Ground Contact Phase

What happens to the foot in the shoe?!

Listening to people at Congresses or Workshops made me realise the importance and, at the same time, the lack of knowledge on good footwear, even among specialists. This knowledge, on the one hand, important for test series in order to obtain comparable results; on the other hand, one only achieves sustained success with treatment or podo-orthesiologic insoles if the shoe really fits.

Consider the following scenario: As a physiotherapist or osteopath, you adjust a patient, straighten the hip, painstakingly loosen contractions and relieve muscles tensions. You prescribe your patient a pair of insoles to support your therapy and guarantee its durability. You even massage the patient's jaw and send him to an optometrist…

AND THEN THE PATIENT PUTS ON THE SHOES!

Do you know what happens then? Most probably, you allow your patient – in this very moment – to pour at least half of your efforts down the drain!
<u>Thereofre, have a look at your patient's footwear.</u> The following four questions can help you assess your patient's footwear:

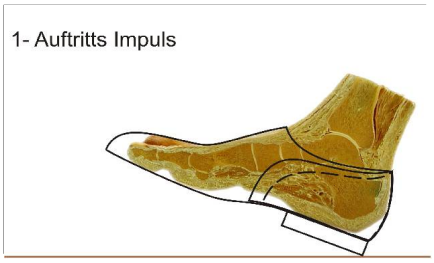
A) What does the foot do in the shoe when walking?
B) What sort of shoe does a healthy foot need?
C) What happens if the footwear is not appropriate?
D) Conclusion: What happens to pathological feet in bad footwear?

The first three points will be dealt with in the article. On this basis, you can easily work out the answer to the fourth question on your own.

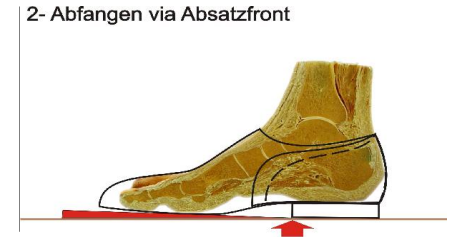
<u>A) What does the foot do?</u>
Dr. Götz-Neumann's detailed studies have been a landmark in the field. For our purposes, I will describe the ground contact of the foot rather schematically, such as we experience it in our everyday life.

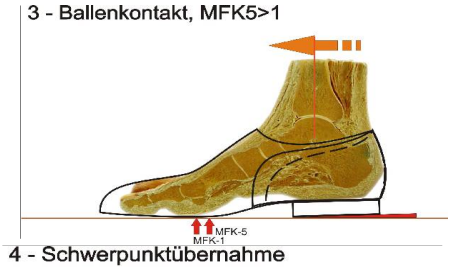
1) Heel Strike

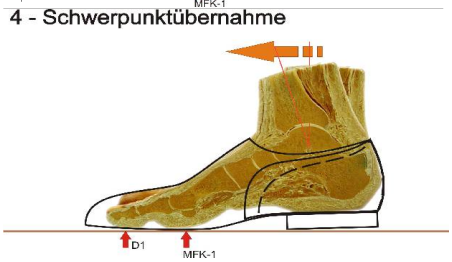
The heel strike directs the subsequent motion of the foot, the leg, and the body. It transmits sensory feedback information and provides the necessary impulse to cushion the force of the body weight, to shift the centre of gravity and, more generally, to steer the motion of our body.



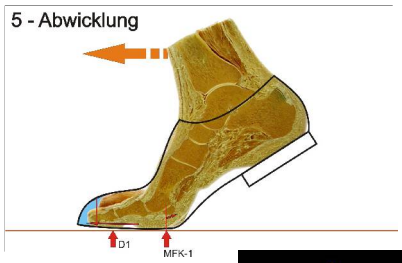
2) Early and late flatfoot
Following the foot rollover, the load on the foot shifts from the tuberosity of the fifth metatarsal bone to the metatarsals V and I, which absorbs, stabilises, and channels the force of the heel strike. It is important that the body has a good sense of direction in this phase to be able to roll over the midfoot evenly. This is to prevent the forefoot and the ball from 'slapping on the ground'. At the same time, a stable stand enables us to fully control the shifting of the centre of gravity from the back to the front.

