Footwear Paradigm Shift

" A personal odyssey"

By Steve Manning

"A paradigm shift causes you to see the same information in an entirely different way." WIKI

At intraining we have always done things differently. That is because our focus is on finding the best shoe for our customers rather than just trying to sell them the most expensive shoe. We believe in the long run a happy customer will return for the service only we provide. A recent article written by Benno Nigg's team out of the University of Calgary has given support to our unique sales process. That in turn inspired me to write this story about how my thinking has evolved over time and created the procedure we use to find you the best shoe for your running.

In 1979, when I first started working in the running footwear industry, Brooks brought out a new shoe with what was called a varus wedge. It was designed by their consultant podiatrist Steve Subotnik. This was a wedge of firmer density placed on the inside of the midsole (cushioning) of the shoe to stop a movement called pronation. At the time pronation was a new concept for running shoes which stated that the rolling inwards of the heel of the shoe led to increased injuries. This shoe and this anti-pronation feature revolutionised footwear design during the running boom of the 1980's.

It was a simple story where a specific movement was the cause of most injuries. Injury risk could then be reduced by simply stopping this action. This theory of injury risk had a major impact not only on footwear design but also on orthotic prescription and gait analysis for the next few decades.

Benno Nigg has been at the forefront of footwear design and research for the last 30 years. Way back in the mid 1980's he had contributed to the Brooks Nexus, the first running shoe with a kinetic wedge. This was a softer section of midsole under the big toe joint which reduced the pressure from the ground allowing better flexion of the big toe in propulsion. This shoe was the most expensive shoe ever sold in Australia at $300 but it was also hugely popular. This feature was very successful for the 15% of runners who needed it but caused knee injuries in most of the runners who did not. As a result the shoe was discontinued despite its advantages. This story illustrates the importance of really understanding someone's individual biomechanics before prescribing a feature in a shoe.

One of the most popular running shoes in the 1990's was a motion control shoe called the Brooks Beast. This shoe was like running with a block of wood on your foot. It completely stopped the chance of any pronation. When people went in to a sports store and asked for the best shoe the sales staff would often point out the Beast as the shoe with the most protection from injury. Its popularity in sports stores was helped by the fact that it was also one of the most expensive running shoes.

As an experienced runner and coach I was always cynical of this simplistic story. I could see clearly that different people needed different amounts of support in different areas of the shoe. People were not designed the same so the idea that there was a best shoe for everyone was false. Just like some people were better at sprinting than distance running there had to be an individual level of stability and cushioning that was best for each runner. I did not even like the idea of cushioning and stability as being the main factors in describing a running shoe and its contribution to injury. Many of my own ideas were influenced by the writings of Peter Cavanagh (The Running Shoe Book, 1980) and Benno Nigg (Biomechanics of Running Shoes, 1986).

Far too frequently runners were sent in to our shop with orthotics that tried to completely block pronation. They were often impossible to fit into a shoe and were often very uncomfortable to run with. The patients were also told by their Podiatrist to purchase the most stable motion control shoe. This seemed to be a huge overkill to me.

I had done a guest lecture to the Podiatry students at Queensland University of Technology on sports footwear and injury. In it I tried to explain a new perspective that "footwear can be a direct or indirect cause of injury in runners". I wanted to teach them that there was an optimum amount of support for each person. While a little bit of anti-pronation control might be good for a runner, that did not mean that more was always better.

With cushioning I believed that softer was not better. A Swedish research study was performed that involved an experiment where bone pins were screwed into the leg bones (femur and tibia) to identify how much force was going through the knee joint. Subjects ran over different surfaces from cement to high jump mats. The surprising finding was that there was a point where a softer surface increased the amount of force that went through the knee. My conclusion from this finding was that softer surfaces reduced feedback from the ground so prevented the coordinated contraction of the muscles which was the most significant dampener of impact forces. I thought that soft shoes might bottom out and cause an unanticipated force wave which would be more destructive - like jumping off a step with your eyes closed. I also felt that harder or firmer shoes would offer less compression and reduce impact reduction. These combined effects suggested that there was an optimum midsole firmness for each runner depending on two factors of their weight and how hard they hit the ground. Force = mass x acceleration. So a heavier runner who landed softly might need a softer midsole than a lighter runner who hit the ground hard.

As a retailer, the challenge was to identify what each runner needed. At our specialty running store "the intraining Running Centre" our staff were taught to let the person's foot decide what was the best shoe. We stopped discussing any shoe technology jargon with our customers. Instead we told the customer how the shoe was supposed to feel when running: They should be comfortable and feel like there is even support on both sides of the feet. The shoes should be quiet to run in with reduced slapping or pounding. The critical factor in selecting the 'best' shoe was to have the customer run in the shoes at their normal pace to see if their gait and the shoes were compatible. We encouraged them to run in one foot of each pair to have a real time comparison between models. In the process of educating our customers, we began to sell fewer motion control shoes while that had become the most popular category of shoe in most stores.

