

The importance of Blood Flow Restriction Training (BFRT) in Physiotherapy: A Review of Literature

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Abstract:

Blood Flow Restriction Treatment (BFRT) is a rehabilitation method that appears to generate improvements in hypertrophy comparable with heavy weightlifting. Despite its growing popularity, the extent to which BFRT has penetrated the physical therapy (PT) industry is unknown. The goal of this study was to evaluate PT's knowledge of and usage of BFRT in clinical settings. The objective of this study was to determine the significance of BFRT in different medical situations and evaluate its therapeutic effects from a physiotherapeutic perspective. PubMed, ResearchGate, Google Scholar, ScienceDirect, Advanced Google Scholar, and Elsevier were used as research databases to locate relevant literature reviews. Ten publications were selected based on predetermined inclusion criteria; these studies collectively provided evidence supporting the efficacy of BFRT in the field of physiotherapy. There appear to be gaps between PT's awareness of BFRT and its implementation in practice, although most of these professionals are willing to give it a shot. Most BFRT practitioners believe that the therapy is successful and plan to use it in the future. More education and training could improve the PT's capacity to use BFRT, as well as possibly improve their long-term clinical outcomes.

Keywords: BFRT, PT, Hypertrophy, Clinical Outcomes, Rehabilitation, Exercise Physiology, Therapeutic Modalities, Physical Therapy Education, Musculoskeletal Health.

Abbreviations: BFRT, Blood Flow Restriction Treatment; (BFRT), Physical Therapy (PT).

INTRODUCTION

Physical therapists play a significant role in enhancing musculoskeletal health. It employs scientifically established treatments such as resistance training with heavy external loads to promote muscle mass. [1]. However, major problems arise in specific patient populations. Some of the most common problems are recovering from joint replacement surgery and health issues that hinder conventional recuperation effects [2]. Gaining or retaining as much muscle mass as possible is crucial in certain conditions, such as among the elderly who are at risk of sarcopenia and an increased risk of falls or following surgery [3].

However, some patients' joints may not be ready for it, and there is a risk of pain or re-injury with strength training. When patients with total knee arthroscopy who have engaged in postoperative activity regimes do not improve, it may be time to look into other treatment options [3]. In response to these challenges, Blood Flow Restriction (BFRT) has been combined as a creative and innovative therapeutic approach [4]. While performing resistance training or exercise, this approach involves applying external pressure to the extremities using a tourniquet or cuff. By exerting sufficient power, it is possible to block the veins from emptying blood from the occlusion site, while maintaining blood flow from the arteries [2].

Patients can achieve greater strength gains by combining blood flow restriction training with low-resistance exercise. It offers hypertrophic effects similar to traditional high-load training, without associated risks [5]. Previous research has emphasized that BFRT can reverse the muscle damage and atrophy caused by inactivity. However, it is beneficial for both athletes and the elderly. Moreover, there is a risk of injury from traditional strength training. [6]. To the best of our knowledge, this is the first study to address this issue. Further research is required to demonstrate its profitability and core usefulness.

Thus, BFRT is a promising and safe treatment option for physical therapists. However, limited data on its prevalence and acceptance has become a challenge in this field [10]. This study aimed to determine clinical physical therapists' awareness, perceived value, and actual utilization of BFRT. This study explored barriers to deployment. The hypothesis proposes that low adoption is due to lack of knowledge, fear, and scepticism among individuals.

This study aims to evaluate the applicability of Blood Flow Restriction Training (BFRT) in different medical contexts and investigate its therapeutic outcomes from a physiotherapy perspective [7]. Through an examination of BFRT's use in various medical settings, this research seeks to clarify its possible advantages and efficacy as a physiotherapy intervention. This study provides an important new understanding of how BFRT affects physiological responses, optimizes rehabilitation strategies, and directs the incorporation of this innovative method into comprehensive physiotherapy protocols for better patient outcomes [8].

Rehabilitation is typically centered on muscle development and strength restoration. This is typically achieved through heavy strength training, which may pose challenges within therapeutic contexts owing to associated mechanical strain [9]. In response to these challenges, Blood Flow Restriction Training (BFRT) has emerged as a promising alternative. This demonstration has comparable efficacy to traditional high-load resistance training. Additionally, BFRT was incorporated, particularly when combined with low-resistance exercise. This unique approach provides flexibility in its application, catering to individuals with varying mechanical strain capacity. [6].

Noa Mills et al. [11] discussed "Knowledge and Use of Blood Flow Restriction Therapy in a Sample of Physical Therapists in the United States". This study aimed to examine (PTs') understanding and use of BFRT. Methods: PTs were asked to complete an online survey to determine their understanding and use of BFRT. With age and sex differences, 88.1% (n=140) of the 159 participants were PTs who had heard of BFRT; however, only 38.6% (n=54) had ever used BFRT. A noteworthy distinction was seen in the understanding (98% vs 81%, $p < 0.001$) and application (48% vs 24%, $p = 0.016$) of BFRT between male and female Pts.' The PTs' awareness of BFRT and its application in practice seemed to differ, although most of these physicians were willing to explore using BFRT.