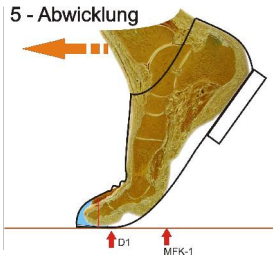


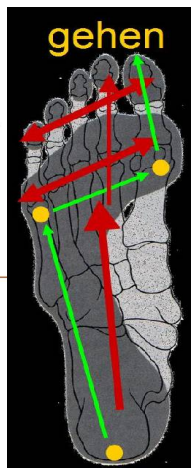




3) Heel rise and toe off
In this phase, the ball and the toes move forward steadily, and the forefoot muscle contracts to become a resilient lever that serves to propel the body forward.



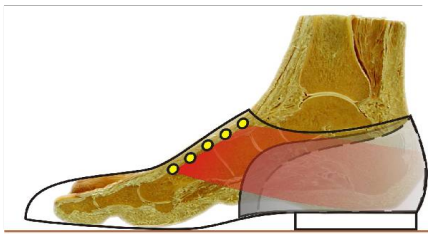




B) What properties should appropriate footwear have?

THE HEEL
The heel should enable the foot to land safely. This reduces the safety tension at the foot and the body after a few steps. At the same time, it is important that the sensory impulse of the heel strike reaches the body in time. If the impulse is lagged as a result of soft heels, for instance, the forefoot has probably already touched the ground before the muscles can react. Another example are high and very straight heels. High heels limit the natural stride length, that is, the heel strikes the ground rather unexpectedly, before our body is 'prepared for landing'. Thus the heel hits the ground rather hard and causes the forefoot to collapse forward at full speed, dragging along the hip and the knee. The higher the heel the more…

THE HEEL CAP
The heel cap allows us a better direction of the foot and stabilises the heel in the shoe. It also makes the upper tight and enhances the grip of the lacing from the instep



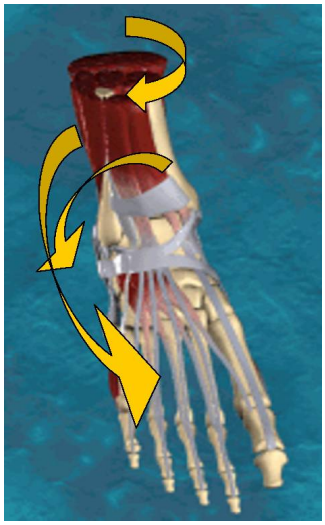
to the heel. The lacing holds the

foot in 'heel position' and prevents it from sliding forward when rolling over. Laterally, the heel cap guarantees a solid stand and direction when shifting the load, thereby avoiding the use of our toes as 'safety crawls'.

THE SCHANK
The shank is the part of the shoe that runs between the heel and the outsole.

It needs to be stable in order to prevent the shoe from turning around its longitudinal axis. It doesn't matter whether the heel and the outsole are at different levels. The floor isn't always even either. If the shank breaks, shifting the load and thus the centre of gravity will become very difficult. In addition, the foot now lacks any support from the shoe under metatarsal V and, as a result, is pulled sideward and becomes unstable. To counter this effect, the foot has to compensate the force pulling it sideward with even

more force, leading to much quicker exhaustion.

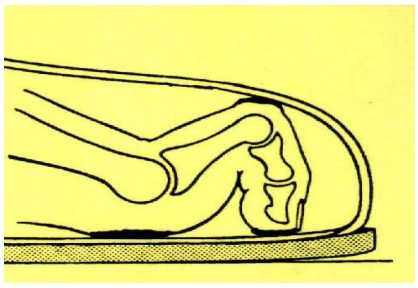


Just imagine a builder of 100kg, wearing security shoes worth 45 Euros...
Security shoe manufacturers know about the importance of the shank. The company *ELTEN*, for instance, offers shoes with and without shank in their catalogue.

