

Barefoot Walking Inspires Healthier Shoe Choices

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Based in part on the work of Dr. Ray McClanahan, DPM

The advantages of barefoot walking can teach us how to choose footwear that follows the body's biomechanics. A detailed look at foot biomechanics guides the recommendations for minimalistic footwear. The foot has 26 bones, and each of these bones should move separately when you walk. For a hands-on experiment, twist your foot to see how much motion is possible. Now turn your shoe upside down and twist it. Grab it at the heel with one hand, and just two inches toward the toe with the other hand, then twist. You are checking for torsional rigidity, a trend in shoes that limits the ability of the tarsal bones to move naturally. Shoes need to be **flexible** to allow your foot and ankle to adapt to the ground. Most shoes that are flexible will also be **lightweight**, which allows natural hip and leg motion.

As you walk, your brain seeks proprioceptive information from the ground. When footwear is too cushioned or supportive, those sensations will be dulled and you will subconsciously strike the ground harder. This causes damaging weight load in the knee, increasing the risk for osteoarthritis. A scientific study (cited below) shows increased joint shock when wearing over-supportive sneakers or stiff clogs but significantly less when barefoot or in flip-flops. When walking barefoot, these heavy steps are punishing, so you quickly adjust your gait. For this reason, it's essential to **feel the ground through your shoes**.

There is a second reason why this is important. Sensory feedback from your feet is essential for the correct firing of motor nerves. The nervous system demands quite a bit of sensory data to guide its motor commands: the neural bandwidth for sensory data is about 5 times more than for motor data. Your brain wants to sense your environment before deciding how to move, so it can make adjustments accordingly. One example of this is the tibialis posterior muscle, which does the job of lifting the arch of the foot, but will tend to be lazy if there is a lack of appropriate sensory information.

When the tibialis posterior is doing a poor job of raising the arch, it is often further weakened by wearing shoes with too much arch support. The arch is meant to be supported by the foot's bone structure, ligaments, and muscles (tibialis posterior and flexors hallucis and digitorum longus). When the arch of the foot not undermined by artificial arch support, it will be stronger and more capable. A stiff arch support interferes with the natural pronation stage of walking, when the medial arch of the foot spreads and flattens. The peroneal muscles will still attempt to pronate the foot against this obstacle, which can cause peroneal tendinitis and even IT band strain. Your foot will be allowed to regulate its own arch support when you choose shoes with **minimal arch support**.

The next step in following foot biomechanics is to seek a shoe with a completely **neutral heel**. Most athletic shoes, sports sandals, and even "flat" dress shoes have a half-inch heel. Even a small heel contributes to tight calves and hamstrings and increased heel strike. A "negative heel" is also not neutral, and I have not heard a scientifically-based argument for why it would be an improvement over nature's design for the heel.

Exercising in an athletic shoe causes the calf to be strengthened in a limited range of motion. Outside the gym, muscles heal in a shortened position if your daily footwear has a raised heel. When the calf is short, the Achilles tendon is vulnerable to tears instead of being strong and resilient. Shortened calves limit ankle freedom, and also impact the rest of the body. Since there is one continuous line of fascia from the bottom of the feet, up the back of the body, to the forehead, it makes sense that short calves could contribute to many problems. Tight hamstrings and lower back trouble are obvious consequences, and perhaps this pull from the calves could even cause neck tension and headaches.

Athletic shoes can set runners up for plantar fascia pain. In one case, an athlete had run many marathons and even a 100-mile race, and wore athletic shoes daily with no problem. However, spending just one day barefoot at a water park triggered severe, lasting plantar fascia pain. The tissue had been overstretched by normal motion after being held short for so long. The typical podiatric recommendation is to avoid being barefoot, but that answer is only a makeshift solution. A better healing plan would be to calm and free the tibial/plantar nerve (between the gastroc heads and along the inner ankle), to lengthen the calf muscles and fascia, and to transition to neutral footwear to support full calf length.

As athletes transition to reduced heels and then neutral heels, proper stretching is necessary to avoid injury. Stretching should occur after calf exercise that fully warms the muscle tissue. Stretch the calf by dropping the heel off the edge of a curb. Start slowly, feeling for the first place of resistance, pausing for 10-20 seconds to let that resistance ease. Sink deeper and look for the next resistance. Once in the full stretch, hold the position for 60 seconds or more. This measured approach to stretching will prevent injury and support the calf in adjusting to shoes with a neutral sole.

A neutral sole will also be **flat through the toes**. In the past decade, athletic shoes commonly feature a 15 degree upward slant, called toespring. Toespring was added to facilitate the rolling action of the foot, but our legs naturally perform this motion without changing shoe shape. If the shoe is flexible, toespring can be reversed by bending the shoe in the other direction for a half hour. Toespring may contribute to deformed toes because it holds the toes in a lifted position. Toespring also limits the ability of the flexors and extensors of the toes to work properly.

