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Effect of Intermittent Passive Stretching on Serial Sarcomere Loss Caused by Electrical Stimulation in Rabbit *Triceps Surae* Muscles

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Abstract

Most individuals with Cerebral Palsy suffer from muscle spasticity. These involuntary muscular contractions are caused by lesions in the brain which develop into hypoextensibility of joints. In a previous study, Tabary and Tardieu found a 25% loss of serial sarcomeres in guinea pig Soleus over 12 hours of electrical stimulation[1]. Thus the hypoextensibility seen in patients may be caused by a decrease in serial sarcomere numbers due to the chronic electrical stimulation. A current method of treatment for spastic Cerebral Palsy patients includes a passive stretch protocol adapted for each patient. In order to observe the effect of passive stretching treatments we conducted an experiment on a New Zealand White Rabbit animal model (n=4). The experimental legs' Medial Gastrocnemius, Plantaris, and Soleus muscles were electrically stimulated at the tibial nerve for 10 hours (20 Hz, 1.5-4.5 V). The stretch protocol employed included a 5 min stimulation free passive stretch period every 55 minutes that dorsi-flexed and plantar-flexed the ankle joint alternatively for 2 seconds. The contralateral leg was used as a control where the tibial nerve was transected to prevent any stimulation cross-over effects. At the end of the experimental period, rabbits were euthanized and the hind limbs were prepared for analysis through a muscle fixation and connective tissue digesting process. Fascicles were then teased out from the target muscles and mounted on slides. Fascicle lengths were measured by a camera and software system and sarcomere lengths were examined through laser diffraction. Results showed a 9.4$\pm$2.8% serial sarcomere loss in the Medial Gastrocnemius, a 3.5$\pm$3.3% loss in the Plantaris, and a 14.7$\pm$10.6% loss in the Soleus. These results indicate that serial sarcomere loss is not eliminated, but prevented to a certain extent.

References

1. Tabary, J., Tardieu, C., Tardieu, G., Tabary, C., Experimental Rapid Sarcomere Loss with Concomitant Hypoextensibility, Muscle & Nerve, Issue 4, 1981, pp. 198-203.