



Grant Information Summary:

Acute and Chronic Adaptations in the Throwing Shoulder of Competitive Baseball Pitchers With Implications Concerning Injury

Practical Significance Statement

The throwing shoulders of active collegiate baseball pitchers do not exhibit clinically significant acute alterations in glenohumeral joint laxity and stiffness, posterior shoulder tightness, or scapular upward rotation at rest or following a bullpen throwing session. However, chronic alterations in rotational range of motion (ROM) is present with a near symmetric gain in throwing shoulder external rotation and loss of internal rotation of approximately 10° that does not change significantly following pitching. Therefore, alterations in these shoulder mobility variables may be early warning signs for the development of shoulder pathology.

Study Background

Four common factors have been attributed to the pathologic throwing shoulder: 1) increased anterior humeral translation, 2) increased posterior shoulder tightness, 4) internal rotation deficit that exceeds external rotation gain, and 5) loss of scapular upward rotation. Limited data are available regarding the chronic adaptations in shoulder mobility that occurs as a result of repetitive overhead throwing. Even fewer data are available that have examined the acute effects of throwing on shoulder mobility. In the

absence of baseline information regarding shoulder mobility adaptations in baseball pitchers, it is difficult to determine their possible contribution towards the development of shoulder pathology.

Objective

To evaluate glenohumeral (GH) joint and scapular kinematics in collegiate baseball pitchers at rest and after a pitching sequence to evaluate the acute and chronic effects of throwing on shoulder girdle mobility.

Design And Setting

A repeated measures design was used to assess shoulder mobility variables prior to and following a pitching session at collegiate baseball facilities.

Subjects

Forty-four asymptomatic collegiate baseball pitchers (age = 19.2 ± 1.0 years, height = 184.9 ± 5.1 cm, mass = 82.7 ± 8.2 kg, years pitching = 8.5 ± 3.9) from a sample of convenience participated in this study.

Measurements

The following dependent variables were measured: 1) GH joint laxity (mm), 2) GH joint stiffness (N/mm), 3) Posterior shoulder tightness (PST) (cm), 4) External rotation (ER), 5) Internal rotation (IR), and 6) Scapular upward rotation (SUR). Shoulder mobility measures were obtained bilaterally prior to any activity and again after throwing a bullpen session. GH laxity and stiffness were measured using a LigMaster™ computerized-stress arthrometer (Figure 1), PST was measured using a carpenter's square, ER and IR were measured using a goniometer, and SUR was measured using a digital inclinometer (Figure 2). Separate 2(side) x 3(position (anterior-neutral, anterior-ninety, posterior-neutral)) x 2(session) repeated measures ANOVAs were used to assess laxity and stiffness. Separate 2(side) x 2(session) repeated measures ANOVAs were performed to evaluate PST, ER, and IR. A 2 (side) x 2(session) x 4 (elevation angle) repeated measures ANOVA was utilized to examine SUR.

Results

Pitchers threw an average of 50.2 ± 10.8 (range 30-75) pitches. No significant main effect for laxity was observed for side ($P=0.051$) or session ($P=0.096$), but a significant main effect for position was observed ($P<.001$). The side x session x position interaction for laxity was non-significant ($P=0.75$). A significant main effect for stiffness was observed for side ($P=0.044$), session ($P=0.002$), and position ($P<.001$). The stiffness side x session x position interaction was non-significant ($P=0.91$). For PST, the main effect for side ($P=0.77$) and the side x session interaction ($P=0.12$) were non-significant. A significant difference between sides was

observed for ER (throwing = $105.1 \pm 8.7^\circ$, non-throwing = $93.8 \pm 8.8^\circ$; $P<.001$). However, the side x session interaction for ER was non-significant ($P=0.84$). A main effect for side was observed for IR (throwing = $44 \pm 8.3^\circ$, non-throwing = $54.8 \pm 8.6^\circ$; $P<.001$). The side x session interaction for IR was non-significant ($P=0.54$). For SUR, the main effect for side ($P=0.62$) and the side x session x elevation angle interaction ($P=0.26$) were non-significant.

Conclusions

Collegiate baseball pitchers demonstrated no significant chronic or acute adaptations in glenohumeral laxity, PST, or SUR. A statistically significant, but clinically small (<1 N/mm), chronic adaptation in glenohumeral stiffness was observed with no significant acute differences. Statistically and clinically significant chronic adaptations in ER and IR were present ($\geq 9^\circ$), but no acute differences were observed as a result of pitching a bullpen session.



Figure 1

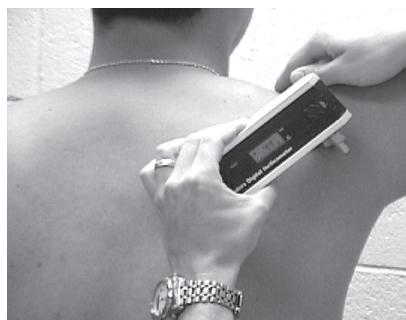


Figure 2

Principal Investigator:



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Eric L. Sauers, PhD in Sports Medicine, Oregon State University. Currently, Dr. Sauers is an Associate Professor/Director of the Athletic Training Program and serves as Chair of the Department of Interdisciplinary Health Sciences at the Arizona School of Health Sciences (ASHS), A. T. Still University, Mesa, Arizona. Dr. Sauers primary research interests are related to examination and rehabilitation of the athletic shoulder with specific interests in shoulder outcomes assessment, the effectiveness of interventions for treating shoulder impairment, and throwing shoulder mobility assessment. He has served as a research consultant to the Chicago Cubs baseball organization and is a Member-at-Large of the American Society of Shoulder and Elbow Therapists.

Publication & Presentation List

Sauers EL, Johnson MP, Tafoya J, Boquiren M. The acute and chronic effects of throwing on shoulder mobility in collegiate baseball pitchers. 2007. NATA Annual Meeting and Clinical Symposium. Anaheim, CA.

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Sauers EL, Crawford SD, Valovich McLeod TM. Reliability of the LigMaster™ computerized-stress device for measuring glenohumeral joint laxity and stiffness in baseball pitchers. *Journal of Athletic Training*. 2005;40(2):S-21.

Crawford SD, Sauers EL. High school baseball pitchers demonstrate side-to-side symmetry in glenohumeral joint laxity and stiffness. *Journal of Athletic Training*. 2005;40(2):S-21.

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