PART 2

Footwear: The Primary Cause of Foot Disorders

A continuation of the scientific review of the failings of modern shoes.

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A Source of Multiple Troubles

Perhaps the single most visible difference between the shoeless and the shod foot is the elevated heel under the shoe. The numerous influences of the shoe heel on the foot and body column are not fully understood by most medical practitioners. The practitioner commonly speaks of "sensible" heels. Such a heel does not exist. Any elevated heel under a shoe automatically initiates an altered series of foot and body biomechanics.

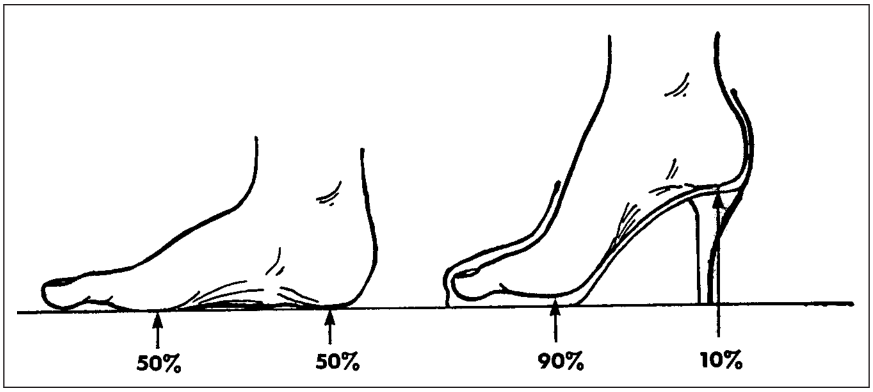

Fig. 23: Weight distribution on foot in standing, barefoot versus high heels.

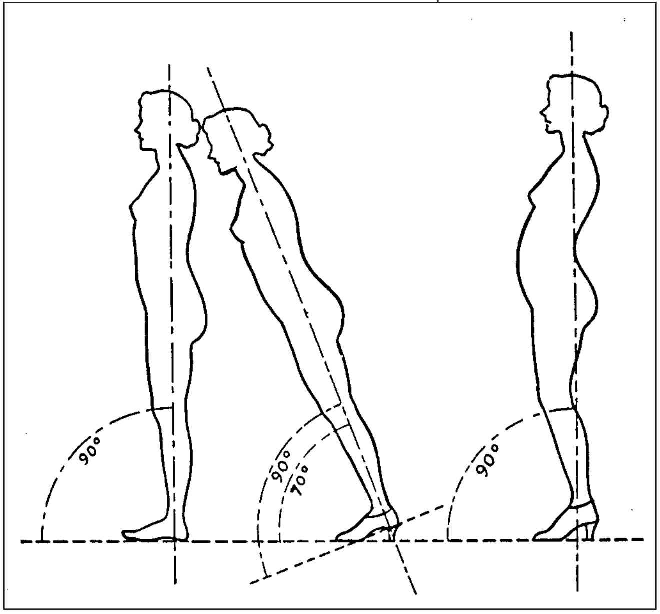

Fig. 24: Left, normal body column stance barefoot; center, tilt of body column on medium heel if body was a rigid column; to regain erect stance, column makes "adjustments" to create new body profile.

Standing barefoot, the falling line of body weight normally forms a perpendicular, a 90-degree angle with the 180-degree angle of the foot's plantar surface. Body weight is distributed 50-50 between heel and fore-foot. (Fig. 23)

The moment any heel elevation, even the most minimal, is applied to the shoe, the normal 90-degree perpendicular of the body column and falling line of body weight is altered. The higher the heel the greater the body column change. The heel on a man's shoe is about one inch in height. On women's shoes it varies from 1 to five inches—and up to six inches in more extreme footwear styles.

If the body column was a single, unjointed column, then even a one-inch heel under the foot could cause the rigid body column to tilt forward or even fall. Like the Leaning Tower of Pisa, only a few inches tilt at the bottom results in a lean of several feet at the top. (Fig. 24)

But the body column is a series of adaptable joints and connecting sections: ankle, knee, hip, pelvis, spine, shoulders, neck and head. Unlike the rigid column of Pisa, the body column sections make "adjustments" to maintain an erect stance. With each sectional adjustment there is a shift in the body's center of gravity (nor-

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mally about hip height). With the shift of gravity there are corresponding shifts in the line of falling body weight both in standing and walking, resulting in shifts in the path of weight distribution throughout the foot, beginning with the rearfoot.

The muscles and ligaments associated with the body column and foot system must also make compensatory changes. Considering that the "simple" act of walking involves half the body's 650 muscles and 208 bones, the number of automatic "adjustments" is enormous. Inevitably, a toll must be taken, most commonly leg and back aches and, of course, foot aches.

On a medium to higher heel the increased bowing of the long arch is accompanied by a contraction or shortening of the plantar fascia as heel and ball are drawn closer together. If the fascia becomes permanently shortened, as is not uncommon among habitual wearers of medium to higher heels, the fascia becomes more vulnerable to strain or tearing when lower heels are worn, or with some traumatic foot action such as jogging or aggressive walking that results in an acute pull on the fascia. There is certainly some common correlation between elevated shoe heels, low to high, and plantar fasciitis.

It is a dogma of footwear fashion that thin, curvy medium to higher heels are always accompanied by pointed-toe shoe styles. Higher heels and broad or round toes are esthetically incompatible. It is only when the higher heel is chunky or heavy looking that the round or broad toe is acceptable. Thus the classic high heel has a double-barreled effect, front and rear.

