A critical appraisal of "Blood Flow Restriction Training for the Shoulder: A Case for Proximal Benefit"

By

Shaelyn Harris, SPT

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Department of Physical Therapy

Angelo State University

Member, Texas Tech University System

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Abstract

This paper provides an appraisal of a 2021 article in the American Journal of Sports Medicine about the use of blood flow restriction training in conjunction with low intensity exercise in the upper extremity. The process of forming a clinical question and searching for an article that coincided with the question is presented. The article chosen for appraisal compares BFR with low intensity exercise to low intensity exercise alone through outcome measures of shoulder lean mass, upper extremity lean mass, rotator cuff strength, muscular endurance, and acute EMG amplitude. A summary of the research conducted and an assessment of introduction, methods, results, and discussion of the article is included as well. A discussion of the intervention of BFR and its clinical implications for different patient populations and injuries is offered. A conclusion of the overall use of BFR with low intensity exercise and the future use of the intervention is incorporated into the appraisal.

Key words: Blood flow restriction (BFR), upper extremity, low intensity exercise

Introduction

The focus of this research study concerned blood flow restriction training (BFR) as an intervention on the upper extremity. The purpose of this appraisal was to investigate the legitimacy of BFR and gain a further understanding of the possibilities surrounding this intervention. As a future physical therapist, I found this appraisal to be important to understand different avenues of treatment for upper extremity weakness and/or injury. Research in this area is limited compared to lower extremity. This lack of research led and propelled my curiosity into how it specifically impacts recovery and the patient populations best suited for this intervention. This curiosity aided in forming my clinical question which states, "In individuals with upper extremity weakness or injury, will blood flow restriction training increase strength gains to a higher degree than traditional strength training, given the same time constraints?"

Methods

When searching for articles relating to my question, I began using PubMed, as well as the ASU library database, and Cochrane Library. The article being appraised came from PubMed. Key words I used for searching included "blood flow restriction therapy," and "upper extremity." Including upper extremity criteria eliminated the large multitude of studies done with BFR on the lower extremity. Limits on my search included full free text and clinical trial. Free full text allows for easy accessibility and clinical trials allow for a reduced bias and show cause and effect relationships. Article publishing date restrictions were not needed due to BFR being already a relatively new intervention. Inclusion criteria included upper extremity studies only. As mentioned prior, research surrounding upper extremity and BFR is very slim, however there is a myriad of research done with BFR and the lower extremity. Even with my keywords, I still had to weed out lower extremity studies in my search. Additionally, my question regarded using

strength training and BFR versus strength training alone so excluding other biophysical agents was part of the process. Another exclusion applied included one time bouts of BFR due to my question relating to BFR use over time. 24 total hits were found prior to reviewing articles. From those 24, further elimination was done based on other criteria that needed to be met.

After careful research and investigation of my 3 articles, I narrowed my appraisal down to a article by Dr. Bradley Lambert along with other authors titled "Blood Flow Restriction Training: A Case for Proximal Benefit." It was published in The American Journal of Sports Medicine in 2021. The study was conducted in Houston, Texas and subjects came from the surrounding areas. The study conducted involved healthy adults and the implementation of BFR with low intensity exercise or low intensity exercise alone. This article was chosen because of its comprehensiveness and organization. It also directly related to my clinical question about the potential benefits of BFR in comparison to strength training alone.

Results

Summary of the study

Upper extremity weakness/injury is a common issue for patients and therefore important for PTs to treat effectively. Factors such as age, fitness level, and timeframe in the clinic can hinder the patient from heavily loading the tissue in order to see strength improvements to heal an injury. BFR bypasses that problem and allows the muscles to fatigue quicker promoting muscle fiber recruitment and increasing strength. In this study involving BFR with the upper extremity, 32 subjects were randomly assigned to one of two groups, BFR with low intensity resistance or solely low intensity resistance. The 8 week training period compared changes in shoulder lean mass, upper extremity lean mass, rotator cuff strength, muscular endurance, and acute EMG amplitude. The exercises included ER and IR with a cable, dumbbell scaption, and

side lying dumbbell ER. The results showed greater improvement in the BFR group's shoulder and upper extremity lean mass, isometric IR strength, single set repetitions to fatigue volume for IR, and weekly training volume than the non-BFR group. The conclusion stated BFR can improve a subject's muscular strength, endurance, muscle mass, and some isometric strength. This information allows space to recommend BFR for injury prevention, injury rehabilitation, and even for performance improvements.

Appraisal of the study introduction

The introduction was successful in its goal of introducing the focus of the study and concepts discussed throughout the article. Blood flow restriction training was explained, clinical situations it's impactful in, the data/effectiveness of it, and its importance to different patient populations were all emphasized. A section I particularly enjoyed reading included the use of BFR for injury prevention in overhand throwers. The conclusion of the literature review provided adequate information regarding the clinical implications for different patient populations and physical/functional levels. Including benefits for athletes and the general population makes this study more applicable to a wider audience. The aim of the study was explicitly stated to be to compare 8 weeks of BFR with low intensity exercise versus low intensity exercise alone with regard to chronic changes in shoulder lean mass, upper extremity lean mass, rotator cuff strength, muscular endurance, and acute EMG amplitude. The authors also included their hypothesis that stated BFR would elicit greater increases in rotator cuff strength, endurance, muscle mass, and EMG amplitude in the shoulder muscles during acute exercise. Following my investigation of the literature references included, I found them to be sufficient and within a reasonable time frame. There were 61 sources in total, all being published in the year 2000 or later. References came from big journals, some even from the American Journal of Sports Medicine. All of these components contributed to the strength of the introduction.

