

# Athletic Shoes & Supports: Facts & Myths

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We wear athletic shoes — sports shoes, sneakers, etc. — like all others, primarily to protect the plantar surface of the foot from the potentially damaging effects of stones, glass, other objects and abrasive surfaces. We also need shoes to keep our feet warm in cold weather. In some sports they serve an additional purpose, such as in cycling where shoes are actually more a part of the bike than your foot. Unfortunately, many people believe athletic shoes provide support and stability to prevent injury, and some actually think the more expensive high-tech footwear can improve athletic function — beliefs strictly created and marketed by the shoe industry.

In reality, wearing today's highly cushioned and oversupported sports shoes are associated with *increased* rates of injury. And many would agree these shoes are the *cause* of many of those injuries. Barefoot athletes, for example, are generally injured much less than those who wear shoes (and there are a surprising number of barefoot runners around the world).

Modern high-tech shoes, while costing only a couple of dollars to make, often retail for upwards of \$100 and more. Steven Robbins, M.D., and colleagues, studied this and other shoe issues extensively for many years and found the injury rate was 123 percent higher in those wearing more expensive running shoes compared to those wearing cheaper shoes, which lack the high-tech support and other features shoe companies claim are good for feet.

From runners to triathletes, and tennis and basketball players, the best shoes for training and competition may be one and the same. And, they may be simple shoes with thin, harder rather than softer, soles. These can provide superior foot and ankle stability and reduce the rate of injury. They should also be the most comfortable.

Another problem with these modern sports shoes is the hype created in a market where shoe companies are almost free to say anything about their products. Unlike the nutrition, food or drug industry, which has strict standards on what can and cannot be stated, shoe manufacturers are free to make almost any claims. Unfortunately, many consumers believe the hype — and pay the price both in terms of their wallets and their health.

Because of all the loud marketing, and the ad dollars which influences sports media editorial content (negative research about shoes almost never gets publicized) it's difficult to know what a good pair of sports shoes looks like, and where to find them. To understand how shoes can be friend and foe, it's important to see how the foot normally functions, the real purpose of the foot's arch and other mechanical factors associated with healthy feet. This article will cut through the hype and allow you to make informed decisions. Then we can discuss how to avoid such pitfalls, have healthy feet, find good shoes and save money.

There are three main potential problems with today's high tech shoes:

1. Sole thickness.
2. Materials, including built-in supports.
3. Fit.

I'll address each, but first a little bit about normal foot mechanics.

### Healthy Feet

Very important to optimal foot function are the muscles. When they don't work properly, we can develop many different foot and ankle problems. Most of these problems are due to muscle imbalance, which when chronic can ultimately cause bone and joint problems. Normally, while weight-bearing, especially during running, for example, the sudden "loading" of the foot and ankle produces a sharp rise of vertically transmitted force — this is called impact. We all feel this when hitting the ground. (Even sports such as cycling produce impact forces.) The normal force of impact for a runner is about 2.5 times the body weight with each footfall. Impact *increases* even further with fatigue and speed. Nature provides us with feet made to adapt to this normal impact, thanks in great part to the muscles. Running, jumping, walking and other natural movement is what humans have done for millions of years. *Improper muscle adaptation* to activity is associated with most types of injuries from plantar fasciitis, shinsplints, and stress fractures to metatarsalgia, osteoarthritis, and various knee problems. Good muscle balance allows us to adapt to the various stresses of being on our feet.

Running-type injuries are so common that many people believe the human foot is poorly designed and fragile, unable to withstand running without injury. Some actually believe running to be "unnatural." As ridiculous as this sounds, it sparked the boom in so-called highly technological and very expensive athletic shoes, complete with marketing hype. The implied *inability* of the human frame to function effectively during natural activity is simply illogical.

One specific problem with today's sports shoes is the sole. Generally speaking, the thicker the sole the more unstable the foot. Wearing thick-soled, soft shoes can prevent the foot from adapting normally to impact. This adversely affects muscle function leading to a potential injury. Researchers Basmajian and Bentzon were among the first to show this in 1954 with electromyographic studies demonstrating poor muscle function in the foot when shoes are worn. Modern shoes are even worse, as many newer studies have shown.

