5-7-2020

Scapular Acceleration during Upper Extremity Elevation in Healthy Individuals with and without Scapular Dyskinesis

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Background

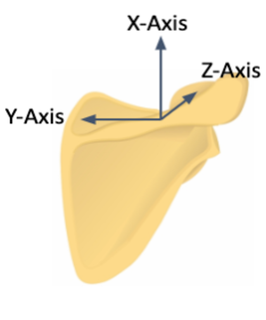
Individuals with shoulder and upper extremity pathology often present with altered scapular motion and muscle performance. There are few clinical tools that are capable of collecting specific and efficient data on alterations in scapular motion and even fewer studies have looked at variations in scapular acceleration as a way of quantifying scapular motion.

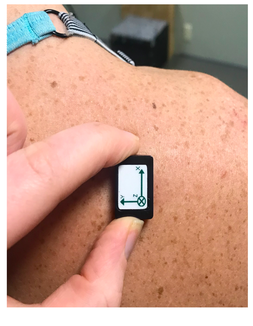
Purpose/Hypothesis

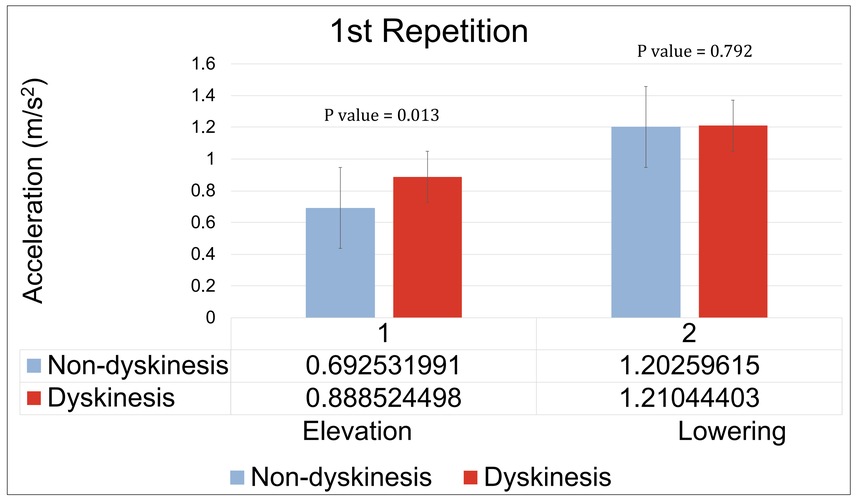
The primary purpose of this study was to determine the effectiveness of wireless accelerometers for detecting changes in acceleration in individuals with and without scapular dyskinesis. There will be significant increases in average axis acceleration for those with scapular dyskinesis compared to those without.

