# MOVEMENT ANALYSIS VIA MOTION CAPTURE SYSTEM HELPS IDENTIFY SEASON ENDING INJURY RISK IN NCAA D1 FOOTBALL PLAYERS

E.M. Mosier[1], A.C. Fry[1], P.G. Moodie[2], N.G. Moodie[3], J.X. Nicoll[1]
[1]Jayhawk Athletic Performance Laboratory, University of Kansas, Lawrence, KS.
[2]Dynamic Athletics Research Institute, Overland Park KS.
[3]Rockhurst University, Kansas City, MO.

Motion capture systems can be used to assess an individual's upper-and lower-body motions, both explosive and functional in nature. Advancements in technology and screening protocols may be capable of projecting future high-risk season ending injuries. **PURPOSE:** This study examined the ability of a pre-season performance motion analysis (PMA) screening using a markerless motion capture system to identify NCAA D1 football players who would experience non-contact season ending injuries. **METHODS:** Sixty-eight division 1 football players ($\bar{X}$±SD; n=68, age=20.7±1.5 yrs., hgt.=187.5±5.3 cm, wgt.=107.2±14.6 kg) were screened pre-season using the PMA protocol, consisting of 19 motions. These include shoulder ranges of motions (i.e., shoulder abduction and adduction, horizonal abduction and adduction, internal and external rotation, flexion and extension). Also assessed were trunk rotation, bilateral overhead squat, unilateral squats, forward lunges, single leg balance, bilateral counter-movement vertical jump (CMVJ), unilateral CMVJs, concentric-only VJ, multiple unilateral CMVJs, and depth VJ. A three-dimensional markerless motion capture system (MCS; DARI, Overland Park, KS) was used to analyze the kinetic and kinematic data, from which 192 variables were calculated. K-means clustering was used to identify four different Voronoi cells for which group centroids were determined. Four data clusters were identified sequentially as possible contributors to non-contact season ending injuries; vulnerability (consisting of neurological control, movement asymmetries, joint angles differences), MCS composite score (combination of strength, power and dysfunction scores), strength-power discrepancy (squat and jump performances), and joint torque differences (lower-body joints during jumps). **RESULTS:** Of the 68 individuals examined, 30 individuals had vulnerability scores above 60, indicating sub-optimal movement patterns. Of these 30 individuals, fourteen reported MCS composite scores <1800 on the MCS composite scores. Of the 14, eight subjects reported differences between strength and power measures of ≥350 points, indicating strength and power imbalances. Of these 8, five individuals reported joint torque differences greater than 30% between bilateral joints, indicating altered stress distribution around the body. Of the 5 indicated athletes, three suffered a non-contact season-ending injury. None of the other athletes suffered such an injury. **CONCLUSION:** Using four clusters of variables (i.e., vulnerability, MCS composite score, strength/power discrepancy, torque differences) 5 players were identified as at-risk for season-ending injuries. Although two individuals were reported as false positives, there were no false negatives (i.e., suffered a season-ending non-contact injury but not identified by the MCS testing). **PRACTICAL APPLICATION:** A MCS such as used in the present study can help identify American football athletes at high risk for non-contact season-ending injuries. This may provide the strength and conditioning professional and sports medicine clinician helpful information when designing training programs and rehabilitation therapies across a season.