You can test whether a shoe is appropriate by holding onto the heel with one hand and twisting the shoe slightly with the other hand.

If you can turn the shoe more than 10 mm in any direction, it has most probably no shank and is thus inappropriate.

THE SHOE LENGTH
The shoe length is important for stretching the foot and the toes during the rollover. A thumb's width should fit between the shoe and your longest toe when sitting. If the toes lack sufficient space, toes turn into 'crawls' as your

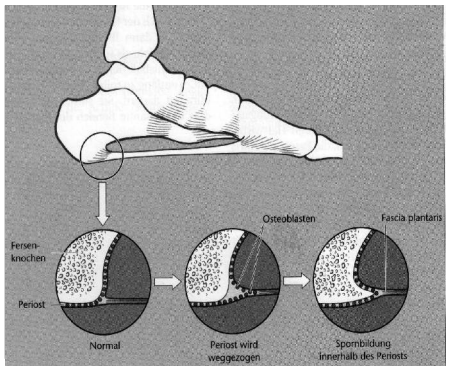


body will try to somehow shorten the foot, either by contracting your toes or the plantar fascia. Possible consequences are a

blocked navicular and cuboid joint, which are both very painful.

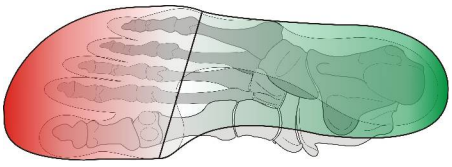
Quite conveniently, the volume of the shoe increases with the size, which has a positive effect on the ball of many patients. If a shoe is too wide, shoe filling insoles can be used. This can also be a good occasion to treat aching metatarsals or heel spurns.

Speaking of the heel spur, our impression is that 90 percent of the patients coming into our workshop with aching heel spurs



are wearing shoes that are too short. Only 10 percent are imputable to traumata.
We found that a treatment combining good advice on footwear and orthopaedic insoles, along with the exercises on a bottle of coke, yielded the best results. This training is very helpful in loosening a tense plantar fascia. The best test of the shoe length is to hit the ground hard with your toe-cap. If your toes reach the shoe cap, the shoe is clearly too short.

THE LACING
The optimal lacing runs down the back of the foot up until 5 mm before the tread line. The ball itself needs to be free, since tying

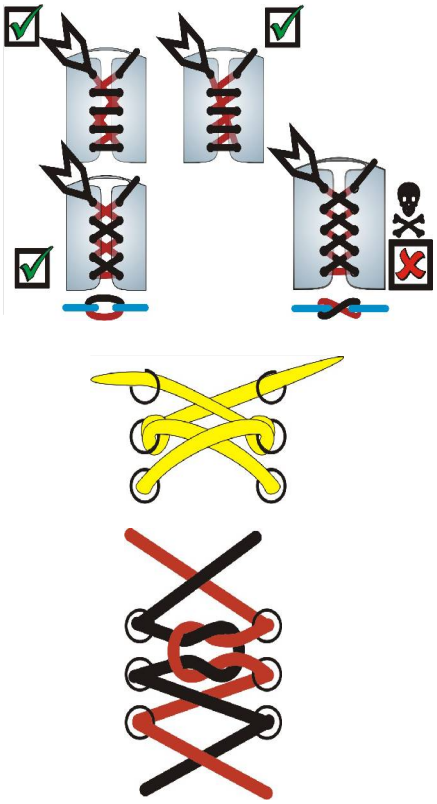


up the ball causes high mechanic tension on the metatarsals. I contend that one naturally ties one's shoes just as tight as the ball can sustain. Consequently, if the lacing goes beyond the tread

line, one tends to tie the shoe rather loose, which reduces the stand of the heel and causes the foot to slide forward while walking.