Saraf et al. [12] conducted a review on "Blood Flow Restriction Training-An Overview and Implication in New Generation Physical Therapy". An innovative strengthening method known as Blood Flow Restriction Training (BFRT) is effective under various circumstances. However, this therapeutic method has not been thoroughly investigated. Numerous ailments, including degenerative muscular weakness, may greatly benefit from workouts. It can enhance circulation and is a crucial therapy to avoid disuse atrophy in postsurgical patients during the first few days of bed rest. When combined with aerobic exercise, BFRT can enhance cardiovascular fitness and aid rehabilitation in all fronts. To find pertinent material on the subject, electronic databases, such as PubMed, ScienceDirect, Scopus, and Google Scholar, were examined along with their reference lists. According to the review's findings, BFRT is a cutting-edge strength-training regimen that has not been tried in India, but is a very successful, affordable, and creative kind of rehabilitation. In the early days of bed rest, postoperative disuse atrophy is a clear indication of the effectiveness of BFRT. Based on available data, BFRT is a highly efficacious training method that effectively enhances muscular function, strength, and hypertrophy.

Separate research by Deshpande and Adnani [13] focused on the knowledge of Blood Flow Restriction Therapy among physiotherapy students. Their findings revealed a considerable lack of expertise, with up to 61% of the participants. Participants were unable to accurately identify the application of BFR. Most students had only basic awareness of BFPT. In our research endeavors, we aimed to further advance the existing knowledge on BFRT by delving into its significance in various medical research areas. Our objective was to evaluate the therapeutic outcomes of BFRT. Notably, in physiotherapy. Building on the current understanding, our research seeks to contribute valuable insights into the effectiveness of BFRT and its practical application in rehabilitation regimens. Moreover, we aimed to identify knowledge gaps in previous research involving physiotherapy students and practicing Pts. In addition to enhancing the understanding of BFRT, it underscores its potential as a valuable therapeutic intervention. Apart from this, our research aspires to position itself as a significant addition to the proliferating landscape of evolving physiotherapy practices.

MATERIALS AND METHODS

This review extensively utilized academic databases, such as Google Scholar and PubMed, and additional sources to curate the collection of articles [8]. Physical therapists and athletes who have undergone PT rehabilitation and cardiovascular resistance training have also recorded their development in this context. To ascertain the relevance of the identified papers to our investigation, we thoroughly examined their abstracts. Fifteen articles that satisfied the established criteria were chosen [14]. The terms "BFRT" and "PTs reconstruction" were utilized significant concepts throughout the article. After applying the inclusion and exclusion criteria and considering the year of publication, a total of ten papers were identified as pertinent to this review [15].

Ten articles were selected based on the established inclusion and exclusion criteria. All Ten of these investigations employed research methodologies such as randomized controlled trials or clinical trials [15]. To uphold a rigorous standard of precision, this study exclusively incorporated the literature written in English. The possibility of a thorough

examination of publications is enhanced when they are published in English, which is widely recognized as the international language of choice [1]. The utilization of materials written in languages other than English has the potential to produce false information [6]. To ensure the accuracy of the data extraction, interpretation, and reporting, we limited our search to publications written exclusively in English [4].

This review employed a analysis of scholarly literature published from 2015 to 2023 to ascertain the efficacy of BFRT as a rehabilitative modality for physical therapists. The year 2015 served as the designated threshold for inclusion of any literary or artistic creation in the evaluation process (Centner et al., 2019). Full-text publications were chosen because of their comprehensive nature and ability to provide the most extensive amount of information [8]. Articles that did not provide information on PT education, PT reconstruction, or BFRT approach were excluded from the assessment [13]. Articles that did not significantly contribute to our understanding of the efficacy of BFRT in the rehabilitation of PTs were omitted for this reason [4].

In this analysis, we focused on blood flow restriction training and physiotherapy and conducted a review of the existing literature. We examined various review studies from reputable journals and noted that none of them extensively discussed the topics of BFRT and Pts. Our study aimed to consolidate the findings from these sources, specifically examining the study design, methods employed, outcome measures, and descriptions of research results (Figure 1). Ultimately, our analysis contributes a unique perspective to the scientific literature review, as no previous studies have undertaken such an endeavor in the context of blood flow restriction training and physiotherapy.

