Tensiomyography and pressure algometry: Assessing the effects of a bout of Kettlebell swings on muscle contractility and pressure pain threshold

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Background

- There are a variety of ways to alter contractility and pressure pain threshold in the lumbosacral region through exercise.
- Tensiomyography (TMG) was used to assess changes in muscle contractility and pressure algometry (PPT) was used to assess changes in pressure pain threshold
- There is little evidence assessing the acute effects of a kettlebell swing protocol on contractility and pressure pain threshold

Research Aims

Using student t-test to assess for within group differences and repeated measures ANOVA to assess for within-group interactions, our research aims were to:

1. Examine the short-term changes in muscle contractility and sensitivity of lumbar erector spinae, biceps femoris, and gluteus maximus in response to a modified Tabata kettlebell swing protocol
2. Examine the short-term changes in pressure pain threshold of quadratus lumborum, erector spinae, and piriformis in response to a modified Tabata kettlebell swing protocol.

Methods

- 40 college-aged participants (27 males, 13 females) met the inclusion criteria: between ages 18-35, no recent history of low-back pain or pre-existing injuries, and no positive responses on the PAR-Q.
- Participants were randomly assigned to the swing (n=13), isometric hold (n=14), or control group (n=13).
- Standard protocols regarding intervention techniques and modified Tabata Protocol were given to each participant prior to a warm-up except the control group.
- PPT with the piriformis muscle was found to have significant pre and post differences (p = 0.015) among the isometric group and kettlebell swing group (p=.017).
- Participants were assessed at baseline and 5-minute post intervention using TMG for maximal displacement (Dm), contraction time (Tc), relaxation time (Tr), delay time (Td), and sustain time (Ts) and Pressure Algometry for PPT.

Figures

Figure 1*

Figure 2**

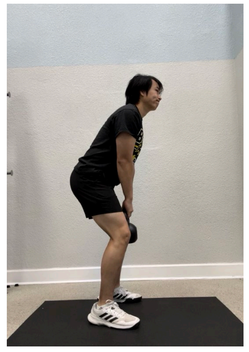


Figure 3***

*Initial position of the Kettlebell Swing
** Ending position of the Kettlebell Swing
*** Position for the Isometric Hold

Figure 4: TMG testing position for Gluteus Maximus

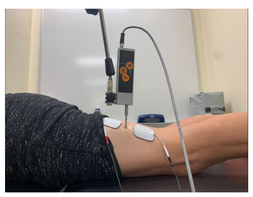


Figure 5: TMG testing position for Biceps Femoris

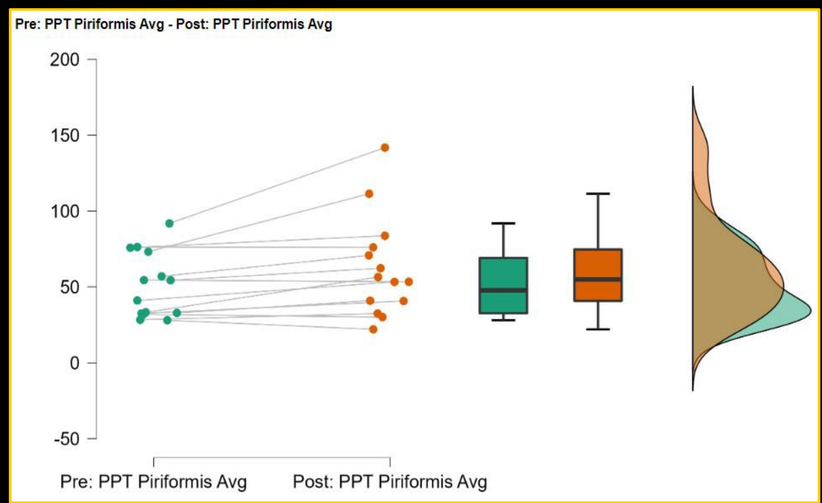
Figure 6: TMG testing position for Erector Spinae

Aim #1 Results

No significant differences were noted on the erector spinae, glute max, and biceps femoris on TMG parameters. These lack of results may be due to contributions of other muscles not examined in the study, and time lag between finishing the exercise protocol and taking measurements.

Aim #2 Results

Significant within-group differences were noted in the piriformis with the swing and isometric hold groups. This indicates that a modified Tabata-style kettlebell swing or isometric hold protocol can produce exercise induced hypoalgesia in the piriformis muscle.



Conclusion

TMG on the erector spinae, gluteus maximus, and bicep femoris did not reproduce significant within-group differences in the control, isometric, and experimental groups. There were significant within-group differences for the isometric and swing groups for PPT on the piriformis. Further research should consider examining changes in contractility of anterior chain muscle groups with TMG. Further research in PPT should consider populations such as those with piriformis related pathologies due to the within-group changes seen in this study.

Clinical Relevance

The kettlebell isometric hold and swing may be useful for clinicians to alter PPT in the piriformis. Clinicians may consider using either modality with patients depending on underlying pathologies whether it's musculoskeletal or cardiovascular related.

Key References

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2. Keilman BM, Hanney WJ, Kolber MJ, et al. The Short-Term Effect of Kettlebell Swings on Lumbopelvic Pressure Pain Thresholds: A Randomized Controlled Trial. *J Strength Cond Res*. 2017;31(11):3001-3009. doi:10.1519/JSC.0000000000001743
3. .Lohr C, Braumann KM, Reer R, Schroeder J, Schmidt T. Reliability of tensiomyography and myotonometry in detecting mechanical and contractile characteristics of the lumbar erector spinae in healthy volunteers. *Eur J Appl Physiol*. 2018;118(7):1349-1359. doi:10.1007/s00421-018-3867-2