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EFFECT OF BLOOD FLOW RESTRICTION TRAINING ON STRENGTH AND RANGE OF MOTION IN POST ARTHROSCOPIC ROTATOR CUFF REPAIR

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KEYWORDS :

INTRODUCTION

Shoulder pathologies are the third most common musculo-skeletal condition encountered by health professionals in their day-to-day clinical practice, approximately 40–54% of patients report ongoing pain lasting 1–3 years. This highlights the chronic nature of shoulder disorders and their significant impact on quality of life and daily functioning.[1]

The shoulder joint classifies as a ball and socket joint; however, the joint sacrifices stability for mobility. The rotator cuff consists of four muscles originating on the scapula and inserting on the superior humeral head to improve stability. The subscapularis inserts on the lesser tubercle of the humerus, and it functions as an internal rotator. The supraspinatus also works as abductor in addition along with the infraspinatus and the teres minor muscles functions as an external rotator. Additionally, they all work as stabilizers of the glenohumeral joint,Together, these muscles stabilize the glenohumeral joint during movement and functional activities.[2]

Rotator cuff injuries are highly prevalent in India, particularly among individuals above 50 years of age, with an estimated prevalence of around 22.5%. Males are more commonly affected due to occupational demands involving repetitive overhead activities and heavy lifting. Advanced diagnostic techniques such as diffusion-weighted MRI and MR arthrography have improved the accuracy of diagnosis. Arthroscopic rotator cuff repair (RCR) has shown high success rates ranging from 70% to 90%, making it a commonly adopted surgical intervention.[3]

Overall, limited data support the various proposed mechanisms of BFR training, but strong evidence indicates that it produces clinically significant changes in strength, hypertrophy, and angiogenesis. Although the mechanisms are still being identified, BFR training appears to increase the ability to load high-threshold motor units and elicit relevant adaptations.[18]

OBJECTIVES

Objectives of the study:

- To analyse effects of blood flow restriction training on strength of rotator cuff muscles and range of motion of in post-arthroscopic rotator cuff repair.
- To analyse effects of blood flow restriction training on range of motion of in post-arthroscopic rotator cuff repair
- To compare the effects of blood flow restriction training on strength and range of motion in post arthroscopic rotator cuff repair.

METHODOLOGY

Study Design: Pre post experimental study with control group

Methodology

Study Subject: 18-45 years old subjects with arthroscopic rotator cuff repair.

Sample Size: 42

The pilot study conducted by Dilara Kara et al. included 5 patients, and based on shoulder ER muscle thickness.

Study Setting and Source of Data: Florence College of physiotherapy OPD and rehabilitation centre.

Study Duration: 4-6 months

Sample Method: Simple random sampling using chit method

Sample Selection:

Inclusion Criteria:[21,50,51]

- 18 -45 years subjects
- Subjects with post arthroscopic rotator cuff repair after 2-6 weeks
- Both genders
- Upper limb dominance

Exclusion Criteria:[21,50]

- Musculoskeletal injuries of UL, spines
- Any surgeries involving UL
- Cardiovascular diseases,

Methods of Data Collection

Ethical clearance was obtained from the ethical committee of Florence College of Physiotherapy (Annexure II). All the subjects fulfilling the inclusion and exclusion criteria were informed about the study and written consent was taken (Annexure–I), and they were randomly allocated.

BFRT Group A

A tourniquet was placed over the (biceps) to the upper brachium of the surgical extremity to restrict blood flow during common isotonic upper extremity strengthening exercises (elevation in the scapular plane, prone horizontal abduction, side-lying external rotation, cable internal rotation at 0°). For safety, the pressure was continuously monitored in the upper arm during the exercises.[21,22]

- External rotation exercise was performed in the side-lying position.
- Cable internal rotation was performed at 0°.

Control Group B (Conventional Group) [4,30,54]

Phase I (0 to 4 Weeks):

Arm immobilization with an abduction pillow was maintained for 2 weeks postoperatively along with pain-free passive motion.

1. Passive forward flexion was performed to at least 110–125°.

Phase II (4–6 to 10–12 Weeks):

From the 4th to 6th week, active-assisted ROM exercises were initiated, including the use of pulleys, canes, and self-assisted ROM.

