TACSM Abstract

Modified Torque Output and Lower Leg Muscle Electromyography after Passive Stretching

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ABSTRACT

Increased stretch of the plantar flexor muscles is reported to increase tissue laxity of the tendons and reduces force output, but in other studies the tendon biomechanical properties are not affected and force output is not changed after stretch. **PURPOSE**: To examine the force output and muscle electromyography activity of lower leg muscles to a prolonged passive stretch. **METHODS**: Five participants (20.6 ± 1.1 yrs: 1.78 ± 0.1 m:, 80.6 ± 9.9 kg) performed maximal plantar and dorsi flexion isometrically while secured to an isokinetic dynamometer. They were seated upright with ~90 deg hip flexion. The knee was fixed at ~30 deg. Participants performed three maximal voluntary isometric efforts (MVIE) of plantar and dorsi flexion, respectively, in +15 deg (plantar flexion) and -15 deg (dorsi flexion) position (0 deg is neutral). Then, passive stretching of the plantar flexors was performed while the ankle joint was positioned at -30 dorsi flexion for 10 min. Immediately after the 10 min passive stretch MVIE were performed in plantar and dorsi flexion. Peak and average torque values were compared, as surface electromyography (EMG) were collected from medial gastrocnemius (MG), lateral gastrocnemius (LG), soleus (SOL), peroneus longus (PL), and tibialis anterior (TA) muscles. Surface EMG signals were normalized (NEMG) to the maximum values in the pre MVIE tests. Torque and NEMG values were compared between pre and post-stretch tests, and between ankle positions using a 2 x 2 ANOVA. Relative passive torque (RPT) values, compared to initial values, were compared over the 10 min stretch using a one-way ANOVA. Alpha was set at $p \leq 0.05$. **RESULTS**: RPT significantly decreased over time (1.0 to 0.73 ± 0.07, $p < 0.01$). Peak (dorsi: +15 -38.0 ± 8.6 Nm, -15 -11.5 ± 5.4 Nm; plantar: +15 106.7 ± 26.3 Nm, -15 177.7 ± 48.0 Nm) and average (dorsi: +15 -34.4 ± 8.0 Nm, -15 -8.3 ± 5.0 Nm; plantar: +15 87.9 ± 23.5 Nm, -15 139.6 ± 43.3 Nm) torques both had significant position x test interactions ($p< 0.001$). Only the TA (pre: 0.49 ± 0.1, post: 0.42 ± 0.1) and SOL (pre: 0.52 ± 0.2, post: 0.43 ± 0.1) NEMG were significantly different between MVIEs ($p < 0.001$ and 0.005, respectively). **CONCLUSION**: Torque output after passive plantar flexor stretch significantly reduces force transmission ability of the plantar flexor muscles. Although force output was reduced, most of the plantar flexor muscles were able to maintain the same EMG level of activation, indicating that the muscle architecture may not change with the stretch. This may suggest that the passive structures within the musculotendonous units have become more compliant as the stretch invoked stress-relaxation of the viscoelastic tissues.