The Effect of Knee Extension Angle on Knee Joint Position Sense Between Genders

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INTRODUCTION
The ability for an individual to accurately sense limb position and movement is critical for proper muscle contraction, stability, and injury prevention [1]. Currently there are many inconsistencies between the proprioceptive acuity of males versus females when examining time to detect passive movement [2]. Specifically, these differences have been noted when there has been maximum tension placed on the ACL. However, these differences are not always present [3]. Further examination of joint position sense (JPS) between males and females may provide more information as to the differences in their respective proprioceptive acuity. Therefore, the purpose of this study was to examine the differences in knee JPS between males and females at both 30 and 60 degrees of knee extension in the dominant leg of healthy young adults.

METHODS
Forty-six subjects (22 males, 24 females) participated in the study; aged 19-25 years old, average height 172.7±8.4cm, and average mass 71.2±12.9kg. All subjects were recruited from the campus of Western Washington University.

An Apple iPod Touch with a preloaded customized software was utilized to measure joint position sense.

The data collection consisted of three position reproduction tasks with two different target angles for a total of six trials. When subjects arrived for testing, they were taken through a standard warm-up consisting of five minutes on a cycle ergometer. Immediately after the warm-up, subjects were outfitted with the iPod, via a neoprene sleeve, approximately 20 mm above the lateral malleolus. After the application of the iPod, subjects were seated on a massage table with shank hanging off, resting at 90 degrees of knee flexion (Fig. 1). There was about 2.54 cm of space between the subject’s popliteal surface and the edge of the table. Once the subject was seated they were given instruction on the procedure. Prior to testing, subjects were given two practice trials to fully understand the position reproduction test. Once testing began the iPod takes the subject through six randomized trials. Specifically, three trials to 30 degrees of knee extension and three trials to 60 degrees of knee extension. The difference in reproduction angle was recorded and the data was then analyzed as an absolute error between position and reposition. Because the initial position of the knee was 90 degrees, the iPod identifies this as zero degrees. Therefore, 30 degrees of knee extension corresponds to an actual knee angle of 120 degrees and 60 degrees of extension corresponds to an actual knee angle 150 degrees.

A 2x2 mixed analysis of variance (ANOVA) was used to analyze the difference between genders as well as knee extension angle.

RESULTS AND DISCUSSION
The mixed ANOVA revealed a significant main effect for position ($p = 0.007$) (Fig. 2). There was no significant main effect between males and females ($p = 0.225$). Furthermore, there was no presence of an interaction effect between gender and position and therefore there was no need to perform post-hoc tests. These results indicate that there is no difference in JPS between genders at positions within the knee’s mid-range of motion. For both males and females, the 30 degree position had greater accuracy than the 60 degree position.

CONCLUSIONS
The results indicate that there is no difference in JPS between males and females at positions within the knee’s mid-range of motion. Different results may have been seen at a position closer to maximum extension where more tension is placed onto the ACL.

REFERENCES