# SENSORIMOTOR CONTROL OF THE KNEE IN MALE AND FEMALE ATHLETES

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**KEY WORDS:** sensorimotor control, EMG, females, knee, quadriceps

**INTRODUCTION:** Evidence suggests that the female predisposition to knee injuries may be related to sensorimotor control (Hewett *et al.*, 2005). The purpose of this study was to compare the quadriceps and hamstrings muscle control strategies of male and female athletes using an established method of testing muscle control (Williams *et al.*, 2003).

**METHODS:** Twenty-four (12 males, 12 females) age and activity-level matched athletes with no history of noteworthy knee injury were the subjects of this study. All were regular participants in sports that require cutting, pivoting, and jumping. The experimental protocol required subjects to place a cursor over a target that appears randomly in 12 locations by generating force with fine control against a 6-axis load cell rigidly fixed to the shank. Testing was performed at 15°, 30° & 45° degrees of knee flexion. Electromyograms (quadriceps & hamstrings), knee angle, and tibiofemoral position were monitored continuously. Circular statistics were used to calculate a specificity index for each muscle that describes the degree of control associated with the muscle activity patterns. The testing order of the subjects' limbs and the knee angles was randomized.

**RESULTS:** A multivariate analysis of variance (MANOVA) with side and angle as within subjects factors and gender as a between subjects factor was used to test for differences in the 5 muscles' specificity indices. Females had significantly lower specificity indices than males for their vastus medialis (*P*<.001), rectus femoris (*P*=.044), and lateral hamstrings (*P*=.001) muscles, but similar specificity in other muscles. Females displayed significantly greater vastus medialis (*P*<.001) and lateralis (*P*<.001) activity than males at the same force level (Figure 1).

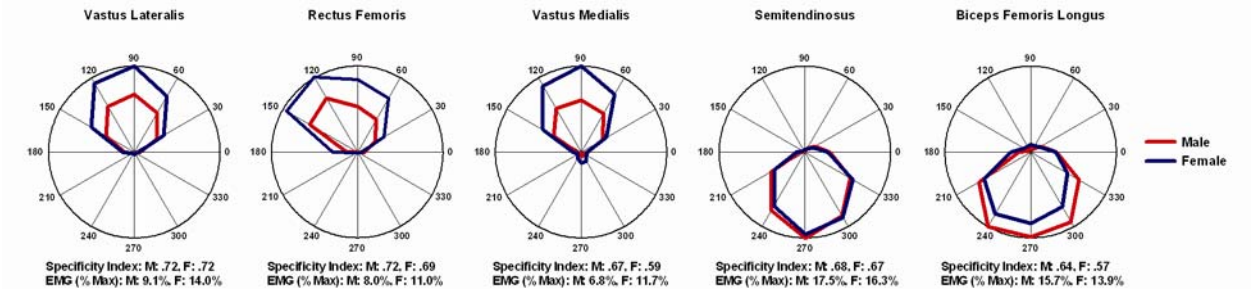


Figure 1: EMG Polar Plots of data collected at 30° of knee flexion.

**DISCUSSION AND CONCLUSIONS:** The differences in quadriceps muscle control observed between males and females suggest that they use different control strategies and that there are neurophysiologic differences by gender (e.g., the EMG-Force relationship differs). These findings may have important implications for gender-specific training and injury epidemiology.

**REFERENCES:**

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