

# WHO IS THE BOSS:

## THE BACK OR THE FOOT?

BY **PATRICIA PANDE, PT, MCLSC, C.PED., CSCS**

**I** REMEMBER SITTING IN PEDORTHIC CLASS IN NEW YORK, BRIGHT EYED AND BUSHY TAILED, MULLING OVER THE GREAT QUESTIONS OF THE UNIVERSE OF FEET. I LISTENED EAGERLY TO DR. WERNICK DESCRIBE THE FOOT AS “PASSIVE,” ACCEPTING “WHAT IT DESERVED,” WHILE THE SPINE DIRECTED THE ENGINE. THAT DAY, I LEFT CLASS GRAPPLING WITH WHAT I HAD HEARD—WHO REALLY IS THE PROVERBIAL BIOMECHANICAL BOSS? IS IT THE BACK OR THE FOOT? DETERMINING THE ANSWER TO THAT VERY QUESTION HAS FUELED MY YEARS IN THE CLINIC.



Some in the field might argue that pieces of the information in this article fall outside the scope of practice for a pedorthist. To that, I pose the counterargument that anyone with an understanding of the triplanar axis of the foot and the biomechanics of gait will similarly recognize the impact the foot has on the other aspects of the kinetic chain. Additionally, I posit that making use of external resources to help an assessment rather than practicing in a void is a unique and rewarding experience. It is my hope that this research will serve to add more evaluative tools to the toolbox and provide a frame of reference for pedorthists, trainers and physical therapists to deliver the best and highest level of care to whichever piece of the chain is driving the equation.

This process starts with the classification of people into groups. There are those who are too loose, too tight, just “right” and every combination in between. The “too loose” individuals, those characterized by lax ligaments, are very prevalent in typical patient populations. Testing with the Beighton and Horan test (Foss et al, 2009) offers input on laxity through testing nine different movements, including:

- flexion of thumb to touch volar aspect of forearm;
- hyperextension of the fifth digit to be parallel with the forearm;
- hyperextension of the elbows beyond a straight angle;
- hyperextension of the knees; and
- placement of the palms to the floor with the feet spread shoulder-width apart.

Successful completion of each of these movements beyond normal range garners one point. A score of four or more classifies hypermobility, which is often associated with torsion of the spine, shoulder instability, instability of the patella and compensated forefoot and/or rear foot varus. This ligament laxity also results in torsional abnormalities in the limbs. The lack of proper muscle pull on bones may influence the degree of torsion of bones.

There are various torsions of the long bones of the leg that impact the way the foot hits the ground. In addition, hypermobile patients may have either coxa vara or coxa valga. Such changes in angulation will be discussed in the following case studies.

The following case studies are illustrative examples of the biomechanical reciprocity between the foot, knee, hip and back. There is a paucity of literature in this field, but observational analysis and biomechanical findings argue that future research in biomechanics is necessary to defend theories of the effects of asymmetry on the lower kinetic chain.

## Hip Retrotorsion

The angle of the medially rotated position of the femoral shaft in relation to the position of the head and neck of the femur is called the angle of torsion.

## Read This Article, Take Survey to Earn Continuing Education Points

The Pedorthic Footcare Association (PFA) offers Continuing Education Points (CEPs), approved by the American Board for Certification in Orthotics, Prosthetics & Pedorthics (ABC) and the Board of Certification/Accreditation International (BOC), via specially designated articles within *Current Pedorthics* magazine.

To take advantage of the program, thoroughly read the adjacent article, “Who is the Boss—the Back or the Foot?,” and then visit [www.pedorthics.org](http://www.pedorthics.org) and click on the Continuing Education Opportunities tab to purchase the 10-question quiz associated with this article. CEP quizzes cost \$15 for members and \$25 for non-members. The quizzes are worth 1.0 Scientific or Business CEP, depending on the content. Successful completion of the quiz will result in 1.0 CEP reported directly to ABC and BOC at the end of each quarter.