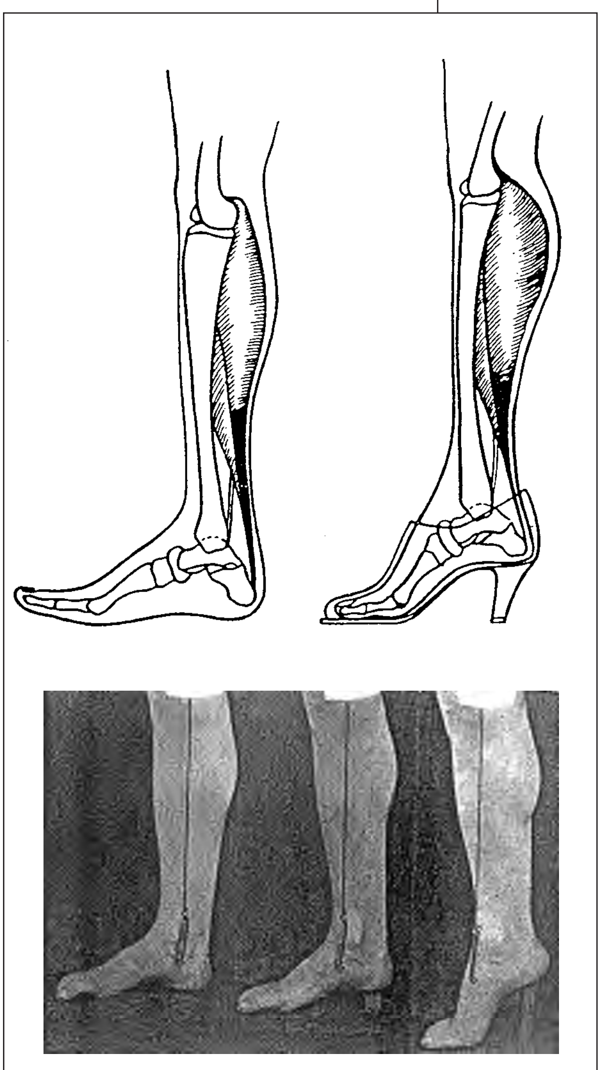

Fig. 25: Top, contrasting effect of elevated heel on foot, Achilles tendon and calf muscles. Tendon is shortened. Bottom, changes in leg musculature from barefoot to low heel to high heel.

However, contrary to conventional medical thinking, it is not so much the pointed-toe shoe that is mainly at fault for the toe squeeze, but the faulty design of the last. Were pointed-toe, high-heel shoes made on better engineered lasts, perhaps at least half of the common distresses of such footwear would be eliminated. While it would not transform the shoe into a "comfort" shoe, it would be considerably more comfortable to wear than such footwear of the past and present.

The ligaments and muscles associated with the body column and foot must also make compensatory changes. Considering that the "simple" act of walking involves half the body's muscles and bones, the number and degree of adjustments are enormous. Inevitably, a toll must be paid via a variety of related symptoms, such as leg or back or foot aches. The specifics of these involvements are difficult to pinpoint because the overlapping effects are so numerous and complex.

But some are traceable. For example, researchers at Harvard University, headed by physiatrist D. Casey Kerrigan, reported in the May, 1998 issue of Lancet, on women walking barefoot and again on 2-inch heels. Barefoot, they found, the weight is shared equally by the lateral and medial surfaces of the knee joint. But on the 2-inch heels the weight was shifted, resulting in a 23 percent increase of weight borne in the center of the knee joint. Kerrigan's report concluded, "The resulting strain on the knee joints, if frequent or habitual, could well be a contributing cause of degenerative arthritis in the knee joints."

On a medium to higher heel, the increased bowing of the long arch is accomplished in part by a contraction or shortening of the plantar fascia as foot heel and ball are drawn closer together. The plantar fascia now becomes more vulnerable to strain and tearing when lower or flat heels are worn, or with some traumatic foot action that causes an acute pull on the fascia. There certainly appears to be some correlation between elevated heels and plantar fasciitis. If

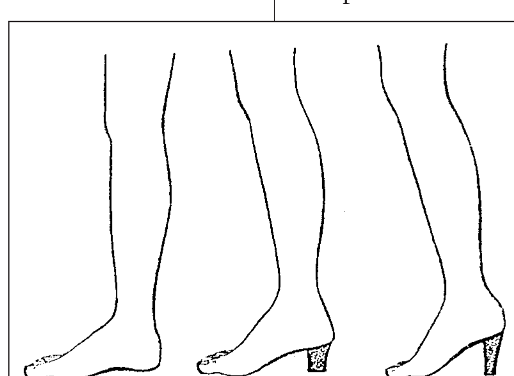

Fig. 26: Altered angles of lower leg, barefoot to high heel. Accommodating changes required in body column joints to return lower leg to vertical position. But many women retain bent-knee stance and accompanying faults of body posture and faulty weight fall on foot.

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there is a shift in body weight distribution throughout the foot because of the elevated heel, it would seem to follow also that the bursa under the calcaneus would be affected, resulting in heel soreness or pain.

Shortened Achilles Tendon

All shoe-wearing people have a shortened Achilles tendon. It begins at about age three or four when tots are wearing footwear with heels three-eighths to one-half inches in height. (Fig. 25) It continues and accelerates into the early puberty years when reaching one inch in height (oxfords, loafers, sneakers, etc.). Few people, including medical practitioners, realize that, relative to body height, a one-half inch heel for a tot or a one-inch heel for a nine-year-old is the equivalent of a two-inch heel for an adult. By the mid or late teen years most girls are into high (two inches or more) heels. By this time the shortening of the heel tendon and calf muscles has become firmly established.

