Minimalist Shoes and Barefoot Running

By Séamus Kennedy, BEng (Mech), CPed

In the last year or two, much has been written about barefoot running and the trend toward minimalist shoe gear for runners. Having an interest in both running and biomechanics, I enjoy reading about this subject, and the more I read, the more I began to wonder about the science behind the trend. In theoretical physics, an initial hypothesis is often tested by considering a "thought experiment." Being far more scientific, I went a step further and conducted a "study of one"—I sacrificed myself as the sample set and tried out some of the different concepts. In other words, what follows is my own personal opinion.

The Barefoot Phenomenon

Starting in 2009, I began to see articles on barefoot running show up in various publications such as *The New York Times, Podiatry Management,* and *TIME.* Clearly a fad was well under way. *(Editor's note: To read* The O&P EDGE's *coverage of this topic, read "Barefoot Running: Crazy Trend or Timeless Wisdom," in the April 2010 issue.)* Several writers mentioned the book *Born To Run* by Christopher McDougall. With a subtitle of *A Hidden Tribe, Superathletes, and the Greatest Race the World Has Never Seen,* I felt compelled to add it to my holiday wish list.

The basic premise behind most of this writing is that the modern athletic-shoe industry had developed over the last 40 years and delivered a wide range of sneakers and shoes that were big on cushioning, control, and special features but short on research. Specifically, there was little scientific evidence to show that injury rates among runners had decreased as the technology had increased. In fact, the consensus is that injury rates have stayed about the same.

Many people credit the legendary Oregon track coach Bill Bowerman and his protégé Phil Knight with the beginning of the modern athletic-shoe industry. They began Blue Ribbon Sports, a forerunner to Nike, back in the 1960s. Since then, Nike and many rivals have developed running shoes and trainers with a continuous stream of innovations including foams, gels, springs, air pockets, and microchips. All of these features are great for marketing purposes, but do they help runners?

McDougall's journey began when it seemed as if his running days had ended. Plagued by some of the typical injuries associated with running, he visited several specialists, all of whom gave him some version of the same advice. The stress caused by running was too hard on his hefty frame; he needed good, cushioned shoes and custom orthotics; he should consider low-impact sports for his cardio workout. Discouraged, but not defeated, he began his own investigation and found that there may be alternatives. This led him to find and meet other researchers and trainers who had come to believe that the sports-shoe industry had taken a wrong turn several decades earlier.

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The shoe industry had been selling "common sense," and consumers and medical practitioners were buying it. If running long distances on hard pavement is stressful to the joints, then cushioning would attenuate that stress and reduce peak impact forces. If some cushioning is good, then more cushioning is better. Research shows that maximum impact comes at heel strike, so they reasoned that adding extra EVA under the heel must be the best solution. The result included shoes that encased the feet with raised heels, thick cushions, and wide bases.

Not everyone agreed with this "common sense" view. One of the most respected opponents of this notion is Daniel Lieberman, PhD, a professor of human evolutionary biology at Harvard University. His research centers on the premise that "humans have engaged in endurance running for millions of years"—so the human foot evolved to run barefoot. His studies and others demonstrate that most barefoot runners will avoid heel strike and prefer to land on the middle or front of the foot. "Barefoot runners point their toes more at landing," the studies found, which helps lessen the impact. *(Author's note: To see a video demonstration of this, visit www.scientificamerican.com/video.cfm?lineup=1406165298&id=63694182001)*

If modern sneakers with cushioned heels allowed runners to get away with heel striking, then they may have inadvertently increased peak impact forces and joint torque, causing injuries further up the chain at the ankles, knees, and hips. By putting our feet into hibernation, we were losing valuable proprioception, sensory feedback, and muscle strength.

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My Experience

About three years ago, I began running using a technique known as ChiRunning (www.chirunning.com). In essence, ChiRunning focuses on developing a natural stride where the runner leans forward and lands with a mid-foot strike beneath the body with the knee slightly bent. This eliminates heel strike, reduces total impact force, and lessens the chance of an injury. This is not unlike the Pose Method, another well-known running system developed by Nicholas Romanov, PhD. The effect is to try and gracefully fall forward, without landing on your face, and generally create a flowing movement. I can truthfully say I am no expert, but I have thoroughly enjoyed applying the principles.

I was still running with traditional cushioned sneakers and my own custom sport orthotics. In general I have pretty good biomechanics and I've never had a running injury, so I decided I could cautiously begin to experiment on myself. I was careful to stretch before and after each run and listen to my body for any signs of trouble. *(Author's note: See my list of tips in the "Changes Afoot" section that follows.)*

I began by toning down my shoes. I switched from a standard stability sneaker with thick, cushioned heels and multiple density mid-soles to a less-engineered shoe. I chose a trail runner with far less cushioning and a much lower heel. The effect was like going from the smooth ride of a Cadillac to the sporty sensation of a BMW—in a good way. I broke in the new shoes slowly, initially doing short distances and building up gradually. I liked the sensation of less cushioning; I could better sense the ground and feel whether I was landing correctly. I did end up adding ¼-inch cork heel raises when I felt slight twinges in my Achilles tendon.

