the timing of the change from pronation to supination is critical during walking and running, another term for this is "prolonged pronation." This condition occurs as a result of several factors, including loss of the medial longitudinal arch, eversion (tilting) of the calcaneus, or excessive dropping of the talus and/or navicular bones.

In addition to interfering with gait and decreasing athletic performance, excessive pronation is important for two major reasons. There is the likelihood of developing painful foot and ankle disability over time, and (especially important for doctors of chiropractic) the probability of transferring abnormal stresses up the lower extremity and into the pelvis and spine. Athletes may suffer from a number of "overuse injuries," which actually are caused by excessive pronation.¹ Many times the developing problems go unnoticed for months or years, and it's only when a new walking or recreational program is begun that symptoms arise. Other times it is the painful end-stage of abnormal biomechanics which brings a patient in for care. Here's a review of the conditions and pathologies associated with excessive pronation.²

Table 1: Foot pathologies linked to excessive pronation.

Hammer toes	Calcaneal periostitis (heel spur)
Hallux valgus	Spring ligament sprain
Sesamoiditis	Longitudinal arch collapse
Tailor's bunions	Medial calcaneal compartment syndrome
Metatarsal calluses	Tarsal tunnel syndrome
Metatarsalgia	Navicular stress fracture
Interdigital neuroma	Toe extensor muscle spasms
Plantar fasciitis	

Table 2: Lower leg conditions linked to excessive pronation.

Achilles tendinitis	Flexor hallucis longus strain/tendinitis
Peroneal tendinitis	Tibial periostitis
Tibialis posterior muscle strain/tendinitis	Tibial stress fracture
Flexor digitorum longus strain/tendinitis	Fibula stress fracture

Table 3: Knee problems linked to excessive pronation.

Patellofemoral pain syndrome
Pes anserine bursitis
Chondromalacia patellae
Anterior cruciate injuries
Knee joint capsulitis

Table 4: Hip, pelvis, spine conditions linked to excessive pronation.

Iliotibial band syndrome
Piriformis muscle strain
Tensor fascia lata strain
Anterior pelvic tilt
Trochanteric bursitis
Sacroiliac problems
Hip joint capsulitis
Excessive lumbar lordosis
Hip flexor muscle strain
Functional scoliosis
Hip adductor muscle strain

Foot Conditions

It's reasonable to assume that abnormal foot biomechanics can lead to foot problems. What is unusual is the number of conditions which have been reported to be linked with excessive pronation. Table 1 is a list of the foot pathologies that have been identified.

Lower Leg Problems

Many of the muscles that move the foot and ankle and provide support during walking, running and jumping arise in the lower leg. Therefore, it makes sense that excessive pronation can result in various strains and tendinitis conditions of the lower leg. When abnormal biomechanics are combined with the higher forces of sports activities, even stress fractures can develop.³ Table 2 is a list of the commonly encountered conditions in the lower leg, associated with excessive pronation.

Knee Pathology

The knee is a hinge (ginglymus) joint, moving primarily in one plane. When excessive pronation at the foot and ankle causes increased medial rotation to transmit up the leg, this rotary motion eventually results in knee symptoms. Knee problems frequently develop in athletes who experience greater rotational forces.⁴ Some studies have even indicated that this can happen on an acute basis, causing rupture of the anterior cruciate ligament.⁵ Table 3 is a list of knee problems which can develop from excessive pronation.

Hip/Pelvis/Spine

Regretfully, there is much less written about the specific conditions of the hip, pelvis and spine caused by excessive pronation. Because the foot is not nearby, correlation of poor foot biomechanics with pelvic and spine problems requires additional research. The most important condition for doctors of chiropractic is the functional short leg, created by arch collapse and medial rotation of the ankle and leg. This results in a pelvic tilt to the shorter side and usually is accompanied by a spinal rotoconvexity (scoliosis). This is sometimes known as "functional scoliosis," since it is flexible and present only while in the standing position. Table 4 is a list of the pathologies which may be seen in the hip, pelvis and spine with excessive pronation.

Support From Toe to Head

Excessive pronation is associated with many musculoskeletal complaints - from the foot itself, up the leg to the knee, hip and even the pelvis and spine. The good news is that all of these conditions can be helped with flexible, custom-made orthotics. Investigation of foot biomechanics is a good idea in all patients, but especially for those who are recreationally active. Many times, correction of recurring subluxations can only be accomplished when an excessively pronating foot is provided with appropriate orthotic support. Competitive athletes must have regular evaluation of the alignment and function of their feet in order to avoid potentially disabling injuries. Preventive measures include wearing well-designed and constructed shoes and considering orthotic support in those patients at risk for developing excessive pronation.

References

1. Busseuil C, et al. Rearfoot-forefoot orientation and traumatic risk for runners. *Foot & Ankle Intl* 1998;19:32-7.
2. Hartley A. *Practical Joint Assessment: A Sports Medicine Manual*. St. Louis: Mosby Year Book, 1991:571.
3. Schweitzer ME, White LM. Does altered biomechanics cause marrow edema? *Radiology*, 1996;198:851-3.
4. Dahle LK, et al. Visual assessment of foot type and relationship of foot type to lower extremity injury. *J Orthop Sports Phys Ther*, 1991;14:70-4.
5. Beckett ME, et al. Incidence of hyperpronation in the ACL injured knee: a clinical perspective. *J Athl Train*, 1992;27:58-62.

DECEMBER 2007