

NOVEL MECHANISMS OF RANGE OF MOTION IMPROVEMENT IN RESPONSE TO PLANTAR FLEXOR STRETCH TRAINING IN MEN

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The process of neuromuscular adaptation in response to muscle stretch training has not been clearly described. In the present study, changes in muscle (at fascicular and whole muscle levels) and tendon mechanics, muscle activity and the excitability of the motor neurone pool were examined during plantar flexor stretches after 3 wk of twice-daily stretch training (4 × 30-s straight-knee calf muscle stretches; 41.0 ± 1.2 sessions).

No changes were observed in a control group (N=9), however stretch training elicited a 19.9% increase in dorsiflexion range (ROM) and 28% increase in passive joint moment at volitional stretch termination (N=12). Only a trend toward a decrease in passive moment during stretch (-9.9%, p=0.15) was observed and no changes in maximum EMG amplitude, EMG amplitude at stretch termination or joint angle at EMG onset were detected during a maximal stretch. Decreases in H_{max}:M_{max} elicited by tibial nerve stimulation were observed at plantar flexed (gastrocnemius medialis and soleus) and neutral (soleus only) joint angles, but not with the ankle dorsiflexed (i.e. with the muscle on stretch). There was an increase in muscle (12.2%) and fascicle (22.6%) strain and a decrease in muscle stiffness (-18%) during stretch to a target joint angle, and an increase in muscle length at stretch termination (13%) without a change in fascicle rotation, tendon elongation or tendon stiffness after the training. A lack of change in peak active joint moment and RFD at any joint angle was taken to indicate a lack of change in series compliance of the muscle-tendon unit.

These results indicate that improvements in ROM were underpinned by increases in the maximum tolerated passive joint moment ('stretch tolerance') and muscle/fascicle elongation rather than by changes in volitional muscle activation or motor neurone pool excitability. Changes in the muscles' passive elastic properties are not likely to be explained by changes within the series elastic component.