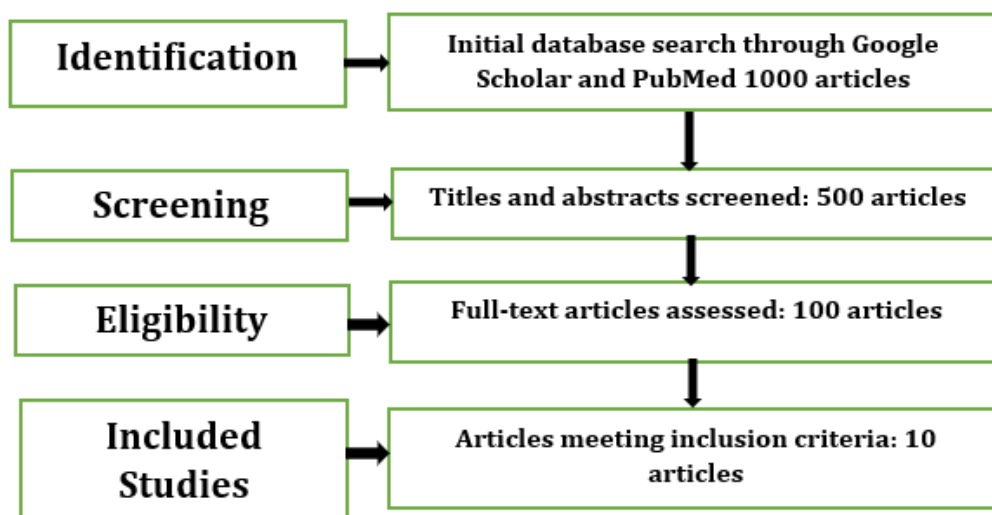


Figure: Flow of the research methodology.

RESULTS and DISCUSSION

The findings of this review suggest that BFRT has a positive impact on knee biomechanics in patients who have undergone prior PTs. The results provide support for the efficacy of BFRT in mitigating pain, improving muscular strength, and augmenting the muscle cross-sectional area, as emphasized in previous studies (Table 1). Analysis of all trials demonstrated that BFRT exhibits greater efficacy than conventional rehabilitation programs in the restoration of typical knee joint kinetics and kinematics after posterior cruciate ligament repair.

SL No.	Author	Year	Design	Pedro Scale	No. of Patients	Treatment Applied	Outcome Measures	No. of Sessions	Follow-up	Result
1	Alsubaie et al.	2021	Randomized Controlled Trial	7/10	44	Low-load resistance BFRT vs. Standard ACL therapy	Knee flexor and extensor muscle torque, Total area of the femoral muscle group's cross-section	5	16 weeks	Implementing high-load rehabilitation treatments post-surgery may increase tendon damage, while BFRT stimulates both muscle fiber types showing potential benefits.
2	Cara et al.	2022	Randomized Controlled Trial	6/10	18	BFRT vs. post-ACL replacement rehabilitation	B-mode ultrasound thigh muscle thickness, Knee extensor muscle strength	12	-	Despite discomfort and weakness post-ACL replacement, BFRT exhibited benefits in muscle thickness and strength, offering safety and cost

										advantages if guided properly.
3	Koc et al.	2022	Randomized Controlled Trial	8/10	60	BFRT + PT vs. BFRT + Placebo	Three-dimensional motion investigation of knee biomechanics, Muscle biopsy physiology	8	4-5 months	Positive impact on muscular strength and cross-sectional area in PT rehabilitation, evaluated through MRI.
4	Lorenz et al.	2021	Randomized Controlled Trial	7/10	40	BFRT vs. non-BFRT post-surgery	Three-dimensional motion examination of knee's kinematics and kinetics	12	-	BFRT effectively decreased knee joint pressures and enhanced muscle strength post-surgery.
5	Vilaca et al.	2022	Randomized Controlled Trial	6/10	14	Standard Therapy vs. Standard Therapy + BFRT	DEXA scan and functional evaluation	16	12 weeks	Notable enhancements in outcomes, especially bone density, when BFRT was combined with standard therapy.
6	Philip et al.	2023	Randomized Controlled Trial	5/10	-	Minimally processed injections vs. Conservative treatment	Pain intensity, Patient-specific functional scale, Global rating of change	8	-	Significant enhancements in pain reduction and functional improvement post-injections for severe knee osteoarthritis.
7	Xiaolin et al.	2023	Randomized Controlled Trial	6/10	-	BFRT vs. Traditional Resistance Training	Peak power, Rate of force generation, Jumping ability, Sprinting speed	9	-	BFRT outperforms traditional resistance training in enhancing lower extremity explosive strength.
8	Dahan et al.	2022	Randomized Controlled Trial	6/10	-	Different cuff sizes in BFRT training	Lower-body explosive power	9	-	BFRT enhances lower-body explosive power, especially when utilizing a broad cuff.
9	Aakash et al.	2022	Randomized Controlled Trial	5/10	-	BFRT with appropriate assessment and monitoring protocols	Strength training outcomes	4	-	BFRT shows transformative potential in treatment practices when guided by proper protocols.
10	Noa et al.	2021	Randomized Controlled Trial	4/10	-	BFRT vs. No intervention	Muscle mass and strength improvement	4	-	BFRT aids in muscle mass and strength improvement for patients' post-amputation.

