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Postoperative Blood Flow Restriction Therapy in Rotator Cuff Repair: Actual Evidence and Future Directions

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Abstract

Blood flow restriction therapy (BFRT) is a widely studied strategy in lower limb pathology; however, BFRT research in shoulder musculoskeletal disorders is limited. Recent literature has shown that BFRT improves upper limb muscle mass and strength in patients with shoulder-related disorders. However, only one study reported the effect of adding BFRT to postoperative rehabilitation of a patient with rotator cuff repair. The novel application of BFRT may be a suitable strategy to attenuate shoulder muscle atrophy and strength deficits in the early stages of postoperative physical rehabilitation in patients with rotator cuff repair. More experimental research is needed to confirm these potential benefits.

Keywords: Exercise, blood flow restriction training, occlusion therapy, physical therapy, rotator cuff tear, shoulder pain

Abbreviations: ACSM: American College of Sports Medicine; BFRT: Blood Flow Restriction Therapy

Background

Rotator cuff tears are one of the main causes of shoulder pain and dysfunction, accounting for about 20% of all shoulder injuries [1]. The goal of rehabilitation after rotator cuff repair is to restore upper limb function, and current guidelines recommend dividing the physical therapy process into three stages based on time-specific criteria. Stage I (passive range of motion), Stage II (assisted active range of motion), and Stage III (active exercise in closed and open chain) [2]. Therefore, although physical therapy can begin within days after surgery, exercises to improve active shoulder movement are not recommended until tendon healing is advanced, not earlier than 10 weeks after surgery [2]. In this period, shoulder immobilization can induce a decrease in skeletal muscle mass and strength in the rotator cuff and periscapular muscles [3,4]. However, to increase skeletal muscle mass and strength, the American College of Sports Medicine (ACSM) recommends performing resistance exercise training at high intensity (> 80% of one-repetition maximum) [5]. Therefore, these ACSM recommendations can be counterproductive in the early stages of postoperative physical therapy, as the tendon is in an early healing phase and shoulder movements are poorly tolerated [6]. In this context, alternative forms of traditional resistance exercise training such as blood flow restriction therapy (BFRT) are emerging as an alternative to allow hypertrophy and muscle strength gains in the early stages of rotator cuff repair postoperative physical therapy.

BFRT is an intervention used during low-load resistance exercise training in which an external pressure system or cuff is applied to a limb with the intention of partially restricting arterial blood flow and fully restricting venous blood flow [7]. The main advantage of BFRT is its ability to induce adaptations to skeletal muscle mass and strength with low-intensity resistance exercises through different metabolic, hormonal and neuromuscular pathways [8]. This can be especially useful in patients with strength deficits secondary to immobilization in the early stages of tendon healing and atrophy due to postoperative disuse.

To date, there is limited evidence on the efficacy of BFRT in clinical population with shoulder musculoskeletal disorders; however, promising studies have recently been reported [9-13].

BFRT in healthy and clinical shoulder populations

Despite the growing use of BFRT in musculoskeletal clinical settings [14] to date there is limited evidence on the efficacy of BFRT in

healthy people and patients with rotator cuff disorders. Lambert et al. [15] demonstrated that low-load resistance exercises targeting rotator cuff muscles plus BFRT produced a significant increase in upper limb lean mass, strength, and muscular endurance compared to low-load resistance exercises alone in healthy participants [15,16].

Few studies have evaluated its use following shoulder disorders [9-13]. To the best knowledge of the authors, only one case report has evaluated the effects of BFRT in patients with rotator cuff repair [13]. In this study, a 54-year-old man with an arthroscopically treated full-thickness rotator cuff tear completed 12 weeks of postoperative physical therapy that included low-load resistance exercises with BFRT. The patient demonstrated clinically significant improvements in the thickness of the biceps brachii muscle, abduction and external rotation strength, shoulder range of motion, movement-evoked pain, and physical function. However, due to design limitations, the author recommends that a randomized clinical trial compare the effectiveness of adding BFRT to standard physical therapy exercises versus standard physical therapy alone in patients after arthroscopic rotator cuff repair. On the other hand, Kara et al. [10] randomized clinical trial reported an increase of 8% in biceps muscle thickness and a 12% increase in shoulder internal rotation strength after shoulder-targeted exercises plus BFRT compared to shoulder-targeted exercises alone in patients with rotator cuff tendinopathy [10]. However, the study included participants treated conservatively for shoulder pain secondary to rotator cuff tendinopathy, without rotator cuff tear, in which tendon healing and local irritability are not primary considered for the postoperative physical therapy program. McGinniss et al. [11] case series showed a clinically significant improvement in shoulder strength and physical function after six to twelve weeks of BFRT in patients who underwent shoulder stabilization surgery [11]. However, this study excluded patients with rotator cuff repair, and BFRT was performed only in patients with surgically repaired glenoid labrum or glenohumeral ligament injuries. Lastly, two case report studies showed clinically significant improvements in shoulder isometric strength, range of motion, and patient-reported function in patients with shoulder subacromial impingement [9,12].

Conclusion

To date, little is known about the effects of BFRT on rotator cuff repair rehabilitation. Despite the promising results of previous investigations, none of these studies have evaluated the effect of BFRT on muscle mass and strength in addition to standard postoperative rehabilitation compared to standard rehabilitation alone through a randomized clinical trial. The different populations and designs, as well as the lack of a detailed description of the BFRT protocols among these studies, suggest a continued need to evaluate BFRT in adults who have had rotator cuff repair.

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