Under Pressure: Customized Insoles for Plantar Pressure Ulcers

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There are approximately 30 million diabetics in the United States; over 15% of them suffer from plantar pressure ulcers. These ulcers, which are essentially open sores, are caused by pressure applied to a given area over an extended period of time. They are commonly formed on bony areas such as the heels and ball of the foot. Diabetics with plantar ulcers are 15-46 times more likely to have lower limb amputations than those without them. There are many current treatment options, including casts and wheelchairs, but those are bulky and significantly limit mobility. The goal of this project was to design a customizable insole for pressure ulcers which would reduce pressure underneath the ulcer, thus allowing it to heal and reduce pain. Personalized insole molds were developed in SolidWorks, including flat and customized insoles. Proof of concept models were then created by casting polyurethane—a plastic that is commonly used to decrease pressure in insoles—into the 3D printed PLA molds. A variety of novel insole designs were then compared with controls. Pressure sensors were used to confirm that the insole selectively reduced pressure on model ulcers ($p < 0.01$).

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