



The Accelerated Rehabilitation of the Injured Athlete

Muscle strength, volume and activation following 12-month resistance training in 70 year old males

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Introduction

Previous work by our group has shown that plantar flexor maximal voluntary contraction (MVC) torque normalised to muscle volume (MVC/VOL) is lower in older compared to younger males. This was found to be largely the result of incomplete agonist muscle activation in the elderly (2). The present study tested the hypothesis that strength training would result in a modulation of activation capacity, through an increase in neural drive to the agonist muscles, thereby increasing torque per unit of muscle volume. MVC/VOL.

Methods

Thirteen elderly males aged 70 years and over (age 73.1 ± 12 years, range 70 - 82 years), undertook a 12 month training programme which involved aerobic, resistive, stretching and tai-chi exercises. Exercise training consisted of supervised and home based exercise sessions. The supervised sessions (2/wk) included the use of resistance training equipment (leg press, leg extension, chest press, seated row and seated calf raise) as well as elastic exercise bands of variable resistances. Workload began with 2 sets of 8-10 reps at 80% of 8RM and was progressively increased to 3 sets of 8-10 reps at 8RM. The home based sessions consisted of Tai-chi, a variety of body weight and elastic band resistance exercises and a 20-40 minute brisk walk. Another eight males (age 74.0 ± 4.7 years, range 70 - 82 years), who maintained their habitual physical activity levels for the same 12-month period as the TRN group acted as controls (CTRL). PF MVC was assessed using isometric contractions at an ankle joint angle of -20° . Agonist muscle activation was calculated using a ratio of supramaximal doublet torque obtained during, and post MVC. Coactivation was measured as the ratio of tibialis anterior electromyography activity during PF MVC to Dorsiflexors' (DF) MVC. Results are presented as means \pm SD.

Results

Isometric plantarflexor maximal voluntary contraction (MVC) torque increased in the TRN group by 20 % ($P < 0.01$), from 113.1 ± 22.0 Nm to 141.5 ± 19.2 Nm. VOL increased by 12 %, from 796.3 ± 78.9 cm³ to 916.8 ± 144.4 cm³. Agonist's muscles (PF) activation increased from 83.6 ± 11.0 % pre training, to 92.1 ± 7.6 % post training ($P < 0.05$). Instead, antagonist muscles (DF) MVC and coactivation did not change with training.

MVC/VOL was 142.6 ± 32.4 kN.m⁻² before training and 157.0 ± 27.9 kN.m⁻² after training (a non-significant increase of 8 %). No significant change in any measurement was observed in the CTRL group.

Discussion

Resistance training resulted in significant hypertrophy of the TS muscle group, which was accompanied by an increase in agonist muscle activation of a magnitude considered sufficient to contribute to the observed increase in PF MVC (1). Even though increases in strength were greater than the observed increases in VOL, no increase was observed in MVC/VOL.



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Conclusion

This study has shown that an increase in muscle strength in response to a 12-month training programme in older men is mostly accounted for by an increase in both muscle volume and agonist muscle activation.

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References

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