

Exercise-Induced Hypoalgesia Comparing Cervical Isometrics to NecksLevel Device

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Study Design

Cross-Over Design: Participants alternatively assigned to Group 1 or Group 2

Purpose

This study aims to compare the effects of isometric and isotonic neck exercises on pain pressure threshold to determine which type of exercise optimizes exercise-induced hypoalgesia (EIH) in the cervical musculature. Additionally, this study aims to examine potential changes in proprioception between the two exercise modalities.

Background

Approximately 289 million individuals in the world experience neck pain each year.¹ Those individuals are then more likely to have physical and cognitive changes such as postural changes, headaches, and dizziness, all of which can lead to a poorer quality of life.² To help correct these changes and decrease neck pain many treatments have been explored such as therapeutic exercise (EIH), manual therapy, and medical interventions.³ The use of therapeutic exercise can have a multitude of effects, such as improving range of motion, increasing strength, decreasing pain, and improving motor control and proprioception. Exercise can also have a pain-relieving effect through a mechanism called exercise-induced hypoalgesia (EIH). EIH leads to a temporary decrease in pain sensitivity that occurs after exercise. EIH has been shown to decrease various pain thresholds and pain pressure thresholds.



Methods

Inclusion Criteria

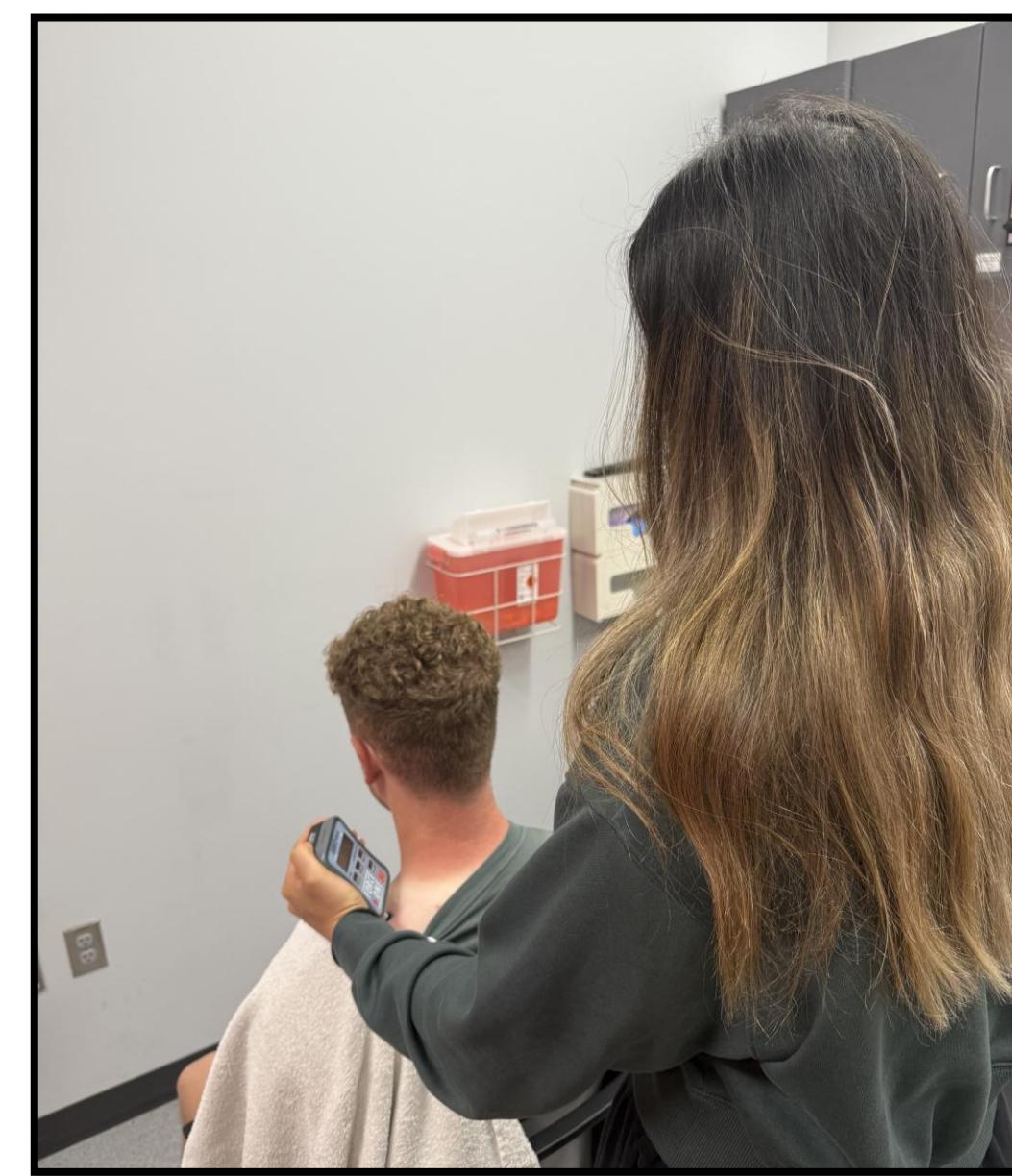
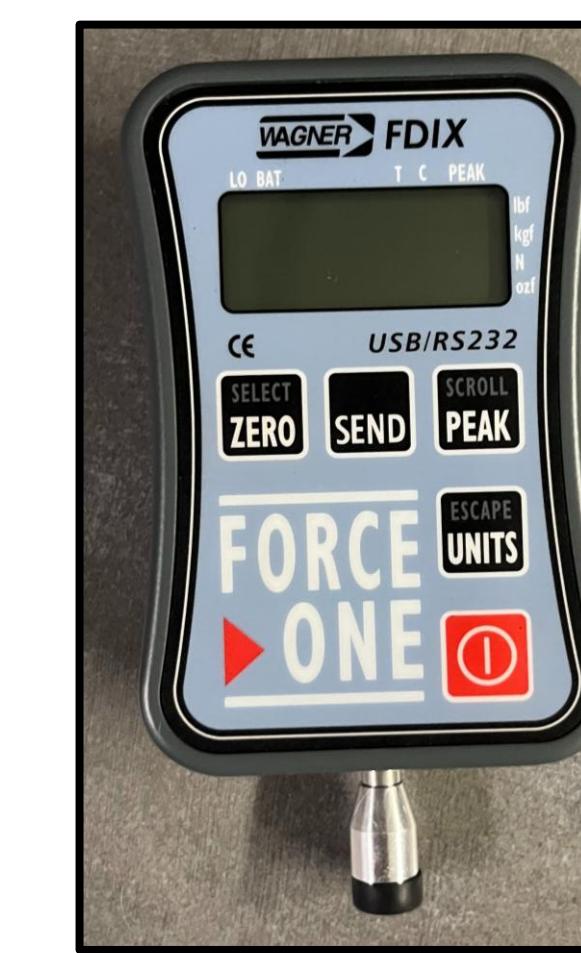
- English-speaking participants between 18-64 years old
- Male or female
- Healthy individuals with no current neck pain