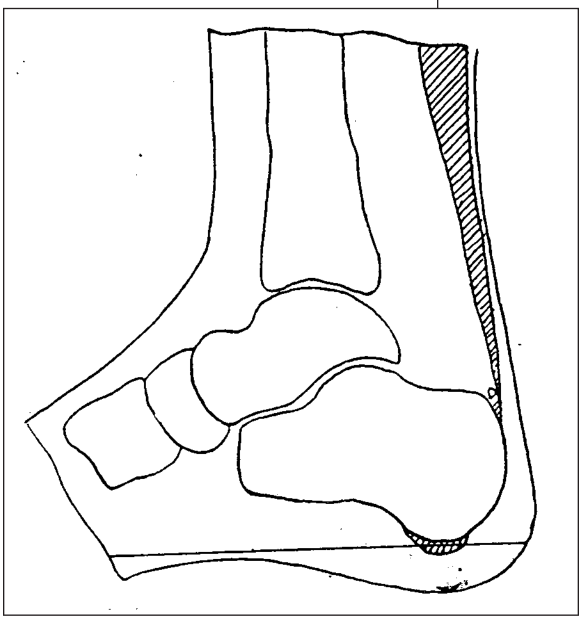

Fig. 27: Concave bottom of calcaneous, with protective bursa. This is normal site of heel strike, allowing foot and weight to roll forward easily with progressive sequences of step.

What are the future consequences? In the case of women who become habitual wearers of higher heels, there usually develops the classic aching of calf muscles and heel tendon syndrome, especially when there are shifts to lower heels or, for example, in an aerobics class, resulting in stretch or stress of the calf muscles or the tendon.

Second, the bursa behind the calcaneus serves as a buffer zone between the tendon and the bone. Any change in the length and function of the tendon resulting from the elevated shoe heel is going to affect the bursa itself.

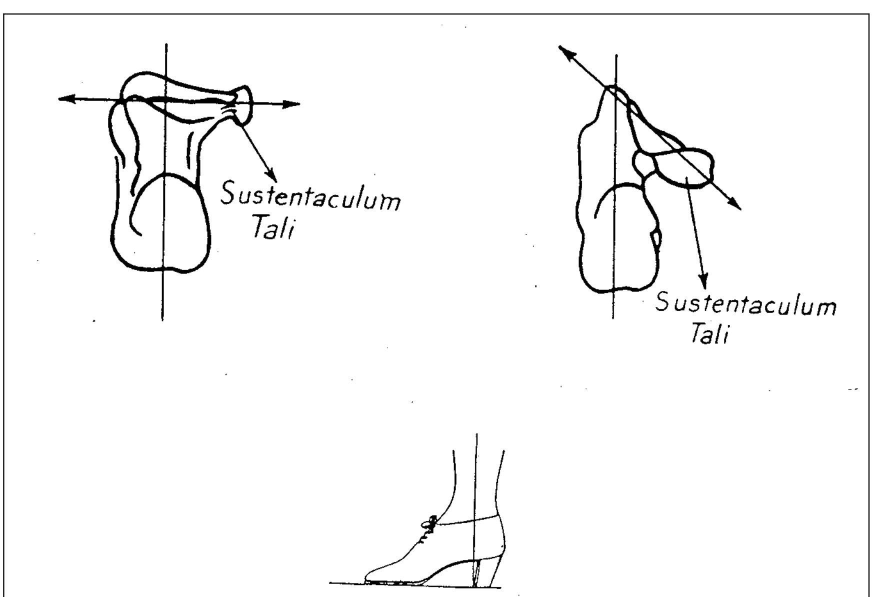

Fig. 28: Left, normal 180-degree angle of sustentaculum tali of human foot—a vital site of support of long arch. Right, angulated sustentaculum tali on gorilla foot. Absence of arch prevents bipedal gait for more than a few steps. Bottom, human foot with line of falling weight through sustentaculum tali, and through breast site of shoe heel.

Thirdly, the lower leg, normally on a perpendicular with the 180-degree plane of the bare foot on the ground to form a 90-degree angle, now on a higher heel tilts forward, reducing the leg angle to, say, 70 degrees. (Fig. 26) Some women in elevated heels learn to maintain the 90-degree angle by keeping the knees “locked” with each step. But most allow the lower leg and knee to angulate. A profile view of the gait quickly reveals this. The result: body weight is no longer falling normally onto the foot, but is moved forward onto the forefoot.

In all ground-linked sports the Achilles tendon plays a vital role, especially where there are quick and violent foot torsions, such as in basketball, football, tennis, etc. Hence a shortened heel tendon would seem to have some influence on athletic performance. We tend to overlook this because most athletes are shoe wearers and have the same heel tendon shortening. But when athletic performance is compared with shoeless athletes, then the difference in tendon length can show itself dramatically.

For example, over the eight years 1991-1998, all the winners in the classic Boston marathon were Africans. In 1998, five of the top 10 finishers were Africans. The same pattern appears in other marathons where the Africans have participated over the past decade. Most of these African runners grew up shoeless, and many continue to train shoeless in their native countries. All, consequently, would likely have normal, full-length Achilles tendons and calf muscles. This would seem to have enormous influence on stride and stamina in a marathon run where there are approximately 44,000 Achilles tendon and calf muscle “pulls.”

The superiority of the African marathoners has nothing to do with race. African-Americans excel in the short sprints up to 400 meters, but not one has ever won a marathon, and few even compete in distances of one mile or more. Like all of us, African-Americans are habitual wearers of shoes with elevated heels (along with

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the crooked lasts) and hence, presumably, have the same shortened heel tendon and calf muscles.

