Poor lower limb stability during dynamic movement is thought to increase the risk of musculoskeletal injury. Biomechanically, stability is determined by a number of factors including the external load and contributions from passive and active tissues. One approach for studying lower limb stability is the single leg squat (SLS) test, which requires coordinated lower limb movement across a range of joint motions under external load. Although clinicians typically assess SLS quality from a single point of view (i.e. frontal plane), a 3D investigation of SLS kinematics would help to determine factors that differentiate clinician-defined “good” from “poor” quality performance.

PURPOSE: To determine the kinematic parameters that characterise a good or a poor SLS performance in young adults.

METHODS: 22 healthy young adults (13 male, 9 female; age: 23.8 ±3.1 years; height: 1.73 ±0.07 m; mass: 69.4 ±12.7 kg) free from musculoskeletal impairment were recruited. Video footage was collected in the frontal plane as participants performed three SLSs on each leg. SLS quality was assessed by a panel of physiotherapists using a ten-point ordinal scale. Performances were subsequently divided into tertiles corresponding to poor, intermediate and good SLS technique. 3D trajectories of 28 reflective markers attached to the pelvis, and lower limbs were simultaneously recorded at 200 Hz using a 10-camera, motion capture system (Vicon Motion Systems, Oxford, UK). Pelvis, hip and knee angles were calculated using a validated lower limb biomechanical model that incorporated functional identification of hip and knee joint centres.

RESULTS: Mean rating of SLS quality as assessed by the panel of physiotherapists was 6.3±1.9 (range: 2.4 - 9.1). 3D analysis of SLS performance revealed that poor squatters had increased hip adduction (22.4° ±6.1 vs 14.7° ±4.7 deg, p<0.01), reduced knee flexion (73.1° ±8.7 vs 90.1° ±12.1 deg, p<0.01) and increased medio-lateral displacement of the knee joint centre (53.7° ±16.8 vs 38.4° ±14.3 mm, p<0.02) compared to good squatters.

CONCLUSION: In healthy young adults a poor SLS is characterised by inadequate knee flexion and excessive frontal plane motion at the knee and hip. It is recommended that clinicians standardise knee flexion angle when using the SLS test as it might confound the perception of SLS quality.