This effect is particularly strong when walking downhill; especially when a heavy rucksack further increases the body weight. In sum, it can be said that 95 percent of all sports shoes are designed defectively and negatively affect the physiology of the foot, mainly because the designers apply the lacing technique in a wrong way.
In this context, it is also worth mentioning the foot reflex zones. Reflexes in the ball are closely linked to the chest. Thus, the wrong lacing can lead to shortness of breath, in particular with women wearing a tight bra, which reinforces this effect. The same applies to sports shoes with Teflon lacing, a sort of modern snap closure that starts at the big toe. These shoes don't allow the hallux to brace medially. In this case, what are the chances of your foot to move normally? Nil. The sheer force that is generated within the bunion joint is not only harmful, this is bodily injury!

Here are some lacing tricks to turn a 'bad' shoe into a 'good' shoe:
(The lacing method suggested below allows the ball to move freely)



THE UPPER AND THE LINING
Regarding the upper and the lining, the most important thing is leather, leather, leather! As for the lining, uncoloured leather should be used preferably. By the way, designs from the art nouveau period combine high functionality and elegance and are still today considered state of the.

By contrast, the upper of contemporary 'performance shoes' is either inappropriately shaped or made of the wrong material. Just have a look where your toes naturally bend and where your shoe actually allows them to bend. Oftentimes, the natural movement of your foot is hindered by seams, thread eyes, and other fashionable nonsense. The worst, in my opinion, is sewing together the biggest parts of the upper right above the toes, exactly where they would want to move.
-The Lining:
Most linings are made of unhealthy material. For instance, all synthetics cause the foot to sweat but are non-absorbing and thus unable to cope with this effect. Very often, the consequence is cold, sweaty and, later, stinky feet, desperately trying to find some grip on the sticky-oily lining, which makes walking more energy-consuming. Let alone the many infections feet can contract under these conditions.
Regarding hiking shoes with Goretex lining, please note that the 'zick-zack' seam on the heel side often causes a sore heel, even when wearing hiking socks.

Therefore, hiking shoes should have only a minimum of seams.

THE SOLES

The sole function of the outsole is to lead the foot safely and evenly through the step without disturbing the natural rhythm of the body. Soles made of extremely soft material overly absorb the force pushing off the foot, whilst extremely hard soles that don't bend well near the toes force the foot, the knee, and the hip to make an extra-movement to even out this effect. This can have serious and painful consequences throughout the body up until the Atlas bone.

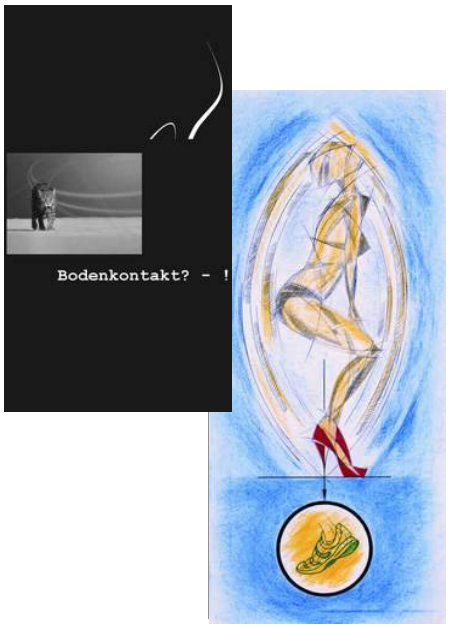
'Cassette Sole'

This insole, which is preferably used for the light-weight design of 'modern' shoes, can cause serious irritations when badly manufactured or worn out. Sweat moistens and softens the upper part (often made of cardboard). As a result, the foot feels like standing on a grate.

This is a real catastrophe for the proprioception as the body cannot rely anymore on the information it obtains from the foot.

PU & PVC Soles

In general, these insoles cause 'hot' feet as the insoles are often non-absorbing (cf. lining).



In summary, it is advisable to carefully assess together with your patient whether the shoe can actually function properly. Does the shoe have good ground contact?

Working on shoes, feet, orthopaedic insoles, and the static of the foot has made me realise the importance of appropriate and functioning footwear for a symptom-free everyday life. This is even more important for patients with aching or handicapped feet.

Michael Weiß,
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