Barefoot Running

The truth behind the hype.

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The benefit of running barefoot has recently received a large amount of media exposure. Much of this media attention has resulted from Nike's recently released "FREE" a shoe designed to be halfway between running barefoot and a traditional running shoe. Vin Lananna (USATF, Athens distance coach) believes "that athletes that trained barefoot run faster and have fewer injuries". Arthur Lydiard the legendary New Zealand coach preferred his athletes to run barefoot. The eccentric Australian coach of Herb Elliot, Percy Cerutty got his athletes to train barefoot in the sand dunes of Portsea, Victoria. These claims are all well and good, but is there any scientific evidence to support them?

Force Differences

It has been stated that the primary aim of running shoes should be to reduce impact forces following heel strike. However, research studies comparing barefoot running to running in shoes have found that the impact force peak is either equal to or lower while running barefoot. These results have also been supported by studies looking at forces in running shoes with very hard, standard and soft soles. The propulsive force experienced in the final stages of ground contact when you are preparing for the fight phase of running is also lower while running barefoot. This is the reverse of what would logically be assumed. The reason behind this is that runners, while running barefoot, make consistent changes to their running technique. One theory is that when landing on a soft surface people land harder to improve their stability. Running shoes do however increase the time taken for the initial force peak to be reached. During barefoot running the initial force peak occurs very rapidly, between 4.8 and 14 milliseconds (ms),after the foot makes contact with the ground. With shoes, this
time is increased to about 30 ms. This increased time to peak force is an important function of cushioning, as the body is better at compensating for gradually applied forces and it is believed that this increase in time taken to reach the impact force peak is what provides the perception of cushioning.

Pressure Changes

Pressure is a ratio of force per area. Therefore, pressure can be low if force is spread over a large area. In-shoe pressure is possibly of more interest than force when investigating the cushioning properties of shoes as it allows for the measurement of loads on specific foot structures. Unlike
force, pressure is considerably decreased in running shoes. Running shoes also partially absorb the extra pressures created by foot malalignment (e.g. high arched feet). This is important, as high pressure has a direct correlation with foot pain. It is understood that an increase in contact area with the soft shoe conforming to the foot is responsible for the decrease in pressure rather than a decrease in force, because as mentioned earlier we know force peaks are not reduced by cushioning.

Technique Differences

While running at the same speed, people running barefoot have a flatter foot placement. It is thought this is a mechanism to protect the heel of the foot and the body from high impact. It also allows the calf muscles to control the lowering of the heel to the ground increasing the time in which the force is applied to the body. This has been backed up by other research that has found midfoot strikers do not have an initial force peak and have lower overall forces. People running barefoot also have a greater rate and amount of knee flexion (bending). This acts as a big shock absorber and increases the time in which the force is applied. Runners running without footwear also have a shorter stride length; higher stride frequency (faster turnover) and a shorter ground contact time. These changes all assist in the reduction of the force peaks. One particularly interesting study investigating pronation (when the foot rolls inwards) and other foot motion when barefoot and in shoes was undertaken in Sweden using bone pin markers. They found that the motion of the heel and lower leg bones was not altered by footwear with support on the inside of the foot. This has been backed up by other research that has also found that the speed and total amount of pronation is lowest while running barefoot. While the motion of the bones may not be reduced in footwear, it is thought that supporting the foot during this motion may help reduce symptoms caused from excessive motion.

Foot Muscle Strength

There is limited research into the claims that barefoot running increases the strength of foot muscles. One study recently funded by Nike and undertaken at the University of Cologne looked at foot muscle strength in runners that used the Nike “FREE” while warming up. They found over a five month period that the strength of toe and foot muscles was increased by 4-5% but not muscles in the calf. This extra foot strength may assist in controlling excessive motion in the foot but there is not yet any evidence for this.

Injury Rates

The claim that barefoot running results in a reduction in injury rates has a legitimate basis. Running injuries are generally categorised into two types, those caused by excessive repetitive forces or those caused by muscles trying to reduce excessive motion. As shoes do not reduce force or motion in the foot, this could theoretically result in a reduction in injuries for barefoot runners. Unfortunately, there is no evidence to support this hypothesis. However, an unprotected foot opens up a completely new type of traumatic injury.

Implementing Barefoot Running

Many runners already regularly train in shoes with very little cushioning (i.e. racing flats & spikes) so they may already experience conditions suitable to make technique changes and develop additional foot muscle strength. As mentioned above it is the lack of cushioning that is regarded as an important factor in implementing these changes. However, more flexibility may be required to enhance foot muscle strength. During research studies, participants made technique changes with very limited adaptation time, so a runner does not have to be exposed for long periods of barefoot running to unconsciously make changes. Longer periods however, may be required for these changes to become permanent once the stimulus is removed. The ideal condition may be for a runner to make the technique changes that result in lower forces but to wear shoes to increase the time to the initial force peak and to reduce pressure. This enhances the body's ability to absorb the forces, and protects the foot from trauma. Theoretically, this would allow a runner to have the best of both worlds.