Reliability of Exercise-Induced Hypoalgesia during Lumbosacral Dynamic Resistance Exercise

Kaitlyn Lyons M.S, CSCS, EPC, Matt S. Stock PhD, William J. Hanney PT, DPT, PhD, ATC, CSCS, Abigail W. Anderson PT, DPT, PhD
School of Kinesiology and Rehabilitation Sciences, University of Central Florida

Introduction

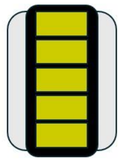
- Quantitative Sensory Testing utilizes measurable pressure and heat stimuli to determine an individual's perception of pain.
- Exercise has been shown to increase pain threshold, known as exercise induced hypoalgesia (EIH).
- The 45-degree Roman Chair (low back extension) is a dynamic resistance exercise that may be beneficial for low back pain as it allows for direct overload of the spinal flexors and extensors.
- However, the ability of this exercise to reliably produce EIH has not been examined.

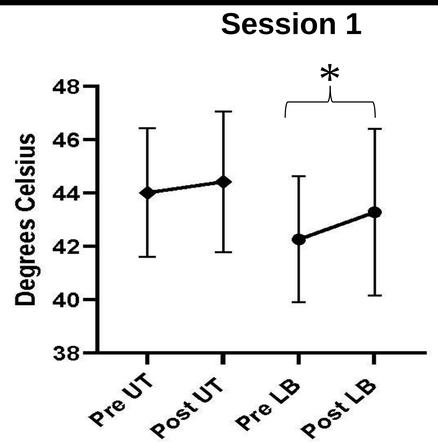
Aims:

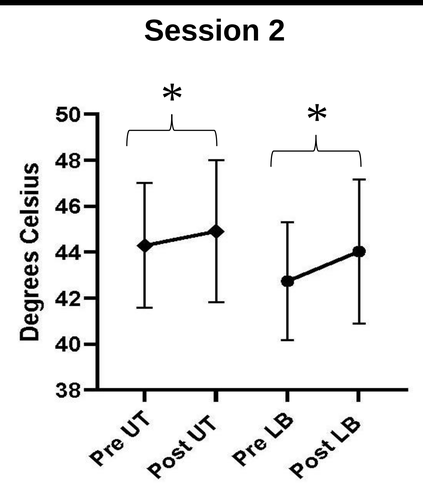
1. Determine the reliability of heat pain threshold (HPT) and pressure pain threshold (PPT) measures after a period of quiet rest.
2. Examine local and systemic EIH effects after a 45-degree Roman chair exercise
3. Determine the test-retest reliability of EIH for HPT and PPT.

Results

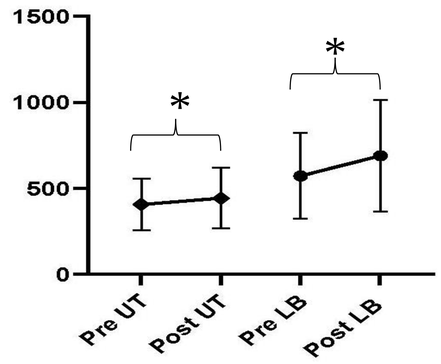
Heat Pain Threshold

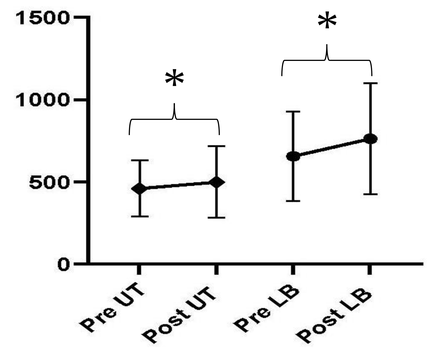






Pressure Pain Threshold





Statistical Analysis:

- Intraclass Correlation Coefficients (ICC) examined reliability

1. Paired samples t-test analyzed HPT and PPT values before and after a period of quiet rest for sessions 1 and 2.
2. Three-way repeated measures analysis of variance (ANOVA) examined for time (pre-exercise/post-exercise) × site (UT/LP) × condition (HPT/PPT).
3. Two-way repeated measures ANOVA was conducted for session × location to analyze EIH values post-exercise between sessions 1 and 2.