Table: Randomized Controlled Studies

This study examined the efficacy of BFRT in individuals who had undergone physical rehabilitation. The inclusion of these five studies in the review was based on the coverage of the BFRT and PT rehabilitation subjects. The outcomes of the selected studies were as follows:

According to Alsubaie et al., [1] Implementing high-load rehabilitation treatments after surgery for PTTD may increase the possibility of tendon damage. The benefit of BFRT is its ability to stimulate both types of muscle fibers [18].

A study by Cara et al. [6], Participants experienced discomfort and weakness despite ACL replacement and busy lives. BFRT showed benefits in muscle thickness and strength, offering safety and cost advantages if properly guided [19].

Koc et al., [8] his study aimed to evaluate the effectiveness of BFRT by quantifying the proportion of contractile tissue to noncontractile tissue using two-dimensional Magnetic Resonance Imaging. The use of Blood Flow Restriction Training (BFRT) resulted in both muscular strength and cross-sectional area, as investigated using Magnetic Resonance Imaging (MRI).

Additionally, Lorenz et al. [9], BFRT used unique mobility strategies that effectively decrease knee joint pressures and enhance muscle strength [17]. The application of BFRT shortly after surgery is considered safe because of its ability to minimize pressure on the surgically repaired knee and restrict unnecessary movement. The observed improvement in strength resulting from BFRT surpassed that achieved with low-load training alone. However, certain individuals may have resorted to compensatory movements because of the strenuous and disagreeable nature of this activity. The results were observed during a minimum of two to three weekly sessions.

According to Vilaca et al. [15], the findings of their study demonstrated a notable enhancement in outcomes when BFRT was combined with standard therapy. Regular BFRT has the potential to improve results, especially in terms of bone density [22].

Philip et al., [14] studied “the application of minimally processed bone marrow aspirate (BMA), fat graft, and platelet-rich plasma (PRP) injections demonstrated a noteworthy enhancement in pain intensity, patient-specific functional scale, and global rating of change among individuals afflicted with severe knee osteoarthritis (OA)”. The study observed that individuals diagnosed with severe knee OA who did not exhibit positive responses to conservative treatment experienced notable enhancements in pain reduction and functional improvement after the administration of injections, including minimally processed BMA, fat graft, and PRP.

Xiaolin et al. [15] concluded that BFRT outperforms TRT in terms of improving the lower extremities' explosive strength in healthy individuals. Individuals who might benefit from BFRT include athletes who play short-duration sports, those who have a reduced ability to withstand physical demands, and other groups.

Based on the findings of Dahan et al. [16], BFRT is more effective than conventional resistance training in enhancing lower-body explosive power. The enhancement of explosive power was much greater when utilizing a broad cuff throughout training as opposed to employing a tiny cuff or engaging in rest intervals. BFRT has the potential to yield outcomes comparable with those of high-intensity exercise regimens.

Aakansha et al. [12] conducted a study on BFRT and analysis of existing evidence reveals that BFRT has the potential to significantly transform treatment practice when used alongside appropriate assessment and monitoring protocols. This technology has the potential for temporary utilization in hospital intensive care units. BFRT is an innovative and transformative methodology for enhancing strength training, which has significantly expanded the realm of possibilities in this field.

According to a study by Noa et al. [17], BFRT has received relatively little investigation, despite its increasing reputation. Recent studies have demonstrated the advantages of BFRT. The BFRT strength-training program will aid patients because it is intended to increase their muscle mass and strength. Although amputation is a tragic event, BFRT has shown promise in enabling patients to lead fulfilling lives without the need for prostheses.

CONCLUSION

The researchers involved in this study were motivated to investigate the level of familiarity with, and utilization of, BFRT among working PTs. Although a significant majority of the physical therapists surveyed had some level of familiarity with BFRT, only a small proportion reported incorporating it in their professional practice. Individuals who openly acknowledged their utilization of BFRT generally regarded it as beneficial and expressed an intention to continue their practice. During the interviews, several physicians with limited knowledge of BFRT but lacking direct experience expressed their curiosity and desire to acquire further understanding of the subject matter. Moreover, there were age and sex differences in the familiarity and utilization of BFRT among the PTs. The integration of BFRT with PT regimens has the potential to enhance patient outcome.

Conflict of Interest – There was no conflict of interest among authors.

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