

Relationships Between Hip, Thoracolumbar and Glenohumeral Ranges of Motion in Division I Collegiate Baseball Players

Matthews LW*, Tucker WS†, Laudner KG‡, Snyder Valier AR§, Decoster LC*, Hollingworth AT*, Lewis EJ*, Huxel Bliven KC§: *New Hampshire Musculoskeletal Institute, Manchester, NH; †University of Central Arkansas, Conway, AR; ‡University of Colorado Colorado Springs, Colorado Springs, CO; §A.T. Still University, Mesa, AZ.

Context:

Baseball players generate forces in the legs that are transferred through the kinetic chain to the hips, trunk, and eventually the upper extremity. Baseball players may develop compensatory joint hypermobility and hypomobility anywhere along the kinetic chain. Compensations can affect performance and increase risk of injury. Limited research describes how hip range of motion (ROM) relates to thoracolumbar and glenohumeral ROM in collegiate baseball players despite the significant force production role of the hip and thoracolumbar joints necessary for throwing motions. The purpose of this study was to examine the hip's relationships with thoracolumbar ROM and throwing side glenohumeral ROM in Division I collegiate baseball players.

Methods:

This prospective study included a convenience sampling of 101 NCAA Division I baseball players (47 pitchers, 54 position players, age: 20.0 ± 1.4 years, height: 183.8 ± 6.1 cm, mass: 89.1 ± 10.2 kgs, years of play: 13.2 ± 3.0) from three universities who were measured during the preseason. Measurements consisted of prone passive stance hip (SH) and lead hip (LH) internal rotation (IR), external rotation (ER), and total ROM (IR+ER); standing active-assisted thoracolumbar rotation to the throwing and non-throwing sides; and supine passive throwing and non-throwing side glenohumeral IR, ER, total rotation ROM and horizontal adduction (HAdd) ROM. Hip and glenohumeral ROM were measured using a digital inclinometer and thoracolumbar rotation ROM was measured using two bubble inclinometers positioned at the C7 and S2 vertebrae, with all measurements reported in degrees. The same investigators took all measurements and a-priori testing showed strong intra-rater reliability ($ICC \geq 0.75$). Pearson Product Moment Correlations (r) were used to identify relationships between hip, thoracolumbar, and glenohumeral ROM ($p < 0.05$).

Results:

Descriptive results of measurements are presented in Table 1. Thoracolumbar rotation to the throwing ($r=0.21$, $p=0.04$) and non-throwing ($r=0.25$, $p=0.01$) sides were weakly correlated to LH total ROM. Hip ROM was weakly correlated with glenohumeral ER according to SH IR ROM ($r=0.35$, $p=0.001$), SH ER ROM ($r=0.20$, $p=0.04$), SH total ROM ($r=0.38$, $p=0.001$), LH IR ROM ($r=0.38$, $p=0.001$), LH ER ROM ($r=0.22$, $p=0.02$), and LH total ROM ($r=0.36$, $p=0.001$). Glenohumeral total ROM was weakly correlated to SH IR ROM ($r=0.31$, $p=0.001$), SH total ROM ($r=0.21$, $p=0.001$), LH IR ROM ($r=0.25$, $p=0.01$), and LH total ROM ($r=0.26$, $p=0.01$). SH total ROM ($r=-0.21$, $p=0.04$), LH IR ROM ($r=-0.28$, $p=0.01$), and LH total ROM ($r=-0.27$, $p=0.01$) were weakly correlated with glenohumeral HAdd ROM. There were no other significant correlations ($r < 0.20$, $p > 0.05$).

Conclusion:

Our results demonstrate that several significant relationships exist between hip ROM, and ROM of the thoracolumbar and glenohumeral joints among Division I collegiate baseball players. While these correlations are weak, they should be studied further given the high force translation through the kinetic chain. Future research is warranted to determine if these relationships are linked to baseball-related injuries.

Table 1. Hip, Thoracolumbar, and Glenohumeral Ranges of Motion (Degrees) in Division I Collegiate Baseball Players.

Measurement Range of Motion (degrees)	Mean \pm SD	95% Confidence Interval	
		Lower	Upper
Hip			
Stance leg IR	26.5 \pm 7.6	25.0	28.0
Stance leg ER	34.7 \pm 6.6	33.4	36.1
Stance leg total ROM	61.2 \pm 10.7	59.0	63.4
Lead leg IR	26.2 \pm 7.1	24.7	27.6
Lead leg ER	34.1 \pm 6.7	32.8	35.5
Lead leg total ROM	60.3 \pm 10.5	58.2	62.4
Thoracolumbar			
Rotation to throwing side	41.1 \pm 9.7	39.1	43.1
Rotation to non-throwing side	43.0 \pm 10.0	41.0	45.0
Glenohumeral Joint			
Throwing IR	36.4 \pm 11.2	34.1	38.7
Throwing ER	107.7 \pm 10.3	105.6	109.8
Throwing total ROM	144.1 \pm 12.8	141.5	146.7
Throwing HAdd	12.4 \pm 9.9	10.4	14.4
Non-throwing IR	50.2 \pm 10.2	48.2	52.3
Non-throwing ER	101.8 \pm 12.1	99.4	104.3
Non-throwing total ROM	152.1 \pm 16.0	148.8	155.3

Footnotes: Internal Rotation, IR, External rotation, ER, Range of motion, ROM, HAdd, Horizontal adduction, SD, standard deviation.