Your toes will enjoy having a **foot-shaped toe box**, which means the toe box needs to be wide at the end of the toes. Narrow toe boxes cause bunions, neuromas, and distorted toes. Watch out for a toe box that narrows too quickly. Athletic shoes are commonly wide at the ball of the toes but narrow at the tips of the toes. If you remove the insole and stand on it, check whether your toes go over the edges of the insole. Avoid sandal straps that cross the toes and pull the toes inward.

Narrow toe boxes are a sneaky contributor to overpronation. If the big toe is pushed toward the other toes, the foot is more likely to overpronate. Try it by holding your big toe in toward your other toes, and then out away from your toes, and attempt to collapse into your medial arch. In the natural position, the big toe helps limit pronation to an appropriate level.

Poor-fitting sandals or flip-flops can also contribute to deformed toes. Footwear needs to **stay on your feet** without having to use your toes. Common culprits can include flip-

flops, clogs, Crocs, and Birkenstocks. Over the years, gripping or lifting your toes will contribute to hammertoes, claw toes, and squished-together toes. Choose a version with a heel strap, or with a design that stays on easily as you walk. Examples would be a Birkenstock or a Croc with a strap behind the ankle, or Mary Jane style dress shoes.

Indigenous peoples who have been barefoot since childhood show us how to walk and run correctly. Allow your foot to stay on the ground longer, rolling through the toes, then swing your leg forward only to the point where it is just a little in front of your body. Contrast this to reaching the foot far in front of the body, striking the heel, and pulling the rest of the body forward. This new stride will be shorter but with a faster cadence. Each step will feel lighter, minimizing both impact and effort. Keep the feet fairly close to your midline, over your center of gravity. This prevents side-to-side rocking, for reduced impact and improved balance.

You've found shoes that are wide at the end of the toes, but when you take out the insole and stand on it, your big toe or little toe still extends past the edge. Your toebox needs a little more room. You can re-lace the shoe, skipping the first pair of eyelets, to allow more room at the toes. You can try to stretch the leather in specific places, using a tool such as the blunt end of a pen.

If the toebox is spacious but your toes are still inactive, you can wake them up by wearing toe socks, which have a separate pocket for each toe, like a glove. This stimulation will increase sensory information coming from your toes and help you learn to use them. Injini brand (<http://www.injinji.com/>) has longer toes, neutral colors, and wicking fibers appropriate for sports. Sock Dreams (www.sockdreams.com) has many styles for women, with shorter toes and fun colors. Of their products, Feelmax anklets have an excellent fit for average sized women. Toe shoes by Vibram Five Fingers are available online and at REI. The original four models (Classic, Sprint, KSO, and Flow) are built with extra-long toes, while the newer models fit people with average toe length. Men's and women's designations simply indicate a slight difference in width.

You don't need to throw away any of your shoes, just put some of them in the back of your closet. Also, new shoe purchases need not be expensive. Just keep these principles in mind as you shop, and you will find many minimalistic shoes for \$80 or less.

The next time you are out shopping for shoes, look first for shoes that have a reasonable toe box and a neutral heel. Pick up each of these shoes, turn them over, and twist specifically at the tarsal bone area to check for flexibility. If they pass the twist test, pull out the insole (if not glued in), which allows you to see how the shoe is constructed and whether it can be worn without the insole for increased sensory feedback and toebox room. Then, try on final candidates for fit and comfort. This way, you are spared trying on shoes that may seem initially comfortable but work against your biomechanics.

Making Reasonable Exceptions

If you have healthy feet, you may wish to use non-minimalistic shoes for specific activities. Examples include:

- Tall heels for tango, salsa, or flamenco

- Hiking boots for extreme mountaineering, especially using crampons for ice
- Work boots for climbing ladders, using a shovel, or other dangerous tasks
- Rock climbing shoes, which pinch the toes
- Ski boots, which closely resemble an ankle cast

For people who love these activities, it is even more important than the rest of your shoe wardrobe is minimalistic. Bring a lightweight shoe to change into immediately after the activity, or stay barefoot if possible. Spread your toes and stretch your calves to restore full motion to your legs and feet.

Please contact me at 503-230-0087, or see my website www.portlandrolfer.com for more information, including a link to a 13-page list of recommended shoe brands and styles with photos, as well as links to scientific studies on feet and shoes.

Scientific articles

“Walking Barefoot Decreases Loading on Lower Extremity Joints in Knee Osteoarthritis,” by Najia Shakoor and Joel Block, published in *Arthritis & Rheumatism*, Sept 2006.

“Foot Strike Patterns and Collision Forces in Habitually Barefoot Versus Shod Runners,” by Daniel Lieberman et al., published in *Nature*, November 2009.