Editorial Commentary: Blood Flow Restriction Therapy Continues to Prove Effective


Abstract: Blood flow restriction (BFR) training continues to look promising to try and maintain muscle mass or to rebuild muscle mass and strength after injury or surgery. Because additional potential benefits include pain control, increased gene expression (leading to atrophy reduction), and muscle excitation, our use of the modality favors earlier over middle- or late-phase postoperative use. We initiate BFR therapy 2-14 days postoperatively, often with reduced cuff pressure in the first several sessions before increasing to the recommended therapeutic occlusion level. We have observed the greatest benefit for individuals who are non-weight-bearing for 6 to 8 weeks and who may have more postoperative restrictions due to the nature of the surgery. Compared with the opposite thigh, we have seen instances in which quadriceps girth has been preserved, although not increased, following the non-weight-bearing period. Ideally, we use 1 to 3 low-load resistance training exercises per session at least 2 times per week for 6 weeks. We also employ BFR following osteotomy or any procedure where bone drilling is used, as researchers have observed improved bone health. Additional benefits relevant to the early postoperative phase, such as effusion and pain reduction, have not been clearly established. Anecdotally, we have seen effusion levels temporarily increase during treatment but then resolve to baseline within 30 to 60 minutes of tourniquet deflation. Further high-level research is necessary to objectively validate BFR use and which patients may best benefit from it.

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The study on “Blood Flow Restriction Training Can Improve Peak Torque Strength in Chronic Atrophic Postoperative Quadriceps and Hamstring Muscles” by Noyes, Barber-Westin, and Sipes reports on the findings of the use of blood flow restriction (BFR) training to assess improvements in peak torque strength and in chronic atrophic postoperative quadriceps and hamstring muscles. The authors performed a prospective study evaluating the ability of BFR to improve the peak torque strength of the quadriceps and hamstrings muscles in patients with postoperative weakness and atrophy. The majority of their patients had been operated on by the senior author (Dr. Noyes) and were following a standard modern supervised rehabilitation program before enrollment in this study. Following a fairly reproducible program of low-resistance BFR exercises, the patients were found to have a >10% increase in quadriceps peak torques of 69% and hamstring peak torques of 75% after 9 sessions. While this was a Level IV study with no control group and the number of BFR sessions were not standardized, the authors’ results are encouraging nonetheless because this group of patients is common enough that better means to treat their muscle weakness would be a step forward. However, as the authors well reported, there are very few peer-reviewed scientific studies on the use of BFR, and we encourage that future studies aim for Level I study enrollment with standardized protocols so we can both validate if BFR is beneficial and also possibly for whom it may be beneficial.

It can be difficult for a clinician to apply the BFR concepts found on healthy individuals, in a controlled
laboratory setting, to a clinical population of individuals with baseline knee pathology or those recovering from injury and/or surgery. Clinical studies often fail to describe their methods in full, which can make it difficult for the reader to replicate the study’s findings. For this reason, we commend the authors for detailing the parameters used for their BFR administration on this population: the authors specified cuff type and width, tourniquet pressure (individualized to each patient), starting load and how it was altered as patients acclimated to tourniquet pressure, and weight. Just as load progression is essential for strength gains under typical, non-BFR conditions, intensity must increase as task difficulty decreases when using BFR training. Clearly stating the procedures allows results to be reproducible even as patient baseline presentations vary.

At our facility, therapists use BFR with multiple postsurgical patients each day. Anecdotally, we have observed strength improvements similar to those reported in the present study. However, due to the additional potential benefits for pain control, gene expression levels (leading to atrophy reduction), and muscle excitation, our use of the modality heavily favors earlier over middle- or late-phase postoperative use. As BFR has shown to be safe following surgery,

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\text{we initiate BFR therapy anywhere from day 2 to day 14 postoperatively, depending on patient presentation and tolerance, often with reduced cuff pressure in the first several sessions prior to increasing to the recommended therapeutic occlusion level. We have observed the greatest benefit for individuals who are non-weight-bearing for 6 to 8 weeks and who may have more postoperative restrictions due to the nature of the surgery. Compared with the opposite thigh, we have seen instances in which quadriceps girth has been preserved, although not increased, following the non-weight-bearing period. Ideally, we use 1 to 3 low-load resistance training exercises per session at least 2 times per week for 6 weeks. We also employ BFR following osteotomy or any procedure where bone drilling is used, as researchers have also observed improvements in bone health. Additional therapeutic benefits relevant to the early postoperative phase, such as effusion and pain reduction, have not been clearly established. Anecdotally, we have seen effusion levels temporarily increase during treatment but then resolve to baseline within 30 to 60 minutes of tourniquet deflation. We transition to heavier load strength training as a main rehabilitation focus when patients are out of the early phase and can tolerate greater-intensity training. Patients can then benefit from not only the metabolic stress stimulus, the main mechanism for strength and hypertrophy with low load BFR, but also from muscle tension and breakdown induced strength improvements only associated with high load training. Middle- and late-phase BFR may include tourniquet use with cardiovascular exercise, “off-day” workouts as a break from heavy loading, or with low-intensity resistance training as part of a warm-up or cool-down before or after heavier load training, respectively. Patients who encounter knee pain with progressions of strength training, particularly isolated quadriceps muscle training, may see benefit with BFR training beyond the initial postoperative period, as more of a pain modulator.

In conclusion, it is becoming increasingly evident that BFR therapy has a role in rehabilitation.

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restriction training: What we know and what we don’t know. Front Physiol 2020;11:887.