Group 1: Isometric exercise day 1, isotonic exercise day 2

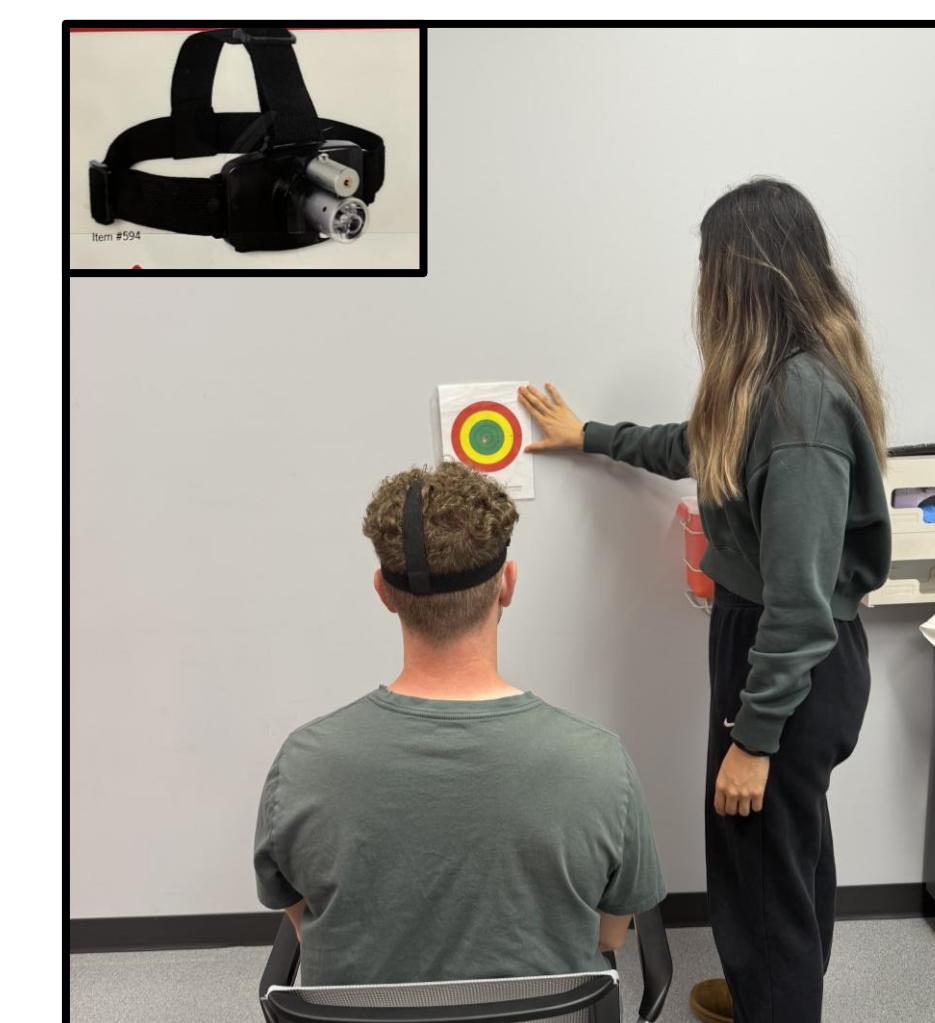
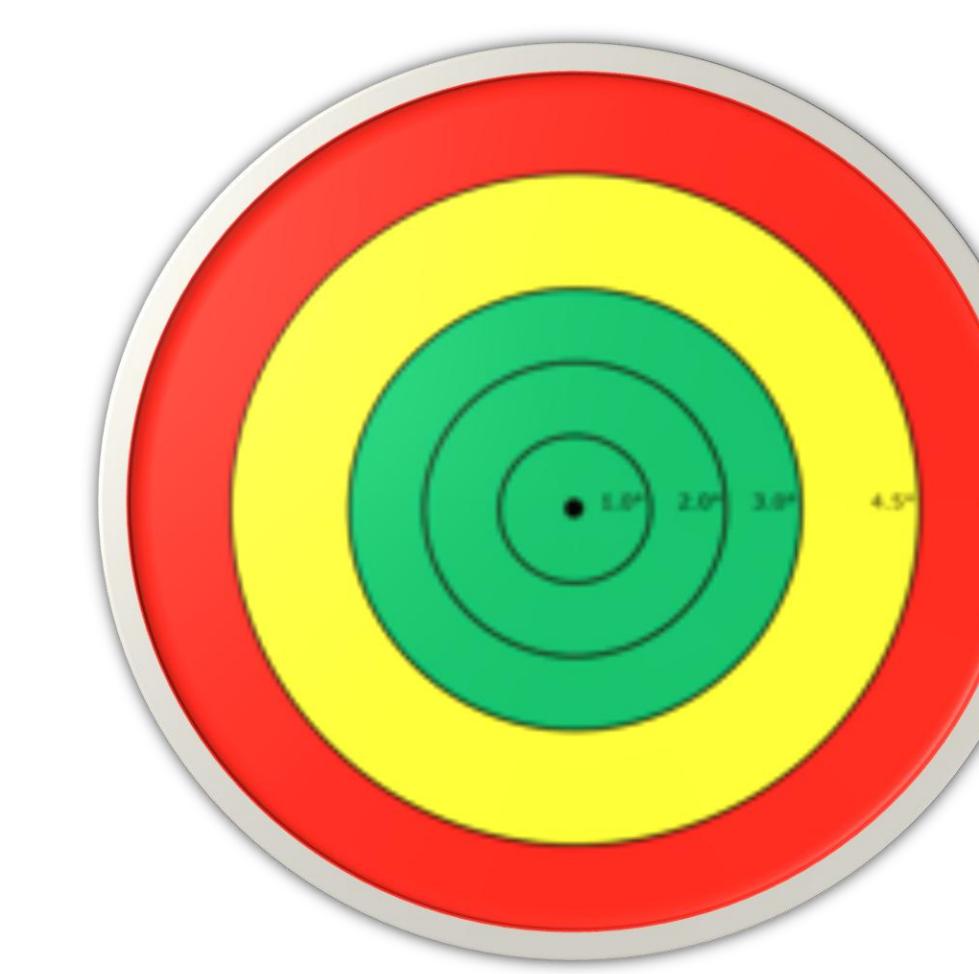
Group 2: Isotonic exercise day 1, isometric exercise day 2

