Ischemic Preconditioning Does Not Affect Early Or Late Phases Of Rate Of Torque Development Following Submaximal Fatiguing Resistance Exercise

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Background

Ischemic preconditioning (IPC) may serve as an ergogenic aid for resistance exercise performance and promote attenuations in muscular fatigue (1,2). There is, however, a lack of available information assessing different IPC pressures and their effects on the early and late phases of rate of torque development (RTD). Thus, the purpose of this investigation was to examine the acute effects of IPC on early and late phases of RTD prior to and immediately following submaximal fatiguing resistance exercise among recreationally active females.

Methods

Twelve (21.8 ±1.8 years, 162.2 ± 6.8 cm, 65.8 ± 12.2 kg) recreationally active females visited the laboratory on three separate occasions. The implementation of IPC was randomized and consisted of a low (20mmHg), moderate (80% of total arterial occlusion pressure [TAOP]), and high (220 mmHg) pressure with a pneumatic cuff placed most proximally on the dominant limb. Each participant underwent three cycles consisting of five minutes with the pressure applied followed by five minutes of rest. After completion of IPC, participants completed one-set to volitional failure of submaximal, unilateral isotonic leg extension muscle actions at 30% of their one-repetition maximum. To examine early (0 to 100 milliseconds) and late (0 to 200 milliseconds) phases of RTD, maximal voluntary isometric contractions (MVICs) were completed prior to and immediately following the one-set to volitional failure. The first derivative of the torque signal was used to compute early and late RTD. Separate 3 (Condition [low, moderate, and high]) x 2 (Time [pretest, posttest]) repeated measure ANOVAs were performed.

IPC performed at moderate and high pressures does not impact early or late RTD

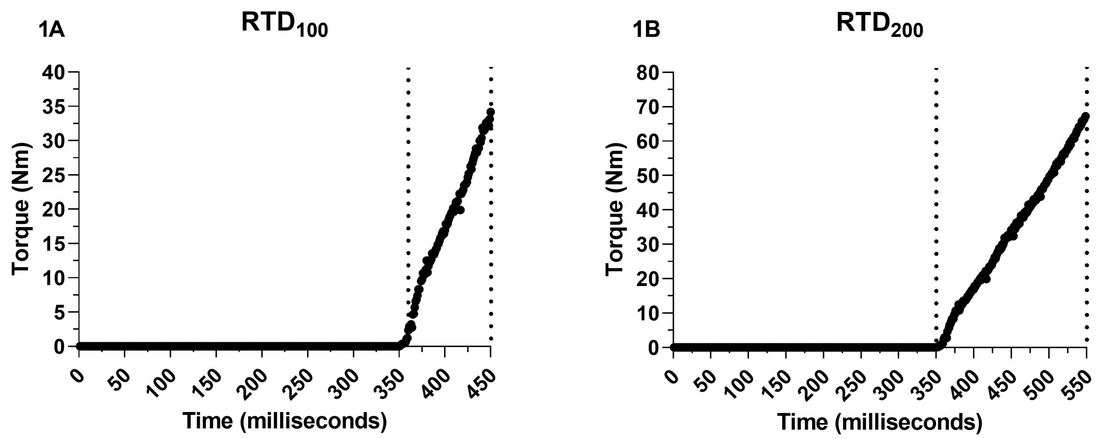

Figure 1A-1B. An example of early (RTD_{100}) and late (RTD_{200}) phases of rate of torque development. Figure 1A and 1B depicts the 0-100ms and 0-200ms epoch of the first derivative of the torque signal, respectively. The onset of torque production was defined as greater than 3 standard deviations above the baseline torque signal.

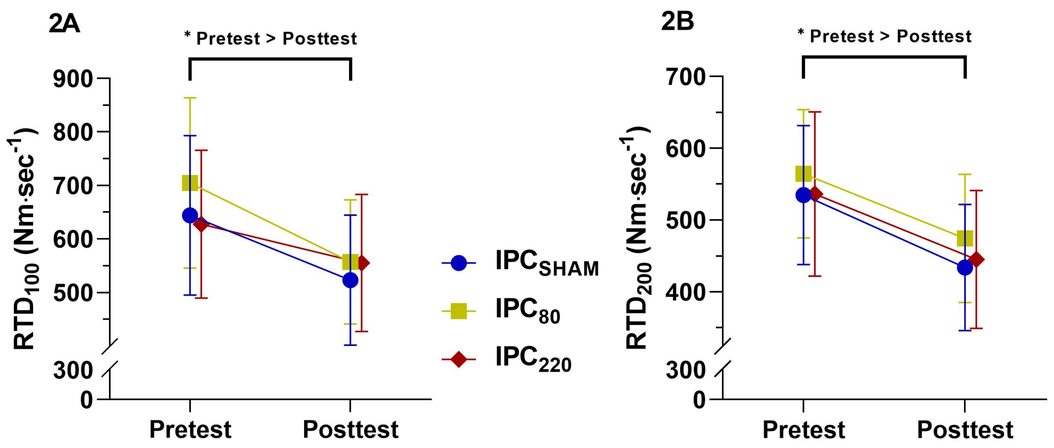

Figure 2A-2B. Displays the mean and 95% confidence interval (95% CI) for the main effect of Time, collapsed across Condition, for early (RTD_{100}; 2A) and late (RTD_{200}; 2B) phases of rate of torque development. Ischemic preconditioning (IPC) was performed at a low (20mmHg [SHAM]; solid blue circle), moderate (80% of total arterial occlusion pressure [TAOP]; solid yellow square), and high (220 mmHg; solid red diamond) pressure with a pneumatic cuff placed most proximally on the dominant limb prior to the acute exercise protocol. *denotes a significant (main effect of Time) decrease from pretest to posttest.

Results

There were no significant (p=0.463-0.673) interactions or main effects (p=0.247-0.476) of Condition for early or late RTD. There was, however, a significant main effect (p=0.015-0.045) of Time for early and late RTD. Specifically, collapsed across Condition, there were decreases from pretest to posttest for early (658.8 ± 230.3 Nm/sec to 544.9 ± 187.5 Nm/sec) (p=0.045) and late (547.6 ± 160.0 Nm/sec to 454.3 ± 141.2 Nm/sec) (p=0.015) RTD.

Conclusions

The use of IPC did not affect early or late phases of RTD. Further, the implementation of various pressures did not impact RTD, suggesting no pressure-specific responses. Thus, the use of IPC does not provide an ergogenic effect on RTD prior to or after performing acute submaximal fatiguing resistance exercise.

Practical Applications

Applying IPC prior to submaximal fatiguing resistance exercise does not affect early or late phases of RTD. Thus, coaches and/or practitioners should consider leveraging alternative approaches (e.g., post-activation potentiation) if preserving RTD or explosive power is a priority, particularly in sports which require repeated explosive movements.

References