Look for additional CEP-eligible articles in future issues of the magazine; previous articles are available in the magazine archive at [www.pedorthics.org](http://www.pedorthics.org).

If you have any questions, contact Lauren Kemp, PFA education coordinator, at (800) 673-8447 or email [info@pedorthics.org](mailto:info@pedorthics.org).

## WHO IS THE BOSS: THE BACK OR THE FOOT?

Retroversion occurs when the angle is decreased below 14 degrees and the angle of the head and neck of the femur is rotated posteriorly with respect to the shaft (Norkin and Levangie, 1992).

To test in supine, rotate the leg outward to the point at which the lateral trochanter falls laterally without falling posteriorly. Other tests include the range of hip rotation, which is excessive in prone and supine with no significant difference between the two; and Craig's Test in prone, which involves the examiner rotating the hip and determining the most lateral prominence of the greater trochanter, which is the neutral position of the acetabulum (Magee DJ, 1997).

At present time, there are no reliable methods to assess retrorsion in standing. The relation of tibial torsion, femoral torsion and forefoot abduction remains difficult to assess and is not predictive of turnout in ballet dancers (Champion and Chatfield, 2008). It is recommended that total turnout be differentiated with femoral torsion, tibial torsion measurements on the table and hip range in supine and prone.

In this case study, the patient stands with feet turned out or in the "Charlie Chaplin" position and attempts to seat the femoral head in an optimal position in the acetabulum. The retroversion can result in early supination and hitting the lateral side of the foot, followed eventually by excessive and prolonged pronation in stance with medial displacement of the center of gravity.

In this instance, the back is the boss and the foot follows. Treatment consists of accommodating late pronation with

a full-contact insert (see picture, left). Certain shoes with a straight last control motion allow for some rocking over the toe, maintain



hallux range of motion and do not force rotation inward, yet they still stretch the muscles gently into inward rotation. The subject is not allowed to tailor sit.

### Coxa Vara

In the frontal plane, the angle of inclination is less than 125 degrees (Mahers et al, 1996). On observation, the lateral trochanter is more visible—the thighs look bigger and the calves smaller. As compensation, the femur is adducted to seat the head of the femur in the acetabular fossa. The contralateral iliac crest is higher during DLS, and the coxa vara creates a leg length discrepancy.

On the pictured subject (see picture, top right), the right leg is more affected than the left and the right iliac crest is lower than the left. In this case, there is a limitation of hip abduction or movement of the leg away from the body. The spine suffers from a compensatory side bend to the left and rotation to the right. The iliotibial band on the right side is positioned more forward of the greater trochanter and the right pelvis may rotate forward with tightening of the hip flexors. The result may be painful trochanteric bursitis and hip flexor tendinitis. In order to create a wider base of support, there may be genu valgum or supination of the feet in standing with tibial varum.

Initial treatment of this patient requires addressing the leg length discrepancy associated with the coxa vara. In addition, accommodating and correcting supination using inserts modified with lateral posting and cutouts for first ray as well as shoes designed with neutral cushioning or rocker action over toes can help many patients. Stretching of tight muscles such as the iliotibial band and hip flexors and self-mobilization of the pelvis for anterior rotation of the pelvic bone will help with symptoms. In this case, the back and hip are boss and can cause great pain and suffering to the afflicted individual.

Though there is little research on the effect of hyper mobility on the feet,

one study conducted on an athletic population used the Beighton and Horan joint mobility index and revealed that increased medial foot loading existed in female athletes screened for hyper mobility (Foss et al., 2009). The study also required participants to walk over a walkway with pressure plates and be tested for levels of dynamic peak pressure and maximum force. The study, however, did not take into consideration any of the proximal effects that might accompany joint instability.



Popular research speculates that internal rotation of the lower leg and an upper body forward tilt occurs when there is hyper mobility at the subtalar and midfoot joints (Pinto et al, 2008). Compensations, including a lordosis or a scoliotic curve (particularly if there is a leg length difference) are believed to follow. In clinics, a great deal of time and effort is spent trying to correct these issues with orthoses, physical therapy and other stabilizing and strengthening tools.

