BLOOD FLOW RESTRICTION TRAINING FOR CHRONIC QUADRICEPS ATROPHY AND WEAKNESS

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Introduction

- Many individuals following knee surgery experience chronic loss of quadriceps strength and size,which is associated with decreased function.
- Blood Flow Restriction Therapy (BFRT), the use of a tourniquet to partially occlude blood flow in the affected extremity during exercise, can be used to induce hypertrophy and strength, ultimately improving functional outcomes.
- The mechanism is thought to occur as a result of blood flow occlusion resulting in a build up of anabolic metabolites, cellular swelling, and increased recruitment of fast-twitch muscle fibers.
- The purpose of this study was to determine if BFRT can reverse long-standing quadriceps weakness, and improve function, in an individual following an ACL reconstruction and meniscus repair.

Methods

- Testing of maximal volitional isometric contraction (MVIC) with a burst superimpositions were used to measure isometric strength of the knee extensors at 60 degrees of knee flexion 1 week prior to training, every 2 weeks during training and 1 week post training.
- The burst superimposition allows for measurement of the central activation ratio (CAR), which assesses the person's ability to volitionally recruit their muscle.
- Knee Injury and Osteoarthritis Outcome Scores (KOOS) and video of single-leg step-up and gait were recorded prior to and at 1 week post training.
- The subject completed 8 weeks of biweekly training sessions, each separated by at least 48 hours.
- Each training session included a 5-minute cycling warm-up followed by unilateral knee extension, step-up and leg press exercises.
- The subject trained at 80% occlusion pressure and performed one set of 30, followed by 3 sets of 15 with a 30-second rest in between each set and a 2-minute rest and release of occlusion pressure in between each exercise.

Results

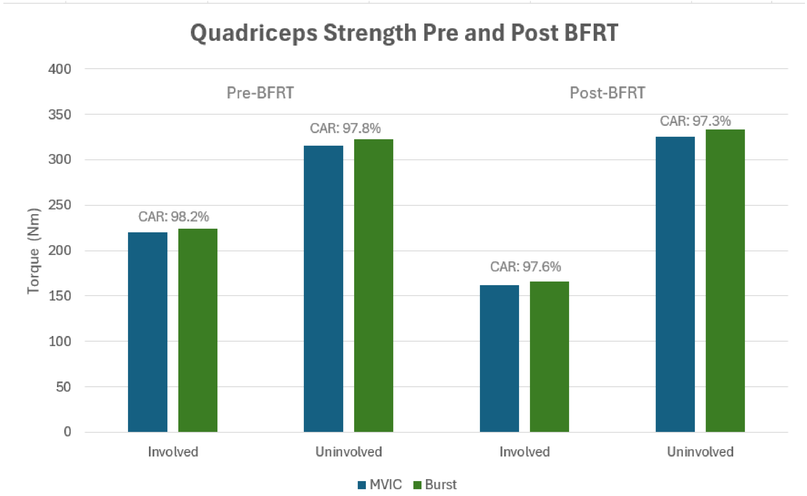


Figure 1. The MVIC and burst superimposition of involved lower extremity (right) vs. uninvolved lower extremity (left) before and at one week follow-up.

Subscale	Pre-KOOS	Post-KOOS
Pain	88.89	91.67
Symptoms	57.14	67.85
Activities of Daily Living	98.53	100
Sport/Recreation	70	90
Quality of Life	50	62.5

Table 1. KOOS subscales scores before and after BFRT; minimal detectable change (MDC) for subscales: 6.1 (pain), 8.5 (symptoms), 8.0 (ADL), 5.8 (Ssport/rec), 7.2 (QoL)

Link to subject's performance with single leg step up and frontal perspective of gait before and after BFRT

Discussion

- We hypothesized that the subject would demonstrate significant increase in strength following 8 weeks of BFRT on the affected limb.
- Strength decreased in the involved knee extensors following the training (Fig. 1); however, improvements greater than or equal to the minimal detectable change were observed for symptoms, sport/rec, and quality of life subscales on the KOOS, indicating functional improvement (Table 1).
- These findings suggest that strength is not the only determinant of function in persons with persistent knee extensor atrophy and weakness following surgery, and that other factors such as neuromuscular control and fatigue resistance may be important.

Conclusion

- This study suggests that despite decreases in quadriceps strength and size, BFRT may improve functional outcomes.



References

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