Heel Strike

The term "heel strike" entered the common language about 30 years ago with the start of the jogging/running and physical fitness boom. It is almost always used in reference to the heel strike inside the shoe, as in walking, running, etc. The problem, however, is that heel strike barefoot is usually quite different than with shoes on.

We assume that the initial strike is at the posterior-lateral edge of the heel because that is where the major tread area is. And we rarely refer to heel strike in the standing position. But while heel strike in walking or running is a traumatic force, in standing there is considerable weight impact force on the heel. Further, we spend much more time standing than walking or running. Also, in standing the pressure effect on the heel is constant, without rest intervals between heel strikes.

The prime function of the plantar bursa under the heel is to serve as a buffer between the plantar calcaneal tuberosity in the center of the calcaneas. (Fig. 27)

We assume that the path of weight movement inside the shoe immediately after heel strike follows a common "normal" path through the foot to step pushoff. Further, from this assumption we develop our premises for heel and rearfoot therapies, including the design and performance of orthotics.

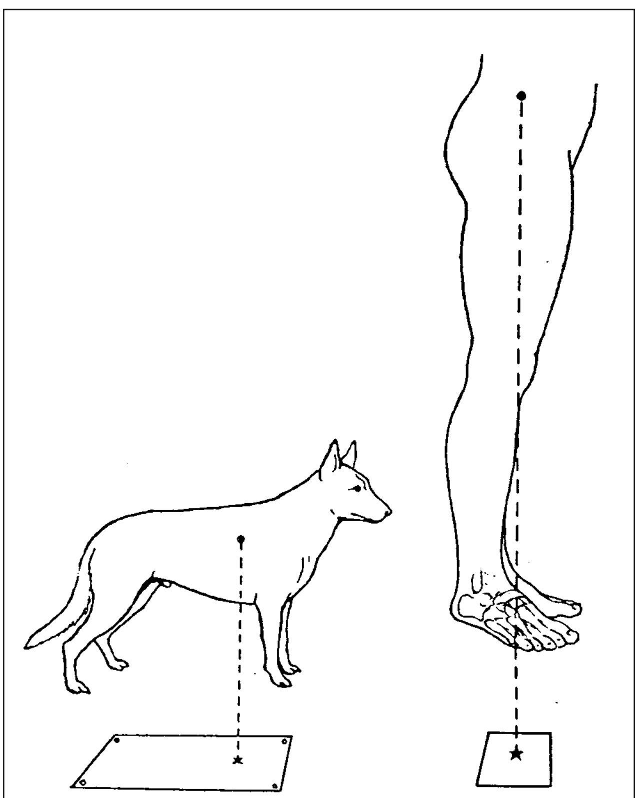

Fig. 30: Dog, much shorter in height than a human, nevertheless has 2 1/2 times greater support base for its body weight. Humans are much more fragilely balanced on much smaller base.

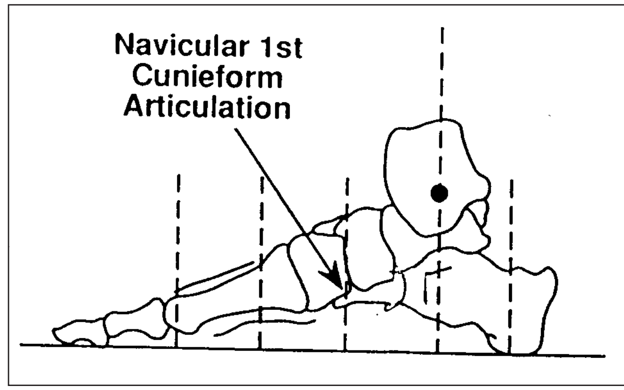

Fig. 29: Usual site of arch support peak at navicular/first cuneiform joint. But line of falling weight is at sustentaculum tali where shoes and orthotics provide no support.

Why these assumptions? Because virtually all footwear shows the majority of tread and wear at the lateral-posterior edge of the heel, we thereby assume that this is the normal site of heel strike. That assumption deserves challenge.

On a "normal" (shoeless native) foot the initial strike is at the posterior (neither lateral nor medial) end of the heel, moving straight forward over the tuberosity in the center of the calcaneus toward the mid-tarsal joint, fifth ray and onto the metatarsal heads, thus creating a smooth, forward rolling or rocker motion.

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Why, then, is this seemingly contradicted by the common heel strike tread pattern at the lateral-posterior area of the shoe heel? Because of two reasons; 1) the crooked or inflared last that alters the normal alignment of the foot, including the heel, and 2) the elevated shoe heel that alters the natural stance of the foot heel itself inside the shoe. Between them, not only is the normal heel strike changed, but also the consequent path of weight flow forward.

Again, note the tuberosity under the center of the calcaneus. Why, along with the bursa, is it there, exactly in the center? For the same reason that every round ball—a basketball, for instance, when resting stationary—has a small, ground-touching surface from which the surrounding portion of the ball's surface tapers or contours upward. Much the same occurs with the plantar surface of the calcaneus. It is the biological law; form follows function.

The concave calcaneal tuberosity serves the same purpose, allowing the heel to roll forward easily and smoothly on weightbearing as the weight shifts forward from heel strike. On the heel of a barefoot native the tread is over the whole plantar surface of the heel. But on the shoe-wearing foot the tread surface is concentrated almost wholly on the posterior-lateral edge of the heel's toplift, with the remainder of the toplift receiving only minimal strike and wear.

