2726

Kinematic Sequencing Of A Baseball Swing: Does Segment Order Influence Exit Velocity?

Bryan S. Bannister[1], Jarrett Phillips[2], Marie R. Jensen[3], Michael L. Bruneau, Jr, FACSM[4], William Waterman[5], Sharon A. West-Sell[1], Courtney D. Jensen[1]. [1]*University of the Pacific, Stockton, CA.* [2]*TrainPMT, Southlake, TX.* [3]*Tufts University, Phoenix, AZ.* [4]*Drexel University, Philadelphia, PA.* [5]*Proteus Motion, Brooklyn, NY.* (Sponsor: Michael L Bruneau, FACSM)
Email: b_bannister@u.pacific.edu
(No relevant relationships reported)

The proper kinematic sequence in a baseball swing is considered to occur when the first segment to reach maximum angular velocity is the hip, followed by the torso, arm, and finally the hand. Research is needed to assess the value of this order.

PURPOSE: To test the effect of swing sequence on exit velocity in baseball players.

METHODS: We captured average and peak exit velocity in 129 baseball players using a Trackman Launch Monitor. This served as our dependent variable. We assessed swing sequence using a K-Motion K-Vest, which captured segmental rotation velocities of the hip, torso, arm, and hand. Independent-samples t-tests compared outcomes of athletes whose swing was in the proper order to those whose swing was out of sequence. Players were also tested for isotonic power in 15 different exercises using a Proteus device to control for variability in strength between athletes. Linear regressions held significant confounders constant to isolate the effect of swing sequence on exit velocity.

RESULTS: Subjects were 15.5 ± 3.0 years of age, height was 69.2 ± 3.9 in, and weight was 157.1 ± 34.7 lb. Rotational speed was 718.5 ± 104.1 °/s for the hip, 929.9 ± 147.1 °/s for the torso, 1,161.9 ± 150.4 °/s for the arm, and 1,518.3 ± 206.6 °/s for the hand. Average exit velocity was 74.8 ± 11.7 mph; peak exit velocity was 78.5 ± 9.6 mph. The ideal swing sequence was realized in 38.8% of players. Holding age, height, and weight constant, proper sequence did not affect average exit velocity ($p=0.532$; 95% CI of β: -2.009, 3.872) or peak exit velocity ($p=0.710$; 95% CI of β: -1.575, 2.305). Holding age, height, weight, and all significant exercise capacities constant, swing sequence did not predict average exit velocity ($p=0.576$; 95% CI of β: -2.025, 3.623) or peak exit velocity ($p=0.755$; 95% CI of β: -1.325, 1.822). Exit velocity was not related to hip or torso rotational speed ($p>0.100$). Arm rotational speed was correlated with average ($r=0.410$; $p<0.001$) and peak ($r=0.386$; $p<0.001$) exit velocity. Hand rotational speed was correlated with average ($r=0.474$; $p<0.001$) and peak ($r=0.558$; $p<0.001$) exit velocity.

CONCLUSIONS: Success in baseball batting is multifactorial. Exit velocity is one component of performance. Proper kinematic sequencing did not result in higher exit velocity in the present study. There may be other domains in which it predicts success.

2727

A Kinematic Analysis Of The Foot & Ankle During Progressive Baseball Swings

Alexandra K. Ramos[1], Jordan P. Ankersen[2], Bradley S. Lambert[2], Haley M. Goble[2], Michael R. Moreno[1], Jason S. Ahuero[2], Patrick C. McCulloch[2]. [1]*Texas A&M University, College Station, TX.* [2]*Houston Methodist Hospital, Houston, TX.*
(No relevant relationships reported)

Baseball is a popular sport with over 15 million participants of all ages in 2018. Return to sport (RTS) following injury relies on interval programs involving progression through different swing types and effort levels. Hitting RTS protocols have been drastically understudied. Investigation of lower extremity biomechanics during hitting RTS programs could inform potential modifications to RTS programs, possibly based on specific lower extremity injuries.

PURPOSE: Characterize ankle kinematics during 5 swing types at 3 effort levels to identify modifications that should be made to the progression.

METHODS: Healthy Division I collegiate baseball players (n=16, age= 20.5±1.3 years) underwent biomechanical assessment during an RTS progression with 5 swing types [wiffle bat dry swing (DSw), regulation bat dry swing (DSr), tee (Tee), soft toss (ST), and pitching machine (PM)] each performed at low (25-50%), medium (50-75%), and high (75-100%) effort. Data was recorded using a 20 camera Motion Capture System (200Hz). Ankle kinematics were analyzed from elbow drop to change in bat direction. To ease comparison across swing types, ball contact was simulated (sBC) as the point when the bat is parallel to the front of home plate. Differences across swing types, efforts, and ankles were determined by one way ANOVA and Bonferroni post-hoc test for pairwise comparisons (∝=0.05).

RESULTS: The lead foot had significantly higher maximum adduction, while the back foot had significantly higher maximum abduction for all combinations of swing type and effort ($p<0.05$, Fig1).

CONCLUSIONS: Present results provide valuable information for physicians and other providers regarding the extent of ankle ab/adduction achieved during various stages of an RTS progression. Such information should be used to determine when an athlete begins and or advances through an RTS program based upon injury laterality and additional constraints imposed by each individual's injury and recovery process.