Relationship Between Glenohumeral Internal Rotation Deficit and Medial Elbow Torque in High School Baseball Pitchters

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Disclosures

- I have no financial disclosures.

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Investigation performed at the Henry Ford Health System, Detroit, Michigan, USA

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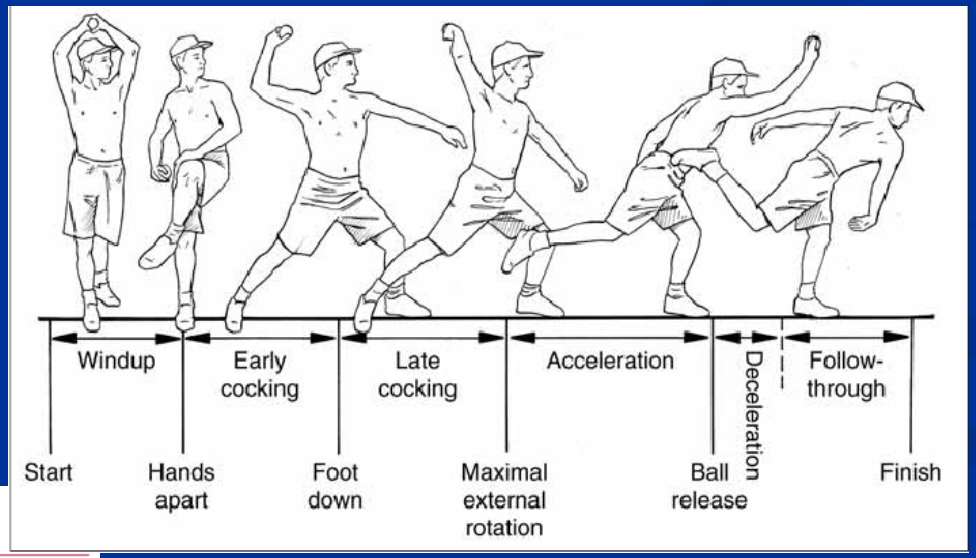
Introduction

- Ball velocity strong predictor of elbow torque

  Makhni et al, Arthroscopy, 2018; Okoroha et al, Am J Sports Med, 2018
- Elbow valgus loads are greatest in late cocking phase
- Baseball players with UCL instability found to have higher incidence of GIRD

  Dines et al, Am J Sports Med, 2009



Limpisvasti, ElAttrache and Jobe, JAAOS 2007

Introduction

Purpose of our study:

- Determine if GIRD is associated with medial elbow torque during pitching in the adolescent pitching population
- Examine if GIRD was related to other throwing kinematics such as shoulder rotation, arm slot and arm speed

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Methods

- A total of 23 male high school baseball players (14-18 years old) were recruited to participate
- All players were active in competitive play without injury or pain
  - Participants had to identify primarily as pitchers and were excluded if arm soreness or pain was reported
  - "Sidearm" pitchers were excluded
- ROM measurements were taken prior to pitching
- Players threw 5 fastball pitches at 100% effort
- Elbow torque, arm speed, arm slot and shoulder rotation measured with arm sleeve that housed a wearable sensor

Results

Demographics

- 23 male pitchers
  - 91% right handed
  - 9% left handed
- Mean Age 15.4
- Mean BMI 21.8

TABLE 1
Pitcher Demographics

	Mean ± SD (Range)
Age, y	15.4 ± 1.03 (14.0-18.0)
Height, m	1.8 ± 0.07 (1.6-1.9)
Weight, kg	68.0 ± 12.00 (45.4-93.9)
Body mass index, kg/m^2	21.8 ± 3.23 (17.0-28.9)
Total arm length, cm	76.7 ± 3.62 (69.3-85.0)
Upper arm length, cm	35.3 ± 1.84 (31.5-39.9)
Forearm length, cm	27.3 ± 1.52 (24.0-30.7)
Elbow circumference, cm	25.8 ± 1.86 (22.4-30.1)

Results

Pitch Parameters

- Mean velocity 67.5mph
- Mean elbow torque 52.3Nm

TABLE 2
Pitch Parameters

	Mean ± SD
Ball velocity, mph	67.5 ± 5.9
Elbow torque, N·m	52.3 ± 12.4
Arm slot, deg	47.8 ± 11.8
Arm speed, rpm	931.0 ± 115.0
Shoulder rotation, deg	154.5 ± 11.6