Thickness in the heels can be particularly harmful. Studies show that heels greater than about ½ inch can cause significant dysfunction in the gastrocnemius and soleus muscles (which control the Achilles tendon), and even the quadriceps muscles at heel strike. Moreover, in one study this resulted a 2.4 percent decrease in VO<sub>2</sub>max, which is significant, and an example of how a seemingly minor structural change can impact the whole body.

A significant problem with thicker soles is foot strike. The natural running gait results in mid- to forefoot strike, depending on how fast the pace. But the thick soles used in today's running shoes force a person to land on his or her heels. Running on one's heel is not natural and a significant mechanical stress. Try running barefoot, and no matter how slow or fast you go it will be almost impossible to land on your heel. (Landing on the heel is a normal *walking* gait.)

Another problem with thick-soled shoes is that they interfere with communication between the feet and the brain. During walking, running and other activity, the whole body responds to what you're doing with each step — nerve endings in the feet continually send messages to the brain. The brain then continually adjusts the whole body based on information it receives from the feet — surface hardness, levelness and other factors. The result is that some muscles contract more and others less. It's a very complex mechanism, but one the body does very well. It's how we maintain balance and can walk, run, or jump with high efficiency. When wearing thick soles, the body can't make these important and intricate adjustments as well to the surface stress. This poor communication between the foot and the brain is referred to as diminished *kinesthetic sense* of foot position. While kinesthetic sense normally declines with age and is a contributing factor to the frequency of falls that occur in later life, many of today's young athletes wearing thick sports shoes show significantly reduced kinesthetic sense similar to or worse than an elderly patient! (These same sports shoes, studies show, often worn by middle aged and older, inactive people also increase the risk of falls and hip fractures.)

While wearing a shoe prevents the transmission of this sensation, barefoot running, for example, allows the muscles of the foot to absorb shock naturally, a process that is not effective when shoes are worn.

Shoe companies say the cushioning in modern sports shoes are important for shock absorption. However, this is contrary to studies, which show that wearing a shoe does not significantly change shock absorption during activity.

### Arch Support

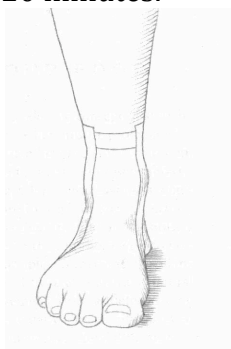
The natural foot, one not exposed to the problems of being in shoes, has both a high and low arch. This is exemplified in populations that live primarily barefoot — they have a high arch when the foot is resting and not bearing weight. This arch significantly flattens when the foot is weight-bearing during walking or running. Unfortunately, this normal response is confused with conditions referred to as flat feet or a pronation problem — neither of which are correct. Most individuals who think they have flat feet or pronation problems have perfectly normal foot mechanics. There are some instances, not common, where *excessive* pronation exists. This is most often due to muscle imbalance.

There are three key arches in the human foot that help support and control normal function; the commonly known one is the inner, medial arch. There is also one on the other side of the foot (the lateral) and another across the front of the foot (transverse). Most importantly, muscles make up all these archways. Some of these muscles are those within the foot, and others originate from the leg, including the large group of calf muscles. For example, one of the more important muscles associated with foot stability is the posterior tibialis muscle, which originates in the calf and runs down the leg, through the ankle to help make up, among other things, the medial arch. Normal arch function in those who wear shoes is often disturbed, probably because the arch support common to most athletic shoes blocks the sensation in the foot and interferes with the normal mechanisms of the medial arch. This is associated with significant muscle imbalance (some muscles become weak, others too tight). The result is too much flattening of the medial arch. Supporting it more can further weaken it.

## Taping and Other Support

Supporting a body part in an otherwise active person in many situations can actually cause muscle weakness. Tape, braces and other support devices reduce ranges of motion, distort the normal gait (leading to further biomechanical stress) and can impair performance. The most common area supported is the knee, and numerous studies clearly demonstrate that knee supports of various types can further increase the incidence of knee injury.