In 1999 I started writing a column for the Australian edition of Runners World magazine on footwear and injury called "The Footman". I also began posting answers to footwear questions regularly on the coolrunning forum website. During this time my theories began to evolve. I tried to explain the footwear contribution to injury on four factors: wear, fit, design and suitability. This threw out the traditional idea that stability and cushioning were what defined injury risk in a shoe.

I thought that there was a niche in podiatry for someone who understood runners so I went back to university as a mature age student. By returning to university to study Podiatry I was able to

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refine my model of injury risk and footwear with more research and a better clinical perspective. I expanded my knowledge by reading the theories from researchers like Kevin Kirby and Benno Nigg. My own perspective on treating running injuries relating to footwear and biomechanics evolved along evidence based medicine. I tried to think outside the box and use this research, as well as my own experiences as an injured runner and coach, to help direct my treatment ideas.

During university I gave a lecture at the Qld conference of Sports Medicine Australia explaining my new thoughts on the footwear contribution to injury. I also became involved with the Qld Sports Podiatry Group and took on the role of continuing education coordinator with an emphasis on the importance of sports footwear. I felt that the shoe had a greater potential effect on biomechanics and injury then an orthotic as the shoe had more depth under the foot than an orthotic. This was an important hypothesis that Podiatry needed to address. I also felt that most running injuries were related to events during propulsion rather than at heel strike or midstance. Three quarter rigid orthotics were incapable of giving help to the runner when it was most important.

After graduation I was able to expand my thoughts on orthotics and footwear by successfully helping injured runners. The traditional workflow was to make up an orthotic and then find a shoe that fit it. Some podiatrists had begun to prescribe neutral shoes to their patients so that the orthotic would offer all the control needed. I felt this was a mistake and instead tried to first find the best shoe to suit each runner and then make an orthotic to suit both the shoe and their foot. That way the orthotic would customise the shoe to their foot without compromising the shoes durability.

I continued to enjoy reading footwear and biomechanics research. Abstracts from the conferences of the Footwear Biomechanics Group of the International Society of Biomechanics were particularly interesting. This research done often by biomechanists rather than Podiatrists went against the Podiatry theoretical status quo. They questioned the role of pronation in injury risk and even the effect of orthotic control on motion. This was then taken to the next step to question the contribution of motion to injury risk. Possibly it was force (Kinetics) rather than motion (Kinematics) that was the major factor in running injuries.

In July this year Benno Nigg and his researchers at the University of Calgary published an article in the British Journal of Sports Medicine called "Running shoes and running injuries: mythbusting and a proposal for two new paradigms: 'preferred movement path' and 'comfort filter'." This article reviewed the research over the past 40 years and in particular the relationship between impact characteristics and ankle pronation to the risk of developing a running related injury. He questioned whether or not running shoes had any influence on injury rates, but concluded that the change in demographics of the running population and the inconsistent definition of running injuries made a comparison over time inappropriate.

There were multiple research studies that found that cushioning did not have a significant effect on injury frequency. Another study found a 200% increase in running injuries between a neutral shoe and a minimalist shoe with the minimalist shoe being more injury prone. With regards to orthotics and injury a softer insole reduced injuries which was the not what was found with a soft shoe midsole. Self-selected comfort of an insole/orthotic had the biggest impact on reducing injury rates.

In the past, without any research evidence, it was thought that foot pronation and impact forces were the main factors in injury risk.

Most of the research on impact forces was inconclusive due to the small sample sizes. Faster runners with higher impact peaks or loading rates also did not have increased impact related injuries as you might expect. One study with a very large sample size found an inverse relationship between foot pronation and injury rates. It found that injury frequency decreased as pronation increased. So the two variables that were considered to be the greatest risk factor for running injuries were not valid.

So how can we select shoes that will reduce our injury risk?

Nigg proposed two new theories of the 'preferred movement path' and the 'comfort filter'.
The idea for the preferred movement path came from studies done with bone pins rather than skin markers to see how the foot and leg actually moved when barefoot, in shoes and with orthotics. They found that the path of movement did not change but the range of motion did. A good running shoe should allow the body to move in the preferred movement path. This means assessment of movement may not be as helpful in selecting shoes as other indirect ways.

Different subjects were found to select different shoes as most comfortable. There is not one type of shoe that is most comfortable for everyone. Comfort was associated with a reduced injury frequency as well as better running economy and performance. The comfort filter paradigm proposes that by selecting the most comfortable shoe a runner will reduce their injury risk.

Fortunately this is the way we have always selected shoes at the intraining Running Centre. We let the runner and his foot decide which shoe works best. The most critical factor is to run in the shoes before you make any decision. During the trial run we tell our customers to pick the shoe that feels like it gives the most even support on both sides of the foot, has the smoothest action making it easier to roll off the forefoot and is the quietest when running. Different runners will find different shoes that meet that criteria.

There will always be different theories and paradigms posed to help us understand what is 'the best shoe'. It is comforting know that a model the intraining Running Centre adopted 30 years ago, has been shown as possibly 'the best fit' by the leading researchers in the field of footwear and biomechanics.