2849 Board #6 May 31 3:15 PM - 5:15 PM

Glenohumeral-Rotation-Deficits In High School, College, And Professional Baseball Pitchers With And Without An Mucl Injury

Rafael F. Escamilla, FACSM. *California State University, Sacramento, Sacramento, CA.*

Email: rescamil@csus.edu

(No relationships reported)

PURPOSE: To assess if a glenohumeral-internal-rotation-(IR)-Loss (GIRLoss), a glenohumeral-external-rotation-(ER)-gain (GERGain) or a total-rotational-motion-(TRM)-deficit (TRMD) predict medial ulnar-collateral-ligament (MUCL) injury-risk among high-school (HS), college (COLL), and professional (PRO) baseball-pitchers with-and-without-MUCL-injury. It was hypothesized that pitchers with MUCL injury would have >GIRLoss and TRMD compared to pitchers without MUCL injury, with no differences in IR, ER, TRM, GIRLoss, GERGain, and TRMD.
METHODS: Two-hundred-sixteen-male HS, COLL, and PRO pitchers were equally divided into MUCL-injury-group (n=108) and control-group (n=108) without MUCL injury. Control-group was matched with the MUCL-injury-group according to number, level &age. Bilateral shoulder passive IR/ER were measured and GIRLoss, GERGain, TRM, and TRMD calculated. A two-way-analysis-of-variance ($p<0.05$) was employed to assess shoulder-rotational-differences among the two-groups and three-pitching-levels.
RESULTS: Compared to control-group, MUCL-injured-group had >GIRLoss (21°±14°-versus-13°±8°;p<0.001), GERGain (14°±9°-versus-10°±9°;p=0.004), and TRMD (7°±13°-versus-3°±9°;p=0.008). For all pitching levels ~60% of subjects in MUCL-injury-group had GIRLoss>18°, compared to ~30% of subjects in control-group. ~60% of subjects in MUCL-injury-group had TRMD >5°, compared to 50% of subjects in control group. No differences were observed among HS, COLL, and PRO pitchers for GIRLoss (16°±12°,17°±11°,19°±13°, respectively; p=0.131), GERGain (11°±9°,11°±10°,13°±10°, respectively; p=0.171), TRMD (5°±11°,6°±11°,5°±14°,respectively; p=0.711), throwing shoulder ER (111°±10°,111°±11°,113°±9°,respectively; p=0.427), throwing shoulder IR (50°±11°,49°±11°,48°±10°, respectively; p=0.121),& throwing shoulder TRM (162°±14°,160°±15°,161°±14°,respectively;p=0.770).
CONCLUSIONS: Greater GIRLoss, GERGain, and TRMD in MUCL-injured-pitchers compared to uninjured-pitchers implies these variables may be related to increased-MUCL-injury-risk, especially since GIRLoss>18° and TRMD>5° demonstrate an increased MUCL injury risk. Shoulder rotational motion and deficits do not vary among HS, COLL, and PRO levels of pitchers.

2850 Board #7 May 31 3:15 PM - 5:15 PM

Kinematic Factors that Contribute to Batting Performance in Collegiate Baseball

Alexia E. Amo, William P. Lydon, Nathaniel J. Holmgren, J. Mark VanNess, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*

Email: l_amo@u.pacific.edu

(No relationships reported)

To remain competitive in collegiate athletics, sports teams now employ advanced analytical tools to identify improvable domains. In baseball, technological limitations have precluded comprehensive interpretation of swing mechanics. Recent developments in technology now permit more complex assessments.
PURPOSE: To test how kinematic factors of bat swing associate with in-season batting performance in college athletes.
METHODS: We enrolled 13 batters from a D1 baseball team in Northern California and used Proteus (Boston Biomotion, USA) to conduct three-dimensional analyses of swing mechanics. Each athlete performed six five-repetition sets of swings at increasing loads of magnetic resistance: 1lb, 2lb, 3lb, 5lb, 7lb, and 9lb. Proteus software computed explosiveness (rate of power production) and endurance (replication of power production in successive swings). Players were tracked through the 2017 season and all batting statistics were recorded. Linear regressions tested the effects of explosiveness and endurance on in-season batting performance. Significance was set at $p<0.05$; owing to a small sample and the novel equipment, trends ($p<0.08$) were considered.
RESULTS: 11 of 13 players had a base hit during the study season; these 11 constituted the study sample. They played 40.1±13.2 games and batted .264±.048. Mean swing explosiveness was 313.7±59.3 and endurance was 97.7±1.4. Batting average was positively related to swing endurance (R=0.638); an additional point of endurance predicted an 8.7% increase in batting average (p=0.047). Runs (R=0.869), triples (R=0.628), and home runs (R=0.585) per at-bat were positively correlated with swing explosiveness; in each at-bat, an additional point of explosiveness predicted a 0.2% increase in runs (p=0.001), 1.3% increase in triples (p=0.052), and 0.8% increase in homeruns (p=0.075). Neither explosiveness (p=0.121) nor endurance (p=0.529) associated with games played.
CONCLUSIONS: In three-dimensional analyses of swing mechanics, increased explosiveness and endurance predicted an improved batting average, more extra base hits, and more runs scored per at-bat. Scouts may be wise to consider swing mechanics in their estimations of a player's value. Likewise, players and coaches may choose training programs that optimize mechanics accordingly.

2851 Board #8 May 31 3:15 PM - 5:15 PM

Relationship Between Ground Reaction Force and Wrist Velocity in Skilled and Novice Baseball Pitchers

Kurt Kornatz, Christopher Wendt, Kevin Ritsche. *Winston-Salem State University, Winston-Salem, NC.* (Sponsor: Mike McKenzie, FACSM)

(No relationships reported)

While throwing, skilled performers transmit forces in a precisely coordinated manner from the foot through the kinetic chain ultimately manifesting in a large velocity of the wrist. Accordingly, stride-leg ground reaction forces have been used to predict wrist velocity in skilled baseball pitchers. However, the relationship between ground reaction force and wrist velocity in novice pitchers is less clear.
PURPOSE: The purpose of this study is to compare the relationship between peak vertical ground reaction forces of the stride leg (Fzpeak) and wrist velocity in skilled and age-matched novice baseball pitchers.
METHODS: Ten collegiate baseball pitchers and ten recreationally active college-aged novice throwers completed one laboratory testing session in which they were asked to throw a baseball as fast and accurately as possible after a standardized instruction and warmup. Each subject performed a total of 15 throws, collected as part of a larger study in which stride-length was altered (comfortable ± 10%), on a dimensionally correct pitching mound equipped with a force platform (1200 Hz). Marker trajectory data (32 reflective markers) was tracked from 10 high-speed cameras at 240 frames/sec. Fzpeak was normalized for body weight (N/BW); wrist velocity (m/s) was measured at ball release.
RESULTS: Skilled pitchers demonstrated larger FzPeak (1.61± 0.19 vs. 1.34± 0.13 N/BW, 16% difference, p<0.01) and higher wrist velocity (18.11± 0.94 vs. 13.96± 1.04 m/s, 23% difference, p<0.01) compared to novice participants. Furthermore, Fzpeak and wrist velocity were correlated for skilled pitchers only (r=0.47, p<0.01 vs. r=0.18, p>0.1).
CONCLUSIONS: Skilled pitchers are more efficient than novice throwers at generating and transmitting ground reaction force through the kinetic chain in order to maximize wrist velocity.