- 2-3-day washout period between day 1 and day 2

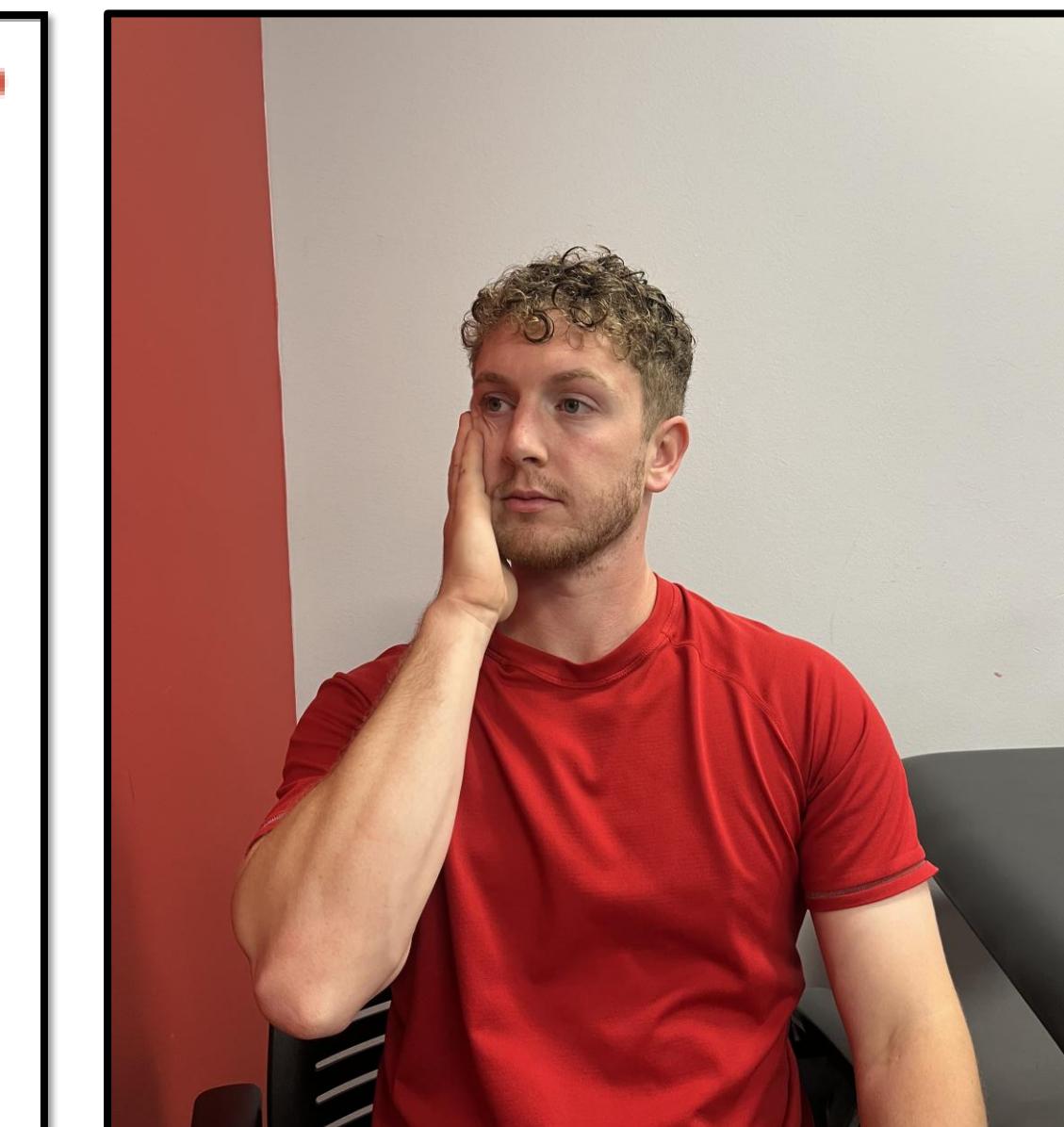
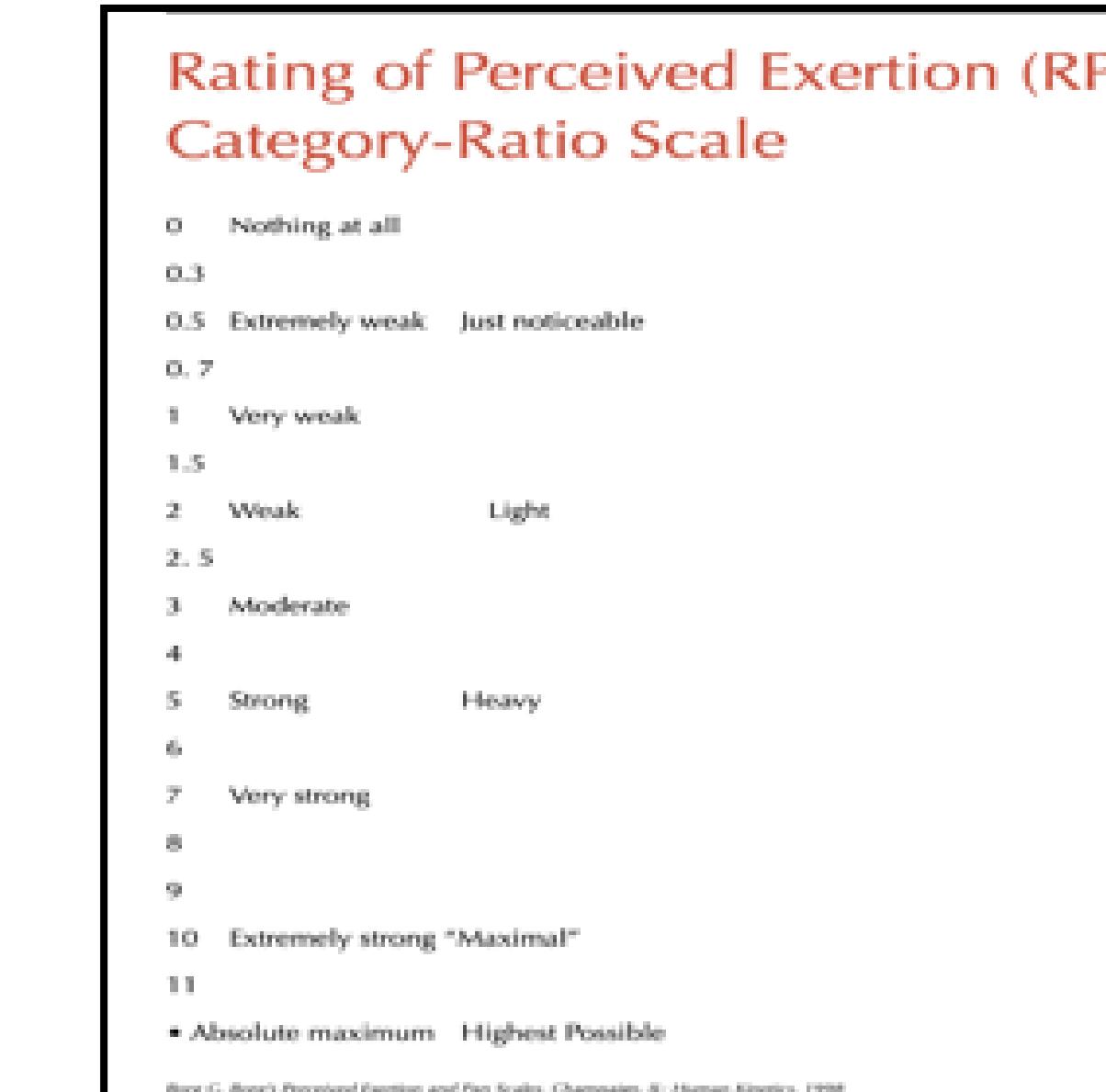
Pain Pressure Threshold: Three pre-test and post-test values taken on upper trapezius muscle bilaterally, halfway between acromion process and C7 spinous process. Pressure applied using pressure algometer with gradually increased pressure until participant verbally reported, "STOP." Values were recorded in kg and averaged.



