

# Risk Factors for Ulnar Collateral Ligament Injury in Baseball Amateurs and Professionals: A Systematic Review

Merritt D. Walker, SPT<sup>1</sup>, Matthew D. DeLang, SPT<sup>1</sup>, Logan Gudde, SPT<sup>1</sup>, Elizabeth Kilborn, SPT<sup>1</sup>, Katherine Fischer, SPT<sup>1</sup>, Charles A. Thigpen, PhD, PT, ATC<sup>2</sup> Michael P. Reiman, PT, DPT, OCS, SCS, ATC/L, FAAOMPT, CSCS<sup>1</sup>  
<sup>1</sup>Duke University School of Medicine, <sup>2</sup>ATI Physical Therapy

## Background

- Prevalence of UCL injuries stands at 25%, 15%, and 23% among Major League, Minor League and high school/youth baseball players respectively.
- These rates are continuing to increase.
- Current public perception regarding Tommy John surgery is misguided with belief that it enhances performance.
- Therefore, it is integral to identify predisposing risk factors for UCL injuries in attempts to most effectively address sport, training and rehabilitation.

## Purpose

1. Identify the currently investigated UCL injury risk factors across amateurs and professionals
2. Assess the clinical and research relevance of these risk factors
3. Determine which risk factors are modifiable

## Methods

A computer-assisted, systematic literature search was conducted utilizing four databases (PubMed, SportDiscus, Cochrane Library, and Embase). Studies were included if they investigated risk factors (both modifiable and non-modifiable) for UCL injury. Studies not differentiating between shoulder and elbow risk factors were excluded.



"Courtesy of Duke Athletics"

## Results

Table 1: Depicts velocity data as reported by the literature

VELOCITY					
	Variable	Study	UCL Group	Control	p-value
Professionals	Mean Fastball Velocity (mph)	DeFroda et al (2016)	91.7±2.4	91.0±2.5	0.014
		Keller et al (2016)	91.5±3.0	91.3±2.7	NR
		Prodromo et al (2016)	92.08±2.61	91.33±2.56	0.001
	Mean Changeup Velocity (mph)	Keller et al (2016)	83.9±2.7	83.8±3.3	NR
		Prodromo et al (2016)	82.96±2.89	83.57±2.75	0.016
	Mean Slider Velocity (mph)	Keller et al (2016)	83.3±3.5	83.5±2.8	NR
		Prodromo et al (2016)	83.62±2.92	83.01±2.72	0.02
	Mean Curveball Velocity (mph)	Keller et al (2016)	78.2±4.7	77.9±4.4	NR
		Prodromo et al (2016)	77.75±3.59	76.86±3.11	0.009
Mean Overall Velocity (mph)	Chalmers et al (2016)	87.8	86.9	0.001	
	Whiteside et al (2016)	89.54±2.88	88.71±2.82	0.005	
Amateurs	Mean Fastball Velocity (mph)	Olsen et al (2006)	88.1±6.6	82.7±5.1	<0.001

Table 2: Depicts professional and amateur experience data as reported by the literature

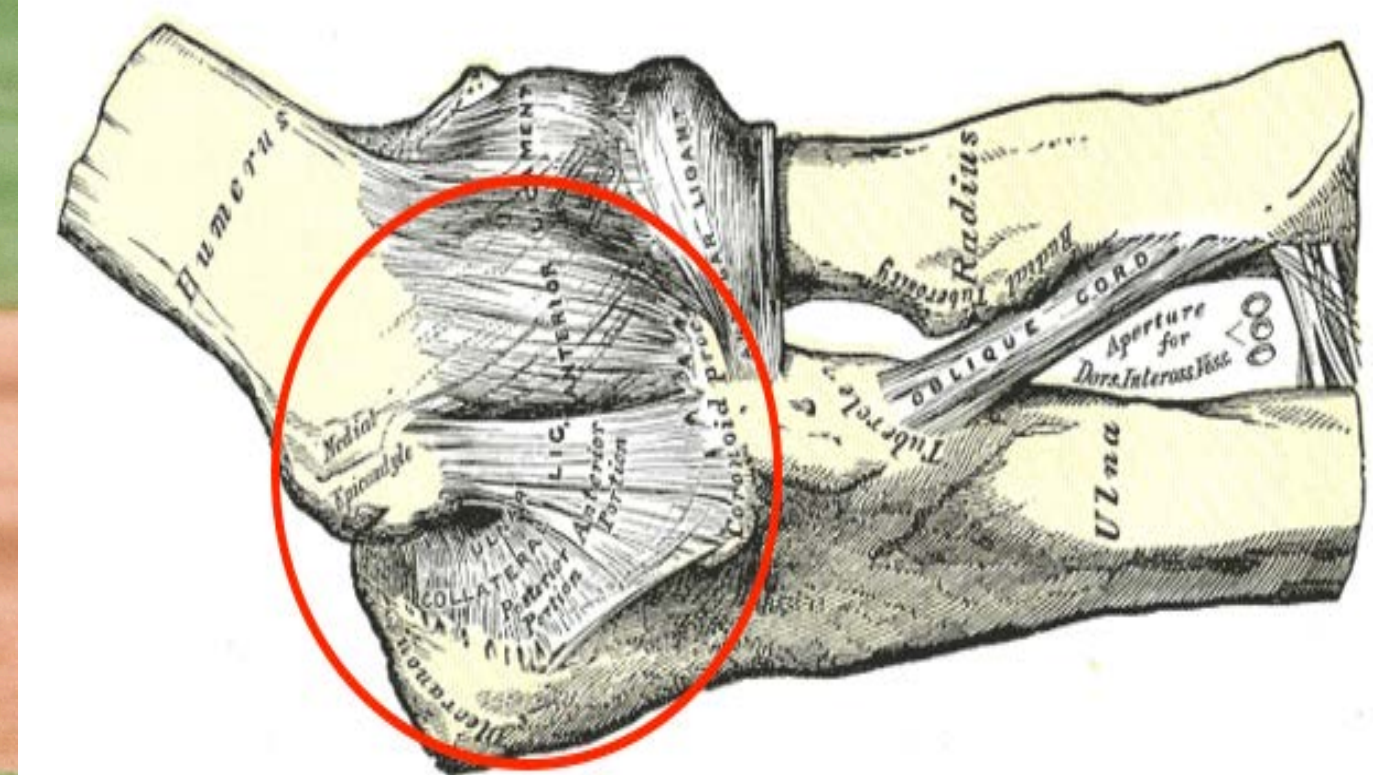
EXPERIENCE					
	Study	Variable	UCL Group	Control Group	p-value
Professionals	Chalmers et al (2016)	Career Pitch Count	2804	2823	0.083
		Career Fastball Count	1772	1764	0.062
		Career Changeup Count	290	327	0.188
		Career Breaking Pitch Count	302	262	0.012
		Career Slider Pitch Count	415	435	0.796
Amateurs	Garrison et al (2012)	Player Experience in Years	14.0±4.93	14.05±1.30	0.957
		Garrison et al (2013)	Player Experience in Years	13.3±2.1	13.5±1.3
	Olsen et al (2006)	Player Experience in Years	9.2±2.8	9.0±2.4	0.687
		Career Showcases	3.8±5.1	1.0±1.8	<0.01

