

Difference of Elbow Extension Velocity During Flat and Mound Throwing

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ABSTRACT

In baseball, players encounter varying forms of throwing that is dependent upon position. Pitchers often throw on a mound, while position players are seen throwing from a flat ground. The throwing motion of a baseball consists of six phases: wind-up, stride, late cocking, acceleration, deceleration, and follow through. Each of these different phases consists of velocities being produced from the lower body through the elbow, which contributes to a potential cause of throwing arm injuries. Given the prominence of elbow injuries to pitchers, investigation into the solution to reducing arm injuries has continued to gain traction.

PURPOSE: The purpose of this study was to examine throwing kinematic velocities when throwing from flat ground compared to throwing from a mound. **METHODS:** Ten healthy individuals (20.2 ± 1.23 years old) with previous pitching experience were recruited for this study. Subjects had 38 retro-reflective markers placed in various anatomical locations to quantify whole body kinematics during the throwing motion using a motion capture system. Subjects completed 10 total throws, five from flat ground, and five from a mound at a throwing distance of 30.5 meters. The five throws from each condition were then averaged. Peak pelvic rotation velocity, peak trunk rotation velocity, peak shoulder horizontal adduction velocity, and peak elbow extension velocity were calculated and analyzed with custom software.

Dependent t-tests were ran to compare the flat ground and mound conditions for each dependent variable.

RESULTS: There were no statistical differences for any of the dependent variables; peak pelvic rotation velocity (Flat $663.8\text{m/s} \pm 80$, Mound $586.7\text{m/s} \pm 105$, $p > .05$), peak trunk rotation velocity (Flat $905.1\text{m/s} \pm 108$, Mound $878.2\text{m/s} \pm 95$, $p > .05$), peak shoulder horizontal adduction velocity (Flat $1314.2\text{m/s} \pm 288$, Mound $1339.1\text{m/s} \pm 265$, $p > .05$) or peak elbow extension velocity (Flat $2417.8\text{m/s} \pm 473$, Mound $2401.1\text{m/s} \pm 453$, $p > .05$).

CONCLUSION: In conclusion, we were unable to elucidate any differences in body kinematics when comparing flat ground to mound throwing. The implications of our study are that it is safe to throw from either the mound or flat ground, as the different throwing condition does not add any additional stress to the arm and the general kinematics of the throw are conserved. Future studies should aim to investigate other potential variables that may contribute to injury, particularly analyzing those variables during specific events during the phases of the throw.