Foot Typing for the Successful Prevention and Treatment of Common Sports Injuries

Evaluating foot types can help prevent and treat specific pathologies.

By Louis J. DeCaro, DPM

Because approximately twenty-five percent of sports-related injuries occur at the foot and ankle, it is imperative to understand foot types and related ankle and foot pathologies. Otherwise, without some form of intervention, a patient will always be vulnerable to certain pathological injuries and conditions of the foot and/or ankle.

In September 2009, *Podiatry Management* published an article describing a clinical algorithm identifying 24 unique foot types. These foot types were broken down into six major categories. These six groups are known as "Quads."To review, the "Quads" are coded A through F, with each possessing its own specific foot morphologies and gait characteristics. This technique of foot typing can easily and effectively demonstrate to your patient that each "Quad" or foot type can or has lead to specific acute or chronic conditions of the foot and ankle. Because education is the cornerstone of building a successful and trusting relationship with your patients, practitioners should be educated about this simple and effective technique.

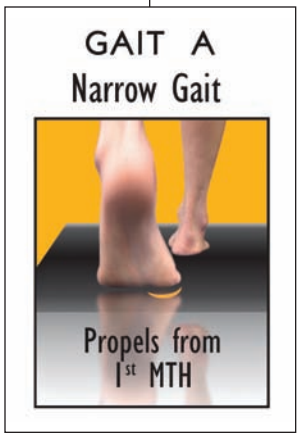

Figure 1

Whether or not you use "this lab" or "that lab" for your orthotics, understanding how to spot certain foot types allows successful treatment and prevention. The goal is to understand the effects of foot type on the foot and ankle, not only in the short-term, but in the long-term as well.With this understanding, future injuries and chief complaints associated therewith can be eliminated, or at least mitigated with proper foot typing and orthotics dispensing.

Evaluation for Foot Type

Inevitably this requires the successful evaluation of the patient to determine his or her foot type. Thus, the goal is to identify which Quad most closely matches the patient's foot.A simple algorithm is used to assist in identifying Quads for your patients. This algorithm has four steps, with each step helping to better identify the patient's foot type. Initially, the patient is evaluated (while weight-bearing) for arch height.Then, the patient is examined for toe sign. Thirdly, the patient is evaluated during the gait cycle to determine the type of gait. Finally, callus patterns on the feet help to complete the analysis. Further details on foot typing can be found at www.whatsmyfoottype.com.

Once the patient's foot type has been identified, it helps to understand the mechanics of each. The A, C and E foot types have an uncompensated rearfoot varus, which

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New Concepts and Studies

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prevents the patient from everting at the subtalar joint of their heels. The B, D and F foot types have a compensated rearfoot, allowing for subtalar eversion at the subtalar joint to a neutral position. The A and B foot types have a valgus forefoot alignment. The C and D foot types have a neutral to small forefoot varus, and the E and F foot types have a medium- large forefoot varus alignment.

Type A

The patient with an A foot type will heel strike with a rather large inverted heel, and propel forcefully from the first metatarsal (Figure 1). This large inverted heal alignment prevents the MTJ from unlocking. This results in poor shock attenuation, excessive supination, and a potentially narrow or cross-over gait pattern. Clinical symptoms resulting from this foot type include lateral ankle instability with resulting peroneal tendonitis and/or heel pain as the patient tries to stabilize his/her foot on heel strike, fifth metatarsal base pressure as the patient struggles to maintain balance through the midfoot, sesamoiditis due to extreme pressures upon propulsion, HAV and hammertoes from clawing the ground for stability through propulsion, knee recurvatum, and lower back pain.

Figure 2

Type B

The patient with a B foot type will mildly invert the heel upon heel strike, pronate through mid-stance, re-supinate during propulsion, with final propulsion coming off of the first and second metatarsal heads (Figure 2). This results in neuromas, sesamoiditis, first ray hypermobility, and sacroiliac pain.This particular foot type is often unilateral and associated with a limb-length discrepancy. This foot type generally seen in the pediatric population is often associated with idiopathic toe-in walking.

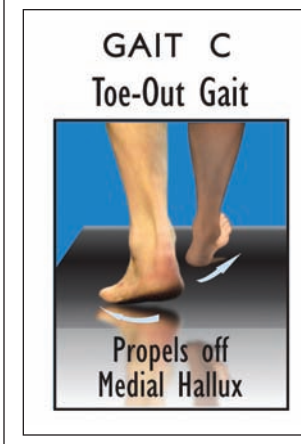

Figure 3

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Type C

The C foot type has a moderate-large inverted heel alignment with a normal forefoot alignment. This foot type is the most "normal" foot, though it still has various associated problems (Figure 3). Like the A foot type, this foot has poor shock attenuation, along with restricted subtalar joint pronation and resulting propulsion off of the medial hallux. Larger rearfoot varus deformities can result in a marked toe-out gait from the hips in order to facilitate loading of the medial column. This external hip rotation often results in piriformis and iliotibial band (ITB) tightness.

Figure 4

Type D

The D foot type has a mildly inverted heel strike with a normal forefoot alignment and a neutral gait.Because the subtalar joint can evert, the midtarsal joint is often unstable, resulting in an impaired locking mechanism (Figure 4). This foot type causes midtarsal joint breakdown at heel rise, and the patient is seen to propel off the second and third metatarsals due to transverse metatarsal arch reversal. This foot type results in pathologies such as plantar fasciitis, metatarsalgia, functional hallux limitus, patellofemoral pain, posterior tibial tendonitis, neuromas, and dorsal bunions.

