Validating the Single-Leg Squat Test as a Functional Test for Hip Abduction Strength

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The single-leg squat (SLS) is a functional test commonly used to assess lower extremity strength. The purpose of this study was to determine the correlation between hip abduction strength and maximal hip adduction angle during the performance of a SLS. A secondary purpose was to evaluate the validity of a clinical observational technique to assess SLS performance as compared to a two-dimensional kinematic analysis. Fifty subjects (age, 24.32 ± 4.78 years; height, 171.64 ± 11,16 cm; mass, 74.84 ± 21,82 kg; 26 males, 24 females) with no lower extremity injuries volunteered for this study. We used a single-measure, concurrent validity study design. Subjects' hip abduction strength was measured on the dominant leg in a side-lying position using a hand-held dynamometer. The average of three trials was normalized to the subjects' bodyweight. We placed reflective markers on the lateral shoulder, both ASIS, greater trochanter, lateral knee, lateral malleolus, heel, and fifth metatarsal head of the dominant leg. Subjects performed a SLS with arms forward flexed and the non-dominant leg flexed to approximately 45° at the hip and 90° at the knee. The subject then squatted down to 60° of knee flexion and returned to the start position within 6 sec. Three SLS squat trials were recorded by the motion analysis system and concurrently graded by two clinicians using pre-determined criteria that assessed hip flexion, hip adduction, and knee valgus. Two-dimensional joint angles were exported from the motion analysis system. Results demonstrated a low correlation between hip abduction strength and measured hip adduction during the SLS ($r = -.12$, $p=.40$). The validity of the clinical observation technique revealed low sensitivity (26 - 68%) but high specificity (62 – 89%). We also found a high negative predictive value (71 – 92%) and a low positive predictive value (23 – 54%), which was expected because we sampled from a healthy population. Agreement between raters for identifying excessive (>10°) hip adduction and knee valgus was 71% ($k= .02$) and 67% ($k=.28$) respectively. We conclude that a SLS does not correlate highly with hip abduction strength and further research on the SLS and quadriceps strength is an appropriate next step. We also conclude that novice clinicians are able to visually determine when the knee and the hip are relatively straight during a SLS but that we are not able to determine excessive (>10°) movement in the frontal plane occurring at the hip and the knee. Finally, clinical decisions simply based upon visual observations without objective and valid measures should not be used to base assessments on patient functions.