BOOK OF ABSTRACTS

Comparison of various 7-day protocols of repeated ischemic preconditioning on 4000m time trial performance of trained cyclists

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Abstract

Repeated short-term leg ischemia prior to an incremental bicycle exercise test has previously been shown to improve maximal oxygen consumption by 3% and power output by 1.6% in healthy trained subjects (de Groot et al., 2010). Despite important implications for cycling performance the effectiveness of continued use of Ischemic Preconditioning (IPC) as a conditioning tool remains unknown with no experimentation of optimal IPC dosage. Using time trial performance of trained age-group cyclists, this research sought to compare over seven days, the effects of twice-a-day (220 and 220 mmHg) alternating unilateral repeated IPC over once-a-day (220 and 20 mmHg) and a SHAM (20 and 20 mmHg) control protocol. Twenty-four elite age-group track cyclists (aged 38 ± 12 years; training 10.3 ± 3.6 hours per week) were recruited and provided their informed consent. Participants were randomly assigned to one of three twice-daily (20 and 20 mmHg - SHAM; 20 and 220 mmHg - Once-a-day; 220 and 220 mmHg - Twice-a-day) alternating unilateral repeated leg IPC protocols (4 x 5-mins ischemia/5-mins reperfusion) over seven consecutive days (Days 1 - 7). After initially having the cuff application method demonstrated and timing of the alternating ischemia and reperfusion explained, athletes were then responsible for the self-administration of the IPC sessions in their own homes. Simulated 4000m cycling time trials were conducted on a Velotron Dynafit cycle ergometer (Racermate, Seattle, WA) before (Day 0), immediately following (Day 8) and one week following (Day 15) the IPC protocols. Participants used the same pre-selected gear that they typically utilised in competition and verbal feedback was only given every 250m to replicate an indoor velodrome setting. Time to completion (s), average power (W), relative and absolute VO2peak (mL·min^{-1}·kg^{-1} and L·min^{-1} respectively), respiratory exchange ratio (RER), finishing heart rate (bpm), and ratings of perceived exertion (RPE) were all measured. Descriptive statistics, mean and standard deviation were recorded for each condition. In conjunction with Cohen's effect sizes (*d*), P values (both within and between groups) for the measured variables were calculated using Satterthwaite's method of denominator synthesis, conducted in the ImerTest package for R. Statistical significance was set at p<0.05. Results showed there was no change in VO2peak for the groups. Repeated IPC did not result in any change in 4000m time trial performance immediately and seven days post treatment for the "sham" (p = 0.2 to 0.5, *d* = 0.05 to 0.22) and "once-a-day" (p = 0.3 to 0.6, *d* = 0.06 to 0.09) protocols. It did however result in a significant but trivial performance detriment immediately post (p = 0.03, *d* = 0.17) and a non-significant and trivial increase in time trial time seven days post (p = 0.07, *d* = 0.14) for the "twice-a-day" protocol. As such, there was no difference in the average power for the "sham" (p = 0.3 to 0.4, *d* = 0.07 to 0.1) and "once-a-day" (p = 0.4 to 0.9, *d* = 0.0 to 0.15) protocols immediately and seven days post-IPC but a significant small decrease (p = 0.03 to 0.04, *d* = 0.23) for the "twice-a-day" protocol. No difference existed between or within the three treatment groups for finishing heart rate, RER, RPE (p > 0.05, *d* < 0.2) and blood lactate concentrations (p > 0.05, *d* < 0.1) following the 4000m time trials. The ineffectiveness of these protocols could suggest these athletes (trained cyclists competing at a national level for their respective age categories) may require a larger IPC stimulus to see even a small adaptation gain. Another possibility is the IPC combined with the athletes current training phase resulted in too great a stress and subsequent maladaptation. Rather than using a maximal exercise test, the current study aimed to provide a more applicable event specfic advice, which in this case equated to a 4000m time trial distance. However, while participants were all track cyclists this distance may have been foreign to a lot of these athletes. Individual differences did exist within each of the treatment groups which may indicate the presence of responders and non-responders. If repeated IPC is to be used as a conditioning tool it does need to be logistically manageable (time efficient) within an athletes' real-life schedule to ensure longer-term compliance and any subsequent protocol needs to be planned with this in mind.

