



Background

Passive blood flow restriction (pBFR) following exercise has been theorized to provide an ergogenic effect for muscle recovery (1,2). There is, however, a lack of evidence assessing the impact of pBFR post exercise on indices of delayed onset muscle soreness. Thus, the purpose of this investigation was to examine acute cycles of pBFR following a muscle damaging protocol on muscle strength, passive range of motion (ROM), and perception of muscle soreness (VAS).

Methods

Twelve (21.3±1.6 years, 172.5±9.3 cm, 79.7±17.7 kg; males=5, females=7) participants visited the laboratory on five separate occasions at the same time of day. Participants performed 3 sets of 25 maximal, unilateral, isokinetic (60°·s⁻¹) concentric-eccentric leg extension muscle actions and each set was separated by 3-minutes of rest. The muscle damaging protocol was then completed on the contralateral leg. After the damaging protocol, each leg was randomly assigned to receive pBFR at 80% of total arterial occlusion pressure or a SHAM (20 mmHg) treatment. pBFR and SHAM were also applied to the assigned leg (in a randomized order) at 24-, 48-, 72-, and 96-hours post muscle damaging protocol. Immediately prior to the muscle damaging protocol and prior to each cycle of pBFR and SHAM, assessments of leg extension maximal voluntary isometric contraction (MVIC) torque, ROM during passive knee flexion, and VAS (0-10, where 0 corresponded to no soreness and 10 corresponded to extreme soreness) were measured. Separate two-way, 2 (Condition [pBFR, SHAM]) × 5 (Time [baseline, 24-, 48-, 72-, 96- hours post]), repeated-measures ANOVAs were used to examine MVIC torque, ROM, and VAS.

References

1. Arriel, R. A., Rodrigues, J. F., Souza, H. L. R. D., Meireles, A., Leitão, L. F. M., Crisafulli, A., & Marocolo, M. (2020). Ischemia-reperfusion intervention: From enhancements in exercise performance to accelerated performance recovery—A systematic review and meta-analysis. *International journal of environmental research and public health*, 17(21), 8161.
2. Arriel, R. A., de Souza, H. L. R., da Mota, G. R., & Marocolo, M. (2018). Declines in exercise performance are prevented 24 hours after post-exercise ischemic conditioning in amateur cyclists. *PLoS one*, 13(11), e0207053.

pBFR preserved ROM and reduced perceptions of soreness, but had no effect on performance

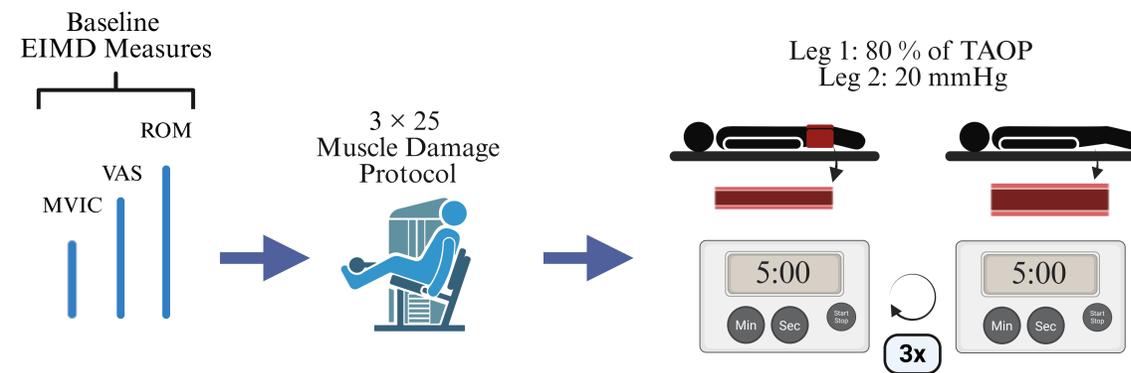


Figure 1: An overview of experimental procedures completed. Schematic was created with BioRender.com.

