

# Running shoes: the real science

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*Shoes come in all shapes and sizes, designed for many different activities. Design may be led by market preference, fashion and/or 'science'. Because of the marketing strategies used in sport and sport products, running shoes have attracted ample claims to support their design and effectiveness. But how much data is there ... really?*

## The word on the street

Seemingly scientific claims determine the marketing, sale, and even clinical prescription of trainers. Manufacturers and sales assistants could probably be forgiven; after all, they are working in a commercial environment. However, many podiatrists, osteopaths, and physiotherapists also recommend specific types of trainers, insoles, or orthotics to help with different running-related injuries.

The majority of readers who have gone into a running shop may well have been told that they either over/under pronate, have high/low arches, have a heavy impact, run too much on their heels, are stiff, or have frontal knee movement, among other issues. And there seems to be a specific shoe that fits every single condition seen.

This would all be very helpful – IF there was actually anything to back it up!

## And the evidence?

The issue is that, despite all the terminology – that sounds convincing and the reasoning – that appears to be logical – supporting scientific evidence is still lacking. In 2009 a research study led by Dr Richards from the University of Newcastle, Australia, produced a review article on the current evidence for running shoe prescription [1]. The objective was: 'To determine whether the current practice of prescribing distance running shoes featuring

elevated cushioned heels and pronation control systems tailored to the individual's foot type is evidence-based'.

The conclusions were stark: "No original research that met the study criteria was identified either directly or via the findings of the six systematic reviews identified". Simply put, there was no viable data out there, leading to the conclusion, "the prescription of this shoe type to distance runners is not evidence-based".

## Army manoeuvres

However, the net has been cast more widely by Knapik and colleagues, who undertook a large study in 2009 with US Army recruits following Basic Combat Training (BCT) [2]. Recruits were assessed for foot type by the imprint test (similar to the wet-foot test and pressure mat test used in many running shops). Following this, recruits were either assigned to the experimental group ( $n=1530$ ) or the control group ( $n=1532$ ). Those in the experimental group were fitted with appropriate trainers based on current recommendations for either low-, mid-, or high-arched feet. The control group received a standard stability running shoe (New Balance 767ST). The BCT lasted for 9 weeks and consisted of 1–1.5 hours of exercise a day, 4–6 days per week.

The results showed no difference between the two conditions, allowing the authors to conclude, "prescribing running shoes to BCT recruits based on static, weight-bearing plantar shape is not effective for injury prevention. This procedure did not protect against injury any more than the prescription of a single shoe, regardless of plantar shape".

## Something to build on

More recently, Dr Ryan and his team from University of British Columbia, Vancouver, undertook a study in which they categorised the foot types of 81 female runners based on the Foot Posture Index [3]. Although a stationary test, this is more comprehensive than the imprint test. Within each classification of foot type (neutral, pronated, or highly pronated), subjects were randomly assigned a neutral, stability, or motion-control running shoe.

Pain and injury scores during a 13-week half-marathon training programme were then recorded.





