Kinetisense Throwing Fatigue Protocol

The Problem:

We know that as players accumulate the total amount of throws, whether it be through a game, practice, or extended period of time, that there is a risk of functional fatigue which can lead to non-functional over-reaching or over-training. This is both detrimental to performance and leads to increased risk of injury. Taking the demands and duration of the professional baseball season, this is a concern. Therefore, there is a need to create a way to objectively monitor the signs of fatigue BEFORE performance is affected or injury occurs.

The Reseach:

In the study Functional Fatigue and Upper Extremity Sensorimotor System Acuity in Baseball Athletes (Tripp et al., 2007), researchers measured active multi-joint reproductions of the arm-cocked and ball-release positions of throwers to examine the effects of functional fatigue on upper extremity position reproduction. They measured variability and accuracy of the flowing joints; scapulothoracic, glenohumeral, elbow, and wrist, in multiple error planes.

The results of this study was able to identify the joints and movement planes where there was increased variability and decreased accuracy in both the arm-cocked and ball-release positions of a throw. Namely, as fatigue sets in as the number of throws increase, there is greater variability in the arm-cocked position in the scapulothoracic joint, glenohumeral internal/external rotation, and elbow flexion/extension. Findings also indicate decreased accuracy in the ball-release position inscapulothoracic internal/external rotation, glenohumeral horizontal adduction/abduction, and elbow pronation/supination.

In the meta-analysis Baseball Pitching Biomechanics in Relation to Injury Risk and Performance (Fortenbaugh et al, 2009), authors analyzed studies of kinematics, kinetics, ball velocity, and injury in baseball pitchers. The analysis showed that increased kinematics of the upper extremity including shoulder adduction/abduction, shoulder internal/external rotation, and trunk rotation lead to increase kinetics, decreased ball velocity, and increased reports of pain in the arm. This suggests that variations in throwing mechanics, such as those caused by fatigue, are detrimental to performance and increase risk of injury.

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The Solution:

Kinetisense is the only markerless 3D motion capture system that can provide objective data from all 3 planes of motion using a single front-facing camera. Given the above research into how functional fatigue affects joint movements during the phases of a throw, we are able to assess these movement patterns and create the Kinetisense Throwing Fatigue Protocol. By having objective joint-plane data provided by Kinetisense, coaches and trainers can establish kinematic baselines for the phases of a throw and reassess players as volume increases. It follows from the research that once kinematics become altered, we will eventually see a decrease in ball velocity and an increased risk of injury. Using the Kinetisense Throwing Fatigue Protocol, coaches and trainers can stay ahead of these detriments and deload a player as soon as signs of fatigue, via altered kinematics.

The Kinetisense Throwing Fatigue Protocol:

Coaches and trainers should establish a baseline using this assessment while the player is well rested. It is recommended that the assessment be performed every 10-20 throws and become more frequent as volume increases. The assessment is as follows:

- Back Rotation (dominant side)
- Shoulder Flexion
- Shoulder Abduction
- Shoulder External Rotation
- Elbow Extension
- Back Rotation (non-dominant side)
- Shoulder Adduction
- Shoulder Extension
- Shoulder Internal Rotation

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References:

Fortenbaugh, D., Fleisig, G., Andrews, J. (2009). Baseball Pitching Biomechanics in Relation to Injury Risk and Performance. Journal of Sports Health, 1(4), 314-320

Tripp, B., Yochem, E., Uhl, T., (2007). Functional Fatigue and Upper Extremity Sensorimotor System Acuity in Baseball Athletes. Journal of Athletic Training, 42(1), 90-98