THE IMPACT OF BLOOD FLOW RESTRICTION COMBINED WITH VERTICAL COUNTERMOVEMENT JUMPS ON FORCE OUTPUT AND MUSCLE EXCITATION

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Introduction

Blood flow restriction (BFR) commonly combines low-load, high repetition resistance exercise and results in significant increases in muscle size and strength. In addition, BFR accelerates the rate at which a muscle fatigues possibly due to lower oxygen levels and a buildup of various metabolites (1). Studies have also found that low load resistance exercise with BFR increases EMG amplitudes and motor unit activation more than low load resistance exercise without BFR (2). Plyometric exercises, such as vertical countermovement jumps, typically require a high number of repetitions to elicit desired results (3). To progress plyometric training, weights or elastic bands or different types of jumps can be used. Due to the fatiguing and beneficial effects that BFR has when used with low loads, it may be possible to use BFR as another progression method. However, it is currently unclear if BFR can be used to increase the intensity of maximal vertical countermovement jumps and therefore promote greater adaptations. Previous studies failed to use personalized pressures or sufficient repetitions than typical for BFR training (4). This study evaluated the effectiveness of BFR use in conjunction with maximal vertical countermovement jumps to determine EMG amplitude changes and force output alterations compared to a non-BFR condition.

Methods

Study Design: Cross-over randomized experimental design; 2 visits, 48+ hrs between visits; 4 sets of 20 reps max vertical countermovement jump (CMJ).
Participants: 12 participants: 18-35 yrs,; Resistance trained 3+ months 3x+/wk; Exc:139+/90+ BP, pregnancy, LE injury, or 4+ BFR clinical ch.
Blood Flow Restriction: 60% arterial occlusion pressure most proximal thigh.
Ground Reaction Forces and Jump Height: Bertec (1000Hz);
Electromyography: Noraxon (1500Hz), Biceps Femoris(BF), Medial Gastrocnemius(MG), Rectus Femoris(RF)
Statistical Analysis: Paired sample T-test for dependent sEMG amplitude normalized to pre-condition. Two-way repeated measures ANOVA for mean force output & jump height.

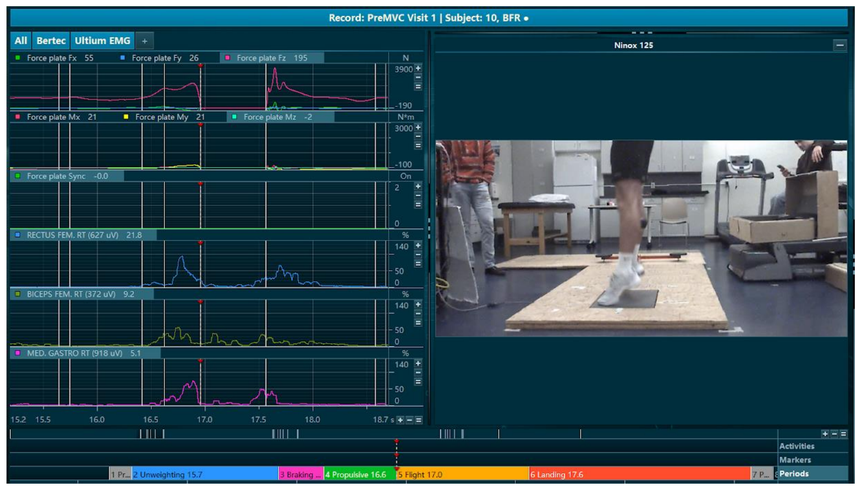

Figure 1: Example of sEMG and force output using NORAXON software.

Results

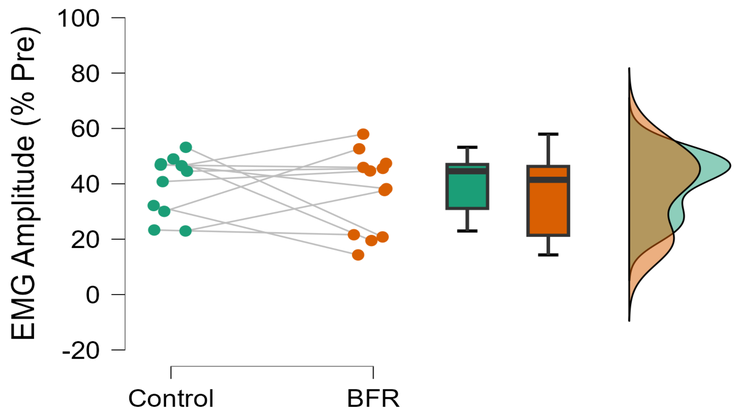

Figure 2: Post sEMG amplitudes as a percentage of pre-sEMG values for BF.

