Title: Use of Body Worn Sensors to Predict Ankle Injuries Using Screening Tools

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Background:
The Single Leg Squat (SLS) is an important screening tool in predicting those at an increased risk of ankle injuries as it relates to landing, running and cutting tasks [1]. However, clinical analysis of this exercise is often completed visually with relatively poor intra-rater reliability. More detailed analysis of SLS completed in biomechanics laboratories is time-consuming and costly. Recent developments in body worn sensors may allow for quick assessments that produce valid and reliable data [2, 3].

Objective: To explore a model for leveraging data obtained from wearable sensors to aid in ankle injury risk factor screening.

Design: A single case study design, with qualitative analysis of quantitative data.

Setting: University research laboratory.

Participants: A single participant (female, 24y/o, 158cm, 47kg) was chosen. The participant was familiar with the SLS exercise and had completed it as part of their exercise routine for the past year.

Interventions: The participant completed 10 left SLS repetitions. These were recorded using the sensors and repetitions where the participant lost balance were noted. Loss of balance was defined as when the subject was unable to maintain single leg stance during the downward or upward phase of the movement and placed their other foot on the ground for support.

Main Outcome Measurements: Visual analysis showed signals from the wearable sensors (accelerometer Y and gyroscope Z) were altered when the participant lost their balance compared to signals obtained when the participant maintained balance.

Conclusions: These preliminary results indicate that body worn sensors may be able to automatize screening tools such as the SLS. An automated system for characterising and quantifying deviations from good form could be developed to aid clinicians and researchers. Such a system would provide objective and reliable data to clinicians and allow researchers to analyse movements quicker and in a more naturalistic setting.

1. Ugalde, V., et al., *Single Leg Squat Test and Its Relationship to Dynamic Knee Valgus and Injury Risk Screening.* PM&R, 2014.
2. Giggins, O., D. Kelly, and B. Caulfield. *Evaluating rehabilitation exercise performance using a single inertial measurement unit.* in *Proceedings of the 7th International Conference on Pervasive Computing Technologies for Healthcare*. 2013. ICST (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering).
3. Chatzitofis, A., et al. *Three-dimensional monitoring of weightlifting for computer assisted training*. in *Proceedings of the Virtual Reality International Conference: Laval Virtual*. 2013. ACM.