VIEWPOINT

Last year, Dr. Ozan Akkus, an academic at Purdue University, in West Lafayette, Indiana, USA, won funding to develop an early-warning device for people prone to stress fractures. In this Viewpoint, he explains why he believes his idea could work well in the athletic apparel and activewear space.

An early warning system for fractures

During prolonged physical activity, athletes, climbers, walkers and dancers repeatedly exert small forces on their bones. These forces are not strong enough to break a bone, but the repetition poses a danger by causing microscopic cracks to accumulate over time; which can eventually result in stress fractures.

It's hard to measure stress in a bone without cutting it open, and there is usually little warning of trouble ahead because you don't suffer horrible pain. You might have some discomfort, but you can keep exercising.

Last year, we came up with an idea for a wearable device that will track cracks as they develop. It will use sensors that will pick up the seismic waves resulting from crack formation in the bone. By linking this to an everyday portable electronic device, athletes or their coaches can have early warning of possible stress fractures, and avoid the problem through rest.

The system records acoustic emission data, or sound waves created by tiny fissures that develop in the bone. The same sorts of acoustic emissions are used to monitor the integrity of bridges, buildings and other structures.

Recently, flexible polymer-based sensors have appeared on the market, and these could be incorporated into athletic apparel, such as exercise tights, and even running shoes, to monitor areas most susceptible to fractures.

We made the initial announcement about this in September 2006 – and I have to admit that, so far, we have received no approach from any textile company or any of the big athletic brands, but I believe this idea could be of great interest to them.

Now, the cross-country running team here at Purdue University has agreed to take part in a trial of the idea. This is a discipline in which athletes are vulnerable to stress fractures. For the trial, we are going to use prototype polycarbonate plastic sensors, with special adhesive and tape on top.

But the application that excites me most is the one incorporating polymer-based sensors into shoes or apparel. I think there's every likelihood we could see this as a product, and I believe it could be very big. Even the biggest names and brands could license the idea from us and incorporate it into their ranges.

Athletes, baseball and basketball players could all benefit from wearing the device during part of their training programmes. The same could apply to soccer players, among whom stress fractures of bones such as the metatarsals have become increasingly common. Amateurs preparing for a marathon or a trip involving prolonged outdoor activity could also benefit.

The sensors would be able to tell them all when the time had come to heal their bones through rest before a stress fracture develops and leaves them on the sidelines for months.