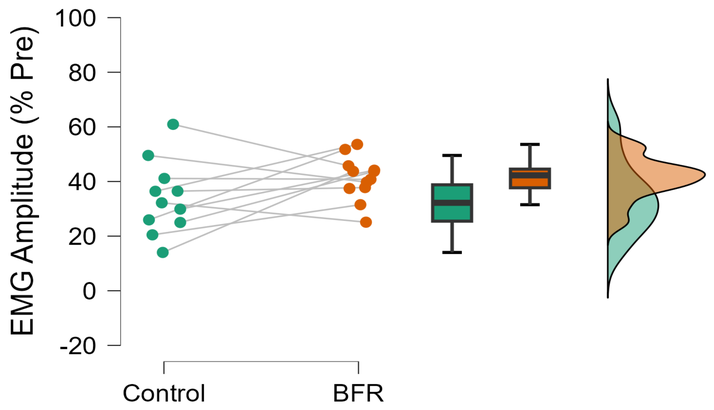

Figure 3: Post sEMG amplitudes as a percentage of pre-sEMG values for MG.

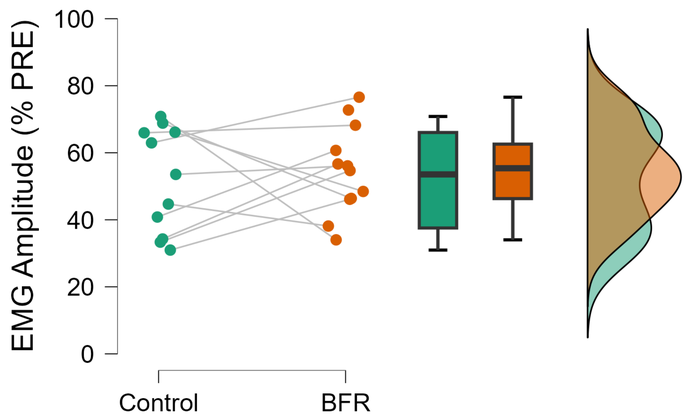

Figure 4: Post sEMG amplitudes as a percentage of pre-sEMG values for RF.

Results

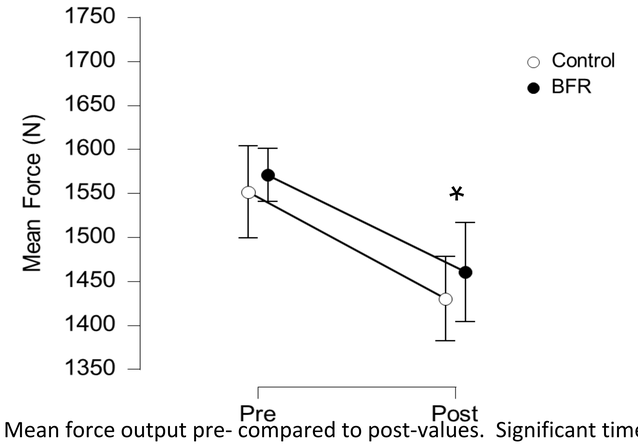

Figure 5: Mean force output pre- compared to post-values. Significant time main effect found. (*p<0.05 vs. Pre)

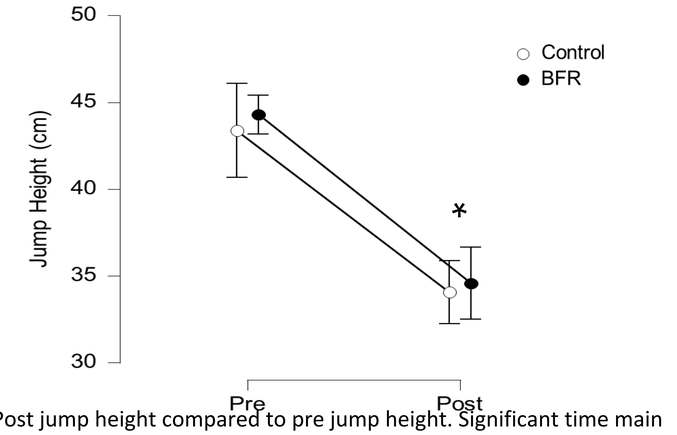

Figure 6: Post jump height compared to pre jump height. Significant time main effect found. (*p<0.05 vs. Pre)

Conclusion

Combining BFR with maximal vertical countermovement jumps results in a similar decrease in sEMG amplitudes and peak vertical ground reaction forces when compared to the non-BFR condition.

Practical Applications

Practitioners utilizing BFR may consider using therapy supported by the literature and omitting BFR use during CMJ sessions. Longitudinal studies are needed to further elucidate the mechanism surrounding the BFR CMJ implementation

Acknowledgements

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References

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