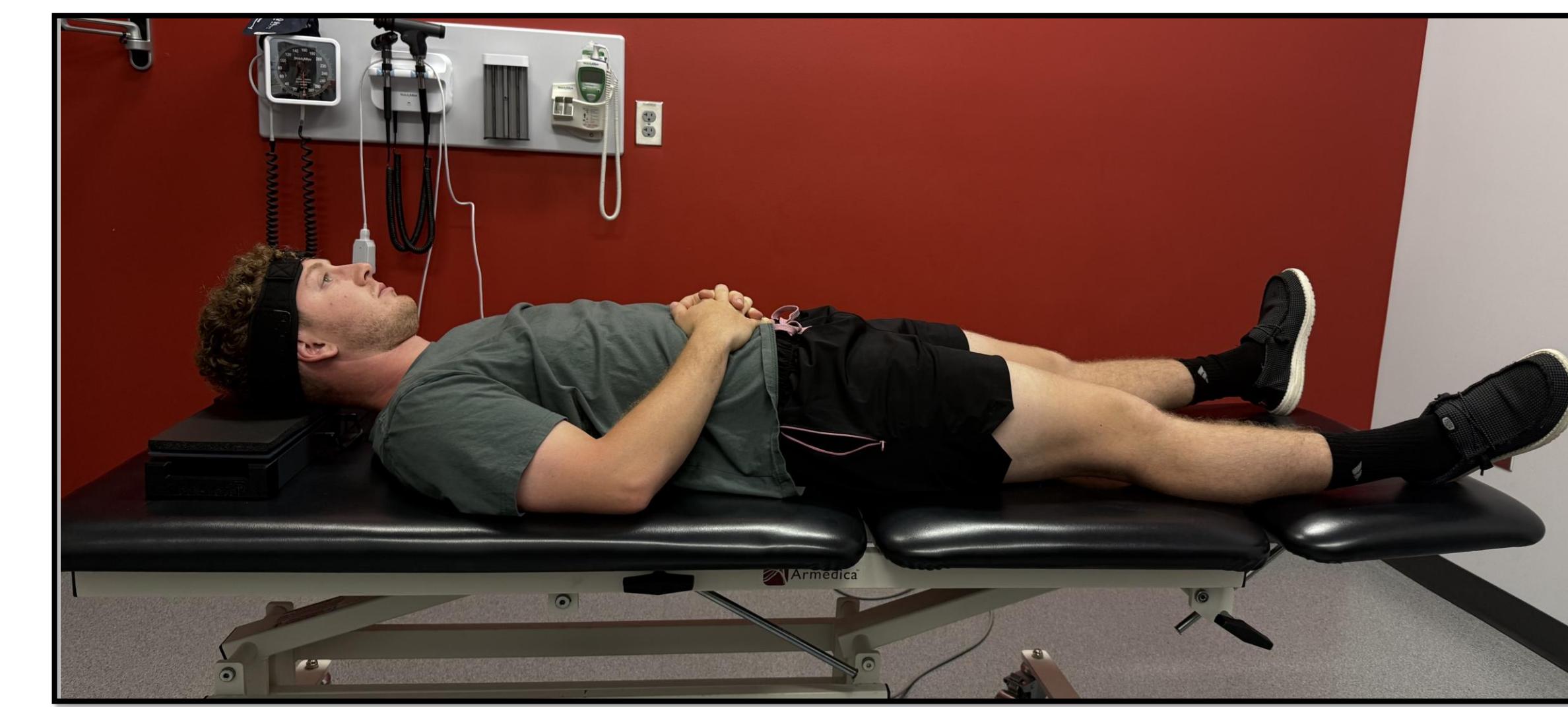
Joint Position Error: Three pre-test and post-test values were taken with the participant seated in a chair 90cm from the target with laser pointer centered on the forehead. With eyes closed, participants turned their heads to the right and back to the perceived center and repeated with heads turned to the right and back to the perceived center. Repeated 6 times in each direction.



