

D. ŠIMŠÍK, A. GALAJDOVA, M. GORLICKY, B. JOBBAGY, R. BALOG. **The mechatronic shoe: A new rehabilitation tool for improving mobility.** *Gerontechnology* 2012;11(2):346; doi:10.4017/gt.2012.11.02.418.00

Purpose Our aim is to apply a rehabilitation device in household. The development of a rehabilitation device is based on the principle of the exoskeleton. **Method** We describe the mechatronic shoe developed as result of research in 7FP-project SMILING with application in geriatric rehabilitation medicine¹⁻⁶. The overall objective is to develop and construct an advanced prototype of a wearable non-invasive computerized miniature rehabilitation device for mechanical chaotic perturbations of gait pattern in order to counteract and prevent tendencies to fall. The main tasks were to develop perturbation algorithms fitted to suit individual user's specific needs and to implement a training system to be used in rehabilitation, health care, and fitness centers for a reorganization of the rehabilitation process in ageing. The SMILING shoe is a complex mechatronical system that requires interaction of various sensors data, mechanical components, and human activity. Two different designs were developed: STRATH and TUKE (*Figure 1, left*). Both left and right shoes are equipped with 4 mechanical units driven by DC-motors. Two are in the front and two are in the back side. In generally, mechanisms change the height after each or several steps, and in such way they change inclinations of the shoes sole in two planes – frontal and sagittal. The SMILING shoe is worn on a standard shoe used by user. The user has to react to changes of the shoe inclinations to stay balanced when walking while completing specific tasks. Beside the SMILING shoe, we are working on the development of a rehabilitation robot for upper limbs using pneumatic air muscles. The robot is designed on the principle of exoskeleton and is intended for the rehabilitation of the shoulder and elbow; the device has 4 degrees of freedom and uses an antagonistic pneumatic air muscles arrangement. **Results & Discussion** In the testing phase, 4 pairs of the SMILING shoes produced by the University of Strathclyde were tested in clinical trials with senior users. The objective of the trials was to determine whether a training program with SMILING shoes enhances gait performance (*Figure 1, right*). Seniors from Israel, Italy, Slovakia, and Switzerland participated in this cross-over randomized-controlled trial. In Slovakia we cooperated with the Highly Specialized Geriatric Institute of St. Lukas Košice.

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Affiliation: Technical University of Kosice, Kosice, Slovakia; E: dusan.simsik@tuke.sk

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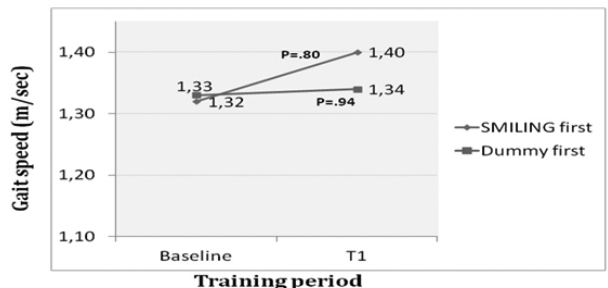


Figure 1. TUKE design of the rehabilitation shoe (left); 1 Change of gait speed over the first training period (right)