THE ACUTE EFFECTS OF STATIC STRETCHING ON FORCE GENERATING CHARACTERISTICS OF SKELETAL MUSCLE
Cannavan Dale, Miller Stuart C., Blazevich Anthony J. (Brunel University, United Kingdom)

Considerable debate has arisen as to the effect of static stretching on subsequent muscle force production. Speculative mechanisms for force reduction include altered neural drive, impaired muscle contraction and changes in the force-length relationship, possibly due to increased tendon compliance. However, most studies that have found stretch induced decrements have used stretches of long duration. Therefore, the purpose of this study was to investigate voluntary and elicited torque in human muscle after passive stretches of a duration that more closely resembles those typically performed prior to exercise.

After a standardised warm-up, changes in maximal isometric plantarflexion torque, muscle activation and muscle contractile properties were assessed after 5-min of passive rest and a passive stretch routine in eighteen active individuals (9 male, 9 female). Maximal isometric contractions (MVCs) were performed on an isokinetic dynamometer, with the ankle set at the anatomical position, before and after four 45-s stretches; MVC torque was corrected to accommodate the effects of co-contraction of the tibialis anterior. Stretches were performed by passively dorsiflexing the ankle joint at 5°/s to the individual’s tolerable limit. Both before the MVCs and after stretching, ankle joint passive torque was measured by passively rotating the ankle from 25° plantarflexion to 25° dorsiflexion at 2°/s. Electromyography of the gastrocnemius medialis, soleus and tibialis anterior was recorded throughout the procedure. Muscle activation was assessed using the interpolated twitch technique. A twitch doublet (interpulse interval of 10 ms) was superimposed on the MVC upon a visible plateau in torque, as well as both before and 1.5-s after each MVC. Activation was calculated using the equation: (superimposed twitch/post twitch) X 100. Peak twitch torque (PTT), time to peak torque (TPT), electromechanical delay (EMD) and half-relaxation time (1/2 RT) were measured from the elicited twitch responses.

There was no change in passive torque after 5-min rest or the stretch routine. During stretch, there was a passive torque decrease (approx 9%), indicative of stress-relaxation. There was no change after rest or stretching in peak voluntary torque (-0.07% and -2.49%, respectively; p>0.05), muscle activation (1.56% and -0.16% respectively; p>0.05) and EMG. There was no effect on PTT, TPT and EMD, although there was a significant decrease in 1/2 RT (-6.75%; p=0.017) pre-to post-stretch.

Four 45-s stretches applied to the triceps surae did not affect voluntary torque production or muscle activation. There were also no changes in muscle twitch properties, although a decrease in 1/2 RT is suggestive of a faster re-uptake of Ca2+ or a decrease in muscle viscosity after stretch. Therefore, stretches of this duration have no effect on muscle force and activation.