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Discovering the Relationship Between Single Leg Balance and Star Excursion Balance Test Performance

Abstract: Human movement requires multiple components such as strength, coordination, and balance. The single leg balance test (SLBT) is used to determine the quality of one's ability to balance. The use of a force plate during this test allows researchers to measure the Center of Pressure (COP) in the foot during a test period. The Star Excursion Balance Test (SEBT) is commonly used for assessing risk of lower extremity injury in athletes as well as measuring dynamic balance. This is done by measuring the distance reached on one leg in three different directions. There is currently no existing literature comparing COP values from the SLBT to reach distances in the SEBT. The purpose of the study is to compare single-legged balance to SEBT reach performance.

Methods: Data was collected on twenty-nine college-aged students. All subjects were healthy and free of lower extremity injuries. Any participants with conditions (E.g. concussion, Vertigo) that would affect balance or recent lower extremity injury were excluded from the study. All subjects provided written informed consent before participation in the study. Measures such as height, weight, leg length (bilateral), foot length (bilateral), and foot width (bilateral) were all obtained. Participants completed strength measurements of the quadriceps muscle and gluteus medius muscle (bilateral), weight bearing lunge test (WBLT) (bilateral) to measure dorsiflexion as well as both the SEBT (bilateral) and the SLBT (bilateral). Testing for the SEBT took place on the Mobile Mat. Each subject had three practice trials and three recorded trials in each direction, bilaterally. Directions included anterior, posterior medial, and posterior lateral. Subjects began the trial with hands on hips, and reached down a measuring tape corresponding to the reach direction. Reach distance was measured when the subject lightly touched their toes/foot to the ground without any weight shifting to the reaching foot. A full reach was completed when subject returned to a standing position. All reach distances were measured in centimeters. Lifting of the heel, falling, coming off of the Mobile Mat, or removal of hands from hips would count as an error and the trial would not be included. Subjects also completed the SLBT using the AMTI force plate. SLBT conditions included both eyes open and eye closed balancing on each foot. Recording began once the subject was in single-legged stance. For eyes closed testing, subjects found their balance on single leg and closed their eyes before recording began. Each trial consisted of ten seconds of balancing. Trials with falling, removing hands from hips, moving foot off of the force plate, or opening their eyes would not be included and counted as an error. The AMTI force plate provided COP measures such as anterior-posterior displacement and velocity as well as medial-lateral displacement and velocity.

Results: Data has been collected and is currently being analyzed. Once all the data is analyzed, a pearson product moment correlation will be performed on SLBT balance measures and reach distance in the three directions (ANT, Post-Med, and Post-Lat). Initial analysis of data found that right-legged eye closed stance had the following correlations to SEBT reach

distances: ANT ($r=-0.09$, $r\text{-squared}= 8.1\%$), Post-Med ($r=-0.31$, $r\text{-squared}= 9.6\%$), and Post-Lat ($r= -0.35$, $r\text{-squared}= 12.2\%$). These preliminary results suggest that more balance is required for successful completion of posterior reaches, which anterior reaches do not. Worse balance or larger COP displacement measures are expected to be seen with worse SEBT reach performance or shorter distances.