Postoperative Use of Blood Flow Restriction in Orthopedics

Andrew J. Curley, MD; Christine M. Conroy, BS; Robin V. West, MD; Edward S. Chang, MD

abstract

Blood flow restriction (BFR) therapy is being used more frequently for rehabilitation from orthopedic injuries. Several physiologic mechanisms of action, at local and systemic levels, have been proposed. Numerous studies have investigated the effects of BFR training in healthy athletes; however, limited clinical data exist supporting the use of BFR after surgery. Given that BFR training may facilitate muscle development using low-load resistance exercises, it offers a unique advantage for the post-surgical patient who cannot tolerate traditional high resistance training. [*Orthopedics*. 2021;44(6):xx-xx.]

Traditional training regimens are based on the concept that muscle growth is induced with high resistance exercises of at least 65% to 70% of 1-repetition maximum.[1,2] Achieving a high resistance level can be challenging for an injured athlete who may be limited by pain, muscle atrophy, diminished proprioception, and psychological factors. Increasing evidence has suggested that blood flow restriction (BFR) in resistance training, while transmitting a decreased load (25% to 50% of 1-repetition maximum) across the injury site, may induce muscular development similar to that of high-intensity exercises.[2]

As athletes continue to strive for a quicker return to play following an injury, BFR therapy is becoming more commonly used in the rehabilitation process. Promising results have been demonstrated in numerous basic science reports, as well as in cohorts of healthy athletes using BFR techniques to enhance muscular training. However, there is a paucity of high-level clinical studies investigating the outcomes of BFR training following orthopedic injuries. The aim of this article is to provide clinicians with an evidence-based review of BFR therapy, from basic science research to clinical outcome studies, while also offering insight into the logistical aspects of implementing BFR in clinical practice.

Physiologic Mechanism of Action

Numerous theories have been suggested to explain the physiologic mechanism by which BFR produces muscular development,[3] which can be broadly categorized into local and systemic effects.

On a local level, BFR training enhances muscular development via increased angiogenesis, metabolic changes, upregulation of protein synthesis, and intracellular swelling. During exercise, the pressure cuff helps to create a hypoxic environment for the muscle fibers, prompting an increase in angiogenic factors such as vascular endothelial growth factor, hypoxia-inducible factor-1, and nitric oxide synthase.[4] Additionally, the anaerobic conditions trigger adenosine triphosphate hydrolysis as an energy source, which creates a metabolic stress that facilitates muscle development.[5]

With long-term BFR training during an 8-week period, these metabolic demands have been associated with increased glycogen production.[6] Blood flow restriction–induced hypoxia was also shown

The authors are from the Department of Orthopaedics (AJC, CMC), Georgetown University Medical Center, and the Department of Orthopaedics (RVW, ESC), Inova Health System, Washington, DC.

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Correspondence should be addressed to: Christine M. Conroy, BS, Department of Orthopaedics, Georgetown University Medical Center, 3900 Reservoir Rd NW, Washington, DC 20007 (Christineconroy5@gmail.com).

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