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The achieve more series from New Balance Web Express is an educational tool for clinicians, their patients, and our customers. Each achieve more article provides insight to the latest information on many common foot and ankle problems. All articles have been prepared by podiatric residents from around the United States. Each article has been edited for content and will periodically be updated as new treatment options arise. We hope you find the achieve more series to be an invaluable resource whether it be for personal or professional use.

Flat Foot:
Can I Live Without an Arch?

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Flat foot is the most common foot deformity known. In fact, sixty million Americans or 25% of the U.S. population have flat feet [1]. Some of these people may experience problems that limit their activities, while others can run marathons or play in the NBA. The good news is that the vast majority of cases, especially in children, require only conservative (non-surgical) treatment, if any at all.

What is flat foot?

If you've ever seen your footprints in the sand and they looked more like bricks than feet, then you probably have flat feet. Simply stated, a flat foot is a foot that does not have an arch when standing. In the medical world, flat feet are associated with "pronated" feet. Pronated is merely the term used to describe the position of the foot when it is flexed upward (dorsiflexed), turned away from the body (abducted), and the heel is rolled outward (everted), all at the same time. A certain amount of pronation is required for normal walking, but too much pronation is often considered a foot's "worst enemy." Over time, excessive pronation can lead to many unpleasant problems including heel pain, bunions, hammertoes, shin splints, and even knee, hip, or back pain. In fact, in his private practice, orthopedic surgeon Dr. Pryce discovered that 95% of his total knee replacement patients and 90% of his total hip replacement patients had flat feet [1]. An easy way to tell if you pronate too much is to take a look at your athletic shoes—excessive wearing of the inside heel (arch side of the shoe) as compared to the outside is a classic indication of excessive pronation.

The normal foot is made up of 28 bones, 30 joints, 128 ligaments, 22 muscles, and 49 tendons. These structures are all arranged in such a way as to be rigid enough to support the weight of the body at certain times, yet flexible enough to conform to the contours of the ground and absorb shock at others. During every step taken while walking or running, the foot switches from rigid to flexible and back to rigid. The focal structure of this ability is the arch. When the arch is high, the foot is rigid for support or pushing off. When the arch is low (as occurs with pronation), the foot is flexible for conforming. So you see, if the arch is fixed in a position too high or too low, or if it is unable to switch back and forth, the foot cannot function properly.

What Causes Flat Feet?

There are many different causes of flat feet, which can be separated into two main categories. The first category, *congenital flat foot*, is a condition that one is born with or is predisposed to at birth. This type includes the completely asymptomatic, pediatric flexible flat foot—by far the most common form of congenital flat foot [2]. Flexible means that an arch is present until weight is put on the foot, at which time the arch disappears. This foot type is a result of the fact that all people are born with different physical features. Some people have bigger noses than others, just as some people have flatter feet (of course, there is no

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known correlation between the two). Any alteration in the many building blocks of the foot can influence its shape.

At the other end of the spectrum, yet within the same category of congenital flat foot, exist several rare, more severe forms of flat foot. These severe conditions include Vertical Talus, Congenital Calcaneal Valgus, and Tarsal Coalitions—all of which are more rigid (no arch with or without weight on the foot) and definitely symptomatic. Luckily, these are much less common, but can usually be identified by specialists at the time of presentation and treated appropriately.

The second category, *acquired flat foot*, develops over time, rather than at birth. Many different factors can contribute to the development of flat feet. These include the types of shoes a child wears, a child's sitting or sleeping positions, compensation for other abnormalities further up the leg, or more severe factors such as rupture of ligaments or tendons in the foot. Very commonly, the reason for flat feet is that the foot is compensating for a tight Achilles tendon. If the Achilles tendon is tight, then it causes the foot to point down, or to plantarflex (as occurs when stepping on the accelerator of your car). Even minimal amounts of plantarflexion can simulate a longer leg on that particular side, assuming that the other foot is in the normal position. The body therefore tries to compensate by pronating, or flattening out the arch, thereby making up for the perceived extra length on the affected side.

The most common acquired flat foot in adults is due to Posterior Tibial Tendon Dysfunction [3]. This develops with repetitive stress on the main supporting tendon of the arch over a long period of time. As the body ages, ligaments and muscles can weaken, leaving the job of supporting the arch all to this tendon. The tendon cannot hold all the weight for long, and it gradually gives out, leading to a progressively lower arch. This form of flat foot is often accompanied by pain radiating behind the ankle, consistent with the course of the posterior tibial tendon.

Compounding matters is the fact that the human foot was not originally designed to withstand the types of terrain and forces it is subjected to today. Nowhere in nature do you see the flat hard surfaces that we so commonly walk on in present times. Walking on this type of surface continuously puts unnatural stress on the arch. The fact that the average American is overweight does not help the arch much either—obesity is a leading cause of flat feet as the arch collapses under the excessive bodyweight. Furthermore, the average life span has increased dramatically in the last century, meaning that not only does the arch deal with heavy weight on hard flat ground, but also must now do so for longer periods of time. These are all reasons to take extra care of our feet now in order to prevent problems later.

