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Spinal And Corticospinal Adaptations Following Sensorimotor Training: 990 *Board #212* 9:00 AM - 10:30 AM

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It was supposed that sensorimotor training of the lower limb causes neural adaptations that lead to improved balance control and strength capability; however, the sites of these adaptations were not identified.

PURPOSE

To determine spinal and corticospinal adaptations after a specific sensorimotor training.

METHODS

H/M ratios from soleus muscle and H-reflexes conditioned by sub threshold TMS were recorded before and after 4 weeks of sensorimotor training (n=11) and in a control group (n=11). Muscular and neuromuscular adaptations were identified by electrical nerve stimulation (single isometric twitches) and maximal voluntary isometric plantarflexions. Surface EMG was analysed by determining mean amplitude voltage and median frequency of different time intervals throughout the strength test. Pre- to posttraining changes were determined with Wilcoxon signed-rank tests for paired samples.

RESULTS

Maximal voluntary isometric plantarflexion strength did not change after training, however considerable increases in mean (±SE) rate of force development (679 ± 74 vs. 752 ± 65 Nm/s, $p<0.05$) and contractile strength were observed (21.9 ± 6.1 % and 18.8 ± 4.9 % for time intervals 0-50 and 50-100ms, $p<0.05$). Peak torque, contraction time and maximal rate of torque development of single twitches as well as the corresponding Mmax peak-to-peak amplitudes for M. gastrocnemius medialis and M. soleus remained unchanged after training. For maximal voluntary isometric plantarflexions, mean amplitude voltage remained unchanged after training, whereas median frequencies increased for M. soleus (85.2 ± 5.9 vs. 95.6 ± 6.5 Hz, $p<0.05$) and M. gastrocnemius (96.8 ± 12.1 vs. 121.2 ± 9.9 Hz, $p<0.05$) at the beginning of muscular action (0-200 ms). Hmax/Mmax ratios decreased (0.50 ± 0.04 vs. 0.40 ± 0.04, $p<0.05$) while early facilitation (interstimulus interval TMS vs. H-Reflex = -3 ms) of conditioned H-Reflexes increased (24.3 ± 3.6 % of Mmax vs. 28.4 ± 3.9 % of Mmax, $p<0.05$). No changes were observed for the control group and for M. tibialis after sensorimotor training.

CONCLUSIONS

Increased explosive strength after 4 weeks of sensorimotor training can mainly be attributed to an enhanced neural drive. On a motoneural level a change in discharge rate seem more likely than a change in recruitment. Decreased H/M ratios and increased TMS conditioned H-reflexes clearly indicate that both, spinal and corticospinal levels are involved in these adaptations. However, enhanced contributions from corticospinal projections are more likely to contribute to increased explosive strength capability than decreased Ia afferent input.