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Doctor of Physical Therapy

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

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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	0.61
	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**

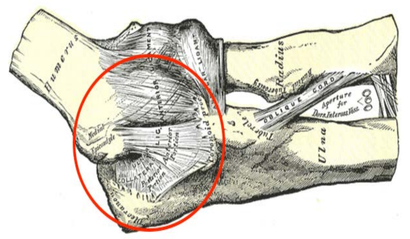
Table 3: Depicts professional and amateur frequency data as reported by the literature

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	5.5±2.3	**<0.001**
		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



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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

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