Acute effects of Achilles tendon vibration on soleus and tibialis anterior spinal and cortical excitability

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Abstract: Prolonged vibration is known to alter muscle performance. Attenuation of Ia afferent efficacy is the main mechanism suggested. However, changes in motor cortex excitability could also be hypothesized. The purpose of the present study was therefore to analyze the acute and outlasting effects of 1 h of Achilles tendon vibration (frequency, 50 Hz) on the soleus (SOL) and tibialis anterior (TA) neuromuscular excitability. Spinal excitability was investigated by means of H-reflexes and F-waves while cortical excitability was characterized by motor evoked potentials (MEPs) obtained by transcranial magnetic stimulation. Twelve subjects performed the experimental procedures 3 times: at the beginning of the testing session (PRE), immediately after 1 h of Achilles tendon vibration (POST), and 1 h after the end of vibration (POST-H). Prolonged vibration led to acute reduced H-reflex amplitudes for SOL only (46.9% ± 7.7% vs. 32.8% ± 7%; p = 0.006). Mainly presynaptic inhibition mechanisms were thought to be involved because of unchanged F-wave persistence and amplitude mean values, suggesting unaffected motoneuronal excitability. While no acute effects were reported for SOL and TA cortical excitability, both muscles were characterized by an outlasting increase in their MEP amplitude (0.64 ± 0.2 mV vs. 0.43 ± 0.18 mV and 2.17 ± 0.56 mV vs. 1.26 ± 0.36 mV, respectively; p < 0.05). The high modulation of Ia afferent input by vibration led to changes in motor cortex excitability that could contribute to the enhancement in muscular activation capacities reported after chronic use of tendon vibration.

Key words: Achilles tendon, vibration, Hoffmann reflex, F-waves, transcranial magnetic stimulation.