

Getting smart about diabetic foot ulcers

8 February 2017, by Dipali Pathak

While wearing appropriate footwear can help treat and prevent diabetic foot ulcers, the leading cause of limb amputation among people with diabetes, noncompliance continues to be an issue, especially among those with loss of protective plantar sensation, known as diabetic peripheral neuropathy. Researchers at Baylor College of Medicine and University of Arizona found that using smart insoles and smartwatch technology to alert patients of harmful plantar pressures was effective in encouraging people with diabetic peripheral neuropathy into compliance with wearing protective footwear. Their report appears in the *Journal of Diabetes Science and Technology*.

"The study suggests that not only is such technology acceptable to people with [diabetic peripheral neuropathy](#) and high risk of [foot ulcers](#), but also that it could encourage them to be more compliant to a prescribed footwear by providing timely and interactive alerts," said Dr. Bijan Najafi, professor in the Michael E. DeBakey Department of Surgery at Baylor and director of clinical research in the division of vascular surgery and endovascular surgery. Najafi, a biomedical engineer, is the director of the Interdisciplinary Consortium on Advanced Motion Performance (iCAMP) at Baylor and first author of the paper.

In this study, he and colleagues aimed to examine acceptability, practicality and effectiveness of wearing a combination of smart insoles and a smartwatch designed to manage unprotected sustained plantar pressure, which often occurs during prolonged standing and walking. They also examined the successful response to an alert and changes in patients' behavior, such as changes in adherence to footwear, over time.

They recruited 17 patients with diabetes and history of neuropathic foot ulcers and asked them to wear a smart insole system (the SurroSense Rx, Orpyx Medical Technologies Inc.) over a three-month period. The device cues patients when pressure is sustained for a significant period of

time. The technology also gives cues when an object, such as a small stone, enters the shoe but due to loss of foot sensation, the patient may not be able to feel it.

The smartwatch alerts the patient when high pressure is detected and indicates which area of the foot is under pressure. The patient can press 'help' on the smartwatch to get advice on how to relieve the pressure.

Researchers assessed changes in adherence to wearing the smart insole and successful response to an alert on a monthly basis over the three months. They also examined the association of frequency of daily alerts and adherence as well as successful response rate to daily alerts.

The study found that users who received at least one alert every two hours could enhance adherence to footwear over time, respond better to alert-based feedback and could better perceive the benefit of such technology-based intervention. They also found that a lower level of daily alerts led to disengagement from using smart insoles.

"The risk awareness seems to have a significant impact on patient engagement over time and improvement in adherence to the footwear, which was equipped with this technology," Najafi said.

Researchers note that this study needs to be followed up with a larger sample size study over a longer period of time to confirm the results, but could potentially have a significant impact on the prevention of foot ulcers and [limb amputation](#) for those with diabetes.

"This could also open new avenues to translate mobile health technologies to change patients' behavior," Najafi said.

More information: Bijan Najafi et al. Smarter Sole Survival, *Journal of Diabetes Science and Technology* (2017). [DOI: 10.1177/1932296816689105](#)

Provided by Baylor College of Medicine

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