

# Ultrasound Imaging to Evaluate Acute Adaptations of the Medial Elbow Joint Complex in College Baseball Pitchers

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## Introduction

- Musculoskeletal ultrasound imaging (MSKUI) has the ability to dynamically monitor musculoskeletal structures, offers a degree of extra visibility over magnetic resonance imaging (MRI), is more cost efficient, and is free of radiation.<sup>1,2</sup>
- MSKUI is becoming a growing topic in the literature regarding the imaging of musculoskeletal injuries. Several studies have investigated the composition and integrity of the ulnar collateral ligament (UCL) with imaging.<sup>3,4,5,6,7,8,9,10,11,12,13</sup>
- Some research suggests that UCL thickness and MJS width increases in professional baseball players through sustained competition and experience.<sup>8,9</sup>
- The purpose of this study is to explore acute UCL thickness, and medial joint space (MJS) width adaptations in the throwing arm of collegiate pitchers.

## Objectives

- To examine acute UCL thickness and MJS adaptations in the throwing arm of Division I collegiate baseball pitchers with MSKUI following one in-game performance at the beginning of the season.

## Methods

- Non-experimental descriptive quantitative repeated measures study
- Ten NCAA Division I collegiate baseball pitchers (mean age 20.4 ± 1.4 yrs) with no history of significant upper extremity injuries participated.
- MSKUI was performed with a GE LOGIQ e ultrasound unit before and immediately after (< 15 minutes) pitching performance during each subject's first game of the season.
- A 3 kg valgus force was applied with a handheld dynamometer (Hoggan Scientific microFET 2) 20 cm distal to the medial epicondyle of the throwing arm during imaging.
- Post-imaging ligament thickness measurements were performed at the mid-substance of UCL and at the apex of the trochlea. Moreover, post-imaging measurements were performed from the apex of the trochlea to the apex of the ulna to evaluate MJS.

## Results

- The results show that there is a significant increase in the MJS width of the throwing arm in collegiate pitchers following their first competitive playoff the season.
- No significant changes were found in the anterior band thickness or mid-substance thickness to apex of trochlea thickness ratio.
- When controlling for variables innings pitched and pitch count through linear regression, they were found to be poor predictors of change in MJS.

### Paired Sample T-Tests

		95% Confidence Interval								
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2 tailed)	
Pair 1	Mean Score Pre & Post-performance Mid-substance	.022	.192	.061	-.115	.159	.362	9	.725	
Pair 2	Mean Score Pre & Post-performance Apex of Trochlea	.060	.146	.046	-.045	.165	1.298	9	.227	
Pair 3	Mean Score Pre & Post-performance MJS	-.247	.211	.067	-.398	-.096	-3.704	9	.005	
Pair 4	Pre & Post-performance Mid-substance to Apex of Trochlea Ratio	-.0174	.074	.0234	-.070	.0355	-.745	9	.476	

