

RELATIONSHIPS BETWEEN HIP AND SHOULDER ROTATION DURING BASEBALL PITCHING

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INTRODUCTION: Baseball pitching is one of the most dynamic movements in sports. Due to the violent nature of the pitching motion, baseball pitchers experience an extremely high rate of injury, particularly to the shoulder. One factor thought to be related to overuse injury at the shoulder is the high magnitude of shoulder external rotation. Because the pitching motion can be viewed as a kinematic chain in which the actions of individual segments have a direct impact on the actions of other segments, angles of internal/external rotation observed for the hip may be related to internal/external rotation observed at the shoulder. Thus, the purpose of the current project is to analyze internal/external rotation for both the shoulder and the hip in an attempt to identify a relationship between these two parameters. It is hypothesized that hip rotation will positively correlate with shoulder rotation.

METHOD: Kinematic data will be collected using The Motion Monitor® system (Innovative Sports Training, Chicago IL) and calculated using the ISB recommendations of the international shoulder group (Wu et al., 2005). The three-dimensional space at the pitching mound will be calibrated per manufacturer recommendations with the world axes system being oriented as described by Wu and Cavanaugh (1995). Once set-up and calibration is complete a set of 10 electromagnetic sensors will be placed at the following locations: the thorax (C7); the sacrum (L5/S1); the lateral epicondyle of the right and left humerus; the styloid process of the right and left ulna; the lateral epicondyle of the left and right femur; and the mid-point of the left and right shank. Following sensor placement, subjects will be allowed unlimited time for warm-up before throwing a series of maximal effort fastball pitches. Between trials, pitchers will be allowed a 40-60 s rest period. The internal/external rotation of both the right and left humerus and femur will be calculated throughout the pitching motion. Data will be reduced using established techniques. Data will be analyzed by calculating the Pearson product moment correlation coefficient for which hip rotation will be the independent variable and shoulder rotation will be the dependent variable.

DISCUSSION and CONCLUSION The identification of those factors associated with changes in the shoulder rotation of baseball pitchers is very important. As dynamic as the pitching motion is, the authors have identified no studies investigating the relationship between shoulder and hip rotation. If hip kinematics are related to shoulder kinematics, a better understanding of how the shoulder truly functions during baseball pitching can be developed through this study. In addition, this study has the potential to aid clinicians and sports medicine practitioners in understanding the underlying causes of shoulder injury in baseball pitchers by providing additional information about the relationship between the lower and upper extremities.

REFERENCES:

- Wu, G. and Cavanaugh, P.R. (1995). ISB recommendations for standardization in the reporting of kinematic data. *Journal of Biomechanics*, 28, 1257-1261.
- Wu, G., van der Helm, F.C.T., Veeger, H.E.J., Makhous, M., Van Roy, P., Anglin, C., et al. (2005). ISB recommendation on definitions of joint coordinate systems of various joints for the reporting of human joint motion – Part II: shoulder, elbow, wrist, and hand. *Journal of Biomechanics*, 38, 981–992.