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Page last updated at 20:07 GMT, Wednesday, 27 January 2010

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Shoes may have changed how we run

By Victoria Gill
Science reporter, BBC News

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Barefoot runners have a different style to those who wear running shoes

Wearing cushioned running shoes may have changed the way in which many of us run, new research suggests.

Using slow-motion footage, scientists have discovered that experienced barefoot runners land very differently from runners who wear shoes.

The researchers showed that runners who have trained barefoot tend to strike the ground with their forefoot or mid-foot, rather than their heel.

The team described their findings in the journal Nature.

Barefoot runners, the scientists say, may be at less risk of certain types of injury than those who wear cushioned running shoes.

Cushioned landing

The question of how best to support and protect a runner's feet is something that has intrigued both scientists and sports shoe designers.

This analysis, the researchers said, took an evolutionary approach to that question.

The research team used a combination of highly sensitive scales, high speed cameras, and 3-D motion analysis to compare barefoot runners to those wearing running shoes.

Their results showed that "shod" runners tended to strike the ground with their heel first.

"This creates an impact; it's like someone hitting your heel with a hammer with up to three times your body weight," said the lead researcher, Dr Daniel Lieberman from Harvard University in the US.

“ Striking the ground with your heel is like someone hitting your heel with a hammer with up to three times your body weight ”

Daniel Lieberman
Harvard University

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"Those collision forces have been implicated, by several studies, in certain kinds of repetitive stress injuries.

"Shoes work because they cushion much of that force - slowing it down, mostly."

But experienced barefoot runners appear to have developed a different way to prevent the pain, striking the ground with the forefoot or mid-foot.

"By forefoot or mid-foot striking correctly, one can almost completely eliminate that collision, making barefoot running comfortable," said Dr Lieberman.

He explained that the style adopted by barefoot runners may, in some respects, be less damaging.

Dr Lieberman's footage also demonstrated the specialised anatomy of the human foot, and caused him and his colleagues to propose that modern sports footwear may have altered how people run.

Minimal shoes

Many successful distance runners have competed barefoot, including the South African-born athlete Zola Budd.



This has caused researchers to question whether barefoot running might well be more efficient.

The results could be of interest to sports shoe designers

Dr William Jungers, an anatomical scientist from Stony Brook University in New York, who was not involved in this study, said that the findings had "potentially useful and thought-provoking implications for sports medicine and running shoe design".

He explained, in an accompanying article in Nature, that by striking the ground with their forefoot, a barefoot runner could take fuller advantage of energy stored in the ankle and in the arch of the foot.

But, as Professor Lieberman explained, "there are tradeoffs."

"Barefoot runners have to use their calf muscles and Achilles tendon much more to control ankle flexion. So people who switch to this style of running are much more likely to develop calf problems if they don't do so slowly, carefully and with a lot of stretching."

Dr Jay Stock, an evolutionary biologist from the University of Cambridge in the UK, told BBC News: "This provides compelling evidence that modern footwear may change the way in which people run, and in turn, cause greater stress on our bodies."

He said that it was also very interesting that "many of the world's best athletes run with a forefoot strike".

Dr Jungers concluded: "An evidence-based approach is badly needed to assess the competing claims as to what, if anything, is the best cover for a runner's foot."

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