PROTECTIVE EFFECT PRODUCED BY LOW INTENSITY LENGTHENING OR MAXIMAL ISOMETRIC CONTRACTIONS AGAINST MAXIMAL LENGTHENING CONTRACTIONS

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Exercise consisting of lengthening contractions (eccentric exercise) confers protective effects against subsequent bouts of the same or more demanding exercise. We recently reported that a low-intensity (40%) eccentric exercise conferred 20-60% protection against a high-intensity (100%) exercise performed 2-3 weeks later (Chen et al. JAP 2007). It is also shown that a light eccentric exercise with a dumbbell set at 10% of maximal isometric strength (MVC) induces some protection against a subsequent eccentric exercise with a dumbbell set at 40% of MVC carried out 2 days later (Lavender and Nosaka JSAMS in press). However, it is unknown whether the protective effect conferred by the low-intensity eccentric exercise lasts more than 2 days. Some animal studies reported that isometric exercise produced protective effect against eccentric exercise; however, this has not been shown in human studies. Thus, the aim of this study was to test the hypotheses that eccentric exercise with a light dumbbell or maximal isometric exercise would confer protection against maximal eccentric exercise. Five groups of subjects (13 men/group) performed two bouts of exercise separated by 2 weeks. In the initial bout, two groups performed 30 maximal isometric contractions either at 90° (ISO-90°) or 160° (ISO-160°). Other three groups performed 30 lengthening contractions with a dumbbell set at 10% (ECC-10%), 20% (ECC-20%) or 100% of MVC (ECC-100%), in which the elbow joint was extended from 50° to 170°. All groups performed the second exercise bout consisting of 30 lengthening contractions using a dumbbell of 100% MVC. Changes in MVC, range of motion (ROM), upper arm circumference (CIR), plasma creatine kinase (CK) activity and myoglobin (Mb) concentration, and muscle soreness after each bout were compared among the groups by a two-way repeated measures ANOVA. Comparison between the first bout of the ECC-100% group and the second bout of each group was also made by a two-way ANOVA. The initial bout did not result in significant (P<0.05) changes in ROM, CIR, CK, and Mb for the ISO-90° and ECC-10% groups, and the changes in all measures was significantly greater for the ECC-100% group compared with other groups. Changes in all measures after the second bout were significantly smaller for the ECC-100% group than other groups. When comparing the first bout of the ECC-100% group and the second bout of each group, no significant differences in all measures existed for the ISO-90° group, and no significant differences in MVC, ROM, and CIR for the ECC-10% group, suggesting that protection conferred by ISO-90° and ECC-10% was negligible. In contrast, the ISO-160° and ECC-20% groups showed significantly (P<0.05) smaller changes for all measures, but the protective effect shown by the groups was significantly (P<0.05) less (50-80%) than that of the ECC-100% group. These results suggest that ISO-160° and ECC-20% conferred minor protection against the maximal eccentric exercise.

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