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Cost-Effective Implementation and Training Strategies for Blood-Flow Restriction Training in Rehabilitation Services: A Systematic Review

Chasity Nadine Porter1 and Dr. Bruce Lazar, MBA, DM2

1MHA, Graduate Student, Southern Illinois University
Carbondale, USA
cnt14@siu.edu
2School of Health Sciences, MHA Lecturer, Southern Illinois University
Carbondale, USA
bruce.lazar@siu.edu

Abstract: *Blood flow restriction therapy (BFRT) is a rising methodology for the treatment of sports injuries. The process can reduce additional and unnecessary stress on patients while maintaining, if not improving, recovery timelines. The systematic literature review aims to identify the most cost-effective strategies for incorporating BFRT into traditional physical therapy for patients with sports injuries, to reduce rehabilitation time. A search transpired using the PubMed/NIH, Science Direct, and EBSCO host academic databases following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. Data from seven relevant articles were meticulously analyzed using screening criteria around the research question. Two themes emerged during the data analysis process. The themes included the implementation of BFRT in rehabilitation services and sports injuries that benefit from the use of BFRT. The finding indicated that there are no set guidelines for the most cost-effective implementation strategies of BFRT in an established rehabilitation program. The results did define that those who benefit the most from BFRT are those injuries that require resistance training for best outcomes, but the injury prevents the patient from using higher weight or resistance for the rehabilitative services. BFRT is also very promising for those with soft tissue damage in that the level of resistance is significantly lower than traditional weight training with similar outcomes. The findings indicate that more research is needed to determine what the most cost-effective implementation and training strategies are for clinics to have the best outcomes for patients.*

Keywords – blood flow restriction therapy; implementation and training; cost-effective

1. Introduction

Rehabilitation for patients with sports injuries takes time, and the period it takes to fully recover is different for each patient and each injury [3]. Reducing this time can be crucial to individuals who are actively participating in a competitive sports arena. Time is only one aspect of the recovery process. To strengthen the muscles to return to competitive levels the load must exceed the load capacity [4]. The traditional way to accomplish this is to weight train or at the early stages use body weight. The risk is when the connective tissues are weakened due to injury or underuse. One way around this is to use blood-flow restriction training (BFRT) [11].

According to the American Physical Therapy Association, 2018, no certification is required to perform BFRT as it is considered within the scope of practice for a physical therapist to perform. There are many certification courses and continuing education opportunities for this training, but this is not necessary to perform the treatment [7]. The stipulations for whom this can be conducted depend on each individual and their injury and disposition. Several contraindications exclude a patient from being able to perform BFRT. These include certain cardiovascular issues, central and peripheral vascular problems, and patients who are pregnant [7]. Therefore, healthcare leaders often struggle to effectively implement BFRT practices in healthcare settings to treat sports injuries efficiently while managing costs.

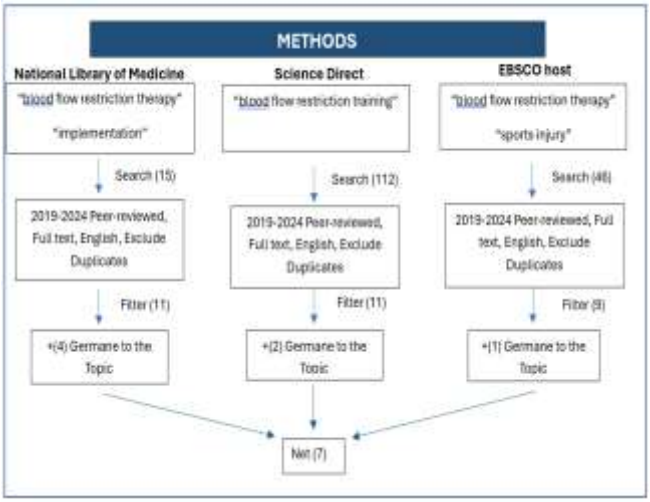
The problem is that healthcare leaders lack information to identify the most cost-effective strategies for integrating BFRT into traditional physical therapy for patients with sports injuries, to reduce rehabilitation time. For those patients who can undergo BFRT, it is believed to be a viable option to reduce recovery time and alleviate stress on their bodies during the rehabilitation process [4]. However, cost-effectively implementing these protocols within individual clinical settings poses a challenge. Several authors have observed that there are minimal requirements for BFRT practices and employee training [7,1]. Since certification is not mandatory, clinics may choose to forego staff training altogether. Additionally, the equipment used for BFRT can vary between settings and may impact resource allocation. Typically, BFRT involves a pneumatic cuff with an attached air pump, although it can also be achieved using tourniquet-like straps without a pump [7]. Currently, there are many methods of delivering BFRT, but minimal information is