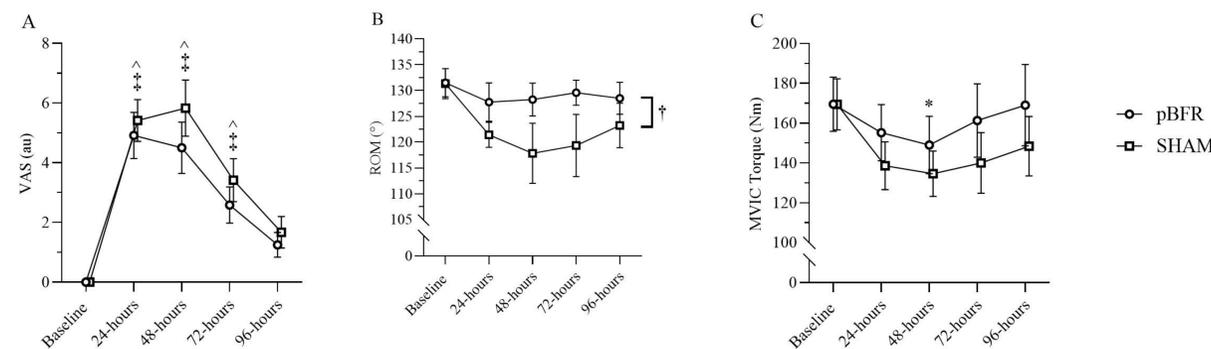


Figure 2: Mean (± SEM) changes in muscle soreness (VAS) (A), range of motion (ROM) (B), and maximal voluntary isometric contraction (MVIC) (C). † Denotes a significant ($p=0.007=0.034$) main effect of Condition. ^ Denotes a significant ($p<0.001-0.018$) main effect of Time. ‡ Denotes a significant ($p=0.004$) main effect of Condition. * Denotes a significant ($p=0.004$) main effect of Time.

Results

There were no significant ($p=0.094-0.154$) interactions for MVIC torque or ROM. MVIC torque, however, decreased across Time ($p=0.004$) from baseline (169.5±44.9Nm) to 48-hours post exercise (141.7±44.7Nm)($p=0.022$) and recovered at 72-hours (161.3±63.7Nm) which was similar between conditions ($p=0.075-0.999$). There were no significant main effect of Time for ROM ($p=0.148$), but there was a main effect for Condition ($p=0.010$) which was greater during pBFR (129.4±10.4°) relative to SHAM (121.5±17.2°)($p<0.001$). There was a significant ($p=0.043$) interaction for VAS. Follow-up simple main effects of Condition indicated that VAS was lower for pBFR than SHAM at 24-(4.9±2.6 vs 5.4±2.4au), 48-(4.5±3.0 vs 5.8±3.3au), and 72-hours (2.5±2.1 vs 3.4±2.5au), respectively ($p=0.007-0.034$). Furthermore, follow-up main effects of Time, indicated that VAS increased for both pBFR and SHAM from baseline (0.0±0.0 and 0.0±0.0au) to 24-(4.9±2.6 and 5.4±2.4au), 48-(4.5±3.0 and 5.8±3.3au), 72-hours (2.5±2.1 and 3.4±2.5au)($p<0.001-0.018$), and recovered by 96-hours (1.2±1.4 and 1.7±1.8au) respectively.

Conclusions

The application of pBFR post exercise-induced muscle damage did not exhibit a performance enhancing effect on maximal strength as assessed by MVIC torque. Applying pBFR, however, did improve both ROM and VAS which may explain anecdotal reports insinuating the efficacy of pBFR to facilitate muscle recovery.

Practical Applications

Coaches and practitioners may consider applying pBFR to improve symptoms of muscle damage (i.e., ROM and VAS), and to facilitate acute passive muscle recovery from stressful exercise. Additionally, within this preliminary report among a relatively small sample size, pBFR did not appear to exhibit an improvement on muscle strength recovery and/or the isometric assessment was not sufficient to delineate the time course of strength recovery between conditions.