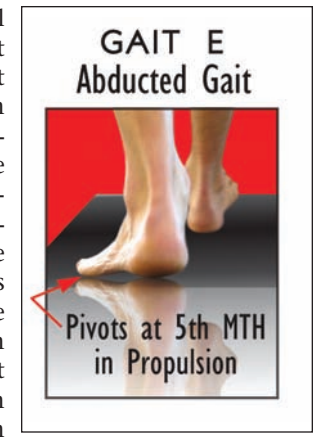

Figure 5

Type E

The patient with an E foot type will have a moderate to large uncompensated rearfoot varus with a moderate to large forefoot varus (Figure 5). This patient will have a narrow heel base with a toe-out gait, restricted subtalar joint pronation and will propel off of the medial hallux. This patient often suffers from retrocalcaneal bursitis, lateral hip pain, a Haglund's deformity, lower back pain, Iliotibial band syndrome, and pinch calluses of the medial halluces.

The E foot-type presents with a moderate to large uncompensated rearfoot varus coupled with a moderate to large forefoot varus alignment. This results in pronation from midstance into propulsion in efforts to load the medial column. Restricted subtalar joint pronation may result in a "medial heel whip" (external

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limb rotation)as the body's adaptation to load the medial column. The result is a narrowed heel base and medial hallux propulsion. Common signs and symptoms are plantar fasciitis, posterior tibial tendonitis, medial knee pain, and Osgood-Schlatter's disease.

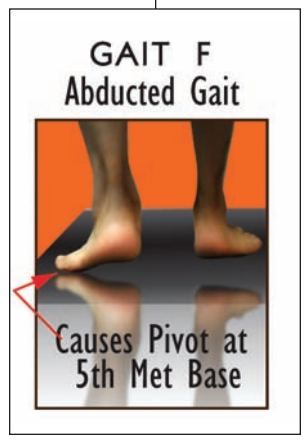

Figure 6

Type F

The F foot type has a mild rearfoot varus with a moderate-large forefoot varus. This patient has severe pes plano valgus, pronates through propulsion, has severe midtarsal joint instability, and propels from the central metatarsals, often resulting in a "Cyclops" callus pattern (Figure 6). Pathologies associated with this foot type include posterior tibial dysfunction, tarsal tunnel syndrome, plantar fasciitis, patellofemoral pain syndrome, subfibular impingement, hallux limitus, and splayfoot.

Foot Type-Specific Injuries

Now, let us look at specific ankle injuries based on foot type. With posterior tibial tendon dysfunction (PTTD), the patient suffers from inflammation of the tendon due to overstretching. This results in poor arch support. The patient often experiences medial ankle pain and swelling, progressive loss of the arch height (flat foot), gradual onset of subfibular impingement pain laterally, weakness, and an inability to stand on the toes and/or tenderness over the midfoot, especially when under stress during activity. A patient with a D or F foot type is most likely to suffer from PTTD.

The progression of this injury begins with inflammation of the posterior tibial tendon with normal strength and a stable arch (Stage 1). The patient may have a flexible hind foot. In Stage II of this progressive injury, a partial tear of the PTT with loss of normal strength and flattening of the arch occurs.At this point, the patient may be unable to perform a single-limb heel rise and will have the onset of lateral ankle impingement pain.

Stage III of this injury includes a full tear of the posterior tibial tendon with no strength and/or loss of normal function, complete arch collapse, and acquired joint fixation. The final stage, Stage IV, includes all of the above as well as arthritis in the ankle joint.

Peroneal Tendon Subluxation

Peroneal tendon subluxation occurs when the retinaculum and ligaments that hold the peroneal tendons in place become torn, allowing the tendons to sublux over

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the malleolus. An acute injury of this type is rare and involves forceful dorsiflexion with peroneal contracture.It is more common to have a chronic injury of the peroneal tendon due to repeated lateral ankle sprains. Symptoms include point tenderness behind the lateral malleolus, swelling and bruising, snapping sensation along the lateral ankle, visible slipping of the peroneal tendon, and pain with toe walking and eversion.

A patient with an A foot type often has equinus, many times both rear foot and forefoot, resulting in restricted ankle dorsiflexion. This patient will benefit from orthoses with a heel lift to decrease knee recurvatum and maintain heel contact longer during the gait cycle. This patient should also be given a gastrocsoleus stretching regimen and possibly a night splint to use with the orthoses.

Ligament Sprains

On average eighty-five percent of all ankle injuries involve ligament sprains, the most common of which occur laterally, and usually involve the anterior talofibular ligament. In these cases,the A type foot is the number one culprit. A patient with an F foot type will have the opposite effect, leading to subfibular compression of the peroneals and severe pes planus. This patient will benefit from orthoses with a deep heel cup and forefoot posting with the first ray cutout.

Understanding Foot Types

The injuries above are just the tip of the iceberg for dealing with athletes and their most common injuries. As a general rule, though, being able to understand what "foot type" or, more specifically, what "quad type" you are dealing with, allows you to correct the biomechanics of the foot and ankle which can reduce the chances of ankle and foot injuries. Proper evaluation of foot type with subsequent prescribing of appropriate orthotics will go a long way in preventing many types of foot and ankle injuries. Treating the foot type before the injury happens is the best form of prevention, while eliminating the chance for repeated, chronic injuries. Remember, no matter what lab you may use, education and understanding of the basic biomechanical principles is essential to a successful well-balanced podiatric practice. ■

Dr. DeCaro specializes in pediatrics with a special interest in sports medicine and biomechanics for both adults and children. He is currently in private practice with three private offices located in South Deerfield, Amherst, and Easthampton MA. He is a member of the surgical and medical staff at Cooley Dickinson Hospital, Franklin Medical Center, as well as Mary Lane, St. Vincent, and the UMASS Hospitals. Dr. DeCaro is a member of AAPPM.