The acuity of joint position sense in elite ballet dancers

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INTRODUCTION: It has been recognized that ballet dancers have a high postural balance ability compared with other athletes and controls [1]. On the other hand, there are reports that dancers have less balance control (larger body sway) when their eyes are closed, where increased demand of proprioceptive information [2]. Ballet dancers tend to have large range of motion (ROM) on the ankle joint and elongated connective tissues because of the usage of the pointe shoe. Several studies have demonstrated that people who have joint hypermobility or ankle instability have less joint position sense [3]. We hypothesized that ballet dancers have less acuity of joint position sense (JPS) because of the larger ROM and decreased tonic stretch reflex.

METHOD: Eight female ballet dancers (mean age 23.9 ± 3.5 years old) and eight women who didn’t have any experience of ballet (mean age 18.6 ± 1.4 years old) participated in this study. JPS was tested by using passive position reproduction test. The protocol was approved by the Ethics Review Committee for Experimental Research with Human Subjects of the Graduate School of Arts and Sciences, The University of Tokyo. We set 0% at the full dorsiflexion and 100% at the full plantar flexion, and calculated the target position (10% - 90%) for each subject, since the ankle joint ROM expected to be different between groups. We obtained the ankle joint angle data from an electrogoniometer and surface electromyographic (EMG) signal from the soleus, medial and lateral head of gastrocnemius, and tibialis anterior muscles. The EMG data was recorded during JPS test to check if there were no voluntary contraction for the joint reproduction. Also, tonic stretch reflex was measured by stretching planter-flexor muscles manually.

RESULTS: Ballet dancers had significantly larger ROM than the control and had more acuity on JPS, especially on middle range (50% and 60%) where the control had poor JPS. Dancers showed decreased tonic stretch reflex.

CONCLUSION: This result suggests that the acuity of JPS of ballet dancers is related to the expected higher ability of somatosensory information processing at the supraspinal nervous centers than the amount of sensory input to the spinal cord.

References: