EFFECTS OF 2 WEEKS OF IMMobilization ON Strength AND NEUROMUSCULAR Activation IN YOUNG AND OLD HEALTHY MEN

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Introduction

Human skeletal muscle is a highly adaptable tissue, responding to multiple types of influence. Aging can have a markedly effect on quantitative as well as qualitative properties of skeletal musculature, including the age-related loss in muscle mass, referred to as sarcopenia. However, sarcopenia is modulated by other factors, and especially the level of physical activity seems to be a potent factor, e.g. in relation to hospitalization or reduced physical activity level in general.

Our objective was to study the effect of two weeks of limb immobilization on changes in muscle strength and neuromuscular activation in healthy young and old men.

Methods

Subjects: Eleven young (YM, 20-26 yrs) and nine old men (OM, age 63-73 yrs), with a low-moderate activity level.

Immobilization: Randomized unilateral whole-leg casting (imm), and contralateral leg serving as control (ctrl).

Maximal muscle torque: Maximal voluntary isometric torque (MVC) of the knee extensors was determined using a custom-build dynamometer, with the knee joint angle at 90° and with the lower leg attached to a strain-gauge.

Neuromuscular activation: Electrically evoked doublet twitches was superimposed prior to (resting), during (superimposed) and after MVC (potentiated). Estimation of muscle activation was determined as: activation (%) = (1 – (superimposed twitch / potentiated twitch)) x 100.

Testing: Subjects was tested on imm and ctrl leg before (pre) and after (post) the immobilization period.

Statistics: Non-parametric tests was used for statistics. The level of significance was p<0.05.

Results

Maximal muscle torque: At pre and post, YM had significantly higher MVC values than OM in both imm and ctrl leg.

In imm leg, MVC decreased significantly in both YM (20.3%, p<0.05) and OM (16.0%, p<0.05, respectively), although the change only tended to be larger in YM than in OM (p=0.057).

Neuromuscular activation: At pre, we observed no difference between YM and OM in either imm or ctrl leg. At post however, OM had a significantly lower neural activation than YM in imm leg (80.8% vs. 88.6%, p<0.05), with a similar tendency in ctrl leg (82.9% vs. 88.9%, p=0.062).

In imm leg, neural activation remained unaltered in both YM and OM, although the latter group had a tendency for a lower activation after immobilization (7.0% decrease from 86.9% to 80.8% activation, p=0.069).

Discussion

The present data demonstrate that physical inactivity, induced by two weeks of whole-leg casting, results in significant decreases in normal muscle contraction strength, with a somewhat equal effect in YM and OM. In contrast to expected, neuromuscular activation remained unaltered in both YM and OM. However, the tendencies for a reduced neuromuscular activation in OM compared to YM after immobilization may indicate that younger persons adapts primarily at the muscular level, whereas older people adapts both at a muscular and a neural level, respectively.

Keywords: Ageing, Immobilisation, Neuromuscular Physiology