Results

Range of Motion

- GIRD ≥ 20° in 35% of pitchers

TABLE 4
Range of Motion Measurements[a]

	Mean ± SD		
	Dominant	Nondominant	*P* Value
Internal rotation in abduction, deg	64.3 ± 11.5	79.6 ± 13.3	**<.001**
External rotation in abduction, deg	122.0 ± 9.8	117.0 ± 9.3	**.006**
Flexion contracture, deg	–11.3 ± 4.5	–12.3 ± 3.9	.09
GIRD, deg	15.3 ± 11.2		
Total rotation deficit, deg	–9.9 ± 12.3		

[a]Bold values are statistically significant ($P \leq .05$). GIRD, glenohumeral internal rotation deficit.

Results

- Medial Elbow Torque
  - No correlation with GIRD or TROM deficit
  - Increased with velocity, age and height
- No correlation between GIRD and ball velocity
- Strong correlation between velocity and age

Medial Elbow Torque[a]

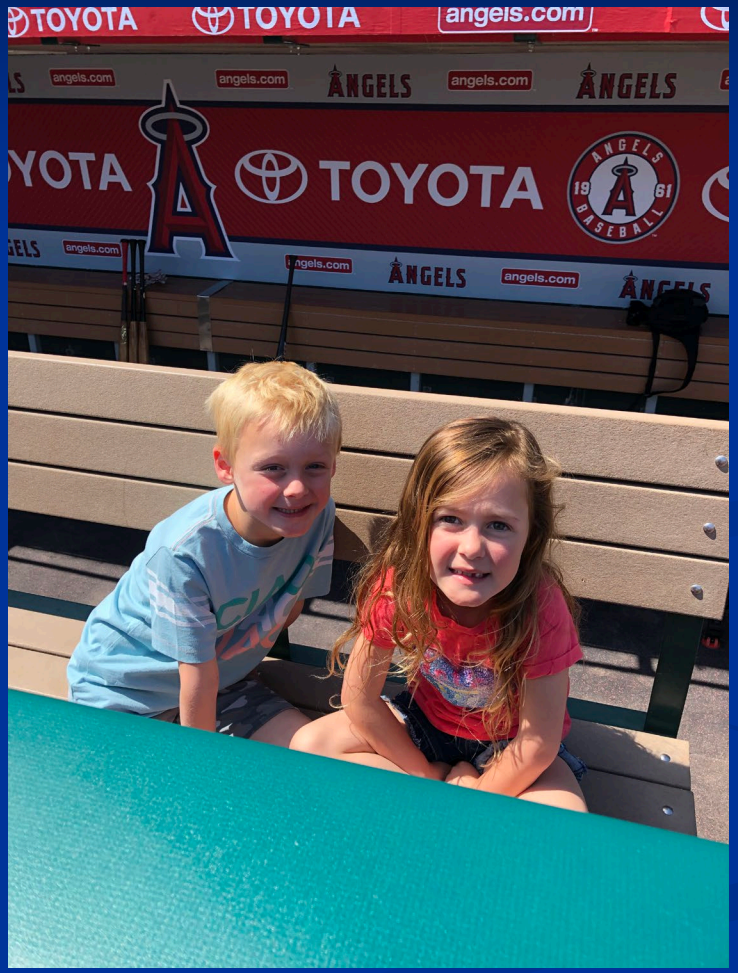
	Elbow Torque, N·m	*P* Value
GIRD, deg	–0.180	.205
Ball velocity, mph	**0.467**	**.012**
Arm slot, deg	0.079	.360
Arm speed, rpm	0.138	.264
Shoulder rotation, deg	0.057	.399
Age, y	**0.549**	**.003**
Height, m	**0.417**	**.024**
Weight, kg	0.125	.285
Body mass index, kg/m^2	–0.066	.383
Total arm length, cm	**0.460**	**.014**
Upper arm length, cm	**0.435**	**.019**
Forearm length, cm	0.316	.071
Elbow circumference, cm	–0.140	.475

[a]Bold values are statistically significant ($P \leq .05$). GIRD, glenohumeral internal rotation deficit.

Conclusion

- GIRD was not associated with medial elbow torque or ball velocity in our cohort of high school baseball pitchers
- Ball velocity continues to be most important predictor of medial elbow torque

Thank You



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