available on which strategies will help provide the best care with the most cost-effective outcome. The purpose of the systematic literature review is to identify the most cost-effective strategies for incorporating BFRT into traditional physical therapy for patients with sports injuries, to reduce rehabilitation time.

2. Methods

After narrowing down the research topic choice, a selection of articles aligned with the research question was utilized for the review. The research question was as follows: What cost-effective, employee training, and patient eligibility strategies do healthcare clinical administrators use to incorporate blood flow restriction therapy (BFRT) with traditional physical therapy for patients with sports injuries to reduce time towards rehabilitation? A search of the literature transpired using National Library of Medicine (PubMed), Science Direct, and EBSCO host databases following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines [8, 10] The method phases included (a) searching for relevant studies, (b) screening for inclusion and exclusion criteria, (c) data extraction based on the screening criteria, (d) synthesis of the data to identify key themes, and (e) reporting and dissemination of the findings. Searching the academic databases utilizing keywords *"blood flow restriction therapy", "sports injury",* and *"implementation"* provided consistent parameters in choosing the best articles to review the topic and answer the research question. For inclusion of articles to review, publications had to meet all the following criteria: (a) articles published between 2019 and 2024, (b) articles written in the English language, (c) peer-reviewed journal articles, (d) full-text articles, and (e), with a focus on implementation strategies for blood flow restriction therapy. When the applied inclusion criteria were in place, the National Library of Medicine resulted in four articles, Science Direct displayed two articles, and EBSCO host produced one article. This review excludes articles not meeting the inclusion criteria above (see Figure 1.).

Figure 1
Flow Diagram



3. Results

The primary research question was, "What cost-effective, employee training, and patient eligibility strategies do healthcare clinical administrators use to incorporate blood flow restriction therapy (BFRT) with traditional physical therapy for patients with sports injuries to reduce time towards rehabilitation?". An in-depth literature search and review transpired using three academic electronic databases National Library of Medicine, Science Direct, and EBSCO host. The review adhered to an established literature search strategy, selection process, and data analysis procedure [8, 10].

Based on the data from 31 studies chosen, seven articles were germane to the topic and relevant to the research question. A final decision transpired by comparing and finalizing the summary findings from each article (see Figure 1). Table 1 below lists the title of the articles and key summation findings from these seven articles.

Table 1

Summarized findings of the literature.

Title	Findings
[1] Blood Flow Restriction Therapy and Its Use for Rehabilitation and Return to Sport: Physiology, Application, and Guidelines for Implementation	Explores the usefulness and effects of implementing BFR training and explains that more studies are needed to optimize the uses of the intervention.
[2] Current Implementation and Barriers to Using Blood Flow Restriction Training: Insights From a Survey of Allied Health Practitioners	The article discusses how often BFR training is implemented for older populations. The relevance is how they implement and why some would not use the intervention.
[3] Blood Flow Restriction Therapy:	This articles covers how BFR works and the science behind the intervention. It discusses

Where We Are and Where We Are Going	who is best suited for BFR and finally explains that it requires more research to optimize uses.
[4] Blood Flow Restriction Training	This article explains the benefits to implementing BFR over traditional resistance training, specifically those with joint injuries commonly found in sports.
[5] The Safety of Blood Flow Restriction Training as a Therapeutic Intervention for Patients With Musculoskeletal Disorders: A Systematic Review.	This review concludes that BFR training is a good approach for knee-related injuries. The final result in the articles about those patients with musculoskeletal disorders is inconclusive as the research has not been conducted.
[6] Blood flow restricted exercise following ankle fractures – feasibility study	Confirms that BFRT can improve the speed of rehabilitation specifically in ankle injuries
[7] Blood flow restriction exercise: considerations of methodology, application, and safety	This article discusses the feasibility of implementation and safety precautions when implementing.

