Good Vibrations: The Impact of Focal Mechanical Vibration on Erector Spinae Morphology and Lumbar Spine ROM

Chandler, Karlee., Robinson, Reily., Nwoke, Jedera., Matics, Brandon, Maher, Ruth.

PCOM Georgia
PHYSICAL THERAPY

INTRODUCTION

Focal mechanical vibration (FMV) therapy involves applying mechanical vibration to a specific body area. It is thought to enhance muscle activation and increase flexibility via the stimulation of muscle spindles. Activities paired with FMV may increase lumbar range of motion, decrease pain, and improve lumbar muscle activity in those with low back pain. However, optimal parameters regarding frequency, intensity, and duration of FMV require further investigation. Ultrasound with shear wave elastography (US-SWE) is an emerging technology that may contribute to understanding the mechanism of action associated with FMV and its impact on tissue morphology. US-SWE quantifies the stiffness or elasticity of soft tissue by measuring the propagation speed of ultrasound-induced shear waves within the tissue. Since muscle stiffness increases with contraction and decreases with relaxation, US-SWE can be used as a surrogate assessment of muscle. activation and force.

OBJECTIVES

The primary objective of this study is to determine if FMV delivered via Vibracool affects erector spinae stiffness, lumbar ROM, and self-report of lumbar stiffness assessed via a Likert Scale.

Image on the left is the set up for ultrasound and Vibracool and imaged on the right is the Schober test

METHODS

The PCOM institutional review board approved this study, and all participants provided informed consent. A convenience sample of three male and seven female students (n=10) were recruited from the PCOM physical therapy department. Participants who met the inclusion criteria self-reported low back stiffness and were healthy. Baseline assessment required participants to self-report their perceived low back stiffness via a Likert scale, and perform the Schober test to determine lumbar spine ROM, followed by the acquisition of US-SWE images to determine muscle stiffness of the erector spinae in a prone position. A linear transducer was used for US-SWE imaging of bilateral erector spinae musculature, which was placed in the sagittal plane parallel to the most prominent portion of the musculature immediately above the iliac crest, centered on L3 – L5 spinal levels, and manipulated until a clear image of the erector spinae was noted. Three US-SWE images were acquired, and the mean will be used in data analysis. Focal mechanical vibration was then applied via a Vibracool device that delivers constant vibration of 225Hz with an intensity of 7.9 g's. for 20 minutes with participants in the prone position. All baseline assessments were repeated post-FMV.

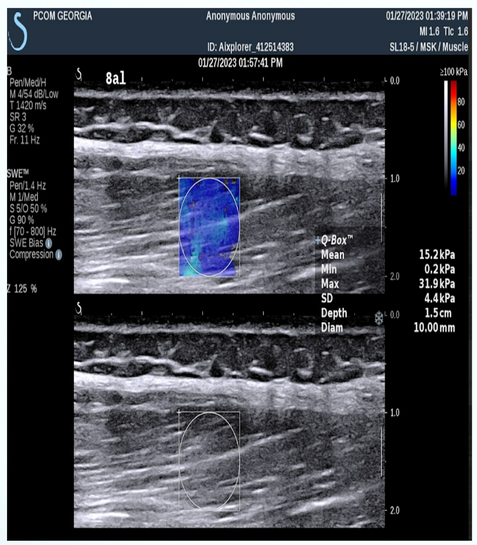

Figure 1: Pre US-SWE prior to Vibracool application

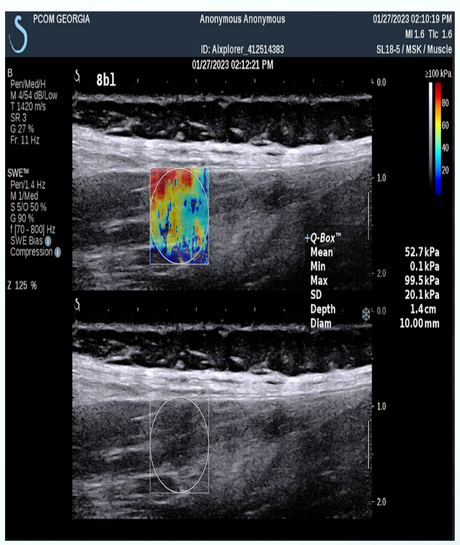

Figure 2: Post US-SWE after Vibracool application

RESULTS

A Friedman test was run to determine the effect of focal mechanical vibration on lumbar range of motion and stiffness. Pairwise comparisons were performed using IBM SPSS Statistics (Version 26) with a Bonferroni correction for multiple comparisons. The application of focal mechanical vibration resulted in a statistically significant difference to the erector spinae $\chi^2(7) = 46.004$, $p = <.001$. Post hoc analysis with a Wilcoxon signed-rank test was conducted with a Bonferroni correction applied, resulting in a significance level set at p=.025. There was no significant differences between pre and post US-SWE data for either the right (Z=-.968,p=.333) or left (Z=-.153,p=.878) erector spinae stiffness. However, there were significant differences between the pre and post test scores on the Schober test Z=-2.716, p=.007) and the self-perceived stiffness scale (Z=-2.694 p=.007).

CONCLUSIONS

Similar to previous research using focal mechanical vibration, our results are concurrent.[1,2,3] Perceived stiffness post FMV was both objectively and subjectively decreased. Based on the results, there were significant differences between pre and post test scores on the Schober test and the self-perceived stiffness scale. Unfortunately, the power of our study was low so results cannot be generalized at this time.

REFERENCES

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