

## **Validation of Vertical Force Measures During Hop Tasks Using Pressure Insoles**

ANDREW CHO, ERIN CAGLE, SYLWIA LIPIOR, & SUSAN SIGWARD

Human Performance Laboratory; Division of Biokinesiology and Physical Therapy; University of Southern California; Los Angeles, CA

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*Advisor / Mentor: Sigward, Susan (sigward@pt.usc.edu)*

### **ABSTRACT**

Assessment of vertical ground reaction forces (vGRF) during jumping and landing tasks is commonly used as a tool to quantify limb loading following injury. While embedded force plates are the current gold standard, cost and poor ecological validity limit their feasibility for assessment of loading during sport agility tasks. Wearable pressure insoles can measure plantar pressure wirelessly and may provide an alternative for on-field assessments. Previous studies have assessed the validity of insoles with varying results. Few studies have considered tasks that require both vertical and horizontal forces similar to those required for agility tasks. This may have important implications for clinical use outside the laboratory setting. **PURPOSE:** Determine concurrent validity of pressure insole and forceplates for measuring vertical loading force during hop tasks. **METHODS:** Fifteen healthy individuals (females=9, age  $26.6 \pm 3.1$  yrs.;  $1.7 \pm 0.1$  m;  $72 \pm 15.8$  kg) participated. Force data was collected concurrently from triaxial force plates (AMTI, 1500 Hz) and pressure insoles (Moticon OpenGo, 25Hz) during single limb stance (SLS), forward hop (FH) and lateral hop (LH) tasks. Impulse (N·s) was calculated as the area under the vertical force time curve for each limb during the stance phase. Impulse was normalized to body weight (force averaged across 3 seconds during SLS) for FH and LH. Three trials per task were used to examine the relationship (Pearson correlation) and agreement (ICC 2,2) between methods. **RESULTS:** Impulse from insoles was positively related to force plates during SLS ( $r = .71, p < .05$ ), FH ( $r = .85, p < .05$ ), and LH ( $r = .89, p < .05$ ). ICC were SLS (.32  $p < .05$ ), FH (.83  $p < .05$ ) and LH (.89  $p < .05$ ). Average relative differences were SLS -290.92 (200.94) N·s, FH .004 (.13) N·s/N-BW, and LH .006 (.08) N·s/N-BW. **CONCLUSION:** Fair ICC during SLS suggest that force measures from insoles and force plates have poor agreement. However, after normalizing by body weight, vertical force from insoles and force plates were highly correlated and showed excellent agreement. These data suggest that insoles provide similar information to force plates during forward and lateral hops. The magnitude of relative difference between instruments should be considered when interpreting data for each use case.