## BASEBALL PITCHING BIOMECHANICS, PITCH VELOCITY, AND BODY POSITION DURING AN INTRASQUAD GAME Kelly A. Brooks

PURPOSE: To observe changes over each inning in body position, pitch velocity, and joint angle during baseball pitching of an intrasquad game. METHODS: Six Division I intercollegiate baseball pitchers volunteered to wear a Zephyr BioHarness during an intrasquad game while a high-speed camera captured their pitching performance. The BioHarness device records several variables, including body position and acceleration. The pitcher's performance was analyzed with Dartfish software. The trunk, elbow, glenohumeral joint, and knee were examined while pitching from the stretch. RESULTS: Five pitchers each completed five innings, and one completed six. The pitchers averaged 15.7 pitches per inning. Based on the kinematic data, during the windup, there is a significant difference in hip (p<0.05) and knee angle from the first to the last inning. In the stride and early cocking phases, there were no significant differences in joint angle found between the first and last inning for all four joints evaluated. In both the late cocking phase and acceleration phase, there was a significant difference in joint angle of the glenohumeral joint, as shoulder horizontal adduction angle increased, and notable changes in trunk rotation from the first to the last inning, with the trunk becoming more erect. During the acceleration phase, there was a significant difference in trunk angle and during the deceleration phase, there were no significant differences found in joint angle between the first and last innings for all four joints evaluated. A significant difference in body position measured by the BioHarness was present between the first inning and the last two innings. There were no significant differences between innings for pitch velocity. CONCLUSION: Data from this study provides some important information for injury prevention in baseball pitchers. Internal and external rotation were not measurable from our camera angle, and that data could provide more information, as previous research has stated that shoulder internal rotation, shoulder external rotation, and shoulder abduction angles will decrease as pitch count increases (Erkel, 2009). The trunk becoming more erect and a greater shoulder horizontal adduction angle were consistent with previous research (Matsuo, 2000). Increased forces on the elbow may be due to the less lateral trunk tilt and/or the greater shoulder horizontal adduction angle. Fleisig (1994) investigated the relationship between elbow medial force and shoulder horizontal adduction, and found a significant correlation between increased horizontal adduction and increased maximum elbow medial force. This may translate into increased risk of injury. PRACTICAL APPLICATION: By understanding pitching biomechanics, pitching coaches, strength coaches, athletic trainers, and therapists can develop better preventative programs for pitchers, and use this information in a rehabilitative program. Learning how to interpret the information from the BioHarness and Dartfish to help identify poor mechanics and to make mechanical adjustments (corrections) during a game will help to offset potential injuries.