This clearly indicates that the heel tread on the natural foot differs from that on the shoe-wearing foot. The question follows: What other changes in the whole rearfoot structure occur because of that altered manner of heel strike and heel tread?

There is also the matter of heel strike impact. Prior to the invention of the rubber toplift by Humphrey O'Sullivan in 1894, shoe heel toplifts consisted almost wholly of leather, often supplemented with a metal clip for abrasion resistance, Either way, the toplift was non-resilient. The body column adapted to "step shock," the repeated heel strike impact some 8,000 or more times a day and sending jolts up through the body column.

The high heel is simply another body deformation device used with the same motive of sex attraction and social status. Nor does the heel have to be high. Medium height heels, with slender styling, achieve the same objective in modified form,

Reformers and medical practitioners are naive in assuming that by warning about the safety and medical hazards of high heels, common sense will prevail and cause women to shift to low or "sensible" heels. Such a belief is delusive, and centuries of experience confirm it. The aphrodisiac power of the high heel has always had more power than common sense.

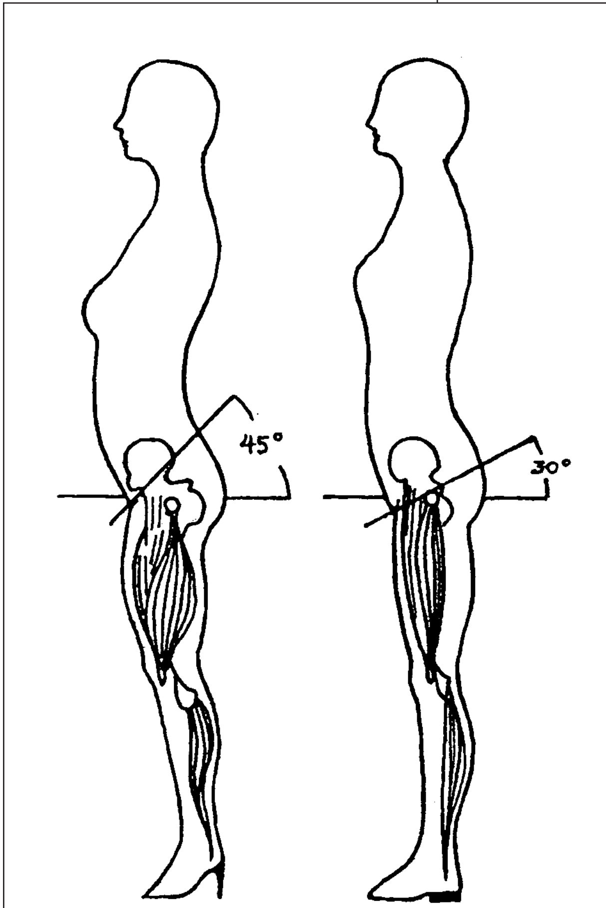

Fig. 31: Left, altered angle of pelvis on high heel. Also note accompanying changes in body contours (buttocks, breast).

The Sustentaculum Tali

This small, flat shelf of bone extending from the medial-upper surface of the calcaneus has not been given the attention it deserves. It is one of the most important elements of the long arch, and in enabling the foot's whole elastic system to function efficiently in gait.

For example, the sustentaculum tali of the gorilla foot is angulated downward at approximately a 45 degree angle, in contrast to the 180 degree plane on the human foot. (Fig.28) Because of this the gorilla (and other apes) cannot maintain an erect posture in walking for more than a minute or so, at which point it must assume a quadruped gait. The gorilla foot, along with that of the chimp and orangutan, has no long arch, mainly because of the downslanted sustentaculum tali.

In fact, the 180-degree position of our own sustentaculum tali may well be the single most distinguishing feature of the human foot—more exclusive, perhaps, than the long arch, straight-ahead hallux and the ground-touching heel, all distinctively human.

Evidence of the vital arch supporting role of the sustentaculum tali is

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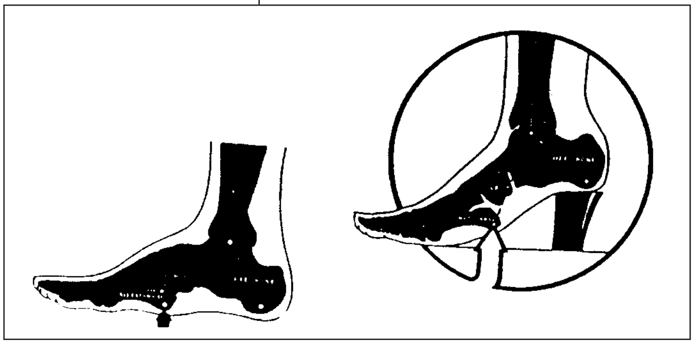

Fig. 32: Left, base of fifth ray as an important weightbearing element. Right, base of ray off ground by shoe heel, eliminating weightbearing function. Normal weightload here now imposed on other parts of foot.

seen again in the fact that a perpendicular line of weight falling from the body column to the foot passes exactly through the center of the sustentaculum tali. Any habitual or chronic shift in this line, such as caused by the elevated shoe heel plus the crooked shoe last, would seem inevitably to have some effect on the sustentaculum tali and the long arch.

Conventional arch therapy almost always focuses on an orthotic to “lift” or “support” the depressed or strained arch. (Fig.29) The support is mainly under the center of the arch curve (navicular-first cuneiform joint). The orthotic is doing what deceptively appears to be the logical course; following the anatomical contour of the arch instead of providing the prime support where it is most needed—under the falling line of body weight through the sustentaculum tali.

