LOW-VOLUME-COMBINED EXERCISE TRAINING PREVENTS IMMOBILIZATION-INDUCED DECREASE IN MUSCLE FUNCTION AND BLOOD FLOW RESPONSE

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PURPOSE: To determine whether upper limb immobilization (IMM) decreases muscle function and muscle blood flow response and whether low-volume-combined exercise training during upper limb IMM preserves muscle function and muscle blood flow response.

METHODS: Seventeen male volunteers participated in the experiment after having been approved by the institutional ethical committee and obtained a written informed consent. They were divided into three groups (Immobilization, IMM-G (n=5); IMM with strength training, IMM+TR-G (n=6); and IMM with endurance and strength training, IMM+ESTR-G (n=6)). Strength training consisted of intermittent isometric (2sec on /2sec off) strength [70% of maximum voluntary contraction (MVC), 10 times], whilst endurance exercise training consisted of one repetition per 1 sec. of 30% MVC. Non-dominant arm was immobilized with a cast for 3 weeks. Exercise training was performed 2 times a week. Endurance exercise test and MVC measurement were performed before and after IMM. The blood velocity and vessel diameter (D) of the brachial artery were measured using ultrasonic Doppler and B-mode methods at rest and immediately after endurance test. Blood flow (BF) was calculated from the blood velocity and D. Changes in BF (Delta BF) were calculated by subtracting resting BF from BF immediately after endurance test.

RESULTS: The MVC for IMM-G (pre, 40kgw; post, 32kgw) and IMM+TR-G (pre, 44kgw; post, 39kgw) were significantly decreased after IMM. On the other hand, the MVC for IMM+ESTR-G (pre, 42kgw; post, 44kgw) was maintained after IMM. Endurance performance was 66 sec, on average, (pre-IMM) and 58 sec (post-IMM) for IMM-G, 54 sec (pre-IMM) and 49 sec (post-IMM) for IMM+TR-G, and 54 sec (pre-IMM) and 66 sec (post-IMM) for IMM+ESTR-G. There was a significant difference in the changes in endurance performance after IMM between IMM-G and IMM+ESTR-G and between IMM+TR-G and IMM+ESTR-G. Resting D was 3.70 mm (pre-IMM) and 3.39 mm (post-IMM) for IMM-G, 4.02 mm (pre-IMM) and 4.09 mm (post-IMM) for IMM+TR-G, and 3.92 mm (pre-IMM) and 3.85 mm (post-IMM) for IMM+ESTR-G. D did not show any significant change pre- and post-IMM for three groups. Resting BF showed no change for IMM-G (pre, 73ml/min; post, 71ml/min; rest, 120ml/min) and IMM+ESTR-G (pre, 89ml/min; post, 110ml/min). Delta BF was decreased by 43% for IMM-G (pre, 479ml/min; post, 260ml/min) and by 32% (pre, 400ml/min; post, 270ml/min) for IMM+TR-G. Delta BF for IMM+ESTR-G showed no change after IMM.

CONCLUSION: Low-volume-combined exercise training during IMM periods was effective in preserving muscle function and muscle BF.

Keywords: Blood Flow, Training, Immobilisation

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