Exercise Science

Associations Between PerformanceMeasures of Vertical Jumping and Bat Swing Mechanics

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Recently, inertial measurement units (IMU) have been affixed to baseball bats for the purpose of analyzing 3 dimensional bat swing mechanics. While weekly jump performance monitoring is somewhat frequently utilized in sports, monitoring swing mechanics appears to be rare. Furthermore, associations between vertical jumping performance and bat swing mechanics have not been completed. The purpose of this study was to evaluate the relationship between bat swing analysis variables as measured by an IMU and jump performance characteristics as measured on a force plate in collegiate softball players. Twenty collegiate softball players participated in this study which was completed in one session. Following a dynamic warm up, all subjects performed two maximum effort squat jumps (SJ) and two maximum effort counter-movement jumps (CMJ). Jump performance variables of interest included jump height (JH), peak velocity (PV), peak power (PP), and PP scaled by body mass (PP/kg). After jump testing, athletes participated in bat swing analysis with an IMU attached to the knob of a bat and each subject completed three maximal effort swings. Variables collected from each swing included the bat velocity at impact (PV@Con), peak hand velocity (PV), time to contact (TtoCon), bat vertical angle at contact (Vert θ), and attack angle (Attack θ). Relative reliability was evaluated with Intraclass Correlation Coefficients (ICC) and associations between jump and bat swing performance variables were evaluated with Pearson's zero order, product-moment correlations. Interpretation of correlation results was completed with the scale provided by Hopkins (2013). Acceptable reliability was observed for all variables accept CMJ PV and the bat swing vertical angle (ICC = 0.48 and 0.63 respectively). The only statistically significant relationships observed were between SJ JH and PV@Con (r = 0.42), CMJ PP and Vert θ (r = .46), SJ PP and PV@Con (r = 0.56), SJ PP and Vert θ (r = 0.68), CMJ PP and PV@Con (r = 0.50). The largest r values observed were between SJ PP and PV@Con, SJ PP and Vert θ, CMJ PP and PV@Con. This appears to indicate

that jumping PP is the best predictor of batting performance of the variables tested, but the relationship with PP was not present with all bat swing performance variables. Furthermore, the strength of other relationships fell within the trivial to moderate range. It should be noted that two outliers based on body mass were found that skewed the data distribution in SJ PP and CMJ PP, which inflated the strength of the relationships. This is evident as the relationship strength decreases between form variables with PP to variables with PP/kg. Data from this study analyzing the relationship between vertical jumping and swing mechanics indicates that it would not be appropriate to replace jump monitoring with bat swing performance monitoring in an athlete monitoring protocol as a trend of large relationships between both assessments was not present. Instead, it appears that both need to be monitored and the results are independent of one another. Future investigators may wish to evaluate the influence of ground reaction forces during a swing on the swing analysis variables measured by an IMU.