Over the eight years 1991-1998, all the winners in the classic Boston marathon were Africans. In 1998, five of the top 10 finishers were Africans.

What causes the tilt of the sustentaculum tali in the first place? As in the case of pes planus, we’re not sure; at least there is no conclusive single cause.

So a series of rationales must be voiced. First, we can assume that if the sustentaculum tall is normally angled at 180 degrees it will maintain its support function.

Second, if any chronic imbalances are imposed beneath the sustentaculum tali, such as with an elevated shoe heel, then there will be a corresponding shift in the falling line of body weight, affecting the angle of the sustentaculum tali, and with consequent effects on the rearfoot structural and functional mechanisms.

Hence the domino sequence; tilted body column and shifting of the gravity center, resulting in a shift In the falling line of body weight, followed by redistribution of weight stress paths through the foot, with corresponding arch strain and rearfoot dislocations. Any combination of variables could become involved.

The pivotal element is the sustentaculum tali. It is so small and seemingly an obscure part of the foot anatomy. Yet its influence on the structural integrity of the rearfoot, as well as the midfoot and forefoot, is enormous. And in turn, it is vulnerable and influenced by the biomechanics of the shoes beneath it.

Rearfoot Influence On Gait

Natural gait is impossible when most (98 percent) of footwear is worn. There are three main reasons for this; 1) the shoe’s elevated heel; 2) the faulty design of the last as found in most footwear; 3) construction and design faults found in the shoe itself (components, materials, shoe weight, limited flexibility, etc.).

Separately or together they influence how the foot functions inside the shoe and how the individual walks. Whereas under these conditions the foot cannot function in a fully natural manner, the gait, so totally dependent on the foot, also cannot be its natural self. The conditions also work in reverse. An alteration in natural gait changes the line of falling weight and the natural path of weight distribution throughout the foot.

Let’s cite one example. Because almost all footwear has some kind of elevated heel, the shank or midfoot section of both foot and shoe is lifted off the ground, denying the base of the fifth ray its normal weight-bearing function in both standing and walking—plus the supplementary support of the cuboid. Body weight is supported almost entirely by the heel and metatarsal heads, imposing an added weightload on these structures. Under these conditions neither the foot nor the gait can function in a fully normal manner.

If this particular shoe default of elevated shank is combined with the inflared or crooked last and toe spring, plus the imbalance caused by the elevated heel, then the rearfoot, wholefoot and gait biomechanical systems become vulnerable to any of a variety of impairments.

The erect, two-legged stride gait of humans is the most precarious among all living creatures. And also the most graceful when executed in natural form. Whereas all other land creatures stand and walk on four or more legs (if on two legs as with birds or fowl the body is semi-horizontal, not erect), the body weight falls within a broad base area. With humans, however, the base area is extraordinarily small relative to

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body height and weight. A small dog, for instance, has more than double the weight-support base area beneath its body than does an adult human. (Fig. 30) It is much like the difference of holding a small, squat cube in the palm of the hand as compared with trying to balance a long broomstick on end in the same palm.

Kinesiologists regard walking as the most complex motor function of the human body. Yet the foundation for this intricately engineered body column consists of just three small base sites: the calcaneum, the base of the fifth ray, and the unit formed by the five metatarsal heads. These are the ground-touching pillars supporting a tall and large superstructure. For the many elastic foot parts (muscles and tendons, ligaments, fascia) to do their work efficiently, the base support pillars themselves must be firmly fixed in their normal positions. Any change in the osseous pillars is instantly accompanied by changes in the associated elastic parts,

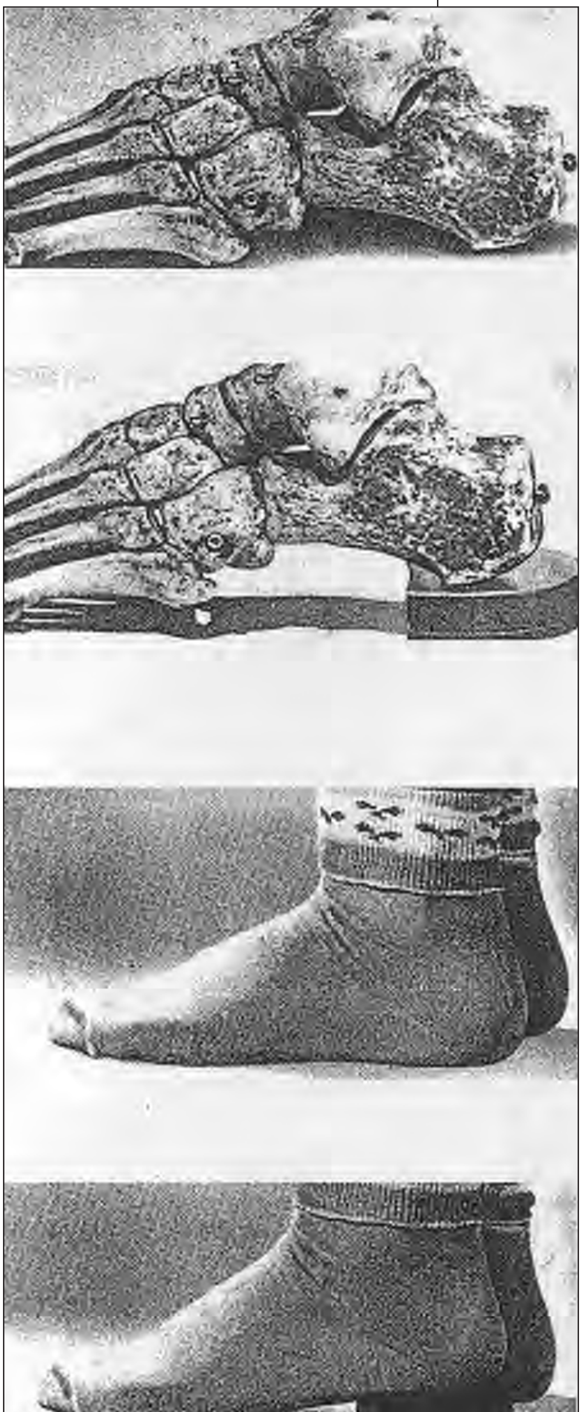

Fig. 33: Top, weightbearing function of base of fifth ray. Second, even low heel denies the ray its normal function. Third and fourth, same effect on flesh-covered foot.