Some styles of taping, however, can be helpful, but for surprisingly different reasons. Therapeutic taping, which uses very little tape, as opposed to support taping, which incorporates a lot of tape to immobilize, can help foot and ankle function, including improving kinesthetic sense. Therapeutic taping of the ankle may help prevent injuries, but not through immobilization as once thought. The stimulating effects of the tape tugging on the skin can improve the brain-muscle communication, enabling the foot to better adapt and function better. The tape should cover areas where the muscles are located – the lower leg, ankle, and bottom of the foot (see figure below). This process may be effective with the use of just two strips of tape lightly wrapped around the ankle and foot (anchored on the lower leg) rather than the many layers of tight support taping. For those with foot, ankle or problems associated with foot instability (even when the foot or ankle doesn't hurt) — such as with knee pain — taping the foot and ankle can be very therapeutic and actually reduce the instability caused by many shoes. Support taping, whereby the ankle or other joint is more immobilized, may not be very effective since the support function is lost after as little as 20 minutes.



Therapeutic Taping

## Orthotics

During my 30 professional years, I may have prescribed less than a dozen pair of orthotics. However, I probably removed and discarded hundreds of pairs of orthotics from athlete's, and other, shoes during that same time. One potential problem with orthotics is that the need for other therapies is often overlooked and not obtained. Consider orthotics almost like surgery — it's one of the last resorts after other more conservative therapies have not found or corrected the problem. (Muscle biofeedback may be the best therapy for these types of foot-muscle problems.) Surgical patients, those with a history of stroke, or people who, for various reasons, may never have optimal foot function and who don't respond adequately to conservative care may benefit from orthotics. Almost all athletes don't fit this category.

Orthotics, like other shoe inserts, not only don't protect against the risks of injury, but may actually further weaken foot arches and provide excessive cushioning, resulting in increased structural stress. While orthotics are often prescribed to help the knee, studies have not shown they do this. In addition, orthotics and other inserts further add to the thickness of the sole, creating more instability as discussed above.

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## First Metatarsal Problems

Bad shoes can cause problems in the metatarsal joints too. These problems are very common in athletes, the result of wearing shoes, especially ones that don't fit the foot properly. Over time, hammertoes, bunions and other common problems develop as the bones and joint become permanently changed. The most common problem is the first metatarsal joint subluxation. This joint, at the back of the big toe, can cause secondary imbalances in the foot, ankle, knee, pelvis, and other mechanical areas.

Sometimes the first metatarsal joint is painful, but often the problem is not accompanied by pain, especially in the early weeks or months. Simple observation of your foot and shoes provide the best clues there's a problem. The ends of the toes may show callusing, and the nail of the first toe is sometimes darkened ("black and blue") as a result of the trauma of being forced into the front of the shoe. The first metatarsal joint may be inflamed as well. The shoe may show signs that the big toe is pushing forward. Feel the inside of your shoe on the area where the nail or tip of the first toe would rest; one often feels a wear pattern — sometimes to the point that there is tearing through the front of the shoe. If the shoe has an insert, removing it to inspect the imprint made by the first toe may reveal the shoe is too small.

The first metatarsal joint problem is almost always the result of wearing shoes that are too small (or too short). A survey from my clinic showed that 52 percent of athletes wore training shoes that were too small.

## "High Tops"

Popular basketball shoes — "high tops" — are promoted as a way to protect the ankles against injury. However, since high tops were made ankle injuries have become the most common injury in the sport of basketball, where almost all athletes use this type of shoe.

One study showed that during a two-year period, 78 percent of basketball players experienced some type of ankle injury. Of these, 83 percent were recurrent. Studies (clinical trials using humans) have not demonstrated that high-top shoes are able to prevent ankle sprains. In fact, Brizuela and colleagues (1997) showed that high-top shoes produced more ankle injuries. These same shoes also *reduced* the average jump height, and they increased the time needed to complete a short running course in comparison to those who wore low-support shoes — something to consider if you're playing basketball!

Now that you've read so many bad things about sports shoes (there are plenty more but not enough space here), the big question is — what to do? There are two important things people can, and should, do to improve the function of their feet, correct existing injuries and prevent further problems, and maintain healthy feet. These benefits are listed below.

