The influence of a laboratory environment on plantar pressure variability in young and older adults during walking

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Introduction
Plantar pressure measurements with in-shoe and platform devices are often used for clinical gait analysis. The effects of walking or running speed, cadence and different data collection protocols on plantar pressures are well discussed in the literature [1-3]. However, an artificial laboratory setting may have an influence on plantar pressure patterns during normal walking, especially in elderly people or patients. The purpose of this study was to investigate the influence of a laboratory environment on plantar pressures during walking for young and elderly adults.

Methods
Plantar in-shoe pressures were determined for 10 young (age 27.2) and 10 elderly (age 64.8) adults during walking. Pressure sensitive insoles (NOVEL GmbH, Munich) were connected with a portable data logger, worn at the subject’s hip. The apparatus does not disturb subjects’ gait and enables measurement in different surroundings. After the system was applied, the subjects were asked to walk at their own cadence outside of the laboratory along a wide and long corridor. The subjects were told that the system has to warm-up for a couple of minutes, before the measurements could start in the laboratory. Without the subjects knowing, first measurements (C1) were already taken in the corridor by using a wireless remote control. Back in the laboratory, the subjects were asked again to walk at their own cadence along a distance of 13 m (C2). Walking speed, peak pressures (PP), relative loads (RL) as well the variability of the pressure data were calculated for 10 different foot areas (Figure 1). The pressure data of four consecutive steps from the middle of the walk were averaged and analysed.

Results
Only small differences in walking speed, peak pressures and relative loads were found for the young and older adults and for both conditions C1 and C2. However, the intraindividual pressure data variability was increased for the lab against the floor condition (Figure 2). This effect is highly significant for the mid and forefoot regions (p<0.01). Furthermore, older adults show a reduction of plantar pressure variability in all testing conditions (Figure 3).

Discussion & Conclusion
The results of this study indicate that the laboratory environment has little influence on gait kinetics but a potential impact on the...
variability of gait. Therefore, in laboratory settings, a higher number of ground contact measurements are necessary to increase the reliability of in-shoe pressure measurements. The reduced variability for older adults is an indication for a well-controlled roll-off process in older subjects. Previously Kimmeskamp & Hennig [4] reported a reduction in plantar pressure variability for Parkinson patients. It seems that young adults allow themselves more gait variability, whereas elderly people - possibly due to reduced motor abilities, show a more consistent roll-off process. The stereotypical roll-off pattern of the foot in elderly people and Parkinson patients may cause difficulties in corresponding with internal and external changes during walking and may be a possible risk factor for idiopathic falls.

References