Here again enter the trouble-makers: the elevated shoe heel and shoe shank, crooked last, toe spring, concave last bottom, shoe bottom filler, limited shoe and foot flexibility, etc. The osseous pillars automatically are either forced out of normal positions, or the normal share of weightbearing loads are shifted. The amount and manner of these changes depends upon the degree of the underlying shoe faults.

On a "medium" two-inch heel, for example, the ankle and subtalar joints are moved out of normal alignment. A series of compensatory joint "adjustments" occur throughout the body column; knee, hip, pelvis, spine, shoulders, neck, head. The pelvis, for example, tilts from its normal 30-degree angle on flat heels to a 45-degree angle when standing or walking on a two-inch heel—and to 55 or 60 degrees on a three-inch heel. (Fig. 31) The organs within the pelvic bowl and abdomen, would have to make corresponding adjustments in position.

The body column is a marvelously adapting structure in response to postural changes. While the joints throughout the column angulate to adjust to the elevated heel, the angles are largely concealed so that the flesh-covered column appears to be a series of curves—more posterior thrust of the buttocks and more anterior thrust of the chest. The body movements also change.

Thus the irony: an essentially abnormalized series of body angles become the beauty-in-motion form—a sensuous, sometimes erotic dynamic which lures the admiring male eye. Women for centuries have been aware of this kinesic and cosmetic magic. No wonder their long love affair with that tiny spindle of shoe heel.

Reduced Tread Surface

The combination of the elevated shoe heel, elevated shoe shank at midfoot, toe spring, and concave shoe bottom at the ball, together force enormous changes in the plantar tread surface, which in turn generate shifts in the gait pattern and weight distribution over rearfoot and fore-foot.

The shoe heel, even at a "low" one inch height, lifts the shoe shank and midfoot off the ground, eliminating the base of the fifth ray from its vital weightbearing function, along with the supplemental weightbearing function of the cuboid. This normal weightbearing task must now be shifted elsewhere, shared by both rearfoot and forefoot. (Figs. 32, 33)

The tread surface of the toplift of a men's shoe appears to be much greater than on the toplift of a women's two-inch heel (9 square inches versus l square inch), and as little as 1/4 square inch on a three-inch stiletto heel. But those differences are very deceptive. The ACTUAL heel strike or tread area on a men's heel toplift is reduced to about 1 square inch. And by the same proportions on a women's shoe heel. This is because the true heel tread surface is reduced to the lateral-rear corner of the toplift. In short, what you see isn't what you get. No matter what the size of the toplift area, 70 to 80 percent of it remains largely unworn because of faulty heel tread.

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Now, compare this with a footprint of a bare foot. The footprint will show a full tread area—a broad heel surface, lateral border of the foot, a full metatarsal area, plus toe imprints. The foot imprint will usually show 65 to 80 percent more tread area than that of the shoe bottom. (Fig.34)

The questions are almost inevitable: Under these conditions of imbalance, what happens to the normal patterns of weight distribution from rearfoot to forefoot? What tolls are taken on the whole elastic support system of the foot? What compensations of joint abutments and alignments are necessary to adjust to the greatly minimized tread surface? What happens to the patterns of heel strike and the whole dynamics of the rearfoot? What happens to the whole body column, already fragilely balanced on a small base, when it is limited to an even smaller tread and support base?

Conventional arch therapy almost always focuses on an orthotic to "lift" or "support" the depressed or strained arch.

A toll must inevitably be paid. Here the pathological consequences become less precise because so many different mechanical elements are involved in so many different ways that a single point of origin is often difficult to pinpoint in a diagnosis.

Nevertheless, questions must be asked. How many ankle and knee lesions have a direct association with drastically reduced plantar tread? How many leg, hip and back aches? And, of course, how many biomechanical disorders of the foot? We cannot expect some 200 pounds of descending body weight to impact some 8,000 times a day on a plantar tread surface little more than three square inches without negative consequences. The many practitioners who place much reliance on orthotics to resolve problems by "rebalancing" or "rehabilitating" the foot are seeing an open door of corrective opportunity where one often does not exist. The common mistake here is the assumption or diagnosis that it is the foot that is at fault, and hence the solution is to "rebalance" the foot. But far more usually it is the shoe that is at fault for any of the reasons already cited. An orthotic may rebalance the foot, but that same rebalanced foot automatically becomes unbalanced when it is in the shoe. The orthotic is often targeting the wrong object.

