

Quadriceps Muscle Activity in Response to Slow and Fast Perturbations following Fatiguing Exercise

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Abstract : Introduction: Quadriceps femoris muscle is frequently involved in various movements e.g., jumping, landing) during sport and/or daily activities. During ballistic movement when individuals are faced with unexpected knee perturbation, fast twitch muscle fibers contribute to force production to stabilize knee joint. Fast twitch muscle fiber is more susceptible to fatigue and therefor may reduce the ability of the quadriceps muscle to stabilize knee joint during fast perturbation. Aim: The aim of this study was to investigate the effect of fatigue on postural response of the knee extensor muscles to fast and slow perturbations. Methods: Fatigue was induced to the quadriceps muscle using a KinCom Isokinetic Dynamometer (Chattanooga, TN). Bipolar surface electromyography (EMG) signals were simultaneously recorded from quadriceps components (vastus medialis, rectus femoris, and vastus lateralis) during pre- and post-fatigue postural perturbation performed at two different velocities of 120 ms and 250 mes. Results: One-way ANOVA showed that maximal voluntary knee extension force and time to task failure, and associated EMG activities were significantly reduced after fatiguing knee exercise ($P < 0.05$). Two-ways ANOVA also showed that ARV of EMG during backward direction was significantly larger than forward direction ($P < 0.05$), and during fast-perturbation it was significantly higher than slow-perturbation ($P < 0.05$). Moreover, ARV of EMG was significantly reduced during post fatigue perturbation, with the largest reduction identified for fast-perturbation compared with slow perturbation ($P < 0.05$). Conclusion: A larger reduction in muscle activity of the quadriceps muscle was observed during post fatigue fast-perturbation to stabilize knee joint, most likely due to preferential recruitment of fast twitch muscle fiber which are more susceptible to fatigue. This may partly explain that why knee injuries is common after fast ballistic movement.

Keywords : electromyography, fast-slow perturbations, fatigue, quadriceps femoris muscle

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