Table 3: Depicts professional and amateur frequency data as reported by the literature

FREQUENCY					
	Study	Variable	UCL Group	Control Group	p-value
Professionals	Chalmers et al (2016)	Annual Pitch Count	589	637	0.002
		Annual Fastball Count	377	418	0.001
		Annual Changeup Count	59	71	0.017
		Annual Breaking Pitch Count	53	48	0.003
		Annual Slider Pitch Count	95	129	0.212
	Whiteside et al (2016)	Days Between Games	4.65±1.20	5.39±2.19	0.002
		Total Pitches/Year	1466.1±630.1	1498.1±615.0	>0.05
		Pitches/Game	50.05±16.00	51.24±15.29	0.003
		Pitches/Inning	16.13±1.25	16.30±1.34	>0.05
		Amateurs	Olsen et al (2006)	Pitching Months/Year	7.8±2.4
Pitching Appearances/Year	30.1±15.6			18.6±13.0	<0.001
Innings/Appearance	5.4±1.4			4.3±1.7	<0.001
Pitches/Appearance	85.2±23.8			66.2±25.3	<0.001
Pitches/Year	2608.4±1587.3			1268.9±1039.7	<0.001

## Conclusions

- Primary risk factors for UCL injury among baseball amateurs and professionals are **velocity, experience and frequency of throwing**, as well as **shoulder range of motion**.
- **Mean fastball velocity** was greater in both professionals and amateurs. It was also the most consistently reported risk factor.
- While experience and frequency currently lack standardized measurements, an increase in **career showcases** and **pitching >8 months/year** was indicative of UCL injury among amateurs.
- Despite conflicting results, **deficits in throwing arm shoulder ROM** appear to be a risk factor for UCL injury, although the magnitude for increasing risk is not clear.
- Although it is likely a combination of these risk factors that predisposes the athlete to future UCL injury, current evidence is insufficient in determining which combination of, or even which specific risk factors are of greatest influence to future UCL injury.



[https://upload.wikimedia.org/wikipedia/commons/8/83/Zack\\_Wheeler\\_on\\_April\\_10%2C\\_2011.jpg](https://upload.wikimedia.org/wikipedia/commons/8/83/Zack_Wheeler_on_April_10%2C_2011.jpg)

<https://upload.wikimedia.org/wikipedia/commons/thumb/9/97/Gray329.png/288px-Gray329.png>

## Clinical Relevance

- Clinicians should consider educating coaches, parents, and players on the effects of increased pitching exposure to reduce the incidence of UCL injury.
- Assessment and treatment of shoulder internal ROM relative to non-dominant arm may also contribute to decrease UCL injury risk.

## Acknowledgements / References

- Chalmers PN, Erickson BJ, Ball B, Romeo AA, Verma NN. Fastball Pitch Velocity Helps Predict Ulnar Collateral Ligament Reconstruction in Major League Baseball Pitchers. *Am J Sports Med.* 2016
- Keller RA, Marshall NE, Guest JM, Okoroafor KR, Jung EK, Moutzouras V. Major League Baseball pitch velocity and pitch type associated with risk of ulnar collateral ligament injury. *Journal of Shoulder and Elbow Surgery.* 2016;25(4):671-675.
- Olsen II SJ, Fleisig GS, Dun S, Loftice J, Andrews JR. Risk factors for shoulder and elbow injuries in adolescent baseball pitchers. *American Journal of Sports Medicine.* 2006;34(6):905-912.