



RELATIONSHIPS BETWEEN KINEMATICS OF THE PELVIS AND TORSO AND EXIT VELOCITY IN BASEBALL HITTERS

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BACKGROUND

Exit velocity (EV) has been defined as how fast the baseball is moving after it has made contact with a swinging baseball bat. Because EV is a common reflection of strength and power in baseball hitters, learning which factors possibly influence EV is vital to improvement.

PURPOSE

The purpose of this study was to assess the relationships between baseball hitting kinematics and exit velocity (EV) of the hit, as well as determine if any hitting kinematics contribute to predictions of EV.

METHODS

Data was obtained from 97 baseball swings through The Open Biomechanics Project by Driveline Baseball. Batters wore a K-motion hitting vest and high-speed cameras with 55 markers recorded hitting kinematics. Correlation and regression analysis examined metrics including bat speed (mph), sweet-spot velocity (mph) at contact, attack angle (°) at contact, and pelvis and torso angles (°) in the X, Y, and Z axes to examine relationships and predictions of EV (mph).

CONCLUSIONS

Faster bat speed and sweet-spot velocity at contact and lower pelvis angles in the Y-axis at first movement are significantly related to EV. Sweet-spot velocity at contact, bat speed at contact, and Z-axis pelvis angle at heel strike jointly account for 76% of EV variability. The general lack of significant relationships between kinematic metrics and predicted EV might While other kinematics are important to hitting performance, the present study suggests that measures such as strength, power, and potentially kinetic measurements during the swing may be worth examining to better understand overall hitting performance as assessed by EV.

- Faster bat speed at contact, faster sweet-spot velocity at contact, and lower pelvis angles in the Y-axis at first movement were significantly related to EV
- Bat speed at contact, sweet-spot velocity at contact, and Z-axis pelvis angle at heel strike together account for 76% EV variability
- The lack of significant relationships between kinematic metrics and EV predictions might suggest that strength, power, and kinetic measurements during the swing may need to be further examined
- Strength and conditioning professionals should emphasize improvements in power and velocity to improve EV if higher EV is an overall goal

PRACTICAL APPLICATIONS

The present study demonstrates that faster swings, as assessed by bat speed and sweet-spot velocity, may have a greater impact on EV than kinematics about the pelvis and torso. Therefore, if a higher EV is the goal for hitting, then strength and conditioning professionals should emphasize improvements in power and velocity, which should then yield improvements in EV. While kinematics are important, other hitting performance factors as assessed by EV should be considered.

RESULTS

Results demonstrated significant positive correlations between EV and bat speed ($r=0.695$, $p<0.001$), and sweet-spot velocity ($r=0.853$, $p<0.001$). A negligible negative correlation between EV and Y-axis pelvis angle at first movement ($r=-0.248$, $p=0.014$). However, no other significant relationships existed between EV and the rest of the kinematic measures ($|r|\leq 0.190$, $p\geq 0.062$). The stepwise regression revealed that sweet-spot velocity at contact, bat speed at contact, and Z-axis pelvis angle at heel strike were predictors of EV ($r^2 = 0.760$, $p < 0.001$) and accounted for 76% of the variability of EV.