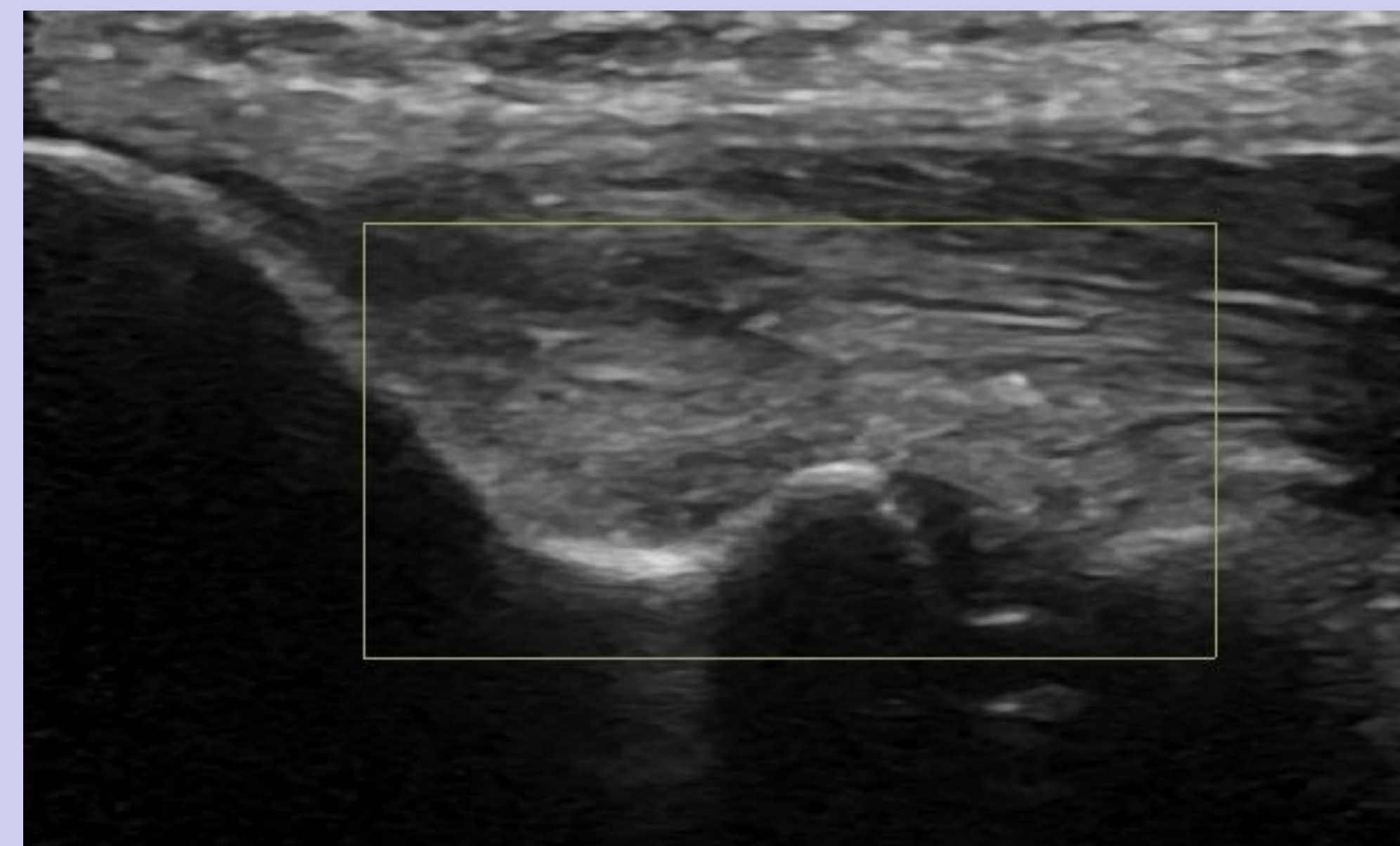
### Linear Regression Models: ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.008	1	.008	.172	.689 <sup>b</sup>
	Residual	.392	8	.049		
	Total	.400	9			
2	Regression	.003	1	.003	.060	.813 <sup>c</sup>
	Residual	.397	8	.050		
	Total	.400	9			

(a)Dependent: Change in MJS

(b)Predictor: (Constant) Pitch Count

(c)Predictor: (Constant) Innings Pitched



## Data Analysis

- Paired Sample T-Tests were performed to compare pre to post mid-substance thickness, pre to post trochlea thickness, pre to post MJS, and pre to post ratio of mid-substance thickness to apex of the trochlea thickness. The alpha level was set at 0.05.
- Linear Regression was performed on post competition changes found to be significant to assess whether or not pitch count or innings pitched were predictive of change.

## Discussion

- This study is the first to describe acute changes of the anterior band of the UCL and MJS as measured by MSKUI.
- Changes in MJS are likely related to thermal effects induced over a certain time period, but there is currently no literature to confirm.
- Study limitations:
  - The applied valgus force of 5 Nm may not be comparable to the forces applied to the arm when throwing as these forces have been found to range from 64 – 124 Nm in the literature.<sup>20</sup>
  - The number of warm-up and in-game defensive throws are likely to vary slightly prior to performance per subject and were not recorded.
  - Time varied between pre and post imaging for each subject for several reasons: in-game pitch count, inning duration, performance, coaching decisions, and whether or not they were a starter or a reliever.
  - It was assumed that the imaging performed at least one hour prior to performance would have the same appearance immediately before they initiated their warm-up.
- Future research to assess acute changes should include larger sample sizes and conduct data collection at varying times of the season to further explore factors that affect UCL and MJS changes and the degree to which they occur immediately following performance.

## Conclusions

- A significant MJS widening did occur after one pitching outing at the start of the season; whereas, no changes were observed in UCL thickness measured at two different locations. Further research is needed to understand the etiology of increased medial elbow joint widening in pitchers at the start of the collegiate baseball season.
- Prior to this study, there have been no studies that have monitored acute changes following competition in the UCL and MJS width of collegiate pitchers following in-game performance.
- More investigation may yield details on the physiological changes that may contribute these changes and if they are related to risk of UCL injury.