## Benefits No. 1: Barefoot

One significant problem with wearing popular sports shoes, and many types of dress shoes too, which can be even worse, is the adverse effect on the muscles that maintain a healthy foot. For many people, some type of regular foot rehabilitation can correct existing problems, and prevent others. Once this is accomplished — which can take just a couple of weeks to many months in difficult cases — some "maintenance" activity would also be beneficial.

One single activity can easily fix the feet better than anything else — being barefoot! This does not necessarily mean you have to exercise barefoot, although plenty of athletes do this. But just spending more time on your feet without shoes can be extremely therapeutic. Being barefoot can help the muscles, ligaments and tendons function better, which will improve joint movement and even bone health. It will prevent future problems as well. Try to spend as much time as possible on your feet without shoes. If you can go outside, it's even better. This process can be started with the removal of the insert found in most shoes; this can reduce some cushioning and height and improve the fit of the shoe.

Peer pressure may be a significant factor when athletes choose which shoes they will wear; this is especially true in younger athletes. For example, a high school basketball player may be reluctant to wear low-top shoes when everyone else wears high-tops. Education rather than hype is very important.

#### Benefit No. 2: The Right Fit

Shopping for the ideal shoe can be as difficult as car or house shopping, but more important because your mechanical health is at stake. Here are some tips to make sure you get the right fit, one of the most important aspects of finding the best shoe for your feet.

1. Perhaps the most important factor in finding the best shoe is comfort. One should not have to “break in” a shoe before it feels good. It should not have to “stretch out” to fit well. Shoes should feel perfectly comfortable when you first put them on, following the guidelines listed here.
2. Always measure both feet while standing on a hard floor — not carpet. Most adults do not measure their feet when buying new shoes, even though their size may have changed. Generally, our feet get larger with age because they spread out, especially in woman. Consequently, people often wear the wrong-size shoe for years, even decades. The largest measurement should be used as a general guide when one is buying shoes. The feet also get larger as the day goes on, so it's best to measure the feet at the end of the day.

The most common way to measure the foot is with the Brannock device — those large metal gadgets popular in shoe stores. While this is considered the industry standard, there really are no standards as shoe companies don't follow the Brannock device numbers. Manufacturers vary their sizes, like shoe color, confusing consumers. One company's size 10 is another's size 9, and even another's size 8½. So don't take the number — your “size” — too serious. Rely instead on how the shoe fits.

3. Allow time to find a proper fitting. It may take you six pair of shoes or three different stores to find a great shoe. When you do, walk on a hard surface for at least a few minutes (carpet can make shoes feel more comfortable) — going outside if necessary. When you find a shoe that feels good, try the next half-size larger. Continue to try half-size-larger shoes until the shoe obviously is too large; then go back to the previous half-size. This one is usually the best fit. Remember to try on shoes with varying widths as necessary.

4. Remove the insert that comes with the shoe. Most sports shoes allow for this, so it should not be a problem when in a store trying on shoes. Some shoes have very rough materials underneath the insert, or it may be glued and may not be appropriate to remove.
5. Some people have significant differences in size between left and right foot. If the variance between the feet is more than a half-size, it's ideal to get two different sized shoes (just how you do that is up to you). If the variance is less than one half-size, fit your larger foot.
6. Some women find that men's shoes fit best. But some stores do not carry men's shoes in sizes small enough to fit women.
7. Be prepared to shop at more than one store. Most outlets carry only some of the many shoes on the market. Mail-order shoe outlets may be less expensive, but it is often necessary to return shoes until the correct size is found.
8. Once you find the shoe that fits properly, is very comfortable, and your workouts don't cause any problems with your feet, ankles or legs, buy several pairs. Shoes are manufactured based on style, color, and other trends that are used to market them, so shoes frequently come and go. When buying multiple pairs of a shoe, try on each pair, as size may vary slightly.
9. Remember, buy flat, thin shoes. Try for a sole thickness of  $\frac{1}{2}$  inch or less, with the same or similar thickness in the heel. Some of racing shoes may fit this bill. Also, cheaper shoes may be your best bet and can be found in many stores.
10. Socks can contribute to foot stress – keep them thin and not too tight.

This issue of shoes and foot function is very complex, and this small article only touches some aspects of the topic.