Phase III (10–12 to 16 Weeks):

This phase was considered a strengthening phase. Patients began stretching and strengthening exercises and continued elastic resistance activities to build muscle endurance.

Phase IV (16–26 Weeks):

Progressive strengthening of the repaired rotator cuff was achieved through various methods. External rotation at 45° abduction using elastic resistance was performed to strengthen the infraspinatus and teres minor.

RESULTS

On comparing the Mean Values of Group A & Group B on Shoulder Abductor strength Score, it shows a significant increase in the post test mean values in both groups, but (Group A) shows 3.96 ± 1.38 which has the higher mean value is more effective than (Group B) 2.62 ± .823 at P ≤ 0.05. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on Shoulder Internal Rotation ROM Score, it shows a significant increase in the post test mean values in both groups, but (Group A) shows 65.00 ± 6.32 which has the higher mean value is more effective than (Group B) 57.38 ± 5.61 at P ≤ 0.05. Hence the null hypothesis is rejected.

On comparing Pre test and Post test within Group A & Group B Shoulder External Rotator Strength, Internal Rotator Strength, Abductor Muscle Strength, Shoulder External Rotation ROM, Internal Rotation ROM & Abduction ROM Score shows significant difference in the mean values at P ≤ 0.05.

Data Analysis

The collected data were tabulated and analyzed using both descriptive and inferential statistics. Statistical analysis of the data was performed using SPSS 20.0.

Table – 11 Comparison of Shoulder Internal Rotation Rom within Group – A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		T - Test	Significance
	Mean Degree	± S.D	Mean Degree	± S.D		
Group- A	45.00	6.70	65.00	6.32	-12.96	.001**
Group- B	45.23	5.58	57.38	5.61	-10.34	.001**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B.

There is a statistically significant difference between the pre test and post test values within Group A and Group B at P ≤ 0.05

Table – 12 Comparison of Shoulder Abduction Rom within Group – A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		T - Test	Significance
	Mean Degree	± S.D	Mean Degree	± S.D		
Group- A	92.85	13.37	137.14	23.64	-15.42	.001**
Group- B	88.57	7.76	106.90	8.72	-10.35	.001**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B.

There is a statistically significant difference between the pre-test and post test values within Group A and Group B at P ≤ 0.05.

DISCUSSION

Our study was conducted to evaluate the effectiveness of blood flow restriction training (BFRT) on shoulder muscle strength and range of motion following arthroscopic rotator cuff repair and to compare it with conventional rehabilitation. The results showed that both groups improved significantly; however In the present study, the between-group comparison showed statistically significant improvements in favour of the BFRT group for shoulder external rotator strength, internal rotator strength, and abductor strength. For instance, the post-test mean value for external rotator strength was higher in Group A (8.12 ± 2.94) compared to Group B (5.32 ± 1.66).were observed in internal rotators and abductors showed. This suggests that BFRT was more effective in improving muscle strength.

The findings suggest that BFRT can be considered a more effective intervention, particularly in the early stages of postoperative rehabilitation where high-load resistance training may not be feasible. It allows patients to achieve better muscle activation and functional recovery using low-load exercises, thereby reducing stress on the healing tissues.

Therefore, BFRT can be recommended as a safe and beneficial addition to conventional rehabilitation protocols for enhancing recovery after arthroscopic rotator cuff repair.

This study aim to find out early rehabilitation through BFRT to achieve effect of shoulder recover in rotator cuff repair patient. So the present study was carried out to determine the effect of blood flow restriction training (BFRT) on shoulder muscle strength and range of motion in individuals who had undergone arthroscopic rotator cuff repair.

Based on the findings of this study, it can be concluded that blood flow restriction training is more effective than conventional rehabilitation in improving shoulder muscle strength and mobility following arthroscopic rotator cuff repair.

So it can be concluded alternative hypothesis is proved. BFRT can be considered as a beneficial and safe addition to postoperative rehabilitation programs, especially in the early stages of recovery when patients are unable to tolerate heavy resistance exercises.

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