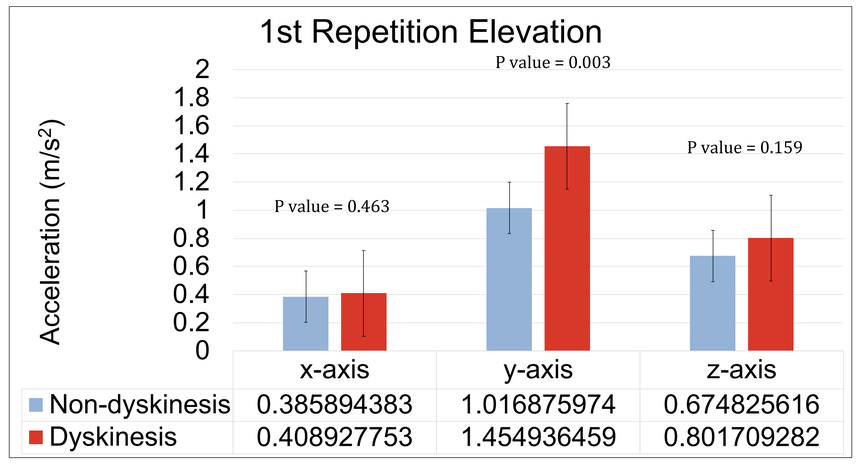
Subjects/Methods

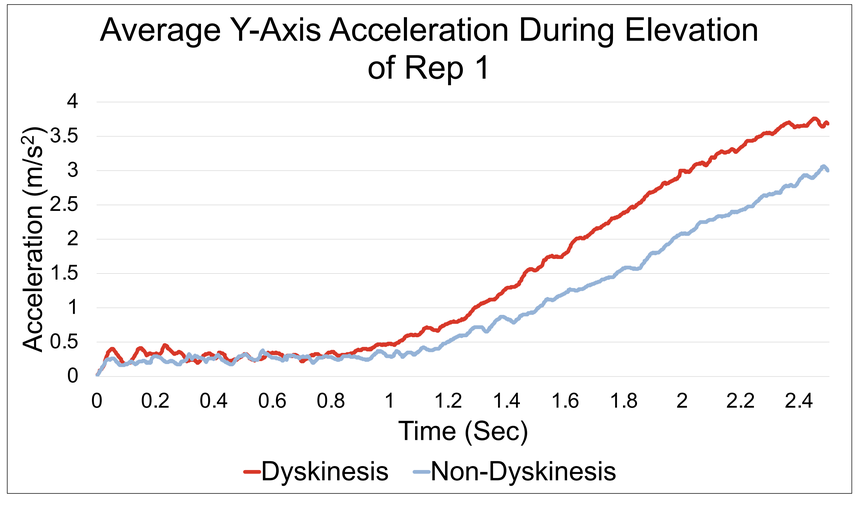
Subject Positioned ⬇	Subjects positioned in standing posture with shoulder placed in scaption. Subject placed in 140° of shoulder elevation and target marked on vertical guide pole.
Screening ⬇	Healthy subjects were screened for scapular dyskinesis using criteria from McClure et al.
Testing ⬇	A wireless accelerometer was secured at the midpoint of the scapular spine. Subject performed 5 repetitions of standing scaption.
Acceleration Collected ⬇	Linear scapular accelerations along 3 orthogonal axes (x, y, z) through the range (0-140°) of arm elevation and lowering.
Process Repeated	For the first 9 patients, the entire process was repeated 1-2 days later for test-retest reliability











Acknowledgements: *Matthew Sheridan, SPT, Dr. Mary Fisher, PT, PhD, OCS*

Data Analysis

- Intraclass correlation coefficients (ICC3, k) were used to determine the between day intra-rater reliability.
- Independent t-test for differences in age and BMI between those with or without dyskinesis
- One-way ANOVA for difference in average axis acceleration between those with and without dyskinesis.
- Mean acceleration across all three axes during elevation and lowering of repetition 1 (MANOVA)
- Acceleration of x y, and z planes were individual extracted during elevation of repetition 1 (MANOVA)

Descriptive Statistics				
	Dyskinesis		Non-Dyskinesis	
Subjects	N=15		N=12	
Age (y)	24 ± 1		25 ± 2	
BMI (kg/m²)	22.76 ± 3.77		25.47 ± 4.22	
Gender	Male = 6	Female = 9	Male = 3	Female = 9
Arm Dominance	Right = 15	Left = 0	Right = 10	Left = 2

Results

- Good intra-rater reliability for the x and y axes (ICC > .80)
- Significant increase in overall acceleration of the scapula in those with dyskinesis (p=.039).
- Differences in acceleration greater during the elevation vs lowering component of arm motion (p=.013).
- Significant increase in acceleration during elevation along the medial/lateral axis for those with dyskinesis (p=.003)

Conclusion/Clinical Relevance

Wireless accelerometers are a reliable tool for quantifying scapular motion in healthy individuals with and without dyskinesis. In a healthy population with dyskinesis, the overall magnitude of scapular acceleration was greater when compared to a healthy group without dyskinesis. Alterations in acceleration occur primarily in the frontal plane while differences in the sagittal and coronal plane are not as large. These findings implicate potential muscle imbalances that need to be further investigated.

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