Results:

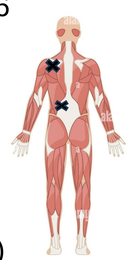
1. HPT and PPT demonstrated good (HPT: $ICC_{3,1}$ >0.741) to excellent reliability (PPT: $ICC_{3,1}$ >0.810).
2. As demonstrated in each figure, for HPT, significant EIH was observed during session1 over the LP (p=0.002) during session 1 and both sites (p's<0.001) during session 2 . PPT demonstrated significant EIH at both sites for session 1 (p UT=0.025, LP<0.001) and session 2 (p's<0.001) with larger effect sizes at the LP (η_p^2 >0.413).
3. EIH can be reliably induced across sessions. For LP: ($ICC_{3,1}$ HPT=0.903, PPT=0.815)(*r* HPT=0.903, PPT=0.814). For UT: ($ICC_{3,1}$ HPT=0.867, PPT=0.729)(*r* HPT=0.877 and PPT=0.744).

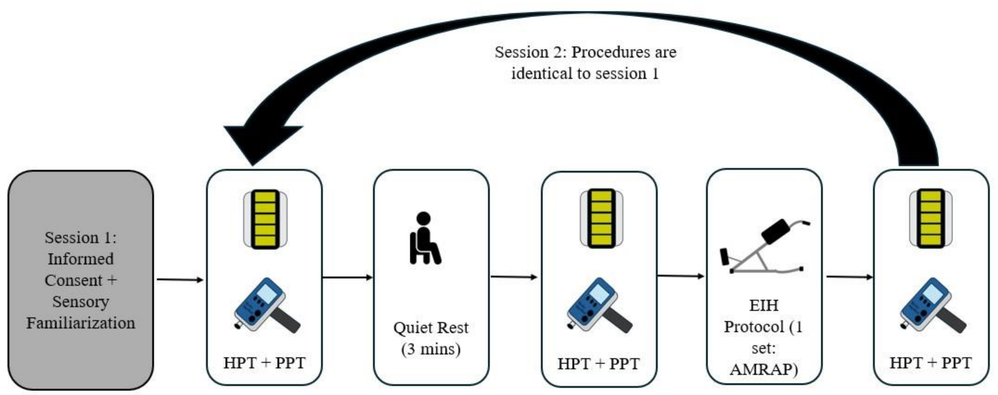
*Indicates significance

Methods

Crossover Design

- 35 healthy participants (16 male, age: 21(1.4) years)
- HPT and PPT measured at the dominant Upper Trapezius (UT) and Lumbar Paraspinal (LP)





Note: HPT= Heat Pain Threshold, PPT= Pressure Pain Threshold, EIH= Exercise Induced Hypoalgesia, AMRAP= As Many Repetitions As Possible

Conclusion

- Our results demonstrate that in healthy individuals, the 45-degree Roman chair can reliably produce significant hypoalgesia in the LP using multimodal measures of pain threshold.
- The 45-degree Roman chair may be a beneficial exercise for strength and conditioning specialists as this exercise allows for reductions in pain sensitivity in the exercising musculature and requires minimal equipment and familiarization.
- This exercise shows potential for serving as both a potential intervention and outcome measure.

References

- Naugle KM, Fillingim RB, Riley JL. A meta-analytic review of the hypoalgesic effects of exercise. *J Pain*. 2012;13(12):1139-1150. doi:10.1016/j.jpain.2012.09.006
- Vaegter HB, Jones MD. Exercise-induced hypoalgesia after acute and regular exercise: experimental and clinical manifestations and possible mechanisms in individuals with and without pain. *Pain Rep*. 2020;5(5):e823. doi:10.1097/PR9.0000000000000823
- Wewege MA, Jones MD. Exercise-Induced Hypoalgesia in Healthy Individuals and People With Chronic Musculoskeletal Pain: A Systematic Review and Meta-Analysis. *J Pain*. 2021;22(1):21-31. doi:10.1016/j.jpain.2020.04.003
- Naugle KM, Fillingim RB, Riley JL. A meta-analytic review of the hypoalgesic effects of exercise. *J Pain*. 2012;13(12):1139-1150. doi:10.1016/j.jpain.2012.09.006
- Vaegter HB, Jones MD. Exercise-induced hypoalgesia after acute and regular exercise: experimental and clinical manifestations and possible mechanisms in individuals with and without pain. *Pain Rep*. 2020;5(5):e823. doi:10.1097/PR9.0000000000000823
- Wewege MA, Jones MD. Exercise-Induced Hypoalgesia in Healthy Individuals and People With Chronic Musculoskeletal Pain: A Systematic Review and Meta-Analysis. *J Pain*. 2021;22(1):21-31. doi:10.1016/j.jpain.2020.04.003
- Mayer JM, Udermann BE, Graves JE, Ploutz-Snyder LL. Effect of Roman Chair Exercise Training on the Development of Lumbar Extension Strength.