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Orthotics work in mysterious ways

Most drivers don't think much about spark plugs and carburetors. They just want their vehicles to run, leaving the details to their mechanics. Most homeowners trust electricians to worry about voltages and alternating currents. They just want their lights to come on. In the same way, most patients who use medical devices just want the devices to work. Knowing how they work is the domain of clinicians and researchers. Unless, that is, the medical device is a foot orthotic.

According to Benno Nigg, professor of biomechanics and codirector of the Human Performance Laboratory at the University of Calgary in Alberta, even medical experts aren't sure exactly how orthotics relieve pain or prevent injury. "Orthotics can work and can have fantastic effects, but we don't know how they work," says Nigg.

The growing orthotics market could reach annual sales of US\$4.7 billion by 2015, according to Global Industry Analysts, Inc. (www.sfgate.com/cgi-bin/article.cgi?f=/g/a/2011/01/13/prweb8061575.DTL). Orthotic devices are used by the public primarily to relieve pain, and by athletes to prevent injury. It is also a diverse business, including everything from custom products made from high-tech materials to inexpensive insoles.

Though prescribed in large numbers by podiatrists and orthotists, clinicians still struggle to determine which type of orthotic will work for a particular patient. In his new book, *Biomechanics of Sport Shoes*, Nigg describes sending a long-distance runner to five orthotics makers to seek help correcting a problem with pronation. Each made a very different type of insert, varying in thickness, hardness and other ways.

"What this means is that specialists come to completely different conclusions on what to do," says Nigg. "It also shows that we don't really understand what we do."

One hypothesis is that orthotics correct skeletal alignment problems, though Nigg says there is no evidence to support that proposition. Rather than moving bones around, it is more likely that orthotics affect muscle activity, he says. Figuring out how they affect muscle activity — and how to correct activity that is causing pain or injury — could lead to more consistent prescribing of orthotics.

"Maybe we should not think of pushing the skeleton around, but rather about finding ways to give signals to the body to do the right thing," says Nigg.

Dr. Michael Nirenberg, a podiatrist in Crown Point, Indiana, says he is not surprised by the lack of consensus on how orthotics work. "There isn't even a consensus on what an orthotic is," he says, noting that the term is used to describe both pricey custom-made inserts and cheap insoles available at any drugstore.

Determining which orthotic will work best for a patient is difficult, says Nirenberg, because so many factors come into play. Even if two patients are similar in many ways — weight, gait, foot structure — they may still experience very different outcomes after using similar orthotics. "You can't guarantee anything is going to work

for everyone, because people are so variable,” he says. “Orthotics can do amazing things for many people, but not for everyone.”

The basic function of an orthotic is to put the foot into a better position, which alleviates pain, says Nirenberg. If a muscle is strained or hurting, a properly chosen orthotic will do some of the muscle’s work for it, thereby reducing its workload and bringing relief. Of course, giving muscles a permanent vacation also has a down side.

“When you brace the foot, that may alter the function of the foot for the better, but in doing so it negates the need for many of the muscles in the foot to do anything,” says Nirenberg. “Common sense tells us that if you don’t use a muscle, it’s going to weaken.”

When visited by a patient in pain, Gordon Ruder, a practising orthotist and the coordinator of the prosthetic and orthotic programs at George Brown College in Toronto, Ontario, won’t prescribe orthotics right away. First, he will recommend such things as better shoes, strength training, stress reduction or lifestyle changes that could alleviate the problem. Sometimes, however, these things aren’t enough.

“You might have chronic pain that can’t be managed by other means, and you still need to work 12-hour shifts, and you can’t change jobs to one that will stop you from spending time on your feet,” says Ruder.

In such cases, Ruder will recommend orthotics, though, like others in his field, he warns that picking the right type for a patient is not an exact science. “It’s not as simple as replacing brake pads on a car after they’ve worn out,” he says. “The human body doesn’t work like that.”

As a researcher, he would like to see more resources put into studying orthotics. Existing research has been lacklustre, mainly because it is difficult to quantify the biomechanical changes that result from wearing orthotics. There is a need for more-sensitive tools that are capable of detecting these subtle changes, says Ruder. “I very much want to see research become a bigger part of what we do.” — Roger Collier, *CMAJ*

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