28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Investigating the Agreement Between Force Platform and Plantar Pressure Insole Data in Barefoot and Sport-Specific Footwear Conditions Across Four Different Movement Patterns

Lockwood, K.1, Dunne, C.1, Tsu, T.1, Holmes, M.1, Wagnac, E.2, Clément, J.3

Brock University

INTRODUCTION:
Conducting applied sport research in real-world settings is challenged by the lack of portable instrumentation that produces valid and reliable data that is collected without interfering with the athletes movement and is meaningful to sport performance. The purpose of the study was to compare and contrast data collected simultaneously from a force platform and a plantar pressure insole to provide support for the use of the XSENSOR® pressure insoles in a sport-performance environment.
METHODS:
Data was collected in two conditions. The barefoot condition consisted of the insole on a force platform in isolation and the in-skate condition consisted of the insole inside a speed skate boot on a force platform. A single-participant design was conducted whereby an injury-free female completed multiple trials in both conditions. A P6000 Force Platform (BTS Bioengineering Corp., MI, Italy) was used to collect force data and a X4 Foot and Gait Measurement Systems plantar pressure insole (XSENSOR® Technology Corporation, AB, Canada) was used to collect pressure data in the two conditions across four movement patterns; static stance (SS), anterior-posterior sway (AP), medial-lateral sway (ML), and lateral jump (LJ).
RESULTS:
Intraclass correlation coefficients (ICC) and Bland-Altman plots revealed excellent agreement between the cumulative centre of pressure (CoP) path length (mm) measured from the force platform and insole in the barefoot condition across the four movement patterns. Moderate agreement was revealed between the cumulative CoP path length (mm) in the in-skate condition across the SS and LJ patterns and poor agreement between the cumulative CoP path length (mm) in the in-skate condition across the AP and ML sway patterns. Bivariate Pearson product-moment correlations revealed significant positive correlations between time-series force (N) data and time-series pressure (psi) data in both conditions across the four movement patterns ($p < 0.05$).
CONCLUSION:
Results confirmed that the XSENSOR® insoles were capable of collecting data comparable to a gold-standard force platform. The level of agreement could be attributed to the high resolution (233 sensels/insole) and high sampling frequency (150 Hz) of the insoles. These results are consistent with a recent study comparing insole plantar pressure data to known pressures and contact areas applied by an inflatable bladder in a non-human model [1]. The current study further investigated the use of XSENSOR® insoles in a human-model under two conditions; a human foot in isolation and a human foot inserted into sport-specific footwear, namely speed skates. Outcomes provided researchers and practitioners with empirical support and confidence to employ the X4 Foot and Gait Measurement Systems plantar pressure insoles (XSENSOR® Technology Corporation, AB, Canada) outside of a laboratory setting in a real-world sport environment to collect and analyze in-skate plantar pressure data during on ice performance.

1. Parker et al. (2023)

Topic: **Sport Technology**

Presentation **E-poster**