Natural Running

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Natural running or barefoot running has gained an incredible popularity within the last years. With the beginning of this running season, all major sports shoe manufacturers have added special barefoot shoes to their product range.

From the orthopedics or sports medicine perspective, the reduction of supporting elements is highly appreciated. Over decades, the development of sport shoes was strongly influenced by the paradigm of "cushion, support and guide". In the 1980s and 1990s the focus was to improve the cushioning of the running shoes. This development was driven by some animal experiments, which supported the theory that running on a hard surface could cause joint degeneration. However, for humans this correlation was never proven to be true, despite several epidemiological investigations.

To prevent running-associated cartilage damage, all kind of cushioning systems have been introduced to the market. Epidemiologic studies did not provide any evidence that the introduction of highly-sophisticated cushioning systems went along with a reduction in running-associated injuries. On the contrary – well cushioned shoes with oversized heel parts were for example suspected to cause Achilles tendon problems.

After increasing scientific evidence that the improvement in hindfoot cushioning did not reduce running-induced injuries, pronation became the center of interest. To some extent, the now recognized instability was "homemade" by the recently-introduced hindfoot cushioning systems. It goes without saying that an excessive pronation can cause problems to the musculoskeletal system. However, pronation is one of our natural cushioning systems. The pronation of the calcaneus in combination with the excentric load of the posterior tibial tendon absorbs a significant part of the heel strike energy. If this mechanism is blocked by running shoe features or orthotics which limit the pronation movement, the ability of the body to absorb the heel impact is substantially reduced. Finally the concept of pronation control did not fulfill the expectations to reduce running-associated injuries.

What should the ideal sports shoe look like? To answer that question, it makes sense to look back many 1000 years in human history. With the development of upright walking, bush men were walking barefoot on the steppe. The daily walking distance was between 20 and 50 km per day – a distance close to the daily workout of a long distance runner.

It goes without saying that due to our climate and surfaces like tar or concrete, we need to wear sport shoes most of the time. There is evidence that the ideal cushioning should cover the difference between hard artificial ground (e.g. tar, concrete, gravel) and natural ground like grass or steppe. It meets the mechanical conditions our locomotive system has adapted to through evolution.

Lever arms in sport shoe geometries play a critical role. The thickness of the heel part between 15 and 24 mm doubles the lever arm affecting the subtalar joint. This causes acceleration of the pronation angle velocity and the plantar flexion angle velocity after heel strike – in combination with an increased eccentric loading of the M. tibialis anterior and M. tibialis posterior.

This is the key aspect of these innovative sports shoe concepts. This function of the sports shoe is reduced to protection against cold and against injuries to the foot. Supporting and cushioning elements are abandoned. Doing that, the foot is hardly influenced in its natural movement.

On the other hand, the foot in a barefoot shoe is challenged to work a lot more. Support and stabilization, which was adopted at least partially by conventional footwear, have now to be accomplished by the foot itself. This is the downside of the ingenious idea to neutralize the negative aspects of sport shoes by barefoot shoes.

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The majority of us has spent most of their lifetime using normal shoes and is not used to the forces they have to cope with when they use barefoot shoes. At best, they end up with sore muscles, in the worst case with bone edema, overloading injuries of ligaments and joints as well as stress fractures.

The challenge for sports medicine is to support the positive trend of using barefoot shoes with the necessary medical knowledge and biomechanical understanding. It is our job to instruct the athlete how to use these new products. In the first line, barefoot shoes should be considered as training tools and not as normal running shoes. Initially, barefoot shoes should only be used for short running distances and with low intensity. When the fitness level of the foot improves, running speed and running distance can be increased. The pace of adaption of bones and soft tissues can vary a lot between individuals. However, it is very likely that this risk to develop overload problems increases with age and especially the risk for stress fractures is highest in postmenopausal women.

An interesting phenomenon is the change in the running pattern in persons using barefoot shoes. Most runners are rear foot runners as long as they use normal running shoes. As soon as they switch to barefoot shoes, the running style changes to more mid foot running style. This change in the running style reduces the heel impact in a way that there is no need for additional cushioning elements. Barefoot running shoes change the running style more sustainably than any course or seminar ever could.

As long as they are used rationally, barefoot shoe concepts are a fascinating asset for all runners.

I wish you a successful and healthy running season 2012 without any injuries, regardless wheter you are a team physician or an active runner!

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accepted: March 2011
published online: April 2012
DOI: 10.5960/dzsm.2012.017
Walther M: Natural Running. Dtsch Z Sportmed 63 (2012) 91-92.