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Purpose:.

Methods:

Results:

Discussion:.

Conclusions:.

References: de Groot, P.C., Thijssen, D.H., Sanchez, M., Ellenkamp, R., Hopman, M.T. (2010). Ischemic preconditioning improves maximal performance in humans. Eur J Appl Physiol.108(1): 141–146.
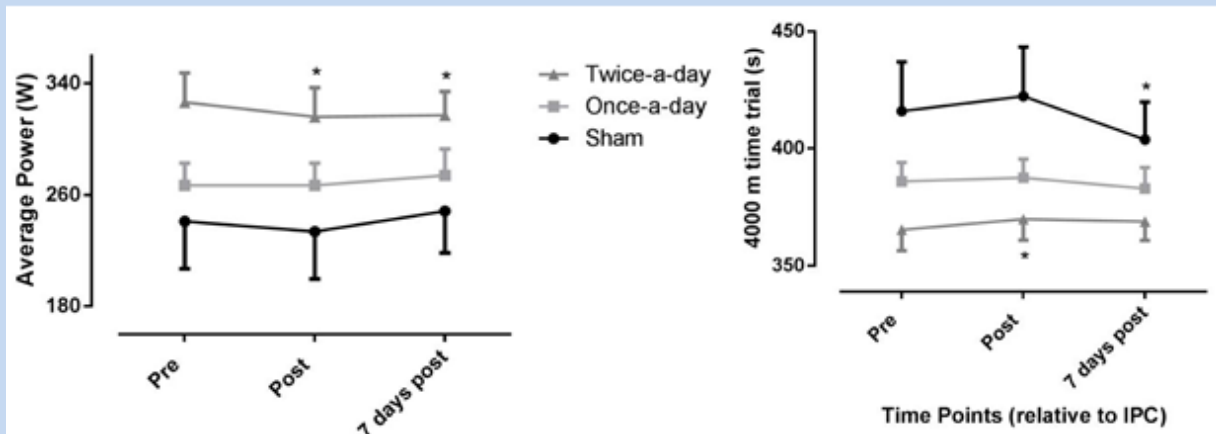
*Figure 1. Average power (A) and 4000 m 9me trial 9me (B) and for each of the repeated ischemic precondi9oning protocols. (Sham = 0 mins/day at 220 mmHg, Once-a-day = 40 mins/day at 220 mmHg, Twice-a-day = 80 mins/day at 220 mmHg). Data are mean + SEM. * p < 0.05.*
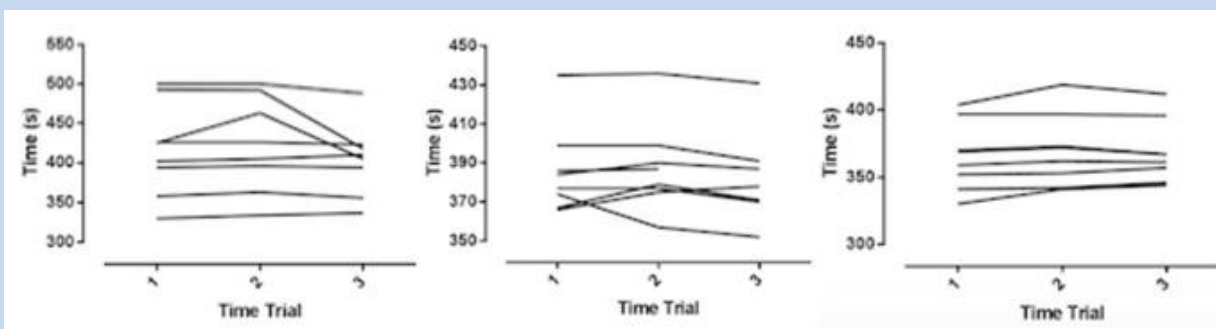

Figure 2. Individual 4000m 9mes across three 9me trials for the Sham protocol (C), Once-a-day protocol (D) and Twice-a-day protocol (E).

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