DYNAMIC EXERCISE INCREASES HAND AND WRIST VOLUME

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It is well known that during exercise, muscle contraction aids return of venous blood to the heart. However, it is less known how repetitive dynamic exercise affects limb volume. Therefore, the purpose of our study was to investigate hand and wrist volume before and after repetitive dynamic hand exercise. We hypothesized that after repetitive dynamic hand exercise, hand and wrist volume (HWV) will increase as a result of expansion of exercising muscle. Five men (age, 34.6±9.0 yr; height, 173.0±3.5 cm; body mass, 67.8±6.8 kg, mean±S.D.) volunteered for this study. HWV was measured with a hand volumeter before and immediately after dynamic exercise. Initially during rest, HWV was measured after the hand was passively hung for 5 minutes. Dynamic exercise was performed by repetitive squeezing and relaxation of the hand around an elastic ball at a maximum frequency. A diameter of hand-sized ball was 7 cm and commercially available as a therapeutic hand ball. The exercise consisted of 6 times 30 seconds exercises with 10 seconds of rest between exercises. In order to standardize the intensity of hand exercise, maximum voluntary contraction (MVC) was measured with a hand grip dynamometer. For MVC measurement, subjects exerted maximum force for 3 seconds. Measurements were repeated three times with at least one-minute rest period between bouts, and the mean value among the measurements was calculated for MVC. MVC was 36.4±5.9 kg. Data are presented as means±S.D. HWV before and after exercise were compared with paired t-test. Statistical significant was set at p<0.05. After the repetitive dynamic hand exercise, HWV increased significantly from 447.2±26.4 ml to 457.1±27.4 ml (p<0.005), which represents an increase of 2.2±0.7 % of resting HWV (p<0.005). There was no significant correlation between increased HWV and MVC over this limited range of MVC. These results suggest that repetitive dynamic exercise with low intensity increases fluid content of the hand and wrist. The higher HWV after exercise may be caused by increased interstitial fluid volume, capillary volume and venous volume in post-exercise hand and wrist tissues. During repetitive exercise, an increase in actual fluid content of muscle is related to an increase in intramuscular pressure during relaxation periods (Crenshaw et al. 1995). Therefore, we suggest that increased HWV after repetitive exercise may be primarily related to elevated intramuscular fluid volume.

Keywords: Exercise Physiology, Muscle Physiology, Hand

12th Annual Congress of the ECSS, 11–14 July 2007, Jyväskylä, Finland