Q&A Karl Zelik

New Science Questions Wearable Technologies

A new study published by a Vanderbilt Research team has looked into the difficulties of estimating stress fractures with wearable technologies. Led by Assistant Professor of Mechanical Engineering, Karl Zelik, the team observed that measurements of ground reaction force predicted by current technologies do not accurately predict total bone loading. The team’s findings have already been implemented into classrooms nationwide and have the potential to revolutionize a subset of the wearables marketspace. In a brief interview, Dr. Zelik spoke to me about the process, importance and implications of his findings.

**You’ve worked extensively with prosthetics, but what got you involved in this specific project?**

This specific project is because our collaborator, who is an orthopedic doctor, approached us and asked, ‘is there a way to use wearable technologies to monitor a runner that could give them some feedback before they got hurt?’ And it was seemingly a very simple question, but it was a very interesting one that lead us down the path looking into the science, thinking about the physics behind it all, looking at the existing wearable technologies on the market, and thinking about what they’re claiming and how they’re interpreting the data that they’re collecting.

**Your primary finding suggests that ankle angular velocity doesn’t correspond with MTU power. How would you explain that to a general audience?**

The basic idea is people have been trying to use the information of the force between your foot and the ground as an indicator or predictor for whether you’d be at high risk of developing a stress fracture. The problem is that even though the force on your foot is two to three times your body weight, the force on your bone is anywhere from six to about fourteen times your body weight, and that’s because most of the forces are your muscles contracting and pulling against your bone. So, to understand the loading, or microdamage caused to the bone, you have to understand all of the forces on your bone, not just the little force on your foot.

**I read that you and your associates recently filed a patent for this new type of technology, what do you envision that looking like?**

It’s all comprised of tiny low power sensors that would fit into your socks or shoes. Basically, it is a way to take multiple sensors and fuse data from them in a way that gives you both the force under your foot and the force due to muscle so that we can combine them together to get a better picture of the actual loading on your bone.

**Do you see this new technology being bought primarily by individuals, professional teams for their athletes or both?**

In terms of hardware, a number of devices that are already on the market only retail in the low hundreds of dollars. So [some are] sold directly to consumers and some of them are sold to professional sports teams and used to monitor their athletes.

**What sort have feedback have you received since your paper’s publication?**

So far, it’s been well received. A student from Penn State took a picture in their lecture and the paper was already being presented in a class on the mechanics of locomotion 5 days later. So that’s kind of a cool thing that can happen with how quickly information is passed on.