Treatment Options

Just as there are many different causes of flat feet, there are also many different treatment options. The most important aspect of treatment is determining the exact type or underlying cause of flat foot that you have. Foot and ankle specialists can determine this through thorough clinical examination and special imaging studies (e.g., x-rays, computed tomography, and/or magnetic resonance imaging). Conservative treatment is effective in the vast majority of flat foot cases, and consists of things such as insoles, splints, manipulation, or casting. Surgery is required much less frequently, and is reserved only for some of the severe types of flat foot that do not respond to conservative therapy.

Congenital Flat Foot Treatment: Pediatric flexible flat foot can be treated with simple conservative treatment if caught early enough. Although often asymptomatic, these children may be treated with some type of support, whether it is molded insoles, special shoes, or braces. The reason for this is that children's bones are in a somewhat soft, pliable state of development. Also, the ligaments that hold those bones in place are very flexible. Without support to hold the foot in the correct position, the bones can develop abnormally, leading to future problems. The key is to catch the problem early. Before the age of 2, and possibly until the age of 4, conservative

treatment can have a lasting effect on the foot [4]. Many people, including some famous professional athletes, live their entire lives with flat feet.

The big question is whether or not to treat a flat foot at all. An infant's "flat looking" foot concerns many parents. Most of the time, the foot is completely normal; there is a natural fat pad in the arch of a newborn's foot that gives the allusion of a flat foot. Also, some practitioners believe that pronated feet (those with lower arches) are normal until puberty [5]. Problematic flat feet usually do not become painful until 6-12 years of age when conservative therapy is usually too late [4]. So the lesson to be learned here is that if you are a concerned parent, consult a foot and ankle specialist. He or she will probably have good news for you and be able to help your child avoid future problems.

Acquired Flat Foot Treatment: Acquired flat foot is an entirely different entity in itself. The best way to treat acquired flat foot is to never acquire it in the first place. This is where proper, well-made and well-fitting shoes come into play. A shoe specifically made for your foot type works wonders against the adverse effects of modern society. Many recent technical advances have been made in the footwear arena. In the past, the only form of motion control, or pronation prevention, was in the form of custom orthotic devices (orthoses), which were inserted into the shoes. These days, many shoe companies have invested time and research into developing shoes with built-in support and motion/pronation control. The good news is that they don't even look like the Frankenstein clodhoppers of the 1960's like Forrest Gump had to wear. For well under $100, you can buy a good pair of shoes that actually look as nice as they feel and function—this investment can prevent priceless pain and suffering in the long run. A trained athletic store employee can direct you to these 'motion-controlling' shoes.

If you have already acquired flat feet, again the treatment is based on the exact type of problem that you have. If the specialist determines a tight Achilles tendon to be the cause, then he or she may prescribe some combination of stretching and strengthening exercises or possibly physical therapy and orthotic devices. If Posterior Tibial Tendon Dysfunction causes your flat foot, conservative measures may include rest, immobilization, shoegear modifications, orthoses, bracing, and anti-inflammatory medications [6]. Depending on the severity, your foot and ankle specialist may deem it necessary to cast your foot while the tendon repairs itself. Because Posterior Tibial Tendon Dysfunction is progressive (worsening over time), it is essential to seek medical attention early, as conservative measures tend to fail in the later stages of dysfunction.

Wonderful World of Orthoses: You may have noticed that one common element in the conservative treatment of all types of flat feet is orthoses. Many companies now manufacture semi-custom orthotic devices that not only improve comfort, but also seek to control abnormal motion of the foot. These over-the-counter inserts, in the $25 to $50 range, are an economical treatment that may help a majority of people. Unfortunately, these semi-custom devices will not fit everyone perfectly, and those of us who differ too much from the average may respond better to custom orthotic devices. Custom inserts are prescribed by your foot and ankle specialist and are made individually from either a physical or computerized impression of your feet. The only drawback of custom orthoses is their cost, ranging anywhere from $300 to $500. Many physicians recommend trying over-the-counter inserts first (and even keep them in stock) as they may save their patients large sums of money.

Surgery: Flat feet that do not respond to conservative therapies, remain painful, and/or continue to cause other problems, may require surgery. Again, the surgical procedure selected is entirely dependant on the type and severity of flat foot, as well as the age of the patient. In younger children, and in less severe cases of adult flat foot, procedures involving tendons and ligaments (i.e., soft tissue procedures) may suffice. These usually result in less recovery time and postoperative discomfort. However, if the problem is a more

severe rigid deformity and arthritis has developed in the joints, then bone work may also be warranted. In these types of procedures, bones are realigned and fixed in position as to actually construct an arch in the foot—yes, a foot and ankle surgeon can reconstruct your foot. Often times, joints are fused in order to eliminate pain that results from movement of these joints. These procedures usually require more recovery time in order for the bones to heal in the correct position. Again, before surgery, conservative treatment options should always be exhausted. Surgery is only indicated when conservative measures fail.

Conclusion

There are many different causes of and treatments for flat foot. The most important part of treatment is determining the exact flat foot type on an individual basis, and doing so early on. The main objective is to become educated on the potential problems, so that you can stop them before they start. Conservative treatment is often successful if initiated early. The old adage "a stitch in time saves nine" definitely applies to the human body, hopefully more figuratively than literally. Do not ignore what your common sense and your body are telling you. Yes, you can live without an arch, but never neglect a symptomatic foot. If you neglect your feet, they will make you pay with every literal step you take.

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