### Ehler Danlos Syndrome

In one case study, a 34-year-old patient with Ehler-Danlos Syndrome sought treatment for stress fractures of the tibia and fifth metatarsal on the right. Although she initially responded favorably to therapy, her poor proprioception and extensive joint instability led to a fall and injury to the left calcaneus. Attempts to stabilize the foot aggressively led to sacroiliac joint pain on the right, and the patient was unable to tolerate an insert with maximum correction. When her right sacroiliac joint became exquisitely painful, she became unable to bend down to tie her shoes and, subsequently,

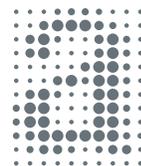
# Fastest Turnaround - Period

	1 Day	3 Day	1 Week
Digital EVA	<input checked="" type="checkbox"/>		
Diabetic		<input checked="" type="checkbox"/>	
Foam EVA		<input checked="" type="checkbox"/>	
Carbon & PolyPro			<input checked="" type="checkbox"/>

## What are you waiting for?

Call now to get the fastest service & highest satisfaction rates! - 800.356.3668 x260

Free gifts to the first 50 callers!



**amfit**<sup>®</sup>

Where technology fits. Perfectly.

800-356-FOOT (3668)  
WWW.AMFIT.COM

# WHO IS THE BOSS: THE BACK OR THE FOOT?



converted to a slip-on shoe (see picture, above) without correction. Her foot pain has since increased, which begs the question, who is the boss of this body?

As these case studies demonstrate, there is no conclusive solution to my

question. Sometimes the foot is the boss and sometimes the back runs the show. Consequently, practitioners must be aware of the movement dysfunction driving the engine. The best way in which to continuously assess and treat complicated patients is through thoughtful and purpose-driven cooperation among the pedorthist, the physical therapist and the patient. It behooves all of us in the field of patient care to work in tandem to combine knowledge and talents to reduce pain and disability in aging populations to ensure that our patients live healthy and productive lives. ■

- athletes. *J Athl Train* 2009; 44(4): 356-62.
3. Magee DJ: *Orthopedic physical assessment*, Ed 3, Philadelphia, 1997, WB Saunders.
4. Mahers et al: *Clinical anatomy principles*, St Louis 1996, Mosby.
5. Norkin CC, Levangie PK: *Joint structure and function: A comprehensive analysis*, Ed 2, 1962, FA Davis.
7. Pinto RZ et al. Bilateral and unilateral increases in calcaneal eversion affect pelvic alignment in standing. *Man Ther* 2008; 13(4): 513- 9.

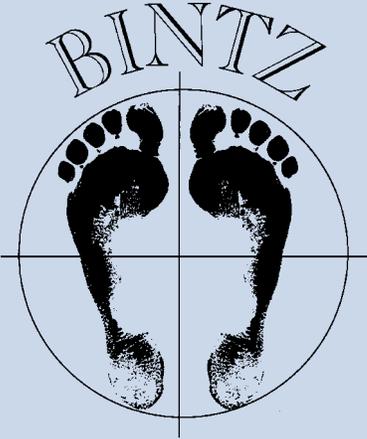
## References

1. Champion LM, Chatfield SI. Measurement of turnout in dance research. A critical review. *J Dance Med Sc* 2008; 12(4): 121-135.
2. Foss et al. Generalized joint laxity associated with increased medial foot loading in female



**Patricia Pande, PT, MCLSc, C.Ped., CSCS**, founder of FootCentric, is a physical therapist, pedorthist and strength and conditioning specialist. She currently

practices as a foot and pedorthic expert at the University of North Carolina Physical Therapy Faculty Clinic and the privately owned Kinetic Institute of Physical Therapy.



## BINTZ COMPANY







**Fitting Aids**



**And much more!**

Also distributing these fine products















**800-235-8458**

**[www.bintzco.com](http://www.bintzco.com)**

---

*PFA Silver Sponsor*  
*2010 PFA Vendor of the Year*