Isometric Neck Exercise: Participants seated in a chair, instructed to push the palm of their hand into right cervical rotation at pressure following moderate (3/11) intensity for 5 repetitions, 10-second hold, and 2-second rest between each repetition all into right rotation. The procedure was repeated into left cervical rotation with 3 total sets on each side.



Isotonic/NecksLevel Device: Participant supine wearing NecksLevel device headband, while first finding moderate (3/11) intensity RPE. Completed 5 repetitions into right rotation at a 1-second concentric and eccentric pace with the assistance of a metronome with a 2-second rest allotted between sets. 5 repetitions were repeated into left cervical rotation with 3 total sets performed alternating rotation sides.



Data Analysis

- ANOVA Repeated Measures Within Factors Analysis (alpha = 0.05)
- Assumptions of normal distribution and sphericity were met
- Effect size calculated using Cohen's *d*.

Results

Demographics					N	%
Age	N	Min	Max	Mean	SD	Gender
						Male
Handedness	27	18	25	21.96	1.99	Female
						44.40%
Right	24					88.90%
						11.10%

Joint Position Error					
Isometrics	Mean	SD	Significance (Two-Sided P)	Effect Size (Point Estimate)	
					Pre Right
Isometrics	6.63	3.14	0.022	0.470	Post Right
	5.67	2.32			Pre Left
NecksLevel	6.87	3.32	0.254	0.224	Post Left
	6.35	3.25			Pre Right
NecksLevel	6.16	2.97	0.499	0.132	Post Right
	5.88	2.75			Pre Left
NecksLevel	6.60	2.76	0.821	0.044	Post Left
	6.69	2.77			Pre Right

Pain Pressure Threshold

		Mean	SD	Significance (Two-Sided P)	Effect Size (Point Estimate)
Isometric	Pre Right	4.81	1.68		
	Post Right	4.72	1.44	0.767	0.058
	Pre Left	4.76	2.35		
	Post Left	4.57	1.41	0.652	0.088
NecksLevel	Pre Right	4.66	1.53		
	Post Right	5.13	1.62	0.004	0.618
	Pre Left	4.51	1.25		
	Post Left	4.96	1.63	0.010	0.535

Pain Pressure Threshold

- No statistically significant difference found following isometric exercise.
- A significant difference found in both right and left PPT following isotonic exercise (medium effect size)

Limitations

Internal Validity:

- Small sample size, below A priori
- Lack of blinding of researchers

External Validity:

- Healthy sample without pain and limited age range
- Short-term study, no long-term follow-up

Conclusion and Clinical Relevance

- The use of the NecksLevel Device demonstrates a significant and moderate effect on inducing EIH.
- We will continue this project to fulfill the A priori number of subjects needed to strengthen findings.
- Future research is needed to assess the effects on a neck pain population.

References

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