

RELATIONSHIPS BETWEEN THE MAXIMUM SHOULDER EXTERNAL ROTATION ANGLE DURING THROWING AND PHYSICAL VARIABLES

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INTRODUCTION: To our knowledge, excessive shoulder external rotation may increase elbow valgus stress during throwing (2005). Inhibition of the greater shoulder external rotation angle could prevent elbow injury during throwing. Thus the purpose of this study was to determine physical factors that would increase the maximum shoulder external rotation (MER) angle.

METHOD: The subjects were 40 male high school baseball players with no elbow or shoulder joint problems (mean age 17.0 ± 0.7 y, height 170.1 ± 5.99 cm, weight 63.0 ± 10.3 kg and years of baseball experience 7.7 ± 2.0 y). Each subject attempted a throwing task with maximum effort in a base-to-base distance (27.43m). High-speed video cameras were placed at right and left behind the subjects for the data collection. Three-dimensional analysis was performed to calculate the MER angle. Then, the shoulder angles of abduction, extension, and external rotation (ER) at the initial contact in the early cocking phase of throwing were computed. The subjects were also measured the range of motion and muscle strength of shoulder ER and internal rotation (IR).

RESULTS: Significant correlations were observed between the MER angle and the ER angle ($r = -0.32$, $p = 0.04$), the extension angle ($r = 0.35$, $p = 0.03$) at the initial foot contact, the IR strength ($r = -0.30$, $p = 0.04$), and the ER range of motion ($r = 0.46$, $p = 0.01$).

DISCUSSION: The MER angle was determined to be at the initial contact of the leading foot in the early cocking phase. Greater MER angle was significantly related to shoulder IR and the extension angle at the initial foot contact. Further, IR muscle weakness and excessive ER range of motion may also be risk factors for elbow injury. These results should provide a better understanding of the mechanism of elbow injury in baseball players.

CONCLUSION: This study identified physical variables responsible for increasing the MER angle during throwing. Greater shoulder IR or extension should be avoided in the early cocking phase. It may be effective to strengthen IR muscles and maintain ER range of motion in proper angle for decreasing the risk of elbow injury.