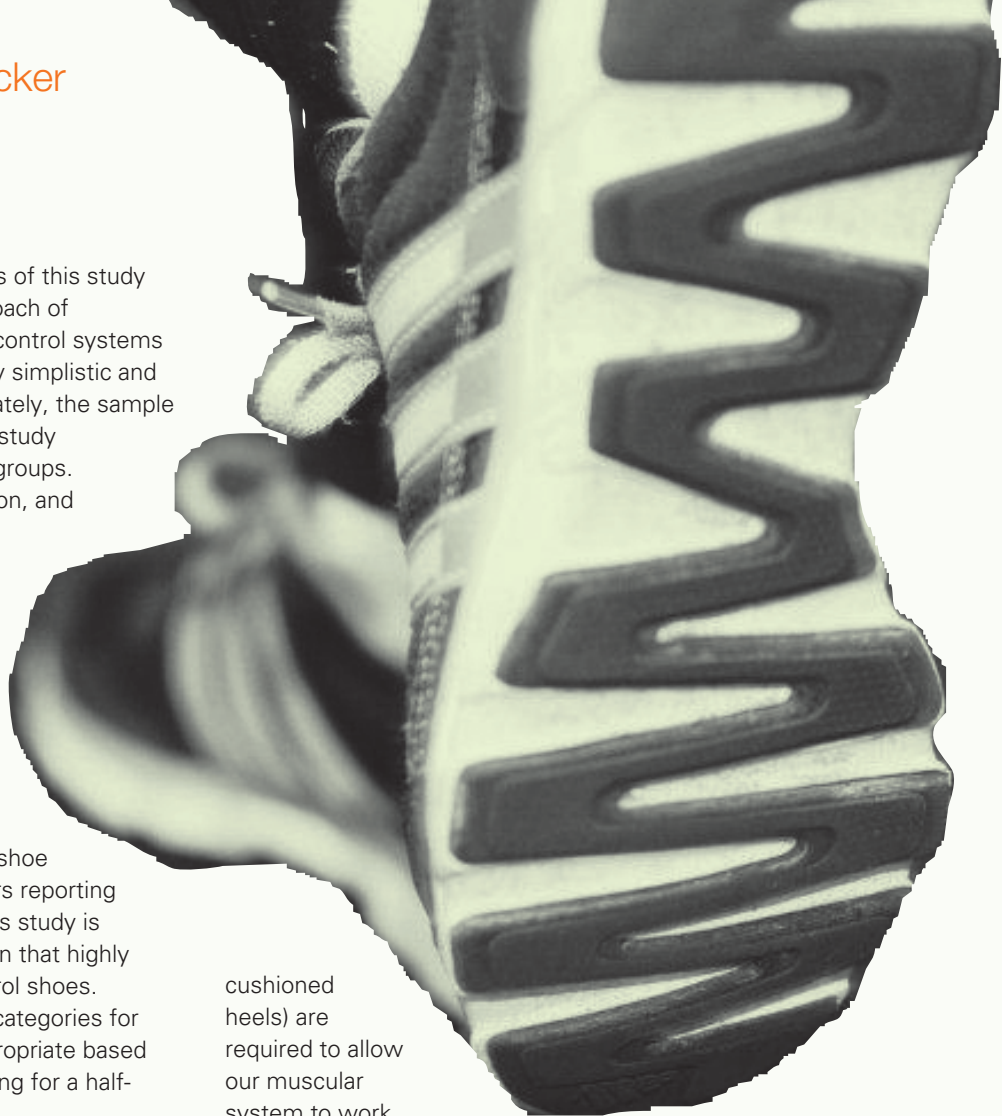
The outcome was, "the findings of this study suggest that our current approach of prescribing in-shoe pronation control systems on the basis of foot type is overly simplistic and potentially injurious." Unfortunately, the sample size of 81 is quite small for a study containing nine independent groups. However, it is all we have to go on, and allows us an insight.

### Challenging convention

Interestingly, all the subjects classified as high pronators and wearing the motion-control shoe reported at least one injury – compared to none of the high pronators wearing a stability shoe. This goes against everything prescribed for a high pronator in accepted practice. In all categories of foot type, the motion-control shoe group had the greatest proportion of runners reporting an injury. The authors finally concluded, "this study is unable to provide support for the convention that highly pronated runners should wear motion-control shoes. Current conventions for assigning stability categories for women's running shoes do not appear appropriate based on the risk of experiencing pain when training for a half-marathon."

### Theories are not enough

So why isn't the research backing the practice? Within science, theories come up all the time, and they are essential in leading research. However, until it is substantiated by research, a theory remains just that. Sounding plausible does not make it correct. This could be the case with foot types, shoe types, and injury (let alone performance). The thinking on shoe types is that 'non-standard' foot types can cause injury, and an external device on the foot may help redress this. Unfortunately, research has not shown support for any of this (broadly, data is scarce and what findings there are have shown the opposite). Dr Nigg from the University of Calgary, who has spent his long and impressive career in researching how we move and the design of shoes, has suggested that the impact forces (thought to be injury-causing, hence big-



cushioned heels) are required to allow our muscular system to work efficiently and effectively throughout the gate cycle, by 'tuning' our muscles [4]. Dr Nigg also shows, importantly, that different running shoes (motion-control, neutral, cushioned, etc) do not affect all runners in the same way: "they produce only small, not systematic, and subject-specific changes of foot and leg movement" [4].

### Address the basics

Research suggests that, instead of hoping for a "quick-fix" from running shoes if we get injuries, we should in fact be focusing on our running mechanics. Running is such a basic activity to us that we think we can go out and run without knowing HOW. It is important to address this issue and to put in the effort and time required to prevent injuries. In future issues, I will address the issue of running trainers and performance – including running technique.

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## References

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