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Interventions to Prevent Serial Sarcomere Loss Caused by Electrical Stimulation in Rabbit *Triceps Surae* Muscles

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Abstract

Patients with spastic Cerebral Palsy (CP) suffer from involuntary muscle contractions due to lesions in the brain. This appears to cause muscles to become very short and stiff, limiting the range of motion of a joint. This hypoextensibility may be explained by a decrease in serial sarcomere number. It has been shown in our lab that a 10 hour electrical stimulation period decreases serial sarcomere numbers in the triceps surae group by approximately 25%[1]. The rapid decrease suggests that electrical stimulation is a very strong regulator of serial sarcomere number. In an attempt to abolish the effects of muscle spasms, CP patients use casts or splints to prevent muscle shortening. Currently, the effect of casting on sarcomere number is not known. Therefore, the purpose of this study is to test if casting a limb will prevent sarcomere loss. In a New Zealand White Rabbit (n=1), the hind limb was placed in a plaster cast at a 70° dorsiflexion position. The leg was then stimulated via the tibial nerve (20 Hz, 4 times α-motorneuron threshold) for 10 hours. The contralateral limb served as the control where the tibial nerve was transected to ensure no cross-over training effects. The Soleus, Medial Gastrocnemius (MG), Plantaris, and Extensor Digitorum Longus (EDL) muscles were extracted and analyzed for sarcomere number. Analysis across different regions of the muscles showed a decrease of 9.6±7.4% in the MG, 6.9±6.6% in the Plantaris, 33.5±6.2% in the Soleus, and 4.4±4.1% in the EDL. No change was expected in the EDL, as it was not stimulated. The MG and Plantaris appeared to have very little decrease in serial sarcomere number, while the Soleus had a surprisingly large decrease. More experiments are required for conclusive results.

References

1. Yamamoto, M., Leonard, T., Herzog, W. (2012). Rapid Serial Sarcomere Loss Caused by Electrical Stimulation in Rabbit Triceps Surae Muscles. Presented at the annual meeting of the Canadian Society of Biomechanics, Burnaby, BC.