Variation in Lumbosacral Muscle Function Throughout the Respiratory Cycle as Measured by Tensiomyography

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INTRODUCTION

Tensiomyography (TMG) has significant potential in examining muscle functionality.[1] The erector spinae and other lumbosacral muscles can be analyzed with little challenge. Such analyses collect data on muscle displacement (Dm), delay time (Td), contraction time (Tc), half-relaxation time (Tr), and sustain time (Ts). Stiffness of lumbosacral muscles fluctuates throughout the respiratory cycle.[2] This study aims to understand how such fluctuations may alter the parameters measured via TMG.

METHODS

Thirty students at the University of Central Florida were examined under four breathing conditions. First, a baseline amplitude for electrical stimulation was found using the TMG. Muscle function at end-tidal inspiratory volume (ETIV), end-tidal expiratory volume (ETEV), total lung capacity (TLC), and residual volume (RV) were analyzed. Visual cues signaled inhalation (ETIV) and exhalation (ETEV), when the diaphragm expanded and contracted, respectively. Inhalation of as much air as possible represented TLC and exhalation of all the air from the lungs represented RV. Measurements were taken twice at all breathing conditions and the highest of two measurements was utilized for data analysis. This procedure was completed on both the erector spinae (ES) and latissimus dorsi (LD). Paired samples t-tests were run to compare data sets from the four respiration levels.

TMG SET-UP FOR ERECTOR SPINAE AND LATISSIMUS DORSI

ERECTOR SPINAE ANALYSES

		Statistical Analyses		
Measure 1	Measure 2	t	df	p
ETIV	ETEV			
	Dm	-6.222	29	< 0.001*
	Tr	-2.773	29	0.010*
	Ts	-3.870	29	< 0.001*
ETIV	TLC			
	Dm	2.544	29	0.017*
ETEV	TLC			
	Dm	5.700	29	< 0.001*
	Tr	2.379	29	0.024*
	Ts	3.810	29	< 0.001*
ETEV	RV			
	Dm	5.326	29	< 0.001*
	Tr	2.734	29	0.011*
	Ts	3.375	29	0.002*

RESULTS

Differences in Dm, Tr, and Ts were statistically significant when comparing measurements for ES under ETIV and ETEV. Comparisons between ETIV and TLC showed Dm differences of statistical significance. ETEV and TLC analyses showed Dm, Tr, and Ts were statistically significant. Comparisons for ETEV and RV illustrated significantly different Dm, Tr, and Ts values. No analyses for LD were statistically significant.

DISCUSSION/CONCLUSION

The erector spinae functions differently at various points of respiration. When utilizing tools like tensiomyography, it is important to understand that data collected on erector spinae may be skewed based on the respiratory conditions of a participant at a given time.

PRACTICAL APPLICATIONS

This is the first study to explicitly examine how respiratory conditions can skew TMG measurements. This data serves to illustrate that muscle function is different throughout the respiratory cycle. Therefore, data collected using TMG on muscles that are affected by respiration may not be accurate to the true functioning of the muscle. This finding should be built upon to create a standardized protocol for analyzing muscles such as the erector spinae.

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