ABSTRACT: People with peripheral neuropathy as a result of diseases such as diabetes or after chemotherapy have reduced sensations in their limbs. This sensory loss can result in numbness and as a consequence, problems with estimating the pressure that is actively applied to the foot which may result in walking and balancing problems.

A feedback system to provide augmented and replaced sensation to patients with sensory loss was developed at Bournemouth University. The development involved designing shoe insoles with tactile sensors which can detect and transmit contact and movement information to areas of skin with normal sensation in the upper leg through electrodes, and use this as augmented feedback to allow patients to learn to compensate for the areas of sensory loss. The signal from the area of sensing will be used to help people to learn to reinterpret this as coming from their affected foot.

A calibration method was developed that allows calibration for an electrotactile feedback system. The calibration method and the estimation of magnitude with the feedback system were tested in nine healthy individuals. It was shown that the average error to estimate the magnitude of stimulation was 11.2%, which shows the potential of the feedback system in terms of giving a useful feedback that can help to compensate for the lost sensation in the feet.

The research group is currently working to test the device in a clinical environment with test subjects that suffer from neuropathy. The goal is to prove that an electrotactile feedback system can help to improve balance and gait for people that suffer from sensation loss. It is tried to find ways to use the system as a possibility to communicate with the wearer and make him aware of situations that could be harmful, e.g. the application of too much pressure over a longer time or faults in the device. This communication can be realised by giving different stimulation patterns to the wearer and briefing the wearer to interpret the patterns.

The feedback system also has the potential to be used for other disabilities. The feedback system could be well suited on an artificial limb allowing the wearer to feel the pressure that is applied to the artificial limb. Another possible scenario is the usage of the feedback system for blind people. The system could give an electrotactile feedback based on the distance of objects that are detected with distance sensors so the wearer would lower the danger of a collision that could be harmful.