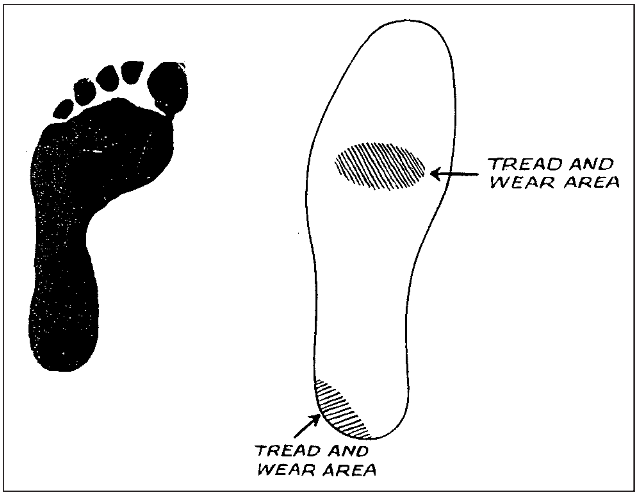

Fig. 34: Normal footprint showing large tread area. Right, tread area on average shoe reduced by 60-80 percent as a result of faulty last design, elevated shoe heel and shank, toe spring, etc.

The Myth of "Sensible" Heels

Medical practitioners have long advocated the wearing of "sensible" shoes and "sensible" heels (1 inch or lower). Both are a myth. ANY shoe with an elevated heel, even a one-inch heel, automatically places the foot at a functional disadvantage. The so-called sensible heel is simply less foot-negative than the higher elevations. But in no instance is it a positive for the foot. (Fig. 35)

The "sensible" shoe—low, broad heel, round or broad toe, oxford or tie pattern, somber styling—is in the same genre as the sensible heel. The common belief that it is a "proper" and foot-friendly shoe is an illusion. Such shoes have almost all the same inherent faults of fashion footwear: crooked lasts, concave bottoms, toe spring, limited tread surface, etc. Further, these shoes do not provide better fit even when fitted in the so-called "proper" size.

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Medical practitioners extol these "sensible" shoes on the premise that they provide more "support". But support of what? And why do the arch and instep need corseting? To the contrary, midfoot corseting denies the foot its natural exercising function and hence would tend to weaken the tissues of the midfoot, By dramatic contrast, the foot of the shoeless native, which toils for longer hours under more conditions of duress, is totally without any artificial support, yet remains strong, healthy and largely trouble-free.

As every podiatric practitioner knows, most women abhor the very term "sensible shoes",which automatically translate into "orthopedic"—meaning anti-feminine, anti-esthetic. The practitioner needs to reevaluate the prescribing of orthopedic-like "sensible" shoes on two grounds; 1) they offer very little therapeutic advantage over conventional footwear, and 2) most women find them as threatening and ugly as an angry gorilla and often refuse to wear them. A patient is, after all, a whole person and not just an object from the ankles down. Does this mean that consumers are locked in to a hopeless dilemma—the choice of foot-abusive fashion shoes or esthetically ugly footwear (sensible, orthopedic, sneakers, athletic, etc.)? No. Fashion and comfort CAN sleep in the same bed—but only if the shoe designers and manufacturers learn to adopt the right design engineering to bring about the long-evasive ideal of genuine comfort with fashion. Unfortunately, podiatric medicine has been of little or no help in achieving this. If and when it happens, it will be one of the great advances of the 21st century.

Fig. 35: Top, typical "sensible" shoe and heel for women. Bottom, "sensible" round toe resolves nothing. Faulty last design squeezes toes much like pointed-toe shoes.

Summary

A "shoe" cannot be regarded as a mere utilitarian, single-piece unit. It consists of numerous separate parts, each or in combination having an enormous influence on the foot, both anatomically and functionally. Hence to view this complex article as a simple, ancillary covering for the foot may well be the single most grave mistake of the podiatric physician. With such a perspective both the diagnostic and therapeutic approaches to foot disorders will fall appreciably short of desired results. Much is made by the podiatric physician about the importance of "proper" size and fit. Yet, neither podiatric medicine nor the footwear industry itself has ever established any fact-based standards of "proper fit." As to shoe sizes, they are without standards or uniformity and have been in a state of chaos for generations, both at the manufacturing and store levels (we are still using shoe sizing "standards" and methods formulated some 625 years ago!)

A shoe, ideally, should be an anatomical and functional replica of the foot. And this can be considered a biomechanical law: The less a shoe does TO a foot, the better FOR the foot. To what degree possible, a shoe should stay out of the foot's way. In its most elemental form a shoe has only two functions: as a non-intrusive, protective foot covering, and as an ornamental dressing. The moment a shoe assumes a therapeutic function for the average foot, the foot is in trouble. Back to the earlier statement: the less a shoe does TO a foot, the more it does FOR a foot.

The modern shoe has evolved into a complex article of engineering—though, unfortunately, much of the engineering has gone awry with many negative consequences to the foot. Nevertheless, it is this "modern" shoe that the podiatric physician must live with, contend with. And because it is so intimately involved with a long array of foot disorders, it is a very serious default of the professional therapist to give only superficial study and attention to footwear. This, unfortunately, has been the long history. Until the foot/shoe relationship becomes an intrinsic part of podiatric education and practice, podiatric medicine itself will remain an unfinished profession.

The first law of all science is objectivity. But in the important matter of the foot/shoe relationship the approach has tended to be much more subjective than objective. It has tended to greatly oversimplify by assuming that if the shoe is "sensible" in styling and heel height, and of "proper" size and fit, then presto, the shoe matter is resolved.

Just as man is not an island unto himself, so the foot is not a separate and isolated object. For better or worse, it is married to the shoe. If the partnership is to be compatible and productive, each must hold some measure of equality and respect in their mutual interests. ■

The author, a shoe industry consultant, has written eight books and over 400 articles, including extensive articles on leather and footwear in *Encyclopaedia Brittanica*.