I then decided to run without orthotics! Just me and the shoe. Except now I looked to stay off asphalt. If I was going to run as nature intended, I needed to look for natural paths and trails. Again, I ran short distances at first and felt even more of the terrain. I am not a natural forefoot-strike runner, so while I was still landing midfoot I felt a little less bounce in my stride.

The final step was to try out a pair of Vibram FiveFingers (www.vibramfivefingers.com). These shoes were introduced around 2006, mainly for boaters and kayakers, but they quickly caught on with the minimalist-running crowd. They are basically thin rubber foot protectors with no real cushion or support. They allow you to run as close to barefoot without actually being barefoot. The most obvious and instant change was that I started to land on my forefoot! Bare heel impact is quite hard, so the body naturally and instantaneously changes to a forefoot strike. You can quickly and easily verify this for yourself by running on a treadmill both with and without shoes and listening to the sound of each footfall. For me this felt great—for a while.

I have found that I can go up to two miles on dirt trails with the FiveFingers, but then two things begin to happen. First, I land pretty hard on the balls of my feet and my met heads become sore. I have a slight Morton's toe bilaterally and callusing under the second metatarsals. Second, because the calf muscles stay engaged throughout the weight bearing phase and there is no heel raise, they feel awfully stiff the following morning. I was

The Flap about Flip-Flops

We often read about the perils of flip-flops and the danger they pose to foot health. Hundreds of millions of pairs of flip-flops are sold worldwide each year—making them the most popular form of casual footwear in the world. This is hardly a surprise—they are usually inexpensive and comfortable. If the human body evolved for barefoot ambulation, then why is there so much consternation about flip-flops?

Flip-flops are not necessarily bad, but one of the potential drawbacks they pose is that most of us switch from wearing "sensible" shoes to flip-flops as soon as the temperature gets warm. If you spend all winter wearing stiff-soled boots, laced leather shoes, or pumps, your feet adapt to an environment of firm counters and raised heels. The intrinsic muscles of the feet may be weakened and heel cords can tighten. Once the mercury begins to rise and you suddenly decide to spend your days shod in nothing but flat, unstable flip-flops, you may be asking for trouble. Going from over-control to no control is a recipe for disaster.

I recommend that any patient who is diagnosed with foot problems such as pes planus, even mild cases of posterior tibial tendon dysfunction (PTTD), Achilles tendinitis, or any hint of neuropathy avoid flip-flops altogether. Wearing them will only aggravate the condition and result in further injury.

sure that my calf muscles would strengthen over time, but I was concerned that I would get a stress fracture if I increased distance on anything but the softest of surfaces.

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I will continue to run short distances with the FiveFingers for their benefits of helping to stimulate the feet and strengthen the intrinsic muscles of the foot, but they will not replace my running shoes. Currently I prefer to run on dirt paths with just a minimalist trail-running shoe. If I run on roads, I use the same low-profile shoe with custom foot orthotics. I have even stripped down the orthotics, removing the traditional rearfoot posts and the cushion top covers. I now run with something closer to a "dress" device—the thermoplastic shell of which provides support and prevents end of range of motion. With the combination of basic shoe and Spartan orthotic, I feel I get protection without giving up any of the sensory feedback that allows me to follow good running form.

Changes Afoot

The recent media buzz about barefoot running has led to increased consumer demand for different types of running shoes. Many people want to try out these newer concepts and styles, and shoe companies have responded. The Nike Free, around since 2005, has gained considerable popularity, as has Terra Plana's VivoBarefoot Evo and Newton Running's shoes. However, customers need to be cautioned: there is a considerable opportunity for injury when making any dramatic change in running style, sneakers, or training regimen.

Not all foot types are created equal. Many people with bad form, a predisposition to injury, or poor biomechanics will be easily injured if they undergo sudden changes. Here are some tips for those seeking to experiment with minimalist shoes or barefoot running:

- Warm up and stretch before each run, and stretch again at the end.
- Begin by only going short distances and build up gradually.
- Listen to your body. If you experience any pain, injury, or inflammation, stop.

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Every year, many people commit to an exercise program and getting fit. Prior ailments, age, weight gain, and other factors will be at play. People will get injured, and I believe one of our roles is to keep them healthy and active for as long as possible. When dealing with the human body, there are no universal answers—each case is unique. I am reminded, once again, that there is much more to know about the foot and biomechanics, and no one theory or notion covers the subject. O&P EDGE

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