The data retrieved from the seven articles connect to categorizing the frequency of occurrence regarding implementation of BFRT and injuries that are considered to be improved by conducting BFRT concerning the research topic and question, which led to the development of two main themes. Each theme directly relates to the research question. The following themes included (a) implementation of BFRT in rehabilitation services and (b) sports injuries that benefit from the use of BFRT.

Table 2

Frequency of occurrence in the literature.

Theme	Occurrences	Instances of Attributes (n)	Percentage (%)
Theme 1: Implementation of BFRT in rehabilitation services	1, 2, 4, & 7	1, 2, 4, & 7	57%
Theme 2: Sports injuries that benefit from the use of BFRT	5 & 6	5 & 6	29%

From these research findings, 57%, four out of seven of the articles mentioned theme one "implementation of BFRT in rehabilitation services", which included articles 1, 2, 4, and 7. 29%, two out of seven of the articles mentioned theme two "sports injuries that benefit from the use of BFRT", that incorporated article five and six.

4. Discussion

Blood flow restriction therapy (BFRT) is a viable option for treating musculoskeletal injuries occurring in many different types of sporting events. It allows the patient to greatly reduce the weight required for resistance training for effective results. This also adds the benefit of reducing the strain on ligaments and tendons involved in exercise movements [7]. In this systematic review, the author aimed to determine what implementation strategies and training were the most cost-effective for a clinic to use. The research revealed as Table 2 delineates, two major themes throughout the literature. These themes give credence to the most cost-effective implementation strategies as well as training for staff to incorporate into their practice.

Examples of implementation strategies of BFRT in rehabilitation services were mentioned in 57% of the articles that were included in this review. A promising venture from one article mentions new and ever-improving versions of BFRT and how to implement those [2]. The second theme explored was sports injuries that benefitted from the use of BFRT. Only 29%, or two, articles displayed this theme in force. The articles mentions the benefit that knee-related and ankle-related sports injuries have but that other injuries require more research to be conclusive [9].

Notwithstanding the findings above, this review had some limitations that included practical time constraints, the exclusion of non-English language articles, the search strategies used, and the subjective nature of the reviewers. The review was conducted over a period of 12 weeks. The review excluded non-English language articles which eliminated certain publications from review. The literature review was performed using a preliminary search strategy using Google Scholar first. An additional search strategy was then conducted using PubMed (NIH), Science Direct, and EBSCO host academic databases for reviewing peer-reviewed journal articles. The search was key word guided. As such, it is possible that some articles were missed that could have been captured if different terminology was used for searching the academic databases. The last limitation is the subjective nature of the reviewer of the articles. There is the potential for the articles to have been interpreted differently.

To minimize the limitations above the author followed the PRISMA based systematic review guidelines and protocol. We filtered the information collected, starting with 31 articles from the PubMed, Science Direct and EBSCO

host academic databases until there was no additional information available to develop themes. The author then read each article and decided whether or not the article was aligned with the research question. In the end the results of this review are that there is more research needed to determine which implementation strategies would be most cost effective, and that there is little information published as to the most cost effective training strategies for BFRT.

Future researchers can use the results of this literature review as a basis for possibly conducting a mixed method study. Researchers should consider incorporating data collection processes with qualitative and quantitative surveys to determine which trainings and implementation strategies would be most cost effective to incorporate into common practice. Additionally, clinicians can use these results to determine the best fit for their practice if they choose to implement BFRT into rehabilitation services.

