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Comparison of Shoulder and Elbow Joint Position Sense Using a Vibration Stimulus

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GRANT INFORMATION SUMMARY

PRACTICAL SIGNIFICANCE

The results of this study suggest that the shoulder and elbow are controlled by different neuromuscular mechanisms; and this information may alter how rehabilitation interventions are prescribed.

STUDY BACKGROUND

Previous studies have used a vibration stimulus to elicit a reflex to measure the afferent contribution from muscle spindles to proprioception. The results of this past work have frequently been generalized to the whole body without considering that proprioception mechanisms may differ between joints. For instance, a recent study from our lab provided evidence that cryotherapy does not decrease shoulder joint position sense unlike that observed in the knee and ankle. Based on these findings the current study was developed to concurrently compare joint proprioceptive mechanisms being utilized at the elbow and shoulder.

OBJECTIVE

The purpose of this study was to establish if applying a mechanical vibration stimulus would affect shoulder and elbow joint proprioception.

DESIGN AND SETTING

This study instituted a within subjects repeated measures design. The independent variables were 2 joints (shoulder, elbow) and 2 vibration conditions (with, without). The dependent variables were variable error, absolute, and constant error. All testing was performed in the Athletic Training/ Sports Medicine Laboratory at the University of Florida.

SUBJECTS

Forty-eight healthy subjects from the university population (ht = 170.9 ± 8.6 cm, mass = 67.9 ± 11.8 kg, age = 20.6 ± 1.6 years) volunteered for this study.

MEASUREMENTS

Elbow and shoulder joint position sense was measured with and without a vibration stimulus (Figure 1). The difference between the target angle and the repositioned angle were recorded and three error scores (absolute error, constant error, and variable error) were calculated. A separate repeated measures ANOVA was used to analyze each error score at a significance level of 0.05.

RESULTS

A significant joint by treatment by angle interaction was identified for absolute error and constant error. The absolute error scores were significantly higher following vibration in the elbow [without 3.7° ± 2.6, with 14.7° ± 5.2, P = .002] and the shoulder [without 3.8° ± 2.0, with 8.0° ± 4.8, P > .001]. (Figure 2.) The elbow repositioning error was significantly higher than the shoulder repositioning error following the vibration stimulus condition. (Figure 2.)

Figure 1. Setup of shoulder proprioceptive testing with vibration stimulus applied to the posterior shoulder musculature.

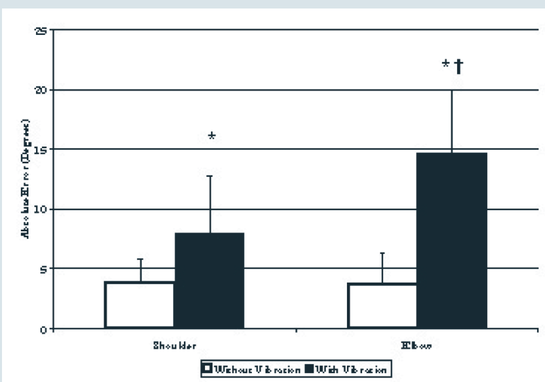

Figure 2. Graph represents diminished joint position sense with vibration on both joints. Significantly greater error was present when the vibration stimulus was applied to the elbow over the shoulder.
* = P < 0.01, indicates vibration causes more error in joint reposition sense for both joints.
† = P < 0.05, indicates vibration to the elbow joint causes more error in joint reposition sense than the shoulder joint.

CONCLUSIONS

The vibration stimulus significantly affected the repositioning in the elbow more than the shoulder. This suggests that clinicians should not assume proprioceptive control and afferent inputs are equal at both the shoulder and the elbow joints. Future research needs to compare proprioceptive testing and interventions between both shoulder and elbow joints.

Publication and Presentation List:

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Supporting and advancing the athletic training profession through research and education.

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