

# A novel offloading insole system designed for healthcare



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## Abstract

Foot pressure is the focus to manage the lesions and/or pain for a broad range of people, such as the elderly (Menz et al., 2007), people with diabetes (Chatwin et al., 2020), or cyclists (Bousie et al., 2018). Common foot lesions like corns and calluses can cause pain and impact quality of life (Farndon et al., 2015). The authors have investigated an offloading technology in a prototype insole, which is potentially used by people with low-risk pressure-induced foot lesions, such as corns and calluses, to reduce plantar pressure.

It is designed with a modular cell structure allowing cells to be removed to create a customised cavity to relieve pressure on the target zone. To evaluate the effects of the insole prototype on the user, foot pressure distribution was measured during normal walking cycles. Fifteen healthy participants walked under four conditions: wearing their normal footwear without the prototype; with the prototype but without cavities; with the prototype and cavity on one insole; with the prototype and cavity on both insoles. Ultra-thin, in-shoe pressure mapping

technology was used to measure the pressure under both feet, synchronised with a motion capture system. User experience (UX) was collected in terms of insole fitting, comfort rating and balance feeling.

The results confirmed the modular design has an offloading effect without affecting gait. On average, wearing the prototype insoles with cavity reduced around 28% of mean pressure in the target zone than wearing normal shoes. In addition, the prototype has cushioning effects, evidenced by reduced plantar forces. UX data also showed their satisfaction in comfort and provided insights for future design development.

The research demonstrates that for a novel insole system to benefit people it is essential for the design development process to measure both subjective and objective responses to the product. Using triangulation between methods, the researchers have been able to validate the design with human factors considered and tested, as well as gain insights from a sample of end users that can be fed into an iterative cycle of designing, prototyping and evaluation to ensure inclusivity.