Influence of Electrical Stimulation on H-Reflex

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Introduction
H-reflex is a reflex reaction of the muscle much like the knee jerk but is evoked by electrical stimulation to the sensory fibers. Researchers have used this reflex to study spasticity in patients with stroke, spinal cord injury and brain trauma. These patients lose control of muscle response and produce strong reflexes that can be so bad that they are unable to walk without continuous shaking. It is believed that applying low intensity electrical current on the leg muscles, for a period of time, reduces spasticity and thus smaller reflex. This reduced reflex effect can also be seen on able-bodied people. The objective of this project is to test on able-bodied people how different parameters of surface functional electrical stimulation (FES) affects the intensity of H-reflex on the calf gastrocnemius muscle.

Method of Experiment
H-reflex varies between people and so the recruitment curve was obtained first. It shows the H-reflex as well as the muscle wave along a range of stimulus intensities. The maximum of the muscle wave (Mmax) represents the total motoneuron pool, i.e. the maximum muscle activation, that a person has and only 20% of it will be used when eliciting the H-reflex.

Results
The results of five subjects show that H-reflex unexpectedly increased non-linearly in amplitude immediately after FES. The averaged increased of each of the H-reflex compared to Href are: H1 = 25%, H2 = 20%, H3 = 28% and H4 = 48%. It was also found that the amplitude range of H-reflex deteriorates with successive experimental trials as the percentage standard deviation was 77%.

The increase in reflex is believed to be related to the FES facilitating the corticospinal pathways. Steins et al [1] found that short term FES stimulations increased the Motor Evoked Potentials ( MEP) in the motor cortex of the brain and correlates to the increase of H-reflex.

The experiment was repeated on one subject with 50% of Mmax [2] and the results obtained were more consistent with what was expected. The H-reflex decreased by: H1 = 9%, H2 = 12%, H3 = 0% and H4 = -9% and the standard deviation is 17%.

Conclusion
H-reflex increases after FES when the reflex was evoked at 20% of Mmax. Although this was not as expected, there are theories which may explain so. On the other hand, stimulating at 50% of Mmax shows a decrease in H-reflex. It also shows a more consistent H-reflex with lower standard deviation. The contrasting results of increase and decrease in H-reflex after FES shows that further study should be done to fully understand the effect of electrical stimulation on reflex.

References