5. Conclusion

Implementing blood flow restriction therapy can be a leap for a clinic. Training the appropriate staff and acquiring the equipment is not a cheap venture. While the benefits for the patients certainly outweigh the costs, the fact is that the cost still exists. This systematic literature review sought to identify the most cost-effective strategies for implementing and training in BFRT within established rehabilitation clinics. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines, a comprehensive search was conducted using the PubMed/NIH, Science Direct, and EBSCO host academic databases. Seven relevant articles were meticulously analyzed based on specific screening criteria aligned with the research question. Two main themes emerged from the data analysis: the integration of BFRT in rehabilitation services and the sports injuries that benefit from BFRT. The review found no established guidelines for the cost-effective implementation of BFRT in existing rehabilitation programs. However, it highlighted that BFRT is particularly beneficial for injuries requiring resistance training where the patient cannot use higher weights or resistance. Additionally, BFRT shows promise for soft tissue injuries, as it uses significantly lower resistance than traditional weight training while achieving similar outcomes. The findings underscore the need for further research to determine the most cost-effective implementation and training strategies for clinics to optimize patient outcomes.

6. References

[1] APTA. (2018). What to know about blood-flow restriction training. Retrieved from American Physical Therapy Association: https://www.apta.org/patient-care/interventions/blood-flow-restriction/what-to-know-about-blood-flow-restriction-training

[2] Cognetti, D. J., Sheean, A. J., & Owens, J. G. (2022). Blood Flow Restriction Therapy and Its Use for Rehabilitation and Return to Sport: Physiology, Application, and Guidelines for Implementation. Arthroscopic, Sports Medicine, and Rehabilitaion, 71-76.

[3] Edouard, P., & Ford, K. R. (2020). Great challenges toward sports injury prevention and rehabilitation. Frontiers in Sports and Active Living. doi:https://doi.org/10.3389/fspor.2020.00080

[4] Gabbett, T. J. (2020). How Much? How Fast? How Soon? Three Simple Concepts for Progressing Training Loads to Minimize Injury Risk and Enhance Performance. Journal of Orthopaedic & Sports Physical Therapy, 570-573. doi:https://www.jospt.org/doi/10.2519/jospt.2020.9256

[5] Larsen, P., Platzer, O. J., Lollesgaard, L., Pedersen, S. K., Nielsen, P. K., Rathleff, M. S., . . . Elseo, R. (2022). Bloof-flow restricted exercise following ankle fractures - feasibility study. Foot and Ankle Surgery, 726-731. doi:https://doi.org/10.1016/j.fas.2021.08.010

[6] Liu, S., Tang, J., Hu, G., Xiong, Y., Ji, W., & Xu, D. (2024). Blood flow restriction training improves the efficacy of routine intervention in patients with chronic ankle instability. Sports Medicine and Health Science, 159-166. doi:https://doi.org/10.1016/j.smhs.2023.11.001

[7] Lorenz, D. S., Lane, B., Kevin, W. E., Robert, M. E., Paul, H., Terry, G. L., & Scot, M. (2021). Blood flow restriction training. Journal of Athletic Training, 937-944. doi:https://doi.org/10.4085/418-20

[8] Minniti, M. C., Statkevich, A. P., Kelly, R. L., Rigsby, V. P., Exline, M. M., Rhon, D. I., & Clewley, D. (2020). The Safety of Blood Flow Restriction Training as a Therapeutic Intervention for Patients With Musculoskeletal Disorders: A Systematic Review. The American Journal of Sports Medicine, 1773-1785.

[9] Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7):e1000097. doi:10.1371/journal.pmed1000097

[10] Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., … Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ (Clinical research ed.), 372, n71. https://doi.org/10.1136/bmj.n71

[11] Patterson, S. D., Hughes, L., Warmington, S., Burr, J., Scott, B. R., Owens, J., . . . Loenneke, J. (2019). Blood Flow Restriction Exercise: Considerations of Methodology, Application, and Safety. Frontiers in Physiology. doi:https://doi.org/10.3389/fphys.2019.00533

[12] Scott, B. R., Marston, K. J., Owens, J., Rolnick, N., & Patterson, S. D. (2024). Current Implementation and Barriers to Using Blood Flow Restriction Training: Insights From a Survey of Allied Health Practitioners. Journal of Strength and Conditioning Research, 481-490.

[13] Vopat, B. G., Vopat, L. M., Bechtold, M. M., & Hodge, K. A. (2020). Blood Flow Restriction Therapy: Where We Are and Where We Are Going. Journal of the American Academy of Orthopaedic Surgeons, 493-500. doi:10.5435/JAAOS-D-19-00347