To further strengthen, I would recommend including why studying BFR was chosen over other modalities. Information regarding shoulder injury/weakness and its prevalence would have been beneficial as well. Furthermore, explaining the management of BFR equipment and how it specifically works would improve the introduction. Although it might already be understood to some readers, its inclusion would cover all readers of different knowledge levels.

Appraisal of the study methods

The methods section sufficiently described the research design and conduction. The criteria of subject participation was included along with detailed explanation of steps, exercises performed, pre and post training tests, number of trials, order of exercises, equipment settings, and resistance amounts. The statistical diagnostic tools were included as well.

A critique about the methods is that specific use of BFR equipment is not included. I understand that those wanting to replicate this study most likely already have prior experience with the equipment. However, to a reader that possesses no prior knowledge of BFR equipment, the article does not provide sufficient instructions how to handle and set up the equipment. Lastly, subjects were not blinded to which treatment they received, making the study only single blinded.

Appraisal of the study results

The results section successfully and concisely conveyed the outcome measures stated earlier in the article. The information was presented in an organized way that matched the introduction, making it easy to follow along as a reader. The statistically significant results were emphasized by section, making it easy to find when looking for specific outcome measure results. Furthermore, the included results were clinically meaningful and significant to the

original aim of the study. The hypothesis was also restated and compared to the results strengthening the article and relating it back to the purpose.

A suggestion to further strengthen the results would be organizing the graphs in a cleaner way. The volume of information was very large, so the tables and graphs were a bit difficult to understand. Tables and graphs are vital in visualizing the results in an easy way, and it was a bit difficult to take in given the formatting. Furthermore, there were two different p values that added to the difficulty of reading the tables correctly. Another critique I have would be the lack of the use of MCID and NNT. Lastly, adding lines to the graphs would help break up the density of information.

Appraisal of the study discussion

The discussion provided clinical implications to the results that went beyond just restating the results. Applying the results to different populations really solidified the effectiveness of BFR for me as a reader. The hypothesis was correct and further expounded on. Other literature and studies were compared to their results as well which I found to be a strength in which they were not just relying on their own results to confirm its impact. These other literature references included came from well supported sources that gave me, as a reader, confidence in their results. Additionally, they included plans of further research emphasizing their interest and care about the subject.

Limitations of the study were included by the authors explicitly. The limitations being the potential user errors using a hand held dynamometer. The technicians and participants were not blinded due to the nature of the study and a control group without any exercise was not included. Furthermore, they did not examine systemic, local, or intramuscular effectors known to effect skeletal muscle metabolism in response to acute or chronic training. Lastly, the authors included

in the article that partial external funding came from Major League Baseball, possibly creating a bias.

Discussion

The findings of this article bode well clinically for current PT practice. With upper extremity injury and weakness being so prevalent among numerous patient populations, and high intensity loads during exercise not always available/beneficial in early intervention, BFR provides a different approach to countering it. Being able to fatigue the muscles quicker with a lower intensity allows for muscle recruitment in a more easily achieved way. Patients are sometimes restricted by surgeons from heavy loads early after surgery, general weakness can hinder sufficient loading, and for others it could be used as a preventative measure. Finding other ways to see strength gains is important for treating patients who need an alternative to traditional strength training. This study directly related to my clinical question about the effects of BFR versus low intensity exercise alone. This study does not offer information comparing BFR to a control group. Further study would be advantageous in solidifying its effectiveness.

In light of my appraisal, I conclude BFR intervention to be favorable in PT practice. Providing an intervention allowing patients to see high intensity strength training results without actual high intensity training is monumental in elevating patient care. Increasing muscle mass, strength-endurance, and some measures of isometric strength were all proven in the study. No intervention comes without risks, those concerning BFR being augmenting blood pressure and blood clotting, along with some pain or discomfort. If properly screened, I believe the benefits to far outweigh the risks. Improving the argument for BFR use includes further study of patients with injuries rather than testing a healthy population. Another avenue of further research I would

suggest would be comparing high intensity strength training with BFR in conjunction with low intensity exercise. This would improve the argument of BFR's role in patient care and its effectiveness.

I am confident in the research's validity. The study was conducted in a highly methodical manner, the authors hold respective credentials, and its publication in the American Journal of Sports Medicine speaks of its legitimacy. In the future, I anticipate using this intervention on patients safely and appropriately. Managing the equipment and understanding the proper loading required for strength gains is something I see myself being skilled in. Furthermore, the significant results further my confidence in its ability to aid multiple patient populations.

In conclusion, this study focused on the intervention of BFR with low intensity exercise as a means of increasing muscle mass and strength in the upper extremity. The study was conducted with validity and the findings supported the hypothesis that BFR is an effective intervention. Limitations as discussed previously are not absent in any study and should be carefully considered, but the results suggest that BFR is a suitable option for treatment that yield significantly favorable results. Further research involving patients with present injuries could be investigated to propel its credibility.