EFFECT OF NEUROMUSCULAR ELECTROSTIMULATION VIA THE PERONEAL NERVE ON ONE-LEGGED PEAK OXYGEN UPTAKE AND PEAK POWER OUTPUT FOLLOWING FOUR WEEKS OF HIGH INTENSITY INTERMITTENT TRAINING

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ABSTRACT

Introduction. Numerous techniques have been suggested to enhance recovery following intense exercise; however, there is evidence that some of these practices, such as cold water immersion, may actually blunt the long term adaptive response to exercise (Yamane et al., 2006). We have previously demonstrated that the use of a novel technique of neuromuscular electrostimulation (NMES) enhances the recovery process following intense intermittent exercise (Ferguson et al., 2013). However, the long term effect of this technique and its impact on the adaptive response to training is not known. The aim of the present study was to examine the effects of NMES immediately following each training session during 4 weeks of high intensity intermittent training (HIIT).
Methods. Seven healthy males (age 23 ± 2 years, height 177 ± 8 cm, body mass 79 ± 17 kg, VO_{2max} 47 ± 7 ml.kg^{-1}.min^{-1}) completed 12 sessions of HIIT (3 sessions per week), which consisted of 3-7 repetitions of 30 second maximal sprints on a cycle ergometer, each separated by 4 minutes recovery. Immediately after each training session, using a within-subjects design, one leg underwent NMES treatment for an 8 hour period and the contralateral leg did not undergo any treatment (CON). Pre- and post-training measurements were made in each leg of one-legged peak oxygen uptake (VO_{2peak}) and peak power output. A two-way (2 x 2) ANOVA with repeated measures was conducted to analyse the within-subject effect of treatment (NMES, CON) and time (pre, post). Significance was accepted at $P < 0.05$ and data are presented as mean ± SD.
Results. Whole body VO_{2max} increased ($P < 0.05$) following 4 weeks of HIIT (47 ± 7 vs. 51 ± 7 ml.kg^{-1}.min^{-1}, pre and post-training, respectively). There was a main effect for time for one-legged VO_{2peak} ($P < 0.05$), which increased following training in CON from 37 ± 8 to 40 ± 8 ml.kg^{-1}.min^{-1} and in NMES from 38 ± 6 to 42 ± 6 ml.kg.min^{-1}. There was a main effect for time on one-legged peak power output ($P < 0.05$), which increased following training in CON from 138 ± 24 W to 157 ± 32 W and in NMES from 142 ± 36 W to 165 ± 30 W. There were, however, no differences between CON and NMES for either measure.
Discussion. The use of a novel NMES technique immediately following each training session during 4 weeks of HIIT does not have a detrimental effect on the adaptive response.

INTRODUCTION

Numerous techniques have been suggested to enhance recovery following intense exercise, however, there is evidence that some of these practices, such as cold water immersion, may actually blunt the long term adaptive response to exercise training (Yamane et al., 2006).

We have previously demonstrated that the use of a novel technique of neuromuscular electrostimulation (NMES) enhances the recovery process following intense intermittent exercise (Ferguson et al., ECSS, Barcelona, 2013).

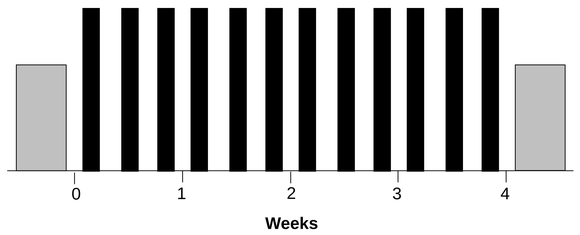
However, the long term effect of this technique and its impact on the adaptive response to training is not known.

PURPOSE OF STUDY

To examine the effects of NMES immediately following each exercise session on the adaptive responses to 4 weeks of high intensity interval training (HIIT).

METHODS

7 untrained male participants
- Age: 23±2 years
- Height: 177±8 cm
- Body mass: 79±17 kg



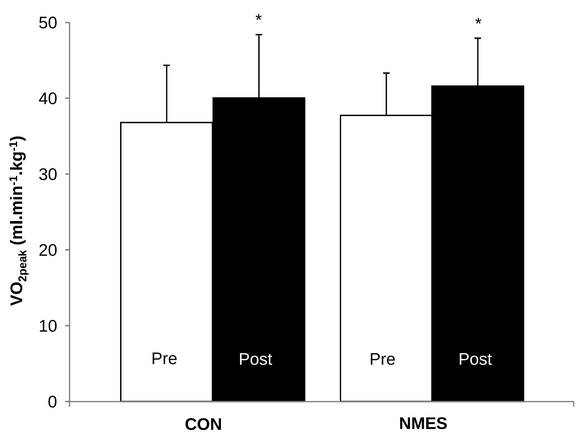
- 4 – 7 x 30 sec maximal sprints
- 4 min recovery

- Whole body VO_{2max}
- One-legged peak oxygen uptake (VO_{2peak})
- Popliteal artery characteristics (Doppler ultrasound); resting diameter and blood flow; peak diameter and peak blood flow in response to 5-min ischaemia

Interventions
- Experimental Limb - Neuromuscular electrical stimulation (NMES) OnPulse™ technology
  - At least level 3 (visible contractions)
  - 8 hours
- Control Limb – No intervention

RESULTS

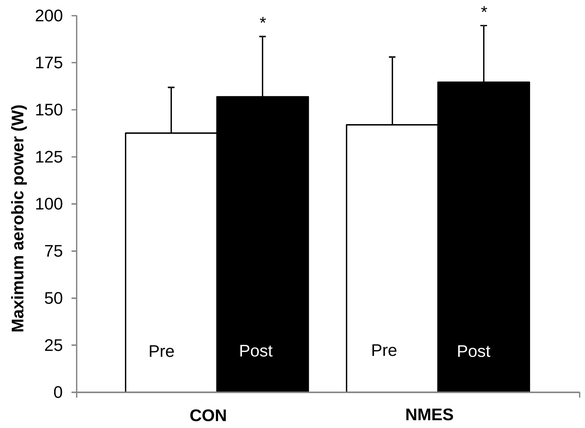
One-legged VO_{2peak}



One-legged VO_{2peak} increased ($P<0.05$) in both CON and NMES legs post training but there was no difference between conditions.

RESULTS continued

One-legged maximal aerobic power



One-legged maximal aerobic power increased ($P<0.05$) in both CON and NMES legs post training but there was no difference between conditions.

Popliteal artery characteristics

	CON		NMES	
	Pre	Post	Pre	Post
Resting diameter (mm)	0.549 ± 0.063	0.579 ± 0.056	0.554 ± 0.056	0.571 ± 0.047
Resting BF (ml/min)	183 ± 59	204 ± 36	237 ± 76	241 ± 89
Peak diameter (mm)	0.596 ± 0.074	0.611 ± 0.063	0.589 ± 0.073	0.609 ± 0.061
Peak BF (ml/min)	1176 ± 419	1215 ± 386	1317 ± 444	1339 ± 301

There were no changes in any popliteal artery blood flow parameters in either CON or NMES.

CONCLUSIONS

The use of a novel NMES technique immediately following each training session during 4 weeks of HIIT does not have a detrimental effect on the adaptive response.

REFERENCES

Yamane et al. (2006). Post-exercise leg and forearm flexor muscle cooling in humans attenuates endurance and resistance training effects on muscle performance and on circulatory adaptation *Eur J Appl Physiol*. **96**: 572-580.

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