

Sensing technology to prevent diabetic foot ulcers

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Credit: University of Southampton

Innovative in-sole sensors will alert diabetic patients during excessive or extended activities that could trigger foot ulcers in a new system being developed at the University of Southampton.

The LLoad Monitoring and Intervention System (LOMIS) processes real-time data from three directional force sensors and detects physical activities over extended periods of time in a five-metric dimensional risk

model.

Live risk alerts are communicated to patients through a connected App to mitigate the risk and dangers of ulceration and amputation.

A LOMIS prototype has been tested in pilot studies and around £1 million of new funding from the National Institute for Health Research (NIHR) will now prepare the technology for clinical trials and adoption within the NHS.

Over 3.3 million people in the UK have diabetes and this is expected to increase to five million by 2025. The NHS spends around £1.13 billion every year on diabetic foot ulcer-related care. Prevention is predominantly through patient education and scheduled foot screening every three, six, or 12 months.

However, a foot ulcer can occur quickly, even within a day. People with diabetes often cannot feel foot pain and so fail to recognise the early warning signs. Therefore ulcers often go unnoticed and untreated, and then the risk of amputation is increased.

Professor Liudi Jiang, head of the Engineering Materials Research Group and LOMIS principal investigator, says: "When we walk, we apply pressure (compression) and forwards and backwards rubbing forces (shear) underneath our feet. It is both the pressure and shear forces applied over prolonged periods of time that cause tissue breakdown which can quickly develop into ulcers.

"Around 80 percent of foot ulcers may be preventable by better management of the forces applied to the sole of the foot. Our LOMIS strategy is to alert patients during excessive loads using force sensors underneath the foot that can 'feel' the load for those who have lost their foot sensation due to the disease. App alerts then help patients change

their behaviour at precisely the right time and provide advice such as taking a break or considering public transport."

Pilot studies have demonstrated clinical feasibility, comfort when worn and the ability to distinguish differences in foot-loading between people with and without diabetes. "This latest work funded by the NIHR will ensure LOMIS has a patient-centred design and offers high usability," Professor Jiang says.

There are over 60,000 people with diabetic foot ulcers in England at any given time, and 160 foot ulcer related amputations every week – unfortunately over 60 percent of these people may die within five years of amputation.

Current systems only measure and manage compression pressure, whereas shear forces are critical in the cause of ulceration.

The LOMIS system further enhances its effectiveness by considering a fourth dimension of different activities, such as walking or climbing stairs, and a fifth dimension of time, where plantar tissues can change physiological status and load tolerance due to deformity and conditioning.

More information: For more information, see www.lomis.co.uk/

Provided by University of Southampton

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