INFLUENCE OF TRAINING HISTORY ON COACTIVATION DURING MAXIMAL EFFORT KNEE EXTENSION

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Introduction

Coactivation, or the simultaneous contraction of both the agonist and antagonist muscle during a is a mechanism used to increase joint stiffness which leads to increased stability. Traditionally coactivation is reported as a ratio using EMG to quantify the amount of coactivation. Previous literature suggests that trained people have less coactivation compared to their sedentary counterparts when using this EMG ratio. However, coactivation ratios from agonist/antagonist muscle torques may give a more accurate assessment of this coactivation because the primary outcome of coactivation, increased joint stability, is a mechanical not neurological phenomenon.

Using an EMG to torque model, we plan to investigate the individual torques produced by both the agonist and antagonist muscles during maximal concentric knee extension to better understand antagonist muscle coactivation.

Methods

EMG for two knee extensor muscles (VL, VM) and two knee flexor muscles (BF, ST) and net knee extensor torque were recorded during maximal effort knee extension at 30, 90, and 150 degrees per second on a dynamometer in trained (regularly perform resistance training on the lower extremity for the past 6 months) or sedentary (no lower extremity exercise) subjects. EMG data were analyzed to determine coactivation ratios (agonist/antagonist).

Results

![Graph showing EMG data for untrained and trained individuals.]

Equations

\[ M_{\text{agonist}} = K_M \cdot EMG_{\text{agonist}} \]
\[ M_{\text{antagonist}} = K_M \cdot EMG_{\text{antagonist}} \]
\[ \text{Ratio} = \frac{EMG_{\text{agonist}}}{EMG_{\text{antagonist}}} \]

Conclusion

As expected, trained subjects produced lower EMG coactivation ratios. However, when agonist and antagonist torques were calculated the ratio of antagonist to agonist torque was similar in trained vs. sedentary individuals. Trained individuals may not suffer a reduction in knee joint stability due to the increased force per unit EMG of trained muscle. Given this new information, trained people actually show similar levels of coactivation as sedentary based on mechanical output.

References