

Shoulder Range of Motion Measures as Risk Factors for Shoulder and Elbow Injuries in High School Softball and Baseball Players

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Investigation performed at 11 high schools in Greenville, South Carolina

Background: Range of motion deficits in shoulder external rotation (ER), internal rotation (IR), total rotation range of motion (ER + IR), and horizontal adduction (HA) have been retrospectively associated with overhand athletes' arm injuries.

Hypothesis: The authors expected the incidence of upper extremity injury in high school softball and baseball players with side-to-side shoulder range of motion deficits to be greater than the incidence of upper extremity injury in players with normal shoulder range of motion.

Study Design: Cohort study (prognosis); Level of evidence, 2.

Methods: High school softball and baseball players (N = 246) participated. Before the start of the season, passive shoulder ER, IR, and HA were assessed at 90° of abduction with the scapula stabilized. Relative risk (RR) was calculated to examine range of motion measure, by categorical criteria, and risk of upper extremity injury.

Results: Twenty-seven shoulder and elbow injuries (9 softball, 18 baseball) were observed during the season. The dominant shoulder of all injured players and baseball players displayed a significant decrease in HA ($P = .05$) and IR ($P = .04$). The dominant shoulder total rotation of injured baseball players displayed a significant decrease (mean difference = $8.0^\circ \pm 0.1^\circ$; $P = .05$) as compared with the dominant shoulder of uninjured baseball players. Players who displayed a decrease of $\geq 25^\circ$ of IR in the dominant shoulder were at 4 times greater risk of upper extremity injury compared with players with a $< 25^\circ$ decrease in IR, especially for baseball players. While we observed a 1.5 to 2 times increased risk of injury for the 10° to 20° loss in rotational range of motion for the overall sample and baseball, the risk estimates were not statistically significant ($P > .05$).

Conclusion: There are large mean deficits in shoulder IR and HA between injured and noninjured players, but not in ER or total rotation. Passive shoulder IR loss $\geq 25^\circ$ as compared bilaterally was predictive of arm injury. Shoulder range of motion deficits differed between sports and appeared more predictive of injury for baseball players.

Keywords: baseball; softball; high school; internal rotation

Shoulder and elbow injuries are common in softball and baseball at multiple competition levels.^{2,9,17,21-23} Posterior-inferior capsule and soft tissue tightness have been

suggested to alter shoulder internal rotation (IR) range of motion (ROM), often termed glenohumeral internal rotation deficit (GIRD), thereby influencing humeral head position and contributing to development of type II superior labral anterior to posterior (SLAP) lesions.^{4,6} Burkhart et al⁶ examined 44 pitchers with type II SLAP lesions. With the arm abducted at 90°, all pitchers were found to have a marked loss of IR of the shoulder with the SLAP lesion when compared with their noninjured shoulder. Grossman et al¹⁵ performed cadaveric studies to examine the effects of capsular changes suspected to occur in overhand athletes. They demonstrated that a created posterior contracture caused a decrease in shoulder IR and limited posterior-inferior translation during maximal shoulder external rotation (ER) at 90° of abduction (cocking phase of throwing), thereby forcing the humeral head to translate posterosuperiorly and load the superior labrum.¹⁵

Alterations in shoulder ROM have been suspected to increase the risk of injury among overhand athletes. While

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